Caprock CO_2 Flood

2015 CO2 Conference

John D. Allison, Jr.

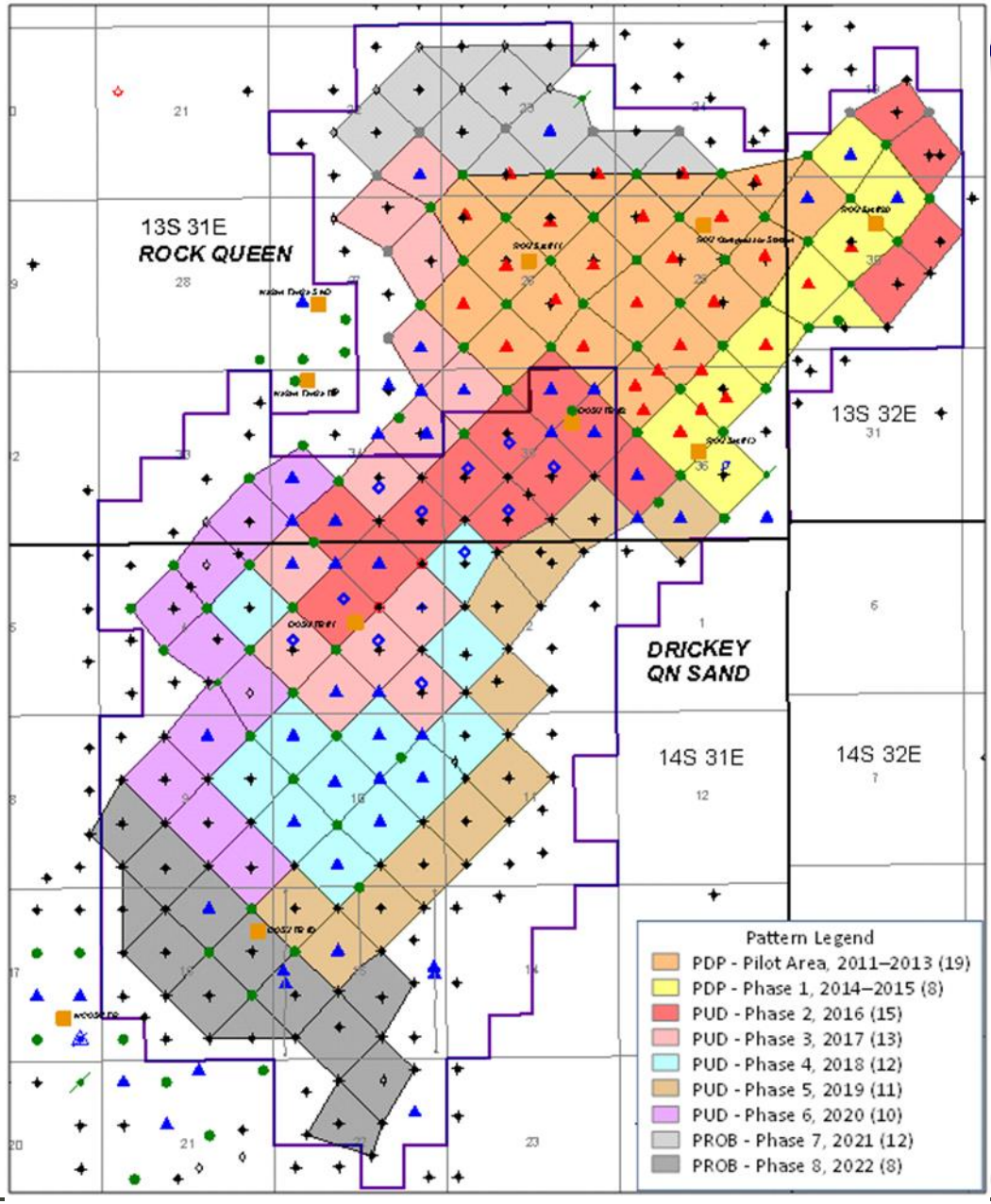
Dec 11, 2015

Forward-Looking Statement

Statements made by representatives of Legacy Reserves LP (the "Partnership") during the course of this presentation that are not historical facts are forward-looking statements. These statements are based on certain assumptions made by the Partnership based on management's experience and perception of historical trends, current conditions, anticipated future developments and other factors believed to be appropriate. Such statements are subject to a number of assumptions, risks and uncertainties, many of which are beyond the control of the Partnership, which may cause actual results to differ materially from those implied or expressed by the forward-looking statements. These include risks relating to financial performance and results, availability of sufficient cash flow to pay distributions or make payments on our notes and execute our business plan, prices and demand for oil and natural gas, our ability to replace reserves and efficiently exploit our current reserves, our ability to make acquisitions on economically acceptable terms, and other important factors that could cause actual results to differ materially from those anticipated or implied in the forward-looking statements. Please see the factors described in the Partnership's Annual Report on Form 10-K for the year ended December 31, 2013 in Item 1A under "Risk Factors" and subsequent filings with the Securities and Exchange Commission. The Partnership undertakes no obligation to publicly update any forward-looking statements, whether as a result of new information or future events.

Any reserve information pertaining to assets acquired after December 31, 2013 and presented herein is based on our internal evaluation and interpretation and has not been independently verified or estimated.

Caprock Overview



Legacy Ownership WI/NRI:

Rock Queen: 99.95%/79.3%

Drickey Queen: 100%/78.1%

Field discovery: 1940

Waterflood Started: 1959

CO2 Flood Started: 2011

Queen Sand @ 3100'

Net Pay 12-20'

Porosity ~20%

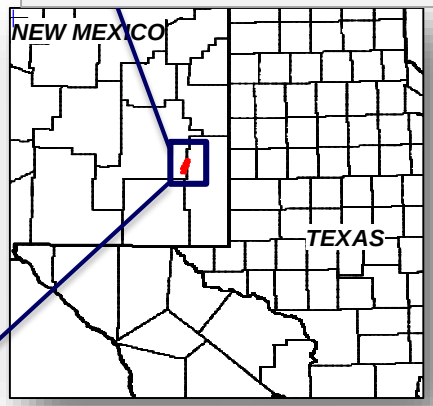
Field Area: 7100 Acres

Total Field OOIP~ 140 MMBO

RQU + DQU ~ 110 MMBO

PUD OOIP: 90.0 MMBO

PRB OOIP = 20.0 MMBO

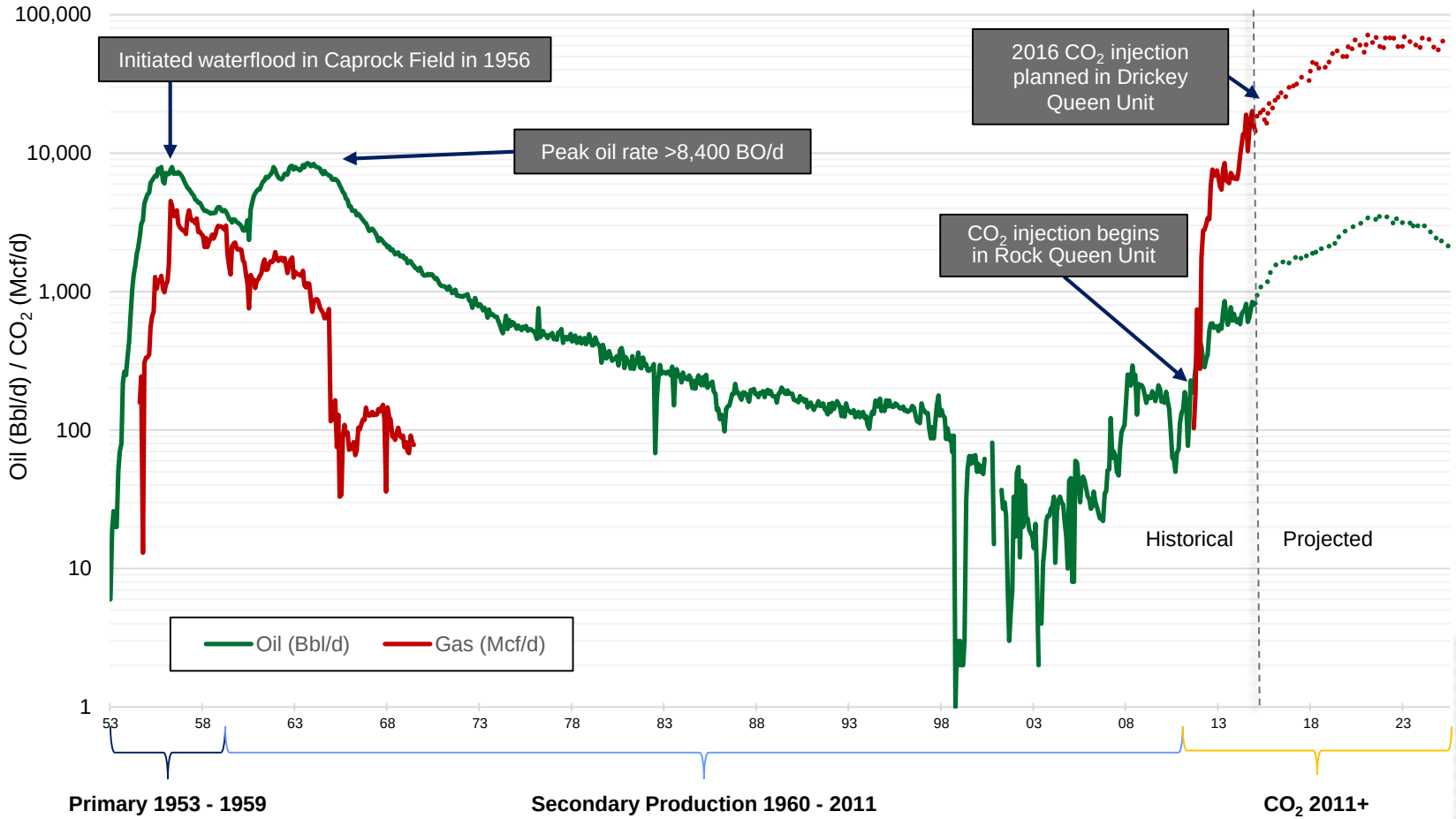


CAPROCK OVERVIEW

1. HIGH QUALITY RESERVOIR
2. EXCEPTIONAL CONTINUITY OF PAY
3. IMPERMEABLE SEAL ABOVE AND BELOW
4. GREAT RESPONSE TO DATE
5. FIELD ONLY 25% DEVELOPED
6. CURRENT CHALLENGES (COMPRESSION AND CAPTIAL)
7. REMEDY AND PLAN FORWARD

Great Waterflood Response => Highly Connected, Quality Reservoir

Combined Primary and Secondary Production History (Rock and Drickey Queen Units)



Primary 1953 - 1959	Secondary Production 1960 - 2011	CO_2 2011+	Primary + Secondary + Tertiary
18% of OOIP ~16 MMBO	18% of OOIP ~16 MMBO	12.5% of OOIP ~11 MMBO	49% of OOIP ~43 MMBO

