

CANDEL MOBIL ET AL N.

RAM PARTS A-59

821-11-05-018

M-NWT 634  
Candel Mobil et al. N. Ramparts A-59



|                               |  |                                     |  |                                                                            |  |                         |  |
|-------------------------------|--|-------------------------------------|--|----------------------------------------------------------------------------|--|-------------------------|--|
| Well Name<br>Nom du puits     |  | CanDel Mobil et al N. Ramparts A-59 |  | Drilling Authority No.<br>Autorisation de forage n°                        |  | 634                     |  |
| Field/Area<br>Gisement/Région |  |                                     |  | Date Issued<br>Date d'émission                                             |  | Dec. 1, 1972            |  |
| Location<br>Emplacement       |  | Unit<br>Unité                       |  | Section                                                                    |  | Permit or Lease<br>4430 |  |
| Latitude                      |  | 65°28'04"                           |  | Longitude                                                                  |  | 130°39'47"              |  |
| U.W.L.R.<br>N.R.U.E.P.        |  | 65.46778 -- 130.66306               |  |                                                                            |  |                         |  |
| U.W.I. No.<br>N.I.P. No.      |  | 300A596530130300                    |  |                                                                            |  |                         |  |
| File Microfilmed              |  |                                     |  | Rig. Release Date<br>Date de transfert de la tour de forage                |  | 11-06-73                |  |
| Tour Sheets, Microfilmed      |  |                                     |  | Status<br>Statut                                                           |  | D + A                   |  |
|                               |  |                                     |  | Information Release Date<br>Date de publication autorisée des informations |  | 11-06-75                |  |

CHANGE OF NAME:  
CHANGEMENT DE NOM:Change of Location  
Changement de emplacement

| INDEX                                                  | DATE RECEIVED<br>RECU LE |   | INDEX                                                                                             |
|--------------------------------------------------------|--------------------------|---|---------------------------------------------------------------------------------------------------|
| Application for a Drilling Authority                   | 13-12-72                 | K | Demande d'autorisation de forage                                                                  |
| Well Completion Data                                   | 23-08-73                 | K | Renseignements sur le forage d'un puits                                                           |
| Well History Report                                    | 23-08-73                 | K | Données chronologiques sur le puits                                                               |
| Application to Amend a Drilling Authority              | 4-6-73                   | K | Demande de modification d'une autorisation de forage                                              |
| Application to Change a Well Name                      |                          |   | Demande de changement du nom d'un puits                                                           |
| Application to Abandon a Well or Suspend Drilling      |                          |   | Demande d'abandon d'un puits ou de suspension du forage                                           |
| Application to Alter Condition of a Well               |                          |   | Demande d'autorisation de modifier l'état d'un puits                                              |
| Well History Supplement                                |                          |   | Supplément aux données chronologiques sur le puits                                                |
| Well Completion Data                                   |                          |   | Renseignements sur le forage d'un puits                                                           |
| Work-Over Report No. ....                              |                          |   | Rapport de reconditionnement n° .....                                                             |
| Application to Commingle Production before Measurement |                          |   | Demande d'autorisation de mélanger la production avant jaugeage                                   |
| Data for Back Pressure Test on Natural Gas Wells       |                          |   | Données de calcul de la capacité de production d'un puits de gaz naturel - Méthode graphique n° 7 |
| Data for Back Pressure Test on Natural Gas Wells       |                          |   | Données de calcul de la capacité de production d'un puits de gaz naturel - Méthode de Vitter      |
| M.P.R. - Oil - Calculations                            |                          |   | Calcul du T.M.P. (Taux maximal de production) de pétrole                                          |
| New Oil Well Report                                    |                          |   | Rapport sur un nouveau puits de pétrole                                                           |
| New Gas Well Report                                    |                          |   | Rapport sur un nouveau puits de gaz naturel                                                       |
| Well Inspection Report                                 |                          |   | Rapport d'inspection de l'emplacement d'un puits                                                  |
| Rig Inspection Report                                  | 28-5-73<br>15-3-73       | K | Rapport d'inspection d'une tour de forage                                                         |
| Battery Inspection Report                              |                          |   | Rapport d'inspection d'une batterie de puits                                                      |
| Equipment Report                                       |                          |   | Rapport d'inspection des compteurs                                                                |
| Well Card                                              | 16-9-73                  | K | Fiche de puits                                                                                    |
| New Service Well Report                                |                          |   | Rapport sur un nouveau puits de service                                                           |
| Strat Service Logs                                     |                          |   | Rapport mensuel des injections d'eau                                                              |
| Logs - Large scale                                     |                          |   | Diagrammes: Grande échelle                                                                        |
| Logs - Small scale                                     |                          |   | Diagrammes: Petite échelle                                                                        |

WELL COMPLETION DATA  
RENSEIGNEMENTS SUR LES FORAGES

Drilling Authority No. 634  
N° de l'autorisation de forage  
Date issued Dec. 1, 1972  
Date de délivrance

To be submitted in duplicate within thirty days after the completion, rework, abandonment, recompletion or suspension of every well.  
À présenter en double dans les trente jours suivant l'achèvement, le remaniement, l'abandon et le reconditionnement de chaque puits, ou après suspension.

|                                                                                                                         |  |                                                                   |                                             |
|-------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------|---------------------------------------------|
| Well Name & No - Nom et n° du puits<br><b>CanDel Mobil et al N. Ramparts A-59</b>                                       |  | Permit No. - N° de permis<br><b>4430</b>                          | Lease No. - N° de concession<br><b>1973</b> |
| (Permittee, License, Lessee) - (Défendeur de permis ou de licence, du concessionnaire)<br><b>Mobil Oil Canada, Ltd.</b> |  | Exploratory Licence No. - N° de licence de sondage<br><b>1471</b> |                                             |
| (Operator) - (Exécutant)<br><b>CanDel Oil Ltd.</b>                                                                      |  | Exploratory Licence No. - N° de licence de sondage<br><b>1534</b> |                                             |

LOCATION - EMPLACEMENT

|                                                                       |                      |                                                  |                                                                                                                                  |                                  |
|-----------------------------------------------------------------------|----------------------|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Unit - Unité<br><b>A</b>                                              | Section<br><b>59</b> | Grid - Étendue quadrillée<br><b>65-30-130-30</b> | Latitude<br><b>65° 28' 04"</b>                                                                                                   | Longitude<br><b>130° 39' 47"</b> |
| Unique Well Identifier - Code d'ordinateur<br><b>300A596530130300</b> |                      |                                                  | Universal Well Location Reference - Références universelles d'emplacement du puits<br><b>Lat. 65.46778° N Long. 130.66305° W</b> |                                  |

|                                                | Date       | Depth - Profondeur | Pool(s)<br>Gisement(s) |
|------------------------------------------------|------------|--------------------|------------------------|
| Spudded<br>Début des travaux                   | Jan. 22/73 |                    |                        |
| Suspended<br>Suspension des travaux            |            |                    |                        |
| Resumed Operations<br>Reprise des travaux      |            |                    |                        |
| Finished Drilling<br>Forage terminé            | June 3/73  | 10515              |                        |
| Deepened<br>Approfondissement                  |            |                    |                        |
| Complete (Gas/Oil)<br>Achèvement (Gaz/Pétrole) |            |                    |                        |
| Abandoned<br>Abandon                           | June 11/73 | 10515              |                        |
| Rig Released<br>Fin des travaux                | June 11/73 | 10515              |                        |

|                                                                     |             |                                               |                          |
|---------------------------------------------------------------------|-------------|-----------------------------------------------|--------------------------|
| Elevation: Gr.<br>Altitude du sol                                   | <b>1890</b> | K.B.<br>du carré d'entraînement               | <b>1904.4</b>            |
| Rig No.<br>N° de la tour de forage                                  | <b>1</b>    | Drilling Contractor<br>Entrepreneur en forage | <b>Jennings Int. Dr.</b> |
| Contractor's Business Licence No.<br>N° du permis de l'entrepreneur |             | <b>10881</b>                                  |                          |

CASING RECORD - TUBAGE

| Casing Size (Inches)<br>Diamètre (en pouces) | Grade<br>Qualité | Weight<br>Poids | Amount<br>Longeur | Set at -<br>Fixation à | Sacks of Cement and Additives<br>Sacs de ciment et d'additifs |
|----------------------------------------------|------------------|-----------------|-------------------|------------------------|---------------------------------------------------------------|
| 1. 20"                                       | Conductor Pipe   |                 | 20'               | 20'                    | Full Lenth                                                    |
| 2. 16"                                       |                  |                 | 126               | 111'                   | 400 sx. + 1% CaCl <sub>2</sub>                                |
| 3. 9-5/8"                                    | KS               | 36#             | 1001'             | 998'                   | 835 sx. + 3% CaCl <sub>2</sub>                                |
| 4. "                                         | N-80             | 23#             | 5793'             | 5789'                  | 400 sx.                                                       |
| 5.                                           |                  |                 |                   |                        |                                                               |
| 6.                                           |                  |                 |                   |                        |                                                               |

| Geological Tops<br>Sommet des formations | Elevation - Profondeur          |                                     | Core Record - Carottes  |        |                    |           |        |                |
|------------------------------------------|---------------------------------|-------------------------------------|-------------------------|--------|--------------------|-----------|--------|----------------|
|                                          | Depths<br>Sous le niveau du sol | Sub Sea<br>Sous le niveau de la mer | From - de               | To - à | Rec.<br>Recupérées | From - de | To - à | Rec.<br>Recup. |
| Tertiary                                 | 145'                            | +1759                               | None                    |        |                    |           |        |                |
| Cretaceous                               | 245'                            | +1659                               |                         |        |                    |           |        |                |
| Sand #1                                  | 572'                            | +1332                               |                         |        |                    |           |        |                |
| Sand #2                                  | 1172'                           | + 732                               |                         |        |                    |           |        |                |
| Sand #3                                  | 1310'                           | + 594                               |                         |        |                    |           |        |                |
| Sand #4                                  | 3080'                           | -1176                               | Log Record - Diagrammes |        |                    |           |        |                |
| Sand #5                                  | 4180'                           | -2776                               |                         |        |                    |           |        |                |
| Mississippian                            | 4354'                           | -2450                               |                         |        |                    |           |        |                |
| U. Dev. - Imperial                       | 4420'                           | -2516                               |                         |        |                    |           |        |                |
| Basal Siltst.                            | 6367'                           | -4463                               |                         |        |                    |           |        |                |
| Canol                                    | 6665'                           | -4761                               |                         |        |                    |           |        |                |
| M. Dev. - Hare Ind.                      | 6920'                           | -5016                               |                         |        |                    |           |        |                |
| Hume                                     | 7133'                           | -5229                               |                         |        |                    |           |        |                |
| Headless                                 | 7306'                           | -5402                               |                         |        |                    |           |        |                |
| Gossage (Ls.)                            | 7556'                           | -5652                               |                         |        |                    |           |        |                |
| (Dol.)                                   | 8206'                           | -6302                               |                         |        |                    |           |        |                |
| Ord/Sil - Ronning                        | 9355'                           | -7451                               |                         |        |                    |           |        |                |

| CEMENTING RECORD (Plug, Squeeze, etc.)<br>CIMENTATION (Bouchon, sous pression, etc.) |           |        |                     | PERFORATING RECORD (Bullet, Jet)<br>PERFORATION (à balles, à jet) |           |        |                     | SERVICING RECORD (Acidizing, Fracing, etc.)<br>ENTRETIEN (acidification, fracturation, etc.) |           |        |                     |
|--------------------------------------------------------------------------------------|-----------|--------|---------------------|-------------------------------------------------------------------|-----------|--------|---------------------|----------------------------------------------------------------------------------------------|-----------|--------|---------------------|
| Date                                                                                 | From - de | To - à | Remarks - Remarques | Date                                                              | From - de | To - à | Remarks - Remarques | Date                                                                                         | From - de | To - à | Remarks - Remarques |
|                                                                                      |           |        | See attached sheet  |                                                                   |           |        |                     |                                                                                              |           |        |                     |

### DRILL STEM TESTS - ESSAIS AUX TIGES

| No. - N° | Date   | Formation | From - de | To - à | V.O. Mins.<br>Vanne ouverte<br>(minutes) | I.S.I. Mins.<br>Première<br>obturation<br>(minutes) | F.S.I. Mins.<br>Obturation<br>définitive<br>(minutes) | I.S.I.B.H.P.<br>Pression de fond<br>à la première<br>obturation | F.S.I.Q.H.P.<br>Pression de fond<br>à l'obturation<br>définitive | I.F.B.H.P.<br>Pression de fond<br>au jaillissement | F.F.B.H.P.<br>Pression de fond<br>à l'écoulement<br>définitif | L.H.P.<br>Pression<br>hydrostatique de<br>début | F.H.P.<br>Pression<br>hydrostatique<br>définitive | Remarks - Remarques                                                                         |
|----------|--------|-----------|-----------|--------|------------------------------------------|-----------------------------------------------------|-------------------------------------------------------|-----------------------------------------------------------------|------------------------------------------------------------------|----------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------|---------------------------------------------------|---------------------------------------------------------------------------------------------|
| 1.       | June 4 | Ronning   | 10230     | 10515  |                                          |                                                     |                                                       |                                                                 |                                                                  |                                                    |                                                               | 4723                                            | 4624                                              | Misrun                                                                                      |
| 2.       | June 5 | Ronning   | 10220     | 10515  |                                          |                                                     |                                                       |                                                                 |                                                                  |                                                    |                                                               | 4721                                            | 4500                                              | Misrun                                                                                      |
| 3.       | June 6 | Ronning   | 10390     | 10515  |                                          |                                                     |                                                       |                                                                 |                                                                  |                                                    |                                                               | 4800                                            | 4654                                              | Misrun                                                                                      |
| 4.       | June 8 | Gossage   | 8720      | 9225   |                                          |                                                     |                                                       |                                                                 |                                                                  |                                                    |                                                               | 4079                                            | 4002                                              | Misrun                                                                                      |
| 5        | June 9 | Gossage   | 8720      | 9225   | 90                                       | 30                                                  | 90                                                    | 3716                                                            | 3714                                                             | 2062                                               | 3706                                                          | 4051                                            | 3984                                              | St. air blow, died in 55 min.<br>Rec. 400' mud, 500' water-<br>cut mud & 7800' fresh water. |

| ANALYSIS - ANALYSE            |                       |           |        |           | PRESENT STATUS OF WELL<br>ETAT ACTUEL DU PUITS |                |            |            |                       |
|-------------------------------|-----------------------|-----------|--------|-----------|------------------------------------------------|----------------|------------|------------|-----------------------|
| Lab. No.<br>No de laboratoire | Sample<br>Echantillon | From - de | To - à | Source    | Remarks - Remarques                            | Oil<br>Pétrole | Gas<br>Gaz | Dry<br>Sec | Susp.<br>Travaux sus. |
| E73-498-3                     | Water                 | 8720      | 9225   | D.S.T. #5 |                                                |                |            |            |                       |
|                               |                       |           |        |           | Plugged & Abandoned                            |                |            |            |                       |
|                               |                       |           |        |           |                                                |                |            |            |                       |
|                               |                       |           |        |           |                                                |                |            |            |                       |

Company  
Société  
Candel Oil Ltd.

Signed by  
Signé par  
*[Signature]*

Title  
Titre  
*[Signature]*

Date  
Date  
August 3, 1973

Forms to be prepared in duplicate and forwarded to the District Conservation Engineer.

Présenter les formules remplies à l'ingénieur en conservation du district

CanDel Mobil et al N. Ramparts A-59

Attachment to Well Completion Data form

Cementing Record

| Date            | From  | To     | Remarks                                              |
|-----------------|-------|--------|------------------------------------------------------|
| Jan. 25/73      |       | 178'   | 150 sacks cement + 3% CaCl <sub>2</sub>              |
| Jan. 27         |       | 162'   | 100 sacks cement + 3% CaCl <sub>2</sub>              |
| Jan. 27         |       | 158'   | 500 sacks cement + 3% CaCl <sub>2</sub>              |
| Jan. 28         |       | 160'   | 300 sacks cement + 3% CaCl <sub>2</sub>              |
| Jan. 30         |       | 190'   | 100 sacks cement + 3% CaCl <sub>2</sub>              |
| Feb. 4          |       | 175'   | 100 sacks cement + 3% CaCl <sub>2</sub>              |
| Feb. 5          |       | 190'   | 100 sacks cement + 3% CaCl <sub>2</sub>              |
| Feb. 6          |       | 207'   | 100 sacks cement + 3% CaCl <sub>2</sub>              |
| Feb. 7          |       | 163'   | 100 sacks cement + 3% CaCl <sub>2</sub>              |
| Feb. 9          |       | 245'   | 100 sacks cement + 3% CaCl <sub>2</sub>              |
| Apr. 17         |       | 7149'  | 100 sacks gel + 30 sacks cement                      |
| Apr. 18         |       | 7149'  | 150 sacks gel w/50 sacks diesel +<br>75 sacks cement |
| Apr. 19         |       | 7149'  | 100 sacks cement w/20 sacks gel +<br>20 bbls. diesel |
| Apr. 26         | 6362' | 6292'  | 150 sacks cement                                     |
| Apr. 26         |       | 6331'  | 150 sacks cement                                     |
| Apr. 27         |       | 6260'  | 150 sacks cement                                     |
| Apr. 27         |       | 6163'  | 150 sacks cement                                     |
| Apr. 28         |       | 5927'  | 150 sacks cement                                     |
| Apr. 30         |       | 6353'  | 100 sacks cement                                     |
| June 5          | 10400 | 10515' | 30 sacks cement. Felt @ 10365'                       |
| June 6          | 9080  | 8880'  | Bridge plug. 45 sacks cement.                        |
| June 7 (re-run) | 9250  | 8850'  | 70 sacks cement. Top @ 9174'                         |
| June 8 (re-run) | 9250  | 8950'  | 69 sacks cement. Felt @ 9225'.                       |
| June 10         | 9225  | 8700'  | 110 sacks cement.                                    |
| June 10         | 5859  | 5739'  | 30 sacks cement. Felt @ 5710'                        |
|                 |       |        | 10 sacks in top surface casing.                      |



Drilling Authority No... 634

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT  
OIL AND MINERAL DIVISION



Application to Amend a Drilling Authority

This application, in triplicate, must be submitted and approved before commencing operations. If the well location is changed, this application must be accompanied where required, with a plan of survey approved by the Surveyor General.

In compliance with the "Canada Oil and Gas Land Regulations", application is hereby made to amend Drilling Authority No. 634, concerning CanDel Mobil et al N. Ramparts A-59

(Name and Number of Well)

Location: Unit A Sec. 59 Grid 65-30-130-30

Lot 65° 28' 04" Long 130° 39' 47"

Unique well Identifier 300A596530130300

20" conductor set @ 20'

16" conductor set @ 87'

9-5/8" surface casing set @ 998'

7" intermediate set @ 5789'

Reasons for the amendment:

No reservoir characteristics that would warrant testing have been encountered to a depth of 9900'. With 500' of Ronning penetrated it is felt that a depth of 10,700 to 10,800 should be given a try since the well is in the Ronning and maybe it will have something develop.

Dated at CALGARY, this 29th day of May, 1973

Signed by

Title Vice-President, Production

Company CanDel Oil Ltd.

(For Oil and Mineral Division use only)

APPROVED

This application has been examined and approved subject to the following conditions:

"CONFIRMING VERTICAL APPROVAL GIVEN MAY 28, 1973 BY J. J. KIRK."

"LICENSED TOTAL DEPTH - 10,800' "

Date June 4, 1973

for District Conservation Engineer

J. J. Kirk

Forms to be submitted to the District Conservation Engineer, for A. F. Halcrow  
Department of Indian Affairs and Northern Development.



MINISTÈRE DES AFFAIRES INDIENNES ET DU NORD CANADIEN  
DIVISION DU PÉTROLE ET DES MINÉRAUX

**Demande d'autorisation de forage**

La présente demande doit être remplie en trois exemplaires, puis présentée et approuvée avant le début des travaux. Si l'emplacement du (des) puits est modifié, la demande doit être accompagnée, au besoin, d'un levé approuvé par l'Arpenteur général.

Conformément au Règlement sur les terres pétrolifères et gazifères du Canada, il est demandé par la présente de modifier l'autorisation de forage n° ....., concernant .....

(nom du (des) puits et nombre)

Les modifications ci-après sont demandées: .....

Motifs de la demande: .....

Fait à ....., ce ..... jour de ....., 19.....

Signée par: .....

Poste: .....

Société: .....

(A l'usage de la Division du pétrole et des minéraux)

**APPROBATION**

La présente demande a été étudiée et approuvée sous réserve des conditions suivantes: .....

Date: ....., 19 .....

Ingénieur en conservation du district

Adresser vos demandes à l'ingénieur en conservation du district,  
Ministère des Affaires indiennes et du Nord canadien.



DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT  
OIL AND MINERAL DIVISION

## Application for a Drilling Authority

This notice of intention to begin drilling operations, in triplicate, and where required a plan of survey approved by the Surveyor General showing the target area or the site of the well must be submitted and approved before commencing operations.

In compliance with the "Canada Oil and Gas Land Regulations", application is hereby made for approval to drill:-

Name and number of well . . . . *Rift Mobil* **Candell et al. N. Ramparts A-59**

Location: Unit . . . . **A** . . . . Section . . . . **59** . . . . Grid . . . . **65-30-130-30**

Latitude . . . . **65° 28' 04"** . . . . Longitude . . . . **130° 39' 47"**

Unique Well Identifier . . . . **300A596530130300**

Universal Well Location Reference . . . . **Lat. 65.46778° N., Long. 130.66305° W.**

Elevation: Ground . . . . **1890** . . . . K.B. . . . . **1905** . . . . feet above sea-level.

Well is expected to produce from . . . . **Ronning** . . . . formation at a depth

of about . . . . **9600** . . . . feet. Expected total final depth **Approximately 10,000'**

Area assigned to well . . . . .

(for District Conservation Engineer's use only)

Permit No. . . . **4430** . . . . Lease No. . . . . Acreage . . . . **53,320**

Permittee, licensee, or lessee . . . . **Mobil Oil Canada, Ltd.**

Exploratory Licence No. . . . . **1471**

Surface owned by Crown or . . . . **D. Crown**

(If alienated submit name and address of owner and occupant.)

Petroleum and natural gas rights owned by . . . . **Crown**

We propose to use the following strings of casing, either cementing or landing them as indicated below:-

| Casing Size C.D. (Inches) | Weight (Lb./Ft.) | Grade                | New or Used | Estimated Depth | Sacks of Cement    |
|---------------------------|------------------|----------------------|-------------|-----------------|--------------------|
| 1. . . . <b>20"</b>       | <b>96#</b>       | <b>H-40 Buttrass</b> | <b>New</b>  | <b>60'</b>      | <b>approx. 60'</b> |
| 2. . . . <b>3-5/8"</b>    | <b>36#</b>       | <b>K-55</b>          | <b>New</b>  | <b>1000'</b>    | <b>525</b>         |
| 3. . . .                  |                  |                      |             |                 |                    |
| 4. . . .                  |                  |                      |             |                 |                    |
| 5. . . .                  |                  |                      |             |                 |                    |

**8-5/8" Open Hole will be drilled to facilitate running up to 7" casing.**

Expected water, gas, and oil horizons and type of control equipment **B.O.P. Equipment & drilling fluid**  
**Four Cretaceous Sands, Gossage, Ronning**

Well will be drilled with Rotary Rig No. . . . **1** . . . . by **Jennings International Drilling**

(Drilling Contractor or company)

**Division of PanCan Industries Ltd.**

Responsible agent of applicant:-

At well . . . . **D. R. Nelson** . . . . Contractor's Business Licence No. . . . **10881**

Address **Box 54, Norman Wells, N.W.T.** . . . . At registered office . . . . **R. K. Terrell**

Address **330 5th Ave. S.W., Calgary, Alberta**

It is understood that if changes become necessary, notice of the change of plan will be submitted.

Dated at **Calgary** . . . . this **23rd** . . . . day of **November** . . . . 19 **72**

Signed by . . . . *R. K. Terrell* . . . . Company **Candell Oil Ltd.**

Title **Vice President, Production** . . . . Operator's Licence No. . . . **1534**

(For Oil and Mineral Division use only)

### APPROVED

This application has been examined and approved subject to the following conditions:

PLEASE SEE ATTACHED FOR CONDITION OF APPROVAL

Dated. December 1, . . . . 19. 72. . . . *John D. Kirk*

District Conservation Engineer

Forms to be submitted to District Conservation Engineer,  
Department of Indian Affairs and Northern Development.



MINISTÈRE DES AFFAIRES INDIENNES ET DU NORD CANADIEN  
DIVISION DU PÉTROLE ET DES MINÉRAUX

# **Demande d'autorisation de forage**

Avant de commencer les travaux, soumettre (en triple exemplaire) et faire approuver le présent avis (indiquant l'intention d'entreprendre des travaux de forage) et, au besoin, un plan d'arpentage reconnu par l'arpenteur général, montrant l'aire de sondage ou l'emplacement du puits.

Conformément au «Règlement sur les terres pétrolifères et gazifères du Canada», nous demandons l'autorisation d'effectuer des travaux de forage.

Nom et n° du puits . . . . .

Emplacement: Unité . . . . . Section . . . . . Étendue quadrillée . . . . .

Latitude . . . . . Longitude . . . . .

Code d'ordinateur . . . . .

Références universelles d'emplacement du puits. . . . .

Élévation: du sol . . . . . du carré d'entraînement . . . . . pieds au-dessus du niveau de la mer

Production prévue quand les tiges atteindront la formation . . . . . à une profondeur approximative de

. . . . . pieds. Profondeur totale prévue . . . . .

Superficie assignée au puits . . . . .  
(à l'usage de l'ingénieur en conservation du district)

No de permis . . . . . No de concession . . . . . Superficie . . . . .

Détenteur de permis ou de licence, ou concessionnaire . . . . .

No de permis de prospection . . . . .

Terres appartenant à la Couronne ou à . . . . .  
(Dans le cas de terres aliénées, donner le nom et l'adresse du propriétaire et de l'occupant)

Détenteur(s) des droits pétroliers et gaziers . . . . .

Nous prévoyons utiliser les colonnes de tubage suivantes et de les cimenter ou de les sceller, tel qu'il est indiqué ci-dessous:--

| Diamètre extérieur (en<br>pouces) de tubages | Poids (liv./pi.) | Qualité   | Tubages neufs ou usagés | Profondeur<br>estimative | Sacs de ciment |
|----------------------------------------------|------------------|-----------|-------------------------|--------------------------|----------------|
| 1. . . . .                                   | . . . . .        | . . . . . | . . . . .               | . . . . .                | . . . . .      |
| 2. . . . .                                   | . . . . .        | . . . . . | . . . . .               | . . . . .                | . . . . .      |
| 3. . . . .                                   | . . . . .        | . . . . . | . . . . .               | . . . . .                | . . . . .      |
| 4. . . . .                                   | . . . . .        | . . . . . | . . . . .               | . . . . .                | . . . . .      |
| 5. . . . .                                   | . . . . .        | . . . . . | . . . . .               | . . . . .                | . . . . .      |

Nappes d'eau, de gaz et de pétrole prévues et genre de matériel anti-éruption. . . . .

Le puits sera foré à l'aide de la tour rotary n°. . . . . par . . . . .  
(Entrepreneur ou société de forage)

Agent responsable pour le requérant:-- No de permis de l'entrepreneur . . . . .

Sur le chantier . . . . . Au siège . . . . .

Adresse . . . . . Adresse . . . . .

Il est entendu que, dans le cas de modifications indispensables, un avis sera soumis.

Datée -- . . . . . le . . . . . 19. . . . .

Signé par . . . . . Société. . . . .

Titre . . . . . No de licence de sondage de l'exécutant . . . . .

(À l'usage de la Division du pétrole et des minéraux)

## **APPROBATION**

Demande étudiée et approuvée sous réserve des conditions suivantes:

Date . . . . . 19. . . . .

Ingénieur en conservation du district  
Présenter les formules à l'ingénieur en conservation du district,  
Ministère des Affaires indiennes et du Nord canadien.

CONDITIONS OF APPROVAL FOR DRILLING AUTHORITY NO. 634  
FOR CanDel Mobil et al Ramparts A-59

1. Copies of this Drilling Authority shall be exhibited at the Drilling rig in both the Doghouse and the Drilling Foremans Office between spud and rig release dates.
2. The Company will submit to this Office, on Tuesdays of each week/daily, the latest reports received by radio on the progress of the well.
3. During well drilling and testing operations, every effort shall be made to ensure that drilling fluids, chemicals and waste shall be disposed of or contained in a manner that will prevent the contamination of adjacent vegetation and surface or sub-surface waters.
4. We draw your attention to Sections 95 and 96 of the Canada Oil and Gas Land Regulations.
5. Any additional strings of casing must be approved by the District Conservation Engineer prior to running.
6. All significant shows of oil and/or gas are to be reported to the District Conservation Engineer immediately.
7. Should a fatal accident occur, drilling operations are to be suspended and the District Conservation Engineer notified immediately. Permission to resume drilling must be granted by the District Conservation Engineer after a fatality.
8. Forward to this Office two field print-copies of all well logs with formation tops marked thereon and three copies of core analysis and fluid analysis as soon as they are available.
9. Formation tops (samples or logs) of the section penetrated each week are to be reported with the weekly drilling reports.

*John J. Kirk*  
for. A.F. Halcrow  
District Conservation Engineer  
District 2 and 3

# GEOLOGICAL PROGNOSIS

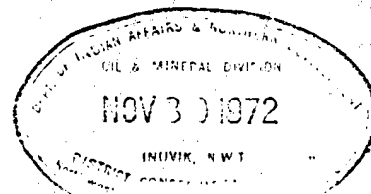
Well Name CanDel Mobil et al N. Ramparts A-59

Location 65°28'04", 130°39'47"

Elevation Ground: 1890' (SP 2450, Line 36-36)  
K. B. : 1905' (Estimated)

Operator CanDel Oil Ltd.

Contractor Jennings International Drilling - Rig # 1



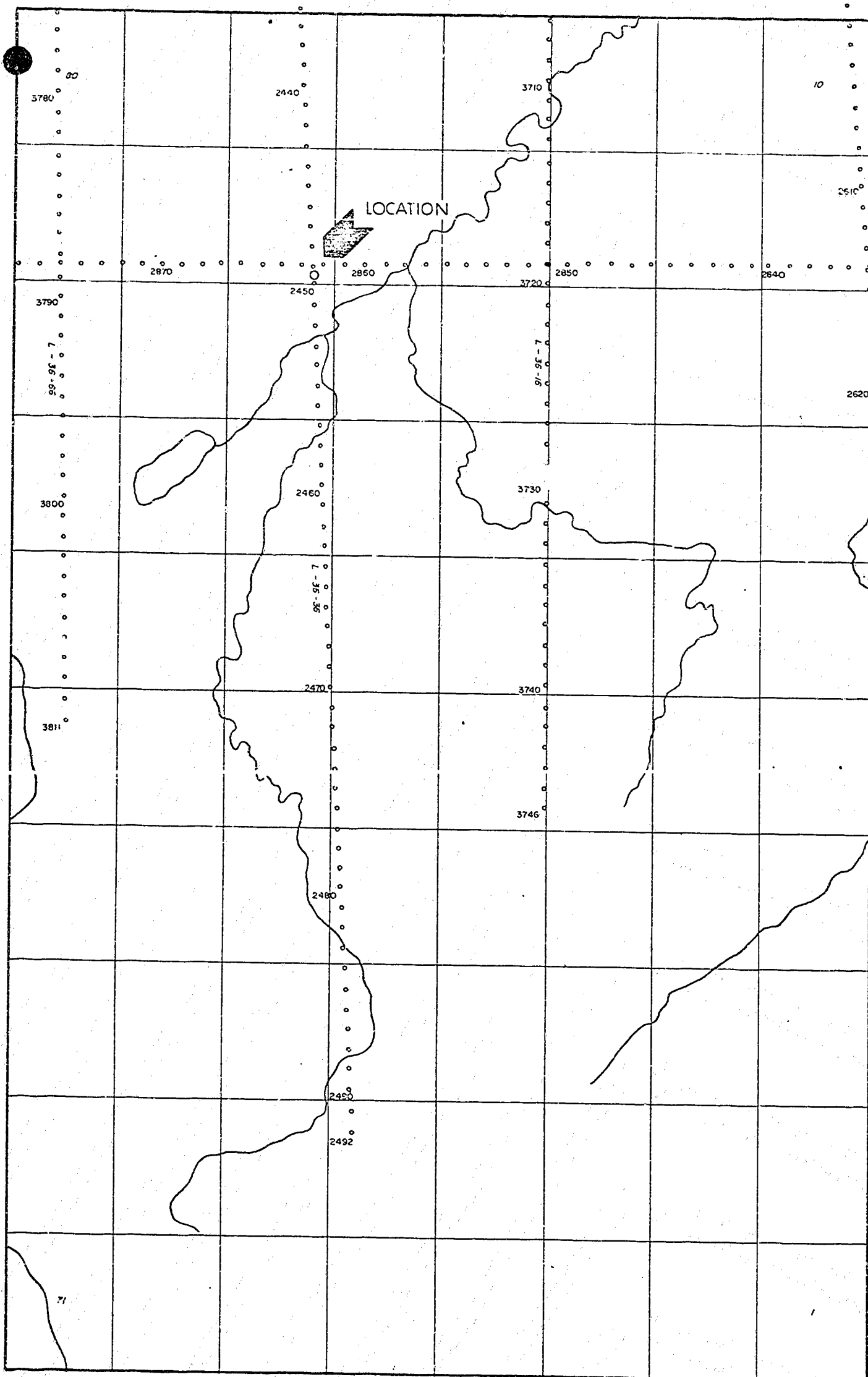
| <u>Markers</u> | <u>Formation</u>            | <u>Drilling Depth</u> | <u>Subsea</u> |
|----------------|-----------------------------|-----------------------|---------------|
|                | Cretaceous                  | Near Surface          |               |
|                | Sand # 1                    | 1225                  | - 630         |
|                | Sand # 2                    | 2035                  | - 130         |
|                | Sand # 3                    | 3195                  | - 1290        |
|                | Sand # 4                    | 3795                  | - 1890        |
|                | Upper Devonian Imperial     | 4355                  | - 2450        |
|                | Canol                       | 6020                  | - 4115        |
|                | Hare Indian                 | 6150                  | - 4245        |
|                | Middle Devonian Hume        | 6915                  | - 5010        |
|                | Gossage                     | 7515                  | - 5610        |
|                | Silurian/Ordovician Ronning | 9255                  | - 7350        |
|                | Total Depth                 | 9755                  | - 7850        |

Nov. 23/72

130° 45'

130° 30'

65° 30'



65° 20'

|                   |  |                    |         |                                                                              |
|-------------------|--|--------------------|---------|------------------------------------------------------------------------------|
| CANDEL OIL LTD.   |  | CALGARY<br>ALBERTA | REVISED | SEISMIC SHOT-POINT MAP<br>WELL LOCATION<br>CANDEL MOBIL ETAL N.Ramparts A-59 |
| INTERPRETATION BY |  |                    |         |                                                                              |
| DRAWN BY          |  | DATE               |         |                                                                              |
| CHECKED BY        |  | DATE               |         |                                                                              |
| SCALE             |  | MILES              | 0       |                                                                              |

JENNINGS INTERNATIONAL DRILLING  
RIG NO. 1  
BOP DIAGRAM

CHECK VALVE

Flow Nipple

2" HOLE FILL LINE

10" HYDRIL  
900 SERIES

1-3" 900 SERIES 1-2" 900 SERIES  
FLANGED STEEL VALVE FLANGED  
STEEL VALVE

2" STEEL LINE  
TO MANIFOLD  
OR MUD TAP

2" OUTLET

3" OUTLET

Blank

SPACE SAVER  
FLANGE

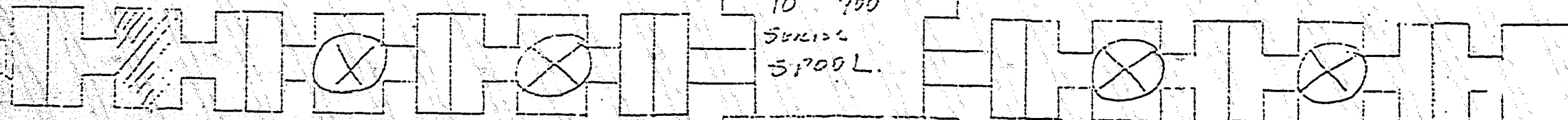
CLOSING ARMS  
EXTEND OUT SIDE  
OF SUB BASE

HYDRAULIC  
10" S.S. CAMBON.  
DOUBLE RAM.  
TOP PIPE RAMS  
BOTTOM BLANK

CLOSING ARMS EXTEND TO OUT  
SIDE SUB BASE

2" LINE TO SUB  
AND MUD TAP

10" 900  
SERIES  
SPOOL



2" 1-2" 900 SERIES  
CHECK STEEL  
FLANGED VALVE

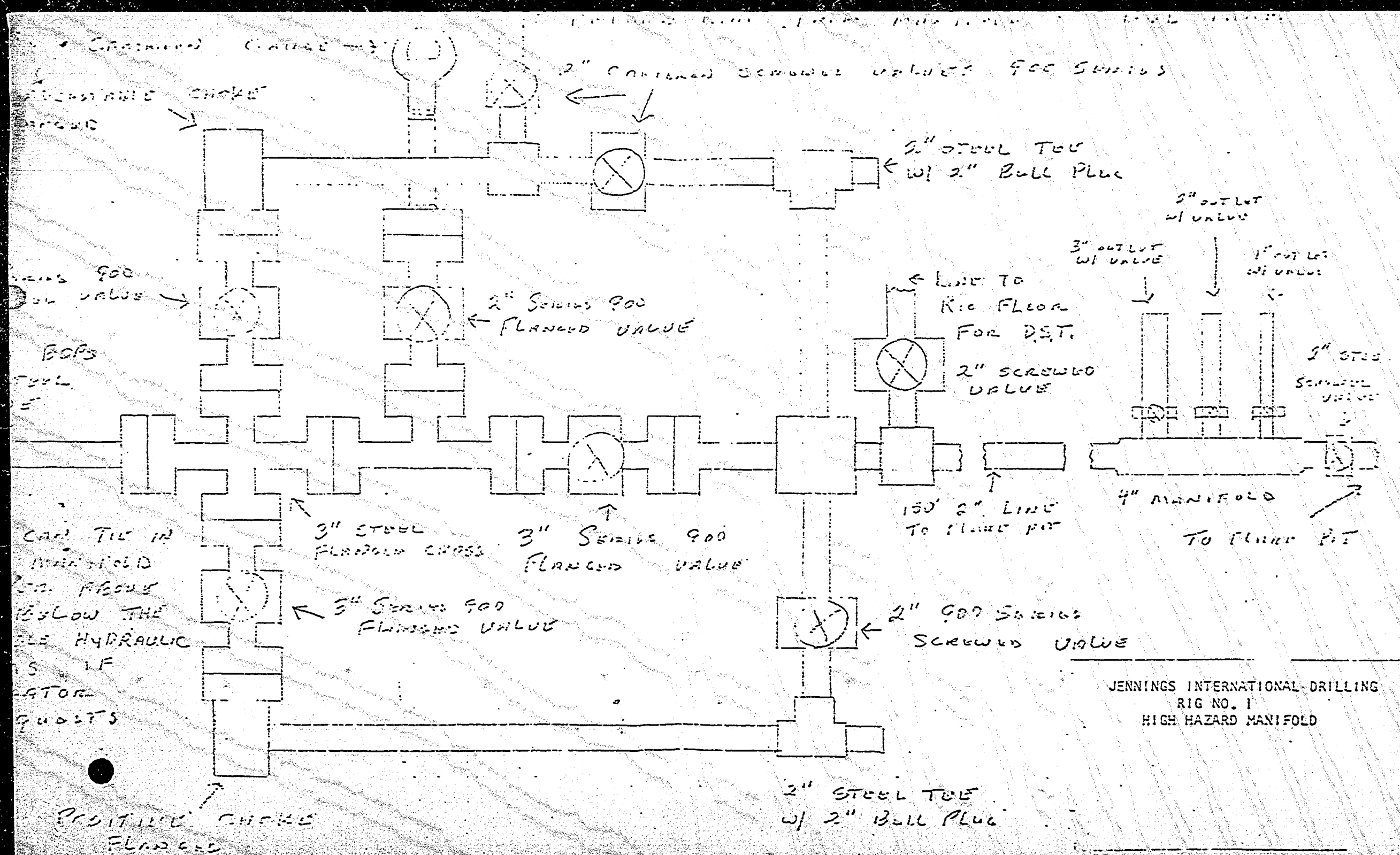
2" 2-2" 900 SERIES  
FLANGED STEEL  
VALVE

CASING  
BOWL

3" OUTLET

2-2" 900 SERIES  
FLANGED STEEL VALVES

1-2" STEEL  
FLANGED POSITI  
CHOKE





# CHEMICAL & GEOLOGICAL LABORATORIES LTD.

EDMONTON — FORT ST. JOHN — CALGARY

## — WATER ANALYSIS —



LABORATORY NUMBER  
E73-498-3

CANDEL OIL LTD.

SAMPLE LOCATION

FIELD OR AREA

OPERATOR NAME AND ADDRESS

WELL OR SAMPLE LOCATION NAME  
CANDEL MOBIL et al N. RAMPARTS A-59

POOL OR ZONE

NAME OF SAMPLER

Jim Nelson

ELEVATIONS  
KB GRD  
1904'

COMPANY  
Lynes United  
Services

TEST TYPE & NO  
D.S.T. 5

TEST RECOVERY  
400' Mud, 500' Water Cut Mud, 7800' Water

TEST INTERVAL OR PERFS

POINT OF SAMPLE

AMT & TYPE OF CUSHION

MUD RESISTIVITY

Bottom

8720' - 9225'

TYPE OF PRODUCTION

PUMPING

FLOWING

GAS LIFT

SWAB

PRODUCTION RATES

WATER

BBL5/D OIL

BBL5/D GAS

MCF/D

PRESSURES - PSIG

TEMPERATURES (°F)

SEPARATOR TREATER

RESERVOIR

CONTAINER  
WHEN  
SAMPLED WHEN  
RECEIVED

SEPARATOR TREATER

CONTAINER  
WHEN  
SAMPLED WHEN  
RECEIVED

DATE SAMPLED (D/M/Y) DATE RECEIVED (D/M/Y) DATE ANALYZED (D/M/Y)

09/06/73

15/06/73

28/06/73

ANALYST

T. Shirtliff

REMARKS

| ION | MG/L  | MG %  | MEQ %  | ION              | MG/L | MG %  | MEQ/L  |
|-----|-------|-------|--------|------------------|------|-------|--------|
| Na  | 2756  | 30.89 | 119.87 | Cl               | 4934 | 46.30 | 139.14 |
| K   |       |       |        | Br               |      |       |        |
| Ca  | 503   | 8.35  | 25.11  | I                |      |       |        |
| Mg  | 64    | 1.76  | 5.29   | HCO <sub>3</sub> | 205  | 1.12  | 3.36   |
| Ba  |       |       |        | SO <sub>4</sub>  | 374  | 2.58  | 7.77   |
| Sr  |       |       |        | CO <sub>3</sub>  |      |       |        |
| Fe  | Trace |       |        | OH               |      |       |        |
|     |       |       |        | H <sub>2</sub> S | Nil  |       |        |

TOTAL SOLIDS Mg/L

BY EVAPORATION

BY EVAPORATION

9440 @ 110°C

@ 180°C

AT IGNITION

CALCULATED

8568

8836

SOME ORGANIC MATTER PRESENT.

SPECIFIC GRAVITY

REFRACTIVE INDEX

1.009 @ 50°C

1.3348 @ 25°C

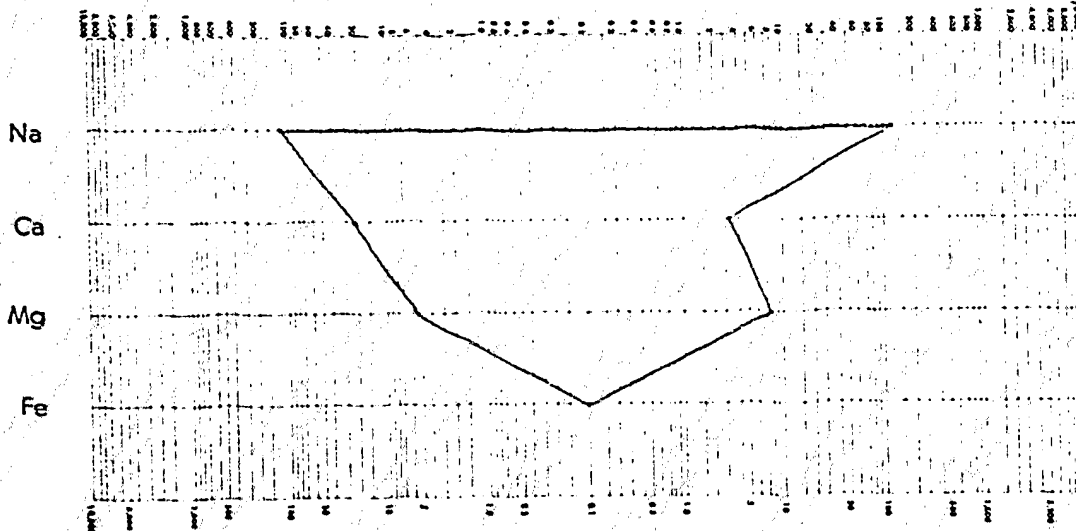
OBSERVED PH

RESISTIVITY (Ohm/meter)

8.2 @ 80°C

0.658 @ 25°C

LOGARITHMIC PATTERN MEQ PER LITER



Remarks and Conclusions

Cl Sample consisted of  
colourless water  
with a thin layer of  
sediment.

HCO<sub>3</sub>

SO<sub>4</sub>

CO<sub>3</sub>

continued.....

CANDEL OIL LTD.

