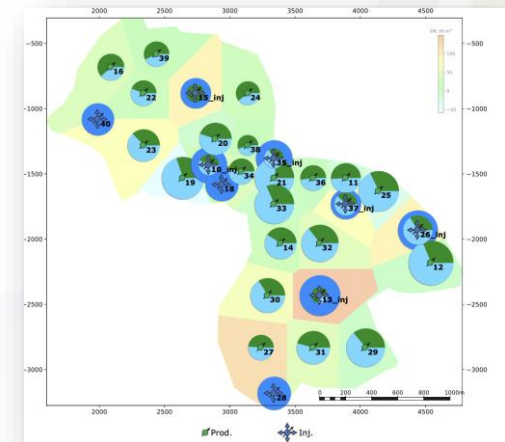
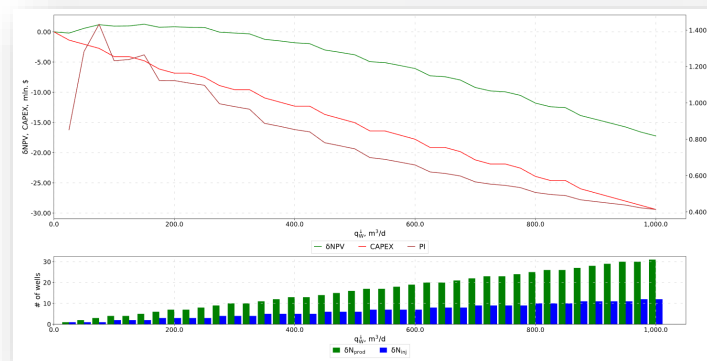
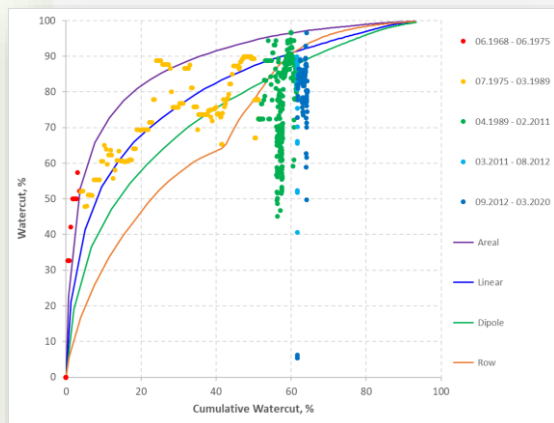


sofoil

PRIME

Advanced Production Analysis



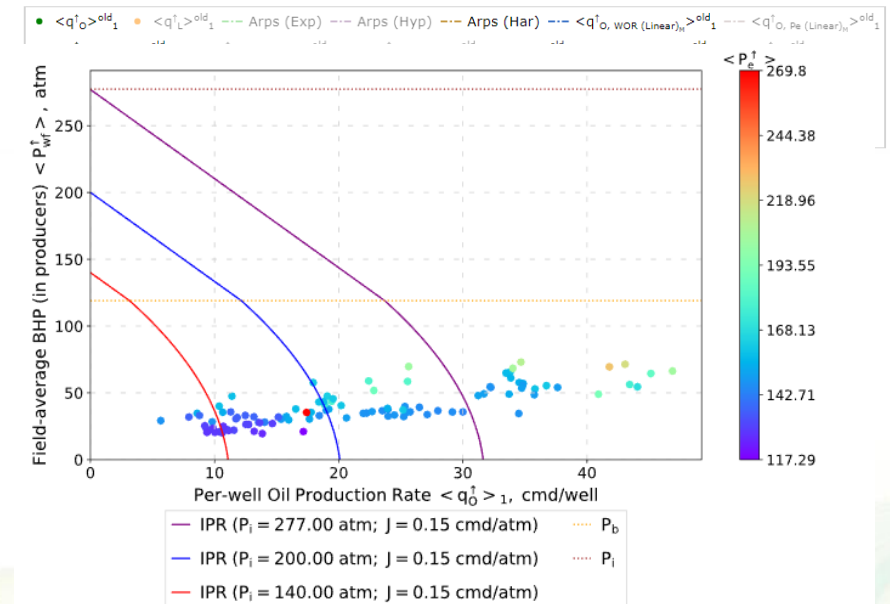
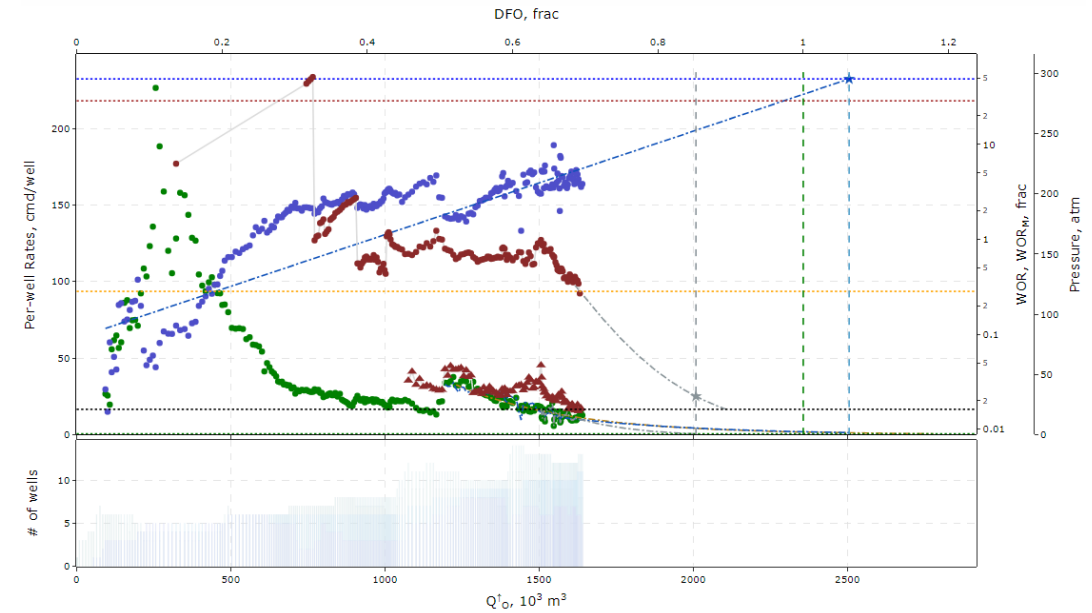
GOALS AND OBJECTIVES

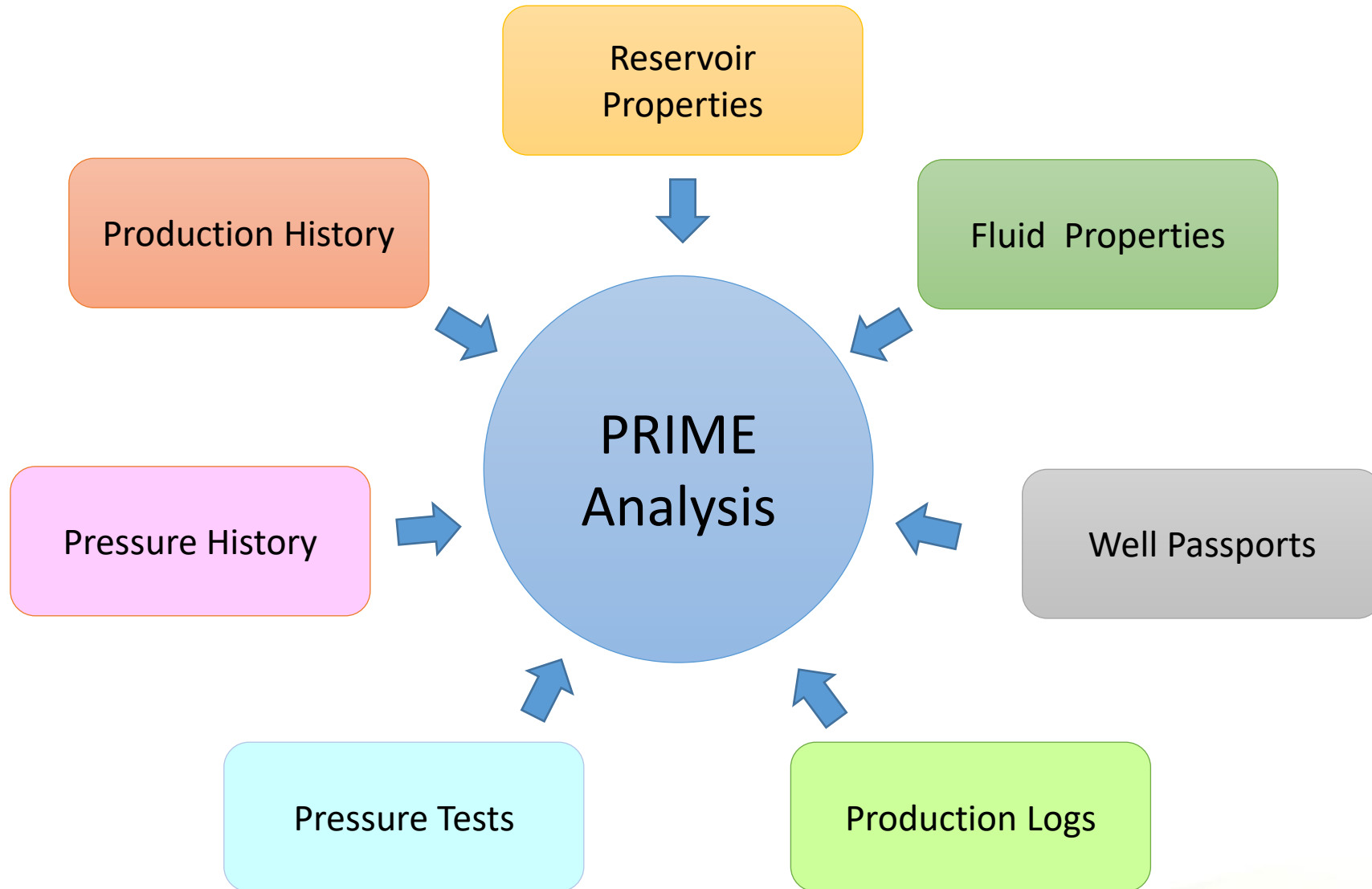
GOALS

- Assess initial and current state of reserves
- Suggest production enhancement opportunities

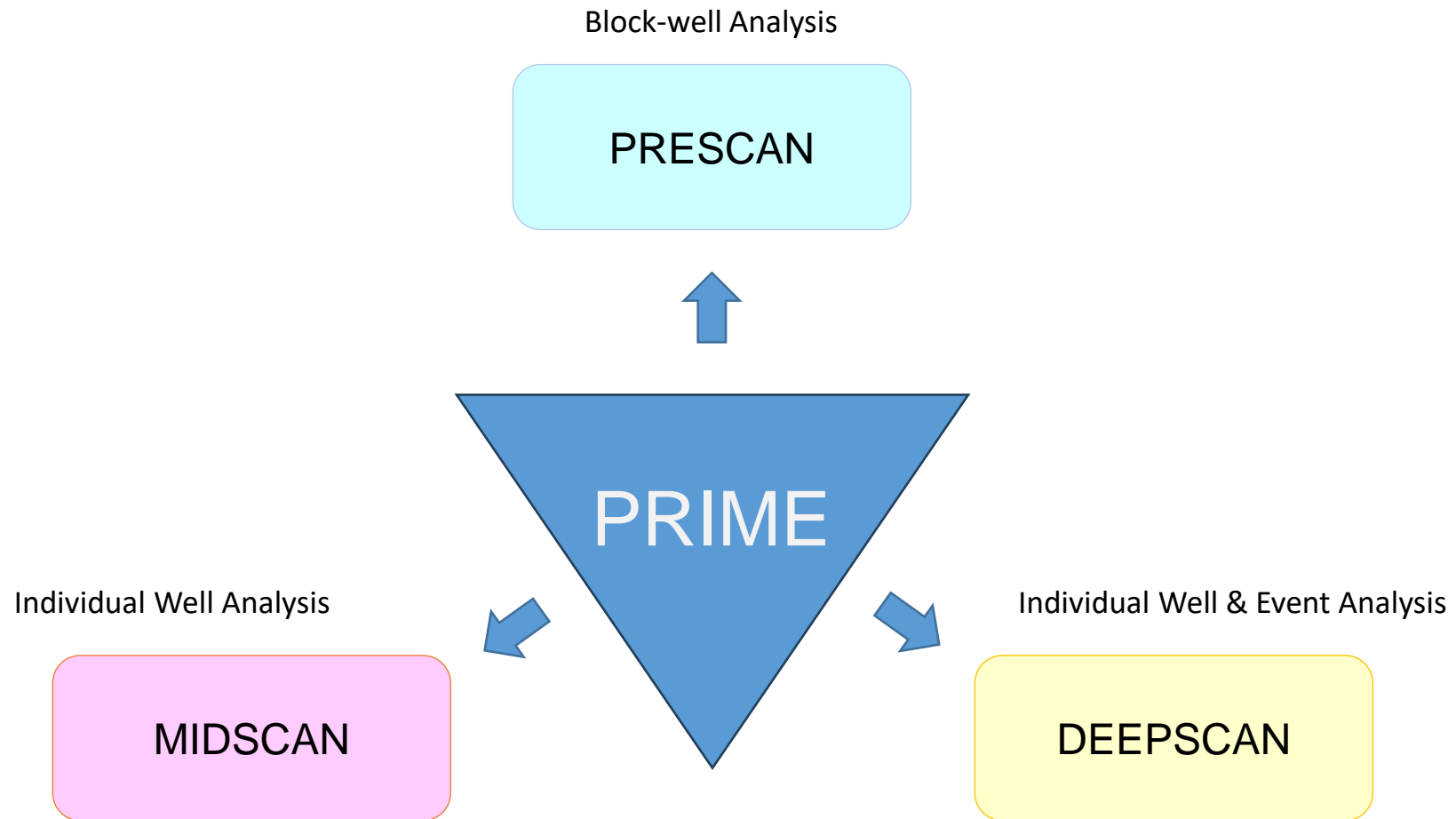
OBJECTIVES

- Assess initial in-situ reserves and estimated ultimate recovery
- Assess current in-situ and estimated remaining recovery
- Assess reserves energy
- Check for the thief water production/injection
- Assess well productivities/injectivities against expectation from reservoir data logs
- Assess waterflood efficiency against expectation





VARIOUS DEPTHS OF ANALYSIS

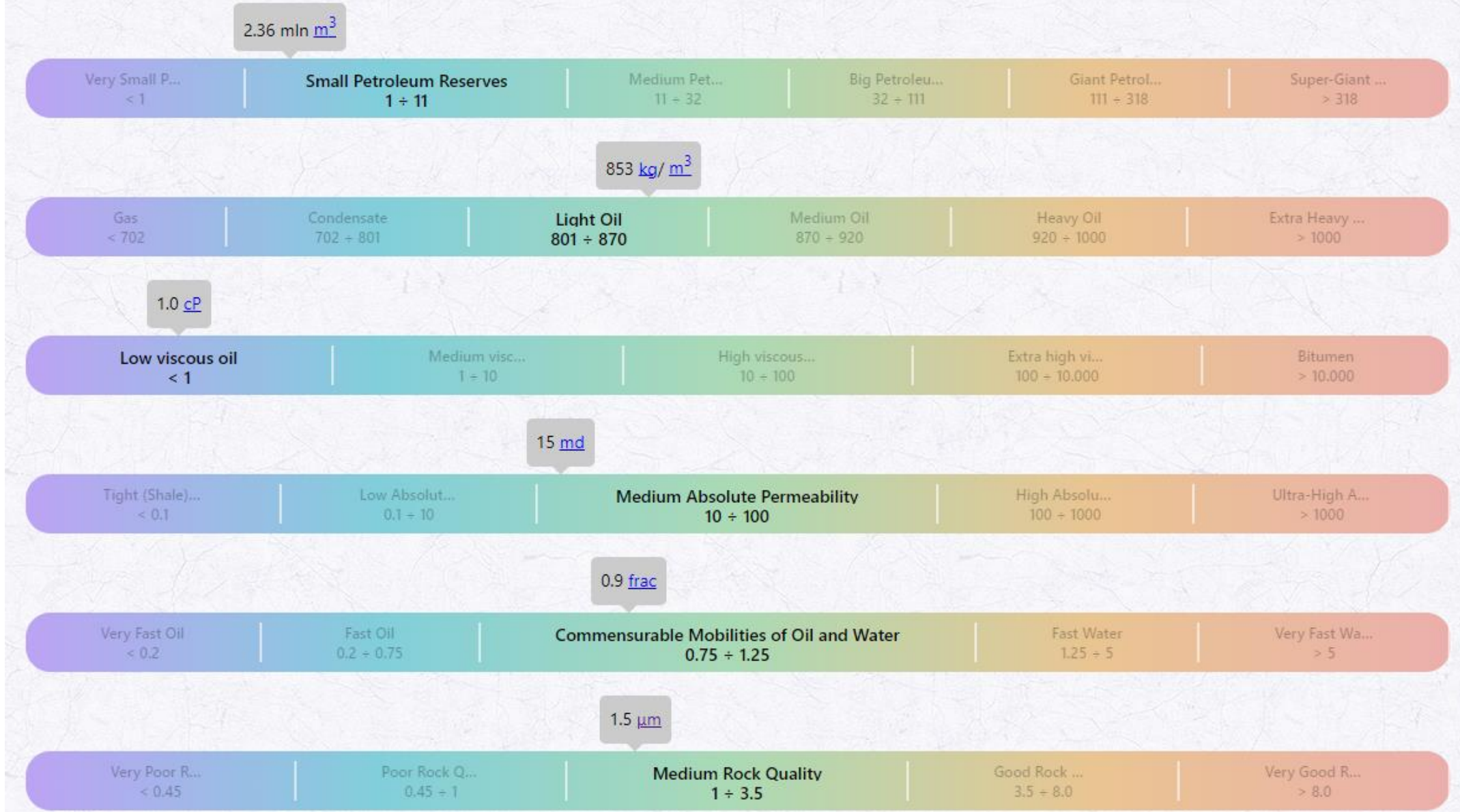




PRESCAN



Undersaturated Medium Gas Oil Reservoir





Production enhancement

Table 1.1.1 — Production enhancement - My_Field

#	Activity	Recommendations
Infill drilling		
1	Production infilling	<ul style="list-style-type: none"> Production infill drilling potential is 2 wells (current remaining drainable oil reserves per well from historical data 85.7 th. m³). ▾
Reservoir workover		
1	Water shut-off	<ul style="list-style-type: none"> WSO recommended in wells OP-1, OP-3 and OP-4. In additional a reservoir-oriented PLT can be conducted before the WSO to indicate cross-flows. ▾
2	Conversions	
	- prod → injection	<ul style="list-style-type: none"> It is recommended to converse the Well OP-12 from production to injection. It can rise formation pressure in area from 190 to 215 bars and help to get 45 m3/d of extra oil from neighbour producers. ▾



Table 1.2.1 — Asset Diagnostics - My_Field

Diagnostic types ▾

1 Oil Depletion (MDP)

- According to MDP (EUORF = 33%), current oil depletion is average high (70%). ▾
- The asset holds 716.4 th. m³ of remaining oil reserves with total worth of -7,060 M\$ (@ -1,567 \$/stb). ▾
- The average remaining oil reserves per well is 89.5 th. m³ worth -882 M\$ (@ -1,567 \$/stb). ▾
- RPR of remaining oil reserves is 15 years. It corresponds medium rate of oil depletion. ▾

2 Drainable Oil Reserves

- According to Pe Log Decline model, the asset holds 466.4 th. m³ of remaining drainable oil reserves with total worth of -4,596 M\$ (@ -1,567 \$/stb), which indicates that more than half (65 %) of expected remaining recoverables are currently drained. ▾
- The average remaining drainable oil reserves per well is 58.3 th. m³ worth -575 M\$ (@ -1,567 \$/stb). ▾
- RPR of remaining drainable oil reserves is 17 years. It corresponds low rate of oil depletion. ▾

3 Non-drainable Oil Reserves

- There are 250.0 th. m³ non-drainable oil reserves in the asset with total worth of -2,463 M\$ (@ -1,567 \$/stb). ▾
- Production infill drilling potential is 2 wells (current remaining drainable oil reserves per well from historical data 85.7 th. m³). ▾

