

Commingled Production from Deep Basin Plays

Wild River region, western Alberta

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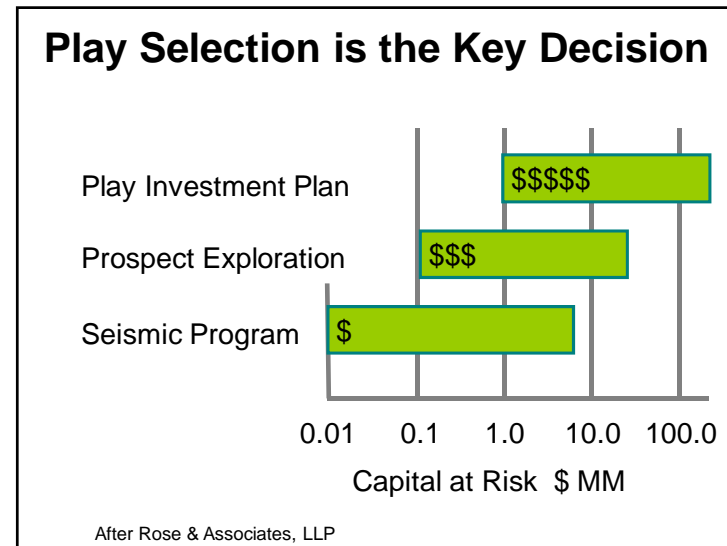
Forward Energy Group Inc.

- Capabilities

- Play focus
- Supply characterization
- Competitor benchmarking
- Resource assessment
- Value analysis

- Products and Services

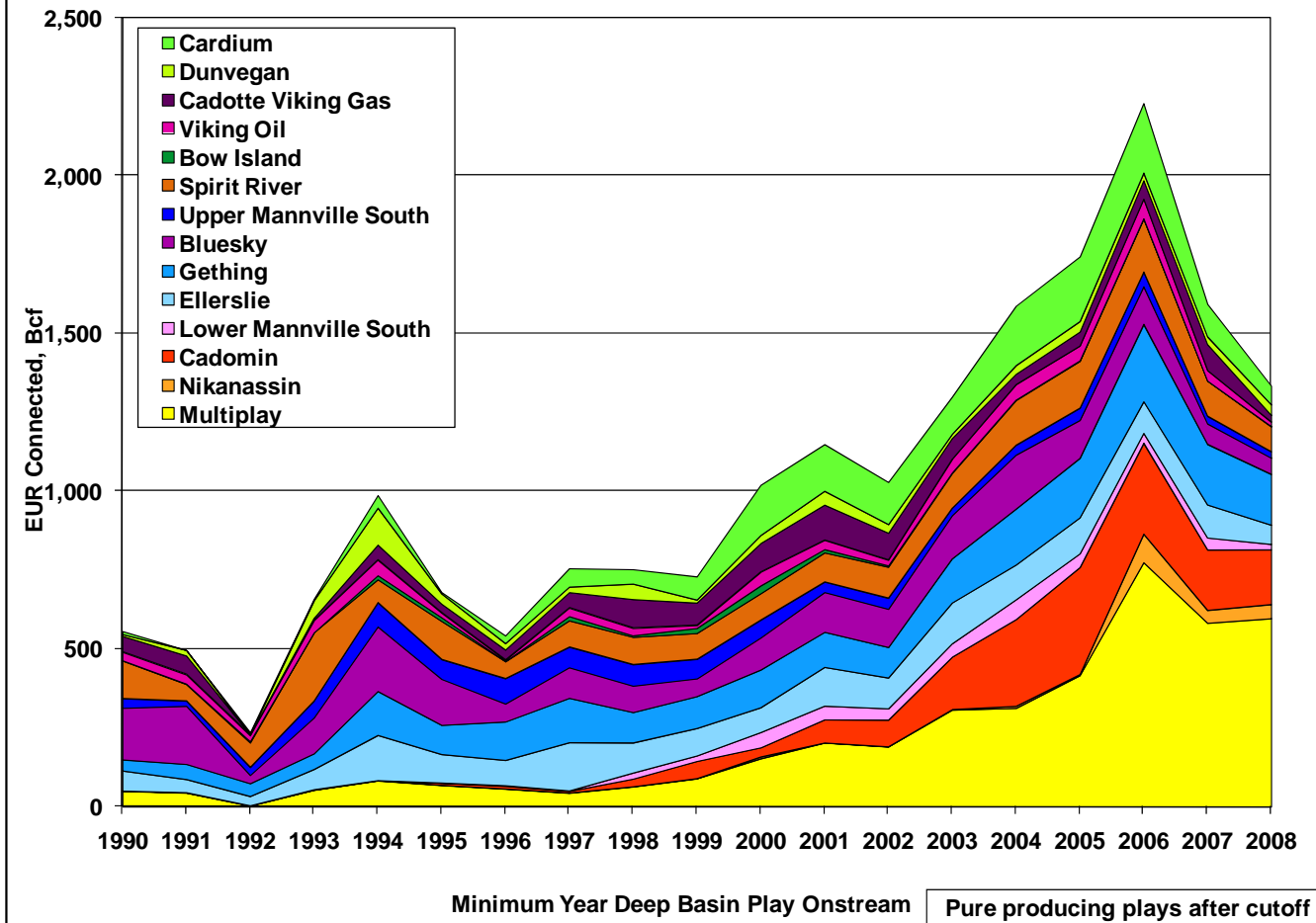
- *Deep Basin Tight Gas Play Characterization*
- *Natural Gas Supply Trends in Western Canada 1990 – 2007*
- *Play, Operator and Value Analysis in the WCSB Foothills*
- CBM resource assessment and production characterization by play
- Operator benchmarking
- Regional play analysis, WCSB
- Exploration, development and production strategies



Strategic information for E&P operators

Commingled production increasing

EUR Connected by Deep Basin Play



- Deep Basin tight gas plays are the largest current source of unconventional gas in the WCSB
- 3.3 Bcfd or 21% of total WCSB production in 2008
- Pre-2000: wells primarily targeted and completed in a single Deep Basin play

- Post-1999: increasing portion of wells targeted to, completed in, and commingling production from multiple Deep Basin plays: **Multiplay**
- Multiplay wells connected 38% of total Deep Basin EUR 2006-08, 45% in 2008

What are the characteristics of these Multiplay wells?

Agenda

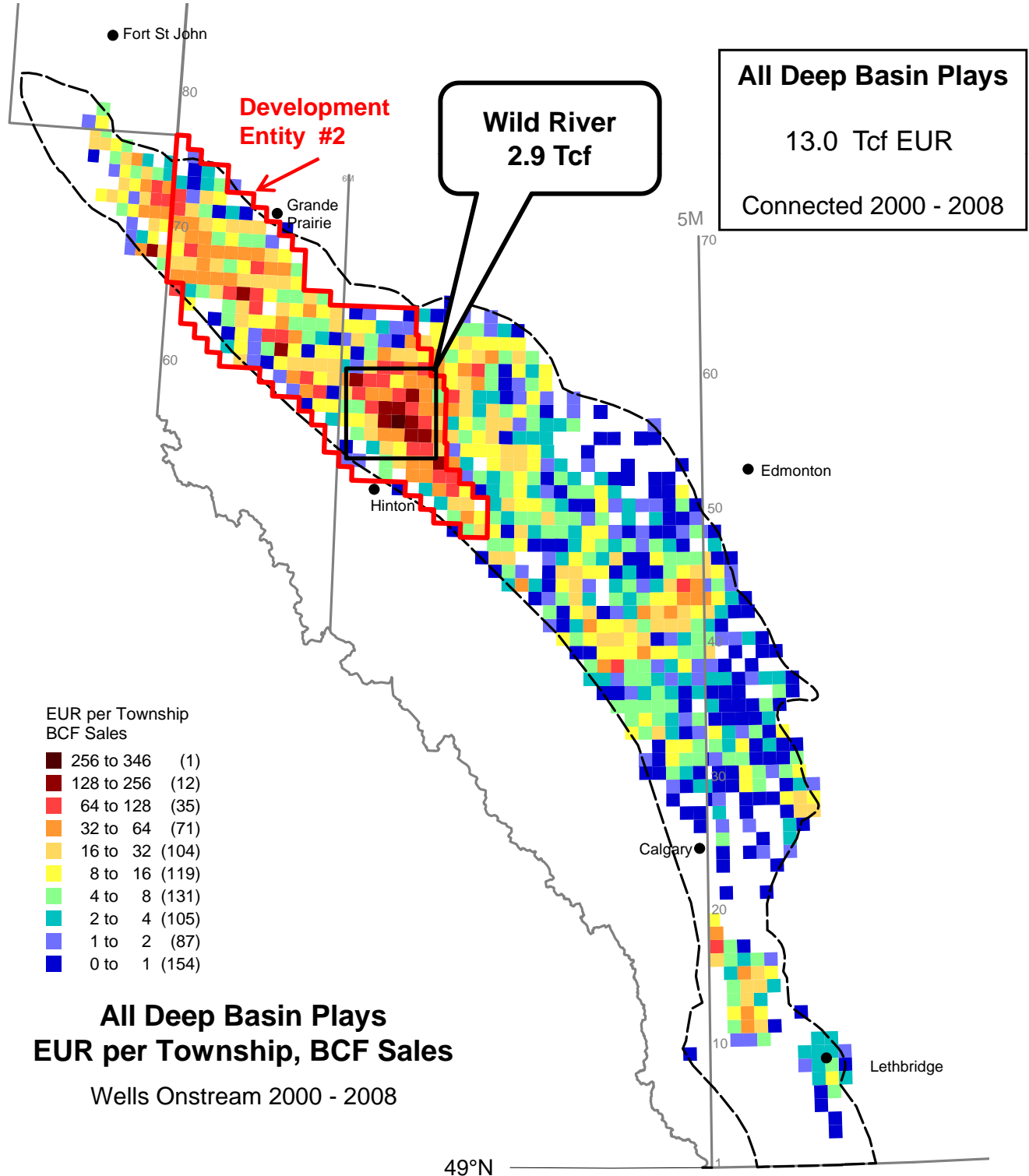
- Deep Basin tight gas
- Commingling regulation
- Wild River study area
 - Deep Basin plays
 - Trends by play
 - Commingled production: Multiplay
 - Plays targeted and completed
 - Success rate
 - Development density
 - Operator benchmarking
- Implications for future tight gas development

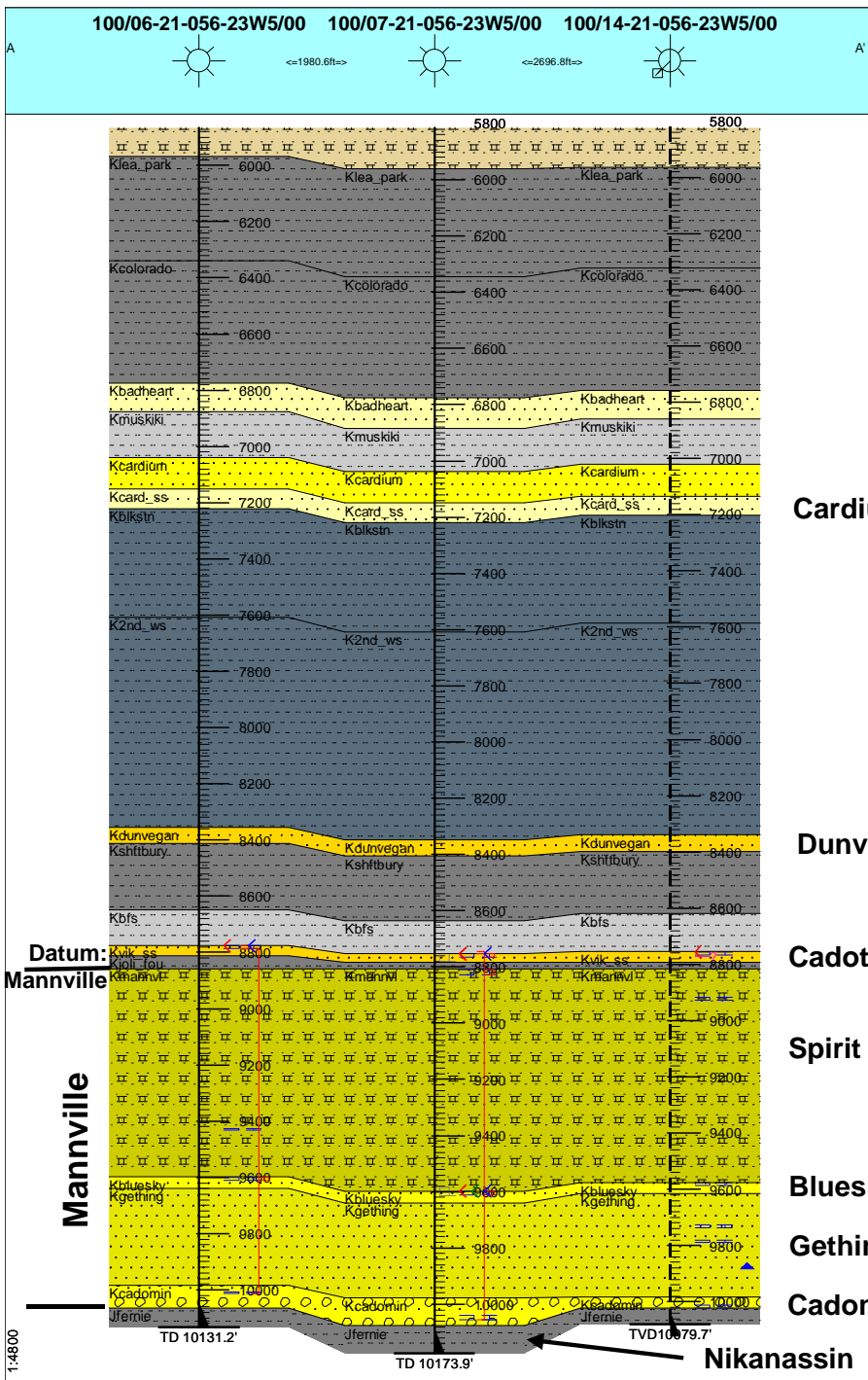
Commingling Regulation

- Single pool and segregated pool production permitted
- Commingling production in wellbore from two or more pools required lengthy application and regulatory approval
- June 2003: EUB introduced Notification process
 - Streamlined process established conditions for notification of commingling as alternative to application for approval
 - Required testing of individual zones prior to commingling
- November 2006: EUB established Development Entity #2, an area and stratigraphic interval where:
 - Testing requirements reduced or eliminated
 - Immediate commingling of gas from approved zones

**Important progress in operational efficiency but
Less data on play producing characteristics:
Commingled wells have become a new play**

- Wild River region selected to examine Multiplay characteristics
- Criteria: high proportion of Multiplay, recent activity, material EUR
- 36 townships include 2.9 Tcf of EUR - 23% of the total Deep Basin EUR connected 2000-2008
- Region includes portions of many ERCB fields: Wild River, Sundance, Cecilia, Leland, Fir, Berland River, Oldman, Wildhay, Obed . . .





