Ash Minnelusa Unit Sweep Improvement

Case Study

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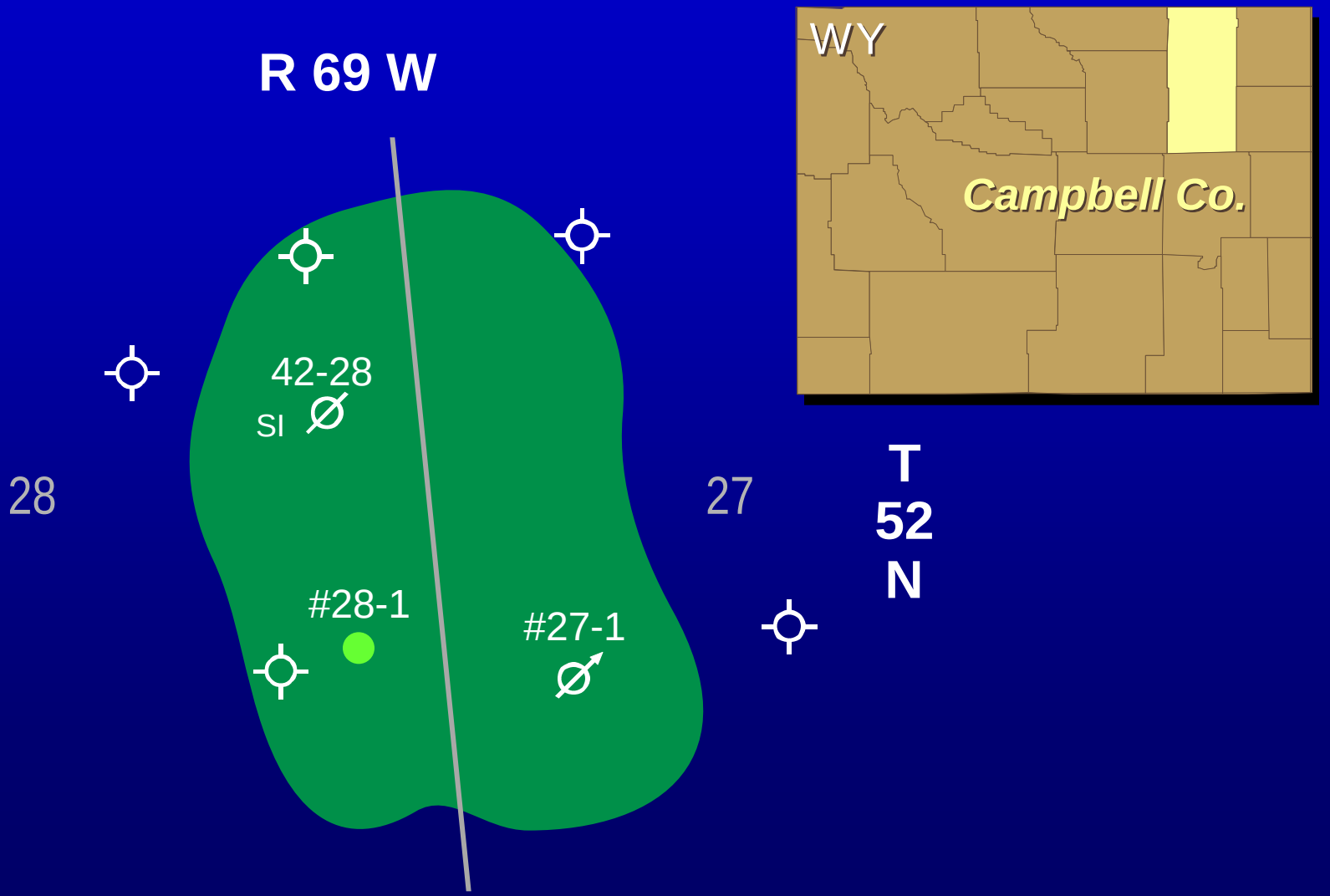
Ash Minnelusa Sand Unit



Ash Minnelusa Sand Unit Reservoir Data

General:	Discovery	July 3, 1987
	Formation	Minnelusa “B” Sandstone
	Type	Stratigraphic
	Average Depth	7775
	Primary Producing Mech	Rock and Fluid Expansion
	Well Spacing	40 Acre
Rock Properties:	Permeability Range	5 – 3000 md
	Average Permeability	300 md
	Permeability Variation	0.746
	Average Porosity	16.3%
	Average Water Saturation	15.5%
	Temperature	140°F
Fluid Properties:	Formation Volume Factor	1.01
	Oil Viscosity	30 cps
	Oil Gravity	20°API
Injection Data:	Cumulative Polymer	33.6% PV
	Cumulative Water	138.4% PV
	Cumulative Total	172.0%PV
Recovery Data:	OOIP	2,170 MSTBO
	Primary Recovery	14.1% OOIP
	Current Oil Recovery	45.4% OOIP

