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Strengthening Marginal and Mature Field Ecosystems: Technology, Innovation, and Collaboration

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Enhancing Recovery in Mature Offshore Reservoirs Through Organic Oil Recovery: Field Results From the North Sea

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Agenda

- Background
- Field Properties
- Operation Timeline
- Pilot Results
- Injector Treatment Results
- Key Challenges and Learnings

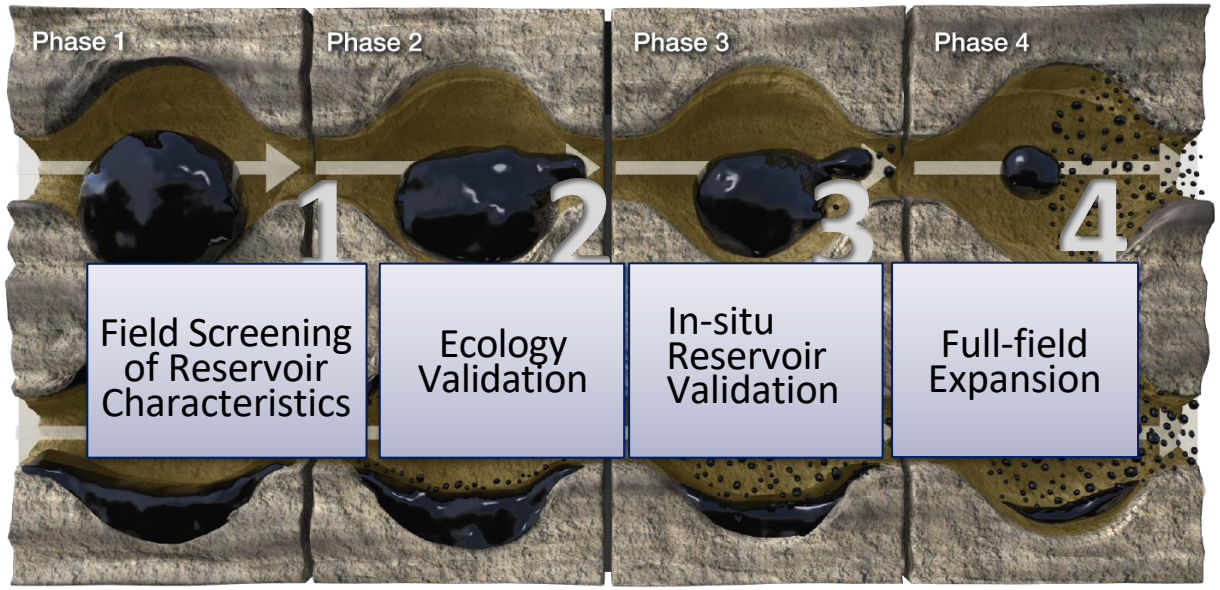
Background

- Increased demand for oil and gas in UK
- Declining production and high water cut
- Restrictions on drilling new wells
- Increased operating expenditure
- Green Technology
- Low CAPEX Enhanced Oil Recovery

Background

- Organic Oil Recovery
- In-situ microbial activation
- Specific nutrient limitation
- Temporal reduction of surface tension
- Release of trapped/residual oil

