

Current Status of CBM in Western Canada

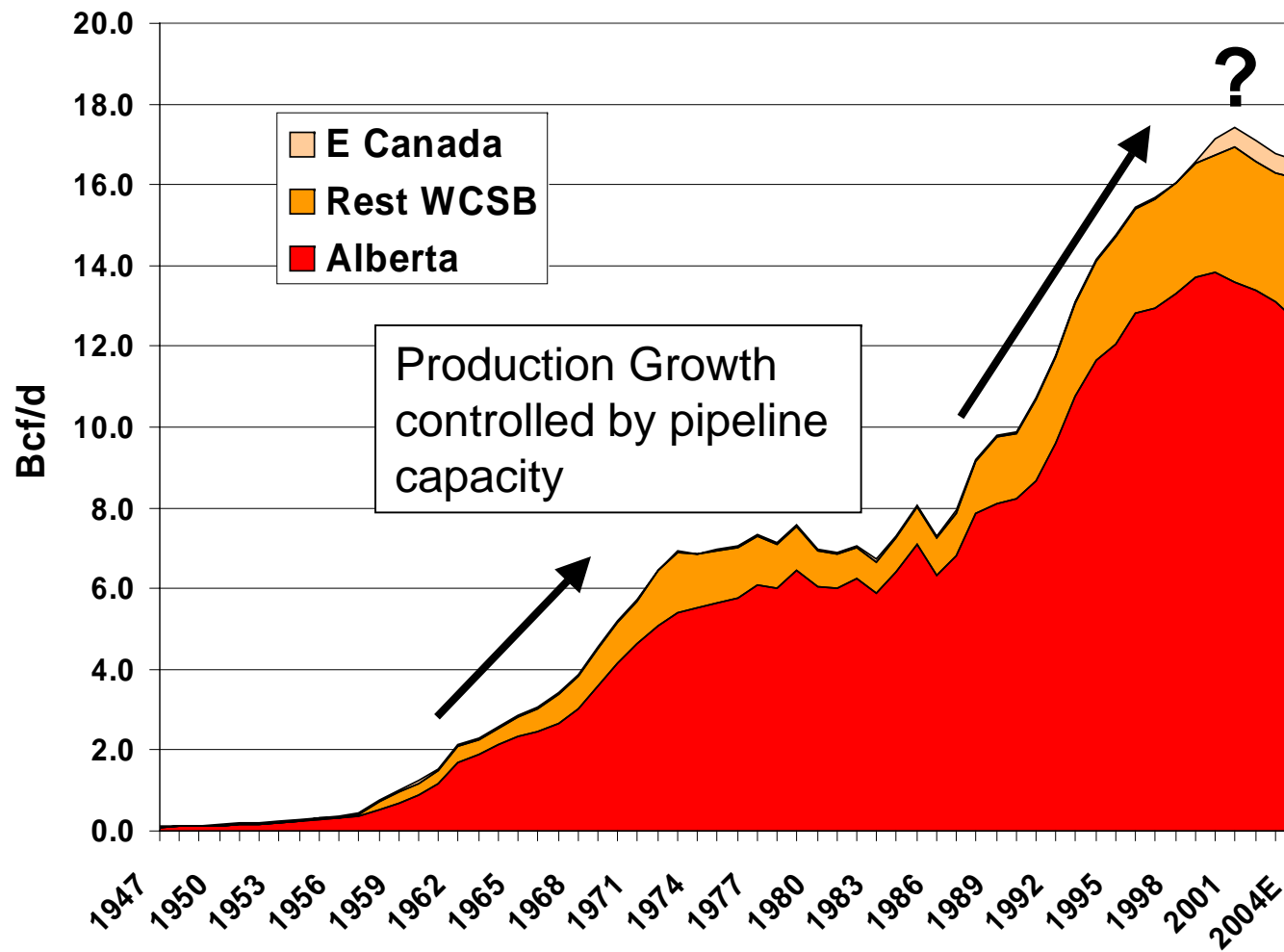
**Dave Russum, P.Geol.
AJM Petroleum Consultants**

**Canadian Institute –
Coalbed Methane Symposium
June 13th 2005**



Canada's Natural Gas Production

(Bcf/d Adapted from CAPP Data)



Record Prices
Record Activity
Production flat to declining
Not Sustainable

Resource Triangle

**Conventional
Reservoirs**

Small Resource
High Quality
Difficult to find
Easy to develop
Low cost
High margin

**Obvious
Traps**

W.C.S.B.

Basin Maturity
Better Technology
(Higher prices)

**Unconventional
Reservoirs**

**Oil
Shale**

**Shale
Gas**

**Gas
Hydrates**

Large Resource
Low Quality
Easy to find
Difficult to develop
High cost
Low margin



Canada's Resources and Reserves

Natural Gas

(Conventional data adapted from CGPC 2001)



?1000'sTcf

Ultimate Resources

**Total
Conventional + Unconventional
592Tcf**

?>1,000Tcf

Discovered

340Tcf

Raw Gas

Sales Gas

204Tcf

Rate of Conversion:

**Accessibility
Technology**

**Price
Motivation**

Remaining Reserves

Unproduced

58 Tcf

(>95% WCSB)

Understanding Remaining Gas Resources



– Accessible and Economically Available

	Accessible	Accessible with restrictions	Inaccessible
Available at current prices	Presently Available Resources	Future Available Resources	Unavailable Resources
Available at higher prices	Future Available Resources	Future Available Resources	Unavailable Resources

Can apply this approach to Conventional and Unconventional Resources

Unconventional Gas Reservoirs

- Any methane not trapped in a porous, permeable, buoyancy driven system
- ‘More Challenging to extract’
- Characteristics – extremely variable
- (Often)
 - Methane not freely dispersed
 - Source rock and reservoir closely related
 - Large, low concentration resources
 - Unusual pressure regimes
 - Low or heterogeneous permeability

Unconventional Gas - Producibility



- Low productivity, often low decline rates
- Low recovery factors
- Require greater drilling density
- Environmental issues
- Technologically challenging to produce:
 - Area and resource specific solutions
 - Low risk once specific solutions identified
- Relatively high development and operating costs

Unconventional Gas - Types

- Shallow Biogenic Gas
- 'Tight' Gas
 - includes Deep Basin and Basin Centred Gas (BCG)
- Coalbed Methane (CBM)
 - Also called Natural Gas from Coal (NGC)
- Shale Gas
- Gas Hydrates – in molecular structure of ice
- Inorganic Methane
- Continuous generated Methane

