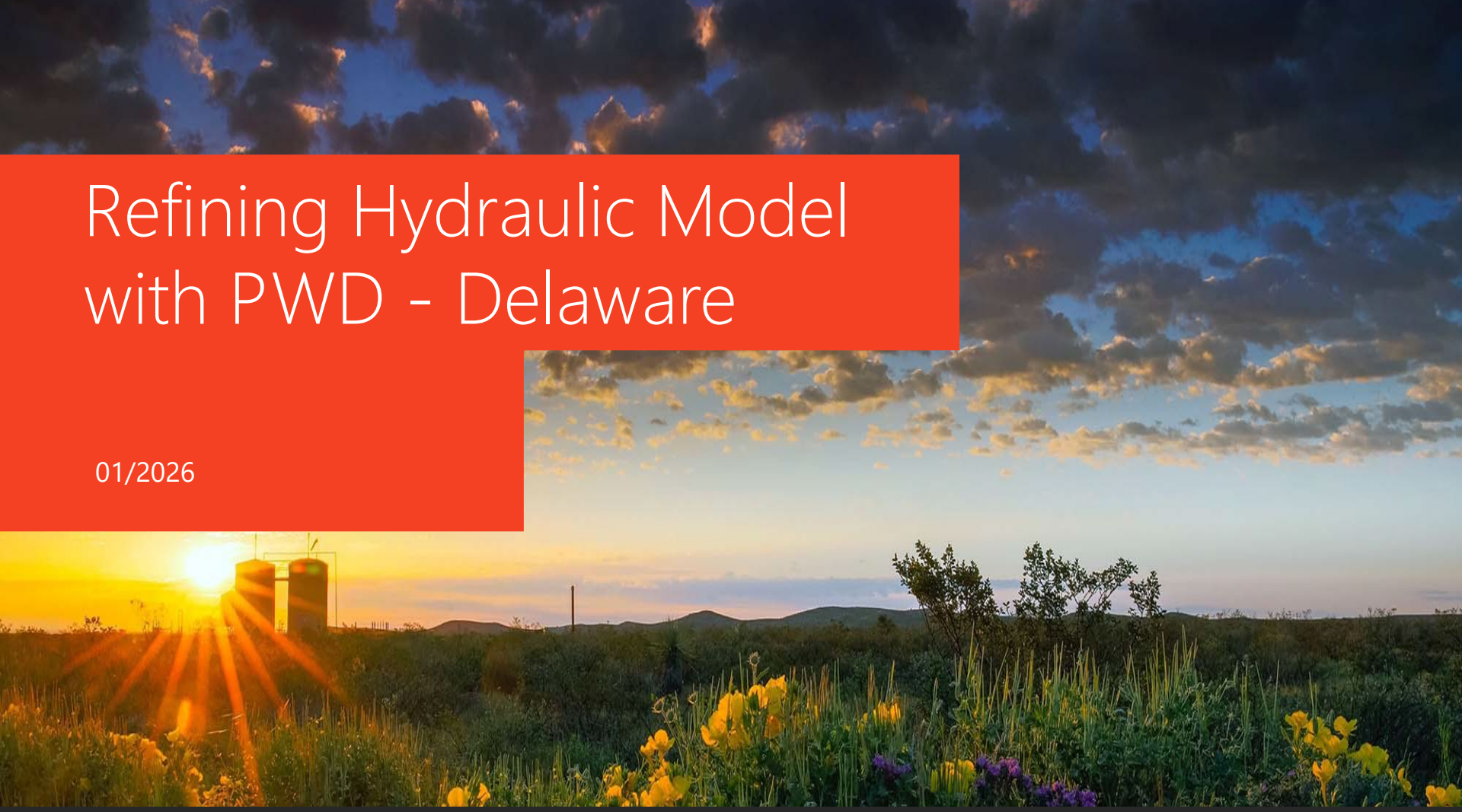
Refining Hydraulic Model with PWD - Delaware

