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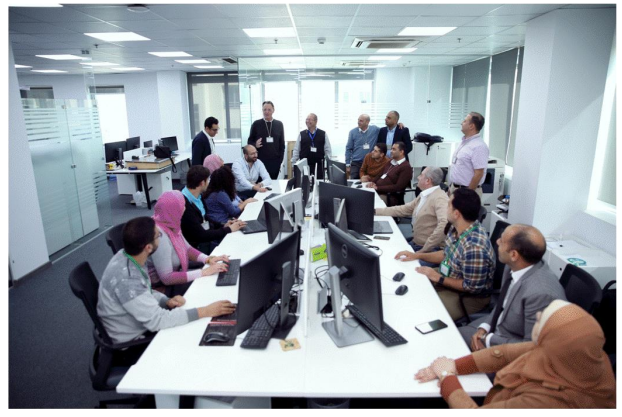
New Dimensions of Acid Stimulation in a Thermal Heavy Oil Carbonate Reservoir

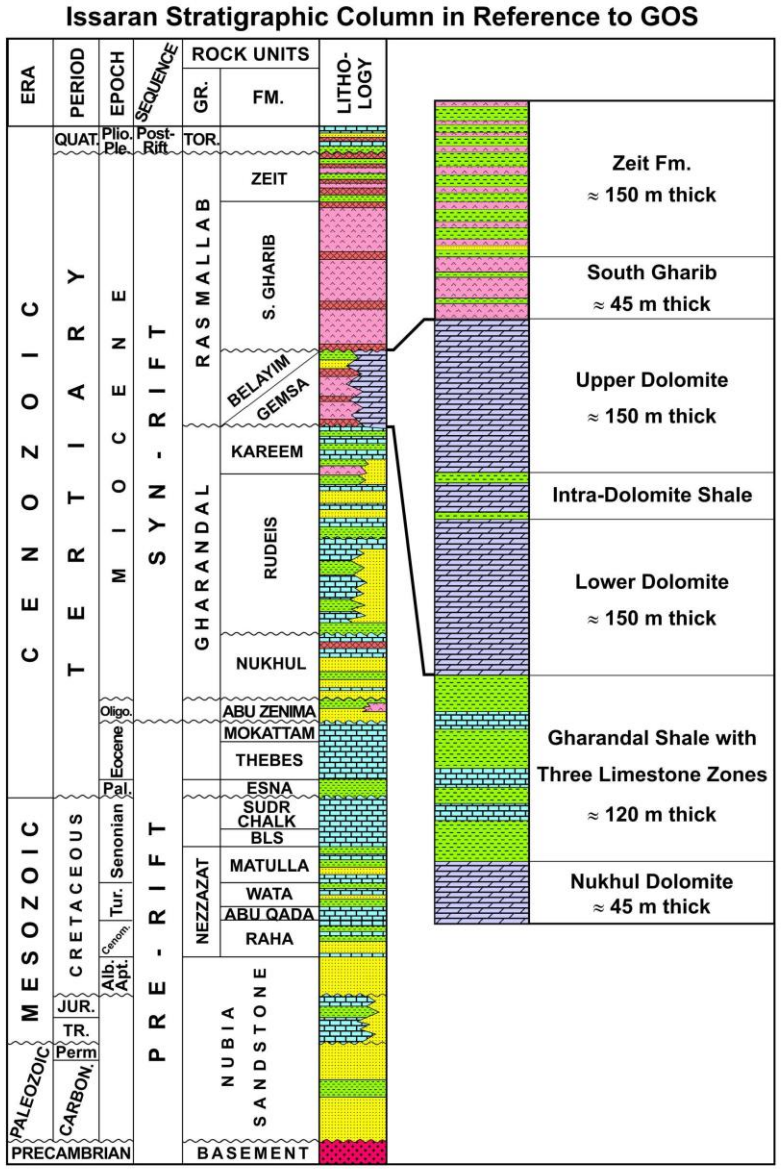





Agenda

- **Introduction**
- **Field Development History &Challenges**
- **Stimulation: What, How and why?**
  - Problem identification
  - Treatment fluid selection
  - Post treatment results
- **Conclusion**

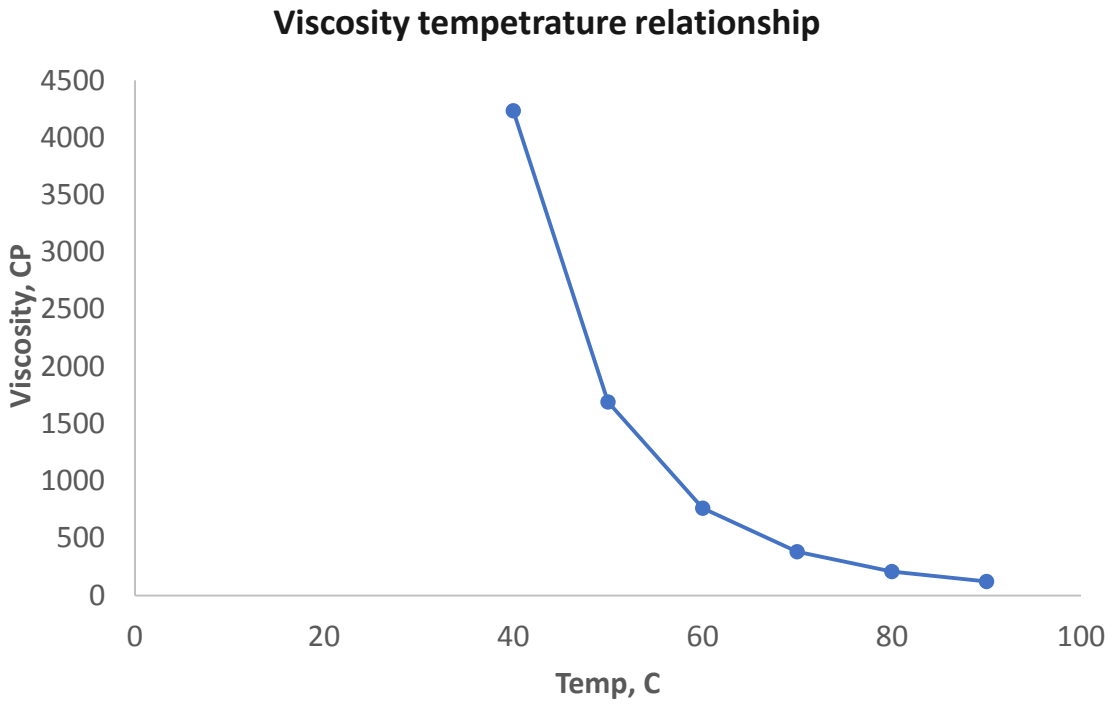
Location Map Of Issaran Field

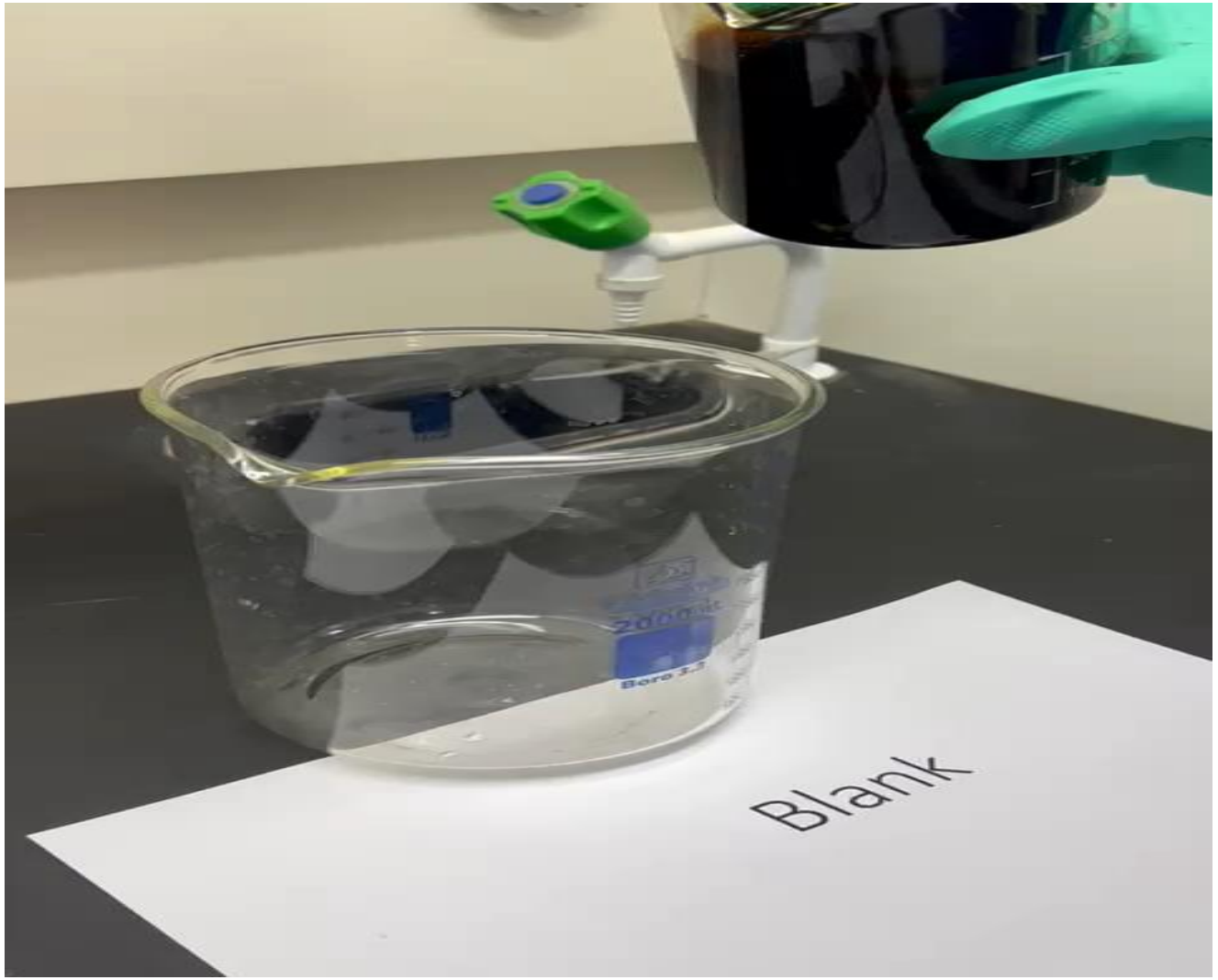


(Fig. 1)

Shallow Reservoirs between 1100-1500 ft

Why do we steam?