LABORATORY REPORT NUMBER: E73-498-3

E73-498-1: Sample From Top

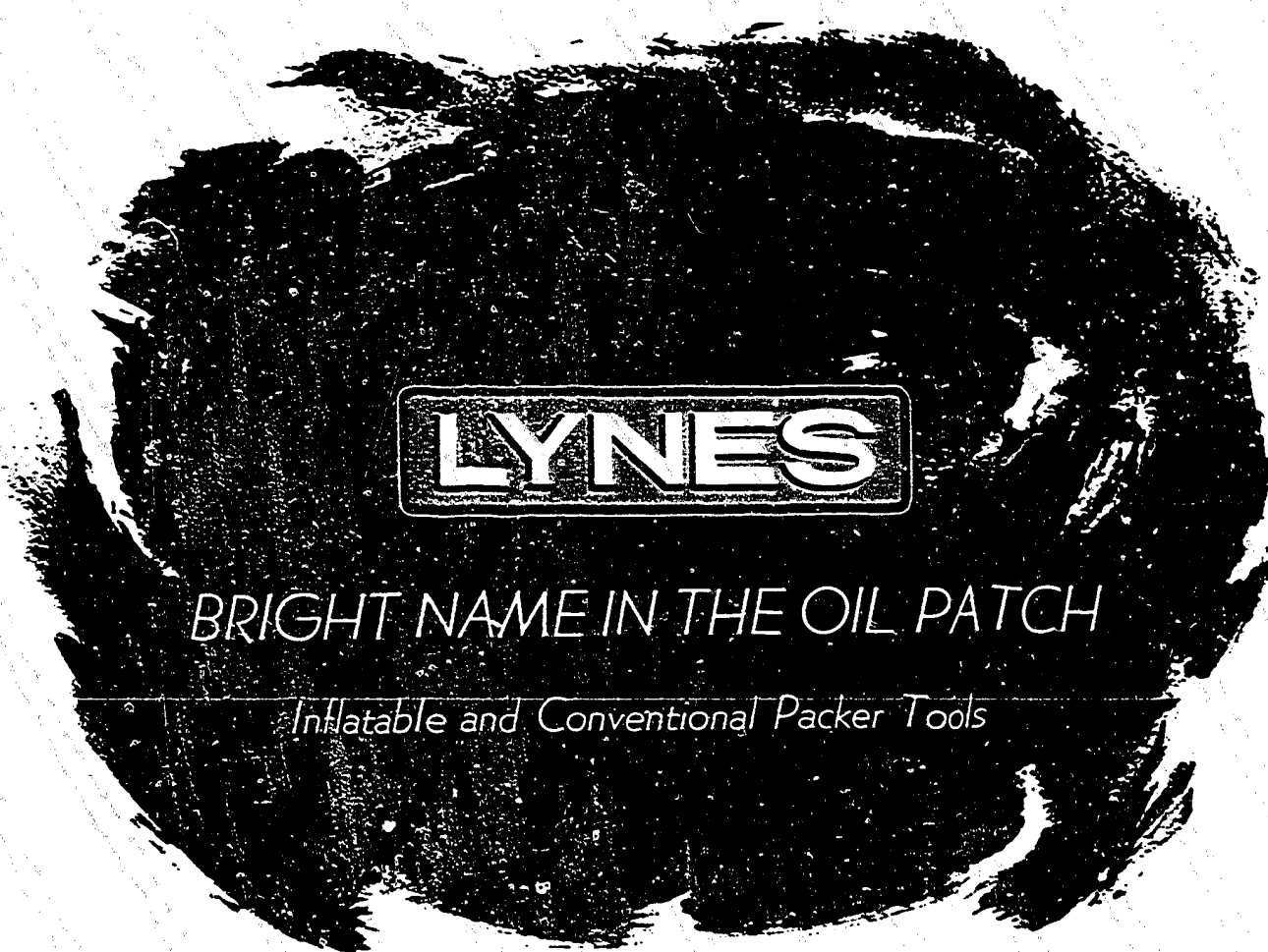
RESISTIVITY: 0.812 Ohm-Meters @ 25°C.

Sample consisted of approximately 50% mud and  
50% colourless water.

E73-498-2: Sample from middle

RESISTIVITY: 0.698 Ohm-Meters @ 25° C.

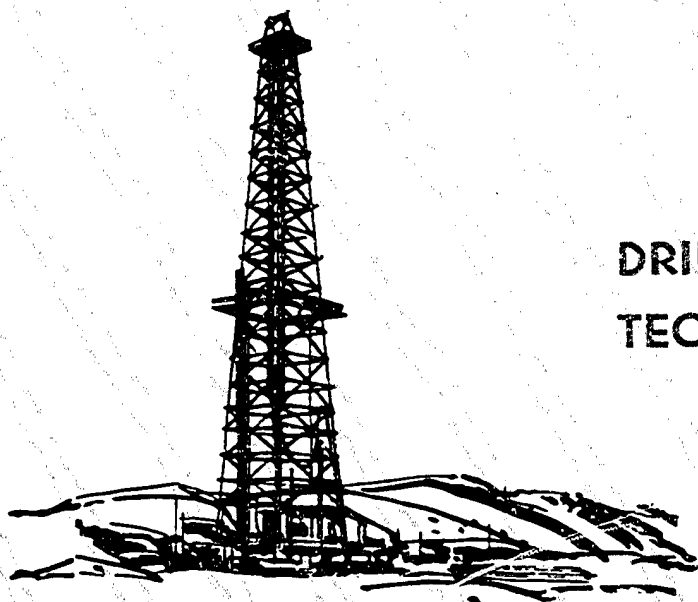
Sample consisted of colourless water with a  
thin layer of sediment.



**LYNES**

BRIGHT NAME IN THE OIL PATCH

*Inflatable and Conventional Packer Tools*



**DRILL STEM TEST  
TECHNICAL SERVICE REPORT**

## NOMENCLATURE (Definition of Symbols)

|          |                                                                                  |
|----------|----------------------------------------------------------------------------------|
| $Q$      | = average production rate during test, bbls./day                                 |
| $Q_g$    | = measured gas production rate during test MCF/day                               |
| $k$      | = permeability, md                                                               |
| $h$      | = net pay thickness, ft. (when unknown, test interval is chosen)                 |
| $\mu$    | = fluid viscosity, centipoise                                                    |
| $Z$      | = compressibility factor                                                         |
| $T_r$    | = reservoir temperature, ° Rankine                                               |
| $m$      | = slope of final SIP buildup plot, psig/cycle (psig <sup>2</sup> /cycle for gas) |
| $b$      | = approximate radius of investigation, feet                                      |
| $r_w$    | = wellbore radius, feet                                                          |
| $t_o$    | = total flowing time, minutes                                                    |
| $P_o$    | = Extrapolated maximum reservoir pressure, psig                                  |
| $P_r$    | = final flowing pressure, psig                                                   |
| $P.I.$   | = productivity index, bbls./day/psi                                              |
| $P.I._t$ | = theoretical productivity index with damage removed, bbl./day/psi               |
| $D.R.$   | = damage ratio                                                                   |
| $E.D.R.$ | = estimated damage ratio                                                         |
| $AOF$    | = absolute open flow potential, MCF/D                                            |
| $AOF_t$  | = theoretical absolute open flow if damage were removed                          |
| $Z$      | = subsea depth                                                                   |
| $W$      | = water gradient based on salinity                                               |
| $H_w$    | = potentiometric surface                                                         |

| INTERPRETATION CALCULATIONS (OIL/WATER)                                                                                                                                                                                                                                                                                                                                                                                              |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| <b>AVERAGE PRODUCTION RATE DURING TEST</b><br>$Q = \frac{1440 (\text{drill collar capacity} \times \text{recovery} - \text{drill pipe capac.} \times \text{recovery})}{\text{initial flow time} - \text{final flow time}}$<br>$= \frac{1440 [ ( ) ( ) - ( ) ( ) ]}{( ) - ( )}$<br>$= \frac{1440 [ ( ) ( ) ( ) ( ) + ( ) ( ) ( ) ( ) ]}{( ) + ( )}$<br>$= \frac{1440 [ ( ) ( ) ( ) ( ) ( ) ( ) ]}{( ) + ( )}$<br>$= \text{bbls./day}$ |  |  |  |
| <b>FLUID PROPERTIES</b> Estimated Bottom Hole Temperature = °                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |
| API Gravity @ 60° F.      ° Specific Gravity @ 60° F      Est. Viscosity      cp                                                                                                                                                                                                                                                                                                                                                     |  |  |  |
| <b>TRANSMISSIBILITY</b><br>$\frac{kh}{\mu} = \frac{162.8 Q_o Z T_r}{m} = \frac{162.8 ( ) ( ) ( )}{( )} = \text{md.-ft./cp}$                                                                                                                                                                                                                                                                                                          |  |  |  |
| <b>IN SITU CAPACITY</b><br>$kh = ( ) ( ) = \text{md.-ft.}$                                                                                                                                                                                                                                                                                                                                                                           |  |  |  |
| <b>AVERAGE EFFECTIVE PERMEABILITY</b> Estimated Pay Thickness      Ft.<br>$k = \frac{( )}{( )} = \text{md.}$ Actual Pay Thickness      Ft.                                                                                                                                                                                                                                                                                           |  |  |  |
| <b>PRODUCTIVITY INDEX</b><br>$PI = \frac{Q}{P_o - P_r} = \frac{( )}{( ) - ( )} = \text{bbl./day-psi}$                                                                                                                                                                                                                                                                                                                                |  |  |  |
| <b>DAMAGE RATIO</b><br>$D.R. = \frac{0.183 (P_o - P_r)}{m} = \frac{0.183 [ ( ) - ( ) ]}{( )} =$                                                                                                                                                                                                                                                                                                                                      |  |  |  |
| <b>PRODUCTIVITY INDEX WITH DAMAGE REMOVED</b><br>$P.I._t = P.I. \times D.R. = ( ) ( ) = \text{bbl./day-psi}$                                                                                                                                                                                                                                                                                                                         |  |  |  |
| <b>APPROXIMATE RADIUS OF INVESTIGATION</b><br>$b = \sqrt{rt_o} = \sqrt{( ) ( )} = \text{ft.}$                                                                                                                                                                                                                                                                                                                                        |  |  |  |
| <b>Drawdown Factor</b> = $\frac{1.813 P_o - F.S.I.P.}{1.813 P_o} \times 100 = \frac{( ) - ( )}{( )} \times 100 = \text{ } \%$ (4% to 5% is considered serious or substantial)                                                                                                                                                                                                                                                        |  |  |  |
| <b>Potentiometric Surface</b> = $H_w + \frac{Z + P_o}{W} - h_w = ( ) + \frac{( ) + ( )}{( )} - ( ) = \text{ft.}$                                                                                                                                                                                                                                                                                                                     |  |  |  |

| INTERPRETATION CALCULATIONS (GAS)                                                                                                                                                                                                                                 |  |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| <b>ESTIMATED GAS PROPERTIES</b> $R(T_d) =$ °<br>Gravity @ 60° F      Viscosity (Res.)      cp      Estimated Bottom Hole Temperature      °<br>Compressibility Factor (Z)                                                                                         |  |  |  |
| <b>TRANSMISSIBILITY</b> Measured D.S.T. Gas Rate =      mcf/d.<br>$\frac{kh}{\mu} = \frac{1637 Q_g Z T_r}{m} = \frac{1637 ( ) ( ) ( )}{( )} = \text{md.-ft./cp.}$                                                                                                 |  |  |  |
| <b>IN SITU CAPACITY</b><br>$kh = ( ) ( ) = \text{md.-ft.}$                                                                                                                                                                                                        |  |  |  |
| <b>AVERAGE EFFECTIVE PERMEABILITY</b> Estimated Pay Thickness      Ft.<br>$k = \frac{( )}{( )} = \text{md.}$ Actual Pay Thickness      Ft.                                                                                                                        |  |  |  |
| <b>APPROXIMATE RADIUS OF INVESTIGATION</b><br>$b = 0.02 \sqrt{kt_o P_o} = 0.02 \sqrt{( ) ( ) ( )} = \text{ft.}$                                                                                                                                                   |  |  |  |
| <b>ACTUAL CAPACITY</b><br>$kh = \frac{3270 Q_g \mu Z T_r \log(0.472 r_o)}{P_o^2 - P_r^2} = \frac{3270 ( ) ( ) ( ) ( ) \log( )}{( )^2 - ( )^2} = \text{md.-ft.}$                                                                                                   |  |  |  |
| <b>DAMAGE RATIO</b> $E.D.R. = \frac{(P_o^2 - P_r^2)}{m (\log T_o + 2.65)}$<br>$D.R. = \frac{\text{In Situ Capacity}}{\text{Actual Capacity}} = \frac{( )}{( )} =$ $E.D.R. =$                                                                                      |  |  |  |
| <b>ESTIMATED RANGE OF AOF POTENTIAL</b><br>$\text{Max. AOF} = \frac{Q_o P_o^2}{P_o^2 - P_r^2} = \frac{( ) ( )^2}{( )^2 - ( )^2} = \text{MCF/D}$<br>$\text{Min. AOF} = \frac{Q_o P_o}{\sqrt{P_o^2 - P_r^2}} = \frac{( ) ( )}{\sqrt{( )^2 - ( )^2}} = \text{MCF/D}$ |  |  |  |
| <b>ESTIMATED RANGE OF AOF POTENTIAL DAMAGE REMOVED</b><br>$\text{Max. AOF}_t = (\text{Max. AOF}) (D.R.) = ( ) ( ) = \text{MCF/D}$<br>$\text{Min. AOF}_t = (\text{Min. AOF}) (D.R.) = ( ) ( ) = \text{MCF/D}$                                                      |  |  |  |
| <b>Drawdown Factor</b> = $\frac{1.813 P_o - F.S.I.P.}{1.813 P_o} \times 100 = \frac{( ) - ( )}{( )} \times 100 = \text{ } \%$ (4% to 5% is considered serious or substantial)                                                                                     |  |  |  |
| <b>Potentiometric Surface</b> = $H_w + \frac{Z + P_o}{W} - h_w = ( ) + \frac{( ) + ( )}{( )} - ( ) = \text{ft.}$                                                                                                                                                  |  |  |  |

# LYNES UNITED SERVICES LTD.

| TEST DATA                                            |  |                               |  | GENERAL INFORMATION                                                  |  |                                                  |  |
|------------------------------------------------------|--|-------------------------------|--|----------------------------------------------------------------------|--|--------------------------------------------------|--|
| Test No. <u>1</u>                                    |  | Lynes Test <u>7</u>           |  | Company <u>Candel Oil Ltd.</u>                                       |  |                                                  |  |
| Formation <u>Bonning</u>                             |  | T.D. <u>10515</u>             |  | Ft. Address                                                          |  |                                                  |  |
| Interval Tested <u>10230</u>                         |  | Ft. to <u>10515</u>           |  | Ft. Address                                                          |  |                                                  |  |
| Interval Tested <u>285</u>                           |  | Ft. Net Pay Tested            |  | Ft.                                                                  |  |                                                  |  |
| Type of Test <u>Bottom Hole Conv.</u>                |  |                               |  |                                                                      |  |                                                  |  |
| Cushion                                              |  | Amount                        |  | Ft.                                                                  |  | Well Name <u>Candel Mobil et al N. Ramparts</u>  |  |
| Started in Hole at <u>2:00</u>                       |  | Hrs. Tool Open at <u>5:00</u> |  | Hrs.                                                                 |  | Well Number <u>A-59</u>                          |  |
| Pre-Flow                                             |  | Mins. Initial Shut-in         |  | Mins.                                                                |  | K.B. Elevation <u>1904</u> Sub-Sea Elevation     |  |
| 2nd Flow                                             |  | Mins. Second Shut-in          |  | Mins.                                                                |  | Area <u>Norman Wells</u> Province <u>Alberta</u> |  |
| Final Flow                                           |  | Mins. Final Shut-in           |  | Mins.                                                                |  | Company Rep. <u>J. Nelson</u>                    |  |
| Remarks: <u>Seat failure.</u>                        |  |                               |  | Tester <u>D. Nelson</u>                                              |  |                                                  |  |
|                                                      |  |                               |  | Contractor <u>Jennings</u> Ria No. <u>1</u>                          |  |                                                  |  |
| Blow:                                                |  |                               |  | Ticket No. <u>7395</u> Date <u>June 4/73</u>                         |  |                                                  |  |
|                                                      |  |                               |  | Service Reports To:                                                  |  |                                                  |  |
|                                                      |  |                               |  | <u>5 - above address</u>                                             |  |                                                  |  |
| GAS BLOW MEASUREMENTS                                |  |                               |  |                                                                      |  |                                                  |  |
| Measured with                                        |  |                               |  | MUD AND HOLE DATA                                                    |  |                                                  |  |
|                                                      |  |                               |  | Mud Type <u>Gel Chem</u>                                             |  |                                                  |  |
|                                                      |  |                               |  | Weight <u>8.9</u> Viscosity <u>80</u> Water Loss <u>9.8</u>          |  |                                                  |  |
|                                                      |  |                               |  | Filter Cake <u>2/32"</u> Bottom Hole Temperature                     |  |                                                  |  |
|                                                      |  |                               |  | Drill Pipe Size <u>3 1/2 IF</u> Weight <u>13.3</u>                   |  |                                                  |  |
|                                                      |  |                               |  | Drill Collars <u>3 1/2 IF</u> I.D. <u>2 1/16</u> Feet Run <u>499</u> |  |                                                  |  |
|                                                      |  |                               |  | Main Hole or Casing Size <u>6 1/8"</u>                               |  |                                                  |  |
|                                                      |  |                               |  | Rathole or Liner Size No. of Feet                                    |  |                                                  |  |
|                                                      |  |                               |  | Bottom Hole Choke Size <u>5/8"</u>                                   |  |                                                  |  |
|                                                      |  |                               |  | Surface Choke Size                                                   |  |                                                  |  |
|                                                      |  |                               |  | Packer Rubber Size <u>5 1/2"</u>                                     |  |                                                  |  |
|                                                      |  |                               |  | REMARKS <u>Seat failure.</u>                                         |  |                                                  |  |
| RECOVERY                                             |  |                               |  |                                                                      |  |                                                  |  |
| TOTAL FLUID RECOVERED <u>3400</u> Ft. Consisting of: |  |                               |  |                                                                      |  |                                                  |  |
| <u>3400</u> Ft. of <u>mud 1</u>                      |  |                               |  |                                                                      |  |                                                  |  |
| Ft. of                                               |  |                               |  |                                                                      |  |                                                  |  |
| Ft. of                                               |  |                               |  |                                                                      |  |                                                  |  |
| Ft. of                                               |  |                               |  |                                                                      |  |                                                  |  |
| Test was/was not Reverse Circulated                  |  |                               |  |                                                                      |  |                                                  |  |
| Oil Recovery A.P.I. Water Specific Gravity           |  |                               |  |                                                                      |  |                                                  |  |
| Salinity                                             |  |                               |  |                                                                      |  |                                                  |  |
| PRESSURE READINGS                                    |  |                               |  |                                                                      |  |                                                  |  |
| Inside <u>X</u> Outside <u>4</u>                     |  | Inside <u>Outside X</u>       |  | Inside <u>Outside X</u>                                              |  | Inside <u>Outside</u>                            |  |
| Recorder No. <u>1619</u>                             |  | Recorder No. <u>5323</u>      |  | Recorder No. <u>662</u>                                              |  | Recorder No.                                     |  |
| Capacity <u>6100</u>                                 |  | Capacity <u>8000</u>          |  | Capacity <u>8400</u>                                                 |  | Capacity                                         |  |
| Depth <u>10214</u>                                   |  | Depth <u>10241</u>            |  | Depth <u>10246</u>                                                   |  | Depth                                            |  |
| NUMBER KEY:                                          |  | recorder                      |  | 4723                                                                 |  | 4726                                             |  |
| 1 - INITIAL HYDROSTATIC                              |  | malfunctioned                 |  |                                                                      |  |                                                  |  |
| 2 - PRE-FLOW                                         |  |                               |  | misrun                                                               |  |                                                  |  |
| 3 - INITIAL SHUT-IN                                  |  |                               |  |                                                                      |  |                                                  |  |
| 4a - 2nd INITIAL FLOW                                |  |                               |  |                                                                      |  |                                                  |  |
| 4b - 2nd FINAL FLOW                                  |  |                               |  |                                                                      |  |                                                  |  |
| 4c - 2nd SHUT-IN                                     |  |                               |  |                                                                      |  |                                                  |  |
| 5 - 3rd INITIAL FLOW                                 |  |                               |  |                                                                      |  |                                                  |  |
| 6 - FINAL FLOW                                       |  |                               |  |                                                                      |  |                                                  |  |
| 7 - FINAL SHUT-IN                                    |  |                               |  |                                                                      |  |                                                  |  |
| 8 - FINAL HYDROSTATIC                                |  |                               |  | 4624                                                                 |  | 4636                                             |  |

Candel Oil Ltd.

Company

Candel Mobil et al N. Ramparts A-59

Well Name and Description

#1

Test No.

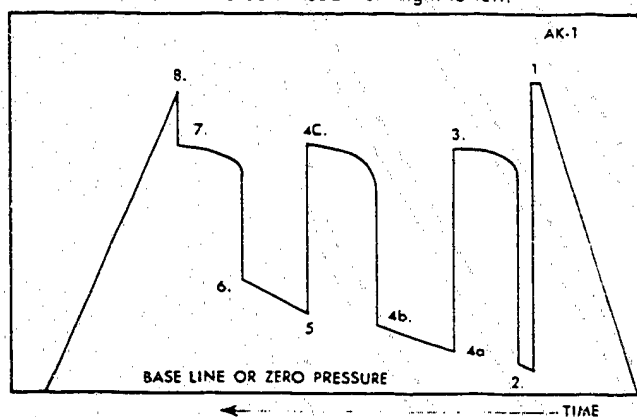
June 4/73

Date of Test

## GUIDE TO INTERPRETATION AND IDENTIFICATION OF LYNES DRILL STEM TEST PRESSURE CHARTS

In making any interpretation, our employees will give Customer the benefit of their best judgment as to the correct interpretation. Nevertheless, since all interpretations are opinions based on inferences from electrical, mechanical or other measurements, we cannot, and do not, guarantee the accuracy or correctness of any interpretations, and we shall not be liable or responsible, except in the case of gross or wilful negligence on our part, for any loss, costs, damages or expenses incurred or sustained by Customer resulting from any interpretation made by any of our agents or employees.

AK-1 recorders. Read from right to left.

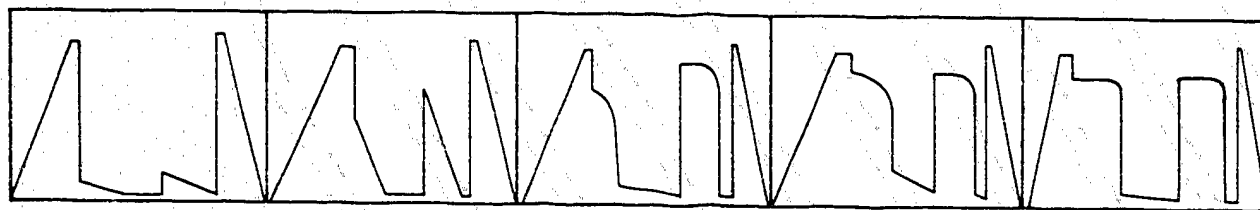


- 1 INITIAL HYDROSTATIC MUD PRESSURE
- 2 PRE FLOW
- 3 INITIAL SHUT-IN
- 4a 2nd INITIAL FLOW
- 4b 2nd FINAL FLOW
- 4c 2nd SHUT-IN
- 5 3rd INITIAL FLOW
- 6 FINAL FLOW
- 7 FINAL SHUT-IN
- 8 FINAL HYDROSTATIC MUD PRESSURE

N.B. When only two shut-in and flow periods are run, 4a, 4b and 4c are omitted.

K-K-3 recorders. Read from left to right.

Typical charts for visual field analysis ranging from very low to high permeability.



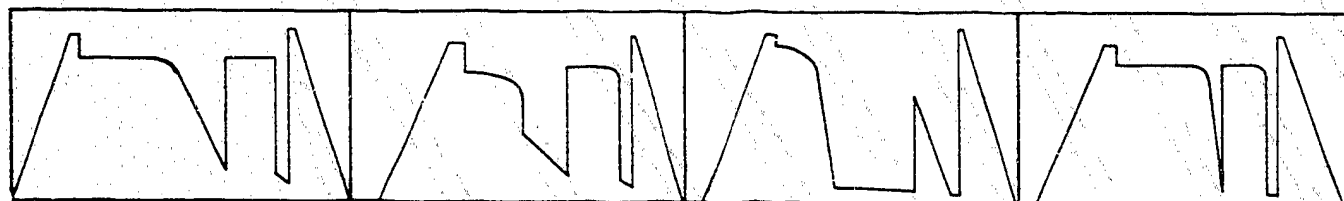
Very low permeability. Usually only mud recovered from interval tested. Virtually no permeability.

Slightly higher permeability. Again mud recovered.

Slightly higher permeability. Small recovery, less than 200 ft).

Average permeability. Final and initial shut-ins differ by 50 psi.

Average permeability. Strong damage effect. High shut-in pressure, low flow pressure.



Excellent permeability where final flow final shut-in pressure.

High permeability where ISIP and FSIP are within 10 psi.

Deep well bore invasion or damage. Final shut-in higher than the initial shut-in.

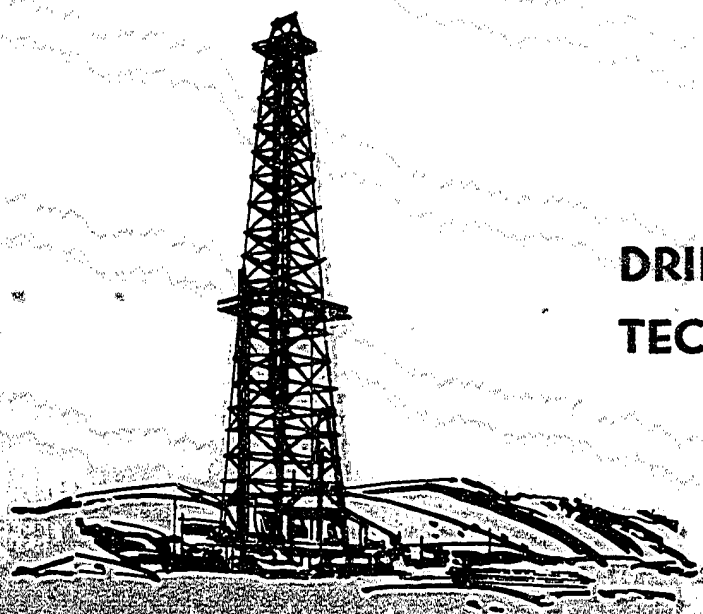
Tight hole chamber tester. Permeability very difficult to interpret unless the recovery is less than chamber length. Flow pressure builds up rapidly if recovery is large, similar to a shut-in.



**LYNES**

*BRIGHT NAME IN THE OIL PATCH*

*Inflatable and Conventional Packer Tools*



**DRILL STEM TEST  
TECHNICAL SERVICE REPORT**

## NOMENCLATURE (Definition of Symbols)

|          |                                                                                  |
|----------|----------------------------------------------------------------------------------|
| $Q$      | = average production rate during test, bbls./day                                 |
| $Q_g$    | = measured gas production rate during test, MCF/day                              |
| $k$      | = permeability, md                                                               |
| $h$      | = net pay thickness, ft. (when unknown, test interval is chosen)                 |
| $\mu$    | = fluid viscosity, centipoise                                                    |
| $Z$      | = compressibility factor                                                         |
| $T_r$    | = reservoir temperature, ° Rankine                                               |
| $m$      | = slope of final SIP buildup plot, psig/cycle (psig <sup>2</sup> /cycle for gas) |
| $b$      | = approximate radius of investigation, feet                                      |
| $r_w$    | = wellbore radius, feet                                                          |
| $t_o$    | = total flowing time, minutes                                                    |
| $P_o$    | = Extrapolated maximum reservoir pressure, psig                                  |
| $P_r$    | = final flowing pressure, psig                                                   |
| $P.I.$   | = productivity index, bbls./day/psi                                              |
| $P.I._t$ | = theoretical productivity index with damage removed, bbl./day/psi               |
| $D.R.$   | = damage ratio                                                                   |
| $E.D.R.$ | = estimated damage ratio                                                         |
| $AOF$    | = absolute open flow potential, MCF/D                                            |
| $AOF_t$  | = theoretical absolute open flow if damage were removed                          |
| $Z$      | = subsea depth                                                                   |
| $W$      | = water gradient based on salinity                                               |
| $H_w$    | = potentiometric surface                                                         |

| INTERPRETATION CALCULATIONS (OIL/WATER)                                                                                                                                                                                                                                                                                                       |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| <b>AVERAGE PRODUCTION RATE DURING TEST</b><br>$Q = \frac{1440 (\text{drill collar capacity} \times \text{recovery} + \text{drill pipe cap.} \times \text{recovery})}{\text{initial flow time} - \text{final flow time}}$<br>$= \frac{1440 [ ( ) + ( ) ]}{( ) - ( )}$<br>$= 1440 [ 0.145 \text{ or } .0073 ] ( )$<br>$= ( ) \text{ bbls./day}$ |  |  |  |
| <b>FLUID PROPERTIES</b> Estimated Bottom Hole Temperature = °                                                                                                                                                                                                                                                                                 |  |  |  |
| API Gravity @ 60° F.      ° Specific Gravity @ 60° F.      Est. Viscosity      cp                                                                                                                                                                                                                                                             |  |  |  |
| <b>TRANSMISSIBILITY</b><br>$\frac{k h}{\mu} = \frac{162.6 Q_o}{m} = \frac{162.6 ( )}{( )} = ( ) \text{ md-ft/cp}$                                                                                                                                                                                                                             |  |  |  |
| <b>IN SITU CAPACITY</b><br>$kh = ( ) ( ) = ( ) \text{ md-ft.}$                                                                                                                                                                                                                                                                                |  |  |  |
| <b>AVERAGE EFFECTIVE PERMEABILITY</b> Estimated Pay Thickness      Ft.<br>$k = ( ) = ( ) \text{ md.}$ Actual Pay Thickness      Ft.                                                                                                                                                                                                           |  |  |  |
| <b>PRODUCTIVITY INDEX</b><br>$PI = \frac{Q}{P_o - P_r} = \frac{( )}{( ) - ( )} = ( ) \text{ bbl./day-psi}$                                                                                                                                                                                                                                    |  |  |  |
| <b>DAMAGE RATIO</b><br>$D.R. = \frac{0.183 (P_o - P_r)}{m} = \frac{0.183 [ ( ) - ( ) ]}{( )} = ( )$                                                                                                                                                                                                                                           |  |  |  |
| <b>PRODUCTIVITY INDEX WITH DAMAGE REMOVED</b><br>$P.I._t = P.I. \times D.R. = ( ) ( ) = ( ) \text{ bbl./day-psi}$                                                                                                                                                                                                                             |  |  |  |
| <b>APPROXIMATE RADIUS OF INVESTIGATION</b><br>$b = \sqrt{\frac{kt_o}{0.0011}} = \sqrt{( )} = ( ) \text{ ft.}$                                                                                                                                                                                                                                 |  |  |  |
| <b>Drawdown Factor</b> = $\frac{I.S.I.P. - F.S.I.P.}{I.S.I.P.} \times 100 = \frac{( ) - ( )}{( )} \times 100 = ( ) \%$<br><small>4% to 5% is considered serious or substantial</small>                                                                                                                                                        |  |  |  |
| <b>Potentiometric Surface</b> = $H_w = Z + \frac{P_o}{W}$ $H_w = ( ) + \frac{( )}{( )} = ( ) \text{ ft.}$                                                                                                                                                                                                                                     |  |  |  |

| INTERPRETATION CALCULATIONS (GAS)                                                                                                                                                                                                                                               |  |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| <b>ESTIMATED GAS PROPERTIES</b> $R(T_d) = ( )$<br>Gravity @ 60° F.      Viscosity (Ret.)      cp.      Estimated Bottom Hole Temperature      °<br>Compressibility Factor (Z)                                                                                                   |  |  |  |
| <b>TRANSMISSIBILITY</b> Measured D.S.T. Gas Rate =      mcf/d.<br>$\frac{k h}{\mu} = \frac{1637 Q_g Z T_r}{m} = \frac{1637 ( ) ( ) ( )}{( )} = ( ) \text{ md-ft.}$<br>cp.                                                                                                       |  |  |  |
| <b>IN SITU CAPACITY</b><br>$kh = ( ) ( ) = ( ) \text{ md-ft.}$                                                                                                                                                                                                                  |  |  |  |
| <b>AVERAGE EFFECTIVE PERMEABILITY</b> Estimated Pay Thickness      Ft.<br>$k = ( ) = ( ) \text{ md.}$ Actual Pay Thickness      Ft.                                                                                                                                             |  |  |  |
| <b>APPROXIMATE RADIUS OF INVESTIGATION</b><br>$b = 0.02 \sqrt{k t_o} = 0.02 \sqrt{( )} = ( ) \text{ ft.}$                                                                                                                                                                       |  |  |  |
| <b>ACTUAL CAPACITY</b><br>$kh = \frac{3270 Q_g Z T_r \log(0.472 \frac{b}{r_w})}{P_o^2 - P_r^2} = \frac{3270 ( ) ( ) ( ) \log(0.472 \frac{( )}{( )})}{( )^2 - ( )^2} = ( ) \text{ md-ft.}$                                                                                       |  |  |  |
| <b>DAMAGE RATIO</b> $E.D.R. = \frac{(P_o^2 - P_r^2)}{m (\log T_o + 2.85)}$<br>$D.R. = \frac{\text{In Situ Capacity}}{\text{Actual Capacity}} = \frac{( )}{( )} = ( )$ $E.D.R. = ( )$                                                                                            |  |  |  |
| <b>ESTIMATED RANGE OF AOF POTENTIAL</b><br>$\text{Max. AOF} = \frac{Q_o P_o^2}{P_o^2 - P_r^2} = \frac{( ) ( )^2}{( )^2 - ( )^2} = ( ) \text{ MCF/D}$<br>$\text{Min. AOF} = \frac{Q_o P_o^2}{\sqrt{P_o^2 - P_r^2}} = \frac{( ) ( )^2}{\sqrt{( )^2 - ( )^2}} = ( ) \text{ MCF/D}$ |  |  |  |
| <b>ESTIMATED RANGE OF AOF POTENTIAL, DAMAGE REMOVED</b><br>$\text{Max. AOF}_t = [\text{Max. AOF}] (D.R.) = ( ) ( ) = ( ) \text{ MCF/D}$<br>$\text{Min. AOF}_t = [\text{Min. AOF}] (D.R.) = ( ) ( ) = ( ) \text{ MCF/D}$                                                         |  |  |  |
| <b>Drawdown Factor</b> = $\frac{I.S.I.P. - F.S.I.P.}{I.S.I.P.} \times 100 = \frac{( ) - ( )}{( )} \times 100 = ( ) \%$<br><small>4% to 5% is considered serious or substantial</small>                                                                                          |  |  |  |
| <b>Potentiometric Surface</b> = $H_w = Z + \frac{P_o}{W}$ $H_w = ( ) + \frac{( )}{( )} = ( ) \text{ ft.}$                                                                                                                                                                       |  |  |  |

# LYNES UNITED SERVICES LTD.

| TEST DATA                                            |  |                                                                             |  | GENERAL INFORMATION                                                         |  |
|------------------------------------------------------|--|-----------------------------------------------------------------------------|--|-----------------------------------------------------------------------------|--|
| Test No. <b>2</b>                                    |  | Lynes Test <b>2</b>                                                         |  | Company <b>Candel Oil Ltd.</b>                                              |  |
| Formation <b>Ronning</b>                             |  | I.D. <b>10515</b>                                                           |  | Address                                                                     |  |
| Interval Tested <b>10220</b>                         |  | Ft. to <b>10515</b>                                                         |  | Address                                                                     |  |
| Interval Tested <b>295</b>                           |  | Ft. Net Pay Tested                                                          |  | Address                                                                     |  |
| Type of Test <b>Bottom Hole Conv.</b>                |  |                                                                             |  |                                                                             |  |
| Cushion                                              |  | Amount                                                                      |  | Ft. Well Name <b>Candel Mobil etlal N. Ramparts</b>                         |  |
| Started in Hole at <b>11:00</b> Hrs.                 |  | Tool Open at <b>2:30</b> Hrs.                                               |  | Well Number <b>A-59</b>                                                     |  |
| Pre-Flow                                             |  | Mins. Initial Shut-in                                                       |  | K.B. Elevation <b>1904</b> Sub-Sea Elevation                                |  |
| 2nd Flow                                             |  | Mins. Second Shut-in                                                        |  | Area <b>Norman Wells</b> Province <b>N.W.T.</b>                             |  |
| Final Flow                                           |  | Mins. Final Shut-in                                                         |  | Company Rep <b>J. Nelson</b>                                                |  |
| Remarks:                                             |  |                                                                             |  | Tester <b>D. Nelson</b>                                                     |  |
|                                                      |  |                                                                             |  | Contractor <b>Jennings</b> Ria No. <b>1</b>                                 |  |
| Blow:                                                |  |                                                                             |  | Ticket No. <b>7396</b> Date <b>June 5/73</b>                                |  |
|                                                      |  |                                                                             |  | Service Reports To:                                                         |  |
|                                                      |  |                                                                             |  | <b>5 - above address</b>                                                    |  |
| GAS BLOW MEASUREMENTS                                |  |                                                                             |  |                                                                             |  |
| Measured with                                        |  |                                                                             |  | MUD AND HOLE DATA                                                           |  |
|                                                      |  |                                                                             |  | Mud Type <b>Gel Chem</b>                                                    |  |
|                                                      |  |                                                                             |  | Weight <b>8.9</b> Viscosity <b>80</b> Water Loss <b>9.8</b>                 |  |
|                                                      |  |                                                                             |  | Filter Cake <b>2/32"</b> Bottom Hole Temperature                            |  |
|                                                      |  |                                                                             |  | Drill Pipe Size <b>3 1/2 IF</b> Weight                                      |  |
|                                                      |  |                                                                             |  | Drill Collars <b>3 1/2 IF</b> I.D. <b>2"</b> Feet Run <b>499</b>            |  |
|                                                      |  |                                                                             |  | Main Hole or Casing Size <b>6 1/8"</b>                                      |  |
|                                                      |  |                                                                             |  | Rathole or Liner Size No. of Feet                                           |  |
|                                                      |  |                                                                             |  | Bottom Hole Choke Size <b>5/8"</b>                                          |  |
|                                                      |  |                                                                             |  | Surface Choke Size                                                          |  |
|                                                      |  |                                                                             |  | Packer Rubber Size <b>5 1/2"</b>                                            |  |
|                                                      |  |                                                                             |  | REMARKS                                                                     |  |
|                                                      |  |                                                                             |  | <b>Misrun - seat failure.</b>                                               |  |
| RECOVERY                                             |  |                                                                             |  |                                                                             |  |
| TOTAL FLUID RECOVERED <b>1000</b> Ft. Consisting of: |  |                                                                             |  |                                                                             |  |
| <b>1000</b> Ft. of <b>drilling mud</b>               |  |                                                                             |  |                                                                             |  |
| Ft. of                                               |  |                                                                             |  |                                                                             |  |
| Ft. of                                               |  |                                                                             |  |                                                                             |  |
| Ft. of                                               |  |                                                                             |  |                                                                             |  |
| Test was/was not Reverse Circulated                  |  |                                                                             |  |                                                                             |  |
| Oil Recovery A.P.I. Water Specific Gravity           |  |                                                                             |  |                                                                             |  |
| Salinity                                             |  |                                                                             |  |                                                                             |  |
| PRESSURE READINGS                                    |  |                                                                             |  |                                                                             |  |
| Inside <input checked="" type="checkbox"/> Outside   |  | Inside <input type="checkbox"/> Outside <input checked="" type="checkbox"/> |  | Inside <input type="checkbox"/> Outside <input checked="" type="checkbox"/> |  |
| Recorder No. <b>1619</b>                             |  | Recorder No. <b>5323</b>                                                    |  | Recorder No. <b>662</b>                                                     |  |
| Capacity <b>6100</b>                                 |  | Capacity <b>8000</b>                                                        |  | Capacity <b>8400</b>                                                        |  |
| Depth <b>10204</b>                                   |  | Depth <b>10241</b>                                                          |  | Depth <b>10246</b>                                                          |  |
| NUMBER KEY:                                          |  |                                                                             |  |                                                                             |  |
| 1 - INITIAL HYDROSTATIC                              |  | <b>4699</b>                                                                 |  | <b>4722</b>                                                                 |  |
| 2 - PRE-FLOW                                         |  |                                                                             |  |                                                                             |  |
| 3 - INITIAL SHUT-IN                                  |  |                                                                             |  |                                                                             |  |
| 4a - 2nd INITIAL FLOW                                |  |                                                                             |  |                                                                             |  |
| 4b - 2nd FINAL FLOW                                  |  | <b>misrun</b>                                                               |  | <b>misrun</b>                                                               |  |
| 4c - 2nd SHUT-IN                                     |  |                                                                             |  |                                                                             |  |
| 5 - 3rd INITIAL FLOW                                 |  |                                                                             |  |                                                                             |  |
| 6 - FINAL FLOW                                       |  |                                                                             |  |                                                                             |  |
| 7 - FINAL SHUT-IN                                    |  |                                                                             |  |                                                                             |  |
| 8 - FINAL HYDROSTATIC                                |  | <b>4481</b>                                                                 |  | <b>4504</b>                                                                 |  |

Company

Well Name and Description

Test No.

Date of Test

Candel Oil Ltd.

Candel Mobil et al N. Ramparts A-59

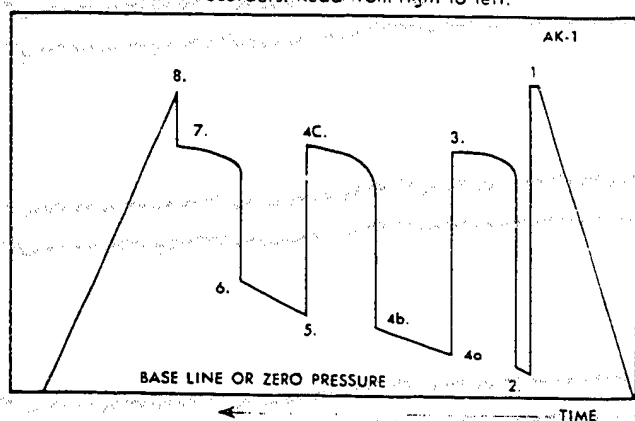
#2

June 5/73

# GUIDE TO INTERPRETATION AND IDENTIFICATION OF LYNES DRILL STEM TEST PRESSURE CHARTS

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AK-1 recorders. Read from right to left.

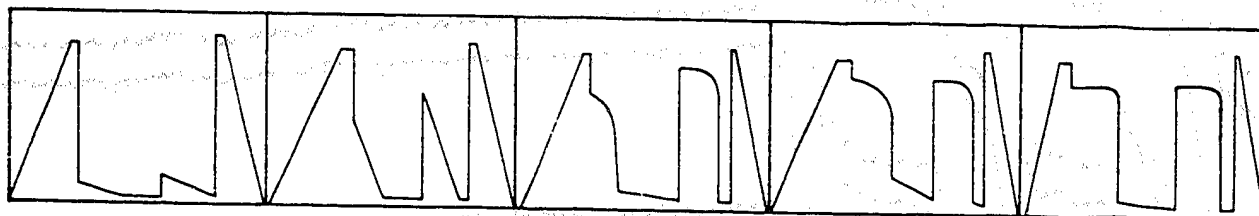


1. INITIAL HYDROSTATIC MUD PRESSURE
2. PRE-FLOW
3. INITIAL SHUT-IN
- 4a. 2nd INITIAL FLOW
- 4b. 2nd FINAL FLOW
- 4c. 2nd SHUT-IN
5. 3rd INITIAL FLOW
6. FINAL FLOW
7. FINAL SHUT-IN
8. FINAL HYDROSTATIC MUD PRESSURE

K-K-3 recorders. Read from left to right.

Typical charts for visual field analysis ranging from very low to high permeability.

N.B. When only two shut-in and flow periods are run, 4a, 4b and 4c are omitted.



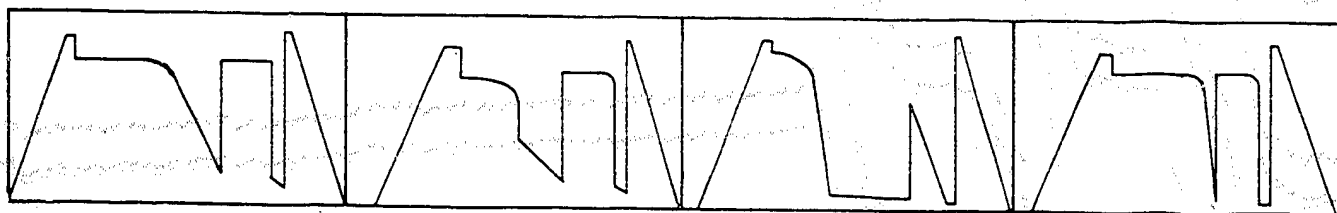
Very low permeability. Usually only mud recovered from interval tested. Virtually no permeability.

Slightly higher permeability. Again usually mud recovered.

Slightly higher permeability. Small recovery, less than 200 ft).

Average permeability. Final and initial shut-ins differ by 50 psi.

Average permeability. Strong damage effect. High shut-in pressure, low flow pressure.



Excellent permeability where final flow final shut-in pressure

High permeability where ISIP and FSIP are within 10 psi.

Deep well bore invasion or damage. Final shut-in higher than the initial shut-in.

Tight hole chamber tester. Permeability very difficult to interpret unless the recovery is less than chamber length. Flow pressure builds up rapidly if recovery is large, similar to a shut-in.



