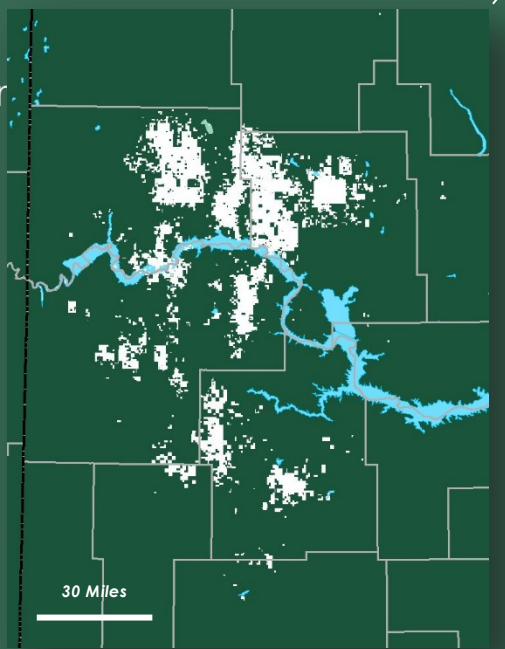
Managing Variability

Bakken Well Factory

Hess in North Dakota

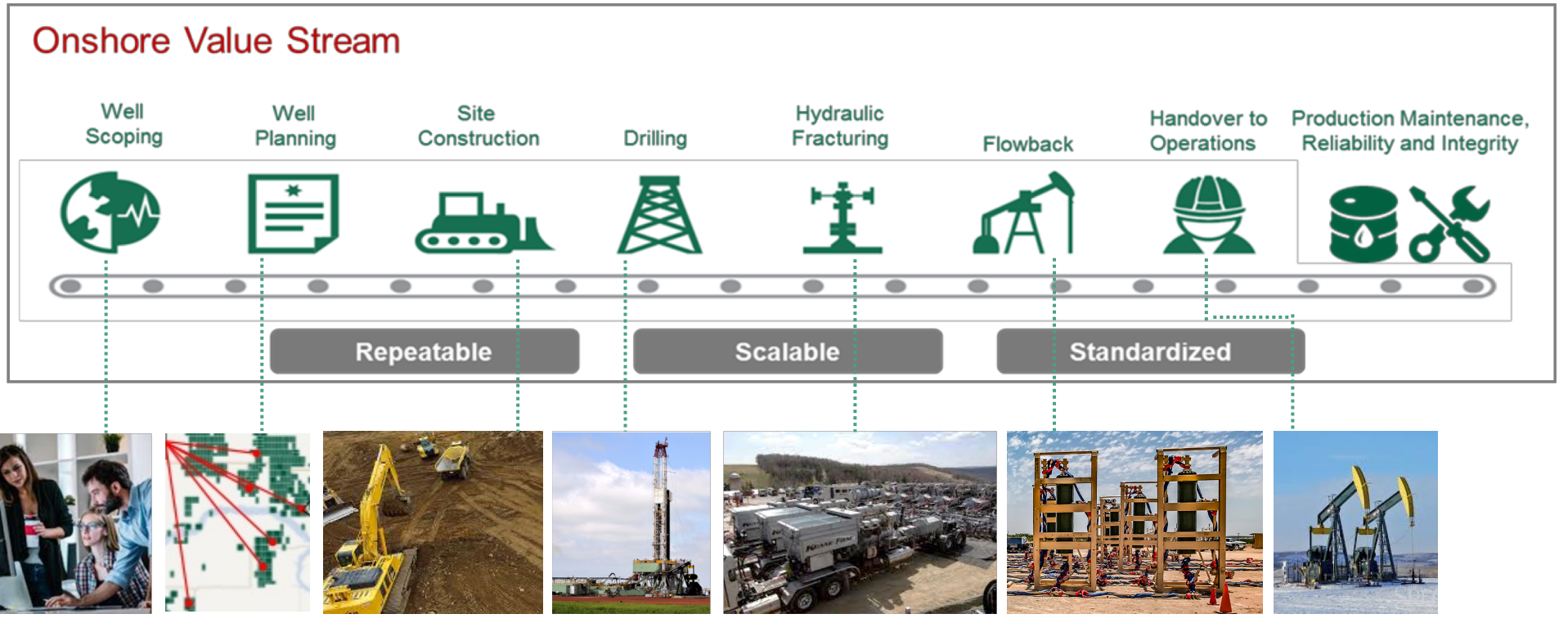
- Bakken Factory is 100 Miles X 125 Miles
- Focus on efficiencies via Lean principles and Projects as a Production System to enhance returns



- > 500,000 net acres (Hess ~75% WI, Operator
- 2018 net production guidance: 115-120 MBOED
- Total wells end 2018 ~ 1,415
- Total facilities end 2018 ~ 720
- Total future operated drilling locations ~2,900*

- 4 Office Locations
- 10 Radio Towers
- 14 WIFI Antennas
- ~ 6,000 Connectivity Components
- ~35,000 Connected Pieces of Equipment

