

# Planning a horizontal well in Middle Montney, KAKWA project with pre-commercial DrillPlan

Emile Abou-Khalil  
Drilling Engineer  
Seven Generations Energy



## What's Next?

SIS Global Forum 2017

September 13-15

Le Palais des Congrès de Paris

**Schlumberger**

# Agenda

- About Seven Generations Energy
- About Kakwa project
- DrillPlan Trial Project
- Current 7G Process
- Team Management Workflows
- Automated Trajectory Design
- Anti Collision Workflows
- BHA Design and Automatic Engineering Analysis (AEA)
- Feedback and Conclusion

# About Seven Generations Energy Ltd.



- Seven Generations Energy Ltd. is an independent, publicly-traded energy company focused on the acquisition, development and value optimization of high-quality, tight-rock, natural gas resource plays.
- Generate low-supply-cost, liquid-rich natural gas and secure access to North American market.
- Focus on Innovation and operational optimization to improve well economics

## 2016 Highlights

- Delivered high growth year in 2016 with 95% production increase YoY to 117,500 (’/d)
- Completed major acquisition of neighboring resources in 2016 for \$1.9 Billion.
- Drilled Super Pad with longer wells and larger Hydraulic Fracs that showed 30% production increase.
- Tied in 60 new producing wells in 2016

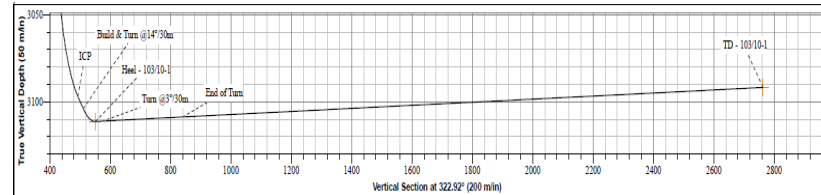
## 2017 Plan & Activity

- 2017 CAPEX ~ 1.6 billion with 60% on Drilling and Completion.
- Drill another ~120 wells to Achieve 190k boe/d
- Focus on newly acquired lands (~40% of CAPEX)
- Reduce drilling times and lower costs, including the use of underbalanced drilling

# About Kakwa Project

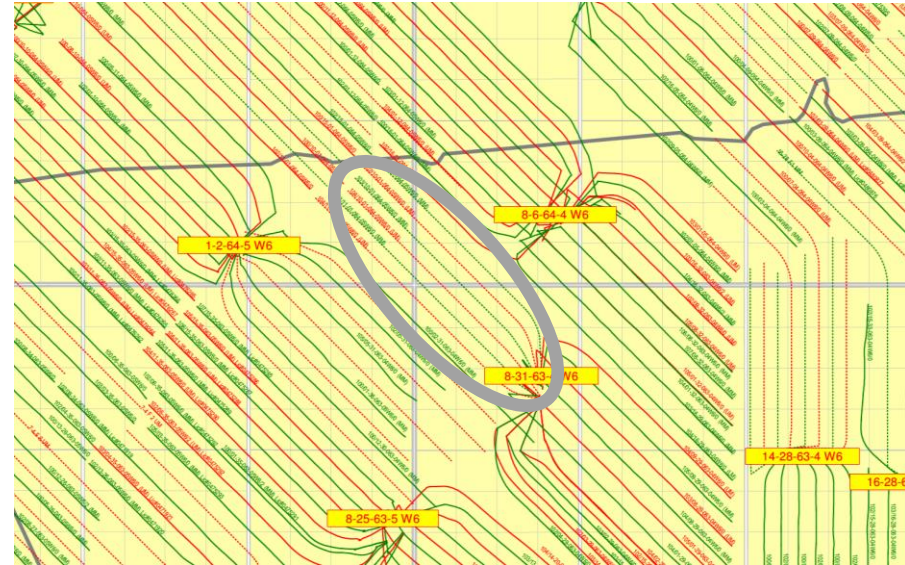


- Developing Natural Gas Liquids Rich Montney
- 420,000 net acres located ~100 km south Grande Prairie, AB
- Wells drilled 3,000m deep, with 3,000m lateral length
- ~ 10 Million dollars to Drill and Complete
- Well inventory:???