01/2026



NYSE: DVN
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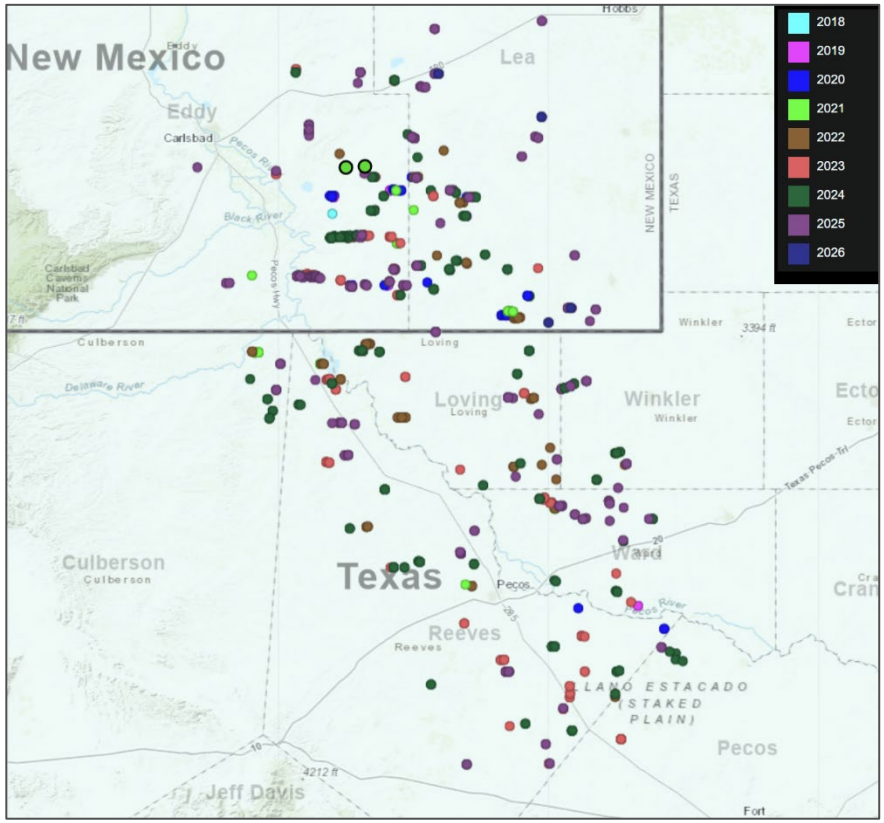
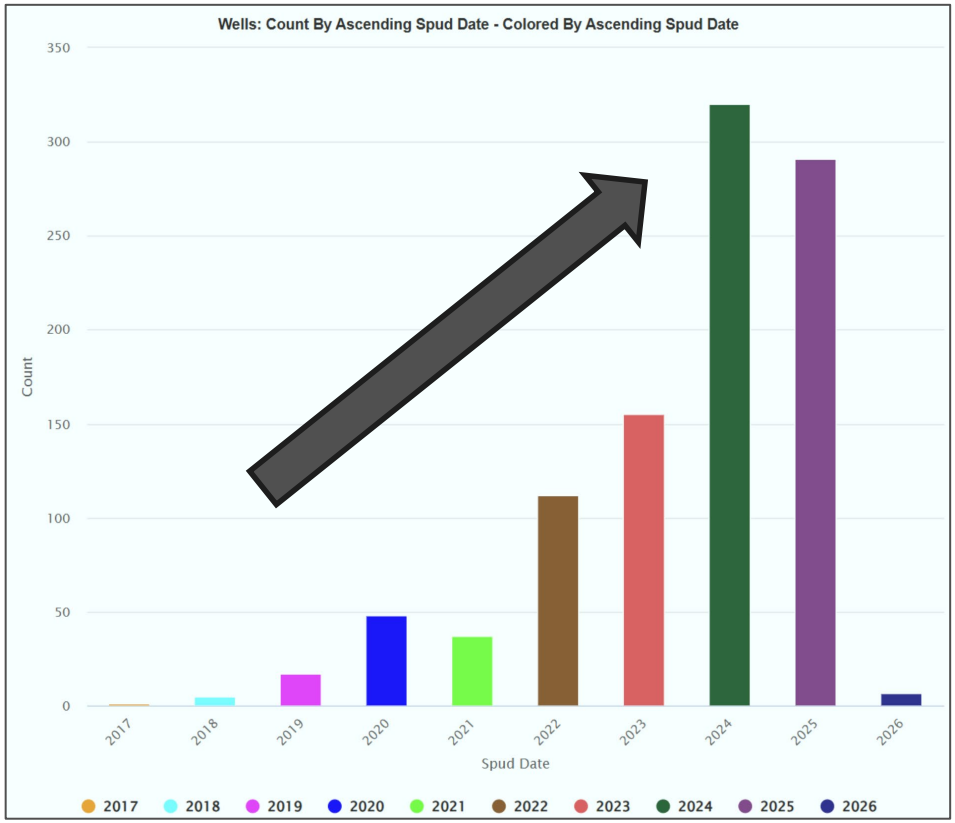
Introduction

Introduction





Source: Enverus

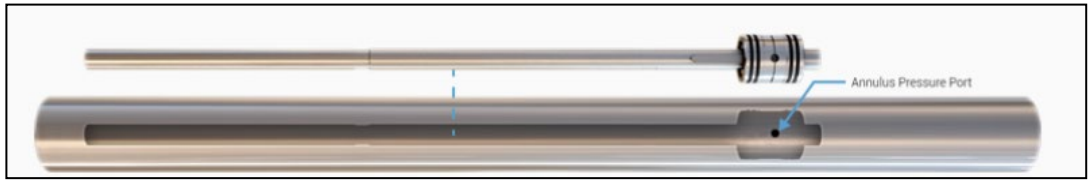
What is PWD?