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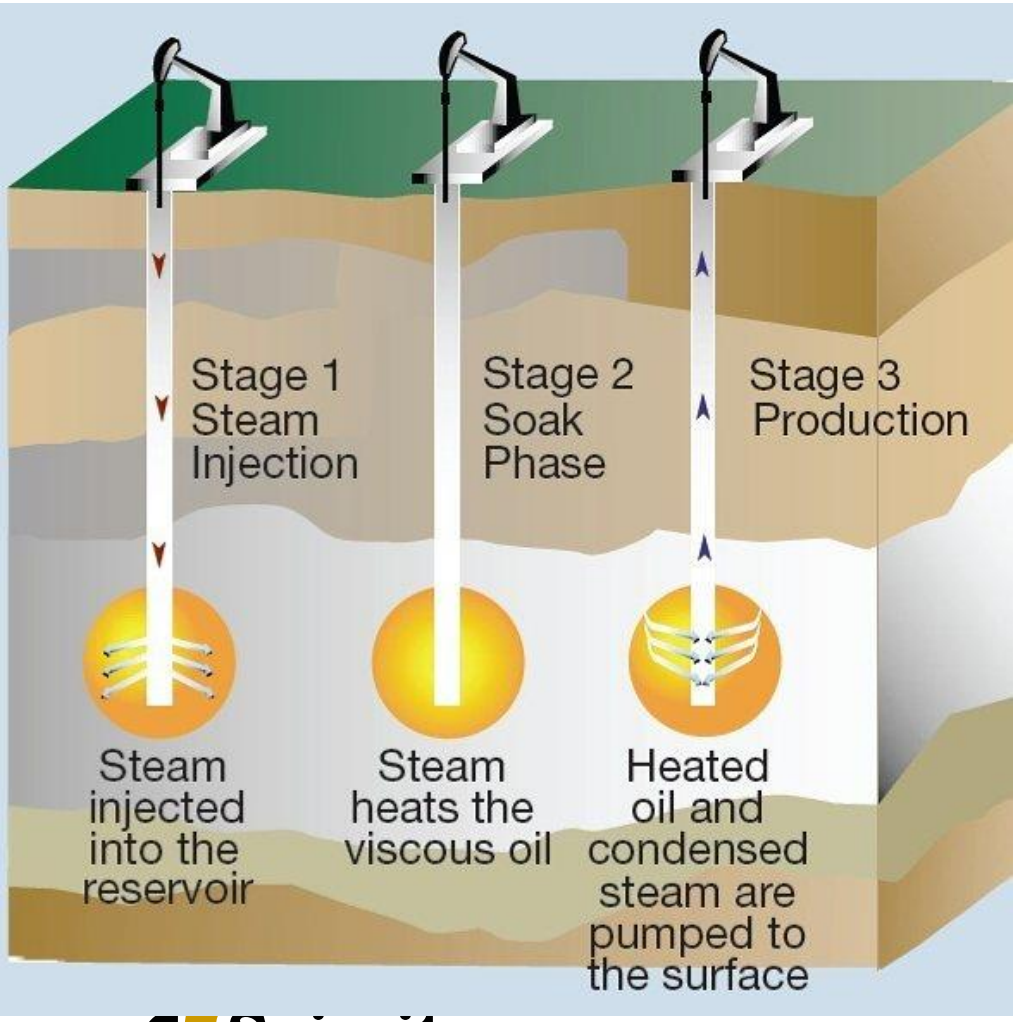
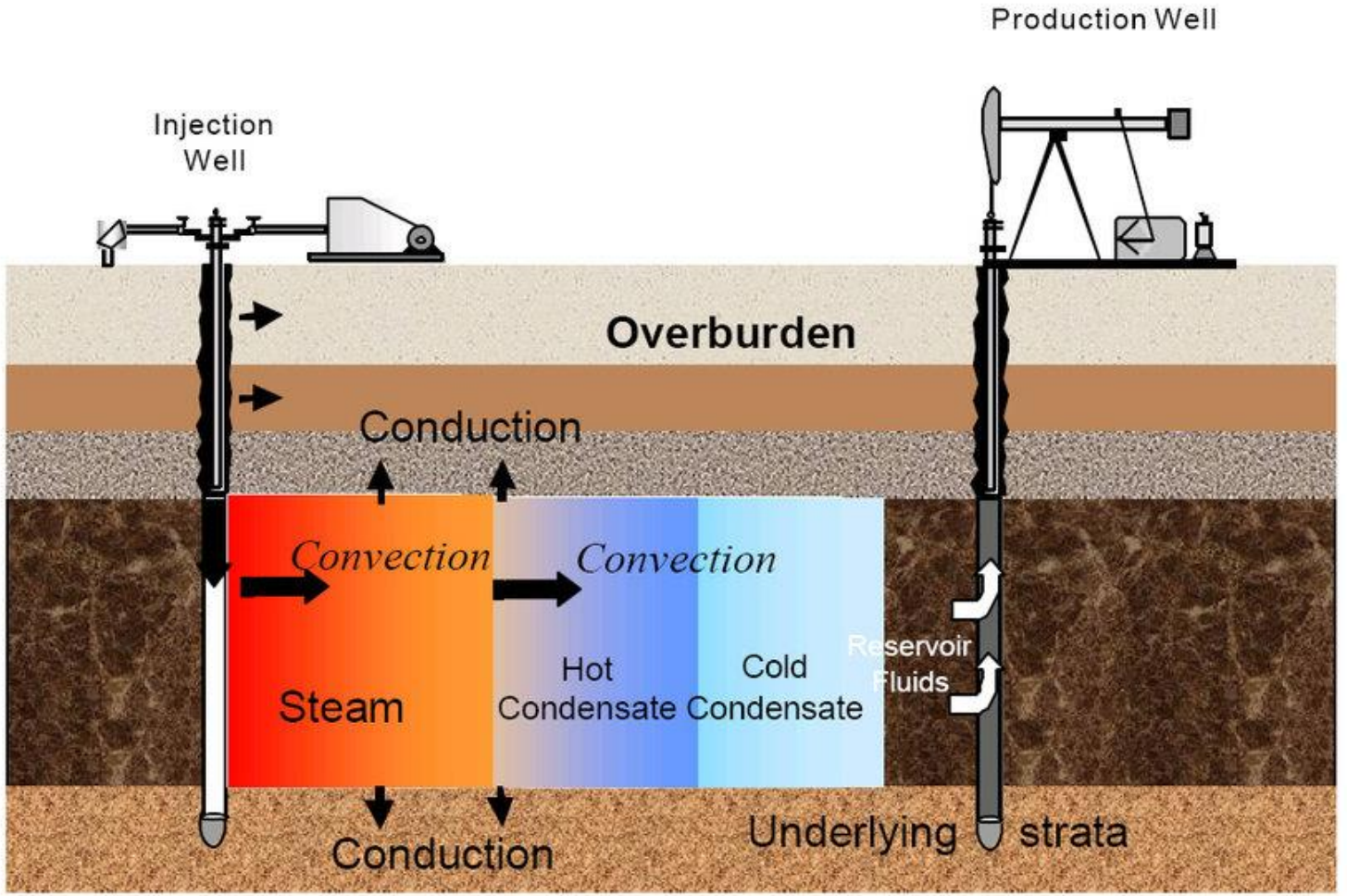
In Issaran, Steam Injection is essential for development