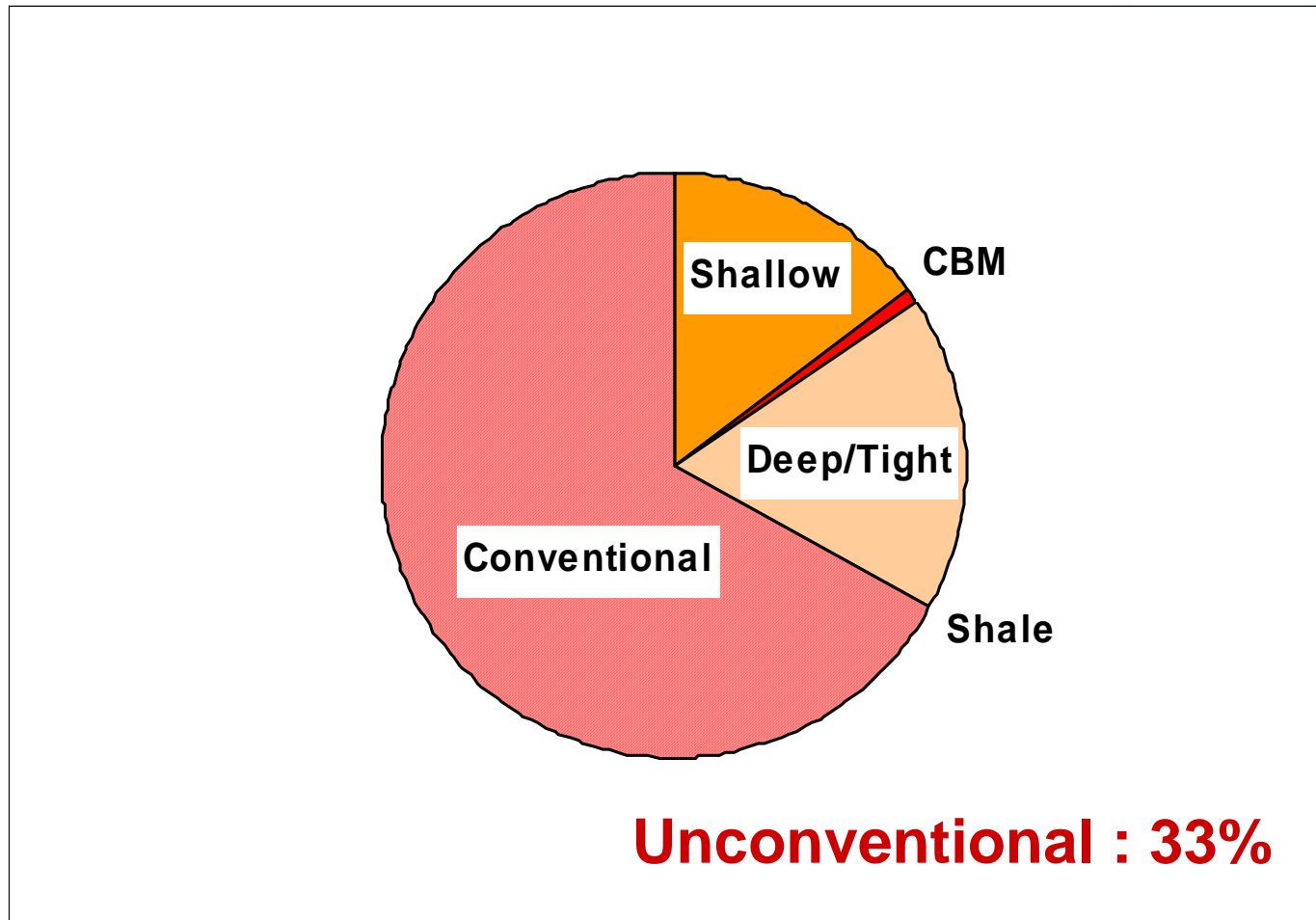
Unconventional Gas – Status and Resources

(*From various sources)



	Status USA	Resource in Canada*	Status Canada
Shallow Biogenic Gas	On-going Production	30Tcf	Production since 1905
Tight Gas	Growth Opportunity	600Tcf	Production since 1976
Coalbed Methane	On-going Production	400Tcf	Production since 2002
Shale Gas	On-going Production	100Tcf	Experimental activity
Gas Hydrates	Experimental Research	5,000Tcf	Experimental Research
Inorganic Methane	?Theoretical	?	?Theoretical
Continuously Generated Methane	Pilot Projects	400Mmcf/d	Pilot Projects

Contribution of Unconventional Gas Production, WCSB, December 2004



Canada's CBM Opportunities

- Significant coal bearing basins from Vancouver Island to Nova Scotia
- Best opportunities in WCSB especially where infrastructure available and environment familiar with gas activity
- 4 primary coal intervals identified:
 - Ardley Coals, Scollard Formation, Upper Cretaceous/Tertiary
 - Horseshoe Canyon Coals, Edmonton Group/Belly River Group, Upper Cretaceous
 - Mannville Coals, Lower Cretaceous
 - Kootenay Coals, Lower Cretaceous/Upper Jurassic
- Major challenge is finding sufficient permeability

WCSB Coalbed Methane

	Resource Potential	Status	
Ardley Coal WC Alberta	Low/Moderate	Limited activity, Best potential is relatively remote	Red
Horseshoe Canyon Coal	High	Focus of current activity, readily accessible, dry gas	Green
Mannville Coal WC Alberta	Very High	Experimental activity, requires de-watering eg. Trident, Corbett Creek.	Orange
Mannville Coal NE BC	Moderate?	Experimental activity, - 7 permits granted, confidential results	Orange
Kootenay Coal SE BC	Moderate	Experimental , Encana, Devon. Coal continuity and environmental problems	Red

