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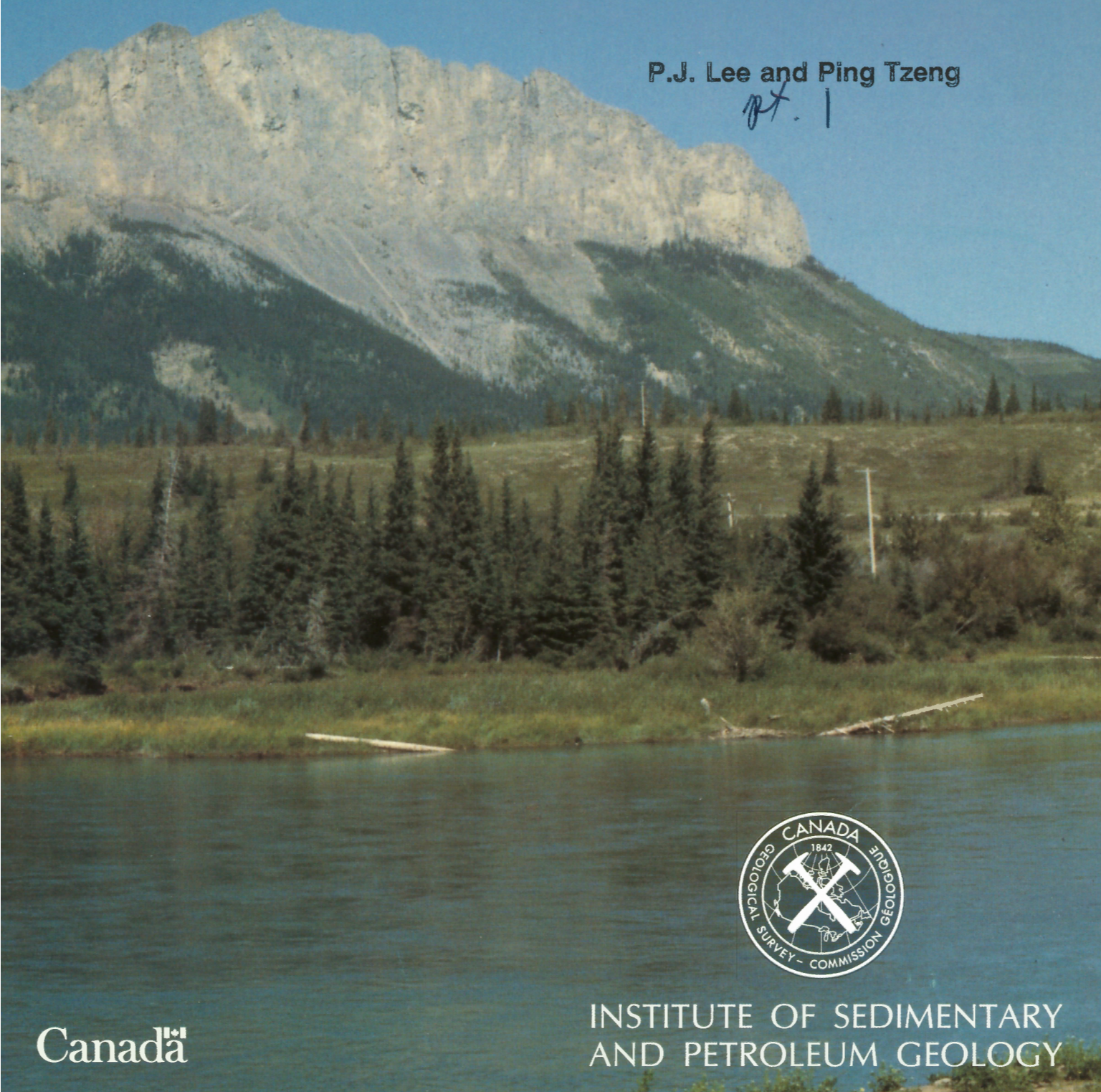
THE PETROLEUM EXPLORATION AND RESOURCE EVALUATION SYSTEM (PETRIMES) WORKING REFERENCE GUIDE Version 3.0 (PC version)

P.J. Lee and Ping Tzeng



Canada

INSTITUTE OF SEDIMENTARY AND PETROLEUM GEOLOGY

GEOLOGICAL SURVEY OF CANADA
COMMISSION GEOLOGIQUE DU CANADA

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THE PETROLEUM EXPLORATION AND RESOURCE EVALUATION SYSTEM (PETRIMES)

WORKING REFERENCE GUIDE
Version 3.0 (PC version)

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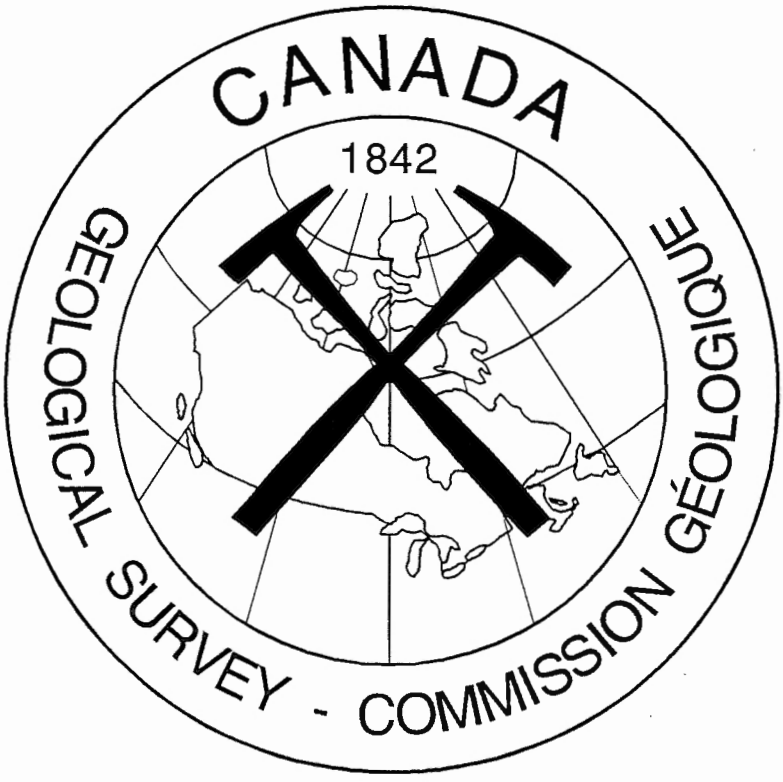

DISCLAIMER

Although all of the modules of PETRIMES have been extensively tested, no guarantee (expressed or implied) is made by the authors or the GEOLOGICAL SURVEY OF CANADA regarding program correctness, accuracy, or proper execution on all computer systems.

The GEOLOGICAL SURVEY OF CANADA has no liability for any consequential damages that may arise out of the use of this software.

IMPORTANT NOTE

Running PETRIMES properly on a personal computer requires an IBM AT or compatible PC computer with:

- DOS 4.0 or higher,
- a minimum of 8 megabytes of extended and expanded memory,
- 300 megabytes of hard disk space,
- an enhanced graphic adaptor (EGA or better),
- KEDIT text editor,
- Microsoft Fortran Compiler (Version 5.0+), and
- PLOTWORKS Inc. plot device library software (Plot 88).

The authors would like to thank Paul Price and Wendy Warters for their comments and suggestions.

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ONE

INTRODUCTION

Welcome to PETRIMES!

Welcome to the powerful and versatile Petroleum Exploration Resource Evaluation System, PETRIMES. With this system, you will be able to manipulate reservoir and well data in a variety of ways, from simple graphic displays to complex and sophisticated statistical analyses that may be used to reveal the hydrocarbon potential of plays, basins, or regions.

1.1 PETRIMES Basics:

PETRIMES is comprehensive and very easy to use. However before using the system, you should:

* Be familiar with well and reservoir data in order to be able to effectively operate the Reservoir and Well Data Base systems.

* Be experienced in the operation of the KEDIT text editor.

* Understand the principles, concepts, and statistical assumptions associated with the evaluation procedure (Lee and Wang, 1990) before using the Evaluation Subsystem.

* Be experienced in the use of graphic functions.

PETRIMES comprises four data bases, statistical and graphic computer programs, and a "Manager". To operate the system, users must first identify themselves to the "Manager" by means of a unique project/assessment identifier (UAI). Then they may execute any of the programs by using high-level commands (e.g. **POOLS**: in this case the command **POOLS** can be used to retrieve all pools that satisfy given retrieval criteria). The "Manager" communicates between users and the system and is also responsible for output/input between programs.

In this document, the function of each command within **PETRIMES** is explained and step-by-step instructions are given with respect to their use. This manual is provided to you as a working reference guide and has been structured so that you can easily "tour" the system by working through the examples given.

1.2 System Capabilities

PETRIMES is capable of performing the following tasks:

* Outline a play boundary, using a polygon

* Retrieving pools and/or wells within the polygon for a given formation

* Plotting exploration history by drill sequence of wells, according to time series or spatial distributions

* Performing risk analyses and prospect analyses

* Estimating numbers and sizes of undiscovered pools for a given play

* Displaying reservoir parameters using various types of plots

* Manipulating or mapping reservoir or well parameters

* Constructing or estimating various probability distributions for reservoir parameters of a specific play or region.

1.3 System Requirements

PETRIMES operates on PC computers. In order for **PETRIMES** to run properly in a personal computer environment, you will need an IBM AT or compatible PC computer with DOS 4.0 or higher that has minimum of 8 megabytes of extended and expanded memory and 300 megabytes of hard disk space. An enhanced graphic adaptor, EGA or better and KEDIT text editor are also required.

1.4 System Architecture

PETRIMES consists of four data bases and six subsystems. The four data bases are:

* All current UAIs
* The reservoir data
* The well data
* The probability distributions.

The six subsystems comprise

* Information management
* Subsurface mapping
* Resource estimation
* Graphic display
* Well data
* Reservoir data subsystems

These subsystems and data bases communicate with each other via the "Manager", which also communicates with users. From the user's perspective, all these subsystems and data bases are linked in an integrated, single system.

The **UAI data base** consists of all current **UAIs (Unique Project/Assessment Identifier)** which have been created by users. The format and creation of UAIs are detailed in Section 2.2.

Each well is indexed by a **Unique Well Identifier (UWI)** in the Well Data Base (W-data base). General information about a well, stratigraphic correlations of each formation, results of drill-stem tests, types of logs, and core intervals are stored in this data base. The data items are described in Section 3.1.5.

The **Reservoir data base (R-data base)** contains all data and information pertaining to a pool or a geological field defined as a single reservoir. Each pool is indexed by a **Unique Pool Identifier (UPI)** in the data base. The structure of the data base is general enough in nature to handle non-Canadian pools. Refer to Section 4.1 for a description of the structure.

The **Probability distribution data base (PD-data base)** contains play information. Each distribution is indexed by a UAI and a Unique Distribution Identifier (UDI). The probability distributions stored can be estimated from actual data, constructed from the geology or derived from the estimation subsystem. The format of the data base is described in Section 6.2.

The **Information Management Subsystem** permits data file manipulations. The **Subsurface Mapping Subsystem** performs subsurface mapping of isopaches and subsea depths of a formation and its equivalent stratigraphic horizons. The **Estimation Subsystem** permits users to assess undiscovered petroleum resources. The **Graphic Display Subsystem** can be used to display data or estimates on colour graphic terminals, plotters, or printers.

Data entry in **PETRIMES** can be via the PD-, R- and/or W-data bases. Furthermore, data can also be entered in the PD-data base using the **TODIGIT** and **DIGIT** commands (refer to Section 6.2).

PETRIMES sends outputs to the following destinations:

* The intermediate disk file.
* The user's disk file, for examination and final report.
* The R-, W- or PD-data base, for updates.

The distributions sent to the PD-data base can be retrieved using the **RTRL** command (Section 6.2.4) and subsequently used with plotting or other commands. The intermediate disk files are used as input to other programs.

1.5 System and Document Conventions

Listed below are the document conventions used throughout this manual. They apply in particular to syntax displays for command, and messages.

SYMBOL	DESCRIPTION
>	The symbol,>, indicates that this is **PETRIMES**'s prompt. You can issue a legitimate command following the prompt.
Bold letters	**PETRIMES** commands

e.g. **RTRL**

Message in bold	Messages appearing in bold letters are those issued by PETRIMES.
Underline	The words in underline have been entered by users.
SI	SI stands for Metric System.
BR	BR stands for British System.
Y	Y stands for Yes.
N	N stands for No.
Character in upper case e.g. Pool, POOL	Upper case characters must be used when responding. The character, P, must be used. The characters, POOL, must be used.
<.....>	The data with a pair of <...> is to be inserted by **PETRIMES.**
{program name}.OUT	{program name} is the output file from a specific program with DOS file extension OUT.
{program name}.DSK	Intermediate output for system use only.
(cr)	Indicates the RETURN key should be pressed.
]]	The symbols]] are used to exit from a **PETRIMES** command.
When the * symbol is located at the first column	This is a comment line and no computing action is taken.
UAI **CRBPYYMM**	UAI is the Unique Assessment Identifier which consists of 8 alpha-numeric letters. C: Country code. R: Region code. B: Basin code. P: Play code. YY: Current year. e.g. 93 as year 1993. MM: Current month. e.g. 05 as May.
UDI **NNUUPVT**	UDI is the Unique Distribution Identifier which consists of 10 alpha-numerical letters. NN: Geological variable code. UU: Unit of the measurement code. P: O, oil or G, gas. V: verions of the distribution. T: type of data, and

	RRR: pool rank for individual pool size.
<uai>	Currently defined UAI.

TWO

INFORMATION MANAGEMENT SUBSYSTEM

In this chapter, the management commands that control **PETRIMES** subsystems are explained.

2.1 Manager Basics

The Information Management Subsystem comprises the Manager, and a set of high-level commands. The Manager is responsible for:

* Communicating with users
* Executing commands issued by users
* Logging all activities
* Allocating disk space for output files
* Linking input/output between programs.

In order for the Manager to perform the above functions, the system requires one key element: a Unique Assessment/project Identifier (UAI). These identifiers allow the Manager to recognize users. Consequently users must sign on to their UAIs before they are able to execute any comments. Upper and lower case letters are accepted equally by the system unless otherwise specified.

To activate **PETRIMES**:

1 Change the current disk drive to the drive onto which **PETRIMES** has been installed.

2. Enter **PETRIMES** at the MS DOS prompt. Once the system is called up, the screen colour changes.

2.2 System Commands

System commands, as well as descriptions of their operation and how they are used are given below in alphabetical order.

BROWSE

The **BROWSE** command allows users to examine all outputs from the system.

> BROWSE {program name}.OUT _(cr)

The {program name} is the program that creates output files users may select to examine.

COPY

The **COPY** command allows users to copy a probability distribution from one UAI to the current UAI within the PD-data base as follows:

> COPY _(cr)

<The status of the current UAI is listed here.>

Copying to UAI: <current UAI>. OK? (Y/N) > y (cr)
From UAI (CRBPYYMM) > Enter the UAI here (cr)
From UDI (NNUUPVT) > Enter the UDI here (cr)
<the UDI decoded> - COPY? (Y/N)> y (cr)
<UAI-UDI> updated Status = OK
From UAI (CRBPYYMM) >]] (cr)
You may continue to copy or exit the process.
>

CREATE

The **CREATE** command is used to create a new UAI. User must have MGR status. See **MGR** command.

1. In order to create a new UAI, UAI validation file must contains country, region, basin and play codes of the new UAI. See **VALUAI** command for updating the UAI validation file. Examples are given in Table 2-1.

2. Users may supply codes for country (C), region or geological province (R), basin or geological period (B), and play (P) (see examples given in Table 2-1). In such cases, the names of the assessors and geologists must be given.

3. The **PETRIMES** system concatinates **C, R, B, P,** codes with current year and month to form the complete UAI and make a CRBPYYMM sub-directory under \PETRIMES\UAI\. **PETRIMES** issues an active UAI for the length of the project or assessment. The system cannot issue two UAI for the same play within the same month and year. An example follows.

> CREATE (cr)

Country > C (cr)

--Canada--
Region > 4 (cr)
--Western Canada--
Basin or Geological code > 1 (cr)
--Devonian--
Play code > 1 (cr)
--Devonian clastic--
Geologists > John Doe (cr)
Assessors > John Doe (cr)
Remark > This project is used to demonstrate PETRIMES(cr)
Once all these prompts have responded to, **PETRIMES** displays the following information:

C4118909 Initiated: 89/09/16 Backup diskette # -none-. Date:?? /??/??
Country: Canada
Region: Western Canada Basin
Basin or Geological Age: Devonian
Play: Devonian Clastic
Geologists: John Doe
Assessors: John Doe
Remarks: This project is used to demonstrate PETRIMES.
The code, C4118909, is the UAI for this project. The user must sign on to this UAI each time before he or she can access the information of the play.

DELETE

The **DELETE** command is used to delete probability distributions from the PD-data base. An example follows

> DELETE _(cr)

< The status of current UAI is printed here >
Deleting from UAI = <current UAI>. OK? (Y/N) y (cr)
UDI (NNUUPVT) > Enter the UDI to be deleted (cr)
UDI <UDI> being deleted.

A message is given if the UDI cannot be found.

HISTORY

The system keeps track all activities for each UAI. To view them, type:

> HISTORY (CR)

The status of the current UAI and its activities are presented.

KEDIT

The **KEDIT** commands allow users access to text editors within **PETRIMES.**

LIST

With the **LIST** command users may browse the status of all UAIs. To use it, type:

> LIST (cr)

The status of each UAI is displayed on the screen.

LOCK and UNLOCK

The **LOCK** command allows you to move a UAI from active to inactive status, whereas the **UNLOCK** command, allows the release of a UAI from inactive status. To employ these commands, the user must obtain manager status and sign on to the UAI to be locked or unlocked. The steps required are given below:

> MGR (cr)
> UAI (cr)
> LOCK or UNLOCK (cr)

The status of the UAI will now be displayed.
UAI: <uai> is now locked.

MGR

The **MGR** command assigns manager status to the user. With this command the **CREATE, LOCK, UNLOCK,** and **PUPDATE, PURGE,** and **WUPDATE** functions may be executed.

> MGR (cr)

MGR manager password > _(cr)
Enter your password here. Note, upper and lower case characters must be matched exactly.
Your manager password is confirmed!!!

If your password is incorrect, the following message is displayed.

Invalid manager password!!!

PASS

The **PASS** command allows manager to change the system password. Manager status is required before execute this command.

> PASS (cr)

New password > _(cr)
Enter new system password here. Note, password is case sensitive.
MGR password changed.
Your manager password is confirmed!!!

PURGE

The **PURGE** command is used to purge an unwanted UAI. User must have MGR status. See **MGR** command.

> PURGE (cr)

UAI (CRBPYYMM) > Enter the UAI to be deleted here (cr)

To change the MS DOS directory to the UAI to be deleted,

DEL D:
D:\PETRIMES\UAI\<uai>\ *.* deleted.
D:\PETRIMES\UAI\<uai> deleted.
<uai> file group deleted.

RMKS

The **RMKS** command allows users to enter text or remarks pertaining to the assessment or project. They may be printed using **RTER** command.

> RMKS (cr)

KEDIT commands are used to enter text. The output file is labelled \PETRIMES\UAI\<uai>\RMKS.OUT.

ROUTE

The **ROUTE** command is to direct the subsequent module outputs either to the screen or to the disk file which can be printed or viewed using **BROWSE.**

> ROUTE (cr)

Route options: (0 for screen; 1 for PRT file)

Default setting of **ROUTE** command is 0 for screen.

RTER and INRTER

The **RTER** command is used to compile all final disk files into one single report. This command initiates a search of all disk files associated with a particular UAI and the creation of a single document and covering page. It is user's responsibility to delete or deactivate (i.e. to insert the symbol * in front of each file name) all disk files that are to be excluded from the report. Editing is done through **KEDIT**. The report can also be printed. For example:

> RTER (cr)

Do you want to set-up/edit the INTER file? (Y/N) > y (cr)
If "Y", then
KEDIT will bring up the **INRTER** file from which files to be excluded from the report can be deleted or deactivated by the user.
End of "Y"

If "N", then
All available files are printed. You must answer "Y" at the start to initialize the **INRTER** file. The command, **INRTER** can also be activated outside **RTER.**
End of "N"

Number of lines per page? > 60 or 64 (cr)
For 8 1/2 by 11 paper, enter 60 lines

Oil or gas play (O/G) > O or G (cr)

A report is compiled, with file name \PETRIMES\UAI\<uai>\REPORT.OUT. All disk files included in the final report are displayed on the screen.

STOP

The **STOP** command allows users to exit from **PETRIMES.**

> **STOP** (cr)

The command takes you back to MS DOS.

UAI

The **UAI** command allows users to identify the default project for subsequent operations. This command must be executed before **PETRIMES** will operate.

> **UAI** <Enter your UAI here> (cr)

The status of the UAI is given at this point. If the UAI entered is incorrect, you will be prompted to re-enter it.

UPDATE

The **UPDATE** command is used to revise the names of geologists and assessors, the remarks, and the comments attached to the UAI file. Manager status is required. See **MGR** command.

> UPDATE (cr)

PETRIMES displays the UAI information and then prompts as following:

Geologists > <Enter the new information here>.
Assessors > <Enter the new information here>.
Remarks > <Enter the new information here>.

PETRIMES displays the revised information and prompts for comments:

Comments (Y/N) > <Enter your comments here>.

VALUAI

The **VALUAI** command allow you to edit country, geological region, basin, and play (Table 2-1) data.

> **VALUAI** (cr)

KEDIT brings up the **\PETRIMES\TABLE\VALUAI** file for editing.

WHO

The **WHO** command displays the current default UAI.

> WHO (cr)

Who am I? **yy/mm/dd** < day of the week, time >
You are using UAI# < current UAI >
Your log-on directory is D:

:

The : command permits the execution of DOS commands within PETRIMES.

> :DIR A: (cr)

allows users to list all files stored on disk drive A.

THREE

THE WELL DATA BASE AND ITS SUBSYSTEM

This chapter describes the commands and options associated with the Well data base and its subsystem.

3.1 Data Base Structure Basics

All wells are indexed by a Unique Well Identifier (UWI). The structure of UWI is as follows:

PS**********

where *'s represent specifications for different survey systems (Refer to Sections 3.1.1, 3.1.2, 3.1.3, or 3.1.4 for various survey systems).

P: Province codes are given below:
- 1 - British Columbia
- 2 - Alberta
- 3 - Saskatchewan
- 4 - Manitoba
- 5 - Ontario
- 6 - Quebec
- 7 - Newfoundland
- 8 - Nova Scotia
- 9 - Yukon Territory
- A - Northwest Territories

S: Survey system code
- 1 - Dominion Land System (DLS);
- 2 - National Topographic System (NTS),
- 3 - Federal Permit Survey System,
- 4 - Longitude and latitude in decimal.

3.1.1 The Dominion Land System

The format for the DLS's is:

1: DLS (for Manitoba, Saskatchewan, and Alberta)

OO: Location within an LSD
LL: LSD

SS: Section
TTT: Township
RR: Range
W: W indicates west of the meridian
M: Meridian
0: Always zero
Q: Well sequence
D: 1 or 2

3.1.2 The National Topographic System

The format for the NTS (Fig. 3-1) is:

2: NTS (for British Columbia)

NNN: NTS unit: primary quadrangle (4^0 by 8^0) divided into A to P as a map sheet,
M: Map sheet(1^0 by 2^0): divided into 1 to 16 as a grid,
GG: Grid (15' by 30') divided into A to L as a block,
B: Block (5' by 7' 30") divided into 100 units,
UUU: Unit divided into a, b, c, and d.
Q: Quarter units a to d.

3.1.3 The Federal Permit Survey System

The following is the Yukon and Northwest Territories Land Survey System format (Figs. 3-2, 3-3, 3-4, 3-5, 3-6):

3: FP (for Northwest Territories, Yukon and Arctic)

U: Unit
SS: Section
LL: Latitude (degree)
NN: Latitude (minute)
GGG: Longitude (degree)
EE: Longitude (minute).

For example, between 60 to 68 degrees, the format is as follows:

(1) One grid area is 10' (NS) by 15' (EW).
(2) Each grid area is divided into 80 sections. Each section is labelled from 1 (SE corner) to 10 (NE corner) and from 71 (SW corner) to 80 (NW corner).

(3) Each section is divided into units labelled as A, B, ..., starting from the SE to the SW corner and ending at the NE corner).

(4) Latitude and longitude are anchored at the NE corner of the grid. Both latitude and longitude are expressed in terms of degrees and minutes.

3.1.4 The Geodetic Co-ordinates

Geodetic coordinates for Quebec, Ontario, and eastern provinces follow:

4: longitude in decimals, latitude in decimals.

3.1.5 The Well Data Variables

The well data variable names are listed as follows:

Name	Explanations
UWI	Unique well identifier
Update	yy/mm/dd
Field code	Table 4-2
Pool code	Table 4-3
Ground elevation	metres
Kelly-bush	metres
Well-depth	metres
True vertical depth	metres
Plugback depth	metres
Spud date	yy/mm/dd
Finish drill date	yy/mm/dd
Rig released date	yy/mm/dd
Initial production date	yy/mm/dd
Latest production date	yy/mm/dd
Surface NS-code	A code used to indicate the direction rom the reference section boundary to the surface hole location
Surface hole NS-distance	The distance from the reference section boundary to the surface hole location
Surface hole EW code	A code used to indicate the direction from the reference section boundary to the surface hole location
Surface hole EW distance	The distance from the reference section boundary to the surface hole location
Surface hole legal description	LSD
Surface hole section	SEC
Surface hole latitude	In decimals
Surface hole longitude	In decimals
Bottom hole NS code	A code used to indicate the direction from the reference section boundary to the bottom hole location

Bottom hole NS distance	The distance from the reference section boundary to the bottom hole location
Bottom hole EW code	A code used to indicate the direction from the reference section boundary to the bottom hole location
Bottom hole legal description	LSD
Bottom hole EW distance	The distance from the reference section boundary to the bottom hole location.
Bottom hole reference description	LSD
Bottom hole reference section	SEC
Bottom hole latitude	In decimals
Bottom hole longitude	In decimals
Confidential flag	A number to indicate whether the well data is confidential (not currently used)
Data Lahee code	To indicate if the code is valid (0) or null (1)
Lahee code	The initial well classification assigned by the Geological Department of ERCB or BC at the time of licensing
Drilling cost area	The drilling cost areas are predefined areas of the province. Costs associated with each area are outlined in the incentive exploratory well regulations
Well status code	Code of physical status for a well
Formation owner code	The code used to indicate the author of the stratigraphic correlation
Formation code	See Table 6-1, 6-2, and 6-3.
Formation depth	Depth in terms of metres

Notes:

Two methods can be used to populate Well Data Base. One is **WUPDATE** command which well data will be inserted one by one. The other method is using mass loader which is not supported by **PETRIMES** system. For more information about massloader, please see **README.** file.

3.2 The Commands

Commands designed to be used in this data base and subsystem are described below in alphabetical order:

CORE

(not available yet)

The **CORE** command is used to retrieve all core intervals of a formation or entire well.

Input:

The input to this program is the output from **FORMATION** (Section 5.2), **WELLS** (Section 3.2), or UWI data entered from the screen.

Computer Operations:

> CORE _(cr)

Operator > _(cr)
Remark > _(cr)
Enter output unit of measurement (SI/BR) > _(cr)
Are you using output from WELLS or FORMATION, or screen input? (W/F/S) > _(cr)

Output:

\PETRIMES\UAI\<uai>\CORE.OUT.

DST

(not available yet)

The **DST** command is used to retrieve drill-stem information.

Input:

The key to retrieve the information is the UWI which can be entered from the **WELLS, FORMATION, RISK** or screen.

Computer Operations:

> DST _(cr)

Operator > _(cr)
Remark >_(cr)
Enter output unit of measurement (SI/BR) > _(cr)
Are you using output file from the WELLS, FORMATION, RISK or screen input (W/F/R/S) > _(cr)

Output:

The DST information is stored as \PETRIMES\UAI\<uai>DST.OUT file.

WELLS

Individual wells can be retrieved using combinations of the components in the UWI. The **WELLS** command can be used to retrieve a specific well or a set of wells from the W-data base as shown below:

Input: W-data base and UWI's entered through the screen.

Computer Operations:

> WELLS _(cr)

Do you want to enter/edit the WELLSin file? (Y/N) >_(cr)

If "Y", then
KEDIT will be used to edit the retrieval statement. The UWI retrieval format and the wild card symbol, @, is used for those columns where any value is acceptable. The retrieval statements are found in the **WELLS.IN** files.
/(example of retrieval statements)
2100@@@@03@2@W40@0

Notes:
For DLS system:

- Col. 1 Province code
- Col. 2 1 for DLS system
- Col. 3 & 4 all location codes
- Col. 5 & 6 all LSDs
- Col. 7 & 8 all sections
- Col. 9 & 11 townships 30's
- Col. 12 & 13 ranges 20's
- Col. 14 & 15 Meridian 4
- Col. 16 always zeros
- Col. 17 well sequence
- Col. 18 1-log depth; 2-TVD depth; 0-unspecified

For NTS system:

- Col. 1 Province code
- Col. 2 2 for NTS system
- Col. 3-4 00 Fixed as zeros
- Col. 5 Q Quarter unit
- Col. 6-8 UUU Unit
- Col. 9 B Block
- Col. 10-12 NNN NTS unit
- Col. 13 M Map unit
- Col. 14-15 GG Grid
- Col. 16 S Sequence
- Col. 17 0 Fixed as zero
- Col. 18 D 1-log depth; 2-TVD depth;0-unspecified

End of "Y"

Do you want to run the retrieval? (Y/N) >_(cr)

Output:

\PETRIMES\UAI\<uai>\WELLS.OUT.

Graphics: **MAPPING.**

WELLSOUT

The **WELLSOUT** command is employed when the user wishes to edit the output file created by **WELLS.**

Input:

Output from the command **WELLS** such as **WELLS.OUT.**

Computer Operation:

> WELLSOUT _(cr)

Use **KEDIT** to edit the output.

Output: The UWIs are displayed on the screen.

WPRINT

The **WPRINT** command is used to print well information. The data is drawn from the WELLS output file. An example follows:

Input: UWI's may be obtained either from **\PETRIMES\UAI\<uai>\WELLS.OUT** or from screen.

Computer Operations:

> WPRINT _(cr)

Do you want to use WELLS.OUT? (Y/N) > _(cr)
If "N" (not from **WELLS.OUT**), then
DLS or NTS system? (D/N) > _(cr)

If "D" (DLS system), then
UWI(PSOOLLSSTTTRRWM0QD) > _(cr)
P: Provincial code
S: Survey system code = 1
OO: Location
LL: LSD
SS: Section
TTT: Township

RR: Range
W: West
M: Meridian
0: Zero
Q: Sequence
D: Drill or vertical depth
End of "D"

If "N" (NTS system), then
UWI(PS00QUUUBNNNMGGS0D) > _(cr)
P: Provincial code
S: Survey system code
00: Always zeros
Q: Quarter unit
UUU: Unit
B: Block
NNN: NTS
M: Map
GG: Grid
S: Sequence
0: Always zero
D: Drill or vertical depth
End of "N" (NTS system)

End of "N" (not from **WELLS.OUT**)

Do you want to edit the output file? > _(cr)
Do you want to save the output file? > _(cr)
Note: The output file must be saved if we wish to print on the printer.

Output:

\PETRIMES\UAI\<uai>\WPRINT.OUT

WUPDATE

The data structure of the W-data base is displayed on the screen. **KEDIT** is then used to edit the information and update back to the W-data base. Manager status is essential when using this command. An example follows:

Input: W-data base and screen.

Computer Operation:

> WUPDATE _(cr)

Province (P) > _(cr)
System (S) > _(cr)

If "1" (DLS system), then
Meridian (M) > _(cr)
Township (TTT) > _(cr)
Range (RR) > _(cr)
Section (SS) > _(cr)
LSD (LL) > _(cr)
Location (OO) > _(cr)
Sequence (Q) > _(cr)
Depth (D) > _(cr)
End of "1"

If "2" (NTS system) then
NTS unit (NNN) > _(cr)
Map sheet (M) > _(cr)
Grid (GG) > _(cr)
BLOCK (B) > _(cr)
UNIT (UUU) > _(cr)
Quarter unit (Q) > _(cr)
Sequence (Q) > _(cr)
Depth (D) > _(cr)
End of "2"

New well? (Y/N) > _(cr)

This prompt will be appear only if the well is first time entered in the W-data base. When a user response with "N", the program immediately return him or her to **PETRIMES**. When the response is "Y", the program brings up a blank form to be filled out with well information by the user (see Table 7-1).

OK to post the changes to the W-data base? (Y/N) > _(cr)
If "Y", then
W-data base will be updated.
End of "Y"

If "N" , then
All the changes made to the well are ignored and the user is returned to **PETRIMES.**

End of "N"

No data points found.
Remove data from the W-data base? (Y/N) > _(cr)
This prompt will appear only if all the lines on the well update form are deleted.
If "Y", then
Current updated well is deleted from W-data base.
End of "Y"

If "N", then
Current update is ignored and the user is returned to **PETRIMES.**
End of "N"

Output: Update to the W-data base.

3.3 The Procedure

The following options may be used to operate the W-data base.

> WELLS _(cr)

This operation is used to retrieve, in the shortest time frame possible, a set of wells that approximately covers the entire polygon and its adjacent area. The retrieval time required by **POLYGON** or **FORMATION** are speeded up when this command is used. Output may then be applied to other programs of the system. A description of options associated with this command follows:

Option 1: **WPRINT**

This option is used to print information from one or more wells.

Option 2: **WUPDATE**

This option is used to update existing well information.

Option 3: **POLYGON**

This option allows the user to retrieve wells that lie within the play boundary or polygon. The disk file is POLYW.DSK.

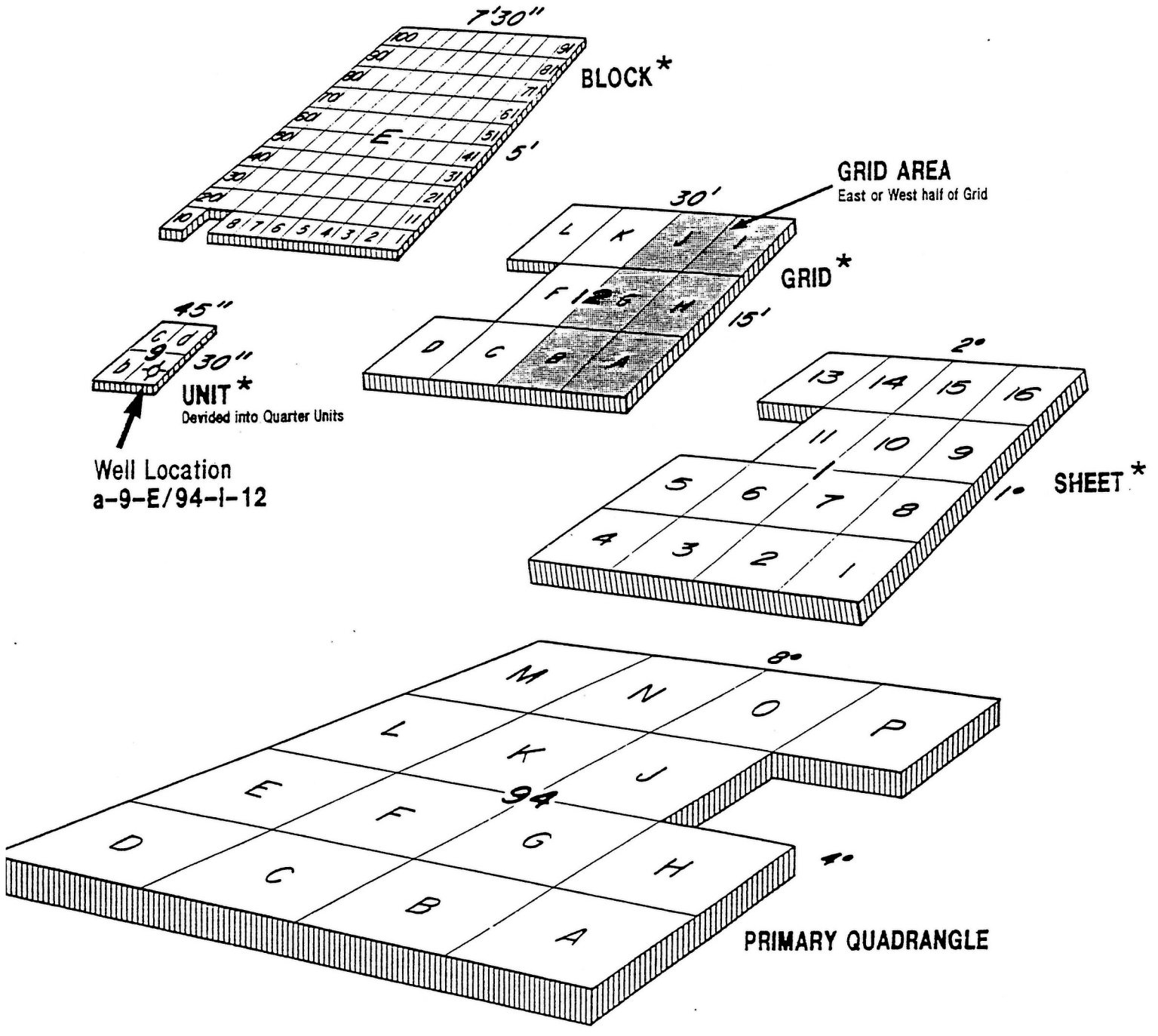
Option 3: **DST**

This option is used to print DST information from one or more wells. The UWIs retrieved are used as keys to obtain information from the **WELLS** (Section 3.2.3), **FORMATION** (Section 5.2.1), or **RISK** (Section 5.2.4) output file or the screen.