Cyclic Steam Stimulation



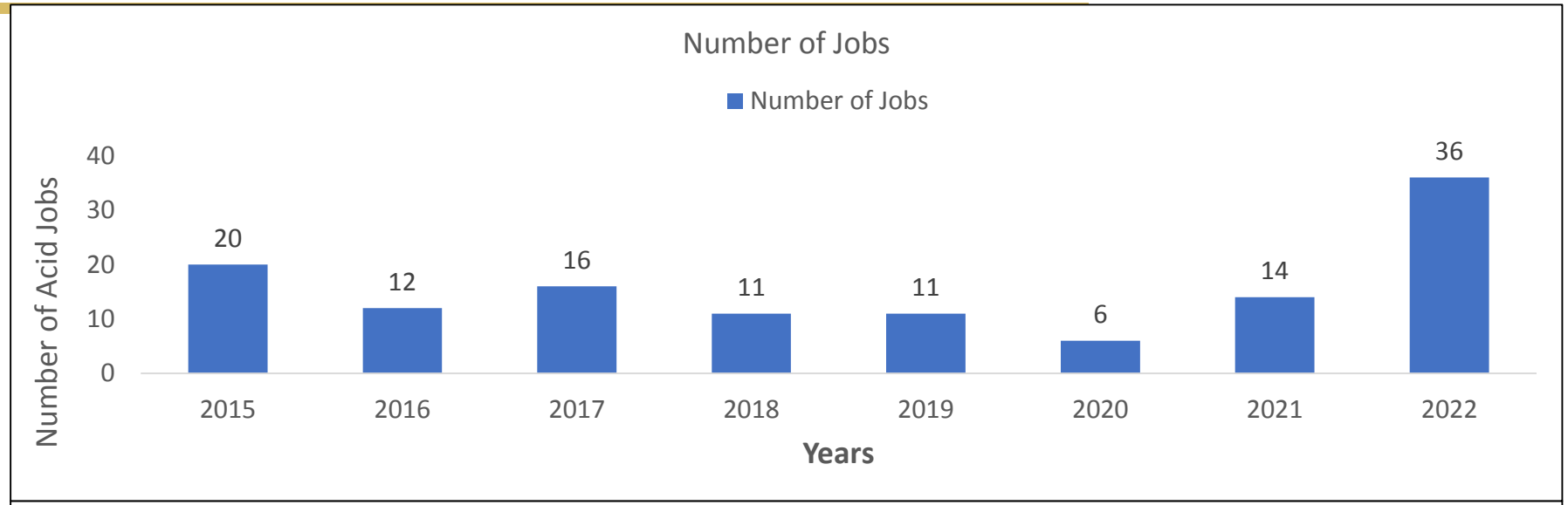
Steam Flooding

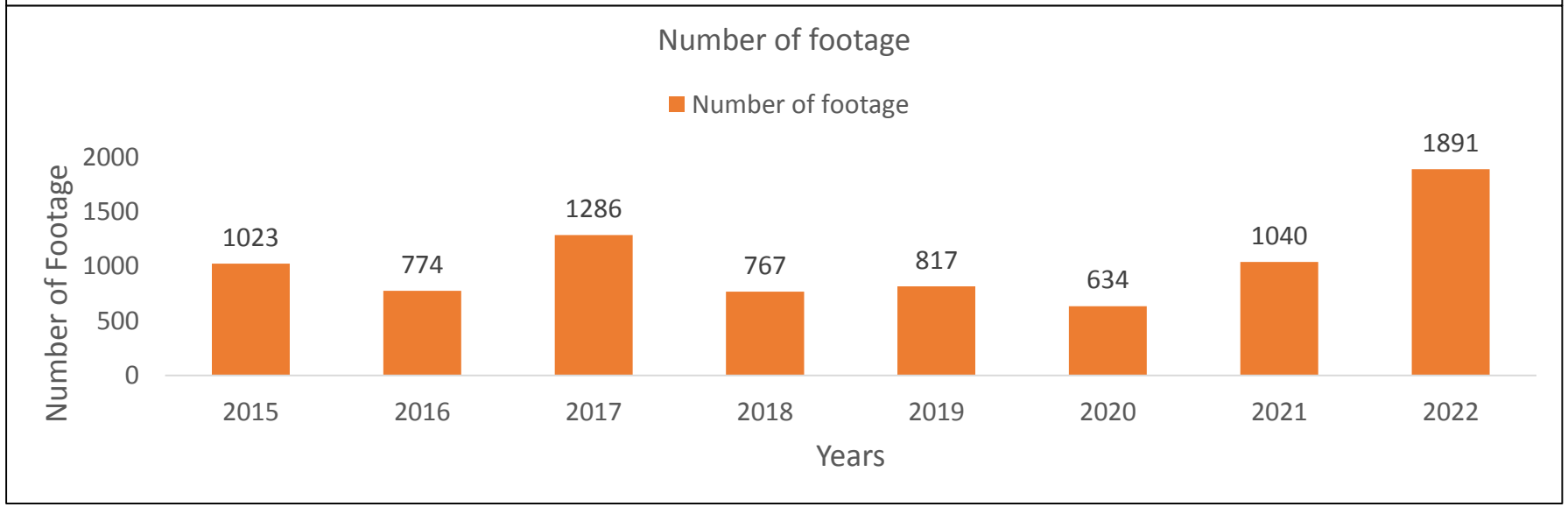


Very high activity levels required: Acid Stimulation Jobs (2015 → 2022)

Total No. of Acid Jobs= 126

Stimulated Footage= 8232





(All these jobs are followed by steam injection)

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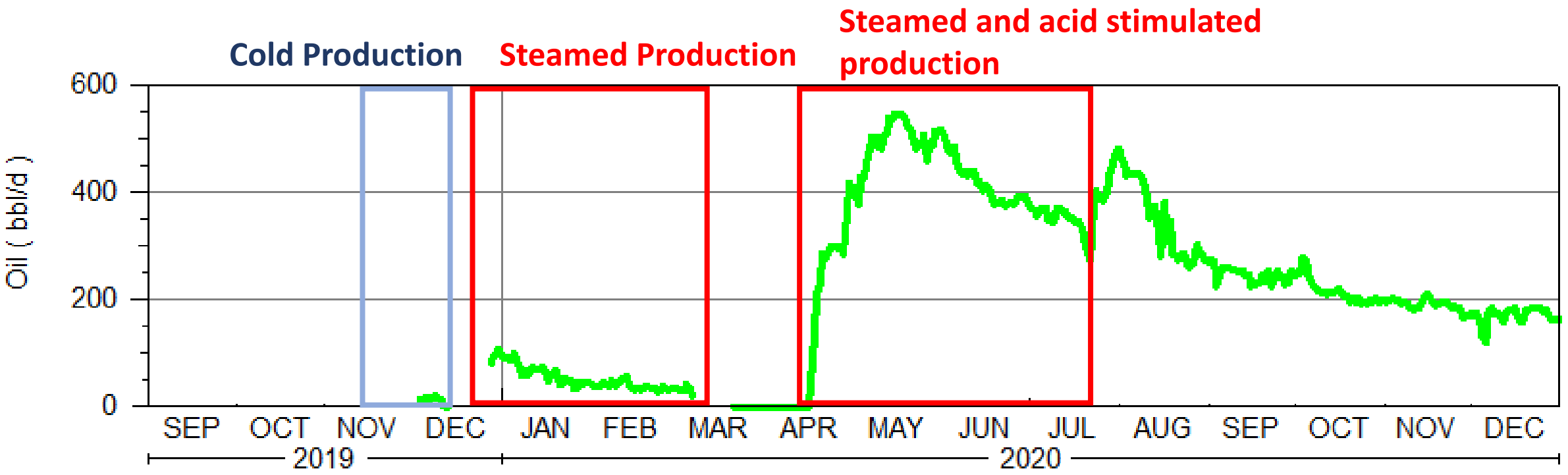
Well life cycle: from cold production to stimulation



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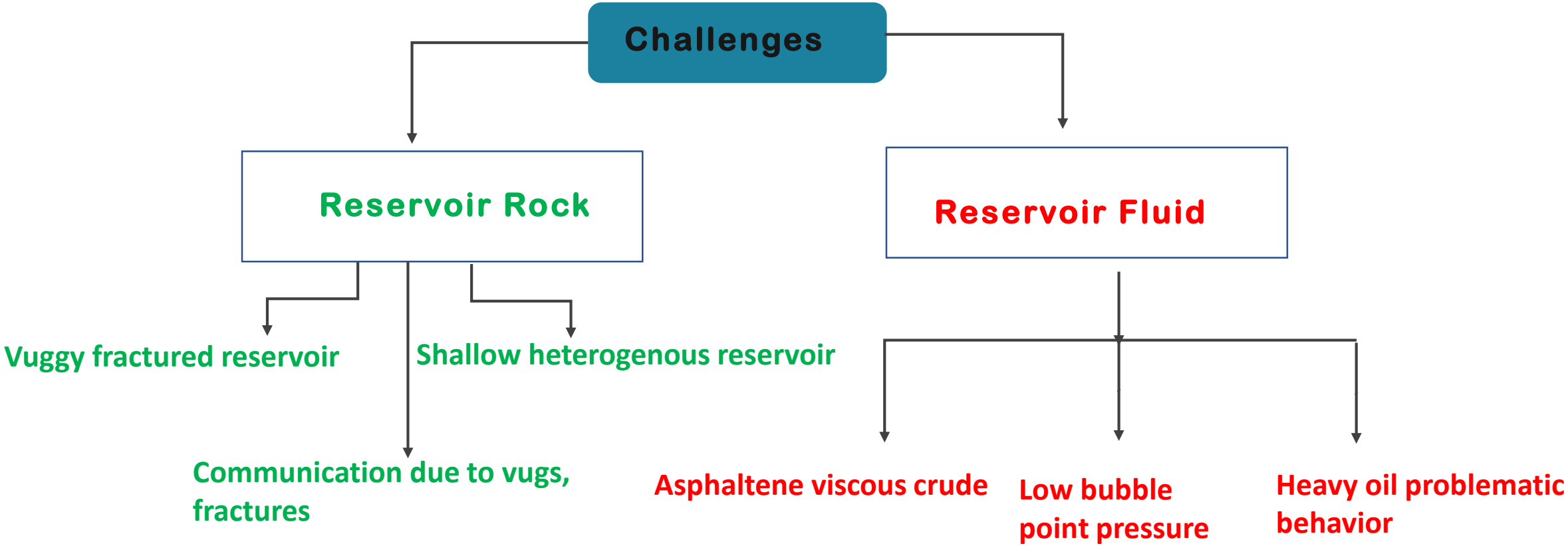
Reservoir Challenges