Mannville CBM

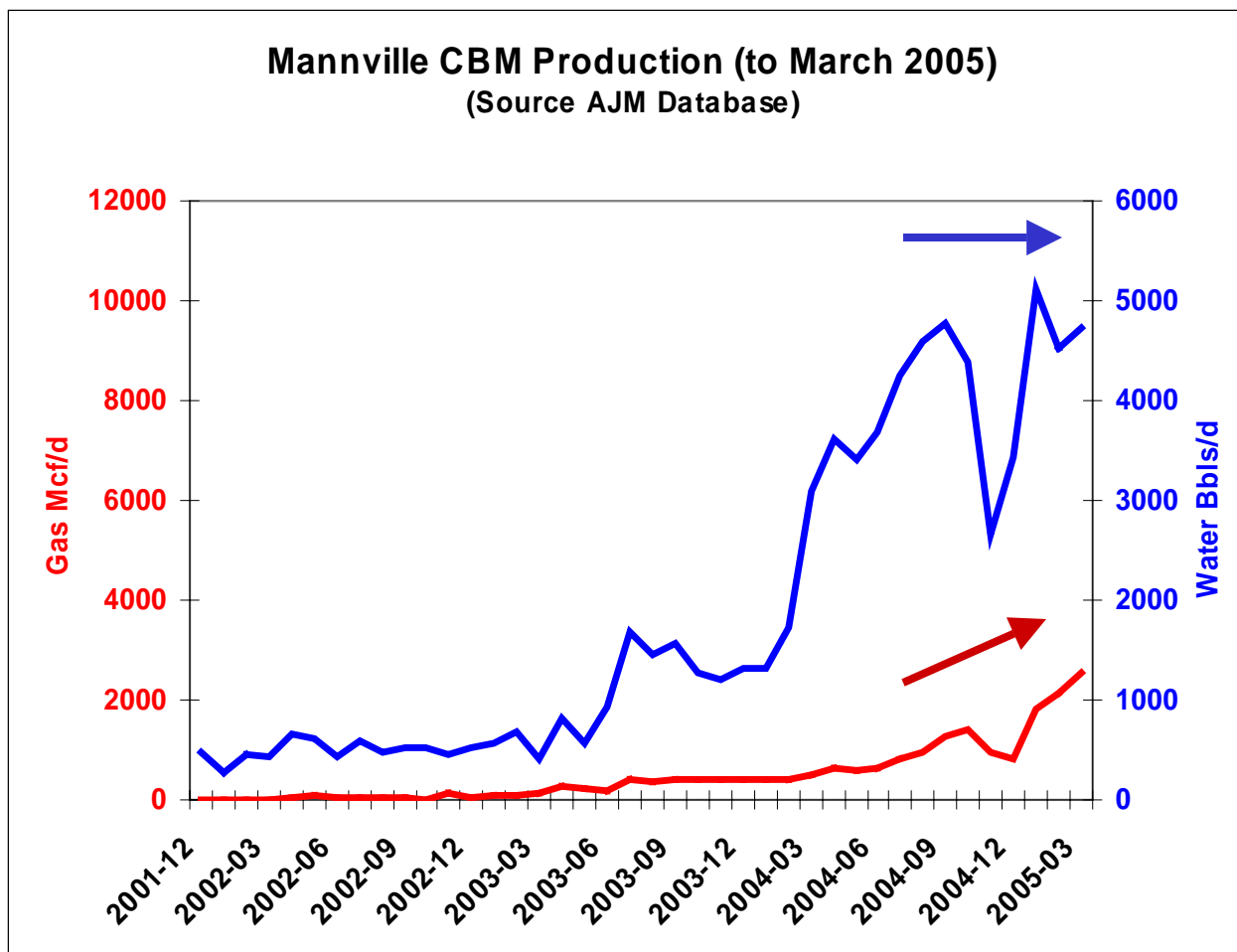


Mannville CBM – Current Status

- Still experimental
- ‘Conventional’ CBM requiring dewatering
- Not yet producing at economic rates
- Need to find ‘sweet spots’ – better permeability
- Main area of interest T60-66, R1-11W5
 - Starting to see experimentation over a wider area
- Main Operators
 - Trident - Corbett Ck
 - Apache
 - Thunder Energy
 - Nexen
 - APF