Option 4: **CORE**

With this option all core intervals associated with a well or a formation may be printed.

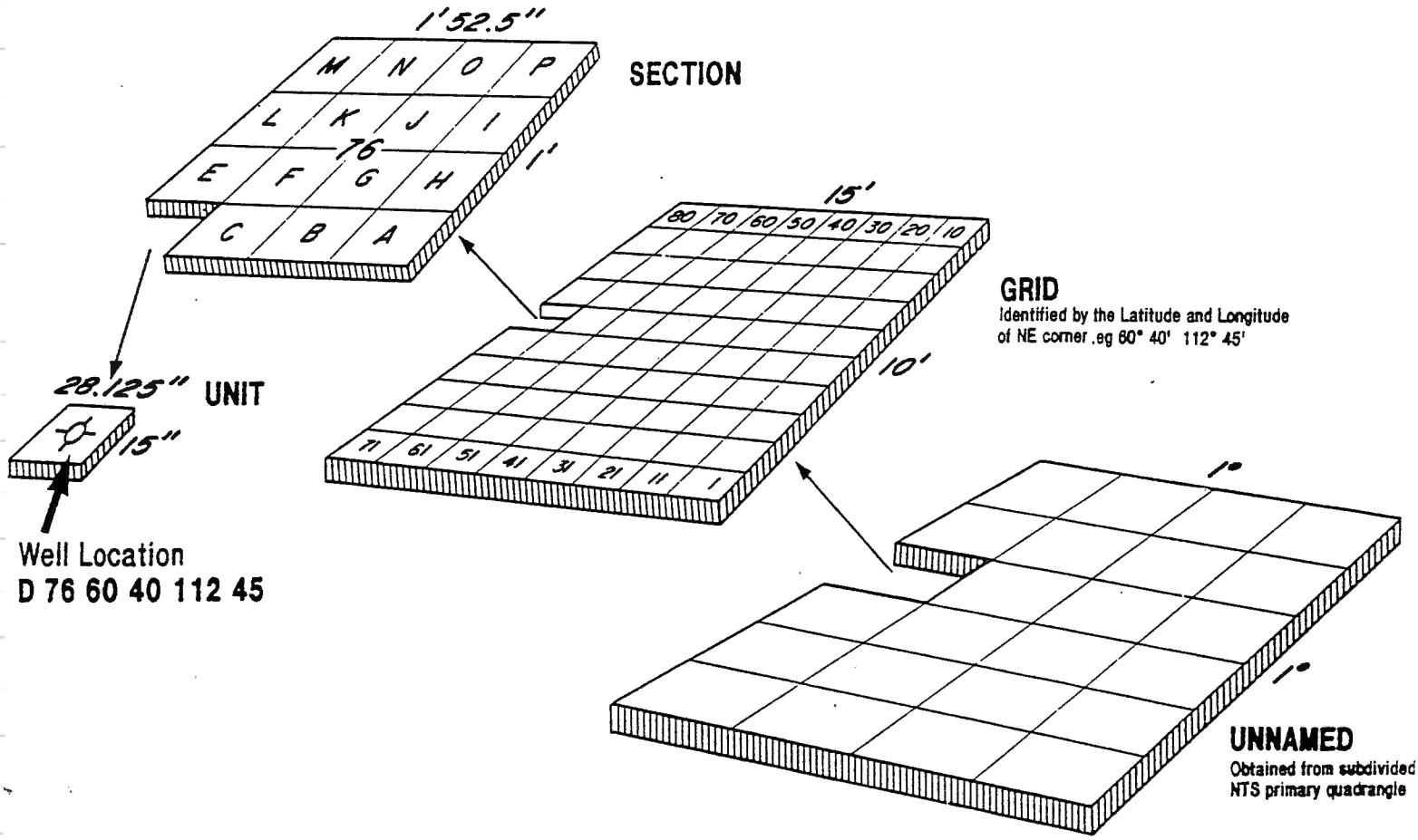
Figure 3-1. Diagram showing the structure of the National Topographic System.



NTS LAND SUBDIVISION - BRITISH COLUMBIA

* Standard format for Sub-Division names does not exist

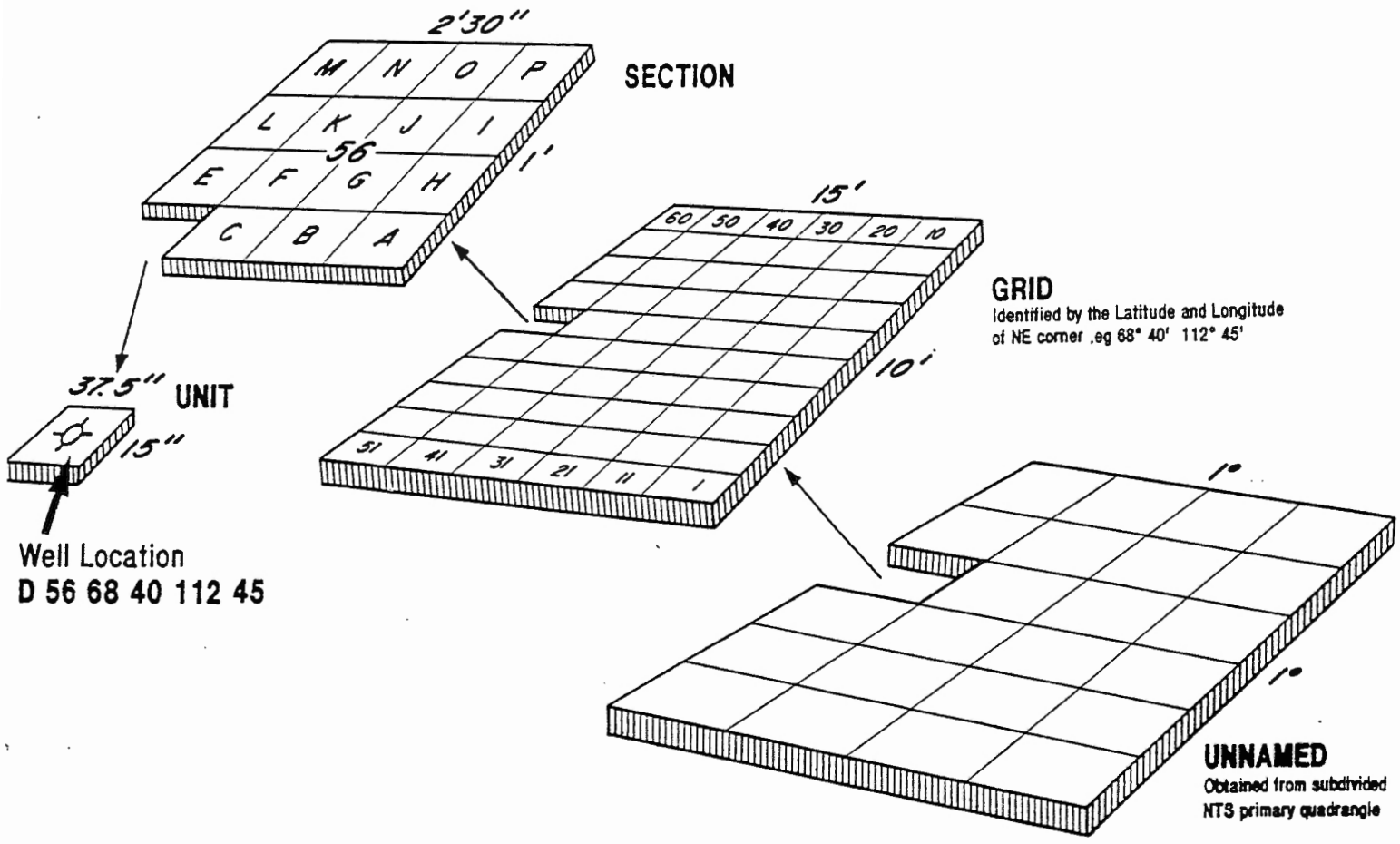
Figure 3-2. Diagram showing the Federal Permit System (60° to 68°).



FEDERAL PERMIT SYSTEM YUKON and NWT

LAND SURVEY BETWEEN 60° and 68° LATITUDE

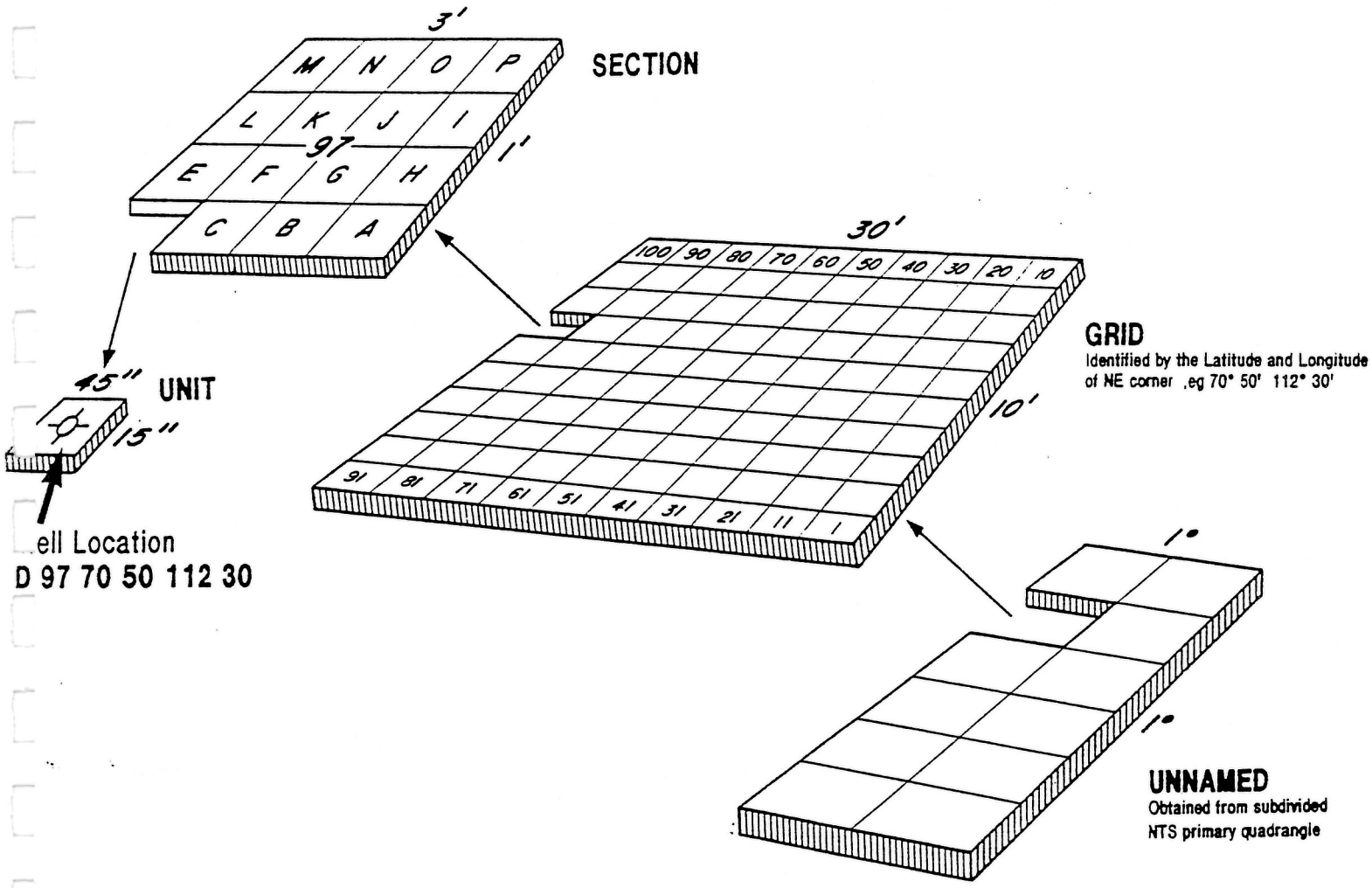
Figure 3-3. Diagram showing the Federal Permit System (68° to 70°).



FEDERAL PERMIT SYSTEM YUKON and NWT

LAND SURVEY BETWEEN 68° and 70° LATITUDE

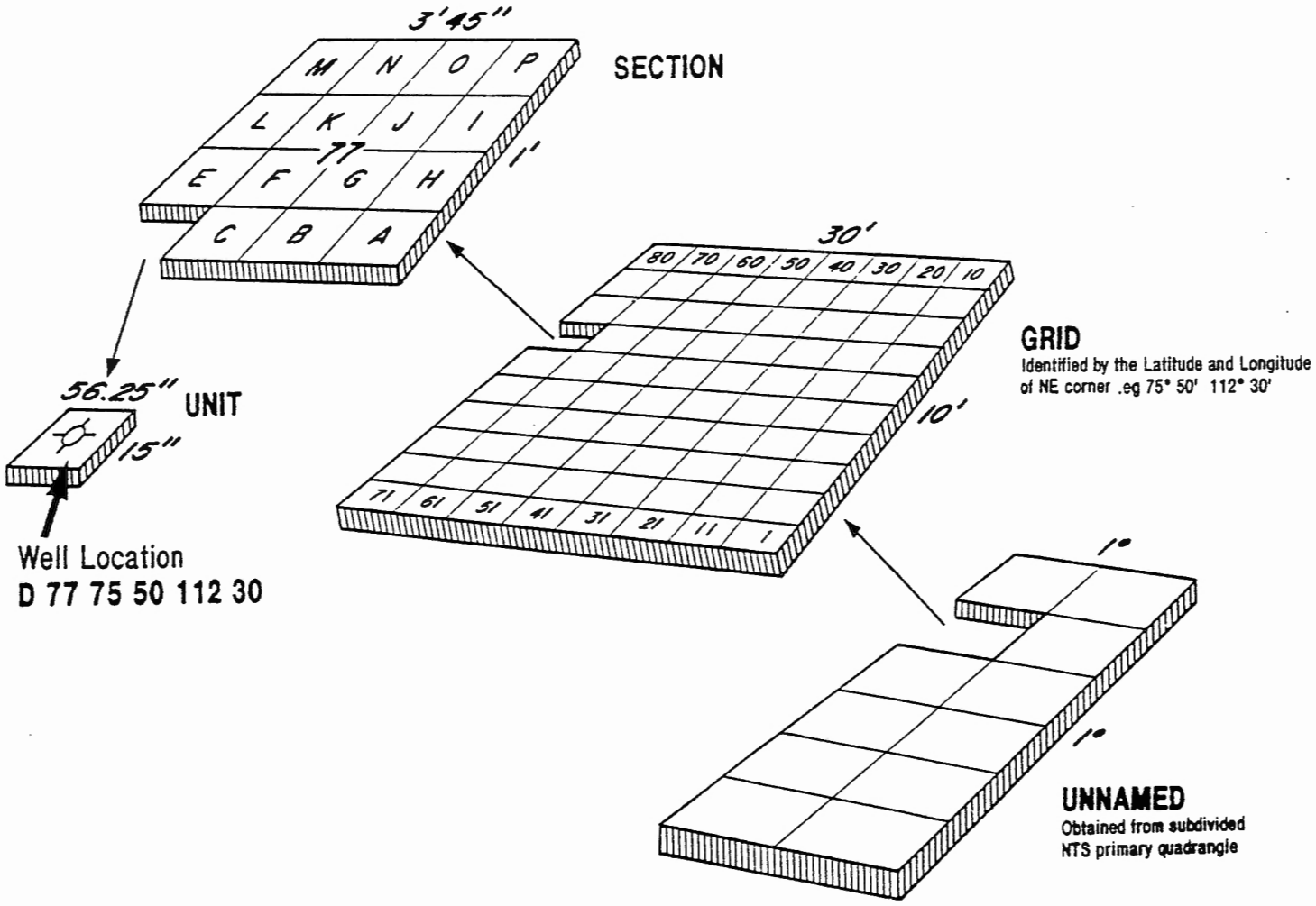
Figure 3-4. Diagram showing the Federal Permit System (70° to 75°).



FEDERAL PERMIT SYSTEM YUKON and NWT

LAND SURVEY BETWEEN 70° and 75° LATITUDE

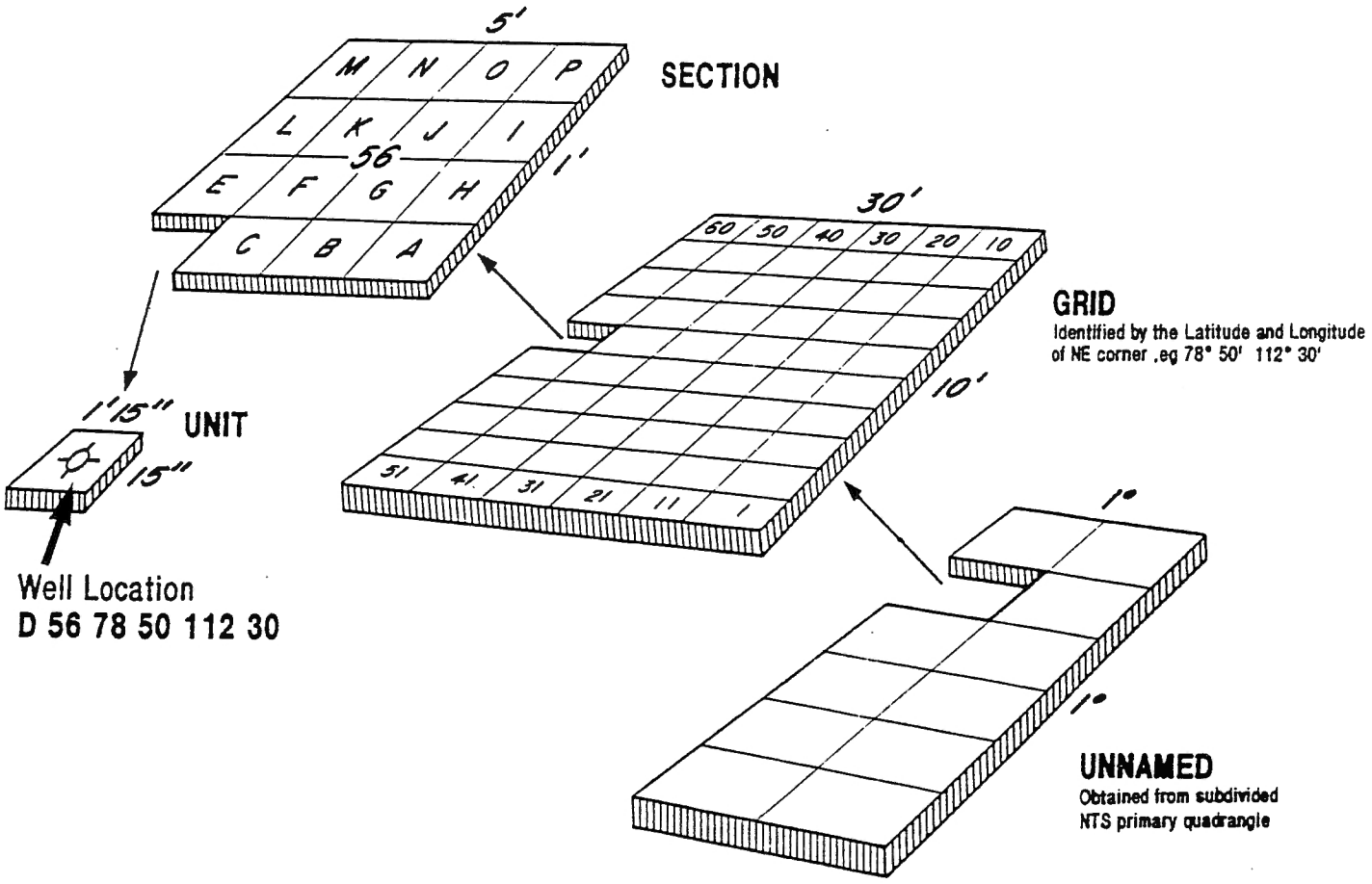
Figure 3-5. Diagram showing the Federal permit System (75° to 78°).



FEDERAL PERMIT SYSTEM YUKON and NWT

LAND SURVEY BETWEEN 75° and 78° LATITUDE

Figure 3-6. Diagram showing the Federal Permit System (78° to 85°).



FEDERAL PERMIT SYSTEM YUKON and NWT

LAND SURVEY BETWEEN 78° and 85° LATITUDE

FOUR

THE RESERVOIR DATA BASE AND ITS SUBSYSTEM

This chapter describes the commands and options associated with the reservoir data base.

4.1 Data Base Structure Basics

The Reservoir data base consists of reservoir parameters and the unique well identifier of the discovery well of the pool.

Each pool is indexed by a Unique Pool Identifier (UPI) in the data base. The UPI consists of 12 components with 23 characters long and its structure is as follows:

CGBVMMMMFFFFFPPPPQQQSHRI
where C = Country code
e.g. C for Canada

G = Geological province code
1 - East Coast
2 - Arctic Islands
3 - Mackenzie Delta-Beaufort Sea
4 - Western Canada Basin

B = Age or basin code
For example, the Western canada Basin code = 0.

V = Political province code
1 - British Columbia
2 - Alberta
3 - Saskatchewan
4 - Manitoba
5 - Ontario
6 - Quebec
7 - Newfoundland
8 - Nova Scotia
9 - Yukon Territory
A - Northwest Territories

MMMM = Formation code.

The formation codes assigned by the provincial governments are used. The codes and formation names are listed in Table 6-1, 6-2, 6-3.

FFFFF = Field code.

The field name codes assigned by the provincial governments are used.

PPPP = Pool code.

The pool codes assigned by the provincial governments are used.

QQQ = Pool sequence.

The sequence codes assigned by the provincial governments of Alberta and British Columbia are used. The sequence code identifies individual pools in a commingled reserve, a multi-portioned pool or an un-designated pool.

(i) A pool may have several gas caps and each is identified by one sequence code.

(ii) Commingled production pools. If pool code = 6@ or 98, then each pool sequence is considered as a single pool. Records with sequence code = 999 contain the sum total of in-place volume, recoverable (for oil) or marketable (for gas), and cumulative production. If the in-place volume equals zero, then the volume recorded in the sequence code 999 is derived using the material balance method.

(iii) An undefined pool is identified by the 98 sequence code.

S = Status code.

0 - Unspecified
1 - Proven estimates
2 - 9 Probability to indicate the uncertainty of the reliability of the reserves

For Alberta, probable reserve is added into the proven reserve. The pool area for the probable reserve is also added into the pool area of the proven reserve. Other variables are not changed.

H = Type of Hydrocarbon

0 - Unspecified
1 - Oil
2 - Condensate
3 - not used
4 - not used
5 - Gas
6 - Non-associated gas
7 - Associated gas
8 - Solution gas

9 - Solution gas or
A - Solution or associated gas
B - Heavy oil

R = Recovery Method code
0 - Unspecified
1 - Summation of all in-place volumes derived from all recovery methods within a pool (used for Alberta oil pools only)
2 - Primary
3 - Water flood
4 - Gas flood
5 - Solvent
6 - Solvent - 1
7 - not used
8 - Gas cycling
9 - Water with solvent
A = Enhanced

I = Indication of types of hydrocarbons
B oil with density >= 900 Kg/m^3
1 oil with density < 900 Kg/m^3
0 gas (including associated, non-associated, and solution gas)

The UPI identifies a pool by a specific country, geological province, basin, political province, formation, field, pool, pool sequence, reserve status, type of hydrocarbon, and recovery method. In other words, if a pool's reserve is derived from different recovery methods, then one or more UPIs are used to identify the information of that pool. Therefore, a pool may be signified by one or more UPIs. Each individual pool can be retrieved using any combination of the components. Retrieval logic is explained in Section 4.2.

4.1.1 The Reservoir Data

The reservoir variables and the units of measurements in brackets are listed as follows:

UWI
Agent
Trap (00)
Netpay (03, 04)
Pressure (11, 12)
Sw (02)
Gas/oil ratio (00)
Surface loss (02)
Gas deviation factor,Z (00)
Producible volume (19,20,24)
Primary recovery factor(02)
The UWI of the discovery well is recorded
Aband (Y,N)
Area (05, 06)
Temperature (13,14,15, 16)
Porosity (02)
Depth (03, 04)
Gas volume factor,1/B (00)
Density,rho (49, 50)
In-place volume (19,20,24)

Enhanced recovery factor (02)
Primary reserve (19,20,24)
Enhanced reserve (19,20,24)
Cumulative production (19,20,24)
Gas/Oil contact(03,03)
Gas/Water contact (03,04)
Oil/Water contact (03,04)
Discovery year (00)

Production year (00)	**H_2 hydrogen (53)**
N_2 nitrogen (53)	**He helium (53)**
Helium Code	**CO_2 Carbon dioxide (53)**
H_2S hydrogen sulphur (53)	**Critical pressure (11, 12)**

Critical temperature (13,14,15,16)

GHV	**GHV Code**
C_1 methane (53)	**C_2 ethene (53)**
C_3 propane (53)	**$_iC_4$ butane (53)**
nC_4 butane (53)	**C_5 pentane (53)**
C_6 hexane (53)	**C_7 heptane (53)**

Notes:

(1) The amount of gas from the gas analysis is expressed as a mole fraction.

(2) The formula for computing sulphur content is:

Sulphur (tons) = H_2S mole fraction x Raw gas volume x Recovery factor x Plant efficiency (98%)/ 0.7375 (7375 m^3 H_2S / metric ton of sulphur).

(3) The formula for computing gas liquid volume is as:
Gas liquid = Marketable gas volume x Plant efficiency x Conversion factor for gas to liquid.

(4) In-place volumes or reserves from different projects (British Columbia's case) or units (Saskatchewan's case) are summed as one integral pool in the R-data base.

(5) Two methods can be used to populate Reservoir Data Base. One is **PUPDATE** command which reservoir data will be inserted one by one. The other method is using mass loader which is not supported by **PETRIMES** system. For more information about massloader, please see **README.** file.

POOLS

The **POOLS** command is used to retrieve all pools that satisfy a set of given conditions. The input required is the R-data base.

Input: From R-data base and screen.

Computer Operations:

> POOLS _(cr)

Do you want to edit/set-up the retrieval statement? (Y/N) > _(cr)
If "Y" , then
Use **KEDIT** to edit the retrieval statement. The retrieval format is the UPI with wild card symbol @. Retrieval statements are found in a **POOLS.IN** file.

The UPI format is as follows:

CGBVMMMMFFFFFPPPPQQQSHRI

C:	Country	
G:	Geological province code	
B:	Basin code	
V:	Political province code	
MMM:		Formation code
FFFFF:		Field code
PPPP:	Pool code	
QQQ:	Sequence code	
S:	Status	
H:	Type of hydrocarbon	
R:	Recovery method code	
I:	Indication of hydrocarbon type	

End of "Y"

Run the retrieval? (Y/N) > _(cr)

Output:

\PETRIMES\UAI\<uai>\POOLS.OUT

Graphics: **MAPPING.**

POOLSOUT

The **POOLSOUT** command is employed to edit the output file created by **POOLS.**

Input: From **POOLS.OUT.**

Computer Operations:

> POOLSOUT _(cr)

Use **KEDIT** to edit the output file.

Output:

\PETRIMES\UAI\<uai>\POOLS.OUT

PPRINT

The **PPRINT** command is used to print pool information. The data is obtained from the **POOLS** output file.

***Input*: POOLS.OUT, POLYP.DSK** or screen input.

Computer Operations:

> PPRINT _(cr)

Do you want to use POOLS.OUT? (Y/N) > _(cr)

If "N", then
UPI(CRBPMMMMFFFFFPPPPQQQSRH) > _(cr)
End of "N"
Do you want to edit the output file? > _(cr)
Do you want to save the output file? > _(cr)

The saved output file name will be **POUT.**

Output:

\PETRIMES\UAI\<uai>\PPRINT.OUT

PSTAT

The **PSTAT** command is used to retrieve pools within a given stratigraphic horizon and tally them by year and size. The top and bottom of the stratigraphic horizon is defined by GSC codes (applications of the GSC code referred to Section 5.1). The user input file is created using the **INPSTAT** command.

Input: R-data base and screen.

Retrieval criteria are stored in the following files:
PSTAT.DAT

Computer Operations:

> PSTAT _(cr)

Do you want to set up the INPSTAT file? (Y/N) > _(cr)
Pools producing from formation(s) can be retrieved by a pair of the GSC 5-digit stratigraphic codes (Refer to Chapter 5). The 5-digit codes are entered here using **KEDIT**. Note, formations confined *inclusively* within pairs of 5-digit codes are retrieved. For example, the codes for retrieving the Triassic interval are: 21999, 18000. Note that the code, 21999, is for the Triassic top, whereas the code, 18000, is the horizon just above the Permian top.

Operator > _(cr)
Remark > _(cr)
Geological Province? > (1/2/3/4) > _(cr)

Codes Geological provinces
1 East Coast
2 Arctic Islands
3 Mackenzie Delta-Beaufort Sea
4 Western Canada Basin

Do you want to divide into political province? (Y/N) > _(cr)
Oil, Gas, Heavy oil or Both? (O/G/H/B) > _(cr)
Type of resource? (Recoverable/ In-Place) > _(cr)
Output unit of measurement (SI/BR) > _(cr)
Class interval (2/10) > _(cr)
Last year? > _(cr)

The program searches pools from year 1 to the year specified under "Last year".

Output:

\PETRIMES\UAI\<uai>\PSTAT.DSK

These files can be printed by printer or laser printer.

PUPDATE

The **PUPDATE** command is used to delete, create, or edit the pool information and update it in the R-data base. Currently this command is only available to the system manager.

Input: R-data base and screen.

Computer Operation:

> PUPDATE _(cr)

The data structure of the R-data base is displayed on the screen. **KEDIT** is then used to edit the information and update back to the R-data base. Manager status is necessary before an edit may be performed.

Country (C) > _(cr)
Geological Province (G) > _(cr)
Basin/Age (B) > _(cr)
Province (P) > _(cr)
Formation code (MMMM) > _(cr)
Field code (FFFFF) > _(cr)
Pool code (PPPP) > _(cr)
Pool Sequence (QQQ) > _(cr)
Status (S) > _(cr)
Hydrocarbon (H) > _(cr)
Recovery method (R) > _(cr)
(0/B/1) > _(cr)
The symbol, 0, indicating gas
B, indicating heavy oil with density > 900 Kg/m^3
1, indicting oil with density < 900 Kg/m^3.

New pool? (Y/N) > _(cr)
This prompt appears only if the pool is first entered in the R-data base. When a user responds with "N", the program immediately return him or her to **PETRIMES**. When the response is "Y", the program brings up a blank form to be filled out by the user with pool information (see Table 7-2).

OK to post the changes to the R-data base? (Y/N) > _(cr)
If "Y", then
R-data base is updated.
End of "Y"

If "N", then
All the changes made to the pool are ignored and the user is returned to **PETRIMES**.
End of "N"

Note: Deletion of a pool from the R-data base can be executed by the following steps:

1. To retrieve the pool to be deleted;
2. To display the contains of the pool;
3. To delete all data from the pool, i.e. from line 1001 to the last line;
4. To update the "empty" pool back to the R-data base;
5. **PETRIMES** will prompt the following question:

No data points found. Remove data from the R-data base? (Y/N) > _(cr)
This prompt appears only when all the lines on the pool update form are deleted.

If "Y", then
The current updated pool is deleted from the R-data base.
End of "Y"

If "N", then
The current update is ignored and the user is returned to the main system.
End of "N"

Output: Update to the R-data base.

TODIGIT

The **TODIGIT** command is used to put reservoir data into a format that can be accepted by **DIGIT** (see Section 6.2) and updated to the PD-data base.

Input: **POOLS.OUT**, or **POLYP.DSK** and the R-data base.

Computer Operation:

> TODIGIT _(cr)

Do you want to enter/edit the INDGT file? (Y/N) >_(cr)

```
**********************************************************************************************************
*  INDGT: Input selection of variables
*
*  This file is used to store a set of pool variables for the TODIGIT module.
*
*  On each line enter exactly one variable code.
*  Pool variables allowed to be exported out by TODIGIT are listed as follows:
*
*  01 Depth                    02 Area
*  03 Netpay                   04 Porosity
*  05 Water saturation         06 Density
*  07 Pressure                 08 Temperature
*  09 Gas deviation factor     10 Recovery factor
*  11 Pool size volume         12 Cumulative production
*  13 Surface loss             14 Discovery date
*  15 Primary reserve          16 Pool code (form + pool)
*  17 Field code               18 Gas formation factor
*  19 GR ratio                 20 G/O ratio
*  21 Shrinkage factor         22 Enhanced reserve
*  23 Recoverable pool size    24 Pool sequence code
*
*  For the gas option, only variables 1 to 19 and 24 can be chosen.
*
*  For the oil option, only variables, 1 - 8, 10 - 12, 14 - 17, 20 - 24, can be chosen.
*
*  For both oil and gas options, only variables 2 - 5, 11, 14, 16, 17, 21 and 24 can be chosen.
*
*  For the hydrocarbon option, only variables 2 - 4, 11, 14, 16, 17 and 24 can be chosen.
*
*  The maximum number of variables can be exported is 18.
*
**********************************************************************************************************
/
```

Use **KEDIT** to enter or edit the **INDGT** file.

Operator > _(cr)
Remarks > _(cr)

Oil, Gas, Both, or Hydrocarbon (O/G/B/H)? > _(cr)
Users can choose oil (O), gas (G), or oil and gas (B). The hydrocarbon (H) option is used when converting gas and oil volumes under surface conditions to volumes under reservoir conditions. The oil and gas volumes are then added together. In the case of oil, in-place volumes are added together from different recovery methods.

If "H", then
The conversion factor for oil equivalent is 0.95 10^6 ft^3 of gas equals 165 10^3 barrels of oil.
Hydrocarbon pore volume or oil equivalent? (P/E) > _(cr)
End of "H"

If "G", then
Do you want to combine solution gas with associated gas? (Y/N) > _(cr)
The in-place volumes of the solution and associated gas are added together.

Individual, Largest volume or Sum of sequence pools? (I/L/S) > _(cr)
If "individual" is chosen, then each UPI is a "pool". If "largest" is chosen, then only the pool with the largest in-place volume within the sequence code is chosen. If "sum of sequence pools" is chosen, then the in-place volume, or reserve are added for all pools with identical field and pool codes. For example, small gas caps above a oil leg are added together.
End of "G"

Output from POOLs or POLYgon? (POOL/POLY) > _(cr)
This command takes output from either POOLS or POLYGON. Note that before this command is executed, users must run the **POOLS** and/or **POLYGON** commands

TODIGIT can take data from either **POOLS.OUT** or **POLYP.DSK**.

Output:

\PETRIMES\UAI\<uai>\TODIGIT.OUT

The above files can then be copied into the PD-data base through **DIGIT**, using **KEDIT**.

4.3 The Procedure

The following options may be used to operate the R-data base.

> POOLS _(cr)

POOLS retrieves a set of pools satisfying specified conditions.

Option 1: **PPRINT**

This command prints all data items contained in the output from **POOLS**.

Option 2: **PSTAT**

This command compiles statistics for number of pools and their sizes by years.

Option 3: **PUPDATE**

This command allows users to update the R-data base.

Option 5. **TODIGIT**

This command creates a file that stores pool data for entry into the PD-data base by means of **DIGIT**. The **TODIGIT** output can also be used with **IDEA** (Refer to Section 5.2.2).

Option 6. **POOLS** output can be used with other programs, such as **RISK, IDEA**, and **MAPPING**.

FIVE

THE SUBSURFACE MAPPING SUBSYSTEM

This chapter describes the commands and options associated with the Subsurface Mapping Subsystem.