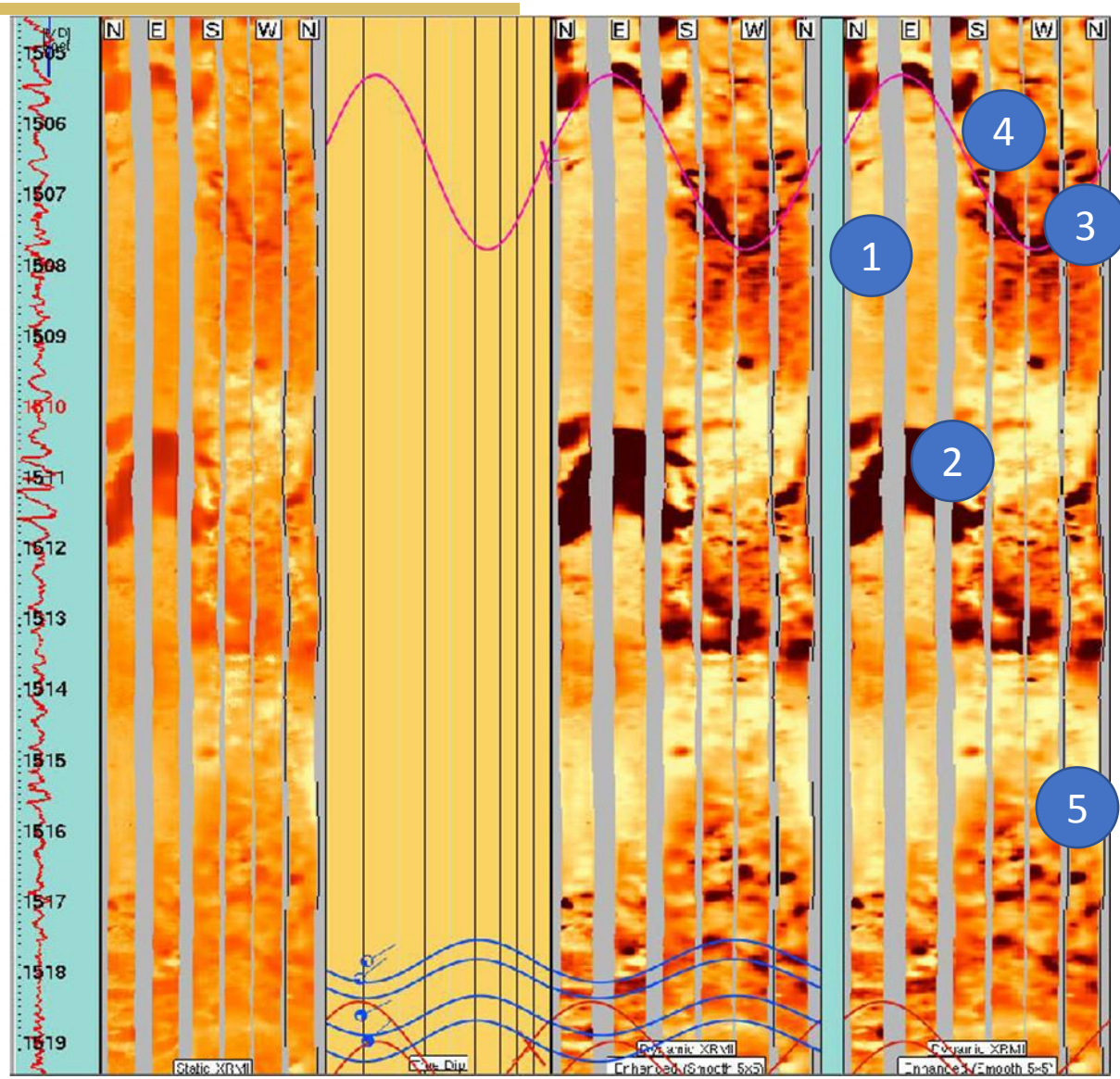
Reservoir Heterogeneity

1. **Dolomitization**
2. **Dissolution**
3. **Fracturing**
4. **Cementation**
5. **Dissolution of Dolomite**

Dissolution and mineralization filled fracture

Dissolution Vugs " 2-3 ft."

Disseminated Dissolution Vugs " 0.1 ft."



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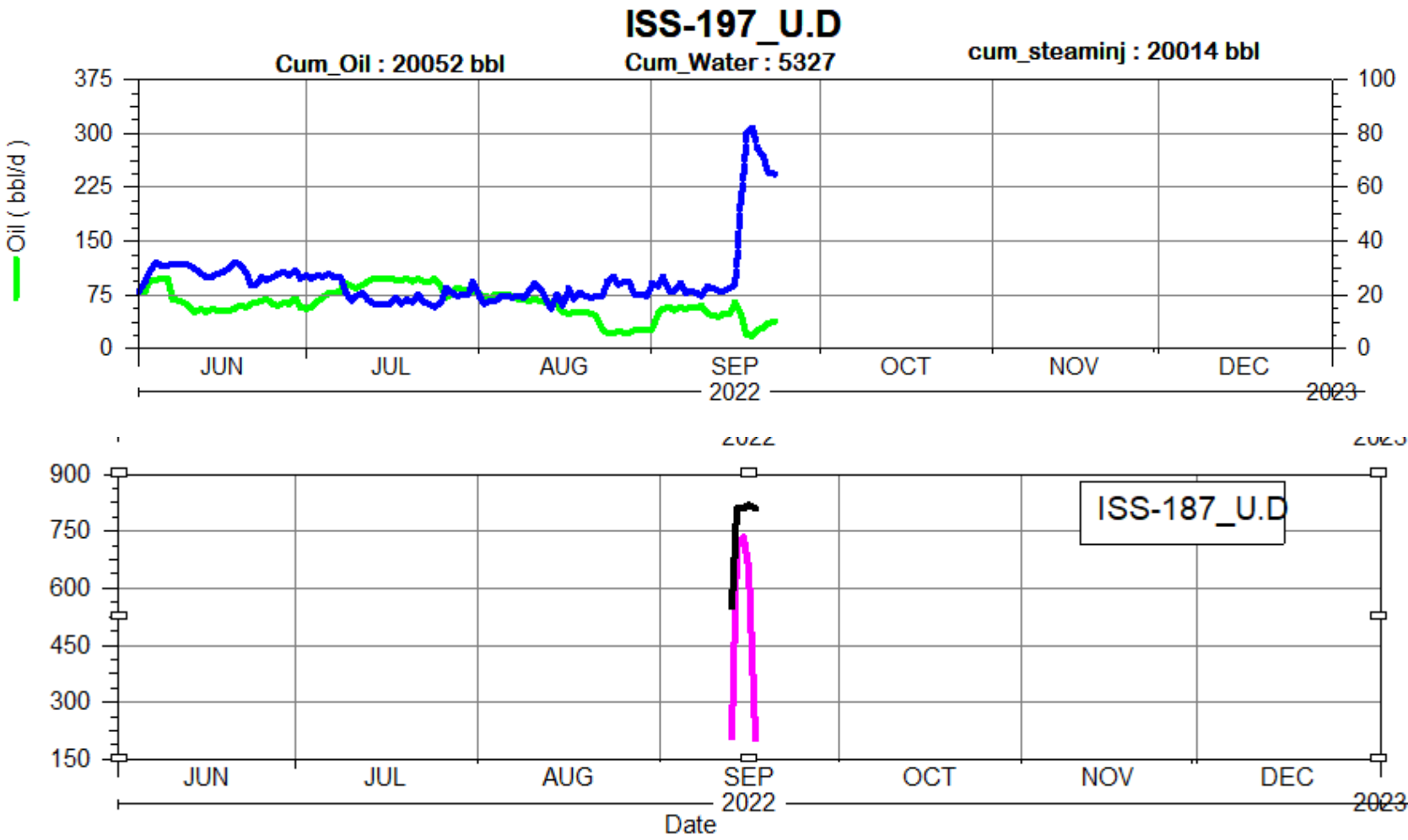
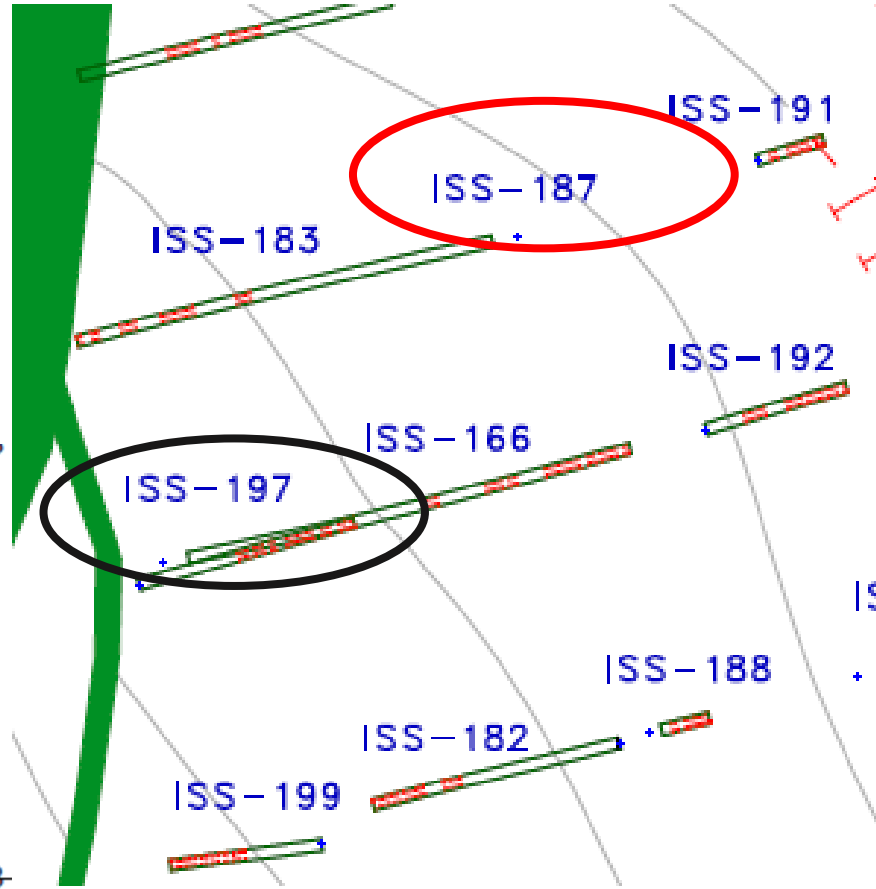
Communication





