Unlocking Issaran Potential by Piloting Prototypes: Combining Three Technologies for the First Time Worldwide

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Production Egypt Ltd

GPC WORKSHOP 2023
"Go to Green-Sustain Oil Gain"

Agenda

- The Value Proposition of Technology Piloting
- Scimitar Technology Piloting& Demonstration Process Workflow
- Case Study: Combining Radial Drilling, Logging, Acid, and Steaming Piloting in Issaran Oilfield
- Conclusion

Value of Leveraging Technologies - PRMS

- **CR vs. Reserves:** The fundamental difference between CR and Ps is leveraging a technology or more to produce the oil commercially.
- All Contingent Resources could be counted as reserves if the recovery technologies and enabling commercial terms are set.
- **Impact on Production:** Having a specific volume in the reserves category means that there is also a time schedule to deploy the HC recovery technology and specific production forecast profile.

CR + Technology and / or enabling Commercial Terms = **Reserves**

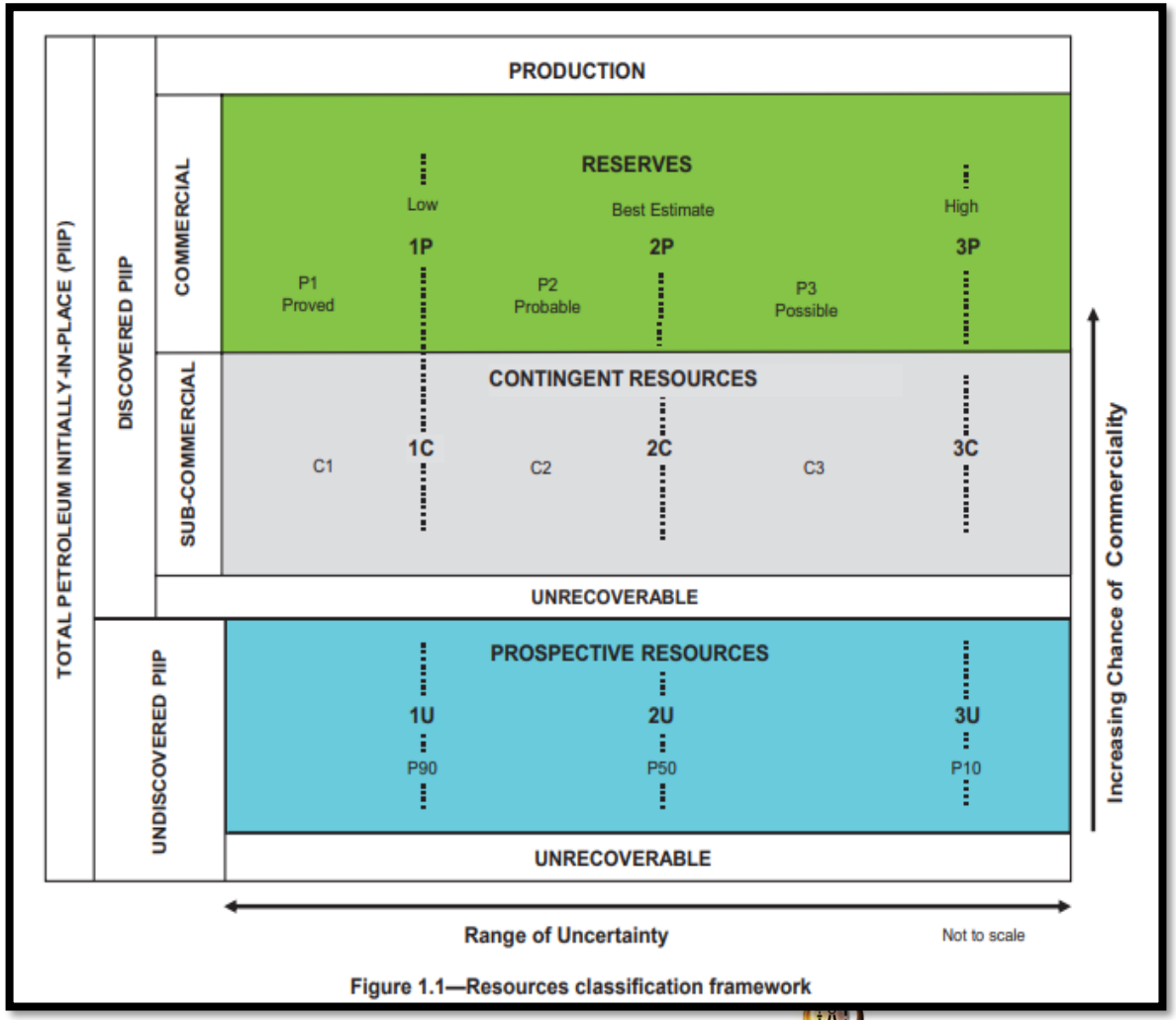

Figure 1.1—Resources classification framework

The Visionary View – THING BIG

How to achieve this:

1. Increase the OIP by New discoveries
2. Convert CR to Reserves by Technologies piloting and / or
3. Enabling commercial terms

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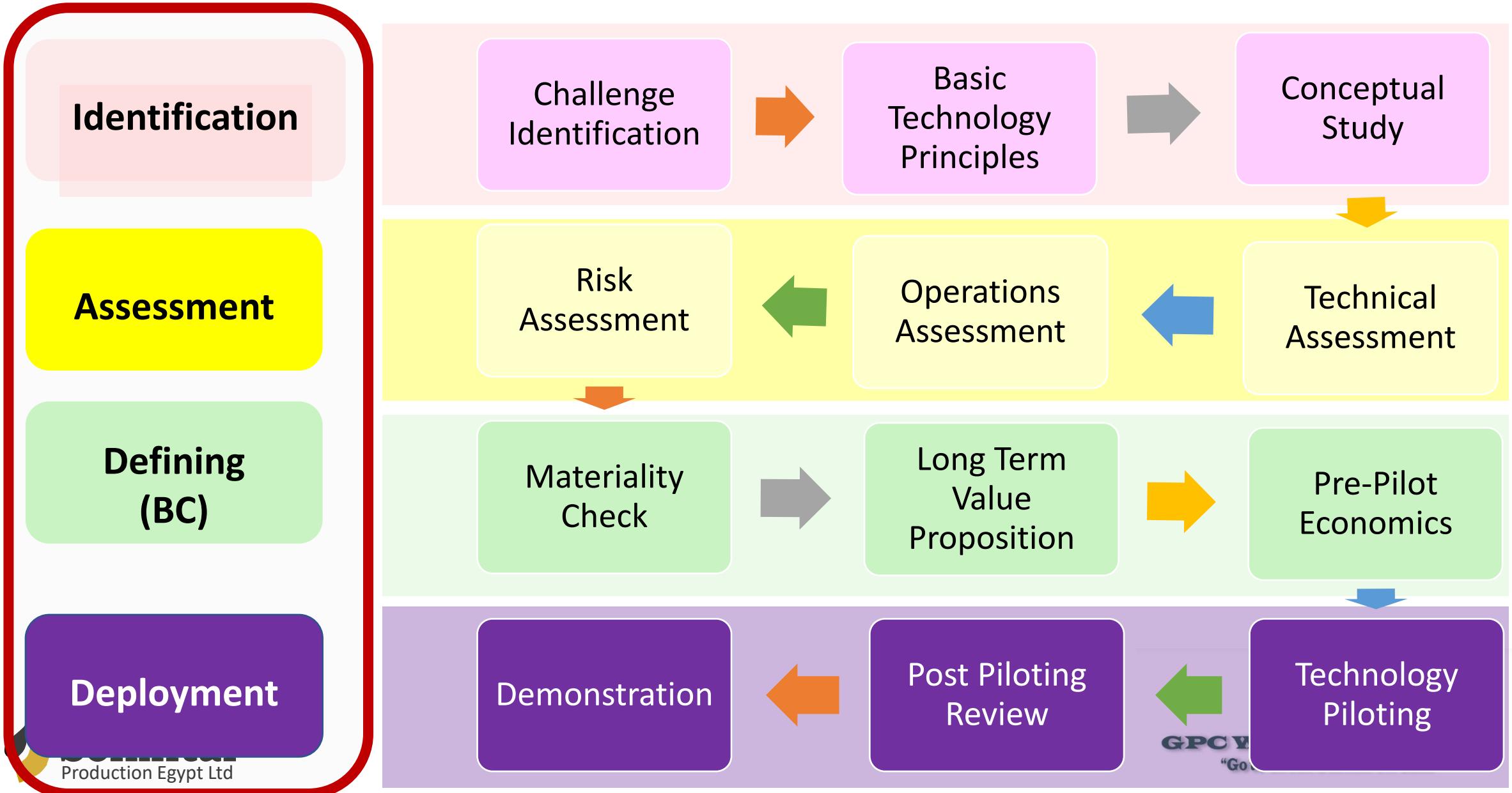
Scimitar Technology Piloting& Demonstration Process Workflow