Plays in Wild River

Eight Deep Basin plays in a 3000' interval between 7000' and 10,000' depth

Nikanassin picked only in western portion of focus area; Cardium gas play limited to south portion of area

Cardium separated by 1200' of shale from Dunvegan; 1600' above the top of the Mannville interval

Dunvegan, Viking, Mannville and Nikanassin producing intervals are commonly targeted in the same well and production is commingled

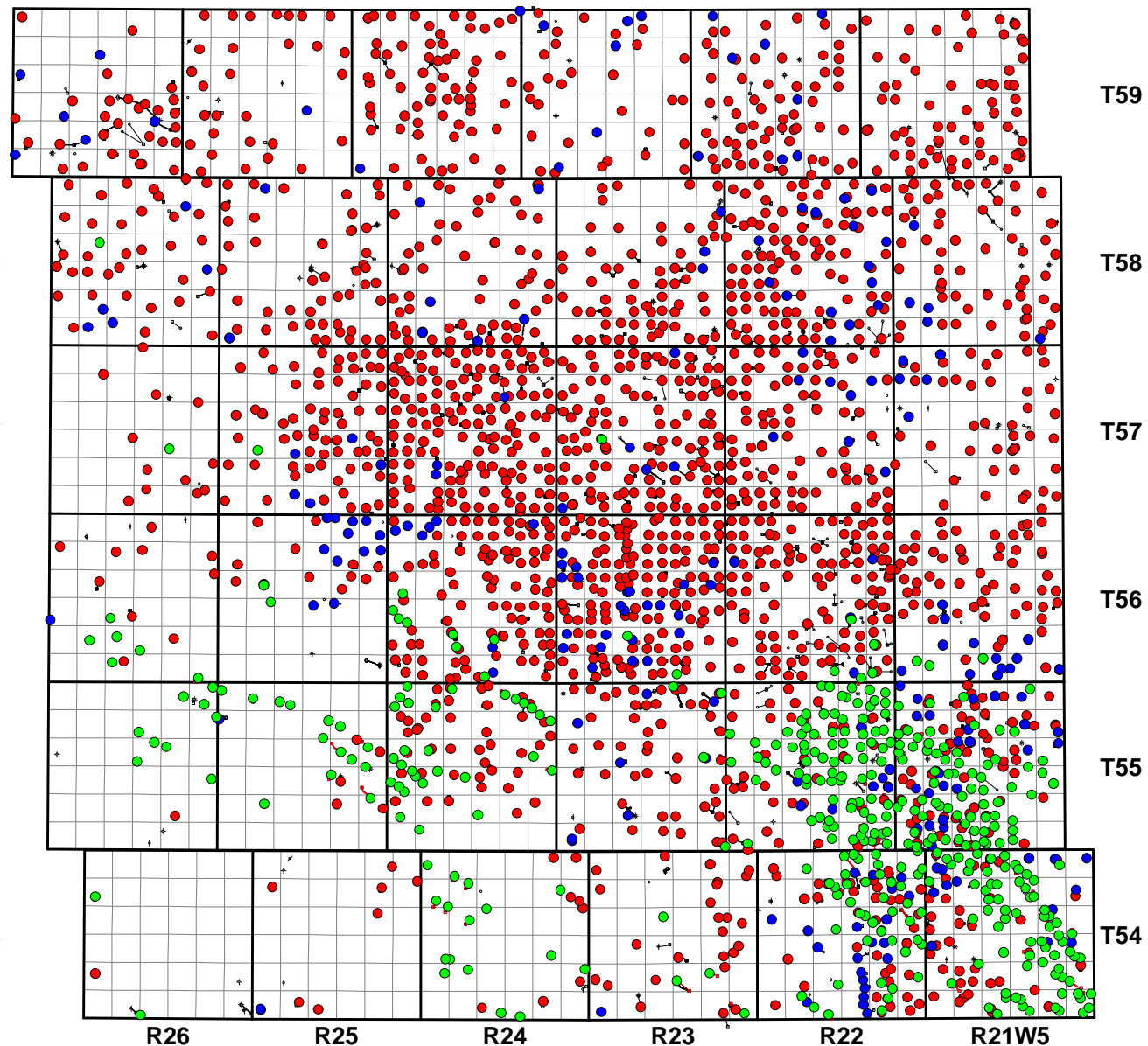
Older plays produced 1.0 Tcf raw to May 2009; primarily from conventional traps in Upper Devonian and Triassic reservoirs

Multiplay: production from 2 or more plays

Deep Basin wells by penetration

Wild River Region Wells Drilled

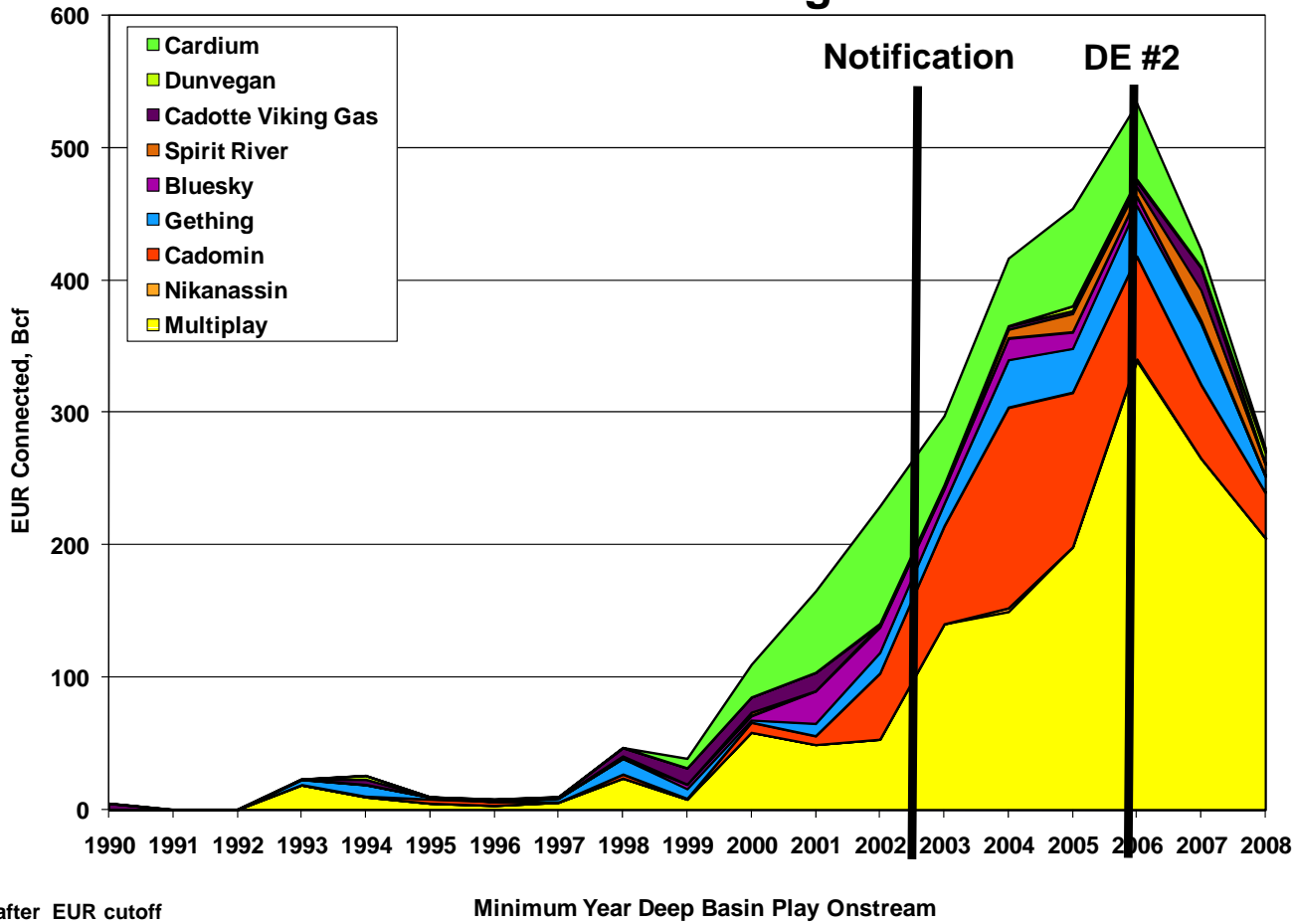
- 2423 wells penetrating at least 1 Deep Basin Play to year end 2008.
- 386 wells targeted only to Cardium
- 230 wells TD between the Dunvegan and Gething
- Wells targeted to Cadomin or deeper : 1807
- 1791 Deep Basin producers
- Horizontal wells immaterial



75% of drilling penetrates all Deep Basin plays
16% of drilling targeted only to the Cardium

Wild River EUR Connected

EUR Connected by Deep Basin Play, Wild River Region

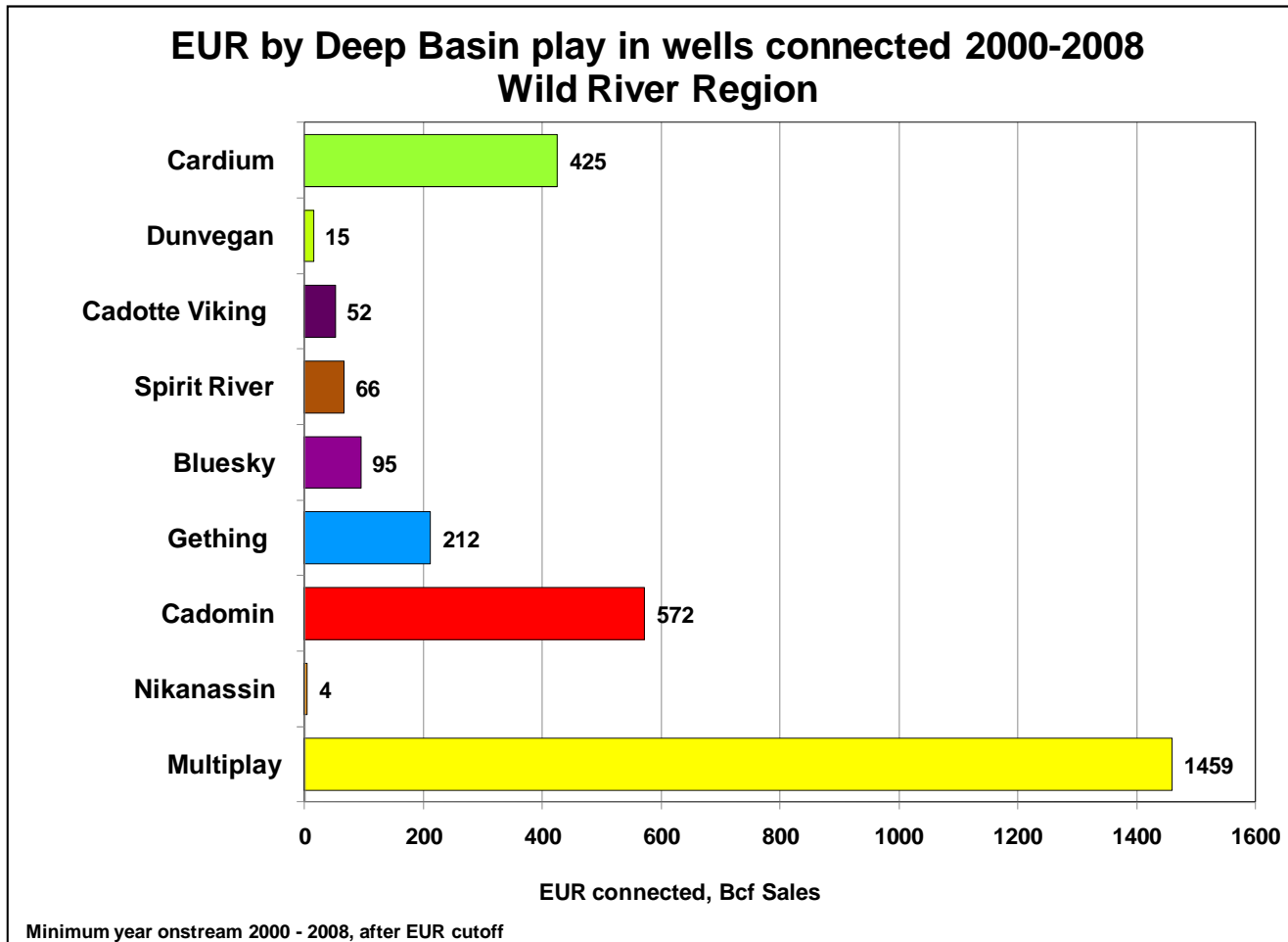


- 95% of EUR connected 2000-08
- Total EUR connected grew rapidly from 2000, until decline in 2007-08
- Multiplay EUR increased in 2003: Notification process for commingling
- Multiplay supplied 66% of all EUR connected in 2006-2008; 75 % in 2008; DE #2 in 2006

- Cadomin EUR connected has been declining since 2004
- Gething EUR steady, at 30-45 Bcf/year since 2004

Multiplay added 75% of EUR in 2008

Wild River EUR Connected, 2000-2008

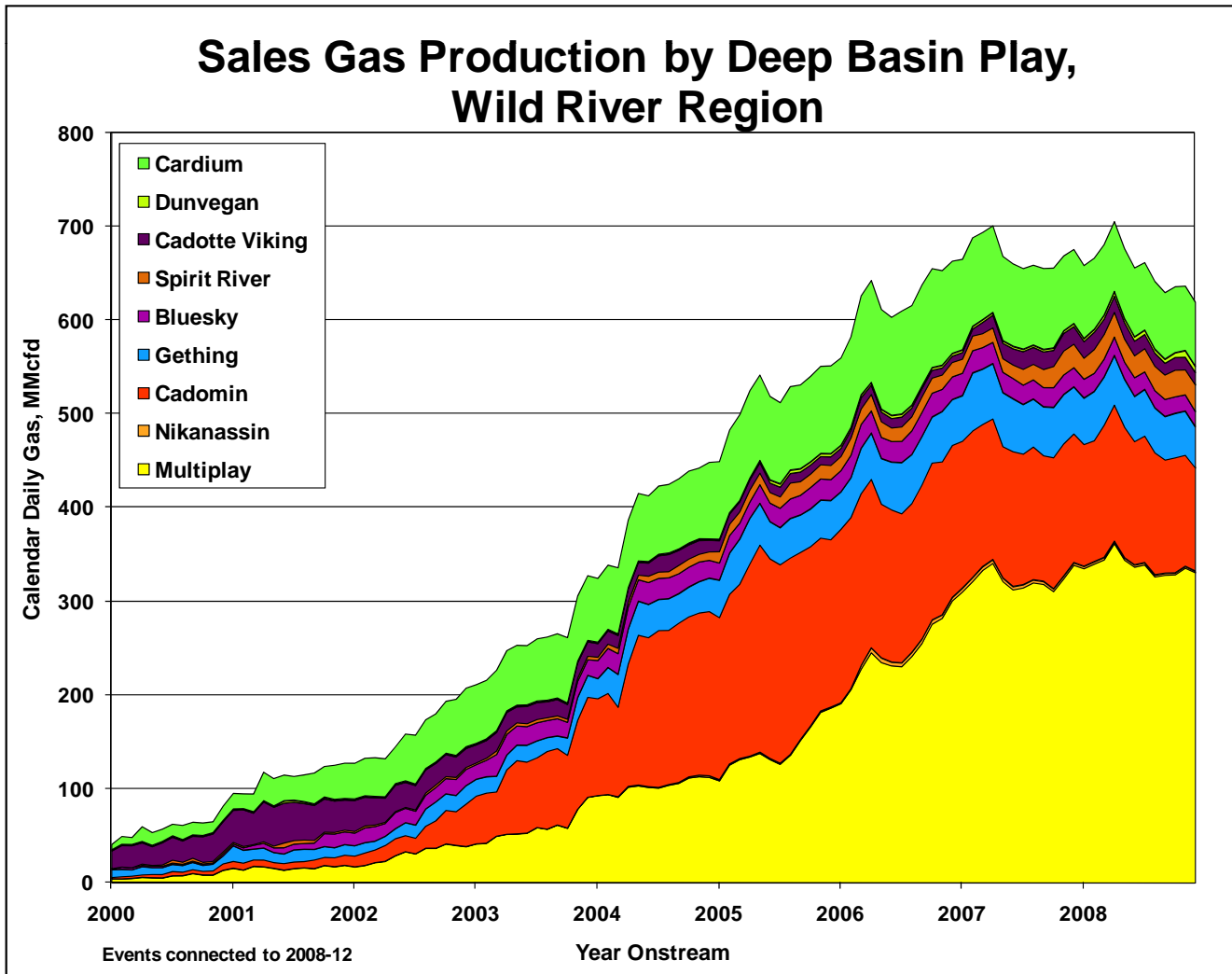


- Total EUR connected was 2,900 Bcf
- Multiplay wells accounted for 1459 Bcf - over 50% of the EUR connected
- Cadomin was the largest pure play with EUR connected of 572 Bcf