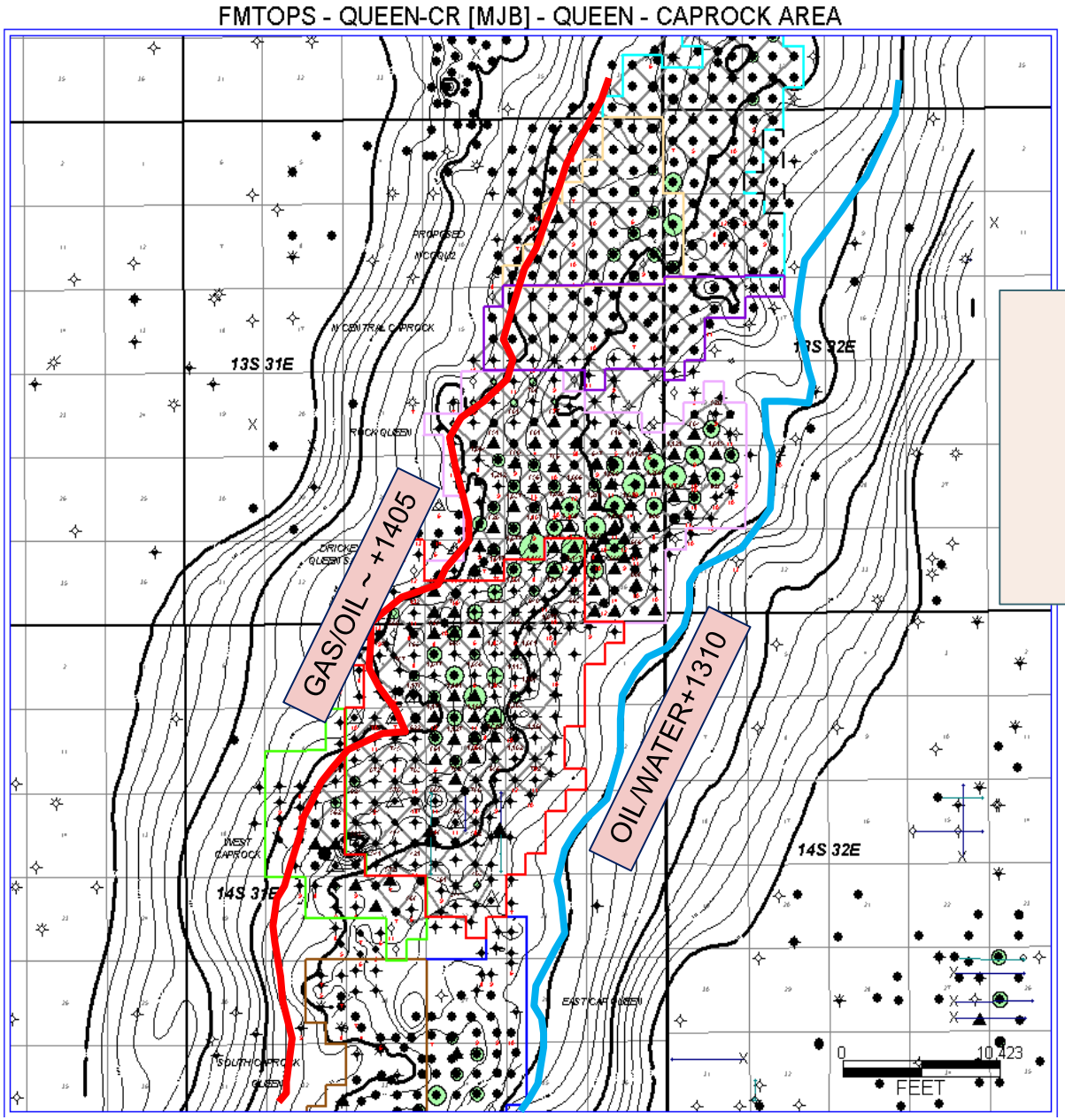
Geology Discussion

Strike/Dip

RQU 320 core

1’ contour pay map

QUEEN SAND STRUCTURE

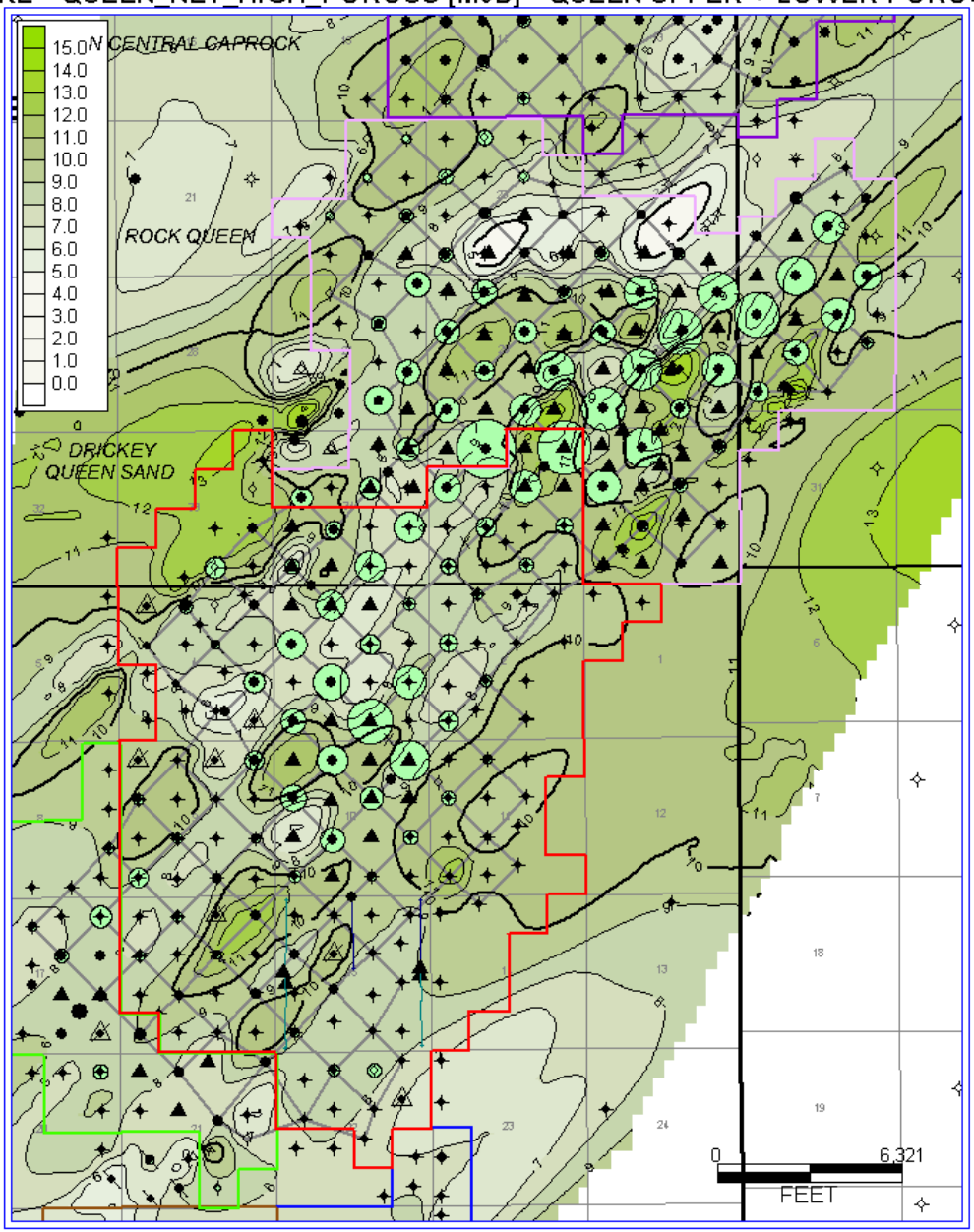


TOP QUEEN STRUCTURE

Regional strike ~~ 26 deg.
Dip: 45'/mile ~~1/2 degree southeast

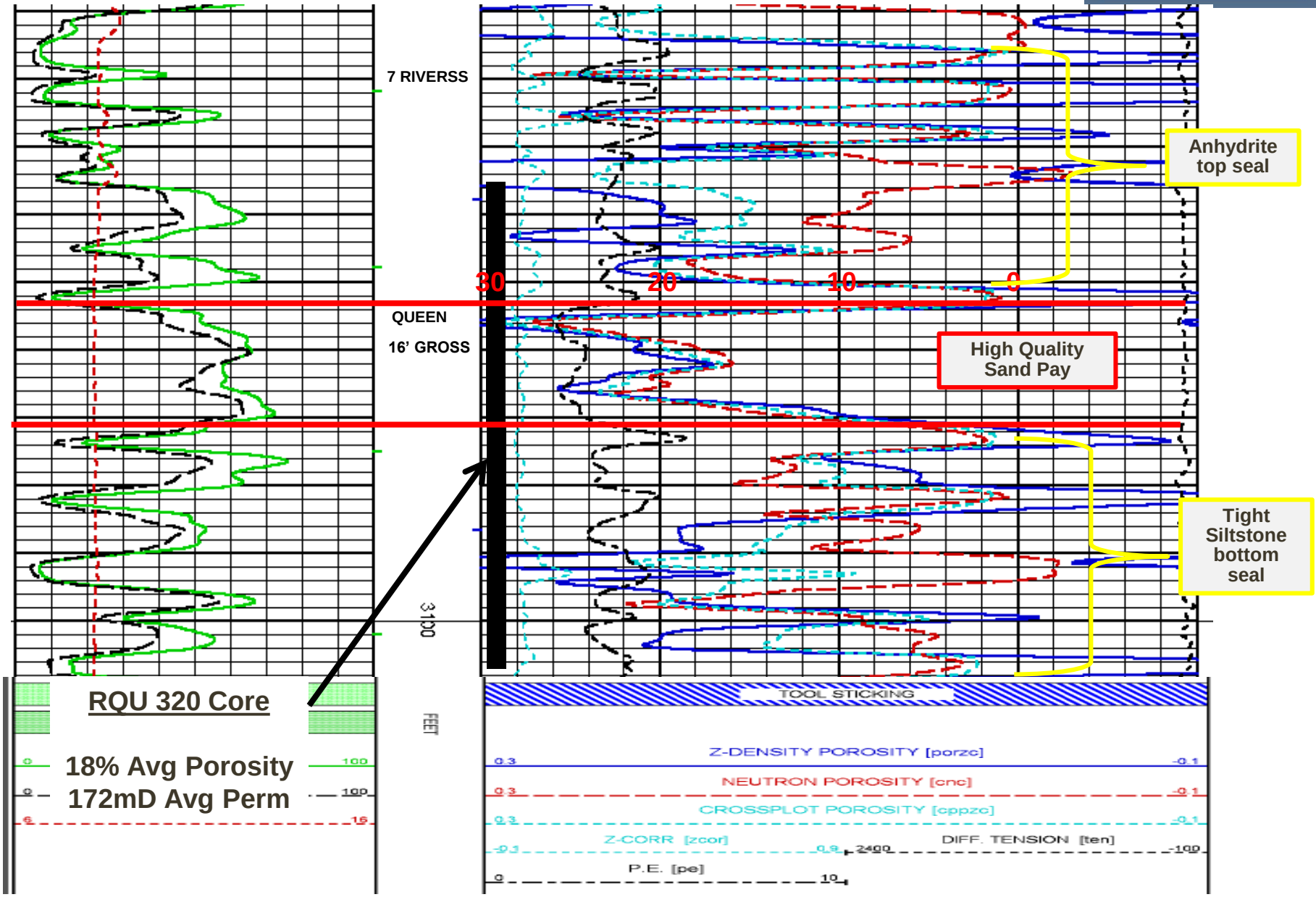
QUEEN SAND: thickness of high porosity sands

MIKE - QUEEN_NET_HIGH_POROUS [MJB] - QUEEN UPPER + LOWER POROUS

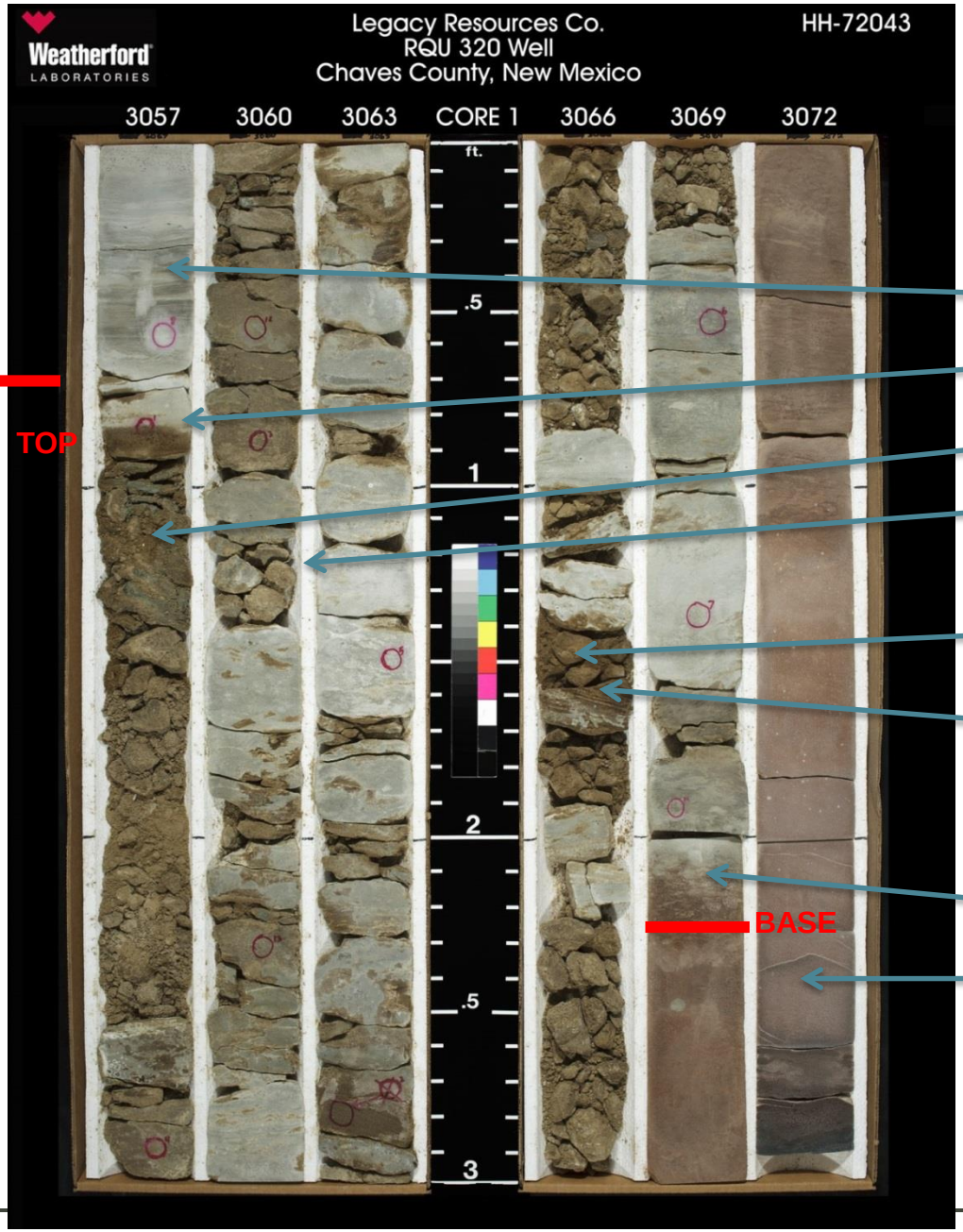


NET PAY > 20% POROSITY

RQU 320 LOG and CORE



QUEEN SAND MAIN PAY ZONE



DENSE ANHYDRITE=CAPROCK + TOP SEAL

SHARP, EROSIONAL CONTACT

MAIN PAY SAND phi=26.5, k=768, So=9.6

INTERBEDDED SAND/ANHYDRITE

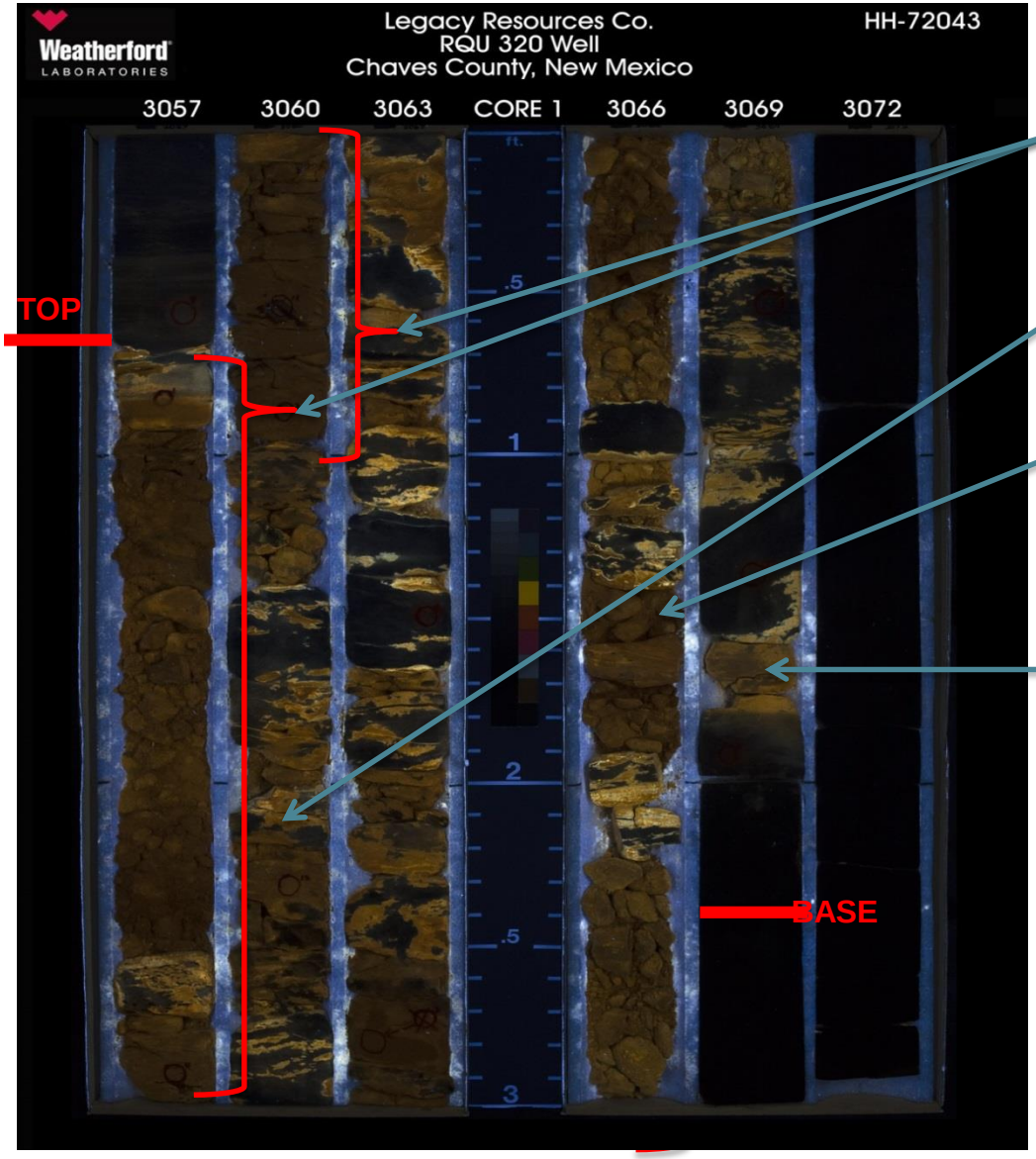
LOWER PAY SAND

REMNANT LOW ANGLE LAMINATED BEDDING IN SS

DENSE ANYDRITE= BASAL SEAL

DENSE SILSTONE/ ANHYDRITE

UV light oil saturations



MAIN PAY SAND, THICK, MASSIVE, CONTINUOUS

LOG DEPTH 3057-3062

INTERMEDIATE ZONE, ANHYDRITE CEMENT

LOG DEPTH 3062-3067

LOWER PAY SAND, MASSIVE WITH MINOR ANHYDRITE

LOG DEPTH 3067-3070

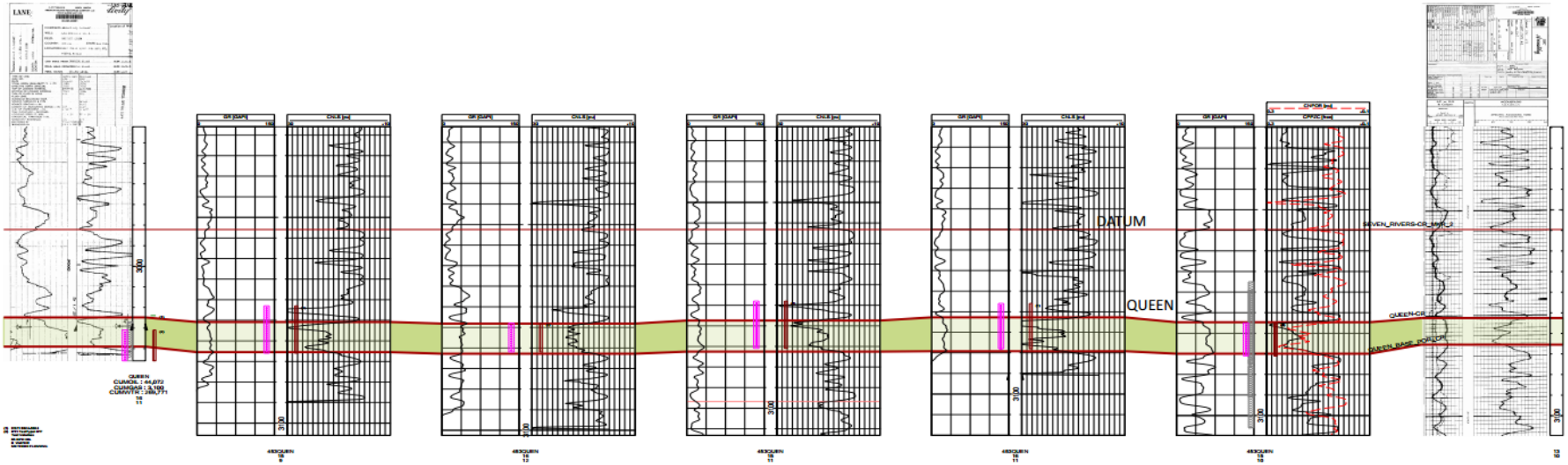
LOWER POROSITY ZONE, ANHYDRITE INTERBEDS

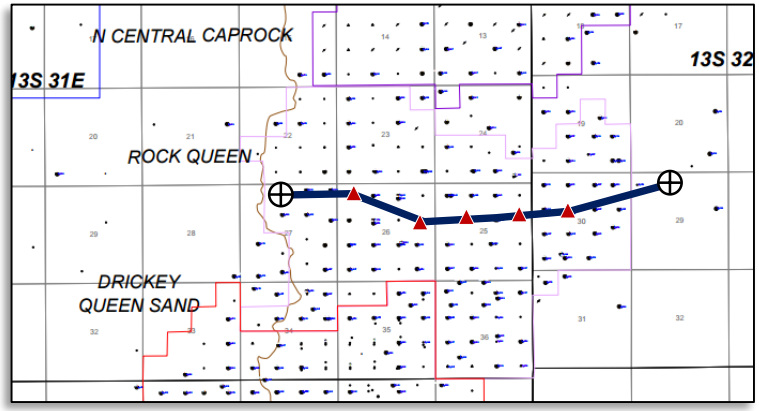
LOG DEPTH 3070-3073

Rock Queen Unit: Excellent Lateral Continuity

W <4,021> <4,242> <2,434> <2,831> <2,663> <5,774> E

RQU TR-3	RQU 305	RQU 315	RQU 302	RQU 303	RQU 320	CABOT STATE 2
13S / 31E / 27	13S / 31E / 26	13S / 31E / 26	13S / 31E / 25	13S / 31E / 25	13S / 32E / 30	13S / 32E / 29
7/14/1955	2/5/2011	11/30/2011	2/5/2011	2/16/2011	9/14/2014	1/16/1974
Elev. Gr: 4,428	Elev. Gr: 4,421	Elev. Gr: 4,411	Elev. Gr: 4,390	Elev. Gr: 4,383	Elev. Gr: 4,376	Elev. Gr: 4,343
Elev KB:	Elev KB: 4,434	Elev KB:	Elev KB: 4,403	Elev KB: 4,396	Elev KB: 4,389	Elev KB: 4,353
TD: 3,046	TD: 3,130	TD: 3,125	TD: 3,207	TD: 3,185	TD: 3,235	TD: 4,459
Cum Oil: 44,072						





Caprock Field
Chaves County, NM

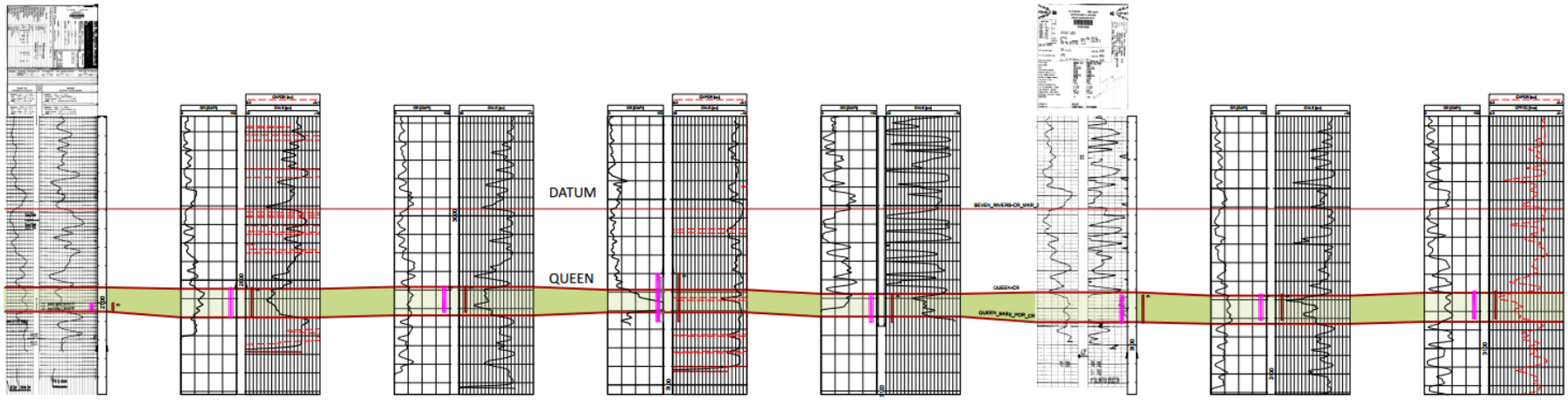
W-E Stratigraphic X Section 1
Rock Queen Unit

