Senate Resources Committee
3 February 2012

William C. Barron

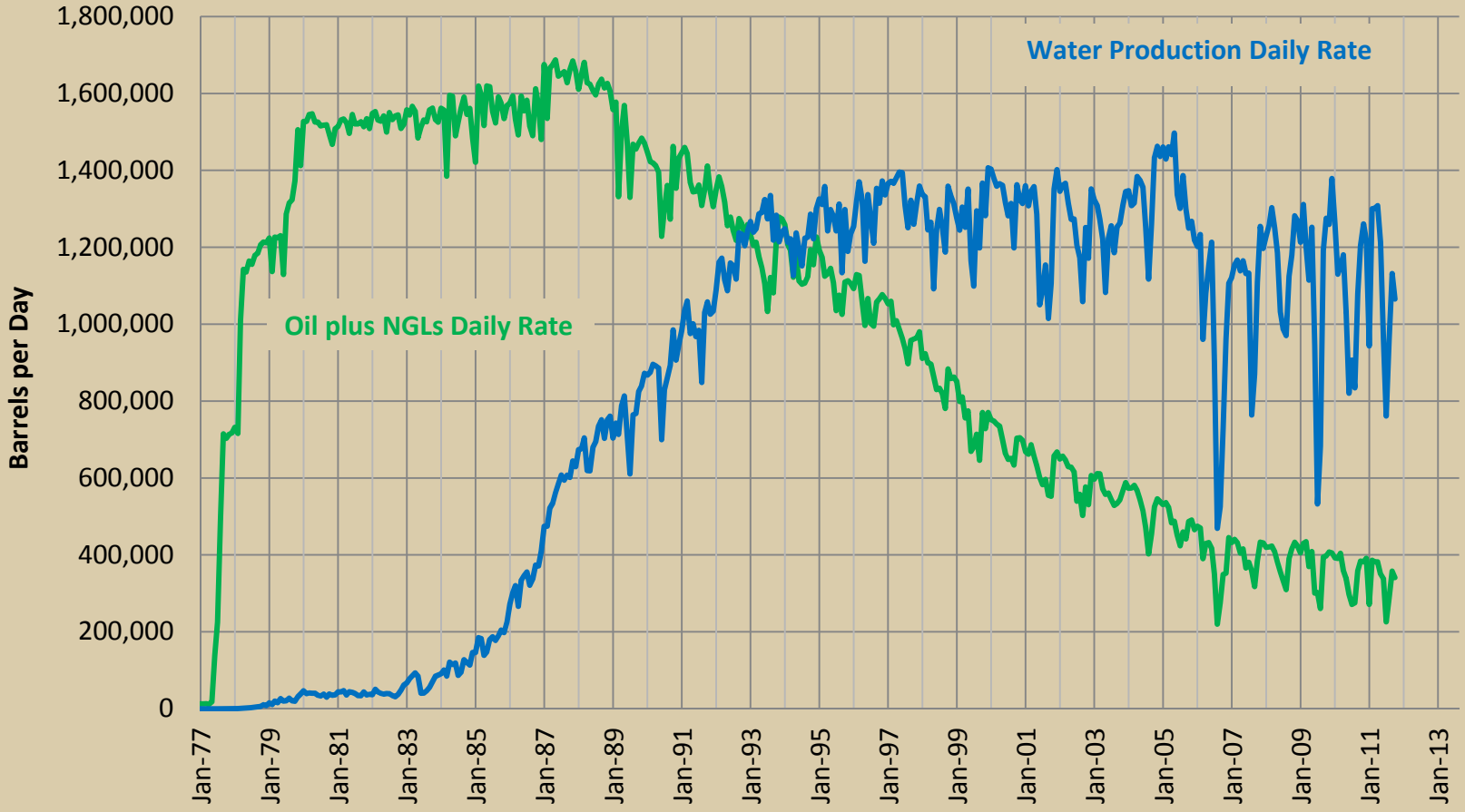
Director

Division of Oil and Gas

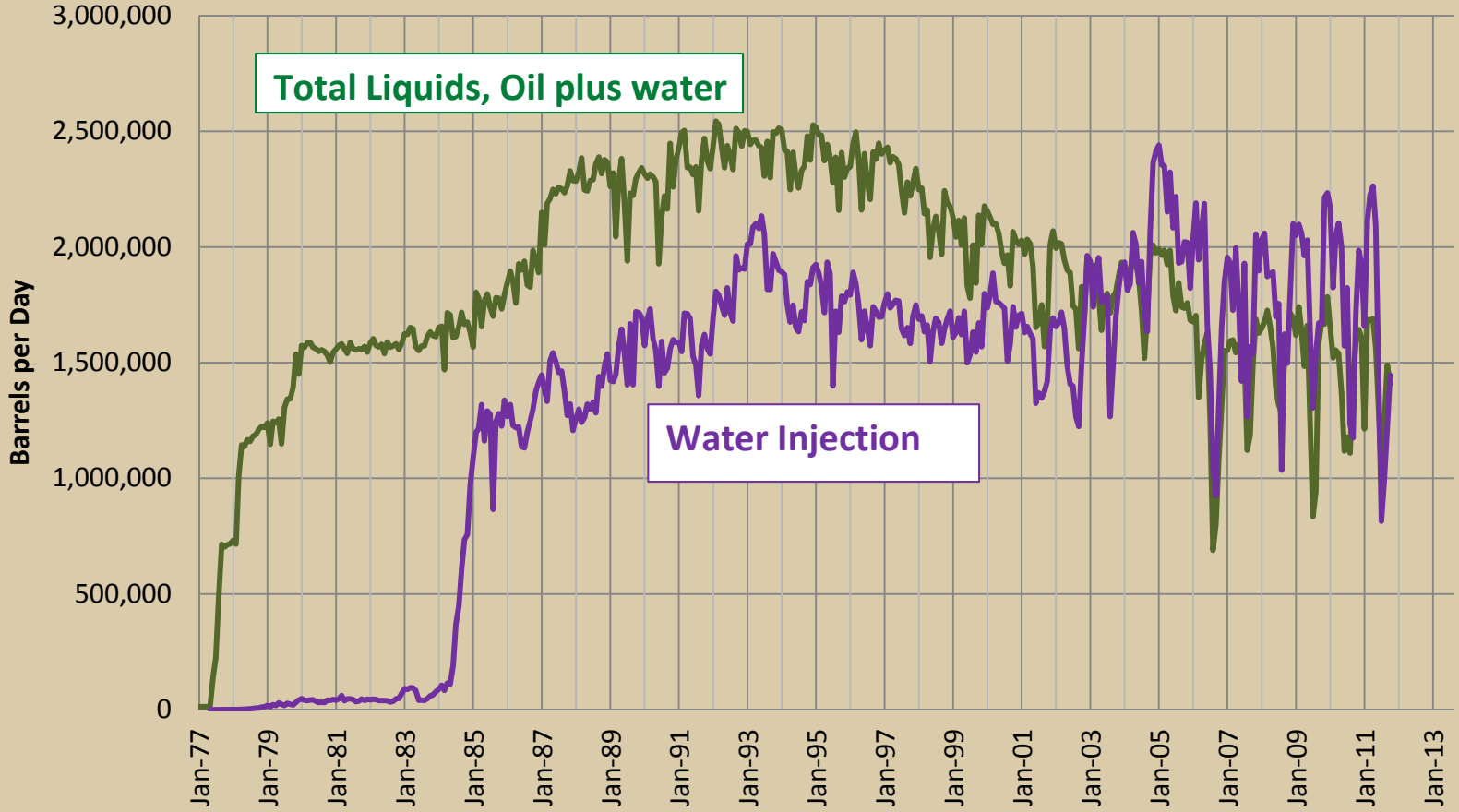
Overview

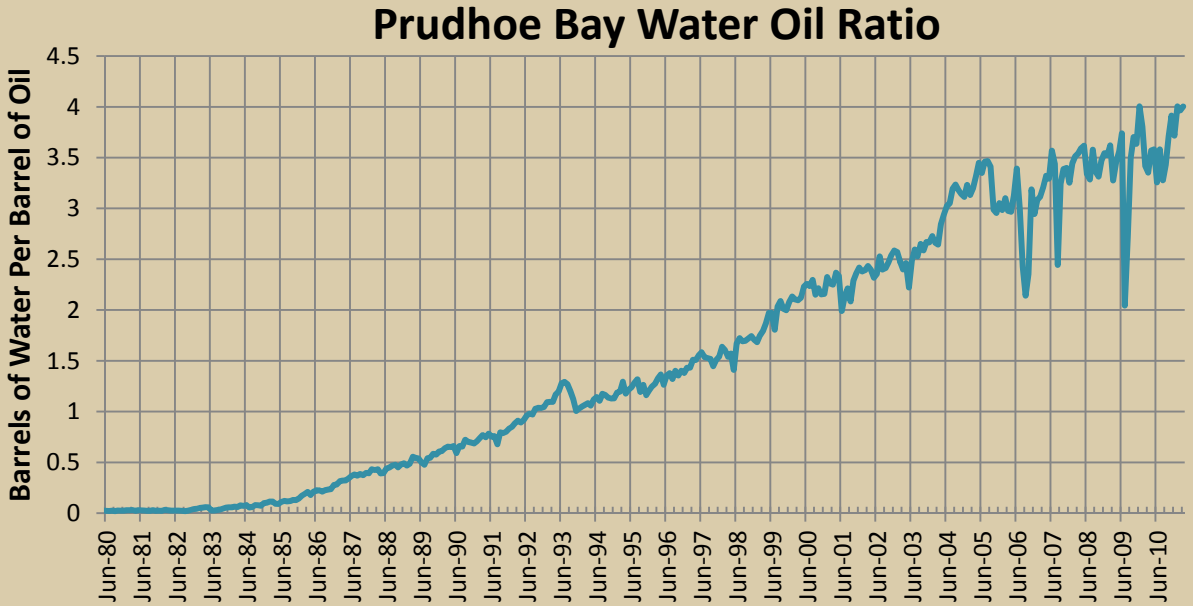
- Update North Slope Facilities Expansion