- Cardium is a distinct single play target with 15% of the EUR
- Gething and other plays totaled less than 15% of EUR

Minor pure play EUR in Dunvegan-Gething interval

Wild River Gas Production Trends



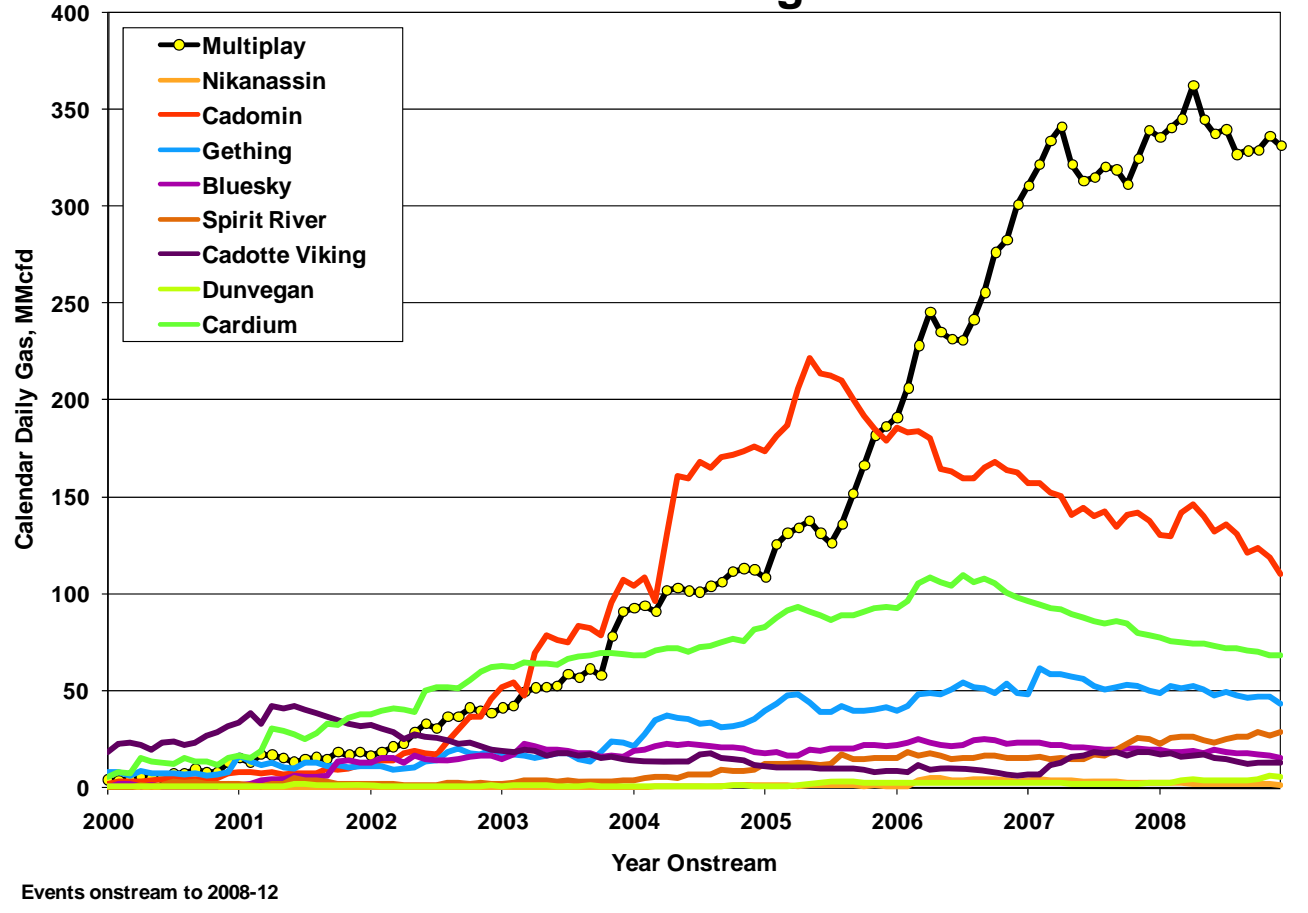
- Production growth continued to April 2008, peaking at over 700 MMcfd (22% of Deep Basin peak)
- Multiplay, Cadomin and Cardium supply most of the production
- Production plateau since 2007: rate added in new wells sufficient to offset declining producers

- Commingling regulations have resulted in increasing production reported from Multiplay producers

Which plays are growing production?

Wild River Production Profiles by Play

Sales Gas Production by Deep Basin Play, Wild River Region



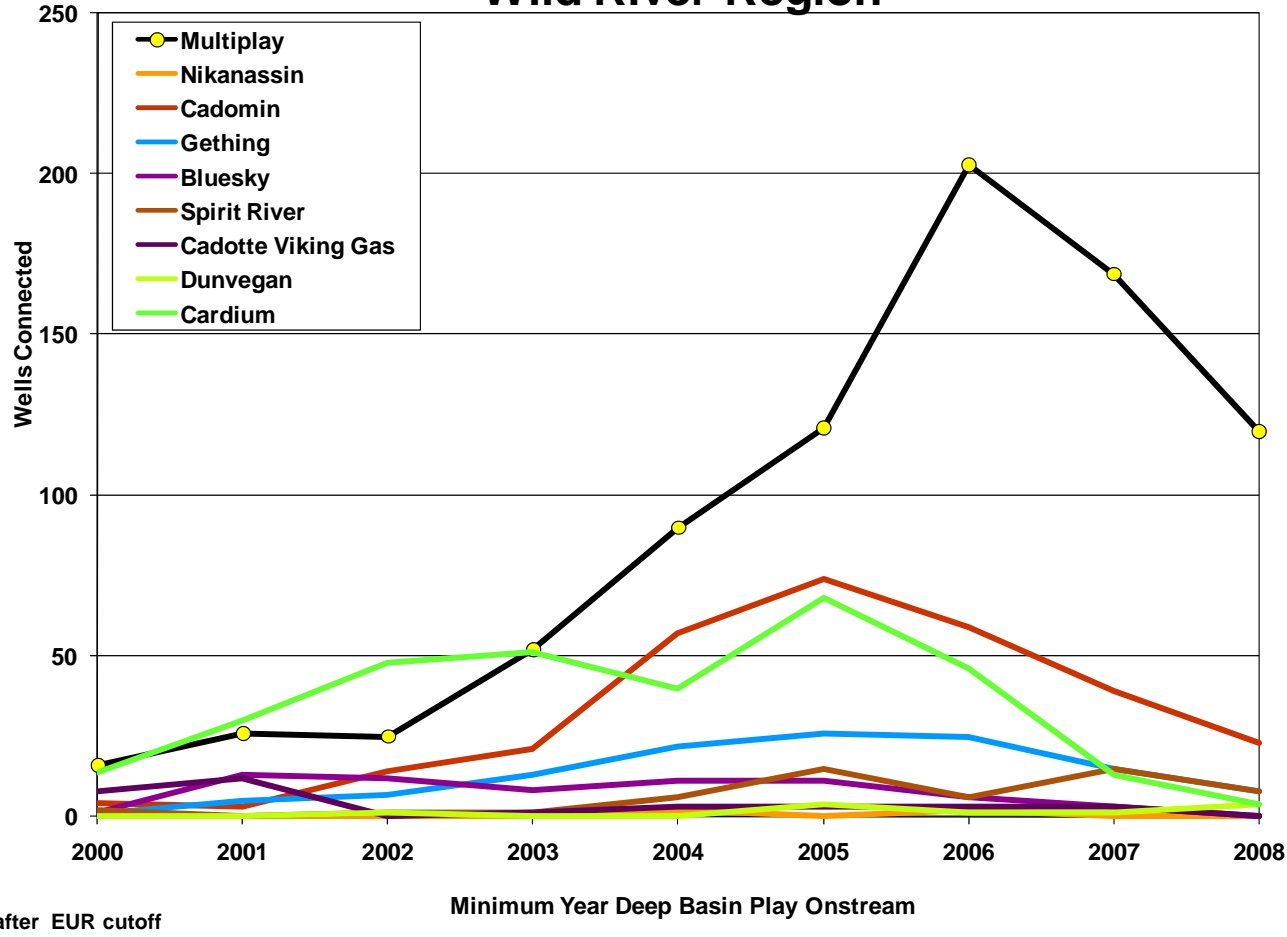
- Multiplay production has grown dramatically to 350 MMcfd (early 2008)
- Non-Multiplay production peaked at 400 MMcfd (early 2005) – declining to less than 300 MMcfd (end 2008)
- Cadomin pure play production peaked in 2005 (over 220 MMcfd) and has been declining since

- Cardium production: steady growth to 2006 (100 MMcfd); decline since
- Gething production: growth to 2007; then steady at 50 MMcfd
- Bluesky, Spirit River, Cadotte Viking and Nikanassin production not material

Commingled production over 50% of total

Gas Well Connections

Wells Connected by Deep Basin Play, Wild River Region



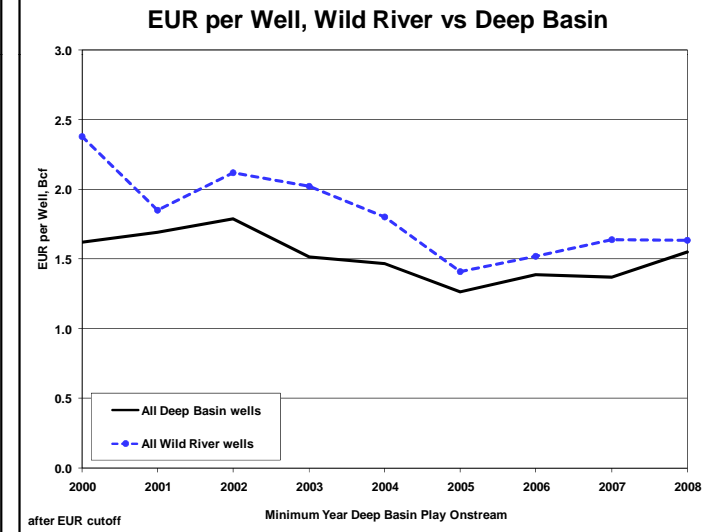
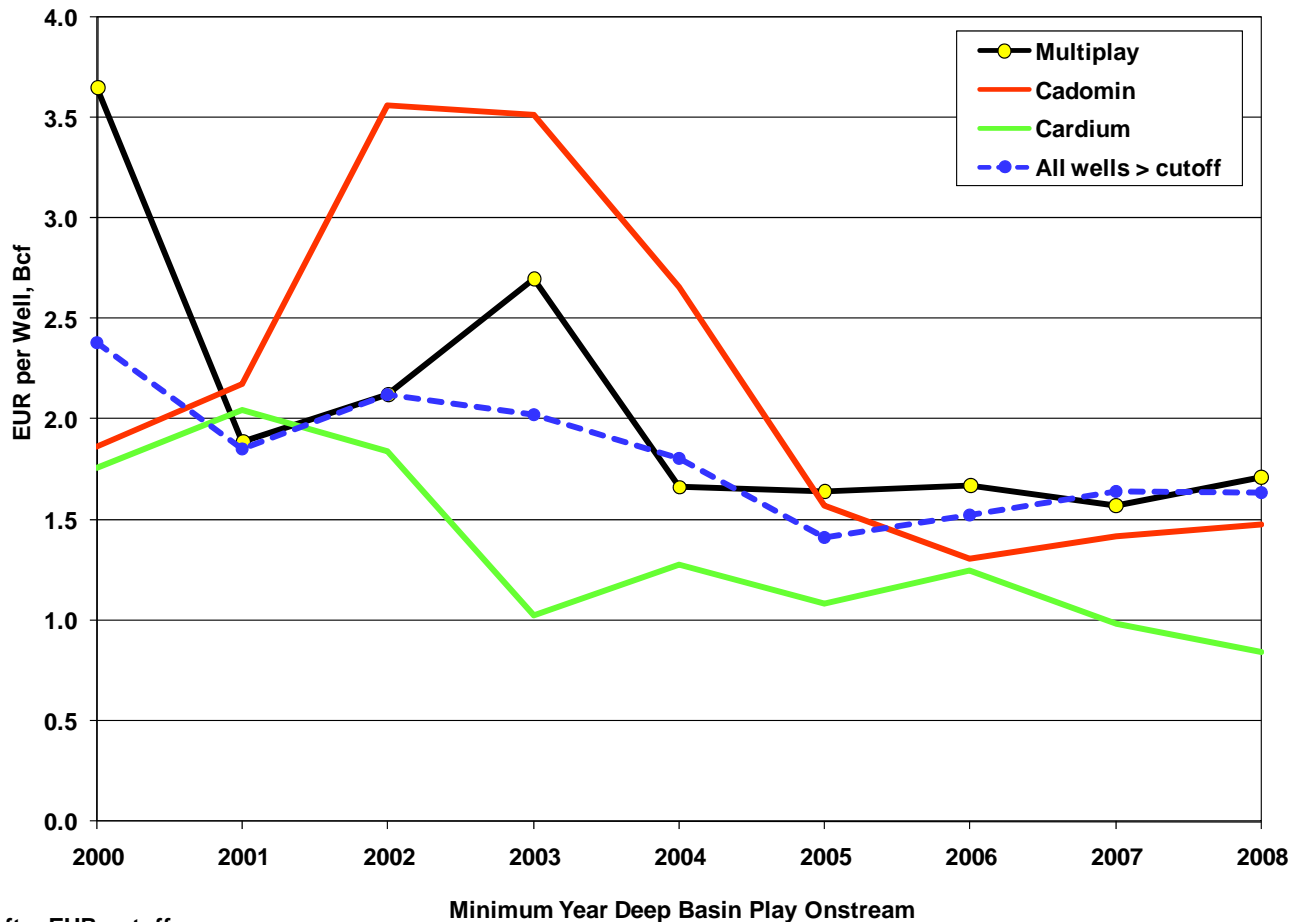
- Total annual connections in Wild River grew rapidly to 351 in 2006, before declining to 167 in 2008
- Multiplay wells – a rapidly growing portion of the mix: averaged 48% in 2000-2008, 72% in 2008 alone
- Low annual connection rate of pure plays other than Cadomin and Cardium