**LYNES**

*BRIGHT NAME IN THE OIL PATCH*

*Inflatable and Conventional Packer Tools*



**DRILL STEM TEST  
TECHNICAL SERVICE REPORT**

## NOMENCLATURE (Definition of Symbols)

|          |                                                                                  |
|----------|----------------------------------------------------------------------------------|
| $Q$      | = average production rate during test, bbls./day                                 |
| $Q_g$    | = measured gas production rate during test, MCF/day                              |
| $k$      | = permeability, md                                                               |
| $h$      | = net pay thickness, ft. (when unknown, test interval is chosen)                 |
| $\mu$    | = fluid viscosity, centipoise                                                    |
| $Z$      | = compressibility factor                                                         |
| $T_r$    | = reservoir temperature, ° Rankine                                               |
| $m$      | = slope of final SIP buildup plot, psig/cycle (psig <sup>2</sup> /cycle for gas) |
| $b$      | = approximate radius of investigation, feet                                      |
| $r_w$    | = wellbore radius, feet                                                          |
| $t_o$    | = total flowing time, minutes                                                    |
| $P_o$    | = Extrapolated maximum reservoir pressure, psig                                  |
| $P_f$    | = final flowing pressure, psig                                                   |
| $P.I.$   | = productivity index, bbls./day/psi                                              |
| $P.I._d$ | = theoretical productivity index with damage removed, bbl./day/psi               |
| $D.R.$   | = damage ratio                                                                   |
| $E.D.R.$ | = estimated damage ratio                                                         |
| $AOF$    | = absolute open flow potential, MCF/D                                            |
| $AOF_d$  | = theoretical absolute open flow if damage were removed                          |
| $z$      | = subsea depth                                                                   |
| $W$      | = water gradient based on salinity                                               |
| $H_w$    | = potentiometric surface                                                         |

| INTERPRETATION CALCULATIONS (OIL/WATER)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>AVERAGE PRODUCTION RATE DURING TEST</b><br>$Q = \frac{1440 \text{ (drill collar capacity + recovery + drill pipe capac. + recovery)}}{\text{initial flow time} + \text{final flow time}}$<br>$= \frac{1440 \left[ \left( \frac{\text{drill collar capacity}}{1440} \right) + \left( \frac{\text{recovery}}{1440} \right) + \left( \frac{\text{drill pipe capac.}}{1440} \right) + \left( \frac{\text{recovery}}{1440} \right) \right]}{\text{initial flow time} + \text{final flow time}}$<br>$= \frac{1440 \left[ (0.0145 \text{ or } 0.0073) \left( \frac{\text{drill collar capacity}}{1440} \right) + \left( \frac{\text{recovery}}{1440} \right) + \left( \frac{\text{drill pipe capac.}}{1440} \right) + \left( \frac{\text{recovery}}{1440} \right) \right]}{\text{initial flow time} + \text{final flow time}}$<br>$= \text{bbls./day}$ |  |
| <b>FLUID PROPERTIES</b><br><div style="display: flex; justify-content: space-between;"> <div>API Gravity @ 60° F.      * Specific Gravity @ 60° F.</div> <div>Estimated Bottom Hole Temperature</div> </div> <div style="display: flex; justify-content: space-between;"> <div>Est. Viscosity</div> <div>cp</div> </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |
| <b>TRANSMISSIBILITY</b><br>$\frac{kh}{\mu} = \frac{162.6Q}{m} = 162.6 \left( \frac{\text{bbls./day}}{\text{md-ft/cp}} \right)$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
| <b>IN SITU CAPACITY</b><br>$kh = \left( \frac{\text{bbls./day}}{\text{md-ft}} \right)$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |
| <b>AVERAGE EFFECTIVE PERMEABILITY</b><br>$k = \left( \frac{\text{md-ft}}{\text{md}} \right)$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |
| <b>PRODUCTIVITY INDEX</b><br>$PI = \frac{Q}{P_o - P_f} = \left( \frac{\text{bbls./day}}{\text{psi}} \right)$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |
| <b>DAMAGE RATIO</b><br>$D.R. = \frac{0.183(P_o - P_f)}{m} = 0.183 \left( \frac{\text{psi}}{\text{psig/cycle}} \right)$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |
| <b>PRODUCTIVITY INDEX WITH DAMAGE REMOVED</b><br>$P.I._d = P.I. \times D.R. = \left( \frac{\text{bbls./day}}{\text{psi}} \right)$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
| <b>APPROXIMATE RADIUS OF INVESTIGATION</b><br>$b = \sqrt{\frac{kt_o}{\phi \mu c}} = \sqrt{\left( \frac{\text{md-ft}^2}{\text{cp}} \right)}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| <b>Drawdown Factor</b> = $\frac{I.S.I.P. - F.S.I.P. \times 100}{I.S.I.P.} = \left( \frac{\text{psi}}{\text{psi}} \right) \times 100 = \%$ (4% to 5% is considered serious or substantial)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
| <b>Potentiometric Surface</b> = $H_w = Z + \frac{P_o}{W}$ $H_w = \text{ft.}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |

| INTERPRETATION CALCULATIONS (GAS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>ESTIMATED GAS PROPERTIES</b><br><div style="display: flex; justify-content: space-between;"> <div>Gravity @ 60° F.</div> <div>Viscosity (Res.)</div> <div>Estimated Bottom Hole Temperature</div> </div> <div style="display: flex; justify-content: space-between;"> <div>cp.</div> <div>Compressibility Factor (Z)</div> </div>                                                                                                                                                                                                                                                                                  |  |
| <b>TRANSMISSIBILITY</b><br>$\frac{kh}{\mu} = \frac{1637 Q_g Z T_r}{m} = 1637 \left( \frac{\text{md-ft}}{\text{cp}} \right)$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |
| <b>IN SITU CAPACITY</b><br>$kh = \left( \frac{\text{md-ft}}{\text{md}} \right)$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |
| <b>AVERAGE EFFECTIVE PERMEABILITY</b><br>$k = \left( \frac{\text{md}}{\text{md-ft}} \right)$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
| <b>APPROXIMATE RADIUS OF INVESTIGATION</b><br>$b = 0.02 \sqrt{k t_o} = 0.02 \sqrt{\left( \frac{\text{md-ft}^2}{\text{cp}} \right)}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |
| <b>ACTUAL CAPACITY</b><br>$kh = \frac{3270 Q_g Z T_r \log \left( \frac{b}{r_w} \right)}{P_o - P_f} = 3270 \left( \frac{\text{md-ft}}{\text{md}} \right)$                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| <b>DAMAGE RATIO</b><br>$D.R. = \frac{\text{In Situ Capacity}}{\text{Actual Capacity}} = \left( \frac{\text{md}}{\text{md}} \right)$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |
| <b>ESTIMATED RANGE OF AOF POTENTIAL</b><br><div style="display: flex; justify-content: space-between;"> <div> <math>\text{Max. AOF} = \frac{Q_g P_o^2}{P_o^2 - P_f^2} = \left( \frac{\text{MCF/D}}{\text{psi}^2} \right)</math><br/> <math>\text{Min. AOF} = \frac{Q_g P_o^2}{P_o^2 - P_f^2} = \left( \frac{\text{MCF/D}}{\text{psi}^2} \right)</math> </div> <div> <math>E.D.R. = \frac{(P_o^2 - P_f^2)}{m (\log \frac{b}{r_w} + 2.65)}</math><br/> <math>E.D.R. =</math> </div> </div>                                                                                                                              |  |
| <b>ESTIMATED RANGE OF AOF POTENTIAL DAMAGE REMOVED</b><br><div style="display: flex; justify-content: space-between;"> <div> <math>\text{Max. AOF}_d = [\text{Max. AOF} (D.R.)] = \left( \frac{\text{MCF/D}}{\text{psi}^2} \right)</math><br/> <math>\text{Min. AOF}_d = [\text{Min. AOF} (D.R.)] = \left( \frac{\text{MCF/D}}{\text{psi}^2} \right)</math> </div> <div> <math>\text{Drawdown Factor} = \frac{I.S.I.P. - F.S.I.P. \times 100}{I.S.I.P.} = \left( \frac{\text{psi}}{\text{psi}} \right) \times 100 = \%</math><br/> <math>\text{Potentiometric Surface} = H_w = Z + \frac{P_o}{W}</math> </div> </div> |  |

**Candel Oil Ltd.**

**Company**

Candel Mobil et al N. Rampart A-59

Well Name and Description

#3

**Test No.**

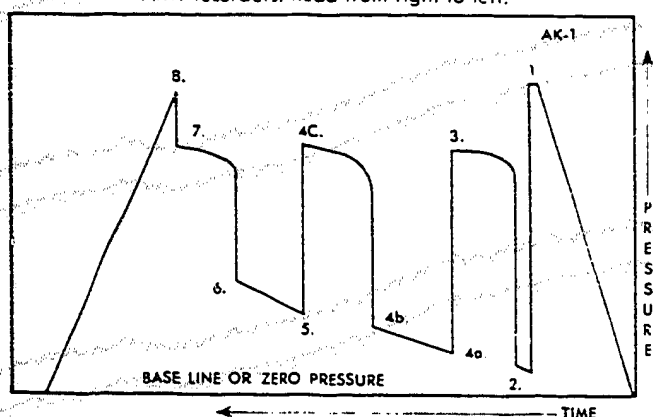
June 6/73

Date of test

## GUIDE TO INTERPRETATION AND IDENTIFICATION OF LYNES DRILL STEM TEST PRESSURE CHARTS

In making any interpretation, our employees will give Customer the benefit of their best judgment as to the correct interpretation. Nevertheless, since all interpretations are opinions based on inferences from electrical, mechanical or other measurements, we cannot, and do not, guarantee the accuracy or correctness of any interpretations, and we shall not be liable or responsible, except in the case of gross or willful negligence on our part, for any loss, costs, damages or expenses incurred or sustained by Customer resulting from any interpretation made by any of our agents or employees.

AK-1 recorders. Read from right to left.

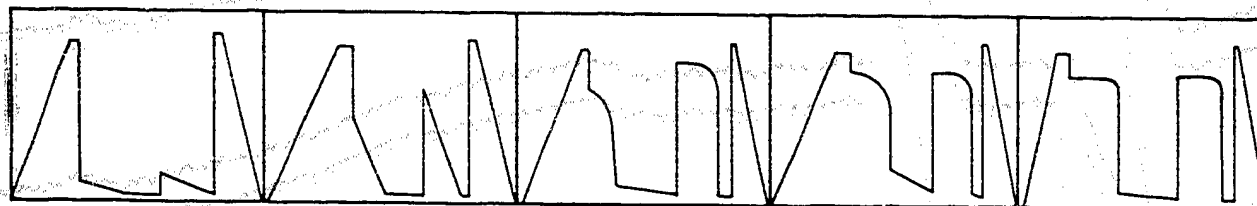


1. INITIAL HYDROSTATIC MUD PRESSURE
2. PRE-FLOW
3. INITIAL SHUT-IN
- 4a. 2nd INITIAL FLOW
- 4b. 2nd FINAL FLOW
- 4c. 2nd SHUT-IN
5. 3rd INITIAL FLOW
6. FINAL FLOW
7. FINAL SHUT-IN
8. FINAL HYDROSTATIC MUD PRESSURE

N.B. When only two shut-in and flow periods are run, 4a, 4b and 4c are omitted.

K-K-3 recorders. Read from left to right.

Typical charts for visual field analysis ranging from very low to high permeability.



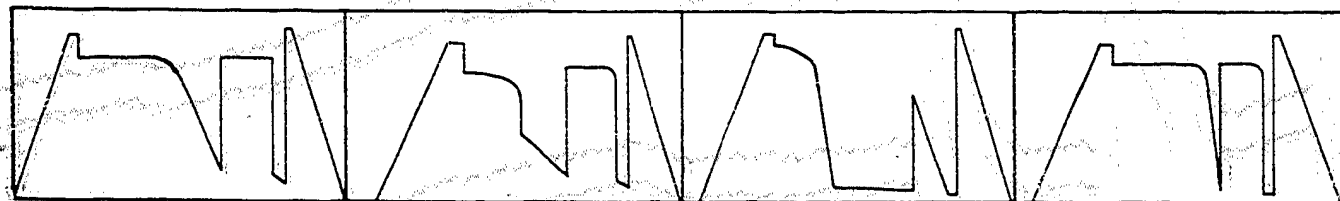
Very low permeability. Usually only mud recovered from interval tested. Virtually no permeability.

Slightly higher permeability. Again mud recovered.

Slightly higher permeability. Small recovery, less than 200 psi.

Average permeability. Final and initial shut-ins differ by 50 psi.

Average permeability. Strong damage effect. High shut-in pressure, low flow pressure.



Excellent permeability where final flow final shut-in pressure.

High permeability where ISIP and FSIP are within 10 psi.

Deep well bore invasion or damage. Final shut-in higher than the initial shut-in.

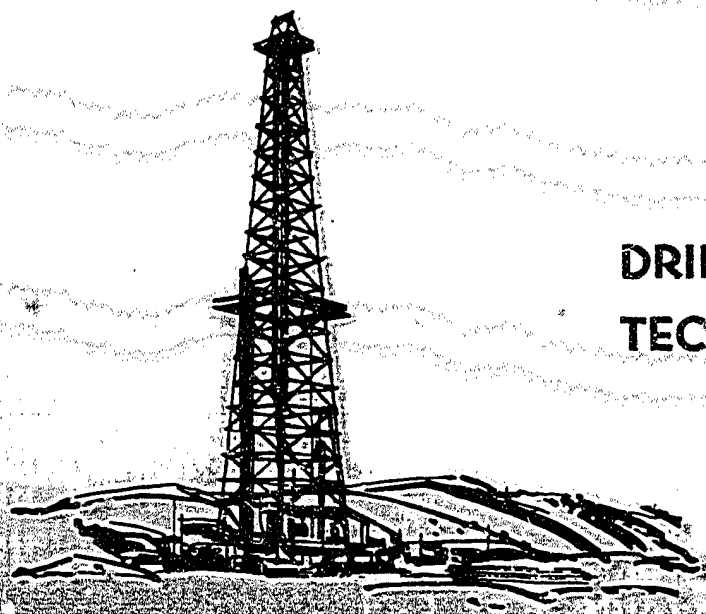
Tight hole chamber tester. Permeability very difficult to interpret unless the recovery is less than chamber length. Flow pressure builds up rapidly if recovery is large, similar to a shut-in.



**LYNES**

*BRIGHT NAME IN THE OIL PATCH*

*Inflatable and Conventional Packer Tools*



**DRILL STEM TEST  
TECHNICAL SERVICE REPORT**

## NOMENCLATURE (Definition of Symbols)

|                   |                                                                                  |
|-------------------|----------------------------------------------------------------------------------|
| $\bar{Q}$         | = average production rate during test, bbls./day                                 |
| $\bar{Q}_g$       | = measured gas production rate during test, MCF/day                              |
| $k$               | = permeability, md                                                               |
| $h$               | = net pay thickness, ft. (when unknown, test interval is chosen)                 |
| $\mu$             | = fluid viscosity, centipoise                                                    |
| $Z$               | = compressibility factor                                                         |
| $T_r$             | = reservoir temperature, ° Rankine                                               |
| $m$               | = slope of final SIP buildup plot, psig/cycle (psig <sup>2</sup> /cycle for gas) |
| $b$               | = approximate radius of investigation, feet                                      |
| $r_w$             | = wellbore radius, feet                                                          |
| $t_o$             | = total flowing time, minutes                                                    |
| $P_o$             | = Extrapolated maximum reservoir pressure, psig                                  |
| $P_f$             | = final flowing pressure, psig                                                   |
| P.I.              | = productivity index, bbls./day/psi                                              |
| P.I. <sub>1</sub> | = theoretical productivity index with damage removed, bbl./day/psi               |
| D.R.              | = damage ratio                                                                   |
| E.D.R.            | = estimated damage ratio                                                         |
| AOF               | = absolute open flow potential, MCF/D                                            |
| AOF <sub>1</sub>  | = theoretical absolute open flow if damage were removed                          |
| $\bar{z}$         | = subsea depth                                                                   |
| $W$               | = water gradient based on salinity                                               |
| $H_w$             | = potentiometric surface                                                         |

| INTERPRETATION CALCULATIONS (OIL/WATER)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| <b>AVERAGE PRODUCTION RATE DURING TEST</b><br>$\bar{Q} = 1440 \left( \frac{\text{drill collar capacity} \times \text{recovery} + \text{drill pipe capac.} \times \text{recovery}}{\text{initial flow time} + \text{final flow time}} \right)$<br>$= 1440 \left( \frac{ \quad + \quad }{ \quad + \quad } \right)$<br>$= 1440 (0.145 \text{ or } .0073) ( \quad )$<br>$= \quad \text{bbls./day}$                                                                                                                                                      |  |  |  |
| <b>FLUID PROPERTIES</b><br><div style="display: flex; justify-content: space-between;"> <div>API Gravity @ 60° F. <span style="margin-left: 20px;">Specific Gravity @ 60° F.</span></div> <div>Estimated Bottom Hole Temperature <span style="margin-left: 20px;">°</span></div> </div> <div style="display: flex; justify-content: space-between;"> <div>Est. Viscosity <span style="margin-left: 20px;">cp</span></div> <div>Mud Expansion = <span style="margin-left: 20px;">ft.</span><br/>(Drill Collar Conversion Is Considered)</div> </div> |  |  |  |
| <b>TRANSMISSIBILITY</b><br>$\frac{kh}{\mu} = \frac{162.6 \bar{Q}_o}{m} = \frac{162.6 ( \quad )}{( \quad )} = \quad \text{md.-ft./cp}$                                                                                                                                                                                                                                                                                                                                                                                                               |  |  |  |
| <b>IN SITU CAPACITY</b><br>$kh = ( \quad ) ( \quad ) = \quad \text{md.-ft.}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |
| <b>AVERAGE EFFECTIVE PERMEABILITY</b><br>$k = \frac{kh}{h} = \frac{ \quad }{ \quad } = \quad \text{md.}$ <div style="display: flex; justify-content: space-between; font-size: small;"> <div>Estimated Pay Thickness <span style="margin-left: 20px;">Ft.</span></div> <div>Actual Pay Thickness <span style="margin-left: 20px;">Ft.</span></div> </div>                                                                                                                                                                                           |  |  |  |
| <b>PRODUCTIVITY INDEX</b><br>$PI = \frac{\bar{Q}}{P_o - P_f} = \frac{ \quad }{ ( \quad ) - ( \quad ) } = \quad \text{bbl./day-psi}$                                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |  |
| <b>DAMAGE RATIO</b><br>$D.R. = \frac{0.183 (P_o - P_f)}{m} = \frac{0.183 ( \quad - \quad )}{( \quad )} = \quad$                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |  |
| <b>PRODUCTIVITY INDEX WITH DAMAGE REMOVED</b><br>$P.I._1 = P.I. \times D.R. = ( \quad ) ( \quad ) = \quad \text{bbl./day-psi}$                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |  |
| <b>APPROXIMATE RADIUS OF INVESTIGATION</b><br>$b = \sqrt{\frac{kt_o}{\pi}} = \sqrt{ \frac{ \quad \times \quad }{ \pi } } = \quad \text{ft.}$                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |
| <b>Drawdown Factor</b> = $\frac{I.S.I.P. - F.S.I.P.}{I.S.I.P.} \times 100 = \frac{ \quad - \quad }{ \quad } \times 100 = \quad \%$<br><small>(4% to 5% is considered serious or substantial)</small>                                                                                                                                                                                                                                                                                                                                                |  |  |  |
| <b>Potentiometric Surface</b> = $H_w = \bar{z} + \frac{P_o}{W}$ $H_w = \quad + \frac{ \quad }{ \quad } = \quad \pm \quad \text{ft.}$                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |  |

| INTERPRETATION CALCULATIONS (GAS)                                                                                                                                                                                                                                                                                                                                       |  |                                                                                                           |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------|--|
| <b>ESTIMATED GAS PROPERTIES</b><br>Gravity @ 60° F. <span style="margin-left: 20px;">Viscosity (Res.) <span style="margin-left: 20px;">cp.</span></span>                                                                                                                                                                                                                |  | Estimated Bottom Hole Temperature <span style="margin-left: 20px;">°</span><br>Compressibility Factor (Z) |  |
| <b>TRANSMISSIBILITY</b><br>Measured D.S.T. Gas Rate = <span style="margin-left: 20px;">mcf/d.</span><br>$\frac{kh}{\mu} = \frac{1627 \bar{Q}_g Z T_r}{m} = \frac{1627 ( \quad ) ( \quad ) ( \quad )}{( \quad )} = \quad \frac{\text{md.-ft.}}{\text{cp.}}$                                                                                                              |  |                                                                                                           |  |
| <b>IN SITU CAPACITY</b><br>$kh = ( \quad ) ( \quad ) = \quad \text{md.-ft.}$                                                                                                                                                                                                                                                                                            |  |                                                                                                           |  |
| <b>AVERAGE EFFECTIVE PERMEABILITY</b><br>$k = \frac{kh}{h} = \frac{ \quad }{ \quad } = \quad \text{md.}$ <div style="display: flex; justify-content: space-between; font-size: small;"> <div>Estimated Pay Thickness <span style="margin-left: 20px;">Ft.</span></div> <div>Actual Pay Thickness <span style="margin-left: 20px;">Ft.</span></div> </div>               |  |                                                                                                           |  |
| <b>APPROXIMATE RADIUS OF INVESTIGATION</b><br>$b = 0.02 \sqrt{kt_o P_o} = 0.02 \sqrt{ \quad \times \quad \times \quad } = \quad \text{ft.}$                                                                                                                                                                                                                             |  |                                                                                                           |  |
| <b>ACTUAL CAPACITY</b><br>$kh = \frac{3270 \bar{Q}_g \mu Z T_r \log(0.472r_w/b)}{P_o^2 - P_f^2} = \frac{3270 ( \quad ) ( \quad ) ( \quad ) \log( \frac{ \quad }{ \quad } )}{ \quad - \quad } = \quad \text{md.-ft.}$                                                                                                                                                    |  |                                                                                                           |  |
| <b>DAMAGE RATIO</b><br>$D.R. = \frac{\text{In Situ Capacity}}{\text{Actual Capacity}} = \frac{ \quad }{ \quad } = \quad$ <div style="display: flex; justify-content: space-between; font-size: small;"> <div>E.D.R. = <math>\frac{(P_o^2 - P_f^2)}{m (\log \frac{r_w}{b} + 2.45)}</math></div> <div>E.D.R. = <span style="margin-left: 20px;">_____</span></div> </div> |  |                                                                                                           |  |
| <b>ESTIMATED RANGE OF AOF POTENTIAL</b><br>Max. AOF = $\frac{\bar{Q}_g P_o}{P_o^2 - P_f^2} = \frac{ \quad \times \quad }{ \quad - \quad } = \frac{ \quad }{ \quad } = \quad \text{MCF/D}$<br>Min. AOF = $\frac{\bar{Q}_g P_o}{\sqrt{P_o^2 - P_f^2}} = \frac{ \quad \times \quad }{ \sqrt{ \quad - \quad } } = \frac{ \quad }{ \quad } = \quad \text{MCF/D}$             |  |                                                                                                           |  |
| <b>ESTIMATED RANGE OF AOF POTENTIAL, DAMAGE REMOVED</b><br>Max. AOF <sub>1</sub> = (Max. AOF) (D.R.) = $( \quad ) ( \quad ) = \quad \text{MCF/D}$<br>Min. AOF <sub>1</sub> = (Min. AOF) (D.R.) = $( \quad ) ( \quad ) = \quad \text{MCF/D}$                                                                                                                             |  |                                                                                                           |  |
| <b>Drawdown Factor</b> = $\frac{I.S.I.P. - F.S.I.P.}{I.S.I.P.} \times 100 = \frac{ \quad - \quad }{ \quad } \times 100 = \quad \%$<br><small>(4% to 5% is considered serious or substantial)</small>                                                                                                                                                                    |  |                                                                                                           |  |
| <b>Potentiometric Surface</b> = $H_w = \bar{z} + \frac{P_o}{W}$ $H_w = \quad + \frac{ \quad }{ \quad } = \quad \pm \quad \text{ft.}$                                                                                                                                                                                                                                    |  |                                                                                                           |  |

# LYNES UNITED SERVICES LTD.

| TEST DATA                           |  |  |  | Test No. 4                                 |  | Lynes Test 4        |  | GENERAL INFORMATION                     |  |                                       |  |
|-------------------------------------|--|--|--|--------------------------------------------|--|---------------------|--|-----------------------------------------|--|---------------------------------------|--|
| Formation                           |  |  |  | T.D. 9247                                  |  | Ft.                 |  | Company Candel Oil Ltd.                 |  |                                       |  |
| Interval Tested                     |  |  |  | 8720                                       |  | Ft. to 9247         |  | Ft.                                     |  | Address                               |  |
| Interval Tested                     |  |  |  | 527                                        |  | Ft.                 |  | Net Pay Tested                          |  | Ft.                                   |  |
| Type of Test                        |  |  |  | Bottom Hole Conv.                          |  |                     |  |                                         |  |                                       |  |
| Cushion                             |  |  |  | Amount                                     |  | Ft.                 |  | Well Name Candel Mobil et al N. Rampart |  |                                       |  |
| Started in Hole at                  |  |  |  | 10:30 Hrs.                                 |  | Tool Open at 1:30   |  | Hrs.                                    |  | Well Number A-59                      |  |
| Pre-Flow                            |  |  |  | Mins.                                      |  | Initial Shut-in     |  | Mins.                                   |  | K.B. Elevation 1904 Sub-Sea Elevation |  |
| 2nd Flow                            |  |  |  | Mins.                                      |  | Second Shut-in      |  | Mins.                                   |  | Area Norman Wells Province N.W.T.     |  |
| Final Flow                          |  |  |  | Mins.                                      |  | Final Shut-in       |  | Mins.                                   |  | Company Rep. D. Nelson                |  |
| Remarks:                            |  |  |  |                                            |  | Tester              |  | J Nelson                                |  |                                       |  |
| Blow:                               |  |  |  | Seat Failure                               |  | Contractor          |  | Jennings                                |  | Rig No. 1                             |  |
|                                     |  |  |  |                                            |  | Ticket No.          |  | 7398                                    |  | Date June 8/73                        |  |
|                                     |  |  |  |                                            |  | Service Reports To: |  |                                         |  |                                       |  |
|                                     |  |  |  |                                            |  |                     |  | 5 - above aydress                       |  |                                       |  |
| GAS BLOW MEASUREMENTS               |  |  |  |                                            |  |                     |  |                                         |  |                                       |  |
| Measured with                       |  |  |  | MUD AND HOLE DATA                          |  |                     |  |                                         |  |                                       |  |
|                                     |  |  |  | Mud Type Gel Chem                          |  |                     |  |                                         |  |                                       |  |
|                                     |  |  |  | Weight 8.9 Viscosity 45 Water Loss 9.8     |  |                     |  |                                         |  |                                       |  |
|                                     |  |  |  | Filter Cake 2/32" Bottom Hole Temperature  |  |                     |  |                                         |  |                                       |  |
|                                     |  |  |  | Drill Pipe Size 3 1/2IF Weight             |  |                     |  |                                         |  |                                       |  |
|                                     |  |  |  | Drill Collars 3 1/2IF I.D. 2" Feet Run 499 |  |                     |  |                                         |  |                                       |  |
|                                     |  |  |  | Main Hole or Casing Size 6 1/8"            |  |                     |  |                                         |  |                                       |  |
|                                     |  |  |  | Rathole or Liner Size No. of Feet          |  |                     |  |                                         |  |                                       |  |
|                                     |  |  |  | Bottom Hole Choke Size 5/8"                |  |                     |  |                                         |  |                                       |  |
|                                     |  |  |  | Surface Choke Size                         |  |                     |  |                                         |  |                                       |  |
|                                     |  |  |  | Packer Rubber Size 5 1/2"                  |  |                     |  |                                         |  |                                       |  |
|                                     |  |  |  | REMARKS Misrun -                           |  |                     |  |                                         |  |                                       |  |
| RECOVERY                            |  |  |  |                                            |  |                     |  |                                         |  |                                       |  |
| TOTAL FLUID RECOVERED               |  |  |  | 20                                         |  | Ft. Consisting of:  |  |                                         |  |                                       |  |
|                                     |  |  |  | 20                                         |  | Ft. of drilling mud |  |                                         |  |                                       |  |
|                                     |  |  |  |                                            |  | Ft. of              |  |                                         |  |                                       |  |
|                                     |  |  |  |                                            |  | Ft. of              |  |                                         |  |                                       |  |
|                                     |  |  |  |                                            |  | Ft. of              |  |                                         |  |                                       |  |
| Test was/was not Reverse Circulated |  |  |  |                                            |  |                     |  |                                         |  |                                       |  |
| Oil Recovery A.P.I.                 |  |  |  | Water Specific Gravity                     |  |                     |  |                                         |  |                                       |  |
| Salinity                            |  |  |  |                                            |  |                     |  |                                         |  |                                       |  |
| PRESSURE READINGS                   |  |  |  |                                            |  |                     |  |                                         |  |                                       |  |
|                                     |  |  |  | Inside X Outside                           |  | Inside Outside X    |  | Inside Outside                          |  | Inside Outside                        |  |
|                                     |  |  |  | Recorder No. 1619                          |  | Recorder No. 5323   |  | Recorder No. 662                        |  | Recorder No.                          |  |
|                                     |  |  |  | Capacity 6100                              |  | Capacity 8000       |  | Capacity 8400                           |  | Capacity                              |  |
|                                     |  |  |  | Depth 8701                                 |  | Depth 8791          |  | Depth 8795                              |  | Depth                                 |  |
| NUMBER KEY:                         |  |  |  | 4035                                       |  | 4079                |  | 4082                                    |  |                                       |  |
| 1 - INITIAL HYDROSTATIC             |  |  |  |                                            |  |                     |  |                                         |  |                                       |  |
| 2 - PRE-FLOW                        |  |  |  |                                            |  |                     |  |                                         |  |                                       |  |
| 3 - INITIAL SHUT-IN                 |  |  |  |                                            |  |                     |  |                                         |  |                                       |  |
| 4a - 2nd INITIAL FLOW               |  |  |  |                                            |  |                     |  |                                         |  |                                       |  |
| 4b - 2nd FINAL FLOW                 |  |  |  | misrun                                     |  | misrun              |  | misrun                                  |  |                                       |  |
| 4c - 2nd SHUT-IN                    |  |  |  |                                            |  |                     |  |                                         |  |                                       |  |
| 5 - 3rd INITIAL FLOW                |  |  |  |                                            |  |                     |  |                                         |  |                                       |  |
| 6 - FINAL FLOW                      |  |  |  |                                            |  |                     |  |                                         |  |                                       |  |
| 7 - FINAL SHUT-IN                   |  |  |  |                                            |  |                     |  |                                         |  |                                       |  |
| 8 - FINAL HYDROSTATIC               |  |  |  | 3976                                       |  | 4002                |  | 4009                                    |  |                                       |  |

Candel Oil Ltd.

Company

Candel Mobil et al N. Rampart A-59

Well Name and Description

#4

Test No.

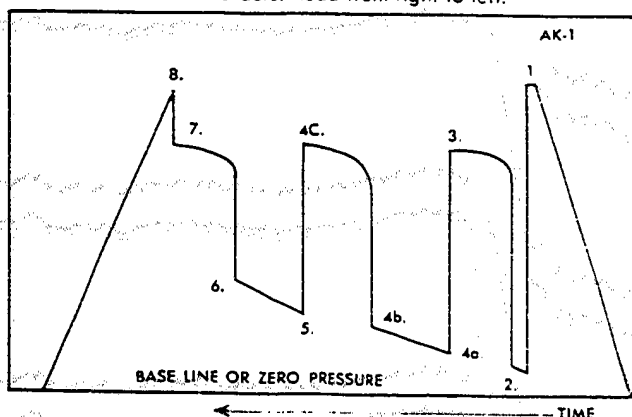
June 8/73

Date of Test

## GUIDE TO INTERPRETATION AND IDENTIFICATION OF LYNES DRILL STEM TEST PRESSURE CHARTS

In making any interpretation, our employees will give Customer the benefit of their best judgment as to the correct interpretation. Nevertheless, since all interpretations are opinions based on inferences from electrical, mechanical or other measurements, we cannot, and do not, guarantee the accuracy or correctness of any interpretations, and we shall not be liable or responsible, except in the case of gross or wilful negligence on our part, for any loss, costs, damages or expenses incurred or sustained by Customer resulting from any interpretation made by any of our agents or employees.

AK-1 recorders. Read from right to left.



1. INITIAL HYDROSTATIC MUD PRESSURE
2. PRE-FLOW
3. INITIAL SHUT-IN
- 4a. 2nd INITIAL FLOW
- 4b. 2nd FINAL FLOW
- 4c. 2nd SHUT-IN
5. 3rd INITIAL FLOW
6. FINAL FLOW
7. FINAL SHUT-IN
8. FINAL HYDROSTATIC MUD PRESSURE

K-K-3 recorders. Read from left to right.

N.B. When only two shut-in and flow periods are run, 4a, 4b and 4c are omitted.

Typical charts for visual field analysis ranging from very low to high permeability.



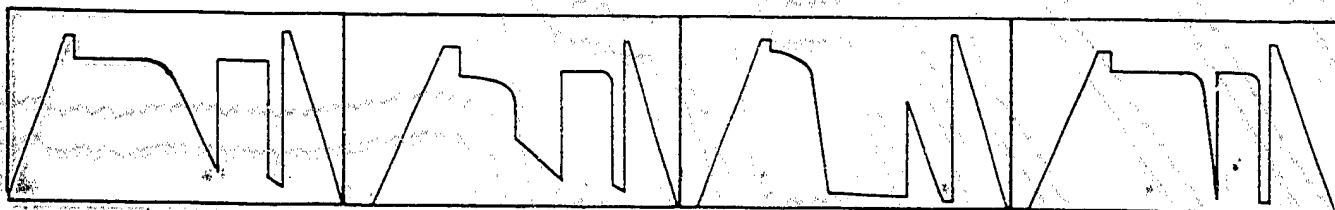
Very low permeability. Usually only mud recovered from interval tested. Virtually no permeability.

Slightly higher permeability. Again usually mud recovered.

Slightly higher permeability. Small recovery, less than 200' ft).

Average permeability. Final and initial shut-ins differ by 50 psi.

Average permeability. Strong damage effect. High shut-in pressure, low flow pressure.



Excellent permeability where final flow final shut-in pressure.

High permeability where ISIP and FSIP are within 10 psi.

Deep well bore invasion or damage. Final shut-in higher than the initial shut-in.

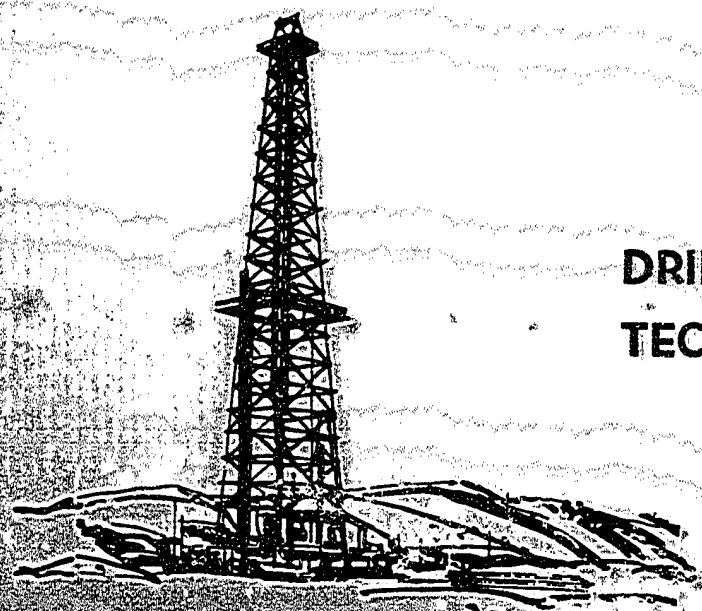
Tight hole chamber tester. Permeability very difficult to interpret unless the recovery is less than chamber length. Flow pressure builds up rapidly if recovery is large, similar to a shut-in.



**LYNES**

*BRIGHT NAME IN THE OIL PATCH*

*Inflatable and Conventional Packer Tools*



**DRILL STEM TEST  
TECHNICAL SERVICE REPORT**

## NOMENCLATURE (Definition of Symbols)

|          |                                                                                  |
|----------|----------------------------------------------------------------------------------|
| $Q$      | = average production rate during test, bbls./day                                 |
| $Q_g$    | = measured gas production rate during test, MCF/day                              |
| $k$      | = permeability, md                                                               |
| $h$      | = net pay thickness, ft. (when unknown test interval is chosen)                  |
| $\mu$    | = fluid viscosity, centipoise                                                    |
| $Z$      | = compressibility factor                                                         |
| $T_i$    | = reservoir temperature, ° Rankine                                               |
| $m$      | = slope of final SIP buildup plot, psig/cycle (psig <sup>2</sup> /cycle for gas) |
| $b$      | = approximate radius of investigation, feet                                      |
| $r_w$    | = wellbore radius, feet                                                          |
| $t_o$    | = total flowing time, minutes                                                    |
| $P_o$    | = extrapolated maximum reservoir pressure, psig                                  |
| $P_i$    | = final flowing pressure, psig                                                   |
| $P.I.$   | = productivity index, bbls./day/psi                                              |
| $P.I._t$ | = theoretical productivity index with damage removed, bbl./day/psi               |
| $D.R.$   | = damage ratio                                                                   |
| $E.D.R.$ | = estimated damage ratio                                                         |
| $AOF$    | = absolute open flow potential, MCF/D                                            |
| $AOF_t$  | = theoretical absolute open flow if damage were removed                          |
| $Z$      | = subsea depth                                                                   |
| $W$      | = water gradient based on salinity                                               |
| $H_w$    | = potentiometric surface                                                         |

| INTERPRETATION CALCULATIONS (OIL/WATER)                                                                                                                                                                                                                                                                                                             |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| <b>AVERAGE PRODUCTION RATE DURING TEST</b><br>$Q = \frac{1440 (\text{drill collar capacity} \times \text{recovery} + \text{drill pipe capac.} \times \text{recovery})}{\text{initial flow time} + \text{final flow time}}$<br>$= \frac{1440 [( ) + ( )]}{( ) + ( )}$<br>$= \frac{1440 [(0.145 \text{ or } .0073) ( )]}{( )}$<br>$= \dots$ bbls./day |  |  |  |
| <b>FLUID PROPERTIES</b> Estimated Bottom Hole Temperature °                                                                                                                                                                                                                                                                                         |  |  |  |
| API Gravity @ 60° F.      * Specific Gravity @ 60° F.      Est. Viscosity cp                                                                                                                                                                                                                                                                        |  |  |  |
| <b>TRANSMISSIBILITY</b><br>$\frac{k h}{\mu} = \frac{162.6 Q}{m} = \frac{162.6 ( )}{( )} = \dots$ md.-ft./cp                                                                                                                                                                                                                                         |  |  |  |
| <b>IN SITU CAPACITY</b><br>$kh = ( ) ( ) = \dots$ md.-ft.                                                                                                                                                                                                                                                                                           |  |  |  |
| <b>AVERAGE EFFECTIVE PERMEABILITY</b> Estimated Pay Thickness Ft.      Actual Pay Thickness Ft.<br>$k = \frac{( )}{( )} = \dots$ md.                                                                                                                                                                                                                |  |  |  |
| <b>PRODUCTIVITY INDEX</b><br>$PI = \frac{Q}{P_o - P_i} = \frac{( )}{( ) - ( )} = \dots$ bbl./day-psi                                                                                                                                                                                                                                                |  |  |  |
| <b>DAMAGE RATIO</b><br>$D.R. = \frac{0.183 (P_o - P_i)}{m} = \frac{0.183 [( ) - ( )]}{( )} = \dots$                                                                                                                                                                                                                                                 |  |  |  |
| <b>PRODUCTIVITY INDEX WITH DAMAGE REMOVED</b><br>$P.I._t = P.I. \times D.R. = ( ) ( ) = \dots$ bbl./day-psi                                                                                                                                                                                                                                         |  |  |  |
| <b>APPROXIMATE RADIUS OF INVESTIGATION</b><br>$b = \sqrt{H_o} = \sqrt{( ) ( )} = \dots$ ft.                                                                                                                                                                                                                                                         |  |  |  |
| Drawdown Factor = $\frac{1.81 P_o - F.S.I.P. \times 100}{1.81 P_o} = \frac{( ) - ( ) \times 100}{( )} = \dots$ % (4% to 5% is considered serious or substantial)                                                                                                                                                                                    |  |  |  |
| Potentiometric Surface = $H_w = Z + P_o = \dots + \dots = \dots$ ft.                                                                                                                                                                                                                                                                                |  |  |  |

| INTERPRETATION CALCULATIONS (GAS)                                                                                                                                                                                            |  |                            |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------|--|
| <b>ESTIMATED GAS PROPERTIES</b><br>Gravity @ 60° F.      Viscosity (Res.) cp.      Estimated Bottom Hole Temperature °                                                                                                       |  | Compressibility Factor (Z) |  |
| <b>TRANSMISSIBILITY</b> Measured D.S.T. Gas Rate = MCF/d.                                                                                                                                                                    |  |                            |  |
| $\frac{k h}{\mu} = \frac{1637 Q_g Z T_i}{m} = \frac{1637 ( ) ( ) ( )}{( )} = \dots$ md.-ft./cp.                                                                                                                              |  |                            |  |
| <b>IN SITU CAPACITY</b><br>$kh = ( ) ( ) = \dots$ md.-ft.                                                                                                                                                                    |  |                            |  |
| <b>AVERAGE EFFECTIVE PERMEABILITY</b> Estimated Pay Thickness Ft.      Actual Pay Thickness Ft.<br>$k = \frac{( )}{( )} = \dots$ md.                                                                                         |  |                            |  |
| <b>APPROXIMATE RADIUS OF INVESTIGATION</b><br>$b = 0.02 \sqrt{H_o P_o} = 0.02 \sqrt{( ) ( )} = \dots$ ft.                                                                                                                    |  |                            |  |
| <b>ACTUAL CAPACITY</b><br>$kh = \frac{3270 Q_g Z T_i \log(0.472 r_o)}{P_o^2 - P_i^2} = \frac{3270 ( ) ( ) ( ) \log( )}{( ) - ( )} = \dots$ md.-ft.                                                                           |  |                            |  |
| <b>DAMAGE RATIO</b> E.D.R. = $\frac{(P_o^2 - P_i^2)}{m (\log T_o + 2.45)}$<br>$D.R. = \frac{\text{In Situ Capacity}}{\text{Actual Capacity}} = \frac{( )}{( )} = \dots$ E.D.R. =                                             |  |                            |  |
| <b>ESTIMATED RANGE OF AOF POTENTIAL</b><br>Max. AOF = $\frac{Q_g P_o^2}{P_o^2 - P_i^2} = \frac{( ) ( )^2}{( ) - ( )^2} = \dots$ MCF/D<br>Min. AOF = $\frac{Q_g P_o^2}{P_o^2 - P_i^2} = \sqrt{( ) ( ) - ( )^2} = \dots$ MCF/D |  |                            |  |
| <b>ESTIMATED RANGE OF AOF POTENTIAL, DAMAGE REMOVED</b><br>Max. AOF <sub>t</sub> = [Max. AOF] [D.R.] = ( ) ( ) = MCF/D<br>Min. AOF <sub>t</sub> = [Min. AOF] [D.R.] = ( ) ( ) = MCF/D                                        |  |                            |  |
| Drawdown Factor = $\frac{1.81 P_o - F.S.I.P. \times 100}{1.81 P_o} = \frac{( ) - ( ) \times 100}{( )} = \dots$ % (4% to 5% is considered serious or substantial)                                                             |  |                            |  |
| Potentiometric Surface = $H_w = Z + \frac{P_o}{W} = \dots + \frac{( )}{( )} = \dots$ ft.                                                                                                                                     |  |                            |  |

## NOMENCLATURE (Definition of Symbols)

|                   |                                                                                  |
|-------------------|----------------------------------------------------------------------------------|
| Q                 | = average production rate during test, bbls./day                                 |
| Q <sub>g</sub>    | = measured gas production rate during test, MCF/day                              |
| k                 | = permeability, md                                                               |
| h                 | = net pay thickness, ft. (when unknown, test interval is chosen)                 |
| μ                 | = fluid viscosity, centipoise                                                    |
| Z                 | = compressibility factor                                                         |
| T <sub>i</sub>    | = reservoir temperature, ° Rankine                                               |
| m                 | = slope of final SIP buildup plot, psig/cycle (psig <sup>2</sup> /cycle for gas) |
| b                 | = approximate radius of investigation, feet                                      |
| r <sub>w</sub>    | = wellbore radius, feet                                                          |
| t <sub>o</sub>    | = total flowing time, minutes                                                    |
| P <sub>o</sub>    | = Extrapolated maximum reservoir pressure, psig                                  |
| P <sub>f</sub>    | = final flowing pressure, psig                                                   |
| P.I.              | = productivity index, bbls./day/psi                                              |
| P.I. <sub>e</sub> | = theoretical productivity index with damage removed, bbl./day/psi               |
| D.R.              | = damage ratio                                                                   |
| ED.R.             | = estimated damage ratio                                                         |
| AOF               | = absolute open flow potential, MCF/D                                            |
| AOF <sub>e</sub>  | = theoretical absolute open flow if damage were removed                          |
| Z                 | = subsea depth                                                                   |
| W                 | = water gradient based on salinity                                               |
| H <sub>w</sub>    | = potentiometric surface                                                         |

| INTERPRETATION CALCULATIONS (OIL/WATER)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| <b>AVERAGE PRODUCTION RATE DURING TEST</b><br>$Q = \frac{1440 \text{ (drill collar capacity} \times \text{recovery} + \text{drill pipe capac.} \times \text{recovery)}}{\text{initial flow time} + \text{final flow time}}$ $= 1440 \left[ \frac{ \quad }{ \quad } + \frac{ \quad }{ \quad } \right]$ $= 1440 \text{ (.0145 or .0073) } \left[ \frac{ \quad }{ \quad } \right]$ <div style="display: flex; justify-content: space-between;"> <span>= <math>\frac{ \quad }{ \quad }</math> bbls./day</span> <span>Mud Expansion = <math>\frac{ \quad }{ \quad }</math> ft.<br/>(Drill Collar Conversion Is Considered)</span> </div> |  |  |  |
| <b>FLUID PROPERTIES</b><br><div style="display: flex; justify-content: space-between;"> <span>API Gravity @ 60° F. <math>\frac{ \quad }{ \quad }</math></span> <span>Specific Gravity @ 60° F. <math>\frac{ \quad }{ \quad }</math></span> <span>Est. Viscosity <math>\frac{ \quad }{ \quad }</math> cp</span> </div>                                                                                                                                                                                                                                                                                                               |  |  |  |
| <b>TRANSMISSIBILITY</b><br>$\frac{k h}{\mu} = \frac{162.6 Q_o}{m} = \frac{162.6 \left( \frac{ \quad }{ \quad } \right)}{ \quad } = \frac{ \quad }{ \quad } \text{ md-ft/cp}$                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |
| <b>IN SITU CAPACITY</b><br>$k h = \left( \frac{ \quad }{ \quad } \right) \left( \frac{ \quad }{ \quad } \right) = \frac{ \quad }{ \quad } \text{ md-ft.}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |  |
| <b>AVERAGE EFFECTIVE PERMEABILITY</b><br>$k = \frac{ \quad }{ \quad } = \frac{ \quad }{ \quad } \text{ md.}$ <div style="display: flex; justify-content: space-between;"> <span>Estimated Pay Thickness <math>\frac{ \quad }{ \quad }</math> Ft.</span> <span>Actual Pay Thickness <math>\frac{ \quad }{ \quad }</math> Ft.</span> </div>                                                                                                                                                                                                                                                                                           |  |  |  |
| <b>PRODUCTIVITY INDEX</b><br>$PI = \frac{Q}{P_o - P_f} = \frac{ \quad }{ \quad - \quad } = \frac{ \quad }{ \quad } \text{ bbl./day-psi}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |  |  |
| <b>DAMAGE RATIO</b><br>$D.R. = \frac{0.183 (P_o - P_f)}{m} = \frac{0.183 \left( \frac{ \quad }{ \quad } - \frac{ \quad }{ \quad } \right)}{ \quad } = \frac{ \quad }{ \quad }$                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |  |
| <b>PRODUCTIVITY INDEX WITH DAMAGE REMOVED</b><br>$P.I._e = P.I. \times D.R. = \left( \frac{ \quad }{ \quad } \right) \left( \frac{ \quad }{ \quad } \right) = \frac{ \quad }{ \quad } \text{ bbl./day-psi}$                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |  |
| <b>APPROXIMATE RADIUS OF INVESTIGATION</b><br>$b = \sqrt{\frac{ \quad }{ \quad }} = \sqrt{ \frac{ \quad }{ \quad } } = \frac{ \quad }{ \quad } \text{ ft.}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |  |
| <b>Drawdown Factor</b> = $\frac{I.S.I.P. - F.S.I.P. \times 100}{I.S.I.P.} = \frac{ \quad - \quad \times 100 }{ \quad } = \frac{ \quad }{ \quad } \%$ <div style="text-align: right; font-size: small;">(4% to 5% is considered serious or substantial)</div>                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |
| <b>Potentiometric Surface</b> = $H_w = Z + \frac{P_o}{W}$<br>$H_w = \frac{ \quad }{ \quad } + \frac{ \quad }{ \quad } = \frac{ \quad }{ \quad } \text{ ft.}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |

| INTERPRETATION CALCULATIONS (GAS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| <b>ESTIMATED GAS PROPERTIES</b><br><div style="display: flex; justify-content: space-between;"> <span>Gravity @ 60° F. <math>\frac{ \quad }{ \quad }</math></span> <span>Viscosity (Res.) <math>\frac{ \quad }{ \quad }</math> cp.</span> <span>Estimated Bottom Hole Temperature <math>\frac{ \quad }{ \quad }</math> °F</span> </div>                                                                                                                                                                             |  |  |  |
| <b>TRANSMISSIBILITY</b><br><div style="display: flex; justify-content: space-between;"> <span>Measured D.S.T. Gas Rate = <math>\frac{ \quad }{ \quad }</math> mcf/d.</span> <span>Compressibility Factor (Z) <math>\frac{ \quad }{ \quad }</math></span> </div> $\frac{k h}{\mu} = \frac{1637 Q_g Z T_c}{m} = \frac{1637 \left( \frac{ \quad }{ \quad } \right) \left( \frac{ \quad }{ \quad } \right) \left( \frac{ \quad }{ \quad } \right)}{ \quad } = \frac{ \quad }{ \quad } \frac{\text{md-ft.}}{\text{cp.}}$ |  |  |  |
| <b>IN SITU CAPACITY</b><br>$k h = \left( \frac{ \quad }{ \quad } \right) \left( \frac{ \quad }{ \quad } \right) = \frac{ \quad }{ \quad } \text{ md-ft.}$                                                                                                                                                                                                                                                                                                                                                           |  |  |  |
| <b>AVERAGE EFFECTIVE PERMEABILITY</b><br>$k = \frac{ \quad }{ \quad } = \frac{ \quad }{ \quad } \text{ md.}$ <div style="display: flex; justify-content: space-between;"> <span>Estimated Pay Thickness <math>\frac{ \quad }{ \quad }</math> Ft.</span> <span>Actual Pay Thickness <math>\frac{ \quad }{ \quad }</math> Ft.</span> </div>                                                                                                                                                                           |  |  |  |
| <b>APPROXIMATE RADIUS OF INVESTIGATION</b><br>$b = 0.02 \sqrt{k h P_o} = 0.02 \sqrt{ \left( \frac{ \quad }{ \quad } \right) \left( \frac{ \quad }{ \quad } \right) \left( \frac{ \quad }{ \quad } \right) } = \frac{ \quad }{ \quad } \text{ ft.}$                                                                                                                                                                                                                                                                  |  |  |  |
| <b>ACTUAL CAPACITY</b><br>$k h = \frac{3270 Q_g \mu Z T_c \log \left( \frac{b}{r_w} \right)}{P_o^2 - P_f^2} = \frac{3270 \left( \frac{ \quad }{ \quad } \right) \left( \frac{ \quad }{ \quad } \right) \left( \frac{ \quad }{ \quad } \right) \log \left( \frac{ \quad }{ \quad } \right)}{ \quad - \quad } = \frac{ \quad }{ \quad } \text{ md-ft.}$                                                                                                                                                               |  |  |  |
| <b>DAMAGE RATIO</b><br>$D.R. = \frac{\text{In Situ Capacity}}{\text{Actual Capacity}} = \frac{ \quad }{ \quad } = \frac{ \quad }{ \quad }$ <div style="display: flex; justify-content: space-between;"> <span>ED.R. = <math>\frac{(P_o^2 - P_f^2)}{m (\log \frac{b}{r_w} + 2.45)}</math></span> <span>ED.R. = <math>\frac{ \quad }{ \quad }</math></span> </div>                                                                                                                                                    |  |  |  |
| <b>ESTIMATED RANGE OF AOF POTENTIAL</b><br>$\text{Max. AOF} = \frac{Q_o P_o^2}{P_o^2 - P_f^2} = \frac{ \quad \times \quad }{ \quad - \quad } = \frac{ \quad }{ \quad } \text{ MCF/D}$ $\text{Min. AOF} = \frac{Q_o P_o^2}{V P_o^2 - P_f^2} = \frac{ \quad \times \quad }{ \quad - \quad } = \frac{ \quad }{ \quad } \text{ MCF/D}$                                                                                                                                                                                  |  |  |  |
| <b>ESTIMATED RANGE OF AOF POTENTIAL, DAMAGE REMOVED</b><br>$\text{Max. AOF}_e = [\text{Max. AOF}] [D.R.] = \left( \frac{ \quad }{ \quad } \right) \left( \frac{ \quad }{ \quad } \right) = \frac{ \quad }{ \quad } \text{ MCF/D}$ $\text{Min. AOF}_e = [\text{Min. AOF}] [D.R.] = \left( \frac{ \quad }{ \quad } \right) \left( \frac{ \quad }{ \quad } \right) = \frac{ \quad }{ \quad } \text{ MCF/D}$                                                                                                            |  |  |  |
| <b>Drawdown Factor</b> = $\frac{I.S.I.P. - F.S.I.P. \times 100}{I.S.I.P.} = \frac{ \quad - \quad \times 100 }{ \quad } = \frac{ \quad }{ \quad } \%$ <div style="text-align: right; font-size: small;">(4% to 5% is considered serious or substantial)</div>                                                                                                                                                                                                                                                        |  |  |  |
| <b>Potentiometric Surface</b> = $H_w = Z + \frac{P_o}{W}$<br>$H_w = \frac{ \quad }{ \quad } + \frac{ \quad }{ \quad } = \frac{ \quad }{ \quad } \text{ ft.}$                                                                                                                                                                                                                                                                                                                                                        |  |  |  |

