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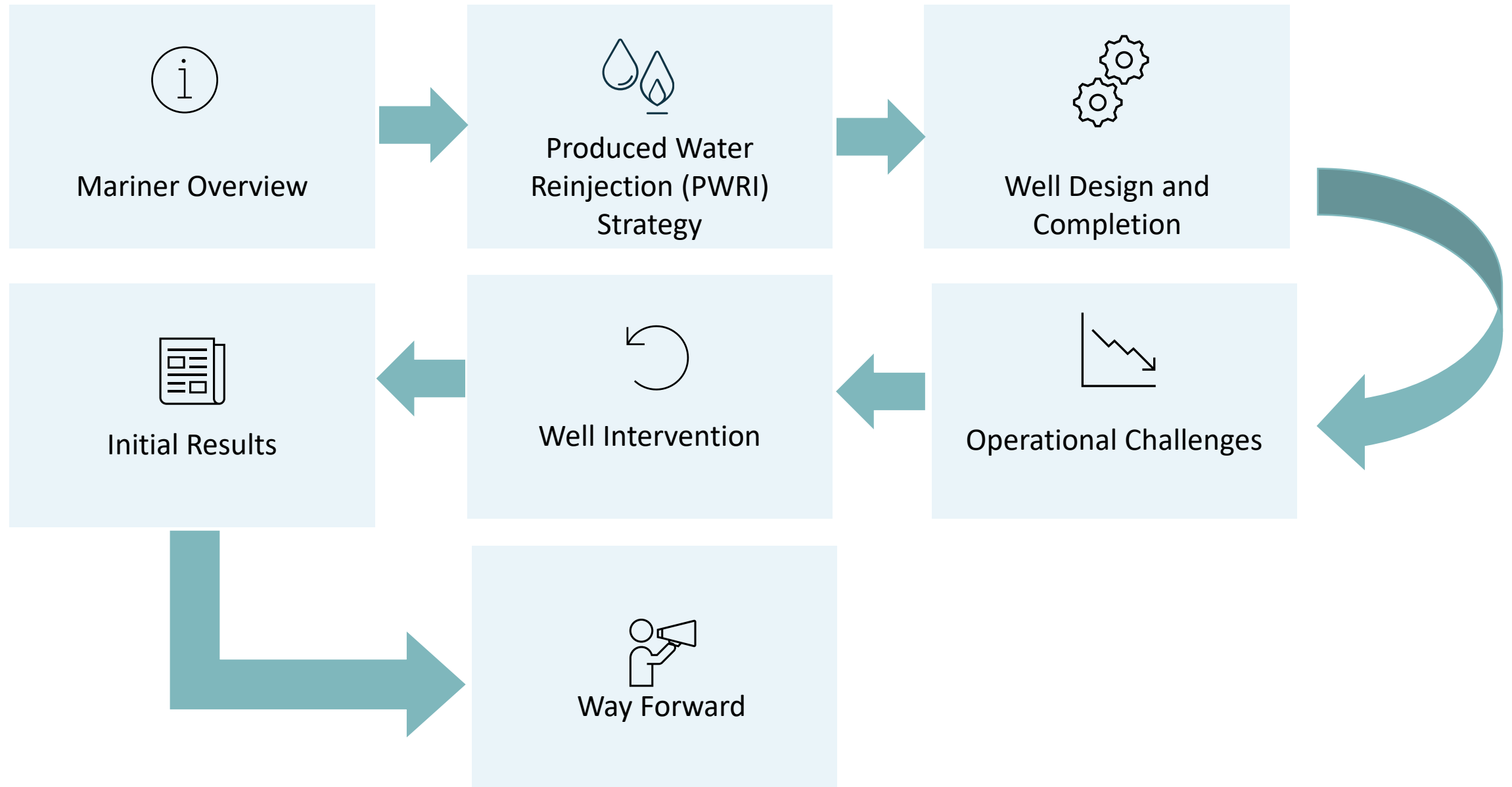


Mariner - Initial results from the first chemical stimulation of a water injector well.

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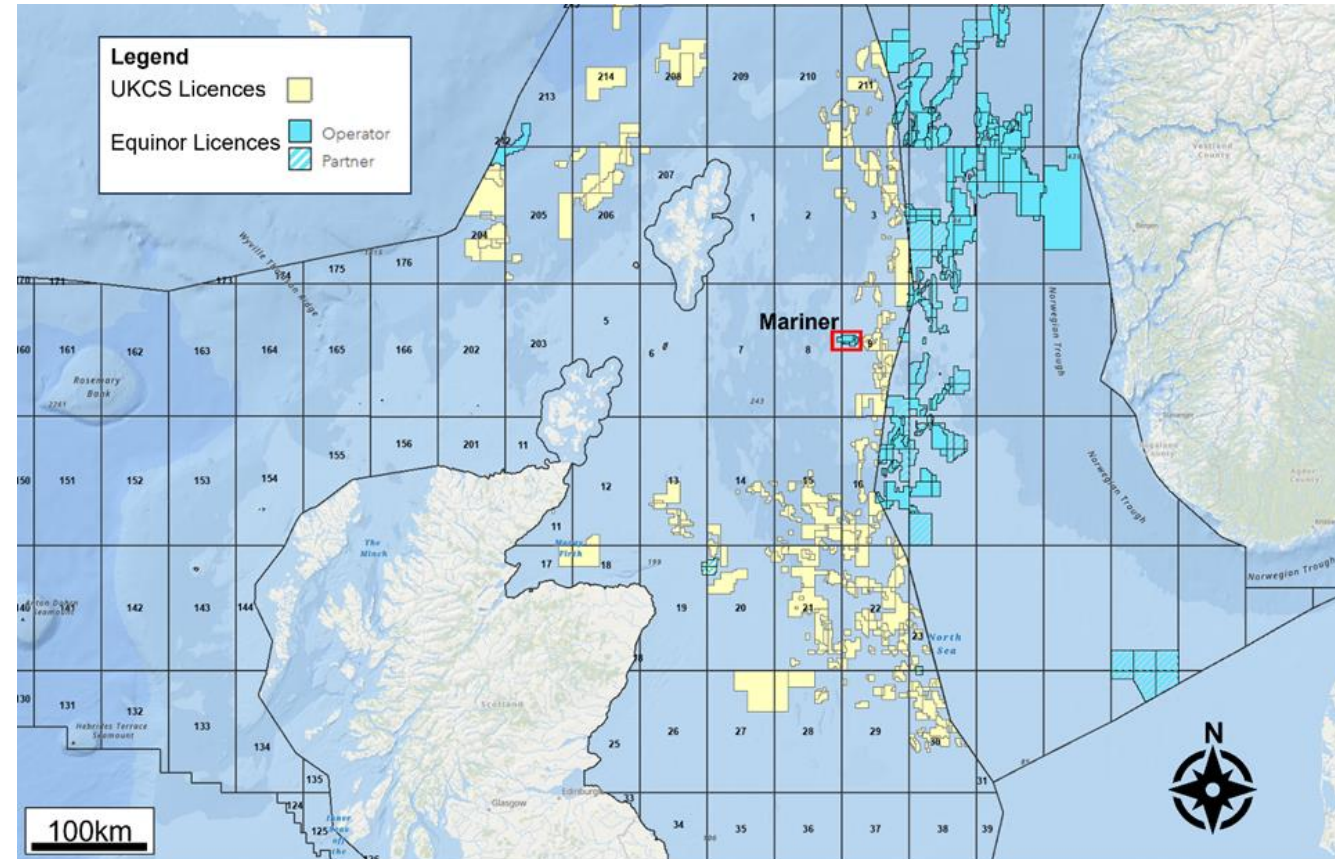
ICoTA Aberdeen 16th November