4 Profitable Oil Reserves

- According to Pe Log Decline model, the asset holds 368.4 th. m³ of remaining profitable oil reserves with total worth of -3,630 M\$ (@ -1,567 \$/stb), which indicates that most (79 %) of expected remaining recoverables will be economically recovered. ▾
- The average remaining profitable oil reserves per well is 46.0 th. m³ worth -454 M\$ (@ -1,567 \$/stb). ▾
- RPR of remaining profitable oil reserves is 13 years. It corresponds medium rate of oil depletion. ▾

5 Non-profitable Oil Reserves

- There are 98.1 th. m³ non-profitable drainable oil reserves in the asset with total worth of -966,279 M\$ (@ -1,567 \$/stb). ▾

6 Reserves Energy

- The current field-average formation pressure is 141 atm which is 51% of initial formation pressure (277 atm). ▾
- The current field average formation pressure is higher than bubble point pressure (119 atm). ▾
- The current field-average injector formation pressure is 152 atm which is 55% of initial formation pressure (277 atm). ▾
- According to IPR models, increasing field-average formation pressure from 129 atm (@06.2021 — 09.2021) to 161 atm (@05.2018 — 07.2018) will cause per-well oil rate from 8.7 m³/d to 17.3 m³/d. ▾

7 Water Production Profile

- According to MatBal model there is cumulatively 1.76 mln. m³ thief water production in the asset, which is 67% of asset cumulative water production. ▾
- Suspect of non-uniform waterflood . Justification: old-wells historical YΣY plot shows that current watercut is lower than expectation from the slowest watercut growth scenario (DWD). ▾

8 Injection Performance

- There is suspect of thief water injection in the asset. Justification: formation pressure drop against the high cumulative voidage replacement. ▾
- According to MatBal model there is cumulatively 1.87 mln. m³ water injection losses in the asset, which is 71% of asset cumulative water injection. ▾
- ▾

9 Productivity Index

- The ratio of actual oil productivity to expected is 3.07. Justification: Oil Productivity Index Plot. ▾
- The ratio of actual oil productivity to expected is 3.85. Justification: Oil Productivity Index Plot. ▾
- The ratio of actual water productivity to expected is 4.4. Justification: Water Productivity Index Plot. ▾

PRESCAN – RESERVES DIAGNOSTICS

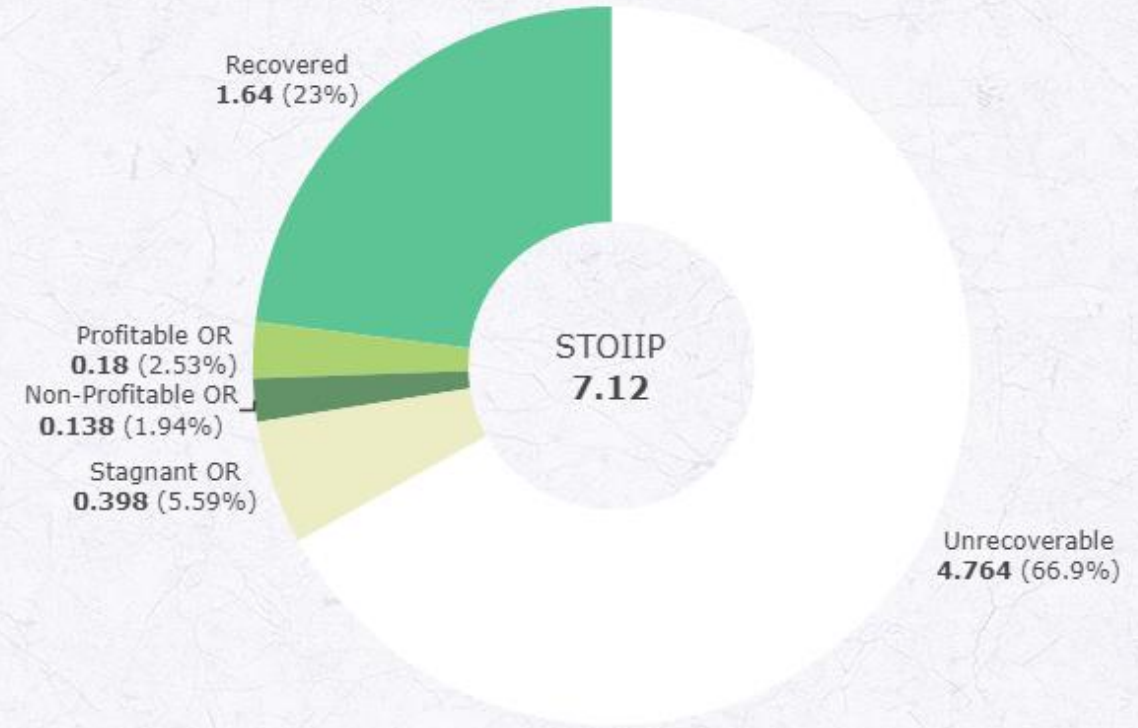
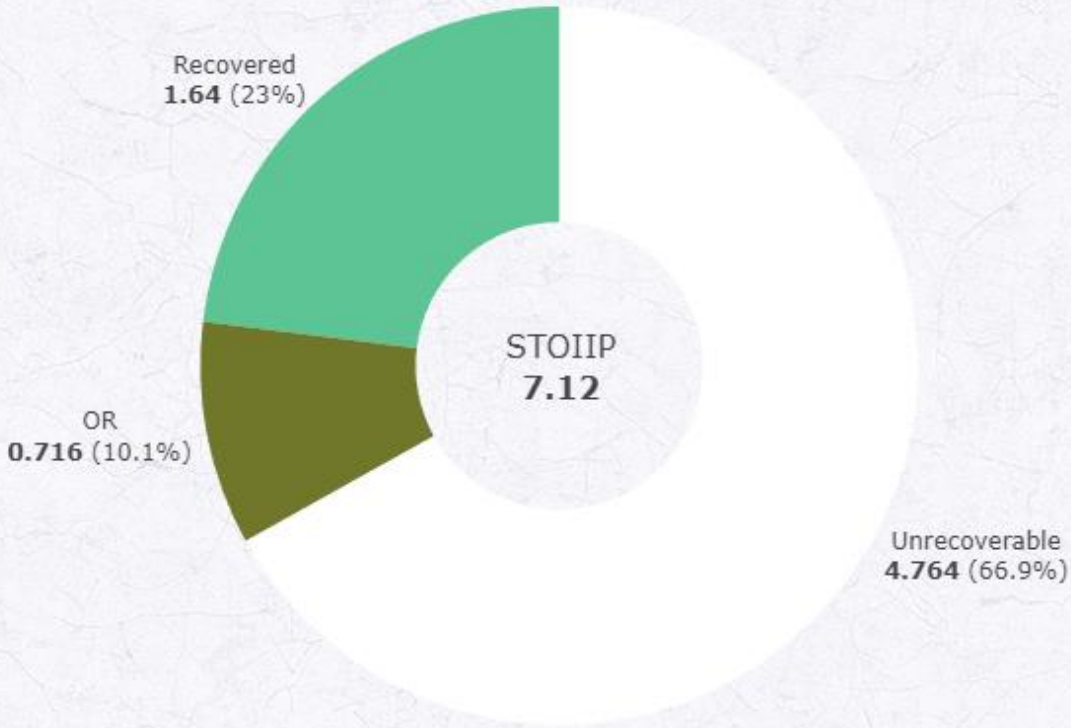




Reserves Breakdown, mln. m³

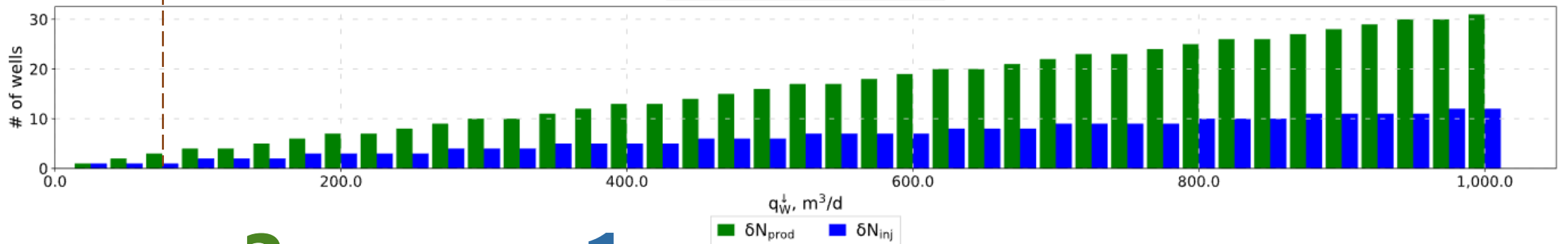
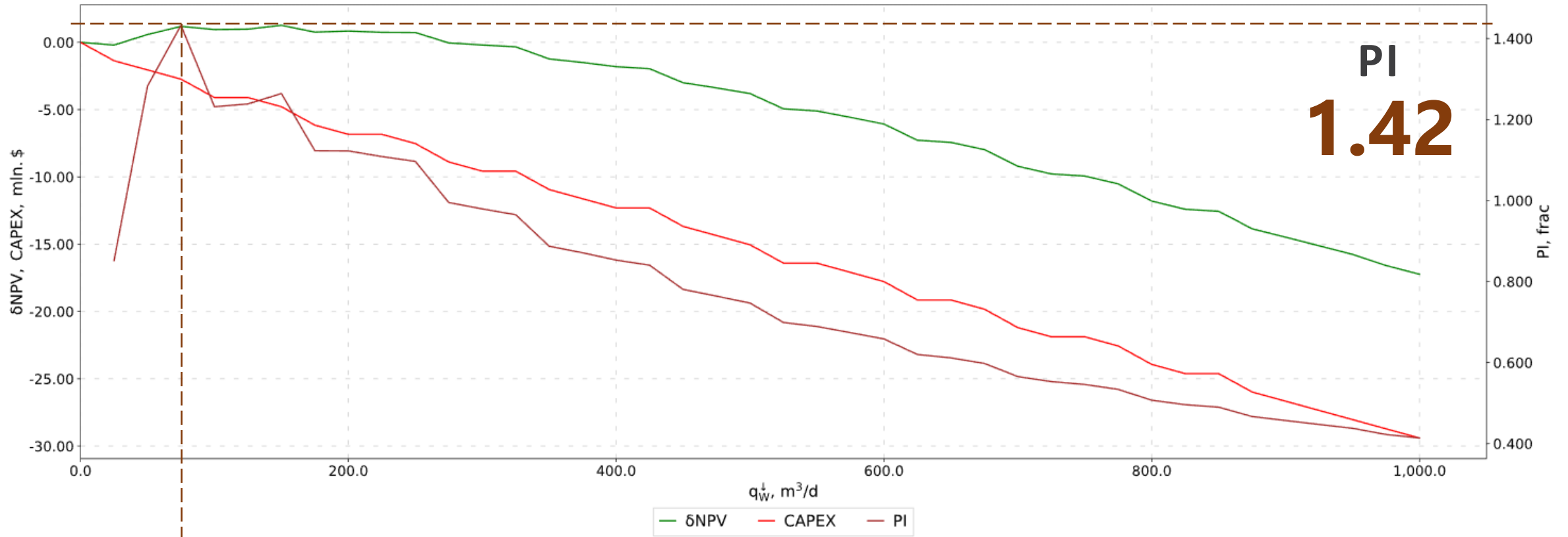
FDP

Forecast



Unrecoverable
 Recovered
 OR
 Profitable OR
 Non-Profitable OR
 Stagnant OR

PRESCAN – BALANCED WATERFLOOD ECONOMICS

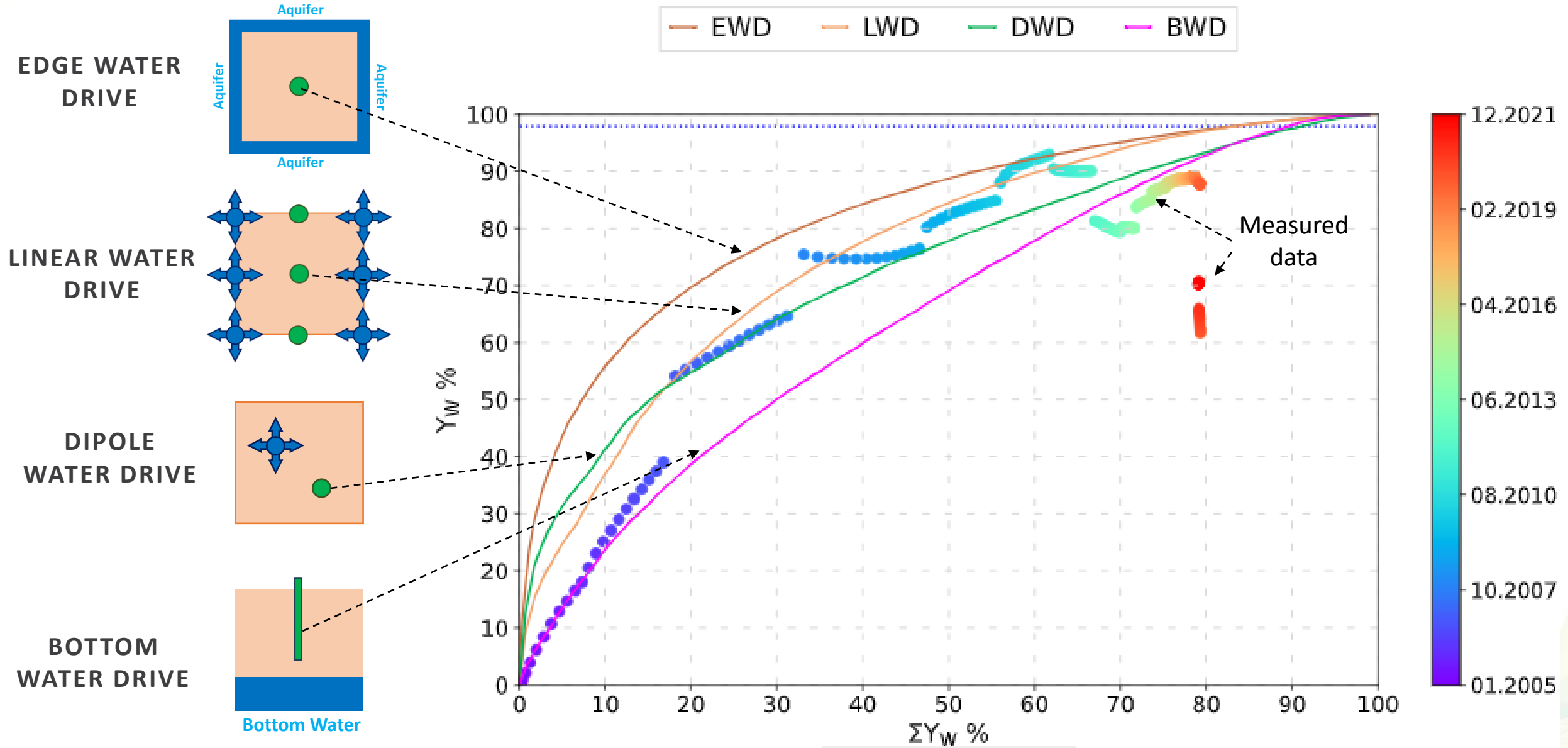


PRODUCERS: **3**

INJECTORS: **1**



PRESCAN – ADVANCED WATERCUT DIAGNOSTICS

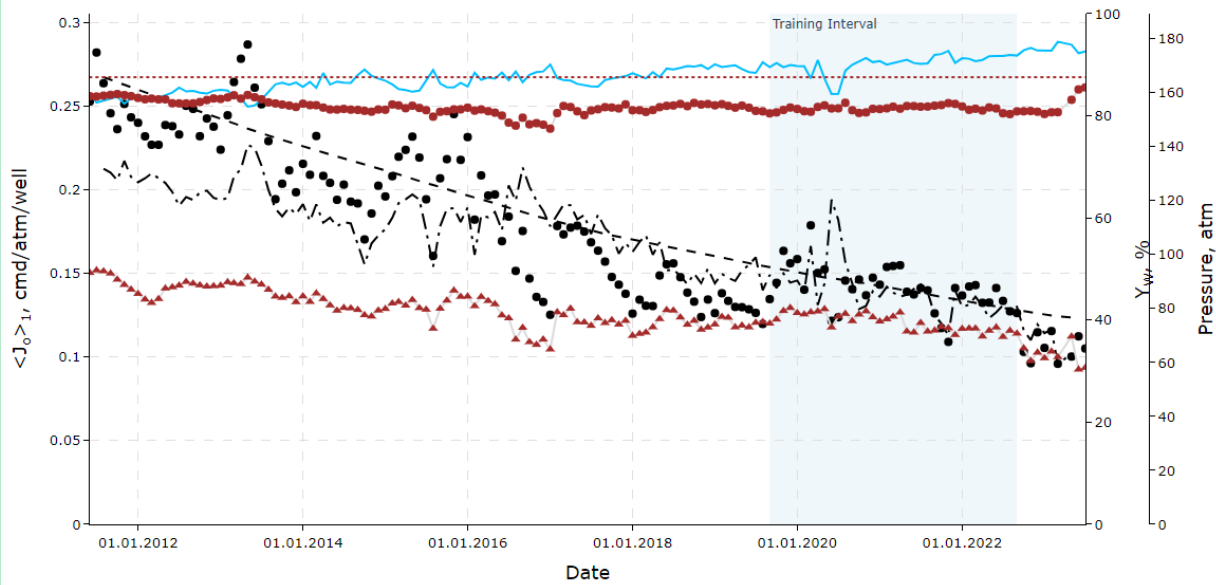


PRESCAN – PRODUCTIVITY DIAGNOSTICS



OIL PI

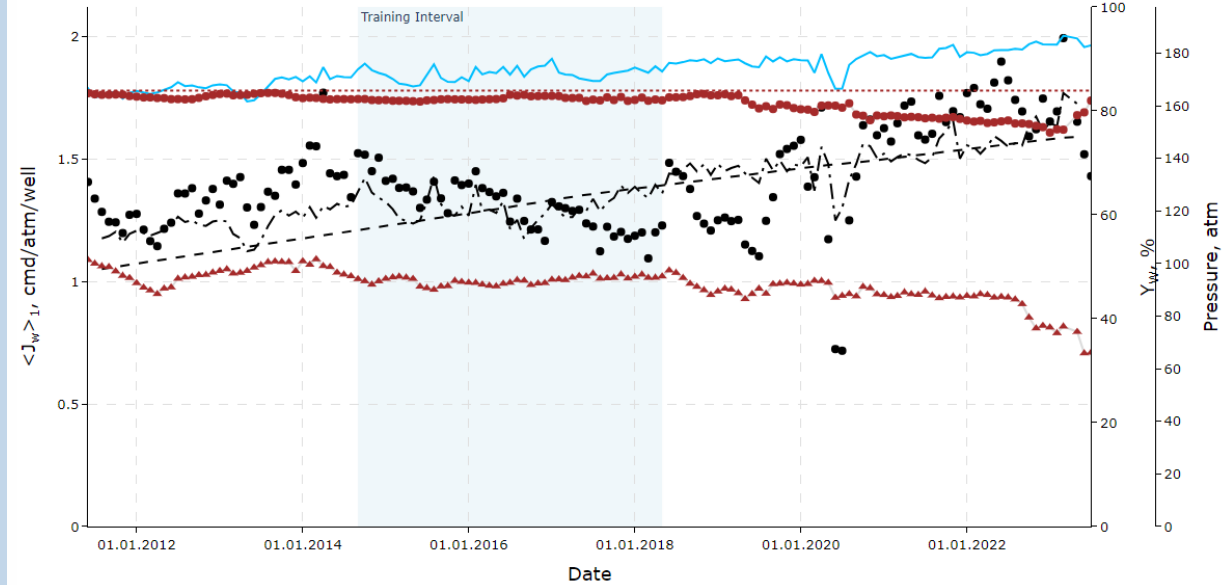
$J_{DFO_o} = 1.53, S^{DFO} = -1.36, J_{Y_o} = 1.28, S^{Y_o} = 0.11$



— $\langle J_o, trend \rangle_1^{old}$ — $\langle J_o, trend \rangle_1^{young}$ * $\langle J_o \rangle_1^{young}$ ● $\langle J_o \rangle_1^{old}$ - - $\langle J_o, DFO \text{ model} \rangle_1$
 - · - $\langle J_o, Y_w \text{ model} \rangle_1$ — Y_w^{old} ● Y_w^{young} ● $\langle J_o \rangle_1^{old}$ - - $\langle J_o, DFO \text{ model} \rangle_1$
 ● $\langle P_e^{\dagger} \rangle^{old}$ ● $\langle P_e^{\dagger} \rangle^{young}$ ● P_i ● $\langle P_{wf}^{\dagger} \rangle^{old}$ ● $\langle P_{wf}^{\dagger} \rangle^{young}$