Well Factory Value Stream

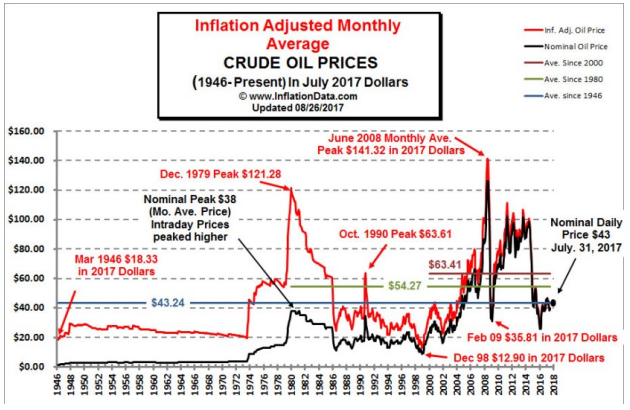


Standard Work

- Multiple 3rd Party Contractors serving multiple Operators in the Bakken
- The 'Value Stream' is Managed as a Production System
- Use the Last Planner© Process and Thinking
- Deliver a Defect free well to the 'Reliability Operations' Team

Well Factory Premise: Variability Happens

- Yes, variation is the problem, but it is a reality
  - External factors induce variability
  - Customers sometimes induce variability



Flex Rig count with higher oil prices … or lower oil prices

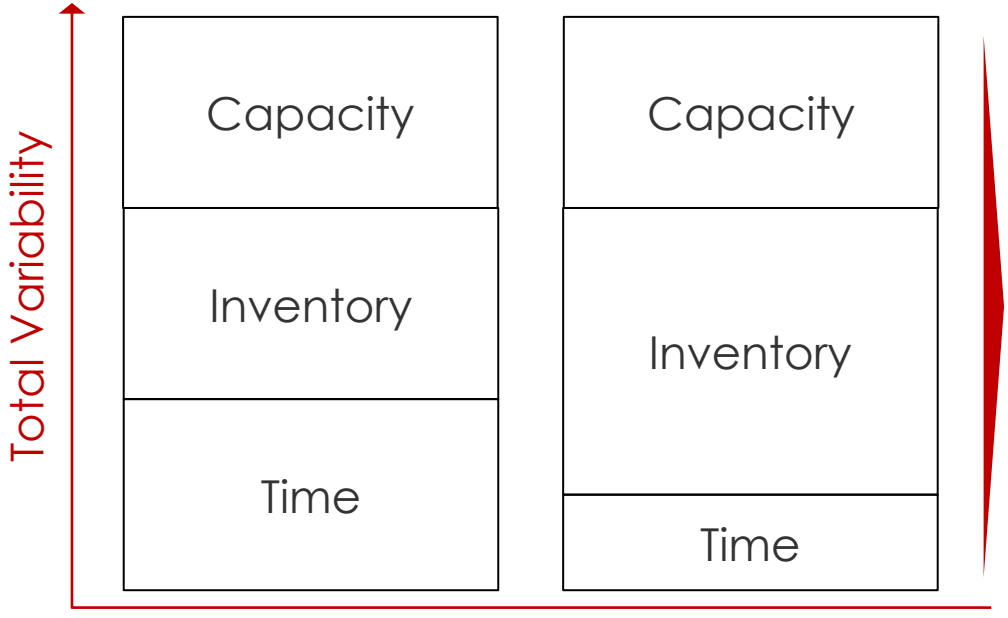
Flexing with winter weather impacts….

Executives request schedule acceleration….

- Understanding Operations Science helps us:
  - Understand Variation's effects – and how to manage it to our advantage

Recognizing the Consequences of Variability…
and managing it to create successful outcomes

There are only three ways to manage Variability: Capacity, Inventory and Time



As Variability goes up, what happens to
- Cycle Time?
- Work in Progress?
- Capacity Utilization?

Is *Inventory* the root of all evil? *No!*
Variability is root of all evil
Inventory is its flower

We Must Reduce Variability ⇩

All Work Activities are Governed by Laws…

Little's Law:

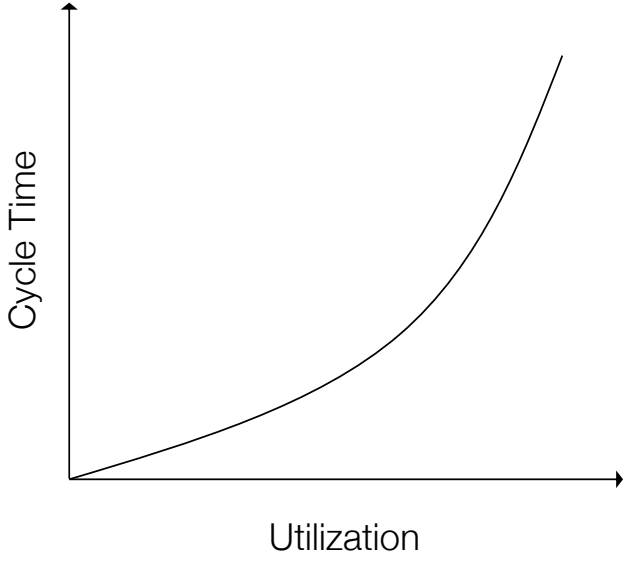
$$TH = WIP / CT$$

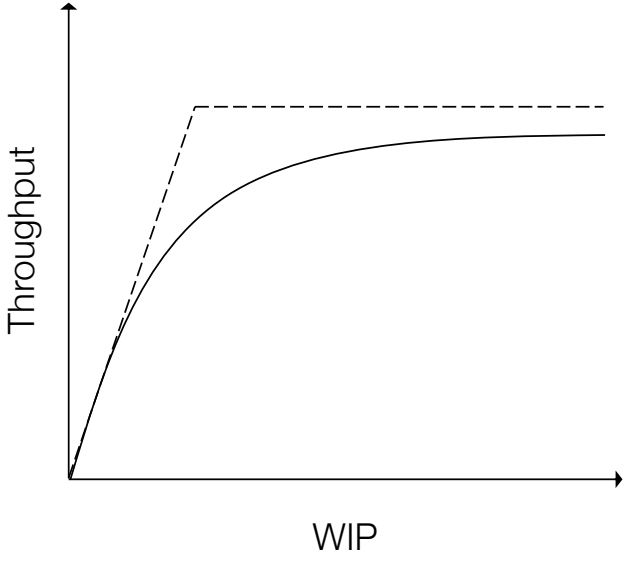
$$WIP = TH \times CT$$

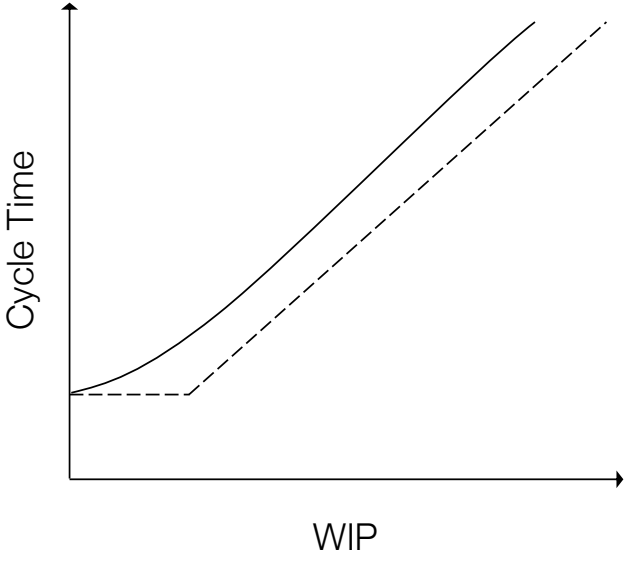
$$CT = WIP / TH$$

Cycle Time Formula:

$$CT = BT + MT + ST + PT + QT$$

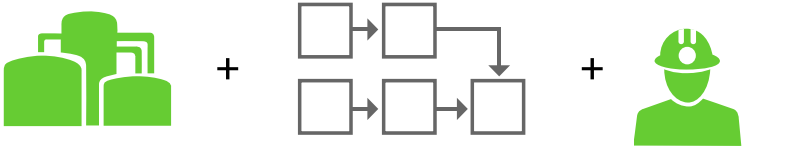






A Better Way to Manage Successful Outcomes in Projects

Project Management

Cost, Time and Cash =  + + +

Scope & Quality | Process Design | Resource Use

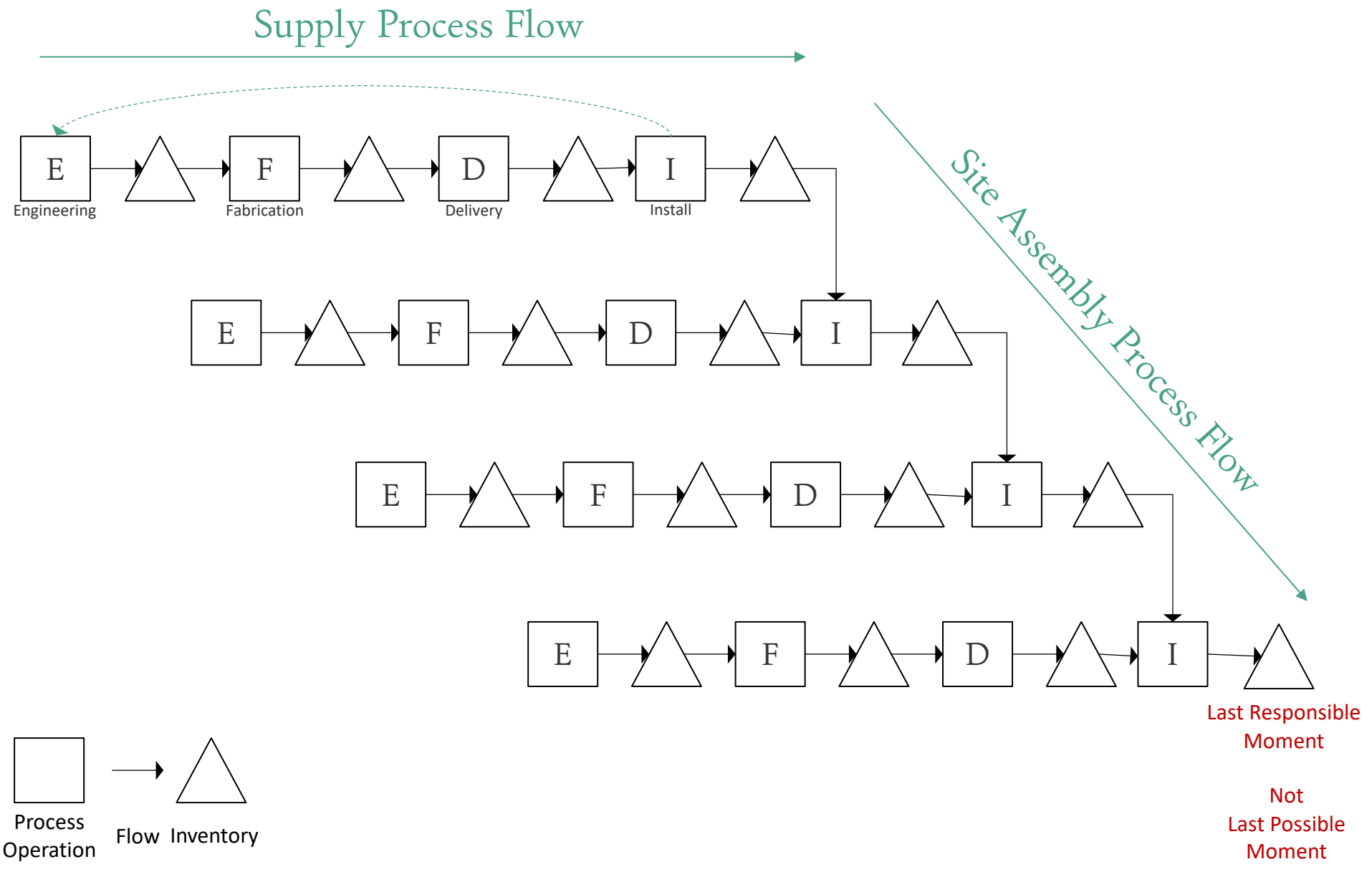
Traditional Project Management enhanced by Production Management

