Note Title 4/19/2016

GAS MATERIAL BALANCE (M.B.)

Real Gas Law PVT_g

$$\bar{p}_R = f\left(G_p \mid G \;\underbrace{(C_w\, c_p)}, \underbrace{V_w}, \underbrace{N_p}, k \ldots\right)$$

W_p W_{inj}

↳ account for moles produced

G = Initial Gas in Place

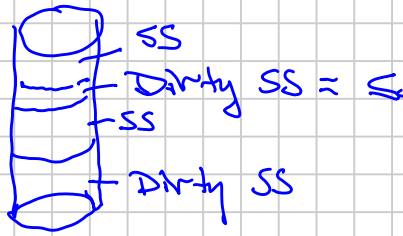
$$G_p = \int_0^t q_g\, dt = \text{cum. production of (surface) gas}$$

c = isothermal compressibility $\equiv -\frac{1}{V}\left(\frac{dV}{dp}\right)_T$

- pore
- water

$\underbrace{V_w}$: Internal Sources of Water

- Connate or initial water sharing the pores with gas (SS) Pay
- Dirty SS = "Non-Net Pay"



$S_{wi} \sim 1$

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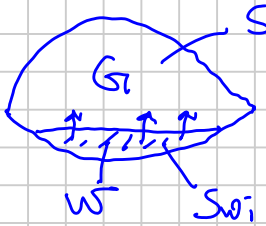
- Aquifer