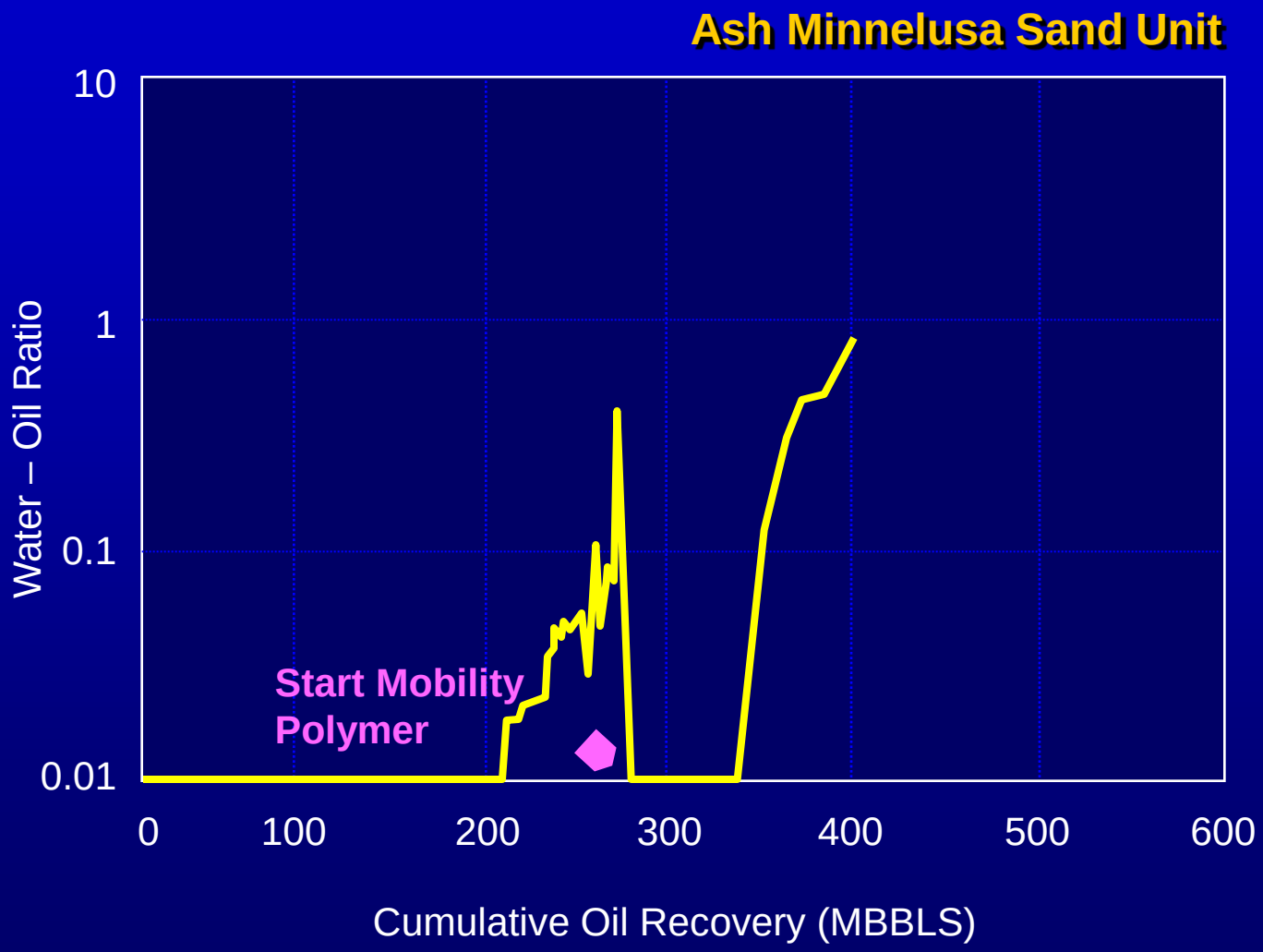
Total Field Production

Ash Minnelusa Sand Unit Polymer-Augmented Processes

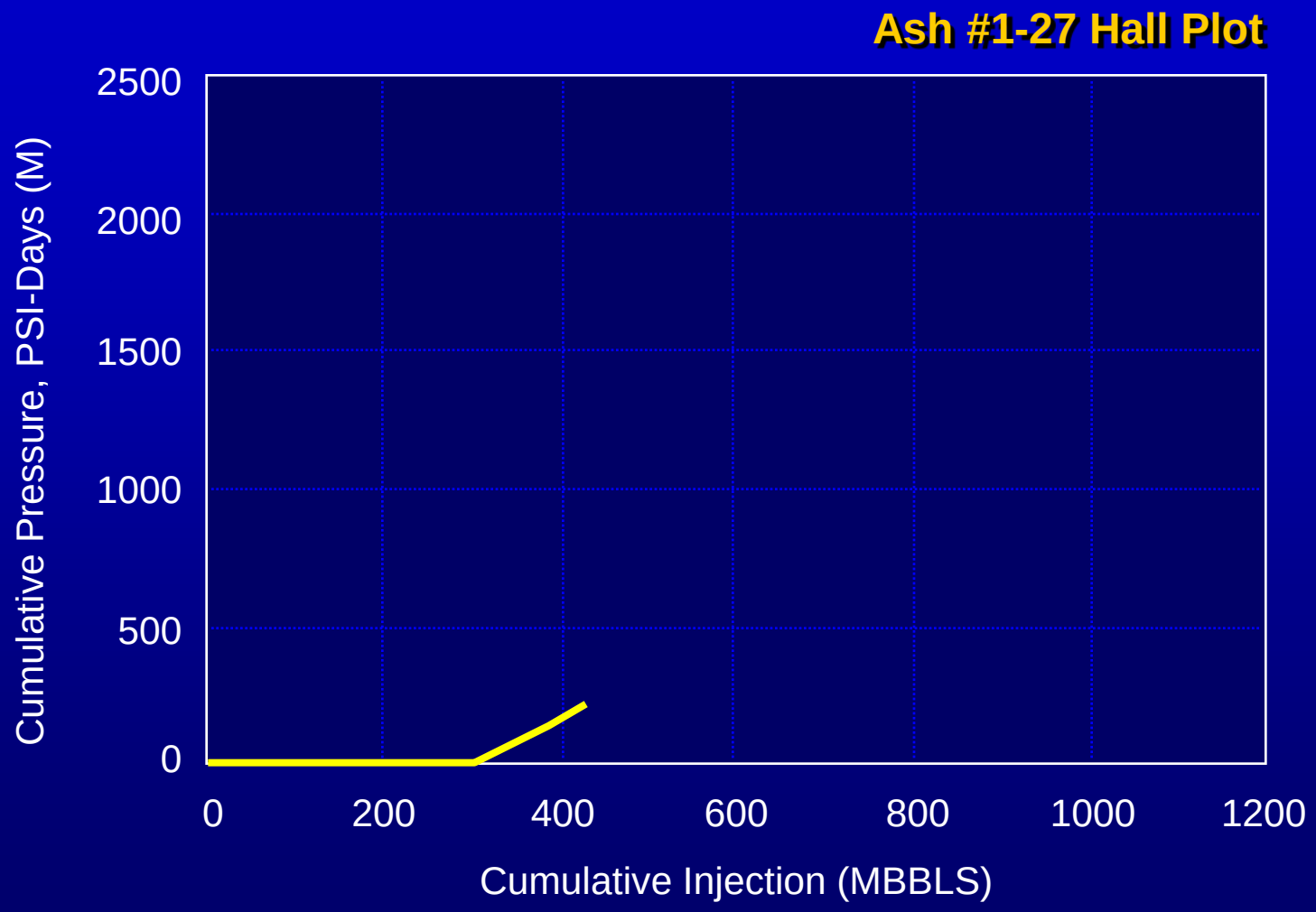
Process	BBLS	% Pore Volume	Avg. Polymer Conc, mg/L
Mobility Control	424,598	16.3	705

