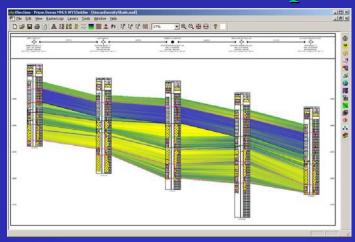
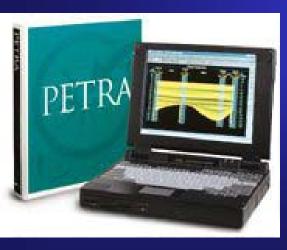
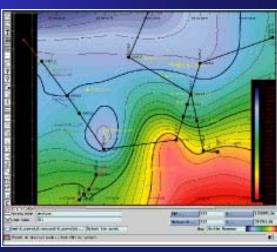


Available Industry Mapping Software Tools

Landmark - GeoGraphix







Available Industry Reserves & Economics Software

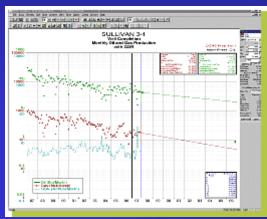
OGRE Partners - OGRE

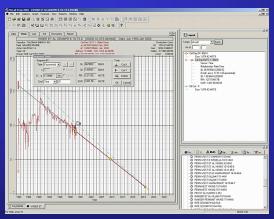
IHS - Power Tools





Landmark - Aries

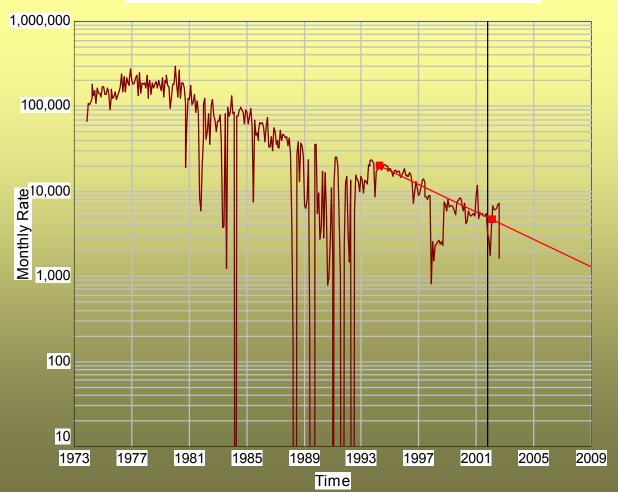




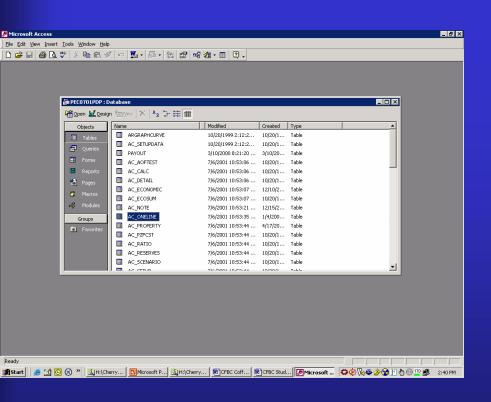
Schlumberger – Merak Peep

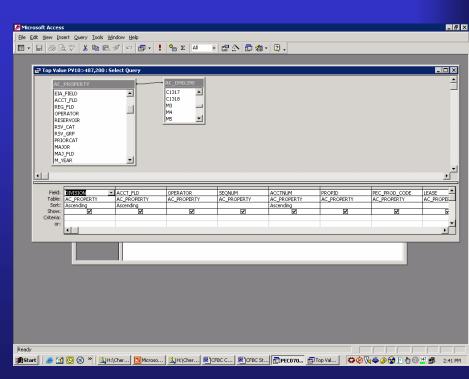
Automated EUR Reserve Estimates

THOMPSON C NE 4 - WATONGA-CHICKASHA TREND



Access Database Exports





Common Uses of Mapping Software

- Mapping Attribute,
 Net Pay, Isopach &
 Structure
- Cross Sections –
 Stratigraphic &
 Structural
- Gridding & Contouring
 Techniques

- Management Presentations
- Acreage Position Management
- Field Development Management
- Mainly Used by
 Drafting & Geo-Tech

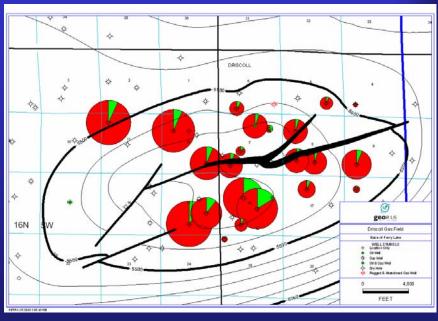
 Personnel

Common Acquisition Prospect Identification

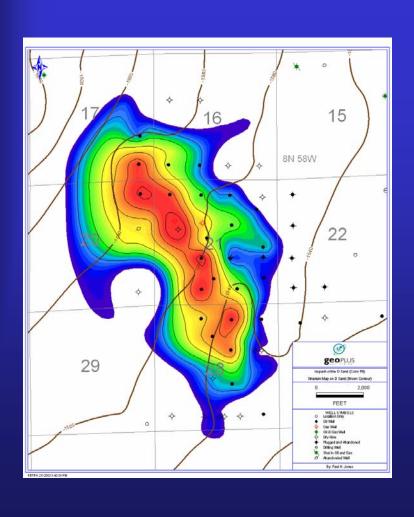
- Contact A&D Brokers to see what is for sale that they represent
- Auctions
- Make contacts of larger companies that typically sell large volumes of properties and attempt a negotiated purchase

Common Development Drilling Prospect Identification

- Analyze existing HBP acreage position for infill or extensional opportunities
- Analyze offset operators to HBP acreage position for anomalies or drainage problems
- Identify field extension opportunities
- Analyze existing nonproducing acreage position for drilling potential