• Patented • Proven • More Oil • Less Cost • Biodegradable



OOR Mechanism

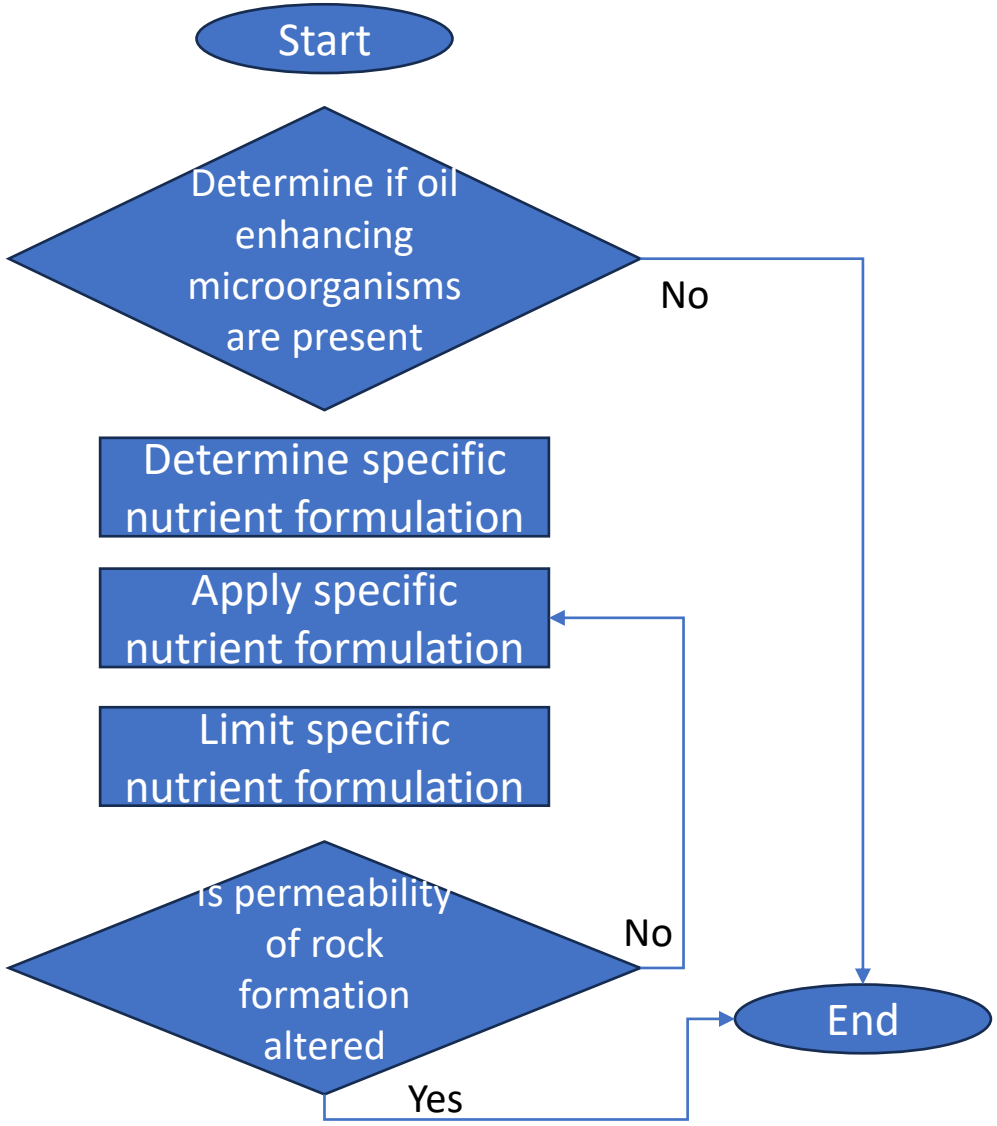
This technology uses **naturally existing microbes in the reservoir** to improve oil production.

The process works by:

- Analyze produced water and reservoir conditions
- Identify and assess resident microorganisms
- Develop a tailored nutrient formulation
- First **stimulating microbes with nutrients**
- Then **limiting nutrients to control their activity**

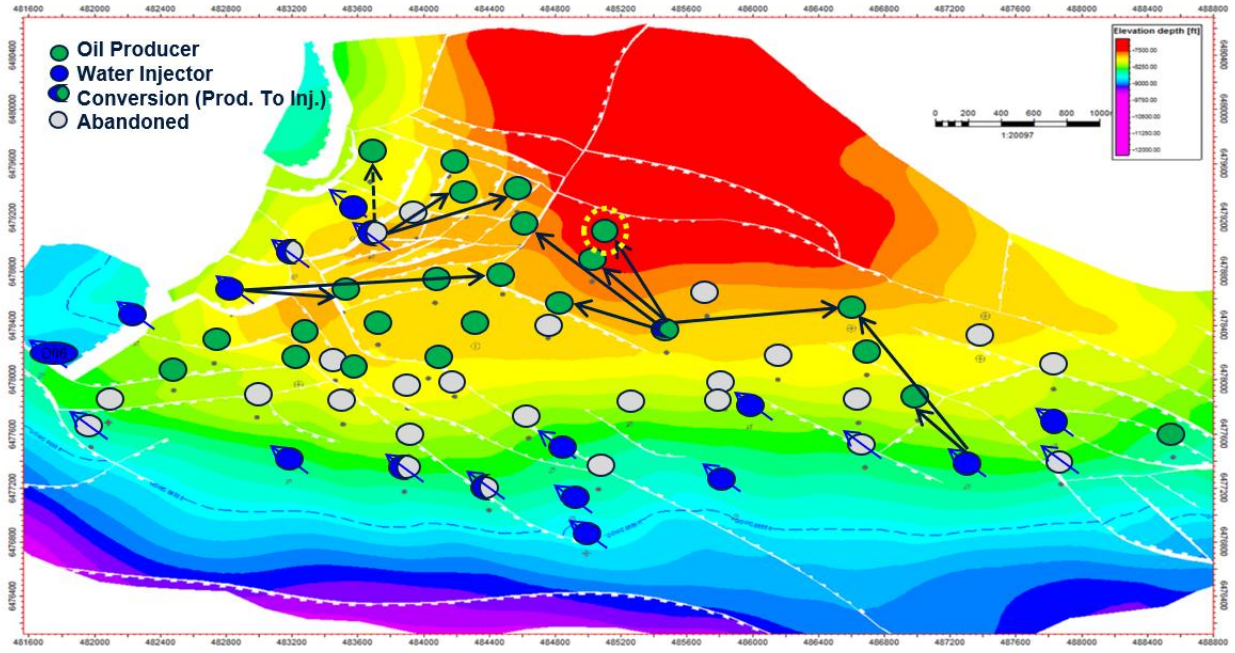
This controlled microbial action helps to:

- Change how oil and water move through the reservoir
- **Improve relative permeability**
- **Wettability Alteration**
- **Increase Oil Mobility of trapped Oil**
- Increase **production rates** and overall **recovery (EUR)**



Field Properties

Property	
Rock	Sandstone
Field Oil Production	8000 BPD
BHT	82.2°C
WC	84%
Waterflooded	Yes, ~40 years
Production Water Temperature	41-56°C
Available Wells	22 PW, 4 IW



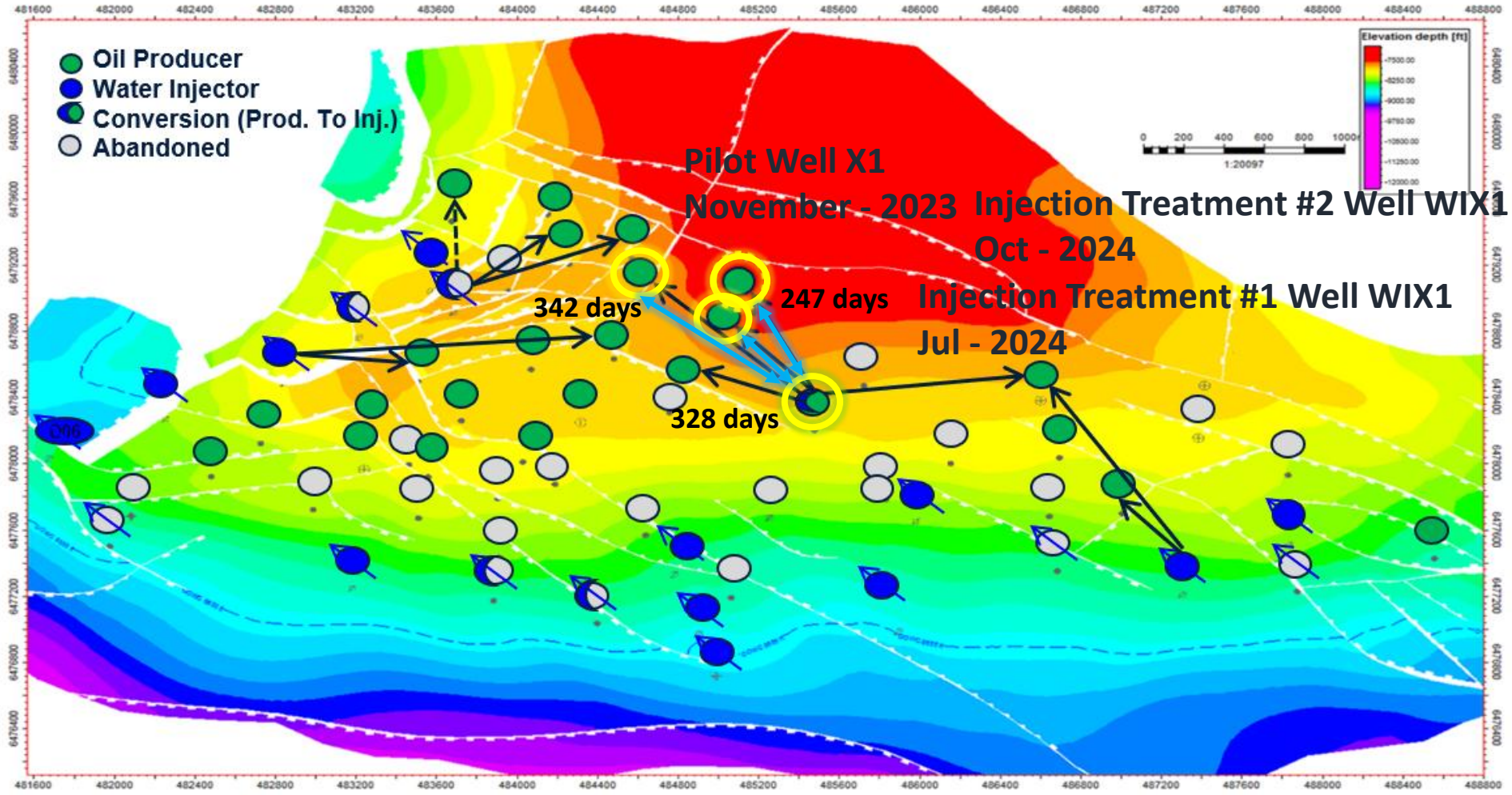
Reservoir Depth Structure Map

Pilot Well Properties	Well X1
Oil Gravity (°API)	27
Reservoir Temperature (°C)	82.2
Produced Water Salinity (ppm)	50,000
Reservoir Permeability (mD)	20-200