Scimitar Process Workflow for Technology Deployment



1. The Identification

Issaran Field Complexity – Only Few Steam / Fractured Carbonates Fields in the World

Complexity

Carbonate Reservoir
- High lateral variability with tight Limestone / Dolomite + interbedded shale (Anhydrite overprint)

Fractured Reservoir
- Fracture density variability (difficult well to well interference)
- Short well fracture peaks (few weeks) and 10-20+ years EOR assisted low production

Heavy Viscous Oil
- 12 API, H2S (up to 30,000ppm), 25-30% discount to brent
- 1000-9000cP – Results in high water mobility bypassing oil

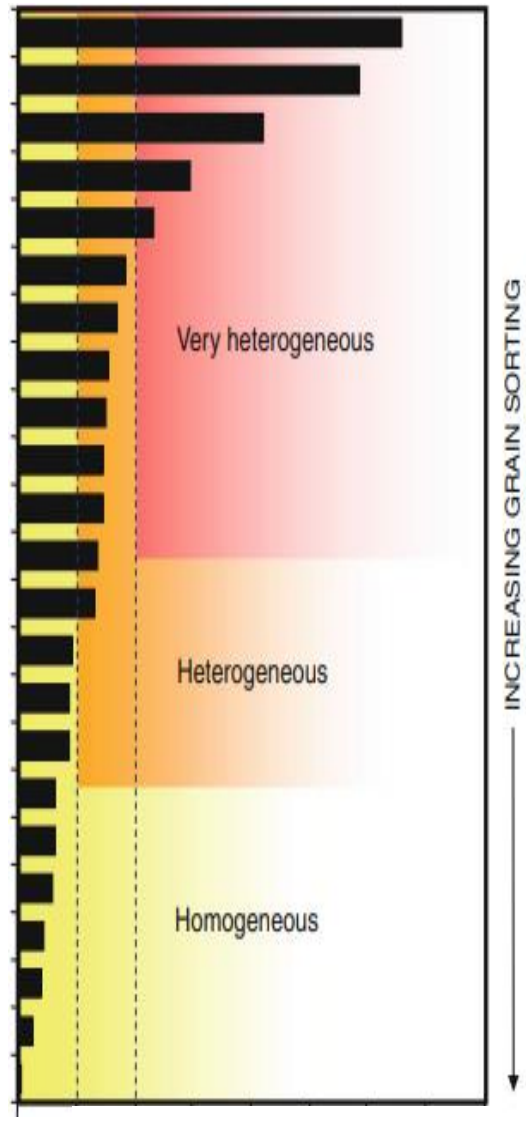
Steam EOR
- Expensive Steam injection
- Adaptive steaming mechanisms (CSS, GCSS, FIMPCSS, CSI or GASF) over reservoir life.

Dual porosity Carbonates

Tidal Clastics

Shallow Marine Clastics

Aeolian Clastics



Issaran

$$Q = C\frac{Kh\,\Delta P}{\mu\beta\left(ln\frac{Re}{Rw}+S\right)}$$

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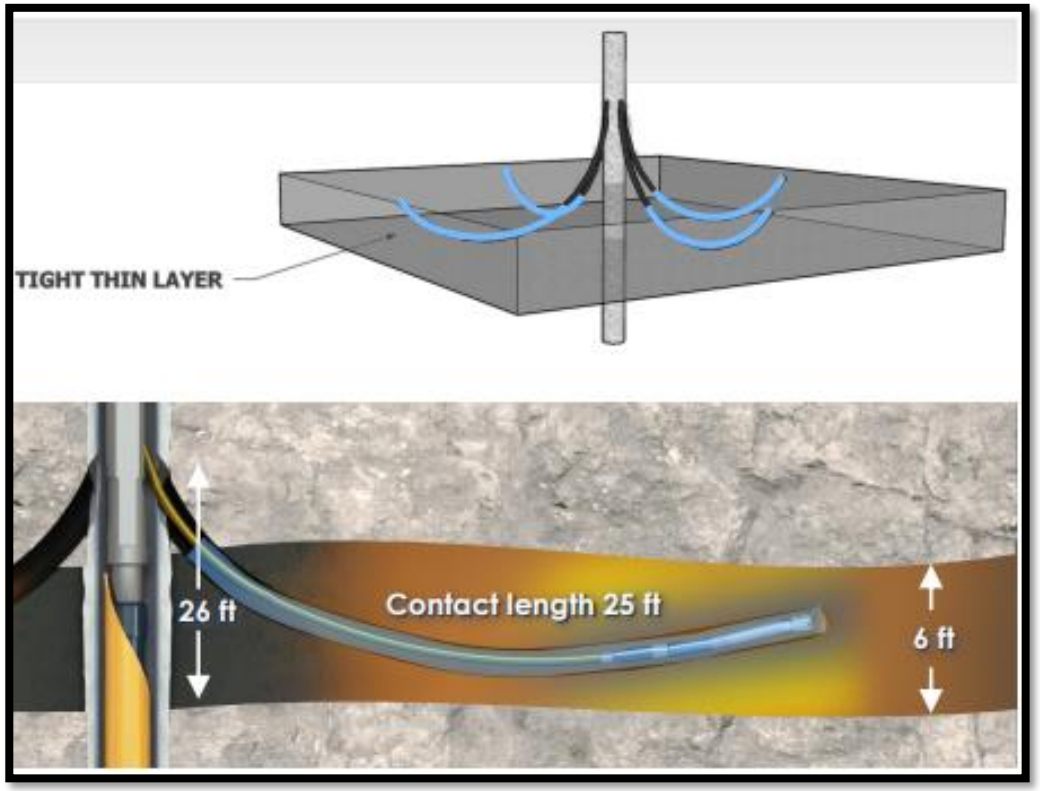
The Radial Drilling Technology

- The proposed technology is a radial drilling technology that provide reservoir access & stimulation using hyper-short radius directional drilling technology.

- First meeting between Scimitar and the provider was held during GPC workshop in Oct. 2022.

- First field operation commenced 2020, 10 jobs performed 2022, total 49 job.



Identification Phase – Specific Applicability in Issaran

- Maximize reservoir contact by increasing surface area while avoid water bearing intervals
- Bypass skin and wellbore damage-zone
- Precise acidizing or chemicals injection directly to laterals
- Create an effective channel for steam injection

$$Q = C\frac{Kh\,\Delta P}{\mu\beta\quad\left(ln\frac{Re}{Rw}+S\right)}$$

2. The Assessment

Technical, Operations, and Business Risk Assessments

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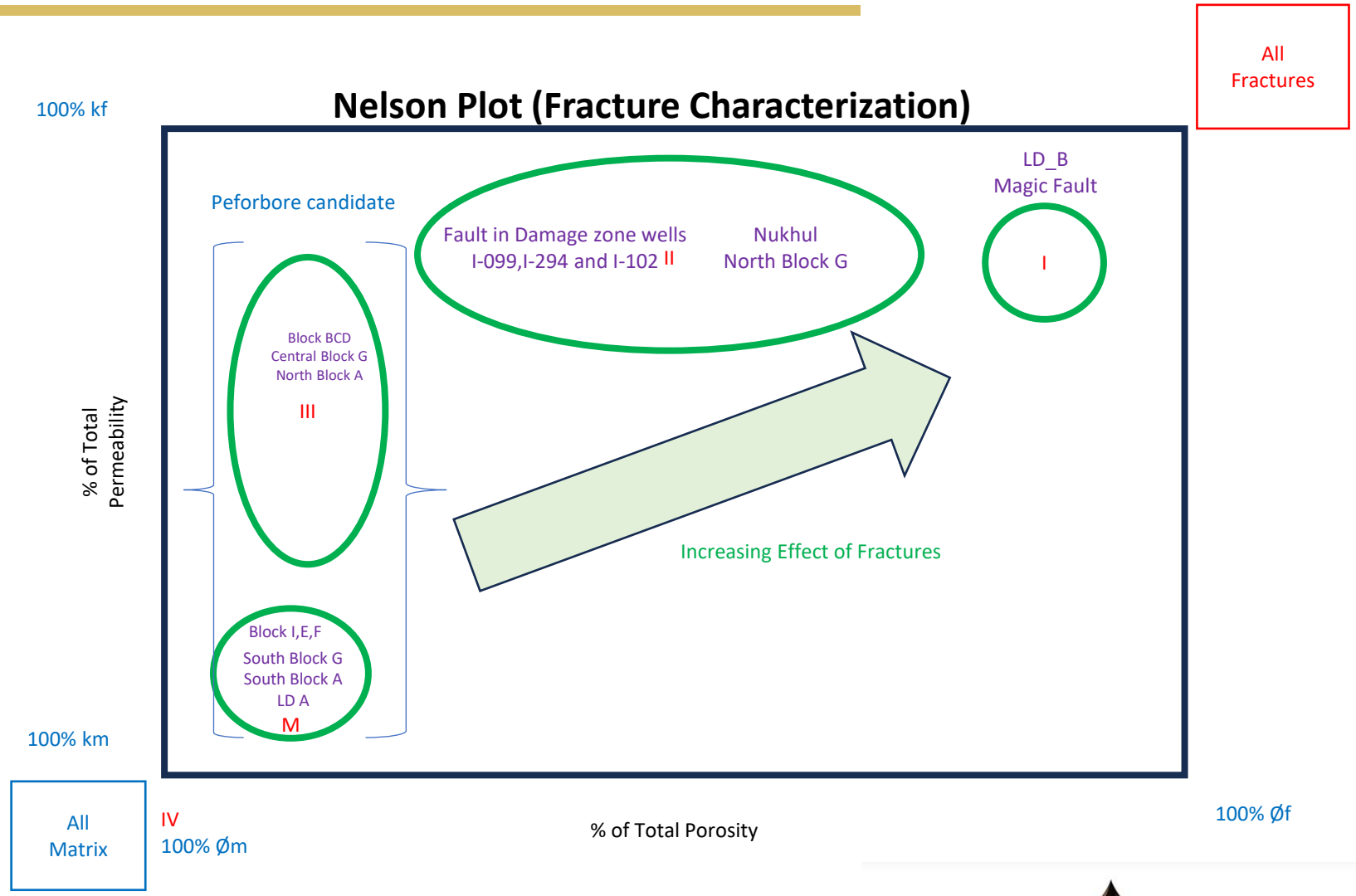
Creation of a task force project team Responsibilities & Accountability