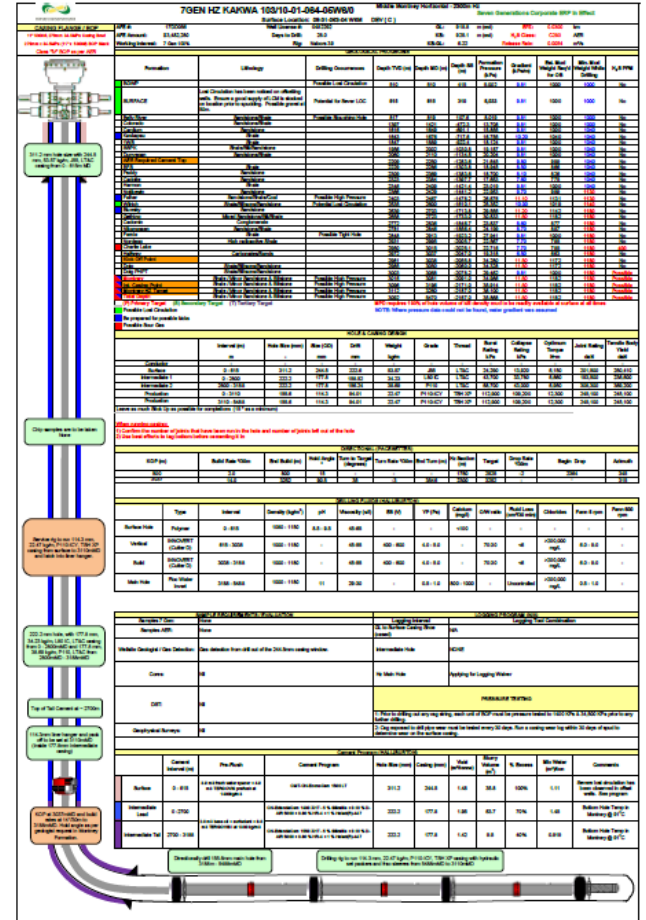
# DrillPlan Trial Project

- Pre-commercial DrillPlan was utilized on trial to plan a well to drill and evaluate a 5570MD (3114mTVD) horizontal well into the Middle Montney formation
- Located on multi-well pad (4 wells)
- **Main concerns:** anti- collision and risk assessment with offset wells
- **Trial Objective & Deliverables:** Evaluate DrillPlan to assess value added for future well plans; with specific focus on engineering and if it can replace current processes making them more efficient for 7G



# Current 7G Process

- **Preplanning:**
  - Engineering Software
  - Offset Well Analysis Software
  - Stick diagram (in-house excel sheet)
- **Team communication:** Typically emails or meetings
  - Geologists ( formation tops; geomechanical targets)
  - Well-planning team (anti collision, final well trajectory plan)
  - Directional drilling team (BHA design)
  - Services (Mud and cementing programs)
  - Licenses and permits (done manually)
- **AFE :** manual with excel
- **Drilling Program:** mostly procedural