- New Technologies
- Appendix

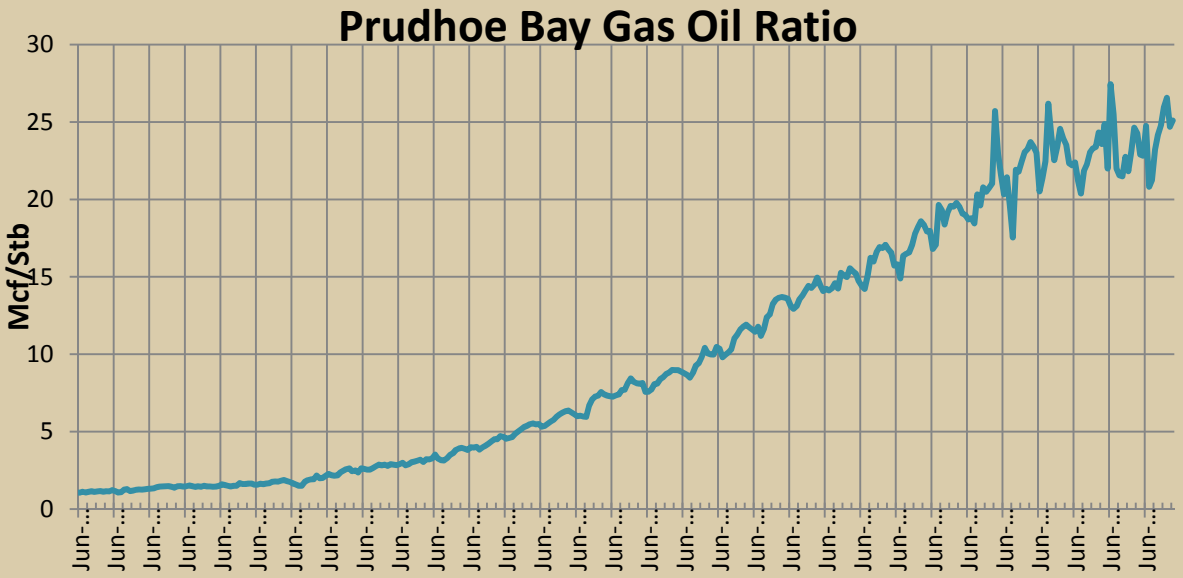
Prudhoe Bay Unit, Oil and Water Production Rates



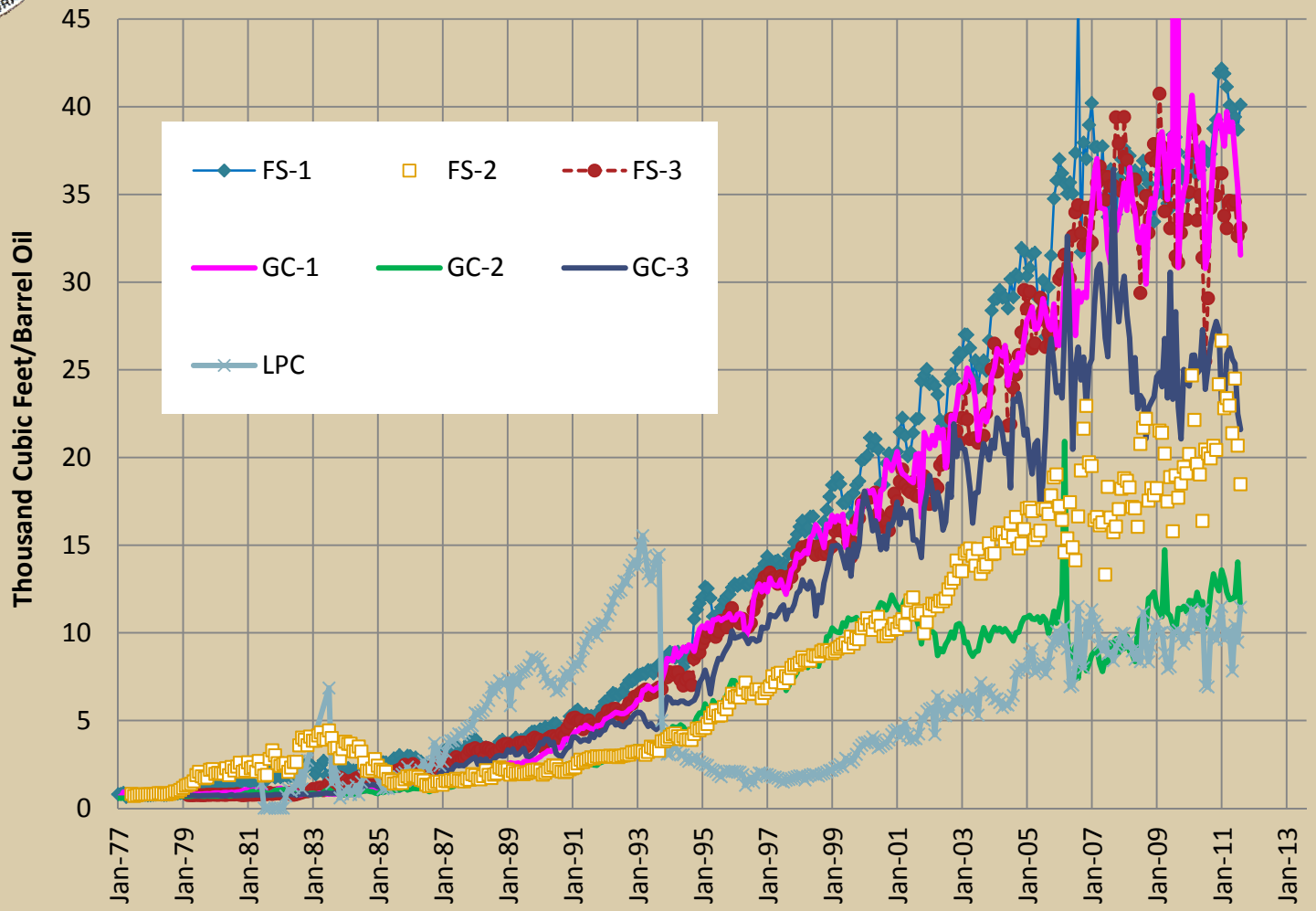
Prudhoe Bay Unit,
Total Fluid Production and Water Injection Rates