- Connection activity in all pure plays has decreased since 2005; in part due to aggregation and reporting within the Multiplay play grouping

Wild River connections decreased in 2007- 08

EUR per Well by Year Onstream

EUR per Well, Selected Wild River Plays



- Wild River EUR averaged 1.69 Bcf/well (00-08); 15% greater than Deep Basin EUR average of 1.47 Bcf/well

- Wild River Multiplay average 1.78 Bcf/well 2000-08, and constant since 2004 at 1.65 Bcf/well
- Cadomin: above average in 2002-2005; below average for 2006-2008

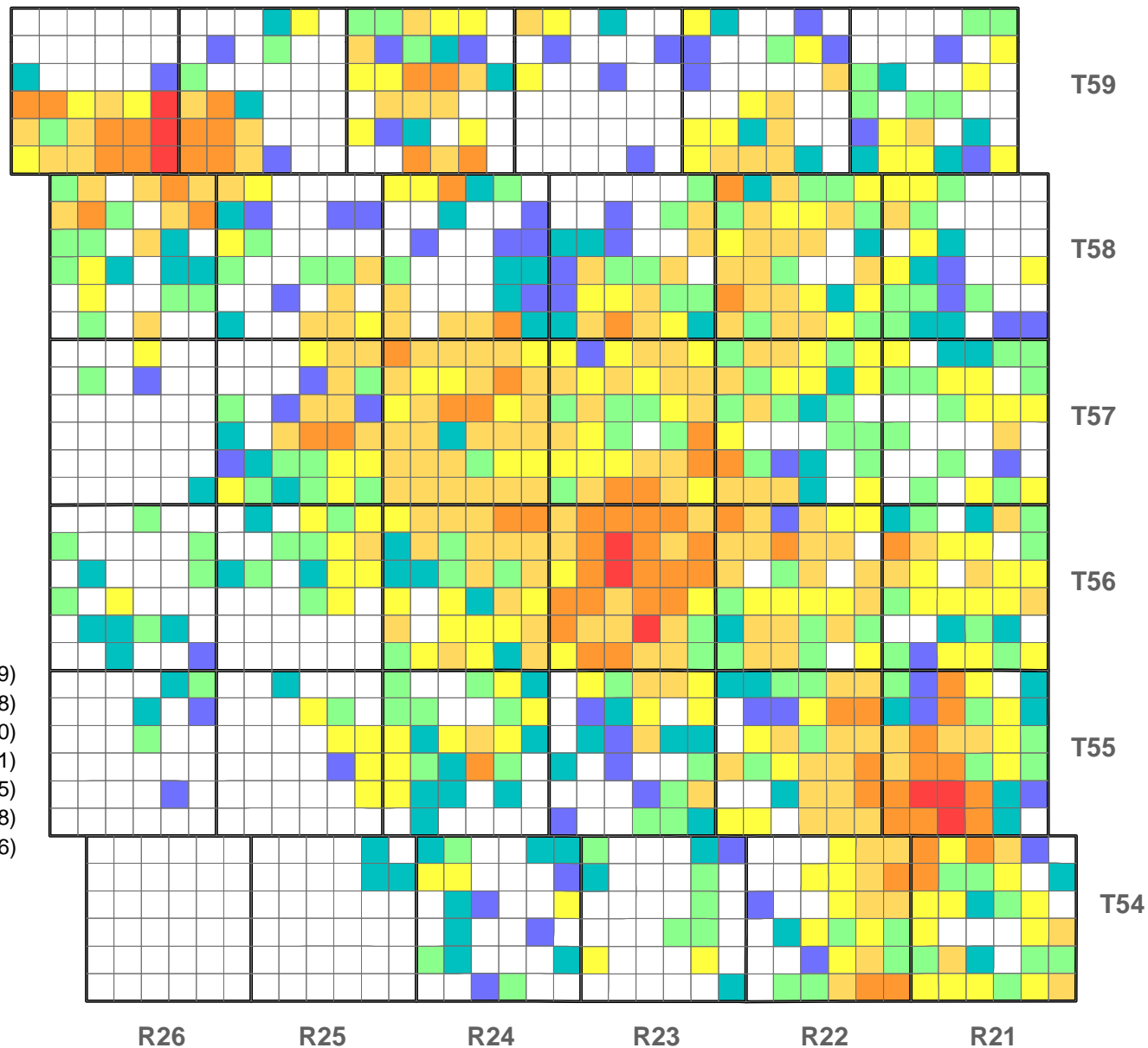
Overall EUR/well trend shows slight increases in 2006-07-08

All Deep Basin Plays: EUR per Section

- EUR per Section for all Deep Basin plays from wells connected 2000 to 2008 – cutoff applied
- Up to 25 Bcf per section connected over 9 years
- One township with no Deep Basin EUR established to year end 2008
- 44% of sections are pure play producers only

EUR per Section
Bcf

Red	16 to 25	(9)
Orange	8 to 16	(78)
Light Orange	4 to 8	(190)
Yellow	2 to 4	(171)
Light Green	1 to 2	(155)
Teal	0.5 to 1	(108)
Blue	0.25 to 0.5	(66)



Wild River Region All Deep Basin Plays

EUR per Section, Bcf

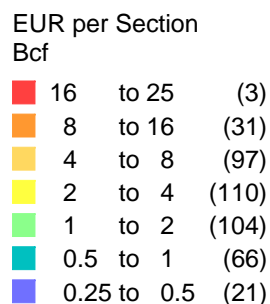
Wells Connected 2000 to 2008

**Cardium play important
source in southeast corner**

Multiplay: EUR per Section

- Commingled production from multiple Deep Basin plays

- Spatial trends reflect the geological trends of component plays, completion and commingling practices, infill drilling density, operator strategies, etc.