Total Field Production

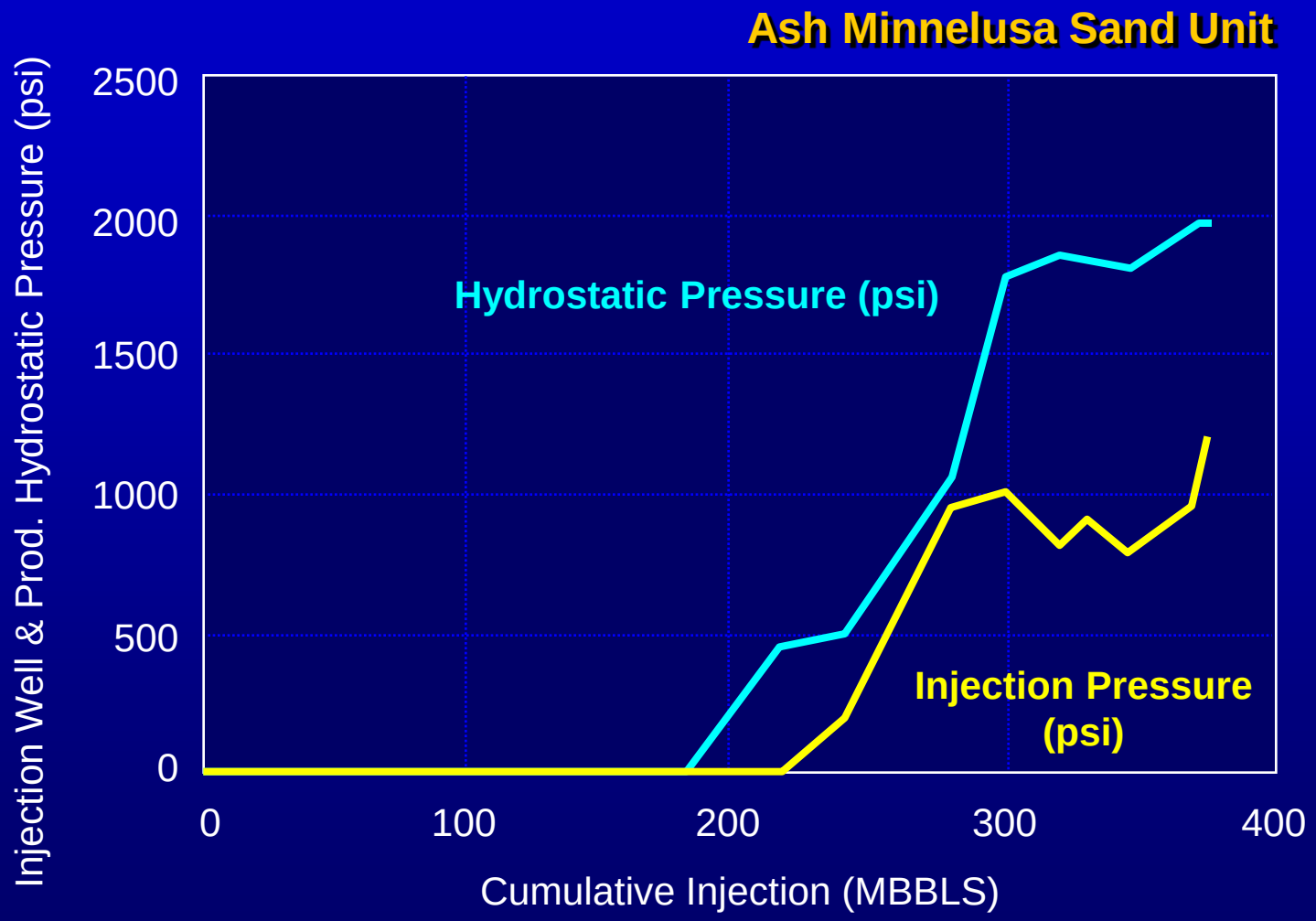
Production Efficiency



Ash Minnelusa Sand Unit



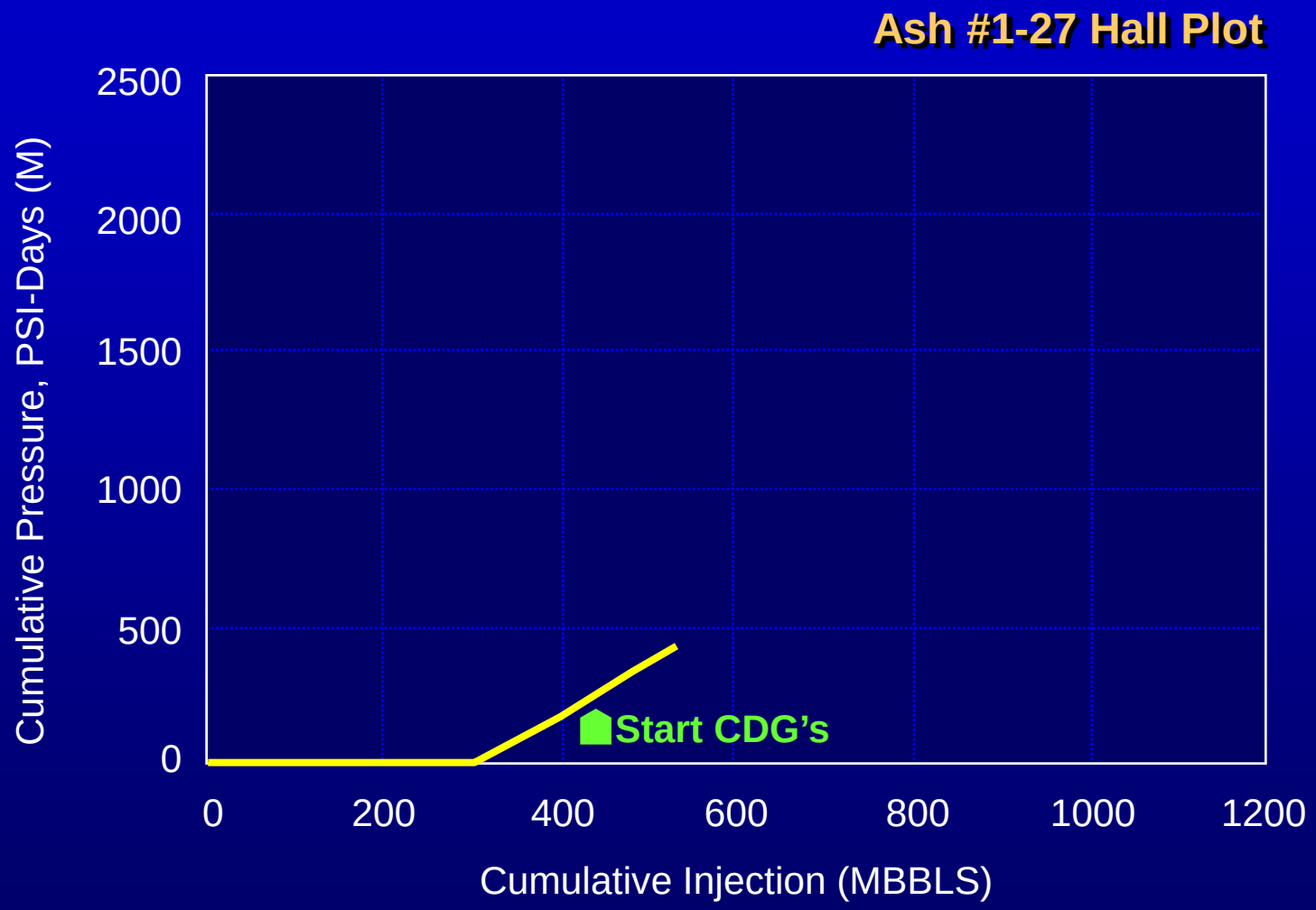