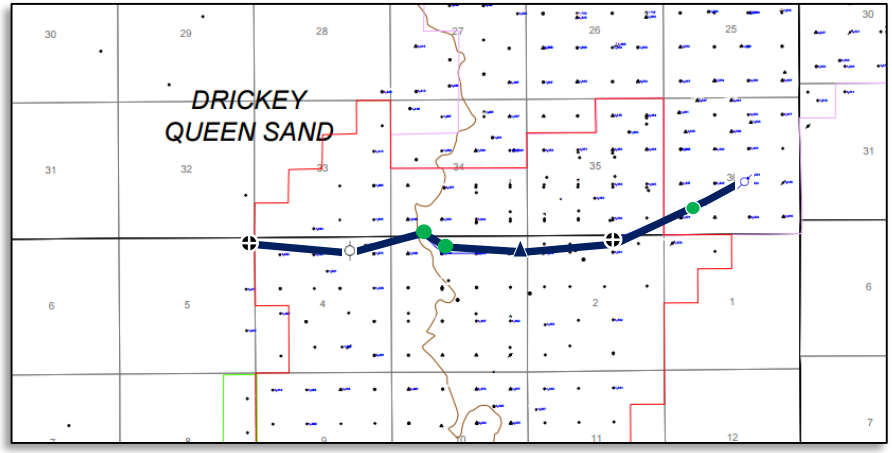
Datum: Seven Rivers Marker

Drickey Queen Unit W-E: Excellent Continuity

W <3,663> <3,379> <938> <1,338> <4,977> <3,919> <2,354> E

TRIGG FED 5-36	TRIGG FED WI16	DQU 701	DQU TR6 18	DQU 16	DQU TR-32 1	RQU 705	RQU 319
14S / 31E / 5	14S / 31E / 4	13S / 31E / 34	14S / 31E / 3	14S / 31E / 3	14S / 31E / 2	13S / 31E / 36	13S / 31E / 36
9/17/1959	12/27/1955	6/17/2013	11/12/1954	10/12/2010	10/31/1956	10/6/2011	9/4/2014
Elev. Gr: 4,109	Elev. Gr:	Elev. Gr: 4,425	Elev. Gr:	Elev. Gr: 4,419	Elev. Gr: 4,409	Elev. Gr: 4,390	Elev. Gr: 4,388
Elev KB: 4,115	Elev KB:	Elev KB: 4,438	Elev KB:	Elev KB: 4,424	Elev KB: 4,418	Elev KB:	Elev KB: 4,401
TD: 2,726	TD: 2,820	TD: 3,135	TD: 3,066	TD: 3,081	TD: 3,125	TD: 3,128	TD: 3,244
	Cum Oil: 53,528	Cum Oil: 3,563	Cum Oil: 355,718		Cum Oil: 101,247	Cum Oil: 1,040	





Caprock Field
Chaves County, NM

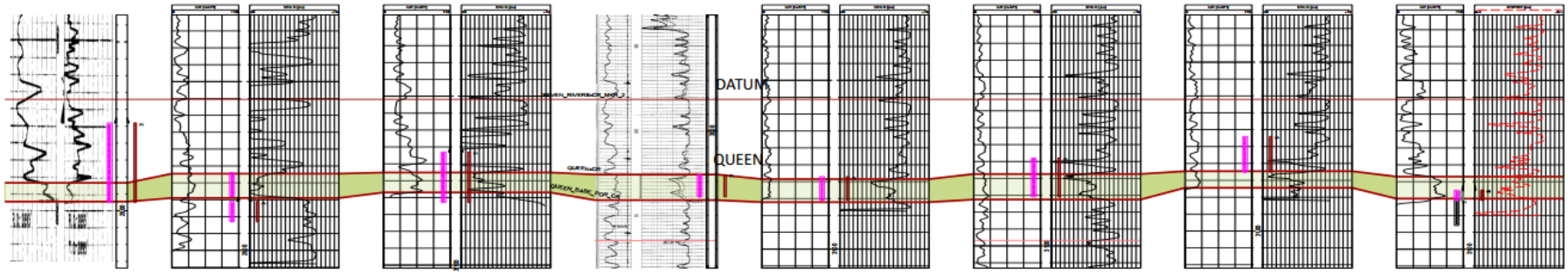
W-E Stratigraphic X Section 1
Drickey Queen Unit

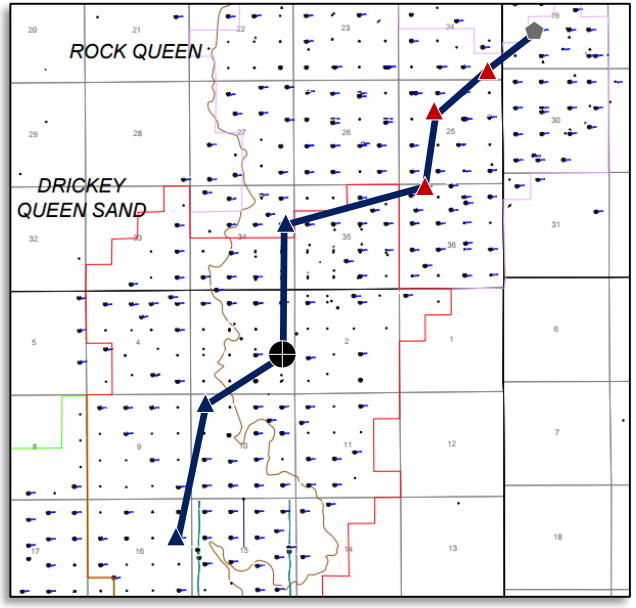
Datum: Seven Rivers Marker

S-N through RQU and DQU: Excellent Continuity

S <6,743> <4,752> <6,616> <7,375> <3,479> <3,471> <3,598> N

DQU TR24 WI2	DQU TR6 WI17	DQU TR6 9	RQU 313	RQU 701	RQU 302	RQU 311	RQU TR-4
14S / 31E / 16	14S / 31E / 10	14S / 31E / 3	13S / 31E / 34	13S / 31E / 36	13S / 31E / 25	13S / 31E / 24	13S / 32E / 19
8/28/1954	11/11/1954	9/27/1954	2/14/2012	3/30/2011	2/5/2011	4/7/2011	6/20/1955
Elev. Gr: 4,234	Elev. Gr: 4,256	Elev. Gr:	Elev. Gr: 4,418	Elev. Gr: 4,393	Elev. Gr: 4,390	Elev. Gr: 4,384	Elev. Gr: 4,372
Elev KB: 4,239	Elev KB:	Elev KB:	Elev KB:	Elev KB: 4,406	Elev KB: 4,403	Elev KB: 4,397	Elev KB: 4,383
TD: 2,895	TD: 2,883	TD: 3,063	TD: 3,115	TD: 3,125	TD: 3,207	TD: 3,131	TD: 3,071
Cum Oil: 42,303	Cum Oil: 41,815	Cum Oil: 398,200	Cum Oil:				Cum Oil: 150,161



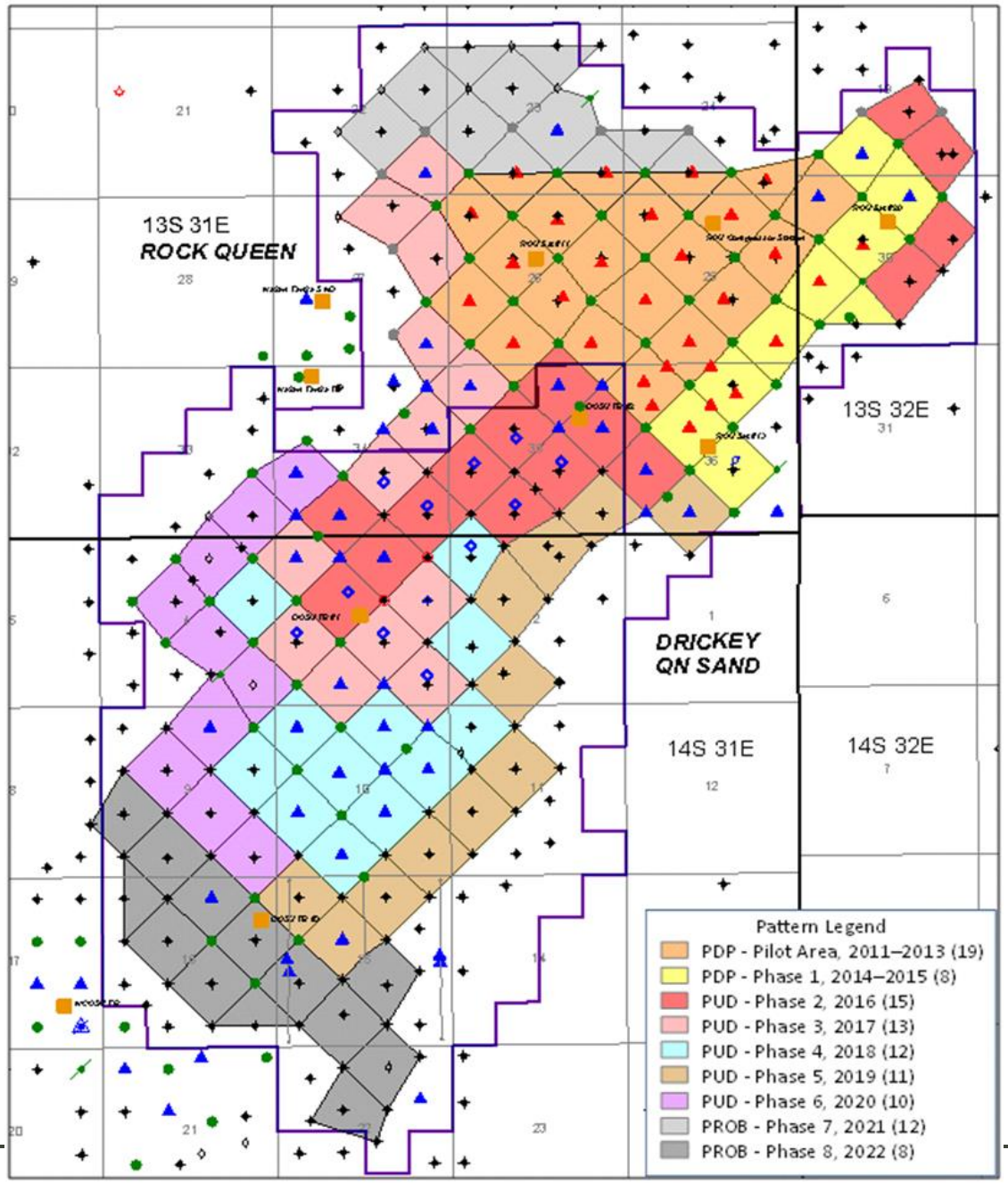


Caprock Field
Chaves County, NM

S-N Stratigraphic X Section 1
Drickey and Rock Queen Units

Datum: Seven Rivers Marker

Development Plan Map and OOIP



Development Pattern OOIP

Average Pattern Values:

Net pay = 16.0'

Porosity = 16.5%

Soi = 70%

Area = 80ac.

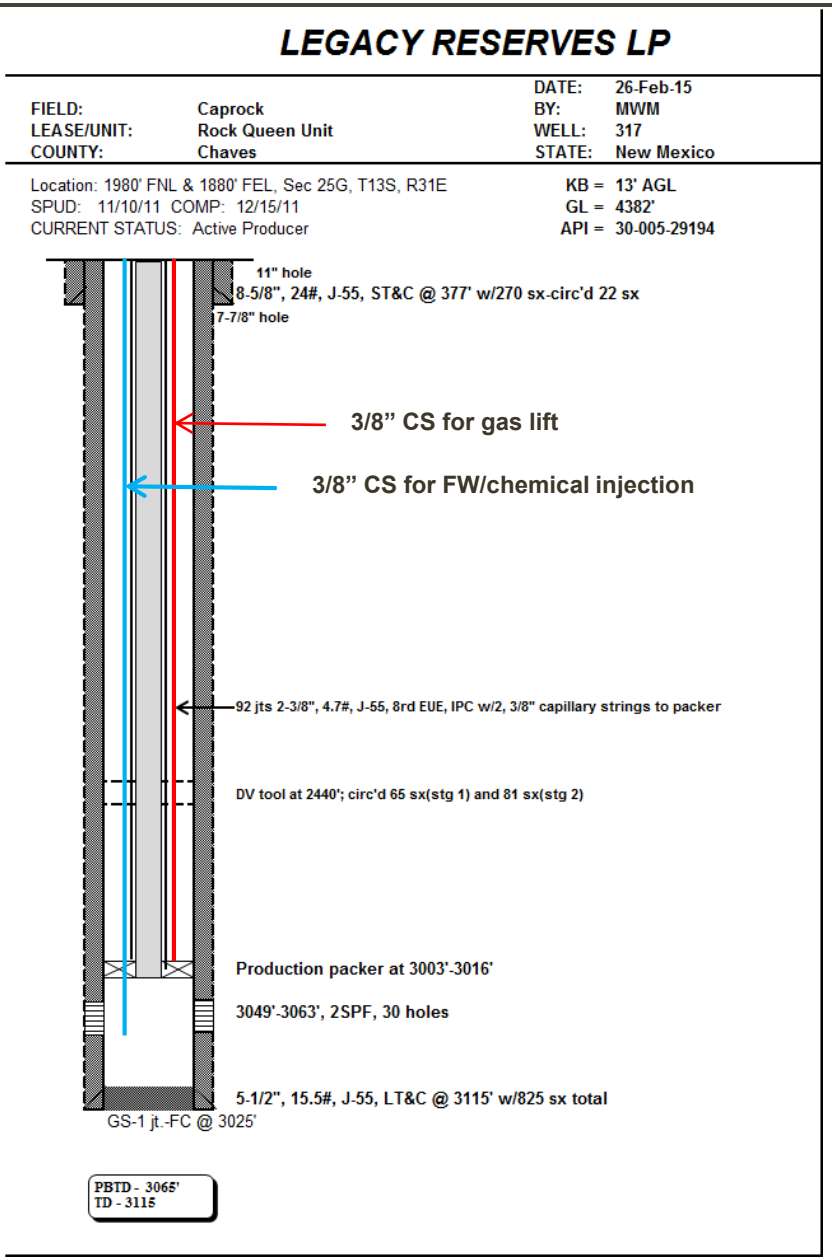
Bo = 1.15

Avg OOIP = **1.009 MMBO per pattern**

Total OOIP in Proved flood area = **88.8 MMBO**

Legacy sees 10-15% upside to OOIP based on further mapping, core analyses and flood performance.

RQU producer – typical wellbore diagram



Typically two 3/8” external capstrings are banded to the tubing string.

Clean CO2 is injected down one capstring for for gas lift operations. Port for gas lift is typically just above the pkr.

Fresh water and/or chemical is injected down the other capstring to prevent tubing restrictions (i.e. salt plugs, paraffin buildup, etc.). FW/chemical is typically injected down thru the pkr and out the bottom of the tailpipe.