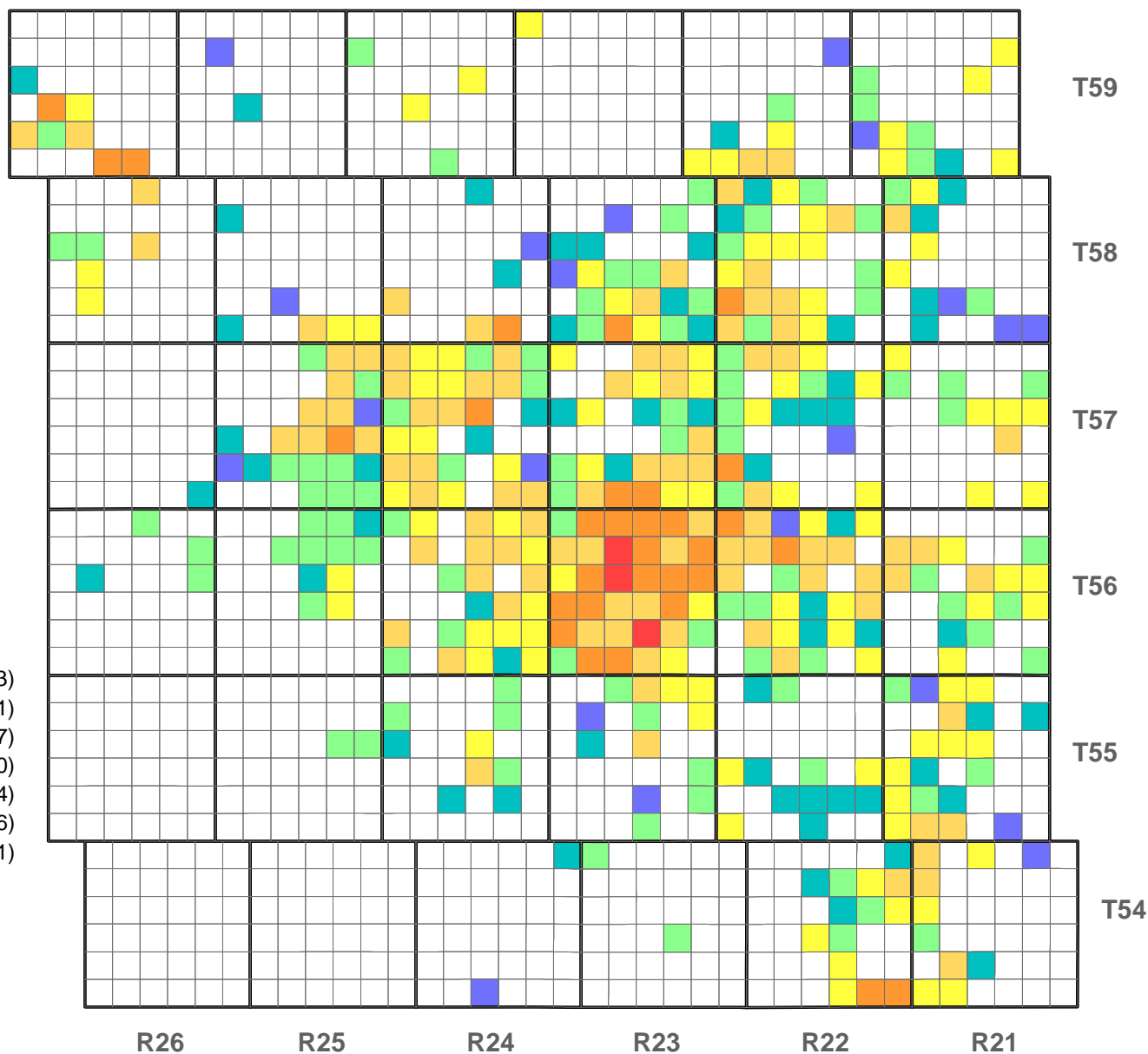


- Only 27% of all producing sections have only Multiplay producers

Wild River Region Multiplay

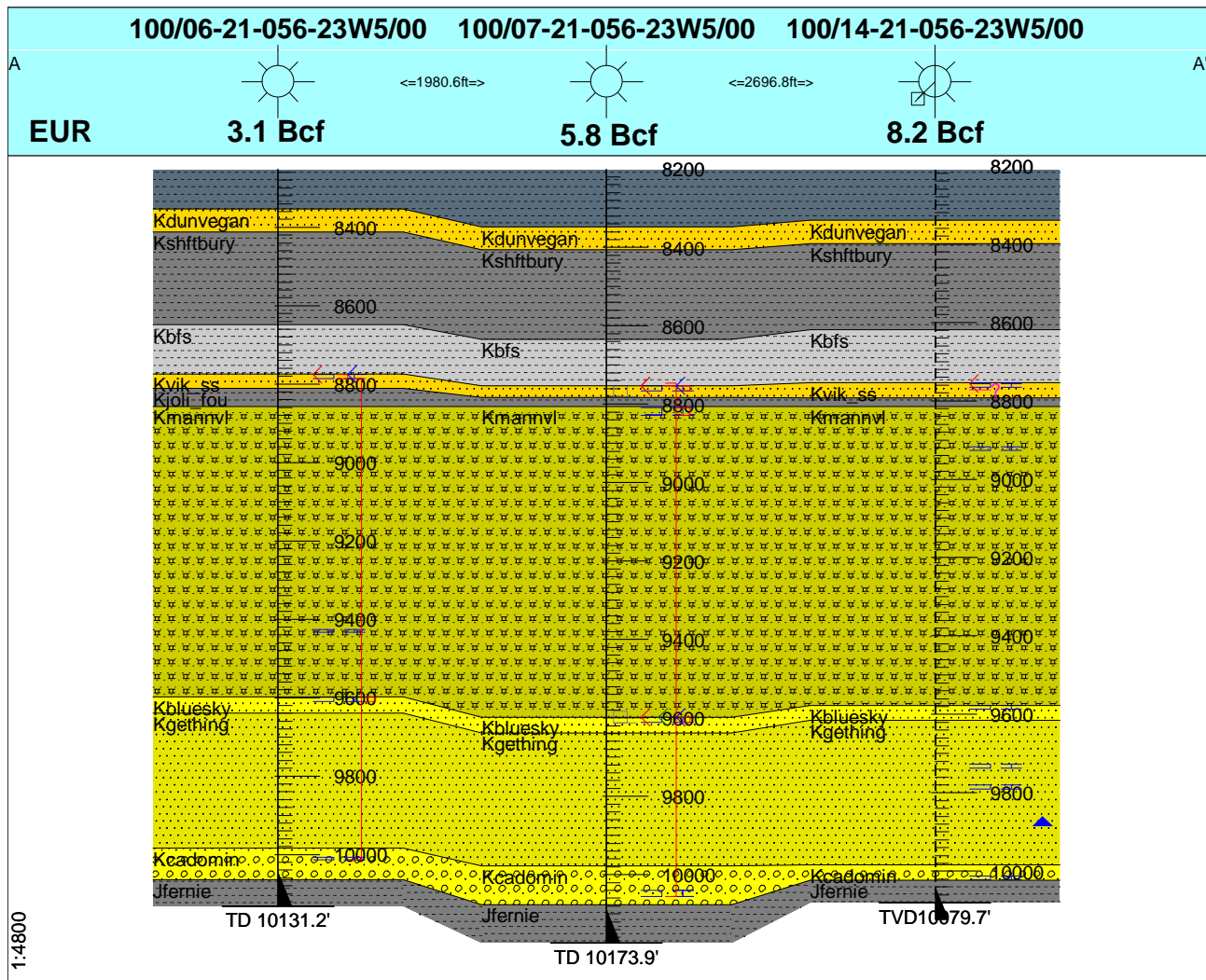
EUR per Section, Bcf

Wells Connected 2000 to 2008



**Multiplay is focused in 56%
of total producing area**

Multiplay Characterization



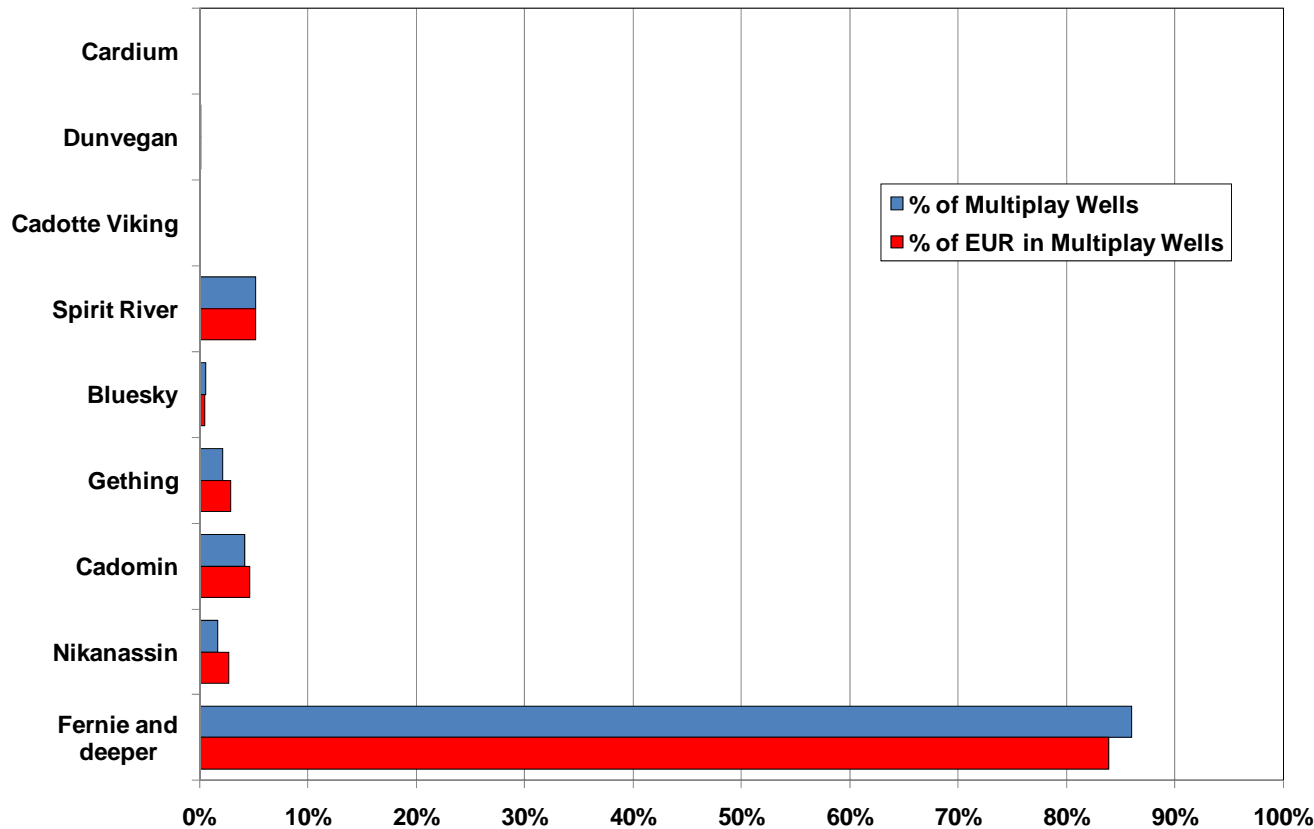
- Cross section of Multiplay producers in Section 21-56-23W5
- Completions in multiple plays and commingled production
- Not all plays perforated in all wells
- Within the thicker plays, multiple intervals were perforated at variable stratigraphic positions

- Perforated and treated intervals appear to be highly selective
- A low percentage of the Deep Basin section is perforated

What is stratigraphic range, # plays and which plays?

Deepest Interval in Multiplay Wells

Deepest Interval Penetrated by Deep Basin Multiplay Wells
Onstream 2000 to 2008 - Wild River Region



827 Multiplay wells, tops picked, Deep Basin play interval(s) perforated

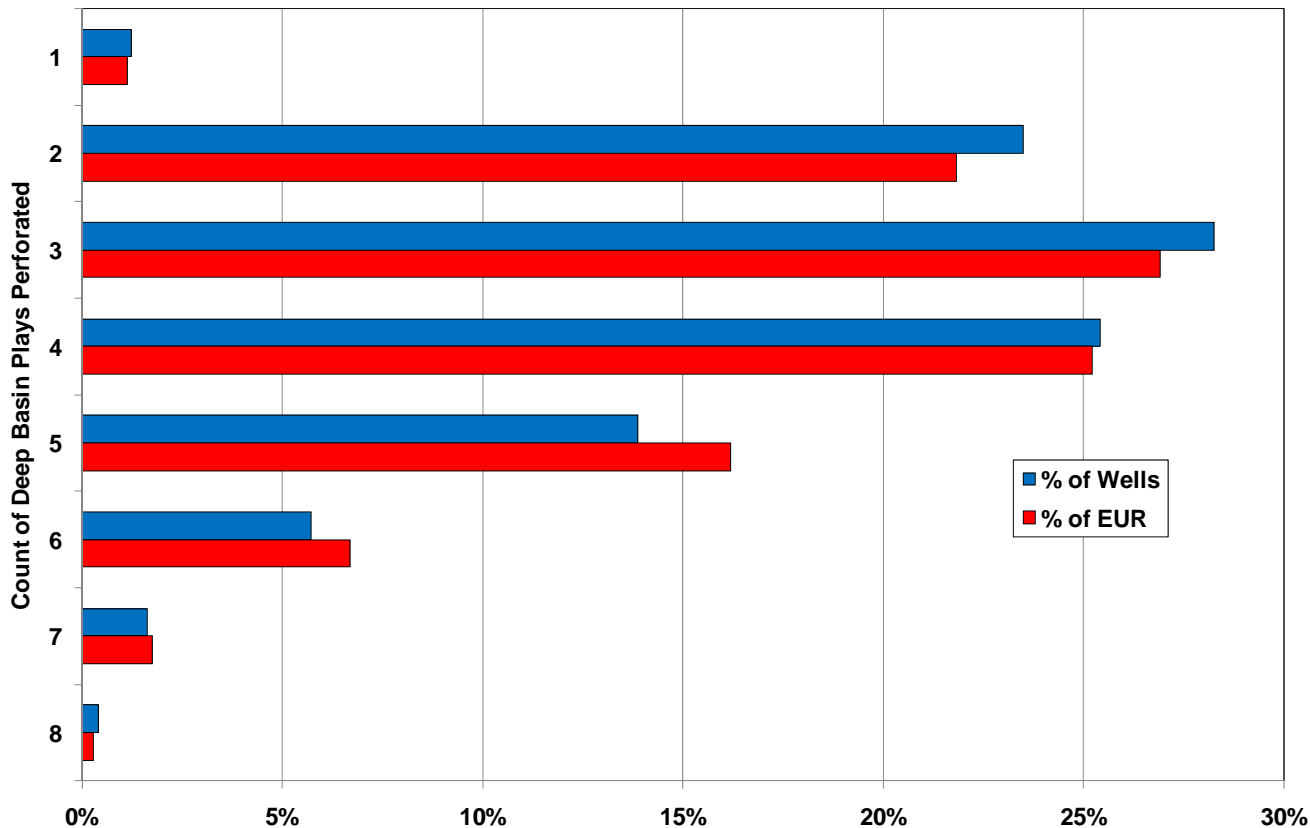
- Wells completed as Multiplay (commingled multiple Deep Basin plays) are overwhelmingly drilled to the Cadomin or deeper
- 92% of the wells penetrate to the Cadomin or deeper and account for 91% of the Multiplay EUR

- Remaining 8% of Multiplay wells target zones within the Mannville

**Multiplay wells drilled to evaluate all plays
Analyze wells that penetrate the Cadomin**

of Plays Perforated in Multiplay Wells

Count of Deep Basin Plays Perforated in Multiplay Wells
Onstream 2000 to 2008 - Wild River Region



736 Multiplay wells, tops picked, Deep Basin play interval(s) perforated, Cadomin penetration, after EUR cutoff

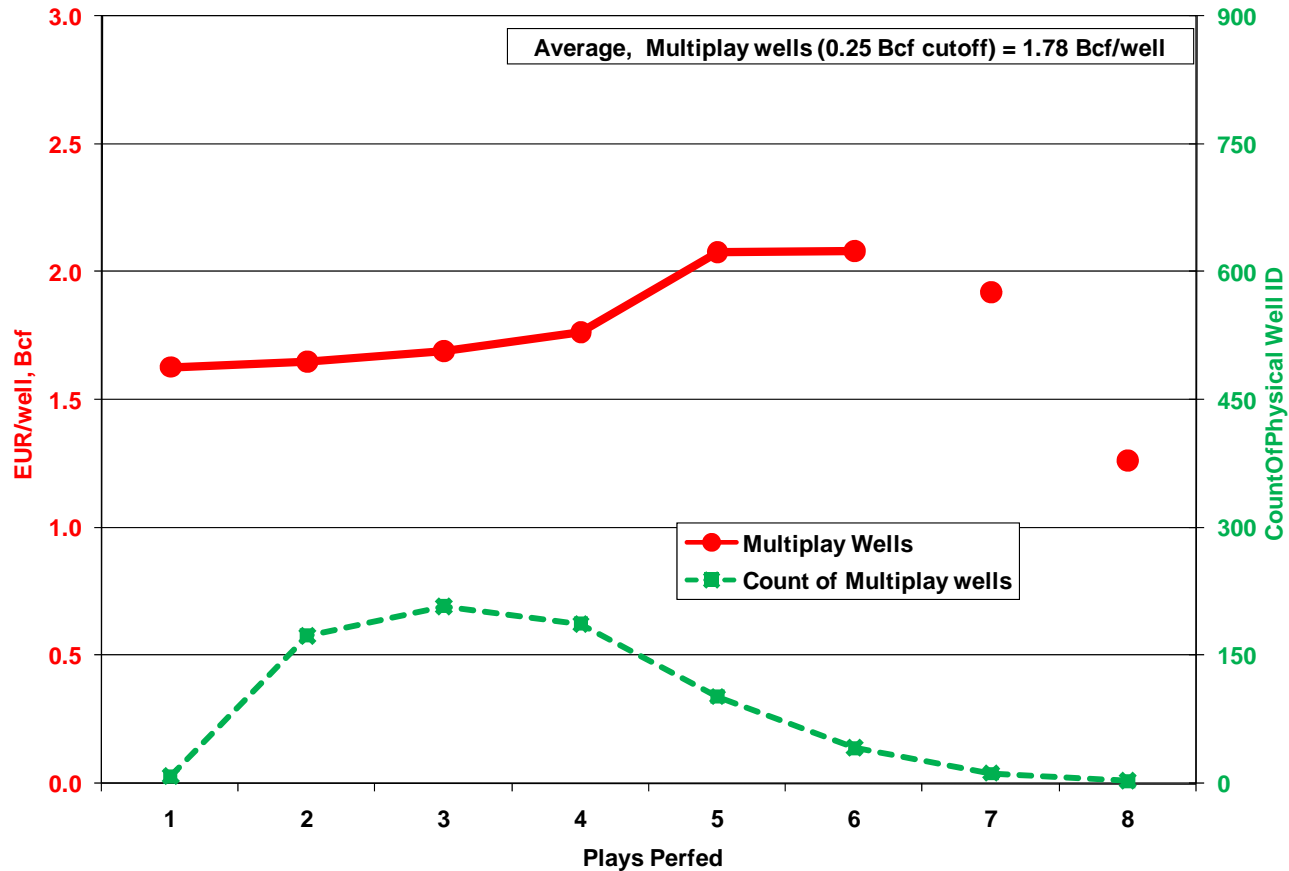
- **3 Plays or more:** 75% of the Multiplay wells that penetrate to the Cadomin or deeper have perforations in three or more Deep Basin plays
- 77% of the EUR connected was in the wells where three or more Deep Basin plays are perforated.

- **Average EUR per Well:** Wells where 5 or more plays are perforated have above average EUR per well

Numerous plays completed in Multiplay wells

EUR per Well, by Count of Plays Perfed

Average EUR/Well, by No. of Plays Perfed
Multiplay Wells, Wild River Region, Onstream 2000-2008



736 wells (after 0.25 Bcf cutoff), tops picked, Deep Basin play interval(s) perforated, Cadomin or deeper penetration

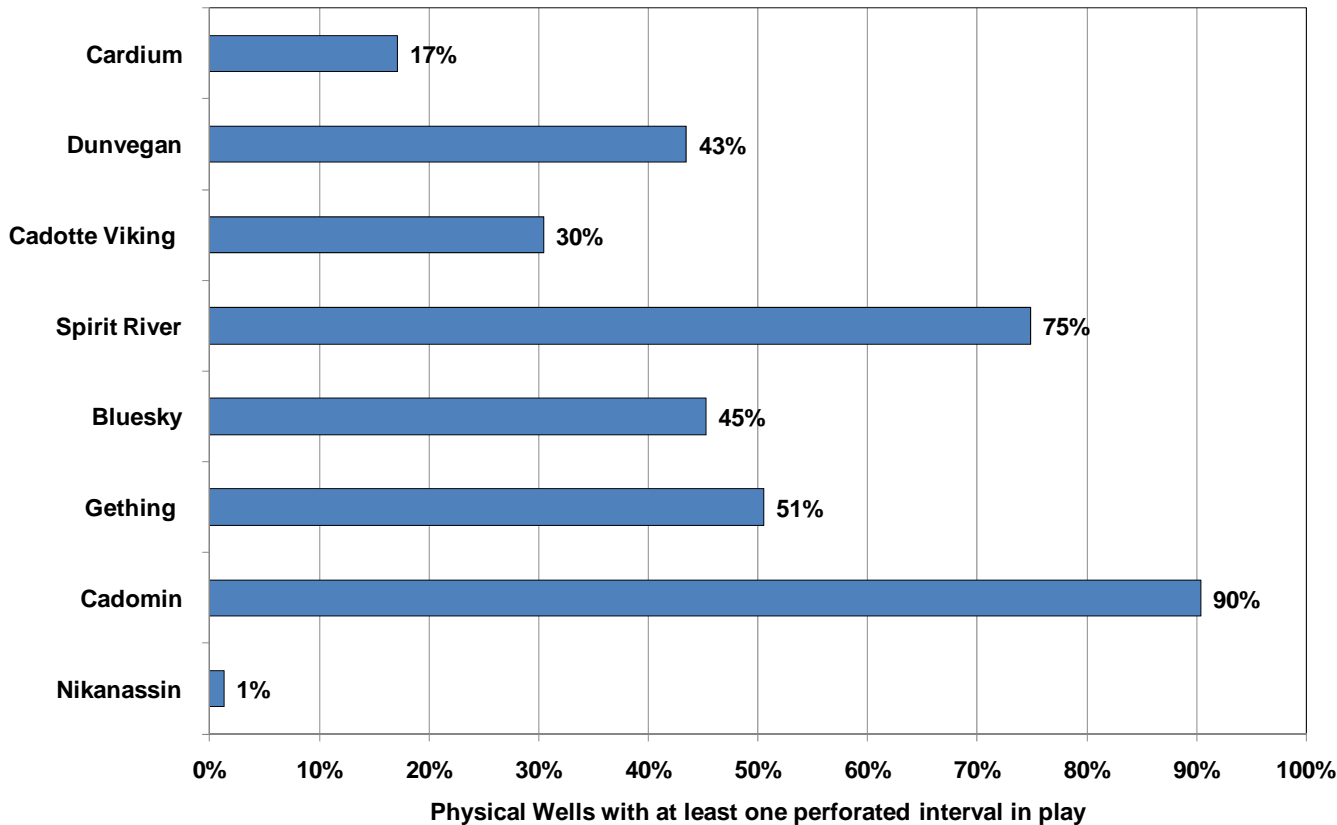
- Within focus area, wells filtered for:
 - penetration to Cadomin or deeper
 - onstream post 1999
 - tops info available
 - perfed in at least 1 Deep Basin play
 - sum of raw EUR better than 0.25 bcf cutoff
- Multiplay count = 736