5.1 Subsurface Mapping Basics

This subsystem is used to retrieve sets of wells that have penetrated specific formations or their stratigraphic equivalents. The output from the subsystem can be merged with the output from the Reservoir Subsystem. A risk analysis for a given play can then be performed. With the Subsurface Mapping Subsystem commands, analysis and mapping of a single variable or a set of variables may be carried out simultaneously.

Each formation in the table of formations (Alberta, British Columbia, Saskatchewan, and Manitoba) is coded with a GSC 5-digit code (Table 6-1, 6-2, 6-3). The structure of the code is as follows:

First digit - Geological Era
1 - Palaeozoic
2 - Mesozoic
3 - Cenozoic

Second digit - Geological System
1 - Palaeozoic
1 - Cambrian
2 - Ordovician
3 - Silurian
4 - Devonian
41 - Lower Devonian
42 - Middle Devonian
43 - Upper Devonian
5 - Mississippian
6 - Pennsylvanian
7 - Permian

2 - Mesozoic
1 - Triassic
2 - Jurassic

3 - Cretaceous
31 - Lower Cretaceous
32 - Upper Cretaceous

Last three digits - stratigraphic correlations within a geological system.

All formations that are stratigraphically equivalent are coded with the same GSC 5-digit code. The older the age of a formation the smaller the number of the 5-digit code.

5.2 The Commands

Commands associated with this subsystem are described below in alphabetical order.

FORMATION

The **FORMATION** command is used to retrieve the subsea regions of a formation and their stratigraphic equivalents within a play boundary or polygon. If the formation is a pinchout or eroded, then a zero isopach value is returned. If the formation top or bottom is missing, then 99999 is used for the top or bottom. If a well penetrates into but does not penetrate through the formation, then the thickness penetrated is returned with a negative sign.

Input: The W-data base, **WELLS.OUT** and screen.

Computer Operations:

> FORMATION _(cr)

Do you want to set-up the INPOOL file? (Y/N) > _(cr)
If "Y" (to set up INPOOL file), then

```
**************************************************************************
* INPOOL : Input field code and pool code
*
* This file is used to store the given province code, field code and pool
* code for FORMATION.
*
* On each line enter three (3) numbers separated by space(s).
*
* First, the one-digit province code is entered:
*
* Example:  1. B.C.   2. Alberta  and so on.
*
* Second, the four-digit field code is entered.
*
* Example:  7200
```

```
*
* Third, the eight-digit pool code is entered. With this eight-digit code,
* users can use the wild card symbol, @.
* Example:  2400@@@@@ or 64010001
*
* Please DO NOT put an "*" in column #1 of a line; otherwise INPOOL will
* interpret the line as a comment line and the data will be ignored.
*
*********************************************************************************
*   PROVINCE        FIELD CODE       POOL CODE
*---------------------------------------------------------------------------------
/
```

End of "Y"

Do you want to set-up the INAUTH file? (Y/N) > _(cr)
If "Y" (INAUTH file), then

```
*********************************************************************************
* INAUTH: Input to AUTHOR code
*
* This file is used to store input parameters for the FORMATION module. Author
* codes are entered by users.
*
* On each line, enter the 1-digit (0-9) author code.
* 0  : ERCB correlation
* 1  : GSC correlation
* 60 : BC correlation provided by industry
* 61 : BC correlation revised by BC government
*********************************************************************************
/
```

Users employ **KEDIT** to enter the codes.
End of "Y"

Operator > _ (cr)
Remarks > _ (cr)
Enter output unit of measurement (SI/BR) > _(cr)
All wells, Province, Wellsout or Polydsk? (A/P/W/O) > _(cr)
If "O" (polygon output), then
Do you want to use field-pool input? (Y/N) > _(cr)
End of "O"

If "W" (wellsout), then
Do you want to use field-pool input? (Y/N) > _(cr)
Projection system: Utm, Polyconic or Lambert? (U/P/L) >_(cr)
If "L" (Lambert conformer), then
Enter reference: XLONG, upper YLAT and lower YLAT >__,__,__(cr)
End of "L"

If "U" or "P" (UTM or Polyconic), then
Enter reference: XLONG and YLAT > __,__ (cr)

End of "U" or "P"
End of "W"

If "A" or "P" (All wells or Province), then
If "P" (Province) then
B.C., Alberta, Manitoba or Saskatchewan? (1/2/3/4) >_(cr)
End of "P"

Projection system: Utm, Polyconic or Lambert? (U/P/L) > (cr)
If "L" (Lambert conformer), then
Enter reference: XLONG, upper YLAT and lower YLAT >__,__,__(cr)
End of "L"

If "U" or "P" (UTM or Polyconic), then
Enter reference: XLONG and YLAT > __,__(cr)
End of "U" or "P"
End of "A" or "P"

First and last spud dates? > __, __(cr)
Users may choose wells drilled within a specific time period, e.g. 1980, 1990
LOG, TVD or TVD/LOG depth? (1/2/3) > _(cr)
LOG: apparent depth; TVD: true depth; TVD/LOG: take true depth if available, otherwise take apparent depth.

Exploratory, Development or All wells? (E/D/A) > _(cr)
Base on Lahee classification

Enter fault condition > _(cr)
0: all wells; -1: no faulted wells; a number, say i: the i-th layer of a faulted formation is chosen.

Enter TOP1, TOP2 and XTOP > _(cr)

TOP1 or TOP2 represent GSC 5-digit stratigraphic codes (Table 6-1, 6-2, 6-3). A stratigraphic horizon may be defined by several formations such as an erosional surface. Therefore, TOP1 and TOP2 are used to include all possible formations that define the stratigraphic horizon. XTOP is expressed in meters or feet and may be a positive or negative number. Numerically, *TOP1 must be greater than or equal to* (or TOP2 is older or equals to TOP1) TOP2. For example, to retrieve all formations from the Pre-Cretaceous unconformity are the code 22999, 99, 0. This means that the unconformity surfaces from the Jurassic to the Pre-Cambrian are retrieved. The XTOP number is added to the formation subsea values, i.e. TOP1 and TOP2.

Do you want to enter the formation bottom code? (Y/N) > _(cr)

If "Y", then

Enter BOT1, BOT2 and XBOT > __,__,__(cr)
BOT1 or **BOT2** represent GSC 5-digit stratigraphic codes. The 5-digit codes are used the same way as in the TOP1 and TOP2 example above.
End of "Y"

Enter well density desired > _(cr)
A scalar is used to form a square area from which one well will be randomly chosen from all wells located within the square area and that satisfy all the retrieval conditions. The area is expressed in terms of square kilometres or miles controlled by the output unit of measurement entered as a response to the above question. For example: if one well / 10 km or mile is required then 10 is entered here. The unit of measurement is kilometre or mile is dependent on the unit specified in the "Unit of measurement".

Sort by UWI, Spud date or Field-pool code? (U/S/F) > _(cr)
Do you want a complete print out? (Y/N) > _(cr)

Output:

(1) The disk files are:
\PETRIMES\UAI\<uai>\FRMT.DSK.

(2) Printer output format is:

Item 1: UWI
Item 2: KB
Item 3: Spud date
Item 4: Well status
Item 5: Field and pool codes
Item 6: Formation top, Z1, and its GSC code
Item 7: Formation bottom, Z2 and its GSC code
Item 8: Isopach of the formation retrieved.

(3) Disk output format is:

Item 1:	UWI	col. 1- 18,	A18
Item 2:	X,	col 19- 31,	F13.5 km
Item 3:	Y,	col 32- 44,	F13.5 km
Item 4:	KB,	col 45- 57,	F13.5
Item 5:	Spud date,	col 58- 65,	I8
Item 6:	CSTATUS,	col 66- 75,	A10
Item 7:	FCODE,	col 76- 79,	A4
Item 8:	PCODE,	col 80- 87,	A8
Item 9:	Z1		
	(formation top),	col 88-100,	F13.5
Item 10:		GSC code,	col 101-105,A5
Item 11:		Z2	
	(formation bottom),	col 106-118,	F13.5

Item 12:	GSC code,	col 119-123,A5
Item 13:	Isopach,	col 124-136,F13.5
Item 14:	Last formation,	col 138-141,A5

Graphics: **MAPPING** and any contouring packages.

IDEA

The **IDEA** command allows users to manipulate variables obtained from the R-data and W-data bases and to create an output file for other users as well. Operations such as addition, subtraction, multiplication, division, exponential, and bracketing are possible. Use of **IDEA** is illustrated in the following example.

Input: From TODIGIT, POLYPDSK, POLYWDSK, FRMTDSK, or RSIKDSK.

Computer Operations:

>IDEA (cr)

Do you want to set-up/edit equations in the INIDEA file? (Y/N) > _ (cr)

If "Y", then
Users use **KEDIT** to set up equations as follows.

```
*******************************************************************************
* INIDEA : Input variable definition
*
* This file is used to store variable definitions for the IDEA module. The definitions
* are defined as follows:
*
* In the first line, enter FORTRAN I/O format for the disk output.
*
* In the second line, enter FORMAT I/O format for the report
*
* From the third line downwards, enter one formula on each line.
* IDEA will accept the following operators:
*  +, -, *, /, **, (, ), and =
* The input variable name has the format X# or F#, where # is an integer ranging
* from 1 to 100.
*
* For well data from the POLYGON output, the following variables may be chosen:
*
* X1: GDDEPTH  X2: KBELEV      X3:WDEPTH      X4: TUDEPTH
* X5: PBDEPTH  X6: SPUD DATE
*
* For pool data from the TODIGIT output or R-data base, the following variables
* may be used:
*
* X1: DEPTH          X2: KB             X3: AREA        X4: NETPAY
* X5: POROSITY       X6: SATURATION     X7: DENSITY     X8: PRESSURE
* X9: TEMP           X10: Z             X11: GOR        X12: SHRINKAGE
* X13: VOLUME        X14: RF            X15: ENHRF      X16: RESERVE
* X17: ENHRV         X18: CUM PROD      X19: SLOSS      X20: PRODUC
* X21: GW1           X22: GOI           X23: OWI        X24: H2
* X25: He            X26: N2            X27: CO2        X28: H2S
* X29: Pc            X30: Tc            X31: GHV        X32: C1
* X33: C2            X34: C3            X35: Ic4        X36: nC4
* X37: C5            X38: C6            X39: C7         X40: DISCYR
*
```

```
* For data from FORMATION output, the following variables may be chosen.
*
* X1: KB                X2: Z1(top)              X3: Z2(base)
*
* For data from RISK output, the following variables may be chosen:

*
* X1: ISOPACH           X2: VOLUME(O)            X3: RV(O)        X4: AREA(O)
* X5: NETPAY(O)         X6: VOLUME(G)            X7: RV(G)        X8: AREA(G)
* X9: NETPAY(G)         X10: AMT1(O)             X11: AMT2(O)     X12: AMT1(G)
* X13: AMT2(G)
*
* F# is used to indicate an ERCB formation code. The symbol, #, designates a
* 4-digit ERCB formation code, and the depth of the formation at that well.
*
* The format of the output variable name is C#, where # is an integer ranging from
* 1 to 100.
*
* The maximum number of equations is limited to 50.
*
* Examples follow:
* First: format for the disk file
* (1x,A24,2G9.3,F11.3,F10.0,F10.3)
* Second: format for the printer output
* (1x,A46,F11.3,F10.0,f10.3)
* C1 = (101.33*X10*X9)/(288.16*X8)
* C2 = (X3*X4*X5)*(1 - X6)/100
* C2 = C2 / C1
* C3 = X13*X28*0.98/0.7375
```

****

/
End of "Y"

Operator > _(cr)
Remarks > _(cr)
Do you want to generate a report file? (Y/N) > _(cr)
Do you want to use the Pool or Well data base? (P/W) > _(cr)
TODIGIT, Polygon, Formation, or Risk output (T/P/F/R) > _(cr)
Do you want a complete output? (Y/N) > _(cr)

Output:

(1) The disk files are:

IDEAP.OUT	R-data base is used
IDEAW.OUT	W-data base is used
IDEAF.OUT	**FORMATION** output is used
IDEAR.OUT	**Risk** output is used

and located under **\PETRIMES\UAI\<uai>** sub-directory.

(2) Printer output is:

UPI and UWI, the variables specified.

(3) The disk files may be accepted by other statistical packages for further processing.

Graphics: The output disk files may be mapped with user supplied contouring package.

POLYGON and INPOLY

These two commands are used to outline a play boundary by means of polygon. The **INPOLY** command is used to enter and store the vertices of the polygon. The vertices can be defined according to survey systems such as DLS, NTS, YNTLS, as well as by latitude and longitude.

Input:

1. The first line (record) indicates the projection system to be used. You may choose from UTM (U), polyconic (P), or lambert (L).

2. The second line indicates the reference point as follows: for UTM and polyconic projections, a longitude and latitude pair; for lambert projection, one longitude and an upper and lower latitude are required. If the numbers, -1 and -1 are entered, then the system chooses an optimal reference point.

3. From the third line and on, each record indicates a vertex as follows:

   (1) For the DLS (Dominion Land System), the format is

   1, township, range, section, LSD, meridian.

   (2) For the NTS (National Topographic System), the format is

   2, NTS unit, map unit, subdivision, map sheet, zone.

   (3) For the Federal Permit System, the format is

   3, unit, section, latitude (degree, minute), longitude (degree, minute).

   (4) For Geodetic coordinates, the format is

   4, longitude and latitude in decimals.

The maximum number of vertices is set at 300; the number can, however, be augmented.

The **POLYGON** command is used to identify a well or a pool either within or outside a given polygon. The input files for POLYGON may be either **WELLS** or **POOLS.**

Computer Operations:

> INPOLY (cr)

****
*

```
*    INPOLY : Input Polygon definitions
*
*    This file is used to store input parameters for the polygon definitions.
*
*    In the first row, enter any one of the projection systems.
*    The three projection systems are UTM (U), Lambert (L) and
*    Polyconic (P).
*
*    In the second row, enter the reference point. For UTM and Polyconic projection systems,
*    enter a longitude and latitude pairs. For the Lambert projection system, enter longitude,
*    and upper and the lower latitudes.
*
*    From the third row downwards, enter the survey system code followed by its location,
*    separated by blanks.
*
*    The system code may be either positive or negative. A positive system code is inclusive,
*    and a negative code is exclusive.
*
*    For the system code:
*
*          1 - DLS system
*                location:  TWP, RANGE, SECTION, LSD, MERIDIAN
*
*          2 - NTS system
*                location:  NTS UNIT, MSHEET, GRID, BLOCK, UNIT
*
*          3 - PEDERAL PERMIT
*
*                location: UNIT, SECTION, LATITUDE (DEGREE, MINUTE),
*                LONGITUDE (DEGREE, MINUTE)
*
*          4 - GEODETIC COORDINATES
*
*    Longitude and latitude in decimals.
*
*    The minimum number of points for each polygon is 3.
*
*    The maximum number of points for each polygon is 300.
*
*    The maximum number of polygons is 10.
*
*********************************************************************************
/
```

Enter the polygon vertex by using **KEDIT**.

> POLYGON (cr)

Do you need to enter/edit the INPOLY file (Y/N) > Y (cr)

If "Y" then
KEDIT may be used to enter or edit the polygon definition.
/ (input example)
U (UTM projection system)
114, 51 (Reference longitude, latitude)

1, 41, 14, 1, 1, 5 (Survey system code, township, range, section, LSD, Meridian)
1, 31, 7, 1, 1, 5
1, 22, 4, 1, 1, 5
1, 14, 4, 1, 1, 5
End of "Y"

Operator > _ (cr)
Remarks > _ (cr)
Do you use output from Pools or Wells? (P/W) > _(cr)
Do you want to store output for report? (Y/N) > _(cr)
Do you require a complete output? (Y/N)> _ (cr)

Output:

(1) Graphic display: **MAPPING**

(2) Disk files: The wells or pools retrieved may be stored for intermediate use or for final report as follows:

(i) The disk files for the final report are:

From R-data base:

POLYP.OUT

From W-data base:

POLYW.OUT

(ii) The disk files for subsequent processes are:

From R-data base:

POLYP.DSK

From W-data base:

POLYW.DSK

and will be located in \PETRIMES\UAI\<uai>\ sub-diectory.

RISK

The **RISK** command is used to integrate the outputs from **FORMATION** and **POOLS** (Section 4.2) into a time series for a play. The following information is provided:

* a time series with all wells, pools and the results of drill-stem
* Markov chain analyses of the series
* Area, volume and average thickness of the polygon
* yields for the play
* success ratio for oil and/or gas of the play
* DST test intervals and results.

Input: From the W- and R-data base and **FRMT.DSK** and **POLYP.DSK.**

Computer Operations:

> RISK _(cr)

Set-up required for INPOLY file? (Y/N) > _(cr)
Operator > _(cr)
Remarks > _(cr)
Enter output unit of measurement (SI/BR) > _(cr)
Do you want to use POOL or POLY output? (POOL/POLY) >_(cr)
Enter TOP1, TOP2 > __,__(cr)
Enter the same GSC codes used in the **FORMATION** program.
Enter BOT1, BOT2 > __,__(cr)
Enter GSC formation code for excluding the wells > _(cr)
Radius of exhausted area > _(cr)
Enter Trend order > _(cr)
Oil, Gas or Both? (O/G/B) > _(cr)
Do you consider DST recovery as a success? (Y/N) > _(cr)

Output:

(1) The disk files are:
RISK.DSK
RISK.DST

(2) Printer output format is (Please use **Docu-Mate** to read the printout):
Format (5x,A25,F10.1,1X,A1,1X)
Item 1: UWI
Item 2: Isopach
Item 3: D for failure well
G for gas discovery
O for oil discovery
B for gas and oil discovery

If item 3 is O,G or B: Format (4F13.5,I4):

Items 4 & 5:
If item 3 is O or B, then oil in-place volume (item 4) and initial recoverable reserve (item 5) in terms of 10^6 m^3.

Items 6 & 7:
If item 3 is G or B, then gas in-place volume (item 6) and marketable reserve (item 7) 10^6 m^3.

Item 8: For gas: number of gas caps overlying on a common oil leg;
for oil: number of recovery methods.

If item 3 is D without DST: no data follows.

If item 3 is D with DST recoveries: Format (2(2F13.5,A1),3X,A2,A1,2F8.2)

Item 4: Oil recovery from DST in terms of 10^3 m^3 per day
Item 5: Oil recovery from DST in terms of m^3 during the test (valve open time). If the unit of fluid recovered is 2 (centimetre), then the inside diameter of the drill pipe will be used to calculate the volume of fluid recovered.

Item 6: "blank" for positive non-zero valve open time and pipe diameter, * for either
one or both of valve open time and pipe diameter are less equal then zero.

Item 7: Gas recovery from DST in terms of 10^3 m^3 per day

Item 8: Gas recovery from DST in terms of m^3 during the test (valve open time). If the unit of fluid recovered is 2 (centimetre), then the inside diameter of the drill pipe will be used to calculate the volume of fluid recovered.

Item 9: "blank" for positive non-zero valve open time and pipe diameter, * for either
one or both of valve open time and pipe diameter are less equal then zero.

Item 10: Symbols for drill-stem recoveries

R: sulphurous
G: gas cut mud
O: oil cut mud
W: water
B: brackish
S: salty
F: fresh water
C: Condensate
DP: Dry pipe
FR: Frothy
SD: Sediment
X: Oil & gas
Y: Condensate & oil
Z: Condensate & oil & gas
CA: Chemical addition
IH: Inhibitor, water cushion
TR: Tar-like
DI: Diesel
DT: Distillate
EM: Emulsified
GN: Gas cushion

If ** is found in this item, then no drill-stem test retrieved

Item 11: The symbols, "blank", O, G, and B are used for the indications of types of recoveries. The information used is obtained from Items 4, 5, 7, or 8.

Item 12 & Item 13: The relationship between the isopach and the DST interval.

Let F_t = formation top; F_b = formation bottom; DST_t = DST test interval top; DST_b = DST test interval bottom; $F = F_b - F_t$ (isopach); $DST = DST_b - DST_t$ (test interval).

(1) If the DST test interval is located within the Formation interval, then Item 12 = - DST; Item 13 = DST.

(2) If the DST test interval is overlapped on the top of the formation interval, then Item 12 = DST, Item 13 = $DST_b - F_t$.

(3) If the DST test interval is overlapping the bottom of the formation interval, then Item 12 = DST, Item 13 = $F_b - DST_t$.

(4) If the formation interval is located within the DST test interval, then Item 12 = - DST, Item 13 = - F.

The above rules are valid if and only if the formation isopach is defined (i.e., no missing top or bottom).

Disk output:

1.	UWI	A18
2.	X and Y	2G13.5
3.	Spud date	I8
4.	Isopach	F13.5
5.	CDRY same as Item 3 of the printer output	A1
6.	Oil in-place volume	G13.5
7.	Oil recoverable volume	G13.5
8.	Gas in-place volume	G13.5
9.	Gas marketable volume	G13.5
10.		GAREAI8
11.		GNPYG9.2
12.		SULWTA2
13.		CDSTA1
14.		OAMT1G13.5
15.		OAMT2G13.5
16.		GAMT1G13.5
17.		GAMT2G13.5
18.		NSEQI4

Graphics: DMAP, CDPLT, DPLT.

TREND

With the **TREND** command, the user can compute, for a set of wells or pools, the trend and residual surfaces. The data may come as output from **FORMATION,** or **XYZ,** or from other data files with (x,y)-coordinates and a Z value for mapping. An example follows:

***Input*: FRMT.DSK**

Computer Operations:

> TREND _(cr)

Operator > _(cr)
Remarks > _(cr)
Enter lower and upper bound trend order > __,__(cr)
This program allows users to calculate more than one trend order. The result is stored in ascending order, according to the user's input.
Variable code: 1. Z1 2. Z2 3. ISOPACH? > _(cr)
Enter selected ranges > _(cr)
Users can enter minimum and maximum values for the selected variable. **TREND** ignores data less than the minimum and greater than the maximum values.

Output:

(1) The disk files are:
\PETRIMES\UAI\<uai>\TREND.DSK

The output format is:
Item 1: UWI
Item 2 & 3: (x,y)-Co-ordinates
Item 4: Formation subsea/isopach
Item 5: Formation subsea trend value
Item 6: Formation subsea residual value

(2) Printer output:
Item 1: UWI
Item 2: (x,y) co-ordinates
Item 3: Formation subsea/isopach
Item 4: Formation subsea/isopach trend value
Item 5: Formation subsea/isopach residual value

Graphics: The output disk files may be used by user supplied contouring packages.

5.3 The Procedure

Several options are associated with the commands described.

> WELLS or POOLS _(cr)

This operational command may be used to retrieve a set of wells or pools covering a specific polygon or area studied.

Option 1: **INPOLY/POLYGON**

With these commands, the play boundaries may be entered and pools may be retrieved that lie within the play boundary or polygon. The boundary, wells, or pools may be displayed by **MAPPING.**

Option 2: **FORMATION**

This option is used to retrieve the subsea regions of formations or their equivalents.

Option 3: **TREND**

This option is used to perform trend surface analyses for formations retrieved using **FORMATION.**

Option 4: **RISK**

This option may be used to create for a time series for the formation within a given play boundary.

Option 5: **POSTING** or **MAPPING**

These options are used to display the output to screen or send it to a plotter.

SIX

THE RESOURCE EVALUATION SUBSYSTEM

In this chapter, tools used to estimate quantities of undiscovered oil and/or gas resources are described.

6.1 Resource Evaluation Basics

The objectives of a resource assessment are:

* to estimate the number of yet-to-be discovered
* to estimate sizes of undiscovered pools
* to predict reservoir characteristics of undiscovered pools
* to provide adequate information for economic analysis
* to validate exploration concepts against known information;
* to estimate pool size distributions and relate these distributions to geological models.

For a description of petroleum resource evaluation principles and statistical concepts, refer to "An Introduction to Petroleum Resource Evaluation Methods" (Lee and Wang, 1990).

6.2 The Evaluation Management Commands

In this section, a number of management commands are explained. These commands apply to the Evaluation Subsystem.

6.2.1 The PD-Data Base Structure

There is a unique identifier for each probability distribution or piece of data from which a probability distribution can be constructed. The unique distribution identifier (UDI) is defined as follows:

NNUUPVT

where NN = geological variable name,
UU = unit of measurement,
P = O, oil or G, gas,
V = version of the distribution,
T = types of data, and
RRR = pool rank for individual pool sizes.

A description of each comment follows:

(1) The names of geological variables are listed in Table 5-2 with their respective codings. The meanings of these terms are adopted from reservoir engineering and are self-explanatory. However, additional explanations are required for reservoir fraction and favourable facies fraction. The former term refers to the fraction of a formation thickness that contains hydrocarbons. The latter refers to the fraction of a formation thickness that has facies favourable to the accumulation of hydrocarbons.

(2) Units of measurement are listed in Table 5-3, with their codings. Although distributions may be expressed in different measurement systems, the output must be expressed in either S.I. or British units, depending on which system the user selects. In Table 5-3, except for the first two codings, the odd number coding is in S. I. units and the even numbers that follow represent equivalent British units. If conversion of units is required, then the corresponding units are also converted. Table 5-4 lists all codings of geological variables and their legitimate units of measure.

(3) Oil or gas distributions are indicated either by O or G, as the case may be.

(4) Up to 9 versions of the distributions for the same play may be kept. For example, if the distribution of a pool area is measured in acres for gas as version 1, then the UDI would be expressed as 0206G1. If the same distribution is measured in hectares, then the UDI becomes 0205G1. Thus, the UDI is unique within a play, but between plays, the UAI together with the UDI are used to index a specific distribution.

(5) There are four types of information in the data base. Type 1 is used to store a string of numbers. These can, for example, be the measurements from some pools. This type of information is used to provide data for exploratory analysis. The maximum number of data points is 200. In cases where the number of data points exceeds the maximum allowable, then different versions may be used to enter all data. The **MERGE** function (referred to the Graphic Display Subsystem) can then be used to merge them together in a single graphic.

Type 2 data is used to store probability distributions with two data items: data values and probabilities in the upper percentiles. The maximum number is 100 pairs.

Type 3 data is derives from measurements of pools or fields. For each pool or field, there are one or more variables, and all these variables constitute a data matrix. For each row, measurements are obtained from the same pool or field. For each column,

measurements are obtained from the same variable, but from different pools or fields. Covariance and correlation matrices can be computed from the data matrix. The maximum number of pools is 800.

Type 4 data is generated from statistical analyses. Type 4 data can only be retrieved for use in evaluations and graphic displays.

(6) The pool ranks for individual pools appear in the last three positions of the UDI.

(7) Each distribution is indexed by both UAI and UDI in the PD-data base. Types 1, 2, 3, and 4 data are stored in the same data base. Single precision is used for the data (i.e., only 7 digits are maintained), while double precision (i.e., 17 digits are used) is applied for numerical computations.

DIGIT Entering Data into the PD-Data Base

The **DIGIT** command is used to enter and update information to the PD-data base. For Type 3 data, you may enter as many distributions as you wish, but on a single screen, you may only enter up to six distributions, and **PETRIMES** can only display four distributions on a single screen. Additional distributions are appended to the end of previous distributions. All variables within the UAI must have the same number of data points. For Type 1 or 2 information, you must enter one distribution at a time.

ENTERING TYPE 1 or TYPE 2 DATA

Guidelines:

(1) For Type 1 data, you may enter only one single number per line (record). For Type 2 data, two numbers per line are required. The first number is the value of the geological variable, followed by a probability expressed in a decimal fraction.

(2) For Type 1 data, the maximum number of data points is 200 for each version. For Type 2 data, the maximum number of pairs is 100.

(3) For discrete distributions, such as number of pools, number of prospects, number of net pay zones, the minimum probability value starts at 0.99. Other variables begin at probability 1.0. All of them end at probability 0.00.

Computer Operations:

Example 1. Entering a New Distribution

> DIGIT _(cr)

"TYPE3" or UDI number (NNUUPV) > 0205G1 _(cr) {Enter UDI here}
NN > 02
---Area of pool --
UU > 05
--ha--
P > G
--gas--
New distribution? (Y/N) _Y (cr)
/
KEDIT is used to enter the data (see Table 7-4, 7-5).
After entering the data and exiting from the editor, the user is prompted,
Do you want to update into the PD-data base? (Y/N) > Y (cr)
Updated.
>

Example 2. Modifying Existing Distribution

> DIGIT _(cr)

"TYPE3 or UDI number (NNUUPV) > 0205G1 _(cr)
NN > 02
---Area of pool---
UU > 05
---ac---
P > G
---Gas---
New Distribution? > N _(cr)
/
KEDIT is used to edit the data. When the editing work is complete, **DIGIT** will ask the following question:
Do you want to update into the PD-data base? (Y/N) > Y _(cr)
Updated.

ENTERING TYPE 3 DATA

Guidelines:

(1) The maximum number of data points is 200 for each version, and 800 is the maximum number that the PD-data base can store.

(2) Each variable has the same number of measurements.

(3) A missing value is signified by -1.

Computer Operations:

> DIGIT _(cr)

"TYPE3 or UDI number (NNUUPV) > type3 (cr)
KEDIT is used to enter or update the PD-data base (see Table 7-6).

Users may also transfer data from the output of **TODIGIT.**
The procedure is:
Get TODIGIT.OUT 1 *

PETRIMES transfers the TODIGIT file into **DIGIT.**
The user exits after completion of the transfer.
Do you want to update into the PD-data base? (Y/N) >Y (cr)
Updated.
>

DELETING AN EXISTING DISTRIBUTION

Computer Operations:

> DIGIT (cr)

"TYPE 3 or UDI (NNUUPV) > 6101G1

NN > 61
---No of prospects---
UU > 01
---No---
P > G
---Gas---
New distribution? (Y/N) > N (cr)
KEDIT is used to delete the distribution (see Table 7-7).
The user exits from the editor.
No sample points found. Delete? (Y/N) > Y (cr)
Deleted.

RTRL Retrieval of UDIs from the PD-Data Base

The **RTRL** command is used to retrieve UDI's for data types 1, 2, 3, and 4.

Instructions

(1) The key Boolean operators are **AND** and **OR**.

(2) The retrieval statement is as follows:

CRBPYYMM-NNUUPVTRRR

where
- C = Country code,
- R = Region or geological province code,
- B = Basin or geological system code,
- P = Play name code,
- YY = The year that the assessment started,
- MM = The month that the assessment started,
- NN = Geological variable name code,
- UU = Unit of measurement,
- P = Oil or gas,
- V = Version number,
- T = Type of data, and
- RRR = Individual pool ranks.

When positions of the retrieval statement are specified by key words, the conditions are requested. Otherwise, the position is entered by the symbol, @. For example, if all data belonging to UAI C41184101 are requested, the retrieval statement is as follows:

C4118401-@@@@@@@@.

Note that the positions for pool rank are blank, this means that all individual pool sizes will be retrieved.

The Boolean operator, "AND", is applied to positions within a statement. One or more retrieval statements may be used. In this case, the operator, "OR" is applied between statements. For example, if both net pay and porosity are requested, then the retrieval statements are:

C411@@@@-05@@@@@, and
C411@@@@-06@@@@@.

In this example, the date, the unit of measurement, oil or gas, version, and type of data are not specified.

Computer Operations:

> RTRL _(cr)

Do you want to edit an RTRL retrieval statement? (Y/N) > _(cr)
If "N", then skip the following operation.
If "Y", then the following instructions are displayed.

```
*****************************************************
*  RTRLin - Notes
*
*  1. For both RTRLin and RTRLout, a "*" in column #1 indicates a comment line.
*  2. The selection line format is CRBPYYMM-NNUUPVTRRR
*  3. The selection line must start at column #1.
*  4. Selection is positional - embedded blanks may not be used.
*  5. Use '@' anywhere in the selection for a wild card.
*  6. The '-' between the UAI and UDI must appear.
*
*RBPYYMM-NNUUPVTRRR
/
```

KEDIT is used to enter retrieval statements.
The user exits from the editors.

Run RTRL? (Y/N) > Y (cr)

Do you want to edit/set-up the RTRL output? (Y/N) >_(cr)
If "Y", then users use editors to edit the RTRLout.
If "N", then the retrieval job is completed.

The contents stored in RTRLout will be used for all evaluation commands (refer to the next section).

6.3 The Evaluation Commands

The following sections explain applications of various commands that can be applied when evaluating the petroleum resources of a given play.

INPPSD, PPSD — Derivation of a Pool or Prospect Size Distribution

This module is used to compute a pool or prospect size distribution using a pool size equation. The probability distributions for all geological variables such as pool area, net pay and others may be approximated by means of a lognormal or other distribution entered by the user.

ENTERING CONSTANTS INTO THE INPPSD FILE

Computer Operations:

> **INPPSD** _(cr)

KEDIT text editors are used to enter constants into the INPPSD file as follows:

```
**************************************************
* INPPSD : Input Constants
*
* This file is used to store constants for the PPSD module.
* On each line enter exactly three (3) numbers, separated by space(s).
* Please DO NOT put a "*" in column #1 of a line; otherwise the modules
* that use this file will interpret the line as a comment line
*
*****************************************************************
* CONSTANT       NN                UU
*---------------+-----------------+-----------------------------------------
/
```

KEDIT is used to enter data.

COMPUTING POOL OR PROSPECT SIZE DISTRIBUTIONS

The Pool Size Equation Model

In reservoir engineering, the volumetric method of computing a pool size is given by the following equation:

Pool Size =
*constant * Pool Area * Net Pay * Porosity * Hydrocarbon Saturation * Recovery*

Factor / Gas or Oil Formation Volume Factor *(6-1)*

To cite two examples, the above equation may be expressed as follows:

Recoverable Oil in STB (standard stock tank barrel) =
*7758 * Area (ac) * Net pay (ft) * Porosity (dec fr) * (1 - Sw) (dec fr) * Shrinkage factor * Recovery Factor (dec fr)* *(6-2)*

Recoverable Gas in SCF (standard cubic feet) =
*43560 * Area (ac) * Net pay (ft) * Porosity (dec fr) * (1 - Sw) (dec fr) * Recovery factor / Gas volume Factor* *(6-3)*

where Gas volume factor = $(P_{sc} * Z * T) / (T_{sc} * P)$
Z = Gas deviation factor

In resource evaluations, the above equations are adapted to define a pool size distribution (Roy, 1979). Each variable is approximated by a probability distribution, and the product of all the distributions gives the distribution of the pool or prospect size. Variable multiplications can be accomplished by either Monte Carlo or lognormal approximations to all variables. The following sections discuss these two approaches.

(1) Lognormal Approximation

In resource evaluations, equation (1) is adopted to define a pool size. In **PETRIMES**, the geological variables are jointly approximated from a multivariate lognormal distribution (Lee and Wang, 1990). Because the product or division of lognormal random variables is again a lognormal variable (Aitchison and Brown, 1973), it follows from Equation (1) that the size of a pool is lognormal. If we let μ, σ^2, cov(i,j), i,j = 1,2,..., denote the means, variances, and covariances of the natural logarithms of the variables, then the mean and variance of a pool size are given by:

$$\text{Mean} = \exp (\mu + 1/2\ \sigma^2) \qquad (6\text{-}4)$$

$$\text{Variance} = \exp (2 * \mu + \sigma^2) [\exp(\sigma^2) - 1] \qquad (6\text{-}5)$$

$$\text{where } \mu = \ln (\text{constant}) + \sum \mu_i \qquad (6\text{-}6)$$

$$\sigma^2 = \sum \sigma^2_i + 2 * \sum_{i<j} \sum \sigma_{i,j} \qquad (6\text{-}7)$$

(2) Monte Carlo Multiplication

The probability distributions may be multiplied together, using a Monte Carlo simulation procedure. In this case, random numbers are generated independently from each distribution, and then these random numbers are multiplied together. The procedure is repeated 5000 times. A pool or prospect size distribution is then obtained.

Input:

(1) The UDIs of geological variable distributions are retrieved using **RTRL**. The maximum number of distributions is 12. It is user's responsibility to choose relevant variables for the equation. The variables are either pool size (NN=72/73) or other geological variables with version 0 to 9 or C.

(2) The Type 3 pool size data can be used to derive a pool size distribution. In this case, the input constant may be used to modify the distribution derived. A μ and σ^2 may also be used to derive a lognormal pool size distribution.

(3) Units of measurement may be expressed as S.I. or British units, or both in a single run. **PETRIMES** will convert units into their equivalents.

(4) Distributions from different UAIs may be combined into one equation. In this case, the covariance matrix is not computed.

(5) **PPSD** will perform a series of validations on the input distributions, but it is user's responsibility to ensure that all distributions are relevant to the assessment.

Execution:

(1) **PPSD** is capable of recognizing what types of variables should be used, which variables are set in the numerator, and which variables are placed in the denominator. The pool size equation is defined by the products and/or divisions of geological variables. Normally, the equation is multiplied by a constant.

(2) If data belongs to Type 3 of the same UAI, then a covariance matrix will be computed, and Fisher's z-test is performed.