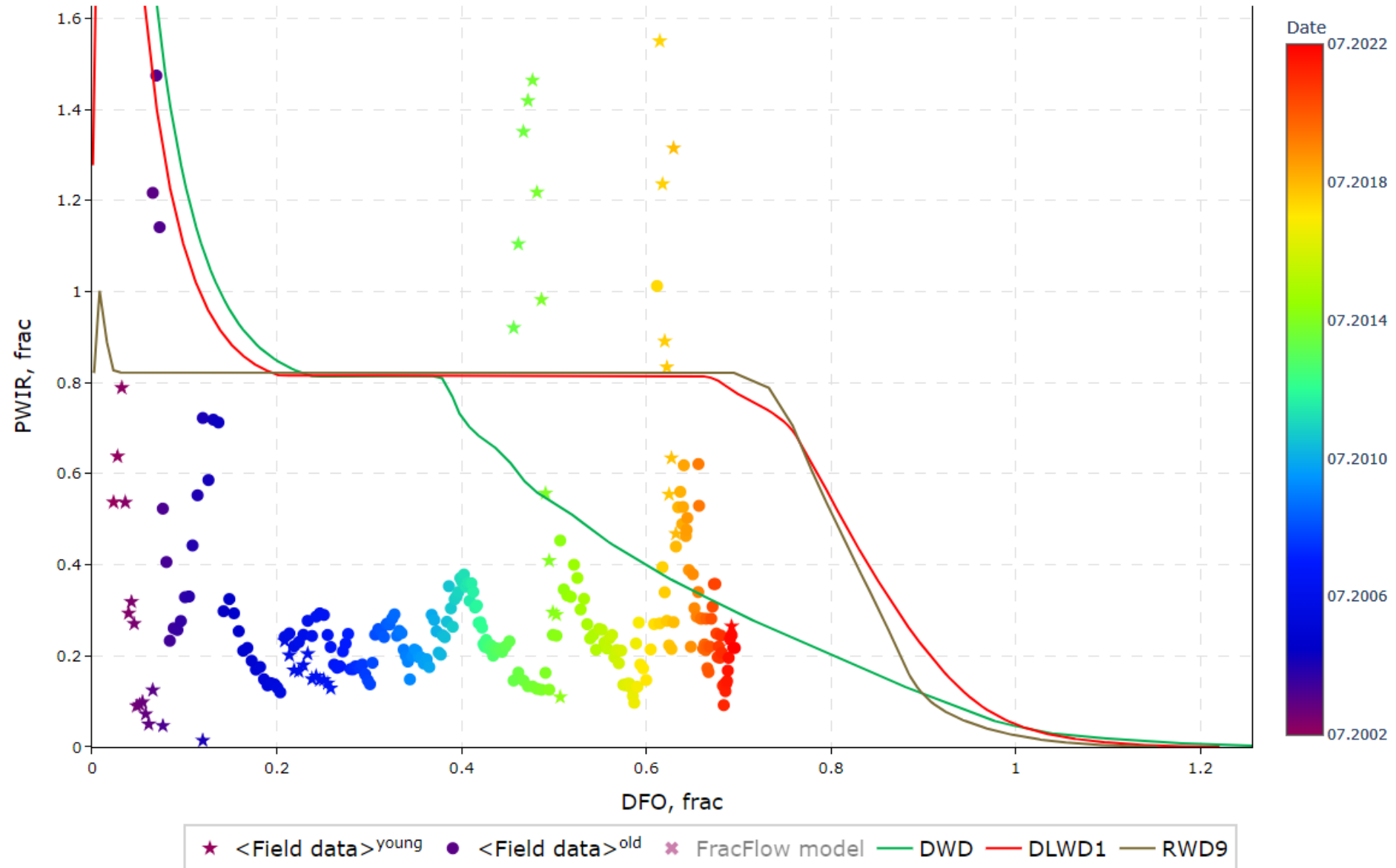
WATER PI

$J_{DFO_w} = 3.11, S^{DFO} = -0.92, J_{Y_w} = 3.35, S^{Y_w} = -1.50, J_{OH_w} = 2.79, S^{REF} = 0.00$



— $\langle J_w, trend \rangle_1^{old}$ — $\langle J_w, trend \rangle_1^{young}$ * $\langle J_w \rangle_1^{young}$ ● $\langle J_w \rangle_1^{old}$ - - $\langle J_w, DFO \text{ model} \rangle_1$
 - · - $\langle J_w, Y_w \text{ model} \rangle_1$ — Y_w^{old} ● Y_w^{young} ● $\langle J_w \rangle_1^{old}$ - - $\langle J_w, DFO \text{ model} \rangle_1$
 ● $\langle P_e^{\dagger} \rangle^{old}$ ● $\langle P_e^{\dagger} \rangle^{young}$ ● P_i ● $\langle P_{wf}^{\dagger} \rangle^{old}$ ● $\langle P_{wf}^{\dagger} \rangle^{young}$

PRESCAN – WATERFLOOD EFFICIENCY





MIDSCAN

MIDSCAN – WELL-BY-WELL DIAGNOSTICS & RECOMMENDATIONS



PRODUCERS

1. Diagnostics and Recommendations > 1.4. Producers Diagnostics >

#	Well ID	Status	Formation Units	Diagnostics Summary	Recommendations	
					Redevelopments	Surveys
1	OP-1	↑ @01.2022	B C	① Overdepletion (01.11.2021) ② Suspect of thief water profuction (01.11.2021)	Water shut-off is recommended	Advanced reservoir-oriented PLT
2	OP-2	↑ @01.2022	B C	① Overdepletion (01.09.2010) ② Suspect of non-uniform depletion (01.09.2010)		
3	OP-3	↑ @01.2022	B C	① Low Oil Depletion (01.01.2022) ② Suspect of thief water production (01.01.2022)	Water shut-off is recommended	Advanced reservoir-oriented PLT
4	OP-4	↑ @01.2022	B C	① Overdepletion (01.05.2021) ② Suspect of thief water production (01.05.2021)		

INJECTORS

1. Diagnostics and Recommendations > 1.5. Injectors Diagnostics >

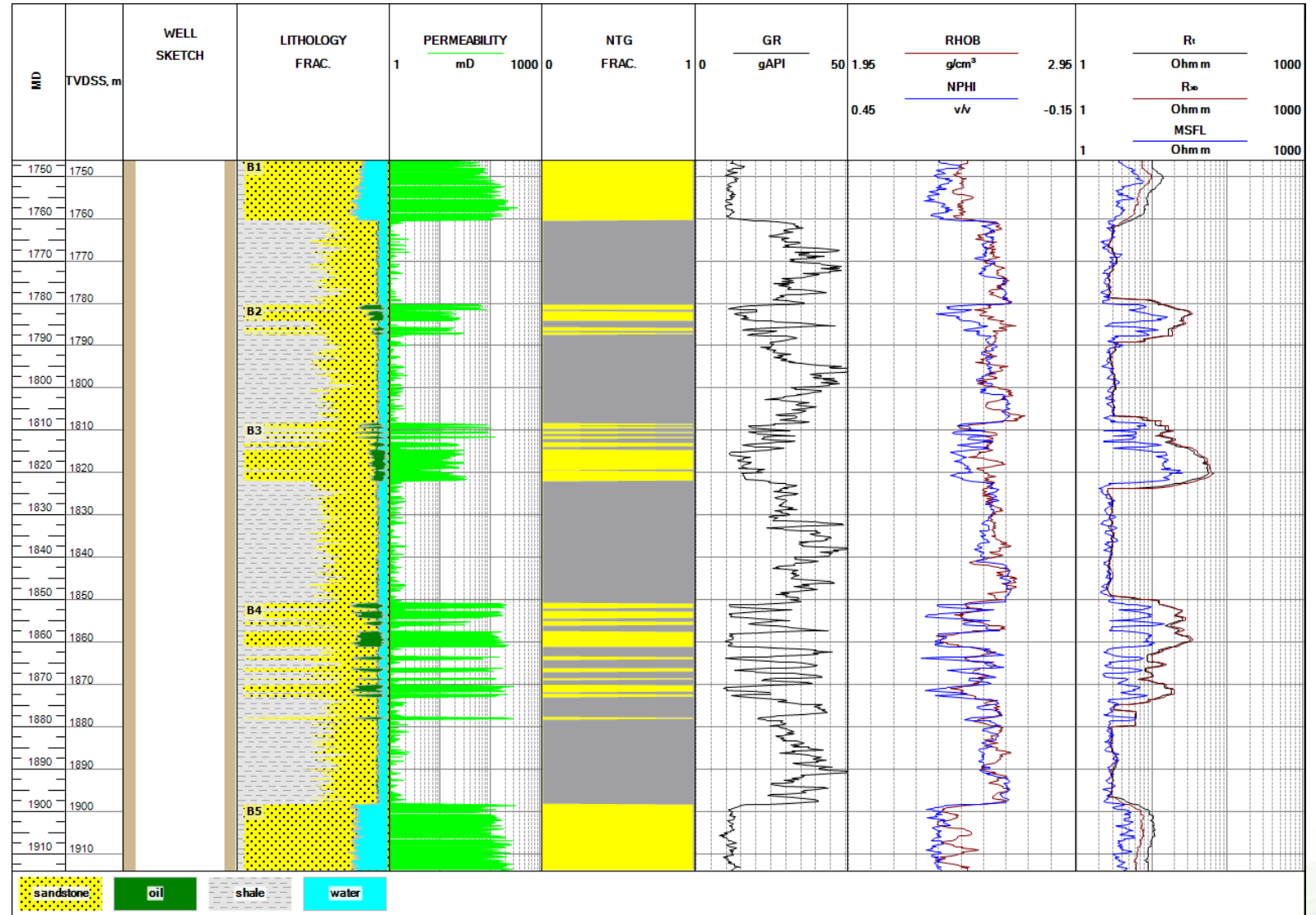
#	Well ID	Status	Formation Units	Diagnostics Summary	Recommendations	
					Redevelopments	Surveys
1	WI-13	↓ @01.2022	B C	① Suspect to thief water injection (01.04.2013)	Water shut-off is recommended.	Advanced reservoir-oriented PLT.
2	WI-14	↓ @01.2022	B C	① Suspect to thief water injection (01.03.2020) ② Low pressure maintenance in area (01.03.2020)	Water shut-off is recommended.	Advanced reservoir-oriented PLT.
3	WI-21	↓ @01.2022	B C	① Poor connection between well and reservoir (01.03.2020)	It is recommended to stimulate (acidising).	

MIDSCAN – WELL PASSPORTS – RESERVOIR DATA LOGS



- ▼ 5. Well Passports
- ▶ 5.1. OP-1 ↑
 - ▶ 5.2. OP-2 ↑
 - ▶ 5.3. OP-3 ↑
 - ▶ 5.4. OP-4 ↑
 - ▶ 5.5. OP-5 ↑
 - ▶ 5.6. OP-6 ↑
 - ▶ 5.7. OP-7 ↑
 - ▶ 5.8. OP-8 ↑
 - ▶ 5.9. OP-9 ↑
 - ▶ 5.10. OP-10 ↑
 - ▶ 5.11. OP-11 ↑
 - ▶ 5.12. OP-12 ↑
 - ▶ 5.13. OP-13 ↑→↓
 - ▶ 5.14. OP-14 ↑→↓
 - ▶ 5.15. OP-15 ↑

RESERVOIR DATA LOGS



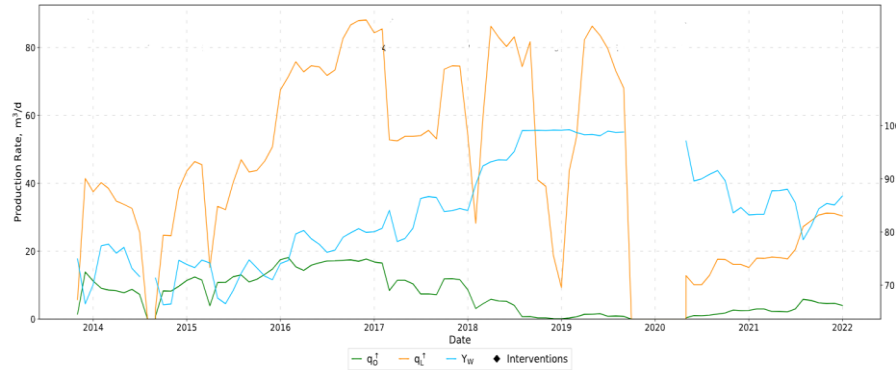
MIDSCAN – AUTOGENERATED WELL PASSPORTS



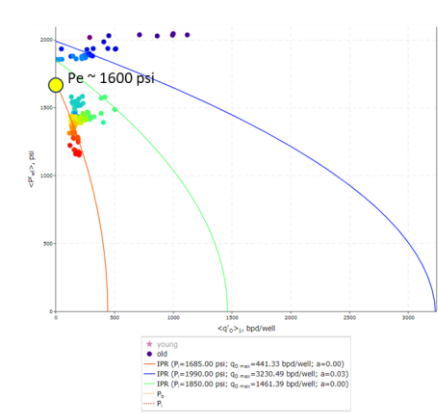
5. Well Passports

- ▶ 5.1. OP-1 ↑
- ▶ 5.2. OP-2 ↑
- ▶ 5.3. OP-3 ↑
- ▶ 5.4. OP-4 ↑
- ▶ 5.5. OP-5 ↑
- ▶ 5.6. OP-6 ↑
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- ▶ 5.8. OP-8 ↑
- ▶ 5.9. OP-9 ↑
- ▶ 5.10. OP-10 ↑
- ▶ 5.11. OP-11 ↑
- ▶ 5.12. OP-12 ↑
- ▶ 5.13. OP-13 ↑↔↓
- ▶ 5.14. OP-14 ↑↔↓
- ▶ 5.15. OP-15 ↑