Agenda

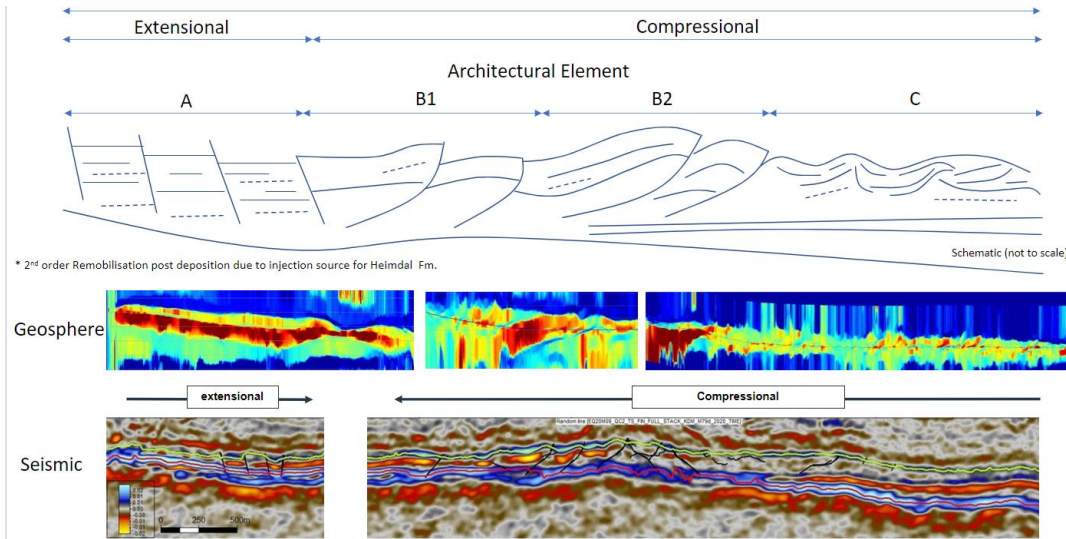


Mariner Overview

- Located 150 km east of Shetland on the UK Continental Shelf (UKCS).
- OOIP 2 - 3 billion barrels
- Expected Recovery +200 million barrels
- Drilling & Completion Unit: DES & ICU
- Started production August 2019 (>35 million barrels Q2 2023)
- Expected Life of Field ~30 years
- 100 operational wells



Mariner Overview



Maureen Reservoir

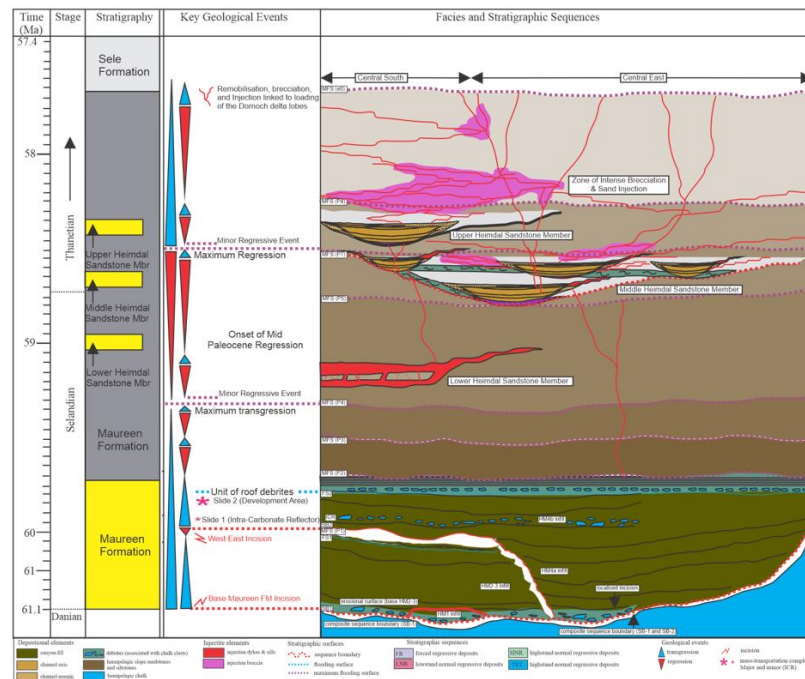
- Mass transport deposit (MTD) of slides, slumps, turbidites, debris & raft blocks
- Stepped oil water contacts from east to west (fault and facies controlled)
- 1300m - 1500m TVDSS
- Unconsolidated Sand 2 – 5 D
- 14 API
- Lower OOIP higher recovery

Heimdal Reservoir

- Deep Marine hybrid system of depositional / remobilised channels and injectites
- 1100m - 1300m TVDSS
- Unconsolidated Sand up to 10 D
- 12 API
- Higher OOIP lower recovery