Production Management

Cost, Time and Cash =  + + + + +

Scope & Quality | Process Design | Capacity | Inventory | Variability

Last Responsible Moment



Managing Variability in the Well Factory

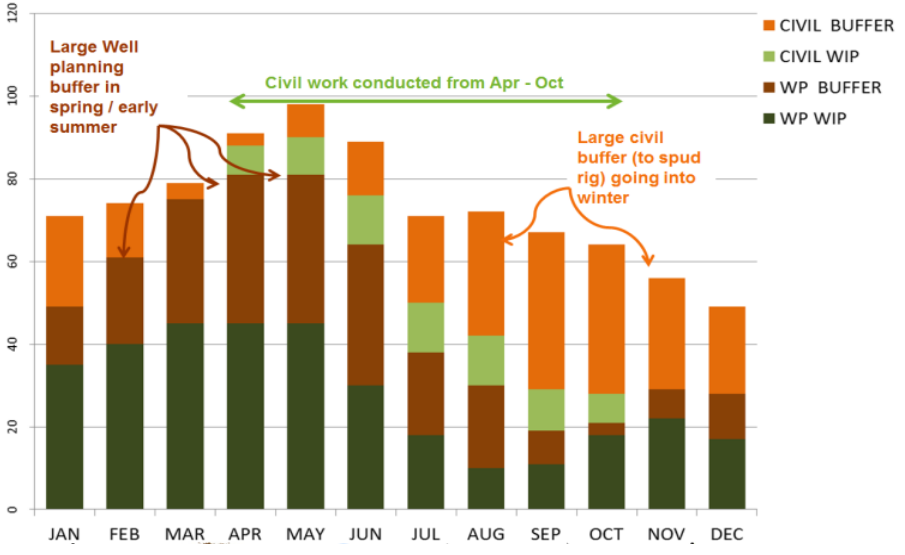
Winter Weather – Creating a Buffer of Well Pads

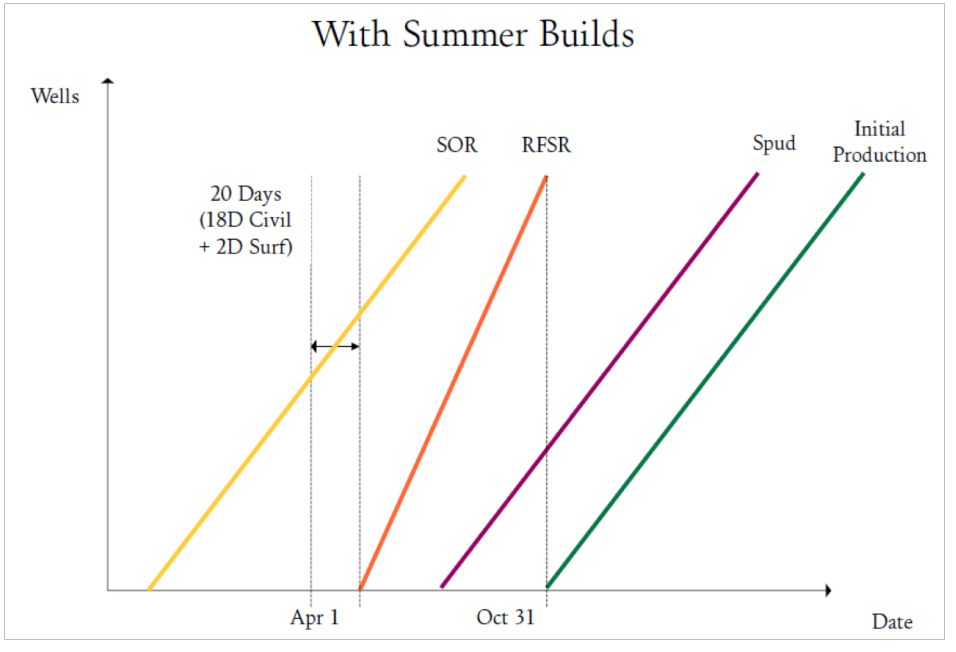
Winter Building = increased cost and unstable pads