Accountability	Who!
Business Owner - Client	Subsurface Manager
Single Point Accountability	Operations Support Manager
Project Operations Manager	Well Engineering Manager
Candidates Technical Assurance	Petrophysics Manager
Operations Team Leader	Drilling Manager
Stimulation Team Leader	Production Optimization Manager
Contracts & Logistics	PCM Manager
Technology Piloting Process Management	Technology Manager

Candidates Selection Criteria

- ❑ Cased Hole Well.
- ❑ Matrix Dominated Flow.
- ❑ Low WC and Sustained Gross Rate.
- ❑ Adequate Well Spacing.
- ❑ Good Cement Integrity.
- ❑ Moderate to high reservoir pressure



90 % of Issaran field OOIP is in type M and Type III

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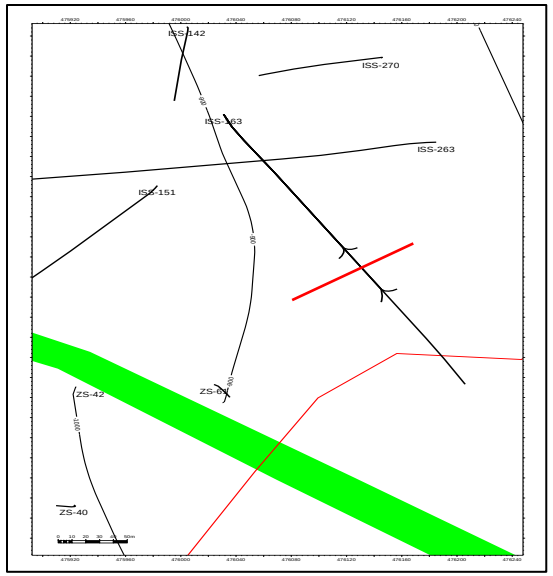
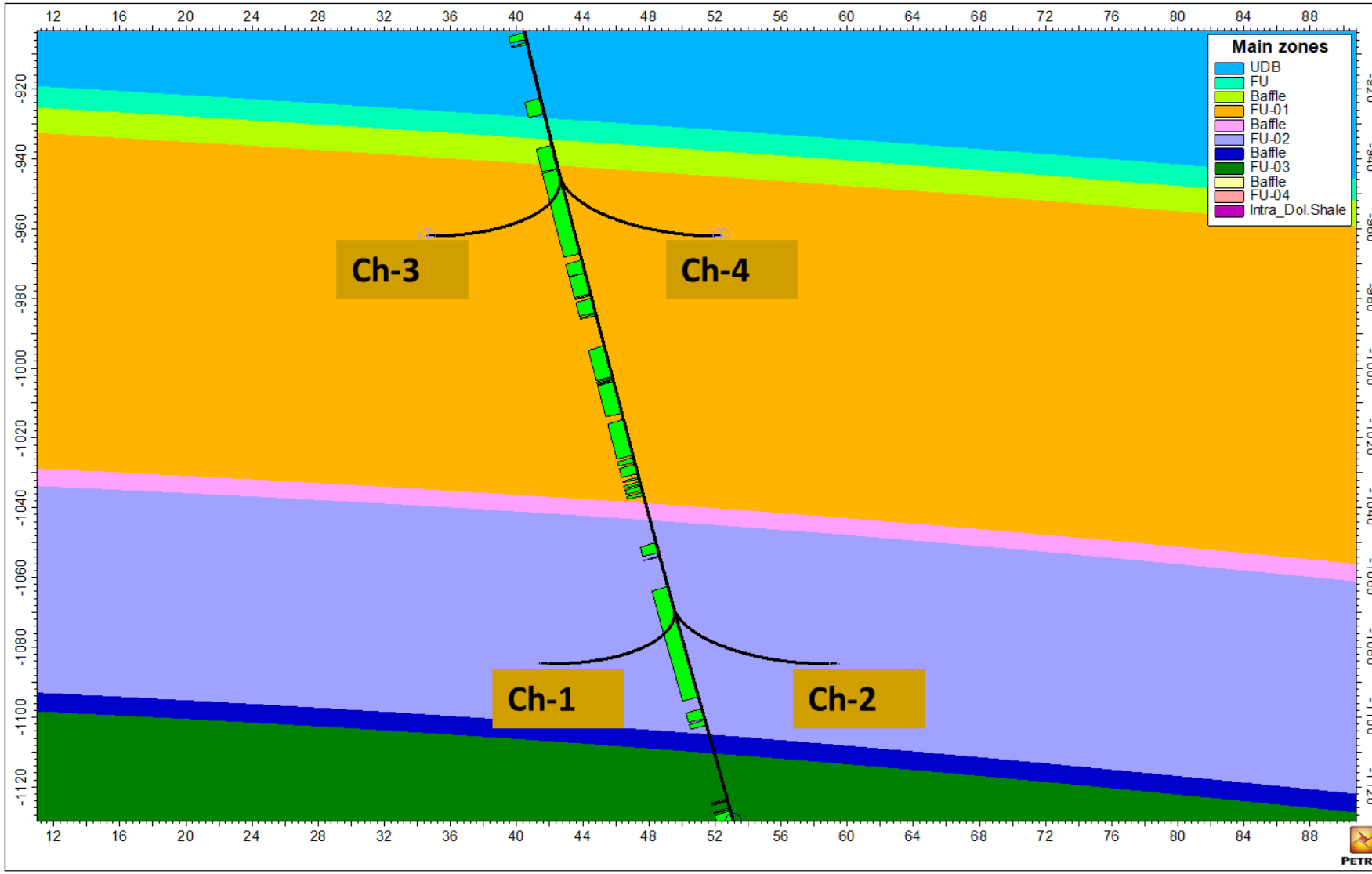
Example of Well Design

- Drilling through two separate flow units
- Oriented channels in thickest pay intervals.