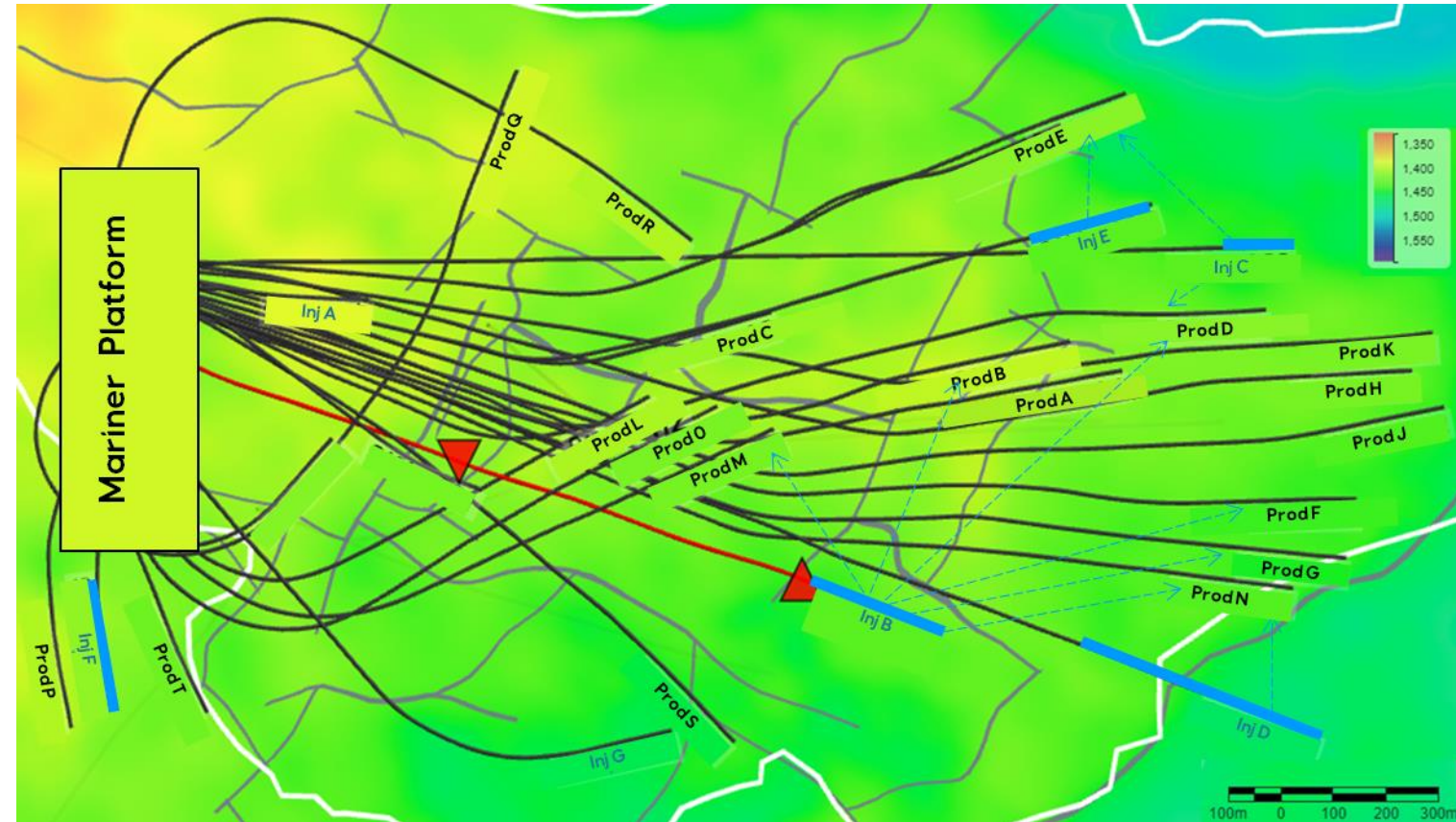
Drainage strategy

- Produced Water Reinjection (PWRI) + Aquifer support

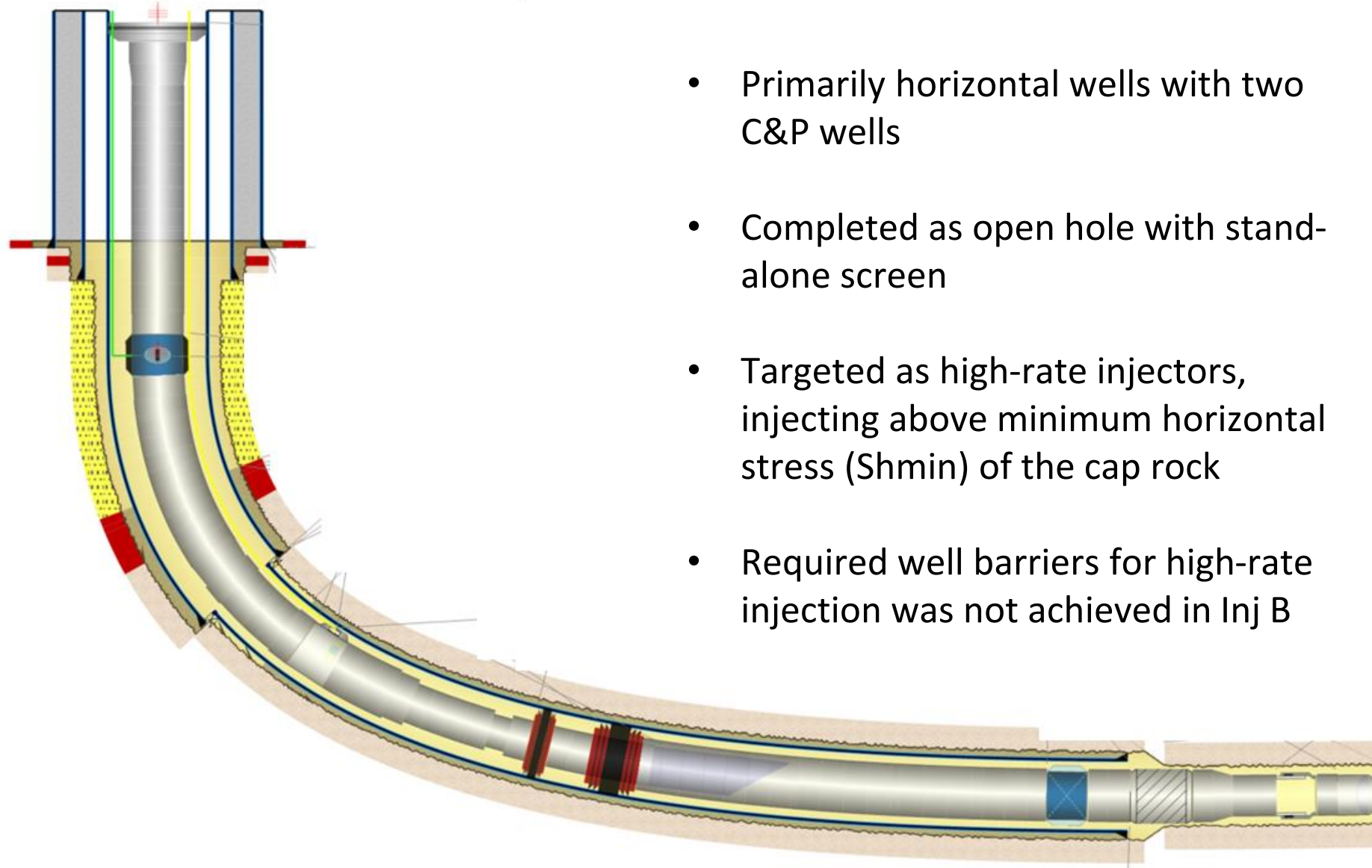


Produced Water Reinjection Strategy

- Maintain reservoir pressure
- Improve sweep and recovery
- Avoid overboarding
- Planned full voidage replacement, but this hasn't been achieved
- 5 operational water leg injectors, providing support mainly to Maureen Reservoir
- Inter-well tracers are injected to confirm connectivity