Reduced build calendar from 12 months to 7 months

- Later realized to 6 months

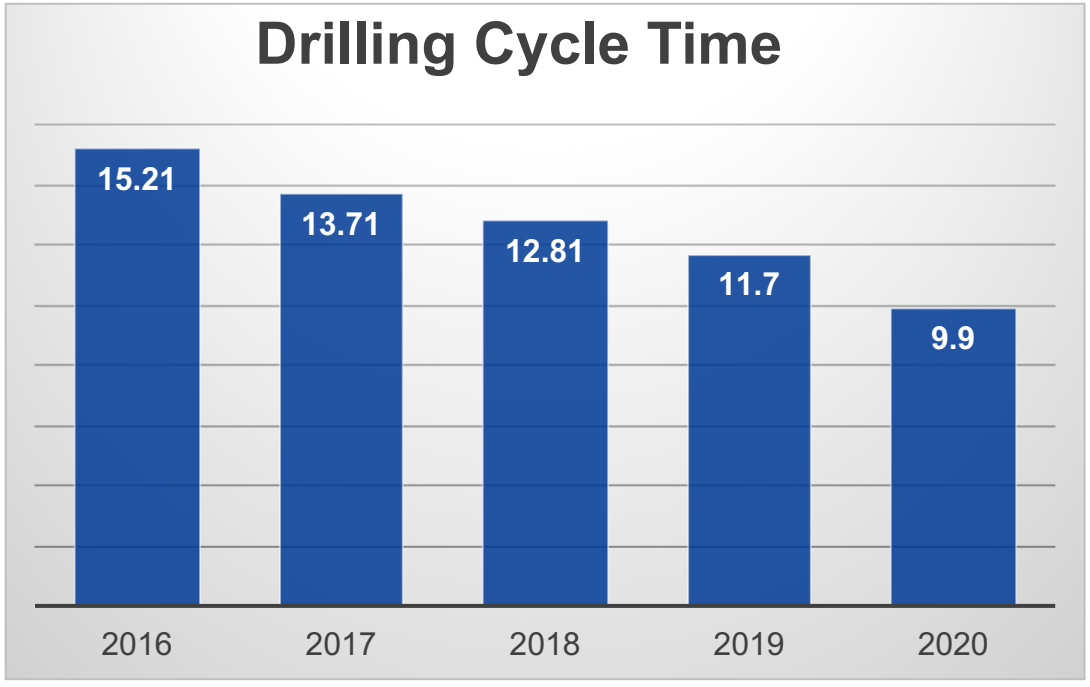
Created intentional buffer to stock locations for Civil crews; all work to be completed prior to the rig's arrival