- For Multiplay wells, EUR/well increases with additional plays perfed – to over 2.0 Bcf/well for wells with 5 or more plays perfed

EUR/well increases with additional plays perfed

Plays Perforated in Multiplay Wells

Frequency of Perforated Intervals by Deep Basin Play
Multiplay Producing Wells - Wild River Region



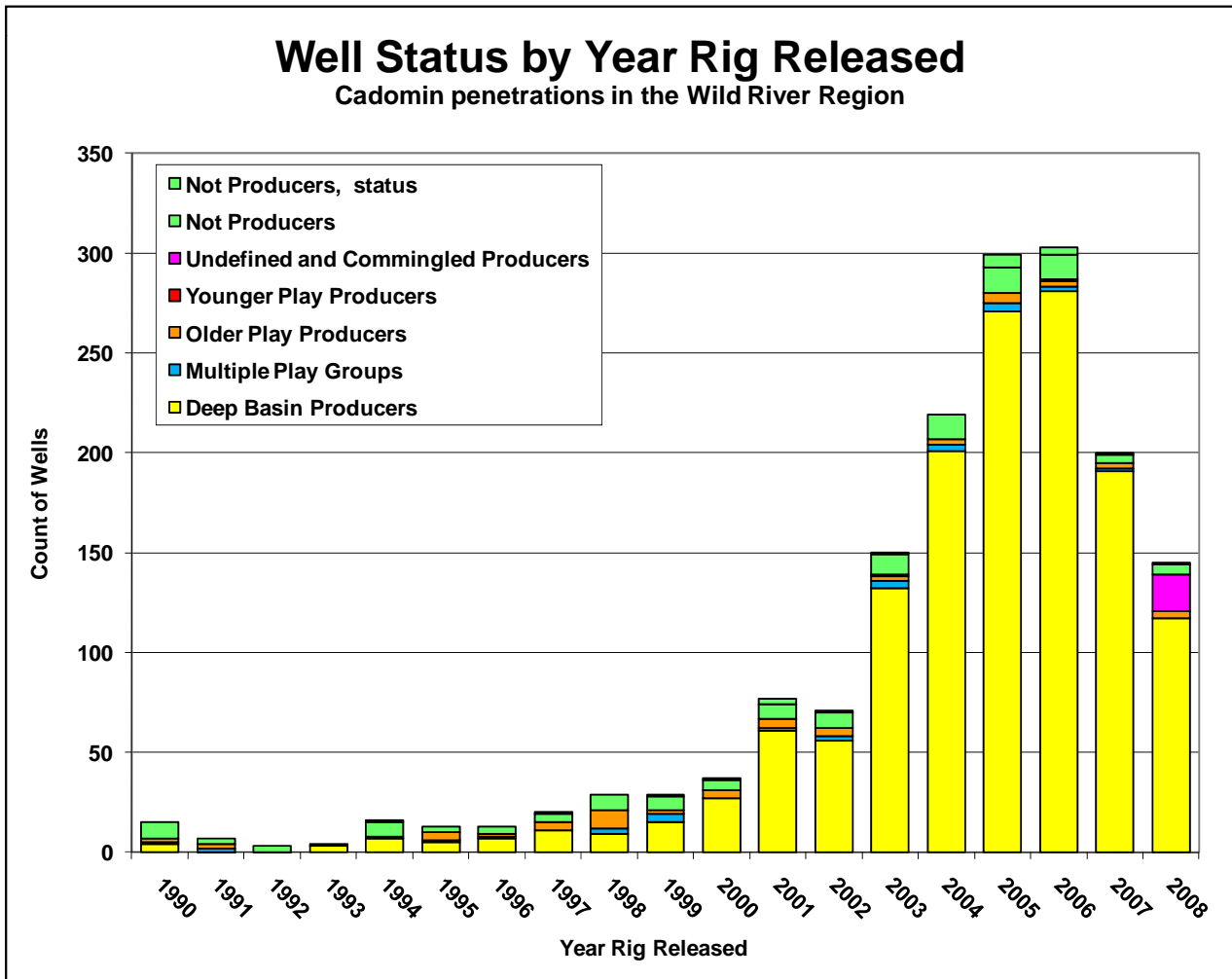
736 wells penetrate Cadomin or deeper, minimum year onstream 2000 - 2008, after EUR cutoff

- Cadomin completions anchor the Multiplay wells (90%)
- Spirit River perforations are quite common (75%) relative to the minor EUR connected as a pure play
- Gething, Bluesky and Dunvegan plays were perforated in almost half the Multiplay wells

- Dunvegan perforations are also surprisingly common relative to the play EUR
- Excluding the Nikanassin, the Cardium is the zone least likely to be perforated in a Multiplay well: Cardium is targeted as a single zone objective

Anchor play + supporting plays

Drilling Activity to Cadomin – Wild River

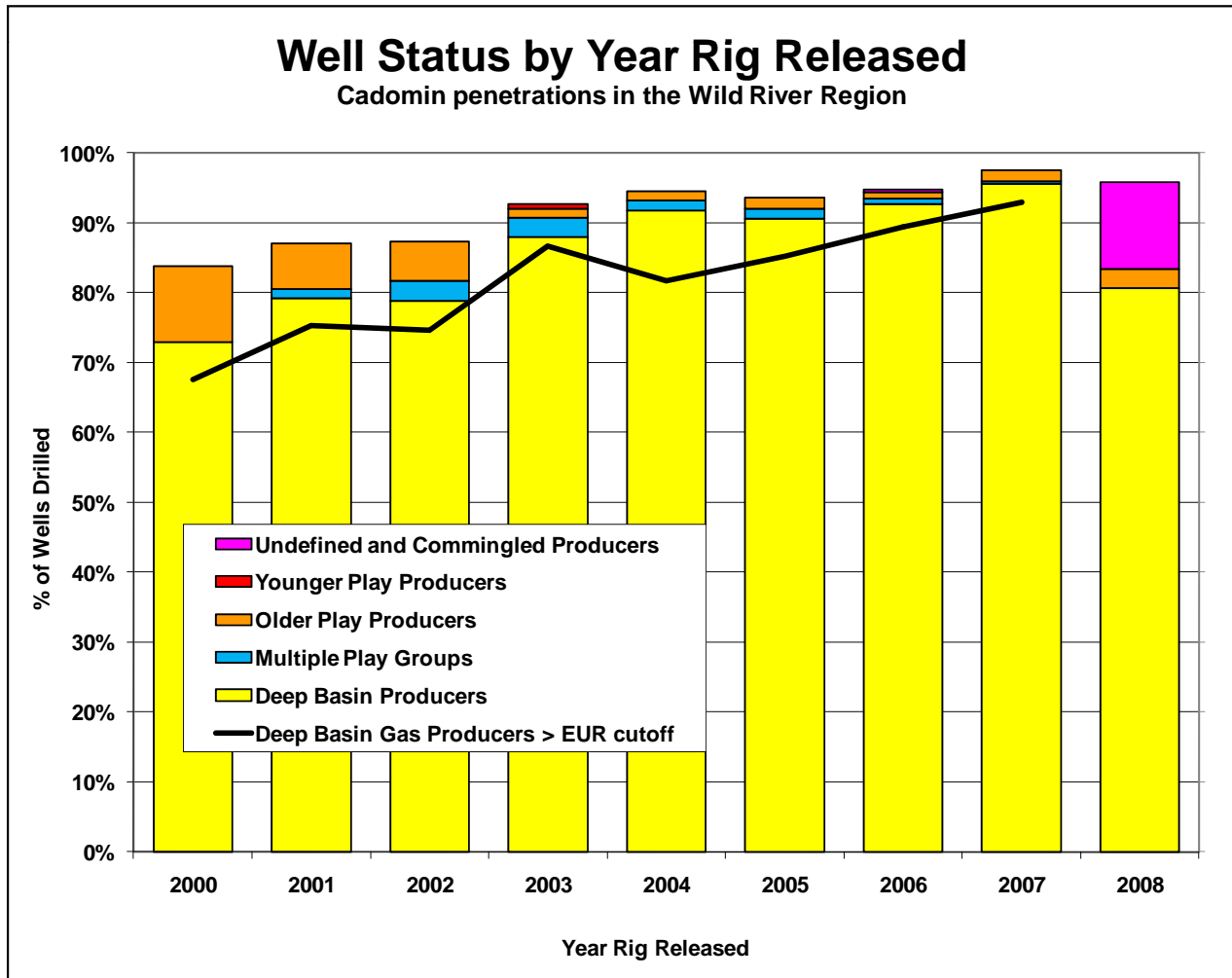


- Count of wells drilled to Cadomin or deeper by year rig-released
- Status shows non-producers and identifies producing play group for producing wells
- Prior to 2000, exploration and development wells were targeted primarily to deeper Triassic and Paleozoic objectives

- Post-1999, exploration, outpost and development infill wells were targeted primarily to Deep Basin plays
- Over 83% of 1807 Cadomin-penetration wells have been drilled since 2000

Activity spiked to over 300 wells per year in 2005-06

% of Cadomin penetration wells producing



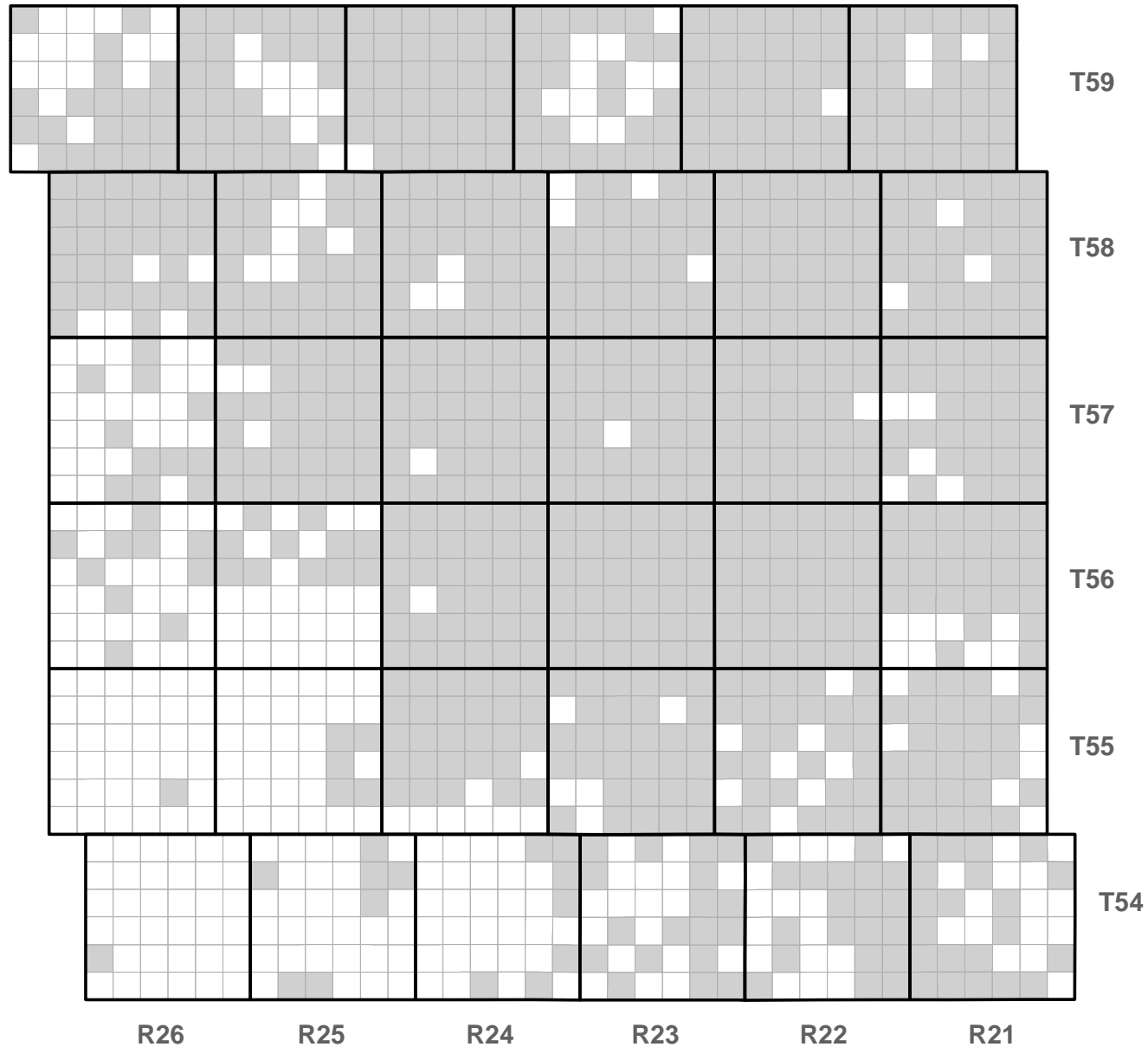
- Column shows % of wells drilled to Cadomin or deeper that are producing by year
- Status identifies pure producing play group for producing wells; Multiple Play Group where more than one play group
- Line shows % of wells drilled that are Deep Basin gas producers with EUR > 0.25 Bcf

- 87% of wells drilled connected Deep Basin EUR > 0.25 Bcf (2004 to 2007)
- Success rate reflects Deep Basin multiplay targets and development success
- Improving over time – targeting, technology, development risk

Sections Drilled to Cadomin – Wild River

Sections Drilled

- Wells penetrating Cadomin or deeper and drilled by year end 2008: 1807
- 901 sections with one or more Cadomin penetrations.
- Average 2 wells/section
- 70% of the Wild River region tested to the Cadomin
- 395 sections remain undrilled to the Cadomin