Injection Wellhead Pressure and Producing Well Hydrostatic Pressure



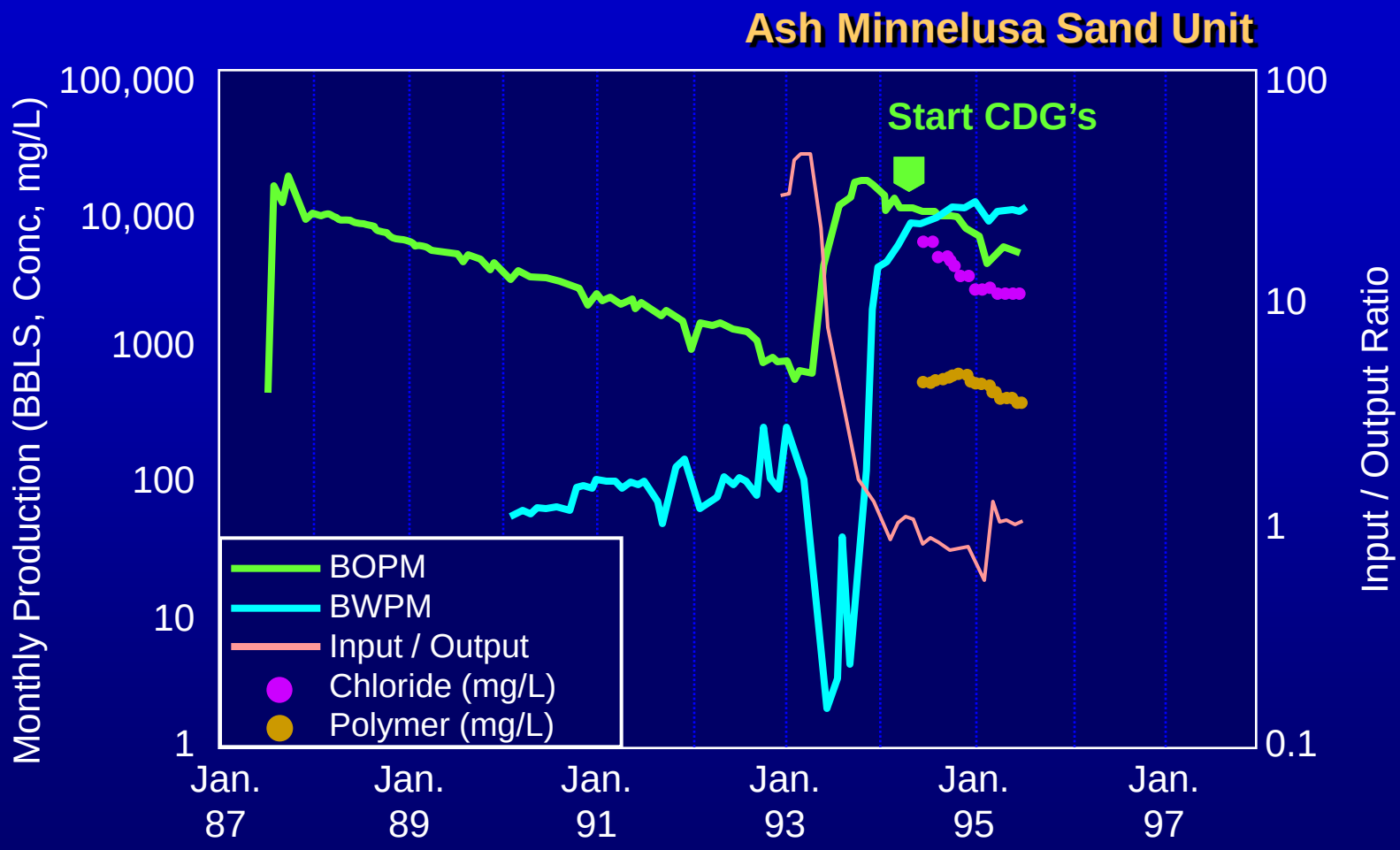
Ash Minnelusa Sand Unit Polymer-Augmented Processes