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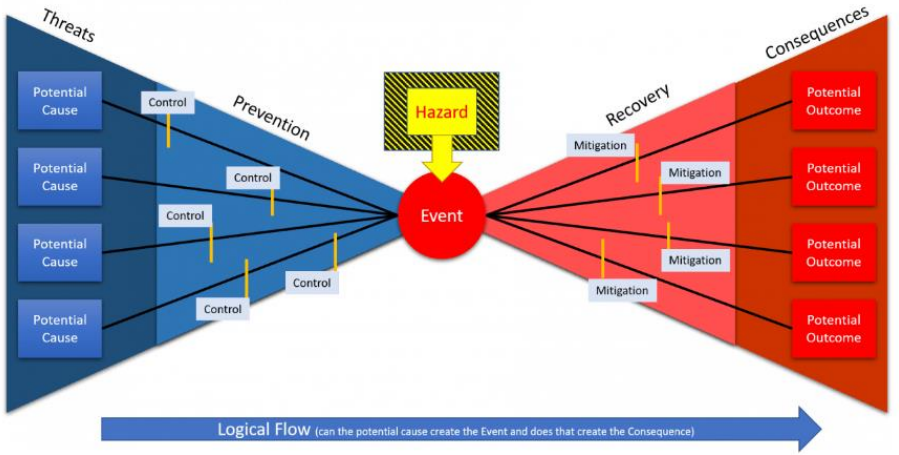
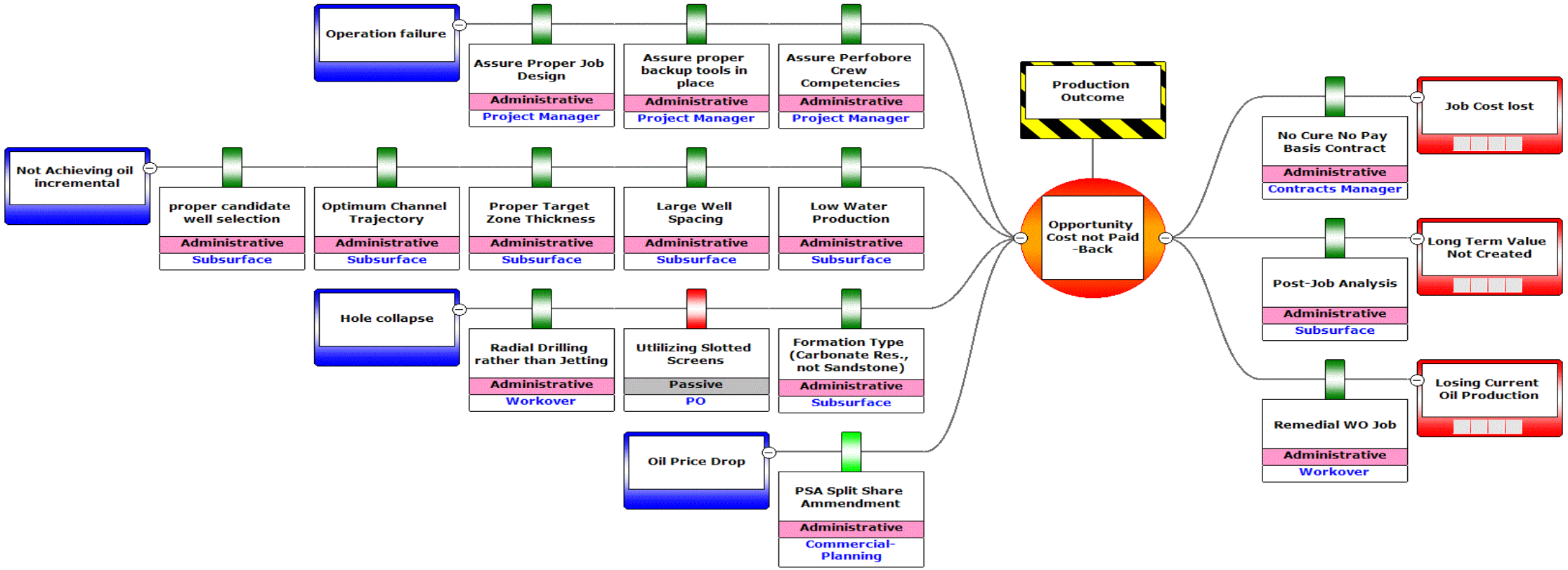
Scimitar Process for Risk Assessment
The Bowtie Analysis

- All risks are listed and a bow-tie analysis for each risk is done.
- The below is an example of one risk

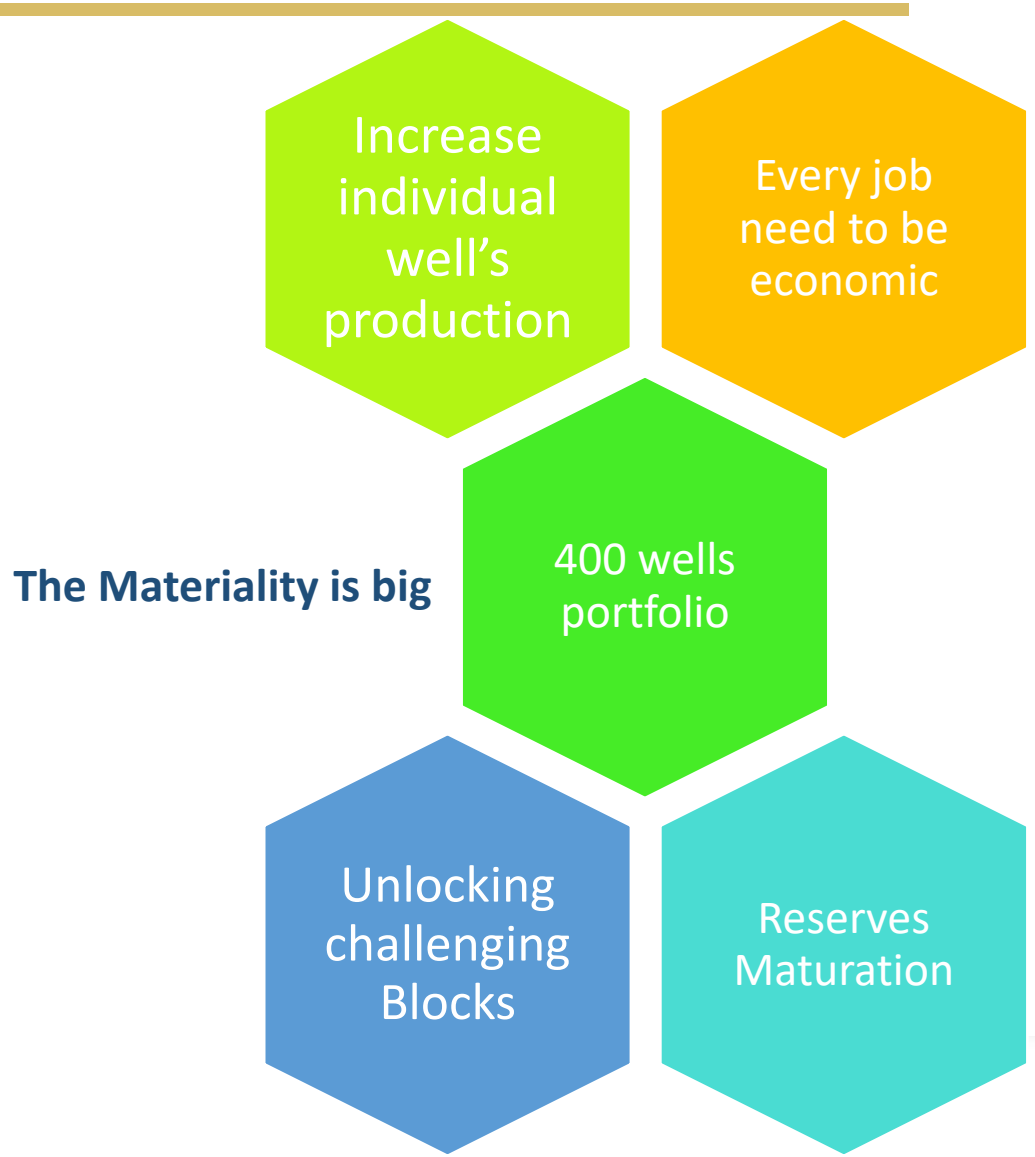




3. Building the Business Case

The Business Case – Technology Piloting Value

- **Key CAPEX Components**
  - Drilling
  - Stimulation
- **Key OPEX**
  - Steam Injection $/bbl
  - Oil Production $/bbl
- **Production Profile**
  - NFA + Acid + Steam
  - RD + Acid + Steam



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4. Execution: Piloting, Review and Demonstration

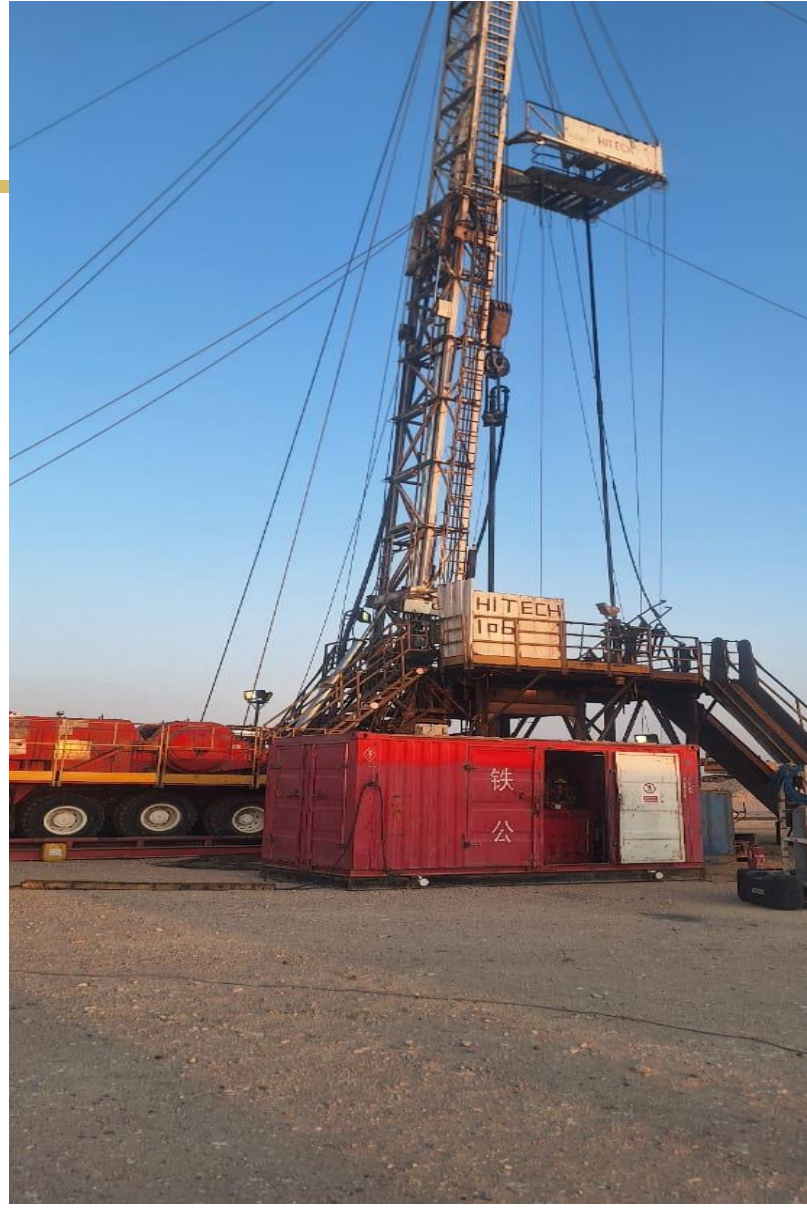
Pre-Job Preparations
Applying Scimitar On ground Leadership Process

- ✓ **Performed on-ground leadership site inspection by field managers and section heads.**

- ✓ **Ensuring Effective Communication (SMCR Model):**
  - Translation from Russian to English and Arabic and vice versa.