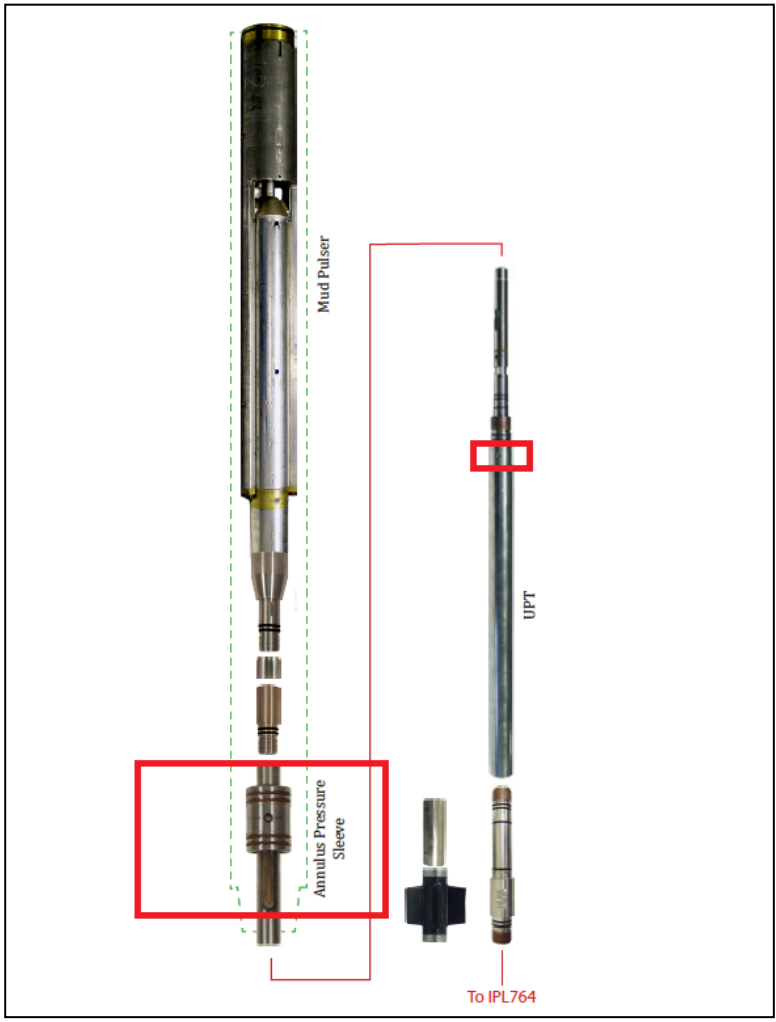
Pressure While Drilling (PWD)

PWD:
- Tool that measures and records
  - Annulus pressure
  - Drill Pipe pressure
  - Temperature
- Able to WITS in data live to EDR and updates every 5 seconds

Specs:
- Pressure range: 0 – 14,500 psi
- Temperature rating: 347° F

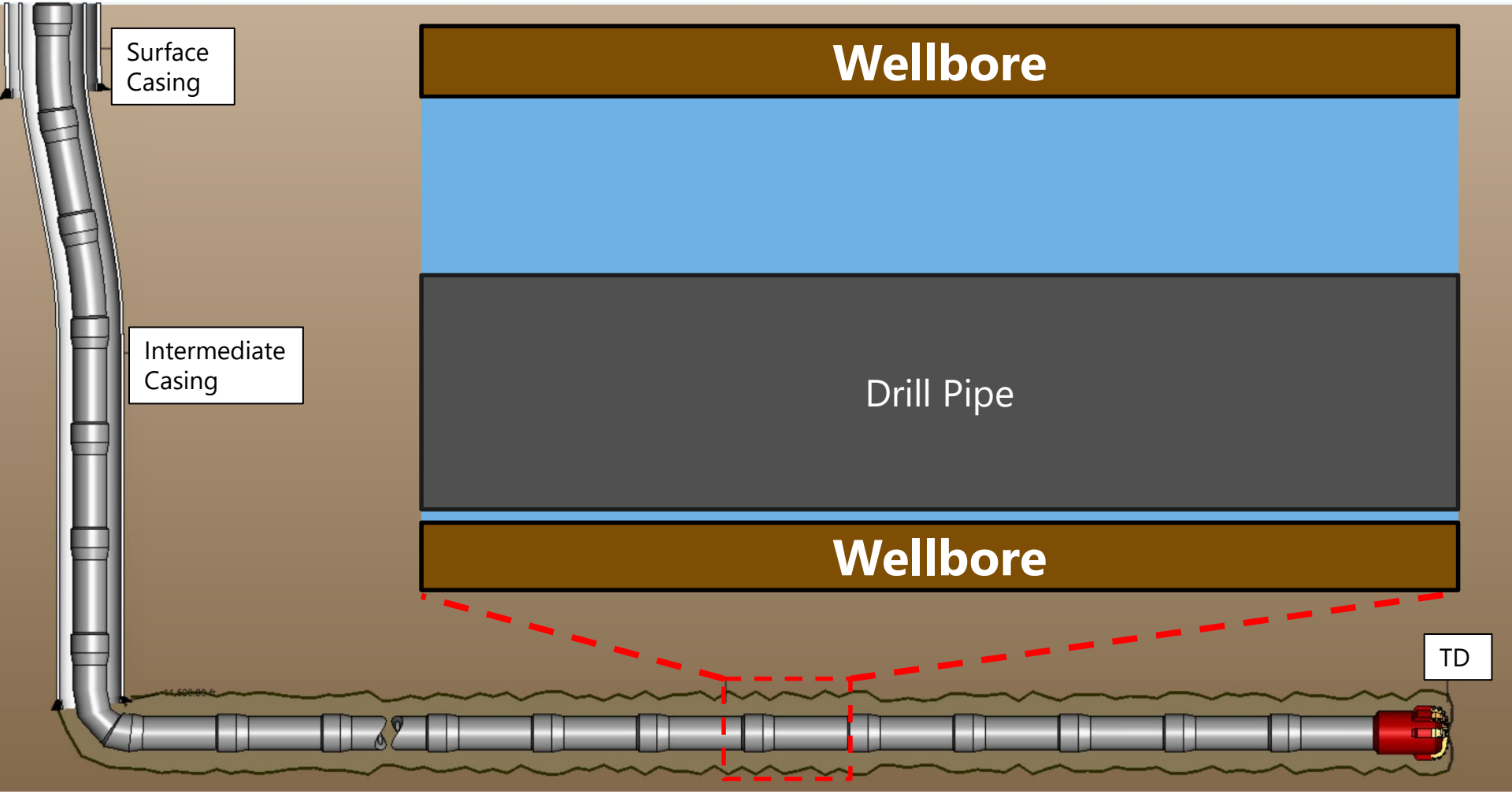
Calibration:
- Calibration done at surface with a hydraulic pump connected to the pressure port
- Pressure up to 2000 psi; confirm readings on pump gauge and tool reading
- Release pressure to 0; confirm readings on pump gauge and tool reading