OOR Screening Criteria

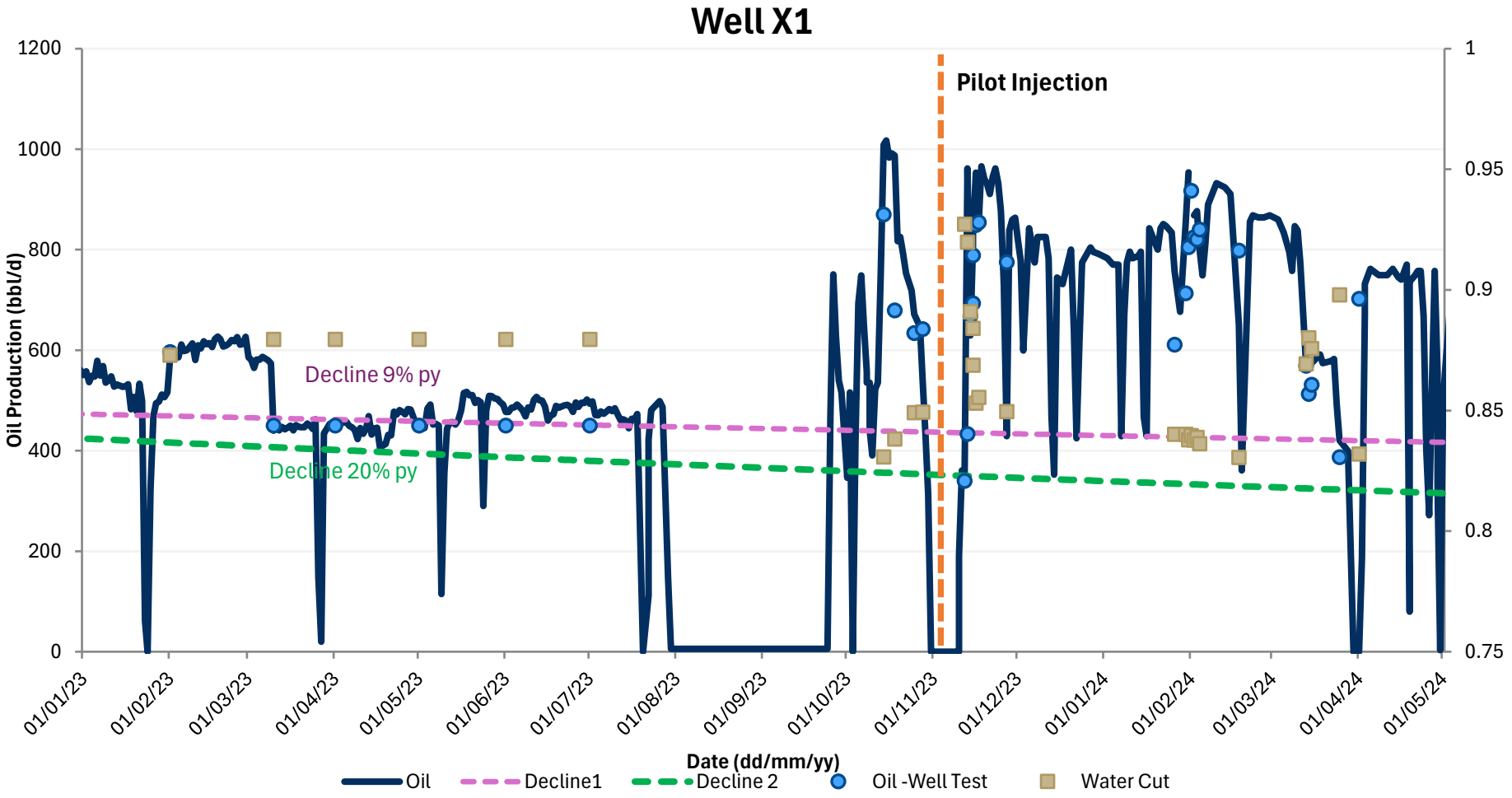
OIL DENSITY	pH	TEMPERATURE	SALINITY	PERMEABILITY	WATERFLOOD
12 - 48 °API	5.5 – 8.5	<121 °C	<240K ppm	>1 mD	Active waterflood