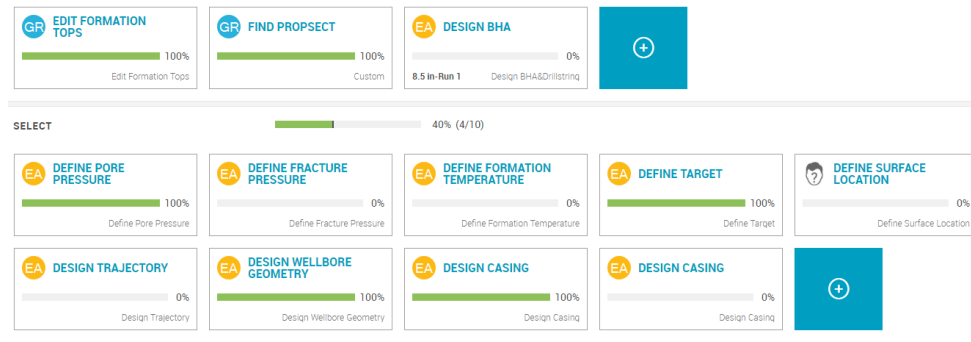


# Team Management Workflows



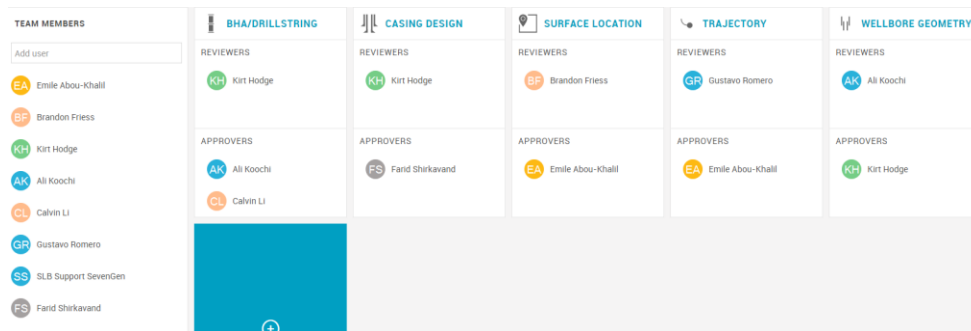
## Tasks Management

- Easy to Navigate
- Clear well construction process
- Allows progress tracking
- Allows visualization by groups or hole section



## Team Management:

- Allows collaboration between team members
- Review and approval hierarchy designation
- Accountability and task assignment to each team member



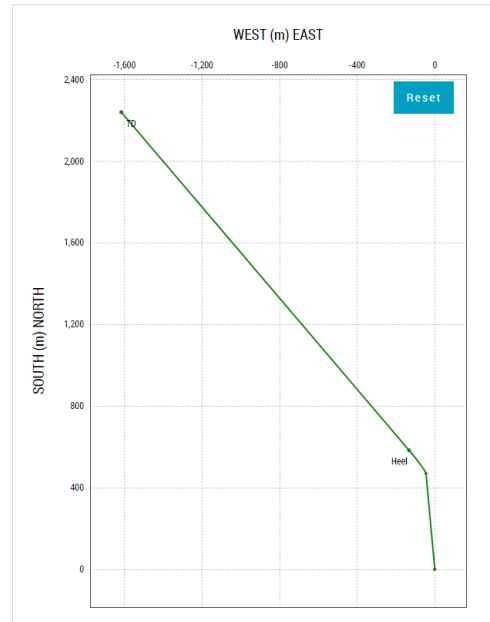
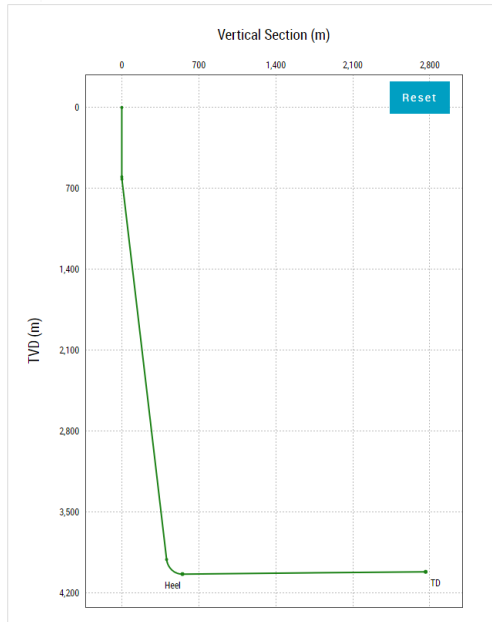
# Automated Trajectory Design



SEVEN GENERATIONS  
ENERGY

- Automated optimal design based on predefined criteria i.e. Surface location, KOP, Targets and DLS.