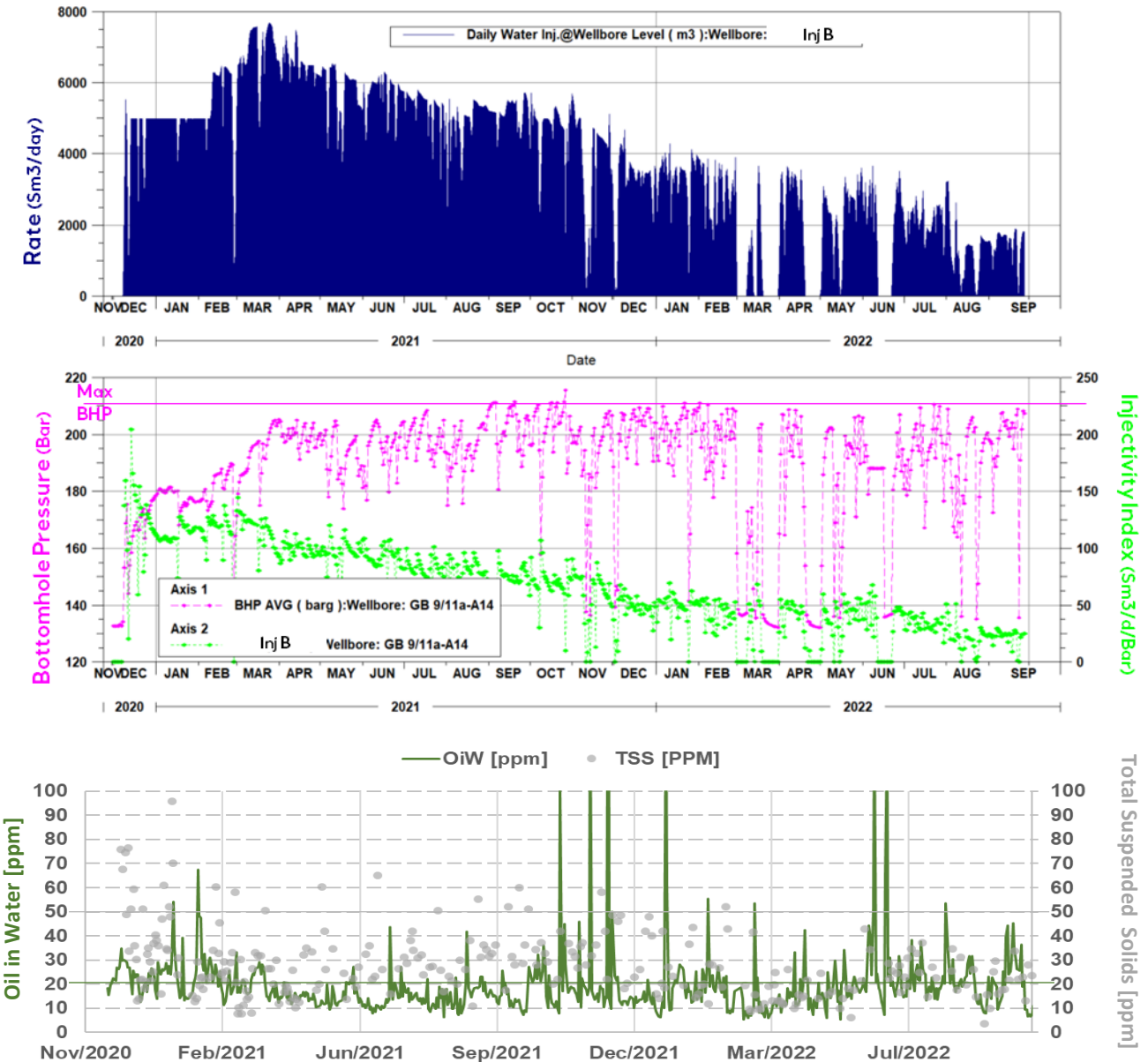
Well Design and Completion



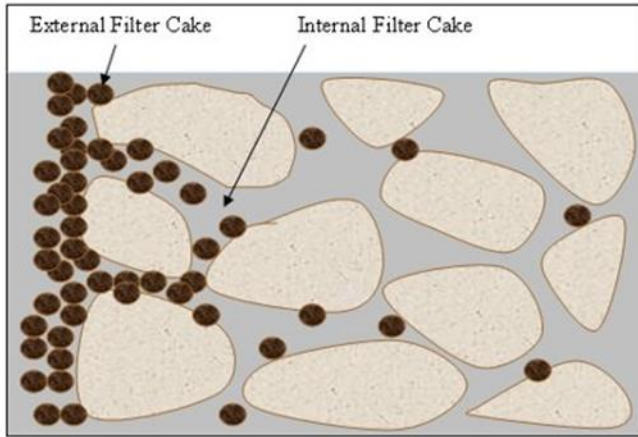
- Primarily horizontal wells with two C&P wells
- Completed as open hole with stand-alone screen
- Targeted as high-rate injectors, injecting above minimum horizontal stress (S_{hmin}) of the cap rock
- Required well barriers for high-rate injection was not achieved in Inj B

Operational Challenges

- Inj B first operational injector in Mariner
- Injectivity in the well reduces rapidly as expected in matrix injection wells
- Frequent well shut-in due to maximum BHP constraint
- Formation damage is a mixture of oily deposit and solids
- All producers are completed with sand screens
- Topside process generally achieve good water quality (OiW < 20 ppm, TSS < 50 ppm)