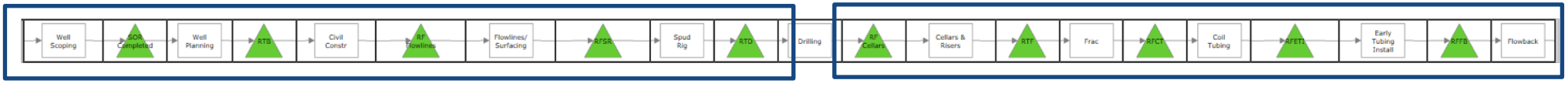


Managing Variability in the Well Factory

Improving Drilling Cycle Time – Adjusting the Rest of the Value Stream

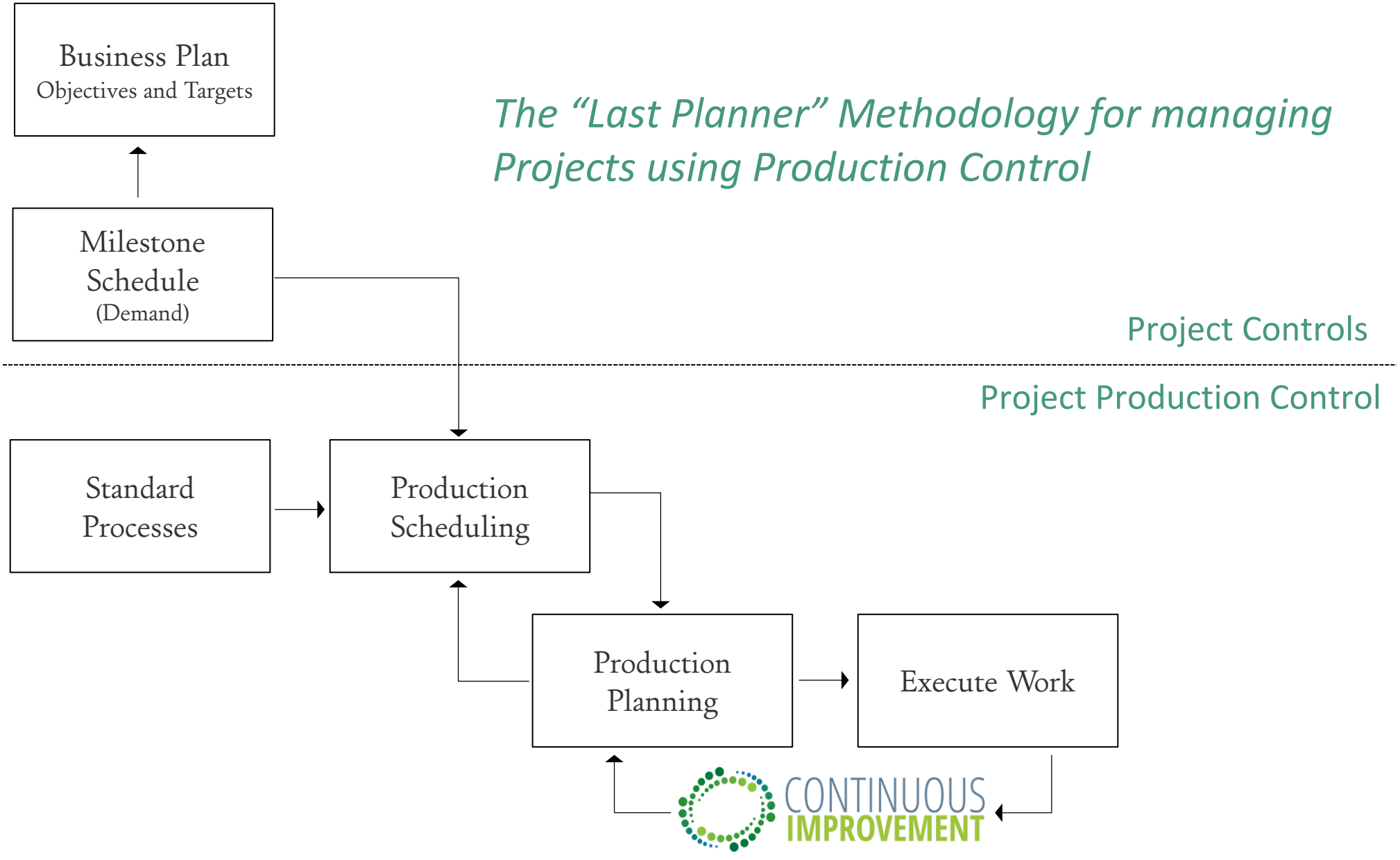


- Tighten the Planning belts
- Increase WIP Upstream of Drilling
- Increase Buffer Upstream of Drilling
- Prepare Downstream Functions

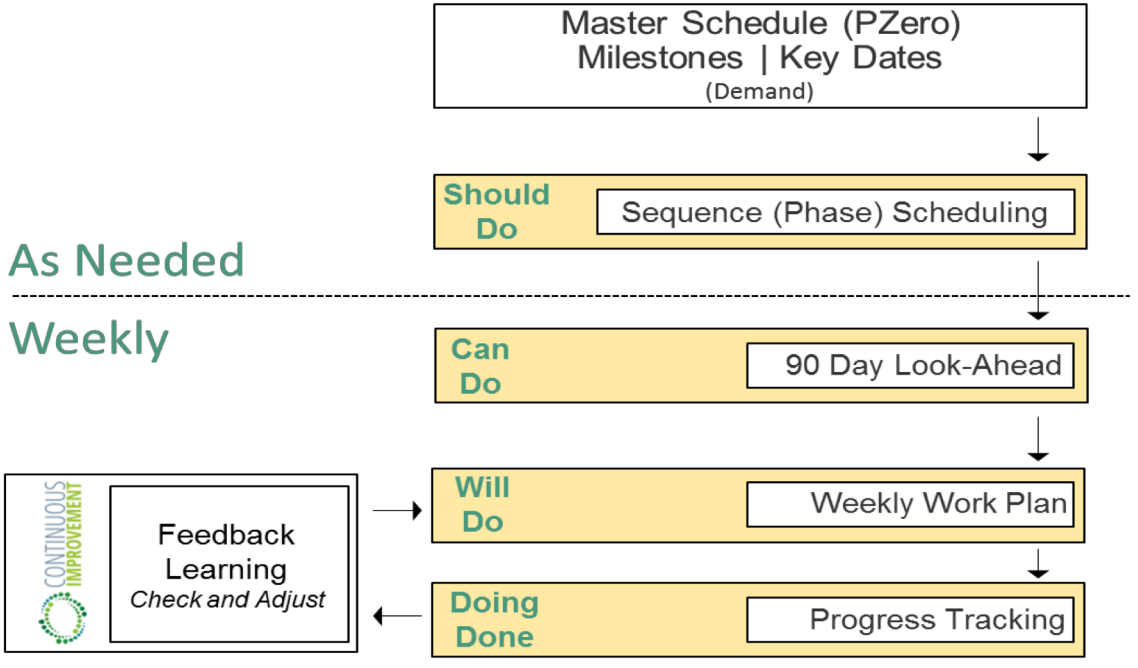


Project Controls | Project Production Control

The "Last Planner" Methodology for managing Projects using Production Control



Last Planner at Hess



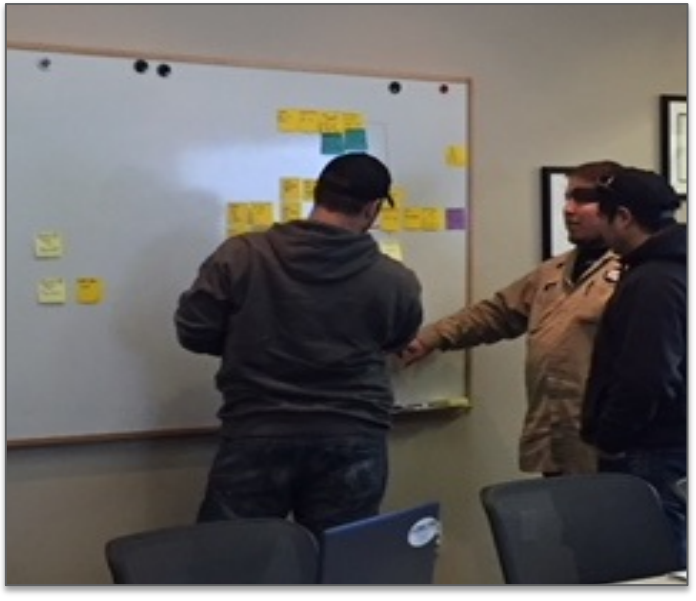
Implementing Last Planner in the Well Factory
With Multiple Contractors