Mannville CBM Production

AJM Database wells producing Mar 2005

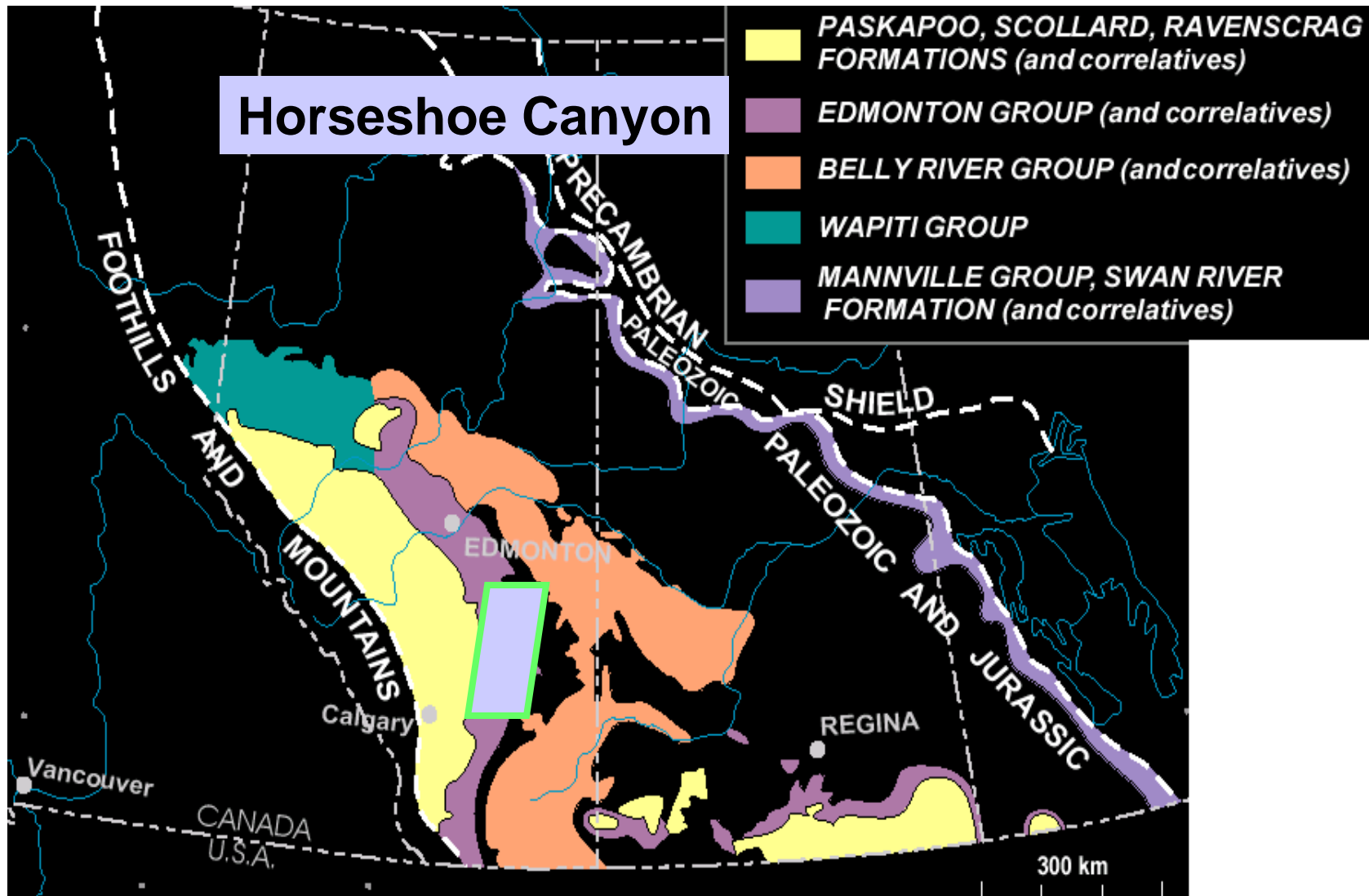


CBM producing well count: 56, Water 2000 bbls/Mmcf

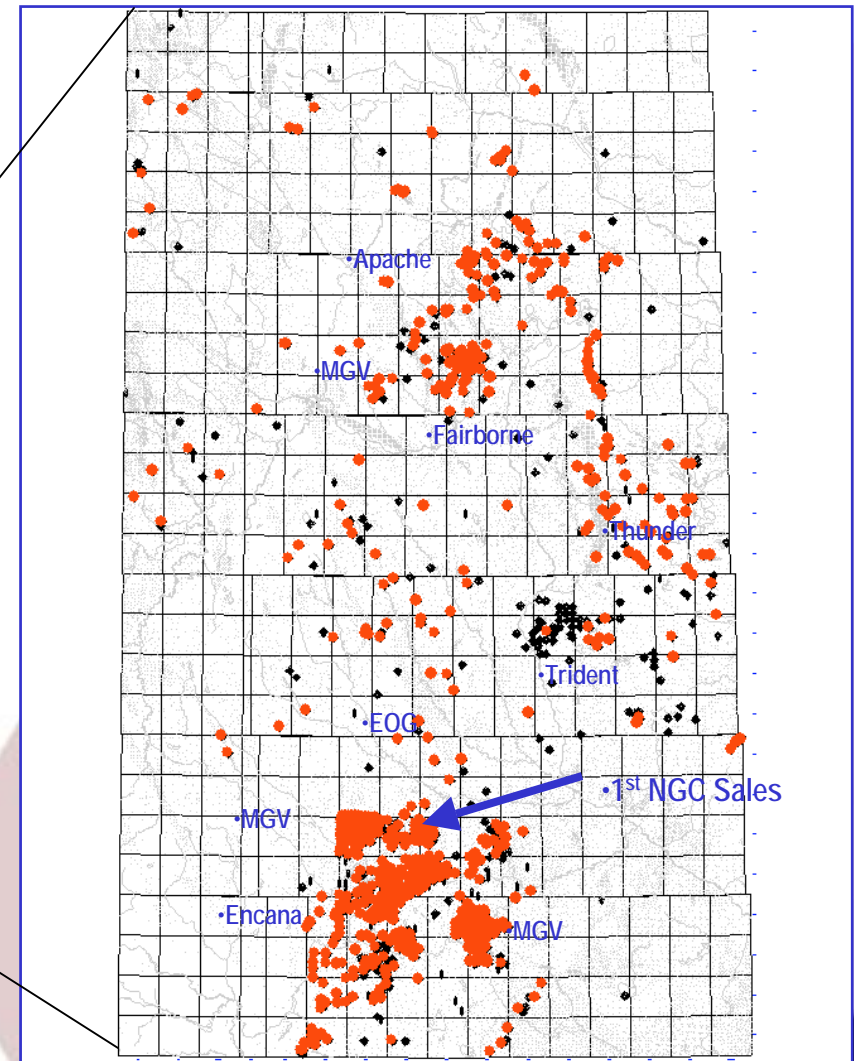
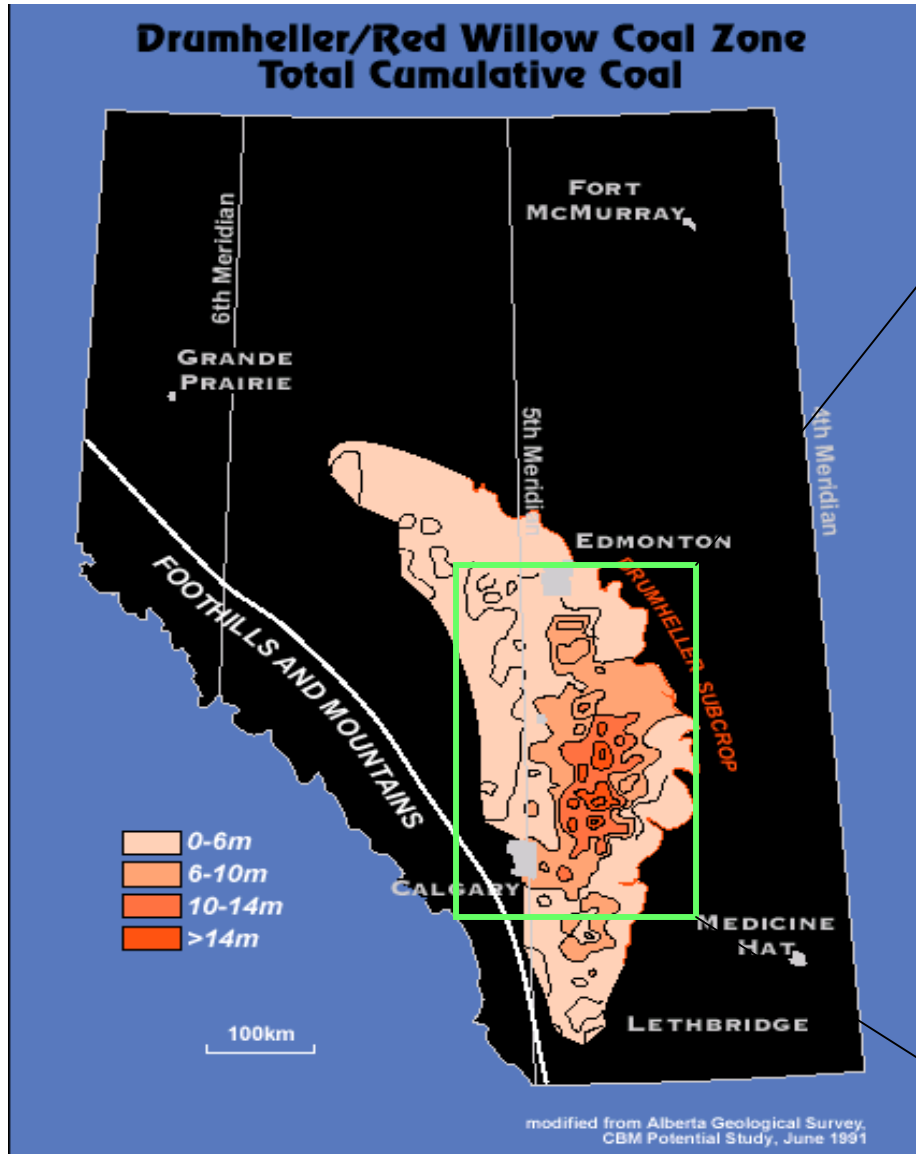
Horseshoe Canyon CBM



Coal-bearing Formations of the Interior Plains



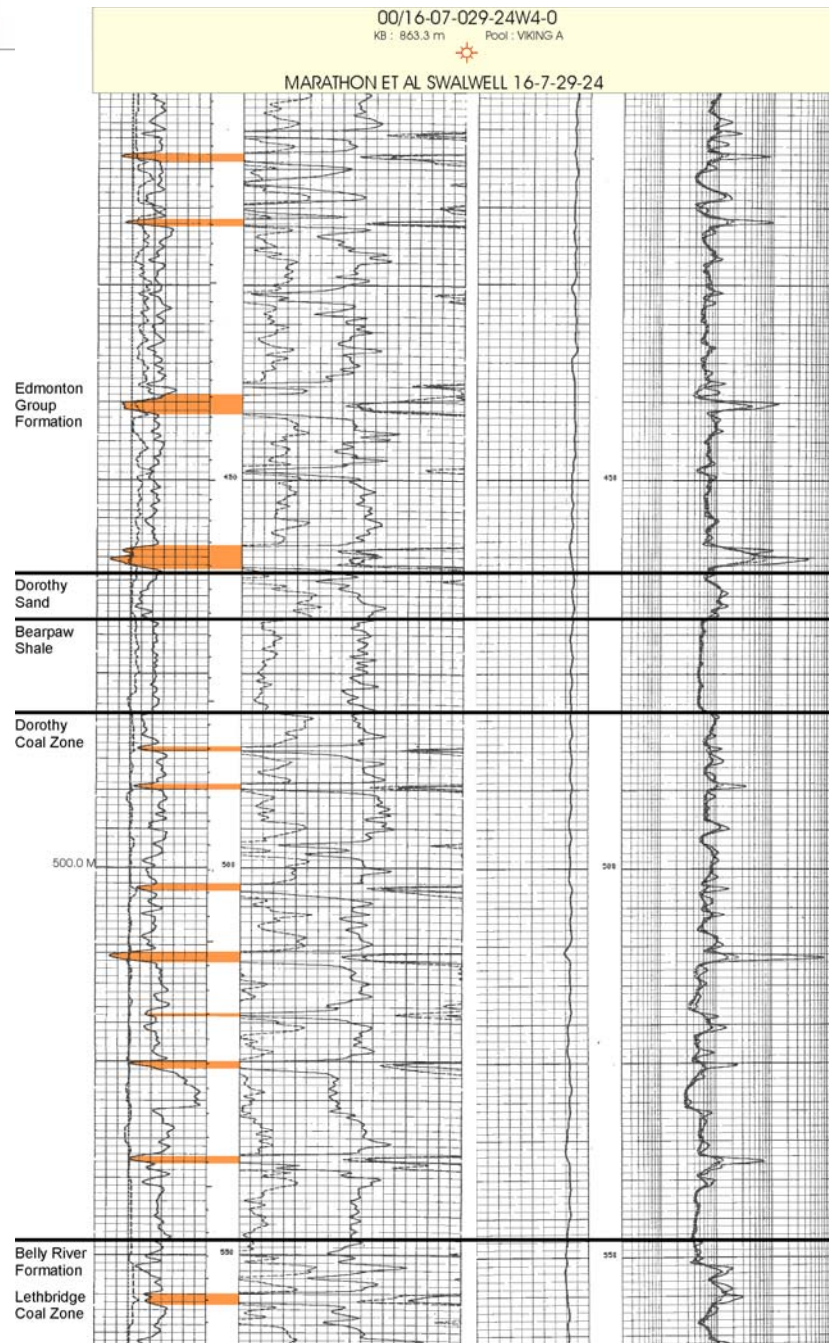
Horseshoe Canyon Coals



- Median depth ranges from 300m to 600m
- drill and complete 3 wells per day
- 10 to 20 seams of 1-2m thickness