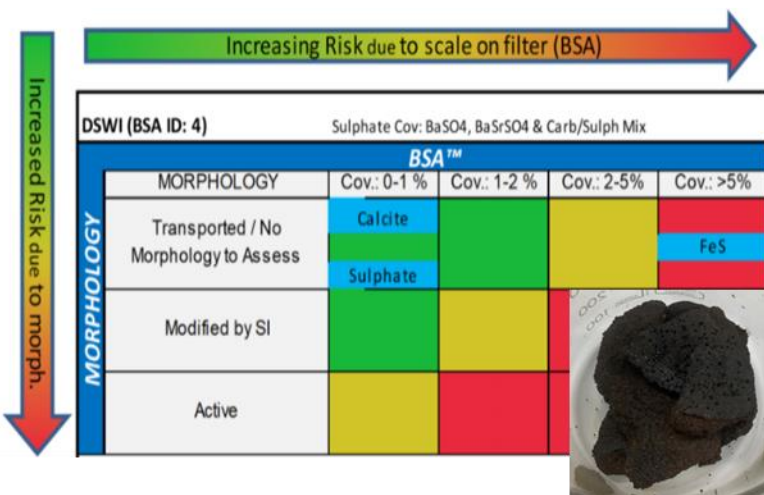
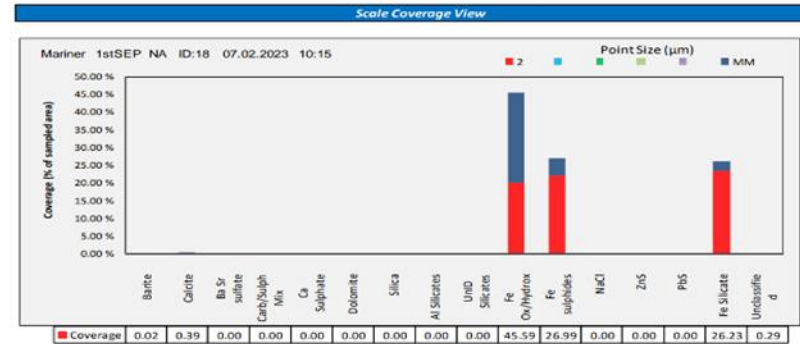
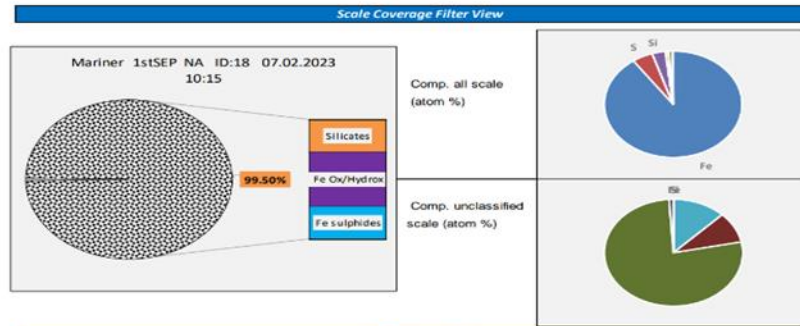


Well Intervention Design



Oilwell	ID	Date	Sulphate	Carbonate	FeS
DSWI	17	07.02.2023	Green	Green	Red
DSWI	15	24.01.2023	Green	Green	Green
1stSEP	14	29.08.2022	Green	Green	Red
1stSEP	11	29.08.2022	Green	Green	Red
A24	13	29.08.2022	Green	Green	Green
A23	12	29.08.2022	Green	Green	Green
CoalesA	10	02.08.2022	Green	Green	Green
2stSEP	8	02.08.2022	Green	Green	Green
1stSEP	9	02.08.2022	Yellow	Yellow	Red
DSWI	7	10.07.2022	Green	Green	Red
DSWI	6	29.06.2022	Green	Green	Red
DSWI	4	24.01.2022	Green	Green	Red
DSWI	3	17.01.2022	Green	Green	Red
DSWI	2	10.01.2022	Green	Green	Red
DSWI	1	27.12.2021	Green	Green	Red
A22	5	29.06.2022	Green	Green	Green

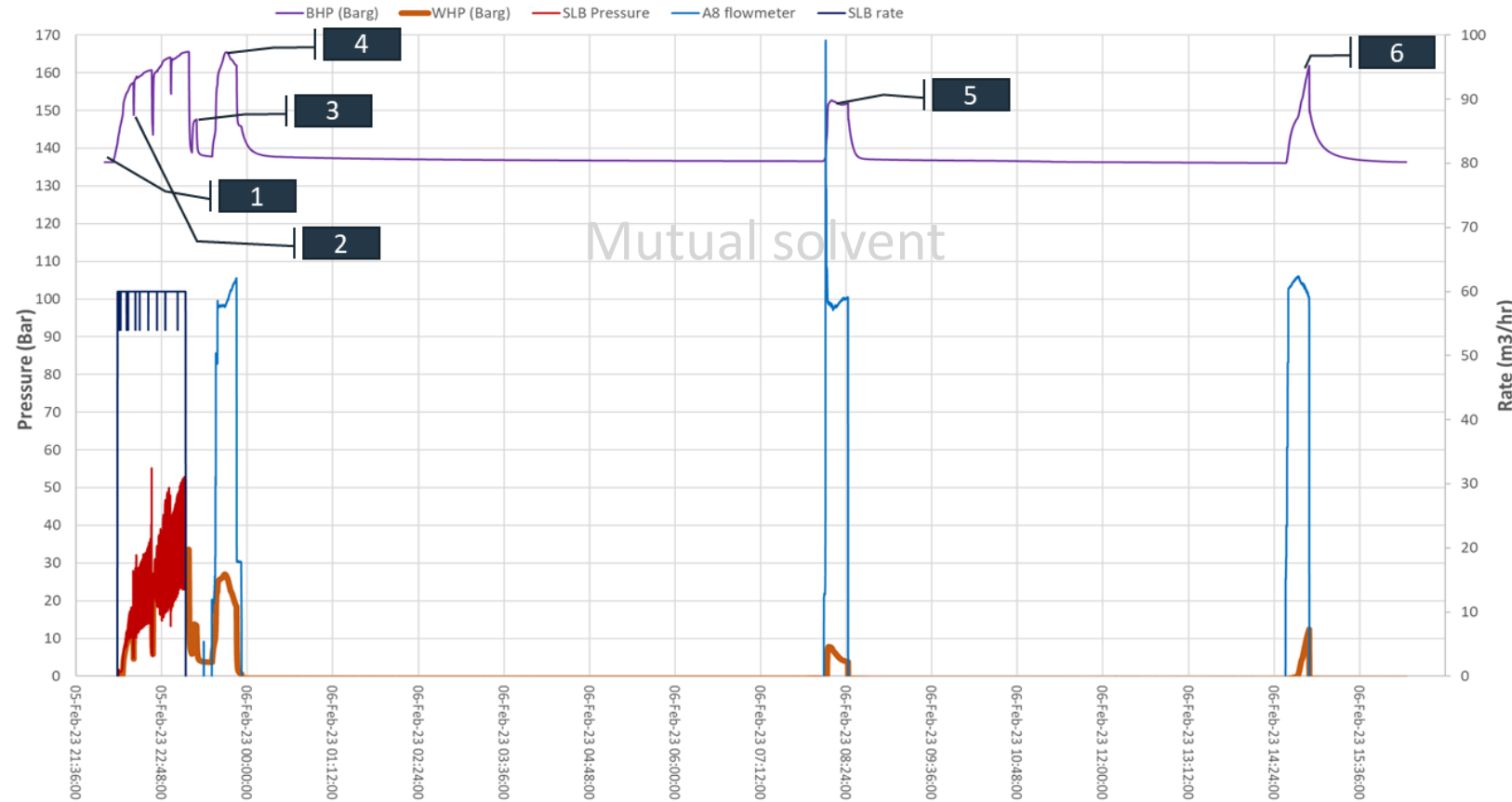
Not Evaluated. Limited risk. Intermediate risk. Critical risk.