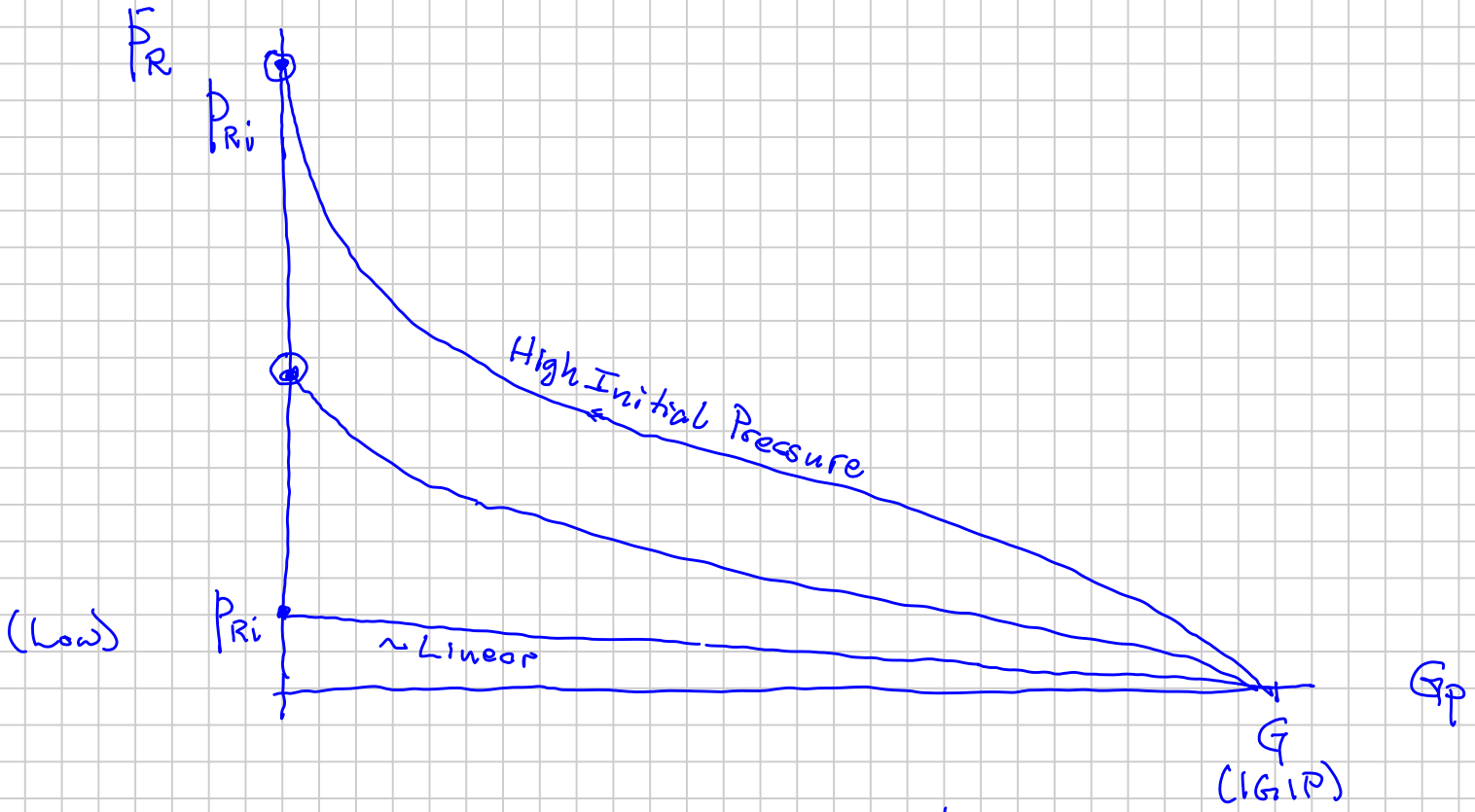
$p_{Rg} \downarrow$

cause

$p_{AQ} \downarrow$



$\bar{p}_R(G_p)$: Gas MB



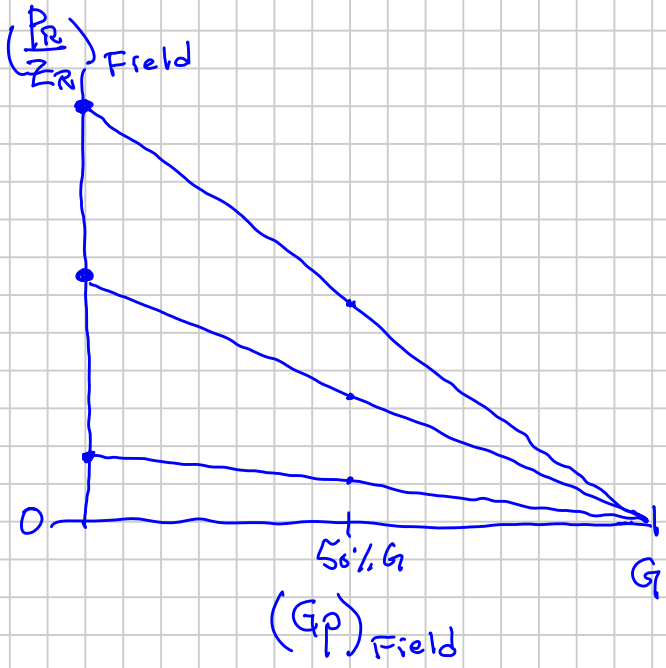
(A) $HCPV_g = V_{pg} = \text{constant}$ | $C_w = C_f = 0$

Use the Real Gas Law to describe PVT of the gas for HCPV = const.

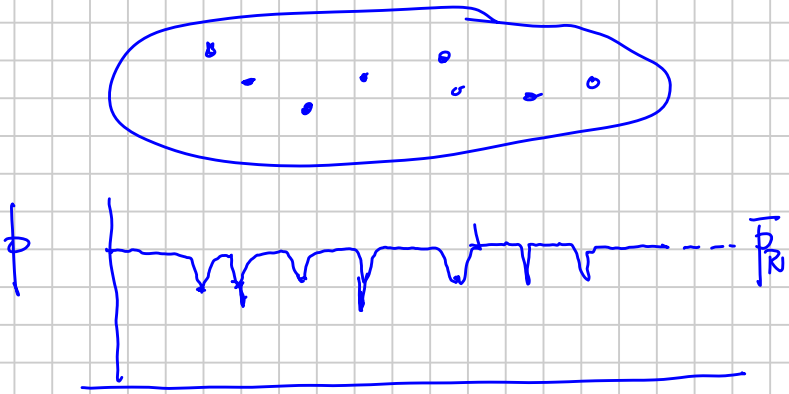
$$\left(\frac{\bar{P}_R}{Z_R}\right) = \left(\frac{P_{Ri}}{Z_i}\right)\left(1 - \frac{G_p}{G}\right)$$