(3) If a temperature variable is entered and expressed in terms of Fahrenheit or Celsius, then the following conversions will be executed by **PPSD** before the pool size is computed.

$T\ ^0K = T\ ^0C + 273.16$, or
$T\ ^0R = T\ ^0F + 459.70$.

(4) If the water saturation variable is entered, it is converted into hydrocarbon saturation by **PPSD**.

(5) For TYPE 2 distributions, linear interpolation is employed to obtain the percentiles used to represent the distribution. The μ and σ^2 are obtained by solving

$$\text{Mean} = \exp(\mu + \sigma^2 / 2)$$

$$\text{Median (50 percentile)} = \exp(\mu)$$

where μ is computed from 5000 random numbers from the distribution, and σ^2 is computed from a percentile specified by the user.

(6) If the number of net pay zones and the net pay distribution for all zones are entered, a Monte Carlo simulation is applied to obtain a new net pay distribution. One thousand simulation runs are carried out.

Computer Operations:

> PPSD_(cr)

Have you set-up an INPPSD file? (Y/N) > _ (cr)
If the answer is "N", **PETRIMES** will bring up the **KEDIT** text editor for users to enter data into or modify the INPPSD data file. This data file is then used to enter constants for the geological variables.

For **PPSD**

Operator > _ (cr)
Remarks > _ (cr)
Do you want to store on disc? (Y/N) > _ (cr)
Enter Oil or Gas (O/G) > _ (cr)
Enter output unit of measurement (SI/BR) > _ (cr)
The input distributions can be expressed in terms of either S.I. or British units. Users specify the output unit as either S.I. or British. **PPSD** will convert all input units into the desired units according to Table 5-4. The unit for pool size is listed as follows:

Type of resource	Unit of measurement S.I.	British	Scale factor S.I.	British
Oil	M cu m	MM bbl	10^6	10^6
Gas	M cu m	Bcf	10^6	10^9

PPSD is able to multiply factors to convert acre-foot or mile-foot unit into cubic feet, or to barrels; or hectare-meters or kilometre-meters into cubic meters.

Recoverable resource? (Y/N) > _ (cr)
This information is used to verify the input distributions whether the variables are identical or not, and to label the output as recoverable or in-place.

Prospect or pool size? (R/O) > _ (cr)
If "R" (prospect), then
prospect size is labelled
End of "R"
If "O" (pool), then
pool size is labelled
End of "O"

Lognormal or Monte Carlo? (L/M) > _ (cr)
If "L" (lognormal), then
Do you want to input μ and σ^2 yourself? (Y/N) > _ (cr)
If "N", then **PETRIMES** shall retrieve all geological variables contained in **RTRLout**, and compute the distribution using the pool size equation.

If "Y", then
Enter μ and its unit of measurement code > __, __ (cr)
If the unit of measurement code for μ is different from that entered in the previous question, then the unit of measurement will be changed as specified in the question "Output system of measurement".

Enter σ^2 > ___ (cr)
End of "Y" (Enter μ and σ^2)
End of "Lognormal"

If "M" (Monte Carlo), then
No. of simulations > __ (cr)
Maximum no. of simulations is 5000.
End of "M"

Do you want to use a constant input file? (Y/N) > _ (cr)
If "N", then
Input constant? > __ (cr)
This is used for cases where variables are entered as constants. For example, recovery factor can be entered as a constant. A variable that is entered as constant, but for which the unit of measurement is not dimensionless, must have the same unit as the output unit; the user is responsible for ensuring the units of measurement match. If surface temperature and pressure are entered into the pool size equation as constants, for example, the standard conditions are as follows:

	S. I.	British
Temperature	288.16 ^{0}K	519.70 ^{0}R
Pressure	101.33 Pka	14.70 psi

The value, 1.0 must be entered if no constant is entered.
End of "N"

No of discoveries to be used > 10 (cr)

The first 10 discoveries, for example, will be used in the computation. It is important that the data be sorted into discovery sequence and stored into the PD-data base.

Which upper percentile is to be honoured? > _(cr)
Usually the 0.05 or 0.02 upper percentile is honoured. The 0.5 percentile is always honoured.

Output:

Users may **BROWSE** the output before printing it. The following disk files are also created by **PPSD**:

(1) Disk file for the final report:
PPSD.OUT

(2) Disk file for subsequent processes:
PPSD.DSK

(3) UDIs for each estimated distribution are as follows:

Distribution Name	NN	V	T
In-place pool or prospect size lognormal	70	L	4
Recoverable pool or prospect size lognormal	71	L	4
In-place pool or prospect size Monte Carlo	70	M	4
Recoverable pool or prospect size Monte Carlo	71	M	4
Lognormal approximation for other variables	01-40	C	4
Monte Carlo multiplication for other variables	01-40	C	4
Output from pool size data (NN=72/73)			
In-place pool size (lognormal)		70	S4
Recoverable pool size (lognormal)	71	S	4
Output obtained by entering μ and σ^2			
In-place pool size (lognormal)		70	I4
Recoverable pool size (lognormal)	71	I	4

Graphics: **CPLT**

LDSCV Estimation of Pool Size Distributions - Lognormal Discovery Process Model -

This module is used to estimate the pool size distribution using the concept of the discovery process model. The lognormal assumption is used for the pool sizes.

Input: UDIs of the pool size (NN = 72/73) and their discovery date (NN = 54) must be retrieved by **RTRL** before users can execute the program.

Computer Operations:

> LDSCV_(cr)

Operator ? > _(cr)
Remarks ? > _(cr)
Do you want to store on disk? (Y/N) > _(cr)
Enter Oil or Gas (O/G) > _(cr)
Enter output unit of measurement (SI/BR) > _(cr)
Recoverable resource? (Y/N) > _(cr)

Minimum, step and maximum number of pools in the play >__,__,__(cr)
Users can enter an incremental range of the number of pools, e.g. 30, 10, 80. **LDSCV** will estimate the μ and σ^2 when N = 30, 40, 50, 60, 70, and 80, respectively. Only 100 combinations of μ, σ^2, and N are allowed in one single run.

Enter no of discoveries to be used > __, __ (cr)
Enter the starting and ending numbers of the discovery sequence.

Do you want to maximize over the β value? (Y/N) > _(cr)

If "N", then
Minimum, step and maximum values of β > _(cr)
Enter the range of β, for example, 0.0, 0.1, 1.0. **LDSCV** will set the β values from 0.0 through 1.0 with an increment of 0.1. For each N and β, the μ and σ^2 are estimated.
End of "N"

If "Y", then
Enter the estimated lower and upper limit for the MLE of β > __, __ (cr)

LDSCV will search for the maximized value between the lower and upper limits entered. It is the users responsibility to make sure that the upper and lower limits cover the entire range.
End of "Y"

Enter base for class intervals? (2/10) > _(cr)
The class size is entered, using either base 2 or base 10.

Do you want a complete output on printer? (Y/N) > _(cr)

Do you want to store in INMATCH? (Y/N) > _(cr)
The output of the N, μ, σ^2 can be stored in the **INMATCH** file.

Output:

For each N and β, the general statistics and grouped distribution are printed. Summaries of log-likelihood estimations for each μ, σ^2, and N are also reported in tabular format.

(1) The disk file for the final report is:
LDSCV.OUT

Cautions

Users must examine the printout to determine whether computational errors have occurred. If an error 3 or higher does occur, then the result for the combination is not correct and should not be used.

NDSCV Estimation of Pool Size Distributions - Nonparametric Discovery Process Model -

This module is used to estimate a pool size distribution based on the discovery process model. No prior distribution for the pool size is assumed.

NONPARAMETRIC ESTIMATION

Input: UDIs of pool size data (NN = 72/73) and their discovery dates (NN = 54) must be retrieved by **RTRL**.

Computer Operations:

> NDSCV_(cr)

Operator? > _ (cr)
Remarks? > _ (cr)
Do you want to store on disk? (Y/N) > _ (cr)
Do you want to store distributions in the PD-data base? (Y/N) > _ (cr)
Enter Oil or Gas (O/G) > _ (cr)
Enter output unit of measurement (SI/BR) > _ (cr)
Recoverable resource? (Y/N) > _ (cr)
Min, Step and Max no. of pools in play > __,__,__ (cr)
Enter no. of discoveries to be used > _(cr)
Min, Step and Max values of β >__,__,__ (cr)
Notes: Only 100 combinations among μ, σ^2, and N are allowed in one single run.

Do you want a long printout? (Y/N) > _ (cr)
Do you want to use the ANCHOR method? (Y/N) > _ (cr)
If "Y", then
Kaufman's finite population (Kaufman, 1986) will be used.
End of "Y"
If "N", then
Maximized log-likelihood will be computed.
End of "N"

Enter the base for class intervals (2/10) > _ (cr)
Do you want to print out the ungrouped pool size distribution? (Y/N) > _ (cr)
Do you want a complete output on print? (Y/N) > _ (cr)

Output:

For each N and β, the general statistics and grouped distribution are printed. The non-parametric distributions are stored to the PD-data base, should the user request to do so.

(1) The disk files for the final report are:
NDSCV.OUT

(2) UDI for the lognormal approximation is NNUUPVTRRR
where NN = 74 or 75,
UU = unit of measurement,
P = O or G,
V = L,
T = 4, and
RRR = pool rank.

(3) UDI for the nonparametric distribution is NNUUPVTRRR
where NN = 74 or 75,
UU = unit of measurement,
P = O or G,
V = N,
T = 4, and
RRR = pool rank.

(4) UDI for the greater then NPMLE distribution is NNUUPVTRRR
where NN = 74 or 75,
UU = unit of measurement,
P = O or G,
V = 1,2,3,4,5,6,7,
T = 4, and
RRR = pool rank.

Graphics: QPLT, CPLT

ESTIMATING 95% CONFIDENCE INTERVAL FOR μ AND σ^2

Input:

The UDI of the nonparametric pool size distribution (NN= 74/75) is retrieved by **RTRL** and its data, in turn, are retrieved by **ENDSCV** from the PD-data base.

Computer Operations:

> ENDSCV_ (cr)

Operator? > _(cr)
Remarks? > _(cr)
Do you want to store on disk? (Y/N) > _(cr)

Enter random seed > _(cr)

Output:

For a nonparametric pool size distribution of N, n and β, 95% confidence intervals of μ and σ^2 are printed. 5000 pairs of μ and σ^2 are also plotted on the printer output.

(1) Disk file for final report:
ENDSCV.OUT

(2) Disk file for μ and σ^2

ENDSCV.DSK

MPRO Estimating Number-of-Pools Distributions

This module is used to compute a number-of-pools distribution using the number-of-prospects distribution and the exploration risk.

ENTERING GEOLOGICAL RISK FACTORS

There are three data items associated with each geological factor, as follows:

(1) Codes for level of play and prospect risks:

Play level = 1, and
Prospect level = 2.

(2) Risk factor codes:

01 Presence of closure
02 Presence of reservoir facies
03 Presence of porosity
04 Adequate seal
05 Adequate timing
06 Adequate source
07 Adequate maturation
08 Adequate preservation
09 Adequate of recovery
10 Presence of formation
11 Adequate migration
14 Adequate prospect condition
19 Adequate play condition

(3) Marginal probability (ranging from 0.0 to 1.0)

Computer Operations:

> INMPRO _(cr)

KEDIT commands may be used to enter or edit the input data.

ESTIMATING THE NUMBER-OF-POOLS DISTRIBUTION

Input:

(1) The UDI of the number-of-prospects distribution (NN=61) must be retrieved by using **RTRL.**
(2) The marginal probability for risk factors is entered by means of the **INMPRO** command.
(3) The maximum number of prospects or pools is 5000.

Computer Operations:

> MPRO _(cr)

Operator > _(cr)
Remarks > _(cr)
Do you want to store on disk? (Y/N) > _(cr)
Do you want to store the no-of-pools dist'n in the PD-data base? (Y/N) > _(cr)
Enter Oil or Gas (O/G) > _(cr)

Output:

(1) The disk files for the final report are:

MPRO.OUT

(2) The disk files for subsequent processes are:

MPRO.DSK.

(3) The number-of-pools distribution is updated into the PD-base with the UDI, 6201PB4, where P = O or G.

Graphics: **CPLT.**

MATCH Matching Process

This command allows the user to perform the matching process when one or more following criteria are specified:

(1) The pool size distribution is lognormal or a geological type.

(2) Some or all pool ranks and their sizes are specified in the **INPSDR** file.

(3) The user indicates the r-largest pools that have been discovered.

(4) Increment ranges for the μ, σ^2, and number of pools, N, are given.

(5) The maximum number of discoveries, n, is 600 and maximum number of pools, N, is 999.

(6) The statistical gauge is measured either (i) by the sum of the distance between the discovered pool size and the median or the mean, or (ii) by the order statistics log-likelihood function (log-L).

(7) The output can be sorted by:

(i) the sum of the distance measured either from the median or mean;
(ii) the number of pools, N;
(iii) the remaining pool size at 50 percentile;
(iv) percent of the remaining play potential, or
(v) log-L values.

Input: UDIs of pool size data (NN =72/73) and their discovery dates (NN = 54) or pool size distribution are retrieved by **RTRL**. Conditional matching is entered by **INPSDR**. Combinations of μ, σ^2, and N also can be entered by **INMATCH**.

Computer Operations:

> MATCH _(cr)

Operator > _(cr)
Remarks > _(cr)
Do you want to store on disk? (Y/N) > _(cr)
Do you want to store distributions in the PD-data base? (Y/N) > _(cr)
Enter Oil or Gas (O/G) > _(cr)
Enter output unit of measurement (SI/BR) > _(cr)
Recoverable resource? (Y/N) > _(cr)
Do you want to use a lognormal pool size distribution? (Y/N) > _(cr)

If "N" (no lognormal), then

PETRIMES shall retrieve the pool size distribution entered as type 2 data from the PD-data base for the computation.
Min, Step and Max No. of pools in play > _(cr)
End of "N" (not to use lognormal distribution)

If "Y" (lognormal), then
Do you want to use the output of PPSD? (Y/N) > (cr)

If "Y" (use output of **PPSD**), then
Min, Step and Max No. of pools in play > __,__,__(cr)
At the same time, the pool size distribution derived from either **PPSD** will be used for the computation.
End of "Y"

If "N" (does not use output of PPSD), then

Do you want to use the N, μ and σ^2 in INMATCH? (Y/N) > _(cr)
This option should be used at the first run when discovery record is available.
If "N" (does not use INMATCH file), then

Min, Step and Max values of the μ range > __,__,__ (cr)
Unit of measurement code for the μ > _(cr)
Min, Step and Max values of σ^2 > __,__,__ (cr)
Min, Step and Max No. of pools in play > __,__,__ (cr)
End of "N" (not use INMATCH file)
End of "N" (not use output of PPSD)
End of "Y" (lognormal)

Do you want to execute a match? (Y/N) > _(cr)
If "N" (not execute match), then only pool sizes are computed.
Min and Max pool rank > __,__ (cr)

Do you want MEAN and SD for the individual pool size?(Y/N) > _(cr)
End of "N" (not execute match)

If "Y" (execute match), then
Enter no. of discoveries to be used > r_(cr)
If r is greater than the total number of pools stored in the PD-data base, the all pool sizes are used in the match process. If r is less than the actual number of pools, than the first r pools in discovery sequence are used in the match process.

Enter the r-largest discoveries for conditional match >_(cr)
If a number r is entered, then the first r largest pools are assumed as discoveries. If 0 is entered, then **MATCH** will decide which pools have been discovered.

If "0" (the answer is 0), then
Do you want to specify the match in INPSDR? (Y/N) > _(cr)

Users can perform a match according to the pool ranks stored in **INPSDR.**
End of "0"

Enter the prediction interval > __,__(cr)
Usually 75-25 interval is used, but if the largest few pools are very different in sizes, then the interval 95-5 interval may be used.

Distance measured from MEAN or MEDIAN? (MSE/MAD) > _(cr)
The distance is measured from the median or the mean of the computed pool sizes to the discovered pool sizes. Therefore, the distance can be a positive or negative number. The sum of all distances is a algebraic sum.

Do you want to store on INPSDR? (Y/N) > _(cr)
The output of the matching process can be stored in the **INPSDR** file.

Do you want a detail printout? (Y/N) > _(cr)
This option allows users to print all output.

Printout sorted by Dist., Gap, Size, N, %U or Log L?(D/G/S/N/U/L) > _(cr)
This option allows us to sorted all match output in terms of the following criteria:

Dist.: sum of all differences between the discovered pool sizes to either the mean or median;
Gap: the rank of the largest undiscovered pool size;
Size: the largest undiscovered pool size;
N: the total number of pools in the play;
%U: the percentage of the undiscovered resource;
Log L: the log likelihood is computed based on the order statistics which takes the pool sizes and their ranks into consideration.

Enter no. of top cases to be printed > _(cr)
End of "Y" (execute match)

Output:

(1) The matched pool size, pool rank, and unit of measurement are stored in **INPSDR.**

(2) The disk file for the final report are:
MATCH.OUT

(3) Distributions are updated into the PD-data base with the following UDI's
NNUUPVTRRR

where NN = 78 or 79,
UU = unit of measurement,
P = O or G,

V = U,
T = 4,
RRR = pool rank.

Graphics: **RPLT, ZPLT.**

PSRK Pool-Size-by-Rank

These modules are used to estimate r-th largest pool sizes, given a pool size distribution and (1) the number-of-pools distribution (i.e. N is a random variable) or (2) the number of pools (i.e. N is a constant).

NUMBER OF POOLS IS A RANDOM VARIABLE

Input:

The **PPSD** command must be successfully executed and the number-of-pools distribution must be updated into the PD-data base and that has been retrieved by **RTRL**. The pool size distribution may be obtained from the output of **PPSD** or when users enter the parameters during the execution of **PSRK**.

Computer Operations:

> PSRK _(cr)

Operator > _(cr)
Remark > _(cr)
Do you want to store on disk? (Y/N) > _(cr)
Do you want to store the distribution in the PD-data base? (Y/N) > _(cr)
Enter Oil or Gas (O/G) > _(cr)
Enter output unit of measurement > (SI/BR) > _(cr)
Recoverable resource? (Y/N) > _(cr)
Do you want to use the output of MPRO? (Y/N) > _(cr)

If "Y", the **PETRIMES** shall retrieve the number-of-pools distribution derived by **MPRO** for computation.
If "N" then
Enter no. of pools in the play > _(cr)
End of "N"

Minimum and maximum pool size rank > __,__(cr)
User may compute from pool rank i to j, j > i.
Do you want to use output of PPSD? (Y/N) > _(cr)

If "N", then
Enter μ and its unit of measurement code? > __,__(cr)
Enter σ^2? > __(cr)
End of "N"

Output:

(1) The disk files for the final report are:

PSRK.OUT

(2) The UDI from this output is expressed as NNUUPVTRRR
where NN = 78/79,
UU = unit of measurement,
P = O or G,
V = N,
T = 4, and
RRR = Pool ranks.

Graphics: **RPLT, ZPLT.**

PSDR Pool-Size-by-Rank Constrained by Discoveries

This module provides a mechanism for the following:

(1) Estimated individual pool sizes contain uncertainties which can be reduced when the pool size and its rank are entered.

(2) For a given pool size distribution and number-of-pools of a play, we can ask the question: What would the largest pool size be if the discovered largest pool is the second largest in the play?

Input:

(1) Output from **INPSDR, PPSD** and **MPRO**, or

(2) Output from **INPSDR**, but users will enter number of pools, μ and σ^2 while users execute **PSDR**.

Computer Operations:

> PSDR _(cr)

Operator > _(cr)
Remark > _(cr)
Do you want to store on disk? (Y/N) > _(cr)
Do you want to store the distribution in the PD-data base? (Y/N) > _(cr)
Enter Oil or Gas (O/G) > _(cr)
Enter output unit of measurement (SI/BR) > _(cr)
Recoverable resource? (Y/N) > _(cr)

Do you want to use the output of MPRO? (Y/N) > _(cr)
If "Y", then **PETRIMES** shall retrieve the number-of-pools distribution derived by **MPRO**.
If "N", then
Enter no. of pools in the play > __(cr)
End of "N"

Minimum, and maximum pool rank > __,__(cr)
Do you use lognormal assumption? (Y/N) > _(cr)

If "N" (not to use lognormal distribution)
Pool size distribution entered as type 2 data must be available and is retrieved in the **RTRL** file at this time. **PETRIMES** retrieves the non-lognormal distribution entered as type 2 data for the computation).
End of "N" (lognormal assumption)

If "Y" (lognormal assumption), then

Do you want to use output of PPSD? > _(cr)
If "Y", **PETRIMES** shall retrieve the output of **PPSD** as pool size distribution.
End of "Y" (End of **PPSD**)

If "N", then
Enter μ and its unit of measurement > __,__(cr)
Enter σ^2 > _(cr)
End of "N"
End of "Y" (lognormal assumption)

Do you want a long printout? (Y/N) > _(cr)

Output:

(1) The disk files for the final report are:

PSDR.OUT.

(3) The distributions are updated into the PD-data base with the format NNUUPVTRRR where NN = 78 or 79,
UU = unit of measurement,
P = O or G,
V = R,
T = 4, and
RRR = pool ranks.

Graphics: **RPLT, ZPLT.**

Cautions: The sum of the means of all undiscovered pool sizes is the mean or expected value of the potential distribution. The expected value derived here may be different from the one obtained from the module, **PPDR.**

PSUM Play Resource Distribution

This module is used to compute a distribution described as a superpopulation play resource.

Input:

(1) To compute a play resource distribution, the **PPSD** and **MPRO** modules must be executed successively before users can execute the play resource distribution module; otherwise, the number of pools and the pool size distribution parameters must be entered.

(2) To compute distributions of world, country, geological province, basin resources, the relevant distributions must be retrieved from **RTRL.**

Computer Operations:

> PSUM _(cr)

Operator > _(cr)
Remarks > _(cr)
Do you want to store on disk ? (Y/N) > _(cr)
Do you want to store the distribution in the PD-data base? (Y/N) > _(cr)
Enter Oil or Gas (O/G) > _(cr)
Enter output unit of measurement (SI/BR) > _(cr)
Recoverable resource ? (Y/N) > _(cr)
Enter level of summations (W/C/R/B/P) > _(cr)
W: World resource
C: Country resource
R: Geological province resource
B: Basin or geological system resource
P: Play resource
Do you want to use the output of MPRO? (Y/N) > _(cr)
If "Y", then **PETRIMES** retrieves the number-of-pools distribution derived by **MPRO.**
If "N", then
Enter no of pools in the play > _(cr)
End of "N"
Do you use lognormal assumption? (Y/N) > _(cr)

If "N" (not to use lognormal pool size distribution), then **PETRIMES** retrieves pool size distributions entered as type 2 data).
End of "N" (not to use lognormal assumption)

If "Y" (lognormal assumption), then
Do you want to use the output of PPSD? (Y/N) > _(cr)
If "Y", then the output of **PPSD** will be used for the pool size distribution.

If "N", then
Enter μ and its unit of measurement > __,__(cr)
Enter σ^2 > __(cr)
End of "N"
End of "Y" (to use lognormal assumption)

Output:

(1) The disk files for the final report are:

PSUM.OUT.

(3) Distributions are updated into the PD-data base with the UDI's NNUUPVT format NNUUPVT
where NN = 88/89 Play
90/91 Basin or Geological system
92/93 Geological province
94/95 Country
96/97 World
UU = unit of measurement
P = O or G,
V = 0, and
T = 4.

Graphics: **CPLT.**

PPDR or PPRK Play Potential Distribution

The **PPDR** command is used to compute the remaining play potential, given that the discovered pool size and its rank are derived from the **MATCH** output in **INPSDR**. The **PPRK** command is used to compute the play potential when the **MATCH** output is provided.

Input: Output from **INPSDR, PPSD, MATCH** and **MPRO** or users may enter **PPSD** or/and **MPRO** while execute **PPDR** are the input for this module.

Computer Operations:

Case 1. Condition on both pool sizes and ranks

> PPDR _(cr)

Operator > _(cr)
Remark > _(cr)
Do you want to store on disk? (Y/N) > _(cr)
Do you want to store the distribution in the PD-data base? (Y/N) > _(cr)
Enter Oil or Gas (O/G) > _(cr)
Enter output unit of measurement (SI/BR) > _(cr)
Recoverable resource? (Y/N) > _(cr)
Do you want to use the output of MPRO? (Y/N) > _(cr)

If "Y", then **PETRIMES** retrieves the output of **MPRO** as the number-of-pools distribution.

If "N", then
Enter no. of pools in the play > _(cr)
End of "Y"

Minimum, and maximum pool size rank > __,__(cr)
Do you use lognormal assumption? (Y/N) > _(cr)

If "N" (not to use lognormal distribution, then **PETRIMES** retrieves the pool size distribution entered as type 2 data for the computation).

If "Y" (lognormal assumption), then
Do you want to use output of PPSD? (Y/N) > _(cr)

If "Y", then **PETRIMES** retrieves the output derived by **PPSD** for the computation).

If "N", then
Enter μ and its unit of measurement > __,__(cr)
Enter σ^2 > __(cr)

End of "N"
End of "Y" (lognormal assumption)

Output:

(1) The disk files for the final report are:

PPDR.OUT.

Case 2. Condition on pool ranks only.

> PPRK _(cr)

Operator > _(cr)
Remark > _(cr)
Do you want to store on disk? (Y/N) > _(cr)
Do you want to store the distribution in the PD-data base? (Y/N) > _(cr)

Output:

(1) The disk files for the final report are:

PPRK.OUT.

(2) Distributions are updated into the PD-data base with the UDI formatted as NNUUPVT

where NN = 80 or 81,
UU = unit of measurement,
P = O or G,
V = R, and
T = 4.

Caution: The mean or expected value of the play potential distribution which is derived by Monte Carlo simulation may differ from the one derived from the **PSDR** module.

RVGN Estimating Reservoir Parameters

This module is used to compute the conditional probability distributions for the geological variables entered into the pool size equation under a given pool size.

Input: Output from **INRVGN**, and **PPSD**.

Entering INRVGN file

KEDIT may be used to enter the following data items: pool size, unit of measurement and no. of simulation trial. Users may enter as many pool sizes as required.

Computer Operations:

> RVGN_(cr)

Operator > _ (cr)
Remarks > _(cr)
Do you want to store on disk ? (Y/N) > _(cr)
Do you want to store the distribution in the PD-data base? (Y/N) > _(cr)

Output:

(1) The disk files for the final reports are:

RVGN.OUT.

(2) Distributions are updated into the PD-data base with the UDI formatted as NNUUPVT
where NN = 01 to 40,
UU = unit of measure,
P = O or G,
V = G, and
T = 4.

Graphics: **CPLT.**

PSRO Ratios Between Pool Sizes

This module is used to compute a ratio between any two pool sizes.

Input: Output may be from **INPSRO, PPSD,** and **MPRO** or users may enter the number of pools and/or pool size distribution.

Computer Operations:

> PSRO_(cr)

Operator > _(cr)
Remarks > _(cr)
Do you want to store on disk? (Y/N) > _(cr)
Do you want to store the distribution in the PD-data base? (Y/N) > _(cr)
Enter Oil or Gas (O/G) > _(cr)
Enter output unit of measurement (SI/BR) > _(cr)
Recoverable resource? (Y/N) > _(cr)
Do you want to use the output of MPRO? (Y/N) > _(cr)

If "Y", then **PETRIMES** retrieves the number-of-pools distribution derived by **MPRO.**

If "N", then
Enter no. of pools in the play > __(cr)
End of "N"

Do you want to use output of PPSD? (Y/N) > _(cr)

If "Y", then **PETRIMES** retrieves the pool size distribution derived by **PPSD.**

If "N", then
Enter μ and its unit of measurement > __,__(cr)
Enter σ^2 > __(cr)
End of "N"

Output:

(1) The disk files for the final reports are:

PSRO.OUT

(2) Distributions are updated into the PD-data base with the UDI formatted as NNUUPVT

where NN = 52 or 53,
UU = unit of measurement,

P = O or G,
V = 0, and
T = 4.

ESUM Remaining Economically Viable Potentials

This module is used to compute remaining play potential by paring pool ranks.

Input:

(1) The pool size distribution of the play is entered either from **PPSD** or TYPE 2 data input by the user.

(2) The number-of-pools distribution, or N.
(3) The **INPSDR** data sets.
(4) The **INESUM** pool ranks for economically viable pools.

Computer Operations:

> INESUM _(cr)

Users must enter a pair of pool ranks, and the first and the last economically viable pools. Each pair is entered in one row in free format. Users may enter as many pairs as they want in a simple execution.

> ESUM _(cr)

Operator > _(cr)
Remarks > _(cr)
Do you want to store on disk? (Y/N) > _(cr)
Do you want to store the distribution in the PD-data base? (Y/N) > _(cr)
Enter Oil or Gas (O/G) >_ (cr)
Enter output unit of measurement (SI/BR) > _(cr)
Recoverable resource? (Y/N) > _(cr)
Do you want to use the output of MPRO? (Y/N) > _(cr)

If "Y", then **PETRIMES** retrieves the number-of-pools distribution derived by **MPRO**.

If "N", then
Enter no. of pools in the play > _(cr)
End of "N"

Do you use lognormal assumption? (Y/N) > _(cr)

If "N", then **PETRIMES** retrieves the pool size distribution entered as type 2 data from the PD-data base.
End of "N" (not lognormal assumption)

If "Y", then
Do you want to use output of **PPSD**? (Y/N) > _(cr)
If "Y", then **PETRIMES** retrieves the pool size distribution derived by **PPSD**.

If "N", then
Enter μ and its unit of measurement > __,__(cr)
Enter σ^2 > _(cr)
End of "N"
End of "Y" (lognormal assumption)

Output:

(1) The disk files for the final report are:

ESUM.OUT

STAT Means and Variances of a Probability Distribution

This module will compute the means, standard deviations, and variances of all TYPE 1 or TYPE 3 distributions retrieved by **RTRL**.

Input: All distributions must be retrieved by **RTRL**.

Computer Operations:

> STAT _(cr)

Operator > _(cr)
Remarks > _(cr)
Do you want to display data on the screen? (Y/N) > _(cr)
Do you want to store on disk ? (Y/N) > _(cr)
Do you want to change the unit of measurement? (Y/N) > _(cr)
If "Y", then
Enter output unit of measurement (SI/BR) > _(cr)
End of "Y"

Output:

(1) The disk files for the final report are:

STAT.OUT

DRISK Estimating Marginal Probability from Well Data

The **DRISK** command is used to compute marginal probability of geological risk factors from well data (Lee, Qin and Shi, 1989).

Input: The raw data are entered into the **INRISK** file as follows:

Computer Operations:

> INRISK _(cr)

> DRISK _(cr)

Set-up required for INRISK file? (Y/N) > _(cr)
Operator > _(cr)
Remarks > _(cr)
Do you want to store on disc? (Y/N) > _(cr)
Do you want to specify no. of pc to be rotated? (Y/N) > _(cr)
If "Y", then
Enter IFAC ? > _(cr)
End of "Y"

Do you use correlation or covariance matrix? (C/V) > _(cr)

Output:

Output is sent to a printer.

NRAND Generation of a Data Set Obeying a Probability Distribution

The **NRAND** command is used to generate a set of random numbers which obey a lognormal or normal distribution, with given population parameters.

Input: Enter population parameters from the screen.

Computer Operations:

> NRAND _(cr)

Operator > _(cr)
Remarks > _(cr)
Enter Oil or Gas (O/G) > _(cr)
Enter output unit of measurement (SI/BR) > _(cr)
Recoverable resource? (Y/N) > _(cr)
Lognormal or normal distribution? (L/N) > _(cr)

If "L" (lognormal), then
Do you want to use the output of PPSD? (Y/N) > _(cr)

If "N", then
Enter μ and its unit of measurement code > __,__(cr)
Enter σ^2 > __(cr)
End of "N"
End of "L"

If "N" (normal), then
Enter mean > __(cr)
Enter standard deviation > __(cr)
End of "N"
Enter no. of random number you want to generate > _(cr)
Enter random number seed (0 as default) > _(cr)

Output:

(1) The output disk file for other modules is:

NRAND.DSK.

SDSCV Generation of a Discovery Sequence Set

The **SDSCV** command is used to simulate a discovery sequence from a data set with a given β value and number of discoveries.

Input: Output from **NRAND**.

Computer Operations:

> SDSCV _(cr)

Operator > _(cr)
Remarks > _(cr)
Enter a random number seed (0 as default) > _(cr)
Enter no. of discovery > _(cr)
Enter β value > _(cr)

Output:

SDSCV.OUT.

PSIZE Sizes — Generation of a Pool Sizes and Numbers by Year with Estimated Pool

The **PSIZE** command is used to compile a table displaying pool sizes and numbers by year for one or more plays estimated pool sizes for the play studied may be tabled together with discovered pool sizes.

Input: UDIs of the pool size (NN=72/73) and/or individual pool size (NN=78/79) are retrieved by **RTRL** before users can execute the program. One or more UAI's data can be retrieved.

Computer Operations:

> PSIZE_(cr)

Operator? >_(cr)
Remarks? >_(cr)
Do you want to store on disk? (Y/N) >_(cr)
Oil or Gas? (O/G) >_(cr)
Output unit of measurement? (SI/BR) >_(cr)
Recoverable resource? (Y/N) >_(cr)
Do you use predicted pools? (Y/N) >_(cr)

If "Y", then
Do you use the mean or upper percentile? (M/U) >_(cr)
If "U", then
Enter upper percentile for predicted pool size? >_(cr)
End of "U"
End of "N" (not using predicted pools)

Last year? >_(cr)
Enter base for class intervals? (2/10) >_(cr)

Output:

(1) The disk files for the final report is:
PSIZE.OUT.

SEVEN

GRAPHIC DISPLAY SUBSYSTEM

There are many graphic modules available for displaying the data, probability distributions, evaluation end products, and well and pool data. All graphics can be viewed on the system's screen or sent to a printer or HP plotter.

7.1 Graphics Basics

General features of the subsystem are described below:

1. **RTRL** is used to retrieve data or distributions. In the RTRLout, each distribution or record is identified by a unique number positioned in front of it. This identification number is used to select a distribution for display.

2. Display commands are used interactively.

3. The system automatically default scales, lengths, and log cycles for each plot; however, users may enter their own options and alter the default options.

4. If the **RETURN** key is pressed after the terminal displays, the system prompts for the next plot.

5. When the]] keys are entered, the execution of the current command is terminated.

6. When using HP7550 plotters, fibre tip, roller-ball, or transparency pens are recommended.

7. The following pens are recommended for the HP 7550 or 7585B plotter:

Pen number	Colour	Function
1	Black	Axes and annotations
2	Red	Gas resource
3	Green	Oil resource
4	Brown/Black	Grid
5	Heavy black	Title

6,7,8 Unused

8. When using an HP 7550 plotter, the rotation must be set to -90 or 00 and this value must match the value set by the **ROTATE** option.

9. When using the **RPLT** command, users may choose paper that is 11 or 14 inches long.

10. Units of measurement may be changed. This must be executed before the user has chosen the distributions.

Graphics function descriptions follow:

(Graph/Plot/List/Optns/Unit/Include/Remove/Merge/Rotation/Clear/Next) > _(cr)

1. Graphic devices - **Graph** directs the display to the monitor whereas **Plot** directs it to the printer or other plotters.

2. The **LIST** function is used to list all UDIs in the RTRLout. Users choose any of them for display.

3. The **OPTION** function is used to change graphics default options.

4. The **UNIT** function is used to change the units of measurement from S.I. to British units and vice versa.

5. The **INCLUDE** function is used to display more than one distribution on the same graph. Users choose one distribution and then apply the command, "I" to include all others to be displayed.

6. The **REMOVE** function is used to remove a distribution already chosen by the command "I".

7. The **MERGE** function is used to merge two or more versions of the same UDI into one display.

8. The **CLEAR** function is used to clear all UDIs selected from the temporary file.

9. The **NEXT** function is used to move the pointer to the next UDI in the RTRLout file.

10. The **ROTATION** function is used to rotate the graphics for display in a landscape or legal orientation. The 00 or 90 degree values must match the plotter's setting.

11. The **VERT** function is used to change the options along the vertical axis.

12. The **HORZ** function is used to change the options along the horizontal axis.

The procedure for displaying a plot follows:

1. Users execute the **RTRL** command in order to retrieve all distributions.

2. Users may choose their own units of measurement by means of the **UNIT** option. The default unit is the unit being stored.

3. Users identify the distribution(s) to be plotted by entering the corresponding identification number(s).

4. Users have the option of changing plot parameters.

5. Once all the desired options have been selected, the user presses the ENTER key to display the plot. To terminate the plot as it is being displayed, the user simply presses ENTER.