- ✓ **The rig is checked initially by the technology team** before equipment shipping confirmed its capability for the Job as per pre-set checklist.

- ✓ **Received tools & inspection certificates on site.**

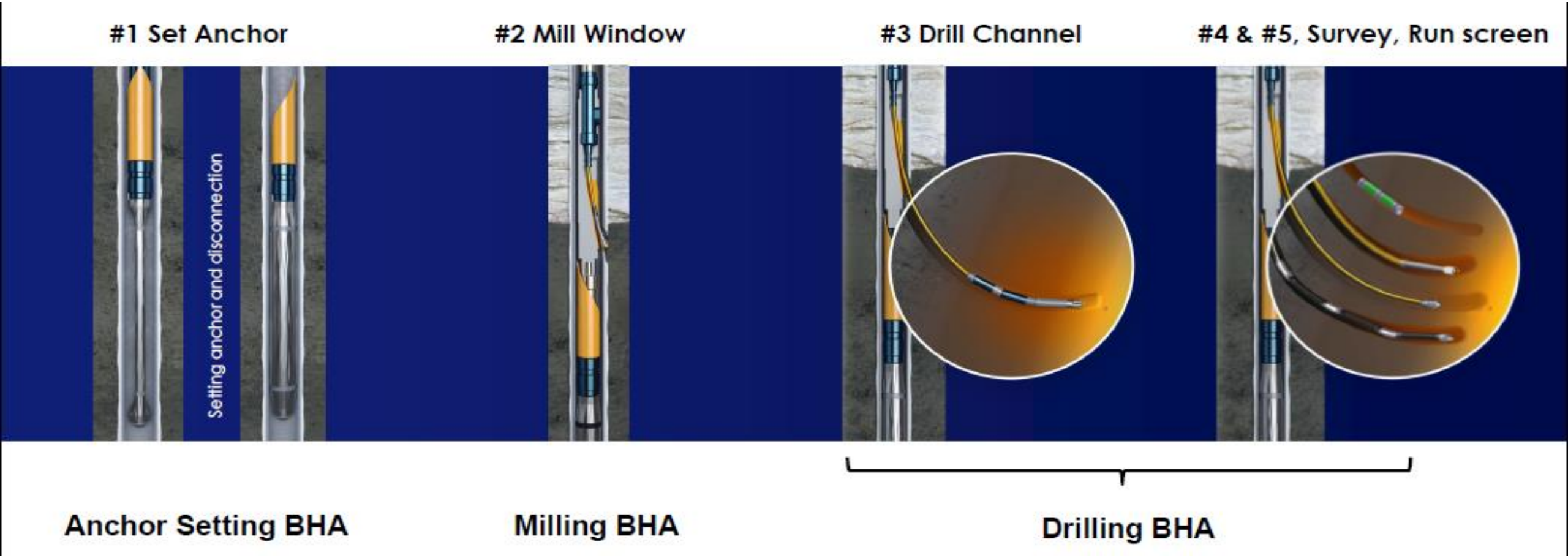


Pre-Job Preparations: The Systematic WOP & Pre-spud sessions

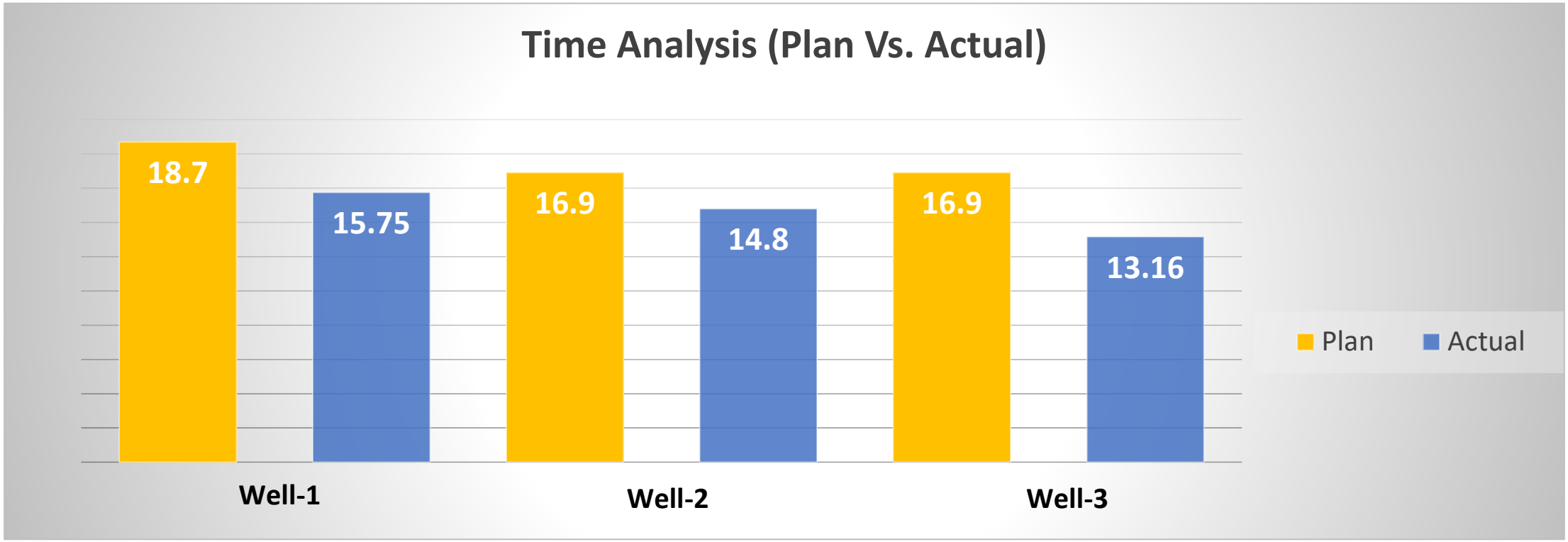
- ✓ **Impediment of the service provider in Scimitar's Contractor Management System:** Perfobore operations team attended Scimitar – Contractor HSE Performance Review Workshop.

- ✓ **Applied SPEL processes** of the Well on Paper (WOP) working session and Pre-spud meeting.