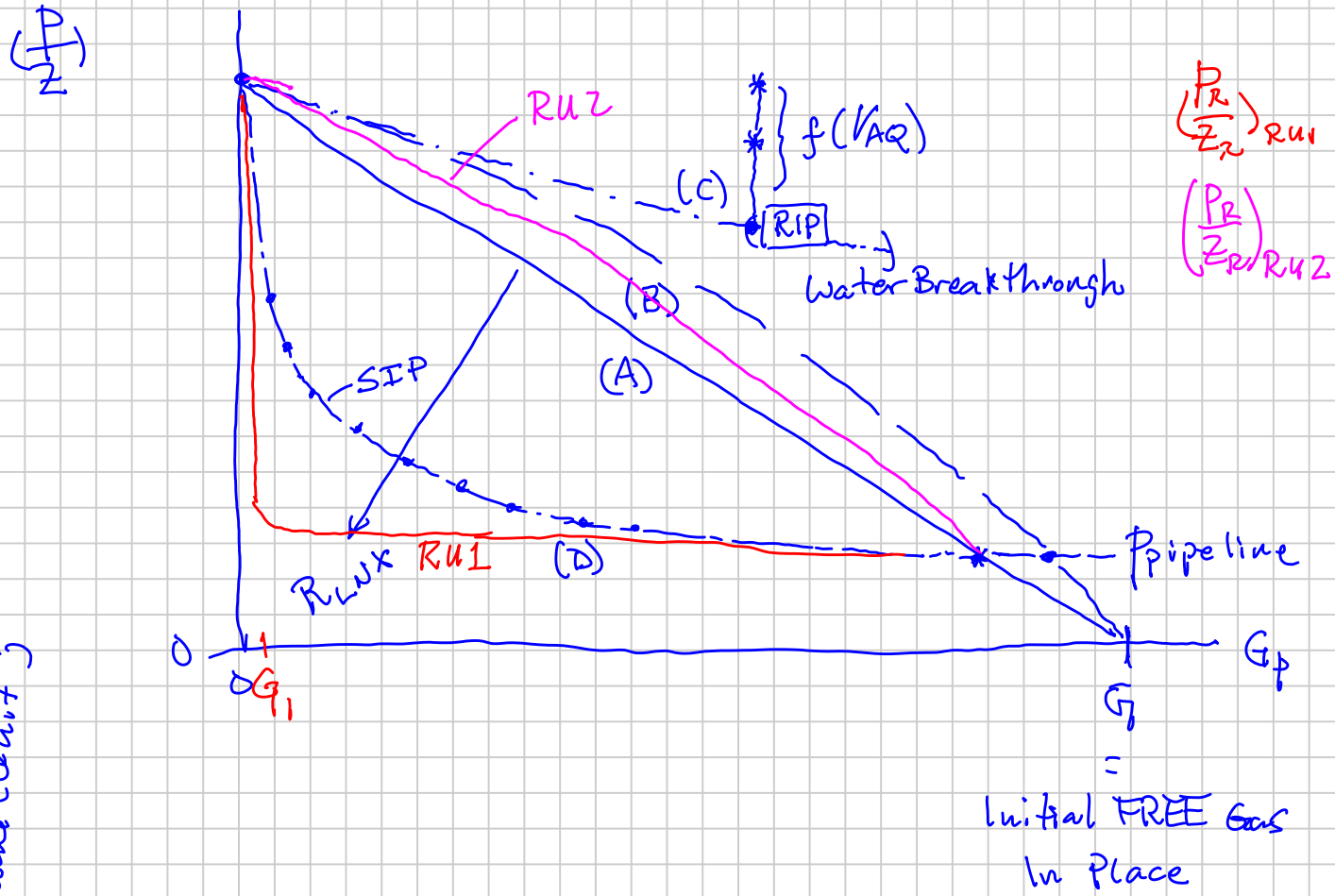
$Z_g(\bar{P}_R, T_R) \rightarrow Z_R$

Straight-line Gas M.B.



$\bar{P}_R$: PTA Methods ~
Build-up $p_{ws}(\Delta t_s)$





Single Communicating Reservoir: Gas Volume (Qunit)

(A) $HCPV_g$ = constant (e.g. $C_p = C_w = 0$)

(B) $HCPV_g$ decreases as pressure decreases but water encroachment doesn't reach (all) gas producers