PRODUCTION HISTORY

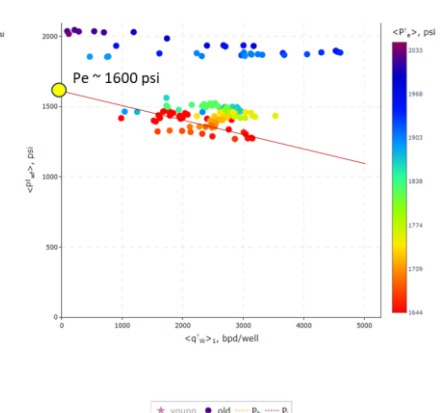


IPR for oil

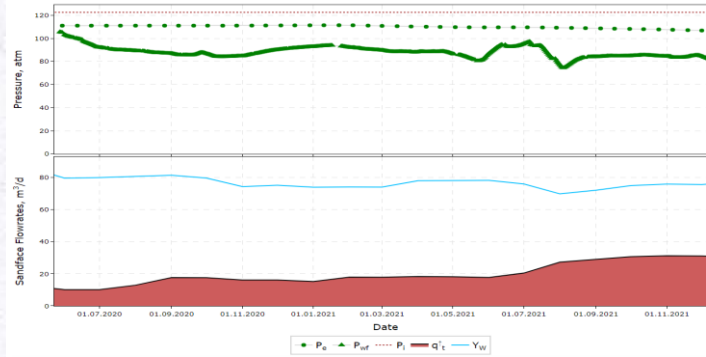


IPR

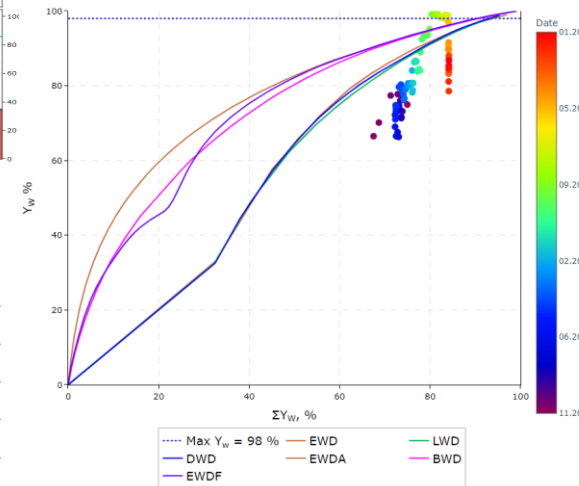
IPR for water



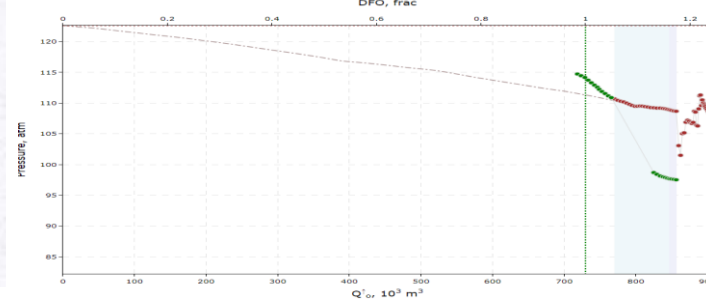
PRESSURE HISTORY



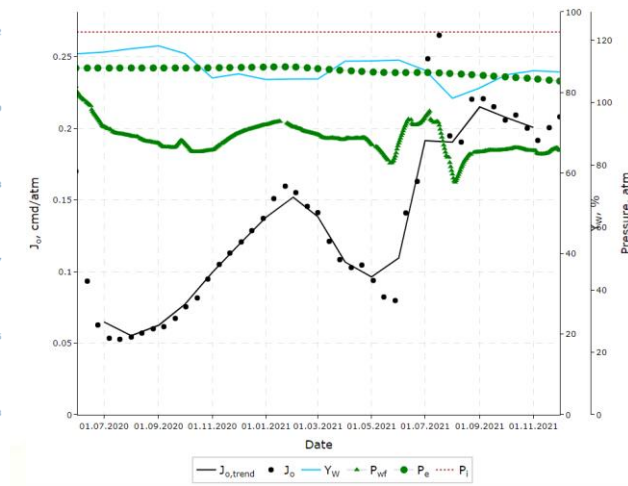
WATERCUT DIAGNOSTICS



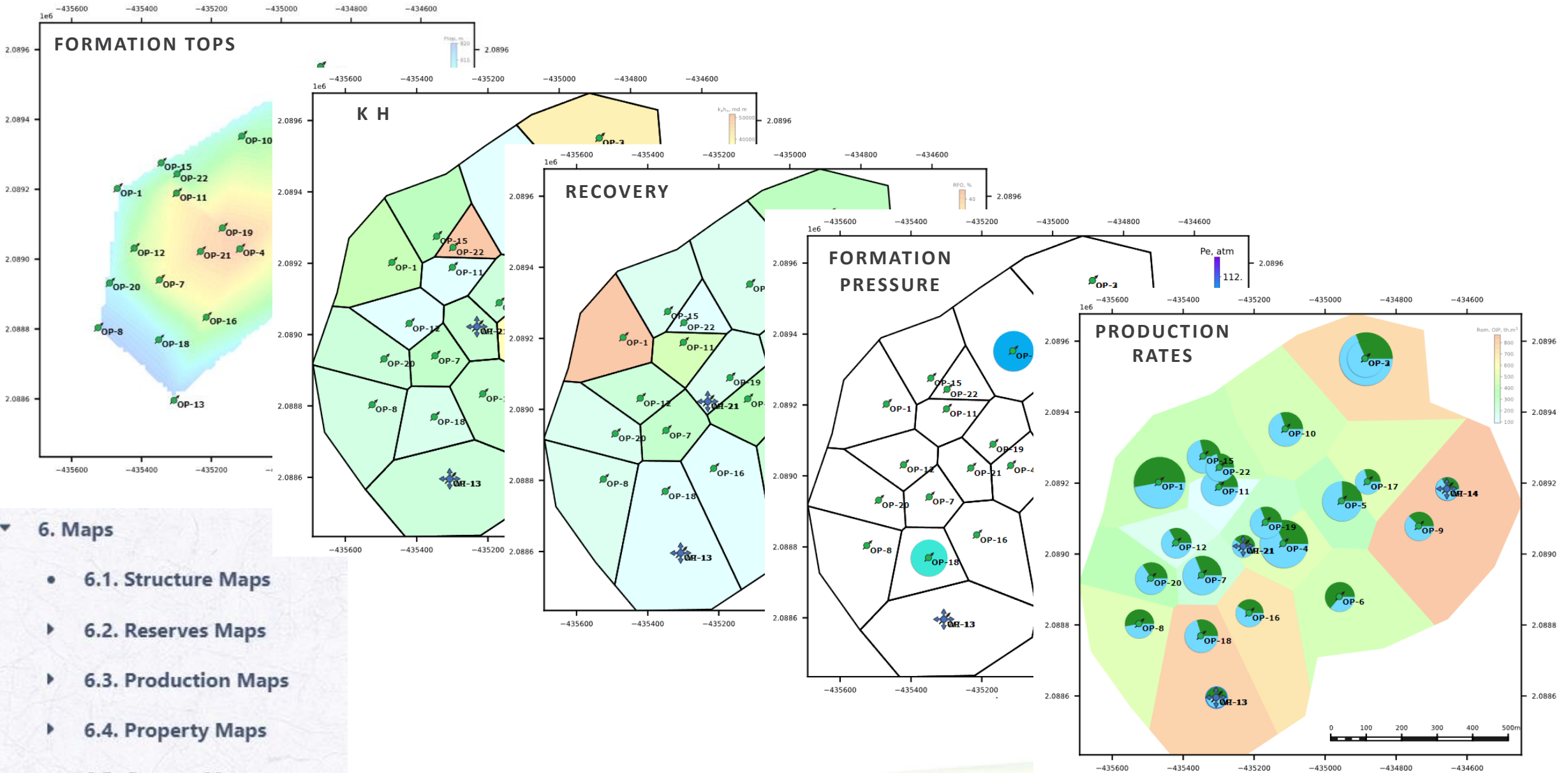
MATERIAL BALANCE



PRODUCTIVITY INDEX

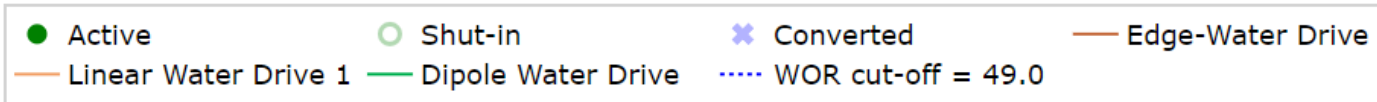
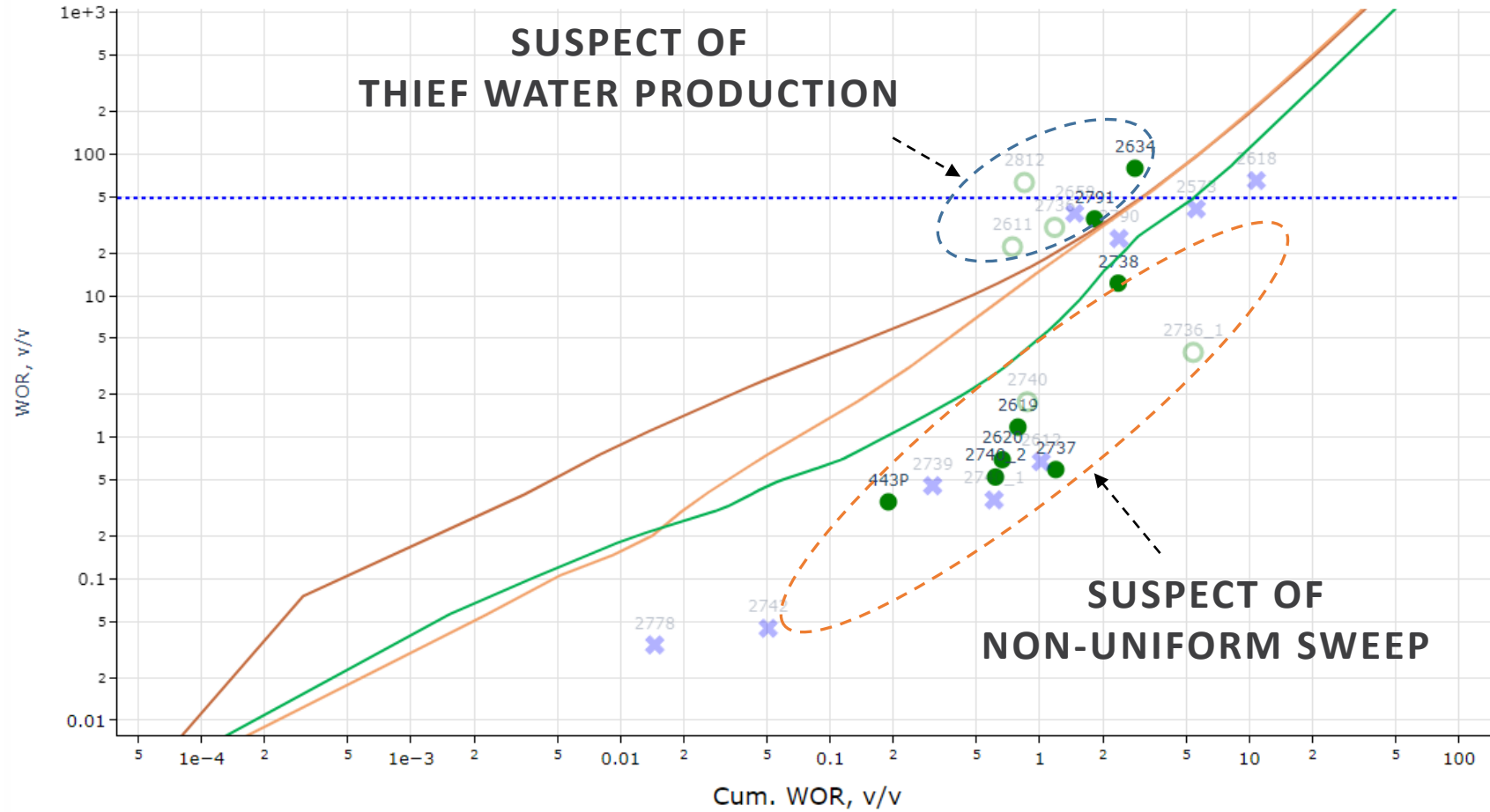


MIDSCAN – AUTOGENERATED MAPS



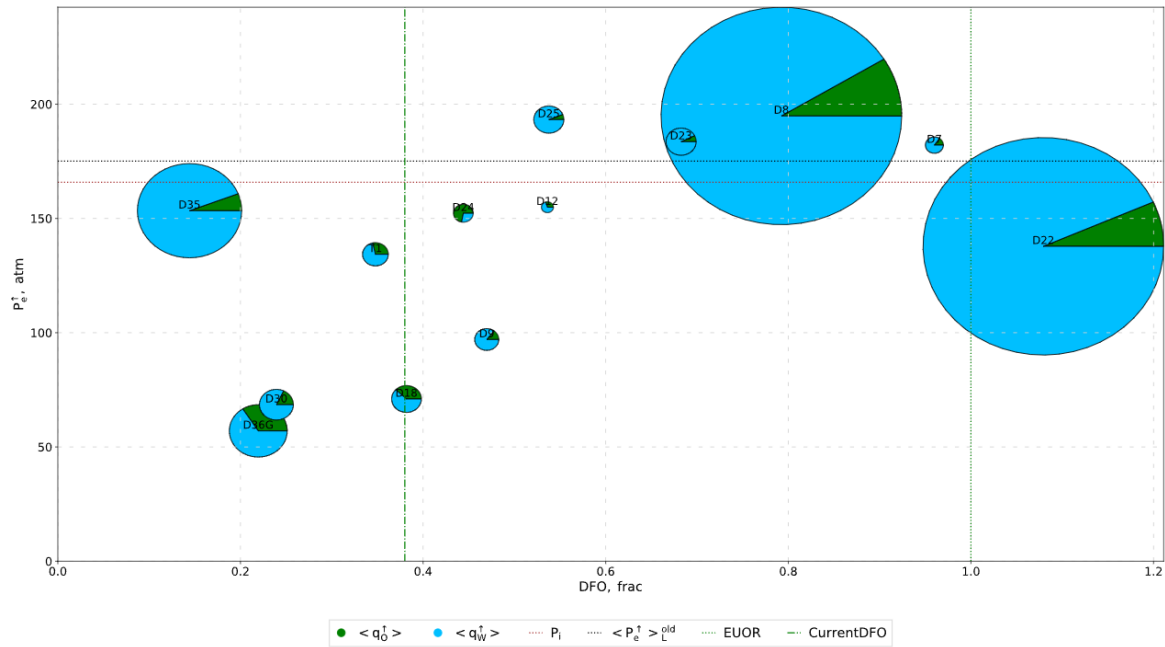
- 6. Maps
 - 6.1. Structure Maps
 - 6.2. Reserves Maps
 - 6.3. Production Maps
 - 6.4. Property Maps
 - 6.5. Custom Maps

MIDSCAN – ADVANCED WATERCUT DIAGNOSTICS

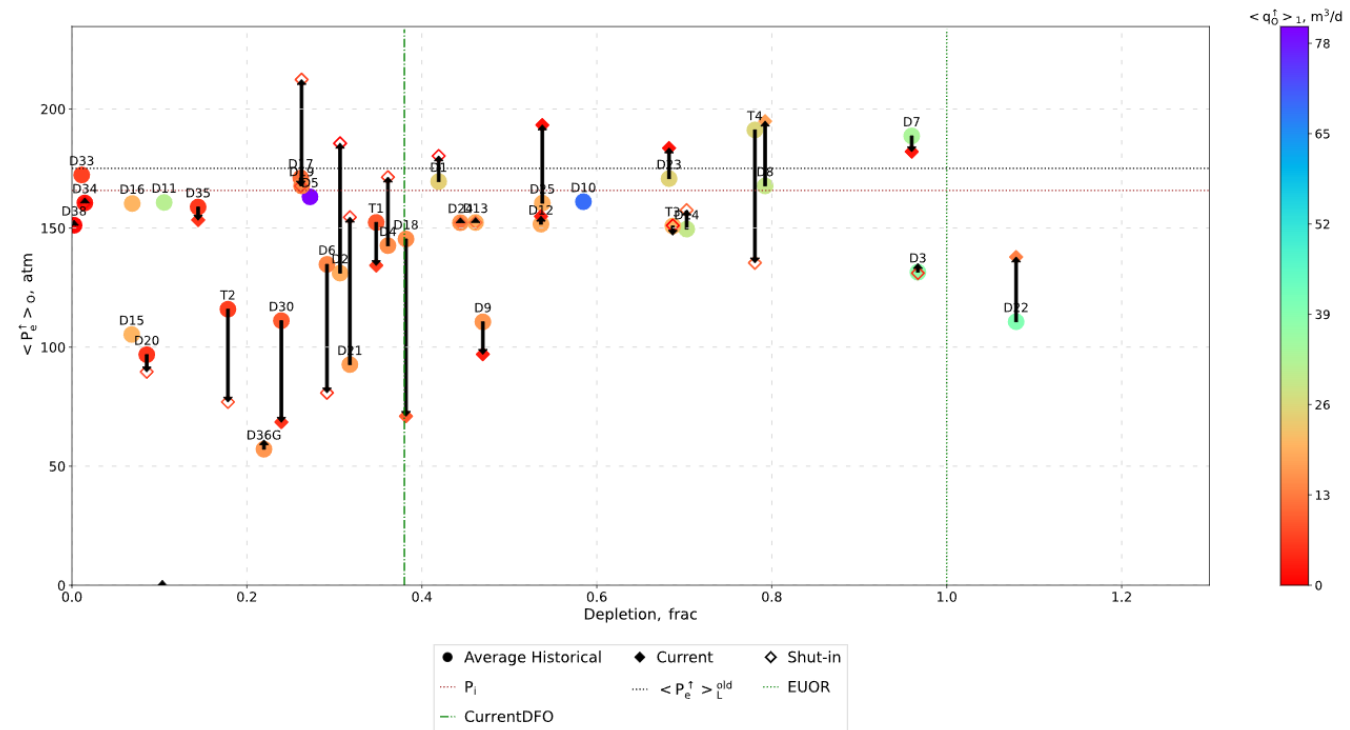




P_e vs DEPLETION with q_o, q_w rates



P_e dynamics with q_o rates





DEEPSCAN

DEEPSCAN – WELL PASSPORTS – WELL INTERVENTIONS



5. Well Passports

- ▶ 5.1. OP-1 ↑
- ▶ 5.2. OP-2 ↑
- ▶ 5.3. OP-3 ↑
- ▶ 5.4. OP-4 ↑
- ▶ 5.5. OP-5 ↑
- ▶ 5.6. OP-6 ↑
- ▶ 5.7. OP-7 ↑
- ▶ 5.8. OP-8 ↑
- ▶ 5.9. OP-9 ↑
- ▶ 5.10. OP-10 ↑
- ▶ 5.11. OP-11 ↑
- ▶ 5.12. OP-12 ↑
- ▶ 5.13. OP-13 ↑↔↓
- ▶ 5.14. OP-14 ↑↔↓
- ▶ 5.15. OP-15 ↑

PRODUCTION HISTORY



WELL INTERVENTIONS HISTORY

Interventions and Survey Tables ▲

Table 5.1.3.1 Well OP-1 Interventions ▼

#	Date	Interventions	Description
1	01.11.1984	Put on stream	OP-1 was completed in unit E .The initial production was 73 m3/d.
2	01.03.1993	Stimulating	Acid stimulation with 15% HCl and 13.5% HCl-3% HF using Coiled Tubing. No incremental gain was observed on the available production history curve
3	01.05.1994	Stimulating	Acid stimulation by bull heading 15% HCl and 12% HCl – 3% HF acids down the tubing. Production increased from 42 to 75 m3 gross with a water cut of approximately 32%. The incremental gain was short lived
4	01.02.1995	Repairing	Replaced downhole tubing pump

Table 5.1.3.2 Well OP-1 Invasive Interventions ▼

#	Date	Interventions	Description
1	01.11.1984	Put on stream	OP-1 was completed in unit E .The initial production was 73 m3/d.
2	01.03.1993	Stimulating	Acid stimulation with 15% HCl and 13.5% HCl-3% HF using Coiled Tubing. No incremental gain was observed on the available production history curve
3	01.05.1994	Stimulating	Acid stimulation by bull heading 15% HCl and 12% HCl – 3% HF acids down the tubing. Production increased from 42 to 75 m3 gross with a water cut of approximately 32%. The incremental gain was short lived
4	01.02.1995	Repairing	Replaced downhole tubing pump

Table 5.1.3.3 Well OP-1 Surveys ▼

#	Date	Surveys	Description
1	01.11.2016	Integrity	Found 4tbg joints having thread damage.
2	01.11.2016	PLT	Interval: 840.0-865.0, oil production rate is 3.5 m3/d, water production rate is 16.85 m3/d.
3	01.01.2017	PTA	Formation pressure is 115 atm.

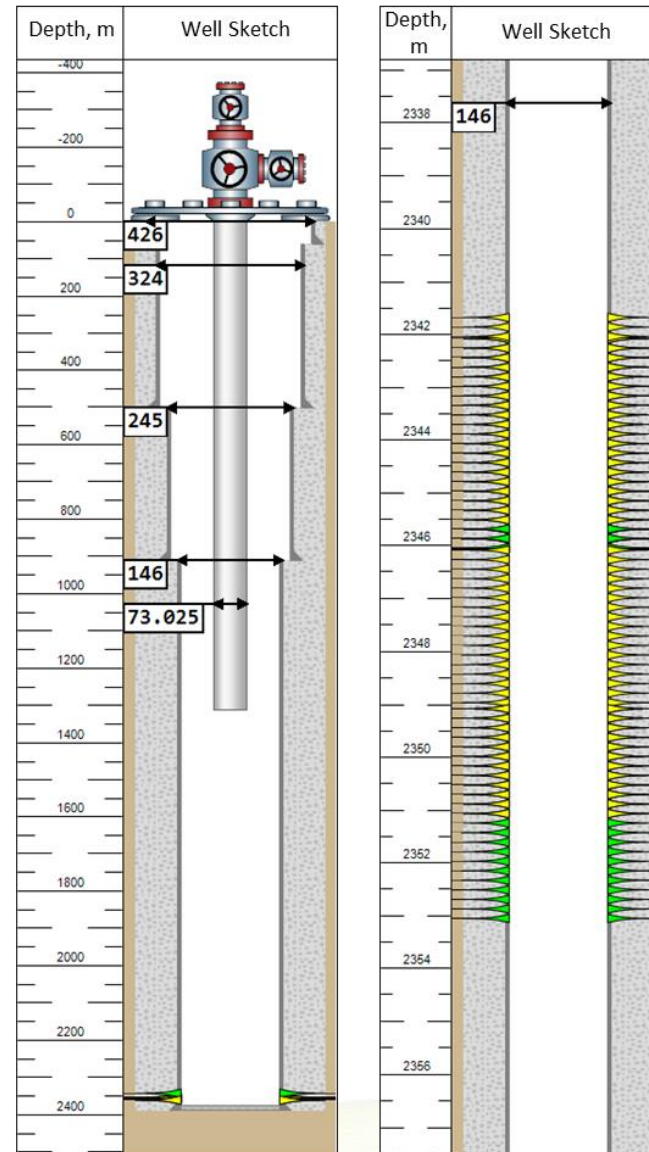
DEEPCAN – WELL PASSPORTS – COMPLETION



▼ 5. Well Passports

▶ 5.1. OP-1	↑
▶ 5.2. OP-2	↑
▶ 5.3. OP-3	↑
▶ 5.4. OP-4	↑
▶ 5.5. OP-5	↑
▶ 5.6. OP-6	↑
▶ 5.7. OP-7	↑
▶ 5.8. OP-8	↑
▶ 5.9. OP-9	↑
▶ 5.10. OP-10	↑
▶ 5.11. OP-11	↑
▶ 5.12. OP-12	↑
▶ 5.13. OP-13	↑→↓
▶ 5.14. OP-14	↑→↓
▶ 5.15. OP-15	↑

COMPLETION



DEEPCAN – WELL PASSPORTS – WELL TESTS



5. Well Passports

- ▶ 5.1. OP-1 ↑
- ▶ 5.2. OP-2 ↑
- ▶ 5.3. OP-3 ↑
- ▶ 5.4. OP-4 ↑
- ▶ 5.5. OP-5 ↑
- ▶ 5.6. OP-6 ↑
- ▶ 5.7. OP-7 ↑
- ▶ 5.8. OP-8 ↑
- ▶ 5.9. OP-9 ↑
- ▶ 5.10. OP-10 ↑
- ▶ 5.11. OP-11 ↑
- ▶ 5.12. OP-12 ↑
- ▶ 5.13. OP-13 ↑→↓
- ▶ 5.14. OP-14 ↑→↓
- ▶ 5.15. OP-15 ↑

Table 1 – Pressure Diffusion Model.

Date	01.04.2021
Wellbore Storage	Constant
Well Model	Vertical
Reservoir Model	Homogeneous
Boundary Model	Infinite
Boundary Type	-
Fluid Type	Water

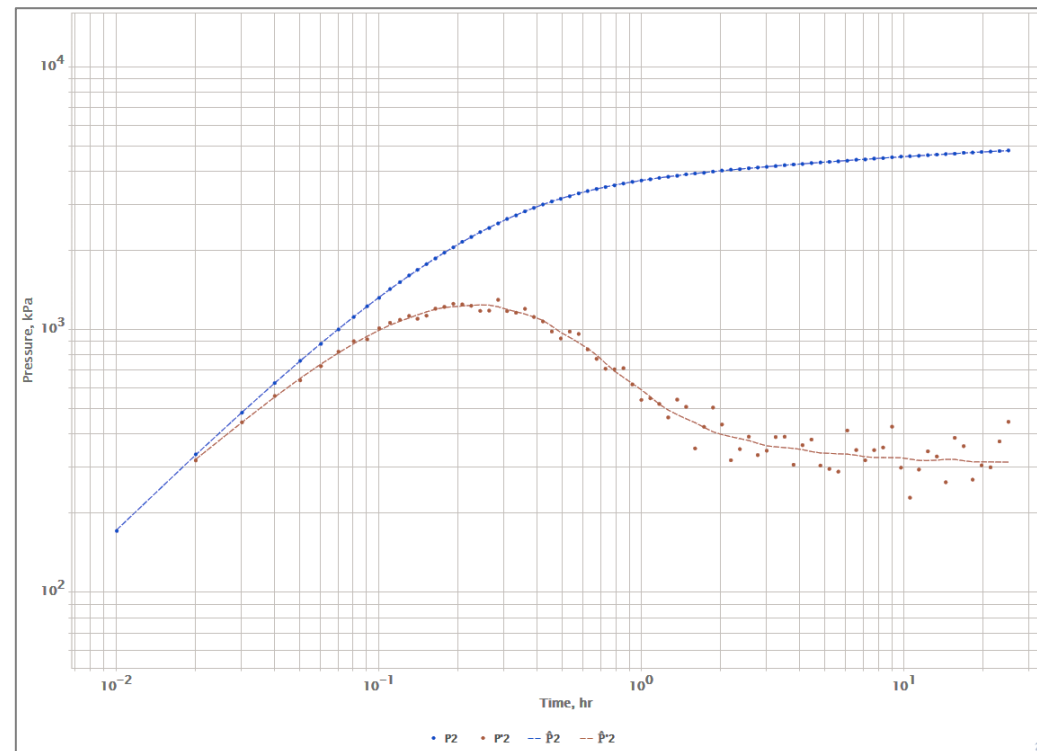
Table 2 – Input Data.