Drilling Operations

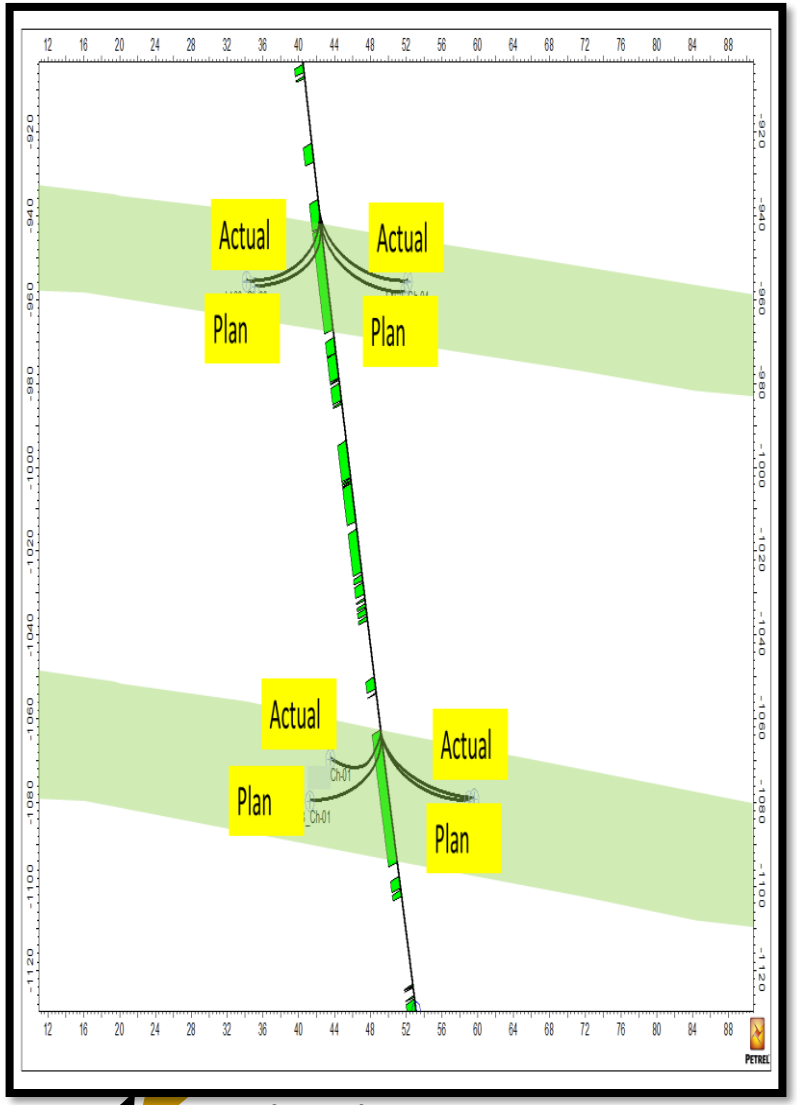


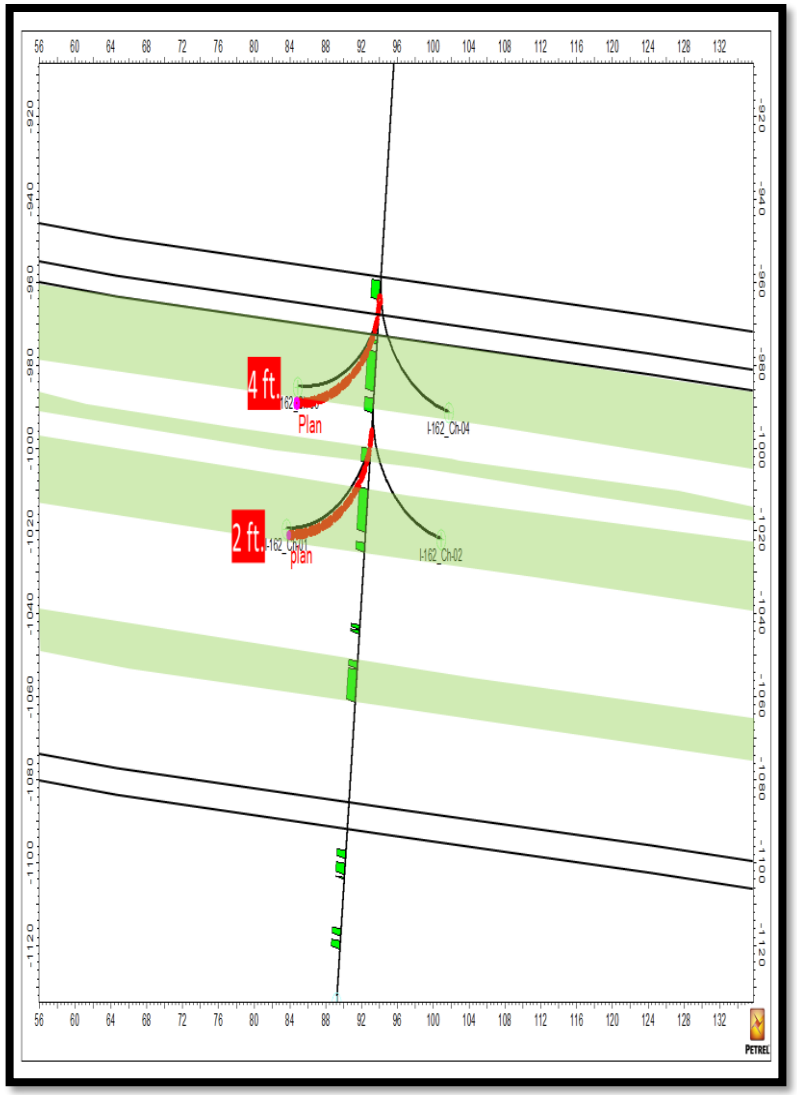
Operations Time

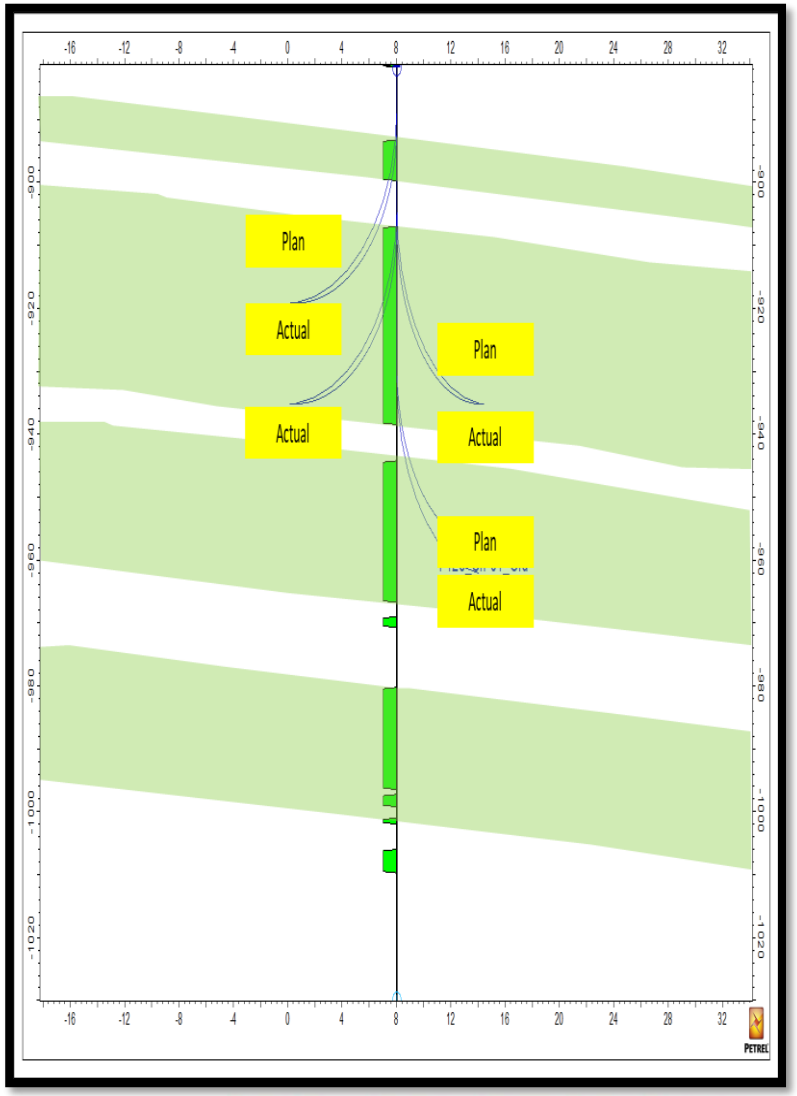


Desc.	Well-1	Well-2	Well-3
Total Well Days	15.75	14.8	13.16
Total NPT Days	2.6	1.98	2.3
Days Ahead/Behind	2.95 Ahead	2.1 Ahead	3.74 Ahead