Operations Timeline



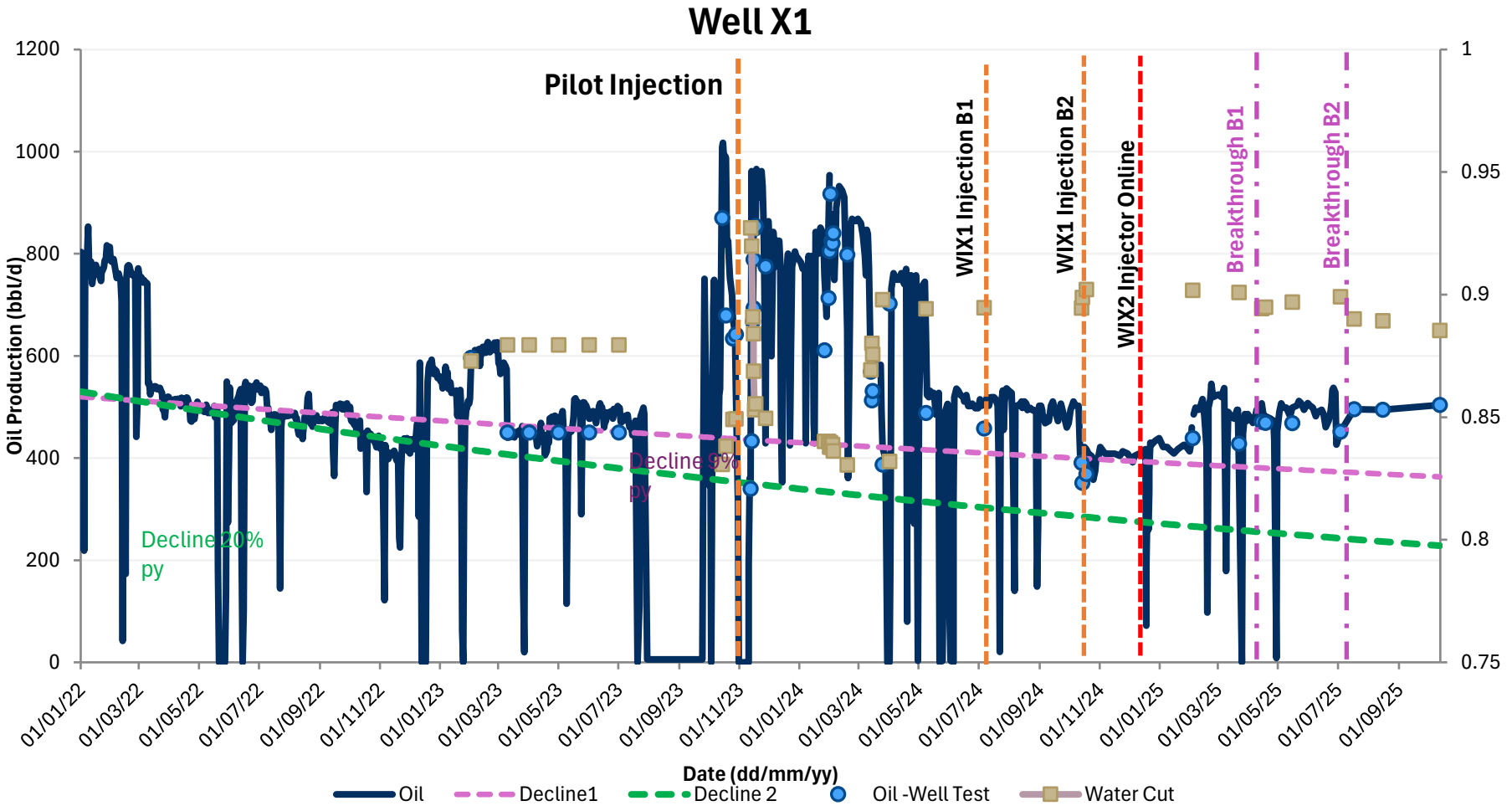
Top Structure Depth Map Integrated with Injection–Production Connectivity