6. To exit from the display command, the] key is pressed twice.

7.2 The Graphic Commands

The following sections explain applications of various plot commands that can be applied to display Type 1, 2, 3, and 4 data.

BPLT Box Plot

Box plots are used to represent data values graphically, without detail. With this command, Types 3 or 1 data are built into a box plot that is able to display the outliers of the data set.

Input: All Type 1 and 3 data set retrieved from **RTRL**.

Computer Operations:

> BPLT _(cr)

(Graph/Plot/List/Optns/Unit/Include/Remove/Merge/Clear/Next) > _(cr)

Optns:
To detect outliers or normalize the data? (O/N) > _(cr)

If "O" (outliers), then

Nature of vertical axis (LOG/LINear) >_(cr)

If "LIN", then
Data minimum: < >, maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division < >
Start (< >) > _(cr)
End (< >) > _(cr)
# of divisions (< >) > _(cr)
Linear axis requested: Start< >, end< >, delta< >, # of division< >
End of "LIN"

If "LOG", then
Data minimum:< >, maximum: < >
Log axis selected: Start< >, end< >, # of division < >

Start (< >) > _(cr)
End (< >) > _(cr)

Log axis requested: Start< >, end < >, # of division< >
End of "LOG"
End of "O" (outliers)

If "N" (normalize), then
Nature of vertical axis is linear.

Data minimum:< >, maximum:< >
Linear axis selected: Start< >, end< >, delta< >, # of division< > _(cr)
Start (< >) > _(cr)
End (< >) > _(cr)
# of div (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division< > _(cr)
End of "N" (normalize)
Do you want to have notch? (Y/N) > _(cr)

Unit:
Entering output unit of measurement (SI/BR) > _(cr)

Remove:
UDI: <7219O13> removed from the plot.

Include:
UDI: <7219O13> included.

Plot:
Printer or plotter output? (1/2) > _(cr)
If "2", then

First or second paper size? (F/S) > _(cr)
90 degree rotation? (Y/N) > _(cr)
End of "2"
Another copy? (Y/N) > _(cr)

Procedure for making a box plot:

(1) Take the median value M
75% value HH
25% value HL

(2) Define H-spread = HH - HL

(3) Inner fence (upper) = HL + 1.5*H-spread
Inner fence (lower) = HH - 1.5*H-spread

The upper and lower inner fences are indicated by horizontal short bars.

(4) Outer fence (upper) = HH + 3*H-spread
Outer fence (lower) = HH - 3*H-spread

The crosses are located within the outer fence whereas the squares are located outside the outer fence.

Comparing Plays:

Often we may want to place several boxplots side by side to compare several plays using notched boxplots. Two plays whose notched intervals do not overlap can be said to be significantly different at roughly the 5% level. The assumption required is that the sample sets are randomly drawn from normal or lognormal distributions. The procedure for making a notch follows:

Step = $1.7 * (1.5*\text{H-spread})/(1.35*n^{1/2})$
Upper notch = M + Step
Lower notch = M - Step

CDPLT Cumulative Reserves Plot

The **CDPLT** command is used to plot oil or gas reserves along a time series. The horizontal axis may be expressed in terms of year or number of wells. Users may choose a "time window" from the series. The vertical axis may indicate in-place or recoverable resources.

Input: Output from **RISK.**

Computer Operations:

> CDPLT _(cr)

No. of wells: < >
No. of dry holes: < >
No. of oil discoveries: < >
No. of gas discoveries: < >
No. of oil/gas discoveries: < >

(Graph/Plot/Axis/Variable) > _(cr)

Variable:
Variables: (In-place/Recoverable) > _(cr)

Axis:
Axis: (Vert./Horz.) > _(cr)

If "H" (horizontal), then
Horizontal: (No. of wells/Year) > _(cr)

If "N" (no. of wells), then
No. of wells (< >) > _(cr)
End of "N"

If "Y" (year), then
Start (0) > _(cr)
End (2000) > _(cr)
End of "Y"
End of "H"

If "V" (vertical), then
Vertical scale: (Oil/Gas) > _(cr)

If "O" (oil), then
Data minimum:< >, maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)
# of divisions (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division< >
End of "O"

If "G" (gas), then
Data minimum:< >, maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division< >
Start (< >) > _(cr)
End (< >) > _(cr)
# of divisions (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division< >
End of "G"
End of "V"

Plot:
Printer or plotter output? (1/2) > _(cr)

If "2", then
First or second paper size? (F/S) > _(cr)
90 degree rotation? (Y/N) > _(cr)
End of "2"

Another copy? (Y/N) > _(cr)

CPLT Cumulative Frequency Plot

The CPLT command is used to plot all Type 1, 2, 3 or 4 data in cumulative greater-than form. A number of different versions of a UDI may be merged into a single data set. In addition, a number of UDIs may be plotted on the same plot. Various options are available for adjusting the horizontal axis.

Input: All Type 1 and 3 data sets retrieved from **RTRL.**

Computer Operations:

> CPLT _(cr)

(Graph/Plot/List/Horz/Unit/Include/Remove/Merge/Clear/Next) > _(cr)
Horz:
Nature of horizontal axis (LOG/LINear) > _(cr)

If "LIN", then
Data minimum: < >, maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)
# of divisions (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division< >
End of "LIN"

If "LOG", then
Data minimum: < >, maximum: < >
Log axis selected: Start< >, end< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)

Log axis requested: Start< >, end< >, # of division< >
End of "LOG"

Unit:
Entering output unit of measurement (SI/BR) > _(cr)

Remove:
UDI: 7219O13 removed from the plot.

Include:
UDI: 7219O13 included.

Plot:
Printer or plotter output? (1/2) > _(cr)
If "2", then
First or second paper size? (F/S) > _(cr)
90 degree rotation? (Y/N) > _(cr)
End of "2"

Another copy? (Y/N) > _(cr)

DMAP Plotting Time-Space Dependent Data

The **DMAP** command is used to plot a set of wells and/or pools according to the time series "window". The "window" may be defined as a number of wells or years.

Input: Output from **RISK**.

Computer Operations:

> DMAP _(cr)

PROJECTION METHOD:
REFERENCE POINT:

No. of wells: < >
No. of dry holes: < >
No. of oil discoveries: < >
No. of gas discoveries: < >
No. of oil/gas discoveries: < >

(Graph/Plot/Option/Variable/Unit) > _(cr)

Variables:
1. **In-place volume**
2. **Recoverable reserve**
3. **Area**
4. **Netpay** > _(cr)

Option: (Display/Year/No. of wells) > _(cr)

If "D" (display), then
Display: (Posting/Location) > _(cr)
End of "D"
If "N" (no. of wells), then
Start from wells (1) > _(cr)
End at wells (N) > _(cr)
End of "N"

If "Y" (year), then
Start (0) > _(cr)
End (2000) > _(cr)
End of "Y"

Unit:
Enter output unit of measurement (SI/BR) > _(cr)

Plot:

Printer or plotter output? (1/2) > _(cr)
If "2", then
First or second paper size? (F/S) > _(cr)
90 degree rotation? (Y/N) > _(cr)
End of "2"
Another copy? (Y/N) > _(cr)

Pen Assignments:

	Pen #	Symbol
Dry hole	1	cross
DST oil	2	cross
DST gas	4	cross
DST o&g	3	cross
Not tested	5	cross
Oil recovery	2	dot
Gas recovery	4	dot
O&G recovery	3	dot

DPLT Plotting Discovery Sequence with Drill-Stem Tests

The **DPLT** command is used to plot a time series with the following data items: failure wells and DST recovery from tested wells.

Input: Output from **RISK**.

Computer Operations:

> DPLT _(cr)

No. of wells: < >
No. of dry holes: < >
No. of oil discoveries: < >
No. of gas discoveries: < >
No. of oil/gas discoveries: < >

(Graph/Plot/Axis/Variable) > _(cr)

Variables: (In-place/Recoverable) > _(cr)

Axis: (Horz./Vert.) > _(cr)

If "H" (horizontal), then
Horizontal: (No. of wells/Year/Scale) > _(cr)
If "N" (no. of wells), then
No. of wells > _(cr)
End of "N"

IF "Y" (year), then
Start (< >) > _(cr)
End (< >) > _(cr)
End of "Y"

If "S" (scale), then
Start (< >) > _(cr)
End (< >) > _(cr)
# of divisions (< >) > _(cr)

End of "S"
End of "H"

If "V" (Vertical), then
Vertical scale: (LINear/LOG) > _(cr)

If "LIN", then

If an oil well exists:
Data minimum: < > , maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)
# of divisions (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division< >

If a gas well exists:
Data minimum: < > , maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)
# of div (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division< >

Data minimum:< > , maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)
# of div (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division< >
End of "LIN"

If "LOG", then
If an oil well exists:
Data minimum:< > , maximum: < >
Log axis selected: Start< >, end< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)

Log axis requested: Start < >, end< >, # of division< >

If a gas well exists:
Data minimum: < > , maximum: < >
Log axis selected: Start< >, end< >, # of division < >

Start (< >) > _(cr)
End (< >) > _(cr)

Log axis requested: Start < >, end< >, # of division<. >

Data minimum:< > , maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division < >

Start (< >) > _(cr)
End (< >) > _(cr)
# of div (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division < >
End of "LOG"

Plot:
Printer or plotter output (1/2)·> _(cr)
If "2", then
First or second paper size? (F/S) > _(cr)
90 degree rotation? (Y/N) >_(cr)
End of "2"

Another copy? (Y/N) > _(cr)

DSEQ Discovery Sequence Plot

The **DSEQ** command is used to plot pool sizes along with their discovery dates. The horizontal axis (discovery sequence) is set at equal distance, whereas the vertical axis (data) may be either set according to a logarithmic or linear scale.

Input: Type 3 data set: pool sizes (NN = 72/73) and their discovery dates (NN = 54) retrieved by **RTRL**.

Computer Operations:

> DSEQ _(cr)

(Graph/Plot/List/Optns/Unit/Merge/Clear/UDI#/Next) > _(cr)

Optns:
Options: (Vert./Horz./No. of discovery) > _(cr)

If "V" (vertical), then
(LOG/LINear) scale > _(cr)

If "LIN", then
Data minimum: < >, maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division< >
Start (< >) > _(cr)
End (< >) > _(cr)
# of div (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division < >
End of "LIN"

If "LOG", then
Data minimum: < >, maximum: < >
Log axis selected: Start< >, end< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)

Log axis requested: Start< >, end< >, # of division< >
End of "LOG"
End of "V"

If "H" (horizontal), then
(by Sequence/by Year) > _(cr)
End of "H"

If "N" (no. of discovery), then

No. of discovery > _(cr)
End of "N"

Unit:
Enter output unit of measurement (SI/BR) > _(cr)

Plot:
Printer or plotter output? (1/2) > _(cr)
If "2" then
First or second paper size? (F/S) > _(cr)
90 degree rotation? (Y/N) > _(cr)
End of "2"

Another copy? (Y/N) > _(cr)

HPLT Histogram Plot

A number of options and the **HPLT** command may be used to construct histograms for Type 1 or 3 data.

Input: All Type 1 or 3 data sets retrieved from **RTRL**.

Computer Operations:

> HPLT _(cr)

(Graph/Plot/List/Options/Unit/Merge/Clear/Next) > _(cr)
Unit:
Enter the output unit of measurement (SI/BR) > _(cr)

Options:
START (< >) > _(cr)
END (< >) > _(cr)
Horizontal axis: (LOG/LINear/USEr) > _(cr)

If "LOG", then
(TWO/TEN) base > _(cr)

If "TWO", then
(Equal/Unequal) width > _(cr)

If "E" (equal), then
Data minimum:< > , maximum: < >
Log axis selected: Start< >, end< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)

Log axis requested: Start< >, end< >, # of division < >
End of "E"

If "U" (unequal), then
Data minimum: < >, maximum:< >
Linear axis selected: Start< >, end< >, # of division< >
Start (< >) > _(cr)
End (< >) > _(cr)
# of div (< >) > _(cr)

Linear axis requested: Start< >, end< >, # of division < >
End of "U"
End of "TWO"

If "TEN", then
(Equal/Unequal) width > _(cr)

If "E" (equal), then
Data minimum:< > , maximum: < >
Log axis selected: Start< >, end< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)

Log axis requested: Start< >, end< >, # of division< >
End of "E"

IF "U" (unequal), then
Data minimum: < >, maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division< >
Start (< >) > _(cr)
End (< >) >_(cr)
# of div (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division< >
End of "U"
End of "TEN"
End of "LOG"

If "LIN", then
WIDTH (< >) > _(cr)
Data minimum: < > , maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)
# of div (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division< >
End of "LIN"

If "USE", then
BOUNDS(< >) > _(cr)
Data minimum: < > , maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division< >

Start (< > > _(cr)
End (< >) > _(cr)
# of div (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division< >

End of "USE"

Vertical axis:
(Frequency/Percentage/Density) > _(cr)

Data minimum: < > , maximum: < >
Log axis selected: Start< > , end < > , # of division < >
Start (< >) > _(cr)
End (< >) >_(cr)

Log axis requested: Start< > , end< >, # of division < >

Plot:
Printer or plotter output? (1/2) > _(cr)
If "2", then
First or second paper size? (F/S) > _(cr)
90 degree rotation? (Y/N) > _(cr)
End of "2"

Another copy? (Y/N) > _(cr)

LPLT Log Probability Plot

The **LPLT** command is used to plot Type 3 or 1 data on logarithmic probability paper.

Input: All Type 1 or 3 data sets retrieved from **RTRL**.

Computer Operations:

> LPLT _(cr)

(Graph/Plot/Optns/Unit/Merge/Clear/Next) > _(cr)

Optns:
Data minimum: < >, maximum: < >
Log axis selected: Start< >, end< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)

Log axis requested: Start< >, end< >, # of division< >

Unit:
Enter output unit of measurement? (SI/BR) > _(cr)

Plot:
Printer or plotter output? (1/2) > _(cr)
If "2", then
First or second paper size? (F/S) > _(cr)
90 degree rotation? (Y/N) > _(cr)
End of "2"

Another copy? (Y/N) > _(cr)

MAPPING Posting Data on Maps

The **MAPPING** command is used to post data on maps at any scale, with or without the polygon.

Input: Output from **WELLS, POOLS, FORMATION,** or **POLYGON.**

Computer Operations:

> MAPPING _(cr)

Do you want to superimpose on base map? (Y/N) > _(cr)
If "Y", then
BASE MAP:
PROJECTION METHOD: < >
REFERENCE POINT: < >
End of "Y"

Do you want to use INPOLY? (Y/N) > _(cr)
If "Y", then
POLYGON:
PROJECTION METHOD: < >
REFERENCE POINT: < >

Polygon only? (Y/N) > _(cr)
End of "Y"

If not superimpose on base map and not using INPOLY then
Projection system (Utm/Lambert/Polyconic) > _(cr)
End of not superimpose and not INPOLY

P- or W-data base (Pool/Well) > _(cr)
If "P" (pool), then
Input file: (POOLsout/POLY) > _(cr)
Variables:

1. Agent	**2. Aband**	**3. Trap**
4. Area	**5. Netpay**	**6. Temperature**
7. Pressure	**8. Porosity**	**9. Sw (water saturation)**
10. Depth	**11. Gas / Oil Ratio**	**12. 1/B(formation volume factor)**
13. Loss	**14. rho (density)**	**15. Z(gas deviation)**
16. Initial in-place volume	**17. Producible volume**	**18. Primary recovery factor**
19. Enhanced recovery factor	**20. Primary reserve**	**21. Enhanced reserve**
22. Cumulative production	**23. Gas / Oil contact**	**24. Gas / Water contact**
25. Oil / Water contact		**26. Discovery date27. Production date**

28. H_2 **29. N_2** **30. He**
31. He code **32. CO_2** **33. H_2S**
34. Critical pressure **35. Critical temperature** **36. Gross heating value**
37. Gross heating **38. C_1** **39. C_2**

value code **40. C_3** **41. iC_4**
42. nC_4 **43. C_5** **44. C_6**
45. C_7 **>**

Output unit of measurement: < >
No. of pools: < >
End of "P"

If "W", then
Input file: (FORMation/POLY) > _(cr)

If "FORM", then
System unit of measurement: < >
No. of wells: < >
Variables:
1. TOP
2. BOTTOM
3. ISOPACH > _(cr)
End of "FORM"
End of "W"

(Graph/Plot/Unit/Option/Scale) > _(cr)

Option:
Option: (Display/Petroleum)? > _(cr)

If "D" (display), then
Display: (Posting/Location)? > _(cr)
End of "D"

If "P" (petroleum), then
Petroleum: (Oil/Gas)? > _(cr)
End of "P"

Unit:
Enter output unit of measurement (SI/BR) > _(cr)

Scale:
(Horizontal/Vertical)? > _(cr)

If "H" (horizontal), then

Start (< >) > _(cr)
End (< >) > _(cr)
# of division (< >) > _(cr)
End of "H"

If "V" (vertical), then
Start (< >) > _(cr)
End (< >) > _(cr)
# of division (< >) > _(cr)
End of "V"

Plot:
Printer or plotter output? (1/2) > _(cr)
If "2", then
First or second paper size? (F/S) > _(cr)
90 degree rotation? (Y/N) > _(cr)
Scale factor > _(cr)
End of "2"

Another copy? (Y/N) > _(cr)

Pen Assignments:

	PC screen
From POOLS (symbol dot)	
Oil pool	pen 2
Gas pool	pen 4
From WELLS (symbol cross)	
Oil pool	pen 2
Gas pool	pen 4
Oil/Gas pool	pen 3
Other pool	pen 1
From FORMATION (symbol cross)	
> 0.0	pen 6
= 0.0	pen 3
< 0.0	pen 1

PPLT Pie Diagram Plot

The PPLT command is used to construct a pie diagram.

Input: Type 1, 3 or 4 data sets retrieved from **RTRL.**

Computer Operations:

> PPLT _(cr)

(Graph/Plot/List/Optns/Unit/Include/Remove/Merge/Clear/Next) > _(cr)

Optns:
Minimum percentile: < > _(cr)
Maximum percentile: < > _(cr)
Percentile > _(cr)

Unit:
Enter output unit of measurement (SI/BR) > _(cr)

Remove:
UDI: 7219O13 removed from the plot.

Include:
UDI: 7219O13 included.

Plot:
Printer or plotter output (1/2)? > _(cr)
If "2", then
First or second paper size? (F/S) > _(cr)
90 degree rotation? (Y/N) > _(cr)
Scale factor > _(cr)
End of "2"

Another copy? (Y/N) > _(cr)

QPLT The Quantile-Quantile or Q-Q Plot

The **QPLT** command is used to construct a Q-Q plot for testing various probability distribution assumptions.

Input: Output from **NDSCV** retrieved from **RTRL**.

Computer Operations:

> QPLT_(cr)

UAI= current UAI UDI= current UDI
Number of pools: no of pools of the current UDI

(Graph/Plot/Dist/Rotate/Vert./Horz./Option/Save) > _(cr)

Procedures:

(1) Using the **OPTION** command, the user decides whether the plot is based on a simple random or a successive sampling assumption.

(2) Although **QPLT** can plot different distributions, the user must select the **Dist** function to choose the desired distribution and its input parameters. The following lists the selection of distributions and parameters available:

Power Normal distribution:
Power > _(cr)

Gamma distribution:
Shape parameter > _(cr)

Shifted Pareto distribution:
Scale factor > _(cr)
Shape parameter > _(cr)
Lower limit > _(cr)

Truncated shifted Pareto distribution:
Scale factor > _(cr)
Shape parameter > _(cr)
Lower limit > _(cr)
Does the sample contain the largest pool? (Y/N) > _(cr)
If "N", then
Prob. of having a pool that is greater than the max. size > _(cr)
End of "N"

(3) The Option function allows users to decide whether the distribution is either simple random or successive sampling.

For simple random sampling:

$P_i = (i - 0.5)/N$, where N is no. of pools

For successive sampling:

$P_i = (F_i + F_{i-1})/2$,

where F_i is the value of the cumulative probability of i^{th} pool under the column LPSD.

(4) Some inverse functions of the distributions are listed below:

$\mathbf{C} = [-2\mathrm{Log}_e(\mathrm{Min}(P_i, 1-P_i))]^{1/2}$

If $P_i < 0.5$, then

$P_i^{-1} = -[\mathbf{C} - (2.30753+0.27061\mathbf{C})/(1.0+0.99229\mathbf{C}+0.04481\mathbf{C}^2)]$

If $P_i = 0.5$, then

$P_i^{-1} = 0.0$

If $P_i > 0.5$, then

$P_i^{-1} = \mathbf{C} - (2.30753+0.27061\mathbf{C})/(1.0+0.99229\mathbf{C}+0.04481\mathbf{C}^2)$

(5) For each plot, the X axis represents the distribution quantile and the Y axis represents the pool size after the transformation required. Pool size transformation and quantile formulas are listed below:

Normal distribution:

$X = P_i^{-1}$
$Y = x_i$

Half normal distribution:

$X = (P_i/2 + 0.5)^{-1}$
$Y = x_i$

Power normal distribution:

$X = P_i^{-1}$
$Y = x_i^{\mathbf{a}}$

where **a** is the power of a normal distribution

Lognormal distribution:

$X = P_i^{-1}$
$Y = Log_e(x_i)$

Weibull distribution:

$X = Log_e(-Log_e(1.0-P_i))$
$Y = Log_e(x_i)$

Uniform distribution:

$X = P_i$
$Y = x_i$

Gamma distribution:

$X = (1.0 - 1/9\tau + P(i)^{-1}/3\tau^{1/2})*\tau^{1/3}$
$Y = x_i^{1/3}$
where τ is user input parameter

One parameter exponential distribution:

$X = (-Log_e(1.0-P_i))^{1/3}$
$Y = x_i^{1/3}$

Two parameter exponential distribution:

$X = -Log_e(1.0-P_i)$
$Y = x_i$

Shifted Pareto distribution:

$X = [(1.0-P_i)^{-b} -1]*a + l$
$Y = x_i$

where **a** is the scale factor,
b is the shape factor,
l is the lower limit

Truncated shifted Pareto distribution:

$X = a*[(d+(1.0-d)*(1.0-P_i)]^{-b} - 1.0) + l$
$Y = x_i$

where **a** is the scale factor,
b is the shape factor,

l is the lower limit,

If the sample contain the largest pool, then
d = ((largest pool size - **l**)/**a** + 1.0)$^{-1/b}$

If the sample does not contain the largest pool, then
d is the prob. of having a pool that is greater than the max. size

RPLT Pool-Size-by-Rank Plot

The **RPLT** command is used to plot individual pool-size-by-rank estimated by **MATCH, PSRK,** or **PSDR.**

Input: Pool-size-by-rank distribution (NN = 78/79) and **INPSDR.**

Computer Operations:

> RPLT _(cr)

(Graph/Plot/List/Optns/Merge/Clear/Unit/Next) > _(cr)

Use INPSDR? (Y/N) > _(cr)

Optns:
(Vert./Horz./% percentiles) > _(cr)

If "V" (vertical), then
Nature of vertical axis? (LOG/LINear) > _(cr)

If "LIN", then
Data minimum:< > , maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)
# of div (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division< >
Endif "LIN"

If "LOG", then
Data minimum:< > , maximum: < >
Log axis selected: Start< >, end< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)

Log axis requested: Start< >, end< >, # of division< >
End of "LOG"
End of "V"

If "H" (horizontal), then
Horizontal axis:
Data minimum:< > , maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)
# of div (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division< >
Endif of "H"

If "%" (percentile), then
Upper percentile (< >) > _(cr)
Lower percentile (< >) > _(cr)
End of "%"

Unit:
Enter output unit of measurement (Default/SI/BR) > _(cr)

Plot:
Printer or plotter output (1/2) > _(cr)
If "2", then
First or second paper size? (F/S) > _(cr)
90 degree rotation? (Y/N) > _(cr)
End of "2"

Another copy? (Y/N) > _(cr)

SPLT Smoothing Plot

This section presents techniques for discovering and summarizing smooth data patterns. The data smoothers discussed here use medians and averages to summarize the overlapping segments. One of the smoothers that seems to perform quite well is **4253H.** It starts with a running median of four, **4**, recentered by **2**. It then resmooths by **5,** by **3,** and finally - now that outliers have been smoothed away by **H.** The smoother, **3RSSH**, has a tendency to chop off peaks and valleys and to leave flat "mesas" and "dales" two points long. The **SPLT** command is used to smooth Type 3 or 1 data.

Input: All Type 3 or 1 data sets retrieved from **RTRL.**

Computer Operations:

> SPLT _(cr)
(Graph/Plot/List/Optns/Unit/Merge/Clear/Next) > _(cr)

Optns:
Which options? (Smoother/Vertical axis) > _(cr)

If "S" (smoother), then
Which method do you choose? (3RSSH/4253H) > _(cr)
End of "S"

If "V" (vertical), then
Nature of vertical axis (LOG/LINear) > _(cr)

If "LIN", then
Data minimum:< > , maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)
# of div (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division< >
End of "LIN"

If "LOG", then
Data minimum:< > , maximum:< >
Log axis selected: Start< >, end< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)

Log axis requested: Start< >, end< >, # of division< >
End of "LOG"

End of "V"

Unit:
Enter output unit of measurement (SI/BR) > _(cr)

Plot:
Printer or plotter output? (1/2) > _(cr)
If "2", then
First or second paper size? (F/S) > _(cr)
90 degree rotation? (Y/N) > _(cr)
End of "2"

Another copy? (Y/N) > _(cr)

STEM Stem and Leaf Plot

The **STEM** command is used to construct a stem and leaf plot. With it we can readily observe the following features:

* How wide a range of values the data cover
* Where the values are concentrated
* How nearly symmetric the batch is
* Whether there are gaps where no values were observed
* Whether any values stray markedly from the rest.

Input: All Type 1 or 3 data sets retrieved from **RTRL**.

Computer Operations:

> STEM _(cr)

(Graph/Plot/List/Optns/Unit/Merge/Clear/UDI#/Next) > _(cr)

Optns:
(Trim/Notrim) > _(cr)

Unit:
Enter output unit of measurement (SI/BR) > _(cr)

Plot:
Printer or plotter output (1/2) > _(cr)
If "2", then
First or second paper size? (F/S) > _(cr)
90 degree rotation? (Y/N) > _(cr)
End of "2"

Another copy? (Y/N) > _(cr)

XPLT Cross Plot

The **XPLT** command is used to plot one geological variable vs another to form a cross-plot.

Input: Any pairs of Type 3 data sets retrieved by **RTRL**.

Computer Operations:

> XPLT _(cr)

(Graph/Plot/List/Vert./Horz./Unit/Merge/Clear/Next) > _(cr)

Vert.:
UDI: <---> Nature of vertical axis? (LOG/LINear) > _(cr)

If "LIN", then
Data minimum:< > , maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)
# of div (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of div< >
End of "LIN"

If "LOG", then
Data minimum:< > , maximum:< >
Log axis selected: Start< >, end< >, # of division < >

Start (< >) > _(cr)
End (< >) > _(cr)

Log axis requested: Start< >, end< >, # of division < >
End of "LOG"

Horz:
UDI:<---> Nature of horizontal axis? (LOG/LINear) > _(cr)

If "LIN", then
Data minimum:< > , maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)
# of div (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division< >
End of "LIN"

If "LOG", then
Data minimum:< > , maximum: < >
Log axis selected: Start< >, end< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)
Log axis requested: Start< >, end< >, # of division< >
End of "LOG"

Unit:
Enter output units of measurement? (SISI/SIBR/BRSI/BRBR) > _ (cr)

Plot:
Printer or plotter output? (1/2) > _(cr)
If "2", then
First or second paper size? (F/S) > _(cr)
90 degree rotation? (Y/N) > _(cr)
End of "2"

Another copy? (Y/N) > _(cr)

ZPLT Zipf's "Law" Plot

The **ZPLT** command is used to plot individual pool sizes by rank with logarithmic vertical and horizontal axes (Zipf, 1949).

Input: Any Type 3 or 4 data sets retrieved from **RTRL.**

Computer Operations:

> Zplt _(cr)

(Graph/Plot/List/Optns/Merge/Clear/Unit/UDI# vs UDI#/Next) > _(cr)

Optns:
(Vert./Horz./% percentiles/# lines plotted) > _(cr)

If "V" (vertical), then
Nature of vertical axis? (LOG/LINear) > _(cr)

If "LIN", then
Data minimum: < > , maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)
# of divisions (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division< >
End of "LIN"

If "LOG", then
Data minimum: < > , maximum: < >
Log axis selected: Start< >, end< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)

Log axis requested: Start< >, end< >, # of division< >
End of "LOG"
End of "V"

If "H", then
Nature of horizontal axis? (LOG/LINear) > _(cr)

If "LIN", then
Data minimum: < > , maximum: < >
Linear axis selected: Start< >, end< >, delta< >, # of division< >

Start (< >) > _(cr)
End (< >) > _(cr)
# of div (< >) > _(cr)

Linear axis requested: Start< >, end< >, delta< >, # of division< >
End of "LIN"

If "LOG", then
Data minimum: < > , maximum: < >
Log axis selected: Start< >, end< >, # of division < >

Start (< >) > _(cr)
End (< >) > _(cr)

Log axis requested: Start< >, end< >, # of division < >
End of "LOG"
End of "H"

If "%" (percentile), then
Upper percentile (< >) > _(cr)
Lower percentile (< >) > _(cr)
End of "%"

If "#" (no. of lines), then
Starting display limit (< >) > _(cr)
Ending display limit (< >) > _(cr)
End of "#"

Unit:
Enter output unit of measurement (Default/SI/BR) > _(cr)

Plot:
Use INPSDR? (Y/N) > _(cr)
Printer or plotter output (1/2) > _(cr)
If "2", then
First or second paper size? (F/S) > _(cr)
90 degree rotation? (Y/N) > _(cr)
End of "2"

Another copy? (Y/N) > _(cr)

BMAP Base Map Generator

The **BMAP** command is used to generate a base map for a number of survey and projection systems, depending on the options chosen.

1. Survey systems include: Dominion Land, National Topographic, Federal permit, and Geodetic co-ordinates.

2. Projection systems include: Lambert, Polyconic, and UTM with assigned reference points. For **PETRIMES** users, the assigned reference points are adopted by other mapping modules.

3. A window of the base map may be chosen.

4. One or more survey systems may appear on a single base map.

Input: Screen input.

Computer Operations:

> BMAP _(cr)

Set up required for INBMAP file? (Y/N) _(cr)
If "N" then the user has set up the parameters through the command, **INBMAP**. iF "Y" then

```
*******************************************************************************
* INBMAP : Input Base Map Polygon definitions
*
* This file is used to store input parameters for the polygon definitions.
*
* In the first row, enter any one of three projection systems (UTM(U), Lambert(L)
* and Polyconic(P)).
*
* In the second row, enter a reference point.  For the UTM and Polyconic projection
* systems, enter a longitude and latitude pair.
*
* For the Lambert projection system, enter a longitude and associated upper and lower latitudes.
* From the third row downwards, enter the survey system code followed by its location,
* separated by blanks.
*
* The system code can be either positive or negative. A positive system code is inclusive
* and a negative system code is exclusive.
*
* System code parameters are:
*
* 1 - DLS system
*         location:  TWP, RANGE, MERIDIAN
*
* 2 - NTS system
*         location:  NTS UNIT, MSHEET, GRID
*
```

```
*  3 - FEDERAL PERMIT
*
*          location: UNIT, SECTION, LATITUDE (DEGREE, MINUTE),
*          LONGITUDE (DEGREE, MINUTE)
*
*  DO NOT enter a "*" in column #1 of a line; otherwise, the
*  program interprets the line as a comment and the data is
*  ignored.
*
*  The base map definitions requires 4 points to be entered.
*********************************************************************************
```

/ The polygon vertex is entered using **KEDIT**.
Note: Use the identical reference points as used in **POLYGON**.
Use four corners to define the boundary of the base map
For example,
1, 70, 1, 5
1, 30, 1, 5
1, 30, 1, 6
1, 70, 1, 6
/E

Operator > _ (cr)
Remarks > _ (cr)
Scale factor? > _(cr)

EIGHT

THE GSC ASSESSMENT PROCEDURES

In this chapter the procedures for mature and immature, or conceptual plays are outlined with examples.

8.1 The Evaluation Procedure-Mature Plays

Procedures are given for the retrieval of well and pool data from **PETRIMES** to be used in resource evaluations. The procedural steps used for assessing petroleum mature plays evolved into a systematic procedures best described by the Westerose gas play from Central Alberta is used to illustrate the procedure.

Step 1. To Enter a Play Boundary

> INPOLY

The following parameters are entered here:
P (Note: Use polyconic projection system)
115 49 (Note: Reference point)
1 044 28 34 04 4 (Note: First polygon)
1 045 28 26 04 4
1 046 28 13 01 4
1 046 27 29 04 4
1 047 27 27 03 4
1 048 27 03 02 4
1 048 27 14 03 4
1 048 27 24 16 4
1 048 26 29 08 4
1 048 25 30 08 4
1 048 25 33 01 4
1 049 25 11 02 4
1 049 25 25 03 4
1 050 25 01 03 4
1 051 25 02 01 4
1 051 25 20 08 4
1 052 25 05 04 4
1 053 25 06 02 4
1 054 25 17 01 4
1 055 25 02 02 4
1 055 24 19 01 4
1 055 24 28 09 4
1 055 24 35 08 4
1 055 23 25 16 4

1 055 22 36 08 4
1 056 21 01 09 4
1 056 20 17 01 4
1 056 20 33 01 4
1 057 20 17 01 4
1 058 21 29 01 4
1 058 22 36 09 4
1 059 22 02 09 4
1 059 22 05 09 4
1 059 22 06 04 4
1 058 23 28 08 4
1 058 24 12 01 4
1 058 24 11 01 4
1 058 24 27 02 4
1 059 24 12 04 4
1 060 23 17 04 4
1 060 23 32 04 4
1 063 24 22 01 4
1 064 24 28 03 4
1 065 24 19 05 4
1 065 26 11 01 4
1 064 26 01 01 4
1 063 25 06 04 4
1 062 26 02 02 4
1 059 25 29 02 4
1 059 25 08 03 4
1 058 26 26 01 4
1 058 26 02 03 4
1 055 26 04 01 4
1 054 26 19 01 4
1 053 26 06 03 4
1 052 27 25 09 4
1 052 27 15 09 4
1 052 27 08 01 4
1 051 27 32 03 4
1 051 27 20 09 4
1 051 27 11 03 4
1 050 27 34 09 4
1 049 27 04 04 4
1 047 28 26 01 4
1 046 01 25 01 5
1 046 01 02 04 5
1 045 01 08 04 5
1 044 01 18 09 5
1 043 02 14 04 5
1 042 02 17 09 5
1 041 03 02 03 5
1 040 03 06 01 5
1 039 04 22 01 5
1 039 04 08 08 5
1 039 05 01 16 5
1 039 05 03 01 5
1 038 05 29 01 5
1 038 05 07 03 5
1 037 06 23 09 5
1 037 06 10 16 5

1 037 06 09 02 5
1 037 06 08 08 5
1 037 07 35 01 5
1 038 07 04 16 5
1 038 07 07 16 5
1 038 08 15 09 5
1 038 09 21 08 5
1 038 10 22 09 5
1 038 10 31 01 5
1 039 11 11 01 5
1 039 11 15 03 5
1 039 11 18 09 5
1 039 12 14 16 5
1 039 12 16 08 5
1 039 12 08 08 5
1 039 12 05 03 5
1 038 12 29 03 5
1 038 12 16 01 5
1 038 12 01 08 5
1 037 10 13 01 5
1 037 09 02 04 5
1 036 08 30 04 5
1 036 08 04 01 5
1 035 08 24 01 5
1 034 07 34 08 5
1 034 06 19 08 5
1 034 06 01 16 5
1 033 05 33 01 5
1 033 05 34 01 5
1 034 05 01 01 5
1 035 03 06 04 5
1 035 03 20 03 5
1 036 03 04 01 5
1 037 03 02 04 5
1 038 03 13 02 5
1 039 03 24 01 5
1 039 02 31 01 5
1 040 02 21 01 5
1 041 02 26 01 5
1 044 01 24 09 5
*
1 028 06 10 03 5 (Note: Second polygon)
1 029 05 09 03 5
1 030 04 20 01 5
1 031 04 11 04 5
1 032 04 02 01 5
1 032 04 35 03 5
1 033 04 10 01 5
1 033 04 20 01 5
1 033 05 25 01 5
1 033 05 28 01 5
1 033 05 31 03 5
1 034 06 09 09 5
1 034 07 24 01 5
1 034 07 28 09 5
1 035 08 28 01 5

1 036 09 27 01 5
1 037 09 05 03 5
1 037 10 10 09 5
1 037 10 17 01 5
1 037 11 12 16 5
1 037 11 12 04 5
1 037 11 01 03 5
1 035 10 32 01 5
1 035 10 01 01 5
1 033 09 01 01 5
1 031 08 01 01 5
1 029 07 14 02 5

> **MAPPING** - to check the polygon entered by displaying the outline of the play polygon.