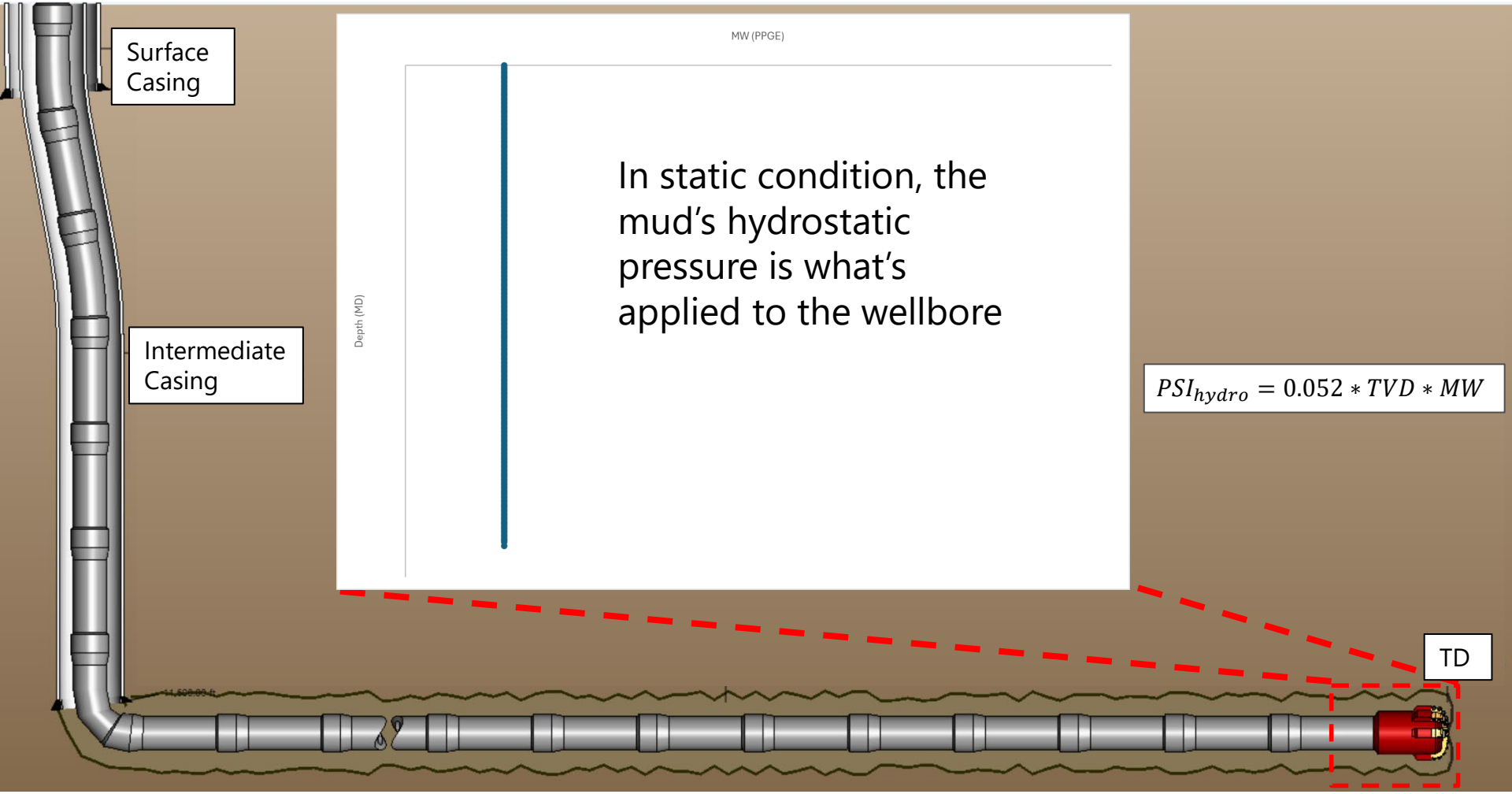


Why PWD?