Property	Unit	Value
B_w	V / V	1
μ_w	cp	1
c_w	10^{-7} kPa $^{-1}$	4
c_{rock}	10^{-7} kPa $^{-1}$	4.35
ϕ	frac	0.1
h_{eff}	m	10

Table 3 – Output Data.

Property	Unit	Value
C_{wbs}	10^{-4} m 3 /kPa	2.31
S		0
$k \cdot h$	mD · m	330
P_e	kPa	34,470

PTA

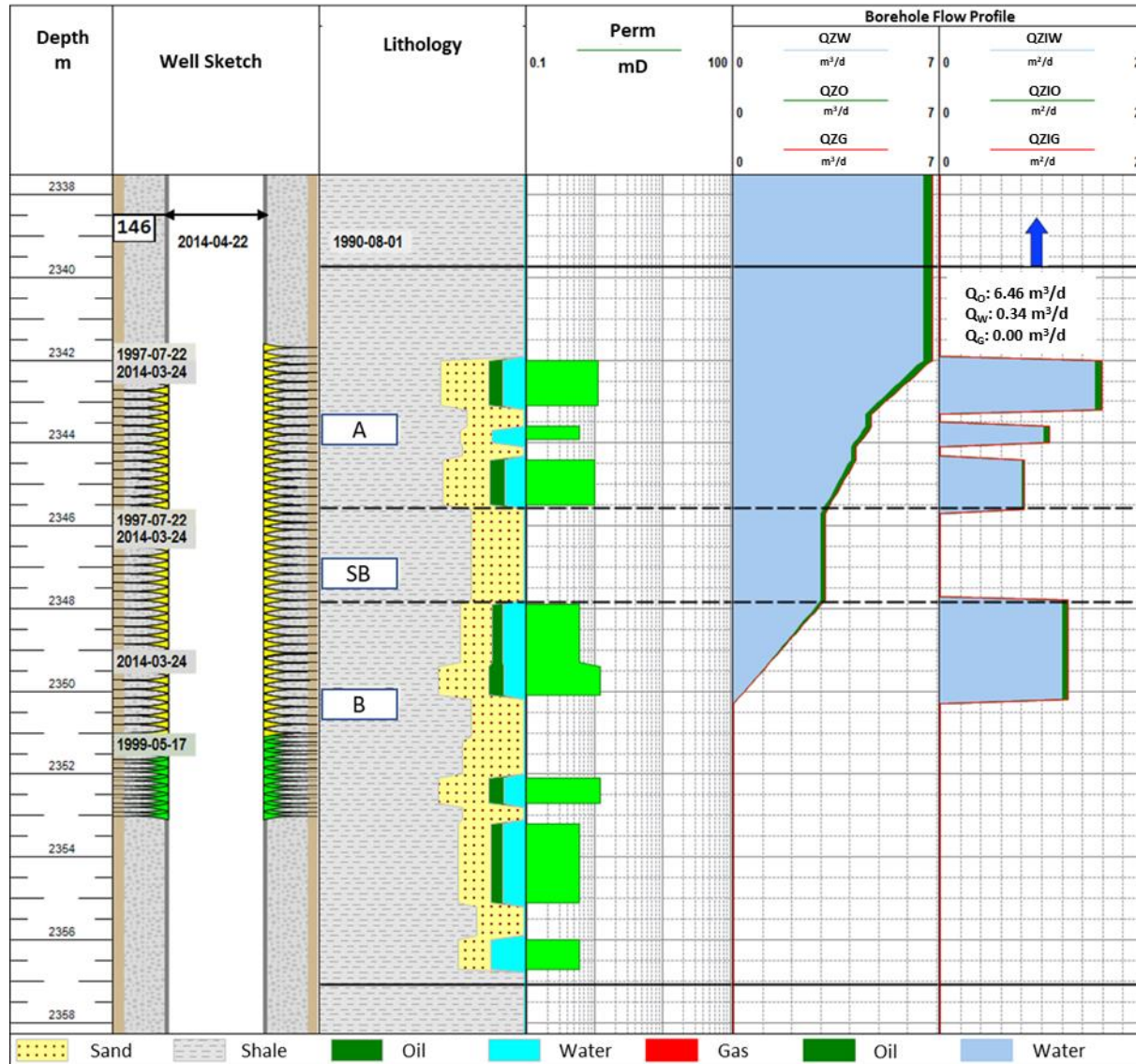


DEEPCAN – WELL PASSPORTS – PRODUCTION LOGS

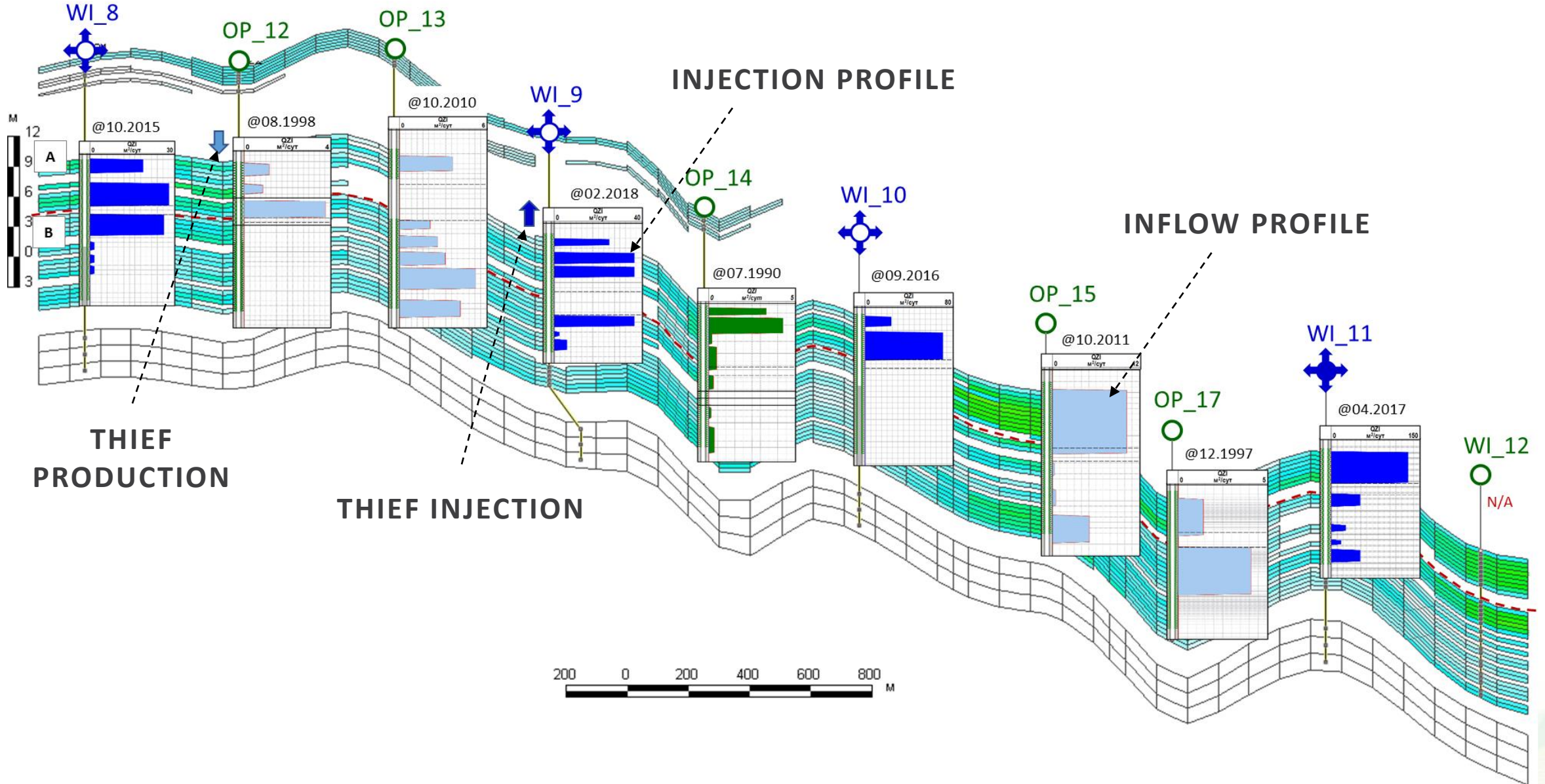


- ▼ 5. Well Passports
- ▶ 5.1. OP-1 ↑
 - ▶ 5.2. OP-2 ↑
 - ▶ 5.3. OP-3 ↑
 - ▶ 5.4. OP-4 ↑
 - ▶ 5.5. OP-5 ↑
 - ▶ 5.6. OP-6 ↑
 - ▶ 5.7. OP-7 ↑
 - ▶ 5.8. OP-8 ↑
 - ▶ 5.9. OP-9 ↑
 - ▶ 5.10. OP-10 ↑
 - ▶ 5.11. OP-11 ↑
 - ▶ 5.12. OP-12 ↑
 - ▶ 5.13. OP-13 ↑→↓
 - ▶ 5.14. OP-14 ↑→↓
 - ▶ 5.15. OP-15 ↑

PRODUCTION LOGS



DEEPSCAN – CROSS-SECTIONS – PLT vs RDL CORRELATION



DEEPCAN – REALLOCATION

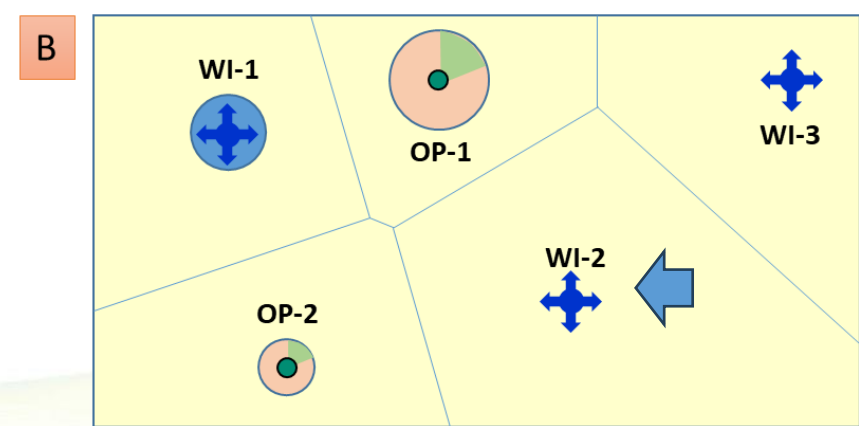
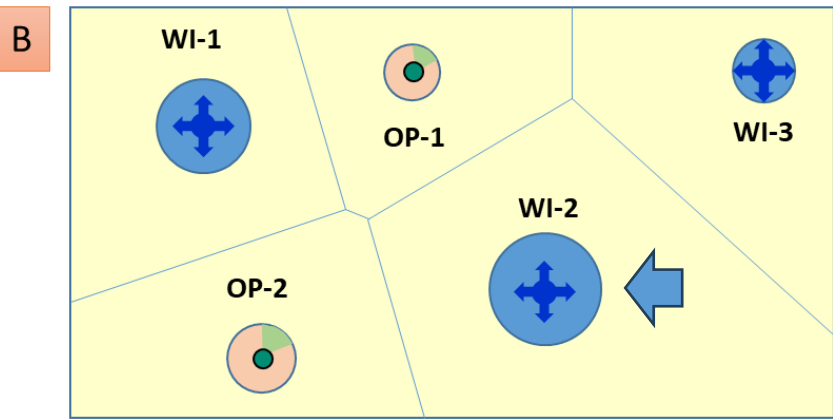
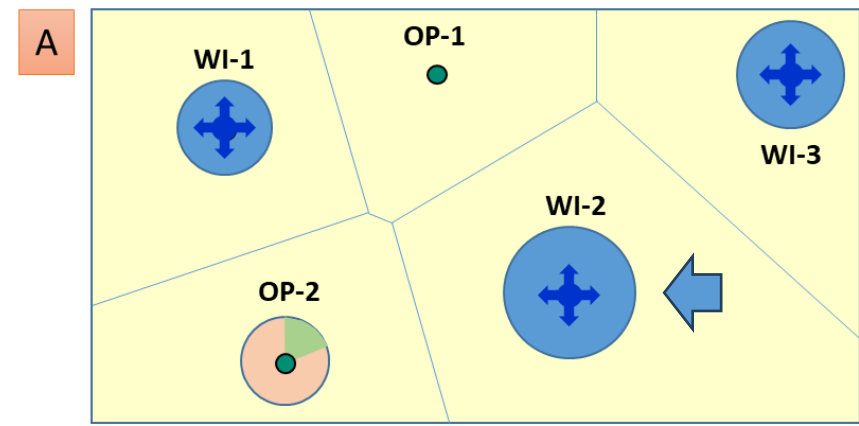
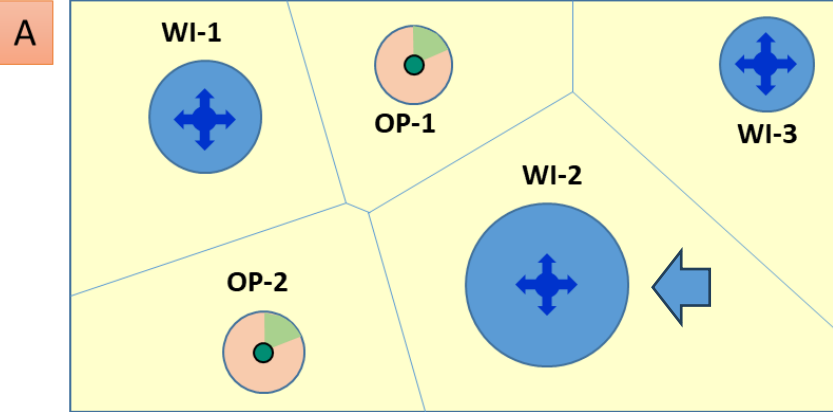
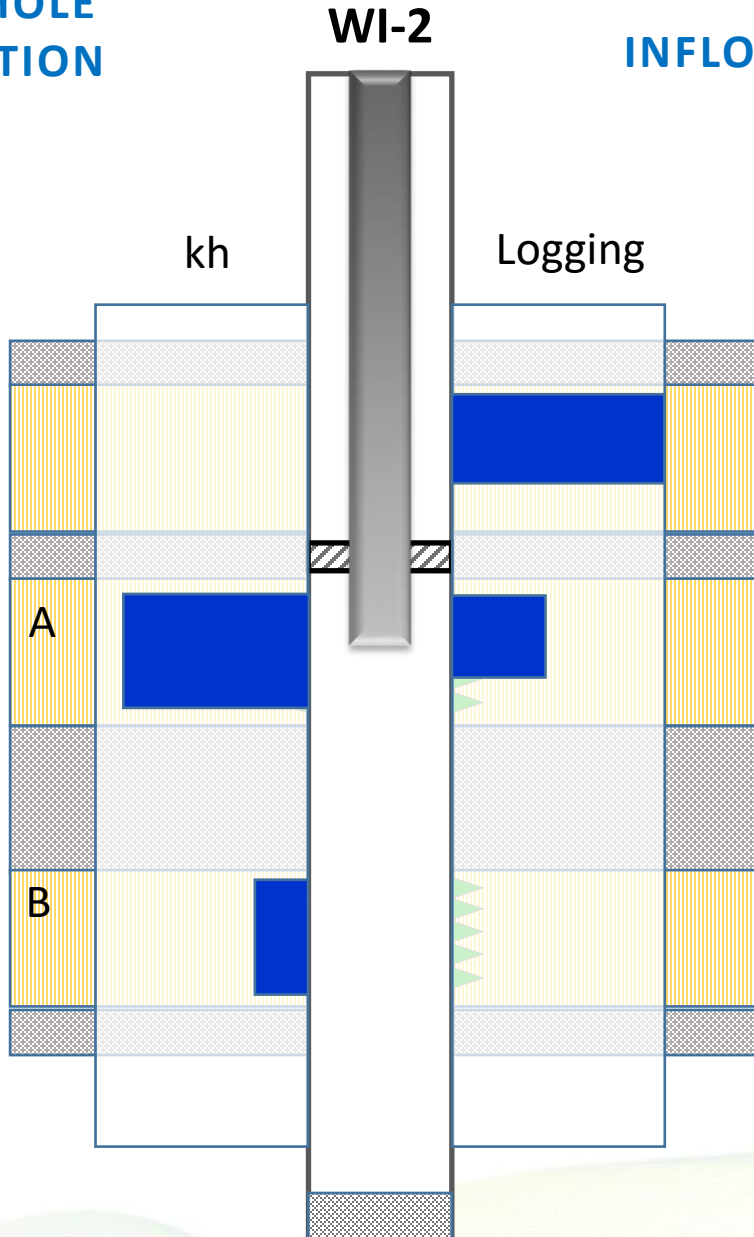


OPEN HOLE
PREDICTION

TRUE
INFLOW PROFILE

KH-BASED ALLOCATION

PLT-BASED ALLOCATION



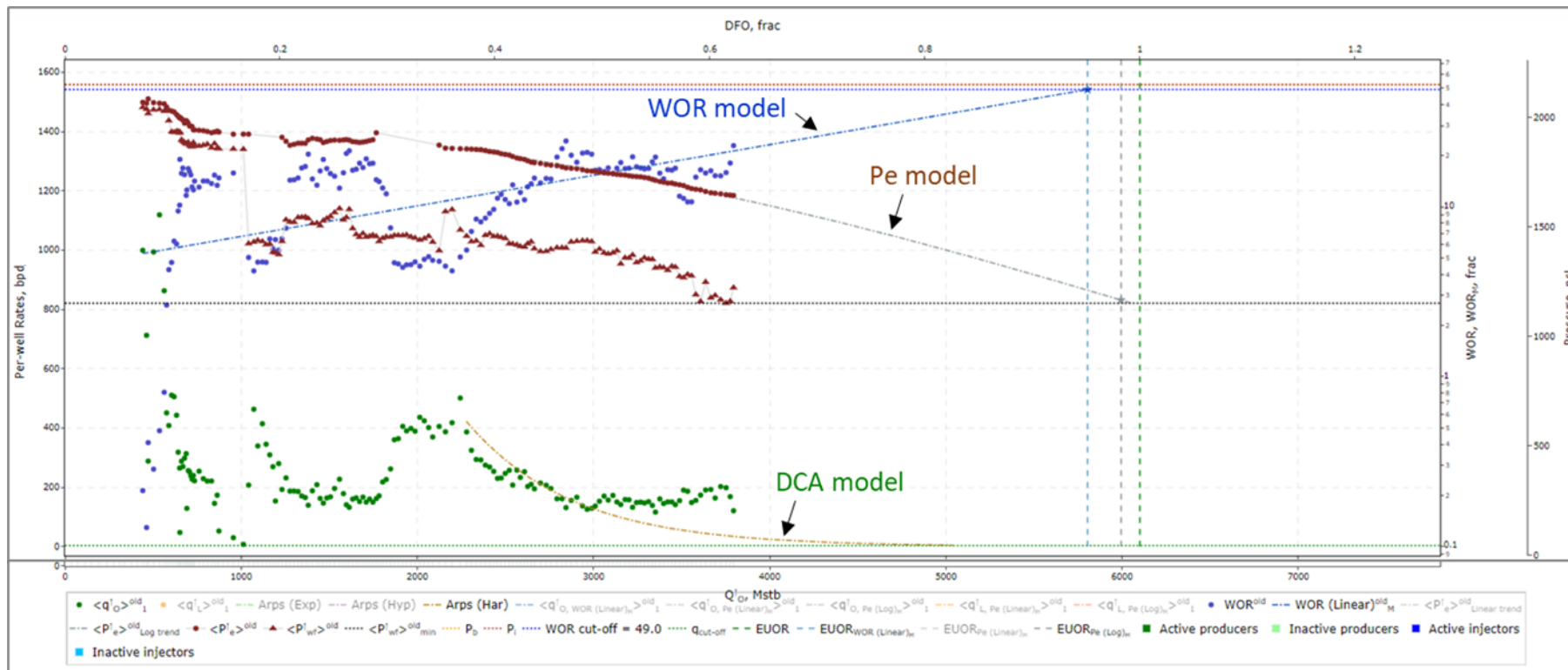
DEEPSCAN – WELL PASSPORTS – PRODUCTION FORECAST



5. Well Passports

- ▶ 5.1. OP-1 ↑
- ▶ 5.2. OP-2 ↑
- ▶ 5.3. OP-3 ↑
- ▶ 5.4. OP-4 ↑
- ▶ 5.5. OP-5 ↑
- ▶ 5.6. OP-6 ↑
- ▶ 5.7. OP-7 ↑
- ▶ 5.8. OP-8 ↑
- ▶ 5.9. OP-9 ↑
- ▶ 5.10. OP-10 ↑
- ▶ 5.11. OP-11 ↑
- ▶ 5.12. OP-12 ↑
- ▶ 5.13. OP-13 ↑→↓
- ▶ 5.14. OP-14 ↑→↓
- ▶ 5.15. OP-15 ↑