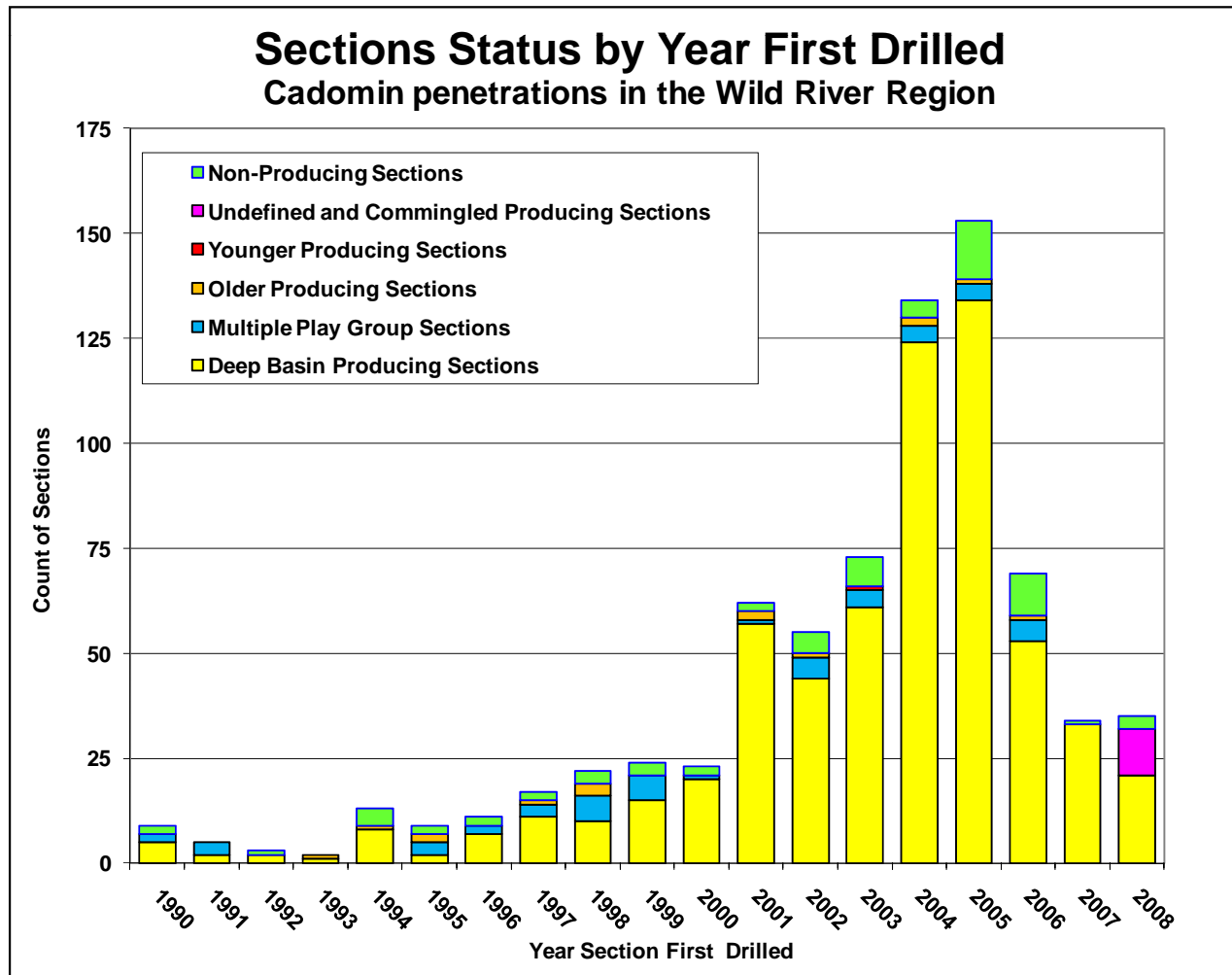


Wild River Region

Sections where wells penetrate to the Cadomin

Wells drilled to 2008-12-31

Sections Drilled to Cadomin by Year

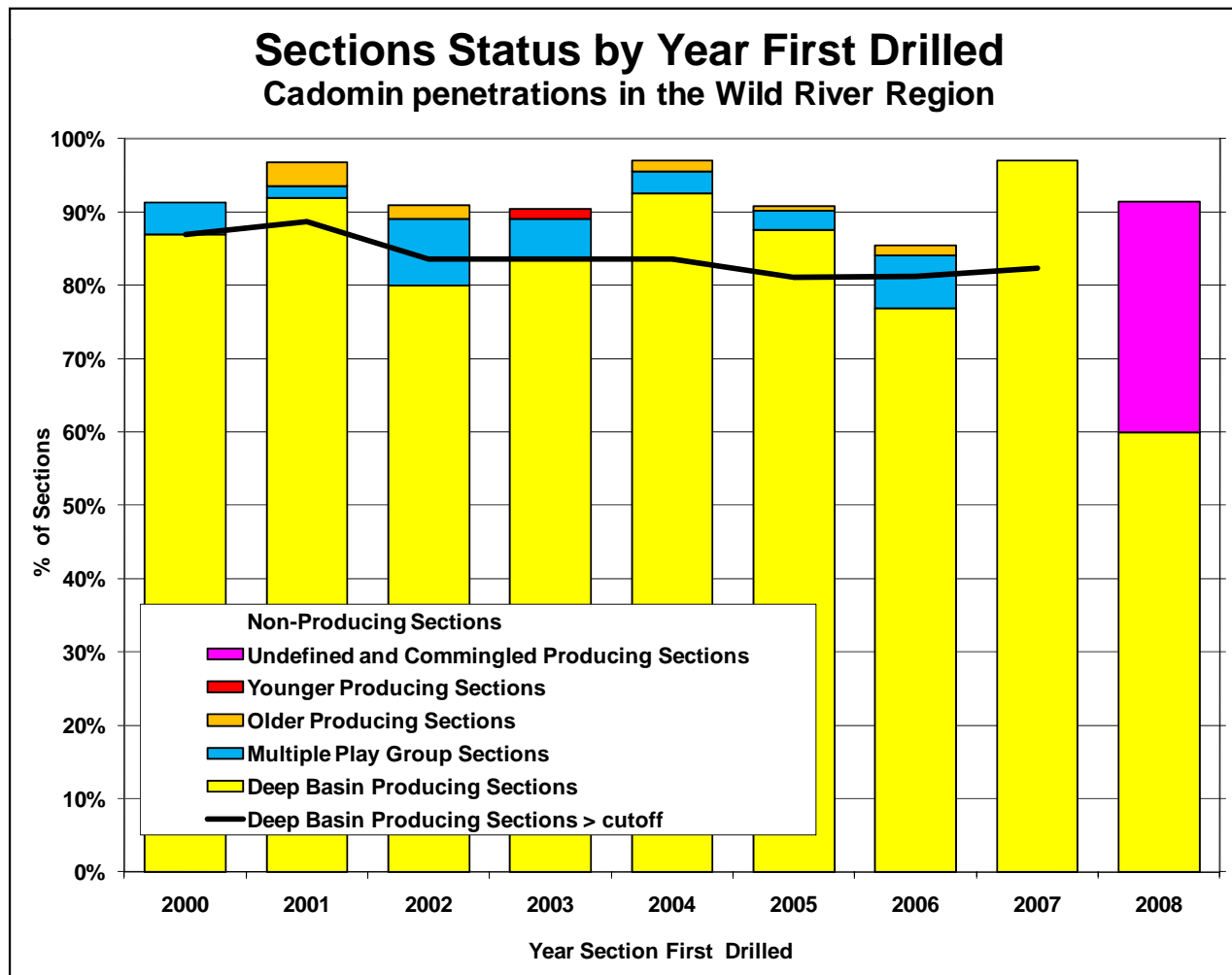


- Count of sections drilled to Cadomin or deeper by year first drilled
- Status shows non-producing sections and identifies producing play group for producing sections
- Similar trends to well activity *but* 50% of scale and earlier peak due to recent infill drilling

- 71% of sections were first drilled since 2000 but over 83% of the wells
- In 2007, 34 new sections were drilled but over 200 new wells were drilled

Significant infill drilling activity since 2003

% of Cadomin-penetration sections producing



- % of sections drilled to Cadomin or deeper by year first drilled
- Status identifies play group for producing sections; Undefined play group producers remain confidential
- Line shows % of sections drilled where at least one well has Deep Basin EUR > cutoff

- Success rate for evaluating previously undrilled sections is relatively constant
- 82% of sections drilled to the Cadomin between 2004 and 2007 contain at least one Deep Basin play producing well with EUR > cutoff

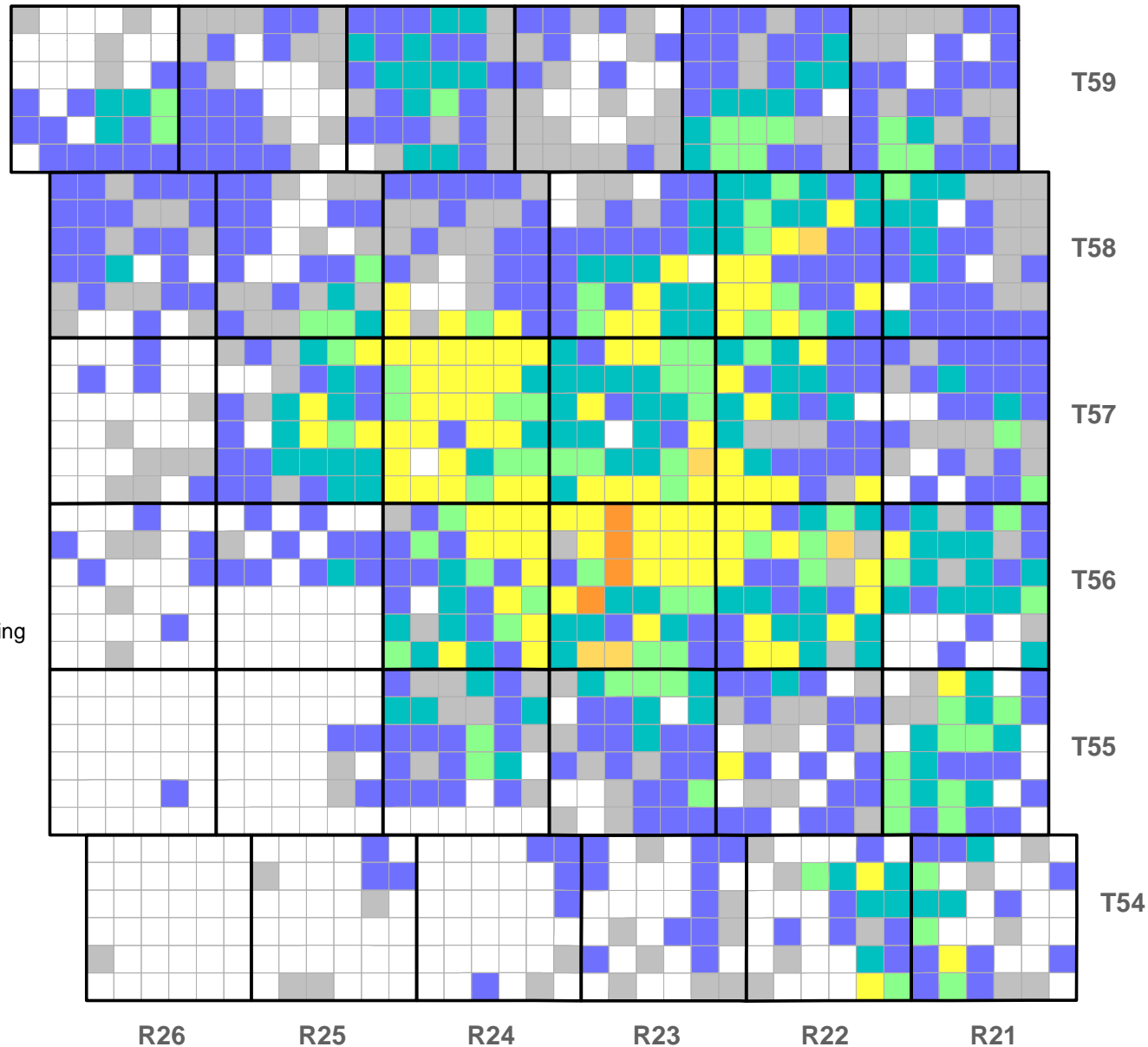
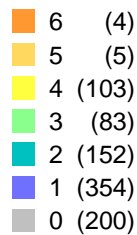
Section success rate is relatively constant

Development Density – Wild River

Development Density

- 701 sections with Deep Basin gas producers, Cadomin penetration with EUR > cutoff (78%)
- 50% of the sections developed with 2 or more Deep Basin gas producers
- Well spacing of 4 to 8 wells per pool per section has been approved in area
- Current development density is less than the approved level

Count of gas wells producing from Deep Basin plays



Wild River Region

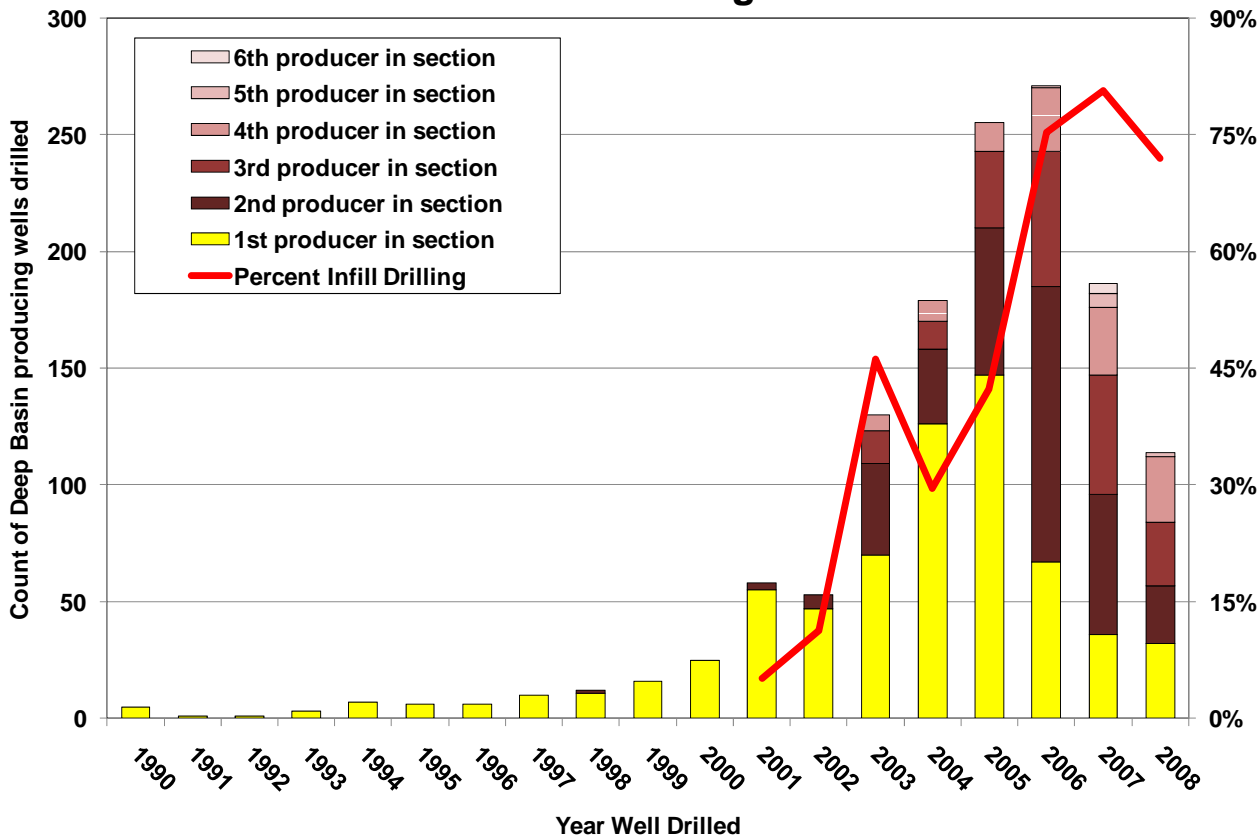
Count of gas wells with Deep Basin play EUR > cutoff