- Understanding the nature of solids in Mariner has been a big challenge
- Mutual Solvent as hydrocarbon solvent to remove organic (oily) deposits
- Tetrakis(hydroxymethyl) phosphonium sulphate (THPS) as an iron sulphide deposits from the near wellbore
- Rig-less operation with volumes targeted to treat near well formation (1 ft from wellbore)

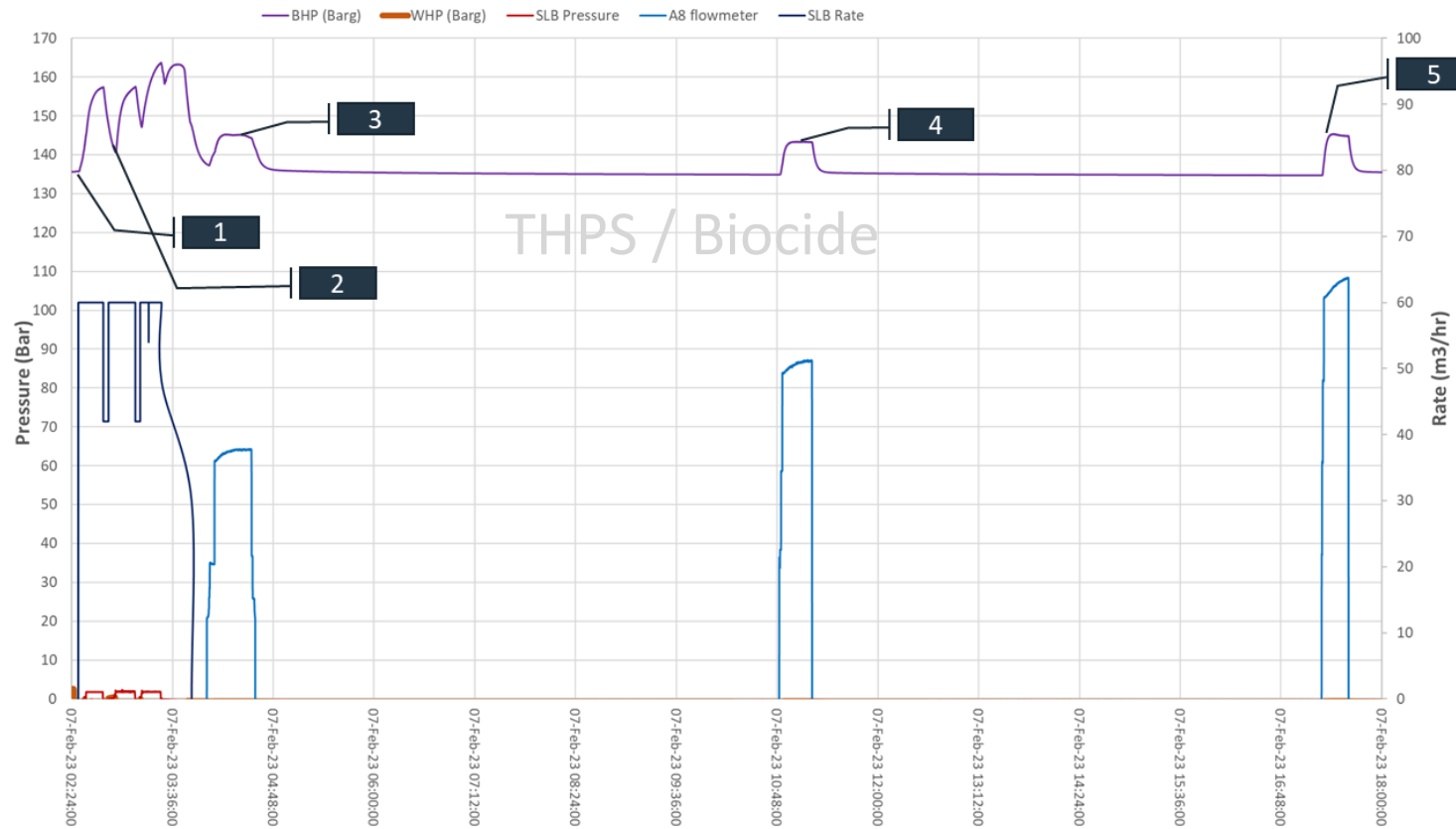
Well Intervention Execution | Mutual Solvent

- With the mutual solvent injection an immediate increase on injectivity was observed
- The wellbore displacement was divided in stages
- Soaking time 6-24 hours between displacement stages
- Improved chemical exposure in the damage area



Event	Remark
1	5/2/23 22:10 Start mutual solvent pump into the well
2	5/2/23 22:10 Change of tank
3	5/2/23 23:15 Displacement of SLB flowlines with Brine
4	5/2/23 23:30 Start of 1/3 displacement out of tubing (19 Sm3)
5	5/3/23 08:05 Start 2/3 displacement out of tubing (19 Sm3)
6	5/3/23 14:31 Start 3/3 displacement out of tubing (19 Sm3)