Under-Utilized Analytical Functions

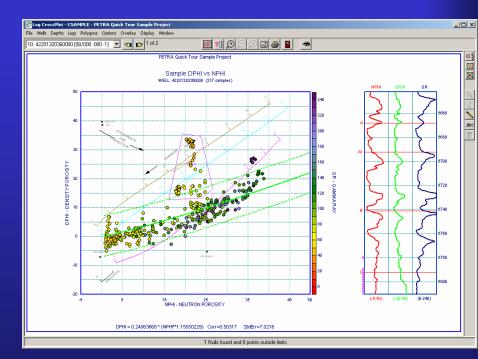


- Petrophysical & Detailed Log Analysis
- Volumetric Reserve

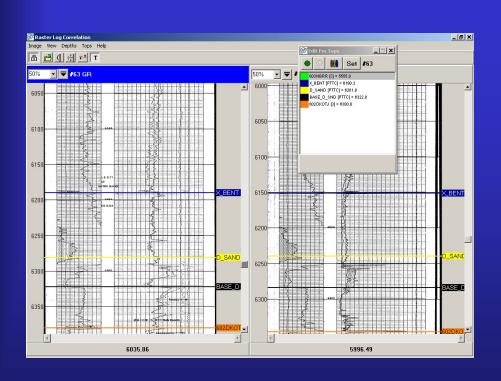
 Analysis of Reservoirs
- Identify/Compare Performance & Success
- Determine Continuity & Compartmentalization of Reservoirs

Under-Utilized Acquisition & Drilling Prospect Analysis

- Perform kh Equivalent
 & EUR Analysis
- Perform DST Analysis for Permeability Indicators
- Perform Darcy's
 Calculations for Well
 Productivity Analysis
- Identify High PI well Anomalies

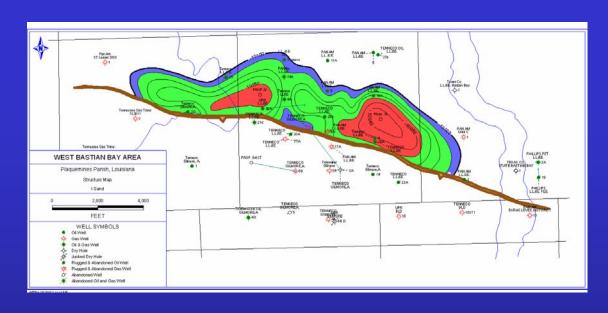


Petrophysical & Detailed Log Analysis



- Log Calculations –
 porosity, S_w, k,
 lithology
- Identify O/W or G/W contacts
- Calculate volumetric reserves

Volumetric Reserve Analysis

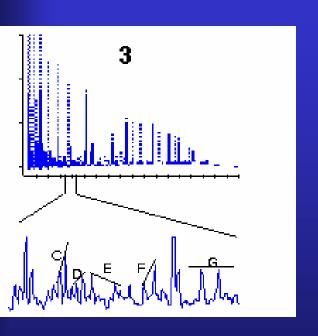


- Calculate Volumetric Reserves by producing interval of a field, basin or region
- Compare theoretical with actual reserves
- Identify anomalies for rework, recompletion or re-drill opportunities

Analyzing Performance & Success of other Operators

- Identify most successful operators by year comparing EUR's & dry holes with drilling/completion dates
- Map areas or regions successful operators are active
- Compare their activity and success with your regional interpretation

Continuity & Compartmentalization



- Verify/confirm continuity or compartmentalization of a reservoir
- Identify gas chromatograph fingerprints of oil or gas sample from producing zone(s)
- Compare fingerprints of zones of offset wells to identify extensional or development opportunities



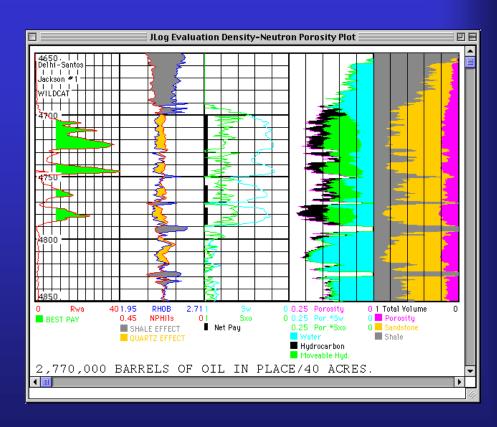


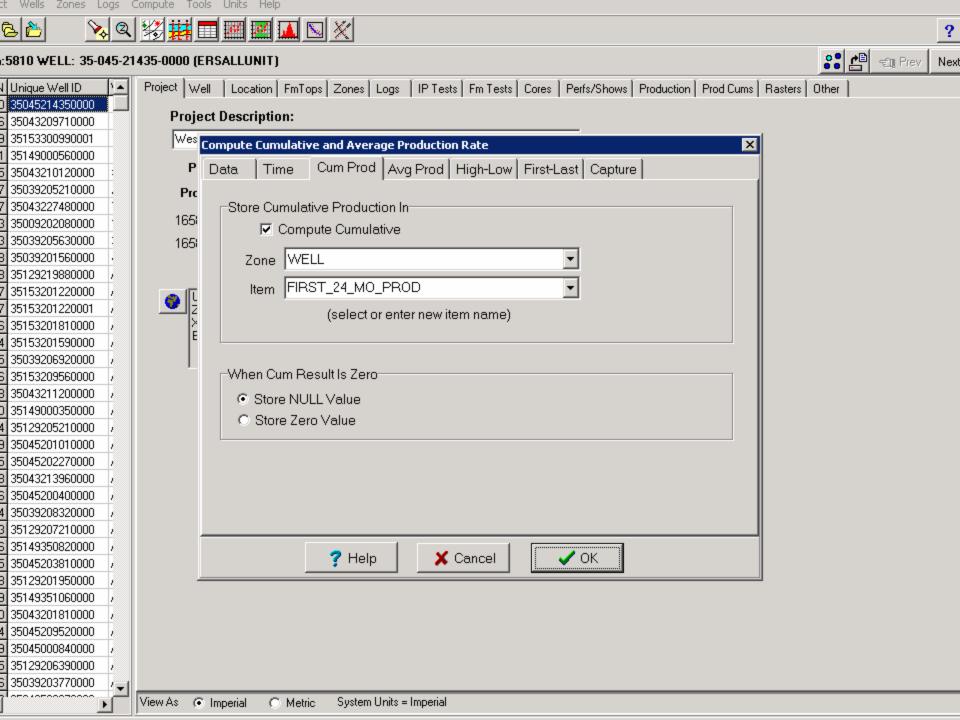
Darcy's Radial Flow Equation

 $Q = (7.08)(kh)(\Delta P) / (B_0)(\mu)(ln r_e/r_w)$

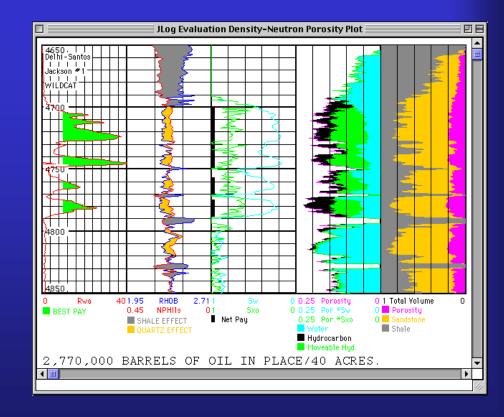
 $Q / \Delta P = (7.08)(kh) / (B_0)(\mu)(ln r_e/r_w)$