Pilot Results – Well X1



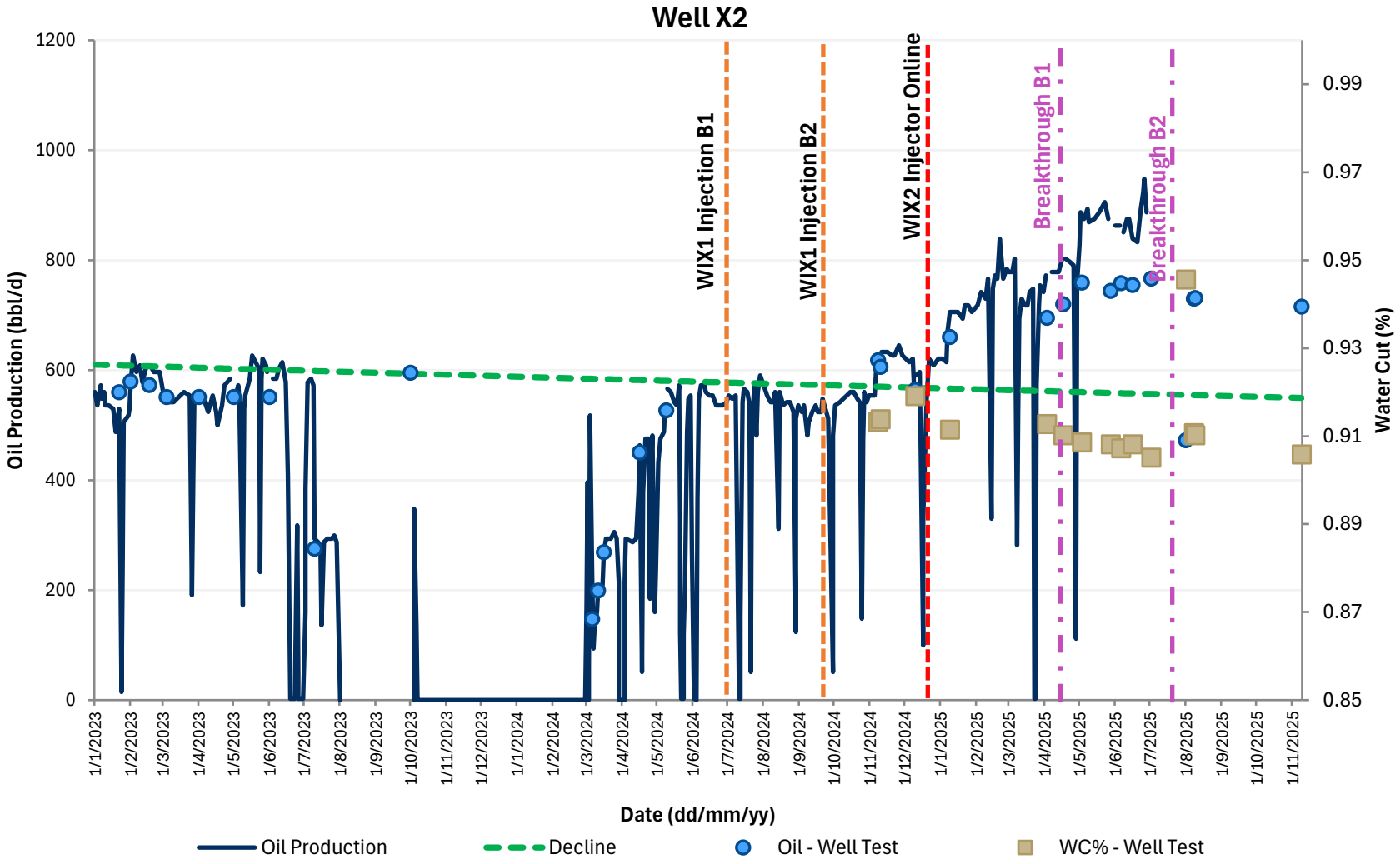
- Highest production achieved after Pilot: **966 BOPD**
- Difference between the baseline and the highest production achieved: **533 BOPD**
- Production more than doubled – increased **123%**
- The effect lasted around **6 months**

Injector Treatment Results - Well X1



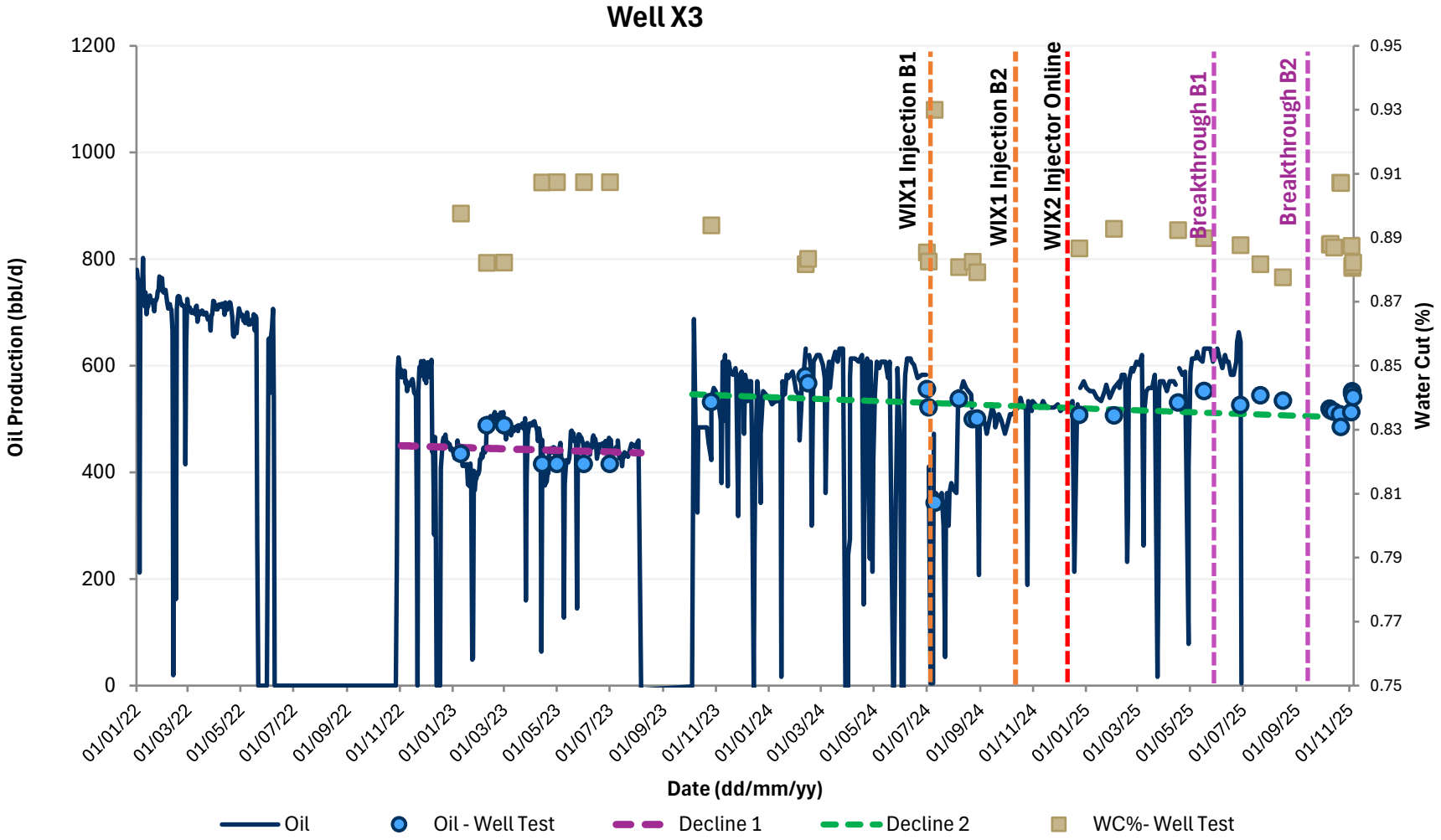
- Well's Transit Time (TT) **247 days**
- Initial increase from **428 to 468 BOPD –** after breakthrough for the first injection. **9%** initial increase.
- Second increase presented from **450 to 500 BOPD**. This corresponds to an **11%**.
- Overall increase of **16%**.
- Water cut decrease of 1-1.5%. Corresponding to 45-60 BWPD.
- **December 2025 - Second injector was commissioned in the area.**