Stimulated by Nitrogen gas fracture treatment

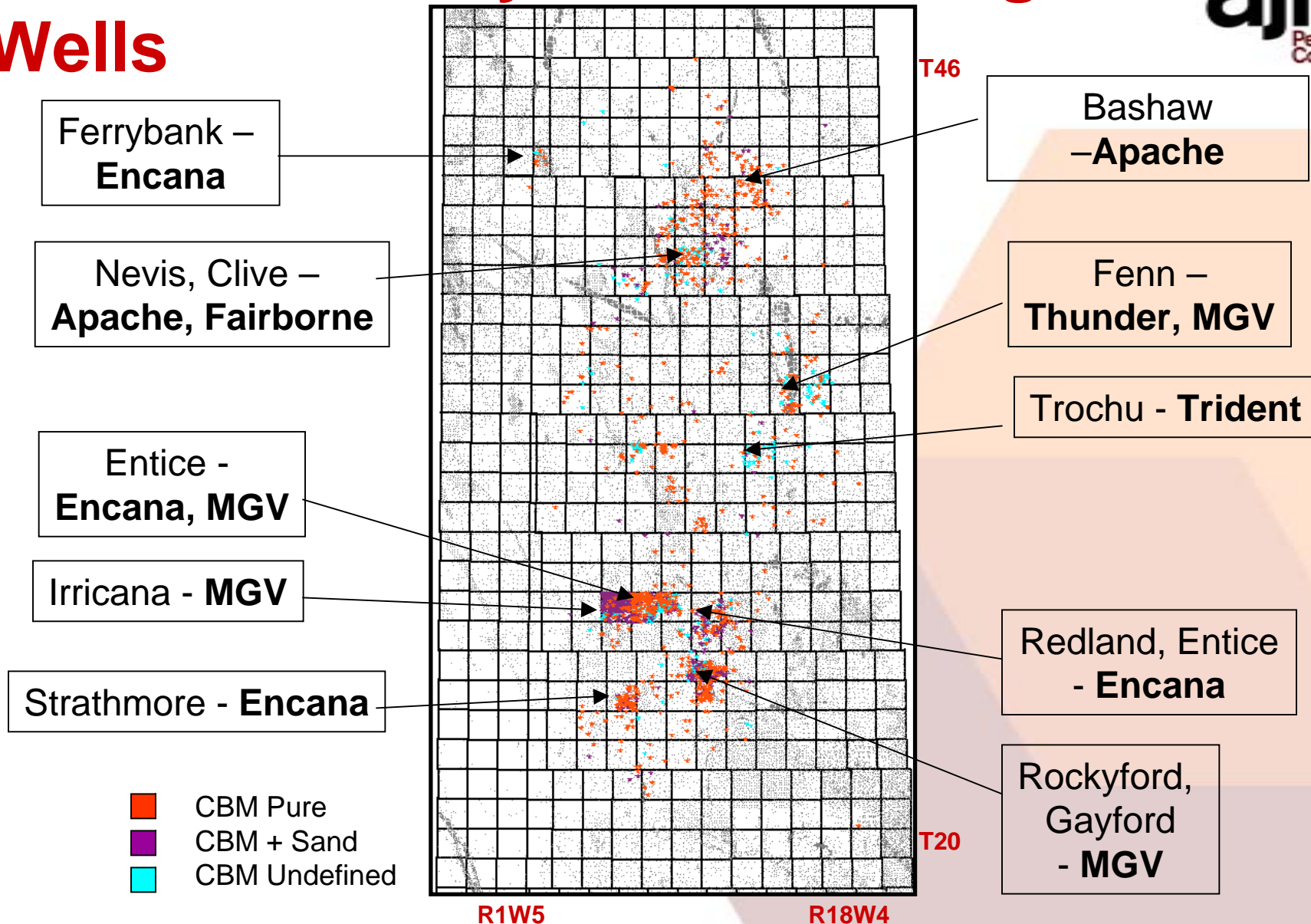
- 3 to 4 week flow testing
- No water production – dry gas
- Range 20 to 500 Mcf/d
- Well head pressure < 5psi
- Compression facilities required
- Four wells per section
- 1 to 4 BCF/section in place



AJM's CBM Database

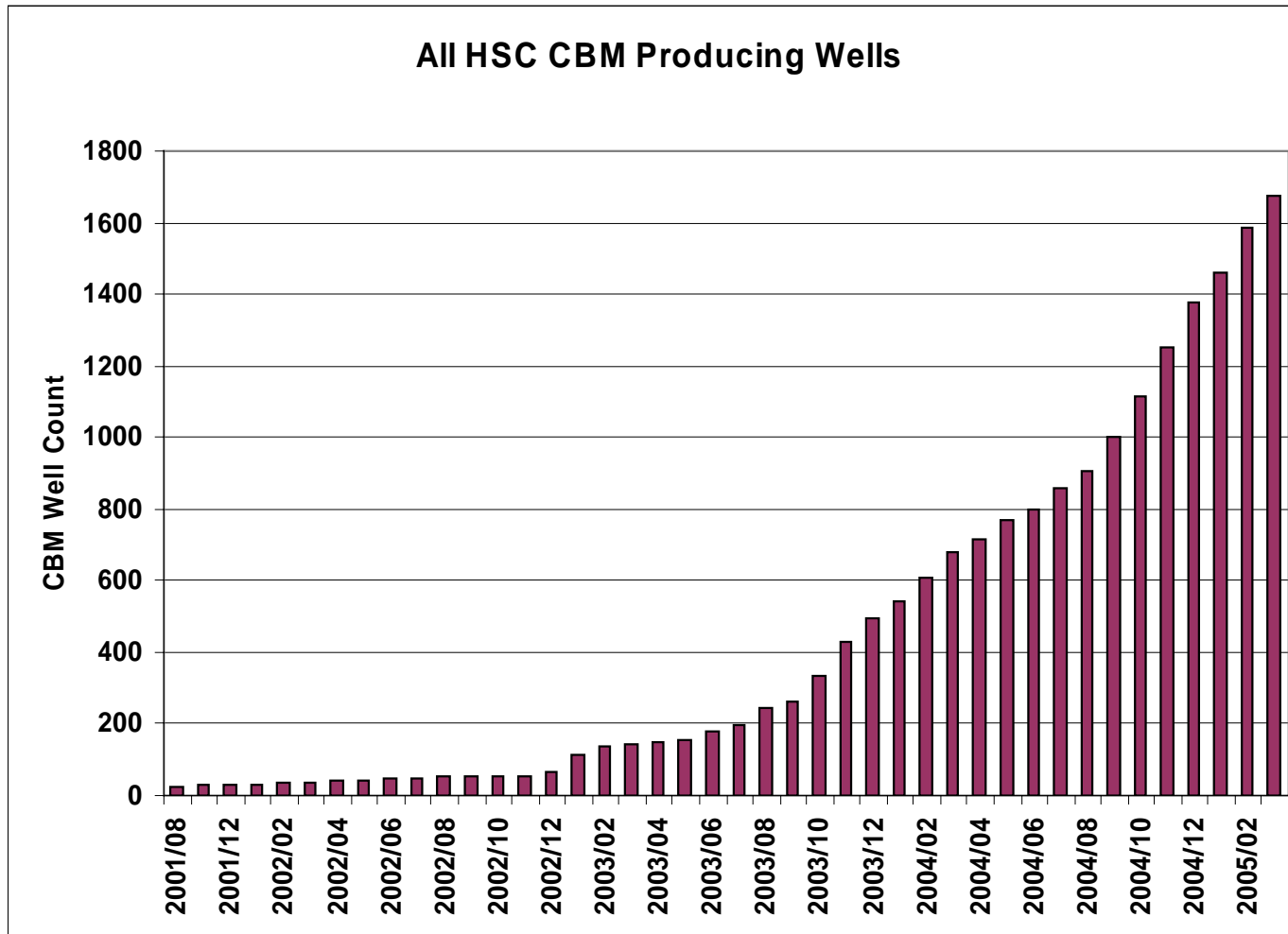
- Focused currently on Horseshoe Canyon
- Reviewed all wells in CBM Fairway
- Excludes confidential wells as of 31st March 2005 (underestimates total wells but gives better confidence in data)
- Assignments are independent of Board data
- Producing wells split into:
 - Pure coalbed methane wells
 - Wells with commingled perforation and production from coal and adjacent sands
 - Wells where there is a contribution from CBM but information is incomplete
 - Confidential wells licensed as CBM