Wellbore – Hydraulics



Wellbore – Hydraulics



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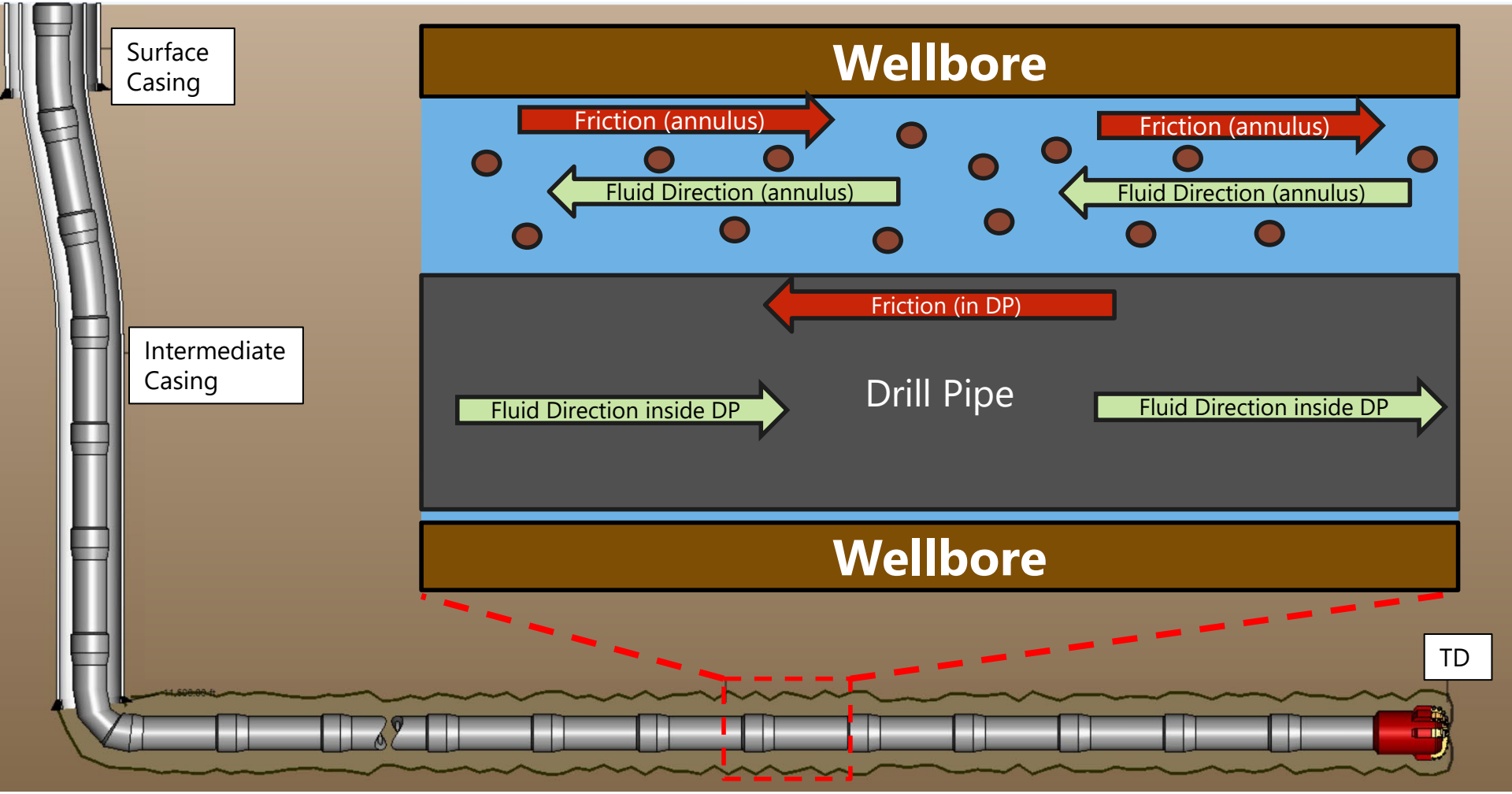