Various contractors for multiple trades

Training

Support/Guidance

Oversight



Positive experience

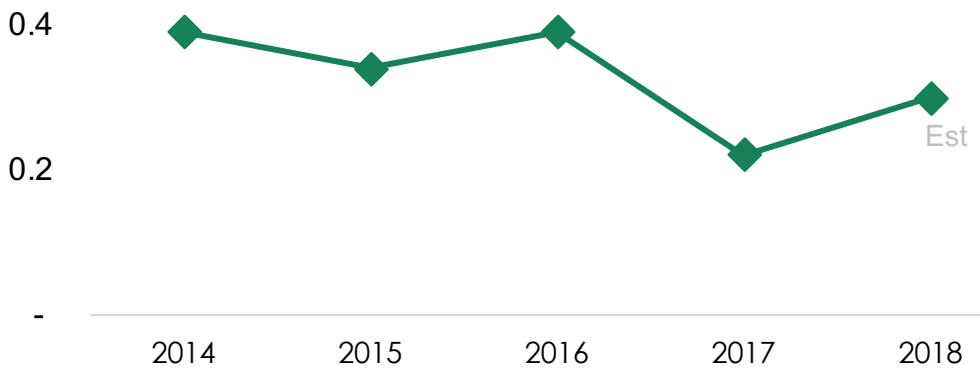
Motivated to learn

Found their own incentives

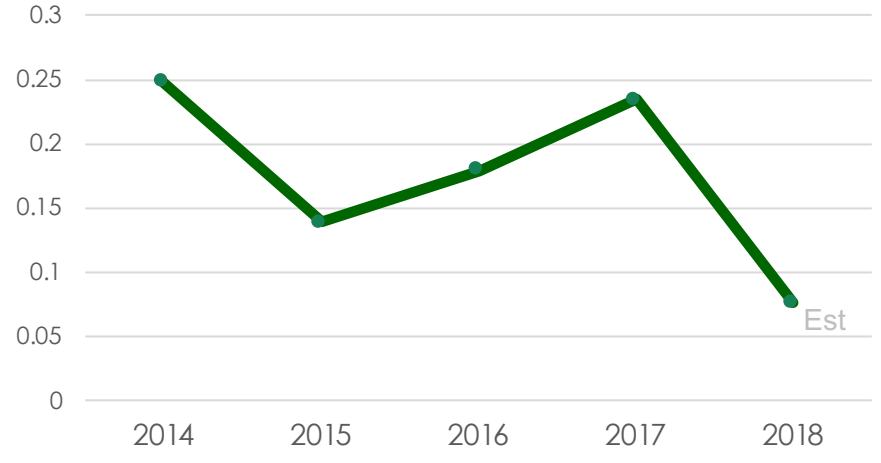
Well Factory Results

Hess is a Top Tier Operator in the Bakken

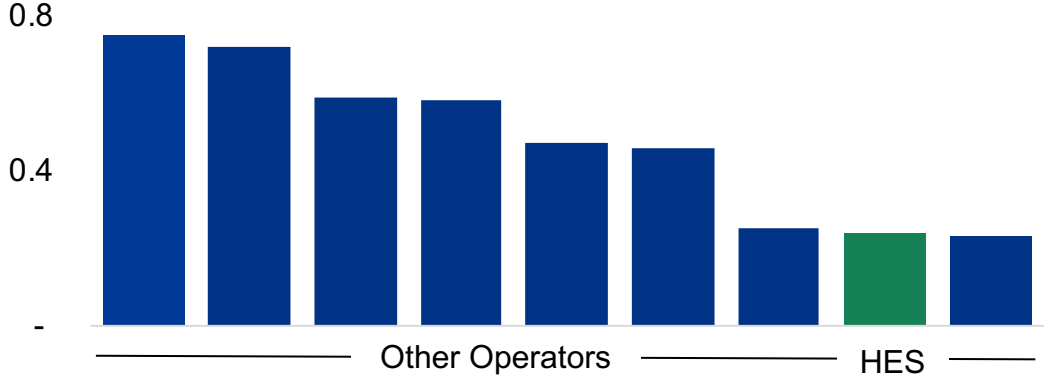
Total Recordable Incident Rate (TRIR)



Severe Safety Rate



Hess TRIR Versus Other Operators (E&P)