# LYNES UNITED SERVICES LTD.

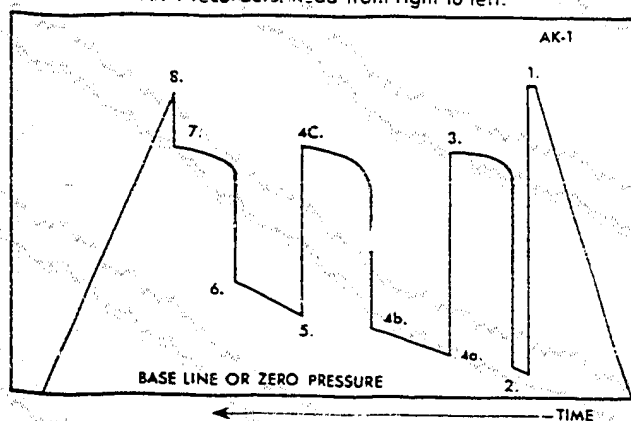
| TEST DATA                                   |  |                          |  | GENERAL INFORMATION                         |  |                |  |
|---------------------------------------------|--|--------------------------|--|---------------------------------------------|--|----------------|--|
| Test No. 5                                  |  | Lynes Test 5             |  | Company Candel Oil Ltd.                     |  |                |  |
| Formation                                   |  | T.D. 9225                |  | Address                                     |  |                |  |
| Interval Tested 8720                        |  | Ft. to 9225              |  | Address                                     |  |                |  |
| Interval Tested 505                         |  | Ft. Net Pay Tested       |  | Address                                     |  |                |  |
| Type of Test Bottom Hole Conv.              |  |                          |  | Well Name Candel Mobil et al N. Ramparts    |  |                |  |
| Cushion                                     |  | Amount                   |  | Well Number A-59                            |  |                |  |
| Started in Hole at 3:30                     |  | Hrs. Tool Open at 6:35   |  | K.B. Elevation 1904 Sub-Sea Elevation       |  |                |  |
| Pre-Flow 15                                 |  | Mins. Initial Shut-in 30 |  | Area Norman Wells Province NWT              |  |                |  |
| 2nd Flow                                    |  | Mins. Second Shut-in     |  | Company Rep. D. Nelson                      |  |                |  |
| Final Flow 90                               |  | Mins. Final Shut-in 90   |  | Tester J. Nelson                            |  |                |  |
| Remarks:                                    |  |                          |  | Contractor Jennings Ria No. 1               |  |                |  |
| Blow: Strong air blow on preflow.           |  |                          |  | Ticket No. 7399 Date June 9/73              |  |                |  |
| Strong air blow on open flow.               |  |                          |  | Service Reports To:                         |  |                |  |
| Decreasing to dead in 55 minutes.           |  |                          |  | 5 = above address                           |  |                |  |
| GAS BLOW MEASUREMENTS                       |  |                          |  |                                             |  |                |  |
| Measured with                               |  |                          |  | MUD AND HOLE DATA                           |  |                |  |
|                                             |  |                          |  | Mud Type Gel Chem                           |  |                |  |
|                                             |  |                          |  | Weight 8.9 Viscosity 50 Water Loss 9.8      |  |                |  |
|                                             |  |                          |  | Filter Cake 2/32" Bottom Hole Temperature   |  |                |  |
|                                             |  |                          |  | Drill Pipe Size 3 1/2 IF Weight             |  |                |  |
|                                             |  |                          |  | Drill Collars 3 1/2 IF I.D. 2" Feet Run 499 |  |                |  |
|                                             |  |                          |  | Main Hole or Casing Size 6 1/8"             |  |                |  |
|                                             |  |                          |  | Rathole or Liner Size No. of Feet           |  |                |  |
|                                             |  |                          |  | Bottom Hole Choke Size 5/8"                 |  |                |  |
|                                             |  |                          |  | Surface Choke Size                          |  |                |  |
|                                             |  |                          |  | Packer Rubber Size 5 1/2"                   |  |                |  |
|                                             |  |                          |  | REMARKS Shut-in pressures suggest           |  |                |  |
|                                             |  |                          |  | excellent permeability within the           |  |                |  |
|                                             |  |                          |  | interval tested. Both of the                |  |                |  |
|                                             |  |                          |  | shut-in curves are perfectly flat           |  |                |  |
|                                             |  |                          |  | therefore a horner plot cannot              |  |                |  |
|                                             |  |                          |  | be made nor a virgin reservoir              |  |                |  |
|                                             |  |                          |  | pressure calculated.                        |  |                |  |
| RECOVERY                                    |  |                          |  |                                             |  |                |  |
| TOTAL FLUID RECOVERED 8700                  |  |                          |  | Ft. Consisting of:                          |  |                |  |
| 400 Ft. of drilling mud                     |  |                          |  |                                             |  |                |  |
| 500 Ft. of water cut mud                    |  |                          |  |                                             |  |                |  |
| 7800 Ft. of water                           |  |                          |  |                                             |  |                |  |
| Ft. of                                      |  |                          |  |                                             |  |                |  |
| Test was/was not Reverse Circulated was not |  |                          |  |                                             |  |                |  |
| Oil Recovery A.P.I. Water Specific Gravity  |  |                          |  |                                             |  |                |  |
| Salinity                                    |  |                          |  |                                             |  |                |  |
| PRESSURE READINGS                           |  |                          |  |                                             |  |                |  |
| Inside Outside                              |  | Inside Outside X         |  | Inside Outside X                            |  | Inside Outside |  |
| Recorder No. 1619                           |  | Recorder No. 5323        |  | Recorder No. 662                            |  | Recorder No.   |  |
| Capacity 6100                               |  | Capacity 8000            |  | Capacity 8400                               |  | Capacity       |  |
| Depth 8701                                  |  | Depth 8724               |  | Depth 8731                                  |  | Depth          |  |
| NUMBER KEY:                                 |  |                          |  |                                             |  |                |  |
| 1 - INITIAL HYDROSTATIC                     |  | 4031                     |  | 4051                                        |  | 4054           |  |
| 2 - PRE-FLOW                                |  | 1668                     |  | 2225                                        |  |                |  |
| 3 - INITIAL SHUT-IN                         |  | 3713                     |  | 3716                                        |  |                |  |
| 4a - 2nd INITIAL FLOW                       |  |                          |  |                                             |  |                |  |
| 4b - 2nd FINAL FLOW                         |  |                          |  |                                             |  |                |  |
| 4c - 2nd SHUT-IN                            |  |                          |  |                                             |  |                |  |
| 5 - 3rd INITIAL FLOW                        |  | 1859                     |  | 2062                                        |  | 2045           |  |
| 6 - FINAL FLOW                              |  | 3684                     |  | 3706                                        |  | 3706           |  |
| 7 - FINAL SHUT-IN                           |  | 3713                     |  | 3714                                        |  | 3710           |  |
| 8 - FINAL HYDROSTATIC                       |  | 3975                     |  | 3984                                        |  | 3985           |  |

Candel Oil Ltd. Company  
 Candel Mobil et al N. Rampart A-59 Well Name and Description  
 #5 Test No.  
 June 9/73 Date of Test

## GUIDE TO INTERPRETATION AND IDENTIFICATION OF LYNES DRILL STEM TEST PRESSURE CHARTS

In making any interpretation, our employees will give Customer the benefit of their best judgment as to the correct interpretation. Nevertheless, since all interpretations are opinions based on inferences from electrical, mechanical or other measurements, we cannot, and do not, guarantee the accuracy or correctness of any interpretations, and we shall not be liable or responsible, except in the case of gross or wilful negligence on our part, for any loss, costs, damages or expenses incurred or sustained by Customer resulting from any interpretation made by any of our agents or employees.

AK-1 recorders. Read from right to left.

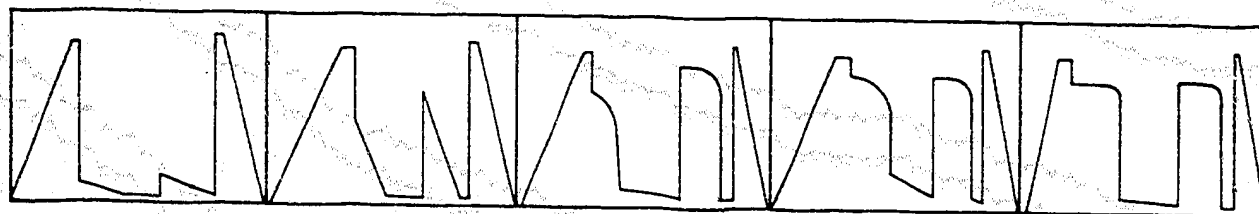


1. INITIAL HYDROSTATIC MUD PRESSURE
2. PRE-FLOW
3. INITIAL SHUT-IN
- 4a. 2nd INITIAL FLOW
- 4b. 2nd FINAL FLOW
- 4c. 2nd SHUT-IN
5. 3rd INITIAL FLOW
6. FINAL FLOW
7. FINAL SHUT-IN
8. FINAL HYDROSTATIC MUD PRESSURE

N.B. When only two shut-in and flow periods are run, 4a, 4b and 4c are omitted.

K-K-3 recorders. Read from left to right.

Typical charts for visual field analysis ranging from very low to high permeability.



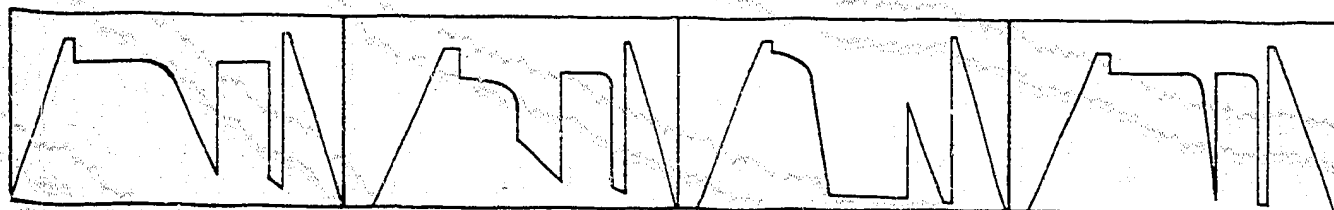
Very low permeability. Usually only mud recovered from interval tested. Virtually no permeability.

Slightly higher permeability. Again usually mud recovered.

Slightly higher permeability. Small recovery, less than 200 psi.

Average permeability. Final and initial shut-ins differ by 50 psi.

Average permeability. Strong damage effect. High shut-in pressure, low flow pressure.



Excellent permeability where final flow final shut-in pressure.

High permeability where ISIP and FSIP are within 10 psi.

Deep well bore invasion or damage. Final shut-in higher than the initial shut-in.

Tight hole chamber tester. Permeability very difficult to interpret unless the recovery is less than chamber length. Flow pressure builds up rapidly if recovery is large, similar to a shut-in.



# Pi Consultants Ltd.

PHONE (403) 262-3600

SUITE 8, 1930 - 5A STREET S.W., CALGARY, ALBERTA  
T2S 2G1

Prepared by Thomas Boleantu, P. Geol.

July 1, 1973

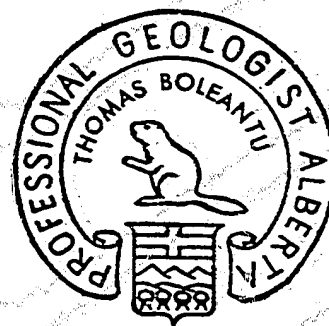
## 821-11-05-018

### WELL HISTORY REPORT

Candell Mobil et al N. Ramparts A-59

65° 30' N. 130° 30' W.

N. W. T.





# Pi Consultants Ltd.

PHONE (403) 262-3600

SUITE 8, 1930 5A STREET S.W. CALGARY ALBERTA  
T2S 2G1

Prepared by Thomas Boleantu, P. Geol.

July 1, 1973

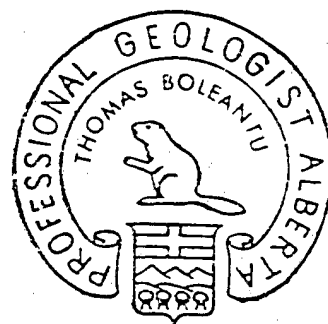
## 821-11-05-018

WELL HISTORY REPORT

CanDel Mobil et al N. Ramparts A-59

65° 30' N. 130° 30' W.

N. W. T.



## WELL HISTORY REPORT

### SECTION 1 - SUMMARY OF WELL DATA

a) Well Name and Number : CanDel Mobil et al N. Ramparts A-59  
b) Permittee : Mobil Oil Canada Ltd.  
c) Name of Operator : CanDel Oil Ltd. - 330 Fifth Avenue S.W.  
Calgary 1, Alberta.  
d) Location : Grid 55-30-130-30  
Lat. 65°28' 04" Long. 130°39' 47"

Unique Well Identifier: 300A596530130300

Universal Well Location Reference: Lat. 65.46778°N  
Long. 130.66305°W

e) Development Well : -  
f) Permit Number : 4430  
g) Drilling Contractor : Jennings International Drilling, Licence 19381  
Rig No.1, G.C. #500 -EMSCO  
EMSCO Pumps DA 700 & D 500  
h) Drilling Authority : No. 634 Issued December 1, 1972  
i) Classification : New Field Wildcat  
j) Elevation : Ground +1890 ft. K.B. +1904.4 ft.  
k) Spudded : January 22nd, 1973 (00:15 A.M.)  
l) Completed Drilling : June 3rd, 1973 (12:45 P.M.)  
m) T.D. : Driller 10,515 ft. in Ronning Fm.  
Log. 10,520 ft.  
n) Well Status : D & A  
o) Rig Released Date : June 11th, 1973 (7 P.M.)  
p) Hole Sizes : 24" - 30 ft.  
17½" - 126 ft.  
13 3/4" - 1,003 ft.  
8 3/4" - 6,380 ft.  
6 1/8" - 10,515 ft. (New Hole from 6362 ft.)

| q) Casing | Size   | Joints | Wt.                      | Grade | New/Used | Depth    | Cement |
|-----------|--------|--------|--------------------------|-------|----------|----------|--------|
|           | 16"    | 7      | (Construction Pipe #236) |       | New      | 111 ft.  | 400 sx |
|           | 9 5/8" | 25     | 36#                      | MM-KS | New      | 998 ft.  | 835 sx |
|           | 7"     | 147    | 23#                      | N-80  | New      | 5789 ft. | 400 sx |

WELL HISTORY REPORT (Continued)SECTION 2 - GEOLOGICAL SUMMARY

| (a) Formation Tops           | FDC/GR<br>CNL/GR | Sub-Sea  | Sample       |
|------------------------------|------------------|----------|--------------|
| Quaternary                   | 14.4 ft          | +1890 ft | Surface      |
| Tertiary                     | 145 ft           | +1759 ft | 150 ft       |
| Cretaceous                   | 245 ft           | +1659 ft | 245 ft       |
| Sand #1                      | 572-700 ft       | +1332 ft | 550-710 ft   |
| Sand #2                      | 1172-1204 ft     | +732 ft  | 1170-1200 ft |
| Sand #3                      | 1310-1318 ft     | +594 ft  | 1310-1320 ft |
| Sand #4                      | 3080-3160 ft     | -1176 ft | 3080-3120 ft |
| Sand #5                      | 4180-4354 ft     | -2776 ft | 4180-4355 ft |
| Mississippian                | 4354 ft          | -2450 ft | 4355 ft      |
| U. Devonian - Imperial Fm    | 4420 ft          | -2516 ft | 4429 ft      |
| (Basal Siltst/Ss. Mbr)       | 6367 ft          | -4463 ft | 6363 ft      |
| - Canol Fm                   | 6665 ft          | -4761 ft | 6660 ft      |
| M. Devonian - Hare Indian Fm | 6920 ft          | -5016 ft | 6915 ft      |
| - Hume Fm                    | 7133 ft          | -5229 ft | 7131 ft      |
| - Headless Fm                | 7306 ft          | -5402 ft | 7305 ft      |
| - Gossage Fm (Landry Ls)     | 7556 ft          | -5652 ft | 7552 ft      |
| (Arnica Dol)                 | 8206 ft          | -6302 ft | 8217 ft      |
| Ordovician/ - Ronning Fm     | 9355 ft          | -7451 ft | 9370 ft      |
| Silurian                     |                  |          |              |
| Total Depth       "          | 10,520 ft        |          | 10,515 ft    |

- (b) Cored Intervals               - None
- (c) Core Description               - None
- (d) Sample Description             - Attached
- (e) Paleontological Determination - None

SECTION 3 - ENGINEERING SUMMARY

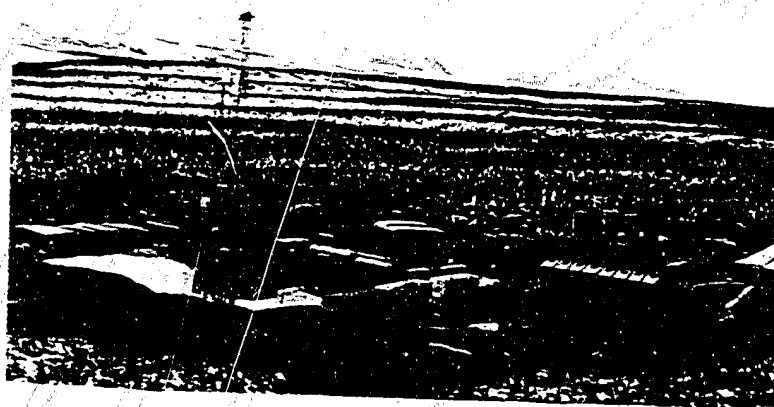
- (a) D.S.T.'s   D.S.T. #1 10230-10515 ft   - Misrun               Ronning Fm  
                   D.S.T. #2 10220-10515 ft   - Misrun               "  
       (Charts    D.S.T. #3 10390-10515 ft   - Misrun               "  
       Attached) D.S.T. #4 8720- 9247 ft   - Misrun               Gossage Fm  
                   D.S.T. #5 8720- 9225 ft   Strong Air Blow  
                                               died in 55 min.  
                   Recov. 400' mud, 500' water cut mud, 7800' fresh water

- (b) Casing Record               - Attached
- (c) Bit Record                 - Attached
- (d) Mud Report                 - Attached
- (e) Deviation Surveys - Attached
- (f) Abandonment Plugs - Plug #1 10400-10515 ft - 30 sx cement  
                               - Plug #2 8700- 9225 ft - 110 sx cement  
                               - Plug #3 5739- 5859 ft - 30 sx cement  
                               - Plug #4 Surface pipe - 10 sx cement
- (g) Lost Circulation Zones: Hume Fm, @ upper contact, 7121-7149 ft.
- (h) Report of Blowouts- None

WELL HISTORY REPORT (Continued)

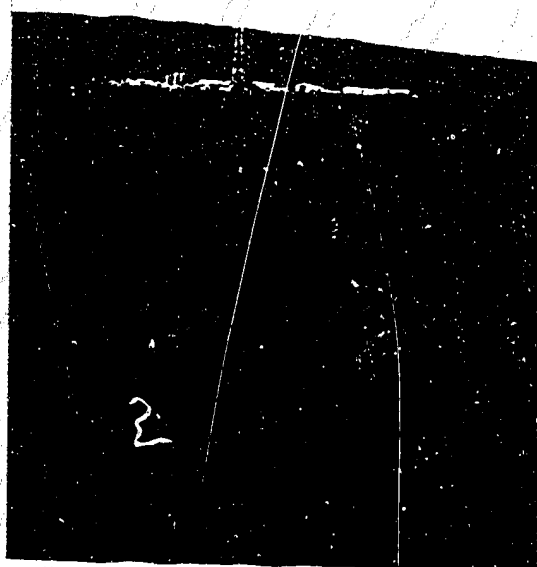
SECTION 4 - LOGS

| a) Electrical: | <u>Dates Run</u> | <u>Intervals</u>  | <u>Type Logs Run</u>                                        |
|----------------|------------------|-------------------|-------------------------------------------------------------|
|                | May 25th         | 5,794- 9,896 ft.  | Dual Induction Laterolog                                    |
|                |                  | 5,794- 9,900 ft.  | BHC Sonic Gamma/Caliper                                     |
|                |                  | 5,792- 9,898 ft.  | Formation Density/Gamma (FDC)<br>/Compensated Neutron (CNL) |
|                |                  | 50- 5,775 ft.     | Compensated Neutron Gamma (CNL-GR)<br>(Cased Hole)          |
|                | June 3rd.        | 9,896-10,512 ft.  | Dual Induction Laterolog                                    |
|                |                  | 9,900-10,515 ft.  | BHC Sonic Gamma/Caliper                                     |
|                |                  | 9,900-10,518 ft.  | Formation Density/Gamma (FDC/GR)                            |
| b) Geological: | May 28th.        | 0-10,000 ft.      | Logged by T. Boleantu (P.Geol.)                             |
|                | June 3rd.        | 10,000-10,515 ft. | Logged by P. Brown                                          |



Rig & Camp. MacKenzie Mountains 10 miles S.W.

May 1973.



Looking N.W. Conglomerate encountered in well, is located as outcrop in ravine near water's edge, in fore-ground.  
Rig ground elev. +1890 ft  
Top conglomerate in well +1759 ft  
River elevation +1733 ft



T. Boleantu, P. Geologist, sitting beside conglomerate. Note large, well-rounded boulders many of which are hard, quartzitic resulting in difficult drilling at well-site.



Rig & Camp. Mackenzie Mountains 10 miles S.W.

May 1973.



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|                          |          |
|--------------------------|----------|
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| Top conglomerate in well | +1759 ft |
| River elevation          | +1733 ft |



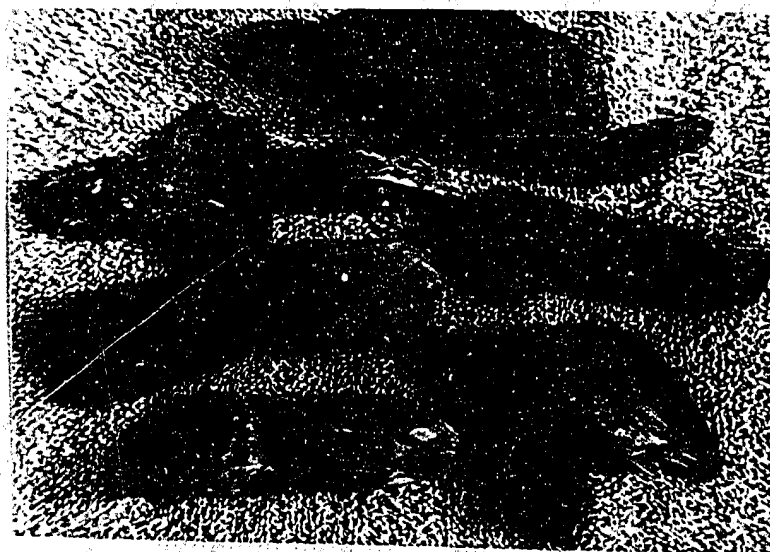
T. Boleantu, P. Geologist, sitting beside conglomerate. Note large, well-rounded boulders many of which are hard, quartzitic resulting in difficult drilling at well-site.

Can-Del Mobil et al N. Ramparts A-59

SAMPLE DESCRIPTION



Large Shale Shard (Caving) Cretaceous. Note  
pyrite nodule and graded silty laminations. X0.9



Cretaceous Shale Shards - Cavings  
following stuck pipe at 4429 ft.  
-Difficult to circulate up.

X0.5



Mottled Limestone, Intrabiosparite. Gossage formation  
(Landry Ls. equivalent) X9



Fine-medium crystalline Dolomite w.  
med-good scattered intercrystalline & micro-  
vug porosity. Gossage fm (Arnica Dol. equiv.) X9

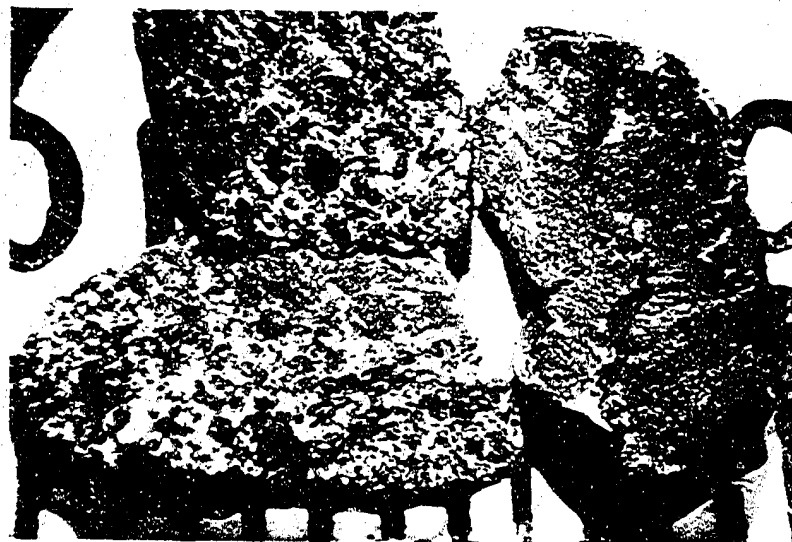


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Fine-medium crystalline Dolomite w.  
med-good scattered intercrystalline & micro-  
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SAMPLE DESCRIPTION - CanDel Mobil et al N. Ramparts A-59

|                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                 |  |
|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <p>0 - 130 ft.<br/>Tertiary<br/>Conglomerate<br/>CNL/GR 145 ft</p>                                 | <p>Extremely poor samples due to drilling with water. 95% of sample was peat, muskeg. Poor samples from reaming indicated the following:<br/>0-10 ft. (surface) MUDSTONE: dk brn, with ice laminae, permafrost, layers of muskeg peat moss.<br/>10-130 ft. Interbeds of peat moss, siltstone &amp; shale, med. ggry to brn, med hd. (Clyst Sandstone, yel-wh., fg. to slty, Coal-blk, bit., Pebbles.(cong.)</p> |  |
|                                                                                                    | <p>170-180 ft. Cong. heterogeneous comp. of Qtzt, Ls, Dol, Ss.(wh-yel.), peb., <math>\frac{1}{2}</math> - 2". No matrix or cement apparant, possibly permafrost (ice) cement as loosely consolidated. Quartzites of wh. f-mg. extremely hd. , well-rounded (up to 40% of sple)</p>                                                                                                                              |  |
|                                                                                                    | <p>190-200 ft. Cong. a/a. minor dk gy Sh &amp; Slst. Pebbles up to 4", heterog. comp.,</p>                                                                                                                                                                                                                                                                                                                      |  |
| <p>200-230 ft.<br/>230-245 ft.<br/>245-250 ft.<br/>Cretaceous<br/>Spl 245 ft<br/>FDC/GR 245 ft</p> | <p>200-230 ft. Cong. a/a, cobbles to 2", well rded. , Qtzt-wh-Fe stn, Dol-wh-lt gy, hd.</p>                                                                                                                                                                                                                                                                                                                     |  |
|                                                                                                    | <p>230-245 ft. Cong A/a (70%),Clyst (30%)-dk. brn-gy, hd, blk, sl. slty. Ss (10%) lt gy, vfg, arg</p>                                                                                                                                                                                                                                                                                                           |  |
|                                                                                                    | <p>245-250 ft. Clayst (70%) med-dk brnsh gry, blocky, hd, mic-micaceous, Ss (20%) lt gy, slty-vfg, arg. Cong. (10%) a/a</p>                                                                                                                                                                                                                                                                                     |  |
|                                                                                                    | <p>250-260 ft Shale (a/a dense clayst. variety) 80%, dk brn-gy, blk, micro-micaceous, Siltstone (20%) med gy, grdg to vfg ss or sh a/a, thn laminae</p>                                                                                                                                                                                                                                                         |  |
|                                                                                                    | <p>260-270 ft. Sh. a/a brn-gy, blk (clyst. var. )mic-mica, (80%) Slst (15%) a/a, s&amp;p. gdg to ss. Ss. (5%) wh. vfg-slty, thn lam,</p>                                                                                                                                                                                                                                                                        |  |
|                                                                                                    | <p>270-280 ft. Sh. a/a(90%w.occ. pyr. nod. Slst. a/a (5%) Ss a/a (5%)</p>                                                                                                                                                                                                                                                                                                                                       |  |
|                                                                                                    | <p>280-290 ft. Sh. a/a (90%) occ. pyr. Slst. a/a (10%) grdg to vfg ss.</p>                                                                                                                                                                                                                                                                                                                                      |  |
|                                                                                                    | <p>290-300 ft. Sh. " (95%) Slst." (5%)</p>                                                                                                                                                                                                                                                                                                                                                                      |  |
|                                                                                                    | <p>300-310 ft/ Sh. "</p>                                                                                                                                                                                                                                                                                                                                                                                        |  |
|                                                                                                    | <p>310-320 ft. Sh. " sl mic-mica (90% Slst. " (10%) lam grdg to vfg ss.</p>                                                                                                                                                                                                                                                                                                                                     |  |
|                                                                                                    | <p>320-340 ft. Sh. " (95%) Slst. " (5%) med. gy, arg. lam.</p>                                                                                                                                                                                                                                                                                                                                                  |  |
|                                                                                                    | <p>340-360 ft. Sh. " (90%) dk gy-brn, mic-mica lam, blk, occ. pyr. Slst. a/a med. gy, arg, lam (10%)</p>                                                                                                                                                                                                                                                                                                        |  |

Page 2, Sample Description - CanDel Mobil et al N. Ramparts A-59

|             |                                                         |                                                              |
|-------------|---------------------------------------------------------|--------------------------------------------------------------|
| 360-370 ft  | Shale (Clayst. var.) 95%, dk brn-gy, blk, mic-mica, hd, | Siltst; (5%) med gy, -brngy lam, arg.                        |
| 370-380 ft  | Sh. " (90%) , ptly slty                                 | Siltst. a/a                                                  |
| 380-400 ft  | Sh. " 100% non-slty, min pyr.nod.                       |                                                              |
| 400-410 ft  | Sh " 95% "                                              | Siltst. " 5%                                                 |
| 410-430 ft  | Sh " 90%                                                | Siltst. " 10% w. grad to vfg, slty ss., lam                  |
| 430-450 ft. | Sh. " 100%, min, pyr nod & lam.                         |                                                              |
| 450-460 ft. | Sh " 95%,                                               | Siltst. " 5% med-dk brn-gy, arg.                             |
| 460-470 ft. | Sh " 90% Occ. slty                                      | Siltst. 10% , "                                              |
| 470-480 ft. | Sh " 95% +pyr. nod.                                     | Siltst. a/a, w. grd to Sh.                                   |
| 480-490 ft. | Sh " 100%, occ slty, min mic-mica                       |                                                              |
| 490-500 ft. | Sh. " 90% , v mic-mica, pyr com                         | Siltst. "10% grd to Sh                                       |
| 500-510 ft  | Sh. " 95%, dk gy, dk brn-gy, mic-mica, pyr,             | Siltst "5%                                                   |
| 510-520 ft  | Sh " 85% Siltst a/a 10%, dk gy                          | <u>Ss</u> wh, s & p, vfg-slty, arg mx.                       |
| 520-530 ft. | Sh " 95%, pyr. nod. Siltst. "                           |                                                              |
| 530-550 ft. | Sh. " 100% dk brn-gy, blk, hd, mic-mica, pyr.nod.       |                                                              |
| 550-560 ft. | Sh. " 80%                                               | Siltst. (20%) med-dk gy, occ grd to vfg ss.                  |
| 560-570 ft. | Sh. " 90% sl pyr.                                       | Siltst. (10%) dk gy. to dk brn-gy.                           |
| 570-580 ft. | Sh. " 90% pyr. nod.                                     | Siltst. (5%) " , grd to ss Ss. (5%) wh-lt gy, slty, s&p vfg. |
| 580-590 ft. | Sh. 95% dk gy, blk, pyr nod, mic-mica                   | Siltst: (5%) dk gy a/a                                       |

|             |                                                                                           |                                             |                                                        |
|-------------|-------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------|
| 590-600 ft. | Sh (Olyst. variety) dk gy, hd, blk, mic-mica, pyr nod. 95%<br>occ. blk blk carb plt frgs, | Sltst (5%) md gy, arg, lam                  |                                                        |
| 600-610 ft  | Sh 90%, " (no pl) ptly slty                                                               | Sltst.(5%) a/a                              | Ss.(5%) wh-lt gy, vfg-slty                             |
| 610-620 ft  | Sh 95% " - -                                                                              | Sltst (5%) "                                |                                                        |
| 620-630 ft. | Sh 85% "                                                                                  | Sltst. 5% "                                 | Ss. lt gy-wh, vfg-slty, s&p (10%)                      |
| 630-640 ft  | Sh 80% "                                                                                  | Sltst. 10% "                                | Ss. 10% "                                              |
| 640-650 ft  | Sh.35% " occ slty, plt frag.                                                              | Sltst. 10% "                                | Ss. 5% "                                               |
| 650-660 ft. | Sh.75% " - -                                                                              | Sltst. 10% "                                | Ss.15% " , arg.                                        |
| 660-670 ft. | Sh.85% " & pyr. nod.                                                                      | Sltst. 15% med-dk gy,occ. vfg. ss, arg.     |                                                        |
| 670-680 ft. | Sh 85% " "                                                                                | Sltst. 10% " , lam                          | Ss. med gy,arg, slty-vfg                               |
| 680-690 ft. | Sh 40% " -                                                                                | Sltst. 30% "                                | Ss. 30% lt gy, slty-vfg, s&p<br>occ mg, subrd,arg,gywk |
| 690-700 ft  | Sh 60% "                                                                                  | Sltst. 20% "                                | Ss. 20% lt gy, slty-vfg, s&p                           |
| 700-710 ft  | Sh 70% "                                                                                  | Sltst. 20% "                                | Ss. 10% a/a                                            |
| 710-720 ft. | Sh 90% "                                                                                  | Silts. 10% " med gry, occ. blk plnt frags.  |                                                        |
| 720-730 ft. | Sh 70% dk gry to brn-gy,a/a                                                               | Silts. 25% " thn arg lam                    | - Ss as 690-700                                        |
| 730-740 ft. | Sh 90% " blk plnt frgs,pyr.                                                               | Silts. 10% "                                |                                                        |
| 740-780 ft. | Sh 95% " (as 590-600 ft) & sks                                                            | Silts. 5% med gry,, lam, in Sh, arg.        |                                                        |
| 780-790 ft. | Sh 90% " -                                                                                | Silts. 10% a/a                              |                                                        |
| 790-800 ft. | Sh 80% "                                                                                  | Silts. 20% lt-med gry, arg. sl sdy          |                                                        |
| 800-810 ft. | Sh 60% "                                                                                  | Silts. 49% med gry, occ vfg, arg w. arg lam |                                                        |
| 810-820 ft. | Sh 85% "                                                                                  | Silts. 15% a/a                              |                                                        |

|              |                                                                                                                                |                              |                             |
|--------------|--------------------------------------------------------------------------------------------------------------------------------|------------------------------|-----------------------------|
| 820-830 ft   | Sh 85% dk gry to dk brn-gry, mic-mica<br>(claystone type-blky) hd pyr, nod.                                                    | Siltst 15% med gry, arg.,    |                             |
| 830-850 ft   | Sh 95% a/a occ. blk                                                                                                            | Silts 5% med-dk gry, arg.    |                             |
| 850-860 ft   | Sh 90% " -                                                                                                                     | Silts 10% a/a                |                             |
| 860-880 ft   | Sh 95% " ptly slty                                                                                                             | Silts 5% "                   |                             |
| 880-890 ft   | Sh 90% " - occ dk gry,<br>& plnt frags.                                                                                        | Silts 10% " occ vfg Ss lam   |                             |
| 890-900 ft   | Sh 95% " " "                                                                                                                   | Silts 5% " -                 |                             |
| 900-920 ft   | Sh 85% " - - occ frac-sks                                                                                                      | Silts 15% " occ vfg          |                             |
| 920-930 ft   | Sh 90% " & blk Sh                                                                                                              | Silts 10% " med-gry -        |                             |
| 930-940 ft   | Sh 95% " dk gry, blk to sl fissile<br>occ pyr, mic-mica                                                                        | Silts 5% "                   | Silts (dolic, grn-gy<br>tr. |
| 940-970 ft   | Sh 100% a/a tr. slty ptgs,                                                                                                     |                              |                             |
| 970-1000 ft  | Sh 100% dk gry to blk, blk to sl fiss.<br>mic-mica, arg lam, hd,                                                               | (9 5/8" casing set @ 996 ft) |                             |
| 1000-1010 ft | Sh 55% a/a dk gry, blk, hd, mic-mica<br>mnr pyr nod.                                                                           | SS- md g, wh, cvgs?,<br>5%   | Cmt: 40%                    |
| 1010-1020 ft | Sh 80% a/a w. mnr pyr nod.                                                                                                     | Ss-tr, cvgs a/a              | Cmt 20%                     |
| 1020-1030 ft | Sh 70% a/a                                                                                                                     |                              | Cmt 30%                     |
| 1030-1040 ft | Sh 100% a/a occ. mic-mica, dk gry-blk, blk<br>sl. fiss,                                                                        |                              |                             |
| 1040-1050 ft | Sh 90% a/a, occ sks                                                                                                            | Silts 10% med gry, arg, lam, |                             |
| 1050-1110 ft | Sh 100% dk gry, blk, sl fiss, mic-mica comm, sl sfter than above, pyr nod.<br>comm. esp 1060-1100 ft, finer spls from jetting. |                              |                             |

|              |                                                             |                                           |                                                                         |
|--------------|-------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------------------|
| 1110-1150 ft | Sh 95% a/a                                                  | no pyr.                                   | Silts 5% med gry, slty lam,                                             |
| 1150-1150 ft | Sh 100% a/a                                                 | occ dk gry to blk, w. occ slty lam.       |                                                                         |
| 1150-1160 ft | Sh 95% a/a                                                  | occ v mic-mica, med gry,<br>hdr, lgr ctgs | Silts 5% med gry, arg. lam                                              |
| 1160-1170 ft | Sh 90% a/a                                                  |                                           | Silts 10% a/a, occ vfg                                                  |
| 1170-1180 ft | Sh 70% a/adk gry,                                           | mnr carb. frags                           | Silts 20% a/a " Ss 10% med gry, vfg<br>wh cly m-trix, gl                |
| 1180-1190 ft | Sh 60% a/a                                                  |                                           | Silts 30% a/a Ss a/a sl dolic cmt, s&p<br>lt gry, mnr glau.             |
| 1190-1200 ft | Sh 80% a/a                                                  |                                           | Silts 10% " 10% Ss slty-vfg, lt gry, s&p                                |
| 1200-1210 ft | Sh 90% "                                                    |                                           | Silts 10% "                                                             |
| 1210-1230 ft | Sh 95% "                                                    | pyr nod com                               | Silts 5% "                                                              |
| 1230-1240 ft | Sh 85% "                                                    | mnr pyr                                   | Silts 15% " med gry.                                                    |
| 1240-1260 ft | Sh 80% "                                                    | -                                         | Silts 20% " med gry-med brn/gry, grdg vfg, sdy,<br>non-dolic            |
| 1260-1270 ft | Sh 60% "                                                    |                                           | Silts 30% " Ss 10%, lt gry, slty                                        |
| 1270-1280 ft | Sh 90% "                                                    |                                           | Silts 10% " "                                                           |
| 1280-1290 ft | Sh 50% med gry, v mic-mica, blk                             |                                           | Silts 10% "                                                             |
|              | Sh 40% dk gry a/a, less mica-mic                            |                                           |                                                                         |
| 1290-1300 ft | Sh 65% lt-med gry, v mic-mica a/a                           |                                           | Silts 10% med gry                                                       |
|              | Sh 25% dk gry a/a                                           |                                           |                                                                         |
| 1300-1310 ft | Sh 80% md gry, med hd, mic-mica                             |                                           | Silts 5% a/a                                                            |
|              | Sh 15% dk gry-blk, hdr, blk                                 |                                           |                                                                         |
| 1310-1320 ft | Sh 50% dk gry, med gry, plnt fra                            |                                           | Silts 20% lt gry, Ss 30% lt gry-wh, dolic, sh,<br>lg musc-mic comm, vfg |
| 1320-1330 ft | Sh 70% med -dk gry a/a                                      |                                           | Silts 20% lt-med gry, Ss 10% wh-lt gry, dolic, sh,<br>arg lg musc. flks |
| 1330-1350 ft | Sh 80% dk gry-blk, mic-mica,<br>hd, brittle, "cyst-variety) |                                           | Silts 20% lt gry, a/a non-dolic, occ sdy                                |
| 1350-1360 ft | Sh 85% a/a                                                  |                                           | Silts 15% " occ lt gry-wh                                               |

|               |                                                                             |                                                   |
|---------------|-----------------------------------------------------------------------------|---------------------------------------------------|
| 1360-1400 ft  | Sh 95% dk gry, mic-mica, blk-y                                              | Silts 5% med-dk gry, arg, occ grdg lt gry, vfg ss |
|               | plty, occ med gry-v mic-mica lam & bds                                      |                                                   |
| 1400-1410 ft  | Sh 100% smoky dk gry, v mic-mica, sl fss, w mnr blk-dk gry, non-mica, blk-y |                                                   |
|               |                                                                             | occ. fiss, sl slty                                |
| 1410-1450 ft  | Sh 95% a/a                                                                  | Silts 5% med gry, arg lam, occ lt gry vfg ss      |
| 1450-1470 ft  | Sh 100% a/a occ slty                                                        | Silts tr, a/a lam                                 |
|               | occ dissem pyr.                                                             |                                                   |
| 1470-1500 ft  | Sh 95% a/a                                                                  | Silts 5% lt-med gry, arg, lam, sl dolic,          |
|               |                                                                             | grdg to hd vit, leached gyp/clay                  |
| 1500-1510 ft  | Sh 90% " dk gry-blk, sl mic-mica:Silts 10% "                                |                                                   |
|               | hdr, splty                                                                  |                                                   |
| 1510-1520 ft  | Sh 95% "                                                                    | Silts 5% lt-med gry, sl. dolic, arg               |
| 1520-1530 ft  | Sh 90% "                                                                    | Silts 10% "                                       |
| 1530-1540 ft  | Sh 85% " occ pyr lam                                                        | Silts 15% "                                       |
| 1540-1600 ft  | Sh 95% dk gry to blk, occ med gry                                           | Silts 5% lt gry-                                  |
|               | blk-y-fiss, sl mic-mica occ plnt frags, occ silty, occ pyr nod.             | lam, blk-yhd, arg                                 |
| 1600-1610 ft  | Sh 95% a/a                                                                  | Dol 5%, lt-med gry, hd, slty, arg                 |
|               |                                                                             | dns                                               |
| 1610-1650 ft  | Sh 100% dk smoky gry, v mic-mica, blk-y-plty                                |                                                   |
|               | occ blk-fiss, mnr pyr nod                                                   |                                                   |
| 1650-1690 ft  | Sh 100% dk gry-blk a/a w vf mic-mica                                        | Silts tr (2-3%) lt gry, arg, dolic, lam           |
|               | mnr pyr nod,                                                                |                                                   |
| 1690-1760 ft  | Sh 100% dk gry-blk, blk-y-fiss, non-mica, mnr smky gry mic-mica lam & ptgs  |                                                   |
|               | no pyr                                                                      |                                                   |
| 1760-1800 ft  | Sh 100% a/a. w. dkr carb lam ptgs, NB-pyric fecal peli comm, vfg, rd        |                                                   |
|               | mnr blk sks, occ carb plnt frgs                                             |                                                   |
| 1800-1810 ft  | Sh 100% a/a -no pyr peli, only pyr nod.                                     |                                                   |
| 1810- 1830 ft | Sh 100% a/a dk gry-blk, occ mic-mica, mnr pyr peli.                         |                                                   |
| 1830-1870 ft  | Sh 100% dk gry-blk a/a, blk-y -sl fiss, occ mic-mica.                       | no pyr                                            |
| 1870-1880 ft  | Sh 100% a/a w occ pyr nod                                                   |                                                   |
| 1880-1890 ft  | Sh 100% a/a                                                                 | BENT, tr, bentonitic sh, lt brn, v mic(musc)      |
|               |                                                                             | ptgs & lam?                                       |
| 1890-1900 ft  | Sh 100% " occ pyr nod, occ sks                                              |                                                   |
| 1900-1930 ft  | Sh 100% a/a w. dk smky gry,                                                 | Ironstone-tr, med brn, hd, dns, nod,              |
|               | no pyr, sl mic-mica                                                         |                                                   |