Wells at 200 m distance

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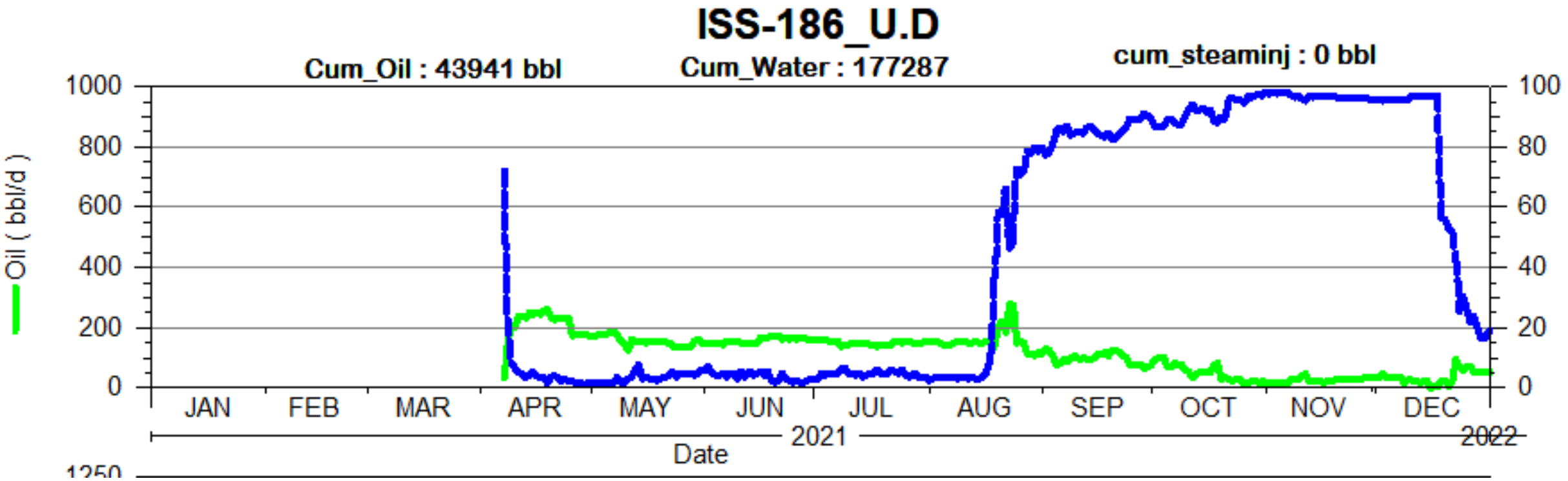
Reservoir Rock Challenges: Water encroachment



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Reservoir Fluid Challenge: High Viscosity/High Asphaltene Content

Kinematic Viscosity mm^2/s (cSt)							
Well No/ Temp	@ 40 °C	@ 50 °C	@ 60 °C	@ 70 °C	@ 80 °C	@ 90 °C	API
C-303	5980	2197	928	441	231	131	10.8
C-324	2718	1153	546	283	160	98	12.4
I-164	3148	1281	594	304	171	103	12.2
I-185	815	395	210	121	75	49	14.5

Varying Asphaltene content in most of wells ranging between 10 %to 15 % of crude oil composition

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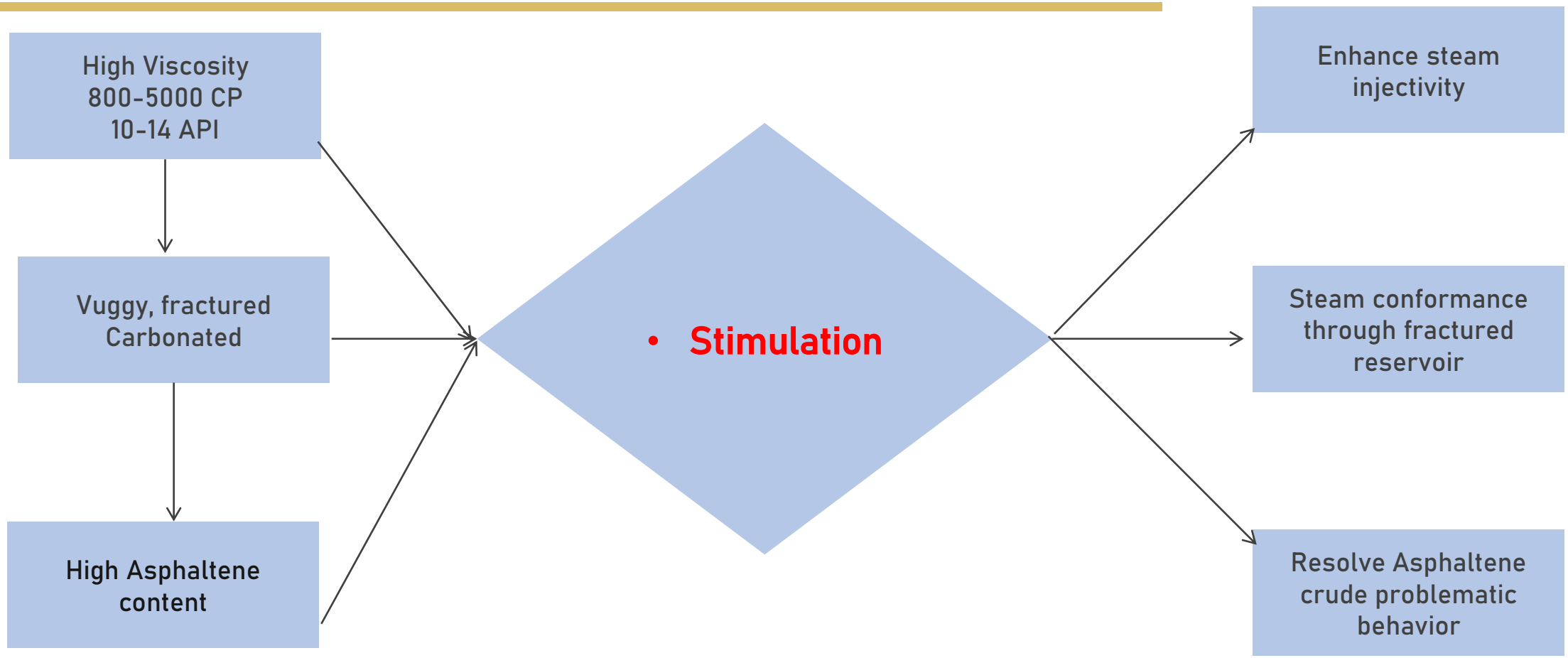
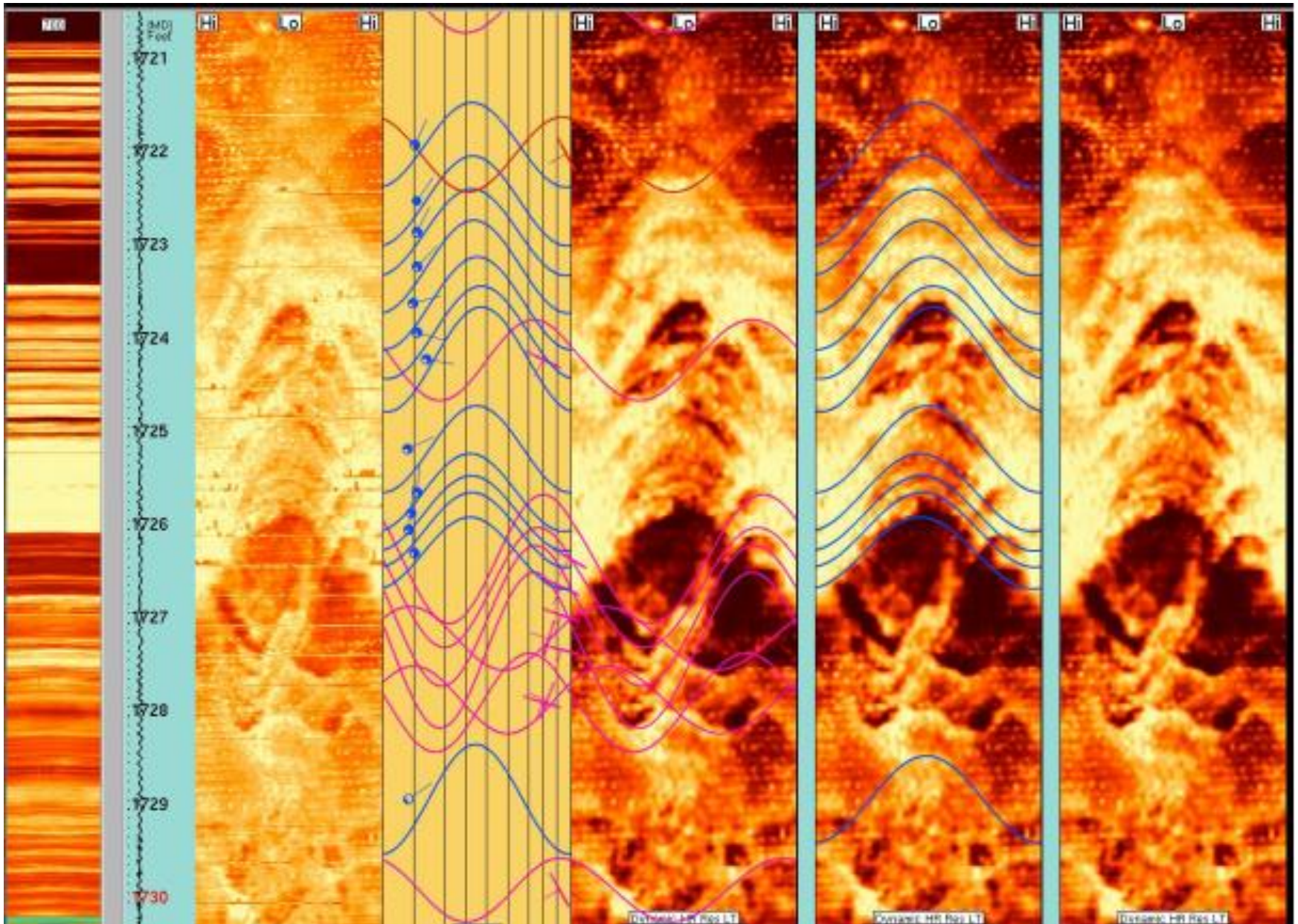
Stimulation: from problem to solution