Injector Treatment Results - Well X2



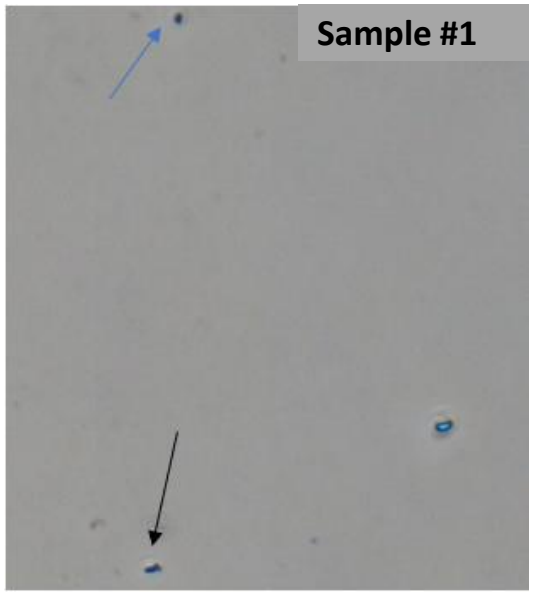
- Well's TT **328 days**
- Previously this well had been producing around **550 BOPD**.
- The well's production started increasing at around the TT.
- First increase from **660 to 759 BOPD**. Corresponding to 15% increase.