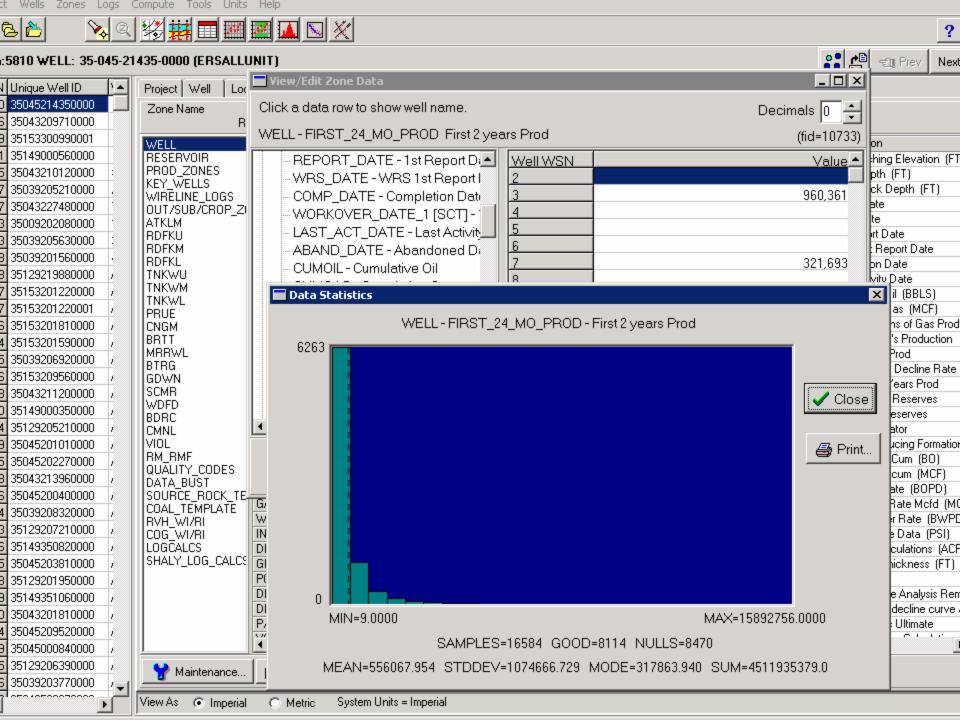
• Calculate first two years of production



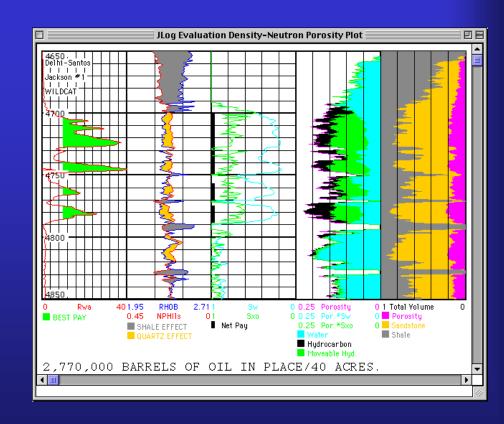


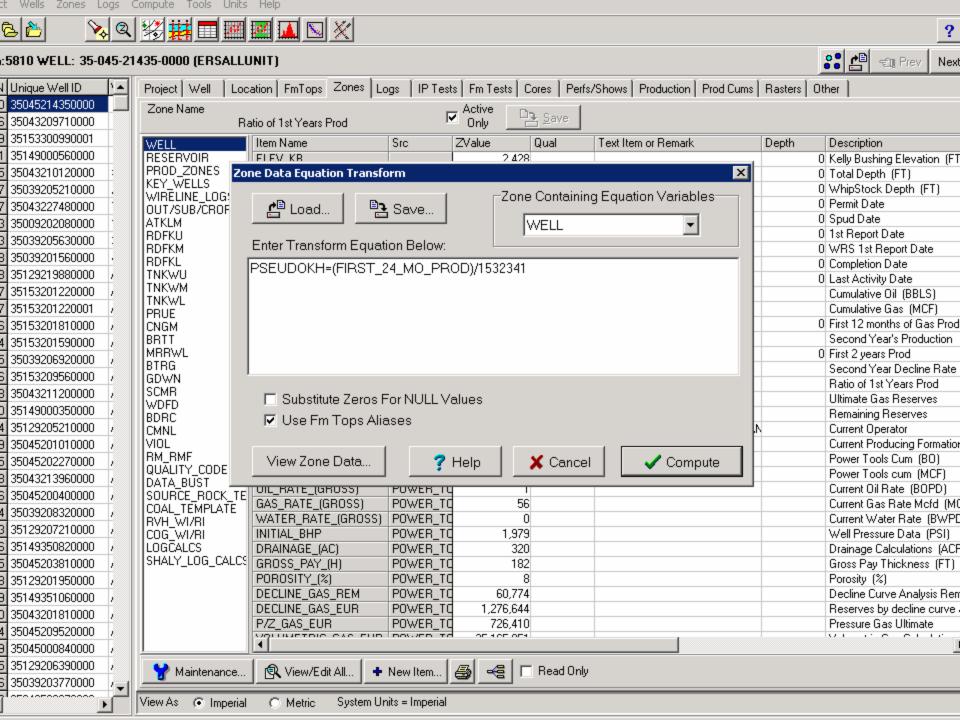
- Calculate first two years of production
- Determine min & max with statistical analysis