Horseshoe Canyon – Producing Wells



Horseshoe Canyon

All CBM – Producing Well Count To Mar 2005 excluding Confidential Wells



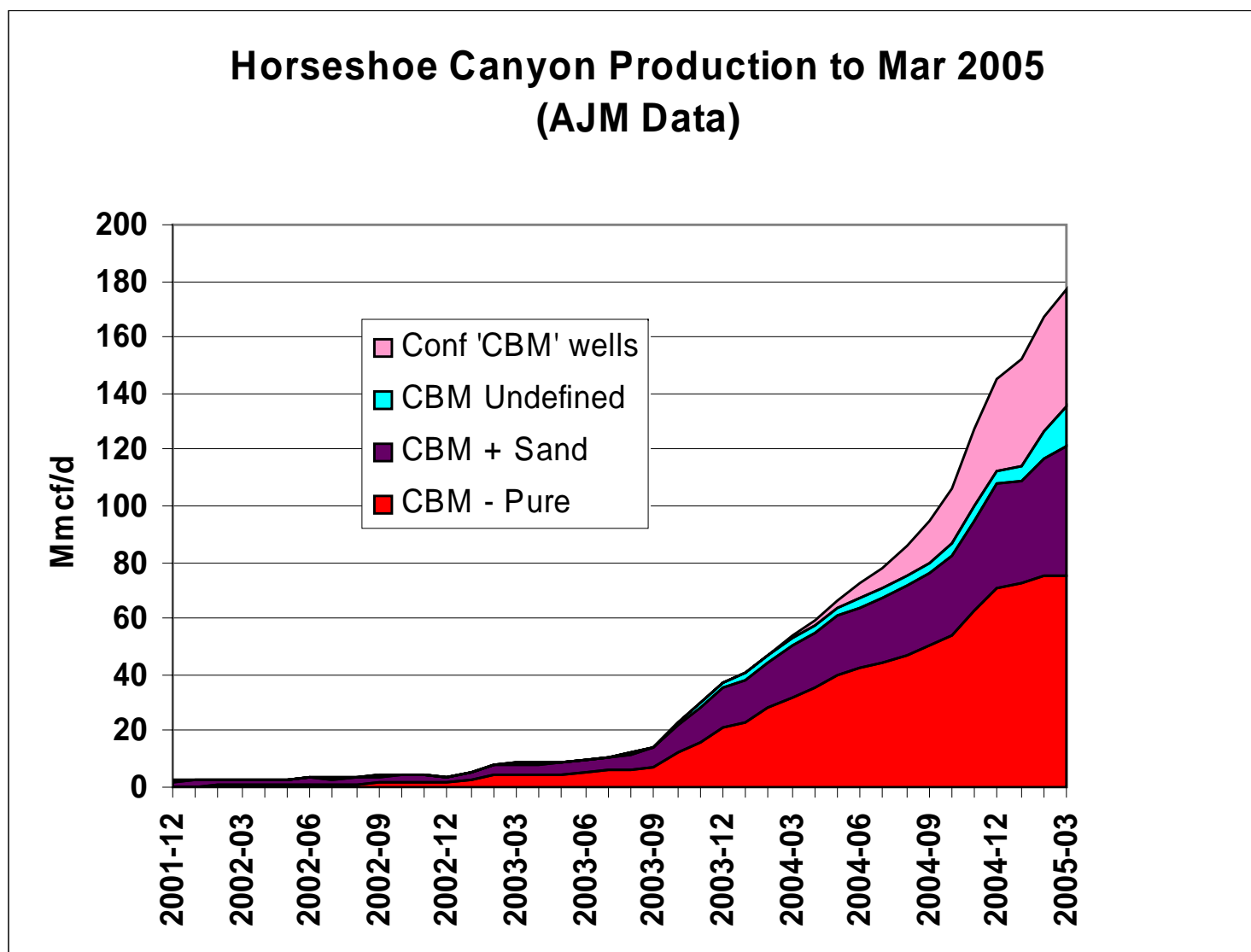
Horseshoe Canyon CBM – Producing well count



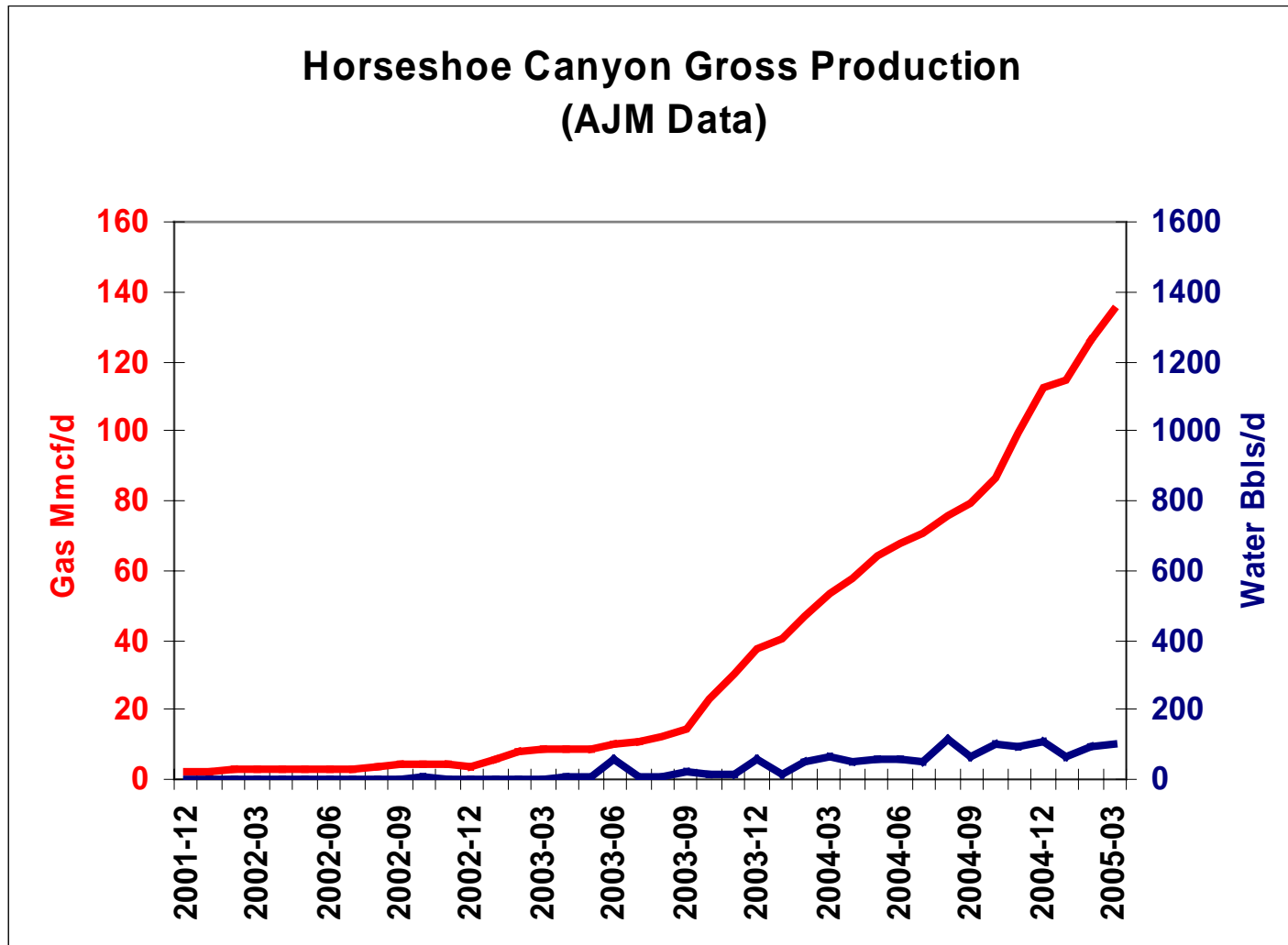
	Horseshoe Canyon Producing Well Count
Wells producing Pure CBM	951
Wells producing from Coal + Sand without differentiation of production	547
Wells producing from coal but insufficient data to define whether production also from adjacent sand	183
Confidential wells probably producing from coal	384
TOTAL	2065*