Well Intervention Execution | THPS

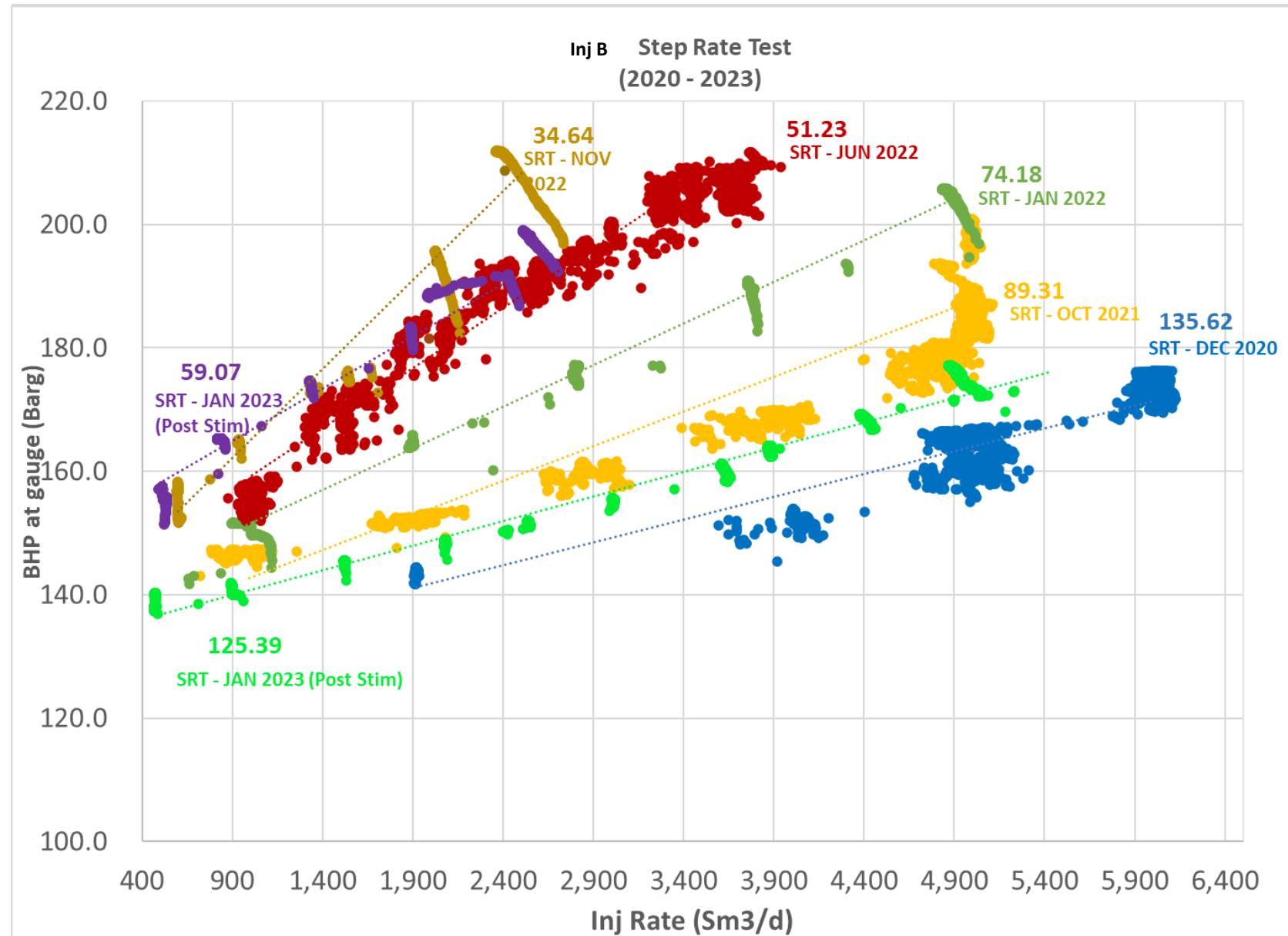


Event	Remark
1	7/2/23 02:30 Start THPS pump into the well (61.65 Sm3)
2	7/2/23 03:00 Change of tank
3	7/2/23 04:00 Start of 1/3 displacement out of tubing (19.24 Sm3)
4	7/2/23 10:45 Start 2/3 displacement out of tubing (19 Sm3)
5	7/2/23 17:15 Start 3/3 displacement out of tubing (19 Sm3)

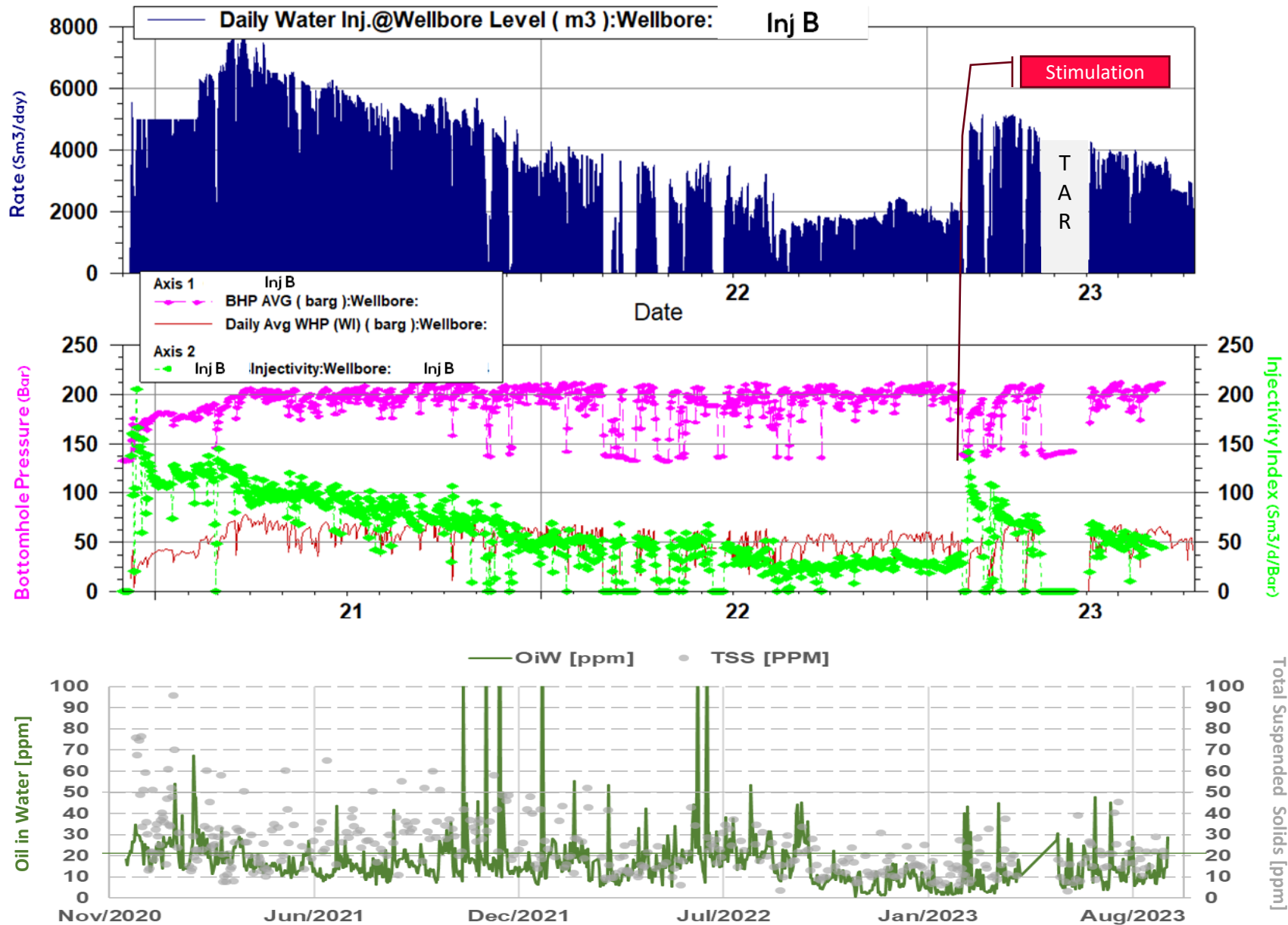
- Similar injection strategy to mutual solvent was followed
- Damage removal wasn't instantaneous as observed with the solvent phase
- Injectivity improvement was observed