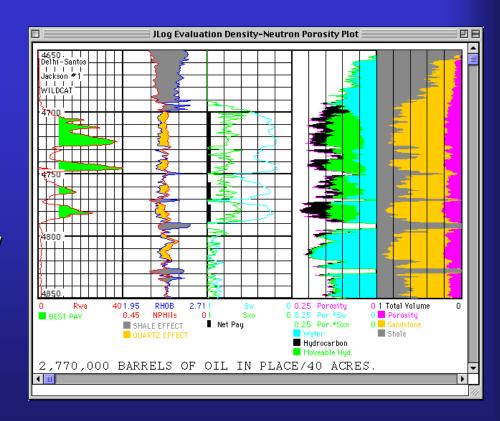


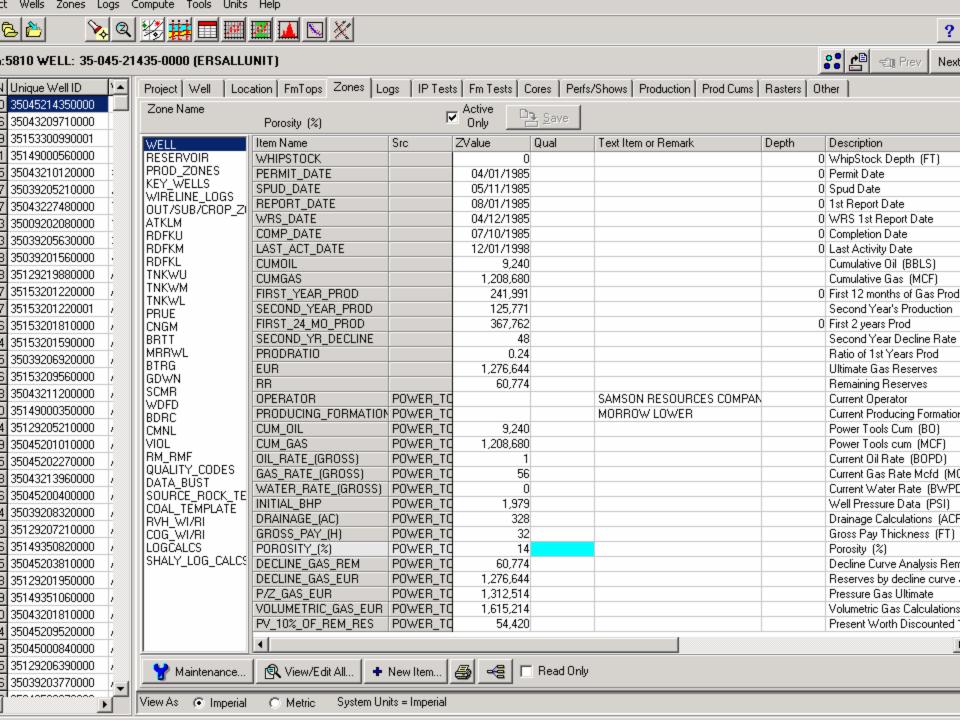
- Calculate first two years of production
- Determine min & max with statistical analysis
- Normalize the data