|              |                                                                      |                                  |                                               |
|--------------|----------------------------------------------------------------------|----------------------------------|-----------------------------------------------|
| 1930-1940 ft | Sh 100% dk gry-blk a/a                                               | Ironstone a/a tr.                | Bent Sh: tr, lt brn,<br>musc. flks congl-agg. |
| 1940-1950 ft | Sh 100% a/a w occ pyr fec pell                                       |                                  |                                               |
| 1950-1960 ft | Sh 100% dk gry, blk to splty, occ pyr nod & lam                      |                                  |                                               |
| 1960-2000 ft | Sh 100% dk gry-blk, hd, dns, sl fiss, splty,<br>w mnr carb plnt frgs |                                  |                                               |
| 2000-2020 ft | Sh 100% " mnr sks                                                    |                                  |                                               |
| 2020-2040 ft | Sh 100% " -                                                          |                                  |                                               |
| 2040-2050 ft | Sh 100% " occ dk brn-gry                                             |                                  |                                               |
| 2050-2060 ft | Sh 100% dk smky gry, mic-mica & a/a, mnr pyr nod,                    |                                  |                                               |
| 2060-2070 ft | Sh 100% dk gry -blk, less mic-mica, occ plnt frgs                    |                                  |                                               |
| 2070-2080 ft | Sh 60% dk smky gry, plty, mic-mica                                   |                                  |                                               |
|              | Sh 40% dk gry-blk, arg, carb,                                        |                                  |                                               |
| 2080-2090 ft | Sh 100% dk gry, smky, plty, mic-mica                                 |                                  |                                               |
| 2090-2100 ft | Sh 100% "                                                            |                                  |                                               |
| 2100-2110 ft | Sh 100% " occ blk-dk gry, non mic-mica                               |                                  |                                               |
| 2110-2120 ft | Sh 60% " dk smky gry, sl mic-mica, plty, hd,                         |                                  |                                               |
|              | Sh 40% dk gry-blk, non mic-mica, occ pyr pell.                       |                                  |                                               |
| 2120-2130 ft | Sh 50% dk smky gry a/a                                               |                                  |                                               |
|              | Sh 50% dk gry-blk a/a                                                |                                  |                                               |
| 2130-2140 ft | Sh 40% dk smky gry a/a,                                              |                                  |                                               |
|              | Sh 60% dk gry-blk a/a, occ plnt frgs                                 |                                  |                                               |
| 2140-2150 ft | Sh 80% dk smky gry, mic-mica a/a                                     | Festn, slty, brn dull gold fluor |                                               |
|              | Sh 20% dk gry-blk a/a                                                |                                  |                                               |
| 2150-2170 ft | Sh 60% dk smky gry a/a                                               |                                  |                                               |
|              | Sh 40% dk gry-blk a/a sl carb, & pyr nod                             |                                  |                                               |
| 2170-2190 ft | Sh 80% dk smky gry, mic-mica a/a w grd to                            |                                  |                                               |
|              | Sh 20% dk gry, occ lam (no blk) non mic                              |                                  |                                               |
| 2190-2200 ft | Sh 60% dk smky gry a/a hd, sl fiss, plty, mnr sks                    |                                  |                                               |
|              | Sh 40% dk gry, non mic                                               |                                  |                                               |
| 2200-2210 ft | Sh 40% dk smky gry a/a                                               |                                  |                                               |
|              | Sh 60% dk gry-blk a/a, occ pyr nod                                   |                                  |                                               |
| 2210-2220 ft | Sh 30% dk smky gry mic-mica a/a                                      |                                  |                                               |
|              | Sh 70% dk gry. a/a                                                   |                                  |                                               |

|              |                                                                           |                                                                           |
|--------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
| 2220-2230 ft | Sh 20% dk smky gry, mic-mica, plty,hd                                     |                                                                           |
|              | Sh 80% dk gry, non mic a/a                                                |                                                                           |
| 2230-2240 ft | Sh 75% dk gry a/a, mnr pyr in frcs                                        | Dol 25% lt brn, (Festn) hd, arg, w<br>mnr blk arg lam in Dol, mnr pyr nod |
| 2240-2250 ft | Sh 90% "                                                                  | Dol 10% a/a (FeStn)                                                       |
| 2250-2270 ft | Sh 95% " w mnr mic-micaSh                                                 | Dol 5% a/a w. arg lam, pyr com (Festn)                                    |
|              | Bent: mnr, lt bl-gry, sft, wxy, pale yell fluor.                          |                                                                           |
| 2270-2290 ft | Sh 98% "                                                                  | Bent tr a/a Festn (Dol) 2% a/a                                            |
| 2290-2300 ft | Sh 95% " -                                                                | Festn (Dol) 5% "                                                          |
| 2300-2320 ft | Sh 97% " w pyr & blk carb lam-<br>& pyr nod                               | Festn " 53 "                                                              |
| 2320-2340 ft | Sh 100% " w mnr pyr nod & lam                                             | Festn " tr "                                                              |
| 2340-2350 ft | Sh 97% " w.occ plnt frgs & pyr nod.                                       | Festn " 5% "                                                              |
| 2350-2380 ft | Sh 100% " dk gry, fiss-blky, hd                                           | Festn " tr. " frc w. wh calc fill                                         |
| 2380-2440 ft | Sh 100% "dk gry, blk-plty, occ mic-mica,<br>al carb lam, hd, occ pyr nod. | -                                                                         |
| 2440-2470 ft | Sh 100% " " a/a, occ dk gry-blk & carb lam                                | -                                                                         |
| 2470-2510 ft | Sh 100% " occ dk brn-gry, no pyr.                                         | Foss: Inoceramus, brn. calcite prisms,<br>tab, 5-lam thk, comm.           |
| 2510-2520 ft | Sh 100% " dk gry-blk, occ pyr nod                                         | Foss: a/a                                                                 |
| 2520-2530 ft | Sh 100% " -                                                               | Foss: Inoceramus prisms a/a                                               |
| 2530-2560 ft | Sh 100% " " -                                                             | -                                                                         |
| 2560-2580 ft | Sh 100% " " occ pyr nod                                                   | Foss: Incc. brn a/a Festn, lt brn a/a                                     |
| 2580-2590 ft | Sh 100% " w smky gry mic-mica Sh                                          | -                                                                         |
| 2590-2600 ft | Sh 100% " -                                                               | -                                                                         |
| 2600-2610 ft | Sh 98% a/a dk gry-blk, occ mic-mica,                                      | Siltst: 2% , lt gry, arg, dolic, s&p                                      |
| 2610-2630 ft | Sh 99% " "                                                                | Siltst 1% a/a, lam in Sh                                                  |
| 2630-2640 ft | Sh 99% " "                                                                | Siltst 1% " Foss: Inoceramus a/a tr                                       |

|              |         |                                                                   |                        |                                         |
|--------------|---------|-------------------------------------------------------------------|------------------------|-----------------------------------------|
| 2640-2660 ft | Sh 95%  | dk gry-blk, in pt mic-mica,<br>plty-blky, mnr sks                 | Siltst: 5%             | lt gry, dolie, mic, arg lam, s&p        |
| 2660-2670 ft | Sh 98%  | "                                                                 | Siltst: 2%             | a/a grdg to sh & arg lam                |
| 2670-2680 ft | Sh 95%  | "                                                                 | Siltst 5%              | med gry, occ lt gry, arg, dolie         |
| 2680-2690 ft | Sh 95%  | "                                                                 | Siltst 3%              | a/a Festn 2% dolie, lt/med<br>brn, conc |
| 2690-2700 ft | Sh 95%  | "                                                                 | Siltst 4%              | " lam Festn 1% a/a                      |
| 2700-2710 ft | Sh 98%  | " occ pyr.lam                                                     | Siltst 2%              | "                                       |
| 2710-2720 ft | Sh 95%  | " occ pyr nod                                                     | Siltst 3%              | " Festn 2% a/a                          |
| 2720-2730 ft | Sh 98%  | a/a dk gry-blk, occ dk brn-blk<br>hd, dns, plty-blky, occ pyr nod | Siltst 2%              | "                                       |
| 2730-2750 ft | Sh 100% | a/a -no pyr                                                       |                        |                                         |
| 2750-2760 ft | Sh 95%  | "                                                                 |                        | Festn 5% a/a dolie                      |
| 2760-2770 ft | Sh 100% | a/a dk gry-blk, hd, blk<br>mnr carb lam & ptgs, occ mic-mica      | Siltst tr,             | a/a                                     |
| 2770-2830 ft | Sh 100% | a/a<br>occ plnt frgs                                              | w. occ Siltst lam,     | lt gry a/a                              |
| 2830-2850 ft | Sh 100% | a/a - occ sks                                                     |                        |                                         |
| 2850-2880 ft | Sh 100% | a/a                                                               | w. occ Festn lam,      | dolie, med brn/gry<br>silty             |
| 2880-2890 ft | Sh 98%  | a/a wpyr as dissem & thn lam                                      | Festn 2%               | a/a, dolie                              |
| 2890-2900 ft | Sh 100% | a/a -                                                             | Festn a/a              | tr.                                     |
| 2900-2930 ft | Sh 100% | a/a                                                               | Siltst, tr,            | lt-med gry, dolie, lam                  |
| 2930-2970 ft | Sh 100% | a/a dk gry-blk, occ mic-mica<br>plty-blky,hd                      | Siltst, tr,            | a/a lam, non-dolie                      |
| 2970-2990 ft | Sh 100% | a/a " w occ dk brn carb lam, s&tr, irreg lam                      |                        |                                         |
| 2990-3020 ft | Sh 100% | a/a "                                                             | FOSS:                  | pyrzed forams- pimpled surf.            |
| 3020-3050 ft | Sh 100% | a/a                                                               | Siltst, tr-lt-med gry, | arg, lam, dolie grdg Ss<br>vfg          |

|              |                                                                                                     |                                                                 |
|--------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| 3050-3060 ft | Sh 98% a/a dk gry-blk                                                                               | Siltst: 2% a/a lam grdg to vfg Ss                               |
| 3060-3080 ft | Sh 90% a/a "                                                                                        | Siltst 10% lt gry-brn to lt gry, arg, sl dol<br>occ grdg vfg Ss |
| 3080-3090 ft | Sh 80% " & Foss: pyzrd<br>forams ps @3000 ft                                                        | Siltst 20% lt&med brn/gry a/a hd dns                            |
| 3090-3100 ft | Sh 70% a/a dk gry-blk, blk-y-fiss                                                                   | Siltst 30% a/a occvfg., mn <u>glauconite</u> g.                 |
| 3100-3110 ft | Sh 75% "                                                                                            | Siltst 25% a/a, no Ss g, sl dolc                                |
| 3110-3120 ft | Sh 65% "                                                                                            | Siltst 35% " "                                                  |
| 3120-3140 ft | Sh 90% "                                                                                            | Siltst 10% " hd, dns, sl dolc, occ<br>lt gry, vfg Ss lam        |
| 3140-3150 ft | Sh 95% "                                                                                            | Siltst 5% a/a, lam & shrp contact & grdg<br>w. sh               |
| 3150-3160 ft | Sh 100% a/a dk gry-blk, hd, blk-y, plty (oft across bds pl)<br>fiss, sl mic-mica, mn pyr nod & pell | Siltst: a/a tr                                                  |
| 3160-3200 ft | Sh 100% a/a mic-sltz size flks, lg pyr nod @ 3190 ft,                                               | Siltst tr, occ lam                                              |
| 3200-3210 ft | Sh 100% a/a : pyr comm                                                                              | Siltst tr lam a/a Festn tr, brn                                 |
| 3210-3230 ft | Sh 100% A/a pyr "nod comm                                                                           | -                                                               |
| 3230-3240 ft | Sh 100% a/a "                                                                                       | Siltst tr, med-gry, slty lam                                    |
| 3240-3250 ft | Sh 100% a/a "                                                                                       | - Festn tr, brn, nod                                            |
| 3250-3290 ft | Sh 100% a/a dk gry to dk brn/gry & blk<br>blk-y, occ fiss, hd, pyr nod comm                         |                                                                 |
| 3290-3330 ft | Sh 100% A/a "                                                                                       | " Foss, occ brn Inoceramus frgs                                 |
| 3330-3340 ft | Sh 100% a/a "                                                                                       | " : occ wh calcite filled frgs                                  |
| 3340-3360 ft | Sh 100% "                                                                                           | " -                                                             |
| 3360-3370 ft | Sh 100% "                                                                                           | " Festn, w wh calc filled frgs                                  |
| 3370-3380 ft | Sh 100% "                                                                                           | " Foss-occ brn Inoceramus frgs                                  |
| 3380-3390 ft | Sh 100% "                                                                                           | " -                                                             |
| 3390-3400 ft | Sh 100% "                                                                                           | " <u>pyzrd plnt stems</u> , frgs, mn <u>shs</u>                 |

|              |         |                                                                                                                            |
|--------------|---------|----------------------------------------------------------------------------------------------------------------------------|
| 3400-3430 ft | Sh 100% | a/a dk gry-blk, blk-y-fiss, plty, mic-mica Sh rare-w dissem mic & Pyr nod & dissem pyr comm, w sks comm & calc filled frcs |
| 3430-3460 ft | Sh 100% | a/a pyr repl. brn calc prisms of Inoceramus Foss. & brn Incc. com                                                          |
| 3460-3470 ft | Sh 100% | " w. mnr Siltst & mnr Festn, Pyr, Inoc a/a, sks                                                                            |
| 3470-3490 ft | Sh 100% | " mnr pyr, sks comm, wh calc filled frcs                                                                                   |
| 3490-3520 ft | Sh 100% | " sl carb., more brtl, plty, sks, mnr dissem pyr & pyr nod                                                                 |
| 3520-3550 ft | Sh 100% | " mnr pyr a/a, & Inoceramus frgs <u>BENT</u> tr, lt brn sft shly, w or. fluor                                              |
| 3550-3560 ft | Sh 99%  | " occ dk brn/blk, dissem pyr lam & nod <u>BENT</u> 1%, lt brn a/a comm                                                     |
| 3560-3590 ft | Sh 100% | " w pyr a/a, sks & wh calc filled frcs <u>BENT</u> tr "                                                                    |
| 3590-3600 ft | Sh 100% | " " " " & mnr brn - <u>BENT</u> tr "                                                                                       |
| 3600-3640 ft | Sh 100% | " " " " Inoc. Foss frgs <u>BENT</u> tr, scat a/a                                                                           |
| 3640-3650 ft | Sh 100% | " " pyr pell, lam & nod comm <u>FESTN</u> tr, brn, dolic, slty                                                             |
| 3650-3670 ft | Sh 100% | " " wh calc filled frcs comm,                                                                                              |
| 3670-3680 ft | Sh 100% | " dk gry to blk, & brn/blk, fiss-blky                                                                                      |
| 3680-3700 ft | Sh 100% | " " " " hd, plty cleav. pyr comm as blebs, nod, dissem, oft replacing                                                      |
| 3700-3710 ft | Sh 100% | " " " " pyr a/a carb frgs & plnt frgs                                                                                      |
| 3710-3720 ft | Sh 100% | " " " " mnr wh calc filled frcs                                                                                            |
| 3720-3740 ft | Sh 100% | " " " " mnr pyr - Festn, brn, silic, nod                                                                                   |
| 3740-3760 ft | Sh 100% | " " " " Festn, tr, a/a                                                                                                     |
| 3760-3770 ft | Sh 100% | " " " " mnr plnt spore-pyrized (rd-disc shp) Festn tr, a/alt-med brn, hd silic, occ frc fil whcalc.                        |
| 3770-3780 ft | Sh 100% | " dk gry, mnr blk, pyr comm oft Festn tr, "                                                                                |
| 3780-3790 ft | Sh 100% | " " " " pyrizied plnt stems                                                                                                |
| 3790-3810 ft | Sh 100% | " " " " mnr pyr Festn tr, "                                                                                                |
| 3810-3820 ft | Sh 100% | " " " " -                                                                                                                  |
| 3820-3830 ft | Sh 100% | " " " " mnr pyr, wh calcite filled frcs                                                                                    |
| 3830-3840 ft | Sh 100% | " " " " nod&lam -                                                                                                          |

|              |         |                                                                                             |                                                                      |
|--------------|---------|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| 3810-3820 ft | Sh 100% | dk gry-blk, w dk brn/blk, carb.<br>sl fiss, -blky, pyr nod & lam comm                       |                                                                      |
| 3820-3850 ft | Sh 100% | a/a<br>occ pyr                                                                              | Festn tr, brn, hd, dns, silic, frcs<br>nod: wh calc filled           |
| 3850-3860 ft | Sh 100% | "                                                                                           | -                                                                    |
| 3860-3870 ft | Sh 99%  | "<br>occ pyr nod                                                                            | Festn 1% a/a                                                         |
| 3870-3880 ft | Sh 100% | "                                                                                           | Festn tr a/a sl dolic, wh calc filled<br>frcs coated w blk gilsonite |
| 3880-3900 ft | Sh 99%  | "<br>occ pyr BENT tr, lt brn, sft, or fluor                                                 | Festn 1% a/a, wh calc fil frcs                                       |
| 3900-3920 ft | Sh 100% | "<br>occ pyrized plnt stems (tubes)                                                         | -                                                                    |
| 3920-3930 ft | Sh 100% | "<br>occ pyr nod<br>occ wh calc fild frcs in sh                                             | BENT tr, lt brn, shly                                                |
| 3930-3940 ft | Sh 100% | "<br>no pyr                                                                                 |                                                                      |
| 3940-3950 ft | Sh 100% | "<br>occ dissem pyr                                                                         | Festn, tr, med brn                                                   |
| 3950-3960 ft | Sh 100% | "<br>" & wh calc, frc/<br>& brn inoc.        sks                                            | Festn tr, a/a frc w blk gils<br>coating, wh calc frcs                |
| 3960-3970 ft | Sh 100% | "<br>occ pyr                                                                                | Festn, tr, brn, hd, dns, frcs                                        |
| 3970-3980 ft | Sh 100% | "                                                                                           | Festn, tr, as 3870-80 ftw. gils<br>& wh calc frcs                    |
| 3980-3990 ft | Sh 100% | "<br>BENT tr, lt brn, Festn tr, brn, silic                                                  | -                                                                    |
| 3990-4000 ft | Sh 100% | "                                                                                           | Festn a/a                                                            |
| 4000-4010 ft | Sh 100% | "<br>w tr scat pyr                                                                          | BENT, tra/a Festn a/a tr                                             |
| 4010-4030 ft | Sh 100% | "<br>dk gry/brn to blk, occ pyr<br>w. lg wh calc xlls filling frcs in sh (minr frc per.     | Festn, tr, a/a                                                       |
| 4030-4070 ft | Sh 100% | "<br>dk gry, dk gry/brn & blk, blk<br>occ splty, carb lam, scatt pyr, Occ pyrysd plnt stems | Festn tr, a/a<br>pyrysd plnt tubes comm                              |
| 4070-4080 ft | Sh 100% | a/a                                                                                         |                                                                      |
| 4080-4090 ft | Sh 100% | "<br>wh calc frcs                                                                           | -                                                                    |
| 4090-4110 ft | Sh 100% | "<br>dk gry-blk, splty tr pyr nod, plnt tubes                                               |                                                                      |
| 4110-4140 ft | Sh 100% | "<br>dk gry, w minr blk, occ pyr nod                                                        |                                                                      |

|                    |                                                       |                                                                           |
|--------------------|-------------------------------------------------------|---------------------------------------------------------------------------|
| 4140-4150 ft       | Sh 100% dk gry, occ blk, blk, splty                   |                                                                           |
| 4150-4160 ft       | Sh 100% a/a                                           | tr frc pyr nod, w blk Gils lining                                         |
| 4160-4170 ft       | Sh 100% "                                             | - Festn, tr, brn, hd nod?                                                 |
| 4170-4180 ft       | Sh 100% "                                             | - frc w wh calc fill, Festn, tr, med brn-dk brn, hd                       |
| 4180-4200 ft       | Sh 95% " dk gry & blk, blk, fiss hd,                  | SILTST 5%, med-dk gry, arg, occ sdy                                       |
| 4200-4210 ft       | Sh 90% a/a, dk gry, plty                              | occ mic-mica ptgs, occ pyr nod oft frc w wh calc.                         |
| 4210-4220 ft       | Sh 75% " w occ mic ptgs                               | SILTST 10%, a/a occ grdg vfg qtz & glau                                   |
| 4220-4230 ft       | Sh 80% "                                              | Siltst 25%, dk gry, arg, occ sdy w                                        |
| 4230-4240 ft       | Sh 40% " sl slty, qtz xlls lining wh                  | Siltst 20%, a/a, w glauc g -                                              |
| 4240-4260 ft       | SILTST 80% dk gry, blk, sdy w vfg-f g,                | Siltst 60% a/a "mic-mica, grdg sdy                                        |
| 4260-4270 ft       | SILTST 70% a/a gywk type, w glau & qtz g, occ vfg-mg. | Sh 20%, dk gry, blk, ptly slty                                            |
| 4270-4290 ft       | Siltst 90% " med-dk gry                               | Sh 30% a/a BENT tr, brn.                                                  |
| 4290-4300 ft       | Siltst 70% " arg, "dirty gywk type"                   | Sh 10% a/a grdg slty                                                      |
| 4300-4310 ft       | Siltst 90% " occ vfg qtz & glauc g                    | Sh 50% a/a                                                                |
| 4310-4320 ft       | Siltst 90% " occ f-med qtz gr, sdy                    | Sh 10% dk gry-blk, w grdg slty                                            |
| 4320-4340 ft       | Siltst 100% " w occ fltg rd qtz g,                    | SS tr, veg. qtz peb,                                                      |
| 4340-4350 ft       | Siltst 100% " med-dk gry & blk, less arg              | SS tr, lt gry, slty, vf-mg, qtzic cem                                     |
| Miss. Spl. 4355 ft | 4350-4355 ft                                          | Siltst 100% med-dk gry, gywk type, a/a occ grdg vf-cs g rd qtz g,         |
| FDC/GR 4354 ft     | 4355-4360 ft                                          | Siltst 60% a/a w more scat qtz g, 50% SS, med gry, vf-m g, w rd, arg matr |
|                    | 4360-4365 ft                                          | Siltst 50% lt gry, slty qtzite, mn                                        |
|                    | 4365-4370 ft                                          | Siltst 20% lt-med gry, arg matr,                                          |

|                                               |                                                                                                                                               |  |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--|
| 4570-4575 ft                                  | Ss 100% wh, qtz, mnr slty matrix, silic cem com w qtz overgrowths masking orig textures, orig well rd, fair srted w grdg slty to vfg, mnr s&p |  |
| 4575-4580 ft                                  | Ss 80% A/a w grdg slty-vfg w blk arg & glauc. g, no por, hd, occ arg mtrx                                                                     |  |
| 4580-4590 ft                                  | Ss 90% as 70-75, occ grdg, slty-vfg-f&m g Sh 10% a/a (avg)                                                                                    |  |
| 4590-4595 ft                                  | Ss 80% " -vfg ss Sh 20% "                                                                                                                     |  |
| 4595-4400 ft                                  | Ss 50% " Sh 50% "                                                                                                                             |  |
| 4400-4405 ft                                  | Ss 60% " qtz Sh 40% " -blk sh, fiss                                                                                                           |  |
| 4405-4410 ft                                  | Ss 70% " wh-lt/med gry, qtz, occ scatt mg Sh 30% "                                                                                            |  |
| 4410-4420 ft                                  | Ss 40% " lt-med gry, vfg grdg slty, Sh 40% med/dk gry, Sh a/a (avg?)<br>occ fr por w qtz xil lined frcs Sh 20% blk, brn/blk arg               |  |
| Imperial Fm<br>Spl. 4429 ft<br>FDC/GR 4420 ft | (pipe stk @ 4429 ft, 10 days cvg & cln hie)                                                                                                   |  |
| 4420-4430 ft ps                               | Ss 10% qtz, vfg a/a Sh 55% blk, sl fiss, blk, carb, mnr pyr (avg?)                                                                            |  |
| 4430-4440 ft ps                               | Ss 5% wh-med gry, qtz, ffg-slty a/a Sh 55% med-dk gry, mic-mica                                                                               |  |
| 4440-4450 ft ps                               | Ss 10% wh lt gry a/a, vf-mg Sh 60% dk gry/brn to blk, A/a                                                                                     |  |
| 4450-4460 ft ps                               | Ss 10% wh lt gry a/a, vf-mg Sh 55% med-dk gry, sl mic-mica a/a                                                                                |  |
| 4460-4470 ft ps                               | SLTST 20% lt gry, grdg sdy vfg, dolc Sh 40% "                                                                                                 |  |
| 4470-4480 ft                                  | SLTST 20% wh-lt gry, grdg sdy, dolc Sh 10% med gry, slty, tr brn Dol, cht Sh 50% "                                                            |  |
| 4480-4490 ft                                  | SLTST 30% lt gry, sl dolc, s&p, occ sdy-vfg, occ glau Sh 20% dk gry/brn-blk, carb, mnr pyr                                                    |  |
| 4490-4500 ft                                  | SLTST 40% med gry, to lt brn/gry, sl slty, waxy, mnr Dol-brn, arg Sh 10% med gry, waxy, slty, tr brn D. Sh 50% dk gry, mic-mica               |  |
| 4500-4510 ft                                  | SLTST 50% wh-lt gry, s&p, occ sdy vfg, dolc, occ glau, Sh 10% brn/blk                                                                         |  |
| 4510-4520 ft                                  | SLTST 70% lt-med gry, pr srtg, dolc, s&p, grdg sdy, occ pyr. Sh 20% med gry, waxy, sl slty, tr Dol, brn, arg Sh 20% dk gry                    |  |
| 4520-4530 ft                                  | SLTST 60% lt gry-grnsh gry, s&p, sl dolc, poorly sorted, grdg sdy Sh 30% a/a                                                                  |  |
| 4530-4540 ft                                  | SLTST 40% a/a occ wh & grn-wh, grdg sdy a/a, dolc Sh 10% a/a                                                                                  |  |
| 4540-4550 ft                                  | Sh 80% a/a med gry, waxy, slty Sitst 20% a/a lt gry, arg, s&p, dolc                                                                           |  |
| 4550-4550 ft                                  | Sh 60% " occ mic Sitst 40% a/a grdg arg, occ grdg wh sdy                                                                                      |  |

(after 4550 ft lighter col, ie more slty, less cvgs)

|              |                                                                                                                     |                                                       |
|--------------|---------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| 4550-4560 ft | Sh 70% md gry, sl slty, blk, waxy,<br>Dol: tr, wh, -bf, grds ls, <u>coccolithoid</u>                                | Siltst 30% wh-lt gry, dolie, arg, s&p<br>occ pyr cam. |
| 4560-4570 ft | Sh 50% med gry a/a                                                                                                  | Siltst 50% a/a                                        |
| 4570-4580 ft | Sh 60% a/a arg, slty                                                                                                | Siltst 40% wh-lt gry, occ Dol lam                     |
| 4580-4590 ft | Sh 60% a/a sl slty Dol: wh, slty,<br>dns 5%                                                                         | Siltst 55% wh-lt gry, dolie a/a -                     |
| 4590-4600 ft | Sh 70% a/a Ls wh, coccolith, tr<br>thin lam                                                                         | Siltst 30% a/a                                        |
| 4600-4620 ft | Sh 80% a/a Dol & Ls a/a, tr<br>(cst, coq)                                                                           | Siltst 20% a/a " occ sdy                              |
| 4620-4630 ft | Sh 85% a/a -                                                                                                        | Siltst 15% a/a poorly sorted                          |
| 4630-4650 ft | Sh 80% " med gry, blk, slty,<br>Ls occ wh-lt gry, limy or dolie coccolith                                           | Siltst 20% lt gry, dolie, occ vfg-mg, occ<br>s&p      |
| 4650-4680 ft | Sh 75% " a/a                                                                                                        | Siltst 25% a/a, occ sdy vfg w dolie cmt<br>mmr mic    |
| 4680-4690 ft | Sh 70% "                                                                                                            | Siltst 30% " grds sdy a/a, vfg-fg                     |
| 4690-4700 ft | Sh 60% "                                                                                                            | Siltst 40% wh-lt gry a/a " " dolie cmt                |
| 4700-4720 ft | Sh 40% "                                                                                                            | Siltst 60% a/a occ arg, occ vfg, s&p                  |
| 4720-4730 ft | Sh 20% "                                                                                                            | Siltst 60% a/a                                        |
| 4730-4740 ft | Ss 30% a/a Ss 20% wh, dolie, vfg occ fg & slty, s&p, (samples lighter - higher SS%)<br>dolie cmt, med hd, dns, slty | Siltst 70% a/a grds sdy, lt gry, dolie                |
| 4740-4770 ft | Ss 20% a/a " w mmr s&p (biot mic)                                                                                   | Siltst 80% a/a Dol, coq, tr in 70'<br>as in 4590 ft   |
| 4770-4780 ft | Ss 15% a/a " "                                                                                                      | Siltst 85% a/a wh-lt gry -                            |
| 4780-4790 ft | Ss 15% " (sples darker, ie less wh ss, incr sh)                                                                     | Siltst 75% " Sh 10% med gry, slt<br>as 4640 ft        |
| 4790-4800 ft | Ss 5% "                                                                                                             | Siltst 25% " Sh 70% a/a                               |
| 4800-4810 ft | SLTST 45% lt gry, dolie a/a Ss 5% a/a, dolie                                                                        | Sh 50% med gry, slty a/a                              |
| 4810-4820 ft | SLTST 65% a/a Ss 5% "                                                                                               | Sh 20% med gry a/a slty<br>Sh 10% blk (cvg)           |
| 4820-4830 ft | SLTST 50% " grds shy & sdy Ss 15% "                                                                                 | Sh 20% med gry, slty, blk a/a<br>Sh 15% blk (cvg)     |

|              |                                                            |                                            |                                            |
|--------------|------------------------------------------------------------|--------------------------------------------|--------------------------------------------|
| 4830-4840 ft | Sltst 50% lt gry, dolie a/a                                | Ss 20% wh-lt gry, vfg, slty dolie omt      | Sh 10% med gry, slty a/a                   |
| 4840-4850 ft | Sltst 60% a/a                                              | Ss 20% "                                   | Sh 20% dk gry-blk vfg                      |
|              | mnr wh calc filled fracs                                   |                                            |                                            |
| 4850-4860 ft | Sltst 50% "                                                | Ss 50% "                                   | Sh 10% "                                   |
| 4860-4870 ft | Sltst 60% "                                                | Ss 10% "                                   | Sh 10% "                                   |
| 4870-4880 ft | Sltst 55% "                                                | Ss 10% "                                   | Sh 20% "                                   |
| 4880-4890 ft | Sltst 65% "                                                | Ss 5% "                                    | Sh 10% "                                   |
| 4890-4900 ft | Sltst 45% a/a wh-lt gry, blkyl sl dolie grdg sdy           | Ss 5% wh, vfg, slty, dolie s&p             | Sh 55% lt-med gry, slty, med hd, blkyl     |
| 4900-4910 ft | Sltst 40% a/a                                              | Ss -                                       | Sh 60% a/a, occ brn/ery                    |
| 4910-4920 ft | Sltst 50% " occ sdy                                        | Ss 10% a/a                                 | Sh 40% " "                                 |
| 4920-4930 ft | Sltst 55% "                                                | Ss 15% "                                   | Sh 30% "                                   |
| 4930-4940 ft | Sltst 60% lt-med gry, dolie Dol br, wh lam, slty, blk spts | Ss 10% wh, vfg, slty, dolie                | Sh 30% med-dk gry/brn, blkyl slty          |
| 4940-4950 ft | Sltst 65% " w sdy grdg comm                                | Ss 15% a/a                                 | Sh 20% lt-med gry, occ gry/brn, slty       |
| 4950-4960 ft | Sltst 55% " grdg v sdy                                     | Ss 30% wh-lt gry, vfg slty dolie, s&p      | Sh 20% a/a                                 |
| 4960-4970 ft | Sltst 50% a/a s&p                                          | Ss 10% a/a                                 | Sh 40% med-dk gry, slty                    |
| 4970-4980 ft | Sltst 60% a/a                                              | Ss 50% a/a vfg, occ fg pr erts, s&p, dolie | Sh 10% a/a                                 |
| 4980-4990 ft | Sltst 45% "                                                | Ss 35% a/a                                 | Sh 20% "                                   |
| 4990-5000 ft | Sltst 60% lt gry, dolie occ sdy                            | Ss 10% wh-lt gry, sl dolie slty, vfg       | Sh 30% med-dk gry, slty blkyl, hd          |
| 5000-5010 ft | Sltst 45% a/a grdg sdy                                     | Ss 10% a/a                                 | Sh 45% a/a                                 |
| 5010-5020 ft | Sltst 25% " -                                              | Ss 5% "                                    | Sh 70% med-dk gry, slty occ brn gry, blkyl |
| 5020-5030 ft | Sltst 30% lt-med gry & gry-brn dolie, mar col.             | Ss 5% "                                    | Sh 65% a/a grdg slty occ mic-mica          |
| 5030-5040 ft | Sltst 25% a/a                                              | Ss 5% "                                    | Sh 70% a/aslty                             |

|              |                                                   |                                                                             |
|--------------|---------------------------------------------------|-----------------------------------------------------------------------------|
| 5040-5050 ft | Sh 60% dk gry, blk, slty                          | Sltst 40% lt gry, med gry/brn, sl dolie                                     |
| 5050-5060 ft | Sh 80% dk gry-gry/brn, "                          | hd, arg<br>Sltst 20% a/a                                                    |
| 5060-5070 ft | Sh 70% a/a, slty                                  | Sltst 30% "                                                                 |
| 5070-5080 ft | Sh 60% "                                          | Sltst 35% " occ grdg sdy Ss, lt gry vfg, slty                               |
| 5080-5090 ft | Sh 80% "                                          | Sltst 20% " med gry, sl dolie, occ sdy                                      |
| 5090-5100 ft | Sh 70% "                                          | Sltst 20% " little or nondolie Sh blk, cvg 10%                              |
| 5100-5110 ft | Sh 55% "                                          | Sltst 35% lt-med gry & gry/brn Sh 10% , blk cvg                             |
| 5110-5120 ft | Sh 60% dk gry-blk, less slty                      | sl dolie<br>Sltst 30% a/a sl dolie, Sh 10% a/a cvg                          |
| 5120-5130 ft | Sh 65% a/a, occ slty, mnr mic                     | Sltst 35% lt-med gry, arg, sl dolie                                         |
| 5130-5140 ft | Sh 80% " "                                        | Sltst 20% med gry, a/a                                                      |
| 5140-5150 ft | Sh 75% dk gry, blk, dns, occ slty                 | Sltst 25% lt gry to med gry, dolie, sl sdy                                  |
| 5150-5180 ft | Sh 85% dk gry-blk, occ slty,<br>occ pyr.          | hder thn above<br>Sltst 15% lt-med gry, med gry/brn, s&p, occ sdy           |
| 5180-5190 ft | Sh 60% a/a                                        | occ mic-mica occ dolie DOL-med gry lam<br>Sltst 40% med gry, arg, NON-dolie |
| 5190-5200 ft | Sh 60% A/a                                        | Sltst 35% a/a Ss 5% wh, sl dolie, vfg                                       |
| 5200-5230 ft | Sh 90% a/a dk gry, mnr slty,<br>mnr mic-mica, blk | occ Ls coquina lam<br>Sltst 10% med gry--sl grnsh, NON-dolie, arg           |
| 5230-5250 ft | Sh 90% a/a                                        | Sltst 10% a/a grdg sdy, <u>only wh-lt gry sdy lam</u><br><u>are dolie</u>   |
| 5250-5270 ft | Sh 85% a/a blk, dns,                              | Sltst 15% " arg, occ sdy                                                    |
| 5270-5280 ft | Sh 80% a/a occ slty                               | Sltst 20% "med-dk gry, arg, <u>non-sdy</u>                                  |
| 5280-5290 ft | Sh 85% " " occ blk, fiss                          | Sltst 15% a/a w. <u>brn hue comm</u>                                        |
| 5290-5300 ft | Sh 90% " "                                        | Sltst 10% arg, " occ lt gry, sdy, dolie                                     |
| 5300-5310 ft | Sh 70% " "                                        | Siltst 30% a/a                                                              |
| 5310-5320 ft | Sh 75% a/a                                        | Siltst 25% "                                                                |

Fr w. mnw wh dol xlls

|              |                                                    |                  |                                                           |
|--------------|----------------------------------------------------|------------------|-----------------------------------------------------------|
| 5320-5340 ft | Sh 70% dk gry-blk, blk, occ slty                   | Sltst 30%        | med-dk gry, & gry brn, arg,                               |
| 5340-5350 ft | Sh 75% mnr pyr & mic-mica lam                      | FR w wh dol xlls | occ gils ctg, occ qtz xlls                                |
| 5350-5360 ft | Sh 70% a/a                                         | Sltst 25%        | a/a                                                       |
| 5360-5370 ft | Sh 75% FR a/a w wh dol & qtz xlls, lining frcs     | Sltst 30%        | med gry a/a                                               |
| 5370-5390 ft | Sh 60% " mnz blk pell in gry dolie mtz             | Sltst 40%        | lt-med gry, occ sdy, occ dolie, arg                       |
| 5390-5400 ft | Sh 70% a/a slty                                    | Sltst 30%        | a/a occ sdy-wh, dolie                                     |
| 5400-5410 ft | Sh 70% " " w LS foss frcs, FR wh, calc filled frcs | Sltst 25%        | med-dk gry, occ sdy, wh Ss 5% wh, vfg                     |
| 5410-5420 ft | Sh 60% dk gry-blk, blk, grd, slty                  | Sltst 35%        | lt-med gry, occ dolie Ss 5% a/a, slty                     |
| 5420-5430 ft | Sh 70% a/a slty                                    | Sltst 25%        | a/a, slty lam in Sh Ss 5% a/a                             |
| 5430-5440 ft | Sh 60% " slty-non slty                             | Sltst 35%        | " occ wh sdy, dolie Ss 5% "                               |
| 5440-5450 ft | Sh 60% a/a occ slty                                | Sltst 40%        | a/a,                                                      |
| 5450-5460 ft | Sh 65% dk gry, ptly slty, sl mic                   | Sltst 35%        | a/a occ sdy-wh, dolie, s&p                                |
| 5460-5470 ft | Sh 70% a/a                                         | Sltst 30%        | "                                                         |
| 5470-5480 ft | Sh 75% dk gry, sl slty, blk                        | Sltst 25%        | " "                                                       |
| 5480-5500 ft | Sh 80% a/a                                         | Sltst 20%        | " dolie & thn lam in Sh                                   |
| 5500-5510 ft | Sh 90% a/a slty                                    | Sltst 10%        | " , arg grd to sh                                         |
| 5510-5520 ft | Sh 85% " "                                         | Sltst 15%        | a/a                                                       |
| 5520-5540 ft | Sh 80% dk gry-blk, blk, slty                       | Sltst 20%        | med gry, med gry/brn, blk, arg, lam, sl s&p sl sdy, dolie |
| 5540-5570 ft | Sh 85% a/a md hd, dns, grd to med gry slty Sh      | Sltst 15%        | a/a hd, sl mic-mica, occ sdy, & slty lam in Sh            |
| 5570-5590 ft | Sh 90% med-dk gry, blk, slty                       | Sltst 10%        | a/a occ dolie                                             |
| 5590-5630 ft | Sh 95% med-dk gry, gry/brn, slty blk, tr pyr nod   | Sltst 5%         | med gry, arg, occ sdy, lt gry, dolie & mnz gry/brn        |

|              |                                                                                                 |                                                       |
|--------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| 5630-5650 ft | Sh 100% dk gry w brn shade, blk, med hd, occ slty, w lam of dolie arg sltst<br>mnr mic-mica tgs |                                                       |
| 5650-5660 ft | Sh 95% a/a. non-slty, tr pyr                                                                    | Sltst 5% med gry, arg, occ lt gry & sd-dolic          |
| 5660-5700 ft | Sh 100% " dk gry, slty, tr pyr<br>occ grdg non-slty                                             | Sltst tr, as lam in sh                                |
| 5700-5730 ft | Sh 95% " a/a                                                                                    | Sltst 5%, lt-med brn/gry, arg, dolie occ sd           |
| 5730-5750 ft | Sh 90% " slty, mnr pyr lam                                                                      | Sltst 10% med gry a/a                                 |
| 5750-5780 ft | Sh 95% " silty grdg non-slty<br>dkr sh=non silty                                                | Sltst 5% lt-med gry & brn/gry a/a                     |
| 5780-5790 ft | Sh 95% med-dk gry, a/a slty                                                                     | Sltst 5% a/a                                          |
| 5790-5800 ft | Sh 90% dk gry, med hd, blk, slty occ non-slty                                                   | Sltst 10% med gry, arg, occ lt gry, dolie<br>blk, dns |
| 5800-5830 ft | Sh 96% a/a slty<br>mnr wh trns l qtz in fcs                                                     | Sltst 4% a/a as thn lam in Sh                         |
| 5830-5840 ft | Sh 75% a/a, dk gry, slty, blk<br>20% blk, sl waxy, sl fiss, carb, mnr pyr                       | Sltst 5% a/a (poss cvgs?)                             |
| 5840-5850 ft | Sh 80% " dk gry, slty a/a                                                                       | Sltst 5% "                                            |
| 5850-5860 ft | Sh 15% blk, non-slty a/a                                                                        |                                                       |
| 5860-5870 ft | Sh 87% " slty grdg non-slty                                                                     | Sltst 5% "                                            |
| 5870-5880 ft | Sh 10% " non-slty                                                                               |                                                       |
| 5880-5890 ft | Sh 82% " "                                                                                      | Sltst 3% "                                            |
| 5890-5900 ft | Sh 15% "                                                                                        |                                                       |
| 5900-5910 ft | Sh 85% med-dk gry, slty, blk a/a                                                                | Sltst 5% med to dk gry, arg, sl dolie                 |
| 5910-5920 ft | Sh 10% dk gry-blk, sl fiss, non-slty, occ carb-plnt frgs                                        |                                                       |
| 5920-5930 ft | Sh 77% med-dk gry a/a                                                                           | Sltst 5% a/a                                          |
| 5930-5940 ft | Sh 20% dk gry to brn blk, non-slty a/a                                                          |                                                       |
| 5940-5950 ft | Sh 80% dk gry, sl slty a/a                                                                      | Sltst 5% a/a                                          |
| 5950-5960 ft | Sh 15% dk gry-blk, non-slty a/a                                                                 |                                                       |
| 5960-5970 ft | Sh 75% a/a grdg non-slty, mnr mic-mica                                                          | Sltst 5% " as thn lam in sh                           |
| 5970-5980 ft | Sh 20% a/a dk gry-occ blk, non slty                                                             |                                                       |
| 5980-5990 ft | Sh 86% " "                                                                                      | Sltst 4% "                                            |
| 5990-6000 ft | Sh 10% a/a                                                                                      |                                                       |
| 6000-6010 ft | Sh 70% " mnr dissem pyr                                                                         | Sltst 5% "                                            |
| 6010-6020 ft | Sh 25% " occ dk brn/gry, carb,                                                                  |                                                       |
| 6020-6030 ft | Sh 60% " " ; FR w wh calc lining                                                                | Sltst 10%, med gry, dolie a/a                         |
| 6030-6040 ft | Sh 30% " " ;                                                                                    |                                                       |
| 6040-6050 ft | Sh 80% " " ; FR "                                                                               | Sltst 5% (less than) a/a                              |
| 6050-6060 ft | Sh 15% " " ;                                                                                    |                                                       |

|              |                                                           |                                  |
|--------------|-----------------------------------------------------------|----------------------------------|
| 5960-5970 ft | Sh 65% med-dk gry, slty, min mic-mica, blk                | Slst 5% med gry, dolc, arg       |
|              | Sh 30% dk gry, brn/blk, carb, non-slty, sl fiss, blk      |                                  |
| 5970-5980 ft | Sh 25% dk gry, med hd, blk, slty                          | Slst 5% a/a occ gry-brn, sl dolc |
|              | Sh 70% dk gry-blk a/a, occ pyr nod                        | arg, lam & grdg sdy slty sh      |
| 5980-5990 ft | Sh 20% a/a                                                | Slst 5% (less than) a/a          |
|              | Sh 75% a/a, occ dissem py, mn pyr Plnt frags, carb        |                                  |
| 5990-6000 ft | Sh 80% dk gry occ blk, carb, med hd, blk-fiss, mn pyr lam | Slst 5% " (mn s&p)               |
|              | Sh 15% med gry a/a, slty occ mic-mica, blk,               |                                  |
| 6000-6010 ft | Sh 80% dk gry, carb a/a                                   | Slst tr                          |
|              | Sh 20% med gry a/a slty                                   |                                  |
| 6010-6030 ft | Sh 90% a/a                                                | (poor samples 6000-6070 ft)      |
|              | Sh 10% " w mn pyr                                         |                                  |
|              | Sh 10% " w slty lam, arg (non-dolic)                      |                                  |
| 6030-6040 ft | Sh 50% "                                                  |                                  |
|              | Sh 50% " grdg slty & occ sdy (wh, non-dolic) lam          |                                  |
| 6040-6050 ft | Sh 70% "                                                  |                                  |
|              | Sh 30% " slty-occ dolc                                    |                                  |
| 6050-6070 ft | Sh 70% dk gry-blk, med hd, blk sl fiss, mn pyr            | FR tr wh qtz, & wh calc in fr    |
|              | Sh 30% a/a med-dk gry, slty-occ dolc, grdg & lam,         |                                  |
| 6070-6080 ft | Sh 75% "                                                  |                                  |
|              | Sh 20% a/a                                                | Slst 5% a/a                      |
| 6080-6090 ft | Sh 80% "                                                  |                                  |
|              | Sh 20% " occ FR w qtz & wh calc filled, Slst tr "         |                                  |
| 6090-6110 ft | Sh 90% " mn pyr, striated tubes (plnt stms)               | FR oc c wh qtz                   |
|              | Sh 10% "                                                  | Slst tr                          |
| 6110-6120 ft | Sh 85% " FR wh calc xlls & qtz xlls, lining fr, tr FR POR |                                  |
|              | Sh 15% "                                                  |                                  |
| 6120-6130 ft | Sh 90% " Fr a/a                                           |                                  |
|              | Sh 10% " slty a/a                                         |                                  |
| 6130-6140 ft | Sh 95% dk gry-blk a/a mn pyr lam & nod in blk sh          |                                  |
|              | Sh 5% dk gry, slty a/a FR w wh calc lining                |                                  |
| 6140-6150 ft | Sh 90% "                                                  |                                  |
|              | Sh 10% "                                                  | Slst a/a tr: dolc, arg           |
| 6150-6160 ft | Sh 80% " scatt pyr nod FR-wh calc lining                  |                                  |
|              | Sh 20% "                                                  |                                  |
| 6160-6170 ft | Sh 40% "                                                  | 5%                               |
|              | Sh 55% med-dk gry, blk sl slty, mn mic-mica               | Slst med gry, gry/brn, arg, dolc |
| 6170-6180 ft | Sh 30% " w mn pyr                                         |                                  |
|              | Sh 65% slty a/a                                           | Slst 5% a/a                      |
| 6180-6190 ft | Sh 70% dk gry-blk a/a                                     |                                  |
|              | Sh 30% slty a/a FR occ wh calc lining                     |                                  |
| 6190-6200 ft | Sh 80% "                                                  |                                  |
|              | Sh 20% slty a/a, med gry-brngry,                          | Slst arg, tr: occ gdg sdy, wh    |
| 6200-6210 ft | Sh 40% "                                                  | dolic                            |
|              | Sh 55% " occ pyr                                          | Slst 5% a/a                      |
|              | FR wh calc & wh cht                                       |                                  |