- Robust modification of the trajectory design constraints



## Automated Trajectory Design Constraints

### 1. VERTICAL SEGMENT

Nudge on Vertical Segment?  Yes  No

Your Desired Kick-Off Depth?

Kick-Off Depth:  m

### 2. BUILD SEGMENT

DLS:  deg/30m

### 3. TARGETS SEGMENT

DLS:  deg/30m

Landing Options:

Landing on Target  
 Landing on Line

Landing on Line (TVD @ LP)  
 Landing on Line (TVD @ 0VS)

Select Targets:

1. Target: Heel (V4)

2. Target: TD (V3)

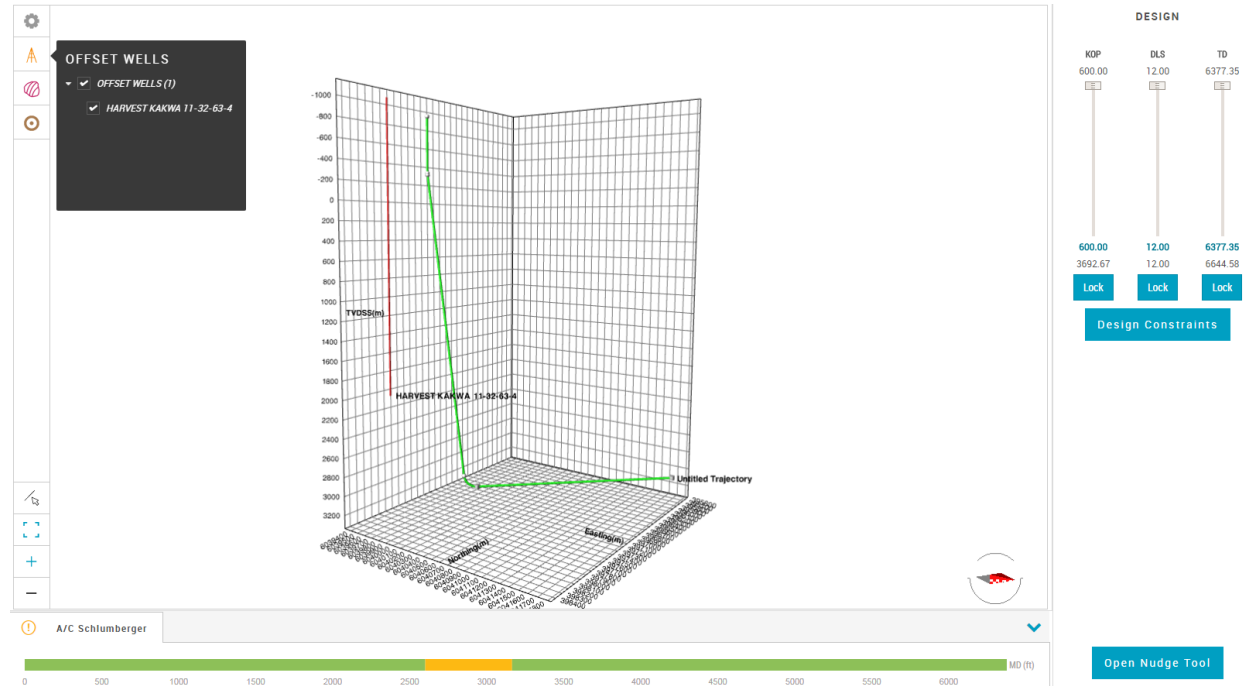
Rerun ATD

Cancel



# Offset wells

- Full 3D visualization of the planning trajectory, targets geological context, and offset wells.
- Instant collision warning
- Interactive design constraint control
- Automatic risk map generations based on well profile similarities