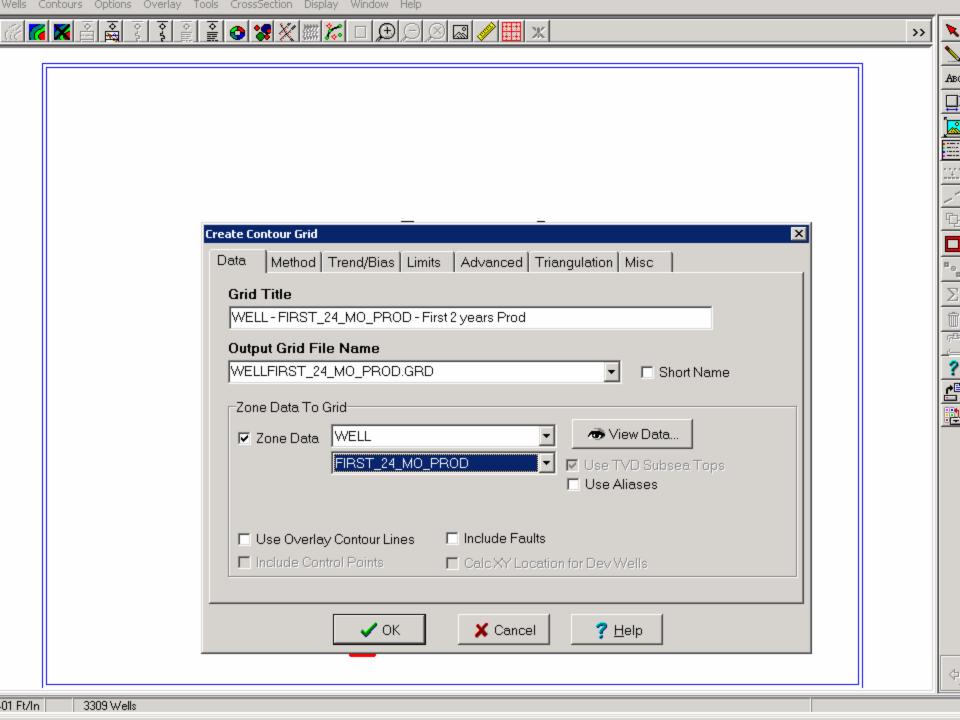


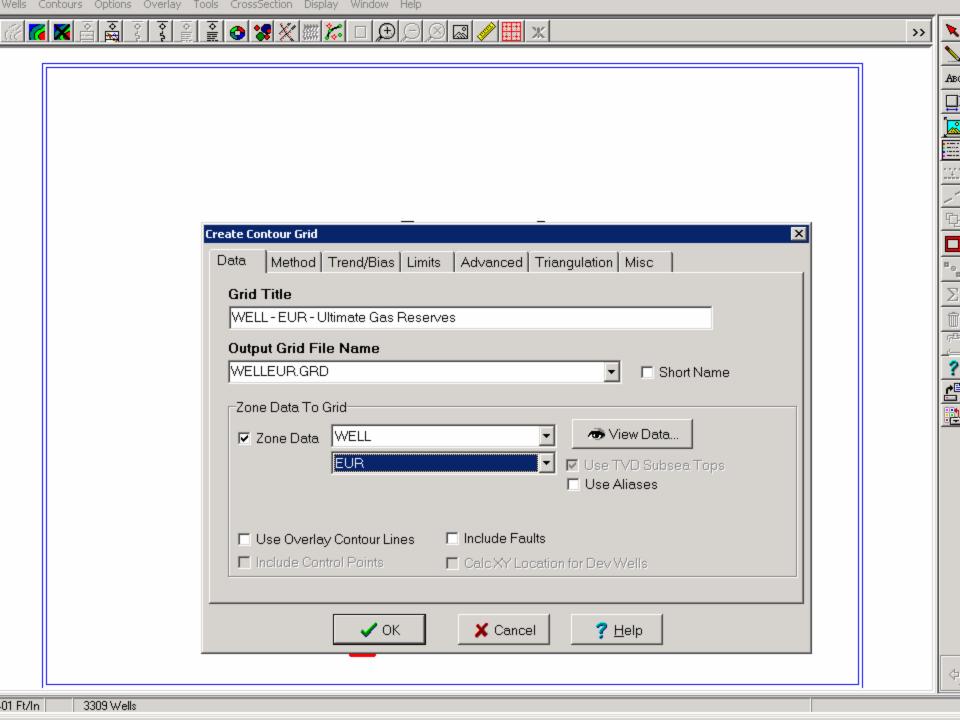


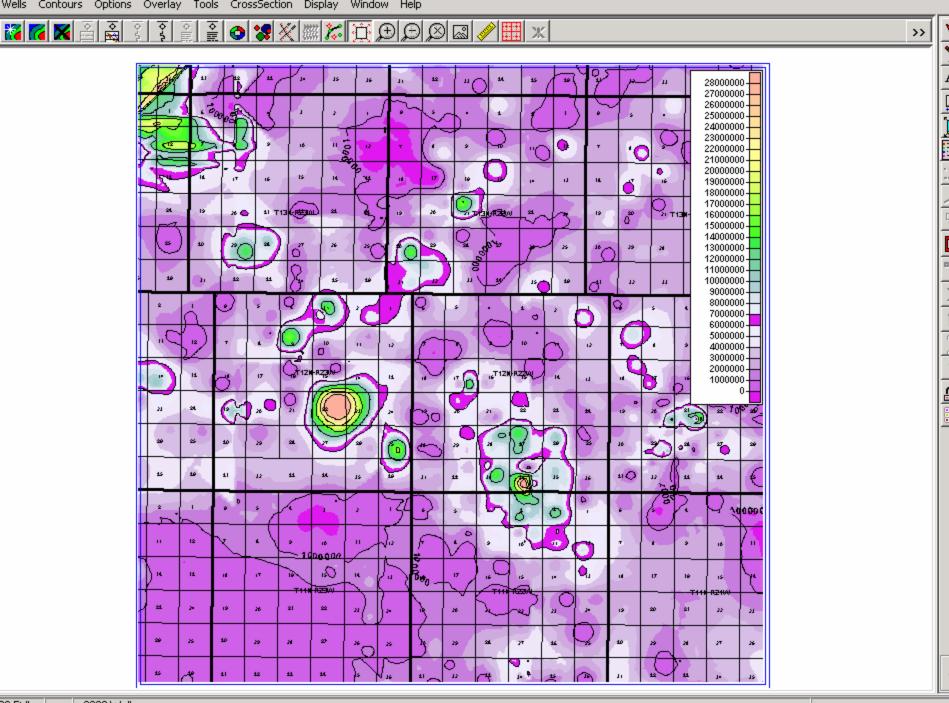
- Calculate first two years of production
- Determine min & max with statistical analysis
- Normalize the data
- Map it just like you would with kh data
- Compare it to EUR's with overlays