ISS-184 :Diversion as a way of sustaining production



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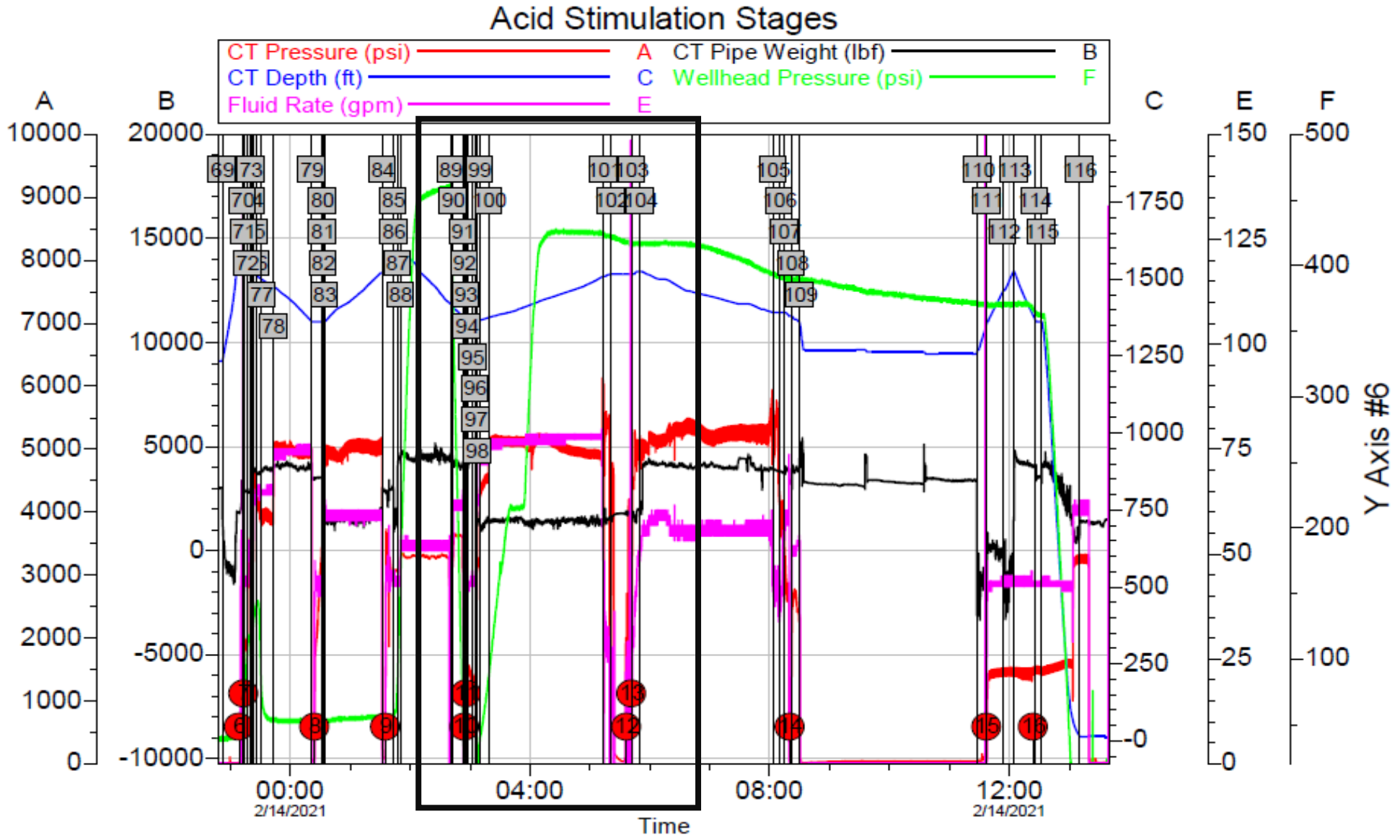
ISS-184 :Diversion as a way of sustaining production



Full Treatment stages

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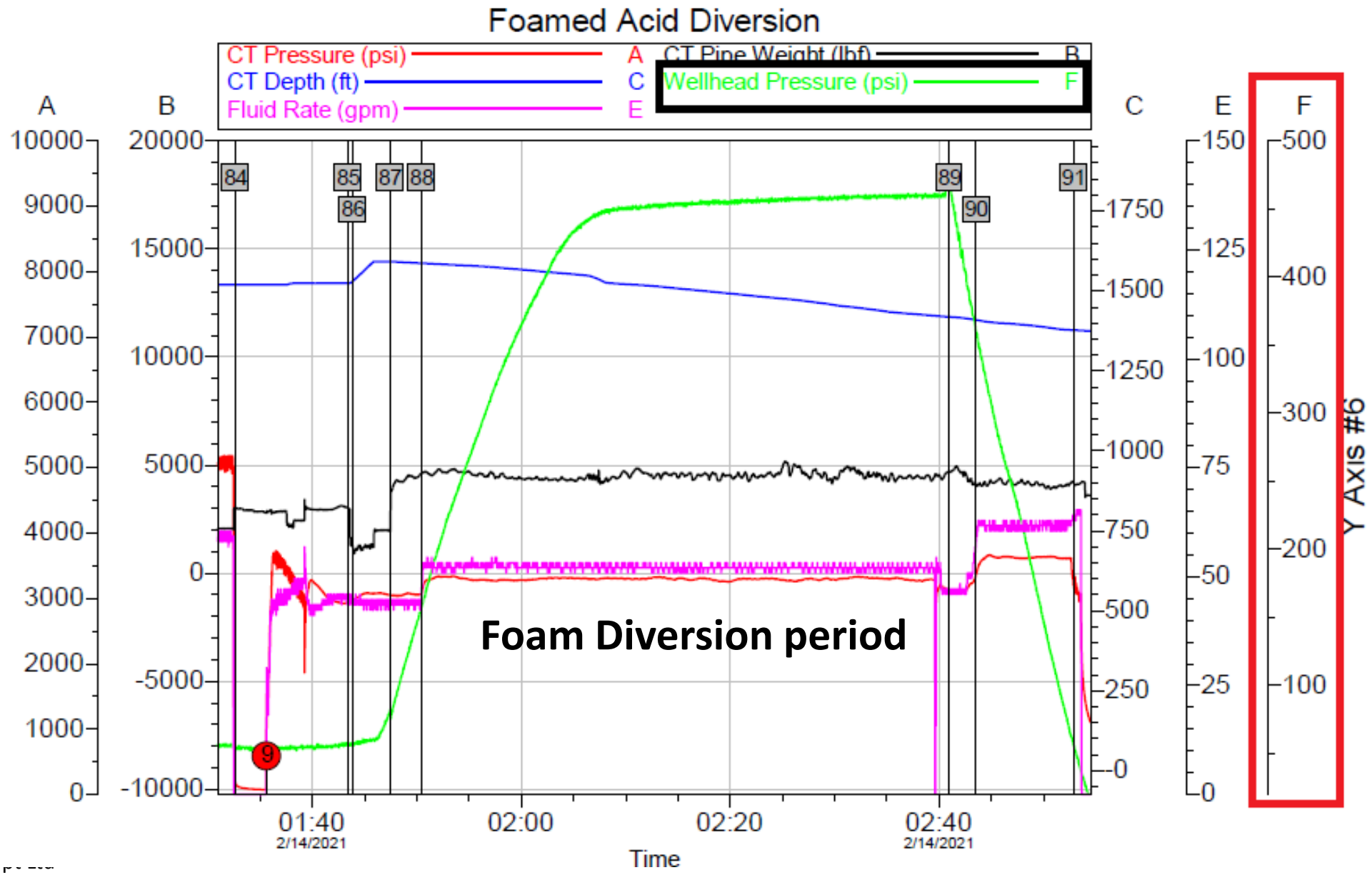
ISS-184 :Diversion as a way of sustaining production