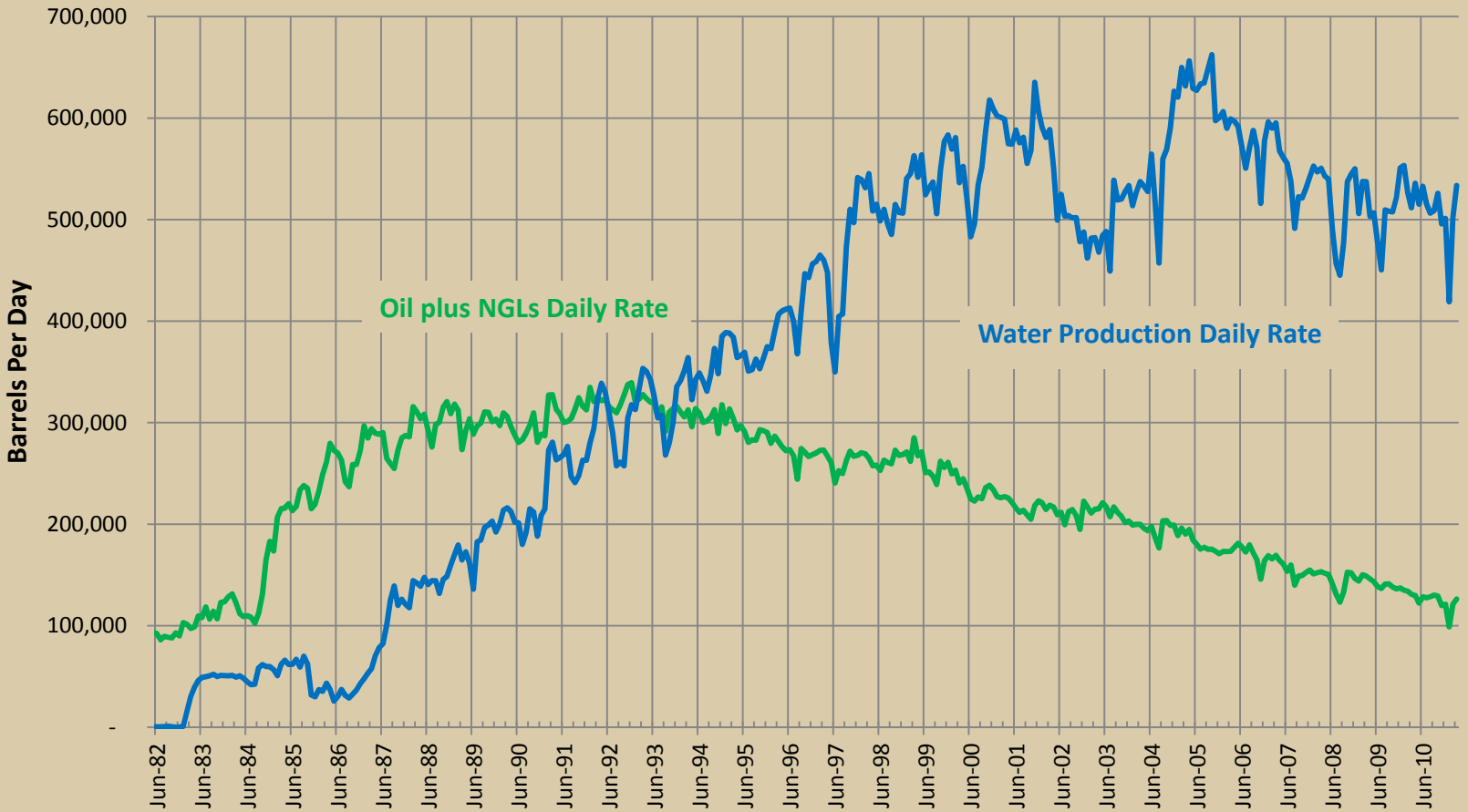



Prudhoe Bay Water Oil Ratio
Barrels of Water Per Barrel of Oil
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Jun-80
Jun-81
Jun-82
Jun-83
Jun-84
Jun-85
Jun-86
Jun-87
Jun-88
Jun-89
Jun-90
Jun-91
Jun-92
Jun-93
Jun-94
Jun-95
Jun-96
Jun-97
Jun-98
Jun-99
Jun-00
Jun-01
Jun-02
Jun-03
Jun-04
Jun-05
Jun-06
Jun-07
Jun-08
Jun-09
Jun-10