* Compares to 1470 wells identified by AEUB as CBM wells

Horseshoe Canyon Production



Horseshoe Canyon CBM Production



CBM producing well count (excludes confidential): 1675, Water <1bbl/Mmcf

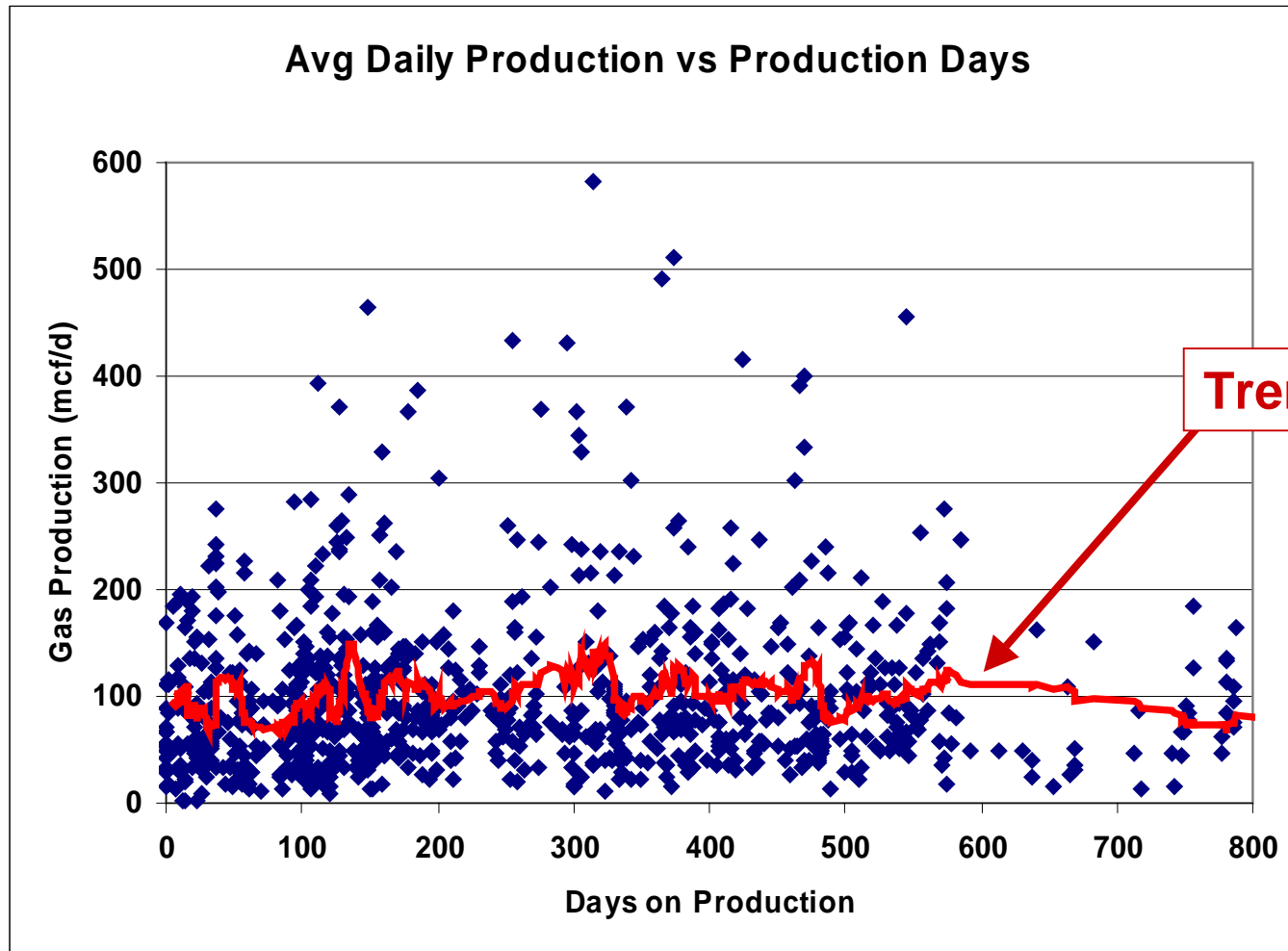
Horseshoe Canyon Production

- Observations



- Considerable variation in production profiles
- Varies between wells, between areas and between operators
- Relative productivity greatly influenced by line pressure
 - Need very low line pressure
 - Noise from compression is major environmental challenge
- Early phase of development limits accurate prediction of ultimate productivity
- Developing tools to better understand and predict results