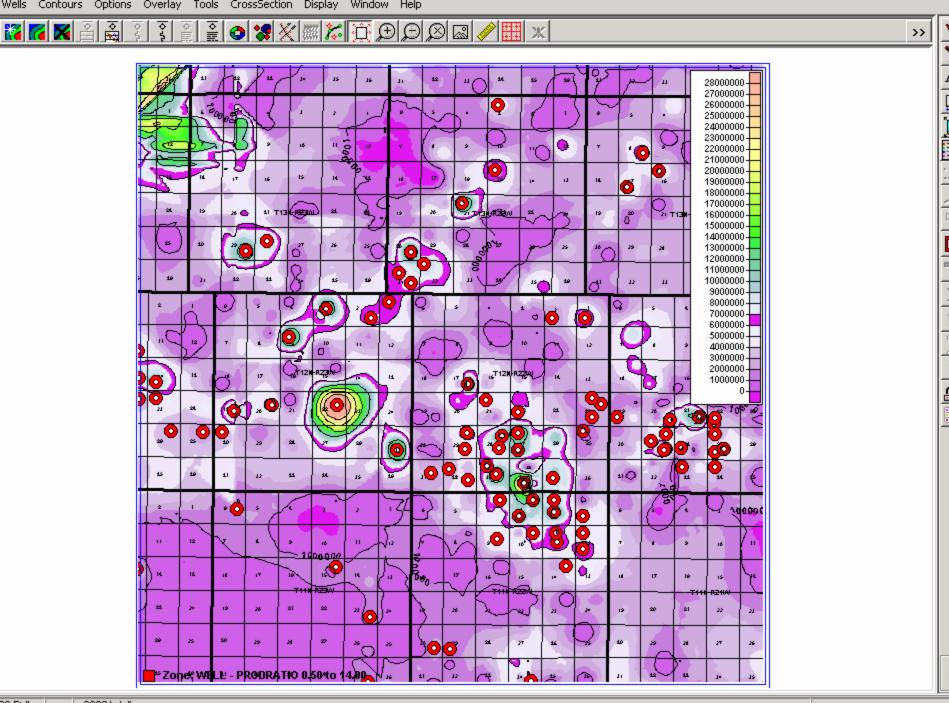






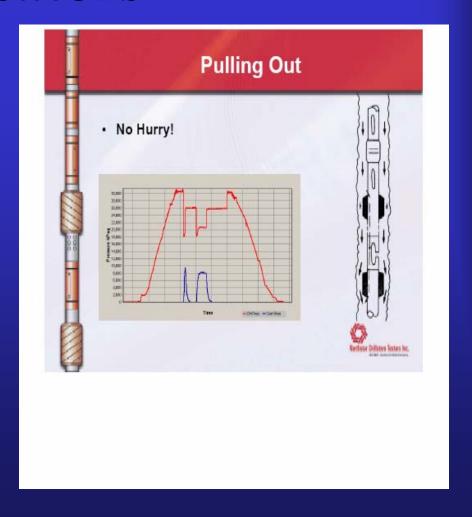




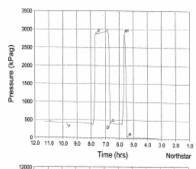


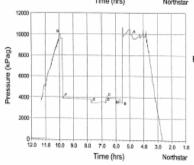
DST Analysis as Permeability Indicators

- Use to Analyze regions or basins for prospect leads
- Compare areas of high permeability with EUR's for anomalies
- Identify areas of high permeability and low EUR's as indicative of damaged zones



Basics of DST Testing





3-11-60-3W5 DST#1

FLUID RECOVERY (DST#1 & #2)

Drilling Mud	30	m
Total	30	m

BLOW DESCRIPTION

Preflow: Weak air blow increasing to strong in 7sec. GTS in 1min. 4 meter flame.

Second flow: Strong air blow immediately. GTS immediately. 4 meter flame.

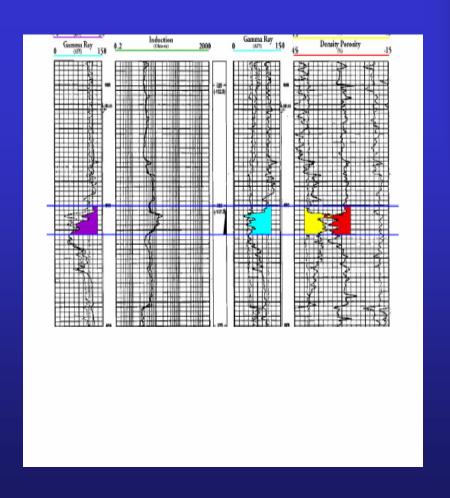
GAS RECOVERY

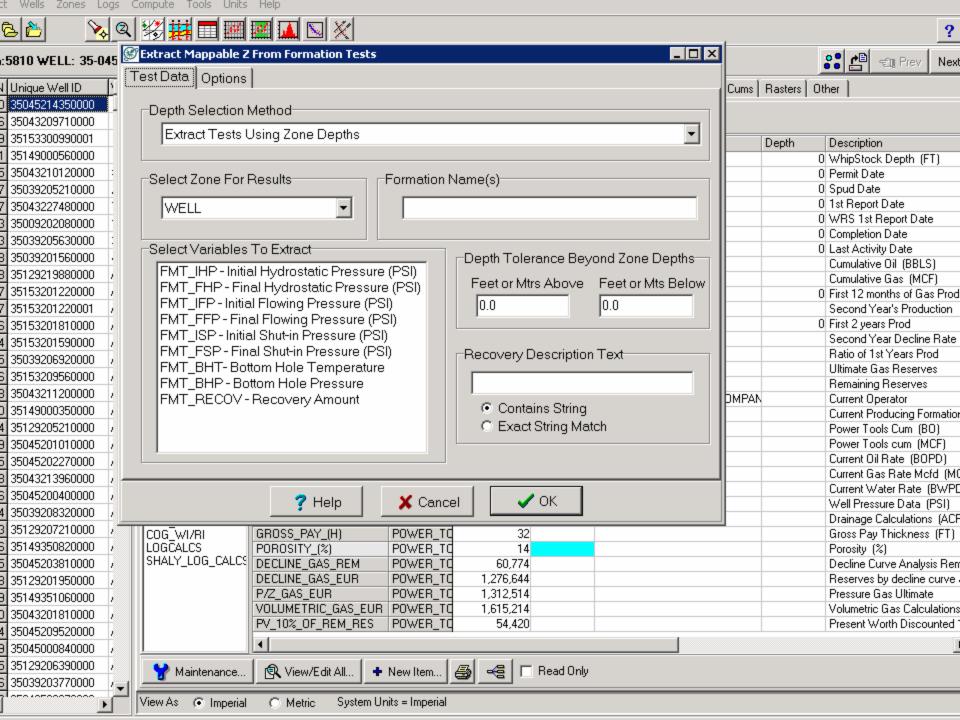
Time	Orifice	Pressure	Rate	Rate
mins	mm	kPaq	m³/d	MCF/D
Preflow	12.700	2100	56358	2000
10	12.700	2250	60198	2140
20	12.700	2250	60198	2140
30	12.700	2250	60198	2140
40	12.700	2250	60198	2140
50	12.700	2250	60198	2140
60	12.700	2250	60198	2140
	mins Preflow 10 20 30 40 50	mins mm Preflow 12.700 10 12.700 20 12.700 30 12.700 40 12.700 50 12.700	mins mm kPag Preflow 12.700 2100 10 12.700 2250 20 12.700 2250 30 12.700 2250 40 12.700 2250 50 12.700 2250	mins mm kPag m³√d Preflow 12.700 2100 56358 10 12.700 2250 60198 20 12.700 2250 60198 30 12.700 2250 60198 40 12.700 2250 60198 50 12.700 2250 60198