Prudhoe Bay Gas Oil Ratio
Mcf/Stb
30
25
20
15
10
5
0

Prudhoe Bay Unit Gas-Oil Ratios by Processing Center




Kuparuk River, Oil and Water Production Rates
Barrels Per Day
700,000
600,000
500,000
400,000
300,000
200,000
100,000
-
Oil plus NGLs Daily Rate
Water Production Daily Rate
Jun-82
Jun-83
Jun-84
Jun-85
Jun-86
Jun-87
Jun-88
Jun-89
Jun-90
Jun-91
Jun-92
Jun-93
Jun-94
Jun-95
Jun-96
Jun-97
Jun-98
Jun-99
Jun-00
Jun-01
Jun-02
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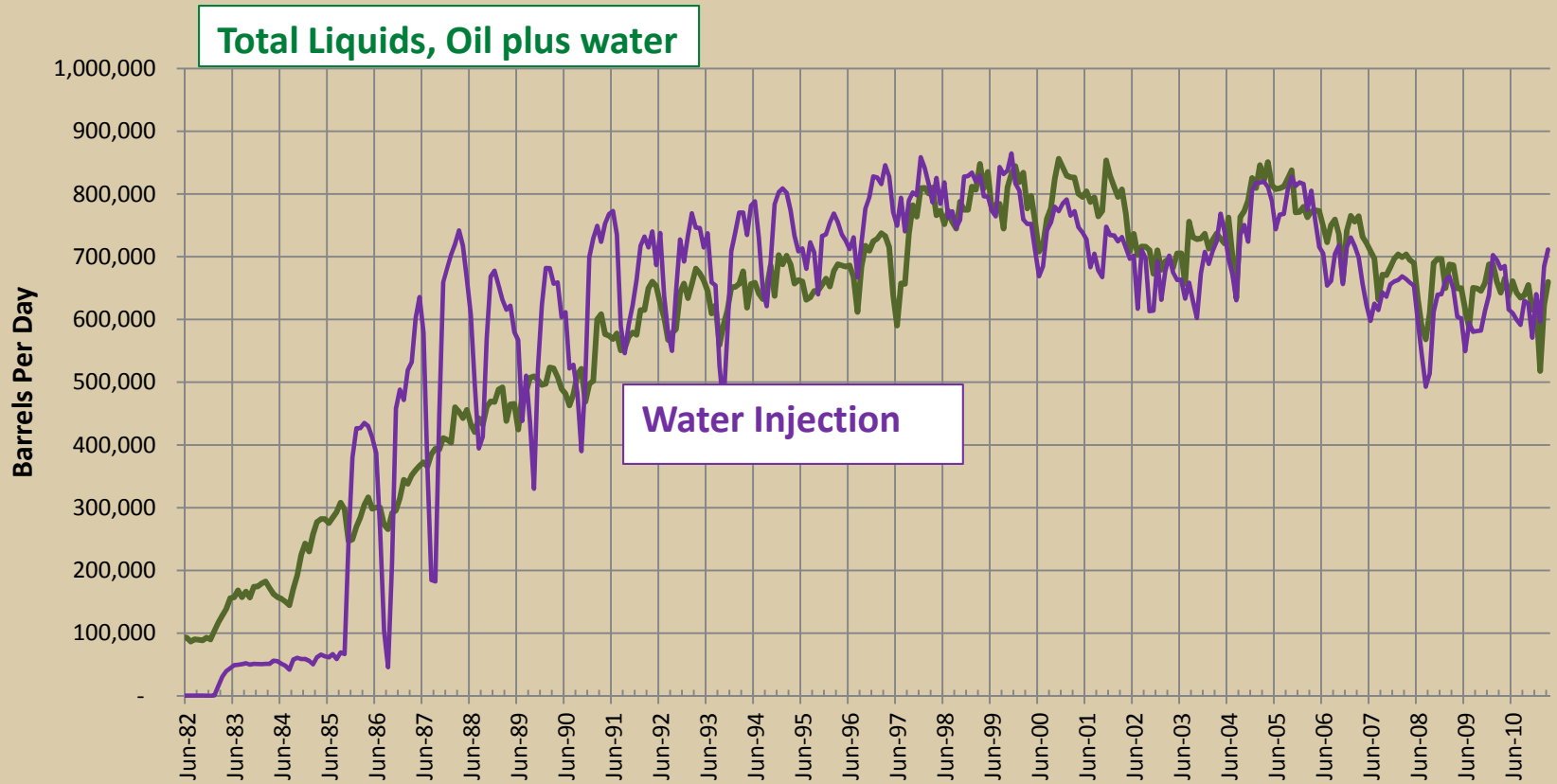
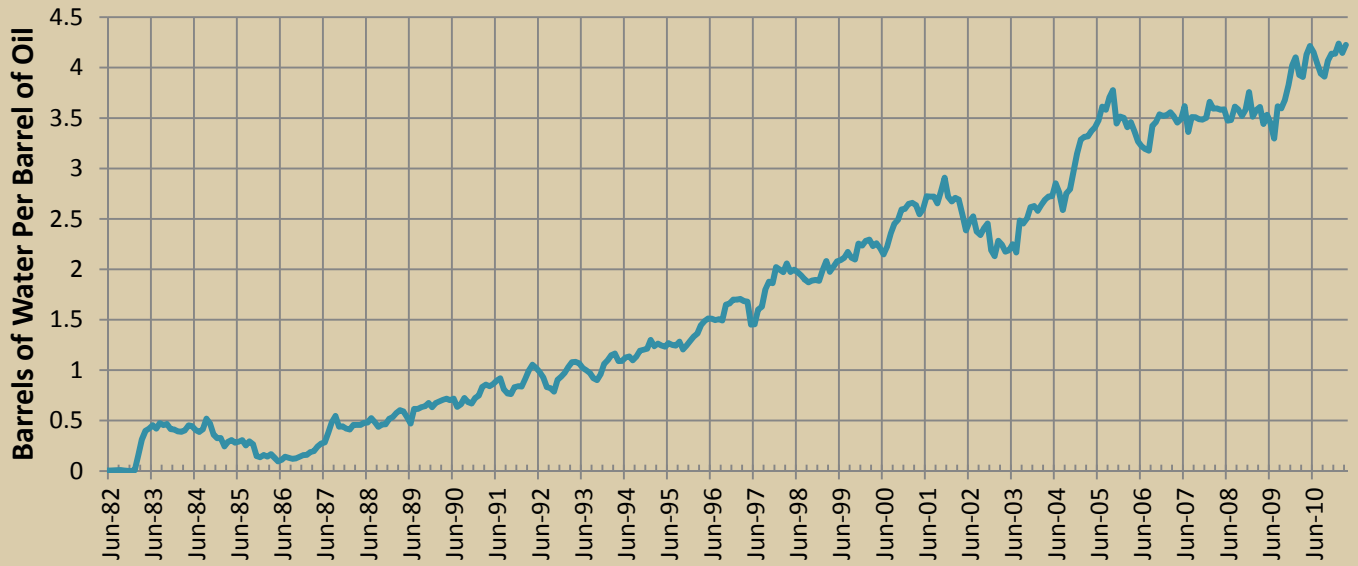
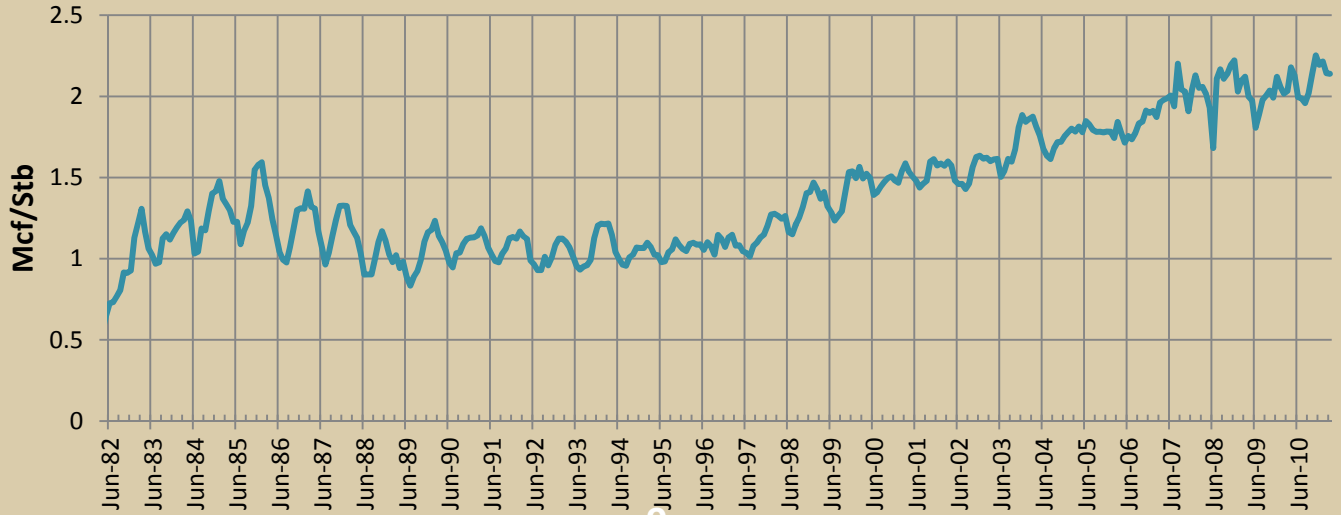
Kuparuk River,
Total Fluid Production and Water Injection Rates