|              |                                                                                    |                                                         |
|--------------|------------------------------------------------------------------------------------|---------------------------------------------------------|
| 6210-6220 ft | Sh 40% dk gry-blk, med hed, sl fiss a/a occ pyr nod FR wh calc & qtz (cht) xlls    |                                                         |
|              | Sh 55% dk gry, slty a/a                                                            | 5% Sltst med gry, arg, sl dolie a/a                     |
| 6220-6230 ft | Sh 60% a/a non-sltty                                                               | FR wh calc & qtz (wh op cht), increasing                |
|              | Sh 40% a/a dk gry, slty                                                            |                                                         |
| 6230-6250 ft | Sh 70% "                                                                           | FR abund wh calc & wh qtz (op cht) a/a filling fr       |
|              | Sh 30% "med gry/brn-med gry, arg& slty lam, sl dolie                               |                                                         |
| 6250-6260 ft | Sh 60% "                                                                           | FR w. abund calc & cht a/a                              |
|              | Sh 40% a/a " slty, occ dolie                                                       | Sltst tr a/a                                            |
| 6260-6270 ft | Sh 75% "                                                                           | SWS&FR w abund calc & cht a/a MNR FR POR (qtz xlls com) |
|              | Sh 20% "                                                                           | Sltst 5% "med gry, dolie, sl sdy                        |
| 6270-6280 ft | Sh 30% "                                                                           | w occ pyr, FR-wh calc lining                            |
|              | Sh 15% "                                                                           | Sltst 5% a/a                                            |
| 6280-6300 ft | Sh 80% " dk gry-blk, fiss-blky FR comm calc & qtz                                  |                                                         |
|              | Sh 20% dk gry, slty, blk a/a                                                       | Sltst tr, "                                             |
| 6300-6310 ft | Sh 85% "                                                                           | mnr pyr FR & calc & qtz(cht) a/a                        |
|              | Sh 15% "                                                                           | Sltst tr "                                              |
| 6310-6320 ft | Sh 90% dk gry-blk, fiss-blky, med hd, mnr dissem pyr, mnr wh calc lam thn,         |                                                         |
|              | Sh 10% dk gry, occ lam slty& dolie lam, FR filled, calc & qtz trans & op cht a/a   |                                                         |
| 6320-6330 ft | Sh 100% dk gry-blk a/a occ carb brn/blk, mnr dissem pyr                            |                                                         |
|              | Sh tr (slty sh a/a)                                                                | SK& FR com, wh calc & wh op cht in FR                   |
| 6330-6340 ft | Sh 90% dk gry-blk a/a                                                              | FR " a/a & thn wh calc lam                              |
|              | Sh 10% slty a/a                                                                    |                                                         |
| 6340-6350 ft | Sh 100% "                                                                          | FR a/a occ cht & occ calc                               |
|              | Sh tr "                                                                            |                                                         |
| 6350-6360 ft | Sh 95% " dk gry-blk, fiss-blky, a/a                                                | Sltst 5% med gry, sl dolie, grdg vfg ss                 |
| 6360-6370 ft | Sh 20% " a/a blk, fiss w occ pyr nod FR mnr wh calc & cht-qtz a/a                  |                                                         |
|              | Sh 70% medgry, slty, sl dolie                                                      | Sltst 10% wh-lt gry, dolie, grdg vfg ss                 |
| 6370-6380 ft | SLTST 50% lt-med gry/brn, sl dolie grdg vfg ss, occ blk arg/carb patches           |                                                         |
|              | Sh 40% med gry sl slty, occ dolie a/a blk                                          | Sh 10% blk, carb a/a                                    |
|              | -Ran Intermediate casing 15 days- Stuck, cvg sh above -                            |                                                         |
| 6380-6390 ft | SLTST sdy 40% lt-med gry, sdy, chl, fr srtg, sl dolie, grdg vfg ss :Dol, anhye lam |                                                         |
|              | SLTST arg 40% med gry, dk, blk, arg,                                               | Sh dk gry-blk a/a (cvg?) in FR                          |
| 6390-6400 ft | Sltst sdy 30% a/a                                                                  | FR wh anhye dol.                                        |
|              | Sltst arg 40% a/a med-dk gry                                                       | Sh dk gry-blk, sl fiss a/a (cvg?).                      |
|              | Incorrect lag 6380-6700 ft 100' min instead of 100' 1/2 min (smir hole)            |                                                         |
| 6400-6410 ft | Sltst sdy 30% a/a                                                                  | occ brn blk sl dolie sh, mnr anhye cmt in               |
|              | Sltst arg 30% a/a                                                                  | 40% Sh dk gry-blk a/a sltst                             |
| 6410-6420 ft | Sltst sdy 20% a/a                                                                  | intergrad of sltst, -sdy, arg and blk sh, thn slty lam  |
|              | Sltst arg 30% a/a                                                                  | Sh 50% a/a                                              |
| 6420-6430 ft | Sltst sdy 20% "                                                                    |                                                         |
|              | Sltst arg 30% " med gry                                                            | Sh 30% "                                                |
| 6430-6440 ft | Sltst sdy 10% "                                                                    | occ sdy wh/lt gry                                       |
|              | Sltst arg 40% "                                                                    | Sh 50% "                                                |

|              |               |                                                      |                                                          |
|--------------|---------------|------------------------------------------------------|----------------------------------------------------------|
| 6440-6450 ft | Sltst sdy 20% | lt-med gry, S&P, sl dolie grdg vfg ss                | FR w mnr wh cht(qtz), mnr anhy.                          |
| 6450-6460 ft | Sltst arg 50% | med gry, occ dolie, arg.                             | SH 30% dk gry-blk, blkly-fiss a/a                        |
| 6460-6470 ft | Sltst sdy 30% | med gry brn, dolie a/a                               | FR w mnr cht a/a, occ anhy lam                           |
| 6470-6480 ft | Sltst arg 40% | med gry, arg a/a                                     | Sh 50% e/a mnr pyr                                       |
| 6480-6490 ft | Sltst sdy 40% | "                                                    | mnr anhy lem & cem, FR mnr wh cht a/a                    |
| 6490-6500 ft | Sltst arg 20% | a/a "                                                | Sh 40% "                                                 |
| 6500-6510 ft | Sltst sdy 20% | "                                                    | mnr dolie/anhy lam, FR mnr wh qtz filled                 |
| 6510-6520 ft | Sltst arg 40% | "                                                    | Sh 40% "                                                 |
| 6520-6530 ft | Sltst sdy 20% | "                                                    | grdg to arg sltst, mnr anhy lam; FR mnr wh qtz & op cht, |
| 6530-6540 ft | Sltst arg 60% | "                                                    | Sh 20% " mnr pyr                                         |
| 6540-6550 ft | Sltst sdy 10% | wh-lt gry, occ sdy, dolie                            | QTZ/FR 7%, wh transp, FR POR mnr, occ anhy               |
| 6550-6560 ft | Sltst arg 75% | med gry-gry brn, w blk arg patches, sl dolie         | SH dk gry/blk, occ slty                                  |
| 6560-6570 ft | Sltst sdy 20% | lt gry, s&p, dolie, & anhy                           | QTZ/FR 5% transp xlls, cxl, mnr FR POR                   |
| 6570-6580 ft | Sltst arg 65% | a/a w. arg patches, grdg cln sltst,                  | Sh 10% slty, dk gry-blk                                  |
| 6580-6590 ft | Sltst sdy 20% | lt gry, slty -vfg, s&p, dolie                        | FR mnr qtz, mnr dol, wh, lam                             |
| 6590-6600 ft | Sltst arg 70% | a/a med gry/brn                                      | Sh 10% dk gry-blk, slty-nonslty                          |
| 6600-6610 ft | Sltst sdy 30% | "                                                    | "                                                        |
| 6610-6620 ft | Sltst arg 60% | " interbedded                                        | Sh 10% a/a                                               |
| 6620-6630 ft | Sltst sdy 40% | "                                                    | "                                                        |
| 6630-6640 ft | Sltst arg 60% | "                                                    | "                                                        |
| 6640-6650 ft | Sltst sdy 45% | " (a/a main % is slty size qtz g)                    | Sh 10% e/a blk slty sh & nonslty                         |
| 6650-6660 ft | Sltst arg 45% | "                                                    | "                                                        |
| 6660-6670 ft | Sltst sdy 50% | " interbedded (dirty-grwketype)                      | "                                                        |
| 6670-6680 ft | Sltst arg 50% | "                                                    | "                                                        |
| 6680-6690 ft | Sltst sdy 40% | "                                                    | Sh 10% a/a                                               |
| 6690-6700 ft | Sltst arg 65% | "                                                    | Sh 5% "                                                  |
| 6700-6710 ft | Sltst sdy 25% | wh-lt gry, s&p, occ sdy-vfg, dolie, blkly            | 10% SH dk gry, sl slty                                   |
| 6710-6720 ft | Sltst arg 65% | med gry a/a w incr arg%, less dolie thn sdy sltst    | "                                                        |
| 6720-6730 ft | Sltst sdy 10% | a/a occ dolie xlls in sltst, DOL wh, cs xl, lam, mnr | IX POR mnr, DB                                           |
| 6730-6740 ft | Sltst arg 80% | a/a                                                  | Sh 10% slty a/a                                          |
| 6740-6750 ft | Sltst sdy 10% | "                                                    | "                                                        |
| 6750-6760 ft | Sltst arg 60% | "                                                    | "                                                        |
| 6760-6770 ft | Sltst sdy 5%  | "                                                    | Sh 50%, dk gry-blk, slty, blkly                          |
| 6770-6780 ft | Sltst arg 75% | "                                                    | "                                                        |
| 6780-6790 ft | Sltst sdy 5%  | lt gry a/a, sl dolie grdg to arg sltst               | Sh 20% a/a slty grdg non-slty                            |
| 6790-6800 ft | Sltst arg 60% | med-dk gry to med gry-brn, sl dolie                  | SH 35% "                                                 |
| 6800-6810 ft | Sltst sdy 10% | " a/a                                                | "                                                        |
| 6810-6820 ft | Sltst arg 60% | " a/a                                                | Sh 30% "                                                 |
| 6820-6830 ft | Sltst sdy 5%  | "                                                    | "                                                        |
| 6830-6840 ft | Sltst arg 50% | "                                                    | Sh 45%                                                   |
| 6840-6850 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 6850-6860 ft | Sltst arg 50% | "                                                    | "                                                        |
| 6860-6870 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 6870-6880 ft | Sltst arg 50% | "                                                    | "                                                        |
| 6880-6890 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 6890-6900 ft | Sltst arg 50% | "                                                    | "                                                        |
| 6900-6910 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 6910-6920 ft | Sltst arg 50% | "                                                    | "                                                        |
| 6920-6930 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 6930-6940 ft | Sltst arg 50% | "                                                    | "                                                        |
| 6940-6950 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 6950-6960 ft | Sltst arg 50% | "                                                    | "                                                        |
| 6960-6970 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 6970-6980 ft | Sltst arg 50% | "                                                    | "                                                        |
| 6980-6990 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 6990-7000 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7000-7010 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7010-7020 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7020-7030 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7030-7040 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7040-7050 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7050-7060 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7060-7070 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7070-7080 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7080-7090 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7090-7100 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7100-7110 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7110-7120 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7120-7130 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7130-7140 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7140-7150 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7150-7160 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7160-7170 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7170-7180 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7180-7190 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7190-7200 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7200-7210 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7210-7220 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7220-7230 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7230-7240 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7240-7250 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7250-7260 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7260-7270 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7270-7280 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7280-7290 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7290-7300 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7300-7310 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7310-7320 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7320-7330 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7330-7340 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7340-7350 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7350-7360 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7360-7370 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7370-7380 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7380-7390 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7390-7400 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7400-7410 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7410-7420 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7420-7430 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7430-7440 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7440-7450 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7450-7460 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7460-7470 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7470-7480 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7480-7490 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7490-7500 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7500-7510 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7510-7520 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7520-7530 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7530-7540 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7540-7550 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7550-7560 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7560-7570 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7570-7580 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7580-7590 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7590-7600 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7600-7610 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7610-7620 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7620-7630 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7630-7640 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7640-7650 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7650-7660 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7660-7670 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7670-7680 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7680-7690 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7690-7700 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7700-7710 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7710-7720 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7720-7730 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7730-7740 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7740-7750 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7750-7760 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7760-7770 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7770-7780 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7780-7790 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7790-7800 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7800-7810 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7810-7820 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7820-7830 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7830-7840 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7840-7850 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7850-7860 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7860-7870 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7870-7880 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7880-7890 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7890-7900 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7900-7910 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7910-7920 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7920-7930 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7930-7940 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7940-7950 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7950-7960 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7960-7970 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7970-7980 ft | Sltst arg 50% | "                                                    | "                                                        |
| 7980-7990 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 7990-8000 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8000-8010 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8010-8020 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8020-8030 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8030-8040 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8040-8050 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8050-8060 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8060-8070 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8070-8080 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8080-8090 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8090-8100 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8100-8110 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8110-8120 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8120-8130 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8130-8140 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8140-8150 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8150-8160 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8160-8170 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8170-8180 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8180-8190 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8190-8200 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8200-8210 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8210-8220 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8220-8230 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8230-8240 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8240-8250 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8250-8260 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8260-8270 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8270-8280 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8280-8290 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8290-8300 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8300-8310 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8310-8320 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8320-8330 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8330-8340 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8340-8350 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8350-8360 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8360-8370 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8370-8380 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8380-8390 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8390-8400 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8400-8410 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8410-8420 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8420-8430 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8430-8440 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8440-8450 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8450-8460 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8460-8470 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8470-8480 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8480-8490 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8490-8500 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8500-8510 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8510-8520 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8520-8530 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8530-8540 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8540-8550 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8550-8560 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8560-8570 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8570-8580 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8580-8590 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8590-8600 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8600-8610 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8610-8620 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8620-8630 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8630-8640 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8640-8650 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8650-8660 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8660-8670 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8670-8680 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8680-8690 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8690-8700 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8700-8710 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8710-8720 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8720-8730 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8730-8740 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8740-8750 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8750-8760 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8760-8770 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8770-8780 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8780-8790 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8790-8800 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8800-8810 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8810-8820 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8820-8830 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8830-8840 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8840-8850 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8850-8860 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8860-8870 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8870-8880 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8880-8890 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8890-8900 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8900-8910 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8910-8920 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8920-8930 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8930-8940 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8940-8950 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8950-8960 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8960-8970 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8970-8980 ft | Sltst arg 50% | "                                                    | "                                                        |
| 8980-8990 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 8990-9000 ft | Sltst arg 50% | "                                                    | "                                                        |
| 9000-9010 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 9010-9020 ft | Sltst arg 50% | "                                                    | "                                                        |
| 9020-9030 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 9030-9040 ft | Sltst arg 50% | "                                                    | "                                                        |
| 9040-9050 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 9050-9060 ft | Sltst arg 50% | "                                                    | "                                                        |
| 9060-9070 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 9070-9080 ft | Sltst arg 50% | "                                                    | "                                                        |
| 9080-9090 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 9090-9100 ft | Sltst arg 50% | "                                                    | "                                                        |
| 9100-9110 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 9110-9120 ft | Sltst arg 50% | "                                                    | "                                                        |
| 9120-9130 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 9130-9140 ft | Sltst arg 50% | "                                                    | "                                                        |
| 9140-9150 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 9150-9160 ft | Sltst arg 50% | "                                                    | "                                                        |
| 9160-9170 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 9170-9180 ft | Sltst arg 50% | "                                                    | "                                                        |
| 9180-9190 ft | Sltst sdy 50% | "                                                    | "                                                        |
| 9190-9200 ft | Sltst arg 50% | "                                                    | "                                                        |
| 9200-        |               |                                                      |                                                          |

|              |                                                                                                                                             |  |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------|--|
| 6670-6680 ft | Sh 60% dk gry-blk, hd, silic, bit, sl fiss, splty, SKS occ.                                                                                 |  |
| 6680-6690 ft | Sh 90% blk, hd, silic a/a 1% wh thin frc filled lam .5mm, w wh dol or<br>sltst, arg & grdg slty Sh a/a 9% (cvg) trns qtz, occ SKS (shnyblk) |  |
| 6690-6700 ft | SH 95% a/a blk, bit, brit 1% wh dol & qtz filled Fr, thin, lam due to<br>sltst 4% med gry, a/a (cvr) brit Sh                                |  |
| 6700-6710 ft | NOTE: LAG CORRECTED @ 6700 ft to $\frac{1}{8}$ min / 100 ft (6 1/8" hole)                                                                   |  |
| 6710-6720 ft | Sh 100% blk a/a w occ pyr nod, lam & dissem in Sh, FR tr, wh dol lining                                                                     |  |
| 6720-6730 ft | Sh 100% a/a " " FR tr, w wh Dol a/a, SKS comm                                                                                               |  |
| 6730-6740 ft | Sh 100% " " " " " "                                                                                                                         |  |
| 6740-6750 ft | Sh 100% " " " " " " & DOL dk gry-blk lam                                                                                                    |  |
| 6750-6760 ft | Sh 95% a/a " " " " " " w SKS                                                                                                                |  |
| 6760-6770 ft | Sh 100% a/a dk gry-blk, bit, brit, Pyr & Fr w. Dol wh a/a                                                                                   |  |
| 6770-6780 ft | Sh 98% a/a w. bit ptgs SKS " " " Dol 2% blk, chty                                                                                           |  |
| 6780-6800 ft | Sh 100% a/a occ slty, occ bit/carb ptgs w wh Dolie FR & pyr a/a                                                                             |  |
| 6800-6810 ft | Sh 90% a/a SKS w occ pyr & wh Dolie FR                                                                                                      |  |
| 6810-6830 ft | Sh 10% " dk gy, occ dolie-silic, mnr mic-mica ptgs                                                                                          |  |
| 6830-6850 ft | Sh 60% a/a blk, hd splty, bit SKS w pyr a/a & wh Dolie FR                                                                                   |  |
| 6850-6860 ft | Sh 40% a/a dk gry, bit, silic but mnr mic-mica                                                                                              |  |
| 6860-6870 ft | Sh 70% a/a blk, bit SKS w thin pyr lam comm. -                                                                                              |  |
| 6870-6880 ft | Sh 50% a/a, mnr mic-mica, dk gry                                                                                                            |  |
| 6880-6890 ft | Sh 40% a/a blk, bit - Pyr lam a/a                                                                                                           |  |
| 6890-6900 ft | Sh 60% a/a dk gry, mic-mica silic DOL dk gry, w scatt mxl dol xls                                                                           |  |
| 6900-6910 ft | Sh 80% " " " " " " occ Pyr lam & wh Dolie Fr occ, & wh qtz lam                                                                              |  |
| 6910-6920 ft | Sh 18% " " " " " " Dol, 2%, dk gry a/a                                                                                                      |  |
| 6920-6930 ft | Sh 80% " " " " " " occ Pyr lam & wh dol & qtz filled FRs                                                                                    |  |
| 6930-6940 ft | Sh 20% " " " " " " " " " " " "                                                                                                              |  |
| 6940-6950 ft | Sh 85% dk gry-blk, silic, bit, splty, a/a Pyr a/a & FR dolie a/a                                                                            |  |
| 6950-6960 ft | Sh 15% dk gry, silic, sl mic-mica a/a CHT blk, occ, silic                                                                                   |  |
| 6960-6970 ft | Sh 90% a/a FR wh dolie a/a,                                                                                                                 |  |
| 6970-6980 ft | Sh 10% a/a dk gry, bit, sl mic-mica Pyr as dissem & scatt in sh & nod.                                                                      |  |
| 6980-6990 ft | Sh 60% a/a dk gry-blk, bit, hd, fiss-splty, silic w FR wh dolie comd pyr a/a                                                                |  |
| 6990-7000 ft | Sh 40% slty, dolie, dk gry, blk, w "cinder or seraceous text", scatt pyr & dol xls<br>in Sh, "                                              |  |

Hare Indian Fm  
Spl. 6915 ft  
FDC/GR 6920 ft

|              |                                                                                     |                                       |
|--------------|-------------------------------------------------------------------------------------|---------------------------------------|
| 6930-6940 ft | Sh 70% dolic, slty. dk gry,hd a/a blk                                               |                                       |
| 6940-6950 ft | Sh 30% dk gry-blk, bit, silic, a/a                                                  | w occ pyr nod & scat FR fld w wh dol. |
|              | Sh 90% dk gry,dolic, slty a/a spec w. wh Dol xlls in sh,                            | occ pyr nod.                          |
|              | Sh 10% dk gry blk, non cindery, appears as interbeds,                               | scat FR fld w wh dol.                 |
| 6950-6960 ft | Sh 95% a/a slty,less dol & pyr specs,blk arg specs,comm.                            |                                       |
|              | Sh 5% a/a                                                                           | occ pyr nod                           |
| 6960-6970 ft | Sh 90% " slty, dk gry w ltr dk gry lam,                                             | & scat FR wh dolie fld,cc pyr nod     |
|              | Sh 10% a/a blk, silic (dvg?)                                                        |                                       |
| 6970-6980 ft | Sh 95% " silty & dolie, w wh Dol specs (xlls) "                                     | " "                                   |
|              | Sh 5% a/a                                                                           | tr LS wh-lt gry,c xl,w scat pyr xlls  |
| 6980-6990 ft | Sh 80% " slty & dolie (cinder-text) a/a                                             | w occ FR wh, dolie fld & scat pyr nod |
|              | SH 20% lt-med gry, sft, fiss, waxy, sl calc,                                        | LS tr, dk gry, micxl                  |
| 6990-7000 ft | SH 50% lt gry, sft, fiss, sl waxy, fiss, occ bl/gry,scatt pyr xlls in sh            |                                       |
|              | Sh 50% slty, dolie,blk dk gry-blk a/a                                               | Mnr Pyr nod.                          |
| 7000-7010 ft | SH 60% lt blush gry, sft, waxy, sl calc,sl mic-mica                                 |                                       |
|              | Sh 40% slty, dolie, blk a/a w mnr pyr nod                                           |                                       |
| 7010-7020 ft | SH 90% lt blush gry, sft, fiss to blk, wxy a/a                                      |                                       |
|              | Sh 10% slty, "cinder-type" a/a (cvgs) w. pyr comm.                                  |                                       |
| 7020-7030 ft | SH 100% lt blush gry,waxy,vel calc, sft, occ grd med gry, fiss,w occ scat pyr       | xlls                                  |
| 7030-7060 ft | SH 100% a/a w occ med gry, arg lam                                                  |                                       |
| 7060-7070 ft | SH 70% blush gry, w sl calc, a/a                                                    |                                       |
|              | Sh 30% slty, dolie a/a (cvgs)                                                       |                                       |
| 7070-7080 ft | SH 50% sft, bluish gry a/a                                                          |                                       |
|              | Sh 50% blk, cinder type, dolie, slty a/a (cvgs?)                                    |                                       |
| 7080-7090 ft | SH 60% lt blush gry, sft a/a mnr dkr sft sh                                         |                                       |
|              | Sh 40% slty, dolie a/a, mnr pyr nod (cvgs?)                                         |                                       |
| 7090-7100 ft | Sh 50% lt blush gry a/a                                                             |                                       |
|              | Sh 50% blk,cinder type,slty w dolie xlls a/a                                        |                                       |
| 7100-7110 ft | Sh 70% lt blush gry a/a w mnr dkr lam                                               |                                       |
|              | Sh 30% blk a/a w mnr pyr nod                                                        |                                       |
| 7110-7120 ft | Sh 70% lt gry a/a,mnr dk                                                            |                                       |
|              | Sh 20% med-dk gry, waxy as ltr Sh,                                                  | Sh 10% blk a/a w pyr nod com          |
| 7120-7125 ft | Sh 60% lt blush gry a/a waxy, mnr rd plnt sprs & frgs (spore impressions)           |                                       |
|              | Sh 40% med -dk gry, waxy grd to lt,fiss                                             |                                       |
| 7125-7130 ft | Sh 30% lt blush gry a/a,sft,wxy,sl calc, mnr mic-mica                               |                                       |
|              | Sh 65% dk gry-blk, hd, fiss, occ wh foss frgs, crn,(poss bds detrital foss LS in Sh |                                       |
|              | LS 5% lt gry, arg, mnr wh foss, biomicrite, crinoidal, f-mg frgs                    |                                       |

Hume Fm.  
Spl. 7131 ft  
FDC/GR 7133 ft

Lost circulation at 7131 ft in original hole (7131-7149 ft appears to be steep dipping fracture/fault or leached cavity, not present in redrilled hole.

|              |                                                                                                                                                                                  |                                                                                                                       |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| 7130-7135 ft | Sh 10% lt blush gry a/a<br>Sh 20% dk gry a/a<br>Calcite: wh, clr to frosted,<br>frc filled, vcrlln, mnr fr por. (no show)                                                        | LS 60% lgry-dk gry brn, hd, sl arg, micritic, dnse<br>sl micro-xlln occ vfxlln, occ wh chalky (cmt?)<br>sl bioclastic |
| 7135-7140 ft | Sh 10% dk gry-blk a/a (cavings?)<br>LS 70% wh-lt gry, chalky, microxlln (poss cmt?) w. tr. wh frsted calc fld frcs<br>LS 20% med-dk gry, arg, micritic, microxlln a/a            |                                                                                                                       |
| 7140-7145 ft | LS 80% lt gry-brn, med hd, microxlln occ vfxlln, chalky, mnr foss frgs, rexll ls,<br>LS 10% dk gry blk a/a                                                                       | CALCITE wh, frc fld, clr-frstd, tr frc por. w cs xl                                                                   |
| 7145-7150 ft | LS 60% lt gry, sft, chky a/a grdg-bf Ml,<br>LS 35% med-dk gry, arg a/a, lith                                                                                                     | 10%<br>CALCITE 5% wh frc fld a/a                                                                                      |
| 7150-7160 ft | LS 60% lt gry-whish gry a/a, chky, sft, microxlln, occ frcs w pyr & calc xlls in frcs<br>LS 20% med-dk gry a/a                                                                   | SH 20% cvg.                                                                                                           |
| 7160-7170 ft | LS 70% wh-lt gry, a/a microxlln sl dolie, rexllzd calcarenite<br>LS 20% med-dk gry, arg a/a                                                                                      | SH 10% dk gry, (cvgs?)                                                                                                |
| 7170-7180 ft | LS 85% a/a lt bf-lt gry, sft rexllzd masking orig texture, microxllz<br>LS 15% med-dk gry occ dk gry, arg, occ pyr, occ wh calc in frcs                                          |                                                                                                                       |
| 7180-7190 ft | LS 95% " wh, occ lt gry-bf, rexllzd, intraspar comm, sl dolie<br>LS 5% med gry a/a                                                                                               |                                                                                                                       |
| 7190-7200 ft | LS 70% lt a/abiosparite comm, fg, med hd, foss frgs, crin, rexll<br>LS 30% med gry a/a occ micritic hd                                                                           |                                                                                                                       |
| 7200-7210 ft | LS 90% " intrbiosparite, occ lmm foss frgs, rexll sparry calcite, occ rexll f-m<br>LS 10% " a/a arg, micritic                                                                    | mnr frc fld w calc xli                                                                                                |
| 7210-7230 ft | LS 60% " lt gry-bf a/a biosparite, rexllzd, foss-brac, bry,<br>LS 40% " med-dk gry, arg, occ scatt crin fgs                                                                      |                                                                                                                       |
| 7230-7240 ft | LS 50% " sl dkr thr above, microxlln, mnr wh calc in frcs<br>LS 50% " a/a med-dk gry                                                                                             |                                                                                                                       |
| 7240-7250 ft | LS 30% " incr in wh calc-FRC w trnspr xlls, occ FR POR<br>LS 70% " med-dk gry/brn, arg, micritic (lith.)                                                                         |                                                                                                                       |
| 7250-7260 ft | LS 20% " lt gry brn a/a, microxlln<br>LS 80% " med-dk gry, micritic, sl arg, occ scatt bioclst, s,                                                                               | CALC 1-2% frc fld, cs xll                                                                                             |
| 7260-7270 ft | LS 30% " lt bf-gry, biomicrite, occ clasts, mnr foss, sl microxlln mnr F <sup>h</sup> c fld c<br>LS 70% " med gry, occ dk gry, micrite, occ intramicrite & scatt foss            |                                                                                                                       |
| 7270-7280 ft | LS 70% " v lt-lt gry, biosparite-biomicrite occ v. foss, microxlln, rexllzd, med hd<br>LS 30% " med gry, micritic a/a                                                            |                                                                                                                       |
| 7280-7290 ft | LS 40% " lt gry/brn, occ gr clasts 1-2 mm, rexllzd<br>LS 60% " micrite (def. not rexllzd as itr ls)                                                                              | 0.1-0.2% wh, fld frcs                                                                                                 |
| 7290-7300 ft | LS 25% " biomicrite-intramicroite, foss frgs in clsts frgs, sl rexllzd<br>LS 75% " med gry, occ dk gry, w scatt foss-bracs & spics                                               |                                                                                                                       |
| 7300-7310 ft | LS 20% " lt gry a/a micro-rexllzd a/a occ ost & brac frgs .5-1mm<br>LS 75% " med gry, occ dk gry, dns, plty, micritic, mnr foss,<br>SE 5% dk gry grdg to arg ls. (sl lith chnge) |                                                                                                                       |

Headless Fm.

Spl. 7305 ft

FDC/GR 7306 ft

|              |        |                                                                               |
|--------------|--------|-------------------------------------------------------------------------------|
| 7310-7320 ft | LS 85% | med gry/brn, occ dk gry, micrite, mnr bio&intramicrite, w clasts less thn 1mm |
|              | Ls 15% | lt gry a/a, biosparite, micr&rexlln, hd, dns, plty, arg, occ pyr.             |
| 7320-7330 ft | LS 70% | " a/a micritic, arg                                                           |
|              | Ls 30% | " bio&intrasparite, w bry, ost, brach frgs 1-2mm clsts, microxlln             |
| 7330-7340 ft | LS 65% | " a/a occ crin (wh g. calc) - occ dk gry, arg                                 |
|              | Ls 35% | " lt gry, less rexll a/a micritic less sparite, less foss frgs, occ py        |
| 7340-7350 ft | LS 60% | " med-dk gry, hd brittle, lith                                                |
|              | Ls 40% | " intrasparite w .5mm g & less w lt & dk Ls & foss frgs in spar cmt           |
| 7350-7360 ft | LS 80% | " arg, a/a w. mnr bio/intra frgs, SH 10% dk gry/blk, lmy, w ls frgs           |
|              | Ls 10% | " biosparite, rexll, occ m-cs xlln-wh calc (vugs/foss), occ wh fres           |
| 7360-7370 ft | LS 70% | " arg, med gry occ dk gry, a/a, grdg more arg & dkr thn above                 |
|              | Ls 30% | " intrabiosparite to micrite, occ microxlln, mnr micritic, non-xlln L         |
|              |        | occ crin, brachs, ost frgs, up to .5mm g, conch frgs                          |
| 7370-7380 ft | LS 80% | " a/a arg, micritic, non-xlln, grdg SH, dk gry w ls frgs, lmy to arg Ls       |
|              | Ls 20% | " a/a occ micro-xlln, sl saccy, occ wh cs calc xlls                           |
| 7380-7390 ft | LS 90% | " a/a sl arg, SH tr, dk gry w. Ls frgs, lmy                                   |
|              | Ls 10% | " a/a sparitic, occ wh cs calc xlls                                           |
| 7390-7400 ft | LS 85% | " a/a arg, med-dk gry, scatt foss, hd SH 10% dk gry-blk, lmy, blk, w Ls frg   |
|              | Ls 5%  | " a/a wh, cs xlln, occ bf, sparite                                            |
| 7400-7410 ft | LS 85% | " a/a arg, occ foss & clastic frgs, SH 5% a/a blk-fiss ptgs                   |
|              | Ls 10% | " a/a micro-xlln, biospar, sft, occ cs xlln calc-foss cavity fld, nonf        |
| 7410-7420 ft | LS 65% | " a/a md br/gry, micrite-biomicrite-.5mm, SH 5% a/a                           |
|              | Ls 30% | " a/a (brach, pelecyp, ost, bry, mnr pyr in Ls)                               |
| 7420-7430 ft | LS 45% | " a/a med gry, micritic SH 5% a/a                                             |
|              | Ls 50% | " a/a bio & intra sparite, grdg non xlln, plyt hd, dns                        |
| 7430-7440 ft | LS 50% | " a/a micro -cs xlln, biosparite common.                                      |
|              | Ls 5%  | " a/a micritic, hdr, nonxlln, brit, occ ost, foss in arg micrite, occ         |
|              |        | cs wh calc xlls reps foss cav. fld                                            |
| 7440-7450 ft | LS 40% | " a/a med gry, non-xlln micrite                                               |
|              | Ls 60% | " lt gry, fossilif w. brach, occ microxlln biospar .5mm occ 1-2 mm            |
| 7450-7460 ft | LS 60% | " a/a                                                                         |
|              | Ls 40% | " a/a biosparite, f-cs xlln, crin, brachs to 1mm. frgs                        |
| 7460-7470 ft | LS 30% | " a/a micritic, occ foss frgs                                                 |
|              | Ls 70% | " a/a microxlln                                                               |
| 7470-7480 ft | LS 30% | " a/a arg, micritic, scatt foss frgs & clsts, SH 5%, blk, occ brach           |
|              | Ls 65% | " a/a occ cs xlln, biosparite, mnr wh cs xlln calc-foss fld cavity            |
| 7480-7490 ft | LS 55% | " a/a micritic grdg lithographic, hd SH 5% a/a                                |
|              | Ls 40% | " a/a occ intraclasts to 1.5mm, mainly biospar of less than .5mm.             |
| 7490-7500 ft | LS 70% | " a/a lt-med gry, micritic, lith, sl arg, occ scatt frgs, occ pyric           |
|              | Ls 30% | " microxlln, fossilif, sft-med hd                                             |
| 7500-7520 ft | LS 90% | " a/a w. mnr pyr nod less thn .5mm & pyric spots.                             |
|              | Ls 10% | " a/a                                                                         |

|                                                             |              |                                                                                                                                                           |
|-------------------------------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Gossage Fm<br>(Landry Ls)<br>Spl. 7552 ft<br>FDC/GR 7556 ft | 7520-7530 ft | LS 85% med gry, micritic, lith, occ microxlin, hd, mn pyr a/a, hd 10%<br>Ls 5% lt gry, intraspar w mnr biospar, med hd, SH med-dk gry, blk w Ls frg       |
|                                                             | 7530-7540 ft | LS 80% " a/a w mn pyr. SH 15% a/a<br>Ls 5% " " a/a                                                                                                        |
|                                                             | 7540-7550 ft | LS 75% " " SH 5%<br>Ls 20% " w. mn pyr in wh-lt gry Ls                                                                                                    |
|                                                             | 7550-7560 ft | LS 10% lt-med gry, lith, micritic SH 15% blk, bit,<br>LS 85% dk gry, occ med gry/brn, micritic, pell, lith, conch frg, brit,                              |
|                                                             | 7560-7570 ft | LS 65% med gry, lith, a/a, w. 2% wh clr calc spar. SH 5% a/a<br>Ls 30% dk gry, a/a                                                                        |
|                                                             | 7570-7580 ft | LS 20% " a/aintramitic, occ foss grdg spar SH 5%, dk gry-blk, blk<br>Ls 75% " lith, micritic a/a plty, hd, brit,                                          |
|                                                             | 7580-7590 ft | LS 40% " intrabiosparite, occ ost & brachs, occ micritic, 1% wh calc foss<br>Ls 60% " lith, pelmicrite vug fld                                            |
|                                                             | 7590-7600 ft | LS 20% " occ lt gry, intraspar-intramicroite, less thn .5 mm frgs<br>Ls 75% " dk brnsh gry-blk, lith, a/a SH 5%                                           |
|                                                             | 7600-7620 ft | LS 10% lt-med gry, intraspar-intramicroite, .5-lmm frgs occ wh calc rexll foss vugs<br>Ls 90% dk gry-dk brnsh gry, lith, fld                              |
|                                                             | 7620-7630 ft | LS 10% lt-med gry a/a intrabiosparite / micrite<br>Ls 70% dk gry, micritic a/a grdg LS 20% tan-lt brn, lith                                               |
|                                                             | 7630-7640 ft | LS 15% tan, lith, brit, hd, micritic, dns,<br>Ls 85% dk gry-brn a/a                                                                                       |
|                                                             | 7640-7650 ft | LS 30% med gry, intrabiosparite to micrite, spotted<br>Ls 60% dk gry to dk gry-brn, micritic a/a lith, LS 10% tan, brit, lith a/a                         |
|                                                             | 7650-7660 ft | LS 40% med gry, intrasparite, spotted, av. .5mm, w wh spar xlls comm. ie 2-3% clr-<br>Ls 60% dk gry, micritic, lith, brit a/a frsted calc xlls spar "eye" |
|                                                             | 7660-7670 ft | LS 90% med gry-brn, lith, pily pel,<br>Ls 10% dk gry, micritic a/a                                                                                        |
|                                                             | 7670-7680 ft | LS 40% med gry brn, micritic, a/a<br>Ls 60% tan, lith, micritic, mn blk pell mottled, occ calc spar "eyes", less thn .5 mm                                |
|                                                             | 7680-7690 ft | LS 20% med gry, intrasparite, spotted, .25-occ .5mm<br>Ls 70% dk gry, lith, micritic a/a, sl bit ptgs LS 10% tan, lith, a/a                               |
|                                                             | 7690-7720 ft | LS 20% med-dk gry, intraspar-micrite w calc "eyes" of 1-2mm, hd, brit, spotted<br>Ls 80% dk gry-dk gry/brn, micritic a/a w. sl bit lam                    |
|                                                             | 7720-7730 ft | LS 70% med gry, intrabiosparite, spotted, .5-2mm g, occ foss<br>Ls 30% med-dk gry, brnsh gry, micritic, brit a/a occ pel. thn interbeds w. above          |
|                                                             | 7730-7740 ft | LS 40% med gry, spotted, intrasparite a/a<br>LS 60% lt gry/tan lith, hd, plty, occ calci "spar-eyes", occ blk arg patched                                 |
|                                                             | 7740-7750 ft | LS 30% med gry intraspar a/a<br>Ls 70% lt grysh tan, lith plty a/aw mn bit ptgs                                                                           |
|                                                             | 7750-7760 ft | LS 20% med gry, -wh mottled intraspara/a<br>Ls 20% tan, micritic, brit, lith a/a<br>Ls 60% dk gry brn, lith, micrite a/a                                  |

|              |        |                                                                               |
|--------------|--------|-------------------------------------------------------------------------------|
| 7760-7770 ft | LS 70% | lt-med gry, intrabiosparite, spotted(mottled) calcispheres comm, occ micritic |
|              | Ls 30% | dk gry, lith, micritic, sl.pell. mnr bit. Sh ptgs                             |
| 7770-7780 ft | LS 60% | " a/a                                                                         |
|              | Ls 40% | " grdg dk gry/brn-med gry, lith, a/a                                          |
| 7780-7790 ft | LS 70% | " a/a grdg micritic, spotted wh frm wh calcispheres & foss frgs               |
|              | Ls 30% | " a/a grdg lt-med gry, tan, lith, micritic                                    |
| 7790-7800 ft | LS 60% | " spotted, detrital a/a                                                       |
|              | Ls 20% | " med-dk gry a/a lith Ls 20% tan, occ mottled gry/tan, occ pel                |
| 7800-7810 ft | LS 20% | " a/a micritic, mnr spar, detrital, occ calcispheres, spotty,                 |
|              | Ls 80% | " a/a lith,                                                                   |
| 7810-7820 ft | LS 20% | " a/a SH blk, thn ptgs, grdg limy                                             |
|              | Ls 75% | " grdg med gry, w. occ sparite "birdseye" calcispheres, dns, hd               |
| 7820-7830 ft | LS 20% | " a/a, detrital, spotted                                                      |
|              | Ls 80% | " grdg med-dk gry a/a, w. calcispheres, grdg dkr thn above                    |
| 7830-7840 ft | LS 10% | " a/a SH 5% dk gry blk, arg, grdg lmy-arg Ls                                  |
|              | Ls 85% | " ess dk gry, lith, w. scatt calcispheres "eyes"                              |
| 7840-7850 ft | LS 40% | " detrital, intrabiosparite a/a, spotted SH 5% blk grdg blk arg               |
|              | Ls 55% | " a/a lith, occ pel w calcispheres Ls                                         |
| 7850-7860 ft | LS 65% | " spotted a/a pelsparcomm, occ intrabiosparite, .5-1mm frgs, SH 5%            |
|              | Ls 30% | " med-dk gry/brn, a/a lith, micritic, occ calcisphere & algal calc lineat     |
| 7860-7870 ft | LS 80% | " a/a pelspar-intraspar, spotted, .5-1.5 mm, grdg micritic                    |
|              | Ls 20% | " a/a w. calcisphere/"birds-eye" tex 1-2mm                                    |
| 7870-7880 ft | LS 10% | " pelspar a/a, spotted                                                        |
|              | Ls 10% | " a/a dk gry, micritic grdg -Ls 80% tan, lith,hd, dns plty, micrite           |
| 7880-7890 ft | LS 15% | " med gry, a/a pelmicrite-pelsparite, spotted, micritic mnr blk bit Sh ptgs   |
|              | Ls 10% | " dk gry, micritic a/a Ls 75% tan, lith, a/a                                  |
| 7890-7900 ft | LS 10% | " a/a pelspar-pelmicrite a/a spotted                                          |
|              | Ls 30% | " medgry/brn, occ pel micrite, lith, Ls 60% tan a/agrdg med gry, lith,        |
| 7900-7910 ft | LS 40% | " a/a spotted POOR rexll, calc por, & rexll calc vugs,                        |
|              | Ls 55% | " med-dk gry, lith a/a, dkr thn above Ls 5%, dk gry blk, arg                  |
| 7910-7920 ft | LS 20% | " a/a spotted w calcispheres, occ wh rexll Ls, sft, occ calc fld fr           |
|              | Ls 75% | " dk gry/brn, lith, occ pelmicrite, Ls 5% blk, arg                            |
| 7920-7930 ft | LS 30% | " a/a spotted, grdg lighter thn above                                         |
|              | Ls 70% | " med gry/brn, lith, micrite                                                  |
| 7930-7940 ft | LS 20% | " a/a spotted                                                                 |
|              | Ls 50% | " dk gry, lith, pelmicrite ot micrite, Ls 30% tan, lith, brit, i              |
| 7940-7950 ft | LS 30% | " a/a spotted, pel-intramicroite .5-1mm, <u>ccc lt grnsh gry arg LS</u>       |
|              | Ls 70% | " a/a lith, w calcisphere "birdseye", occ foss, pel,                          |
| 7950-7960 ft | LS 10% | " a/a spotted                                                                 |
|              | Ls 90% | " med-dk gry, lith a/a                                                        |

|              |         |                                                                      |                                               |
|--------------|---------|----------------------------------------------------------------------|-----------------------------------------------|
| 7960-7970 ft | LS 20%  | lt-med gry, pel, intra, biosparite, spotted, occ pyr                 | tr SH grn/gry                                 |
|              | Ls 80%  | med-dk gry/brn, lith, occ frgs, w calcispheres                       |                                               |
| 7970-7980 ft | LS 10%  | " a/a spotted                                                        | tr SH grn                                     |
|              | Ls 40%  | " a/a lith, micritic                                                 | Ls 50% tan, lith, hd, brit,                   |
| 7980-7990 ft | LS 20%  | " a/a spotted pel, intra, bio-sparite                                | tr SH grn                                     |
|              | Ls 60%  | dk gry, lith a/a                                                     |                                               |
| 7990-8000 ft | LS 10%  | " a/a spotted                                                        |                                               |
|              | Ls 80%  | " occ intr, pel micrite, lith, sl frgs                               | Ls 10% tan a/a                                |
| 8000-8010 ft | LS 10%  | " a/a spotted, grdg wh calc focs biospar,                            |                                               |
|              | Ls 85%  | dk gry/brn, micrite, a/a                                             | Ls 5% blk, arg, grdg lmy sh.                  |
| 8010-8020 ft | LS 40%  | " a/a spotted, intrapel micrite, grdg sparite, occ wh microxlin      |                                               |
|              | Ls 50%  | " lith a/a: Ls 10% arg a/a                                           | /occ. bit. fld vugs                           |
| 8020-8030 ft | LS 30%  | " a/a spotted calcar.                                                |                                               |
|              | Ls 40%  | dk gry, lith, a/a                                                    | Ls 30% tan, lith, brit a/a                    |
| 8030-8040 ft | LS 20%  | med brn/gry, spotted, sparite, occ micritic                          |                                               |
|              | Ls 70%  | dk gry/brn, lith a/a, pel.                                           | Ls 10% dk gry to blk, arg, plty               |
| 8040-8050 ft | LS 30%  | lt gry-wh, spotted, calcar-sparite                                   |                                               |
|              | Ls 70%  | med-dk gry/brn, lith, w wh calcispheres                              |                                               |
| 8050-8060 ft | LS 40%  | wh-lt gry, occ tan, intrasparite comm, sl rexlin, lighter thn above  |                                               |
|              | Ls 55%  | med gry a/a, lith                                                    | SH 5% lt grnsh gry, sl limy, blk pel & foss f |
| 8060-8070 ft | LS 70%  | " a/a rexlin sparite, spotted                                        |                                               |
|              | Ls 30%  | med-dk gry/brn, lith a/a                                             | occ grdg grnsh gry, arg LS                    |
| 8080-8090 ft | LS 20%  | " occ tan, sparite, occ rexlin & chky/wh                             |                                               |
|              | Ls 20%  | " a/a, lith                                                          | Ls 60% tan, lith, scatt calcispheres, hd, br  |
| 8090-8100 ft | LS 30%  | " calcar/sparite, re                                                 | (orig gr masked)                              |
|              | Ls 60%  | " a/a lith occ tn,                                                   | Ls 10% tan, a/a                               |
| 8100-8110 ft | LS 20%  | " a/a sl rexlin                                                      |                                               |
|              | Ls 10%  | dk gry, occ blk, arg                                                 | Ls 70% tan, hd, brit, lith, occ calcisph      |
| 8110-8120 ft | LS 30%  | " a/a calcar/sparite                                                 |                                               |
|              | Ls 50%  | med gry, occ dkr gry/arg                                             | Ls 20% tan, a/a                               |
| 8120-8130 ft | LS 10%  | wh-tn, calcar spar, w wh calcispheres, sl rexlin (wh)                |                                               |
|              | Ls 90%  | tan, hd, brit, lith, micrite, plty, occ scatt foss frgs              |                                               |
| 8130-8140 ft | LS 20%  | " intrabiosparite, sl rexlin wh spar, a/a                            |                                               |
|              | Ls 80%  | tan, hd plty, a/a                                                    |                                               |
| 8140-8150 ft | LS 10%  | " a/a calcar, sparitic, a/a sl rexlin w. calc calcisphere "birdseye" |                                               |
|              | Ls 85%  | tan, med gry/brn, lith, brit a/a                                     |                                               |
|              | DOL 10% | wh, fxltn, mntr bds                                                  |                                               |
| 8150-8160 ft | LS 10%  | wh-lt gry, calcar-spar a/a                                           | DOL: 15% wh-lt gry, falln occ m xlin          |
|              | Ls 80%  | tan, occ med gry brn, lith, hd brit a/a                              |                                               |
| 8160-8170 ft | LS 15%  | " a/a sparitic w "birdseye" tex, grdg f-cs xlin Ls                   |                                               |
|              | Ls 80%  | " a/a                                                                | DOL 5% a/a                                    |