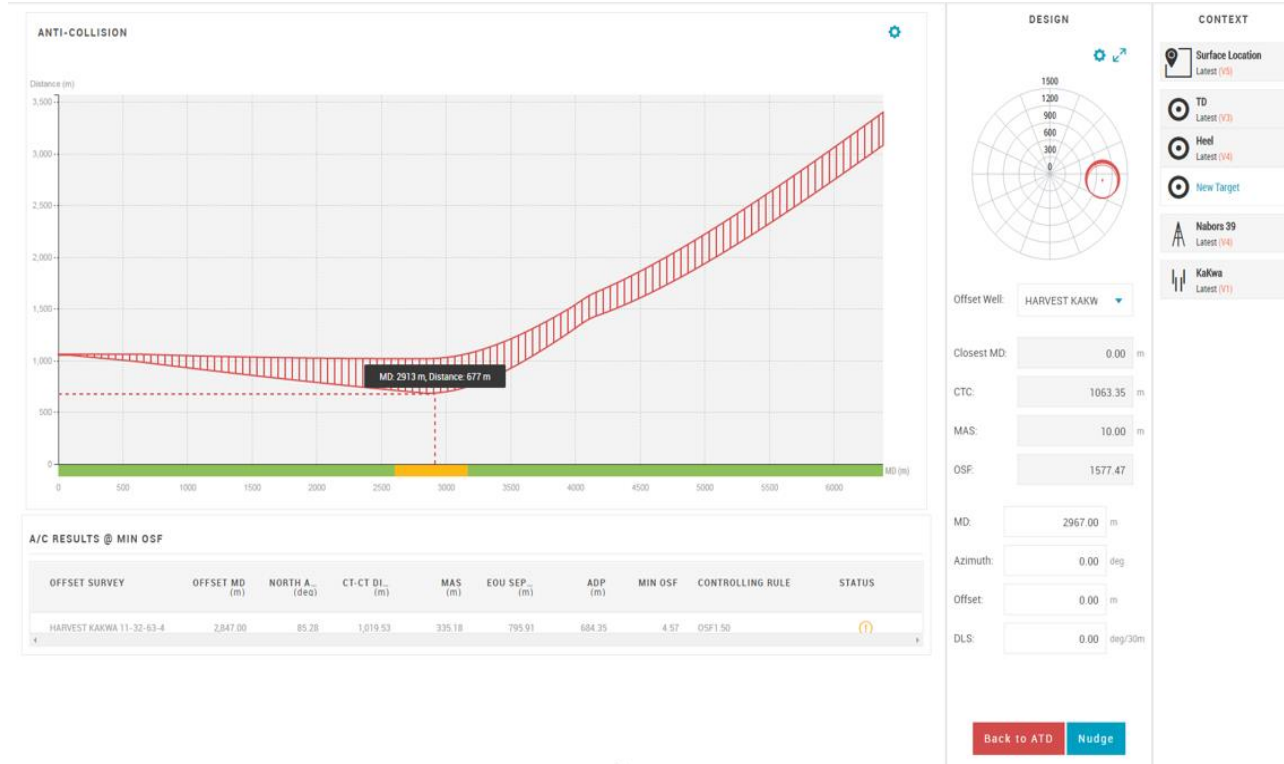


# Anti Collision Workflows



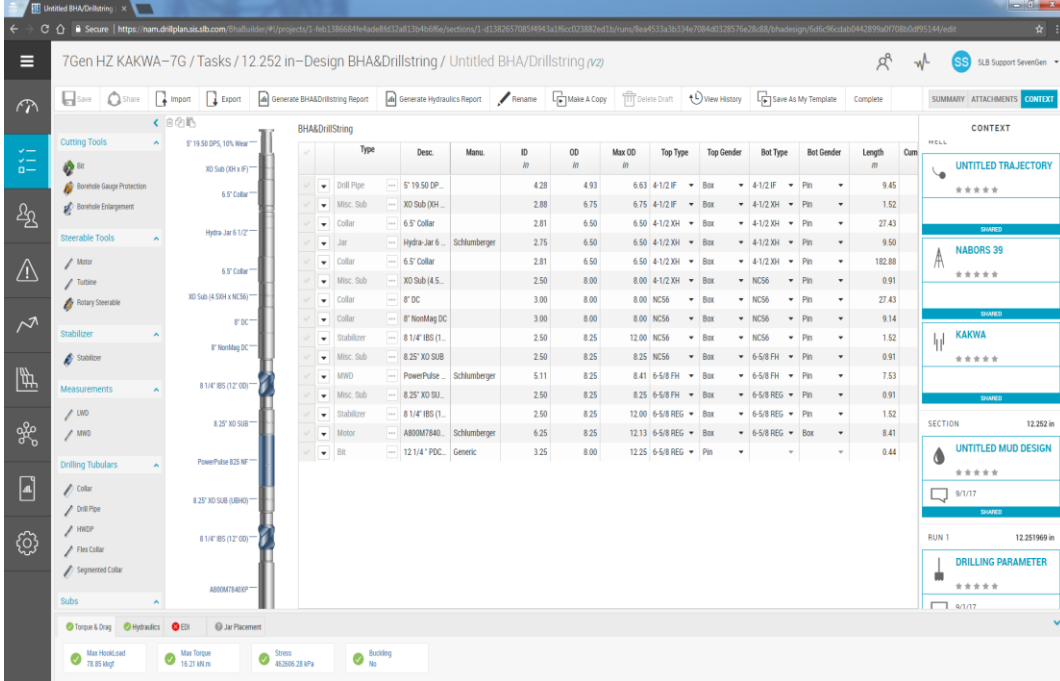
SEVEN GENERATIONS  
ENERGY

- Full 3D visualization of the planning trajectory, targets geological context, and offset wells.
- Ladder plot visualizes separation vs depth for multiple wells
- Robust modification of design constrains such center to center (CTC), minimum allowable separation (MAS) and Oriented separator factor (OSF)



# BHA Design

- Current BHA design is good enough
- Catalogue can be improved
- We design currently based on past experience
- But we would like to see DrillPlan help us design the appropriate BHA for each section based with focus on trajectory; geomechanics and specific build rates



7Gen HZ KAKWA-7G / Tasks / 12.252 in-Design BHA&Drillstring / Untitled BHA/Drillstring (v2)

Type	Desc.	Manu.	ID #	OD #	Max OD #	Top Type	Top Gender	Bot Type	Bot Gender	Length #	Com
Drill Pipe	5' 19.50 DP...		4.28	4.93	6.63	4-1/2 IF	Box	4-1/2 IF	Pin	9.45	