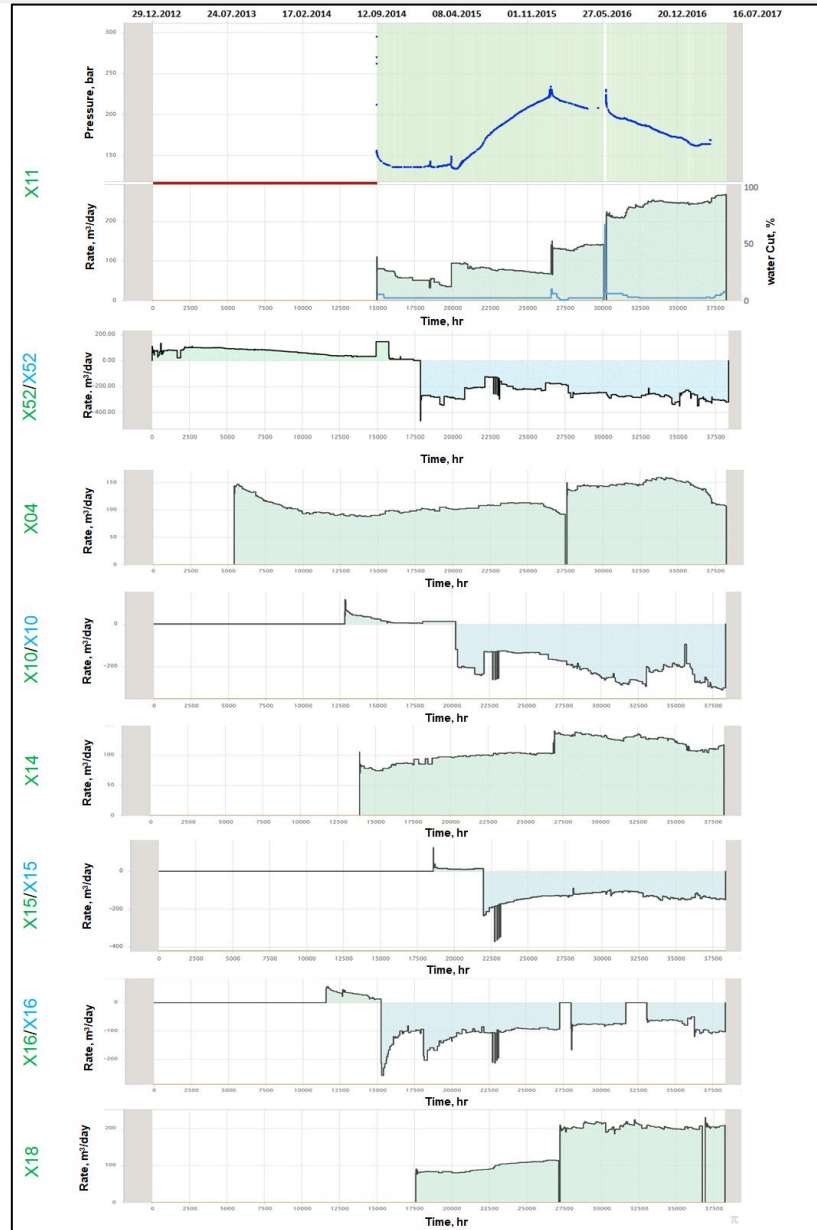
PRODUCTION FORECAST



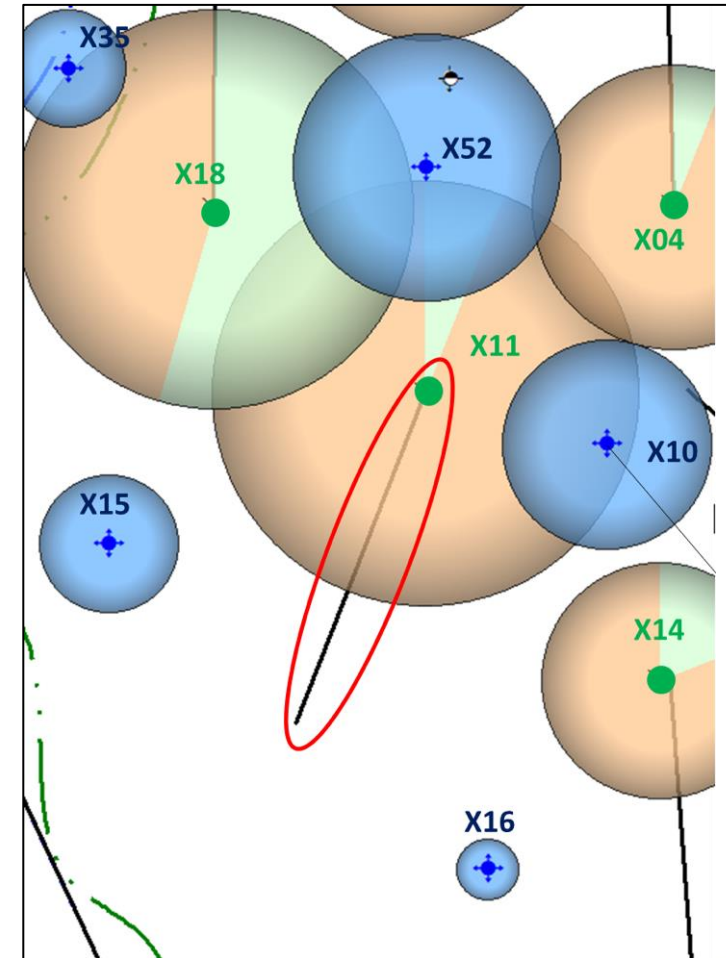


COMPLEMENTARY STUDIES

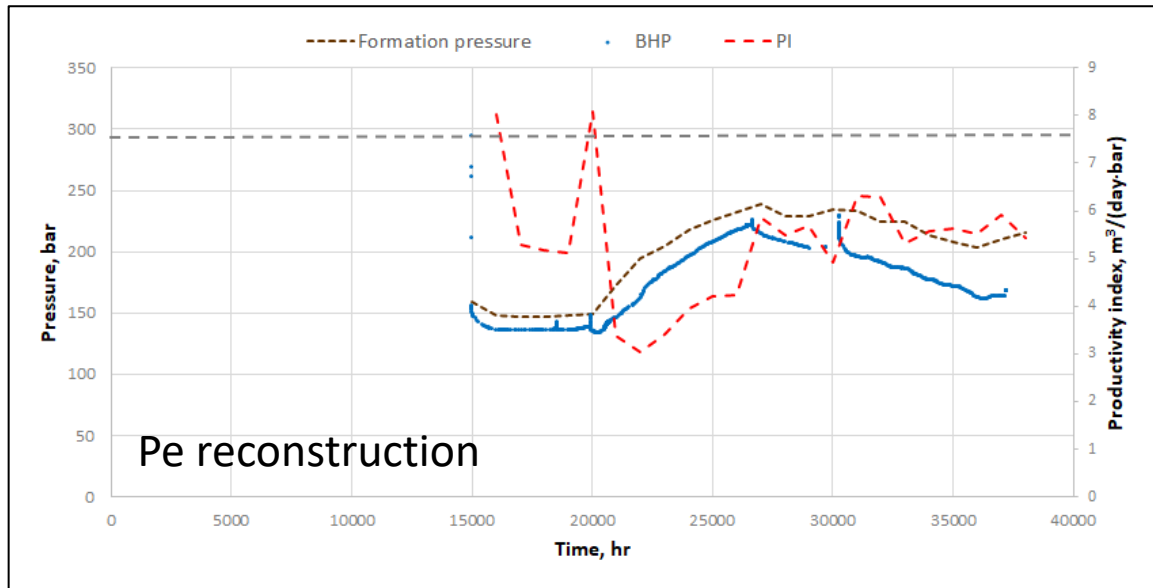
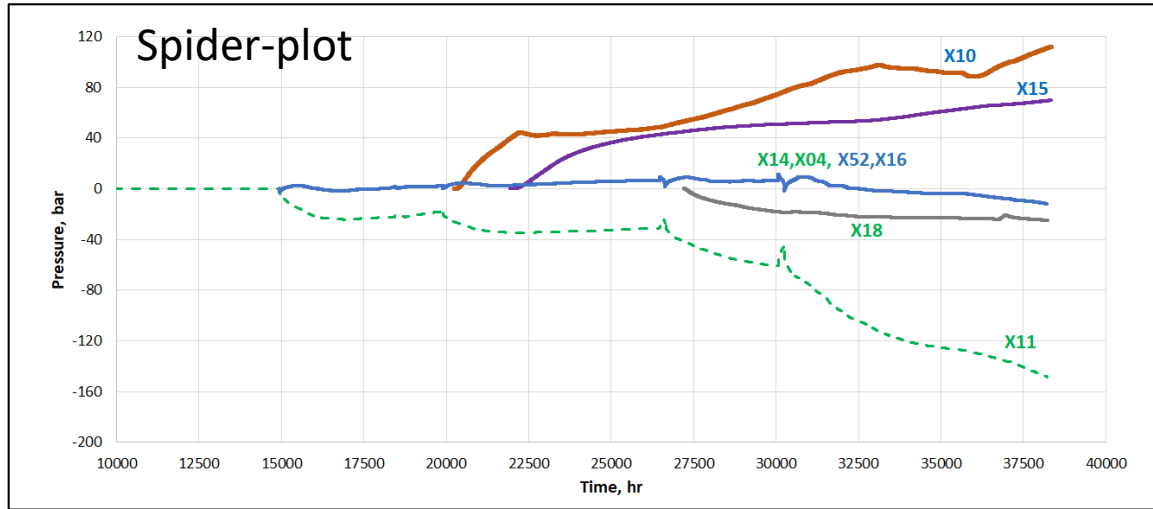
CASE #1 – INTEGRATED WITH MULTIWELL RETROSPECTIVE TESTING (MRT)



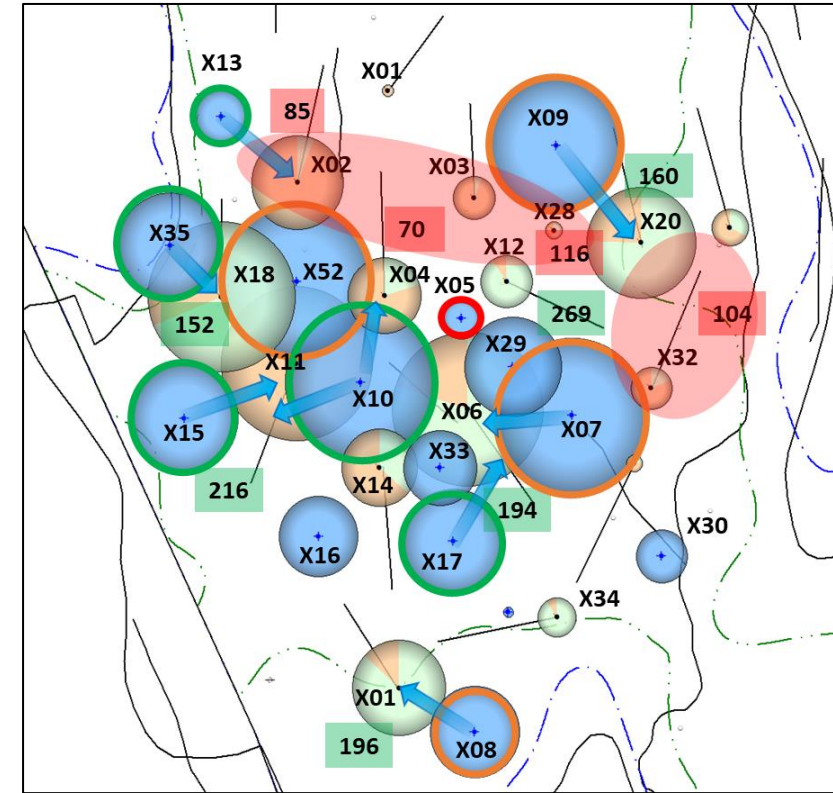
SURVEY AREA



CASE #1 – INPUTS FROM MRT



PRIME FINDINGS

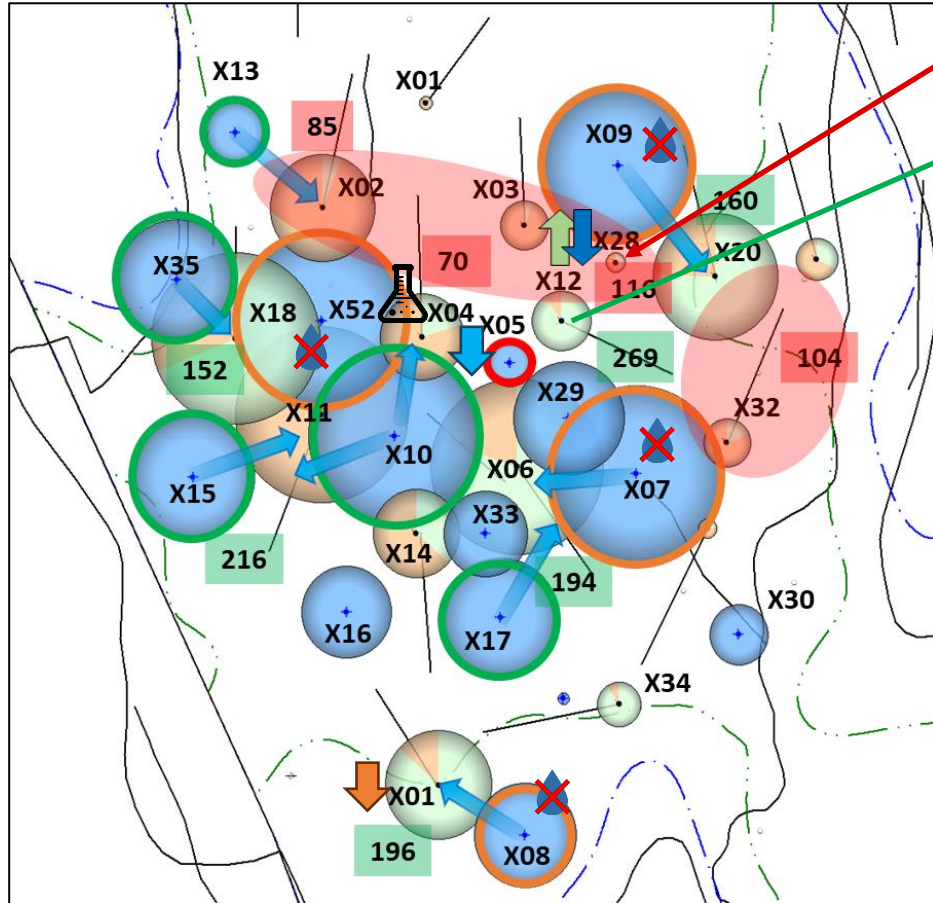


- Pressure maintenance wells
- Wells with cross-flow
- Source of water breakthrough
- Low formation pressure areas
- 196 Formation pressure, bar (@ MRT)
- 70 Low formation pressure, bar (@ MRT)

CASE #1 – PRIME/MRT RECOMMENDATIONS

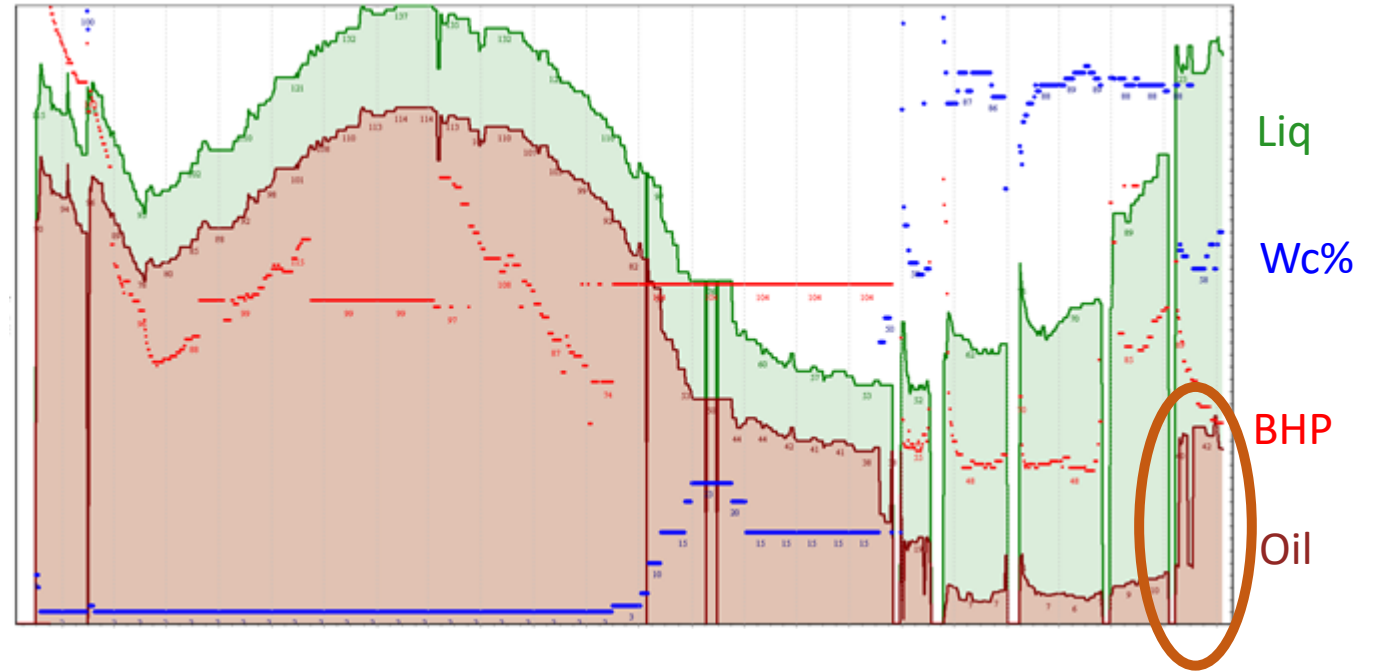


RECOMMENDATIONS MAP



X28 converting to injection

X12 oil production **4 times** increase

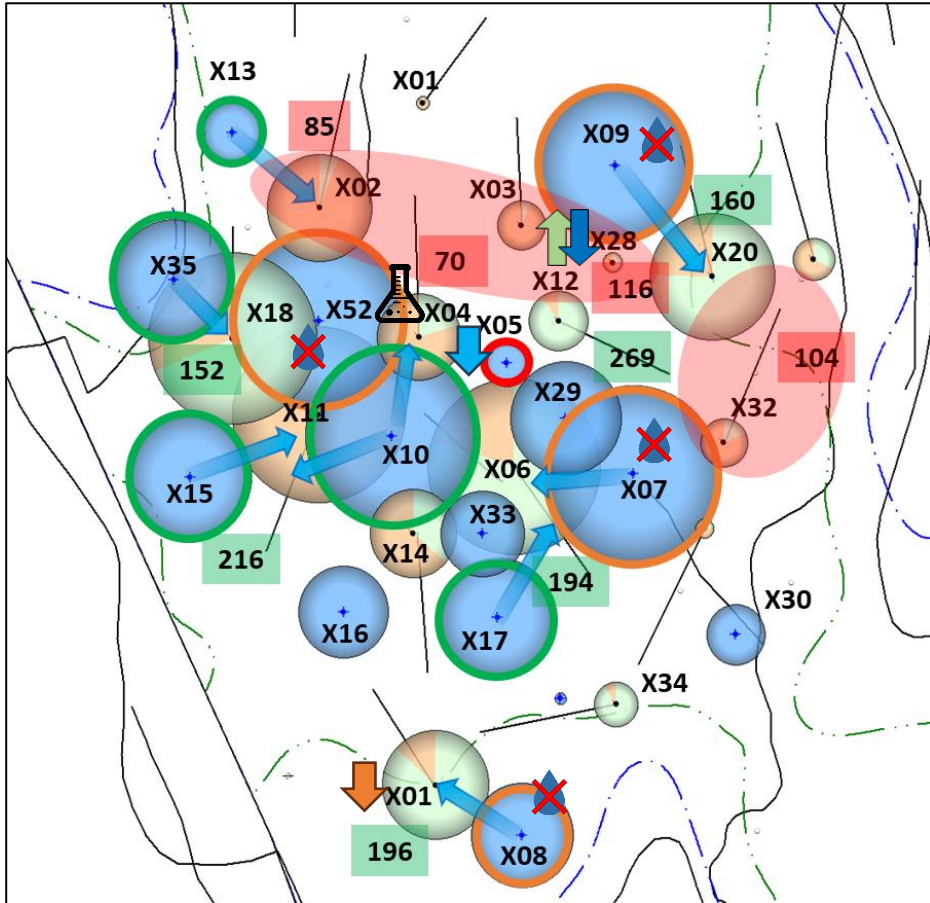


- Reduce drawdown
- Reduce injection (optim.)
- Acidizing
- PLT + WSO
- Converting to injection