ISS-184 :Diversion as a way of sustaining production

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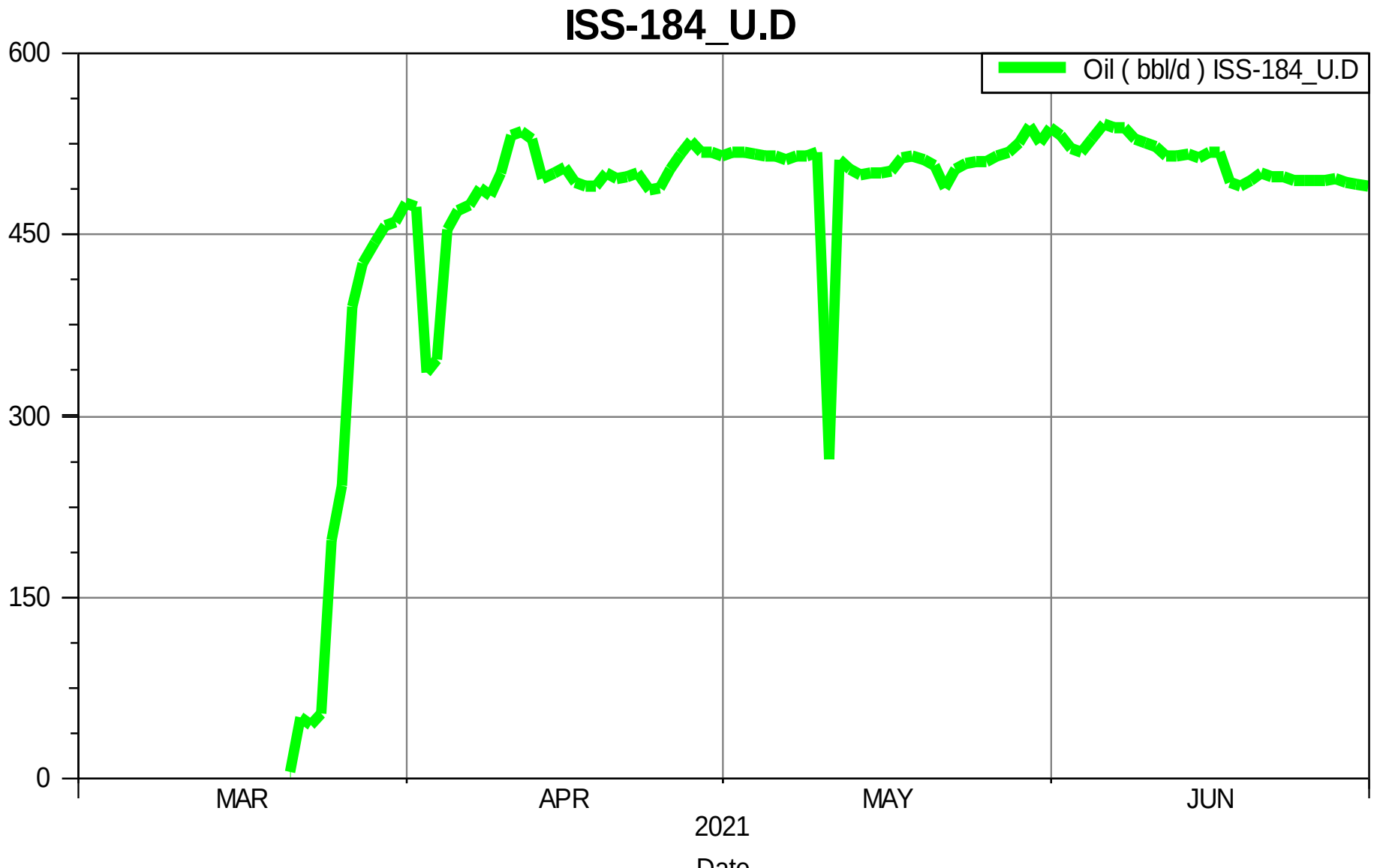
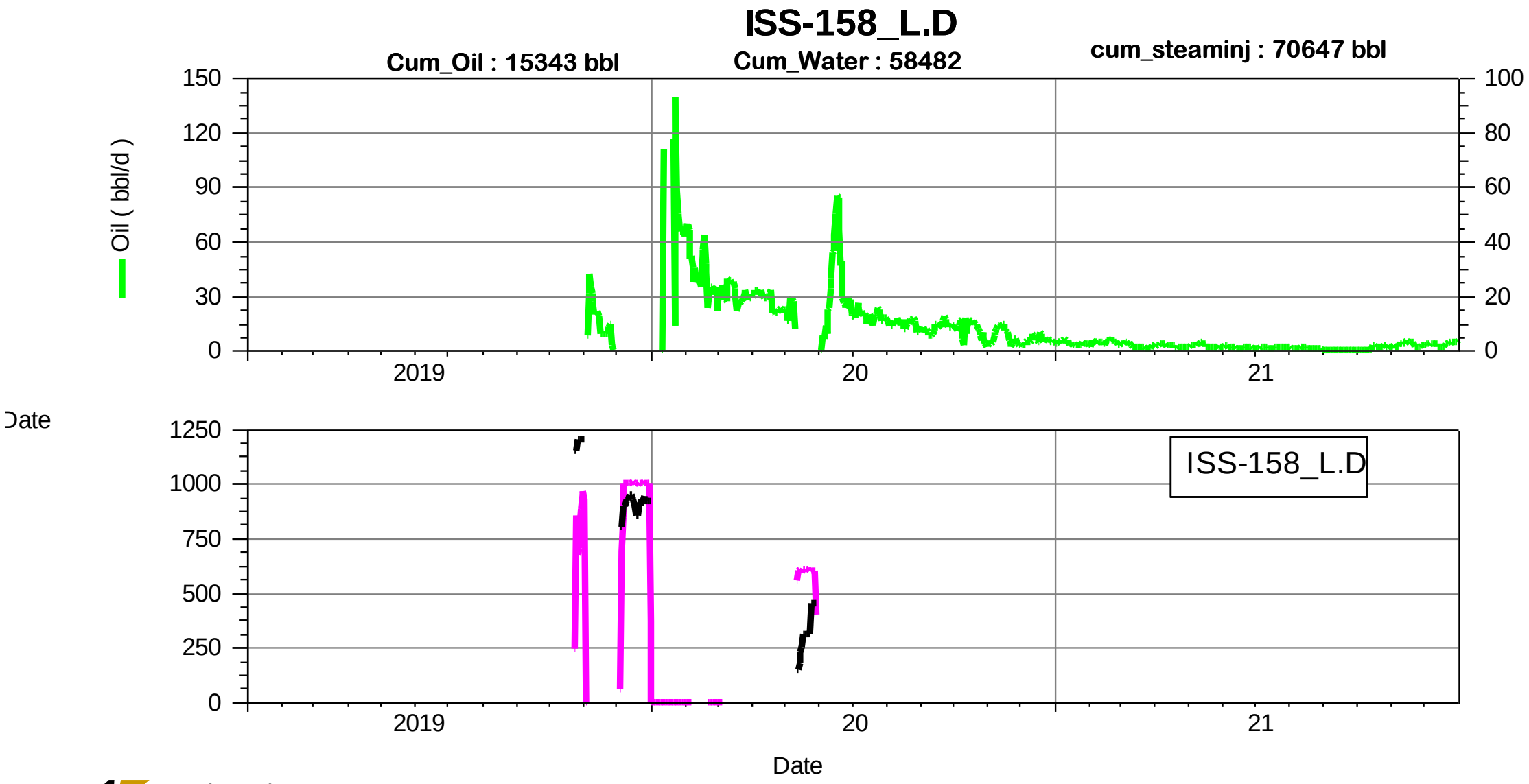
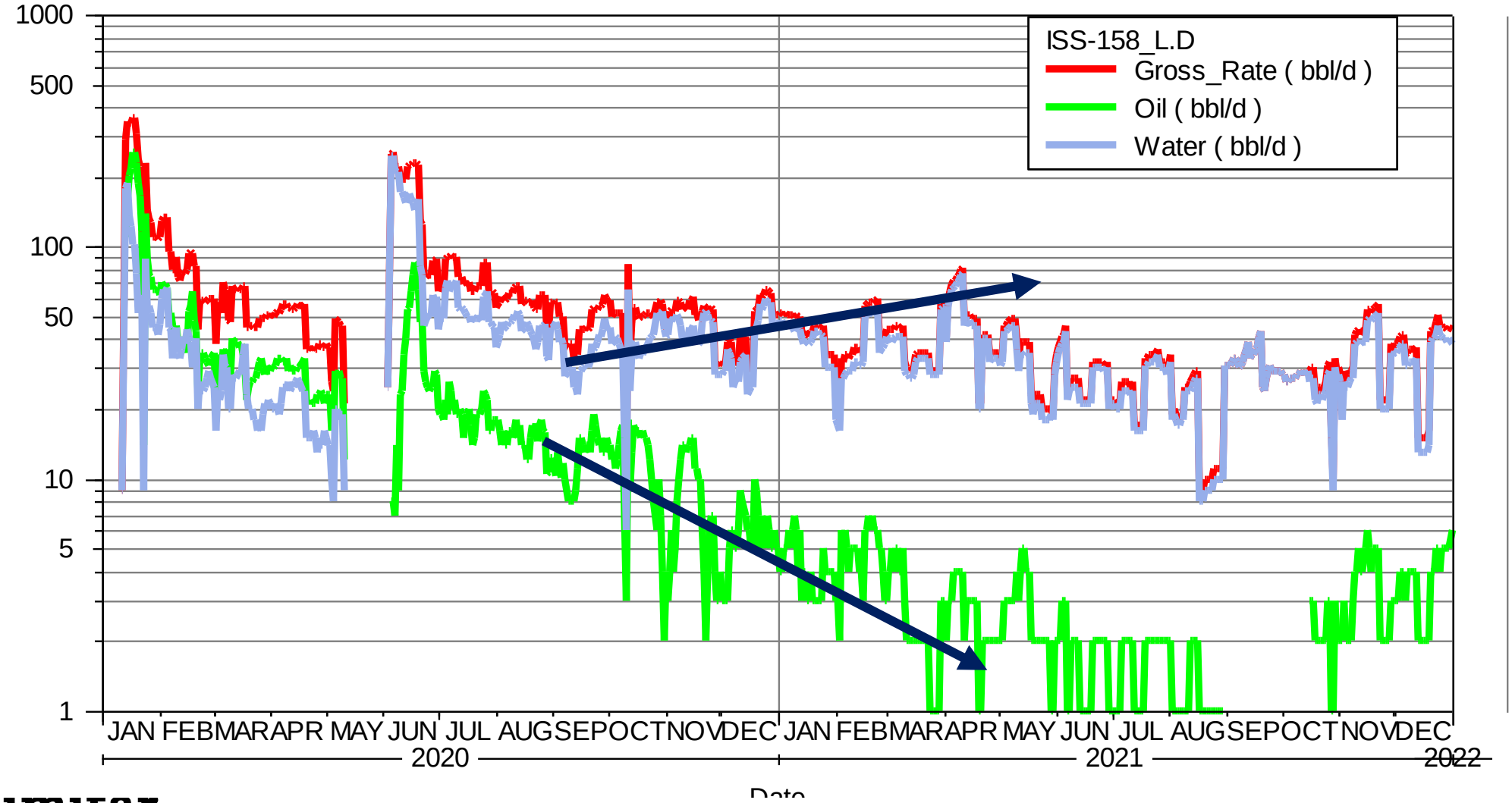
ISS-184 :Diversion as a way of sustaining production