Misc. Sub	XO Sub (DH #)		2.88	6.75	6.75	4-1/2 IF	Box	4-1/2 XH	Pin	1.52	
Collar	6.5" Collar		2.81	6.50	6.50	4-1/2 XH	Box	4-1/2 XH	Pin	27.43	
Jar	Hydra-Jar 6...	Schlumberger	2.75	6.50	6.50	4-1/2 XH	Box	4-1/2 XH	Pin	9.50	
Collar	6.5" Collar		2.81	6.50	6.50	4-1/2 XH	Box	4-1/2 XH	Pin	182.88	
Misc. Sub	XO Sub (A.S.)		2.50	8.00	8.00	4-1/2 XH	Box	NC56	Pin	0.91	
Collar	8" DC		3.00	8.00	8.00	NC56	Box	NC56	Pin	27.43	
Collar	8" NonMag DC		3.00	8.00	8.00	NC56	Box	NC56	Pin	9.14	
Stabilizer	8 1/4" IBS (1...		2.50	8.25	12.00	NC56	Box	NC56	Pin	1.52	
Misc. Sub	8.25" XO SUB		2.50	8.25	8.25	NC56	Box	6-5/8 FH	Pin	0.91	
MWD	PowerPulse...	Schlumberger	5.11	8.25	8.41	6-5/8 FH	Box	6-5/8 FH	Pin	7.53	
Misc. Sub	8.25" XO SUB		2.50	8.25	8.25	6-5/8 FH	Box	6-5/8 REG	Pin	0.91	
Stabilizer	8 1/4" IBS (1...		2.50	8.25	12.00	6-5/8 REG	Box	6-5/8 REG	Pin	1.52	
Motor	AB00M7840...	Schlumberger	6.25	8.25	12.13	6-5/8 REG	Box	6-5/8 REG	Box	0.41	
Bit	12 1/4" PDC...	Generic	3.25	8.00	12.25	6-5/8 REG	Pin			0.44	