CASE #1 – PRIME/MRT RECOMMENDATIONS

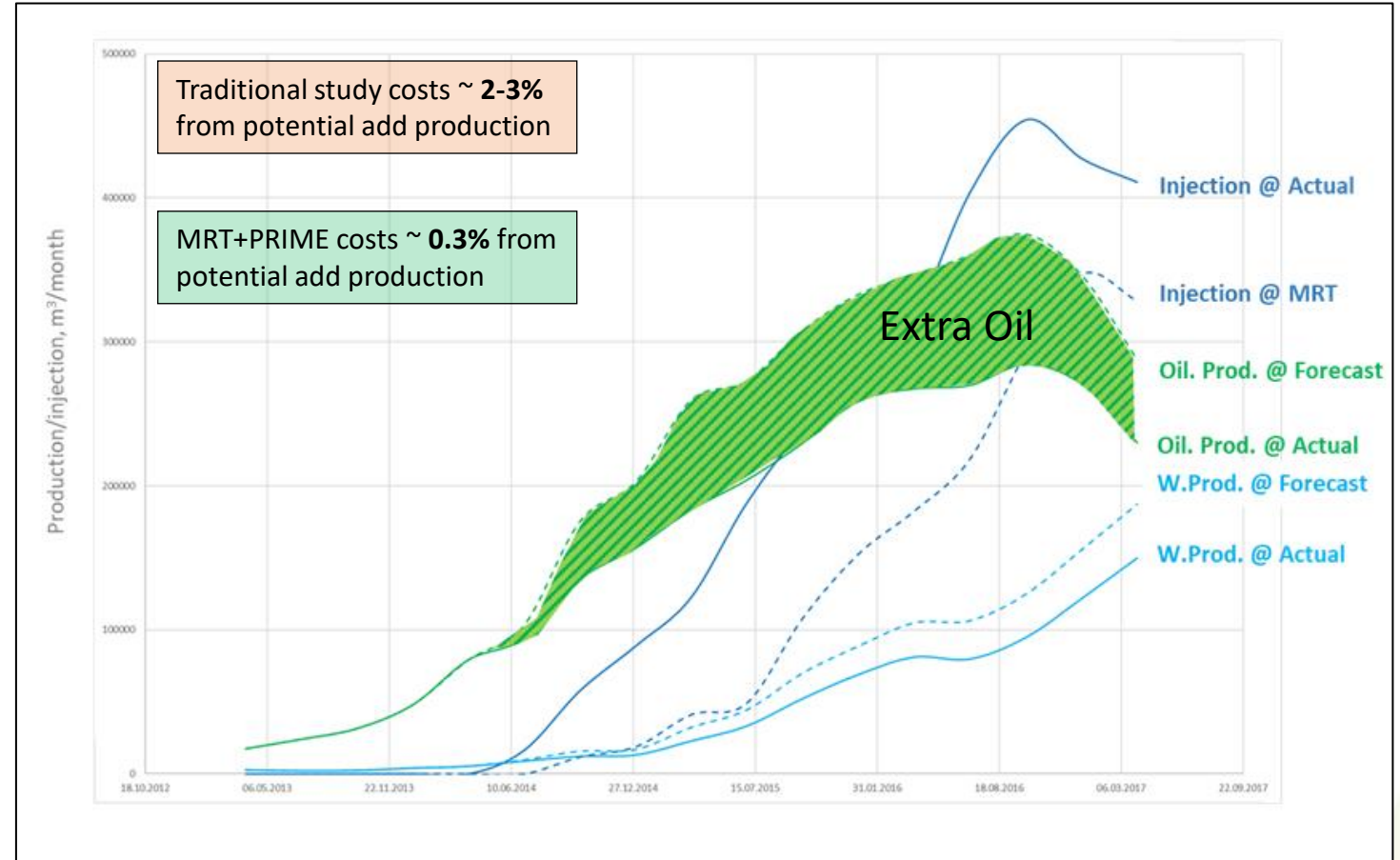


RECOMMENDATIONS MAP

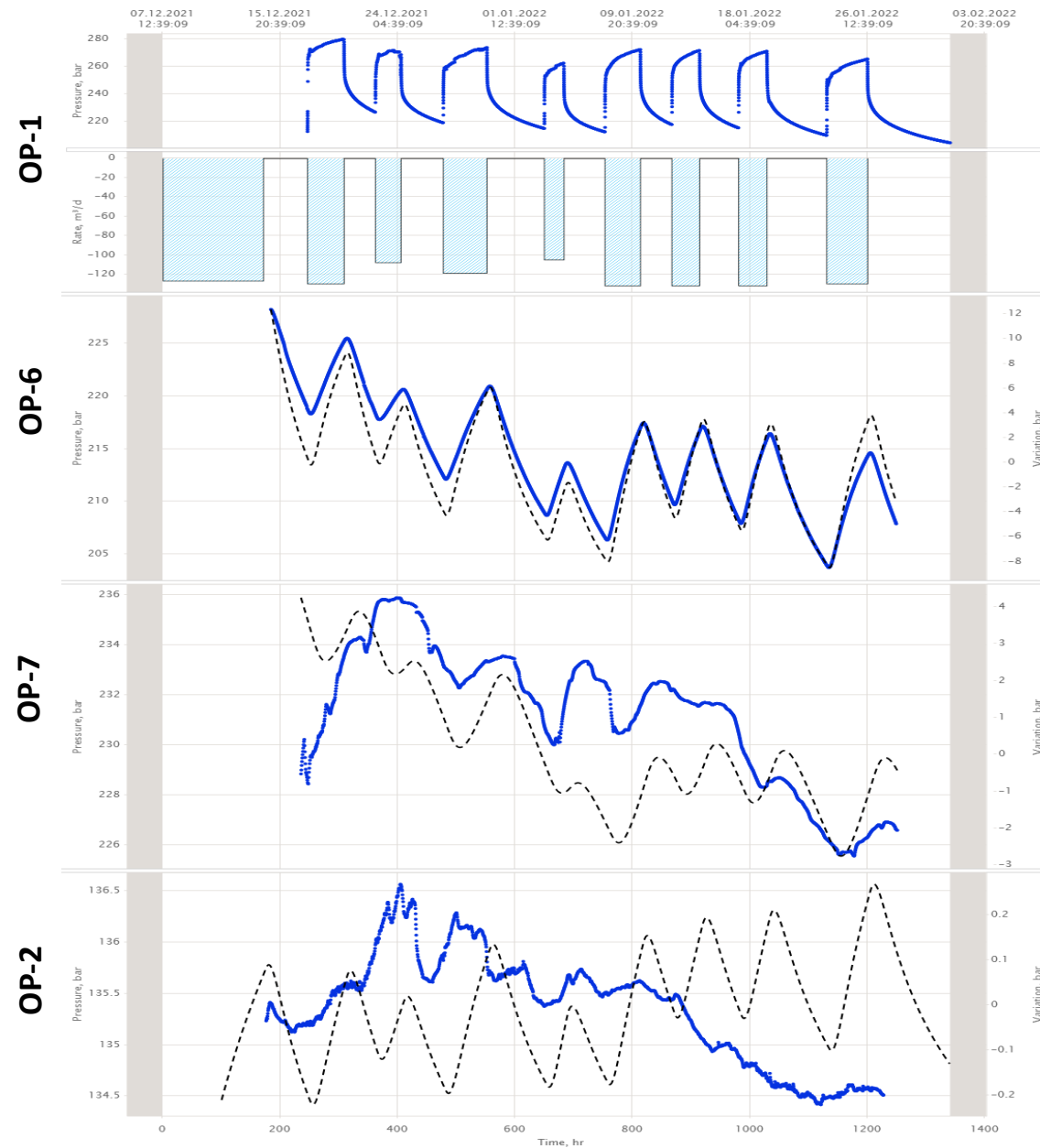


- Reduce drawdown
- Reduce injection (optim.)
- Acidizing
- PLT + WSO
- Converting to injection

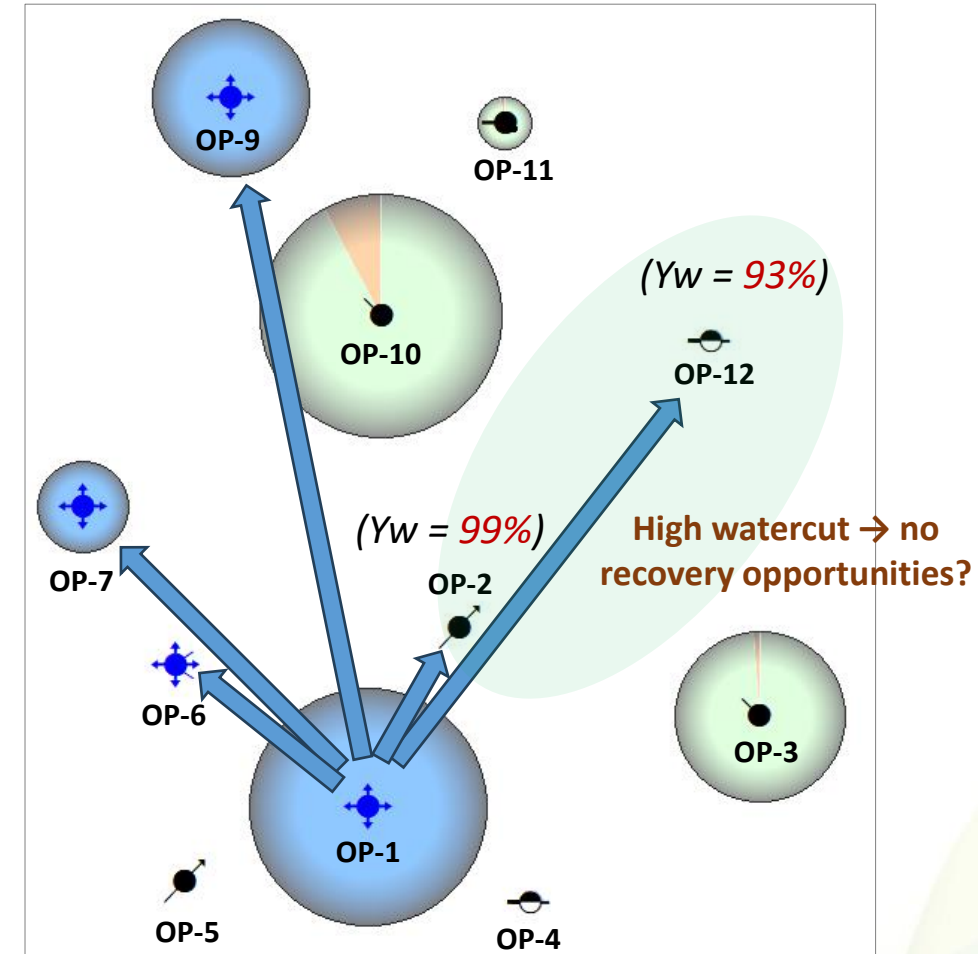
Potential production enhancement from WSO based on thief injection/production surveillance



CASE #2 – INTEGRATED WITH PULSE CODE TESTING (PCT)