Reservoir Model

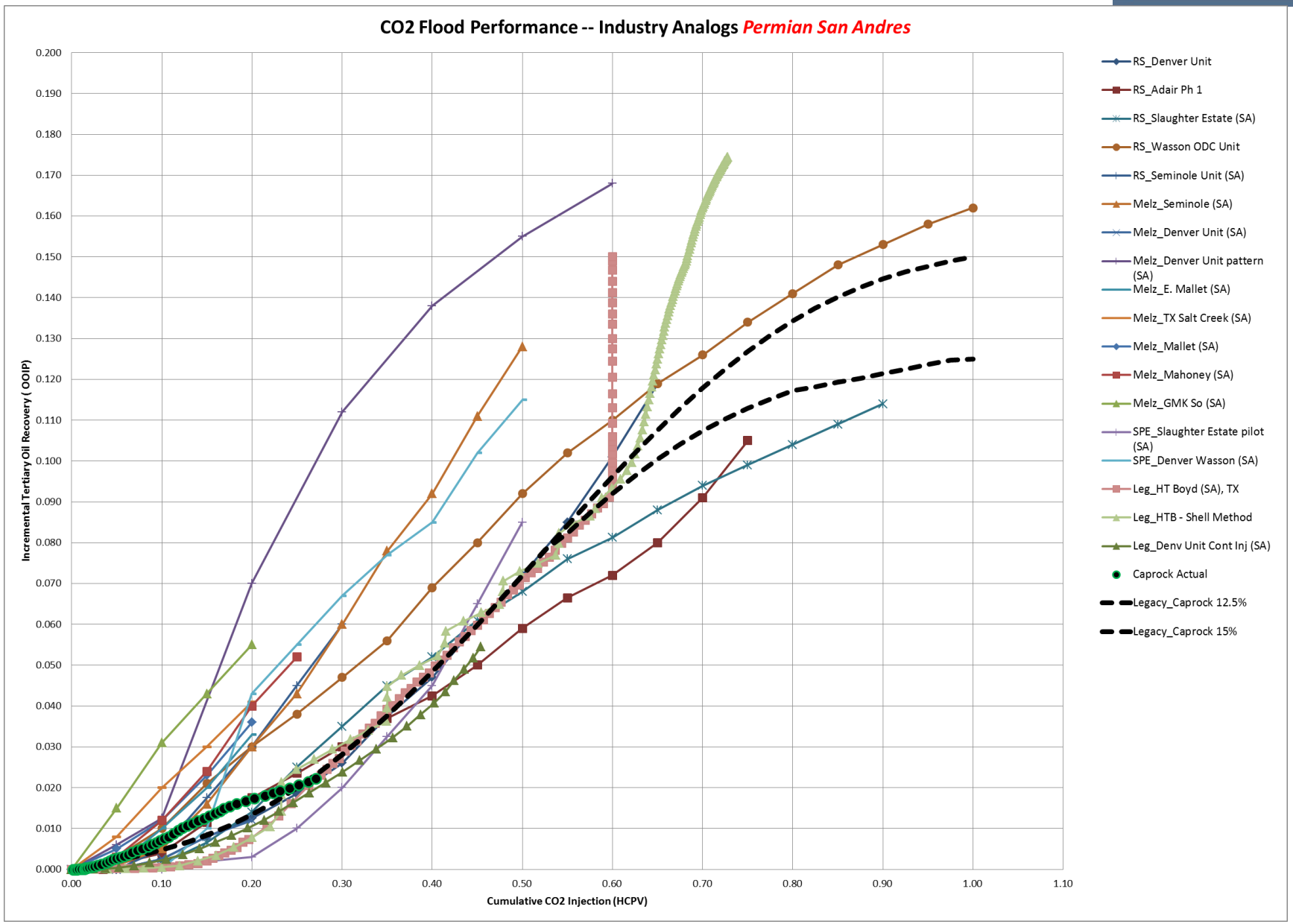
Analog curves

Dimensionless model

History match

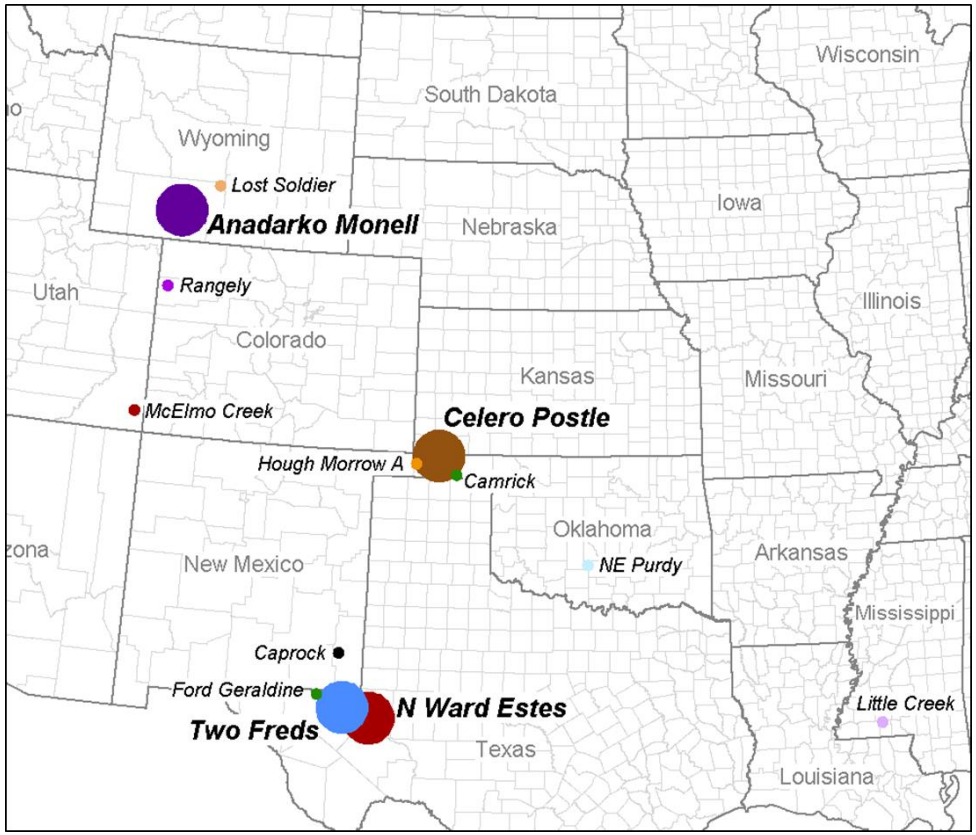
Surveillance

Proved Reserves Recovery Range: Permian Fields



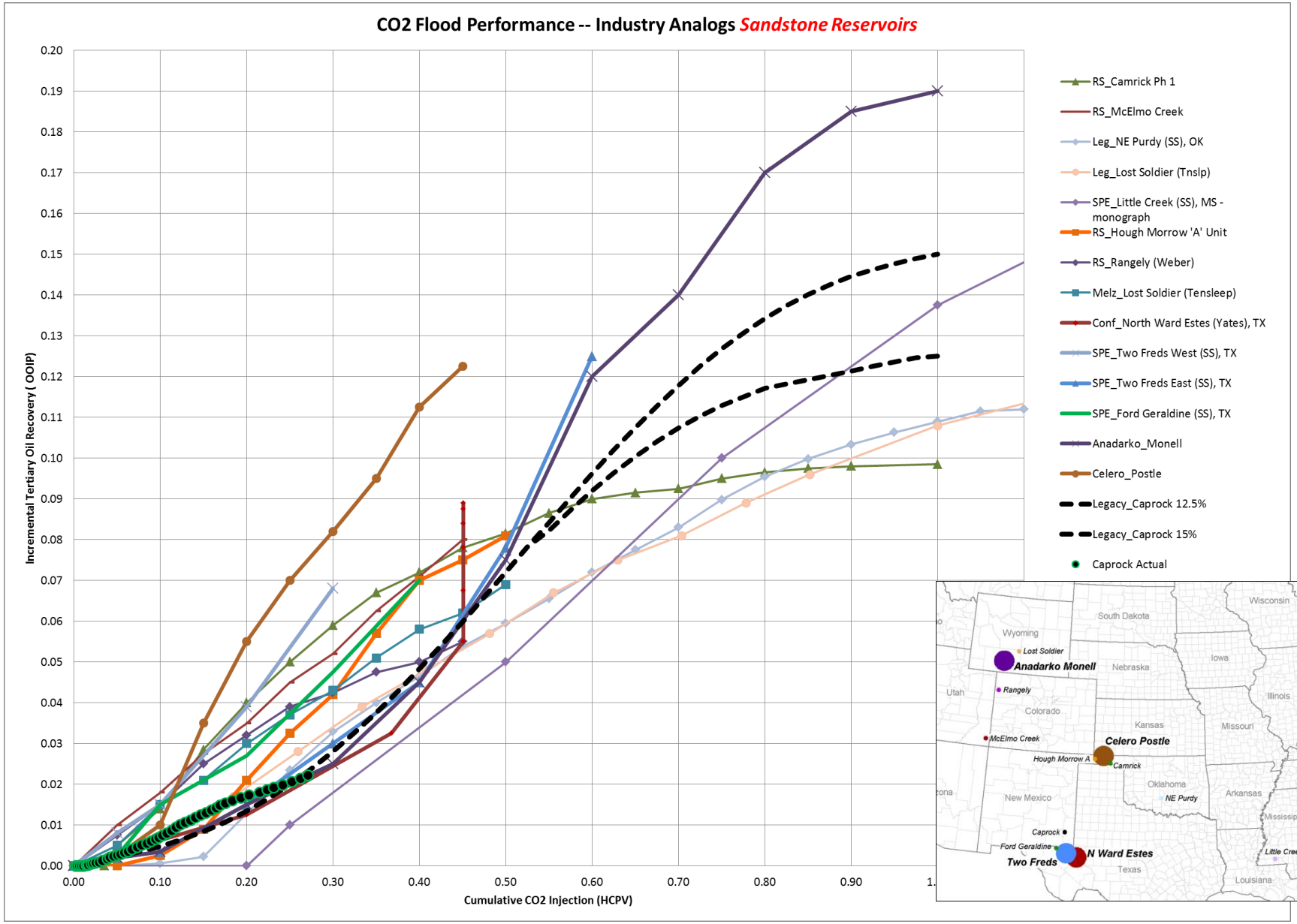
Analog Field Data: Sandstone Reservoirs

								Recovery Factors			
Field	Reservoir	OOIP(MMBO)	Depth(ft)	Thickness(ft.)	Porosity(%)	Perm(md)	Swi(%)	Primary	Secondary	Tertiary	Total
Caprock	Queen Sand	88.8	3100	16	20%	100	30%	18%	18%	12.5%	49%
Monell Unit	Almond Sand	100	4500	25	20%	30	40%	20%	14%	25.0%	59%
Two Freds East	Bell Canyon	51	4820	18	20%	33.4	43%	13%	4%	12.7%	30%
North Ward Estes	Yates/Queen	1250	2600	100	16%	37	50%	20%	20%	13.0%	53%
Postle	Upper Morrow	300	6100	28	16%	65	40%	18%	20%	12.5%	51%

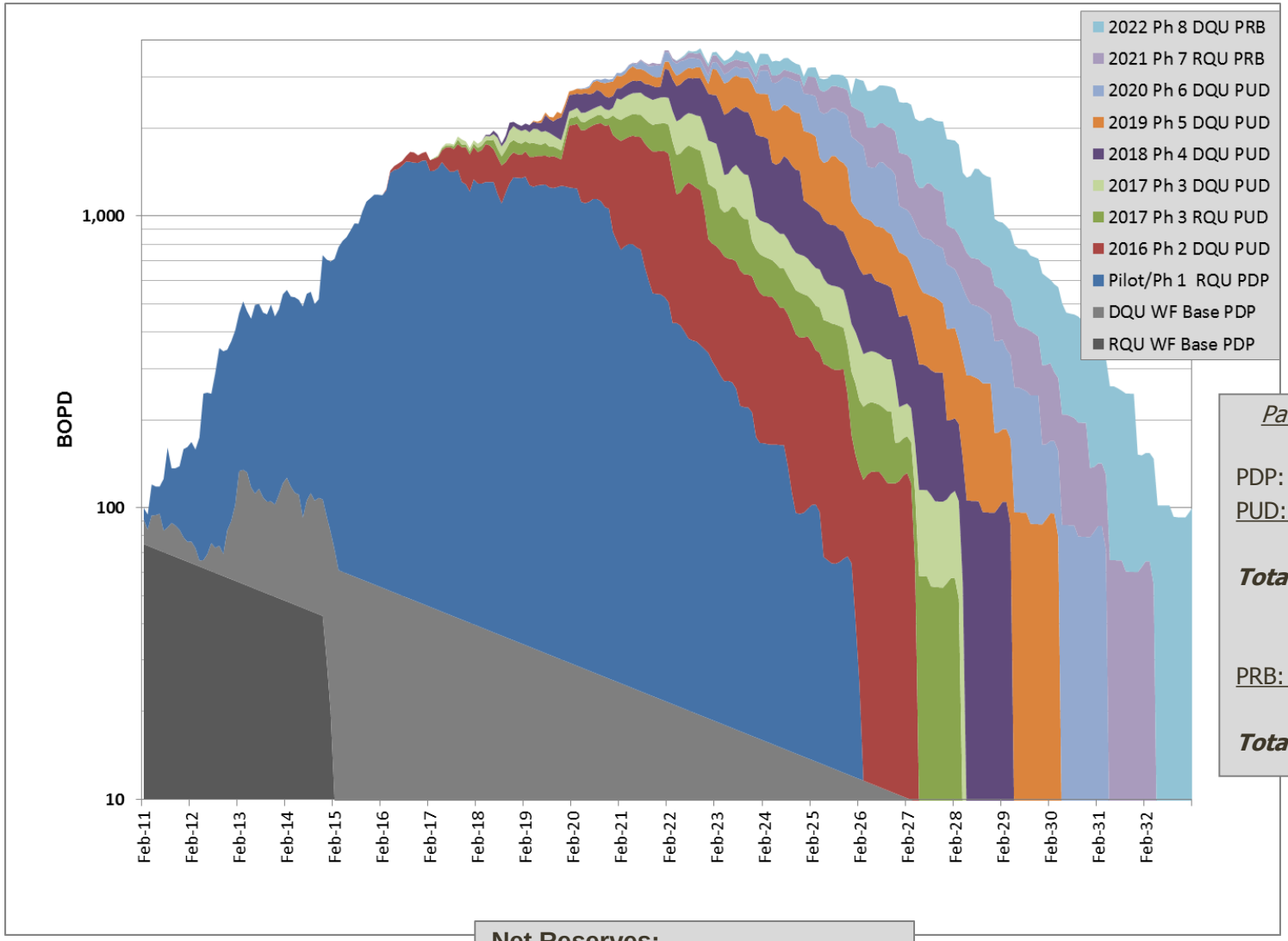


- **Continuous pay, no faulting or natural fractures, similar perm, porosity and thickness to Caprock.**
- **Caprock tertiary endpoint RF of 12.5% is conservative compared to the top four analogs.**
- **Two analogs nearby in Permian, three in OK, one in MS, four in Rockies.**

Proved Reserve Recovery Range: Sandstone Reservoirs



Reserves Overview: 12.5% Analog Curve



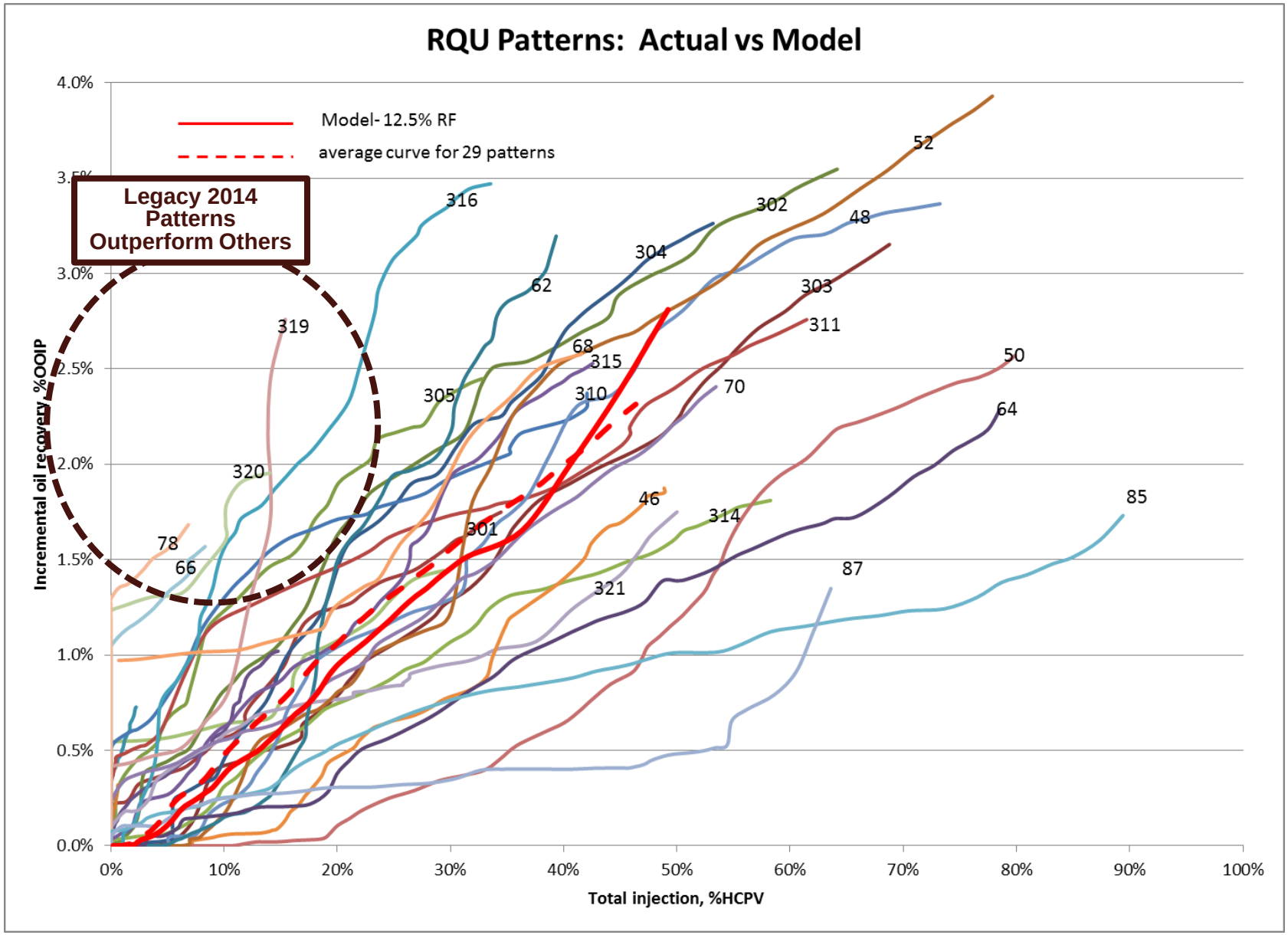
Pattern Count by Reserve Class

PDP: Phase 1/Pilot	27
PUD: Phase 2-6	61
Total Proved	***88***
PRB: Phase 7-8	20
Total Proved+PRB	***108***

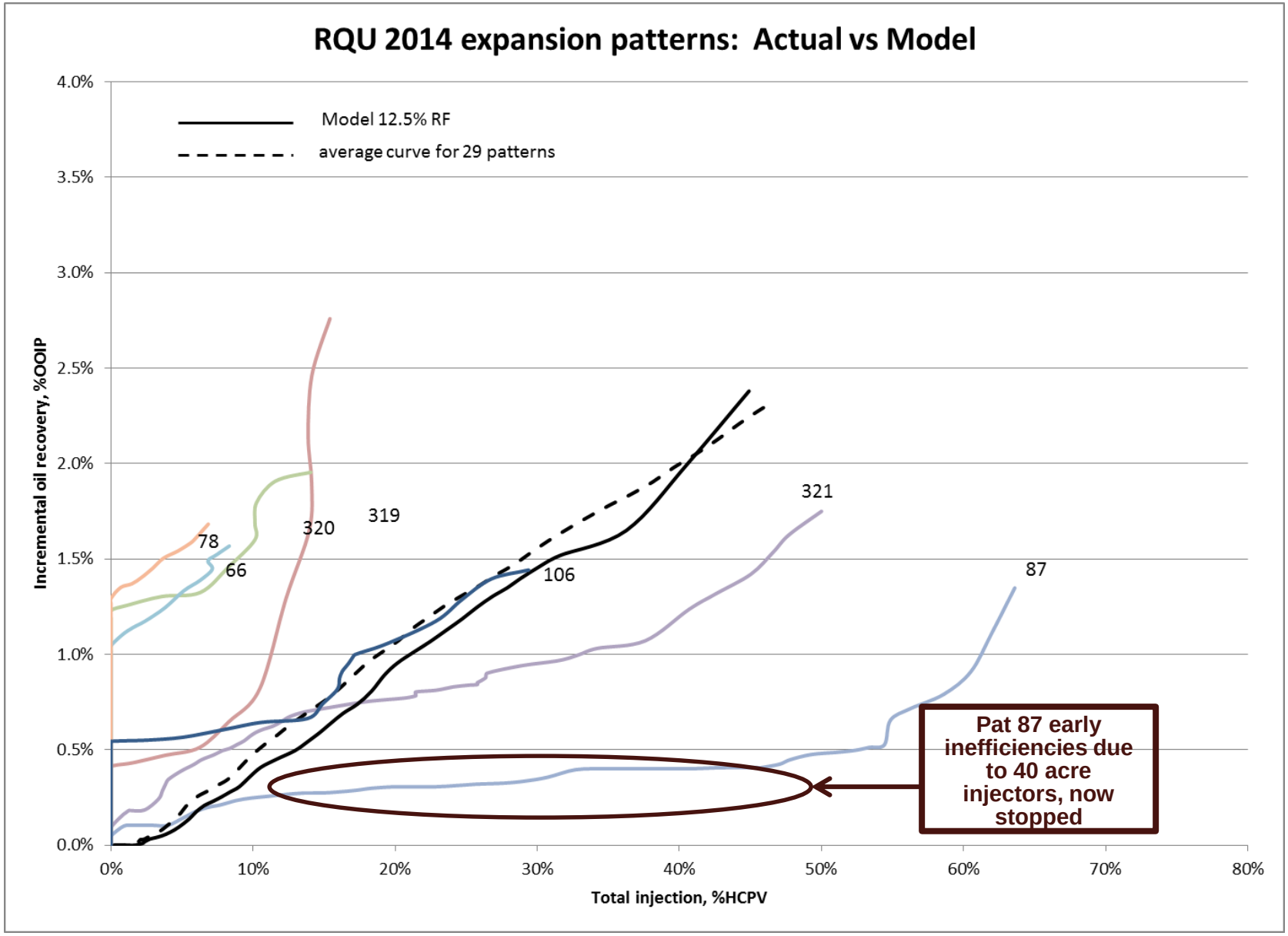
Net Reserves:

- **PDP = 2,200 MBO @ 12.5 % RF**
- **PUD = 5,700 MBO @ 12.5% RF**
- **PRB = 1,861 MBO @ 12.5% RF**
- **Total = 9,761 MBO**