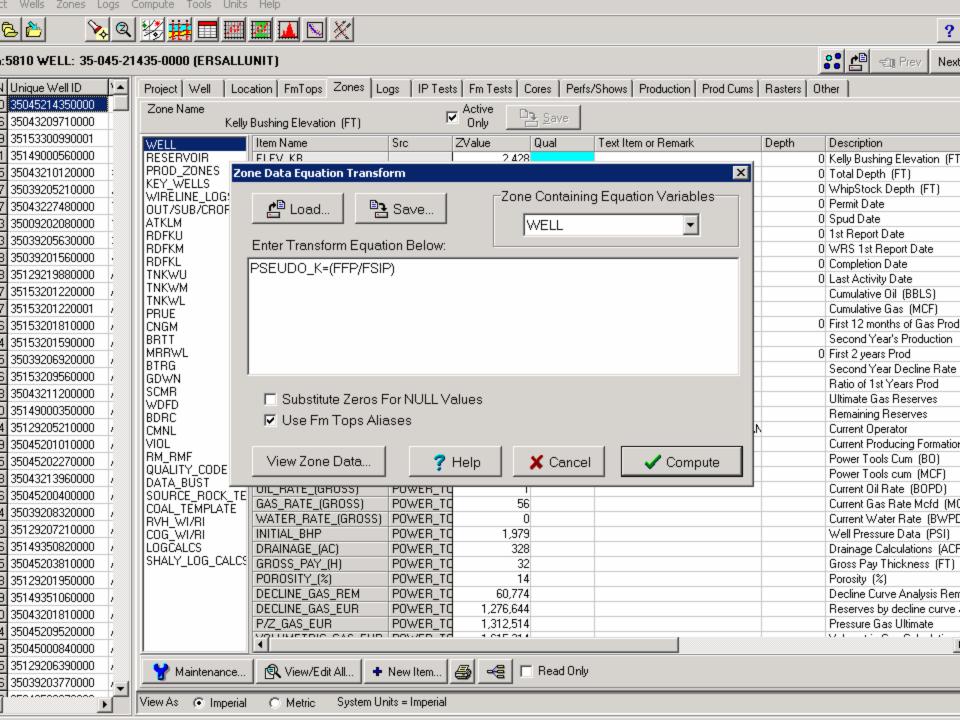
- ISIP = FSIP, reservoir not depleted or limited
- IHP = FHP & > SIP's, no significant mud loss and a good test for using data
- Large fluid recoveries = good permeability

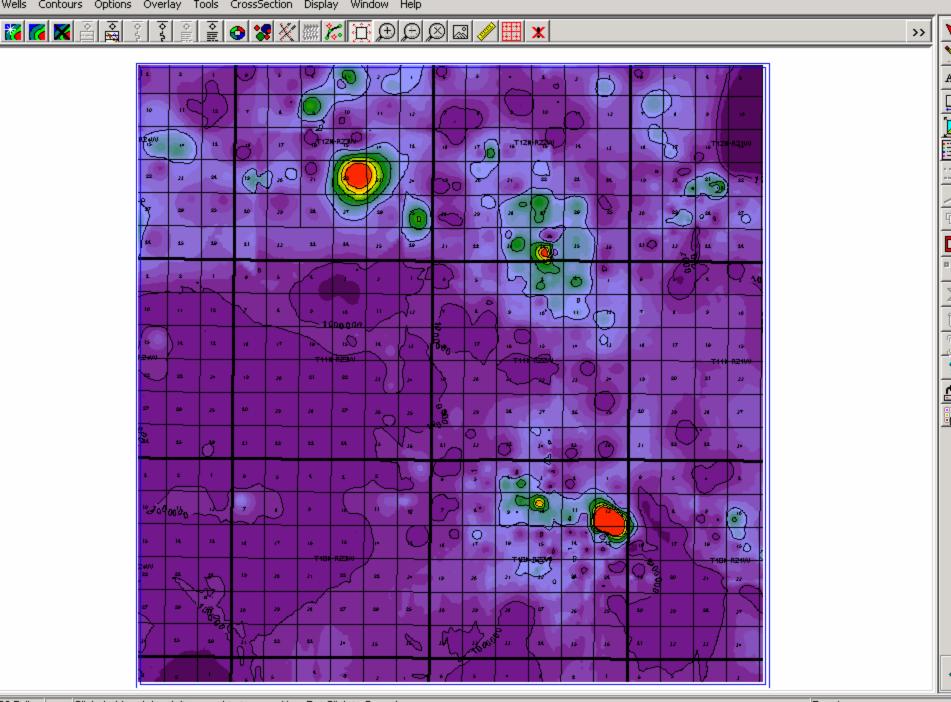
Calculating k from DST's

- Calculate ratio of FFP/FSIP
- Higher ratio is indicative of good k
- FP/SIP ratios with fluid recoveries – 75% higher than without fluid recovery, indicating higher k
- High FP/SIP with little or no fluid recovery is indicative of near wellbore damage

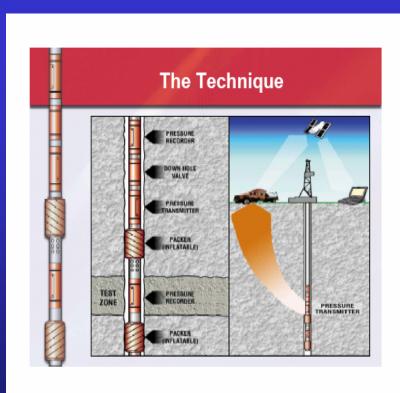








Permeability Indicators



- High $k = \overline{FP}$ is closer to SIP
- Low k FP is much smaller than SIP
- FSIP < ISIP is indicative of depletion or limited reservoirs

Darcy Equations & Productivity Analysis

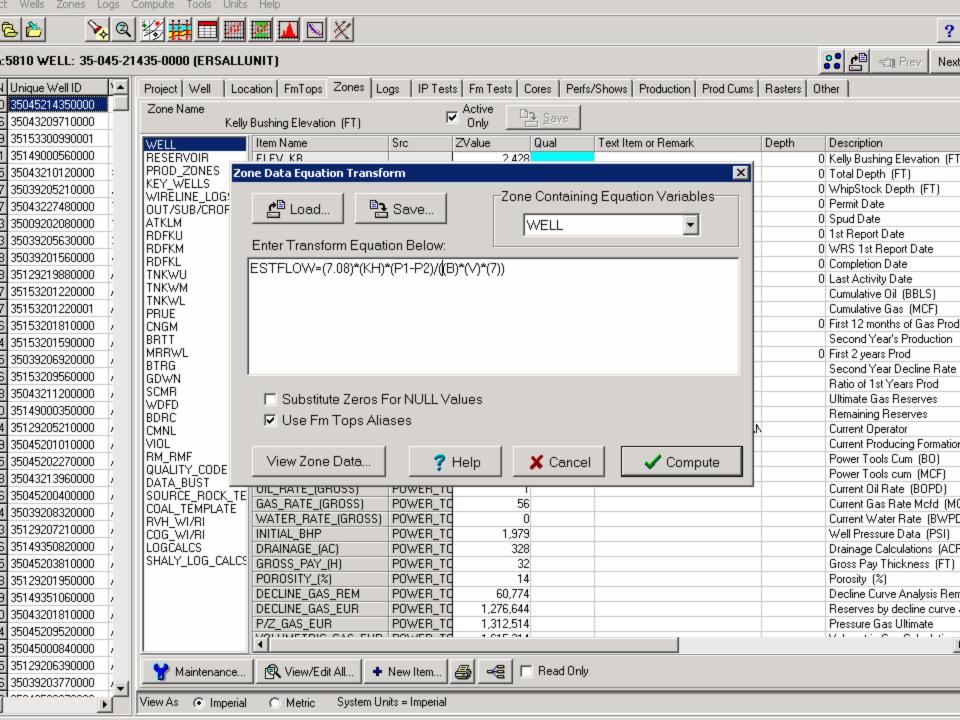
- Calculate which wells should be capable of producing if no damage exists
- Compare theoretical flow rates with actual flow rates for anomalies
- Identify wells that can be reworked or redrilled