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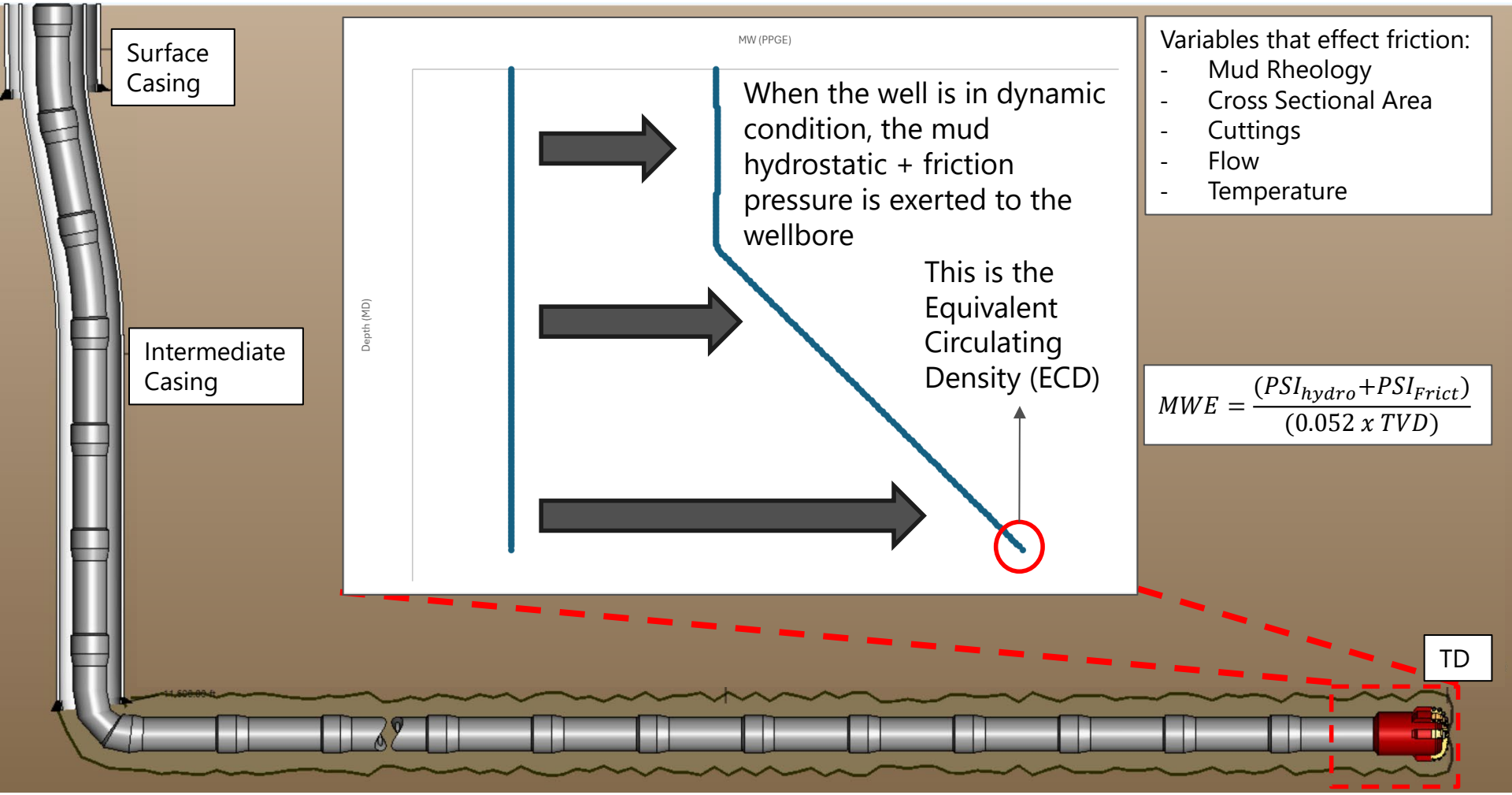
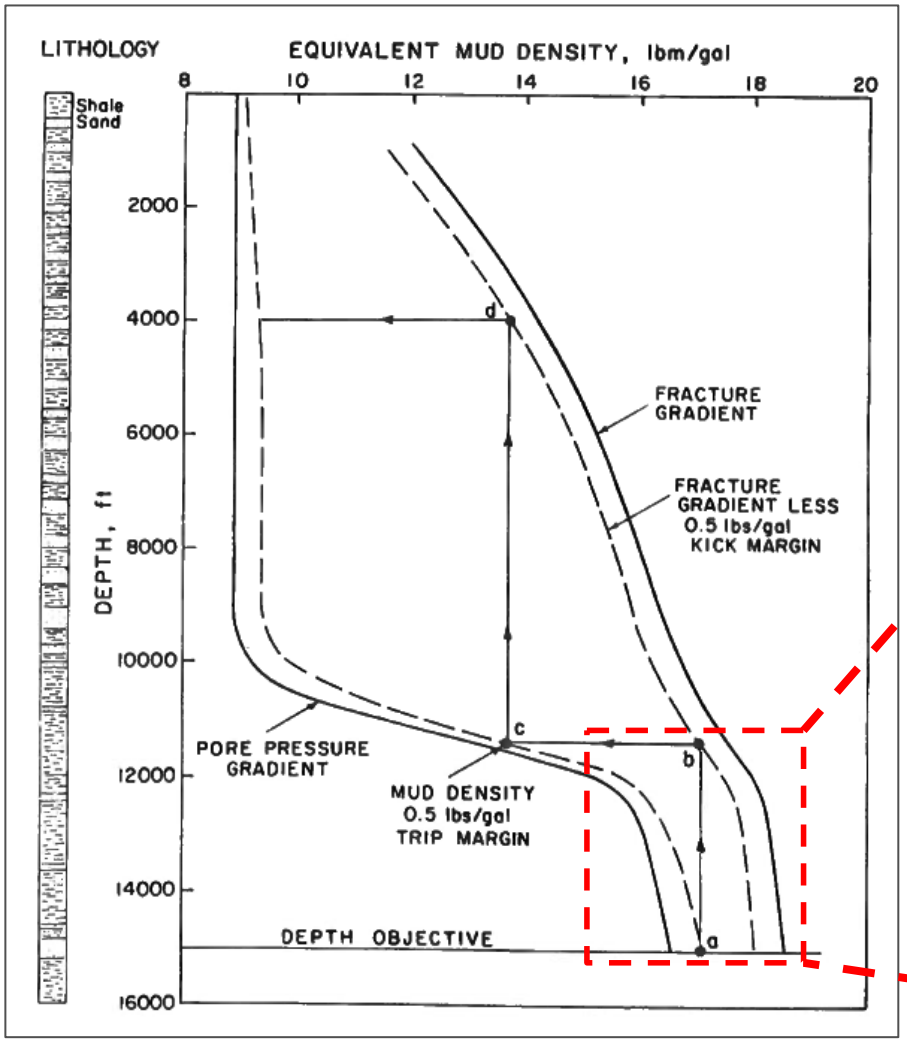


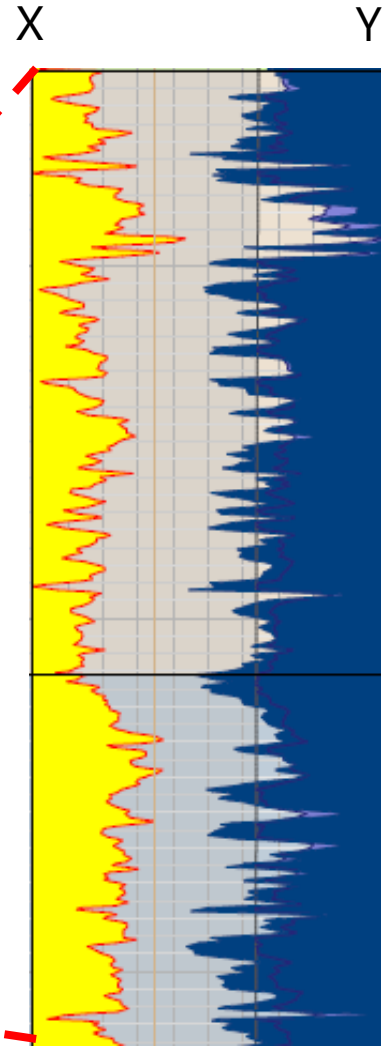
Variables that effect friction:
- Mud Rheology
- Cross Sectional Area
- Cuttings
- Flow
- Temperature