|                                                              |              |                                                                                                                                                                                 |                                        |
|--------------------------------------------------------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| Gossage Fm<br>(Arnica Dol)<br>Spl. 8217 ft<br>FEC/GR 8206 ft | 8170-8180 ft | LS 20% wh-tan, a/a calcar/sparite, sl rexlin<br>Ls 80% tan, lith grdg dker gry, hd, dns micritic                                                                                |                                        |
|                                                              | 8180-8190 ft | LS 30% wh-tan a/a. grdg wh rexlin sparite, calcar<br>Ls 65% med gry brn-tan, lith a/a                                                                                           | DOL 5% a/a med gry, fxlin              |
|                                                              | 8190-8200 ft | LS 40% tan to wn, calcar/spar a/a sl rexlin to wh fxlin<br>Ls 60% med gry brn, to tan, lith a/a                                                                                 |                                        |
|                                                              | 8200-8210 ft | LS 10% " a/a calcar/spar sl rexlin grdg Dolie<br>Ls 70% tan-med gry/brn, occ dk gry arg, lith, hd, brit/                                                                        | DOL 20% tan, occ med gry/brn, wh fxlin |
|                                                              | 8210-8220 ft | DOL 30% lt gry-wh, fxlin, occ microxlin, hd, dns<br>Ls 70% med gry/brn, occ tan, micritic a/a                                                                                   | occ blk pyrobit in prim por. (no Ø)    |
|                                                              | 8220-8230 ft | DOL 80% buff-lt brn, microxlin, occ wh spar (birdseye)<br>Ls 20% med-dk gry-lith, occ arg, hd, dns,                                                                             |                                        |
|                                                              | 8230-8240 ft | DOL 95% bf-lt brn a/a microxlin, occ f-m xlin, occ tr frc por in med xlin Dol.<br>Ls 5% occ dolie Ls a/a                                                                        |                                        |
|                                                              | 8240-8250 ft | DOL 95% a/a microxlin occ fxlin (no Ø)<br>Ls 5% occ grdg limy med gry Dol.                                                                                                      |                                        |
|                                                              | 8250-8260 ft | DOL 95% a/a microxlin, occ med gry, w sl limy gradations, w scatt wh calc foss or<br>Ls 5% a/a dolie                                                                            | birdseye, calc-wh to 2mm., 1-2%        |
|                                                              | 8260-8270 ft | DOL 95% a/a fxlin occ m xlin, occ med gry, scatt pr-fr por in xlin Dol, fst drilli<br>Ls 5% occ gry Ls, dolie interbeds                                                         | frm 8268-70 ft.                        |
|                                                              | 8270-8280 ft | DOL 40% a/a<br>Ls 60% tan, britt, lith, occ med gry/brn                                                                                                                         |                                        |
|                                                              | 8280-8290 ft | DOL 60% buff, micro-f xlin, grdg limy<br>Ls 40% tan, lt-med gry, micritic, lith                                                                                                 |                                        |
|                                                              | 8290-8300 ft | Dol 40% med gry, occ bf, microxlin, grdg lmy<br>Ls 60% wh, bf, micritic, occ sl dolie                                                                                           |                                        |
|                                                              | 8300-8310 ft | DOL 90% med gry occ bf, microxlin occ fxlin, sl limy, w wh calc "birdseye"<br>Ls 10% med gry, occ dk gry                                                                        |                                        |
|                                                              | 8310-8320 ft | DOL 40% bf, microxlin sl limy grdg to 50% DOL med gry<br>Ls 30% tan-med gry/brn, lith, brit, hd, ply, grdg dolie                                                                |                                        |
|                                                              | 8320-8330 ft | DOL 90% lt gry-bf, microxlin occ fxlin grdg lmy<br>Ls 10% lt-med gry, lith, more arg thn dolie, grdg dolie a/a                                                                  |                                        |
|                                                              | 8330-8340 ft | DOL 100% lt-med gry, microxlin occ fxlin, hd sl limy, w intergrad to Ls                                                                                                         |                                        |
|                                                              | 8340-8350 ft | DOL 100% med gry, sl dkr thn above, fxlin, occ micro & m xlin, hd, grdg lt gry, lmy<br>scatt occ p-f interxlin por.                                                             |                                        |
|                                                              | 8350-8360 ft | DOL 30% wh, bf, microxlin, sl limy, grdg vfxlin, no por.<br>Dol 65% lt-med gry, microxlin, limy occ grdg dolie Ls                                                               | SE 5% blk sh ptgs,                     |
|                                                              | 8360-8370 ft | DOL 60% wh, bf a/a vfxlin sl lmy more "birdseye" calc in lt DOL<br>Dol 40% med gry, sl arg, microxlin occ fxlin, sl lmy                                                         | TR: dk gry arg Dol                     |
|                                                              | 8370-8380 ft | DOL 80% " vfxlin, a/a occ fxlin grdg limy to rexlin Ls, 1-2% wh calc.<br>Dol 20% " a/a microxlin sl limy occ arg limy sam, 1-2% wh calc FRcs.<br>occ pr-fr ix por in fxlin Dol. |                                        |

|              |          |                                                                                                                       |
|--------------|----------|-----------------------------------------------------------------------------------------------------------------------|
| 8380-8390 ft | DOL 90%  | bf-lt brn, vfxlln a/a, occ fxlln, 5% wh calc, clr & opaque, fr fld, pr-fr por                                         |
|              | LS 10%   | med-dk gry, arg, sl dolie, micritic in fxlln                                                                          |
| 8390-8400 ft | DOL 40%  | bf-tan, vfxlln, Dol 40% med gry brn, gry, arg, sl limy                                                                |
|              | LS 20%   | dk gry, arg, dolie a/a w blk carb ptgs 1% wh calc fld frcs                                                            |
| 8400-8410 ft | DOL 20%  | bf-tan, a/a sl limy tr. wh calc fld frcs                                                                              |
|              | Dol 80%  | med gry, dkr, sl lmy, grdg arg, dolie LS, vfxlln occ fxlln                                                            |
| 8410-8420 ft | DOL 40%  | " a/a tr. wh calc fld frcs                                                                                            |
|              | Dol 60%  | " to med gry/brn, occ dk gry arg LS                                                                                   |
| 8420-8430 ft | DOL 60%  | " grdg med grysh/brn, occ vfxlln                                                                                      |
|              | Dol 40%  | " -med/dk brn/gry, vf-fxlln tr. wh calc fld frcs                                                                      |
| 8430-8450 ft | DOL 60%  | " a/a                                                                                                                 |
|              | Dol 40%  | " a/a fxlln grdg-vfxlln, tr p-f ix por in fxlln Dol, scatt.occ mvgs                                                   |
| 8450-8460 ft | DOL 60%  | " grdg medgry/brn, fxlln to vfxlln, sl lmy, grdg dkr, occ pyr                                                         |
|              | Dol 40%  | " med brn/gry, grdg dkr, arg. /p-f ix por in fxlln, occ mvgs<br>occ wh calc filled vgs & orig intrmicrite w .5-lmm g. |
| 8460-8470 ft | DOL 50%  | " a/a vfxlln                                                                                                          |
|              | Dol 50%  | " a/a (pr smple-trip)                                                                                                 |
| 8470-8480 ft | DOL 100% | lt-med gry, fx; m pcc vf & exlln, grdg dkr gry, arg, sl lmy, gd ix-mv por (drill brk) no show                         |
| 8480-8490 ft | DOL 100% | " vf-fxlln, saccy tex, gd scatt ix & mvgs por.                                                                        |
| 8490-8500 ft | DOL 100% | " a/a intergrading ltgry-med gry, vfxlln-fxlln, rare scat gd ix por                                                   |
| 8500-8510 ft | DOL 100% | " a/a fvlln-occ fxlln, sl arg, 1% wh calc fld frcs, mnpr pr ix por.                                                   |
| 8510-8520 ft | DOL 90%  | " a/a hd, dns, microxlln-vfxlln, in pt lmy, tr, scatt pr ix por                                                       |
|              | Dol 10%  | dk gry, arg, grdg blk, occ fxlln                                                                                      |
| 8520-8530 ft | DOL 100% | med gry a/a, vfxlln SH tr, blk w pyr, occ grdg limy vfxlln LS, tr por                                                 |
| 8530-8540 ft | DOL 95%  | " a/a sl arg, sl limy, grdg vfxlln dolie LS, tr, rare pr por.                                                         |
|              | Dol 5%   | dk gry/blk, arg, thn ptgs, occ pyric in SH, /1-2% wh calc frcs                                                        |
| 8540-8550 ft | DOL 85%  | " a/a vfxlln, sl arg, sl lmy, 1% wh calc fld frcs, 1% wh calc frcs                                                    |
|              | Dol 10%  | " a/a grdg blk sh,, /occ pyr nod & lam in Dol                                                                         |
|              | LS 5%    | dk gry, lith dnse, occ intravimicrite, grdg dolie                                                                     |
| 8550-8560 ft | DOL 100% | med gry a/a, vfxlln, sl arg & lmy, occ ix, scatt pr por., 1% wh calc fld frc                                          |
| 8560-8570 ft | DOL 60%  | " a/a grdg Dol 20% dk gry, vfxlln, sl lmy, mnpr arg Dol lam                                                           |
|              | Dol 20%  | lt brn gry, vfxlln w mnpr, occ pr por-ix, tr: lt grn sh, mnpr vfg or coated Si grns, mnpr wh calc fld frcs            |
| 8570-8580 ft | DOL 60%  | " a/a, vfxlln, grdg sl lmy, arg occ dk gry / or Si grns a/a (qtz)                                                     |
|              | Dol 40%  | lt brn to lt gry a/a, vfxlln, LS 5% brn, lith, occ fxlln                                                              |

|              |         |                                                                |                                                                    |
|--------------|---------|----------------------------------------------------------------|--------------------------------------------------------------------|
| 8580-8590 ft | Dol 55% | lt gry, bf, vf-fxlln, sl pyr                                   |                                                                    |
|              | DOL 45% | med-dk gry, vfxlln, sl lmy                                     | DOL dk gry, blk w carb ptgs, grdg Sh, mnr pyr                      |
| 8590-8600 ft | DOL 70% | med-dk gry, fxlln occ microxlln                                | occ wh calc fld frcs                                               |
|              | Dol 50% | lt gry a/a                                                     | tr blk sh, 2% blk, grdg Ls                                         |
| 8600-8610 ft | DOL 50% | med gry occ dk gry a/a                                         | w tr blk SH                                                        |
|              | Dol 40% | wh, lt gry/brn, micro xlln vfxlln, grdg lmy & LS 10%           | med gry brn,                                                       |
| 8610-8620 ft | DOL 85% | "                                                              | occ dk gry a/a occ lmy, vfxlln, mnr pyr conc. ,tr wh calc fld frcs |
|              | Dol 10% | lt gry bf, a/a vf-fxlln, sl lmy, LS 5%                         | med gry brn, lith sl microxlln                                     |
|              |         | scatt pr-fr ix, fxlln por                                      |                                                                    |
| 8620-8630 ft | DOL 95% | "                                                              | a/a occ lt gry-dk gry, vf-occ fxlln, sl lmy, 1-2% wh calc fld frcs |
|              | Ls 5%   | med gry a/a                                                    |                                                                    |
| 8630-8640 ft | DOL 20% | "                                                              | occ dk gry, arg a/a                                                |
|              | Dol 75% | lt gry-bf, vfxlln occ fxlln, occ tr pr ix porin vfxlln dol, wh | LS 5% med brn/gry-tan, lith, hd, dns, hd                           |
| 8640-8650 ft | DOL 75% | "                                                              | grdg dk gry a/a, vfxlln                                            |
|              | Dol 20% | bf-lt gry a/a                                                  | occ lmy, tr wh calc fld frcs, vgs                                  |
|              | Dol 5%  | blk, arg, grdg dolie Sh, interbds mnr tr Ls a/a                | & poss "birdseye", m-cg.                                           |
| 8650-8660 ft | DOL 60  | med gry, fxlln, grdg dk gry a/a                                | tr wh calc fld frcs                                                |
|              | Dol 35% | lt gry/bf a/a vf-fxlln,                                        | LS 5% lt gry-dk gry/brn, dolie microxlln                           |
| 8660-8670 ft | DOL 75% | "                                                              | a/a                                                                |
|              | Dol 10% | "                                                              | a/a                                                                |
| 8670-8680 ft | DOL 65% | "                                                              | micro-vfxlln, a/a                                                  |
|              | Dol 25% | "                                                              | a/a vf-fxlln                                                       |
| 8680-8690 ft | DOL 85% | "                                                              | a/a occ grdg dk gry, vf-fxlln, occ mxlln                           |
|              | Dol 10% | "                                                              | a/vfxlln, occ fxlln, occ lmy, tr wh calc fld frcs                  |
| 8690-8700 ft | DOL 20% | "                                                              | a/a                                                                |
|              | Dol 70% | "                                                              | to lt brn/gry, micro-vfxlln, hd, dns ,/tr wh calc fld frcs         |
| 8700-8710 ft | DOL 40% | "                                                              | a/a                                                                |
|              | Dol 60% | "                                                              | a/vfxlln                                                           |
| 8710-8720 ft | DOL 80% | "                                                              | a/a micro-vfxlln, sl lmy, dkr                                      |
|              | Dol 10% | "                                                              | a/a                                                                |
| 8720-8730 ft | DOL 70% | "                                                              | a/a sl arg, lmy occ grdg Ls                                        |
|              | Dol 20% | "                                                              | a/a                                                                |
| 8730-8740 ft | DOL 38% | "                                                              | a/a                                                                |
|              | Dol 60% | "                                                              | to wh, grdg Ls, hd plty, micro-vfxlln, micritic                    |
| 8740-8750 ft | DOL 55% | "                                                              | a/a vfxlln, sl arg                                                 |
|              | Dol 30% | "                                                              | wh, grdg lt gry, micro-vfxlln                                      |
| 8750-8760 ft | DOL 48% | "                                                              | a/a sl arg, vfxlln grdg dk gry, mnr scatt pyr                      |
|              | Dol 50% | "                                                              | lt gry/wh, vf-fxlln, grdg microxlln lmy dol, scatt pr ix & mg por. |
| 8760-8770 ft | DOL 40% | "                                                              | a/a sl arg, vfxlln, occ pyr nod                                    |
|              | Dol 58% | "                                                              | grdg lt gry/brn a/a                                                |

SH 5% dk gry/blk, fiss,  
Dol dk gry, arg, vfxlln a/a  
Sh 2% blk a/a grdg shly Ls, fiss  
LS dk gry blk, arg, grdg sh, dol  
SH 2% blk, lmy  
SH 2% blk grdg dk fry arg  
Ls (dolie)

|              |                               |                                                                                 |
|--------------|-------------------------------|---------------------------------------------------------------------------------|
| 8770-8780 ft | DOL 30% med gry, vf-fxlln a/a | Sh 2% blk, grdg dk gry agr Ls, dolie                                            |
|              | Dol 68%                       | lt gry brn a/a vfxlln occ fxlln, w scatt pr ix por in fxlln Dol                 |
| 8780-8790 ft | DOL 40% "                     | a/a SH 2% dk brn blk, limy, arg lam                                             |
|              | Dol 58%                       | " , fxlln Occ mxlln, occ fr ix por, 2% wh calc fld frcs                         |
| 8790-8800 ft | DOL 55%                       | a/a sl arg, mnr pyr Ls 5% dk gry/blk, grdg blk sh                               |
|              | Dol 40%                       | lt gry grdg m gry, a/a, 2% calc filled fr,                                      |
| 8800-8810 ft | DOL 10%                       | a/a, arg occ svatt pyr Ls dk gry/blk, arg, grdg blk SH                          |
|              | LS 80%                        | lt gry-wh, microxlln occ vfxlln grdg dolie                                      |
| 8810-8820 ft | DOL 85%                       | a/avf-fxlln, grdg dkr arg, sl lmy occ wh calc fld frcs                          |
|              | LS 10%                        | " a/a Ls 5% brn, lith, pelspar, hd, blkly                                       |
| 8820-8830 ft | DOL 75%                       | a/a vfxlln & 20% DOL dk gry arg, vfxlln, occ grdg dk gry/blk SH                 |
|              | LS 5%                         | brn, pelsparticle a/a                                                           |
| 8830-8840 ft | DOL 50%                       | a/a vf/fxlln Ls 20% dk gry brn-dk brn, micritic, lith,                          |
|              | Dol 25%                       | lt gry-lt gry/brn, (bf) microxlln occ vfxlln, limy, 2% wh calc fld fr           |
|              | Sh 5%                         | med gry, sl bluish, sl lmy, blkly-fiss                                          |
| 8840-8850 ft | DOL 50%                       | a/avf-microxlln, occ arg LS 10% med dk grn a/a lith                             |
|              | Dol 40%                       | " oec wh, a/a grdg lt gry/brn, microxlln occ mxlln, lmy                         |
| 8850-8860 ft | DOL 10%                       | a/a Ls 5% dk brn, lith a/a                                                      |
|              | Dol 85%                       | lt brn/gry, to lt gry & wh, microxlln-m xlln, limy grdg rexll Ls                |
| 8860-8870 ft | DOL 80%                       | grdg lt gry, microxlln occ vfxlln, occ arg, dk gry                              |
|              | Dol 10%                       | lt brn/gry-wh a/a, limy, Ls 5% dk brn a/a SH 5% gry, sl waxy, lam               |
| 8870-8880 ft | DOL 80%                       | lt-med gry, grdg dk gry, vfxlln, lmy occ wh calc fld frcs                       |
|              | Sh 5%                         | med gry/bluish to blk, med ld. Ls 15% med-dk brn aa, pelintremicrite,           |
| 8880-8890 ft | DOL 60%                       | med gry a/a SH 5% a/a                                                           |
|              | Dol 20%                       | lt gry, vfxlln occ fxlln, Ls 15% brn a/a                                        |
| 8890-8900 ft | DOL 20%                       | med gry, vfxlln, occ dkr arg                                                    |
|              | Dol 60%                       | lt gry-brn, vfxlln lmy grdg Dol 20% wh-lt gry, microxlln LIMY                   |
| 8900-8910 ft | DOL 100%                      | dk gry, arg, grdg med gry, vfxlln, occ limy w. blkarg lam., darker gry          |
| 8910-8920 ft | DOL 30%                       | dk gry, arg a/a Dol 40% wh-lt gry a/a, microxlln to f-m xlln                    |
|              | Dol 30%                       | med gry, a/a vfxlln, sl lmy <u>limy</u>                                         |
| 8920-8930 ft | DOL 20%                       | lt-med gry, a/avfxlln                                                           |
|              | Dol 80%                       | wh-lt gry, microxlln, hd, dns, plty, limy                                       |
| 8930-8940 ft | DOL 40%                       | lt-med gry, sl arg, vfxlln, occ microvgs                                        |
|              | Dol 20%                       | med-dk gry, grding dker, arg,                                                   |
|              | Dol 40%                       | wh-lt gry, crm, bf, a/a microxlln, occ vfxlln, hd, occ limy, occ pyr.           |
| 8940-8950 ft | DOL 30%                       | med gry, arg, vfxlln a/a                                                        |
|              | DOL 20%                       | dk gry arg, lmy grdg blk Sh and arg Ls                                          |
|              | LS 50%                        | tan, lt brn, micritic, pelletall, hd, dns, lith                                 |
| 8950-8960 ft | LS 100%                       | tan to lt gry/brn, lith, hd, micritic, occ fxlln, occ grdg wh-lt gry, dns, plty |
| 8960-8970 ft | LS 60%                        | lt gry/bf a/a lith, micritic                                                    |
|              | Dol 40%                       | med gry/brn, sl arg, occ bl/gry Sh SH tr grn sh, mnr scatt pyr                  |

|              |                                                                                       |                                                   |
|--------------|---------------------------------------------------------------------------------------|---------------------------------------------------|
| 8970-8980 ft | LS 90% lt gry/brn-wh, a/a lith, micritic                                              | w. mnr scatt pyr xlls                             |
|              | SH 10% pale grn. hd, waxy, poss silic or dolic w silty pyr specks                     |                                                   |
| 8980-8990 ft | LS 90% lt gry, occ tan & occ grn/gry, occ sl dolic, w scatt silty-vfg pyr xlls        |                                                   |
|              | SH 10% pale grn a/a sl silic.                                                         |                                                   |
| 8990-9000 ft | LS 95% wh-lt gry, bf, a/a pity, lith, hd, dns                                         |                                                   |
|              | SH 5% pale grn. silic, vitreous, occ dolic, occ frc -wh calc fld frcs in Sh.          |                                                   |
| 9000-9010 ft | LS 75% wh-bf, occ lt gry, plty, lith, dolic, hd, dns, mnr vfg foss frgs, lith-microxl |                                                   |
|              | Dol 20% lt gry, microxlin a/a                                                         | SH 5% pale grn a/a, occ pyr                       |
| 9010-9020 ft | LS 20% " lith-microxlin, dolic, intergrdg LS & DOL, mnr pyr specks & nod              |                                                   |
|              | Dol 80% " hd, dns, microxlin occ vfxlin, sl limy, SH tr grn a/a grdg dk gry           |                                                   |
| 9020-9030 ft | Dol 100% lt gry-lt grn/gry, hd, plty, microxlin, dns, dissem pyr comm, mnr wh frc     |                                                   |
|              | SH tr. pale grn a/a sl dolic, silic.                                                  |                                                   |
| 9030-9040 ft | Dol 50% lt gry-bf, a/a w. mnr grn sh, grdg dkrocc micritic, mnr pyr & wh calc frcs    |                                                   |
|              | DOL 70% med gry, microxlin, hd, dns a/a, sl arg                                       |                                                   |
| 9040-9050 ft | Dol 20% lt gry-bf a/a                                                                 | mnr pyr, mn wh calc fld frcs                      |
|              | DOL 80% med gry, microxlin occ vfxlin, hd, dns                                        |                                                   |
| 9050-9060 ft | Dol 20% " a/a intergrdg w.                                                            |                                                   |
|              | DOL 80% " a/a                                                                         |                                                   |
| 9060-9070 ft | Dol 10% " a/a                                                                         | " "                                               |
|              | DOL 90% "to gry brn, a/a grdg dk brn/gry,                                             |                                                   |
| 9070-9080 ft | Dol 20% lt grn/gry, a/a micro-vfxlin                                                  | occ scatt pr ix por                               |
|              | DOL 80% med gry brn a/a, " , hd, dns                                                  | " "                                               |
| 9080-9090 ft | Dol 85% " a/a microxlin, occ vfxlin,                                                  | mnr dissem pyr xlls, vfg-silty                    |
|              | DOL 10% " grdg ltr gry, microxlin, LS 5% dk brn, lith, hd, dns                        |                                                   |
| 9090-9100 ft | Dol 80% " a/a, micro-vfxlin, occ saccy, limy, hd, dns, occ pyr & wh calc frcs         |                                                   |
|              | DOL 20% " occ dk gry, a/a                                                             | LS tr, a/a                                        |
| 9100-9110 ft | Dol 90% lt gry-wh, a/a non-limy, micro-vfxlin, 5% wh calc fld frcs                    |                                                   |
|              | DOL 5% med gry a/a                                                                    | LS 5% wh, calc fld frcs LS 2% a/a                 |
| 9110-9120 ft | Dol 95% " a/a                                                                         | 2% wh calc fld frcs                               |
|              | DOL 5% " grdg dk gry a/a, occ arg, mn pyr-lam, nod, dissem                            |                                                   |
| 9120-9130 ft | Dol 95% " a/a sl limy, saccy                                                          | "                                                 |
|              | DOL 5% " a/a                                                                          | "                                                 |
| 9130-9140 ft | Dol 70% " a/a vf-fxlin, hd, dns                                                       | "                                                 |
|              | DOL 10% " a/a vfxlin, sl limy                                                         | LS 20% dk gry, brn lith                           |
| 9140-9150 ft | Dol 60% " a/a                                                                         |                                                   |
|              | DOL 35% " to dk gry, micro-vfxlin                                                     | LS a/a pyr a/a mn                                 |
| 9150-9160 ft | Dol 50% " a/a vf-f xlin, occ m xlin, occ scatt por.                                   |                                                   |
|              | DOL 40% " a/a dkr.                                                                    | LS 10% brn a/a                                    |
| 9160-9170 ft | DOL 40% " a/a                                                                         | OVG 50% blk sh, pr. sple LS 10% med gry, micritic |
| 9170-9180 ft | Dol 10% " a/a                                                                         | OVG 20% blk sh a/a, LS 15% dk grn -gry, lith      |
|              | DOL 55% " a/a                                                                         | mnr wh calc fld fr.                               |

|                             |                                                                                     |
|-----------------------------|-------------------------------------------------------------------------------------|
| 9180-9190 ft                | Dol 40% lt gry-wh, f-mxlin, a/a tr wh calc fld frgs (trans & opaque)                |
|                             | DOL 30% med gry, vf-fxlin, mottled, poss orig intrabiosparite                       |
|                             | Ls 10% dk brn, lith, sl dolc, CVG 20% dk gry blk Sh                                 |
| 9190-9200 ft                | Dol 70% lt gry-wh, occ grn/gry, vf-mxlin, scatt m-g ix por.                         |
|                             | DOL 20% med gry, mottled, vfxlin, pss orig pelisparite CVG 5%, Ls 5% a/a            |
| 9200-9210 ft                | Dol 70% " a/a micro-vfxlin, occ wh calc fld frgs                                    |
|                             | DOL 30% " a/a sl, mottled LS tra/a                                                  |
| 9210-9220 ft                | Dol 15% " a/a f-mxlin 5% LS med -dk gry/brn, lith mnz wh frc                        |
|                             | DOL 80% " occ dkr arg matrix, mottled, vf-fxlin, silmy                              |
| 9220-9230 ft                | Dol 15% " a/a fxlin, occ mxlin LS 5% m/a                                            |
|                             | DOL 80% " occ mottled, micro-vfxlin, grdg lt gry                                    |
| 9230-9240 ft                | DOL 100% med gry, mottled a/a f xlin occ vf&mxlin, w dkr rexllzd clastic frgs       |
| 9240-9250 ft                | DOL 80% med gry, a/a fxlin, clastic "ghosts" up to lmm. poss foss intrasparite      |
|                             | Dol 20% dk gry, sl mottled, grdg arg, dkr thn abv                                   |
| 9250-9260 ft                | DOL 40% " a/a fxlin intrgrdg w.                                                     |
|                             | Dol 60% dk gry a/a, arg, grdg blk & sl limy                                         |
| 9260-9270 ft                | DOL 60% " -med gry/brn fxlin, mottled a/a w scatt fr por, ix.                       |
|                             | Dol 40% lt brn-brn/gry, mottled, fxlin, occ m xlin.                                 |
| 9270-9280 ft                | DOL 60% " a/a f-vf xlin, mottled LS 5% dk brn a/a                                   |
|                             | Dol 35% " a/a fxlin oc m xlin                                                       |
| 9280-9290 ft                | DOL 85% " a/a fxlin, occ cs clastic g to lmm, mottled, rexll spar cement            |
|                             | Dol 10% " a/a Ls 5% dk brn a/a                                                      |
| 9290-9300 ft                | DOL 40% " a/a mottled a 1-2% wh calc fr. Ls 5% tan, dk brn                          |
|                             | Dol 55% " a/a fxlin occ m-c clln, mottled, scatt prix por,                          |
| 9300-9310 ft                | DOL 20% " a/a                                                                       |
|                             | Dol 30% " f-mxlin, mottled a/a                                                      |
|                             | Calc. 50% wh, sl dolc, opaque to frosted, fracture zone filled, mnz pyr in calc.    |
| 9310-9320 ft                | DOL 40% med-dk gry, micro-fxlin, occ mnz mottled                                    |
|                             | Dol 20% lt gry/brn a/a f-m xlin,                                                    |
| 9320-9330 ft                | Calcite 40% wh, frosted a/a sl striated six, cs xlin (fracture zone fld)            |
|                             | DOL 55% med-dk gry a/a f-m xlin, mottled                                            |
|                             | Dol 17% lt gry/brn, f-m xlin mottled w m-c g clastic ghosts                         |
|                             | Calcite 20% wh frc filed a/a Ls 8% dk gry ot dk gry/brn, lith                       |
| 9330-9340 ft                | DOL 100% med gry-med gry/brn, mottled av mxlin grdg lt mottled tan/wh, occ fxlin    |
|                             | w grdg to dk gry arg dol. poss biosparite (crin?)                                   |
| 9340-9350 ft                | DOL 100% med grybrn, mottled a/a fxlin occ mxlin, occ sl limy grdg mottled wh & tan |
|                             | mottled and to med gry/brn, arg.                                                    |
| Ronning Fm 9350-9360 ft     | DOL 80% med gry/brn, mottled, fxlin occ mxli grdg ltr, mnz pyr                      |
| Spl. 9370 ft                | Dol 20% lt brn/gry, bf, wh, microx-fxlin, hdr, dns, non-mottled                     |
| FDC/GR 9355 ft 9360-9370 ft | DOL 80% " a/a & wh cs xlin calc, fld frgs, wh, opaque                               |
|                             | Dol 20% " a/a microxlin                                                             |
| 9380-9390 ft                | DOL 60% " a/a mottled w. f-mg clasts, mottled, grdg to                              |
| 9370-9380 ft                | Dol 40% lt bf, vf-fxlin, hd, dns grdg w. above.                                     |
|                             | DOL 70% med gry mottled a/a Dol 30% lt gry microxlin, hd, dns non-mottled.          |

|              |         |                                                                              |
|--------------|---------|------------------------------------------------------------------------------|
| 9390-9400 ft | DOL 90% | med gry, micro-vfxlln, hd, dns, (def xll chg frm f-mxlln above to micro-vfxl |
|              | Dol 10% | wh-lt gry, micro-vfxlln, occ pyr, scatt wh calc/dol xlls (vgs?)              |
| 9400-9410 ft | DOL 95% | " a/a grdg ltr gry, micro-vfxlln, hd dns plty grdg w. (non-mottled)          |
|              | Dol 5%  | " a/a sl saccy                                                               |
| 9410-9420 ft | DOL 75% | " a/a grdg ltr, med hd microxlln-vfxlln                                      |
|              | Dol 20% | " a/a esp saccy, Ls 5% brn, lith, hd, dns                                    |
| 9420-9440 ft | DOL 70% | " a/asaccy, micro-vfxlln,hd, dns,grdg w.                                     |
|              | Dol 30% | " a/a vfg, saccy occ fr, occ pyr                                             |
| 9440-9450 ft | DOL 60% | " a/amicroxlln grdg w                                                        |
|              | Dol 40% | " a/a vfxlln, saccy,occ bf                                                   |
| 9450-9470 ft | DOL 40% | " a/a microxlln-vfxlln, occ fr & pyr grdg to                                 |
|              | Dol 60% | " a/a grdg ltgry/bf, hd,dns brit                                             |
| 9470-9480 ft | DOL 30% | " a/a grdg mnr wh calc fld frcs (vugs?)                                      |
|              | Dol 70% | lt gry, bf, wh, saccy, vfxllnocc microxlln, hd dns, thn plty                 |
| 9480-9490 ft | DOL 45% | " a/a grdg sl dkr, vfxlln-microxlln, hd, dns, grdg 5% Ls tan                 |
|              | Dol 50% | " a/a QHERT 1st appear. creamy wh, conc. to lmm, rare.                       |
| 9490-9500 ft | DOL 38% | " a/amicroxlln occ vfxlln, med hd grdg no cht, 2% LS                         |
|              | Dol 60% | " a/avfxlln,saccyocc microxlln (ltr Dol is larger xlln, saccy)               |
| 9500-9510 ft | DOL 40% | " a/a                                                                        |
|              | Dol 60% | " a/a pr sple, cvgs.(trip)                                                   |
| 9510-9520 ft | DOL 50% | " a/a grdg dk gry                                                            |
|              | Dol 50% | " a/amicroxlln occ vfxlln                                                    |
| 9520-9530 ft | DOL 65% | " a/a micro-vfxlln, SH 5% dk gry /wh f-mxll dol in vugs                      |
|              | Dol 30% | " occ wh, fxlln, wh xll dol fld vugs, mnr mvg por.,no ix por.                |
| 9530-9540 ft | DOL 80% | " a/a micro-vf xlln                                                          |
|              | Dol 20% | " a/a ess vfxlln                                                             |
| 9540-9550 ft | DOL 65% | " a/a ess vfxlln , microxlln grdg                                            |
|              | Dol 35% | " a/a                                                                        |
| 9550-9560 ft | DOL 85% | " a/amicroxlln, occ vfxlln grdg                                              |
|              | Dol 15% | " " " "                                                                      |
| 9560-9570 ft | DOL 80% | " " " "                                                                      |
|              | Dol 20% | " a/a " " "                                                                  |
| 9570-9580 ft | DOL 90% | " " " "                                                                      |
|              | Dol 10% | " a/a " " "                                                                  |
| 9580-9590 ft | DOL 70% | " " " dkr gry, gdg /mnr dol fld vgs                                          |
|              | Dol 30% | " a/a " " "                                                                  |
| 9590-9600 ft | DOL 90% | " " " " "                                                                    |
|              | Dol 10% | " a/a vfxlln occ microxlln & fxlln,saccy, lt gry-ltgry/brn                   |
| 9600-9610 ft | DOL 55% | " grdg dkr gry, sl arg, grdg                                                 |
|              | Dol 45% | " a/a lt gry/brn vfxlln, mnr microxlln                                       |
| 9610-9620 ft | DOL 60% | " ess microxlln occ vfxlln, grdg dkr, arg                                    |
|              | Dol 40% | " a/a occ bf, saccy ess vfxlln,mnr microxlln                                 |

|              |          |                                                                             |
|--------------|----------|-----------------------------------------------------------------------------|
| 9620-9630 ft | DOL 70%  | med gry, microxlin occ vfxlin, grdg dkr gry, hd, dns,                       |
|              | Dol 30%  | lt gry-lt gry/brn, saccy, vfxlin                                            |
| 9630-9640 ft | DOL 30%  | " a/a xilina/a                                                              |
|              | Dol 70%  | " -wh, bf, saccy, vfxlin a/a med hd                                         |
| 9640-9650 ft | DOL 80%  | " a/a grdg dk gry, arg grdg (wh dol fld vugs rather thn dol fld frcs)-foss? |
|              | Dol 20%  | " a/a                                                                       |
| 9650-9660 ft | DOL 75%  | " a/am-vfxlin, grdg dkr arg, dol w. arg ptgs                                |
|              | Dol 25%  | " a/vfxlin, occ f-mxlin, mnr ix por, <u>CHERT</u> -tr, milky wh             |
| 9660-9670 ft | DOL 70%  | " a/a less arg grdg mnr pyr                                                 |
|              | Dol 30%  | " bf, a/a occ saccy, wh, micro-vfxlin                                       |
| 9670-9680 ft | DOL 80%  | " a/a grdgitr dol as, mnr pyr nod                                           |
|              | Dol 20%  | " a/avfxlin, saccy mnr Cht, lt brn-milky wh                                 |
| 9680-9690 ft | DOL 90%  | " a/agrdg lt brn gry, less microxlin, grdg dk dk gry, arg wh dol f          |
|              | Dol 10%  | " a/a lt brn/gry, saccy (40% of sple is saccy lt-med gry)                   |
| 9690-9700 ft | DOL 95%  | " -med gry/brn, ltr thn above, saccy, vfxlin grdg mico-vfxlin,              |
|              | Slst 5%  | med/dk gry, blk, dolie /mnr arg ptgs, 40% saccy vfxlin                      |
| 9700-9710 ft | DOL 100% | " microxlin, hd, dns, grdg dk gry, w grdg ltr saccy, vfxlin                 |
|              |          | tr. blk Sh, / sft-med hd (40% saccy)                                        |
| 9710-9720 ft | DOL 80%  | " a/a                                                                       |
|              | Sh 20%   | blk, incl CWG.                                                              |
| 9720-9730 ft | DOL 100% | " grdg dk gry, sl arg, hd, dns, microxlin grdg ltrgry/brn, saccy            |
|              |          | vfxlin (20%), mnr dol fld spar vugs                                         |
| 9730-9740 ft | DOL 90%  | " a/a, hd, dns, <u>mnr CHT</u> , wh, semitranslucent, diff to identify      |
|              | Dol 10%  | bf/wh, a/a saccy poss Dol sl silic, mnr calc fld vg/frcs                    |
| 9740-9750 ft | DOL 90%  | " a/a tr CHT a/a                                                            |
|              | Dol 10%  | " a/a ltr, saccy                                                            |
| 9750-9760 ft | DOL 85%  | " a/amed gry/brn, microxlin, 30% vfxlin, saccy, ltr, occ dkr gry            |
|              | Dol 10%  | " a/a saccy, vfxlin, tr CHT, appears grdg dolie (repl.) 5% SH,              |
| 9760-9770 ft | DOL 90%  | " a/a 40% saccy vfxlin, wh calc/dol xll frc/vg fld                          |
|              | Dol 10%  | " a/a /mnr pyr nod                                                          |
| 9770-9780 ft | DOL 75%  | " a/a grdg dk gry, microxlin w 20% vfxlin, saccy, hd, dns                   |
|              | Dol 20%  | " a/a saccy, vfxlin, tr CHT ie 1-2 frgs only noted                          |
|              | Dol 10%  | dk gry, microxlin, sl arg, SH 5%, blk                                       |
| 9780-9790 ft | DOL 60%  | " a/a -med gry/brn, grdg lt gry, microxlin, (30% saccy a/a)                 |
|              | Dol 40%  | " a/a saccy, vfxlin, tr CHT, occ 10 bl/gry, 1-2mm, more abund               |
|              |          | mnr dol/calc xll fr/vg fld                                                  |
| 9790-9800 ft | DOL 60%  | " a/a microxlin, 10% saccy, -vfxlin, tr CHT                                 |
|              | Dol 40%  | " a/a saccy-vfxlin                                                          |
| 9800-9810 ft | DOL 75%  | " a/a microxlin, 10% saccy-vfxlin tr cht, mnr dissem & lin pyr              |
|              | DOL 10%  | " a/a, Dol 10% dk gry grdg, 5% blk SH                                       |
| 9810-9820 ft | DOL 95%  | " a/a microxlin, 20% saccy-vfxlin, hdtr cht-milky wh, tr SH lam             |
|              | Dol 5%   | " a/a, saccy-vfxlin,                                                        |
| 9820-9830 ft | DOL 70%  | " a/a microxlin, 50% saccy-vfxlin, occ thn blk Sh lam, tr Cht               |
|              | Dol 30%  | " a/a, saccy-vfxlin                                                         |

|               |         |                                                                           |
|---------------|---------|---------------------------------------------------------------------------|
| 9830-9850 ft  | DOL 60% | med gry, grdg lt, microxlin grdg saccy-vfxlin 10%, hd, dns, tr Cht to 2mm |
|               | Dol 40% | lt gry, wh, vfxlin-saccy                                                  |
| 9850-9860 ft  | DOL 40% | " a/a, microxlin mnr pyr; scatt cht, rare, bl/gry, sl dolie               |
|               | Dol 60% | " a/a " , 20% saccy-vfxlin /w pyr in frcs of cht                          |
| 9860-9870 ft  | DOL 70% | " a/a grdg bl/gry, microxlin, tr Cht, tr calc/dol frc/vg fld              |
|               | Dol 30% | " a/a microxlin, 20% vfxlin-saccy                                         |
| 9870-9890 ft  | DOL 80% | " a/asl dkr, microxlin, tr wh Cht, mnr pyr nod. .1-.5mm & spts            |
|               | Dol 20% | " a/a saccy-vfxlin, tr blk SH lam in Dol                                  |
| 9890-9900 ft  | DOL 70% | " a/a microxlin, hd, dns, 20% saccy-vfxlin, rare Cht,                     |
|               | Dol 30% | " a/a saccy-vfxlin, /tr dol/calc fld frcs/vugs                            |
| 9900-9910 ft  | DOL 80% | " a/a rare Cht, mnr pyr, tr frc/vg fld                                    |
|               | Dol 20% | " a/a w. dol/calc                                                         |
| 9910-9920 ft  | DOL 70% | " a/a " "                                                                 |
|               | Dol 30% | " a/a tr Sh, blk grdg arg Dol                                             |
| 9920-9930 ft  | DOL 80% | " a/amed gry/brn,                                                         |
|               | Dol 20% | " a/a - rare Cht                                                          |
| 9930-9940 ft  | DOL 75% | " a/a "                                                                   |
|               | Dol 25% | " a/a "                                                                   |
| 9940-9950 ft  | DOL 90% | " a/a microxlin, hd, dns, grdg arg to blk Sh lam, rare cht,               |
|               | Dol 10% | " a/a saccy-vfxlin /w tr frc/vg fld w Dol/Calc                            |
| 9950-9960 ft  | DOL 20% | " a/a microxlin mnr Cht (easily noted) "                                  |
|               | Dol 80% | lt gry/brn, saccy-vfxlin                                                  |
| 9960-9970 ft  | DOL 10% | " A/a mnr Cht                                                             |
|               | Dol 90% | " a/a, av saccy vfxlin grdg microxlin-fxlin, tr pr ix por.                |
| 9970-9980 ft  | DOL 20% | med gry/brn a/a, microxlin, hd, dns mnr Cht                               |
|               | Dol 80% | lt gry/brn, a/a saccy                                                     |
| 9980-9990 ft  | DOL 60% | " a/a, microxlin -vfxlin mnr cht                                          |
|               | Dol 40% | " a/a vfxlin, occ f/m xlin                                                |
| 9990-10,000ft | DOL 80% | med gry/brn, sl arg, occ dkr gry, micro-vfxlin, hd, dns, CHT 1%, mnr pyr  |
|               | Dol 20% | lt gry/brn, vf-fxlin, occ m xlin, saccy tex, / mnr calc/dol fld frc/vg    |

Samples logged 0-10,000 by T. Boleantu, P. Geol. -Pi Consultants Ltd  
10,000-10,515 ft by P. Brown

Sample Description:

- 10,000 - 10,020 Dolomite, light brown grey, silicious, very fine - micro crystalline, platy, vitreous luster; some light colored chert & rare dark brown chert.
- 10,020 - 10,030 Limestone, dark brown, argillaceous, silicious, crypto crystalline, dense; some grey & black bitumitic shale; trace light blue grey pyritic dolomite.
- 10,030 - 10,040 Dolomite, brown grey, silicious, very fine - micro crystalline, platy, vitreous luster; much dark brown & white chert; trace calcite & black shale.
- 10,040 - 10,050 Dolomite, grey-medium grey, slightly argillaceous & silicious, very fine - micro crystalline, dense; trace pyrite & chert.
- 10,050 - 10,060 Dolomite, grey, silicious, very fine - finely crystalline, platy, vitreous luster, dense; some pyrite & dark brown chert; calcite veining, trace bitumitic shale.
- 10,060 - 10,070 Dolomite, medium grey, some brown grey, silicious, argillaceous, very fine - micro crystalline; abundant platy silica fragments.
- 10,070 - 10,080 Dolomite, white & cream, very silicious, micro-crypto crystalline, dense; much quartz; trace pale green shale; (?) glauconite; trace quartzitic sand grains;
- 10,080 - 10,090 Dolomite, white-cream, very silicious, medium crystalline- fragmental crystalline; some coarse quartz sand grains; trace black shale.
- 10,090 - 10,105 Dolomite, cream, silicious, many very fine & rare coarse quartz grains medium-fragmental crystalline, dense; vitreous luster.
- 10,105 - 10,110 Dolomite, cream, very silicious, medium crystalline, dense; some very dark brown crypto crystalline argillaceous, silicious lime fragments; trace black bitumitic shale; rare green shale.
- 10,110 - 10,120 Dolomite, cream-white, silicious, micro-crypto crystalline, very platy, dense.
- 10,120 - 10,130 Dolomite, cream-light grey, crypto crystalline, dense.
- 10,130 - 10,140 Dolomite as above, some black shale; trace dark brown very argillaceous finely granular Dolomite (trace poor porosity),
- 10,140 - 10,145 As above; some chalky earthy dolomite.
- 10,145 - 10,150 Dolomite, light grey; some cream, very finely granular-micro crystalline dense; some black bitumitic shale.
- 10,150 - 10,155 Dolomite, cream, medium crystalline; trace porosity.
- 10,155 - 10,170 Dolomite, white & cream, <sup>medium</sup> fine-micro crystalline, platy, vitreous luster, silicious quartz inclusions; some brown crypto crystalline limestone; some black bitumitic shale; rare pyrite,

Sample Description Cont'd:

- 10,170 - 10,180 As above; and Dolomite, cream, medium crystalline; trace porosity.
- 10,180 - 10,190 Dolomite, white-cream, fine-medium crystalline; rare pyrite & chert.
- 10,190 - 10,210 Dolomite, cream-light buff grey, medium crystalline to finely granular, rare pyrite; trace brown very finely granular dolomite with (?) trace porosity.
- 10,210 - 10,220 Dolomite, white, medium crystalline, slightly silicious; trace black shale & brown limestone; and as above.
- 10,220 - 10,230 Dolomite, white, very finely crystalline, some flakey, vitreous luster, some quartz inclusions.
- 10,230 - 10,240 As above; with ~~much~~ much dark brown limestone & black bitumitic shale.
- 10,240 - 10,250 Dolomite, cream & buff grey, very fine-micro crystalline, dense; some pyrite & lime & shale.
- 10,250 - 10,270 Limestone, very dark brown, argillaceous, crypto crystalline, dense; some black bitumitic shale; trace sulfur & pyrite; & Dolomite, buff & grey fine-micro crystalline, some silicious, dense.
- 10,270 - 10,280 Dolomite, white-light grey, silicious, micro crystalline, vitreous luster dense; some quartz inclusions.
- 10,280 - 10,290 Dolomite as above, but fine-medium crystalline; more quartz fragments.
- 10,290 - 10,300 As above; less quartz; very rare pyrite.
- 10,300 - 10,310 As above; with some light blue grey finely crystalline Dolomite; with scattered pyrite & rare bitumen - (?) trace porosity.
- 10,310 - 10,320 Dolomite, cream & light grey, slightly silicious, fine-medium crystalline trace porosity & some blue grey dolomite as above.
- 10,320 - 10,330 As above; trace dark brown argillaceous, crypto crystalline slightly silicious limestone & black bitumitic shale; rare quartz fragments.
- 10,330 - 10,340 Dolomite, white-light grey, some cream, slightly silicious, very fine-medium crystalline, some very finely granular; trace bitumen & pyrite; some quartz inclusions.
- 10,340 - 10,350 Dolomite, white-light grey, trace light blue grey, very fine-medium crystalline, slightly silicious; some quartz, pyrite & dark brown lime.
- 10,350 - 10,360 Dolomite, white, silicious, medium crystalline, very platy, dense; much dark brown crypto crystalline limestone & black bitumitic shale.
- 10,360 - 10,370 Dolomite, white-light grey, light buff grey, slightly silicious, finely crystalline, dense.
- 10,370 - 10,380 Dolomite, light buff grey, slightly silicious, micro-crypto crystalline, dense; scattered pyrite; trace black bitumitic shale.