Initial Results

- Operation was conducted safely and in a cost-effective manner
- Initial injectivity increased by two-fold post chemical injection



Current Performance

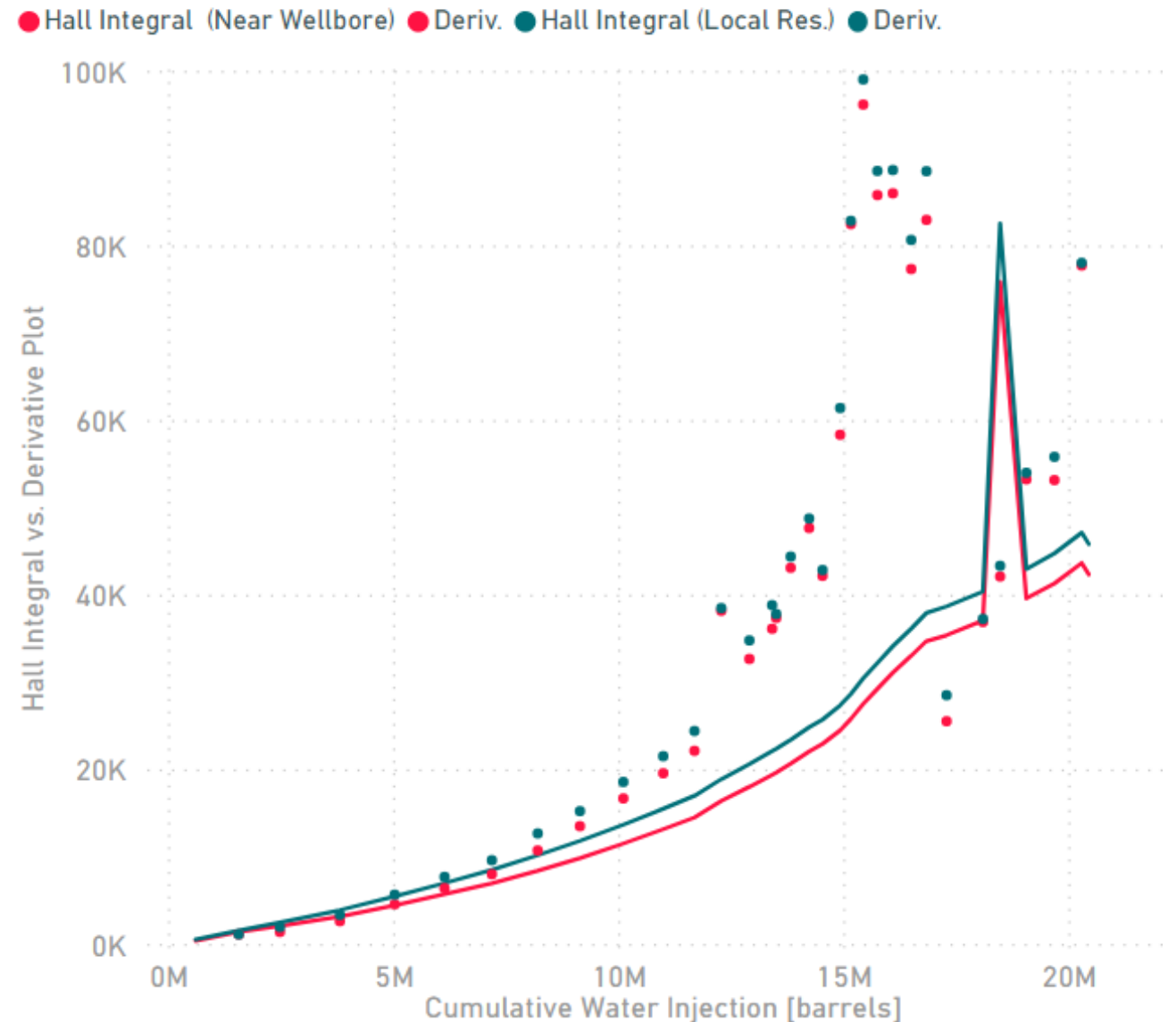


- Restored injection to levels well above pre-intervention
- Inj B Injectivity decline comparable to before intervention
- Renewed injectivity decline following treatment demonstrates the importance of water quality and highlights the need for and timing of future intervention campaigns

Way Forward

- Injection strategy evaluation on going (matrix vs fracture)
- Intervention campaign to improve injectivity in matrix wells
- Alternative workover options to enable higher injection pressures (PPS gauge)
- Fracture injectors observed stable injectivity, more robust to PWRI damage
- Identification and characterization of solids deposits is paramount for the asset
- Topside treatment improvements to prevent or dissolve iron sulphide or other scales

Hall Integral vs. Derivative Plot



Acknowledgments

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