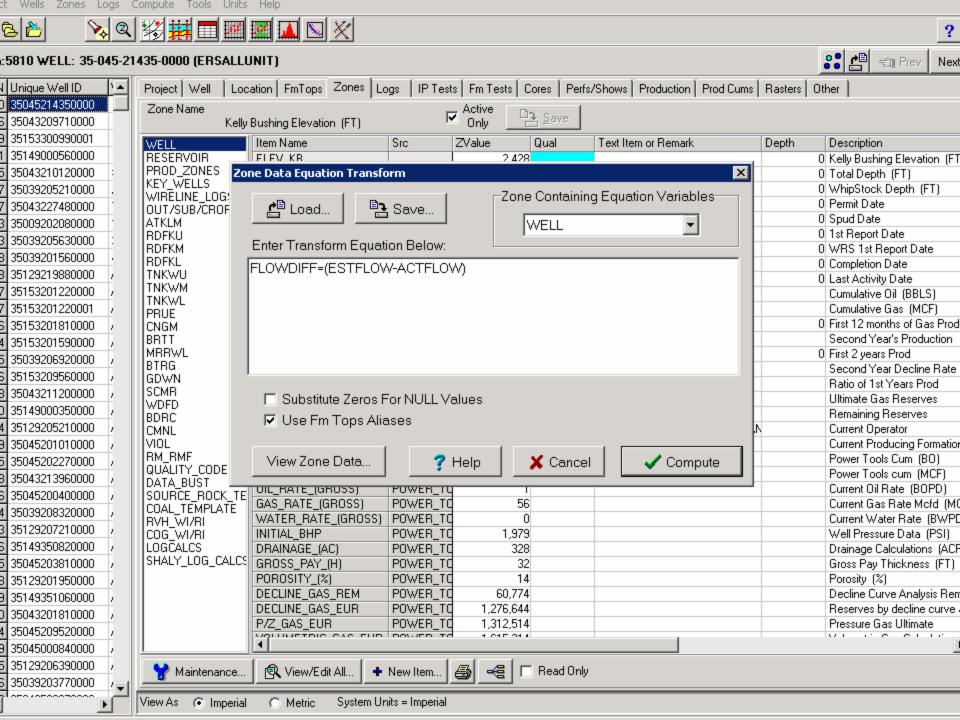
Darcy's Radial Flow Equation

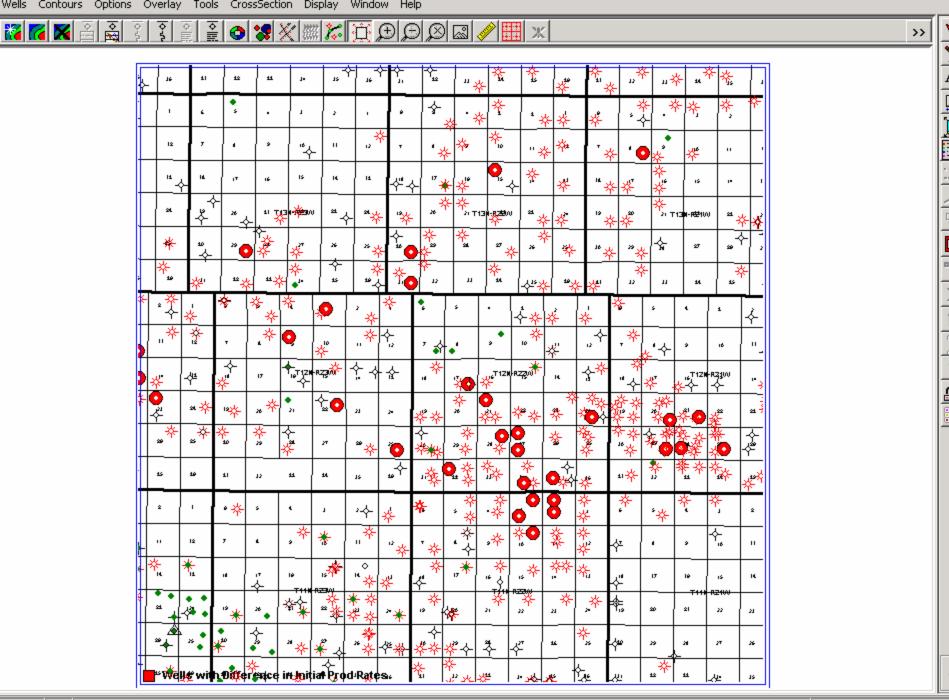
$$Q = (7.08)(kh)(\Delta P) / (B_o)(\mu)(\ln r_e/r_w), bopd$$

$$Q = (0.703)(kh)(\Delta P) / (z)(BHT)(\mu)(\ln r_e/r_w), mcfd$$

 $\ln r_e/r_w = 6 \text{ to } 8$ therefore use 7 as a good estimate







High PI Well Anomalies

- Calculate Productivity Index (PI) for region or basin
- Identify areas of high PI potential
- Compare PI's with EUR's for anomalies

Determine PI

 Use Darcy's Equation to calculate and populate zones for mapping and contouring

$$(Q/\Delta P) = (7.08)(kh)/(B_o)(\mu)(\ln r_e/r_w)$$

- Calculate Bcf/1000 psi or MMbo/1000 psi for each well in region or basin
- Identify anomalies for acquisition or drilling prospects