$$MWE = \frac{(PSI_{hydro} + PSI_{Frict})}{(0.052\ x\ TVD)}$$

MW Window – ECD vs Fracture Gradient



Mechanical Earth Model



Source: Applied Drilling Engineering SPE Textbook Series, Vol 2

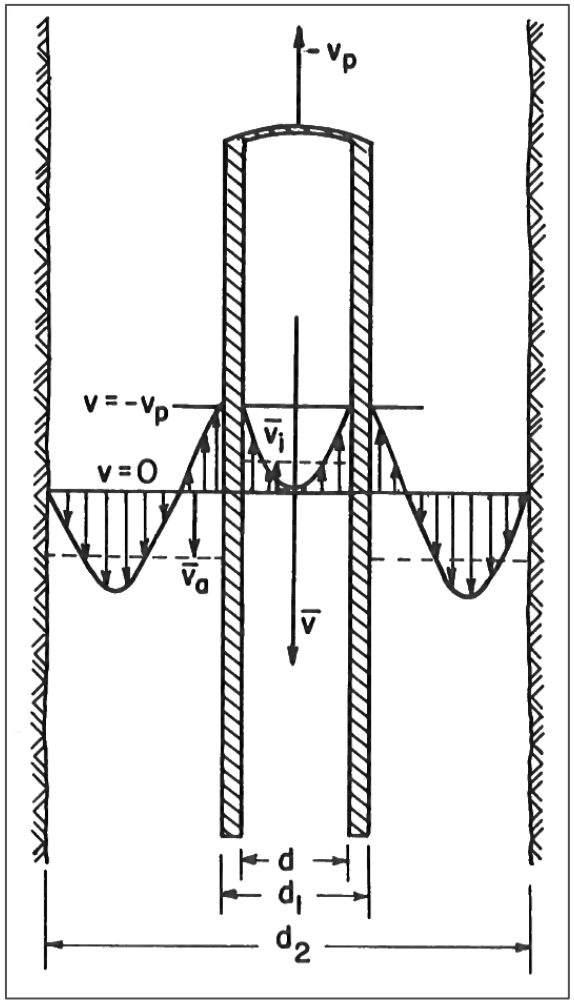
MW Window - Surge & Swab

Surge
- Pressure increase due to a downward pipe movement
- Fluid movement upward due to steel displacement (open-ended or closed-ended)

Swab
- Pressure decrease due to an upward pipe movement
- Fluid movement downward due to steel displacement (open-ended or close-ended)

Variables
- OD/ID of tubulars
- Cross-sectional area
- Trip speed
- Surface pressure