Process	BBLS	% Pore Volume	Avg. Polymer Conc, mg/L
Mobility Control	424,598	16.3	705
CDG	180,000	6.9	431

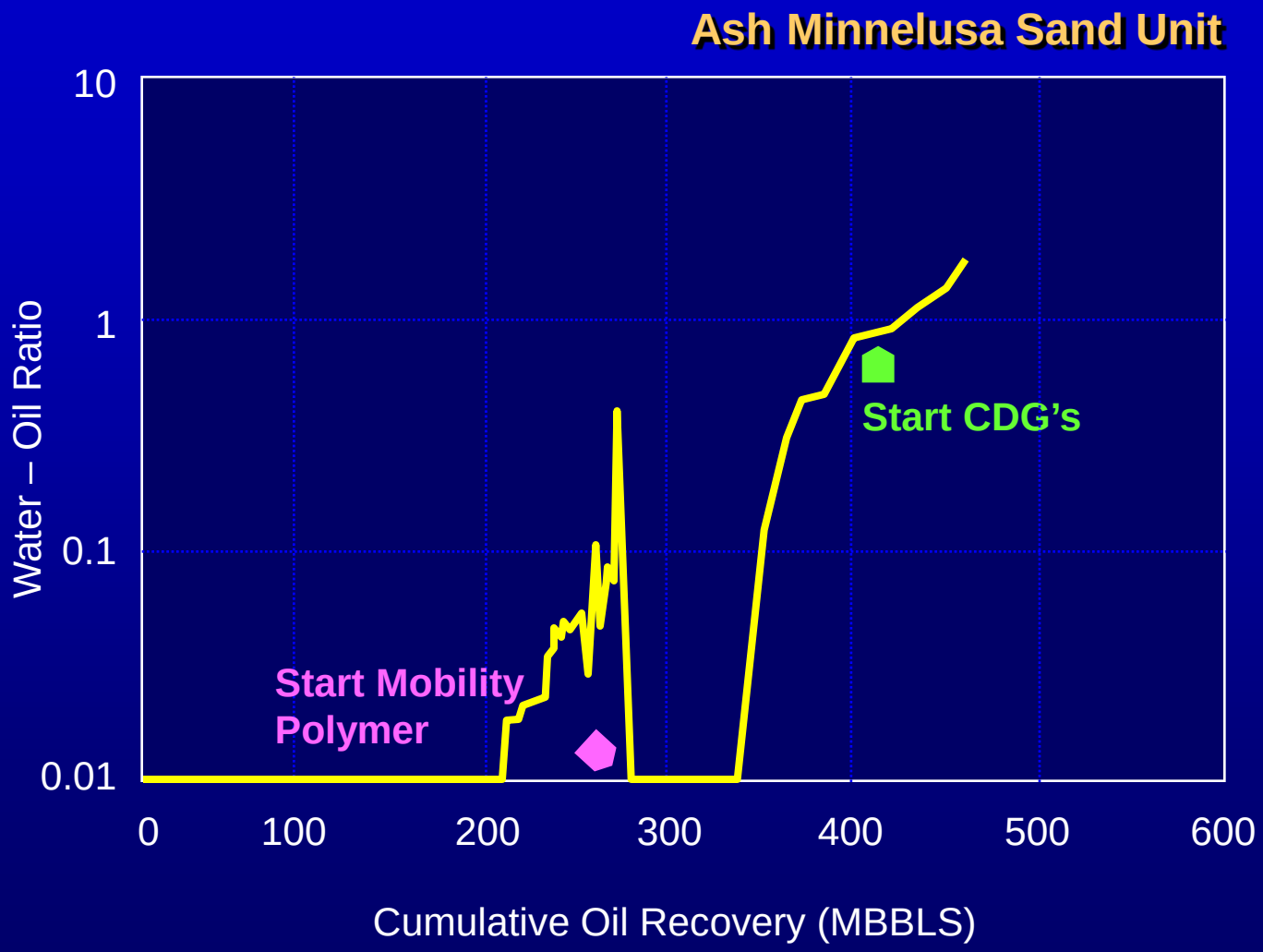
Ash Minnelusa Sand Unit



Total Field Production



Production Efficiency

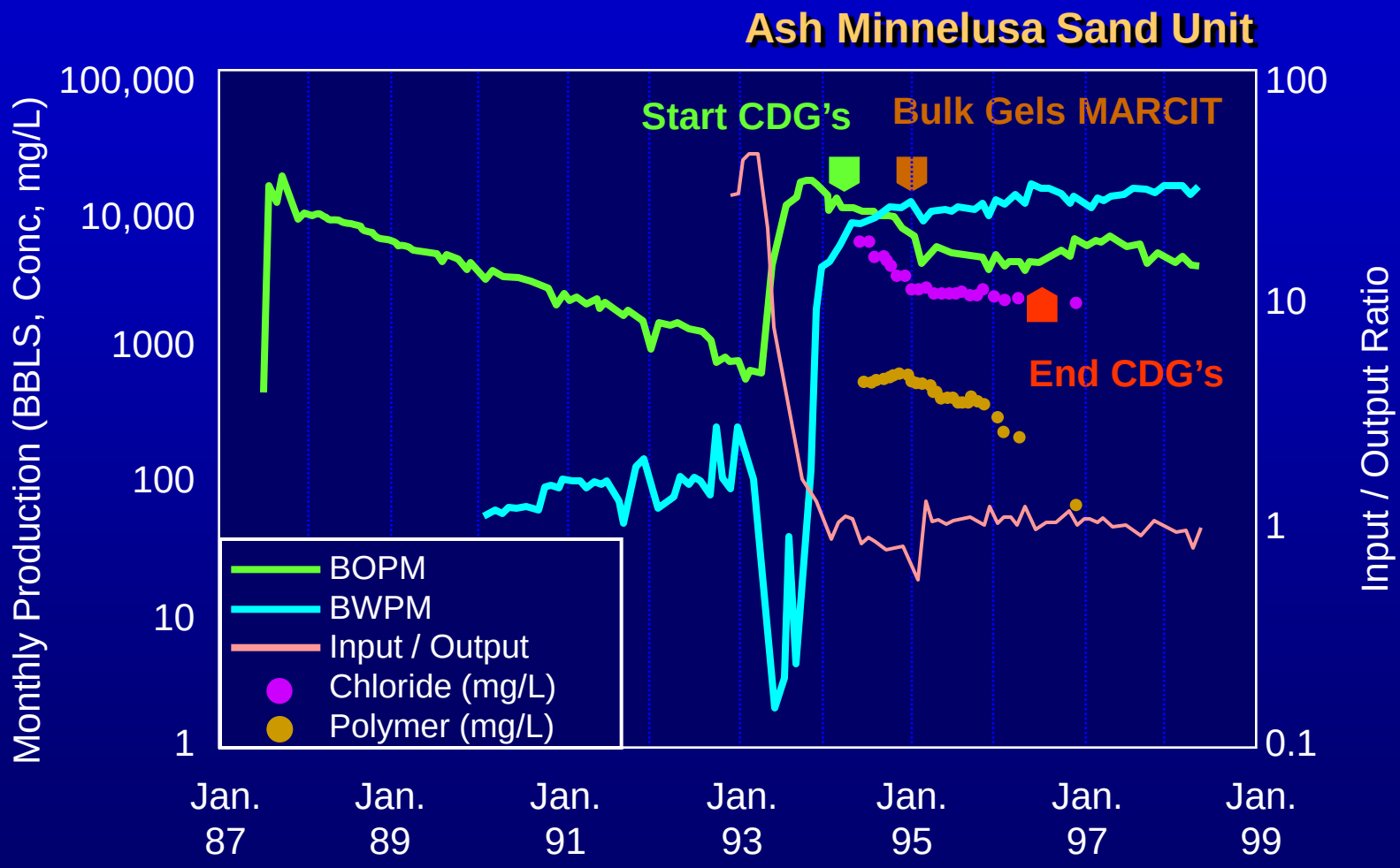