Step 2a. To Retrieve Pools from the R-data base

> **POOLS**

To retrieve pools belonging to one or more formations
The UPI format is as follows:
CGBVMMMMFFFFFPPPPQQQSHRB
C40272@@@@@@@@@@@@@@@@@@0
(Note: Retrieval of all the pools belonging to the Leduc formation)

> **POLYGON**

To retrieve pools which have been retrieved by the command, **POOLS,** located inside or on the boundary of the given polygon. Do not print all pools, unless required.

>:**PRINT POLYP.OUT**

To print out all pools located within the polygon.

C402-6580-01510-0098-005-1600 N-A BONNIE GLEN, WAB UND
21-00-05-14-046-28-W4-00
C402-6580-08710-0098-005-1600 N-A STRACHAN, WAB UND
21-00-11-27-037-09-W5-00
C402-6580-09430-0098-005-1600 N-A WESTEROSE SOUTH, WAB UND
21-00-12-02-045-01-W5-00
C402-6780-01510-0098-005-1600 N-A BONNIE GLEN, GRAM UND
21-00-05-14-046-28-W4-00
C402-6960-00090-0001-000-1800 S-G ACHESON, D-2 A
21-02-11-11-053-26-W4-00
C402-6960-00090-0002-000-1700 A-G ACHESON, NISKU B
21-02-07-26-052-26-W4-00
C402-6960-00090-0002-000-1800 S-G ACHESON, NISKU B
21-02-07-26-052-26-W4-00

C402-6960-00090-0098-005-1600 N-A ACHESON, NIS UND
21-02-12-27-052-26-W4-00
C402-6960-01510-0001-000-1800 S-G BONNIE GLEN, D-2 A
21-00-02-06-047-27-W4-00
C402-6960-01940-0098-005-1600 N-A CAROLINE, NIS UND
21-00-11-35-033-07-W5-00
C402-6960-04050-0001-000-1800 S-G GARRINGTON, D-2 A
21-00-01-01-035-04-W5-00
C402-6960-04180-0001-000-1700 A-G GLEN PARK, D-2 A
21-02-03-02-049-27-W4-00
C402-6960-04180-0098-005-1600 N-A GLEN PARK, NIS UND
21-00-02-11-049-27-W4-00
C402-6960-04210-0001-000-1700 A-G GOLDEN SPIKE, D-2 A
21-00-09-22-051-27-W4-00
C402-6960-04210-0001-000-1800 S-G GOLDEN SPIKE, D-2 A
21-00-09-22-051-27-W4-00
C402-6960-04210-0002-000-1700 A-G GOLDEN SPIKE, NISKU B
21-02-11-34-051-27-W4-00
C402-6960-04210-0002-000-1800 S-G GOLDEN SPIKE, NISKU B
21-02-11-34-051-27-W4-00
C402-6960-04700-0098-005-1600 N-A HOMEGLEN-RIMBEY, NIS UND
21-00-09-02-043-02-W5-00
C402-6960-05510-0001-000-1700 A-G LEDUC-WOODBEND, D-2 A
21-00-08-34-050-26-W4-00
C402-6960-05510-0001-000-1800 S-G LEDUC-WOODBEND, D-2 A
21-00-08-34-050-26-W4-00
C402-6960-05510-0002-000-1800 S-G LEDUC-WOODBEND, NISKU B
21-03-05-25-049-26-W4-00
C402-6960-05510-0003-000-1800 S-G LEDUC-WOODBEND, NISKU C
21-00-13-07-049-26-W4-00
C402-6960-05510-0005-000-1800 S-G LEDUC-WOODBEND, NISKU E
21-00-11-13-050-27-W4-00
C402-6960-07850-0098-005-1600 N-A RICINUS, NIS UND
21-00-08-19-034-07-W5-00
C402-6960-07850-0098-010-1600 N-A RICINUS, NIS UND
21-00-06-32-032-06-W5-00
C402-6960-09410-0098-005-1600 N-A WESTEROSE, NIS UND
21-00-06-03-046-28-W4-00
C402-6960-09850-0001-000-1700 A-G WIZARD LAKE, D-2 A
21-00-12-22-048-27-W4-00
C402-6960-09850-0001-000-1800 S-G WIZARD LAKE, D-2 A
21-00-12-22-048-27-W4-00
C402-7200-00090-0001-000-1700 A-G ACHESON, D-3 A
21-00-10-11-053-26-W4-00
C402-7200-00090-0001-000-1800 S-G ACHESON, D-3 A
21-00-10-11-053-26-W4-00
C402-7200-01510-0001-000-1700 A-G BONNIE GLEN, D-3 A

21-00-03-20-047-27-W4-00
C402-7200-01510-0001-000-1800 S-G BONNIE GLEN, D-3 A
21-00-03-20-047-27-W4-00
C402-7200-01510-0002-000-1600 N-A BONNIE GLEN, D-3 B
21-00-09-14-046-28-W4-00
C402-7200-01940-0001-000-1600 N-A CAROLINE, D-3 A
21-00-10-03-034-06-W5-00
C402-7200-01940-0098-010-1600 N-A CAROLINE, LED UND
21-00-11-35-033-07-W5-00
C402-7200-02260-0001-000-1600 N-A CHEDDERVILLE, D-3 A
21-00-16-19-037-07-W5-00
C402-7200-02260-0002-000-1600 N-A CHEDDERVILLE, D-3 B
21-00-15-27-037-07-W5-00
C402-7200-04050-0001-000-1600 N-A GARRINGTON, D-3 A
21-00-11-33-034-04-W5-00
C402-7200-04050-0002-000-1600 N-A GARRINGTON, D-3 B
21-00-02-23-035-04-W5-00
C402-7200-04050-0003-000-1600 N-A GARRINGTON, D-3 C
21-00-11-36-035-04-W5-00
C402-7200-04050-0004-000-1700 A-G GARRINGTON, D-3 D
21-00-11-31-035-03-W5-00
C402-7200-04050-0004-000-1800 S-G GARRINGTON, D-3 D
21-00-11-31-035-03-W5-00
C402-7200-04050-0005-000-1600 N-A GARRINGTON, D-3 E
21-00-15-25-035-04-W5-00
C402-7200-04050-0098-020-1600 N-A GARRINGTON, LED UND
21-00-16-11-037-05-W5-00
C402-7200-04180-0001-000-1800 S-G GLEN PARK, D-3 A
21-00-10-02-049-27-W4-00
C402-7200-04180-0002-000-1800 S-G GLEN PARK, D-3 B
21-00-02-11-049-27-W4-00
C402-7200-04210-0001-000-1700 A-G GOLDEN SPIKE, D-3 A
21-00-09-22-051-27-W4-00
C402-7200-04210-0001-000-1800 S-G GOLDEN SPIKE, D-3 A
21-00-09-22-051-27-W4-00
C402-7200-04210-0002-000-1800 S-G GOLDEN SPIKE, D-3 B
21-00-11-26-051-27-W4-00
C402-7200-04500-0001-000-1600 N-A HARMATTAN-ELKTON, D-3 A
21-00-04-15-032-04-W5-00
C402-7200-04700-0000-000-1700 A-G HOMEGLEN-RIMBEY, D-3
21-00-03-29-043-01-W5-00
C402-7200-04700-0000-000-1800 S-G HOMEGLEN-RIMBEY, D-3
21-00-03-29-043-01-W5-00
C402-7200-04700-0002-000-1700 A-G HOMEGLEN-RIMBEY, D-3 B
21-00-06-22-042-02-W5-00
C402-7200-04700-0002-000-1800 S-G HOMEGLEN-RIMBEY, D-3 B
21-00-06-22-042-02-W5-00

C402-7200-05440-0001-000-1700 A-G LANAWAY, D-3 A
21-00-07-31-036-03-W5-00
C402-7200-05440-0002-000-1600 N-A LANAWAY, D-3 B
21-00-08-30-036-03-W5-00
C402-7200-05440-0003-000-1600 N-A LANAWAY, D-3 C
21-02-16-01-036-04-W5-00
C402-7200-05440-0098-010-1600 N-A LANAWAY, LED UND
21-02-16-01-036-04-W5-00
C402-7200-05510-0001-000-1700 A-G LEDUC-WOODBEND, D-3 A
21-00-05-22-050-26-W4-00
C402-7200-05510-0001-000-1800 S-G LEDUC-WOODBEND, D-3 A
21-00-05-22-050-26-W4-00
C402-7200-05510-0002-000-1700 A-G LEDUC-WOODBEND, D-3 B
21-00-10-33-049-26-W4-00
C402-7200-05510-0002-000-1800 S-G LEDUC-WOODBEND, D-3 B
21-00-10-33-049-26-W4-00
C402-7200-05510-0003-000-1800 S-G LEDUC-WOODBEND, D-3 C
21-00-11-01-050-27-W4-00
C402-7200-05510-0004-000-1800 S-G LEDUC-WOODBEND, D-3 D
21-00-10-13-050-27-W4-00
C402-7200-05510-0005-000-1700 A-G LEDUC-WOODBEND, D-3 E
21-00-01-11-050-26-W4-00
C402-7200-05510-0005-000-1800 S-G LEDUC-WOODBEND, D-3 E
21-00-01-11-050-26-W4-00
C402-7200-05510-0006-000-1800 S-G LEDUC-WOODBEND, D-3 F
21-00-03-14-050-26-W4-00
C402-7200-06040-0098-005-1600 N-A MEDICINE RIVER, LED UND
21-00-11-27-038-03-W5-00
C402-7200-06040-0098-085-1600 N-A MEDICINE RIVER, LED UND
21-02-08-14-038-05-W5-00
C402-7200-06200-0002-000-1800 S-G MORINVILLE, D-3 B
21-00-04-19-054-25-W4-00
C402-7200-07700-0000-000-1700 A-G REDWATER, D-3
21-00-01-32-057-21-W4-00
C402-7200-07700-0000-000-1800 S-G REDWATER, D-3
21-00-01-32-057-21-W4-00
C402-7200-07850-0001-000-1600 N-A RICINUS, D-3 A
21-00-07-19-035-08-W5-00
C402-7200-07850-0002-000-1600 N-A RICINUS, D-3 B
21-00-07-15-034-08-W5-00
C402-7200-07860-0001-000-1600 N-A RICINUS WEST, D-3 A
21-00-06-25-036-10-W5-00
C402-7200-08040-0002-000-1800 S-G ST ALBERT-BIG LAKE, D-3 B
21-00-14-36-053-26-W4-00
C402-7200-08710-0001-000-1600 N-A STRACHAN, D-3 A
21-00-06-33-037-09-W5-00
C402-7200-08710-0002-000-1600 N-A STRACHAN, D-3 B

21-00-14-02-038-10-W5-00
C402-7200-08710-0003-000-1600 N-A STRACHAN, D-3 C
21-00-11-28-037-08-W5-00
C402-7200-08710-0003-000-8600 N-A STRACHAN, D-3 C
21-00-11-28-037-08-W5-00
C402-7200-08910-0001-000-1700 A-G SYLVAN LAKE, D-3 A
21-00-06-17-037-03-W5-00
C402-7200-08910-0001-000-1800 S-G SYLVAN LAKE, D-3 A
21-00-06-17-037-03-W5-00
C402-7200-08910-0002-000-1700 A-G SYLVAN LAKE, D-3 B
21-00-16-32-037-04-W5-00
C402-7200-08910-0098-005-1600 N-A SYLVAN LAKE, LED UND
21-00-07-02-038-04-W5-00
C402-7200-09410-0000-000-1700 A-G WESTEROSE, D-3
21-00-12-34-045-28-W4-00
C402-7200-09410-0000-000-1800 S-G WESTEROSE, D-3
21-00-12-34-045-28-W4-00
C402-7200-09430-0001-000-1600 N-A WESTEROSE SOUTH, D-3 A
21-00-12-25-044-01-W5-00
C402-7200-09850-0001-000-1700 A-G WIZARD LAKE, D-3 A
21-00-12-22-048-27-W4-00
C402-7200-09850-0001-000-1800 S-G WIZARD LAKE, D-3 A
21-00-12-22-048-27-W4-00
C402-7320-07860-0001-000-1600 N-A RICINUS WEST,COOKING LAKE A
21-00-07-09-037-10-W5-00

Step 2b. To Retrieve Wells from the W-data base

> WELLS

The retrieval statement is the UWI formats of different survey systems as:

For DLS: P1OOLLSSTTTRRWM0QD
For NTS: 1200QUUUBNNNMGGS0D

> POLYGON

To retrieve all wells belonging to the polygon. Please do not print all wells unless it is necessary.
The wells retrieved are stored in the disk files: POLYWDSK.<uai>.

Step 3. To Retrieve Formation Tops

> FORMATION

To retrieve wells penetrate into the Leduc formation and also lie within the polygon. The GSC 5-digit codes are from (14350, 14330) (Note: top of Ireton to Dunvernay) to

(14330, 13420) (Note: top of Dunvernay to top of Waterways).

Step 4. To Construct a Time Series - Wells and Pools

> RISK

The **RISK** module combines the wells from **FORMATION** and the pools from **POLYGON** to construct a time series for petroleum assessments. This series consists of all failure wildcat wells and DST recoveries of failed wells, pools in-place and recoverable volumes. The output from **RISK** can be displayed by **DMAP.**

> DMAP

The **DMAP** module allows us to display the complete spatial distribution or a specific time window (e.g. from 1980 to 1989) of the exploration results.

> DPLT

The **DPLT** module allows us to construct a time series for oil or/and gas vs the number of wildcat wells.

> CDPLT

The **CDPLT** module allows us to construct cumulative additions for oil and/or gas resources vs wildcat wells.

Step 5. To Print DST Tests Belonging to the Formation and Polygon

> DST

The **DST** module allows us to print all DST recoveries in order to examine whether there are any significant recoveries. These significant discoveries should be used together with the pool sizes from pools designated by the provincial governments.

Step 6. To Transfer Data from the R-Data Base to the PD-Data Base

> TODIGIT

The **TODIGIT** module allows us to retrieve specific pool parameters from the R-data base and format the data retrieved into **DIGIT**'s format as follows:

(1) Enter either O, G, B, or H for oil, gas, oil and gas, or hydrocarbon.

(2) If it is hydrocarbon, then it can be the pore volume at the reservoir condition (i.e. trap size), or gas converted into oil equivalent volume (i.e. barrels using the conversion factor stated in the Section **TODIGIT** of Chapter 4.

(3) Choice of individual, largest pool size, or sum of pool sizes within the same pool sequence code.

(4) Choice of pools output from either the output of **POOLS** or **POLYGON**.

> DIGIT

The **DIGIT** module allows us to enter pool parameters into the **PD-data base** as follows:

(1) Enter from the screen. Users apply either **KEDIT** to enter data.

(2) Enter data from another disk file such as **TODIGIT** output, then users apply **KEDIT** to transfer data into **PD-data** base as follows:

Use **KEDIT** to copy \PETRIMES\UAI\<uai>\TODIGIT.OUT into **DIGIT** as follows:

(1) Move the cursor to the line where you want to add the data
(2) Press key F5
(3) Press key Home
(4) Type: get todigit.out 1 *
(5) Type: file
(6) Update the data into PD-data base.

Step 7. To Retrieve UDI's From the PD-Data Base

> RTRL

To retrieve all UDIs from one or more UAIs as follows:

(1) To set-up the retrieval statement
(2) To retrieve all UDIs specified
(3) To examine all UDIs retrieved (optional).

Note: Only the UDIs are retrieved and stored in the file, RTRL.OUT. All graphic modules and evaluation modules shall choose one or more UDIs for analyses.

Step 8. To Display the Data Stored in PD-data base and Retrieved by RTRL

> LPLT

To display Type 3 or 1 data such as pool size, pool area, net pay, or porosity on a log

probability graph in order to examine the linearity of the plot as the results of

1. Mixed populations
2. Data that do not obey a lognormal distribution
3. Data that are not randomly drawn from their population
4. Sample size being too small
5. Any combination of the above.

The statistical assumption required by the log probability plot is that the data are randomly drawn from a normal or lognormal distribution. If the plot shows a more or less straight line, then there is ***no evidence to negate*** the facts mentioned above (from item 1 to 4).

> XPLT

To construct a cross-plot in order to examine relationships between variables. For example, a cross-plot of pool area and pool size reveals how large a pool area required for a certain pool size.

> DSEQ

The discovery sequence plot provides information about the exploration efficiency (β value) of the play. This information is used for initial β values entered into the **LDSCV** or **NDSCV** modules.

> BPLT

To use boxplots to examine outliers of normality of a given data set.

Note: Other graphic modules can be use to perform a exploratory data analysis which may lead to understand the nature of the data belonging to a play.

Step 9. To Estimate Pool Size Distribution

> LDSCV

To apply the lognormal discovery process model to estimate the μ and σ^2 of a lognormal superpopulation pool size distribution.

Explanations of the output are as follows:

(1) Printout the input parameters and data used

```
PETRIMES MODULE LDSCV

ESTIMATION OF POOL SIZE DISTRIBUTION
UNDER PPSWOR DISCOVERY MODEL: (LOGNORMAL)
*****************************************
UAI        C4119102
Assessor   Devonian Assessment Group
Geologist  Fred Trollope
```

```
Operator  hp
Remarks   Western Canada Gas Assessment Project test
Run date  91/02/25 (MON,  4:27 PM)


A) Basic Information
--------------------
TYPE OF RESOURCE         =Gas In Place
SYSTEM OF MEASUREMENT    =S.I.
UNIT OF MEASUREMENT      =M cu m  (19)
ESTIMATED INTERVAL
FOR THE MLE OF BETA      =<  .0000,  .8000>

B) Discovery Sequence
---------------------

YEAR  MONTH  DATE  POOL SIZE  CUMULATIVE
----  -----  ----  ---------  ----------
46      11     20    17538.     17538.
48       2     19    449.00     17987.
48       7     23    6831.0     24818.
48      11     25    4767.0     29585.
49      11      2    6.0000     29591.
50       5      5    12.000     29603.
50       7     11    50.000     29653.
51       3     14    7303.0     36956.
51       9     16    31728.     68684.
51      12     29    494.00     69178.
52       3      2    2679.0     71857.
52       7      9    381.00     72238.
52      10     25    33047.     .10529E+06
53       1      5    8743.0     .11403E+06
53       1     20    128.00     .11416E+06
53       9     19    148.00     .11430E+06
53      11      6    52006.     .16631E+06
55      11      5    68.000     .16638E+06
60       6      5    199.00     .16658E+06
61       2     21    13400.     .17998E+06
61      10     14    1586.0     .18156E+06
62       6     10    166.00     .18173E+06
64       6      5    172.00     .18190E+06
67       7     10    40741.     .22264E+06
67       8     16    36.000     .22268E+06
67       9     29    2078.0     .22476E+06
68       7     30    11668.     .23642E+06
68       9     11    97.000     .23652E+06
68      10     23    540.00     .23706E+06
69       3     30    194.00     .23726E+06
69       6     22    49494.     .28675E+06
70       6     19    1516.0     .28827E+06
70       9     22    262.00     .28853E+06
71      11     30    2246.0     .29077E+06
72       1     21    2833.0     .29361E+06
72       6      1    87.000     .29369E+06
83       7     24    248.00     .29394E+06
83      10     12    14.000     .29396E+06
84       3     31    18.000     .29397E+06
84       9     30    400.00     .29437E+06
84       9     30    52.000     .29443E+06
85       9     21    866.00     .29529E+06
86       9      4    117.00     .29541E+06
86      10     22    129.00     .29554E+06
86      12      6    340.00     .29588E+06
86      12     23    1123.0     .29700E+06
86      12     25    186.00     .29719E+06
87       8      6    350.00     .29754E+06
-----------------------------------------

NO. OF DISCOVERIES = 48

RANGE FOR NO. OF POOLS YET
TO BE DISCOVERED = 2 TO 252
RANDOM SAMPLING ESTIMATES OF
MU           = 6.4579
SIGMA SQUARE = 5.6679

(2) The intermediate output.

The following output records the estimates for each maximization step.
**************************************************
* Global Maximum Likelihood Estimation for N=   190 *
**************************************************

----------------------------------------

GLOBAL: N=   190 & BETA=    .3056
```

```
---------------------------------
Statistics
----------
Initial estimates of mu & sig. sq.   =  4.345090      7.316265
MLE of mu and sigma square           =  4.946345      6.215402
Max. loglikelihood                   = -514.6094
-------------------------------------------------------
GLOBAL: N=   190 & BETA=    .4944
---------------------------------
Statistics
----------
Initial estimates of mu & sig. sq.   =  4.946345      6.215402
MLE of mu and sigma square           =  3.999371      7.746208
Max. loglikelihood                   = -514.2029
-------------------------------------------------------
GLOBAL: N=   190 & BETA=    .6111
---------------------------------
Statistics
----------
Initial estimates of mu & sig. sq.   =  3.999371      7.746208
MLE of mu and sigma square           =  3.791162      8.006072
Max. loglikelihood                   = -516.2353
-------------------------------------------------------
GLOBAL: N=   190 & BETA=    .4168
---------------------------------
Statistics
----------
Initial estimates of mu & sig. sq.   =  3.791162      8.006072
MLE of mu and sigma square           =  4.339872      7.112409
Max. loglikelihood                   = -514.0758
-------------------------------------------------------
GLOBAL: N=   190 & BETA=    .4316
---------------------------------
Statistics
----------
Initial estimates of mu & sig. sq.   =  4.339872      7.112409
MLE of mu and sigma square           =  4.264836      7.248559
Max. loglikelihood                   = -514.0487
-------------------------------------------------------
GLOBAL: N=   190 & BETA=    .4408
---------------------------------
Statistics
----------
Initial estimates of mu & sig. sq.   =  4.264836      7.248559
MLE of mu and sigma square           =  4.219943      7.331731
Max. loglikelihood                   = -514.0418
-------------------------------------------------------
GLOBAL: N=   190 & BETA=    .4444
---------------------------------
Statistics
----------
Initial estimates of mu & sig. sq.   =  4.219943      7.331731
MLE of mu and sigma square           =  4.202823      7.363720
Max. loglikelihood                   = -514.0414
-------------------------------------------------------
GLOBAL: N=   190 & BETA=    .4434
---------------------------------
Statistics
----------
Initial estimates of mu & sig. sq.   =  4.202823      7.363720
MLE of mu and sigma square           =  4.207535      7.354902
Max. loglikelihood                   = -514.0414
-------------------------------------------------------
GLOBAL: N=   190 & BETA=    .4424
---------------------------------
Statistics
----------
Initial estimates of mu & sig. sq.   =  4.207535      7.354902
MLE of mu and sigma square           =  4.212268      7.346055
Max. loglikelihood                   = -514.0415
Summary of Max. Likelihood for N=   190
---------------------------------------
MLE of beta                          =  .4434148
MLE of mu & sigma square             =  4.207535      7.354902
Maximum log-likelihood               = -514.0414
Asym 95% ci for mu                   =  2.955688      5.459382
Asym 95% ci for sigma square         =  3.793211      12.08513

GROUPED DISTRIBUTION
--------------------
CLASS                                                NO. OF POOLS
INTERVAL                  PROB.      DISCOVERED      UNDISCOVERED   TOTAL
-------------------------------------------------------------------------
LESS THAN-      1.0       .0603963   0               11             11
1.0      -     10.0       .1808132   1               33             34
```

10.0	- 100.0	.3170749	9	51	60	
100.0	- 1000.0	.2820077	19	34	53	
1000.0	- 10000.0	.1271671	11	13	24	
10000.0	- 1000000.0	.0290080	8	0	8	
TOTAL			1.0	48	142	190

Note: The group distribution is computed using the superpopulation pool size distribution and the total number of pools in a play (i.e. N). The number of undiscovered pools in each size class is computed by the substraction of total number of pools within a size class and the number of discovered pools.

(3) The summary of the final analysis. The estimates of μ and σ^2 are point estimates of the pool size distribution. This output shall be input to the module, **MATCH**.

```
**************************************************
* Summary of Marginal Log Likelihood for fixed N *
**************************************************
```

N	beta	mu	sig. sq.	log likelihood	eror
50	.1842	6.355	5.746	-513.652900	0
70	.2959	5.670	6.570	-513.452900	0
90	.3422	5.243	6.898	-513.598800	0
110	.3728	4.936	7.077	-513.725000	0
130	.3959	4.698	7.189	-513.827100	0
150	.4146	4.505	7.264	-513.911100	0
170	.4300	4.345	7.316	-513.981400	0
190	.4434	4.208	7.355	-514.041400	0
210	.4549	4.089	7.381	-514.093400	0
230	.4652	3.984	7.402	-514.139000	0
250	.4752	3.887	7.423	-514.179400	0
270	.4837	3.803	7.435	-514.215600	0
290	.4912	3.727	7.442	-514.248300	0

Note: If eror (error) = 3 or higher, then the computation is incorrect.

> NDSCV

To apply the nonparametric discovery process model to estimate the empirical distribution, mean, and variance of a superpopulation pool size distribution.

Explanations of the output are as follows:

(1) Printout the input parameters and data used.

```
PETRIMES MODULE NDSCV

ESTIMATION OF POOL SIZE DISTRIBUTION
UNDER PPSWOR DISCOVERY MODEL: NONPARAMETRIC
*******************************************

UAI         C4119102
Assessor    Devonian Assessment Group
Geologist   Fred Trollope
Operator    pjl
Remarks     Western Canada Gas Assessment Project
system documentation
Run date    91/04/03 (WED,  3:00 PM)


A) Basic Information
--------------------
TYPE OF RESOURCE       =Gas In Place
SYSTEM OF MEASUREMENT =S.I.
UNIT OF MEASUREMENT    =M cu m  (19)
RANGE FOR BETA         =  .2000+(j-1)*  .1000 j=1,2,..  7

B) Discovery Sequence
---------------------

YEAR MONTH DATE  POOL SIZE     CUMULATIVE
---- ----- ----  ----------    ----------
46   11    20    17538.         17538.
```

```
48    2    19    449.00        17987.
48    7    23    6831.0        24818.
48   11    25    4767.0        29585.
49   11     2    6.0000        29591.
50    5     5    12.000        29603.
50    7    11    50.000        29653.
51    3    14    7303.0        36956.
51    9    16    31728.        68684.
51   12    29    494.00        69178.
52    3     2    2679.0        71857.
52    7     9    381.00        72238.
52   10    25    33047.        .10529E+06
53    1     5    8743.0        .11403E+06
53    1    20    128.00        .11416E+06
53    9    19    148.00        .11430E+06
53   11     6    52006.        .16631E+06
55   11     5    68.000        .16638E+06
60    6     5    199.00        .16658E+06
61    2    21    13400.        .17998E+06
61   10    14    1586.0        .18156E+06
62    6    10    166.00        .18173E+06
64    6     5    172.00        .18190E+06
67    7    10    40741.        .22264E+06
67    8    16    36.000        .22268E+06
67    9    29    2078.0        .22476E+06
68    7    30    11668.        .23642E+06
68    9    11    97.000        .23652E+06
68   10    23    540.00        .23706E+06
69    3    30    194.00        .23726E+06
69    6    22    49494.        .28675E+06
70    6    19    1516.0        .28827E+06
70    9    22    262.00        .28853E+06
71   11    30    2246.0        .29077E+06
72    1    21    2833.0        .29361E+06
72    6     1    87.000        .29369E+06
83    7    24    248.00        .29394E+06
83   10    12    14.000        .29396E+06
84    3    31    18.000        .29397E+06
84    9    30    400.00        .29437E+06
84    9    30    52.000        .29443E+06
85    9    21    866.00        .29529E+06
86    9     4    117.00        .29541E+06
86   10    22    129.00        .29554E+06
86   12     6    340.00        .29588E+06
86   12    23    1123.0        .29700E+06
86   12    25    186.00        .29719E+06
87    8     6    350.00        .29754E+06
-----------------------------------------

NO. OF DISCOVERIES =  48

RANGE FOR NO. OF POOLS YET
TO BE DISCOVERED              =  52 TO 202

RANDOM SAMPLING ESTIMATES OF
MU           = 6.4579
SIGMA SQUARE = 5.6679
```

2. The intermediate output for one N and one β:

```
58) MAXIMUM LIKELIHOOD ESTIMATION FOR N = 190 AND BETA =    .50
-----------------------------------------------
SUMMARY OF NP MAXIMUM LIKELIHOOD ESTIMATION
*******************************************

UDI                          = NOT IN DB
NO. OF POOLS IN PLAY         =   190
NO. OF DISCOVERIES           =    48
BETA                         =     .50
NP LOG-LIKELIHOOD AT MLE     = -324.2898

Note: The following lognormal approximation is applied to the ungrouped distribution.

LOGNORMAL APPROXIMATION OF POOL SIZE DISTRIBUTION
-------------------------------------------------
SUMMARY      MU      = 4.4847     E(X)    = 1905.2
STATISTICS   SIG.SQ.= 6.1353     S.D.(X)= 40901.
QQ CORR= .97962     QQ UDI = NOT IN DB

UPPER  99.99% = .88514E-02 60.00% = 47.330 15.00% = 1155.0
PERCENTILES 99.00% = .27871     55.00% = 64.936 10.00% = 2119.7
95.00% = 1.5075     50.00% = 88.647  8.00% = 2878.3
90.00% = 3.7074     45.00% = 121.02  6.00% = 4170.4
85.00% = 6.8037     40.00% = 166.03  5.00% = 5212.9
80.00% = 11.023     35.00% = 230.23  4.00% = 6775.3
```

75.00% = 16.676 30.00% = 324.92 2.00% = 14353.
70.00% = 24.185 25.00% = 471.23 1.00% = 28196.
65.00% = 34.132 20.00% = 712.89 .01% =.88781E+06

Note: The following distribution is obtained from the ungrouped distribution.

EMPIRICAL POOL SIZE DISTRIBUTION

SUMMARY STATISTICS MU = 4.6336 SIG.SQ.= 4.4001 E(X) = 1759.5 S.D.(X)= 7047.0

UPPER PERCENTILES 99.99% = .57800E-02 99.00% = .57800 95.00% = 2.8900 90.00% = 5.7800 85.00% = 9.7484 80.00% = 12.649 75.00% = 14.239 70.00% = 17.529 65.00% = 35.641 60.00% = 50.632 55.00% = 64.200 50.00% = 91.759 45.00% = 121.50 40.00% = 138.22 35.00% = 170.55 30.00% = 194.89 25.00% = 259.65 20.00% = 379.84 15.00% = 514.17 10.00% = 1717.3 8.00% = 2545.9 6.00% = 5709.7 5.00% = 7353.2 4.00% = 10774. 2.00% = 32067. 1.00% = 41793. .01% = 51959.

3. The nonparametric pool size distribution.

This distribution may be used for probability distributional assumption test by **QPLT** (The value under the column LPSD). The probability values under the heading "PROB" are the probabilities for each pool size class (including the discovered and undiscovered pools).

NONPARAMETRIC POOL SIZE DISTRIBUTION

NO.	POOL SIZE	PROB.	LPSD
1	6.0000	.104	.896
2	12.000	.739E-01	.822
3	14.000	.686E-01	.754
4	18.000	.608E-01	.693
5	36.000	.437E-01	.649
6	50.000	.375E-01	.612
7	52.000	.368E-01	.575
8	68.000	.325E-01	.542
9	87.000	.291E-01	.513
10	97.000	.277E-01	.485
11	117.00	.255E-01	.460
12	128.00	.245E-01	.436
13	129.00	.244E-01	.411
14	148.00	.230E-01	.388
15	166.00	.218E-01	.366
16	172.00	.215E-01	.345
17	186.00	.208E-01	.324
18	194.00	.204E-01	.304
19	199.00	.202E-01	.283
20	248.00	.184E-01	.265
21	262.00	.180E-01	.247
22	340.00	.162E-01	.231
23	350.00	.160E-01	.215
24	381.00	.154E-01	.199
25	400.00	.151E-01	.184
26	449.00	.145E-01	.170
27	494.00	.139E-01	.156
28	540.00	.135E-01	.142
29	866.00	.113E-01	.131
30	1123.0	.103E-01	.121
31	1516.0	.935E-02	.111
32	1586.0	.922E-02	.102
33	2078.0	.849E-02	.938E-01
34	2246.0	.830E-02	.855E-01
35	2679.0	.790E-02	.776E-01
36	2833.0	.779E-02	.698E-01
37	4767.0	.687E-02	.629E-01
38	6831.0	.639E-02	.565E-01
39	7303.0	.631E-02	.502E-01
40	8743.0	.613E-02	.441E-01
41	11668.	.588E-02	.382E-01
42	13400.	.578E-02	.324E-01
43	17538.	.563E-02	.268E-01
44	31728.	.541E-02	.214E-01
45	33047.	.540E-02	.160E-01
46	40741.	.535E-02	.106E-01
47	49494.	.532E-02	.532E-02
48	52006.	.532E-02	.000

GROUPED DISTRIBUTION

CLASS NO. OF POOLS

INTERVAL			PROB	DISCOVERED	UNDISCOVERED	TOTAL
1.0	-	10.0	.1038054	1	19	20
10.0	-	100.0	.4107098	9	69	78
100.0	-	1000.0	.3543354	19	48	67
1000.0	-	10000.0	.8706484E-01	11	6	17
	>	10000.0	.4408455E-01	8	0	8
TOTAL			1.0	48	132	180

4. The summary of the final analysis.

The estimates of μ and σ^2 are the point estimates of the pool size distribution. The μ and σ^2 are the logarithmic mean and variance of the empirical distribution.