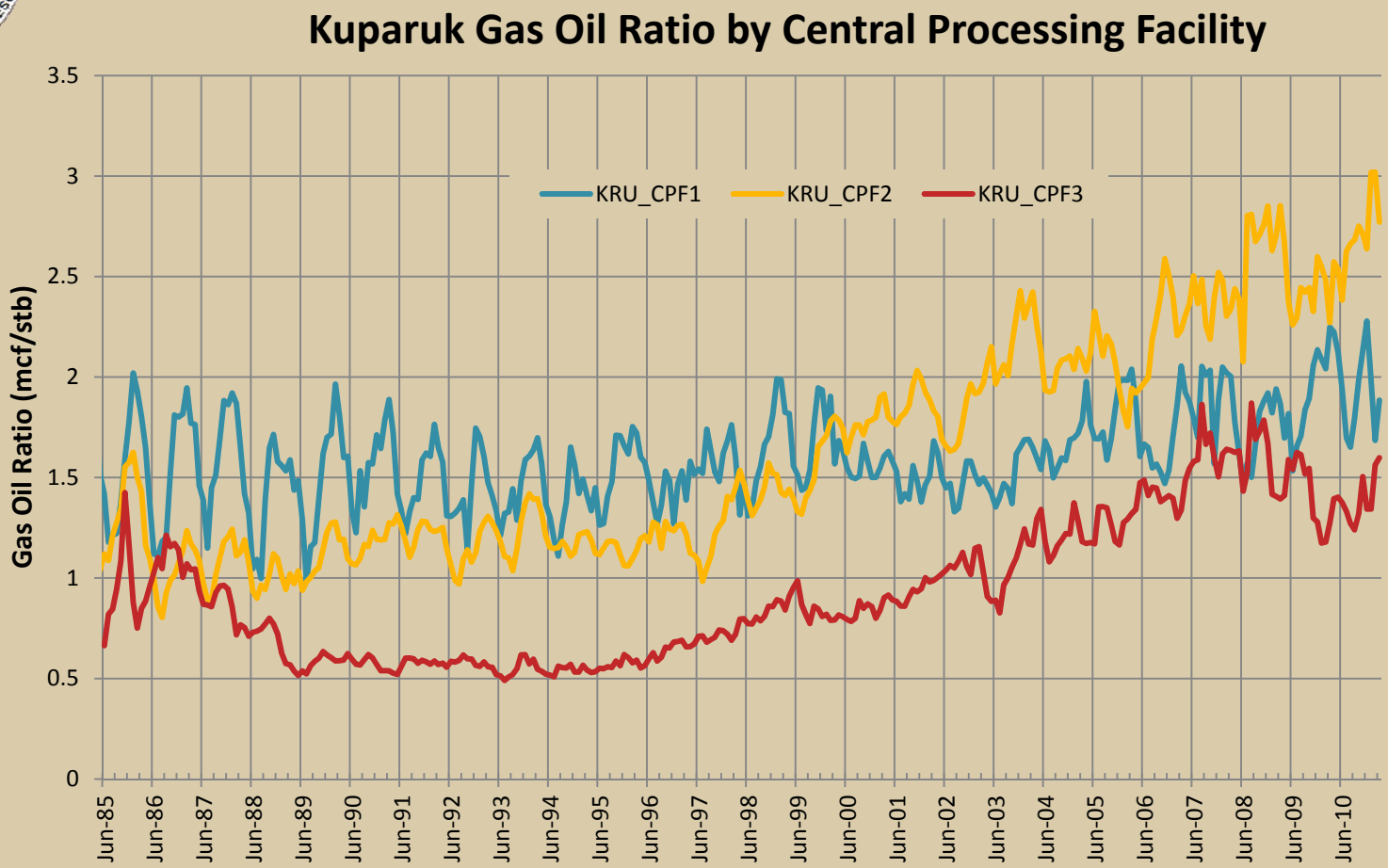


Kuparuk River Water Oil Ratio



Kuparuk River Gas Oil Ratio





- GOR behavior by facility indicates that CPF2 could have the largest issue with gas constraints if oil production were to increase

Capacity of North Slope Facilities

Unit	Facility startup date	Oil and NGLs, Standard barrels Per day (stb/d)	Gas, million standard cubic feet per day (mmscfd)	Water (bwpd)	Water injection (bwpd)	Handling limitations & comments
Badami	1998	35,000	25	12,000	30,000	No limits
Colville River	2000, exp 2004,2005	140,000	180	100,000	140,000	We know of no limits
Endicott	1986	115,000	455	225,000	245,000	Limited gas & water
Kuparuk						
CPF-1	1981	170,000	200	250,000	250,000	
CPF-2	1983	160,000	260	250,000	300,000	
CPF-3	1985	85,000	150	100,000	220,000	
Milne Point	1983	75,000	42	99,000		None known for current development
Northstar	2001	77,000	555	30,000		Limited by gas handling, water production is not at limit. Uncertain whether rated capacity is current
PBU						
FS-1	1977	360,000	2,800	140,000		
FS-2	1977	360,000	1,200	650,000		
FS-2	1979	360,000	1,300	300,000		
GC-1	1977	330,000	2,600	180,000		
GC-2	1977	250,000	1,070	300,000		
GC-3	1978		1,100	275,000		
CGF	1977 , exp 1986, 1990, 1994		8,700			
CCP	6/1977, exp 1986, 1990, 1994		7,700			
LPC Greater Pt. McIntyre	12/1986	205,000	450	120,000		Limited gas, water, and total fluid. Some wells from Pt. McIntyre flow into GC1
Oooguruk	2008					Production to Kuparuk CPF-3. No known handling limits at Oooguruk
Nikaitchuq	2011	40,000	Unknown	120,000		No limits at this time

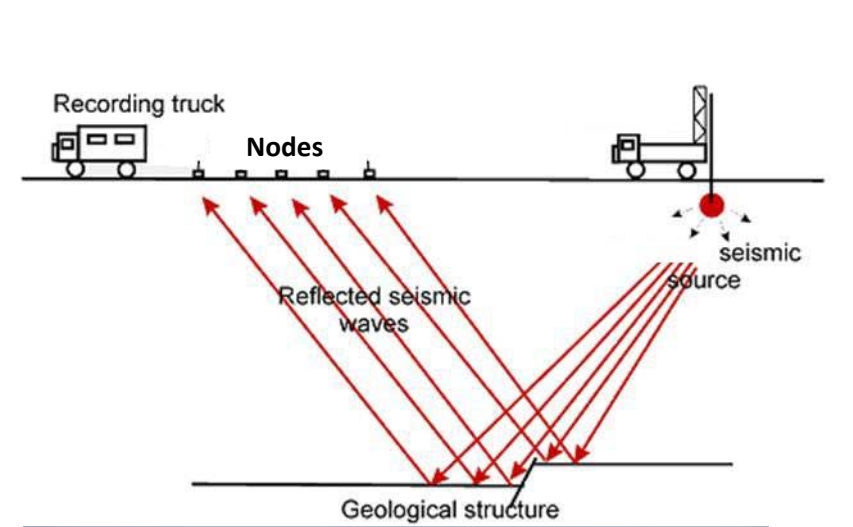
New Technologies

- Nodal technology
- Heavy Oil – CHOPS
- Gas Cap Water Injection

Nodal Technology

State of the Art Technology

- Recording Impact is Minimized:
  - Size and weight is up to 9X less
  - No cables on land minimizing impact to vegetation and wildlife = Footprint minimized
  - Time in area of operation is reduced
- Autonomous: There is no communication between any of the components.
- Cable-Free Operation: Each unit is 100 percent free of external cables/wireless.
- Reliability: The absence of any external cables provides the units with extraordinary field reliability.
- Continuous Recording: Each node begins acquiring data, recording continuously and locally storing the data onto internal FLASH memory until retrieved.
- Self Contained: Each unit contains all of the elements and technologies needed to sense, acquire, digitize, filter and store the seismic data.



Operation:
The sound waves that are generated are sent deep into the subsurface. When they reflect back to the surface, they are captured by geophones and recorded by a computer.

An image of the subsurface, called a seismic profile, is created. This profile allows geologists to predict where oil and natural gas deposits may be located. An **"Ultra-sound"** of the earth is created.