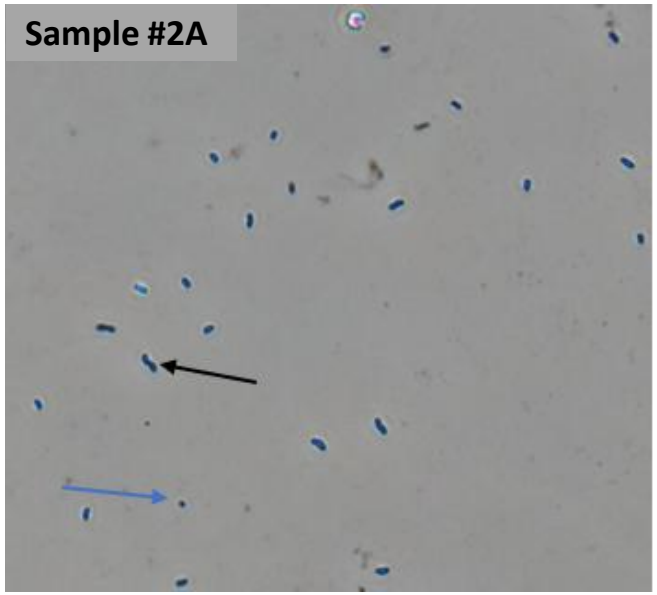
Injector Treatment Results Well X3

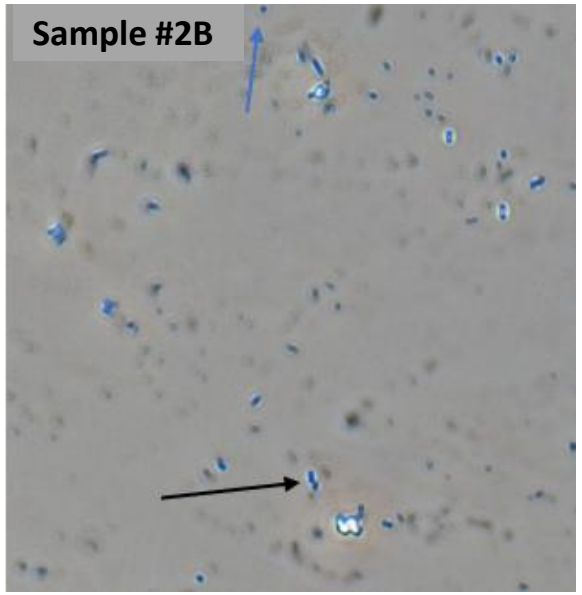


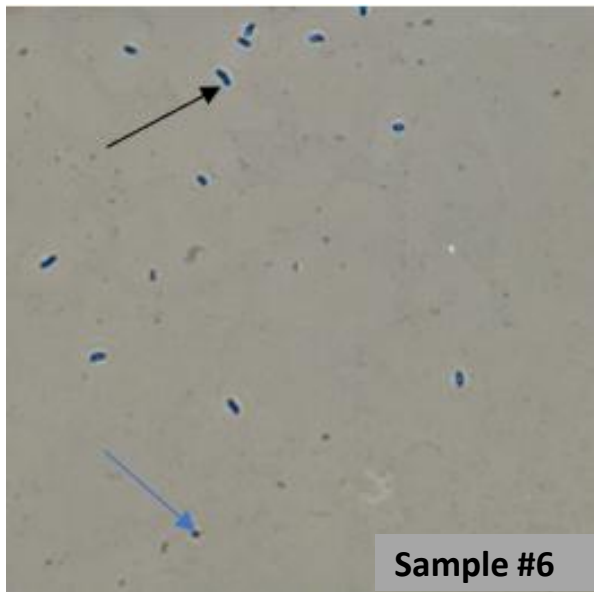
- Well's TT **342 days**
- **Longest Transit Time** out of the three wells monitored
- The surge observed was of around **50 BOPD** reaching production values of around **540-550 BOPD**.
- Steady production with minimal decline
- **1%** WC decrease

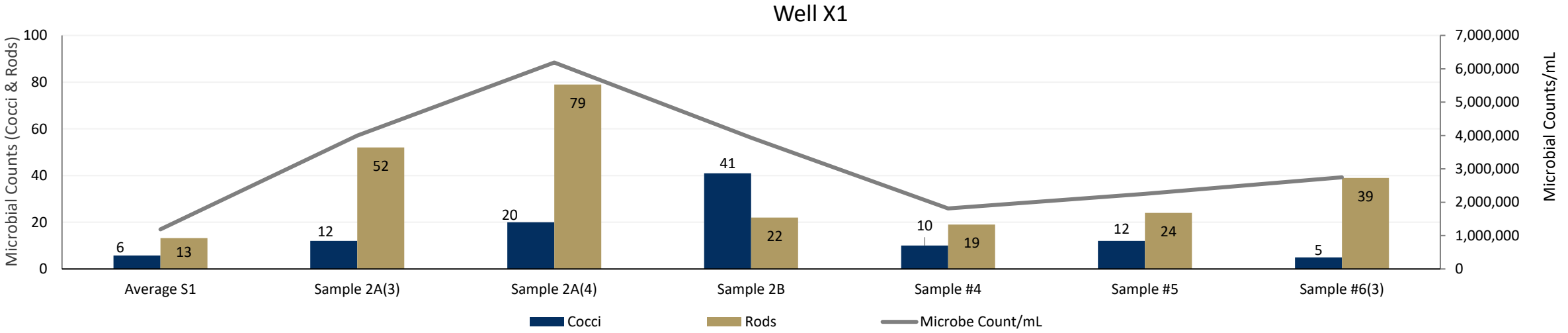
Water Sample X1 - Monitoring











Key Challenges & Learnings

Challenges	Key Learnings
Attribution Ambiguity (Injector Vs OOR)	Trust OOR Signal Observations
Timing Lags And Spatial Effects	Microbial Surveillance Adds Confidence
Data Sharing, Collection, Gaps	Robust Documentation Is Essential
Baseline Uncertainty	Water Cut – Critical Discriminator
Surveillance Frequency	Sustained Impacts > Short Spikes
Loss Of Technical Continuity	Cross-Functional Review Meetings Improve Continuity
Delayed Decision-Making and Project Slowdown	Communication And Data Sharing Is Fundamental
Fragmented Data Ownership and Documentation Gaps	Clear Definition of Responsibilities and Ownership

Conclusions

- Production performance demonstrates improvement aligned with expected timing of microbial breakthrough.
- Monitored wells exceeded baseline forecasts.
- Decrease and stabilization in Water Cut is expected with the OOR effect.
- Commissioned injector in the area had to be properly assessed.
- Reservoir heterogeneity has to be considered.
- Microbial analysis confirmed increased microbial activity providing direct evidence that the treatment reached the monitored wells.
- While some contribution from pressure maintenance is likely, the magnitude, timing and water-cut behaviour support the conclusion that the treatments were the primary driver of enhanced production.