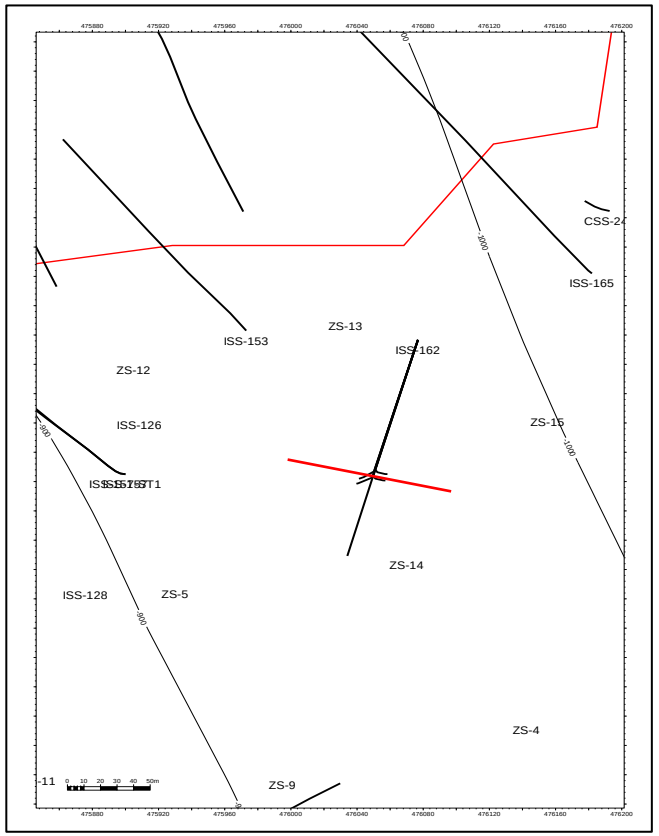
Actual Vs. Planned Trajectory

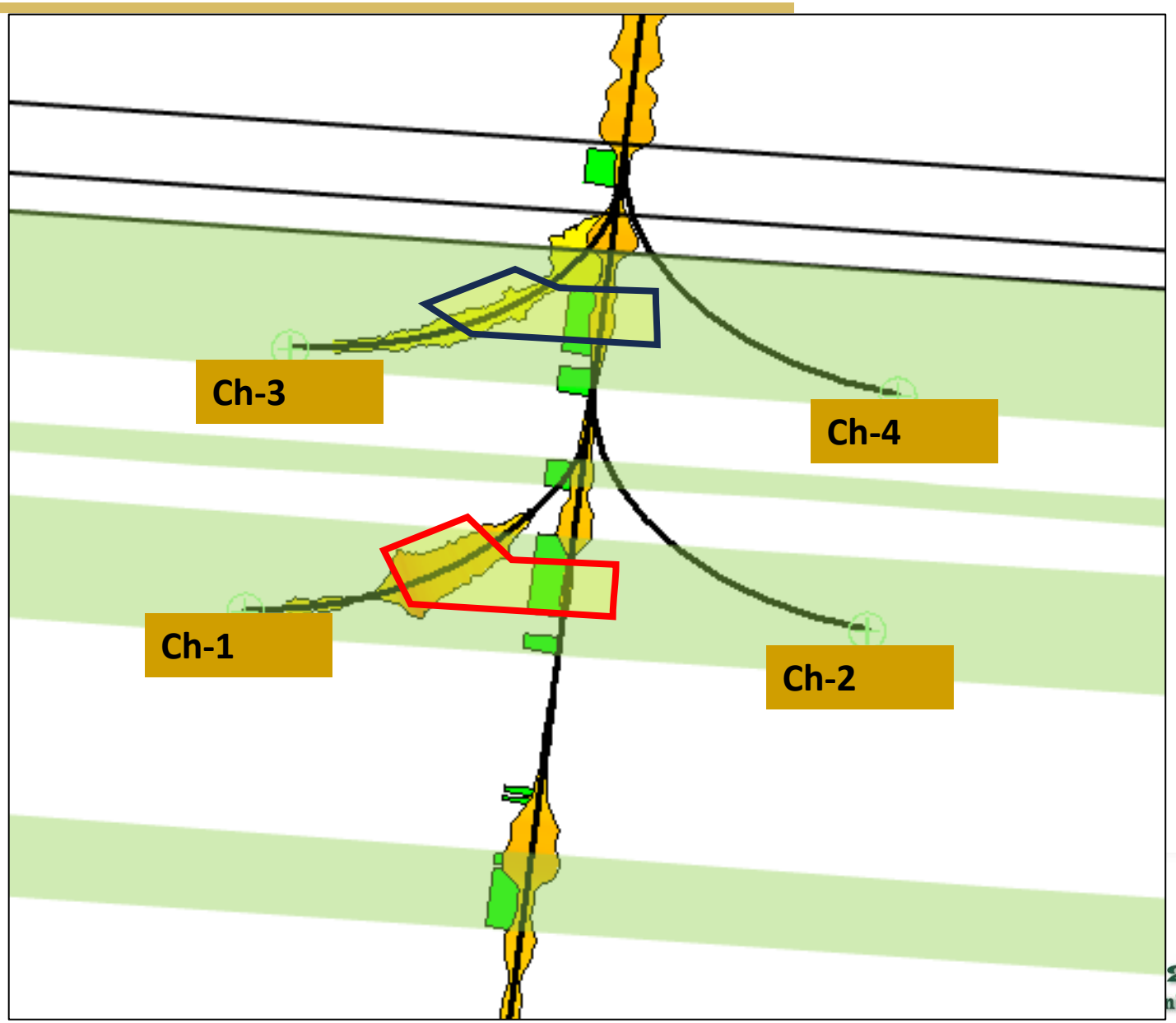






Ability to Confirm the Channels Trajectory: GR-Resistivity Logging





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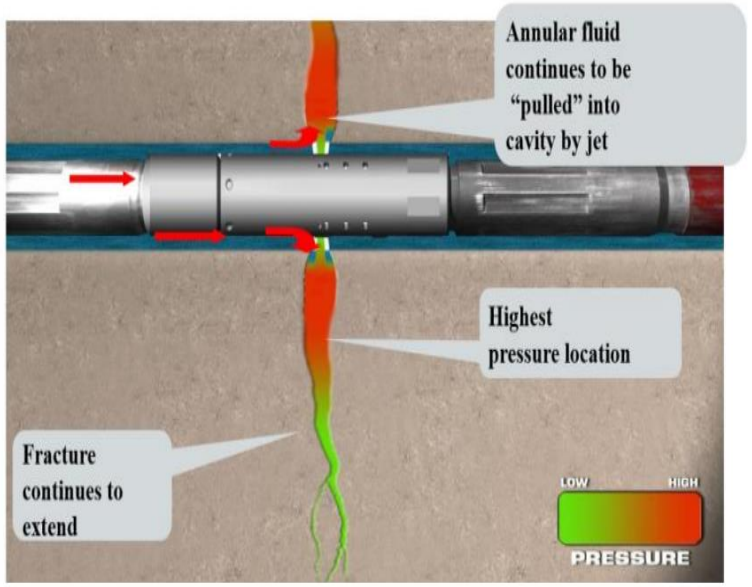
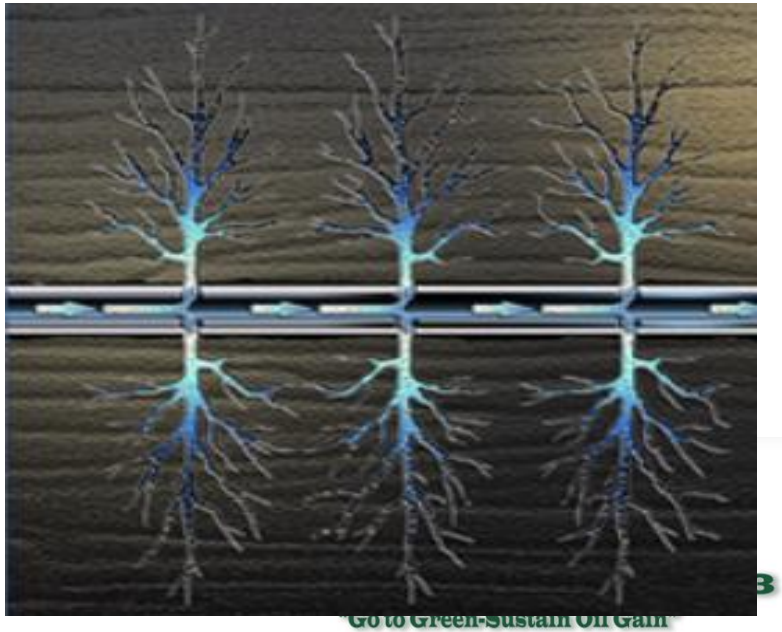
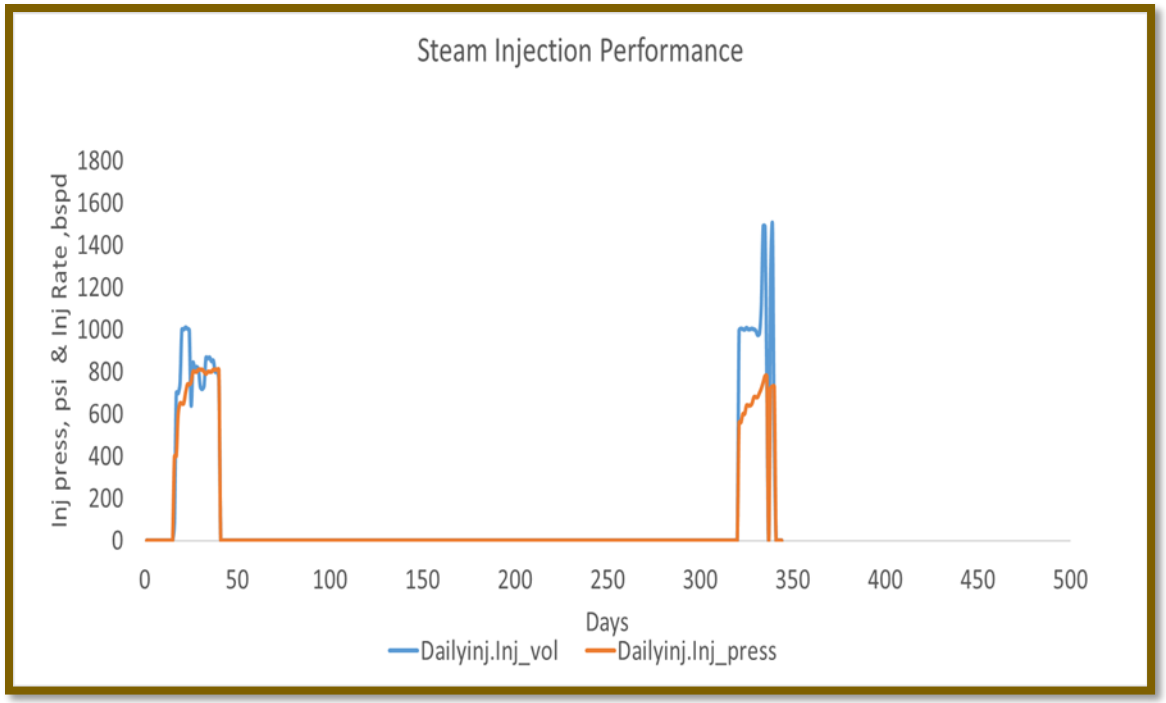
Easy Go & Back Access to Every Channel: The Stimulation