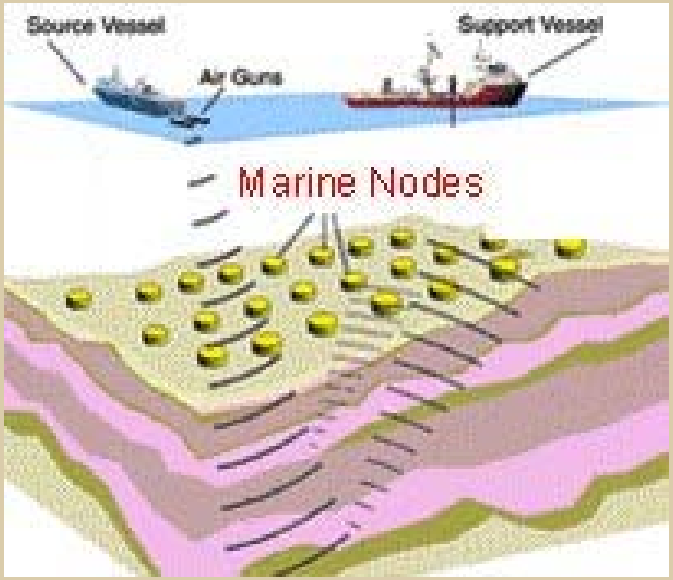
Deploying land nodes

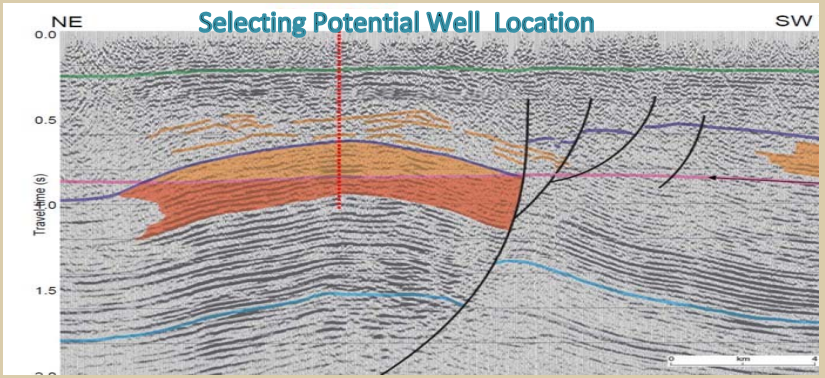
Apache Cook Inlet November 2011

- Marine (Wireless) Nodes deployed in the Cook Inlet from vessels made and rigged in Alaska….and manned by Alaskan crews.
- The nodes are tethered to each other with rope and retrieved within 15 days.
- The nodes are rated to 700 meters of water depth.
- Minimizes Tidal influence
- Nodes Rest on the Seabed providing higher quality data
- Sound waves are produced using compressed air
- Multi vessel acquisition permits a larger “acquisition area” in a shorter period of time

Deploying and Retrieving nodes (data)

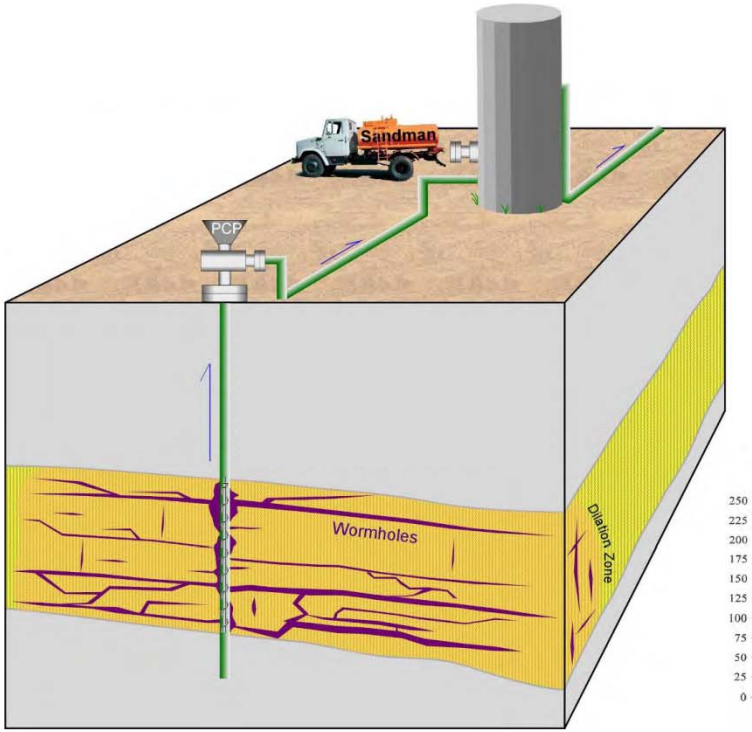
Downloading seismic information and recharging



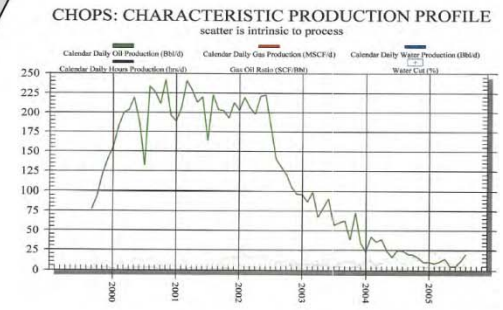


Cold Heavy Oil Production with Sand

CHOPS Elements



- Unconsolidated rocks
- PCP Pump
- Surface Drive
- Heated Separation Tank
- Sand Disposal