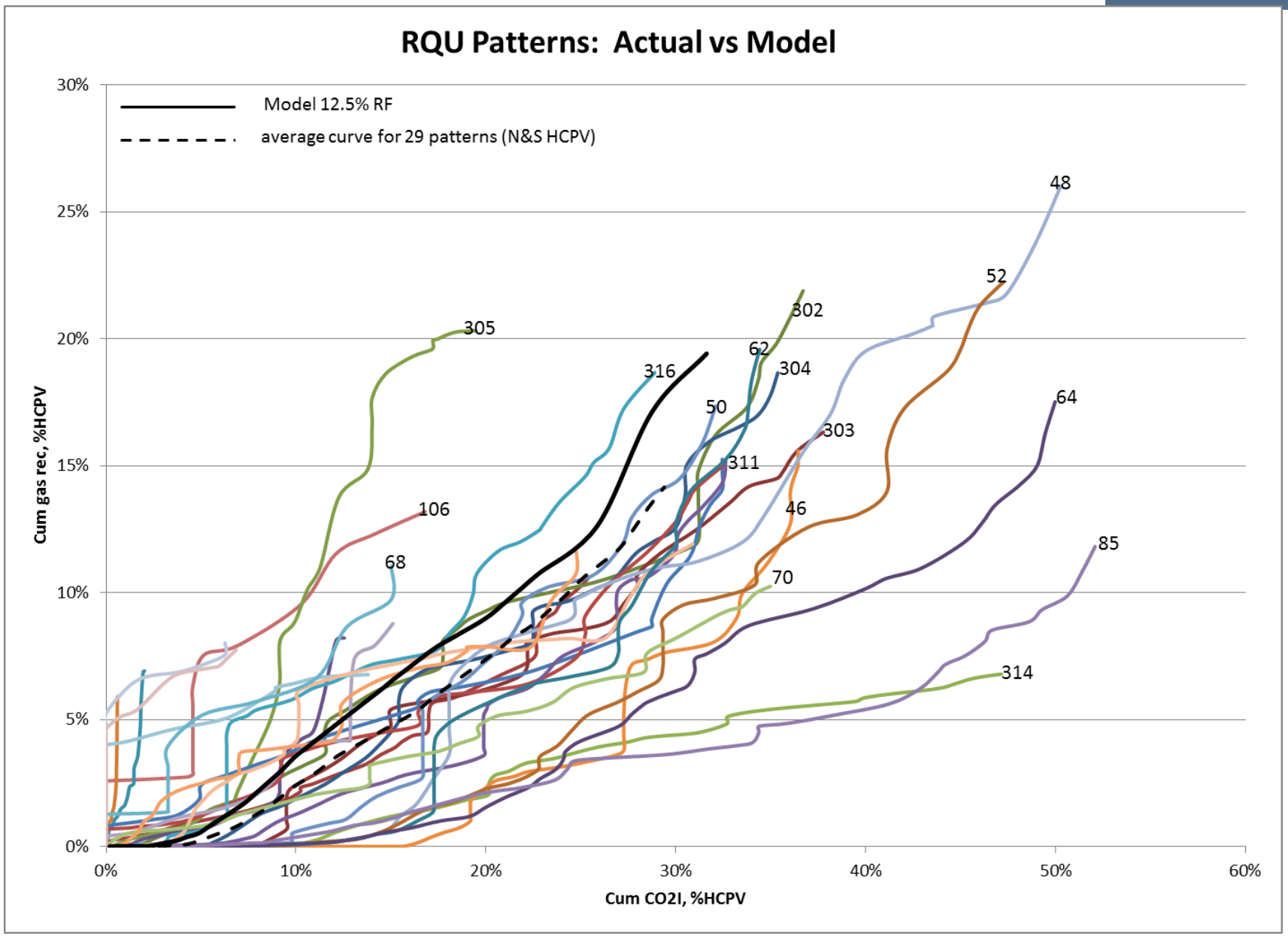
Individual Pattern Oil RF vs HCPVI



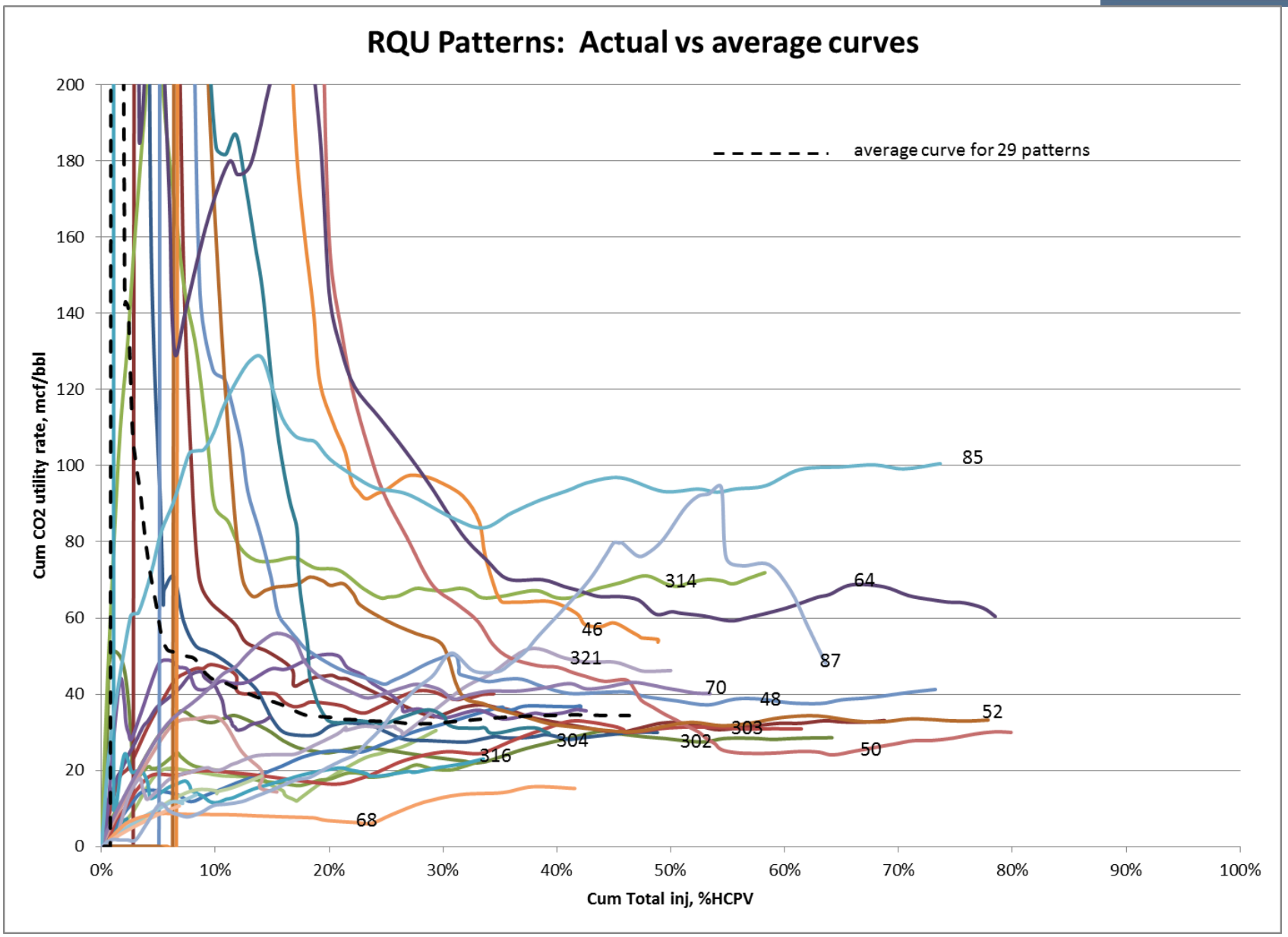
Legacy Installed Patterns 2014 - 2015



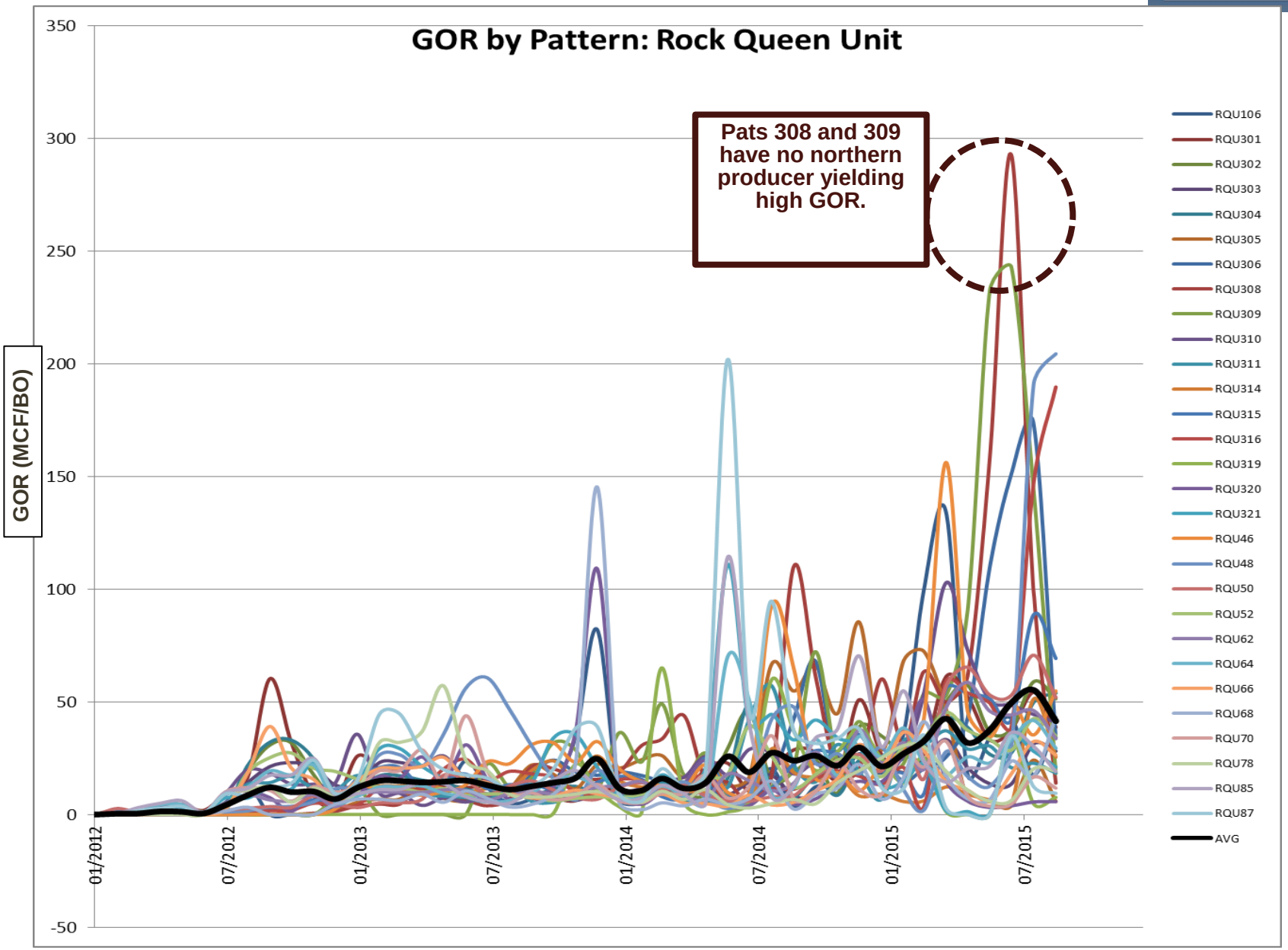
Individual Pattern Gas Recovery vs.CO2 PVI