Horseshoe Canyon Current Productivity



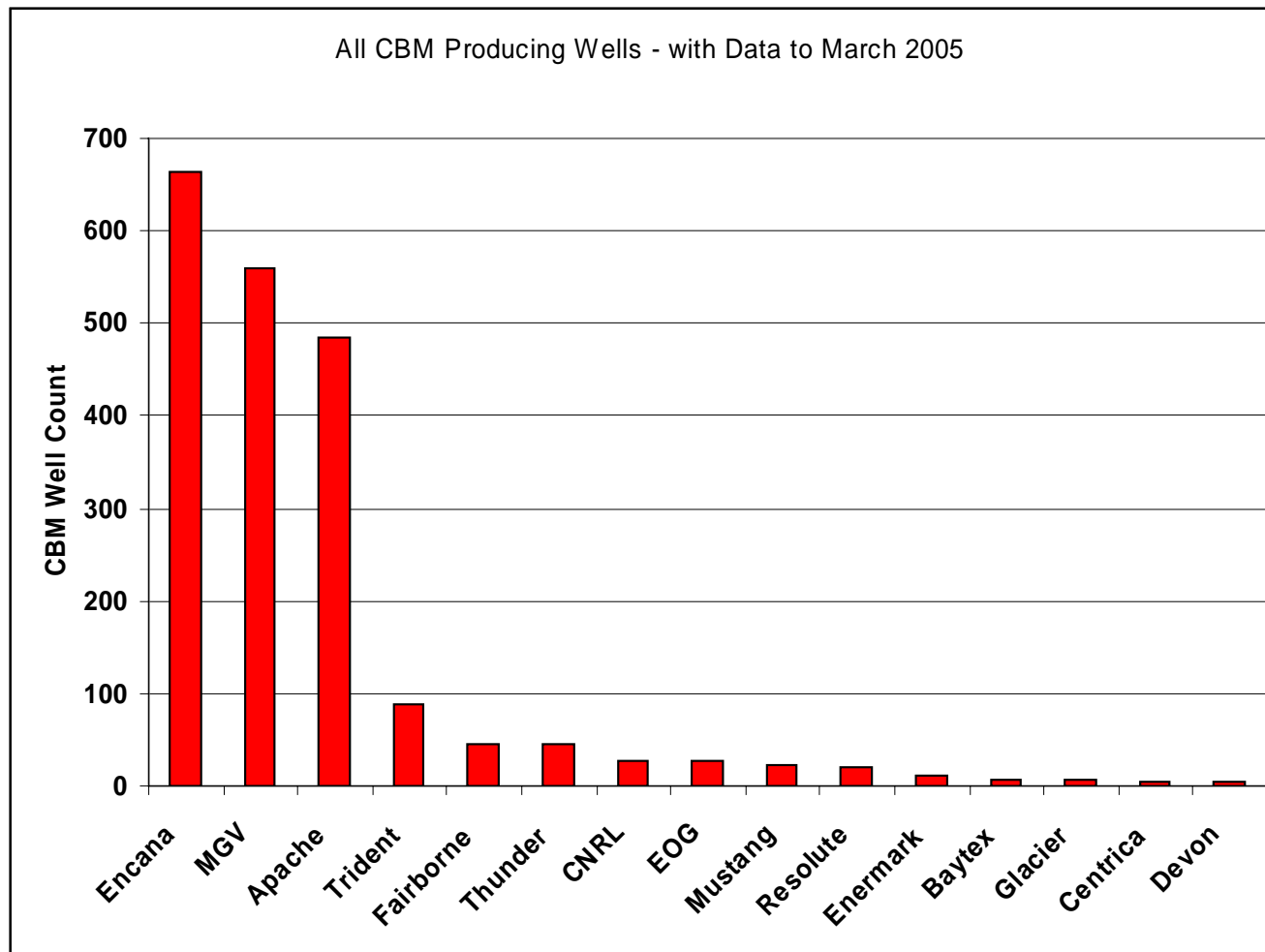
Horseshoe Canyon Productivity Statistics (mcf/d) to March 2005



	Pmean Daily Production	P10	P50	P90
CBM Pure	100	186	81	32
CBM + Sand	104	202	80	44
CBM Unconfirmed	100	172	81	35

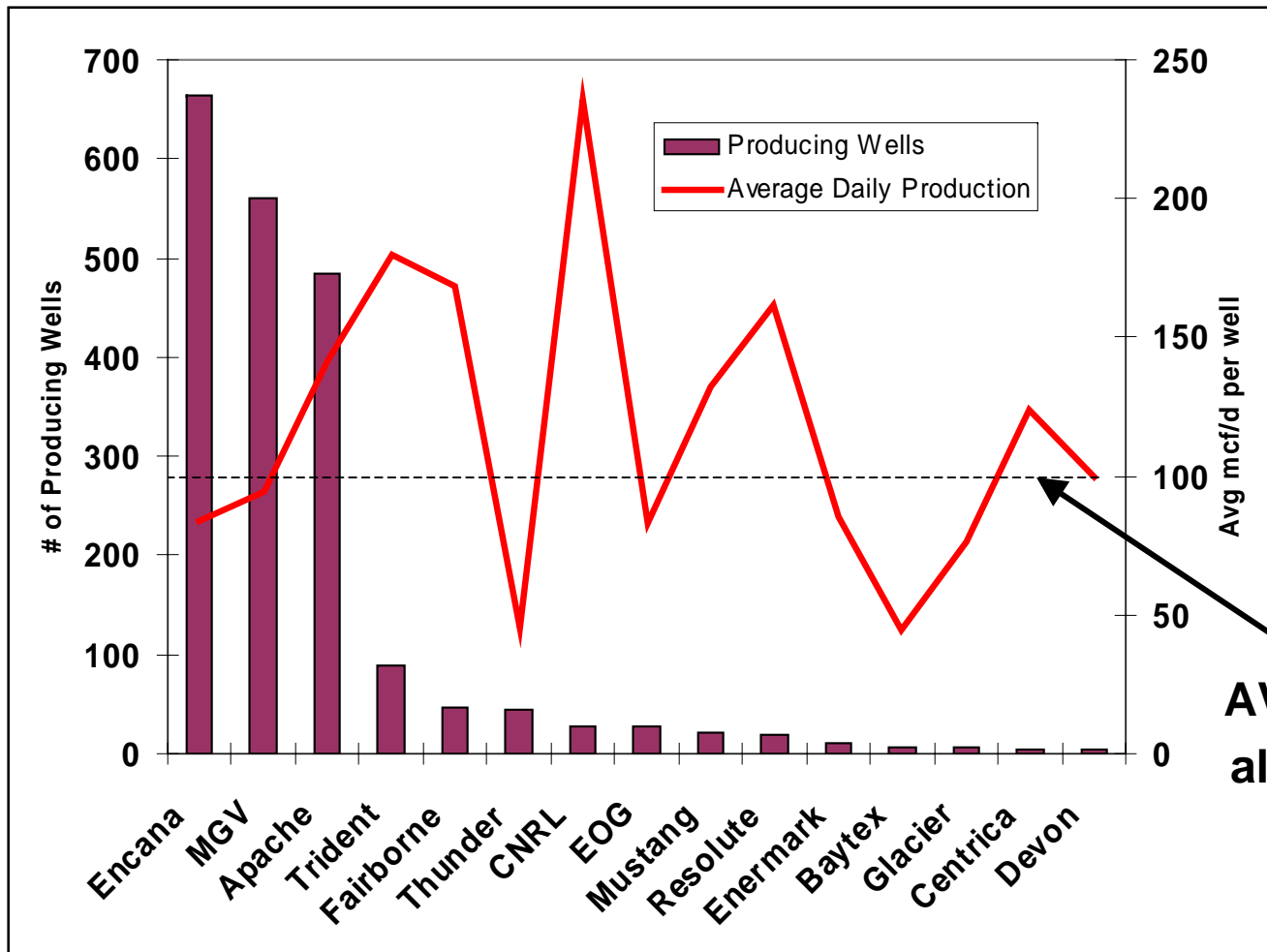
HSC CBM wells data to March 2005

- 5 or more wells on production



+ 26 Operators with <5 wells on Production

Average HSC Productivity for main CBM Producers



**AVG all wells
all producers**

Horseshoe Canyon CBM – How significant?

- Fairway with >4m net aggregate coal covers approximately 12,000 sq miles
- 4 wells per sq mile = 48,000 well
- If 24,000 wells on production at one time @ 100mcf/d = **2.4Bcf/d**
- 48,000 wells @ 300mcf = approx. **15Tcf of Marketable gas**

In Conclusion:

- Typical Horseshoe Canyon CBM well produces 100mcf per day
- Considerable variations in the productivity by area and Company
- AJM will continue to gather data on CBM as it evolves in Canada to identify trends, productivity and ultimately reserves per well

More Information?

Dave Russum, drussum@ajma.net

CBM Studies at AJM: Larry Boyd, lboyd@ajma.net

**AJM Petroleum Consultants, Petrocube and Well Load:
Hugh Mosher, hmosher@ajma.net**

www.ajma.net or www.petrocube.com

AJM Petroleum Consultants: (403) 232-6600