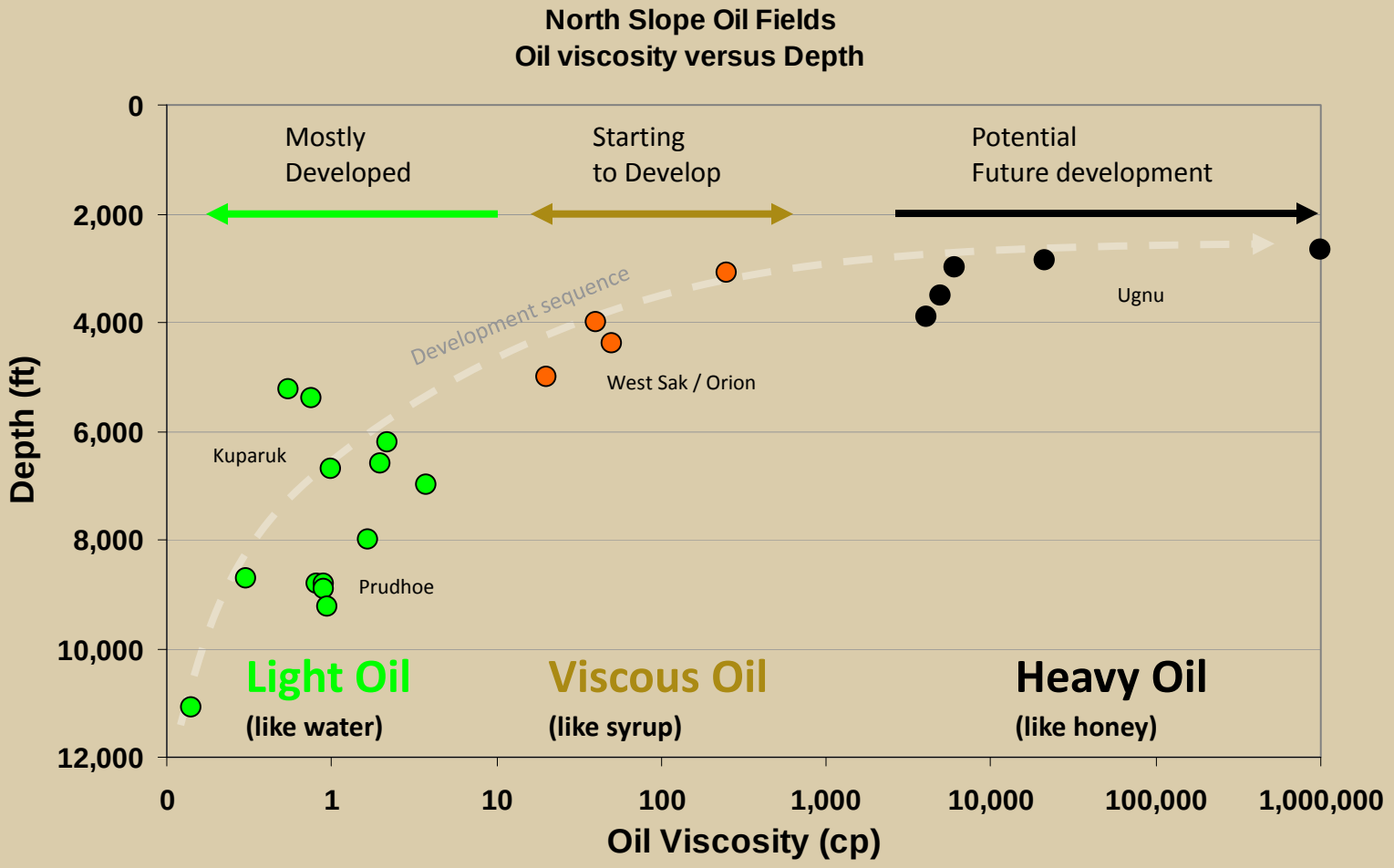


RENEWAL

Courtesy of BP

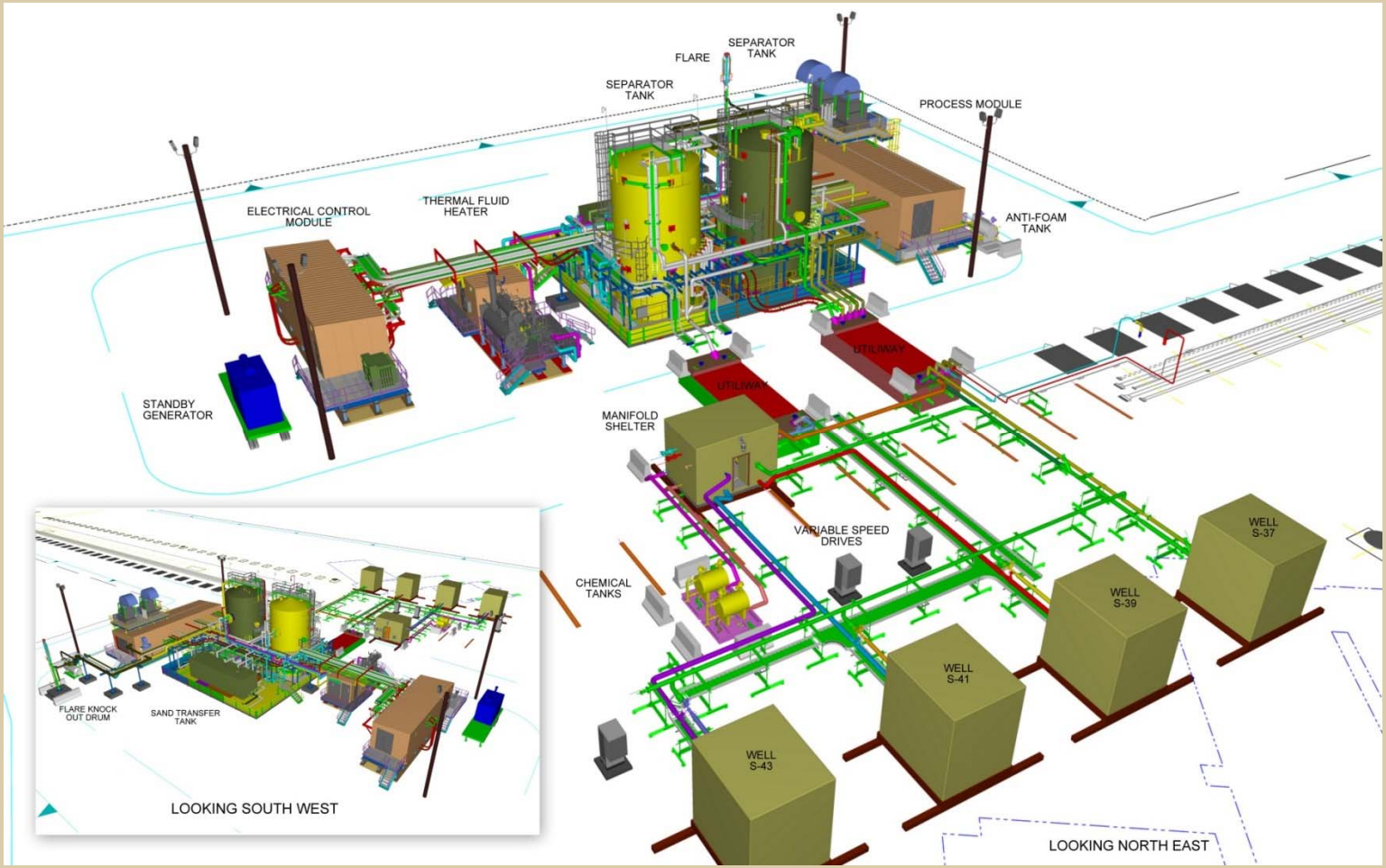
Alaska Fluid Viscosity

Alaska fluids range over a continuum of viscosities



Courtesy of BP

Milne Point S-Pad Heavy Oil Facility

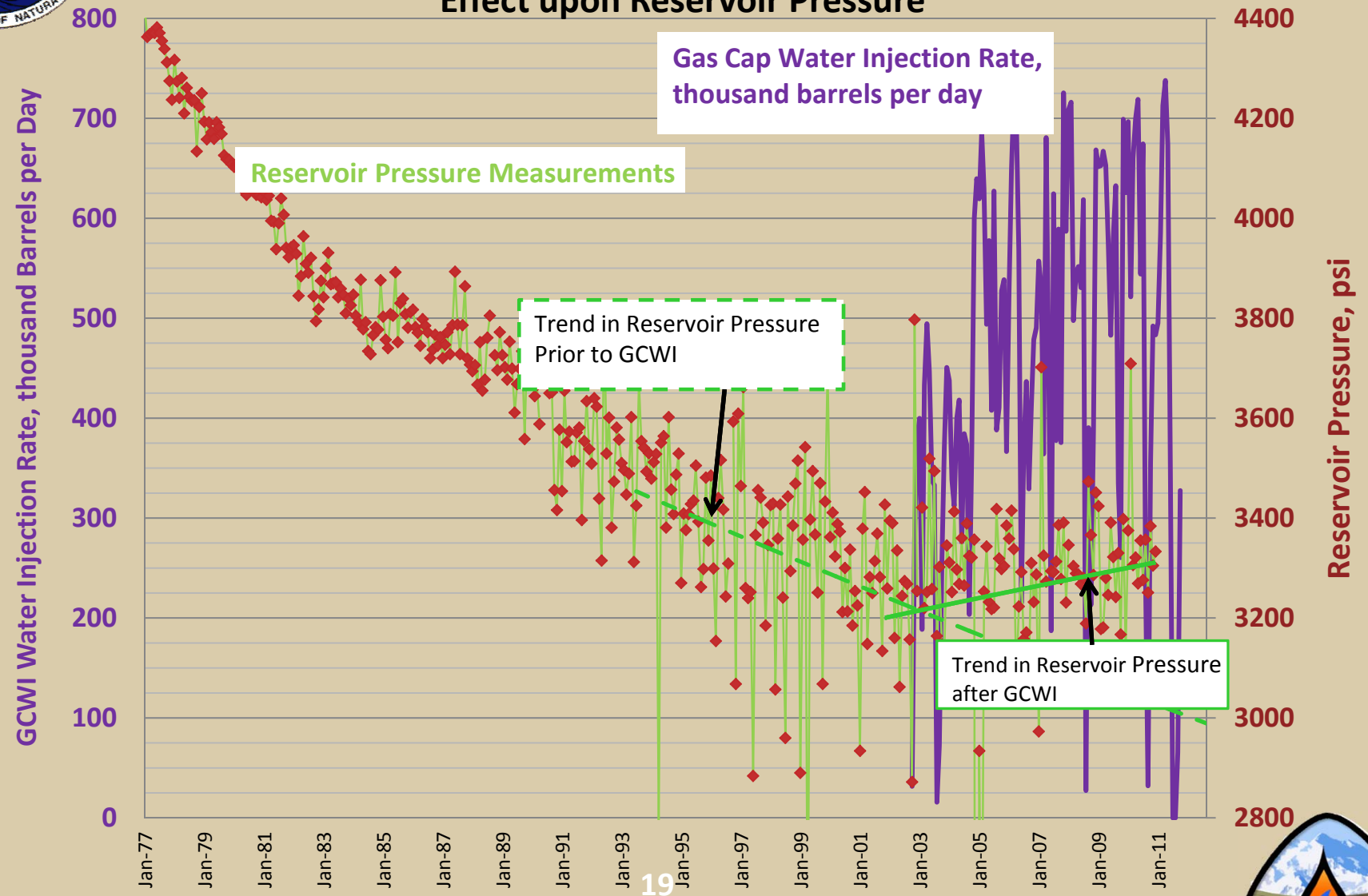


Courtesy of BP

Prudhoe Bay Unit, Ivishak Reservoir Gas Cap (GCWI)