Velocity Profiles for laminar flow pattern when pipe is pulled out of hole



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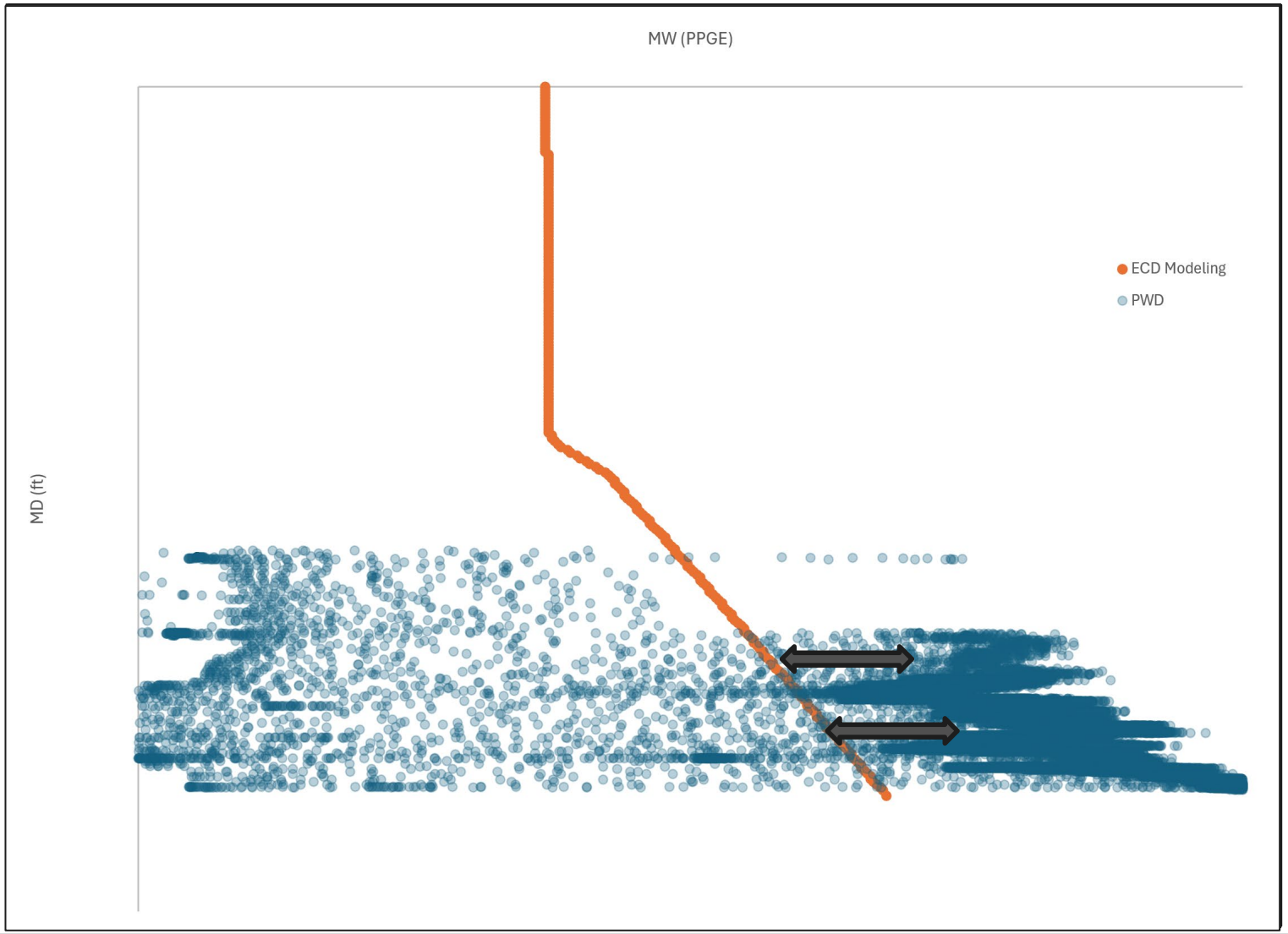
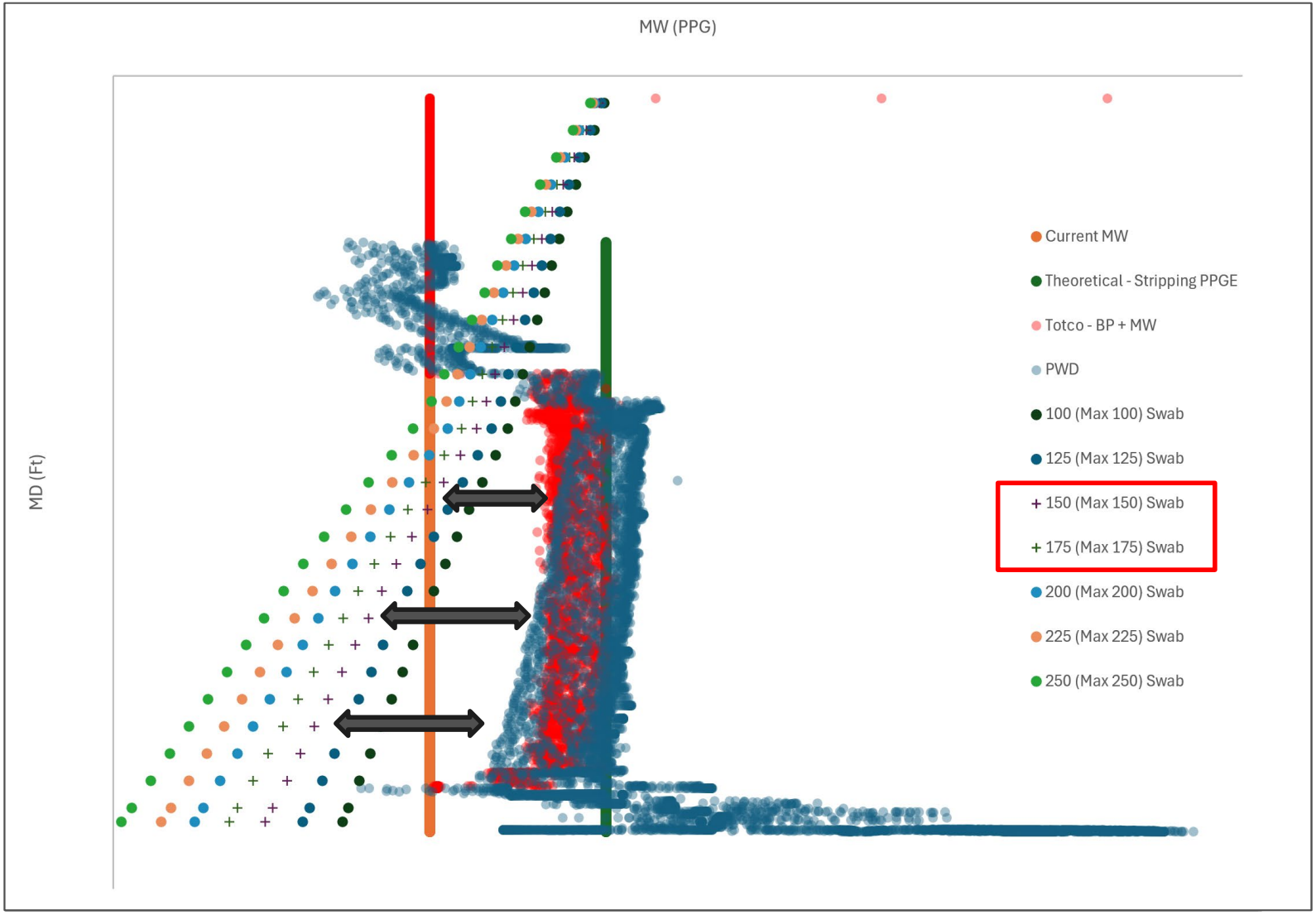
Case Study

Case Study – ECD



Case Study – Swab



Next Steps

Continue to gather more data

- Identify trends
- Adjust modeling parameters to “close the gap”
- Adjust operational practices
- Apply learnings in challenging horizons with wellbore instability

Thank you.