N	BETA	MU	SIG.SQ.	LogL
100	.20000	5.7364	5.2012	-325.19340
100	.30000	5.4556	5.1926	-324.41360
100	.40000	5.2646	5.2824	-324.11190
100	.50000	5.1665	5.3406	-325.14200
100	.60000	5.1318	5.3221	-328.03130
100	.70000	5.1308	5.2547	-332.83570
100	.80000	5.1437	5.1715	-339.36030
110	.20000	5.7001	5.1441	-325.32200
110	.30000	5.3965	5.0869	-324.55520
110	.40000	5.1796	5.1431	-324.11650
110	.50000	5.0634	5.1892	-324.85050
110	.60000	5.0215	5.1628	-327.38700
110	.70000	5.0199	5.0860	-331.85640
110	.80000	5.0352	4.9931	-338.09390
120	.20000	5.6716	5.0972	-325.42800
120	.30000	5.3500	4.9975	-324.68500
120	.40000	5.1109	5.0197	-324.15460
120	.50000	4.9775	5.0518	-324.64840
120	.60000	4.9282	5.0176	-326.87810
120	.70000	4.9259	4.9326	-331.04780
120	.80000	4.9435	4.8310	-337.02510
130	.20000	5.6485	5.0582	-325.51670
130	.30000	5.3126	4.9217	-324.80220
130	.40000	5.0548	4.9110	-324.21120
130	.50000	4.9049	4.9279	-324.50860
130	.60000	4.8479	4.8861	-326.46880
130	.70000	4.8447	4.7939	-330.36760
130	.80000	4.8646	4.6848	-336.10590
140	.20000	5.6294	5.0252	-325.59190
140	.30000	5.2821	4.8568	-324.90720
140	.40000	5.0081	4.8151	-324.27750
140	.50000	4.8428	4.8163	-324.41330
140	.60000	4.7781	4.7671	-326.13510
140	.70000	4.7736	4.6686	-329.78690
150	.20000	5.6134	4.9970	-325.65650
150	.30000	5.2566	4.8010	-325.00140
150	.40000	4.9691	4.7305	-324.34830
150	.50000	4.7892	4.7157	-324.35070
150	.60000	4.7166	4.6594	-325.86010
150	.70000	4.7106	4.5554	-329.28540
160	.20000	5.5998	4.9726	-325.71250
160	.30000	5.2352	4.7525	-325.08610
160	.40000	4.9359	4.6556	-324.42030
160	.50000	4.7425	4.6249	-324.31240
160	.60000	4.6621	4.5617	-325.63170
160	.70000	4.6544	4.4527	-328.84820
170	.20000	5.5881	4.9514	-325.76150
170	.30000	5.2168	4.7100	-325.16220
170	.40000	4.9076	4.5891	-324.49170
170	.50000	4.7016	4.5427	-324.29220
170	.60000	4.6133	4.4727	-325.44090
170	.70000	4.6036	4.3593	-328.46410
180	.20000	5.5779	4.9327	-325.80470
180	.30000	5.2010	4.6727	-325.23100
180	.40000	4.8833	4.5297	-324.56120
180	.50000	4.6655	4.4680	-324.28580
180	.60000	4.5693	4.3914	-325.28070
180	.70000	4.5575	4.2741	-328.12420
190	.20000	5.5689	4.9161	-325.84310
190	.30000	5.1873	4.6396	-325.29340
190	.40000	4.8621	4.4765	-324.62820
190	.50000	4.6336	4.4001	-324.28980
190	.60000	4.5295	4.3170	-325.14590
190	.70000	4.5153	4.1961	-327.82190
200	.20000	5.5610	4.9013	-325.87750
200	.30000	5.1752	4.6100	-325.35020
200	.40000	4.8436	4.4287	-324.69230
200	.50000	4.6052	4.3381	-324.30170

200	.60000	4.4933	4.2486	-325.03210
200	.70000	4.4766	4.1244	-327.55160
210	.20000	5.5539	4.8880	-325.90840
210	.30000	5.1645	4.5835	-325.40200
210	.40000	4.8274	4.3856	-324.75340
210	.50000	4.5798	4.2814	-324.31970
210	.60000	4.4602	4.1855	-324.93600
210	.70000	4.4409	4.0583	-327.30890
220	.20000	5.5475	4.8760	-325.93640
220	.30000	5.1549	4.5597	-325.44950
220	.40000	4.8130	4.3465	-324.81160
220	.50000	4.5570	4.2293	-324.34220
220	.60000	4.4299	4.1273	-324.85490
220	.70000	4.4077	3.9971	-327.09020
230	.20000	5.5418	4.8652	-325.96180
230	.30000	5.1464	4.5380	-325.49310
230	.40000	4.8002	4.3109	-324.86670
230	.50000	4.5366	4.1814	-324.36800
230	.60000	4.4020	4.0733	-324.78660
230	.70000	4.3769	3.9404	-326.89240
240	.20000	5.5366	4.8553	-325.98500
240	.30000	5.1387	4.5184	-325.53330
240	.40000	4.7888	4.2785	-324.91890
240	.50000	4.5181	4.1372	-324.39640
240	.60000	4.3763	4.0231	-324.72920
240	.70000	4.3481	3.8877	-326.71300
250	.20000	5.5319	4.8462	-326.00620
250	.30000	5.1317	4.5004	-325.57040
250	.40000	4.7785	4.2488	-324.96840
250	.50000	4.5014	4.0964	-324.42660
250	.60000	4.3525	3.9764	-324.68110
250	.70000	4.3211	3.8385	-326.54980

Step 10. The Matching Process

> INMATCH

The point estimates from the **LDSCV** or **NDSCV** may be entered here in order to examine which combination of N, μ, and σ^2 will yield "best" match the discovered pool sizes. This input will be used in the module, **MATCH**. For example, the point estimates may be entered here or created by **LDSCV** as follows:

* N	MU	sigma square	unit for mu	beta
* 50	6.355	5.746	19	.1842
* 70	5.670	6.570	19	.2959
* 90	5.243	6.898	19	.3422
* 110	4.936	7.077	19	.3728
* 130	4.698	7.189	19	.3959
* 150	4.505	7.264	19	.4146
* 170	4.345	7.316	19	.4300
* 190	4.208	7.355	19	.4434
* 210	4.089	7.381	19	.4549
* 230	3.984	7.402	19	.4652
* 250	3.887	7.423	19	.4752
* 270	3.803	7.435	19	.4837
* 290	3.727	7.442	19	.4912

> MATCH

Criteria for choosing the "best" or an acceptable match are explained as follows:

or

1. The final match should be consistent with the Group Distributions either from **LDSCV NDSCV.**

2. Run the input from **INMATCH** to examine which combination of N, μ, and σ^2 can match most discovered pool sizes. The input specifications are as follows:

Do you want to use a lognormal pool size distribution? YES
Do you want to use the output of PPSD? (Y/N) NO
Do you want to use match intervals in INMATCH? (Y/N) YES
Do you want to execute a match (Y/N)> YES
Enter no. of discoveries to be used > n
If n is smaller than the number of discoveries, then the first n number of pools are used for the match. If n is greater than the number of pools of the play, then all pools stored in the PD-data base are used in the match.

Enter the r-th largest discoveries for conditional match > r

If r is greater than 0, then the first r largest pools have been discovered. If r equals 0, then the module, **MATCH**, will decide that have we discovered the largest pool.

Do you want to specify the match in INPSDR? N
If the answer is "Y", then the pool ranks specified in the **INPSDR** are used for matching.

Enter the prediction interval > 75, 25 (cr)
Use prediction interval 75-25 for the first run. In the cases where the largest pool sizes are very different, then 95-5 interval may be used.

Distance measured from mean or median? (MSE/MAD) > MAD
Do you want to store on INPSDR? Y
Do you want a detail printout? (Y/N) > N
Printout sorted by Dist., Gap, Size, N, %U or Log L? > L
Enter no. of top cases to be printed > 0

3. After the first run, choose the "best" or acceptable match using the following criteria:

(a) The match that can accommodate the most discovered pool sizes, the match that also more or less agrees with group distributions from **LDSCV** or **NDSCV'** outputs.

(b) Examine the following criteria to see whether there are other matches that are plausible:

(i) To examine the largest remaining pool size. This is a very critical criterion, because it can be validated using geological and geophysical information.

(ii) The distance from the median. The distance from either the median or the mean is simply the algebraic sum of the differences between the discovered pool size and the

median or mean, whichever is chosen.

(iii) The log likelihood values. The log likelihood value is computed by order statistics. The likelihood value considers the values of combination N, μ, σ^2 and the discovered pool sizes matched to pool ranks.

(iv) The percent of undiscovered resource.

4. The following questions should be asked when we examine the output of match:

(a) How many discovered pool sizes can be matched into the prediction interval?

(b) If not all discovered pool sizes match to the prediction interval, the question is whether the values of σ^2 and/or μ are too low or to high.

(c) Repeat **MATCH** by increasing or decreasing the point estimates of σ^2 and/or μ until all or most discovered pool sizes can be matched.

(d) It is preferable to keep the μ as constant while the value of σ^2 is increasing or vice versa. Results from our validation study, the μ and σ^2 may be under-estimated, therefore, both of them may increased in order to match the discovered pools.

(e) If the 75-25 prediction interval is not adequate, then 95-5 prediction interval may be used.

(f) The median as the point for measurement of distance may be replaced by the mean. If you use the mean as the point, larger resources would be yielded than if the median were used.

5. When a "best" match is decided, then

(a) Run **PPSD** using the final μ and σ^2 as input.

(b) Repeat **MATCH** by answering "Y" to the question: "Do you want to use output of **PPSD**?"

(c) Enter the final N as the minimum, step and maximum values to the question: "Min, Step and Max No. of pools in the play".

(d) Save all outputs for the disk file, in the PD-data base and **INPSDR** file.

(e) Make sure that **INPSDR** file is the one you want to use for subsequent computation.

Step 11. Computing the Undiscovered Pool Sizes

> **PSDR** OR **PSDR**

Execute the **PSDR** module for the computing r-th largest pool sizes when conditioning on the **INPSDR** file. Before you execute this module, make sure to use **DELETE** to delete all existing information computed in the previous run from the PD-data base.

Step 12. Computing the Play Potential Distribution

> **PPDR** OR **PPRK**

Execute the **PPDR** module for computing the play potential distribution (remaining play resource) based the output of **MATCH.** The **PPRK** computes the play potential distribution based on the output of **MATCH** without constrained to the pool sizes.

Step 13. Entering a text for the final report.

The **RMKS** allows us to enter and save a text for the final report. **KEDIT** may be used to enter texts.

> **RMKS**

Step 14. Compiling the Final report

> **RTER**

To execute **RTER** with the following answers:

(a) Make sure to delete or ignore all disk files which excluded from the report by placing the symbol, "*" in front of the module name.

(b) For laser printer output, answer 60 line per page.

(c) Answer either O for oil or G for oil or gas play, respectively.

Step 15. Print the Final Report

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Table 2-1. Codes for Country, Geological Province, Basin and Play.

C	Canada
C1	East Canada Region
C11	Scotian Shelf
C2	Arctic Islands Region
C21	Arctic Fold Belt
C3	MacKenzie-Beaufort Region
C31	Tuk Peninsula
C4	Western Canada
C41	Devonian

Table 3-1. Variable Names for the W-Data Base - General information.

Wellname (A36)	
Fcode (I4)	Pcode (I7)
SH_NS_code (A1)	SH_NS_dist (F7.1)
SH_EW_code (A1)	SH_EW_dist (F7.1)
SH_TWP (I3)	SH_M (A1)
SH_RNG (I2)	SH_SEC (I2)
SH_LSD (I2)	
SH_latitude (F10.6)	SH_longitude (F10.6)
BH_NS_code (A1)	BH_NS_dist (F7.1)
BH_EW_code (A1)	BH_EW_dist (F7.1)
BH_TWP (I3)	BH_M (A1)
BH_RNG (I2)	BH_SEC (I2)
BH_LSD (I2)	
BH_latitude (F10.6)	BH_longitude (F10.6)
Init_Prod_date (I6)	Latest_Prod_date (I6)
Ground_elevation (F7.1)	KB_elevation (F7.1)
Well_depth (F7.1)	TV-depth (F7.1)
PB_depth (F7.1)	Spud_date (I6)
Fin_Drill_Date (I6)	Rig_Rlse_date (I6)
Licence_date (I6)	Conf_flag (A1)
Drill_cost_area (I2)	Data_Lahee_code (I2)
Lahee_Class_code (A2)	Well_status_date (I6)
Well_status_code (I10)	
Author (I2)	Formation Code (I5)
Depth (F7.1)	

Table 3-2. Variable Names for the W-Data Base - DST information.

Update date (I6)	Update flag (A1)
DST test number (I2)	DST date (I6)
DST test code and test sub-code (A1)	
DST misrun flag (A1)	
DST test interval top (F8.2)	DST test interval base (F8.2)
Recorder depth (F8.2)	Shut-in pressure (I6)
Final flowing pressure (I6)	Valve open time (I4)
Cushion type code (A2)	Cushion length (F6.1)
Pipe diameter (F7.1)	Oil surface time (I3)
Gas surface time (F7.1)	Maximum oil flow rate (F7.1)
Maximum gas flow rate (F7.1)	Final gas flow rate (F7.1)

Maximum water flow rate (F7.1)	Water surface time (I3)
DST water type (I3)	
DST fluid code (I3)	DST recovered volume (F8.2)
DST fluid units (A3)	

Table 4-1. Variable Names for the R-Data Base.

Wellid (A20)	Agent (A2)
Aband (A2)	Trap (A2)
Latitude (F8.4)	Longitude (F8.4)
Area of Pool (I7)	Netpay (F6.2)
Temperature (I3)	Pressure (I5)
Porosity (F5.3)	Saturation (F5.2)
Depth (F6.1)	GOR (F6.3)
1/B (F9.5)	Surface Loss (F4.2)
rho (F7.2)	Unit of rho (I2)
KB elevation (F7.1)	Z (F6.3)
In-place Volume (F10.3)	Producible Volume (F10.3)
Primary recovery factor (F3.2)	
Enhance recovery factor (F3.2)	
Primary reserve (F10.3)	
Enhance reserve (F10.3)	
Cumulative Production (F12.3)	
G/O (F8.2)	G/W (F8.2)
O/W (F8.2)	Discovery Year (I6)
Production Year (I6)	
H_2 (F10.5)	N_2 (F10.5)
He (F10.5)	He Code (I1)
CO_2 (F10.5)	H_2S (F10.5)
Pc (I6)	Tc (I4)
GHV (F5.2)	GHV Code (I1)
C_1 (F10.5)	C_2 (F10.5)
C_3 (F10.5)	iC_4 (F10.5)
nC_4 (F10.5)	C_5 (F10.5)
C_6 (F10.5)	C_7+ (F10.5)

Table 5-2. Names Geological Variables and their Codes.

Code	Name	Code	Name
01	Area of closure	02	Area of pool
03	Formation thickness	04	Reservoir fraction
05	Net pay	06	Porosity
07	Trap fill	08	Hydrocarbon saturation
09	Water saturation	10	Recovery factor
11	Yield	12	Reservoir pressure
13	Gas fraction	14	Oil fraction
15	Shrinkage factor	16	No of net pay zones
17	Gas/Oil ratio	18	Favourable facies fraction
19	Permeability	20	Surface loss
21	Enhanced factor	22	Hydrocarbon volume
30	Reservoir temperature	31	Gas deviation factor
32	Gas fmn factor	33	Oil fmn factor
38	N2	39	H2S
40	He	41	CO2
42	C1	43	C2
44	C3	45	iC4
46	nC4	47	C5
48	C6	49	C7
50	Depth	51	Density
52	In place pool size ratio	53	Recoverable pool size ratio
54	Discovery date	55	Production year
56	Cumulative production	61	No of prospects
57	GR ratio (gas only)		
58	Field name code		
59	Pool name code	61	No of prospects
62	No of pools(derived)	63	No of pools(data)
68	In place prospect size	69	Recoverable prospect size
70	In place pool size	71	Recoverable pool size
72	In-place pool size(data)	73	Recoverable pool size(data)
74	In-place pool size (nonparametric)	75	Recoverable pool size (nonparametric)
76	Primary reserve	77	Enhance reserve
78	In-place individual pool size	79	Recoverable individual pool size
80	In-place play potential	81	Recoverable play potential
82	In-place basin potential	83	Recoverable basin potential
84	In-place region potential	85	Recoverable region potential
86	In-place country potential		87Recoverable country potential
88	In-place play resource	89	Recoverable play resource
90	In-place basin resource	91	Recoverable basin resource
92	In-place region resource	93	Recoverable region resource

Table 5-3. Units of Measurement and their Codes.

Code	Unit	Print symbol
00	Dimensionless	
01	Numbers	no
02	Decimal fractions	dec fr
03	Meters	m
04	Feet	ft
05	Hectares	ha
06	Acres	ac
07	Square meters	sq m
08	Square feet	sq ft
09	Square kilometres	sq km
10	Square miles	sq mi
11	Kilopascals	Kpa
12	Pounds/sq inch	psi
13	Kelvin	Ok
14	Rankine	Or
15	Celsius	Oc
16	Fahrenheit	Of
17	Cubic meters	cu m
18	Cubic feet	cu ft
19	Million cubic meters	M cu m
20	Billion cubic feet	Bcf
22	Barrels	bbl
24	Million barrels	MM bbl
25	Million cubic meters/ hectare-meter M cu (used for gas only)	m/ha-m
26	Million cubic feet/acre-foot	Mmcf/ac-ft
27	Cubic meters/hectare-meter (used for oil only)	cu m/ha-m
28	barrels/acre-foot	bbl/ac-ft
29	Cubic meters/cubic meter (used for GOR only)	cu m/cu m
30	Cubic feet/barrel	cu ft/bbl
31	Billion cubic meters	B cu m
32	Trillion cubic feet	Tcf
33	Billion cubic meters	B cu m
34	Billion barrels	B bbl
35	Cubic meters/kpa(gas)	cu m/kpa
36	Thousand cubic feet/psi	Mcf/psi
37	Cubic meters/kpa(oil)	cu m/kpa
38	barrels/psi	bbl/psi
39	Cubic meters/day(gas)	cu m/day

40	Thousand cubic feet/day	Mcf/day
41	Cubic meters/day(oil)	cu m/day
42	Barrels/day	bbl/day
43	Millidarcy	md
44	Millidarcy	md
45	Million cubic meters(gas)	M cu m/ww
46	Billion cubic feet	Bcf
47	Million cubic meters(oil)	M cu m/ww
48	Million barrels/ww	MM bbl/ww
49	Kilogram/cubic meter	kg/cu m
50	Degree	API
51	Rock ratio (GR)	m^3 / m^3
52	Rock ratio (GR)	ft^3 / ft^3

Table 5-4. Geological Variables and Their Permissible Units of Measurement for PETRIMES.

Code	Variable	Unit of Measurement S.I.	British
01	Area of closure	05 ha	06 ac
02	Area of pool	07 Sq m 09 Sq km	08 Sq ft 10 Sq mi
03	Formation thickness	03 m	04 ft
05	Net pay		
50	Depth		
04	Reservoir fraction	02 dec fr	02 dec fr
06	Porosity		
07	Trap fill		
08	Hydrocarbon saturation		
09	Water saturation		
10	Recovery factor		
13	Gas fraction		
14	Oil fraction		
18	Favourable facies fraction		
20	Surface loss		
52	In-place pool size ratio		
53	Recoverable pool size ratio		
11	Yield	25 M cum/ha-m 27 cu m/ha-m	26 Mmcf/ac-ft 28 bbl/ac-ft
12	Reservoir pressure	11 Kpa	12 psi
15	Shrinkage factor	00 Dimensionless	00 Dimensionless
31	Gas deviation factor		
32	Gas formation volume factor		
33	Oil formation volume factor		
54	Discovery date		
91	Field code		
92	Pool code (formation code + pool code)		
16	No of net pay zone	01 no	01 no
61	No of prospects		
62	No of pools,derived		
63	No of pools,data		
17	Gas/oil ratio	29 cu m/cu m	30 cu ft/bbl

19	Permeability	43 md	44 md
30	Reservoir temperature	13 Kelvin 15 Celsius	14 Rankine 16 Fahrenheit
51	Density	49 Kg/cu m	50 API
54	Flow rate	39 cu m/day (gas) 41 cu m/day (oil)	40 Mcf/day 42 bbl/day
55	Productivity index	35 cu m/kpa 37 cu m/kpa	36 Mcf/psi 38 bbl/kpa
57	Discovery rate	45 M cu m/ww (gas) 47 M cu m/ww	46 Bcf/ww 48 MM bbl/ww
68	In-place pool size, Monte Carlo	19 M cu m (gas)	20 Bcf (gas)
69	Recoverable pool size, Monte Carlo	19 M cu m (oil)	24 MM bbl (oil)
70	In-place pool size,lognormal	51 10**4 T (oil)	52 MM bbl (oil)
71	Recoverable pool size,lognormal		
72	In-place pool size, data		
73	Recoverable pool size, data		
74	In-place pool size, nonparametric		
75	Recoverable pool size, nonparametric		
76	Primary reserve		
77	Enhanced reserve		
78	In-place individual pool size		
79	Recoverable individual pool size		
80	In-place play potential	19 M cu m 19 M cu m	20 Bcf 24 MM bbl
81	Recoverable play potential	31 B cu m (gas) 33 B cu m (oil)	32 Tcf 34 B bbl
82	In-place basin potential		
83	Recoverable basin potential		
84	In-place region potential		
85	Recoverable region potential		
86	In-place country potential		
87	Recoverable country potential		
56	Cumulative production		

Table 6-1. British Columbia Formations Names, Codes and Their GSC Correlation Codes Sorted by GSC Codes.

BC Code	GSC Code	Formation names
10040	41999	CENOZOIC
10050	41999	QUATERNARY
10070	41999	CAPE BALL
10060	41998	PLEISTOCENE
10075	31999	PRE-TERTIARY
10100	31999	TERTIARY
10120	31799	SKONUN
10130	31399	MASSET
10180	23999	CRETACEOUS
10200	23999	UPPER CRETACEOUS
10400	23999	MESOZOIC
10600	23999	GABRIOLA
10610	23999	SPRAY
10620	23999	GEOFFREY
10630	23999	NORTHUMBERLAND
10640	23999	DE COURCY
10650	23999	CEDAR DISTRICT
10660	23999	PROTECTION
10670	23999	NEWCASTLE
10673	23999	DOUGLAS COAL
10675	23999	PENDER
10680	23999	EXTENSION
10690	23999	EAST WELLINGTON
10700	23999	HASLAM
10710	23999	COMOX
10720	23999	BENSON
11412	23999	FIRST PETROLIFEROUS SHALE
11414	23999	SECOND PETROLIFEROUS SHALE
11490	23999	QUEEN CHARLOTTE GROUP
11600	23999	HAIDA
12810	23999	JACKASS MOUNTAIN
11713	23302	BASE OF FISH SCALES
11300	23299	WAPITI
11350	23280	BELLY RIVER
11365	23260	PUSKWASKAU
11368	23260	CHINOOK
11360	23240	WAPIABI
11380	23236	BAD HEART
11390	23234	MUSKIKI
11398	23233	CARDIUM ZONE
11400	23233	CARDIUM SAND
11405	23230	BLACKSTONE
11410	23230	KASKAPAU
11415	23230	POUCE COUPE
11411	23222	SECOND WHITE SPECKLED SHALE
11420	23210	DOE CREEK
11450	23208	FORT NELSON
11500	23208	DUNVEGAN
11530	23206	FT ST JOHN
11660	23206	SULLY

11680	23206	SIKANNI
11700	23206	SHAFTESBURY
11705	23206	LEPINE
11710	23200	GOODRICH
12750	23199	LONG ARM
11850	23193	COMMOTION
11730	23192	SCATTER
12000	23192	PADDY
12330	23192	PEACE RIVER
11520	23190	CROWSNEST VOLCANICS
11715	23190	HASLER
11720	23190	BUCKINGHORSE
12200	23188	CADOTTE
11800	23187	BLAIRMORE
12220	23180	HARMON
11725	23175	GATES
11740	23170	GARBUTT
12350	23170	SPIRIT RIVER
12400	23170	NOTIKEWIN
12500	23160	FALHER
12525	23160	FOURTH COAL MEASURE
12535	23160	FALHER SAND
12505	23159	FALHER A
12510	23158	FALHER B
12515	23157	FALHER C
12520	23156	FALHER D
12530	23155	FALHER E
11870	23150	MOOSEBAR
12550	23148	WILRICH
12600	23140	BLUESKY
12625	23140	BASAL BLUESKY
12630	23140	BLUESKY-GETHING
12690	23130	BULLHEAD
12692	23130	LOWER BLAIRMORE
12700	23130	GETHING
12890	23130	BUICK CREEK
12710	23125	LOWER GETHING
12720	23125	BASAL GETHING
12800	23120	CADOMIN
12820	23120	DALHOUSIE
12650	23115	DETRITAL
12830	23115	BASAL CRETACEOUS SANDSTONE
12705	23110	LOWER BULLHEAD
12840	23100	KOOTENAY
12850	22999	NIKANASSIN
12900	22999	DUNLEVY
12920	22999	JURASSIC
12950	22999	FERNIE
12960	22999	FIRST BLACK SHALE
12970	22999	SECOND BLACK SHALE
13010	22999	GREEN BEDS
13020	22999	GREY BEDS
13030	22999	ROCK CREEK
13220	22999	RITCHIE
14000	22999	YAKOUN
14010	22999	MAUDE

12910	22995	LOWER DUNLEVY
13000	22988	PASSAGE BEDS
13040	22941	POKER CHIP
13200	22910	NORDEGG
14040	21999	TRIASSIC
14200	21999	TAKLA
14511	21999	SIPHON DISCONFORMITY
14600	21999	TRIASSIC VOLCANIC BASEMENT
14802	21999	TRIASSIC D
14950	21999	SPRAY RIVER
15500	21999	CACHE CREEK
14050	21995	PARDONET
14060	21995	PARDONET-BALDONNEL
14090	21995	SCHOOLER CREEK
14100	21990	BALDONNEL
14150	21990	BALDONNEL/UPPER CHARLIE LAKE
13070	21980	HAZELTON
14500	21980	CHARLIE LAKE
14512	21980	TWO RIVERS
14524	21980	RED CREEK
14531	21980	FIRST GREEN MARKER
14532	21980	SECOND BROWN MARKER
14537	21980	PINK MARKER
14539	21980	FIRST ORANGE MARKER
14541	21980	COPLIN UNCONFORMITY
14591	21980	PURPLE MARKER
14592	21980	SECOND ORANGE MARKER
14595	21980	KERN
14605	21980	SECOND GREEN MARKER
14612	21980	LOWER CHARLIE LAKE SANDS
14615	21980	B ANHYDRITE MARKER
14705	21980	DALE MEMBER
14710	21980	COLDSTREAM MEMBER
14505	21974	FIRST BROWN MARKER
14510	21973	SIPHON
14520	21972	CECIL
14530	21971	NANCY
14534	21970	BOUNDARY DISCONFORMITY
14535	21970	BOUNDARY LAKE
14536	21968	BASAL BOUNDARY
14540	21964	COPLIN
14542	21963	SEPTIMUS
14545	21962	MICA
14547	21962	LA GLACE
14550	21961	KOBES
14560	21960	BLUEBERRY
14570	21959	FARRELL
14575	21958	INGA
14578	21957	SILVERBERRY
14580	21957	NORTH PINE
14582	21956	BEAR FLAT
14585	21955	WILDER
14590	21954	PINGEL
14538	21953	YELLOW MARKER
14609	21953	LIMESTONE 'A' BED
14610	21953	A MARKER/BASE OF LIME

14700	21952	ARTEX
14750	21952	LIARD
14702	21951	BASE OF ARTEX
14790	21950	HALFWAY A
14792	21950	HALFWAY B
14794	21950	HALFWAY C
14798	21950	UPPER HALFWAY
14800	21950	HALFWAY
14805	21945	LOWER HALFWAY
14890	21940	DAIBER
14900	21940	DOIG
14905	21940	DOIG SAND
14980	21940	DOIG PHOSPHATE BEDS
14910	21930	TOAD GRAYLING
14920	21930	TOAD
15000	21930	MONTNEY
14930	21920	GRAYLING
15999	19999	PALEOZOIC
16000	17999	PERMIAN
16100	17999	PERMO CARBONIFEROUS
16110	17999	PERMO PENNSYLVNIAN
16150	17999	ROCKY MOUNTAIN
16210	17999	FANTASQUE
16170	17995	ISHBEL
16200	17990	BELLOY
16250	17990	BELLOY-KISKATINAW
16222	17910	LOWER BELLOY
16295	16990	UPPER TAYLOR FLAT
16300	16990	TAYLOR FLAT
16305	16990	LOWER TAYLOR FLAT
17100	16990	MATTSON
16260	15999	STODDART
17000	15999	MISSISSIPPIAN
17200	15999	UPPER KISKATINAW
17250	15999	KISKATINAW
17340	15999	BASAL KISKATINAW
17220	15995	ETHERINGTON
17300	15995	LOWER KISKATINAW
17510	15990	DESAN
17240	15985	FLETT
17350	15985	GOLATA
17224	15980	CARNARVON
17380	15980	MOUNT HEAD
17390	15980	UPPER DEBOLT
17400	15980	DEBOLT
17405	15980	RUNDLE
17420	15980	LOWER DEBOLT
17228	15978	MARSTON
17230	15976	LOOMIS
17232	15975	SALTER
17234	15974	BARIL
17236	15973	WILEMAN
17270	15970	TUNNEL MTN.
17410	15970	LIVINGSTONE
17450	15960	ELKTON
17500	15955	SHUNDA

17600	15950	PEKISKO
17610	15950	PEKISKO CARBONATE
17590	15945	BESA RIVER
17730	15945	BESA RIVER
17700	15940	BANFF
17710	15905	EXSHAW
18000	14399	DEVONIAN
18070	14399	UPPER DEVONIAN
18090	14399	KOTCHO
18100	14399	WABAMUN
18110	14399	PALLISER
18272	14399	DUPEROW
18125	14380	TETCHO
18130	14370	TROUT RIVER
18135	14370	WINTERBURN
18145	14370	CALMAR
18132	14369	ALEXO
18150	14368	KAKISA
18220	14364	REDKNIFE
18155	14360	MOUNT HAWK
18180	14360	FAIRHOLME
18185	14360	SOUTHESK
18190	14360	NISKU
18195	14360	ARCS
18200	14355	JEAN MARIE
18240	14355	UTAHN
18398	14355	ISLAND RIVER
18270	14350	WOODBEND
18271	14350	IRETON
18273	14350	GROTTO
18280	14350	FORT SIMPSON
18282	14346	PEECHEE
18275	14345	LEDUC
18210	14340	HAY RIVER
18283	14330	PERDRIX
18284	14330	CAIRN
18300	14330	DUVERNAY
18310	14325	COOKING LAKE
18285	14320	HORN RIVER
18290	14320	MUSKWA
18330	14320	FLUME
18340	14320	BEAVERHILL LAKE
18395	14310	OTTER PARK
18400	14310	SLAVE POINT
18510	14310	KLUA
18410	14305	FORT VERMILLION
18390	14299	MIDDLE DEVONIAN
18430	14299	ELK POINT
18440	14299	WATT MOUNTAIN
18680	14299	EBBUTT
18450	14295	GILWOOD
18460	14280	PRESQU'ILE
18500	14280	SULPHUR POINT
18528	14270	UPPER KEG RIVER
18530	14270	MUSKEG
18540	14270	KEG RIVER

18600	14270	PINE POINT
18550	14234	EVIE
18590	14234	HARE
18560	14232	LOWER KEG RIVER
18580	14232	NAHANNI
18620	14232	LOWER PINE POINT
18702	14232	STONE
18730	14232	STONE
18420	14231	DUNEDIN
18640	14230	UPPER CHINCHAGA
18658	14230	HEADLESS
18660	14230	CHINCHAGA
18715	14230	GRANITE WASH
18760	14230	YAHATINDA
18700	14228	LOWER CHINCHAGA
18710	14228	RED BEDS
18720	14220	ARNICA
18115	14199	LOWER PALEOZOIC
18740	14199	WORKKPASH
18750	14100	MUNCHO-MCCONNELL
18752	13999	PRE-DEVONIAN
18755	13999	PRE-DEVONIAN QUARTZITE
18770	13999	SILURIAN
18780	13999	NONDA
18900	13999	ORDOVICIAN
18920	13999	RONNING
19050	11999	CAMBRIAN
19140	11399	FLATHEAD
19100	11299	WINDSOR MOUNTAIN
19108	11299	PIKA
19120	11299	ELKO
19109	11280	ELDON
19110	11260	STEPHEN
19111	11240	CATHEDRAL
19130	11240	GORDON
19112	11220	MOUNT WHYTE
19900	00099	PRECAMBRIAN
19910	00099	WINDERMERE SYSTEM
19920	00099	PURCELL SYSTEM
19922	00099	ALDRIDGE
19925	00099	MOYIE INTRUSIONS
19930	00099	HAIGHBROOK
19932	00099	KINTLA
19935	00099	PHILLIPS
19940	00099	GATEWAY
19945	00099	SHEPPARD
19950	00099	PURCELL LAVA
19960	00099	SIYEH
19961	00099	UPPER SIYEH
19962	00099	MIDDLE SIYEH
19963	00099	LOWER SIYEH
19965	00099	GRINELL
19970	00099	APPEKUNNY
19971	00099	UPPER APPEKUNNY
19972	00099	MIDDLE APPEKUNNY
19973	00099	LOWER APPEKUNNY

19974	00099	ALTYN
19975	00099	TOMBSTONE MOUNTAIN
19976	00099	WATERTON

Table 6-2. Alberta Formations Names, Codes and Their GSC Correlation Codes Sorted by GSC Codes.

AB Code	GSC Code	Formation names
20001	99999	NONE
29999	99999	TOTAL DEPTH
29998	99998	UNDEFINED
29805	52000	FRESH WATER
29990	50000	FAULT
20020	41999	QUATERNARY SYSTEM
20010	33000	BASE OF DRIFT
20500	31999	TERTIARY SYSTEM
20520	31996	HAND HILLS CGL
20540	31994	WINTERING HILLS CGL
20560	31992	CRAWFORD PLATEAU CGL
20580	31990	CYPRESS HILLS FM
20600	31985	SWIFT CURRENT CK BEDS
20620	31965	PORCUPINE HILLS FM
20640	31950	PASKAPOO FM
20660	31935	RAVENSCRAG FM
21050	31935	SCOLLARD FM
20680	31930	WILLOW CREEK FM
20990	23999	MESOZOIC ERA
21000	23999	CRETACEOUS SYSTEM
21020	23999	UPPER CRETACEOUS
21040	23999	FRENCHMAN FM
21120	23299	WAPITI GRP
21060	23290	EDMONTON GRP
21061	23290	EDMONTON POOL #1
21080	23290	EDMONTON COAL MKR
21100	23290	ST. MARY RIVER FM
21180	23290	KNEEHILLS TUFF ZONE
21185	23290	BATTLE FM
21280	23290	BRAZEAU FM
21190	23286	WHITEMUD FM
21195	23284	EASTEND FM
21200	23284	HORSESHOE CANYON FM
21220	23282	BLOOD RESERVE MBR
21240	23281	BEARPAW FM
21260	23280	BELLY RIVER GRP
21261	23280	BELLY RIVER-CARDIUM
21262	23280	BELLY RIVER & MILK RIVER
21263	23280	BELLY RIVER GRP
21264	23280	BELLY RIVER GRP
21265	23280	BELLY RIVER POOL NO. 1
21266	23280	BELLY RIVER POOL NO. 2
21267	23280	BELLY RIVER POOL NO. 3
21300	23280	OLDMAN FM
21305	23280	OLDMAN TONGUE
21268	23270	UPPER BASAL BELLY RIVER
21271	23267	BELLY RIVER & LOWER MANN
21325	23267	RIBSTONE CREEK MBR
21320	23265	FOREMOST FM
21360	23265	VICTORIA MBR
21361	23265	VICTORIA SS
21370	23263	BROSSEAU TONGUE
21269	23260	BASE OF BELLY RIVER
21340	23260	BASAL BELLY RIVER SD
21400	23260	LEA PARK FM
21420	23260	PAKOWKI FM

21440	23260	ALBERTA GRP
21460	23260	SMOKY RIVER GRP
21480	23260	WAPIABI FM
21500	23260	LABICHE FM
21520	23260	PUSKWASKAU FM
21540	23255	CHINOOK MBR
21390	23250	VERDIGRIS MBR
21550	23250	CHUNGO MBR
21580	23250	MILK RIVER FM
21581	23250	MILK RIVER & MED HAT
21582	23250	RESERVED SE
21583	23250	RESERVED SE
21584	23250	RESERVED SE
21585	23250	UPPER MILK RIVER
21619	23250	BASE OF MILK RIVER
21380	23248	SOLOMON MBR
21560	23245	HIGHWOOD SS
21590	23245	LOWER MILK RIVER
21600	23240	COLORADO GRP
21601	23240	UPPER COLORADO
21620	23240	FIRST WHITE SPECKLED SH
21621	23240	U WHITE SPECKLED& VIKING
21622	23240	1ST WS & VIKING
21640	23237	MEDICINE HAT SD
21641	23237	UPPER MEDICINE HAT
21642	23237	MED HAT SUB ZONE
21646	23237	MED HAT D ZONE
21649	23237	BASE OF MEDICINE HAT
21644	23236	LOWER MEDICINE HAT
21660	23236	BADHEART FM
21680	23234	MUSKIKI FM
21700	23233	CARDIUM FM
21720	23233	UPPER CARDIUM
21740	23233	CARDIUM CGL
21761	23233	CARDIUM & VIKING
21766	23233	CARDIUM & BLUESKY
21750	23232	MAIN CARDIUM SAND
21751	23232	A CARDIUM SAND
21753	23232	C CARDIUM SAND
21760	23232	CARDIUM SD
21762	23232	CARDIUM POOL NO. 1
21763	23232	CARDIUM SD
21764	23232	CARDIUM-2 WHITE SPECKS
21765	23232	CARDIUM & 2 WS & OST
21780	23231	LOWER CARDIUM
21799	23230	BASE OF CARDIUM
21800	23230	BLACKSTONE FM
21820	23230	KASKAPAU FM
21880	23230	POUCE COUPE MBR
21840	23222	JUMPING POUND MBR SS
21860	23222	SECOND WHITE SPECKLED SH
21861	23222	2WS POOL NO. 1
21862	23222	2WS POOL NO. 2
21868	23222	2 WS & VIKING
21869	23222	BASE OF 2 WHITE SPECKS
21900	23210	DOE CREEK MBR
21910	23210	BASE OF DOE CREEK
22109	23210	LOWER COLORADO
22110	23210	LOWER COLORADO SAND
22111	23210	L COLO & BSL COLO
21920	23208	DUNVEGAN FM
21959	23208	BASE OF DUNVEGAN