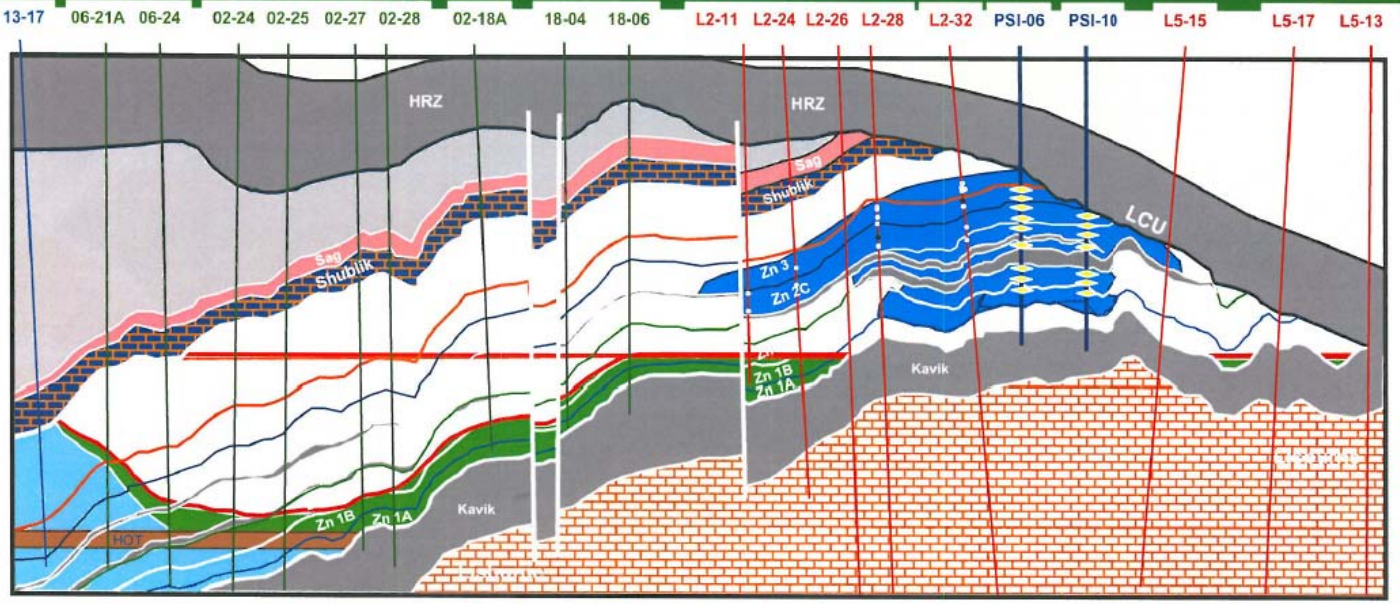
- Water Injection into the gas cap of the Ivishak reservoir was begun in late 2002 to maintain reservoir pressure and increase oil reserves.
- In 2001, the Prudhoe Bay Unit Working Interest Owners (WIO) testified to AOGCC that approximately 200 million Barrels additional recovery would result from the project.
- Average pressure decline was approximately 25-35 psi per year before GCWI.
- Since the start of GCWI, the reservoir pressure has increased by approximately 100 psi (approximate increase of 12 psi per year).

Prudhoe Bay Unit, Ivishak Initial Participating Area
Gas Cap Water Injection
Effect upon Reservoir Pressure



Courtesy of BP

2010 A – A' into GD area

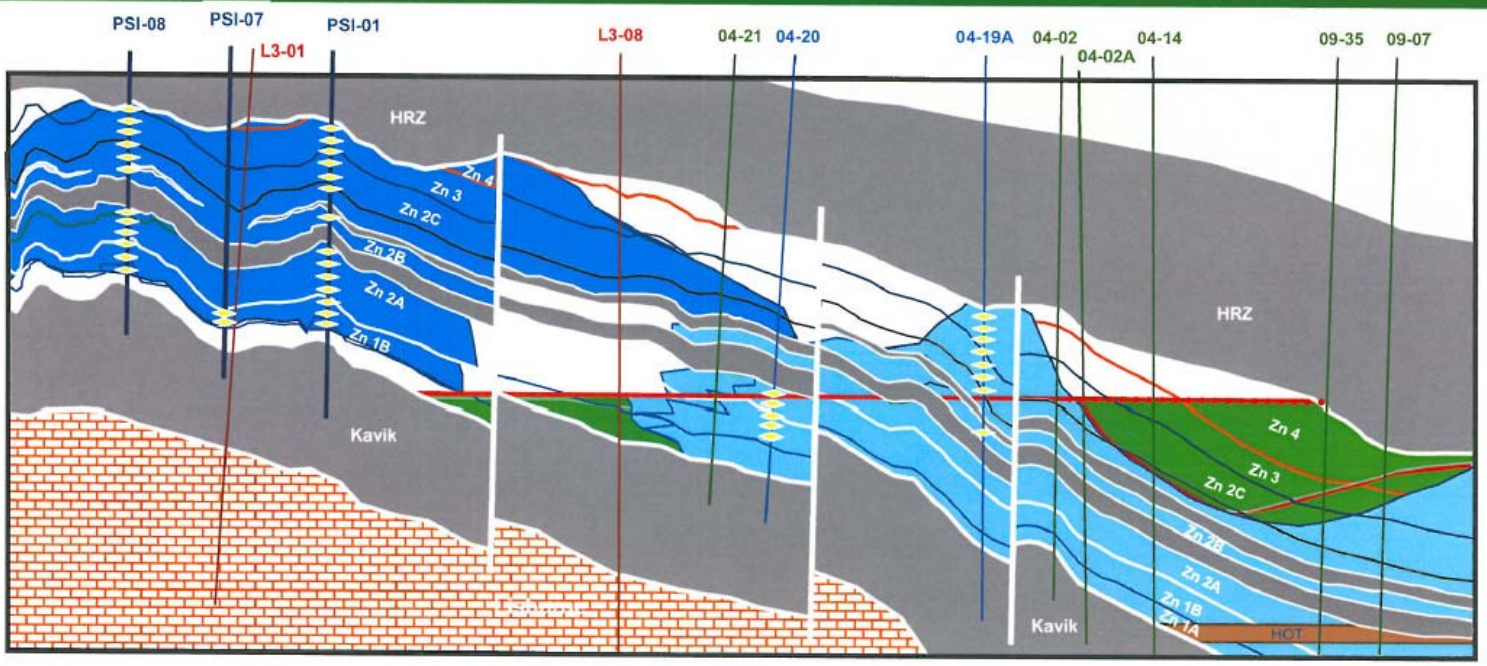


- Flood behavior is consistent with past
- L5-15 shows water is making it past the 2C truncation
- L2-28 shows Zone 1B water is now ahead of Zn 2A (dedicated 1B injection is working)

From March 22, 2011 PBU Annual Field Overview
BP/WIO presentation to DNR and AOGCC

Courtesy of BP

2010 B – B' into FS2 area



- Flood behavior is consistent with past
- GCWI is extending to FS2 waterflood

From March 22, 2011 PBU Annual Field Overview
BP/WIO presentation to DNR and AOGCC

Courtesy of BP