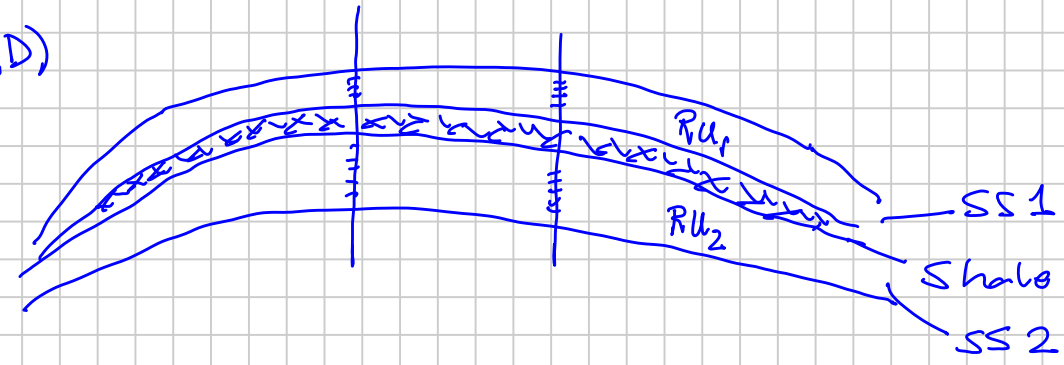
(C) Active External Water Drive (encroachment)

W_e = reservoir volume of external water entering what was originally V_{pgi} ($HCPV_{gi}$)

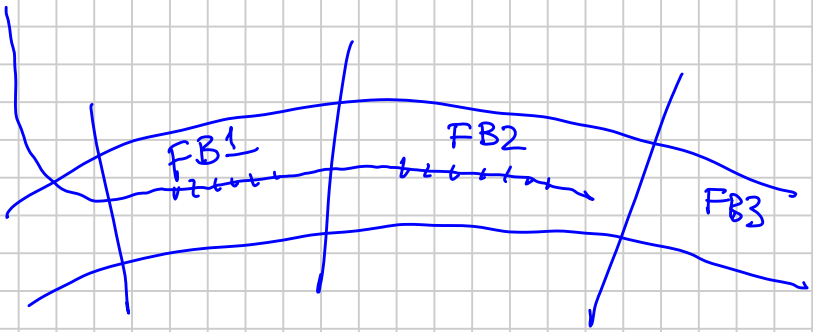
Potential $W_e > V_{pgi}$ so producing gas wells start to dieing.

- Artificial lift almost never used in gas wells.
- $(G_p/G)_{ultimate\ RF\ @\ Water\ BT}$ = f (q_{gF} - i.e. how fast you empty the reservoir)

(D)

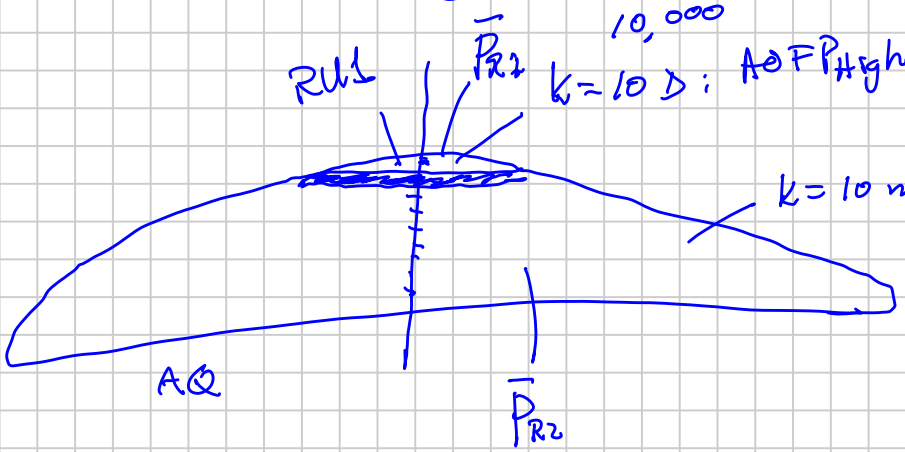


Layered No-Crossflow (LNX)



Single-Layer Sealing Fault Barriers

$$R_{LNX} = \frac{\left[\frac{(AOFP)_{RU1}}{(HCPV \mid G)_{RU1}}\right]}{\left[\frac{(AOFP)_{RU2}}{(HCPV \mid G)_{RU2}}\right]} > 2\text{-}3 \Rightarrow 10+$$



$(\phi/Z) - G_p$ of (D) is just a composite of all RU $(p/Z) - G_p$ which differ. (Ⓐ, Ⓑ, Ⓒ)