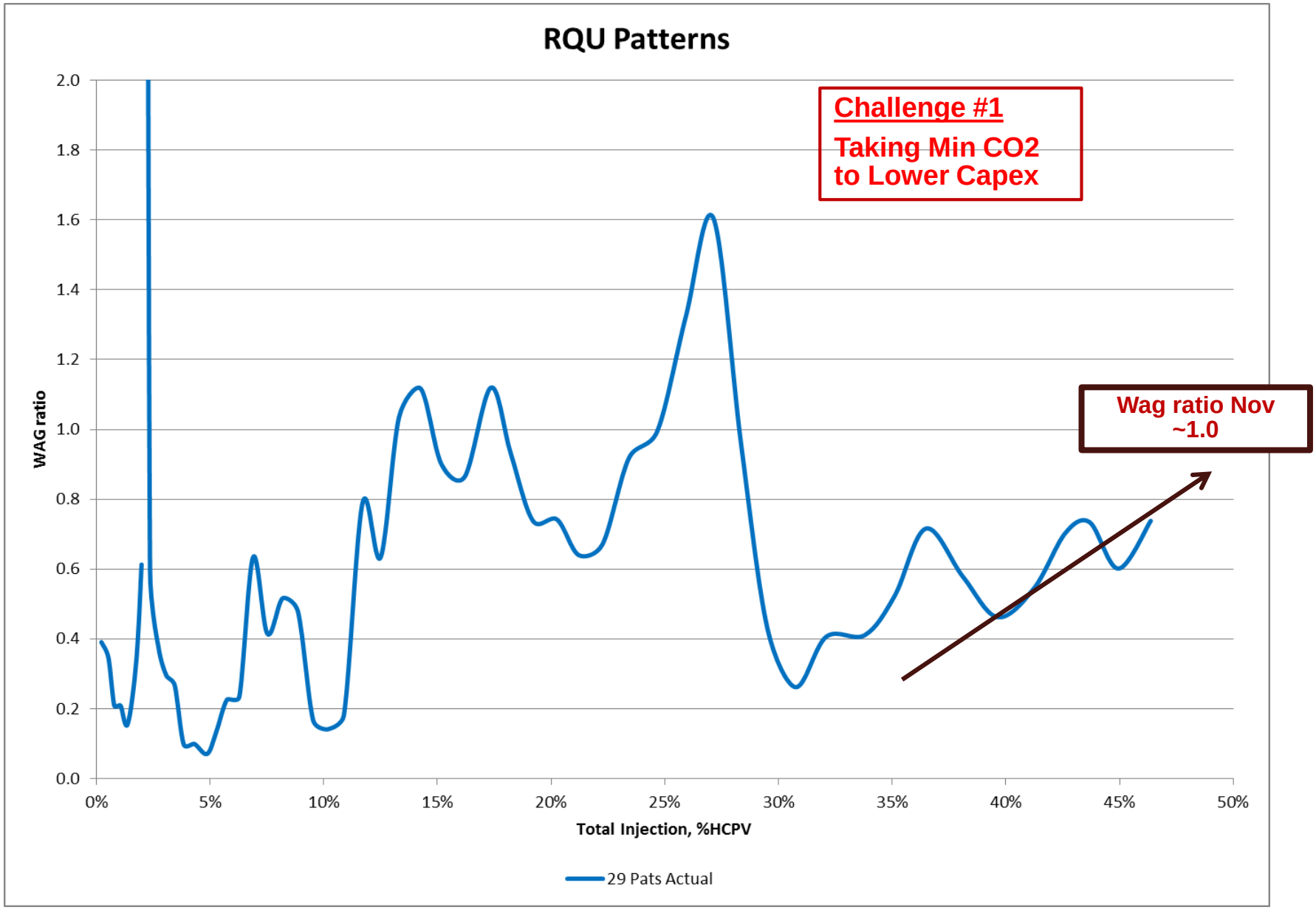
Caprock Field CO2 Utility



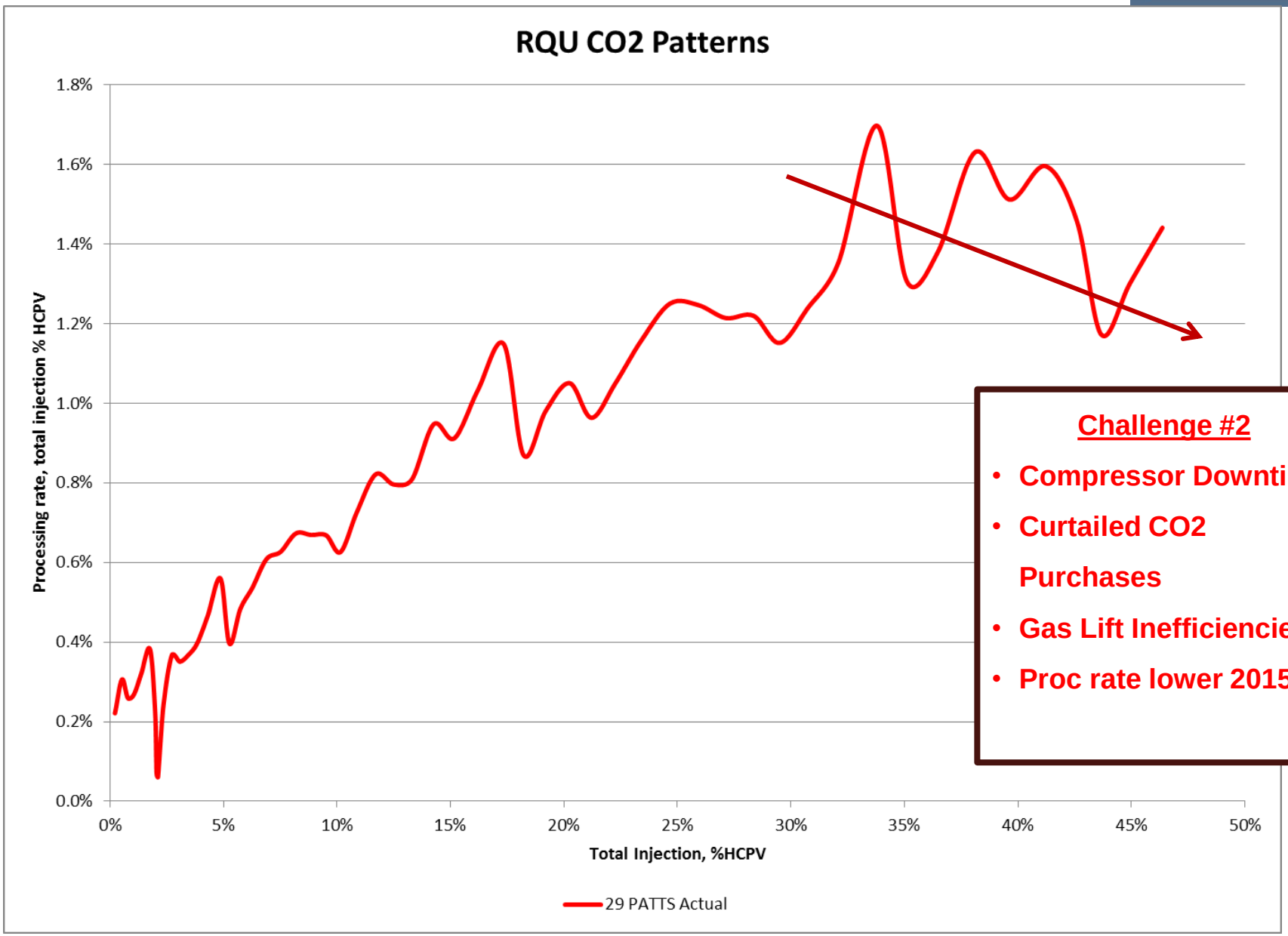
GOR by Pattern



Caprock Field WAG Ratio



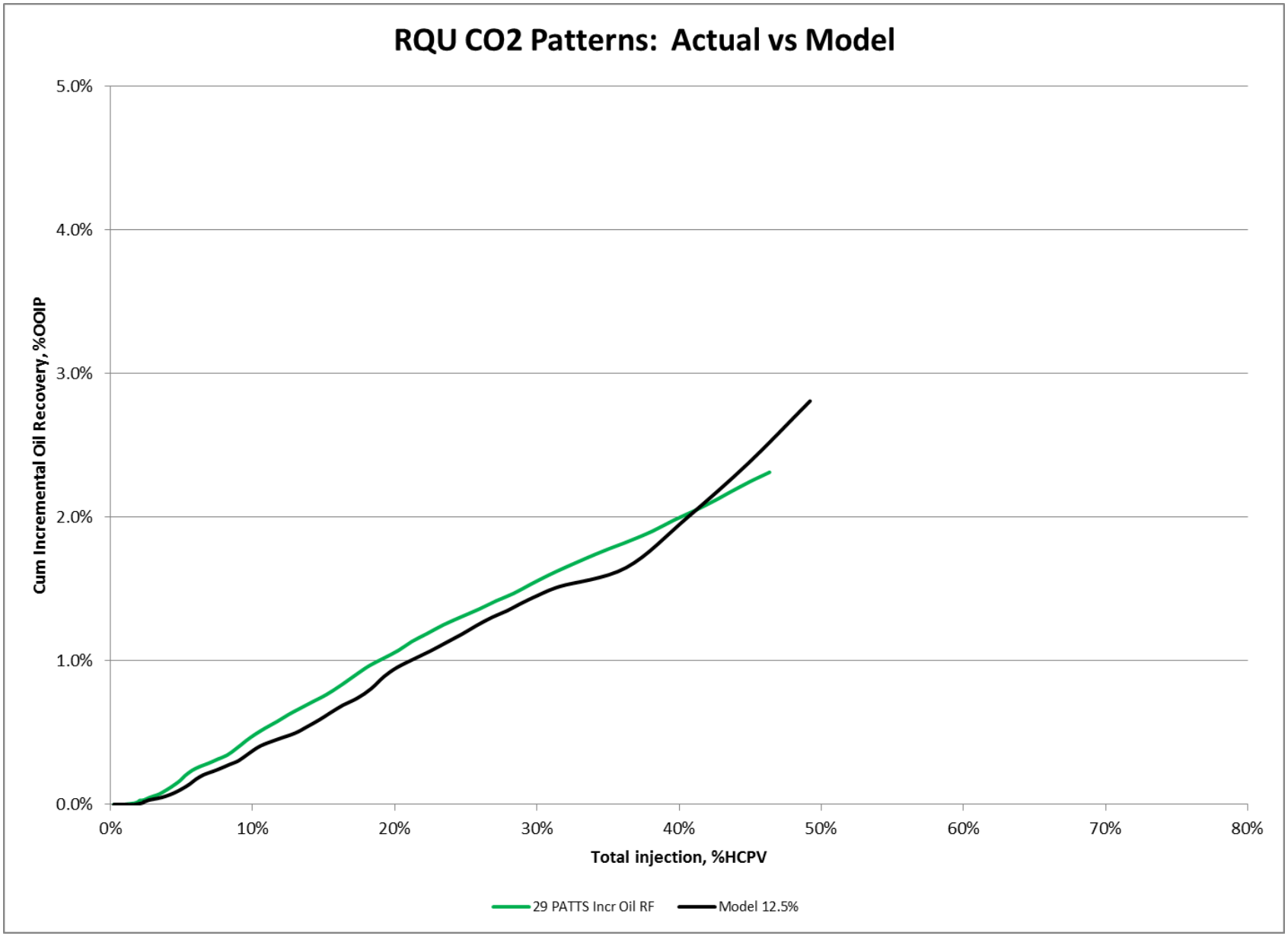
Caprock Field Processing Rate



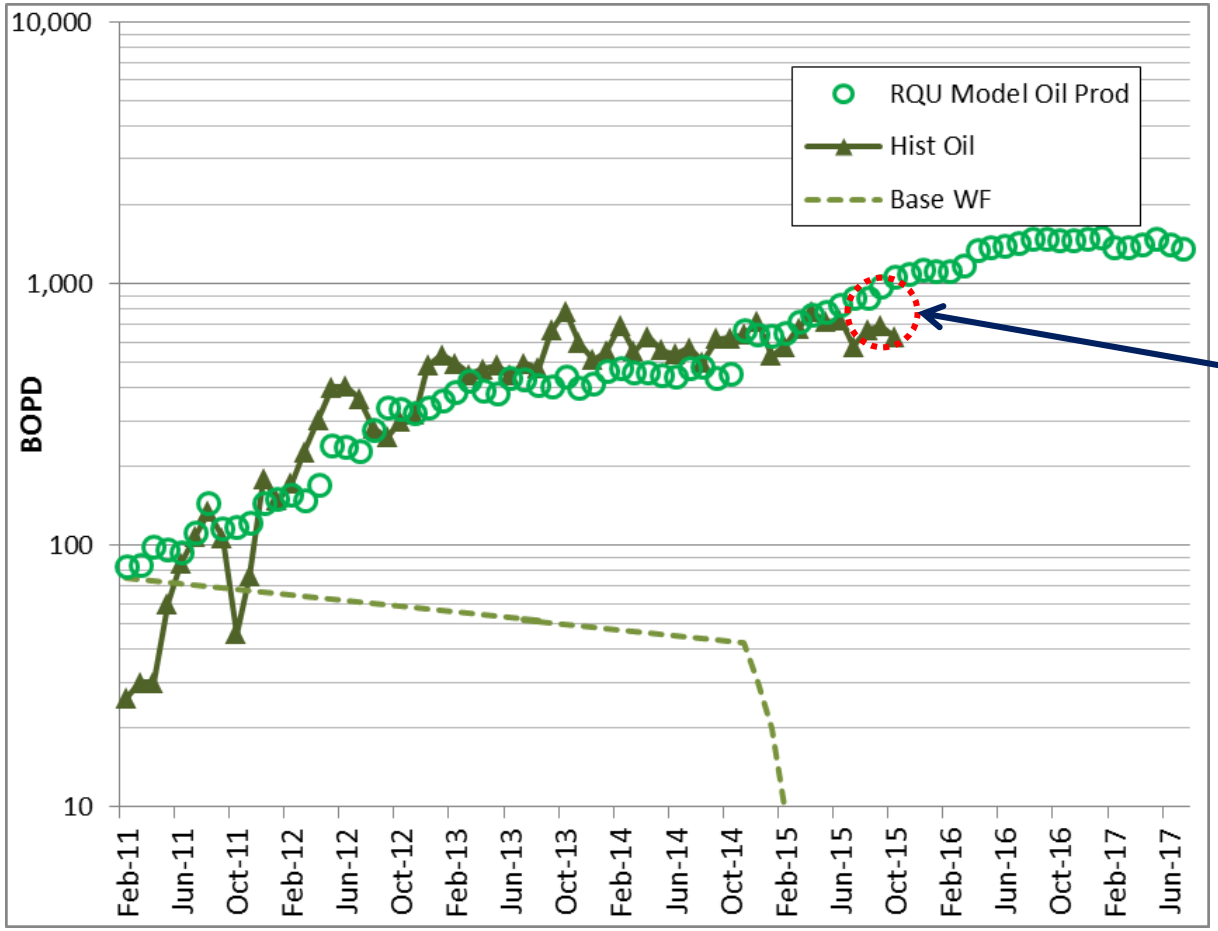
Challenge #2

- **Compressor Downtime**
- **Curtailed CO2 Purchases**
- **Gas Lift Inefficiencies**
- **Proc rate lower 2015**

RQU Dimensionless Oil Recovery



Current Challenges



CHALLENGES

COMP. DOWNTIME => LOWER PR RATE

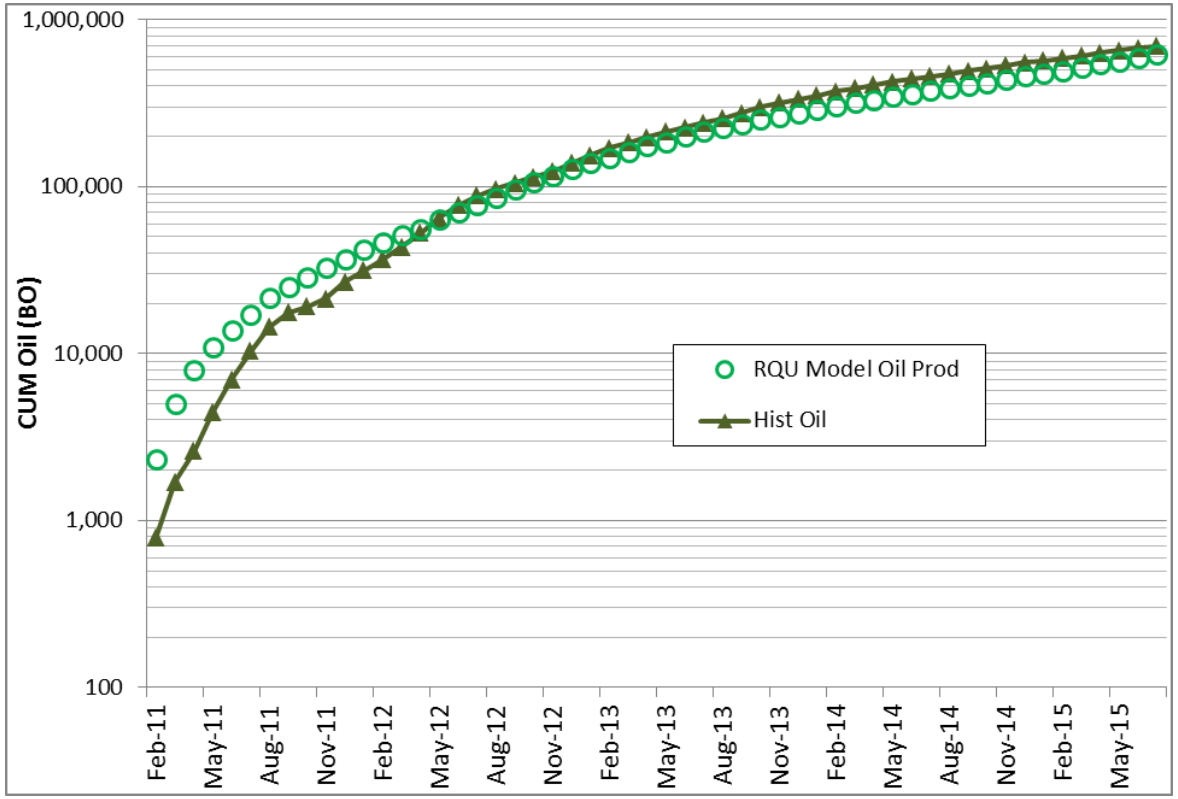
MIN. CO2 PURCH => HIGHER WAG RATIO

2 WELLS DOWN W/ CASING LEAK

GLVOLS TOO HIGH => LOWER PR RATE

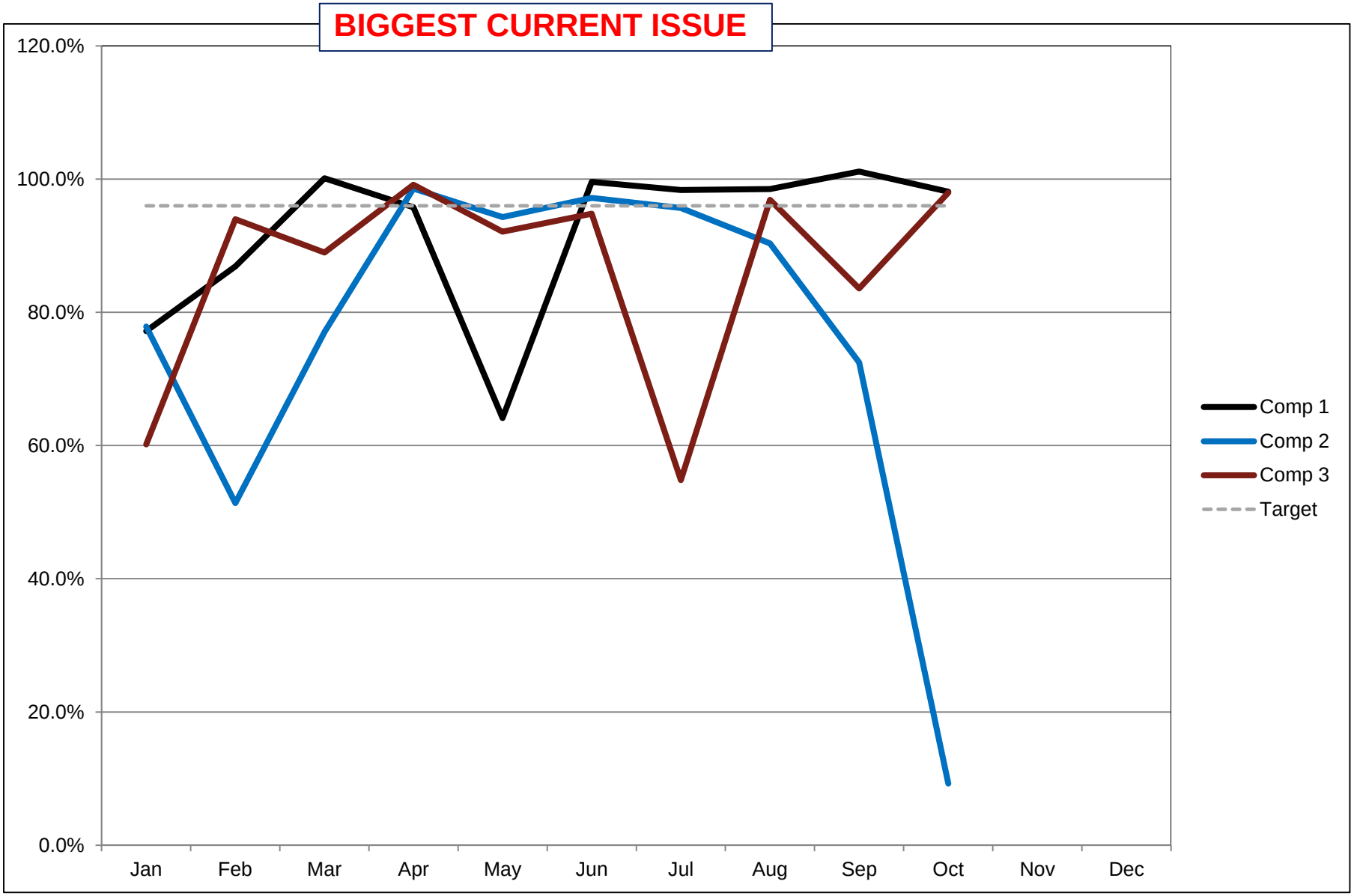
Model Results: History Match RQU Oil

Close match on CUM volumes since CO2 flood inception



- **Model is working**
  - **GOR under control**
  - **Utility good**
  - **Newer patterns outperforming**
- **Solve current issues**
- **Get back on rate time curve**

Caprock 2015 Compressor Monthly Percent Runtime



Fixing Compressor Downtime

Current compression:

Comp #1 – 6 MMCFD Rental Unit

Comp #2 – 6 MMCFD Rental Unit

Comp #3 – 16 MMCFD Rental Unit

W/O Rental Co For Repair

April 2016 Compression

Comp #1 – Released

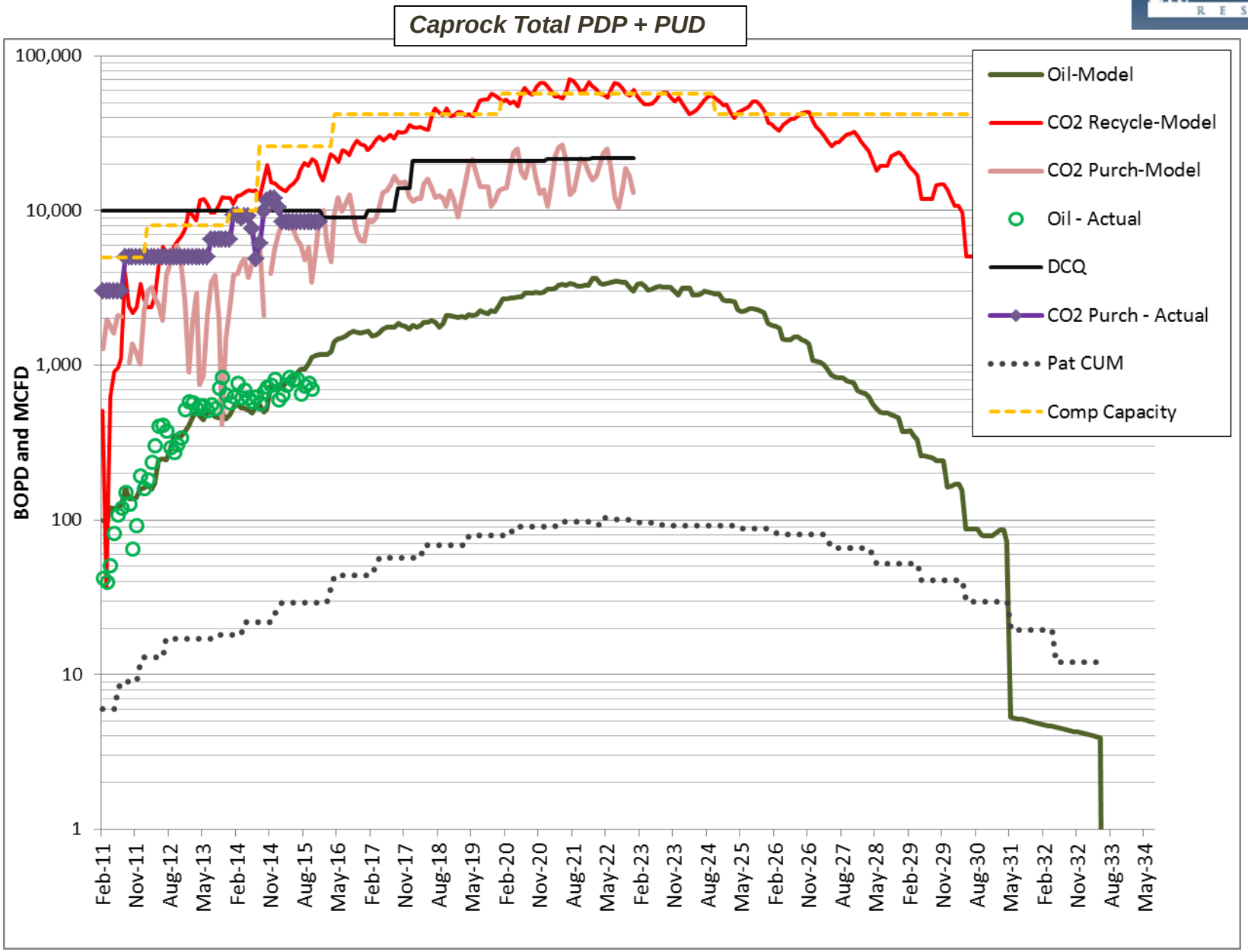
Comp #2 – Released

Comp #3 – 16 MMCFD Lease to Own w/ US Bank

Comp #4 – 25 MMCFD – Lease to Own w/ US Bank

Company Mechanic repairs on site

Total Model Overview: Proved RQU+DQU

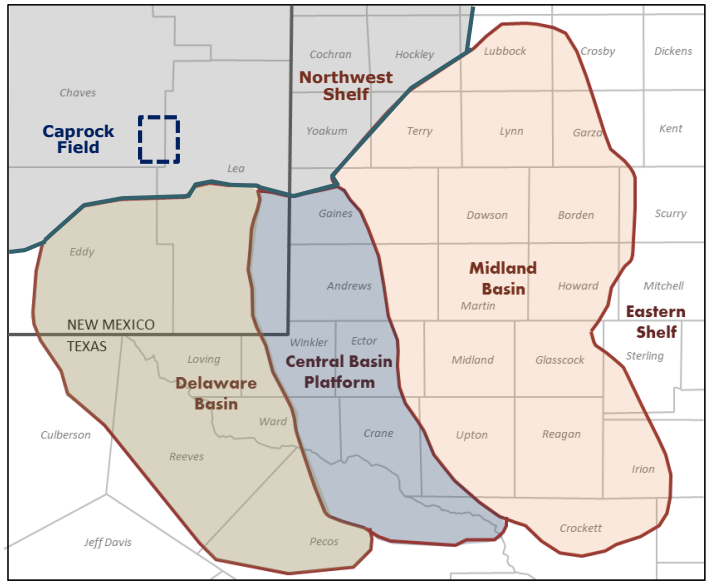


APPENDICIES

Northwest Shelf Depositional Environment

Summary

- Northwest Shelf reservoirs consist primarily of dolostones, limestones and sandstones deposited in restricted shallow-marine shelf or back-reef environments
- Carbonate and evaporate deposition dominated during sea-level highstands; siliciclastic deposition dominated during lowstands
- Traps are largely stratigraphic, formed by evaporitic or dolomitic / anhydrite updip porosity plugs
- In the Upper San Andres, Grayburg and Upper Guadalupian formations, reservoirs are principally oriented along an east to west trend in northern Eddy and central Lea Counties