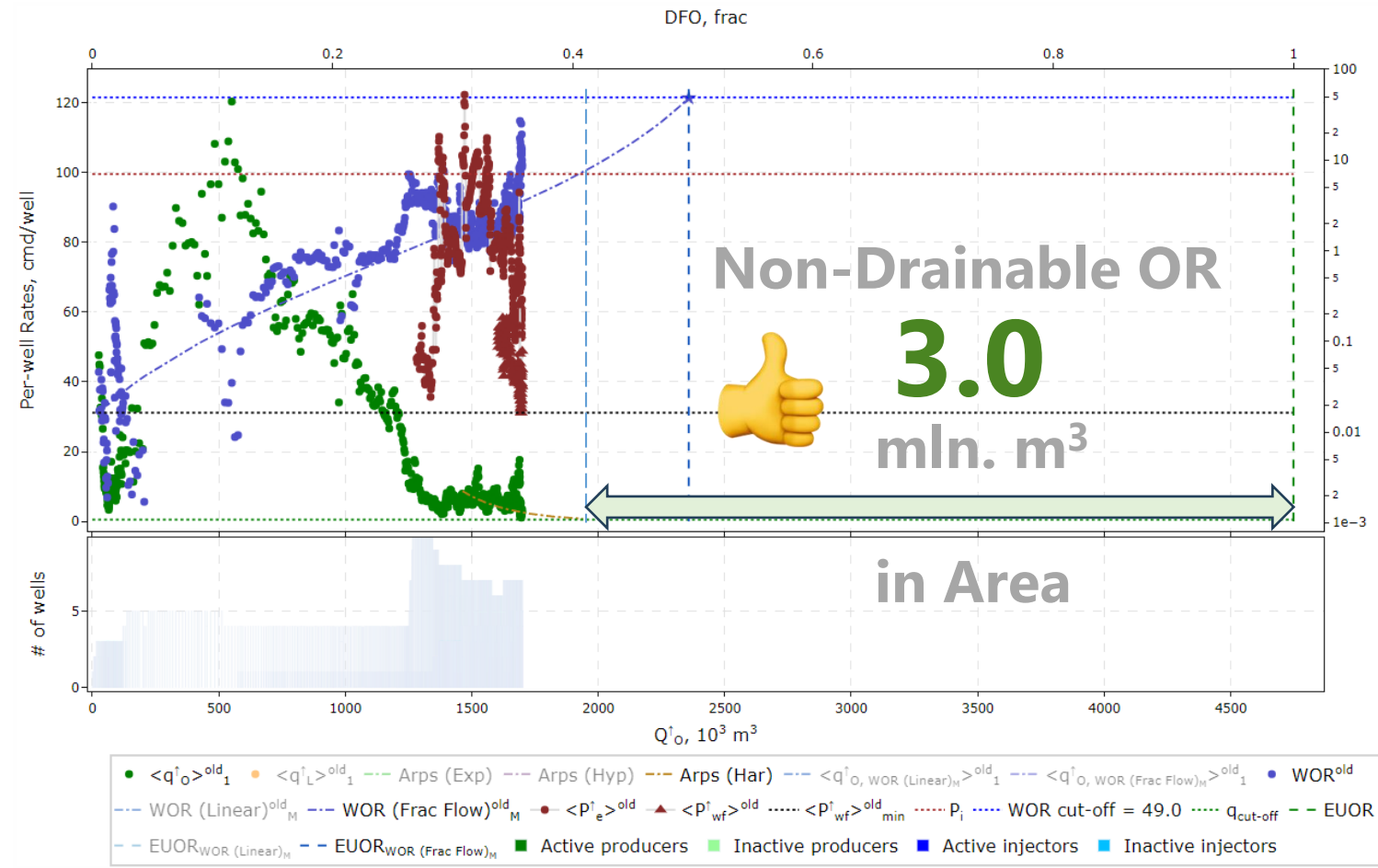


SURVEY AREA

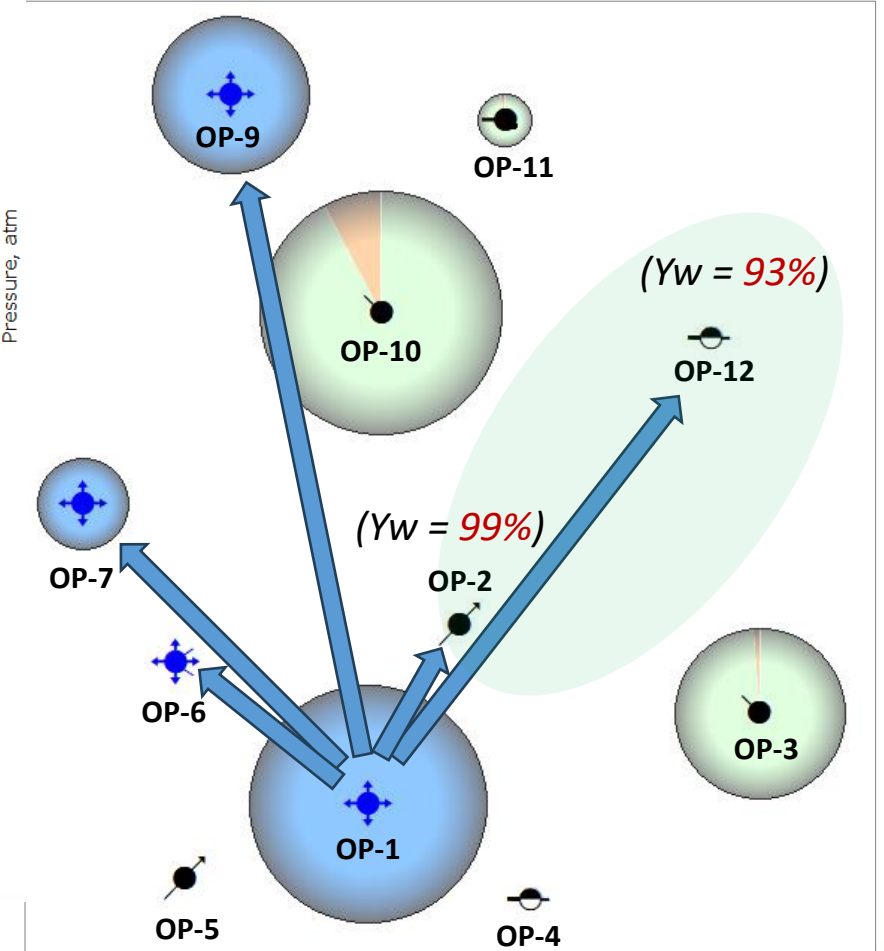


*Yw – watercut

CASE #2 – INPUTS FROM PCT

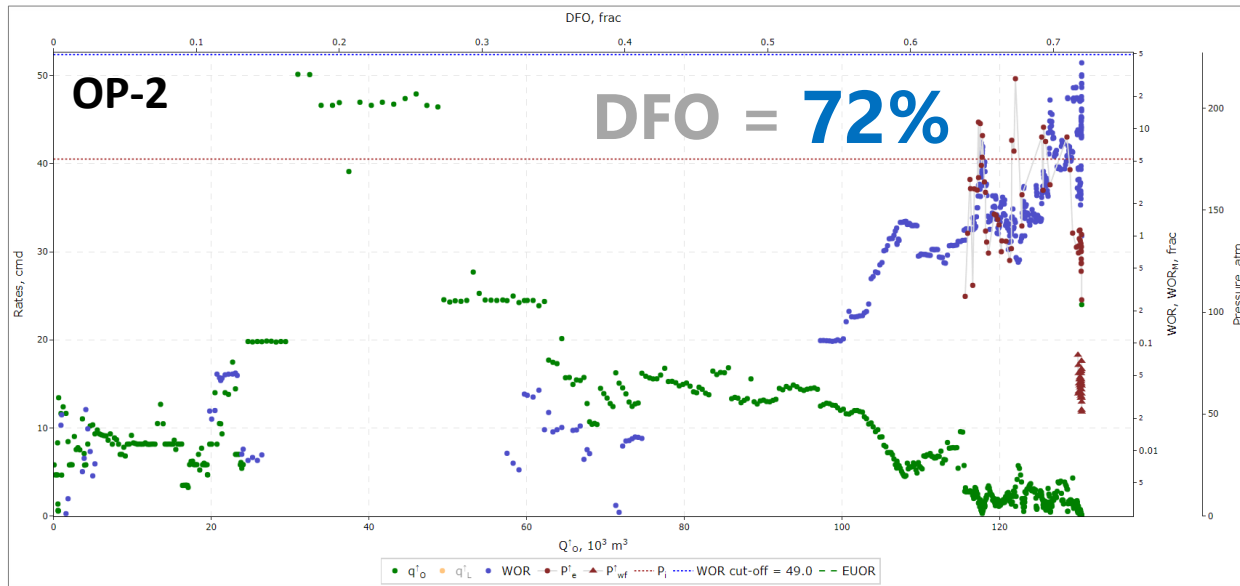
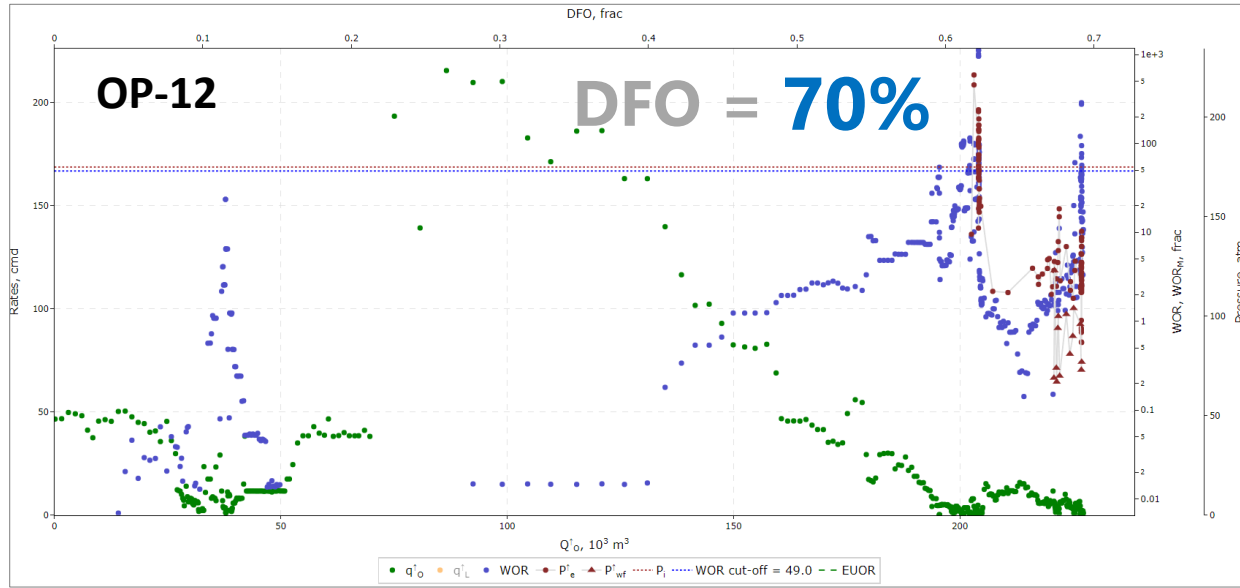


SURVEY AREA

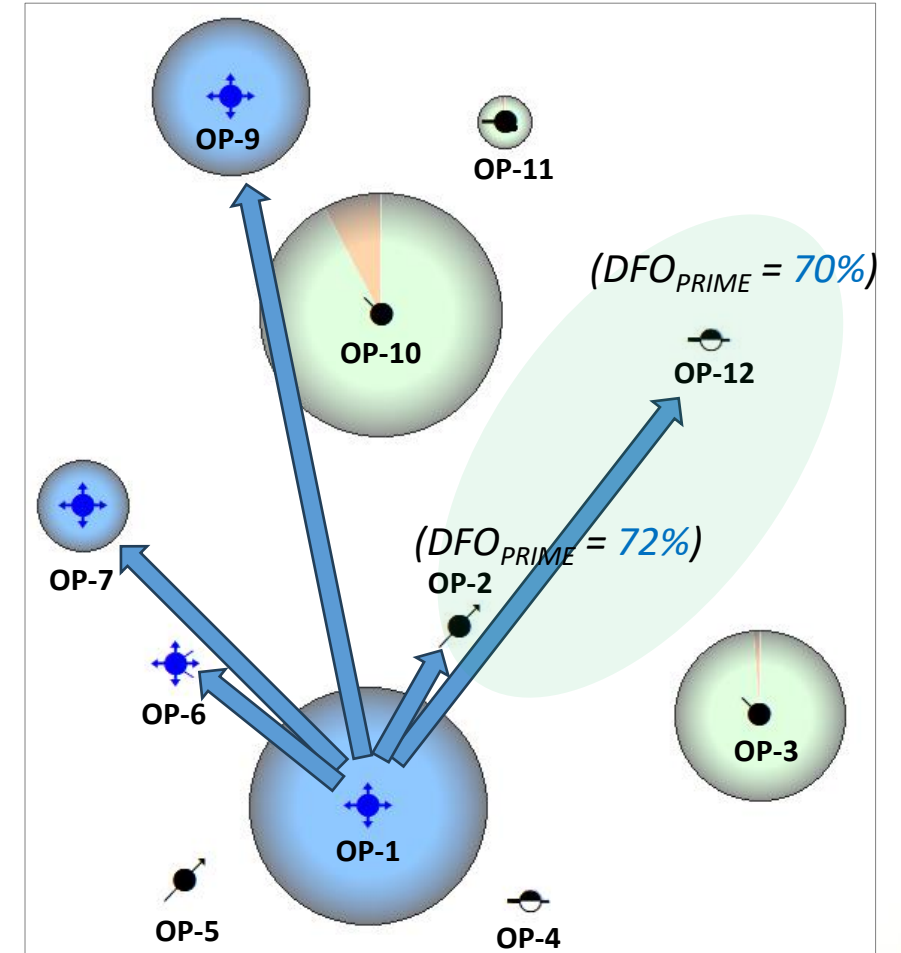


*Yw – watercut

CASE #2 – INPUTS FROM PCT

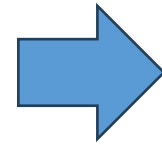
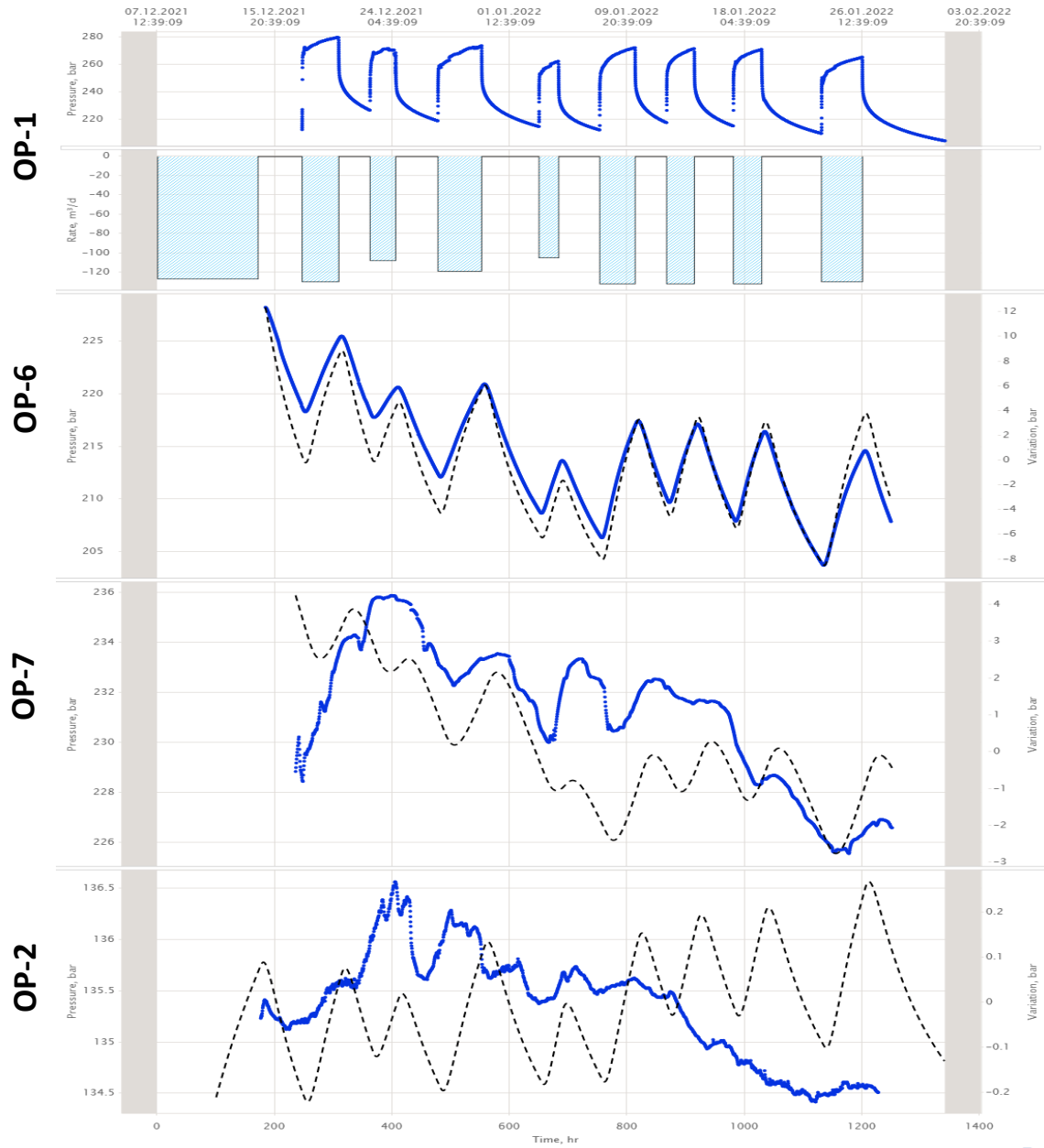


SURVEY AREA

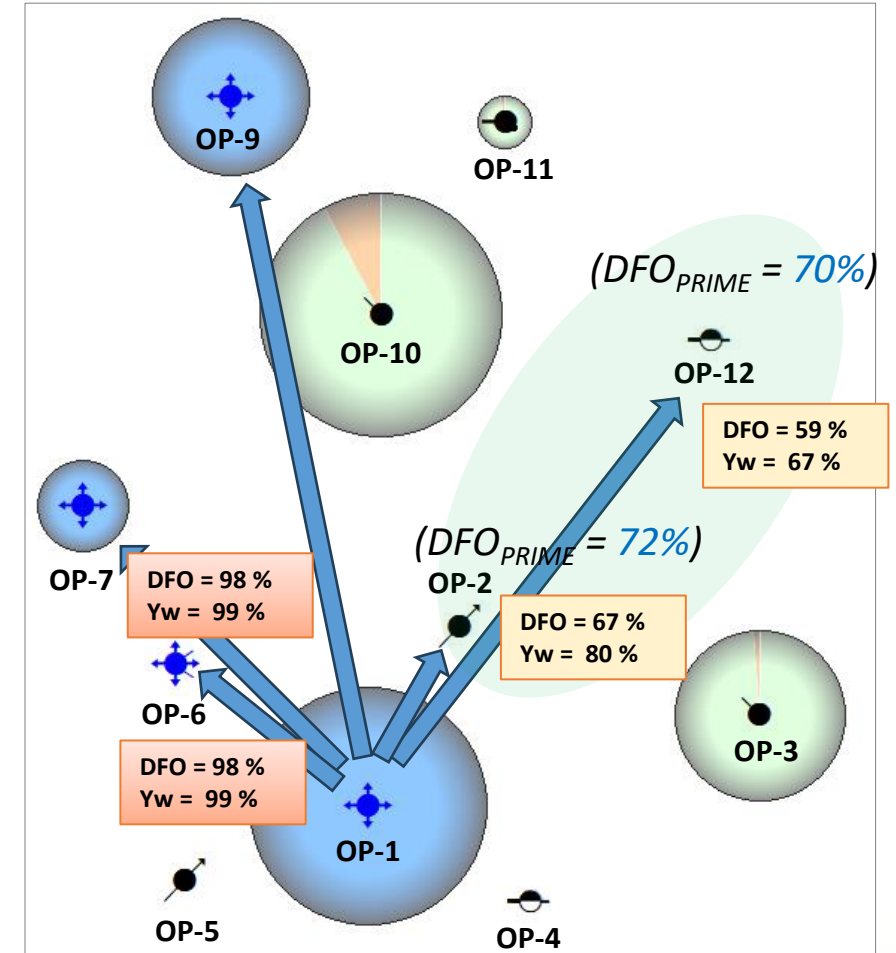


*Yw – watercut

CASE #2 – INPUTS FROM PCT

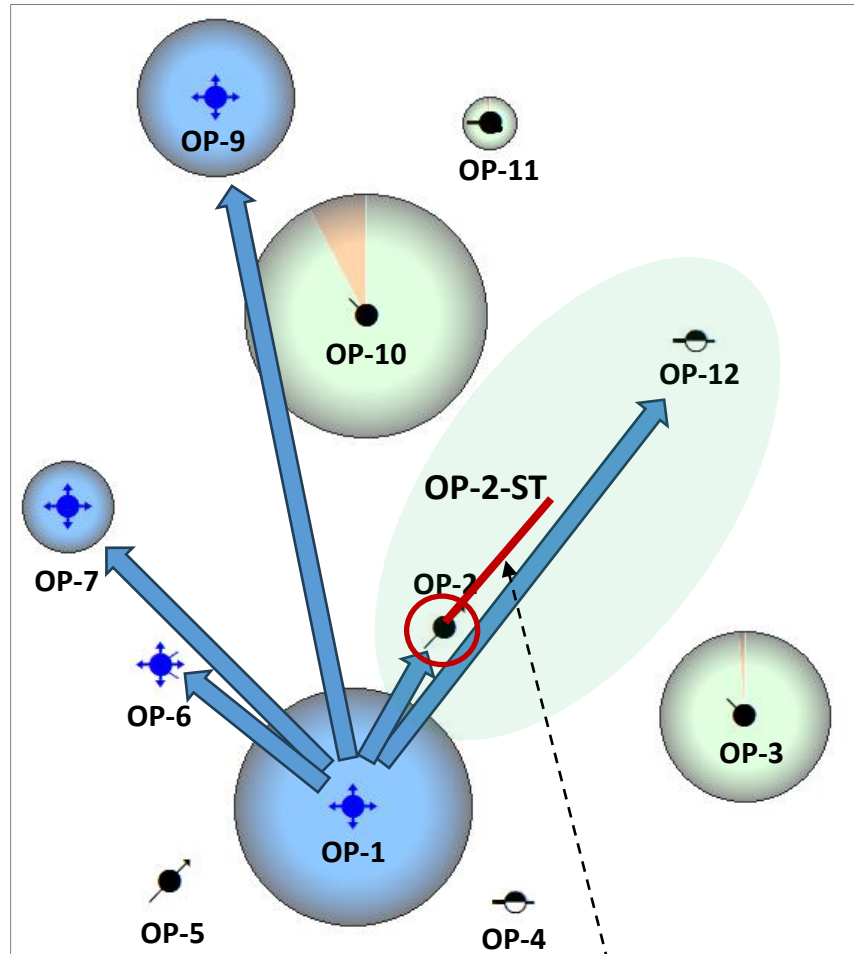


SURVEY AREA



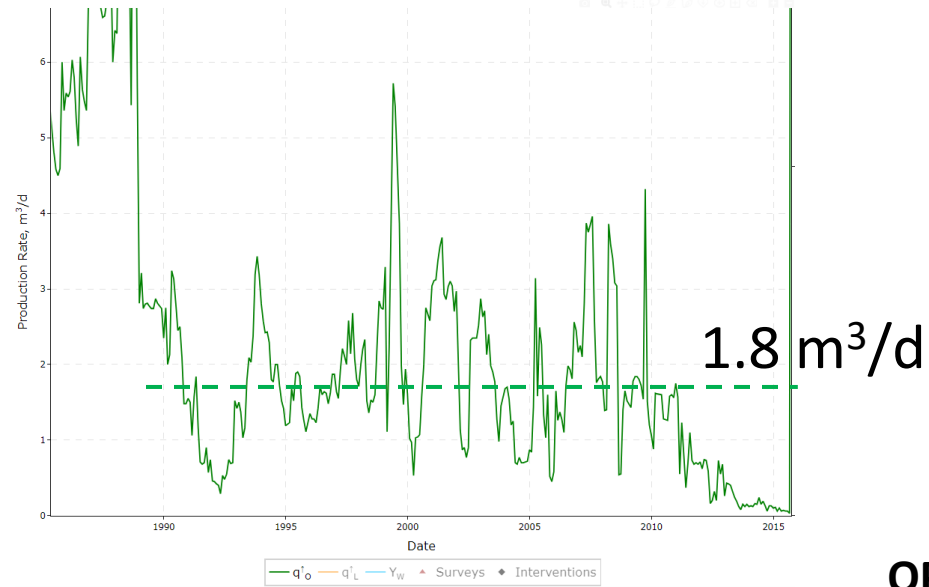
*Yw – watercut

CASE #2 – PRIME/PCT RECOMMENDATIONS

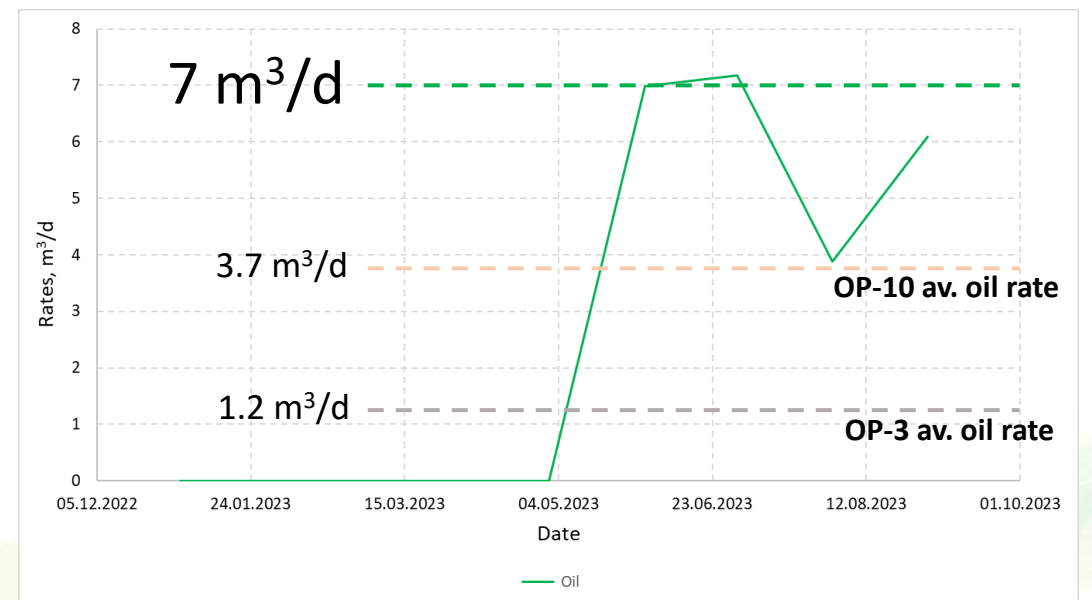


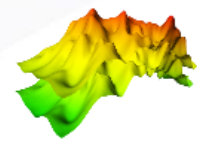
Sidetrack was drilled

OP-2 Production History



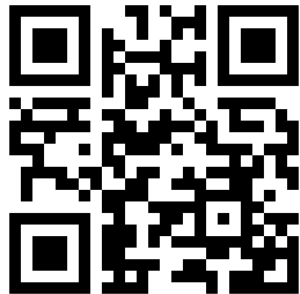
OP-2-ST Production History





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Thank you!



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