21940	23206	FORT ST JOHN GRP
21960	23206	SHAFTESBURY FM
22080	23205	GRIT BEDS
22000	23204	FISH SCALE ZONE
22020	23204	FISH SCALE SD
22040	23204	BARONS SD
22060	23202	BASE FISH SCALES ZONE
22100	23199	LOWER CRETACEOUS
22206	23199	VIKING POOL NO. 13
22120	23192	BOW ISLAND FM
22121	23192	BOW ISLAND-COLORADO SH
22122	23192	BOW ISL-U MANN-L MANN
22133	23192	BOW ISLAND POOL NO. 1
22280	23192	PEACE RIVER FM
22281	23192	PEACE RIV + NOT + GETH
22282	23192	UPPER PEACE RIVER
22284	23192	PEACE RIVER - RUNDLE
22300	23192	PADDY MBR
22301	23192	PADDY+CADOTTE
22399	23192	BASE OF PEACE RIVER
22439	23192	BASE OF BOW ISLAND
21980	23191	CROWSNEST VOL
22130	23191	BOW ISLAND SD
22131	23191	FIRST BOW ISLAND SS
22132	23190	SECOND BOW ISLAND SS
22140	23190	VIKING FM
22141	23190	VIKING & COLONY
22142	23190	VIKING & 1WS
22160	23190	UPPER VIKING
22161	23190	UPPER & LOWER VIKING
22180	23190	VIKING SANDSTONE
22181	23190	VIKING & LOWER MANNVILLE
22182	23190	VIKING & UPPER MANNVILLE
22183	23190	VIKING & BASAL COLORADO
22184	23190	VIKING & MANNVILLE
22185	23190	VIKING & BASAL MANNVILLE
22186	23190	UPPER + MIDDLE VIKING
22187	23190	U+M+L VIK (VIK POOL 1)
22188	23190	VIKING SS-DETRITAL
22189	23190	U VIK,M VIK + U MANN
22190	23190	U VIK,M VIK + B MANN
22191	23190	U+M+L VIK (VIK POOL 2)
22192	23190	VIKING POOL NO. 3
22193	23190	VIKING POOL NO. 4
22194	23190	VIKING POOL NO. 5
22195	23190	VIKING-JOLI FOU
22196	23190	VIKING POOL NO. 6
22197	23190	VIKING POOL NO. 7
22198	23190	VIKING POOL NO. 8
22199	23190	VIKING POOL NO. 9
22200	23190	PROVOST MBR
22201	23190	VIKING POOL NO. 10
22202	23190	VIKING POOL NO. 11
22203	23190	VIKING POOL NO. 12
22204	23190	VIKING
22205	23190	VIKING & CADOMIN
22207	23190	VIK&MANN&UMANN
22340	23190	PELICAN FM
22358	23190	BASE OF VIKING
22220	23189	HAMILTON LAKE MBR
22320	23188	CADOTTE MBR
22440	23187	BLAIRMORE GRP

22460	23187	UPPER BLAIRMORE
22210	23185	MIDDLE VIKING
22211	23185	MIDDLE & LOWER VIKING
22240	23180	LOWER VIKING
22283	23180	LOWER PEACE RIVER
22380	23180	HARMON MBR
22260	23178	MOUNTAIN PARK FM
22359	23178	BELOW BS VIK TO BS MANN
22360	23178	JOLI FOU FM
22369	23178	BASE OF JOLI FOU
22635	23178	GATES FM
22960	23178	LUSCAR FM
22400	23176	CESSFORD SD
22420	23175	BASAL COLORADO SD
22421	23175	BASAL COLO + MANNVILLE
22422	23175	BSL COLORADO+BLAIRMORE
22499	23175	BASE OF BASAL COLORADO
22520	23172	O SULLIVAN MBR
22560	23172	COLONY MBR
22561	23172	COLONY POOL NO. 1
22562	23172	COLONY SANDSTONE
22563	23172	COLONY & GRAND RAPIDS
22564	23172	COLONY MBR
22565	23172	COLONY & MCLAREN
22566	23172	CLNY & GRD RP & GROSMONT
22580	23172	UPPER COLONY
22581	23172	SUB U COLONY CRETACEOUS
22582	23172	SUB U COLONY TO TOP MCMY
22583	23172	UP CLNY TO BASE MCMURRAY
22601	23172	SUB-COLONY GRAND RAPIDS
22604	23172	SUB_COLONY CRETACEOUS
22605	23172	BASE U CLY TO MCMURRAY
22620	23172	GRAND RAPIDS FM
22621	23172	UPPER GRAND RAPIDS
22622	23172	GRAND RAPIDS-CLEARWATER
22623	23172	GRAND RAPIDS & SPARKY
22624	23172	U & L GRD RPDS - CLWT
22625	23172	GRAND RAPIDS
22540	23171	ST. EDOUARD MBR
22541	23171	ST. EDOUARD POOL NO. 1
22542	23171	ST. EDOUARD POOL NO. 2
22543	23171	ST. EDOUARD POOL NO. 3
22630	23171	FORT AUGUSTUS FM
22480	23170	MANNVILLE GRP
22481	23170	MANNVILLE GRP
22482	23170	MANNVILLE GRP
22490	23170	MANNVILLE & U MANNVILLE
22491	23170	MANNVILLE + L MANNVILLE
22500	23170	UPPER MANNVILLE FM
22501	23170	U MANN & BSL MANN
22502	23170	UPPER MANNVILLE & SPARKY
22503	23170	U MANN & L MANN
22504	23170	UPPER MANN & ELLERSLIE
22505	23170	U MANN,SPARKY & COLONY
22506	23170	UPPER MANN & BLAIRMORE
22507	23170	UPPER MANNVILLE
22508	23170	UPPER MANNVILLE&CAMROSE
22509	23170	UPPER MANN & GEN PETE
22511	23170	UPPER MANNVILLE
22512	23170	UPPER MANNVILLE NO. 1
22513	23170	UPPER MANN + CUMMINGS
22514	23170	UPPER MANN+LLOYDMINSTER

22515	23170	UPPER MANNVILLE FM
22600	23170	LOWER COLONY
22602	23170	LOWER COLONY-DINA
22603	23170	L COLONY TO MCMURRAY
22606	23170	L COLONY TO B OF MANN
22640	23170	SPIRIT RIVER FM
22660	23170	NOTIKEWIN MBR
22661	23170	NOTIKEWIN-GETHING
22662	23170	SPIRIT R & BULLHEAD
22802	23170	MANNVILLE MU NO. 1
23039	23170	BASE OF SPRIRT RIVER
22607	23169	BASE OF L COLONY TO MCM
22750	23168	LOWER GRAND RAPIDS
22751	23168	L GRD RAP+CLWTR+MCM
22680	23165	MCLAREN MBR
22705	23165	GRAND CACHE MBR
22700	23160	WASECA MBR
22710	23160	MIDDLE GRAND RAPIDS
22715	23160	FALHER MBR
22716	23160	FALHER & BLUESKY
22717	23160	FALHER & NIKANASSIN
22720	23159	FALHER A
22721	23158	FALHER B
22722	23157	FALHER C
22723	23156	FALHER D
22740	23155	BORRADAILE MBR
22760	23155	SPARKY MBR
22761	23155	SPARKY-GEN PETE
22762	23155	SPARKY MBR
22763	23155	SPARKY & GENERAL PETROLEUM
22764	23155	SPARKY & REX
22780	23155	WAINWRIGHT SD
22781	23155	WAINWRIGHT & SPARKY
22782	23155	WAINWRIGHT & UPPER MANNVILLE
22724	23154	FALHER E
22725	23153	FALHER F
22728	23152	FALHER TIGHT SANDSTONE
22791	23150	MIDDLE MANNVILLE
22800	23150	CLEARWATER FM
22801	23150	CLEARWATER-MCMURRAY
22810	23150	CLEARWATER SD
22820	23150	TOVELL MBR
22840	23150	VERMILION SD
22950	23150	CLEARWATER (COLD LAKE)
22735	23149	TORRENS MBR
22860	23149	GENERAL PETROLEUM MBR
22861	23149	GEN PET + CUMMINGS
22880	23148	REX MBR
22900	23148	WILRICH MBR
22890	23144	MOOSEBAR FM
22940	23144	LLOYDMINSTER MBR
22941	23144	LLOYDMINSTER&SPARKY
22942	23144	LLOYDMINSTER & CUMMINGS
22920	23140	ISLAY MBR
22980	23140	HOME SD
22990	23140	HACKETT SAND
23000	23140	GLAUCONITIC SS
23001	23140	GLAUCONITIC-MCMURRAY
23002	23140	GLAUCONITIC & ELLERSLIE
23003	23140	GLAUC & SHUNDA
23004	23140	GLAUCONITIC&LOWER MANN
23005	23140	GLAUC & OSTRACOD

23006	23140	GLAUCONITIC POOL NO. 1
23007	23140	GLAUCONITIC POOL NO. 2
23008	23140	GLAUCONITIC POOL NO. 3
23009	23140	GLAUCONITIC SS
23010	23140	GLAUCONITIC POOL NO. 4
23011	23140	GLAUCONITIC POOL NO. 5
23012	23140	GLAUCONITIC & BSL QUARTZ
23013	23140	GLAUCONITIC & BSL MANN
23014	23140	GLAU+LOW MANN+BSL QTZ
23015	23140	GLAUCONITIC
23016	23140	GLAUCONITIC + BLAIRMORE
23017	23140	GLAUCONITIC
23018	23140	GLAUCONITIC POOL NO. 6
23020	23140	CUMMINGS MBR
23021	23140	CUMMINGS MBR
23022	23140	CUMMINGS MBR
23023	23140	CUMMINGS MBR
23024	23140	CUMMINGS & DINA
23041	23140	BLUESKY POOL NO. 1
23042	23140	BLSK-DETR-DBLT NO. 1
23043	23140	BLSK-DETR-DBLT
23045	23140	BLUESKY-MONTNEY
23046	23140	BLSK-BLHD-DBLT-SHUN
23047	23140	BLUESKY-TRIASSIC
23048	23140	BLUESKY-PEKISKO
23049	23140	BLUESKY-SHUNDA
23050	23140	BLUESKY-GETHING
23051	23140	BLUESKY-GETHING+BANFF
23052	23140	BLUESKY - BULLHEAD
23053	23140	BLUESKY-BULLHEAD-BELLOY
23054	23140	BLUESKY-LOWER MANNVILLE
23055	23140	BLUESKY-DETRITAL
23056	23140	BLUESKY-BULLHEAD-SHUNDA
23057	23140	BLUESKY-GETHING-BELLOY
23058	23140	BLSKY-BLHD-BELLOY-DBLT
23059	23140	BLUESKY-GETHING-WABAMUN
23060	23140	WABISKAW MBR
23061	23140	WABISKAW+WABAMUN
23062	23140	WABISKAW-MCMURRAY
23063	23140	WABISKAW-GROSMONT
23064	23140	WBSK-NIS-U IRETON-GROSMT
23069	23140	BSE OF WABISKAW-MCMURRAY
23070	23140	BASE OF BLUESKY-BULLHEAD
23071	23140	BASE OF BLUESKY - GETHING
23072	23140	BLUESKY - DEBOLT
23119	23140	BASE OF BLUESKY
23300	23140	MOULTON SD
23040	23139	BLUESKY FM
23080	23130	LOWER BLAIRMORE
23081	23130	L SANDSTONE OF L BLAIR
23100	23130	LOWER MANNVILLE FM
23101	23130	LOWER MANNVILLE
23105	23130	LOWER MANNVILLE & ELKTON
23106	23130	LOWER MANNVILLE&JURASSIC
23107	23130	L MANNVILLE & ROCK CREEK
23109	23130	LOWER MANNVILLE & NISKU
23110	23130	LOWER MANN-PEKISKO
23111	23130	LOWER MANN & CAMROSE
23112	23130	LOWER MANN & WABAMUN
23115	23130	L MANNVILLE & BLAIRMORE
23120	23130	OSTRACOD ZONE
23140	23130	CALCAREOUS MBR

23160	23130	OSTRACOD SS
23161	23130	OSTRACOD-BASAL QUARTZ
23162	23130	OSTRACOD-LOWER MANNVILLE
23163	23130	OSTRACOD & PEKISKO
23170	23130	BANTRY SHALE
23180	23130	BASAL BLAIRMORE
23190	23130	BASAL CRETACEOUS
23200	23130	BASAL MANNVILLE
23201	23130	BASAL MANN-JUR
23202	23130	BASAL MANN-OST
23206	23130	BASAL MANNVILLE
23207	23130	BASAL MANNVILLE
23220	23130	DINA MBR
23240	23130	BULLHEAD GRP
23260	23130	GETHING FM
23261	23130	GETHING + CADOMIN
23262	23130	GETHING POOL NO. 1
23263	23130	GETHING+ROCK CREEK
23279	23130	TO TOP OF MCMURRAY
23280	23130	MCMURRAY FM
23281	23130	MCMURRAY & OSTRACOD
23282	23130	MCMURRAY-GROSMONT
23283	23130	MCMURRAY & WABAMUN
23284	23130	MCMURRAY POOL NO. 1
23286	23130	MCMURRAY
23320	23128	SUNBURST SD
23321	23128	SUNBURST SD
23330	23128	SUNBURST-SWIFT
23340	23128	BASAL QUARTZ SD
23341	23128	QUARTZ SANDSTONE
23342	23128	BASAL QUARTZ SS-DETRITAL
23343	23128	BASAL QUARTZ & ELKTON
23344	23128	BASAL QUARTZ+ROCK CREEK
23345	23128	BASAL QUARTZ + LOW MANN
23350	23128	LOWER MANNVILLE SD
23360	23128	ELLERSLIE MBR
23361	23128	ELLERSLIE & JURASSIC
23362	23128	ELLERSLIE & ROCK CREEK
23363	23128	ELLERSLIE & OSTRACOD
23364	23128	ELLERSLIE POOL #1
23365	23128	ELLERSLIE MBR
23380	23128	CAMERON SS
23270	23125	BASAL GETHING
23400	23125	POPLAR SD
23420	23120	DALHOUSIE CGL
23440	23120	CUTBANK SS
23441	23120	CUTBANK-RUNDLE
23460	23120	TABER SD
23480	23120	CADOMIN FM
23481	23120	CADOMIN & JURASSIC
23482	23120	CADOMIN POOL NO 1
23483	23120	CADOMIN - NIKANASSIN
23498	23118	BASE OF BULLHEAD
23499	23118	B OF BLSK,BULLH,BELL,DEB
23501	23118	DETRITAL-WABAMUN
23502	23118	DETRITAL-MISSISSIPPIAN
23503	23118	DETRITAL-ELKTON
23210	23115	BASAL MANN-DETRITAL SS
23500	23115	DETRITAL =CRET=
23504	23115	DETRITAL SANDSTONE
23203	23101	B MANN,JUR-RUN + U MANN
23204	23101	B OF MANN TO B OF WOODB

24020	23100	KOOTENAY FM
24025	23100	ELK FM
24040	23100	MUTZ MBR
24080	23100	NIKANASSIN FM
24099	23100	BASE OF NIKANASSIN
24060	23090	HILLCREST MBR
24100	23085	ADANAC MBR
24000	22999	JURASSIC SYSTEM
24010	22999	JURASSIC-TRIASSIC
24461	22999	JURASSIC-RUNDLE
24465	22999	JURASSIC-PEKISKO
24035	22992	MIST MOUNTAIN FM
24110	22991	MORRISSEY FM
24120	22991	MOOSE MOUNTAIN MBR
24140	22988	FERNIE GRP
24160	22988	PASSAGE BEDS
24180	22980	ELLIS GRP
24200	22980	SWIFT FM
24210	22980	UPPER VANGUARD
24220	22975	GREEN BEDS
24240	22960	RIERDON FM
24250	22960	LOWER VANGUARD
24260	22960	GREY BEDS
24280	22945	SAWTOOTH FM
24281	22945	SAWTOOTH FM
24300	22945	CONRAD MBR
24320	22945	ROCK CREEK MBR
24321	22945	ROCK CREEK & RUNDLE
24340	22945	SHAUNAVON FM
24380	22945	BROWN SD
24398	22945	BASE OF SAWTOOTH
24399	22945	BASE OF ROCK CREEK
24350	22944	GRAVELBOURG FM
24360	22943	BELEMNITE ZONE
24165	22941	FERNIE SH
24400	22941	POKER CHIP SH
24420	22941	JURASSIC SH
24440	22910	NORDEGG MBR
24441	22910	NORDEGG+PEKISKO
24442	22910	NORDEGG-DETRITAL
24443	22910	NORDEGG-BANFF
24444	22910	NORDEGG+TRIASSIC
24449	22910	BASE OF NORDEGG
24460	22908	JURASSIC SS
24480	22901	CHANNEL FILL SD
24500	22901	JURASSIC DETRITAL
24501	22901	JURASSIC-DETR-RUND
24999	22901	BASE OF JURASSIC
25000	21999	TRIASSIC SYSTEM
25001	21999	TRIASSIC-SCHOOLER CREEK
25002	21999	TRIASSIC-RUNDLE
25020	21995	SCHOOLER CREEK GRP
25040	21995	PARDONET FM
25060	21990	BALDONNEL FM
25069	21990	BASE OF BALDONNEL
25120	21990	SPRAY RIVER FM
25122	21990	SPRAY RIVER & RUNDLE
25140	21990	WHITEHORSE FM
25080	21980	CHARLIE LAKE FM
25101	21980	BOUNDARY & CHARLIE LAKE
25159	21980	BASE OF CHARLIE LAKE
25163	21980	CHARLIE LAKE & HALFWAY

25100	21970	BOUNDARY MBR
25158	21970	BASE OF BOUNDARY
25160	21950	HALFWAY FM
25161	21950	HALFWAY-DOIG
25162	21950	HALFWAY POOL#1
25164	21950	HALFWAY & DOIG
25199	21950	BASE OF HALFWAY
25180	21940	DAIBER GRP
25200	21940	DOIG FM
25220	21940	TOAD FM .
25230	21940	TOAD-GRAYLING
25260	21940	SULPHUR MOUNTAIN FM
25240	21930	MONTNEY FM
25280	21930	GRAYLING FM
25399	21930	BASE OF TRIASSIC
25400	19999	PALEOZOIC ERA
25500	17999	PERMIAN SYSTEM
25600	17999	PERMO-PENN SYSTEM
25520	17995	ROCKY MTN GRP
25540	17995	ISHBEL GRP
25560	17990	BELLOY FM
25569	17990	BASE OF BELLOY
25700	16999	PENNSYLVANIAN SYSTEM
26040	16999	STODDART FM
25720	16990	KANANASKIS FM
25740	16990	KANANASKIS FM
25760	16990	STORM CREEK FM
26050	16990	TAYLOR FLAT FM
25780	16983	NORQUAY FM
25800	16980	TUNNEL MTN FM
26000	15999	MISSISSIPPIAN SYSTEM
26001	15999	MISSISSIPPIAN LEACHED
26002	15999	MISSISSIPPIAN CHERT
26060	15999	KISKATINAW FM
26061	15999	KISKATINAW-GOLATA
26020	15995	ETHERINGTON FM
26049	15985	BASE OF STODDART
26080	15985	GOLATA FM
26081	15985	GOLATA+KISKATINAW
26100	15980	RUNDLE GRP
26110	15980	RUNDLE-WABAMUN
26111	15980	RUNDLE + PALLISER
26119	15980	UPPER DEBOLT
26120	15980	DEBOLT FM
26121	15980	DEBOLT POOL NO. 1
26122	15980	UPPER DEBOLT
26140	15980	MOUNT HEAD FM
26160	15980	CARNARVON MBR
26180	15978	MARSTON MBR
26200	15976	LOOMIS MBR
26220	15975	SALTER MBR
26240	15974	BARIL MBR
26260	15973	WILEMAN MBR
26123	15970	LOWER DEBOLT
26125	15970	DEBOLT-DETRITAL
26280	15970	LIVINGSTONE FM
26299	15970	SURF TO TURNERVALLEY TOP
26300	15970	TURNER VALLEY FM
26305	15970	TURNER VALLEY-SHUNDA
26320	15970	UPPER POROUS
26398	15970	LOWER DEBOLT
26340	15965	MIDDLE DENSE

26360	15960	LOWER POROUS
26380	15960	ELKTON MBR
26389	15960	BASE OF TURNER VALLEY
26390	15960	ELKTON - SHUNDA
26399	15955	BASE OF DEBOLT
26400	15955	SHUNDA FM
26401	15955	SHUNDA-PEKISKO
26402	15955	UPPER SHUNDA
26419	15955	BASE OF SHUNDA
26420	15950	PEKISKO FM
26421	15950	PEKISKO + BANFF
26422	15950	PEKISKO + U BANFF
26423	15950	UPPER PEKISKO
26424	15950	PEKISKO & SUNBURST
26438	15950	BASE OF RUNDLE
26439	15950	BASE OF PEKISKO
26440	15940	BANFF FM
26441	15940	BANFF POOL NO. 1
26445	15940	UPPER BANFF
26449	15940	BASE OF BANFF
26450	15940	MIDDLE BANFF
26455	15940	LOWER BANFF
26457	15935	BANFF SHALE
26460	15920	BAKKEN FM
26469	15920	BASE OF BAKKEN
26480	15905	EXSHAW FM
26481	15905	EXSHAW + WABAMUN
26499	14399	REWORKED DEVONIAN
26500	14399	DEVONIAN SYSTEM
26520	14399	UPPER DEVONIAN
26540	14399	PALLISER FM
26560	14399	COSTIGAN MBR
26580	14399	WABAMUN GRP
26581	14399	WABAMUN GRP
26585	14399	WABAMUN-WINTERBURN
26590	14399	WABAMUN-GRAMINIA
26591	14399	WABAMUN & BLUERIDGE
26592	14399	WABAMUN-CALMAR
26600	14399	BIG VALLEY FM
26610	14399	KOTCHO FM
26620	14399	THREE FORKS FM
26640	14385	MORRO MBR
26660	14385	STETTLER FM
26599	14380	BASE OF WABAMUN-GRAMINIA
26650	14380	TETCHO FM
26680	14380	CROSSFIELD MBR
26699	14380	BASE OF WABAMUN
26700	14370	WINTERBURN GRP
26720	14370	ALEXO FM
26730	14370	SASSENACH MBR
26740	14370	TROUT RIVER FM
26760	14370	CROWFOOT FM
26780	14370	GRAMINIA FM
26790	14370	GRAMINIA-BLUERIDGE
26800	14368	BLUERIDGE MBR
26820	14368	KAKISA FM
26810	14365	WINTERBURN SHALE
26860	14365	CALMAR FM
26840	14364	RED KNIFE FM
26880	14360	FAIRHOLME GRP
26900	14360	SOUTHESK FM
26920	14360	JEFFERSON FM

26940	14360	ARCS MBR
26950	14360	ARCS-GROTTO
26960	14360	NISKU FM
26961	14360	NISKU & UPPER MANNVILLE
26962	14360	NISKU-LEDUC
26963	14360	NISKU-MCMURRAY
26964	14360	NISKU-U IRETON-GROSMONT
26965	14360	NISKU-IRETON-LEDUC
26966	14360	NISKU-CAMROSE
26967	14360	NISKU-UPPER IRETON
26980	14360	MOUNT HAWK FM
27020	14355	JEAN MARIE FM
27000	14350	UTAHN FM
27039	14350	BASE OF NISKU
27040	14350	WOODBEND GRP
27060	14350	GROTTO MBR
27100	14350	IRETON FM
27101	14350	U IRE-GROSMONT-L IRETON
27102	14350	IRETON-GROSMONT-L IRETON
27103	14350	UPPER IRETON - GROSMONT
27104	14350	UPPER IRETON
27116	14350	DETRITAL-IRETON
27120	14350	FORT SIMPSON FM
27125	14350	IRETON SHALE
27130	14350	TATHLINA FM
27139	14350	BASE OF U IRETON-GROSMNT
27140	14350	HONDO FM
27179	14350	BASE OF IRETON
27080	14348	CAMROSE TONGUE =DOL=
27081	14348	CAMROSE MBR
27115	14348	CAMROSE MBR
27160	14348	GROSMONT FM
27161	14348	GROSMONT-IRETON
27162	14348	GROSMONT-LOWER IRETON
27166	14348	GROSMONT D
27165	14347	TWIN FALLS FM
27167	14347	GROSMONT C
27168	14346	GROSMONT B
27180	14346	PEECHEE MBR
27169	14345	GROSMONT A
27200	14345	LEDUC FM
27201	14345	LEDUC-COOKING LAKE
27202	14345	WOODBENDREEF-GRANITEWASH
27203	14345	WOODBEND REEF
27279	14345	BASE OF LEDUC
27170	14340	LOWER IRETON
27220	14340	HAY RIVER FM
27240	14340	HAY RIVER LS
27260	14330	CAIRN FM
27261	14330	UPPER CAIRN
27280	14330	DUVERNAY FM
27300	14330	BASAL REEF
27340	14330	PERDRIX FM
27320	14325	COOKING LAKE FM
27321	14325	COOKING LK+BEAVERHILL LK
27330	14325	LOWER CAIRN
27360	14325	FRAGMENTAL LS
27425	14325	BASE OF LED-COOKING LAKE
27400	14324	MAJEAU LAKE FM
27420	14322	BASAL COOKING LK
27380	14320	FLUME FM
27430	14320	MUSKWA FM

27440	14320	BEAVERHILL LAKE FM
27450	14320	WATERWAYS FM
27460	14320	MILDRED MBR
27698	14320	BASE OF BEAVERHILL LAKE
27825	14320	HORN RIVER FM
27480	14318	MOBERLY MBR
27560	14317	SWAN HILLS MBR
27500	14316	CHRISTINA MBR
27520	14314	CALUMET MBR
27540	14312	FIREBAG MBR
27580	14310	SLAVE POINT FM
27581	14310	SLAVE PT & GRANITE W
27582	14310	SLAVE PT & SULP PT
27583	14310	SLAVE POINT + KEG RIVER
27699	14310	BASE OF SLAVE POINT
27600	14308	LIVOCK FM
27620	14305	FORT VERMILION MBR
27640	14303	GHOST RIVER FM
27660	14301	BASAL DEVONIAN UNIT
27680	14299	MIDDLE DEVONIAN
27700	14299	ELK POINT GRP
27710	14299	FIRST RED BEDS
27720	14299	WATT MTN FM
27730	14295	DAWSON BAY FM
27780	14295	GILWOOD MBR
27786	14295	GILWOOD & GRANITE WASH
27789	14295	BASE OF GILWOOD
27800	14295	MANNING SD
27815	14290	PRESQUILE FM
27810	14280	SULPHUR POINT FM
27811	14280	SULPH PT,MUSK & KEG RIV
27813	14280	SULP PT & KEG RIVER
27819	14280	BASE OF SULPHUR POINT
27860	14280	PRAIRIE EVAPORITE FM
27865	14280	BLACK CREEK MBR
27870	14280	FIRST SALT
27820	14270	MUSKEG FM
27821	14270	MUSKEG & KEG RIVER
27822	14270	MUSKEG FM
27830	14270	PINE POINT FM
27850	14265	ZAMA MBR
27855	14265	ZAMA & KEG RIVER
27885	14265	RAINBOW MBR
27886	14265	KEG RIVER FM & GRAN WASH
27920	14265	WINNIPEGOSIS FM
27880	14240	KEG RIVER FM
27881	14240	KEG RIVER FM
27882	14240	KEG RIVER FM
27883	14240	KEG RIVER FM
27900	14240	METHY FM
27890	14232	KEG RIVER SS
27899	14232	BASE OF KEG RIVER SS
27930	14232	LOWER KEG RIVER
27690	14230	YAHATINDA FM
27940	14230	CHINCHAGA FM
27960	14230	CONTACT RAPIDS FM
27970	14230	ASSINEAU SD
29760	14230	GRANITE WASH
29761	14230	GRANITE WASH
27980	14226	RED BEDS
28000	14226	COLD LAKE FM
28010	14226	SECOND SALT

28020	14224	ERNESTINA LK FM
28040	14220	LOTSBERG FM
28045	14220	THIRD SALT
28046	14220	UPPER LOTSBERG
28055	14220	FOURTH SALT
28056	14220	LOWER LOTSBERG
28060	14215	BASAL RED BEDS
28200	13999	SILURIAN SYSTEM
28500	12999	ORDOVICIAN SYSTEM
28520	12399	UPPER ORDOVICIAN
28600	12299	MIDDLE ORDOVICIAN
28610	12199	RED RIVER FM
28700	12199	LOWER ORDOVICIAN
29000	11999	CAMBRIAN SYSTEM
29020	11399	UPPER CAMBRIAN
29030	11399	LYNX GROUP
29040	11399	FINNEGAN FM
29100	11399	MONS FM
29140	11350	SULLIVAN FM
29150	11350	WATERFOWL FM
29160	11350	DEADWOOD FM
29180	11350	ARCTOMYS FM
29200	11299	MIDDLE CAMBRIAN
29205	11299	EARLIE FM
29210	11299	PIKA FM
29220	11280	ELDON FM
29260	11280	ELDON SHALE
29280	11280	ELDON CARBONATE
29300	11260	STEPHEN FM
29400	11240	CATHEDRAL FM
29420	11240	CATHEDRAL CARBONATE
29440	11235	ALBERTELLA ZONE
29460	11220	MOUNT WHYTE FM
29480	11215	BASAL SANDSTONE UNIT
29500	11199	LOWER CAMBRIAN
29550	11115	GOG GROUP
29800	00099	PRECAMBRIAN SYSTEM

Table 6-3. Saskatchewan Formations Names, Codes and Their GSC Correlation Codes Sorted by GSC Codes.

SASK Code	GSC Code	Formation names
31114	41999	GLACIIAL DRIFT
31231	31999	RAVENSCRAG
32170	23280	BELLY RIVER
32191	23267	RIBSTONE
32190	23260	LEA PARK
32195	23250	MILK RIVER
32197	23237	MILK RIVER MEDHAT
32221	23237	MEDICINE HAT
32230	23222	2ND WHITE SPECKS
32264	23191	ST WALBURG
32273	23190	VIKING
32280	23178	SPINNEY HILL
32311	23172	COLONY
30250	23170	U MANNVILLE
32300	23170	MANNVILLE
32309	23170	MANNVILLE
32312	23165	MCLAREN
32313	23160	WASECA
32321	23155	SPARKY
32322	23155	SPARKY/G.P.
32325	23149	GP
32331	23148	REX
32341	23144	LLOYDMINSTER
32345	23144	LLOYD-CUMMINGS
32350	23140	CUMMINGS
32359	23140	CUMMINGS-DINA
32387	23140	UNITY
32361	23130	DINA
32381	23130	CANTUAR
32383	23130	BSL CANTUAR
32390	23130	BASAL BLAIRMORE
32386	23115	WAPELLA
32400	23115	DETRITAL
33000	22999	JURASSIC
33142	22978	PREMIER
33145	22975	ROSERAY
33146	22975	UPPER ROSERAY
33147	22970	LOWER ROSERAY
33300	22945	SHAUNAVON
33310	22945	UPPER SHAUNAVON
33365	22945	SHAUNAVON GRAVELBRG
33350	22940	LOWER SHAUNAVON
33549	22935	GRAVELBOURG
39600	22930	WATROUS
33751	22910	LOWER WATROUS
34300	15975	MADISON
34320	15973	RATCLIFFE
34323	15972	OUNGRE
34330	15971	MIDALE
34350	15955	FROBISHER-ALIDA
34351	15955	FROBISHER
34354	15954	KISBEY
34357	15952	ALIDA
34362	15952	ALIDA TILSTON
34370	15950	TILSTON
34375	15950	TILSTON SOURIS VLY

34380	15945	SOURIS VALLEY
34410	15920	BSL MANN BAKKEN
34414	15920	BAKKEN
35111	14399	DEVONIAN
36010	14399	INTERLAKE
35115	14395	TORQUAY
35210	14360	BIRDBEAR
35430	14235	WINNIPEGOSIS
37050	12999	RED RIVER
39100	12999	DUPEROW
37055	12995	YOEMAN
38010	11399	DEADWOOD

Table 7-1. Screen format for Well update

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2100061712211W6001                                  Date: 90/05/04
-------------------------------------------------------------------
Wellname:PACIFIC ET AL DICKINS 6-17-122-11     Updflg: 0
Fcode:       0998                    Pcode:   00000000
SH_NS_code:        N                 SH_NS_dist:             508.1
SH_EW_code:        E                 SH_EW_dist:             499.0
SH_LSD:            4                 SH_SEC:
SH_latitude:     59.594710           SH_longitude:      119.858500
BH_NS_code:        N                 BH_NS_dist:             508.1
BH_EW_code:        E                 BH_EW_dist:             499.0
BH_LSD:            4                 BH_SEC:
BH_latitude:     59.594710           BH_longitude:      119.858500
Ground-elev:       547.10            KB-elev:                552.60
Well-depth:       1938.50
TV-depth:             .00            PB-depth:                  .00
Spude date:        710205            Fin-Drill-Date:         710225
Rig-Rlse-date:          0            Licence date:           710202
Init_Prod_date:         0            Latest_Prod_date:            0
Conf-flag:         1                 Drill-cost-area:       0
Data-Lahee-code:   0                 Lahee-Class-code:       6
Well-state-date:    710228           Well-state-code:  0002000000
Author:   0    FMN Code:  6440       Depth:     494.70
Author:   0    FMN Code:  6580       Depth:     648.90
Author:   0    FMN Code:  6740       Depth:     865.60
Author:   0    FMN Code:  6820       Depth:     907.70
Author:   0    FMN Code:  6840       Depth:     943.10
Author:   0    FMN Code:  7020       Depth:    1040.00
Author:   0    FMN Code:  7120       Depth:    1053.40
Author:   0    FMN Code:  7430       Depth:    1643.80
Author:   0    FMN Code:  7580       Depth:    1672.40
Author:   0    FMN Code:  7825       Depth:    1806.90
Author:   0    FMN Code:  7830       Depth:    1871.50
```

Table 7-2. Screen format for Pool update

C4023042026300001000160 Date: 91/07/08

Wellid:	100062509402W600NW	Agent:	1 Aband: N Trap: 00
Lat :	57.187	Long :	118.17
Area :	5411	Netpay:	7.8600
T :	303	P :	5500
Poros :	.17200	Sw :	.20000
Depth :	750.00	GOR :	.00000E+00
1/B :	.00000E+00	Loss :	.50000E-01
rho :	.58000	Unit :	02
KB :	719.00	Z :	.90700
Volume:	2587.0	Pro'dV:	1811.0
PRf :	.70000	ERf :	.00000E+00
P r've:	1720.0	E r've:	.00000E+00
Cum P :	773.00	G/O :	.00000E+00
G/W :	.10000	O/W :	.00000E+00
DiscYr:	730118	ProdYr:	730124
H2 :	.00000E+00	N2 :	.59000E-02
He :	.10000E-03	He Code:	M
CO2 :	.27500E-01	H2S :	.00000E+00
Pc :	4672	Tc :	193
GHV :	36.450	GHV Code:	C
C1 :	.96540	C2 :	.70000E-03
C3 :	.30000E-03	iC4 :	.10000E-03
nC4 :	.00000E+00	C5 :	.00000E+00
C6 :	.00000E+00	C7+ :	.00000E+00

Table 7-3. Example of TYPE 1 data for DIGIT

```
C0009008-0503O1              Curve type:1      Date: 93/05/09
---------+---------+---------+---------+---------+---------
[    0503O1    ]
   2.440000
   2.850000
   2.540000
   3.800000
   3.900000
   2.590000
   3.540000
   3.060000
   2.970000
   4.500000
   3.000000
   1.760000
   3.800000
   3.720000
   6.400000
```

Table 7-4. Example of TYPE 2 data for DIGIT

```
C0009008-7219G1              Curve type:2      Date: 90/11/19
---------+---------+---------+---------+---------+---------
   .1100000E-01   1.000000
   5.330000       .9500000
   10.66000       .9000000
   21.33000       .8000000
   31.99000       .7000000
   42.65000       .6000000
   71.60000       .5000000
   166.6500       .4000000
   270.9600       .3000000
   1026.000       .2000000
   7700.000       .1000000
   12658.00       .6000000E-01
   15716.00       .4000000E-01
   16896.00       .2000000E-01
   28929.00       .1000000E-03
   35000.00       .0000000
```

Table 7-5. Example of TYPE 3 data for DIGIT

C0009305 Curve type: 3 Date: 93/05/11

[721901]	[540001]
.4610000E-01	641009.0
.3030000	850215.0
.8630000E-01	860207.0
.1390000	860309.0
.4470000	851114.0
.2650000	851011.0
.5350000	851012.0
.3840000	850615.0
.1670000	840811.0
.2450000	841010.0
.9610000E-01	800509.0
.1340000	800129.0
.2760000	831004.0
.9540000	830120.0
.4760000	840212.0
2.370000	560101.0
.2540000	570126.0
4.000000	581231.0
1.280000	640312.0
.1360000	580317.0
.5330000	670916.0
.3160000	680626.0
.4270000	571207.0
.4560000E-01	700112.0
.6830000E-01	690101.0
.4400000	721208.0
.1320000	790717.0
.9250000E-01	791113.0
.2310000	801001.0
.1590000	801024.0
.3720000	821010.0
.5570000E-01	811231.0
.7450000	831210.0
.5310000	801206.0
.7790000	820801.0
.8620000E-01	840828.0
.2500000	850123.0
.4100000	841213.0
.1930000	850205.0