System	Northwest Shelf		
Permian		Dewey	
		Rustler	
		Salado	
	Whiten Horse	Tansill	Goat Seep - Capitan Reef
		Yates	
		7 Rivers	
		Queen	
		Grayburg	
	Word	San Andres	
		Glorieta	
	Yeso	Paddock	
		Blineberry	
		Tubb	
		L. Clearfork	
		Abo	
		Wolfcamp	
Pennsylvanian		Cisco	
		Canyon	
		Strawn	
		Atoka	
		Morrow	

2016 Caprock Expansion

Overview

- Add 10 full patterns in Drickey Queen Unit
- Add 5 partial patterns in Rock Queen Unit
- Add 28 producers
- Add 15 injectors
- Lay Trunk Lines to DQU
- Satellite & Battery work
- Well work – drilling and conversions
- Lay flow lines and lateral lines for patterns

Total Capital for Phase 2 Expansion

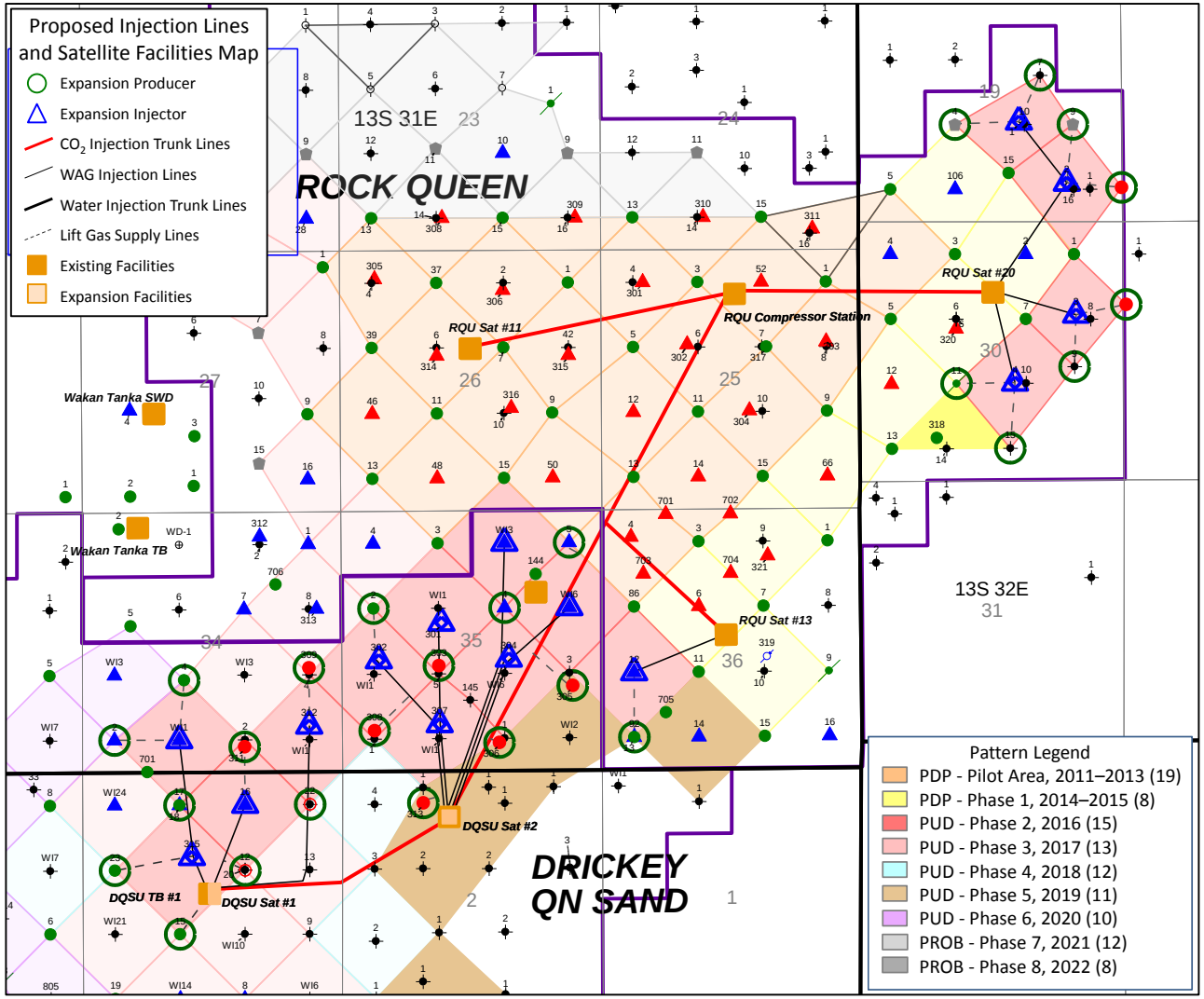
- **$19.2 MM - Total Phase 2 Expansion Capital**
- **$10.1 MM – Facility Capital**
- **$9.1 MM – Well Work Capital**

Facilities Capital Detail

- $1.0 MM - Install trunk line
- $0.5 MM – Upgrade and expand DQSU Battery
- $0.7 MM - Build 1 new satellite and expand 1 existing satellite
- $6.8 MM – Install individual well flow/injection lines
- $1.0 MM – Install Compressor
- $0.1 MM – Upgrade vent at RQU Battery

Well Work Capital Detail

- $4.2 MM - Drill 13 Producers
- $3.0 MM - Drill 10 Injectors
- $0.5 MM – Convert 5 WIW to Producers
- $0.3 MM – Convert 5 WIW to WAG inj.
- $0.8 MM – install gas lift in 8 producers
- $0.3 MM – re-enter 2 producers



Caprock Capital Forecast

Caprock Total Development Capital Estimate

YEAR	# of Patterns	# OF WELLS	Drill Wells	Other	Conversions	Well Work	Gathering &Trunk lines	Compressor & Facilities	TOTAL COSTS
2016	15	43	23	2	18	$9,060,000	$6,880,000	$3,250,000	$19,190,000
2017	13	30	10	0	20	$4,820,000	$4,800,000	$0	$9,620,000
2018	12	29	15	1	13	$5,760,000	$4,640,000	$850,000	$11,250,000
2019	11	24	18	2	4	$5,980,000	$3,840,000	$0	$9,820,000
2020	10	22	10	0	12	$4,120,000	$3,520,000	$350,000	$7,990,000
South	13	30	23	2	5	$7,620,000	$4,800,000	$0	$12,420,000
North	8	18	9	0	9	$3,600,000	$2,880,000	$0	$6,480,000
GRAND TOTAL:	82	196	108	7	81	$40,960,000	$31,360,000	$4,450,000	$76,770,000

Rock Queen Unit Total Development Capital Estimate

YEAR	# of Patterns	# OF WELLS	Drill Wells	Other	Conversions	Well Work	Gathering &Trunk lines	Compressor & Facilities	TOTAL COSTS
2016	5	15	10	0	5	$3,580,000	$2,400,000	$1,100,000	$7,080,000
2017	6	14	2	0	12	$1,640,000	$2,240,000	$0	$3,880,000
2018	0	0	0	0	0	$0	$0	$0	$0
2019	1	1	0	0	1	$60,000	$160,000	$0	$220,000
2020	0	1	0	0	1	$100,000	$160,000	$0	$260,000
South	0	0	0	0	0	$0	$0	$0	$0
North	8	18	9	0	9	$3,600,000	$2,880,000	$0	$6,480,000
GRAND TOTAL:	20	49	21	0	28	$8,980,000	$7,840,000	$1,100,000	$17,920,000

Drickey Queen Sand Unit Total Development Capital Estimate

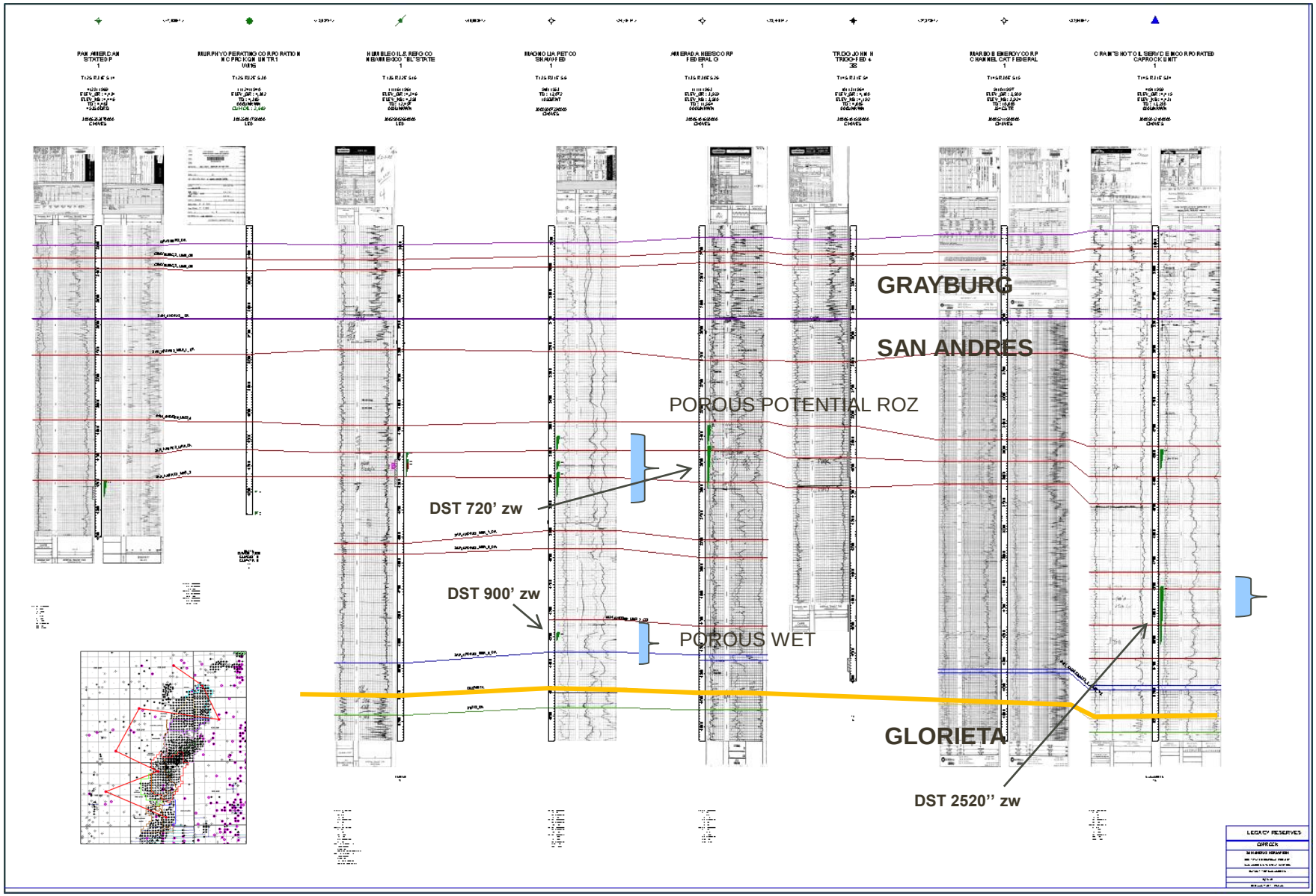
YEAR	# of Patterns	# OF WELLS	Drill Wells	Other	Conversions	Well Work	Gathering &Trunk lines	Compressor & Facilities	TOTAL COSTS
2016	10	28	13	2	13	$5,480,000	$4,480,000	$2,150,000	$12,110,000
2017	7	16	8	0	8	$3,180,000	$2,560,000	$0	$5,740,000
2018	12	29	15	1	13	$5,760,000	$4,640,000	$850,000	$11,250,000
2019	10	23	18	2	3	$5,920,000	$3,680,000	$0	$9,600,000
2020	10	21	10	0	11	$4,020,000	$3,360,000	$350,000	$7,730,000
South	13	30	23	2	5	$7,620,000	$4,800,000	$0	$12,420,000
North	0	0	0	0	0	$0	$0	$0	$0
GRAND TOTAL:	62	147	87	7	53	$31,980,000	$23,520,000	$3,350,000	$58,850,000

Water disposal

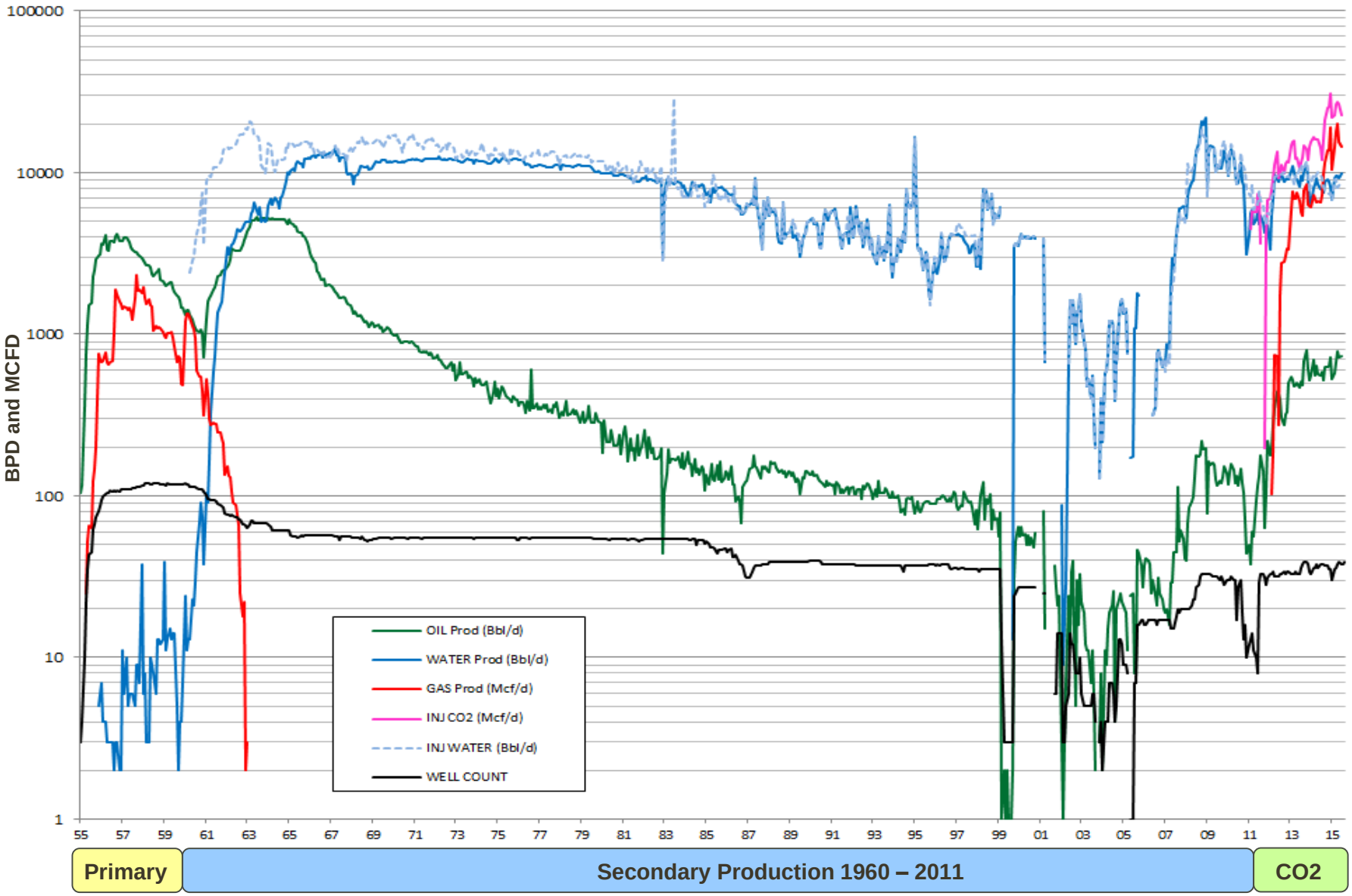
- Need for future disposal
  - As Drickey Queen waterflood is converted to CO2 flood, SWD may be needed

- Several zones within the San Andres have potential for water disposal or ROZ oil recovery
- 5 older deep wells have DST recoveries of up to 2520' of sulphur water or salt water, indicating high permeability as well as potential ROZ oil
- Approximately 60 wells penetrate the San Andres Formation in the vicinity of Rock Queen and Drickey Queen Units. Of these, 4 are within the boundaries of the units.