CONTEXT

UNTITLED TRAJECTORY

NABORS 39

KAKWA

SECTION 12.252 in

UNTITLED MUD DESIGN

RUN 1 12.251969 in

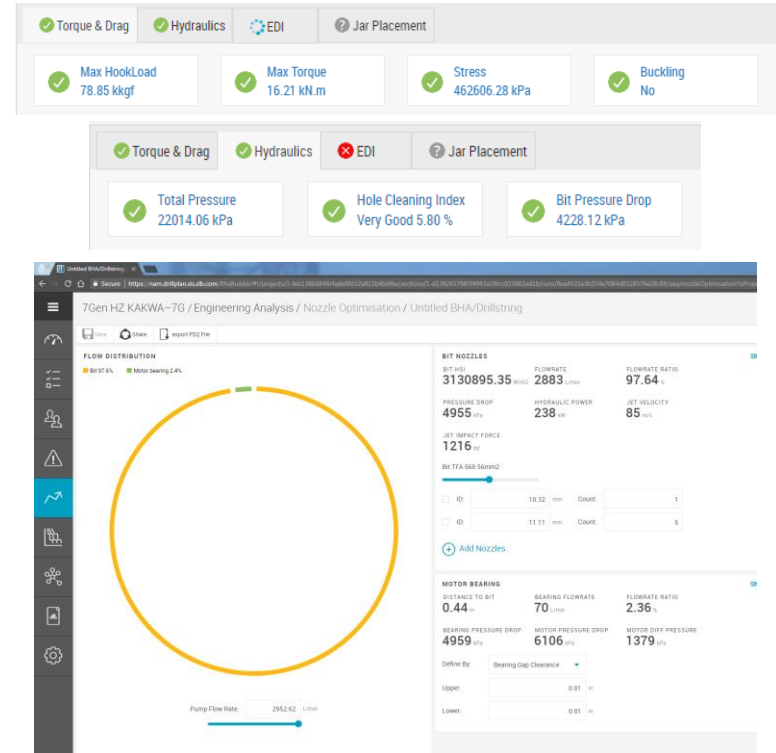
DRILLING PARAMETER

Torque & Drag Hydraulics EN Jar Placement

Max HookLoad 79.85 kNp Max Torque 16.21 kN.m Stress 40266.28 MPa Buckling No

# Automated Engineering analysis

- Analysis and update of well plan at a glance
- Validation against pre-set allowable engineering limits criteria and tolerances.
- Expansion on engineering criteria to refine the design in more details



# Feedback and Conclusion



- Very user friendly
- Easy to navigate to different tasks and modules- very responsive
- Suitable and has potential to make our planning process very efficient
- By saving time in planning, allows us to spend more time on engineering
- Quick turn around time on feedbacks and continuous development is attractive
- Since DrillPlan is Cloud base it makes collaboration between the team and even field much easier
- Potential to use DrillPlan once our main requirements are realized