Ash Minnelusa Sand Unit
Polymer Augmented Processes

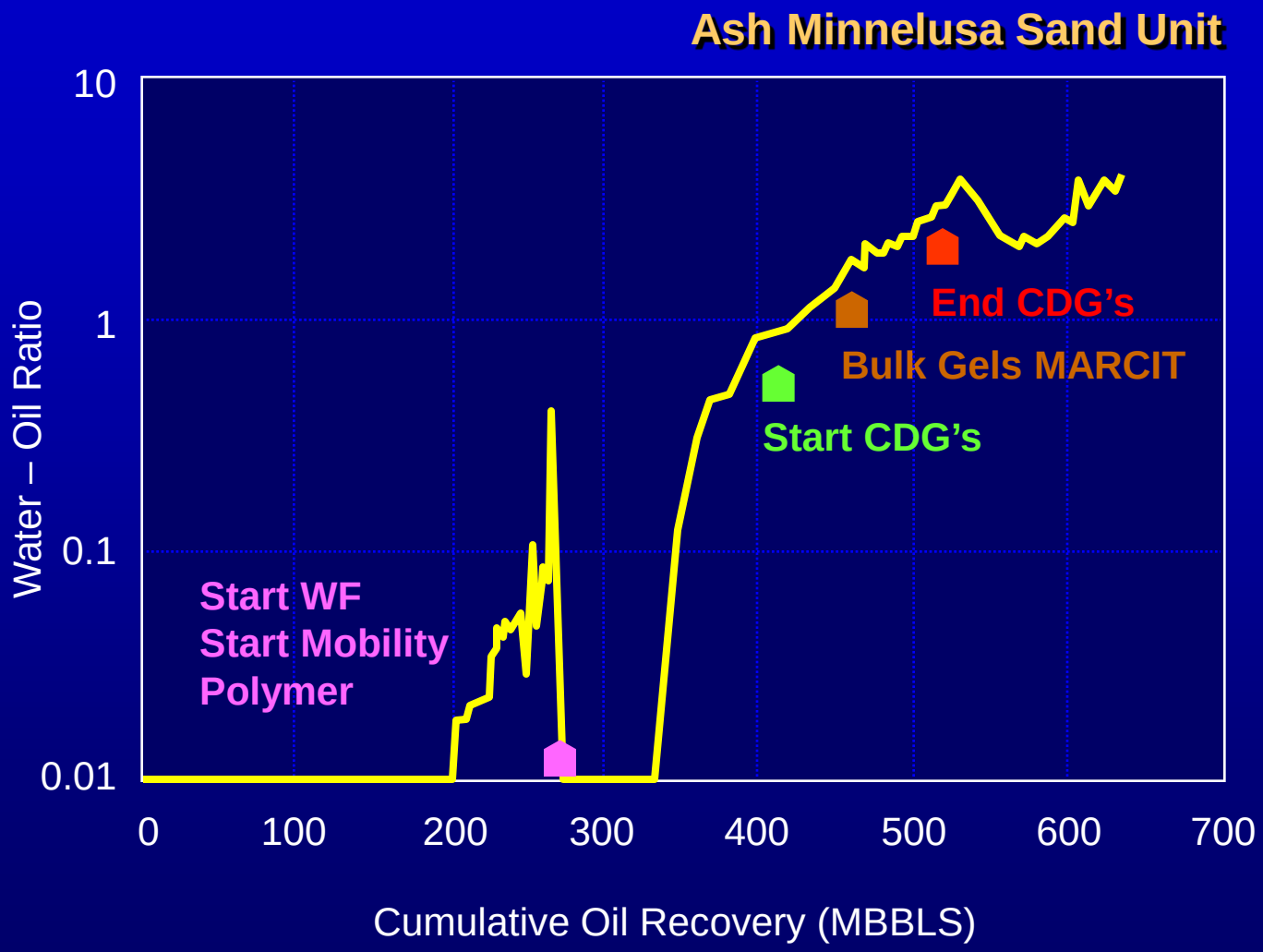
Process	BBLS	% Pore Volume	Avg Polymer Conc, mg/L
Mobility Control	424,598	16.3	705
CDG	180,000	6.9	431
Bulk Gel (MARCIT)	10,192	0.4	1,500 2,250 3,000 4,000