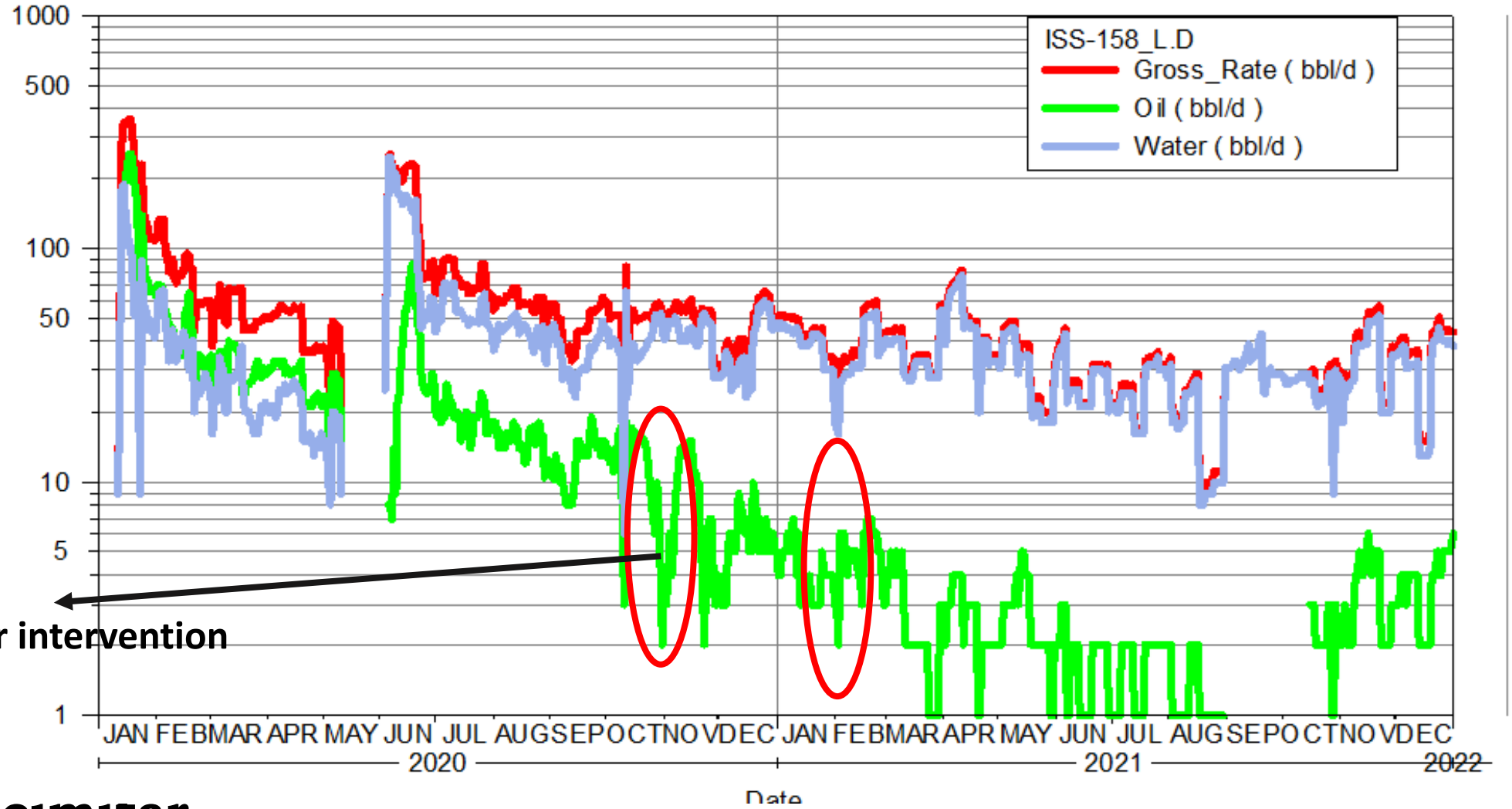
ISS-158 Asphaltene results in poor production



How to identify Asphaltenes



Emulsions created following Work-Over intervention



Work over intervention

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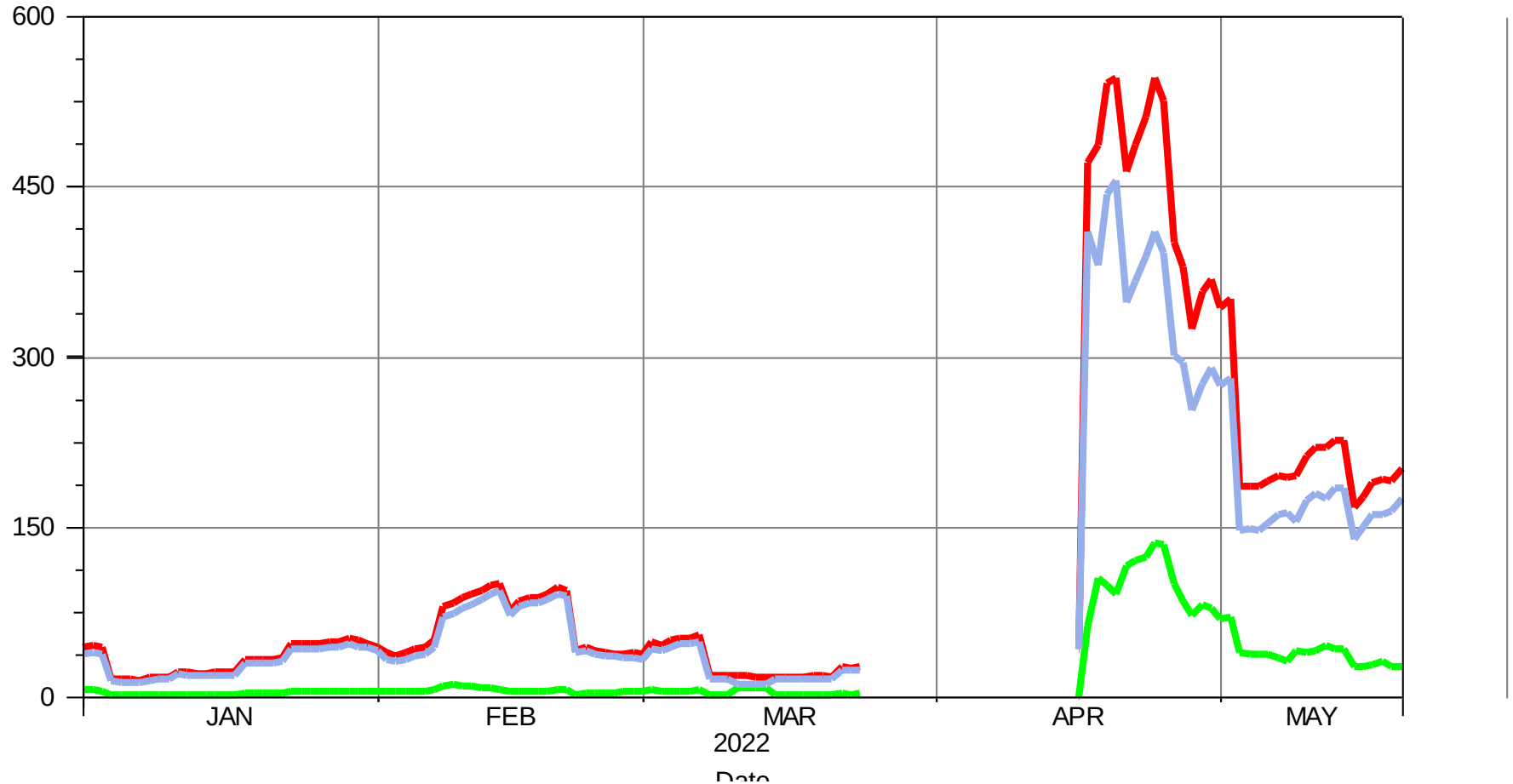
Multi purpose fluids give a great effect on Asphaltenes

- **Resolving the asphaltene issue: After treatment with a multi purpose fluid, there is a great enhance in Kro relative permeability.**



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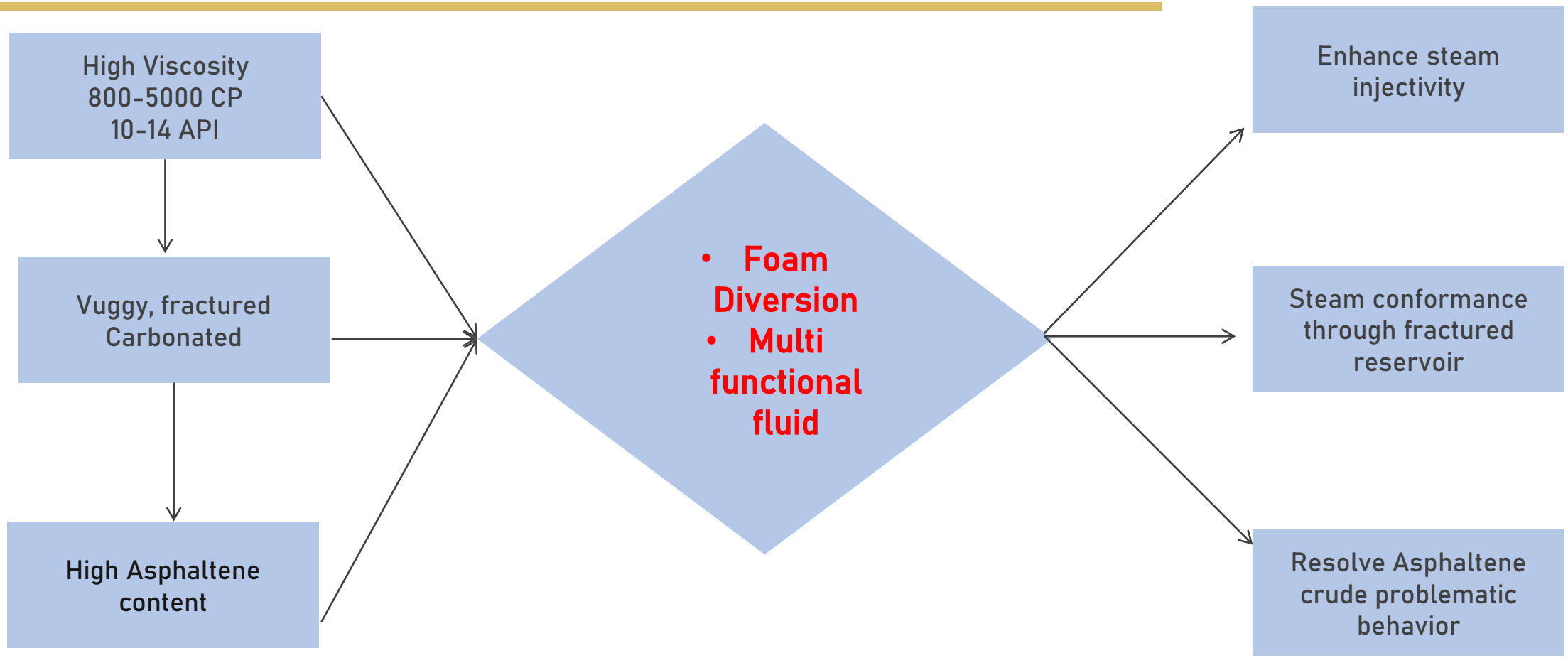
Stimulation: from problem to solution



Conclusion

- **Right damage identification led to suitable treatment as misdiagnosis lead to inaccurate recommendation for stimulation.**
- **Foam acid using nitrogen is very effective in treatment placement especially in highly fractured depleted reservoir system.**
- **Steam conformance is achieved through foam diversion . This is essential in naturally fractured carbonate reservoir stimulation.**
- **Use of multifunctional fluid instead of conventional treatment proves its potential and commerciality in heavy oil stimulation.**
- **The combination of stimulation treatment followed by steam stimulation is a novel technique in thermal heavy oil recovery.**

Thank You