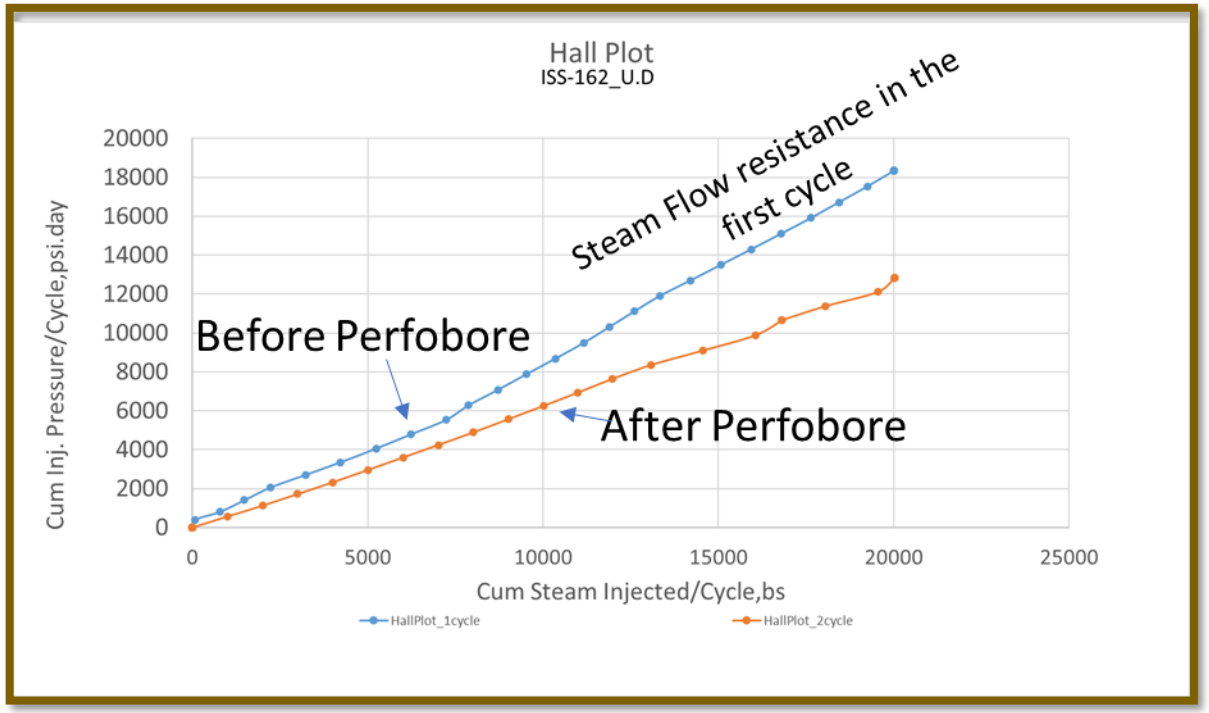
- Acid Stimulation is performed using the radial drilling string and downhole completion (Nozzle/ Jet Sub)
- The stimulation will be performed with 15% HCL and Carbonate Emulsified Acid.
- Each Leg/Channel was divided into three stops and RD tool kept stationary at each stop to perform the required Acid Stimulation at each stop.





Improved Steam Injectivity





Summary
Prototyping Radial Drilling by Scimitar Systematic Approach

For the first time worldwide, a combination of technologies is deployed in a challenging reservoir:

- 12 channels in 3 wells: 4 Channels per well in carbonate reservoir with 12deg API +1500-4200cP viscosity oil at reservoir temperature.
- Channels GR – Resistivity logging
- 4 channels acidizing per well
- Applied +/- 20k bbls CSS per well

By inclusion of systematically adopted Scimitar Processes:

- Technology Piloting & Demonstration Process
- Risk Assessment Process
- Contractors Management Process
- On-ground Leadership Inspection Process
- WOP Process

Conclusion

- **Prototyping followed by technology deployment is a key: in** conversion of contingent resources into reserves (through activities schedule, leveling up production is reached).

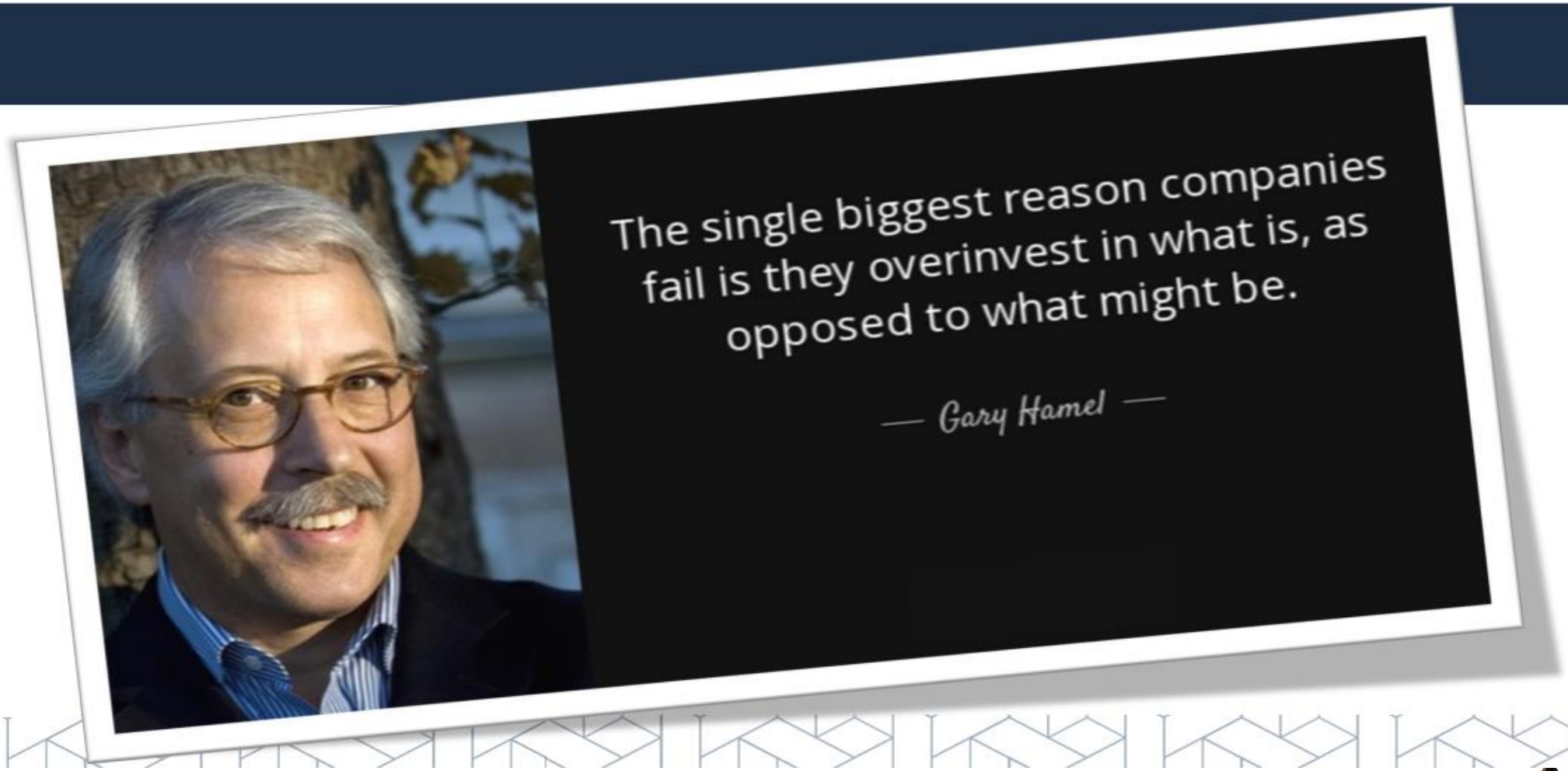
- Following a structured approach promotes the high responsiveness towards new technologies, proper resources allocation and speeds up the decision-making process.

- Proper planning prevents poor performance – Proper planning prepares for perfect performance.

- **The systemic deployment of the new technologies allows unleashing existing producing wells and a key to further unlock the stranded assets in Issaran and beyond (across Egypt).**

TECHNOLOGIES PILOTING - TECHNOLOGIES PILOTING - TECHNOLOGIES PILOTING

Conclusion


The single biggest reason companies fail is they overinvest in what is, as opposed to what might be.
— Gary Hamel —

Thank you