Ash Minnelusa Sand Unit

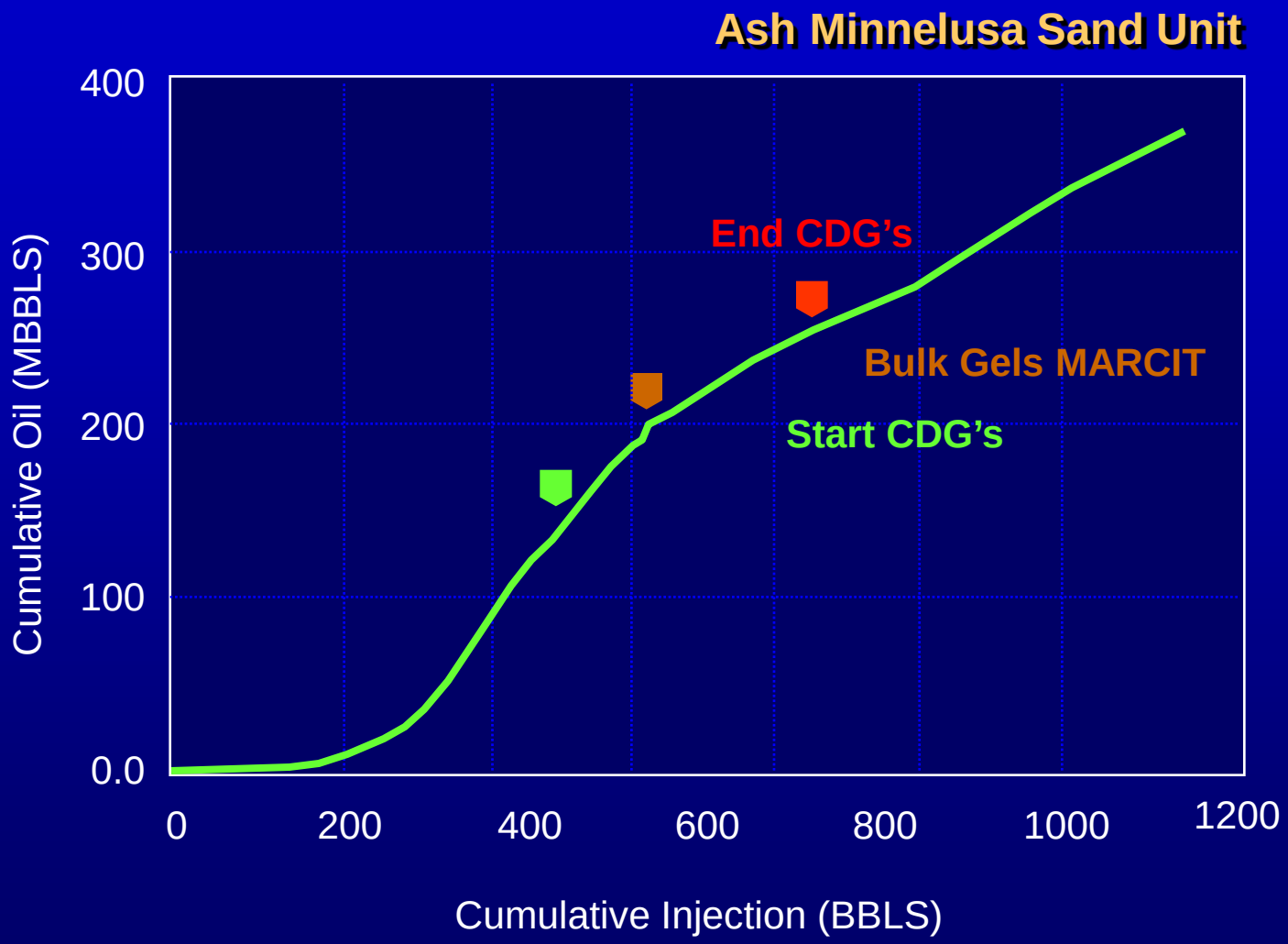
Total Field Production



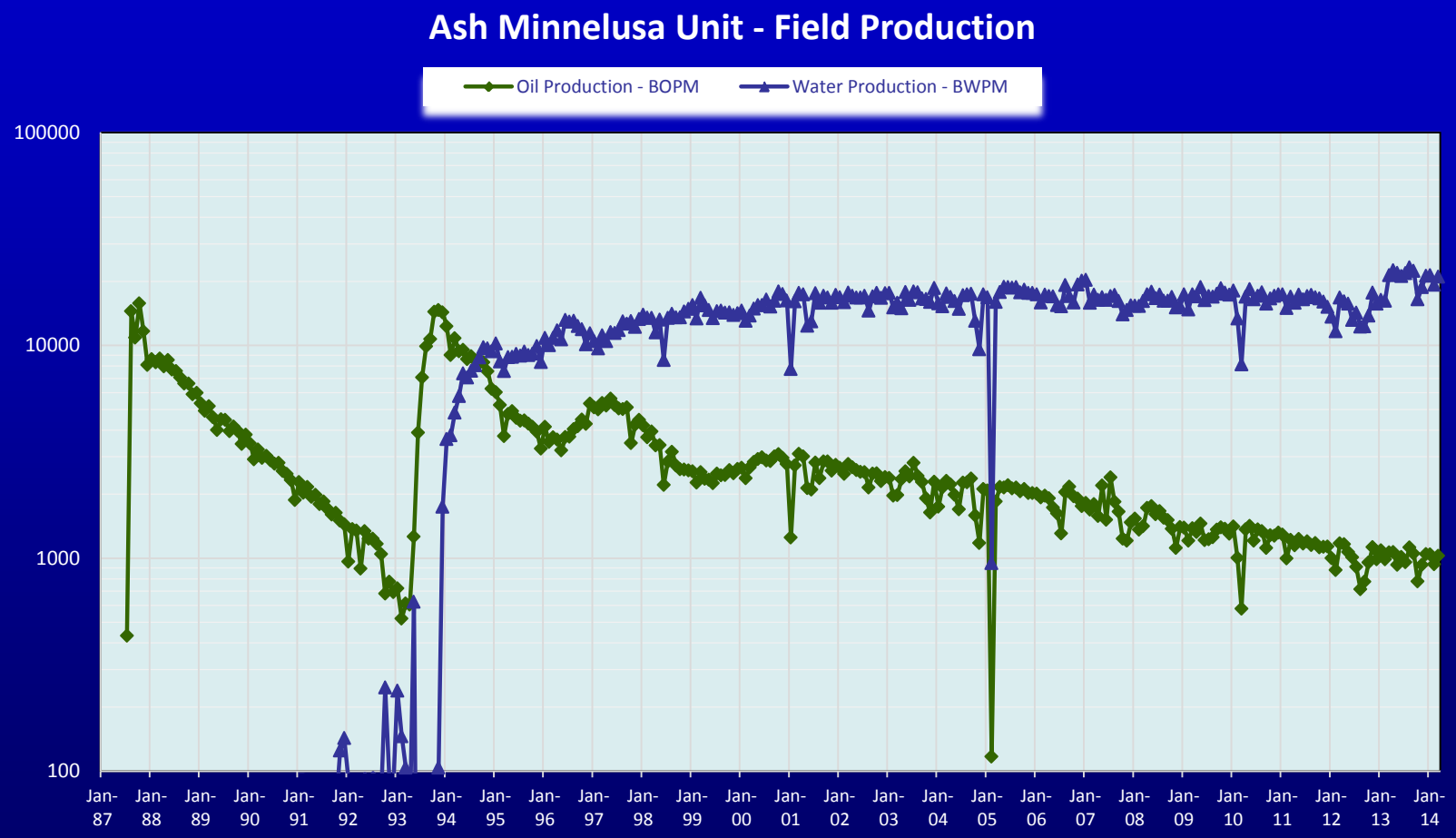
Production Efficiency



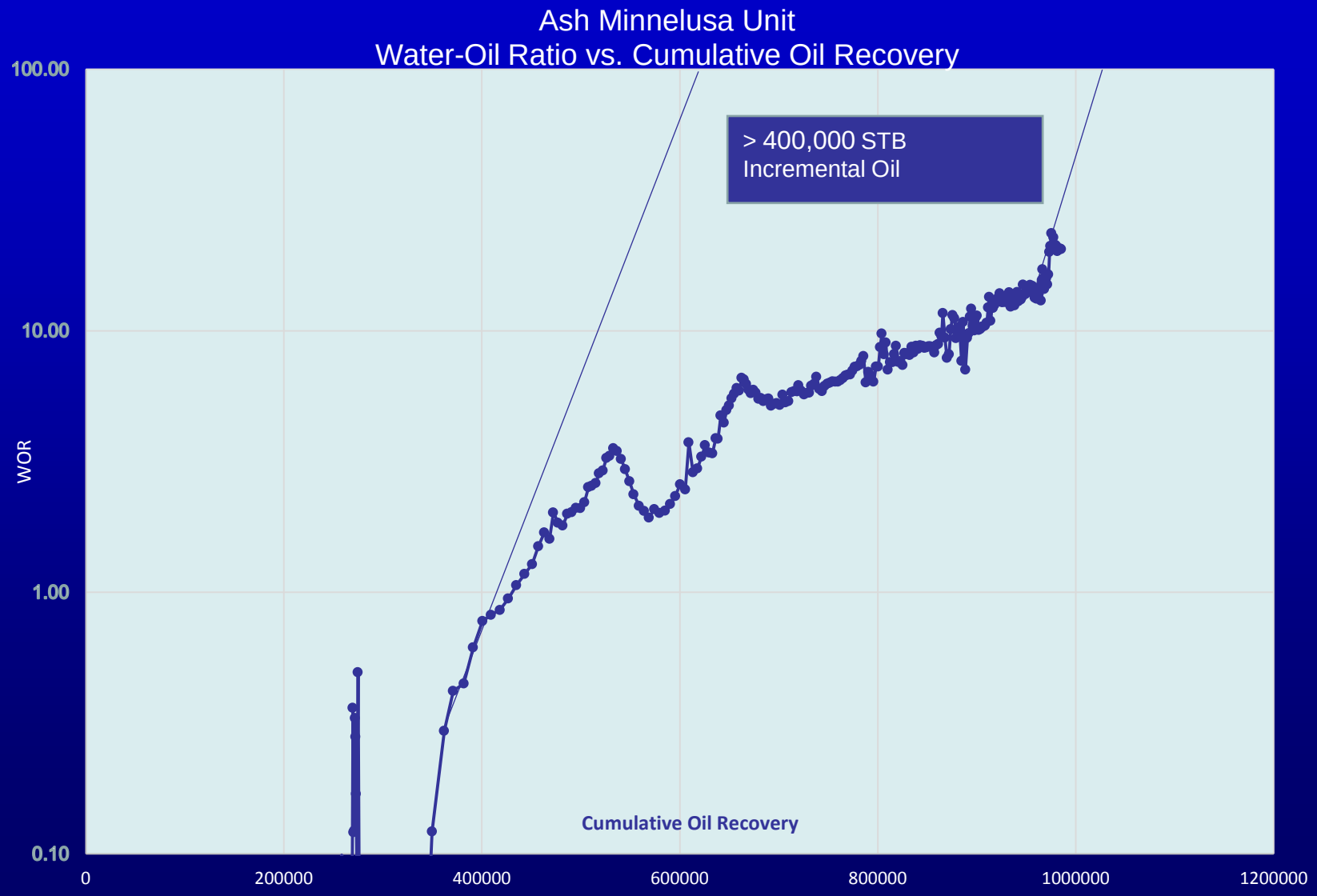
Injection Efficiency



Total Field Production



Production Efficiency



Ash Minnelusa Unit Conclusions

- Monitor, monitor, monitor. Make changes based upon reservoir response
- Improved understanding of the problem improves process application and results
- Volumetric sweep (gels) should be applied before mobility control
- Implement gel processes early for maximum benefits
- Incremental oil expected to exceed 400,000 BBLS (18.4% OOIP) for $0.88/BBL
- Field experience is critical with gel processes. Experience at Ash can be applied to other reservoirs.