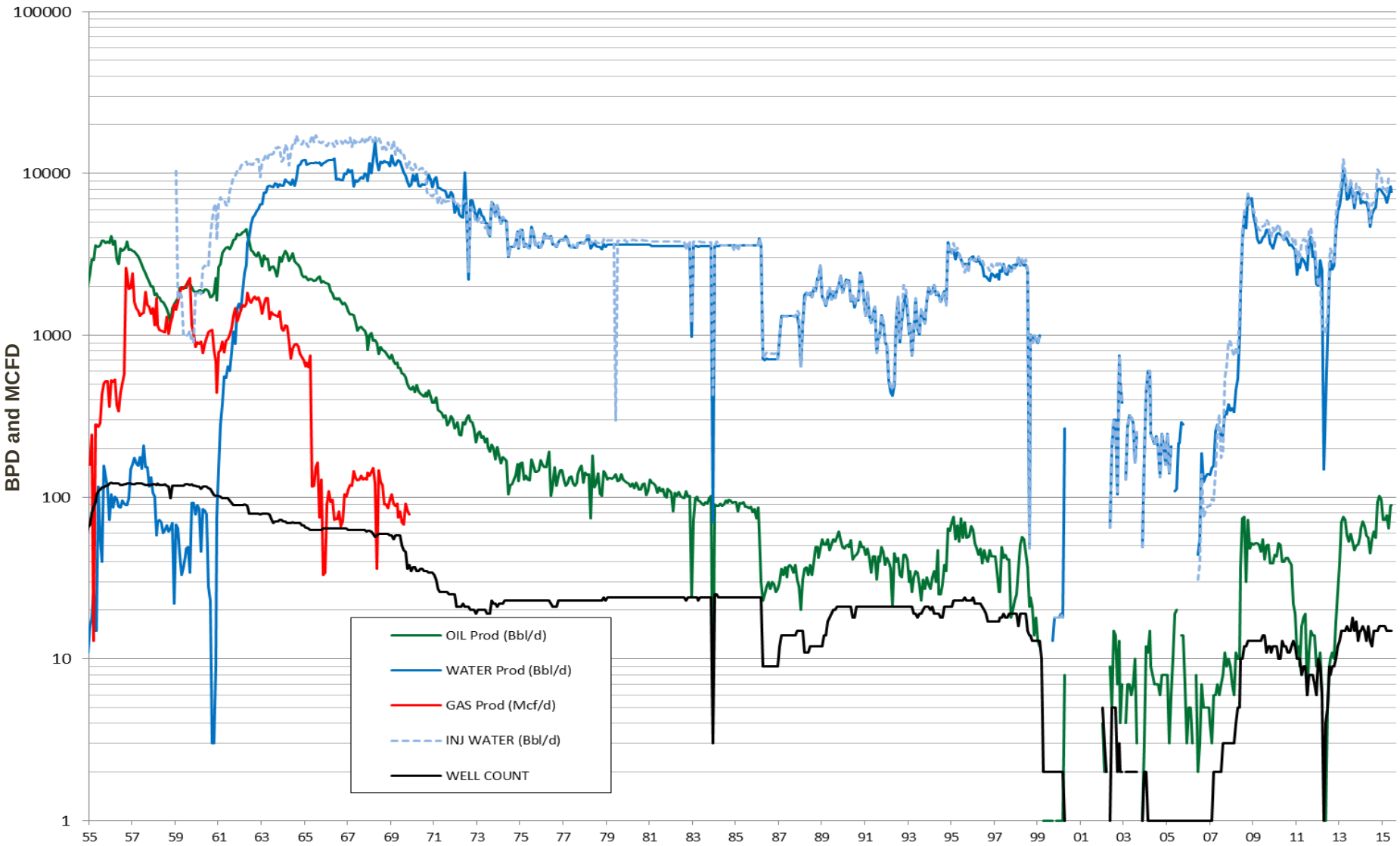
WATER DISPOSAL / ROZ



Rock Queen Unit Production History: Good CO2 Response



Drickey Queen Unit Production History



Primary | Secondary Production 1960 – 2015 | CO2

GEOLOGY OVERVIEW

- **QUEEN SAND (Guadeloupian)** is regionally extensive, highly productive in SE New Mexico
- Oil at Caprock is trapped by a porosity pinchout to the NE updip; a marginal gas cap exists to the NE updip of Unit
- Downdip field limit is an oil/water contact at approx +1310' above SL. (regional dip ½ deg SE)
- Potential for residual oil saturation below this contact exists to the east of field.
- Queen gross thickness within the field = 12-20 ft; sand is continuous across the entire field
- Net thickness is determined by porosity occlusion by Anhydrite cement, and is 10 to 18' within the field
- Queen sand contains lithic fragments and feldspars, resulting in high gamma ray response
- Sand consists mainly of angular fine grained quartz and lithic fragments, cement is anhydrite and dolomite
- Excellent permeability observed in Legacy core: 10-768 mD, avg 172 mD
- Excellent porosity: 10-28%, avg 15.8%

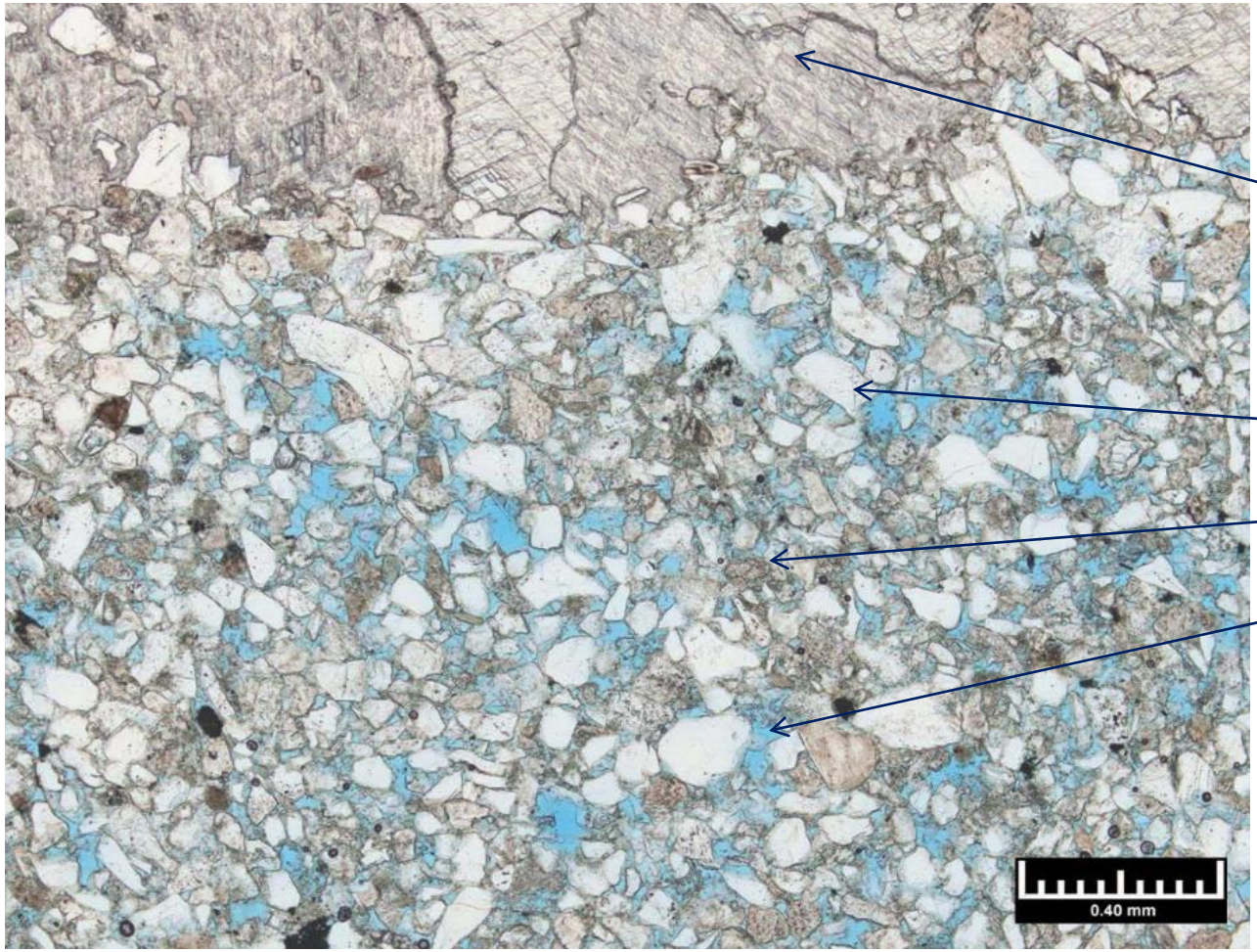
- ***Pay zone is capped by a regional thick anhydrite, and underlain by a regional tight siltstone, providing excellent containment for CO2 flood.***

- ***Queen sand extends laterally over entire unit area with no faults or tight baffles yielding excellent horizontal sweep efficiency for CO2 flood.***

QUEEN sand lithology

RQU 320 Core

18% Avg Porosity
172mD Avg Perm



Massive dolomite

Angular quartz, fine but poorly sorted

Rock fragments (granitic?)

Porosity (blue)

- Fine grained, angular quartz and lithic fragments
- Patchy anhydrite cement
- Rock fragments (brown) make up ~30-50% of the grains
- Porosity (>25%) is blue epoxy
- Traces of anhydrite cement; otherwise little cement

Tank Size: OOIP Determination

Reservoir:

- Impermeable solid seal on top and bottom of Queen pay
- Available modern openhole porosity logs on new drills
  - Clear indication of sand on PE curve
  - Clear interval boundaries seen on density-neutron and microlog
  - Very scalable to CNL and older Neutron count logs

OOIP Methodology:

1. Log data
   - Neutron curves from modern logs used to transform CNL and old neutron count logs for porosity mapping field wide

2. Core on RQU 320 to verify reservoir data
   - Remapped entire field on 1" contour interval
   - Porosity values from 320 core and logs through field match well
   - Flat Sw used across field due to low dip of 1/2 degree
   - Bo 1.15

Results:

- *Legacy mapped OOIP for RQU + DQU is 108.9 MMBO.*
- *PDP+PUD planned development of 88 total patterns is 88.8 MMBO*
- *PRB reserves of 20.2 MMBO using additional 20 patterns*

Development Model Overview

1. **Define CO2 Flood Remaining Oil Target**
   A. Floodable Tank Size
      - *Logs, Core, MBAL*
   B. Top and Base of Target Oil Bearing interval
      - *Log database and ~80 producer histories(perf'd interval)*
      - *RQU 320 Core*
   C. Remaining Oil Saturation after Waterflood
      - *MBAL, Primary and Secondary CUM to date…..*

2. **CO2 Flood Development Plan**
   A. Develop existing 80 acre 5-spot waterflood well locations in 7 CO2 expansion phases
   B. Deepen wells through Queen pay to cover base of remaining commercial oil target
   C. Redrill producers and injectors with poor wellbores to improve conformance
   D. Maintain water curtain/monitor wells in undeveloped areas
      - *Future utility as injectors or producers in expansion*
   E. Investigated water disposal zones as waterflood converts to CO2

3. **Define Recovery Efficiency Curves**
   A. Establish analog projects with similar geologic and operating conditions
      - *Monell, Two Freds, North Ward Estes, Postle identified as key analogs*
4. **Define Pattern Processing Speed (Production Rates)**
5. **Define Project Costs**
6. **Generate Economic Model Using Industry Standard 'Pattern Scale Up' Method**

Overview of surveillance process

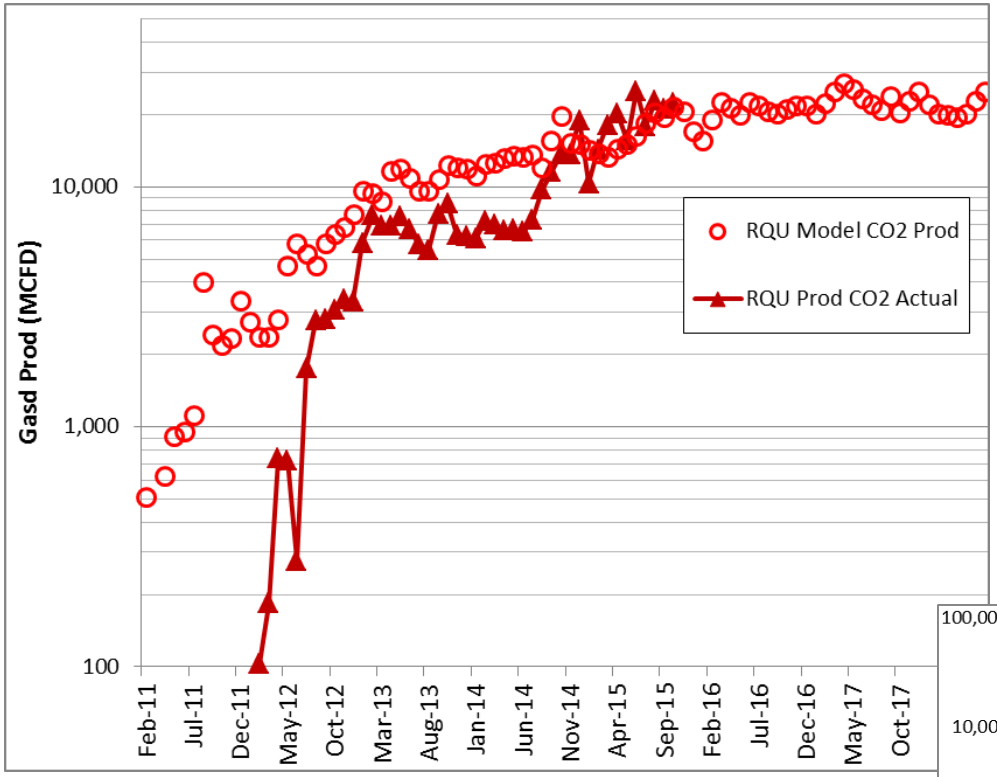
- **Data**
  - Operators>TotalRod>Oilfield Manager (OFM)
  - Capture daily and monthly production/injection data
  - Acquire static and dynamic BHPs as needed

- **Tools**
  - OFM – Pattern analysis
  - TotalRod - daily data database

- **Flood management guidelines**
  - Initial CO2 slugs – target of 20%-30% HCPV
  - Reservoir pressure > MMP ~ 1,100 psia
  - Pattern Balancing – Injection withdrawal ratios (IWR) >=1.0
  - Water-Alternating-Gas (WAG) ratios of 1:2 or drier
  - Processing rate of > 1.2% HCPV per month

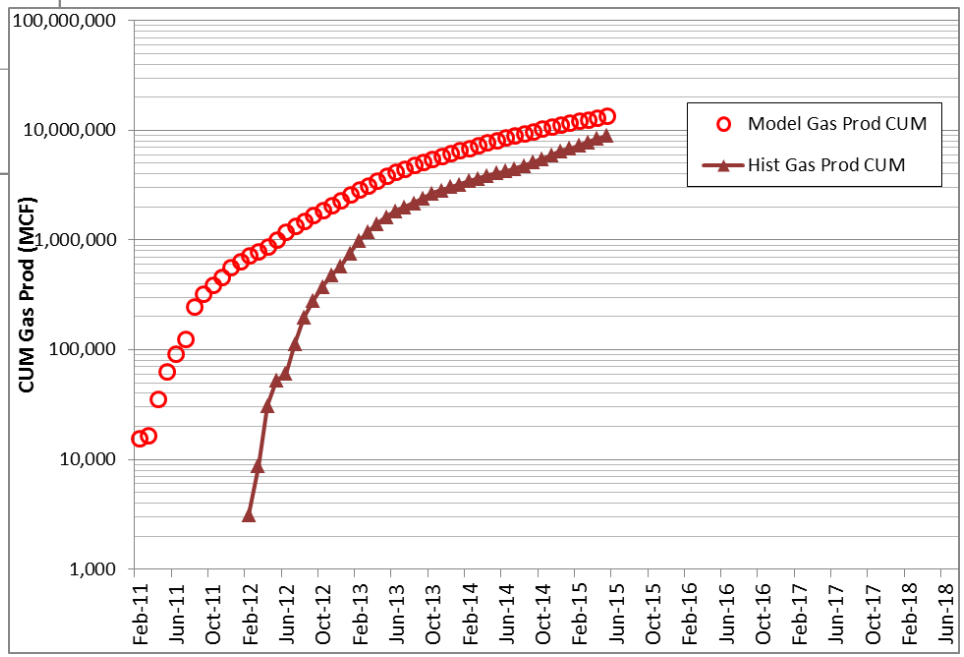
- **Performance tracking**
  - WAG tracking tool – WAGs reviewed and adjusted periodically
  - Pattern Reviews out in the field conducted quarterly

Model Results: History Match and Projection RQU Gas Prod

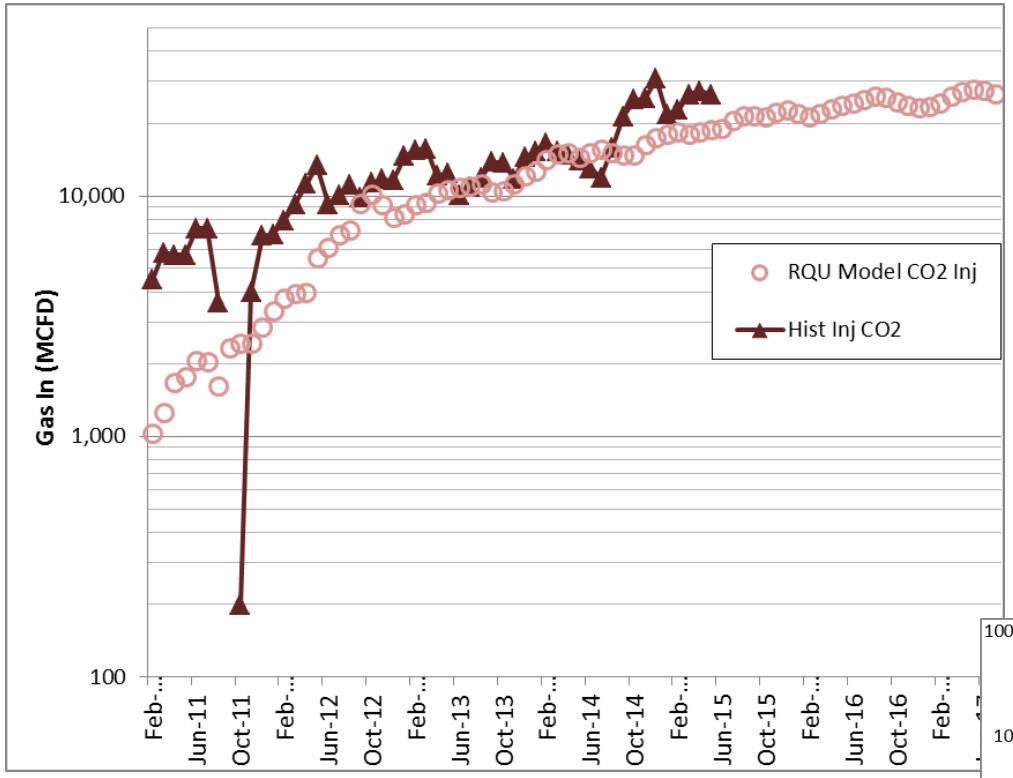


- Data from first CO2 inj Feb 2011
- Good History match
- Gas Rec curve adjusted for early time measurement to match this data

- CUM volumes are poor match in early time due to measurement error of produced gas.
- Facility issues at Sat 11 have been fixed



Model Results: History Match and Projection RQU Gas Inj



- Data from first CO2 inj Feb 2011
- Good History match
- Gas Rec curve adjusted for measurement to match this data

- CUM volumes injected match model