Cadomin penetration wells drilled to 2008-12-31

Opportunity to increase development density

Initial Producer and Infill Drilling

Initial Deep Basin Producing Wells and Infill Wells
Wild River Region



Cadomin penetration Deep Basin producing wells after EUR cutoff

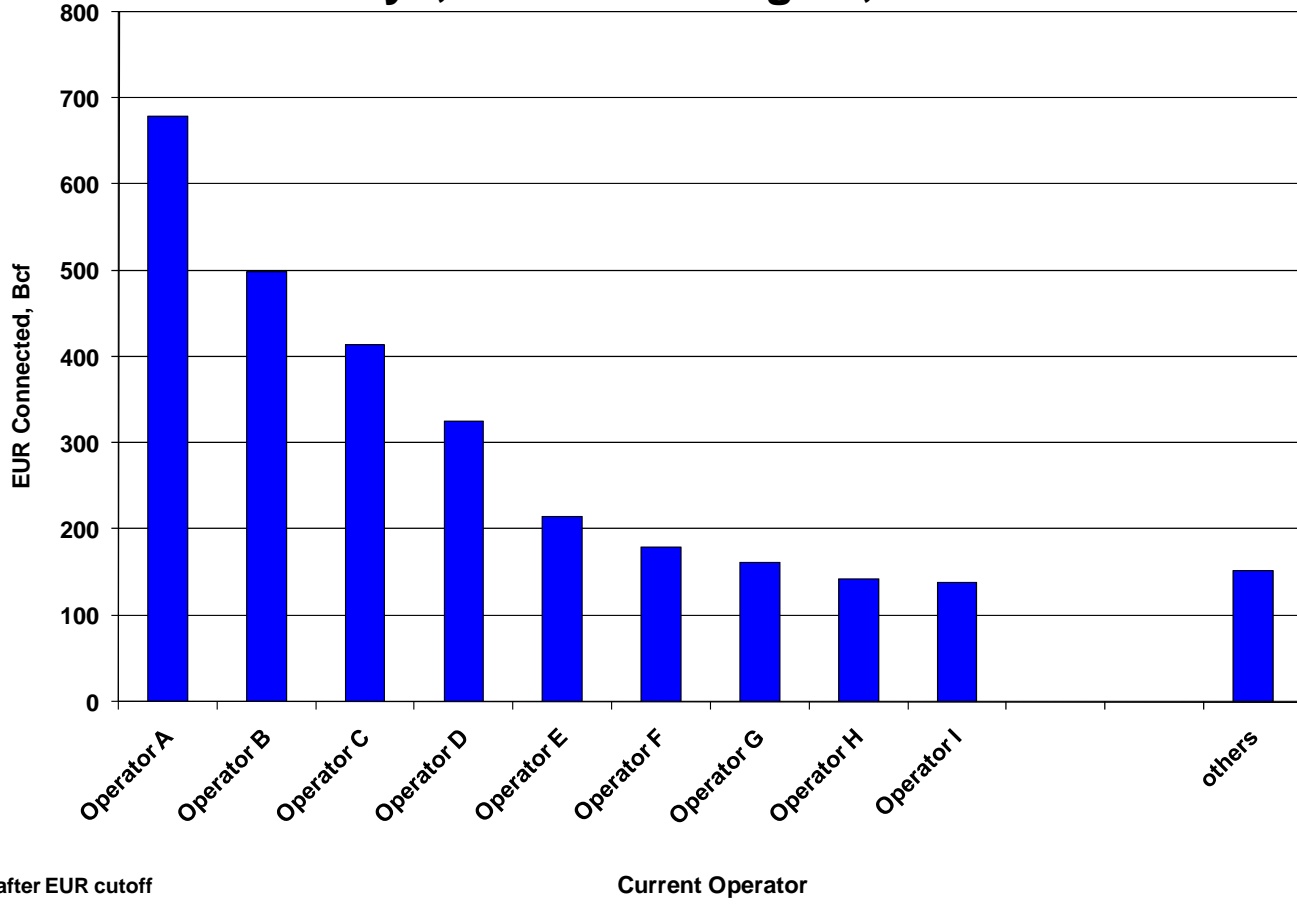
- Drilling for the first Deep Basin well in a section peaked in 2005
- Infill drilling of producing sections started in 2003
- Infill well drilling has exceeded initial well drilling since 2005
- Infill drilling comprised about 75% of all drilling 2006-2008

- Development density of 4 wells per section since 2003, 6 wells since 2007
- Currently developed spacing of 100 -160 acres is still low in comparison to tight gas plays in US Rockies

Recovery very sensitive to development density

Wild River Operators

**EUR Connected by Top 9 Current Operators,
All Plays, Wild River Region, 2000-2008**



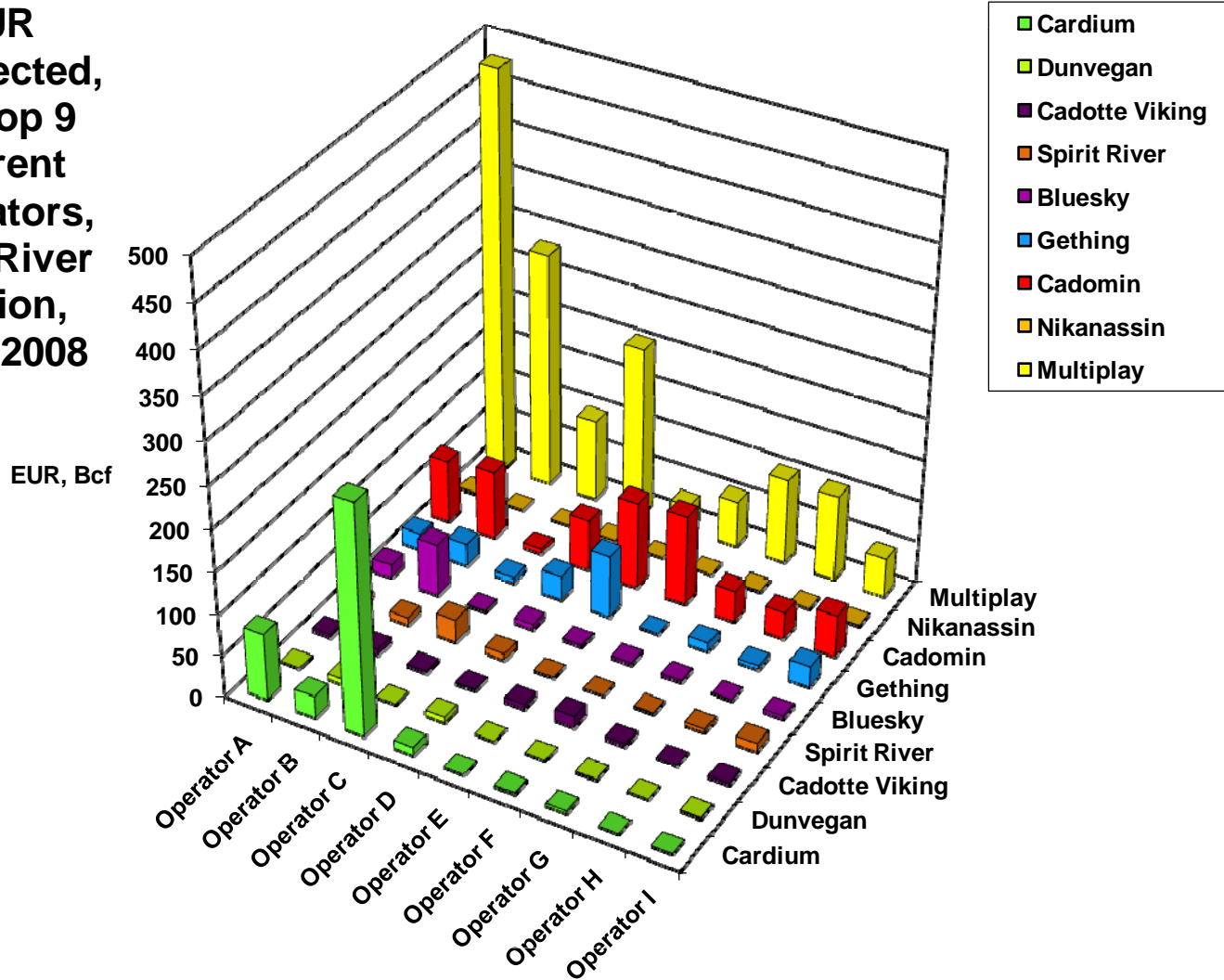
- Analysis based on current operator
- Includes wells with minimum onstream years 2000-2008
- Top 9 current operators connected 2.75 Tcf (95%)
- Operators A and B – largest 2 operators, connected 41% of EUR

- Rank ordering on subsequent displays

Many operators; largest operator < 24% of EUR

Wild River Portfolios by Play

EUR
Connected,
by Top 9
Current
Operators,
Wild River
Region,
2000-2008



after EUR cutoff

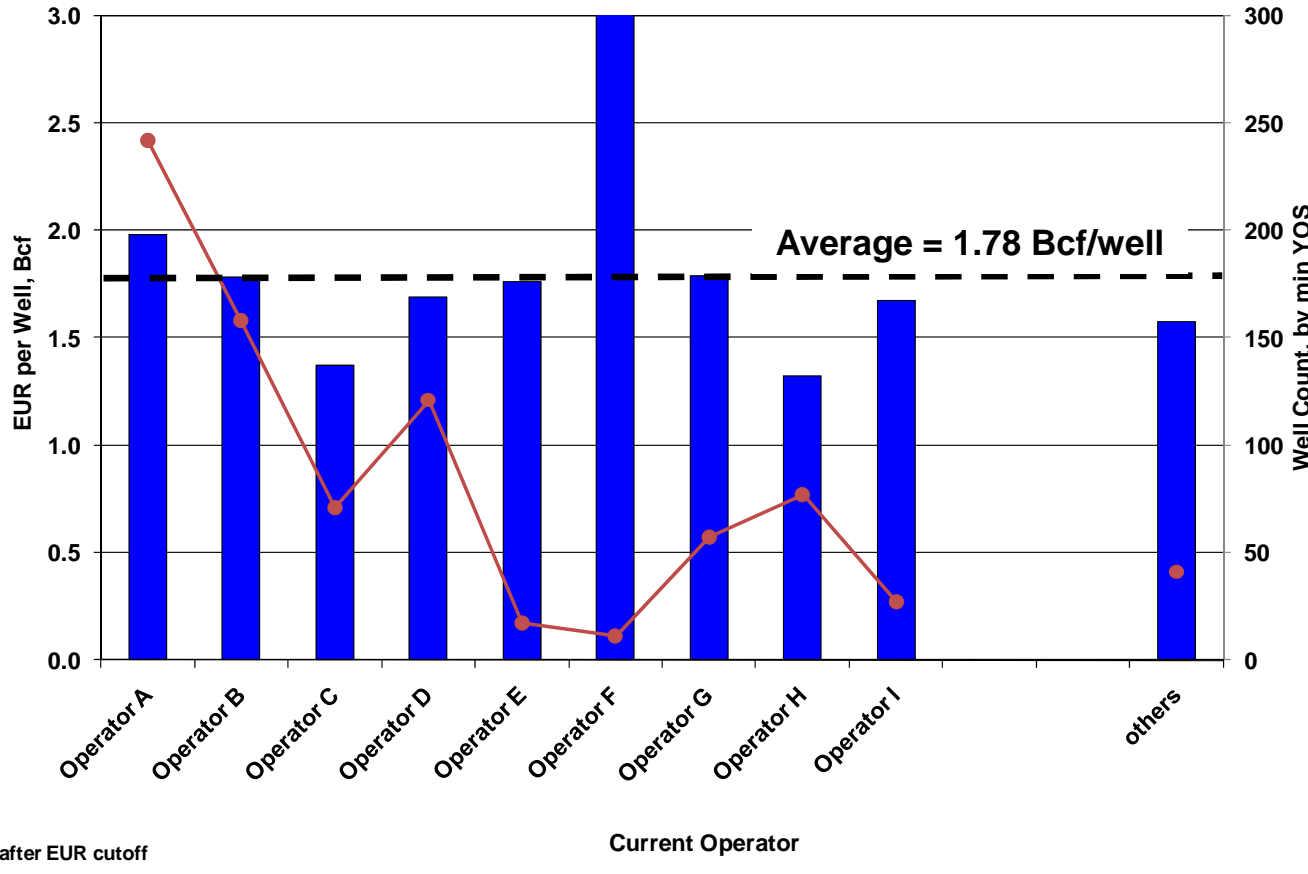
- Most operators have Multiplay as largest focus
- Notable exception is pure play focus of Operator C on the Cardium
- Other operators with a pure play focus:
Op E (Cadomin and Gething);
Op F and I (Cadomin)

- Operators A and B, in Multiplay alone, account for 0.76 Tcf (26% of all Wild River)

Multiplay strategy adopted by most operators

EUR per Well by Operator

EUR per Well Connected by Top 9 Current Operators, Multiplay, Wild River Region, minimum YOS 2000-2008



- Wild River Multiplay EUR averaged 1.78 Bcf/well (2000-08)
- Operators A and B, largest 2 operators, averaged 2.0 and 1.8, respectively
- Operator F had highest average - 5.0 Bcf/well; low well count and a few high impact Multiplay wells

- Operators C and H each averaged less than 1.4 Bcf/well; Operator A average EUR per well was more than 40% higher

Opportunity to improve EUR/well

Wild River Summary

- Multiplay wells are the largest source of EUR in Wild River
- Multiplay wells are drilled to evaluate all eight Deep Basin intervals
- Multiplay wells are commonly completed in three or more plays
- Average EUR per well is higher for Multiplay wells than for pure play wells
- EUR per well is higher in Multiplay wells with more plays completed
- Multiplay wells are completed in anchor plays and supporting plays
- Success rate, on well basis, has been increasing to over 90%
- Success rate, on a section basis, has been constant at over 80%
- Infill drilling accounted for about 75% of producers since 2005
- 50% of the sections are developed by 2 or more wells
- Well spacing approvals permit more development than current density
- Average Multiplay EUR per well differs by up to 40% between operators

**More resource to be developed in Wild River;
A cameo of future development in the Deep Basin**

Implications of Multiplay Strategy

- For Development in other areas
 - The Multiplay strategy developed in the Wild River region will be applied more frequently over the greater Deep Basin area
 - Establishment and expansion of DE #2 and similar commingling rules in BC
 - The single play strategy will decrease in importance except in:
 - Single play permeability sweet spots (conglomerates, fracture trends)
 - Single plays where recovery technology, such as horizontal drilling and multi-stage fracturing, is particularly effective at enhancing recovery from a limited vertical interval with sufficient in-place resource density
- For Deep Basin recoverable resource estimates
 - Multiplay strategy sustains or increases the EUR per well, reduces the likelihood of failure and supports increased wells per section
 - Extrapolating the higher success rate and development density in Wild River to the greater Deep Basin leads to higher estimates of recoverable resource
 - Recoverable resources estimates prepared for the northern portion of the Deep Basin, using recent higher success rates and development density, still forecast only a modest recovery factor of 11% of gas in place.

Challenge remains to increase recovery from large resource of gas-in-place

Commingled Production from Deep Basin Plays

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