- 10,380 - 10,390 Dolomite, light grey-light buff grey, slightly silicious, micro-finely crystalline, platy, dense; rare pyrite & very rare pin point vugs.
- 10,390 - 10,400 Dolomite, white, very silicious, finely crystalline, vitreous luster, dense; much quartz.
- 10,400 - 10,420 Silica, white, platy, ~~much~~ silica replacing very fine-finely crystalline dolomite.
- 10,420 - 10,430 Dolomite, white, cream, some buff, micro-finely crystalline, silicious, some quartz, black bituminic shale & dark brown line - poor samples-trip.
- 10,430 - 10,440 Dolomite, cream, silicious, very fine-micro crystalline, platy, dense; some black shale, dark brown line & quartz.
- 10,440 - 10,450 Dolomite, buff, silicious, very fine-micro crystalline, some platy, (?) trace porosity; some quartz fragments.
- 10,450 - 10,460 Dolomite, light brown, slightly silicious, finely crystalline, dense.
- 10,460 - 10,470 Dolomite, light brown, finely crystalline, rare trace pin point vugs & pyrite; trace intercrystalline porosity.
- 10,470 - 10,480 Dolomite, light buff - brown, very fine - micro crystalline; some finely granular with trace porosity; rare white gypsum.
- 10,480 - 10,490 Dolomite, cream-light buff grey, very fine - micro crystalline, dense; rare pyrite & light grey chert.
- 10,490 - 10,500 Dolomite, light grey-light brown, very fine-micro crystalline, dense; rare bitumen.
- 10,500 - 10,510 Dolomite, cream-light grey, micro crystalline, dense.
- 10,510 - 10,515 Dolomite, cream-light grey, very fine crystalline; some very finely granular, platy, dense.

TOTAL DEPTH 10,515.

ovgth Overgrowth  
ox Oxidized

p Poor  
pbl Pebble  
pbly Pebbly

Pchgr Parachgetes  
Pdcr Productids  
pel Pellet(oid)  
perm Permeability  
per Petroliferous  
phos Phosphate(ic)  
plso Pisolite(ic)  
pit Pitted  
pk Pink  
pl Plant  
plag Plagioclase  
plas Plastic  
Plcy Pelecypod  
plt Plate(s)  
platy Platy  
por Porous(sity)  
porc Porcelaneous  
pos Possible(ility)  
p-p Pin Point  
pred Predominate(ly)  
pres Preserved(ation)  
pris Prism(atic)  
prly Pearly  
prob Probable(ly)  
psdo Pseudo  
pt Part(ly)  
ptch Patch(es)  
ptchy Patchy  
ptg Parting  
purp Purple  
pyr Pyrite(ic)(ized)  
pyrbir Pyrobitumen

qtz Quartz  
qtzc Quartzitic  
qtzs Quartzose  
qtzt Quartzite

rad Radiate(ing)  
rd Round(ed)  
reg Regular  
Ren Renalcis  
repl Replaced(ing)(ment)  
resd Residue(al)  
rexl Recrystallized  
rhmb Rhomb(ic)  
rk Rock  
rmn Remains(nant)  
rng Range(ing)  
rr Rare  
rshs Resinous  
rthy Earthy  
rug Rugose(Rugosa)

s Small  
S Sulphur  
sa Salt  
sa-c Salt Cast(ic)  
sa.p Salt & pepper  
sat Saturated  
sc Scales  
scaph Scaphopod  
sar Scattered  
sch Schist

Scol Scolecodonts  
sd Sand  
sdy Sandy  
sec Secondary  
sed Sediment(ary)  
sel Selenite  
sept Septate  
sf Sequence  
sft Soft  
sh Shale  
shad Shadow  
shy Shaly  
sid Siderite  
sil Silica(eous)  
sks Slickensided  
sl Slight(ly)  
sln Solution  
slt Silt  
sltst Siltstone  
sfty Silty  
sm Smooth  
sol Solitary  
Solen Solenopora  
sp Spot(ted)(ty)  
spec Speck(led)  
Spfr Spirifers  
Spg Sponge  
sph Spherules  
Sphaer Sphaerocodium  
sphal Sphalerite  
spic Spicule(ar)  
spl Sample  
splty Splintery  
spn Spine  
Spr Spore  
srt Sort  
srtg Sorted  
srtg Sorting  
ss Sandstone  
st Stone  
Stach Stachyodes  
stn Stain(ed)(ing)  
strat Strata(ified)  
strg Stringer  
stri Striated  
Strom Stromatoporoid  
stromit Stromatolite  
struc Structure  
styl Styliolite(ic)  
Stylio Styliolina  
suc Sucrosic  
surf Surface  
srct Sericite  
sy-Ca Sparry Calcite  
Syring Syringopora  
sz Size

tab Tabular  
Tenr Tentaculites  
tex Texture  
tgh Tough  
Tham Thamnopora  
thk Thick  
thin Thin  
thru Throughout  
tr Trace  
Trilo Trilobite  
trip Tripoli(ic)  
trnsl Translucent  
trasp Transparent

Troc Trochiliscus  
tt Tight(ly)  
tub Tubular  
tuf Tuffaceous

unconf Unconformity  
uncons Unconsolidated  
uni Uniform  
up Upper

v Very  
var Variable  
vcol Varicolored  
vit Vitreous  
vn Vein  
volc Volcanics  
vps Very poor samples  
vrtl Vertical  
vrvd Varved  
vug Vug(gy)(ular)

/ With  
w Well  
wh White  
wk Weak  
wld Welded  
wthr Weather  
wthrd Weathered  
wtr Water  
wvy Wavy  
wxy Waxy

xbd Cross-bedded  
xbdg Cross-bedding  
xl Crystal(line)  
xlam Cross-laminated

yel Yellow

zeo Zeolite  
zn Zone

# ENGINEERING ABBREVIATIONS

abnd abandoned  
 AOF absolute open flow  
 bbl(s) barrel(s)  
 BHFP bottom hole flow pressure  
 BHP bottom hole pressure  
 BHSIP bottom hole shut in pressure  
 BHT bottom hole temperature  
 BO barrels of oil  
 BOPD barrels of oil per day  
 BOPH barrels of oil per hour  
 brk brackish  
 BS&W basic sediment and water  
 BW barrels of water  
 BWPD barrels of water per day  
 BWPH barrels of water per hour  
 CB conservation board  
 Co company  
 circ circulate (ed) (tion)  
 ck choke  
 comp completed  
 crd cored  
 csg casing  
 D&A dry and abandoned  
 DD drilled deeper  
 decr decreasing  
 DF derrick floor  
 dist distillate  
 drld drilling  
 drlr driller  
 DST drill stem test  
 E east  
 est estimated  
 FTAB faint air blow  
 FAB fair air blow  
 FIB fair initial blow  
 FIP fair initial puff  
 fl flowed (ing)  
 FP flowing pressure  
 FBHP flowing bottom hole pressure  
 form formation  
 GAB good air blow  
 GC gas cut  
 GCM gas cut mud  
 GCW gas cut water  
 G&OCM gas and oil cut mud  
 GIB good initial blow  
 GIP good initial puff  
 GOR gas to oil ratio  
 Gr ground  
 GTS gas to surface  
 gty gravity  
 H heavy

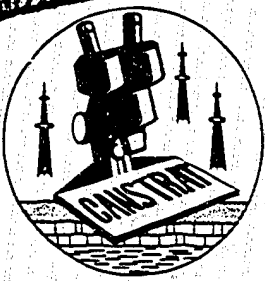
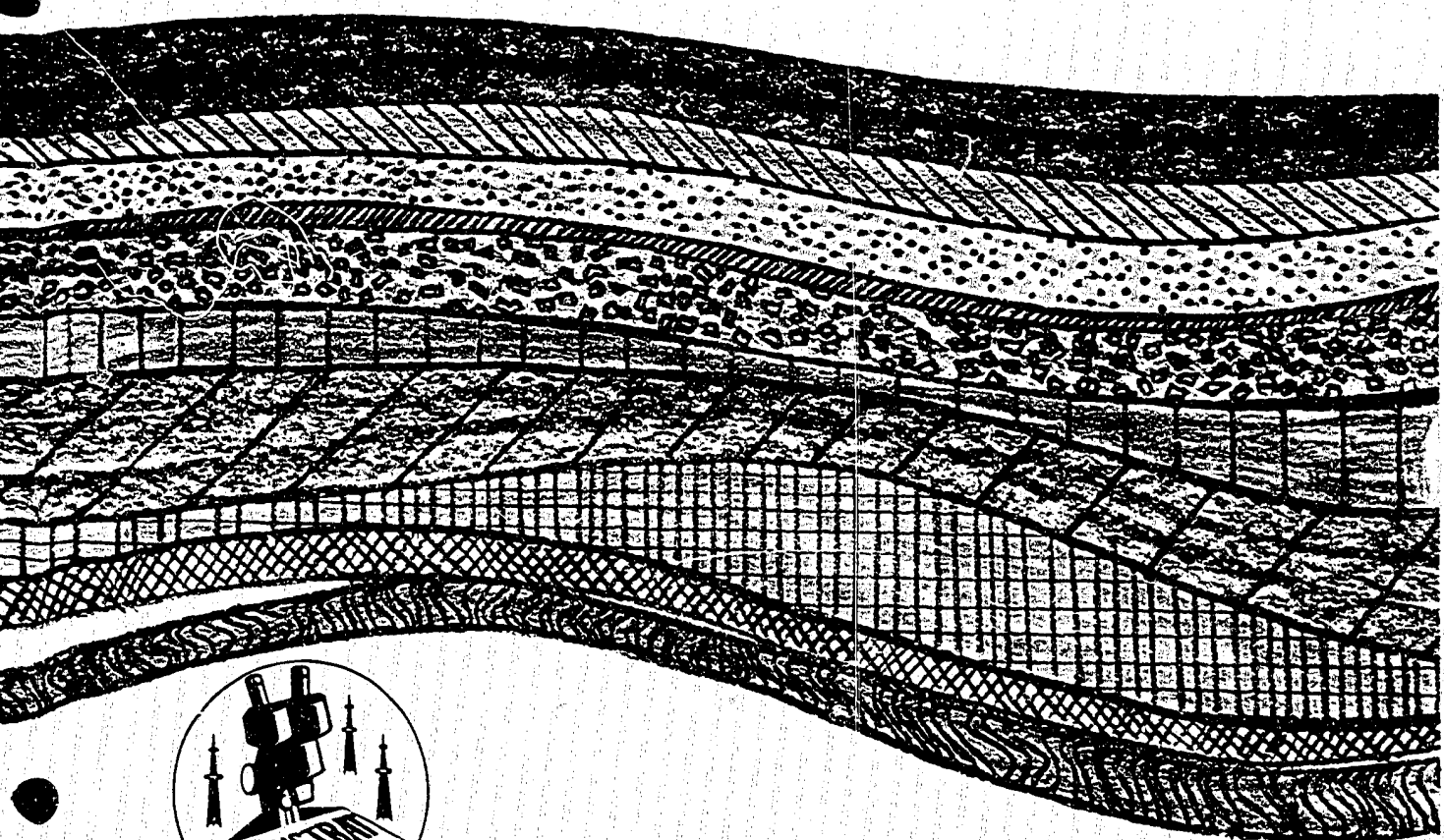
HH hydrostatic head  
 HO heavy oil  
 HHP hydrostatic head pressure  
 HP hydrostatic pressure  
 hvly heavily  
 hrs hours  
 IAB initial air blow  
 IP initial production  
 KB kelly bushing  
 loc location  
 LSD legal subdivision  
 MCF/D thousand cubic feet of gas per day  
 MMCF/D million cubic feet of gas per day  
 MCO mud cut oil  
 MCW mud cut water  
 MTS mud to surface  
 MWT mud weight  
 min minutes  
 N north  
 NS no show  
 O&G oil and gas  
 O&SW oil and salt water  
 OC oil cut  
 OCM oil cut mud  
 OCSW oil cut salt water  
 OFM oil flecked mud  
 op open  
 OTD old total depth  
 OTS oil to surface  
 OWDD old well drilled deeper  
 OWPB old well plugged back  
 OWWO old well worked over  
 P&A plugged and abandoned  
 PB plugged back  
 PBTD plugged back total depth  
 PD per day  
 perf perforated  
 perm permeability  
 pkr packer  
 psi pounds per square inch  
 R range  
 RB rotary bushing  
 rec recovered  
 RT rotary table  
 RM resistivity mud  
 RW resistivity water  
 S south  
 SAB small air blow  
 STRAB strong air blow  
 Sec section

SGCM slight gas cut mud  
 SGCW slight gas cut water  
 SI shut in  
 SIBHP shut in bottom hole pressure  
 SIP shut in pressure  
 SOCM slight oil cut mud  
 SOCW slight oil cut water  
 sqz squeezed  
 SW salt water  
 swbd swabbed  
 sx sacks  
 T township  
 tbg tubing  
 T.D. total depth  
 temp temperature  
 TOT through out test  
 tstg testing  
 TSTM too small to measure  
 TWTM too weak to measure  
 V.op valve open  
 W west  
 (W) wildcat  
 WAB weak air blow  
 WC water cut  
 WCM water cut mud  
 WCTS water cushion to surface  
 wtr cush water cushion  
 WIP weak initial puff  
 wtr water

## Mechanical Log Abbreviations

BHCS bore hole compensated sonic  
 Cal caliber  
 DIL dual induction log  
 DILL dual induction laterolog  
 ES electric  
 IES induction electric  
 FDL formation density log  
 GR gamma ray  
 GR-N gamma ray neutron  
 GR-S gamma ray sonic  
 L laterolog  
 ML microlog, minilog  
 MLL microlaterolog  
 N neutron  
 S sonic, acoustilog  
 PL proximity log  
 PML proximity microlog  
 ● oil well  
 \* gas well  
 ✱ dry and abandoned  
 ✱ abandoned oil well  
 ✱ abandoned gas well  
 ✱ suspended  
 O location of rig

# LITHOLOGIC SYMBOLS & ABBREVIATIONS



CANADIAN STRATIGRAPHIC SERVICES LTD. 1972

|              |              |              |              |
|--------------|--------------|--------------|--------------|
| @            | Abund        | At           | Abund        |
| abnt         | Above        | Abund        | Above        |
| abv          | Acicu        | Acicu        | Acicu        |
| acic         | After        | After        | After        |
| aftr         | Aggreg       | Aggreg       | Aggreg       |
| agg          | Agglom       | Agglom       | Agglom       |
| aglm         | Agglut       | Agglut       | Agglut       |
| aglt         | Algae        | Algae        | Algae        |
| Alg          | Altere       | Altere       | Altere       |
| alt          | Alveol       | Alveol       | Alveol       |
| <u>Alveo</u> | Amber        | Amber        | Amber        |
| amb          | Amorph       | Amorph       | Amorph       |
| amor         | Amphi        | Amphi        | Amphi        |
| <u>Amph</u>  | Amount       | Amount       | Amount       |
| amt          | Angula       | Angula       | Angula       |
| ang          | Anhed        | Anhed        | Anhed        |
| anhed        | Anhyd        | Anhyd        | Anhyd        |
| anhy         | Appea        | Appea        | Appea        |
| app          | Appare       | Appare       | Appare       |
| apr          | Approx       | Approx       | Approx       |
| aprox        | Aragon       | Aragon       | Aragon       |
| arag         | Arenac       | Arenac       | Arenac       |
| aren         | Argill       | Argill       | Argill       |
| arg          | Argill       | Argill       | Argill       |
| argl         | Arkos        | Arkos        | Arkos        |
| ark          | Aspha        | Aspha        | Aspha        |
| asph         | Authiq       | Authiq       | Authiq       |
| authgn       |              |              |              |
|              |              |              |              |
| bar          | Barite       | Barite       | Barite       |
| bcm          | Becom        | Becom        | Becom        |
| bd           | Bed          | Bed          | Bed          |
| bdd          | Bedde        | Bedde        | Bedde        |
| bdeye        | Birds        | Birds        | Birds        |
| bdg          | Beddi        | Beddi        | Beddi        |
| <u>Belm</u>  | <u>Belem</u> | <u>Belem</u> | <u>Belem</u> |
| bent         | Bentol       | Bentol       | Bentol       |
| bf           | Buff         | Buff         | Buff         |
| biocl        | Biocl        | Biocl        | Biocl        |
| biot         | Biotit       | Biotit       | Biotit       |
| bit          | Bitum        | Bitum        | Bitum        |
| bldr         | Bould        | Bould        | Bould        |
| blk          | Black        | Black        | Black        |
| blky         | Black        | Black        | Black        |
| bnd          | Band         | Band         | Band         |
| boudg        | Boudi        | Boudi        | Boudi        |
| Brac         | Brach        | Brach        | Brach        |
| branch       | Branc        | Branc        | Branc        |
| brec         | Brecc        | Brecc        | Brecc        |
| brit         | Brittl       | Brittl       | Brittl       |
| brd          | Bore         | Bore         | Bore         |
| brn          | Brown        | Brown        | Brown        |
| Bry          | Bryoz        | Bryoz        | Bryoz        |
| btry         | Botry        | Botry        | Botry        |
| bulb         | Bulbo        | Bulbo        | Bulbo        |
| bur          | Burro        | Burro        | Burro        |
|              |              |              |              |
| c            | Coars        | Coars        | Coars        |
| ¢            | Core         | Core         | Core         |
| calc         | Calci        | Calci        | Calci        |
| calclut      | Calci        | Calci        | Calci        |
| calent       | Calca        | Calca        | Calca        |
| calcrud      | Calci        | Calci        | Calci        |
| calcslt      | Calci        | Calci        | Calci        |
| carb         | Carbo        | Carbo        | Carbo        |
| <u>Gasph</u> | <u>Calci</u> | <u>Calci</u> | <u>Calci</u> |
| cbl          | Cobbl        | Cobbl        | Cobbl        |
| Ceph         | Ceph         | Ceph         | Ceph         |
| cgl          | Cong         | Cong         | Cong         |
| <u>Chae</u>  | <u>Chae</u>  | <u>Chae</u>  | <u>Chae</u>  |

# SUMMARY OF ABBREVIATIONS

|              |                    |                 |                      |             |                    |            |                   |
|--------------|--------------------|-----------------|----------------------|-------------|--------------------|------------|-------------------|
| @            | At                 | chal            | Chalcedony           | f           | Finally            | intbd      | Interbedded       |
| abnt         | Abundant           | chit            | Chitinous            | <u>Fvst</u> | <u>Favosites</u>   | intrcl     | Intraclast        |
| abv          | Above              | chk             | Chalky               | Fe          | Iron-Ferruginous   | intfrag    | Interfragmental   |
| acic         | Acicular           | chlar           | Chlorite             | fenst       | Fenestral,         | intgran    | Intergranular     |
| aft          | After              | cht             | Chert                |             | Fenestrate,        | intgwn     | Intergrown        |
| agg          | Aggregate          | chty            | Cherry               |             | Fenestroe          | intlam     | Interlaminated    |
| aglm         | Agglomerate        | cl              | Clastic              | fenst       | Fenestellid        | intpt      | Interpretation    |
| aglt         | Agglutinated       | clot            | Clotted              | Fest        | Ironstone          | intstl     | Interstitial      |
| Alg          | Algae(al)          | clr             | Clear                | fib         | Fibrous            | intv       | Interval          |
| alt          | Altered(ing)       | clus            | Cluster              | fis         | Fissile            | intxl      | Intercrystalline  |
| <u>Alveo</u> | <u>Alveolites</u>  | cly             | Clay(ey)             | fl          | Fill, filled       | ireg       | Irregular         |
| amb          | Amber              | clyst           | Claystone            | flat        | Flattened          | irid       | Iridescent        |
| amor         | Amorphous          | cmt             | Cement(ed)           | fld         | Feldspar (thic)    | kao        | Kaolin            |
| <u>Amph</u>  | <u>Amphipera</u>   | cncn            | Concentric           | flk         | Flake              | lam        | Laminated         |
| amt          | Amount             | cntr            | Center(ed)           | flky        | Flaky              | lamr       | Lamellar          |
| ang          | Angular            | <u>Coen</u>     | <u>Coenites</u>      | flor        | Fluorescence       | lchd       | Leached           |
| anhed        | Anhydral           | col             | Color(ed)            | flt         | Fault(ed)          | len        | Lentic(ular)      |
| anhy         | Anhydrite(ic)      | coln            | Colonial             | fltq        | Floating           | lg         | Long              |
| app          | Appearance         | com             | Common               | fnt         | Faint(ly)          | lig        | Lignite(ic)       |
| apr          | Apparent           | conc            | Concretion (ionary)  | Foram       | Foraminifera       | lithcl     | Lithoclast        |
| aprox        | Approximately (ly) | conch           | Conchoidal           | fos         | Fossil (iferous)   | lmm        | Limonite(ic)      |
| arag         | Aragonite          | conld           | Conularids           | fr          | Fair               | lmy        | Limy              |
| aren         | Arenaceous         |                 | (Conularia)          | frac        | Fracture(ed)       | low        | Lower             |
| arg          | Argillaceous       | Cano            | Conodont             | frag        | Fragment(al)       | lrg        | Large(er)         |
| argl         | Argillite          | contm           | Contaminated         | fri         | Friable            | ls         | Limestone         |
| ark          | Arkose(ic)         | coa             | Coquina              | fros        | Frosted            | lse        | Loose             |
| asph         | Asphalt(ic)        | cor             | Coral                | Fus         | Fusulinid          | lstr       | Lustre            |
| authgn       | Authigenic         | cpct            | Compact              | g           | Good               | lt         | Light(er)         |
|              |                    | crbnt           | Carbonate            | Gast        | Gastropod          | hl         | Little            |
| bar          | Barite(ic)         | cren            | Crenulated           | <u>Girv</u> | <u>Girvanella</u>  | m          | Medium            |
| bcm          | Become(ing)        | Crin            | Crinoid(al)          | gl          | Glassy             | magn       | Magnetite         |
| bd           | Bed                | crk             | Crack(s)             | glau        | Glaucanitic(ic)    | mar        | Maroon            |
| bdd          | Bedded             | crm             | Cream                | <u>Glob</u> | <u>Globigerina</u> | mas        | Massive           |
| bdeye        | Birdseye           | crnk            | Crinkled             | glos        | Gloss(y)           | mat        | Material, matter  |
| bdg          | Bedding            | crpal           | Cryptocrystalline    | gn          | Green              | meta       | Metamorphic       |
| <u>Belm</u>  | <u>Belemnites</u>  | crc             | Contact              | gns         | Gneiss             | mic        | Micro             |
| bent         | Bentonite(ic)      | ctd             | Coated               | gr          | Grain(ed)          | mica       | Mica (ceous)      |
| bf           | Buff               | ctgs            | Cuttings             | gran        | Granular           | mic-mica   | Micro-Micaceous   |
| biocl        | Bioclastic         | cvg             | Caving               | Grap        | Graptolite         | micrt      | Micrite           |
| biot         | Biotite            | cyc             | Cyclic               | grd         | Grade(ed)          | micxl      | Microcrystalline  |
| bit          | Bitumen (inous)    |                 |                      | grdg        | Grading            | mnr        | Minor             |
| bldr         | Boulder            | dd              | Dead                 | grnl        | Granule            | mnrl       | Mineral(ized)     |
| blk          | Black              | deb             | Debris               | grnt        | Granite            | mod        | Moderate          |
| blky         | Blocky             | decr            | Decrease (ing)       | grnt,w      | Granite Wash       | mol        | Mollusc           |
| bnd          | Band(ed)           | def             | Deformed             | gsy         | Greasy             | mos        | Mosaic            |
| baudg        | Boudinage          |                 | (Deformation)        | gvl         | Gravel             | mot        | Mottled           |
| Brac         | Brachiopod         | dend            | Dendrite(ic)         | gy          | Gray               | marlst     | Marlstone         |
| branch       | Branching          | dess            | Desiccation          | gyp         | Gypsum(iferous)    | msm        | Metasomatic (ism) |
| brec         | Breccia(ed)        |                 | Desiccate(d)         | gywk        | Graywacke          | mtx        | Matrix            |
| brit         | Brittle            | dif             | Difference           | hd          | Hard               | musc       | Muscovite         |
| brd          | Bored              | dism            | Disseminated         | hem         | Hematite(ic)       | nod        | Nodule (ar)       |
| brn          | Brown              | dk              | Dark(er)             | hex         | Hexagonal          | num        | Numerous          |
| Bry          | Bryozoa            | dns             | Dense(er)            | hi          | High               | o          | Oil               |
| btry         | Botryoidal         | dol             | Dolomite (ic)        | hky         | Hackly             | oblq       | Oblique           |
| bulb         | Bulbous            | drlg            | Drilling             | hrl         | Horizontal         | occ        | Occasional        |
| bur          | Burrowed           | drsy            | Drusely              | hvy         | Heavy              | od         | Odor              |
|              |                    | dtrl            | Detrital (us)        | hydc        | Hydrocarbon        | onc        | Oncolites         |
| c            | Coarse (ly)        | Ech             | Echinoid             | hydthm      | Hydrothermal       | ool        | Oolite(ic)        |
| f            | Core               | Echderm         | Echinoderm (ara)     | <u>Idio</u> | <u>Idiostroma</u>  | oot        | Ootoid            |
| calc         | Calcite(areous)    | elg             | Elongate             | ig          | Igneous            | op         | Opaque            |
| calclut      | Calclutite         | elip            | Elliptical           | imbd        | Imbedded           | org        | Organic           |
| calent       | Calcarenite        | <u>Endo</u>     | <u>Endothyra</u>     | imp         | Impression         | orng       | Orange            |
| calcrud      | Calcirudite        | enl             | Enlarged             | incl        | Included (sion)    | <u>Ort</u> | <u>Ortonella</u>  |
| calcsilt     | Calcsiltite        | entlith         | Enterolithic         | incr        | Increase (ing)     | orth       | Orthoclase        |
| carb         | Carbonaceous       | equiv           | Equivalent           | ind         | Induratea          | ost        | Ostracod          |
| <u>Casph</u> | <u>Casphaera</u>   | erd             | Erode(d)             | indst       | Indistinct         |            |                   |
| cbl          | Cobble             | erul            | Erosional            | <u>Inoc</u> | <u>Inoceramus</u>  |            |                   |
| Ceph         | Cephalopod         | euhed           | Euhedral             |             |                    |            |                   |
| cgl          | Conglomerate       | <u>Euryamph</u> | <u>Euryamphibora</u> |             |                    |            |                   |
| <u>Chact</u> | <u>Chacteres</u>   |                 |                      |             |                    |            |                   |

## COLUMN No. 1

FORMATION TOPS

FOOTNOTES

FAULTS

OIL SHOWS

### FAULTS

-  NORMAL FAULT
-  REVERSE FAULT
-  OVERTURNED STRATA

### OIL SHOWS

INDICATED FROM DST RECOVERY — see Column No. 10

STAINING IN CUTTINGS OR CORE

- EVEN STAINING — light to heavy gravity, will cut in solvent & fluoresce
- SPOTTED STAINING — light to heavy gravity, will cut in solvent & fluoresce
- QUESTIONABLE OIL STAIN — brown staining, no cut in solvent or fluorescence
- D DEAD- ASPHALT, BITUMEN, etc.

INDICATED FROM OTHER SOURCES (e.g. Production Data) — no staining or DST

- OIL
- ▲ GAS

## COLUMN No. 2

### POROSITY TYPES

COMBINATIONS OF UP TO THREE POROSITIES MAY BE USED :

- X INTERCRYSTALLINE, INTERFRAGMENTAL, INTERGRANULAR
- φ INTERCOLLITIC, INTERPELLETOID
- V VUGGY — voids greater than 1/16 mm
- P PINPOINT — voids less than 1/16 mm
- E EARTHY — low permeability, non effective, crystals or grains less than 1/16 mm
- O ORGANIC — bridged, intrafossil, burrows, borings
- F FRACTURE
- FENESTRAL — voids from gas bubbles, shrinkage cracks, birdseye texture
- Δ OOMOLDIC

## COLUMN No. 3

### POROSITY GRADES

FOUR DIVISIONS — right to left

#### DIVISION I

UP TO 6% Poor porosity with low permeability

#### DIVISION II

6% — 12% Fair porosity

#### DIVISION III

12% — 20% Good porosity

#### DIVISION IV

OVER 20% Excellent porosity

# COLUMN No. 4

## DETAILED GRAPHIC LITHOLOGY

### MAIN ROCK TYPES

|  |                                          |
|--|------------------------------------------|
|  | CLAYSTONE, light gray                    |
|  | CLAYSTONE, medium gray                   |
|  | CLAYSTONE, dark gray                     |
|  | CLAYSTONE COLORED, light                 |
|  | CLAYSTONE COLORED, medium                |
|  | CLAYSTONE COLORED, dark                  |
|  | SHALE, light gray                        |
|  | SHALE, medium gray                       |
|  | SHALE, dark gray                         |
|  | SHALE COLORED, light                     |
|  | SHALE COLORED, medium                    |
|  | SHALE COLORED, dark                      |
|  | SHALE, black                             |
|  | COAL, pure                               |
|  | COAL, impure (inter bedded)              |
|  | BENTONITE                                |
|  | CHERT, bedded                            |
|  | BRECCIA                                  |
|  | GLACIAL TILL                             |
|  | CONGLOMERATE                             |
|  | SILTSTONE                                |
|  | SANDSTONE                                |
|  | MARLSTONE, calcareous                    |
|  | LIMESTONE-mudsupported-FW under 7        |
|  | LIMESTONE-grainsupported-FW over 7       |
|  | MARLSTONE, dolomitic                     |
|  | DOLOMITE                                 |
|  | ANHYDRITE                                |
|  | ANHYDRITE, secondary                     |
|  | GYPSUM                                   |
|  | SALT                                     |
|  | FERRUGINOUS-siderite, limonite, hematite |
|  | IGNEOUS, basic                           |
|  | IGNEOUS, acidic                          |
|  | VOLCANIC                                 |
|  | METAMORPHIC                              |

### ACCESSORIES

NO SYMBOL UNDER 10 %  
ONE SYMBOL MAXIMUM 20 %  
TWO SYMBOLS MAXIMUM 40 %  
THREE SYMBOLS MAXIMUM 50 %

|  |                      |
|--|----------------------|
|  | SANDY                |
|  | SANDSTONE, stringers |
|  | SILTY                |
|  | SILTSTONE, stringers |

|  |                                                          |
|--|----------------------------------------------------------|
|  | SAND GRAINS, over 1 to 2 mm                              |
|  | CIRCLED SYMBOL- PEBBLE (over 2mm)<br>quartz, chert, lime |
|  | BRECCIA FRAGMENT                                         |
|  | SILICEOUS                                                |
|  | CHERT, light                                             |
|  | CHERT, dark                                              |
|  | CHERT, tripolitic                                        |
|  | CHERT, sandy                                             |
|  | CHERT, oolitic                                           |
|  | ARGILLACEOUS                                             |
|  | SHALE, stringers                                         |
|  | ARGILLITE GRAIN                                          |
|  | HEAVY, DARK MINERALS                                     |
|  | CARBONACEOUS FLAKES                                      |
|  | COAL, thin beds                                          |
|  | CEMENTING BITUMENOUS SUBSTANCE                           |
|  | CALCAREOUS                                               |
|  | MARLSTONE - calcareous                                   |
|  | LIMESTONE, stringers                                     |
|  | DOLOMITIC                                                |
|  | MARLSTONE - dolomitic                                    |
|  | DOLOMITE, stringers                                      |
|  | ANHYDRITIC                                               |
|  | ANHYDRITE, stringers                                     |
|  | GYPSIFEROUS                                              |
|  | GYPSUM, stringers                                        |
|  | SALT CAST or INFILL                                      |
|  | FELDSPATHIC                                              |
|  | PHOSPHATE-PELLETS or NODULES                             |
|  | FERRUGINOUS PELLETS -<br>limonite, siderite, hematite    |
|  | FERRUGINOUS -<br>limonite, siderite, hematite            |
|  | FERRUGINOUS STRINGERS -<br>limonite, siderite, hematite  |
|  | NODULES - eg calcareous,<br>ferruginous, chert           |
|  | VOLCANIC                                                 |

SYMBOLS USED FOR SIGNIFICANT OCCURRENCES  
(may be less than 10 %)

|  |                 |
|--|-----------------|
|  | GLAUCONITE      |
|  | MINERAL CRYSTAL |
|  | PYRITE          |
|  | KAOLIN          |
|  | PLANT SPORES    |
|  | PLANT REMAINS   |
|  | FISH REMAINS    |
|  | BENTONITE       |

### ROCK BUILDERS

F INDICATES FOSSIL MATERIAL  
up to 20 %  
ONE SYMBOL 20% - 50 %  
TWO SYMBOLS 50% - 70 %  
THREE SYMBOLS 70% - 100 %

#### ORGANIC

|  |                                   |
|--|-----------------------------------|
|  | FORAMINIFERA                      |
|  | CRINOID                           |
|  | BIOCLASTIC or FRAGMENTAL          |
|  | AMPHIPORA                         |
|  | STROMATOPOROID                    |
|  | CORAL                             |
|  | BRYOZOA                           |
|  | PELECYPOD                         |
|  | OSTRACOD                          |
|  | CEPHALOPOD                        |
|  | GASTROPOD                         |
|  | SCAPHOPOD                         |
|  | BELEMNITE                         |
|  | ECHINOID                          |
|  | BRACHIOPOD                        |
|  | FOSSIL MATERIAL,<br>less than 20% |

#### ORGANIC or NON ORGANIC

|  |            |
|--|------------|
|  | OOLITES    |
|  | PISOLITE   |
|  | PELLETS    |
|  | INTRACLAST |

#### ALGAL

|  |               |
|--|---------------|
|  | FRAMEWORK     |
|  | Skeletal      |
|  | Ooloid        |
|  | NON FRAMEWORK |
|  | Non descript  |
|  | Laminated     |

### MISCELLANEOUS

|  |                                |
|--|--------------------------------|
|  | KARST TOPOGRAPHY               |
|  | QUESTIONABLE<br>INTERPRETATION |
|  | CAVING - cannot interpret      |
|  | NO SAMPLES                     |

### TEXTURES

|  |                   |
|--|-------------------|
|  | CRYPTOCRYSTALLINE |
|  | EARTHY            |
|  | CHALKY            |

# LOG FORM

[illegible]

**COLUMN No. 5**

CRYSTAL, GRAIN or FRAGMENT SIZE

FIVE DIVISIONS (left to right) WENTWORTH SCALE

DIVISION 1 .004 mm — .0625 mm Silt and microcrystalline

DIVISION 2 .0625mm - .125 mm Very fine

DIVISION 3 .125 mm - .250 mm Fine

#### DIVISION 4 .250 mm — .500 mm Medium

DIVISION 5 .500 mm -1.000 mm Coarse

**COLUMN No. 6**

## ALTERATION AFTER LITHIFICATION

M METASOMATISM

D DOLOMITIZATION

R RECRYSTALLIZATION

## F FRACTURING

L LEACHING

K KAOLINIZATION

## SECONDARY CEMENTATION

A ANHYDRITE

S      SILICA

**X KAOLIN**

C    CALCITE    and    OTHERS

## SANDSTONE ROUNDING

A      A N G U L A R                      R      R O U N D E D

| Q   | SUBANGULAR | r | SUBROUNDED |
|-----|------------|---|------------|
| 1   |            |   |            |
| 2   |            |   |            |
| 3   |            |   |            |
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| 100 |            |   |            |

**COLUMN No. 7**

### DEGREE of ALTERATION AFTER LITHIFICATION

|   |           |   |     |   |     |
|---|-----------|---|-----|---|-----|
| N | 0-5% none | 4 | 40% | 8 | 80% |
|---|-----------|---|-----|---|-----|

**1      10%                  5      50%                  9      90%**

2      20%                  6      60%                  C      100%

|   |     |   |     |   |                 |
|---|-----|---|-----|---|-----------------|
| 3 | 30% | 7 | 70% | ? | Uninterpretable |
|---|-----|---|-----|---|-----------------|

# SANDSTONE SORTING

W WELL - 1 or 2 sizegrades

M MEDIUM - 3 or 4 size grades

P POOR - 5 or more size grades

## COLUMN No. 8

### FRAMEWORK

|   |       |   |      |   |                                                      |
|---|-------|---|------|---|------------------------------------------------------|
| 0 | 0-5 % | 5 | 50 % | C | 100 %                                                |
| 1 | 10 %  | 6 | 60 % | ? | Uninterpretable after intense alteration             |
| 2 | 20 %  | 7 | 70 % | ? | Questionable interpretation after intense alteration |
| 3 | 30 %  | 8 | 80 % |   |                                                      |
| 4 | 40 %  | 9 | 90 % |   |                                                      |

ORGANIC MATERIAL (eg. Stromatoporoid and Coral) IS CONSIDERED FRAMEWORK WHETHER GROWING IN PLACE OR TRANSPORTED.

## COLUMN No. 9

### DESCRIPTION

DESCRIPTION COLUMN IS USED FOR INFORMATION THAT CANNOT BE PRESENTED IN COLUMNS 1 THROUGH 8. EG. COLOR, SPECIFIC FOSSIL IDENTIFICATION, OBSERVATIONS ON BEDDING, INDURATION, HARDNESS, STRUCTURE ETC.

DESCRIPTIVE TERMS ARE ABBREVIATED. (see abbreviation list)

## COLUMN No. 10

### DRILLSTEM TEST RESULTS

|             |                                                 |
|-------------|-------------------------------------------------|
| I           | POSITIVE GAS RECOVERY                           |
| I           | POSITIVE OIL RECOVERY                           |
| I           | POSITIVE WATER RECOVERY                         |
| UP TO 3     | SYMBOLS MAY BE USED IN APPROPRIATE COMBINATIONS |
| I<br>I<br>I | POSITIVE GAS, OIL AND WATER RECOVERY            |

### WIRELINE TEST RESULTS

|   |                         |
|---|-------------------------|
| ↑ | POSITIVE GAS RECOVERY   |
| ■ | POSITIVE OIL RECOVERY   |
| W | POSITIVE WATER RECOVERY |

## COLUMN No. 11

### DRILLSTEM AND WIRELINE TEST INTERVALS

|   |                         |
|---|-------------------------|
| I | DRILLSTEM TEST INTERVAL |
| Δ | WIRELINE TESTED ZONE    |

## COLUMN No. 12

### CORED INTERVALS AND SIDEWALL CORE DEPTHS

|   |                |
|---|----------------|
| I | CORED INTERVAL |
| Δ | SIDEWALL CORE  |

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D.S.T. CHARTS

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CASING RECORD

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BIT RECORD

## Section 3 (c)

BIT RECORD

| NO.     | SIZE    | TYPE | FOOTAGE               | HOURS   |
|---------|---------|------|-----------------------|---------|
| 1A      | 8 3/4"  | XIG  | 184 ft                | 9 3/4   |
| 2A      | "       | XDV  | 0 (Ream 20 ft)        | 13 1/2  |
| 3A      | "       | XDV  | 0 (Ream 10 ft)        | 20 1/2  |
| 4A      | "       | X7   | 0 (Ream 16 ft)        | 10 1/2  |
| 5A      | "       | WD7J | 0 (Ream 5 ft)         | 2 1/2   |
| 6A      | "       | XDV  | 6 ft (+Ream)          | 26 1/2  |
| Ream #1 | 17 1/2" | H.O. | 126 ft                | 7       |
| 7A      | 8 3/4"  | XIG  | 0 (Ream)              | 11 1/2  |
| 8A      | "       | XDV  | 17 ft (+Ream)         | 13      |
| 9A      | "       | WD7  | 5 ft (+Ream)          | 21      |
| 10A     | "       | WD7  | 21 ft (+Ream)         | 11 1/2  |
| 11A     | "       | WD7  | 12 ft (+Ream)         | 4 1/2   |
| 12A     | "       | XIG  | 0 (Cement)            | -       |
| 13A     | "       | WD7  | 87 ft                 | 8 3/4   |
| 14A     | "       | XDV  | 257 ft                | 34 3/4  |
| 15A     | "       | XIG  | 31 ft                 | 10 1/2  |
| 16A     | "       | XDV  | 93 ft                 | 30 3/4  |
| 17A     | "       | XDV  | 201 ft                | 146 1/2 |
| 18A     | "       | XDV  | 89 ft                 | 7 1/2   |
| 1A Ream | 13 3/4" | H.O. | 530 ft                | 35      |
| 2A Ream | "       | H.O. | 250 ft                | 18 3/4  |
| 3A Ream | "       | H.O. | 223 ft                | 32      |
| 1       | 8 3/4"  | XIG  | 821 ft                | 34 3/4  |
| 2       | "       | J-55 | 2605 ft               | 115 1/2 |
| RR #14  | "       | XDV  | Cleaning hole         |         |
| 3       | "       | J-44 | 1951 ft               | 228 1/2 |
| 4       | "       | XDV  | 26 ft (Cleaning) hole | 23 1/2  |

## Section 3 (c)

## BIT RECORD (continued)

| NO.     | SIZE    | TYPE             | FOOTAGE            | HOURS   |
|---------|---------|------------------|--------------------|---------|
| RR #16A | 8 3/4"  | XDV              | Cleaning<br>Hole   |         |
| 5       | 6 1/8"  | J33              | 252 ft             | 54      |
| 6       | "       | J33              | 517 ft             | 48      |
| 7       | "       | FCH-5            | Drill Cmt          |         |
| 8       | "       | W7J              | Cleaning Hole<br>" |         |
| RR5     | "       | J33              | "                  |         |
| 9       | "       | OSCIG            | "                  |         |
| 10      | "       | W7               | 98 ft              | 9 3/4   |
| 11      | "       | J-33             | 318 ft             | 64 1/2  |
| 12      | "       | FCH5J            | 170 ft             | 25 1/2  |
| 13      | "       | J-33             | 506 ft             | 66 3/4  |
| 14      | "       | J-33             | 1111 ft            | 107 1/2 |
| RR13    | "       | J-33             | 416 ft             | 47 1/2  |
| RR7     | "       | FCH5             | 265 ft             | 41 1/2  |
| 15      | 6 3/32" | Diamond<br>MD-33 | 20 ft              | 1 3/4   |
| 16      | 6 1/8"  | F5               | 346 ft             | 36 1/2  |
| 17      | "       | F5               | 207 ft             | 22 1/4  |
| 18      | "       | FCH-5            | 130 ft             | 18 1/2  |
| 19      | "       | FCH-5            | 59 ft              | 8 1/2   |
| 20      | "       | J33              | 110 ft             | 17      |
| 21      | "       | W7J              | 19 ft              | 5       |
| 22      | "       | SS5              | 41 ft              | 11 1/4  |
| 23      | 6 3/32" | Diamond          | .0                 | 0       |
| 24      | "       | SS5              | 67 ft              | 21      |
| 25      | "       | SS5              | 100 ft             | 15 1/2  |
| 26      | 6 3/32" | Diamond          | 33 ft              | 3 1/2   |
| 27      | 6 1/8"  | J-55             | 164 ft             | 25      |
| 28      | "       | J-55             | 81 ft              | 13 1/2  |

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MUD REPORT

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DEVIATION SURVEYS

## Section 3 (e)

## DEVIATION SURVEY RECORD

Td=Teledyne Survey

To=Totco Wireline Survey

|        |                |         |                   |         |                   |
|--------|----------------|---------|-------------------|---------|-------------------|
| 90 ft  | $\frac{1}{2}$  | 840 ft  | 2                 | 1850 ft | $5\frac{1}{2}$ Td |
| 170 ft | $\frac{3}{4}$  | 870 ft  | $2\frac{1}{8}$    | 1950 ft | 6Td               |
| 160 ft | $\frac{3}{4}$  | 876 ft  | 3                 | 2050 ft | $6\frac{1}{8}$ To |
| 60 ft  | $\frac{3}{4}$  | 914 ft  | 3                 | 2060 ft | 6 Td              |
| 148 ft | $1\frac{1}{2}$ | 929 ft  | $2\frac{1}{2}$    | 2227 ft | $6\frac{3}{4}$ To |
| 177 ft | $1\frac{3}{4}$ | 960 ft  | $2\frac{1}{2}$    | 2250 ft | 6 Td              |
| 208 ft | $1\frac{1}{2}$ | 884 ft  | $2\frac{1}{2}$    | 2350 ft | 6 Td              |
| 245 ft | $1\frac{1}{2}$ | Ream 13 | $\frac{3}{4}$     | 2450 ft | $6\frac{1}{2}$ Td |
| 276 ft | $1\frac{1}{2}$ | 180 ft  | $1\frac{1}{8}$    | 2550 ft | $6\frac{1}{2}$ To |
| 307 ft | $1\frac{7}{8}$ | 273 ft  | $1\frac{1}{2}$    | 2650 ft | 6 Td              |
| 337 ft | 2              | 360 ft  | 2                 | 2750 ft | $6\frac{1}{2}$ Td |
| 368 ft | $1\frac{3}{4}$ | 486 ft  | $2\frac{1}{2}$    | 2840 ft | 6 Td              |
| 390 ft | $1\frac{3}{4}$ | 578 ft  | $2\frac{3}{4}$    | 2850 ft | $7\frac{1}{8}$ To |
| 420 ft | $1\frac{3}{4}$ | 673 ft  | $2\frac{1}{2}$    | 2950 ft | 6 Td              |
| 494 ft | 2              | 769 ft  | 2                 | 3050 ft | 6 Td              |
| 525 ft | 2              | 864 ft  | 2                 | 3150 ft | $7\frac{1}{2}$ To |
| 557 ft | $1\frac{7}{8}$ | 960 ft  | 2                 | 3450 ft | $6\frac{3}{4}$ To |
| 578 ft | $2\frac{1}{2}$ | 1010 ft | 2 Td              | 3579 ft | $5\frac{1}{2}$ Td |
| 606 ft | $2\frac{3}{8}$ | 1140 ft | 2 Td              | 3760 ft | 6 To              |
| 620 ft | $2\frac{1}{2}$ | 1230 ft | $2\frac{3}{8}$ Td | 4050 ft | $6\frac{1}{8}$ To |
| 639 ft | 2              | 1320 ft | $2\frac{3}{8}$ Td | 4350 ft | 7 To              |
| 670 ft | $2\frac{1}{4}$ | 1480 ft | $2\frac{1}{2}$ Td | 4482 ft | 6 Td              |
| 710 ft | 2              | 1535 ft | $5\frac{1}{8}$ To | 4552 ft | $6\frac{1}{2}$ Td |
| 756 ft | 2              | 1700 ft | $5\frac{1}{2}$ To | 4682 ft | $6\frac{1}{2}$ Td |
| 775 ft | 2              | 1775 ft | $5\frac{5}{8}$ To | 4780 ft | 7 Td              |
| 810 ft | 2              | 1800 ft | $5\frac{1}{2}$ Td | 4980 ft | 7 Td              |

## Section 3 (e)

## DEVIATION SURVEY RECORD (Continued)

|         |           |          |           |
|---------|-----------|----------|-----------|
| 5100 ft | 7 Td      | 7825 ft  | 7½ To     |
| 5200 ft | 7 Td      | 8109 ft  | 8½ To     |
| 5315 ft | 7½ Td     | 8466 ft  | 12½ To    |
| 5440 ft | 7 Td      | 8750 ft  | 14½ To    |
| 5540 ft | 7 Td      | 8883 ft  | 15 To     |
| 5640 ft | 7½ Td     | 9148 ft  | 20½ To    |
| 5740 ft | 8½ Td     | 9168 ft  | 21 To     |
| 5840 ft | 8 Td      | 9450 ft  | 24 To     |
| 5930 ft | 8 Td      | 9504 ft  | 23½ To    |
| 6060 ft | 8½ Td     | 9750 ft  | 28 To     |
| 6150 ft | 8½ Td     | 10434 ft | 38 To     |
| 6250 ft | 8½ Td     | 10515 ft | 40 To TD. |
| 6370 ft | 9 Td      |          |           |
| 6380 ft | 9 7/8 To  |          |           |
| 6410 ft | 9 To      |          |           |
| 6466 ft | 10 To     |          |           |
| 6632 ft | 10 To     |          |           |
| 6730 ft | 11 3/4 To |          |           |
| 6950 ft | 11 3/4 To |          |           |
| 6353 ft | 9 To      |          |           |
| 6380 ft | 8 To      |          |           |
| 6680 ft | 10½ To    |          |           |
| 6850 ft | 10½ To    |          |           |
| 7162 ft | 10½ To    |          |           |
| 7356 ft | 9½ To     |          |           |
| 7563 ft | 8½ To     |          |           |