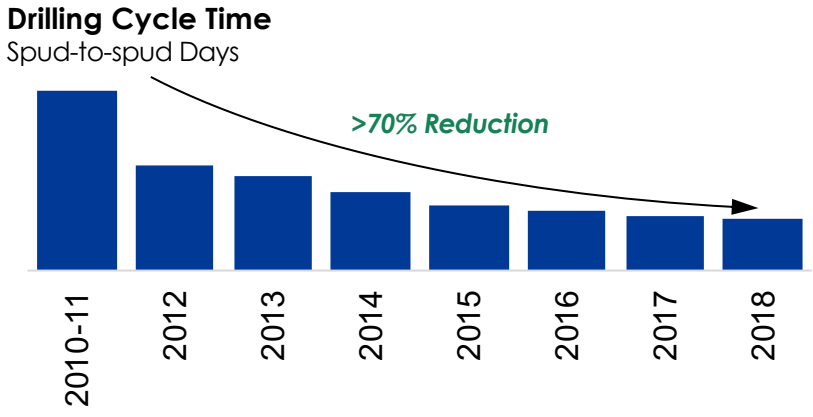


Industry leading safety performance - License to operate, core to our values…

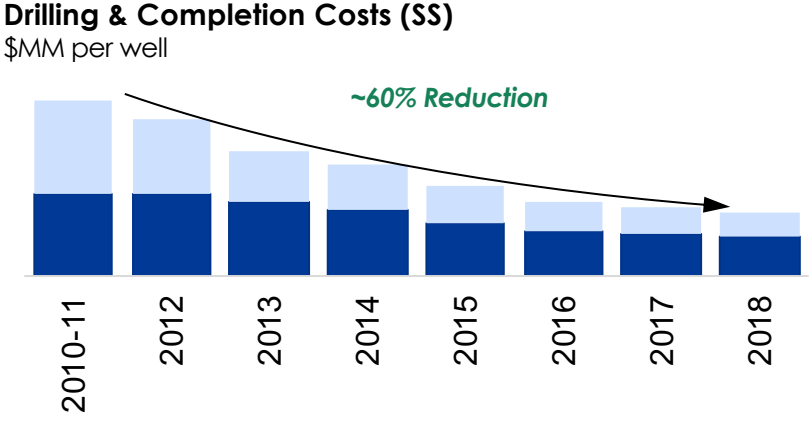
Well Factory Results

Hess is a Top Tier Operator in the Bakken

Drilling Cycle Time (Spud-To-Spud Days)



Drilling & Completion Costs $MM Per Well



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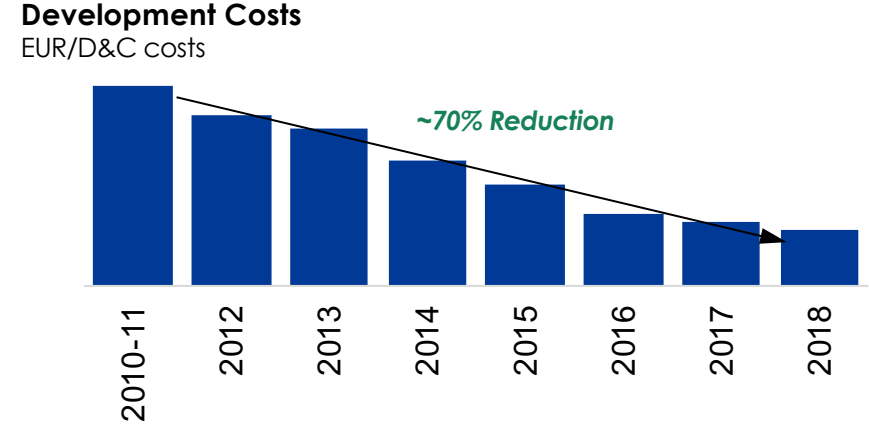
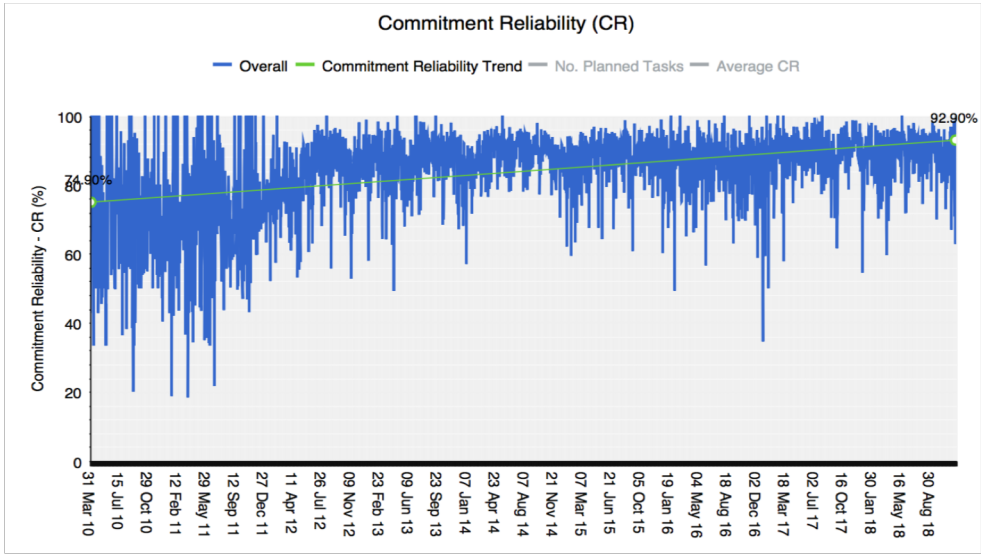


Best-in-class operational excellence positions us to continue to drive out cost in transition to P&P

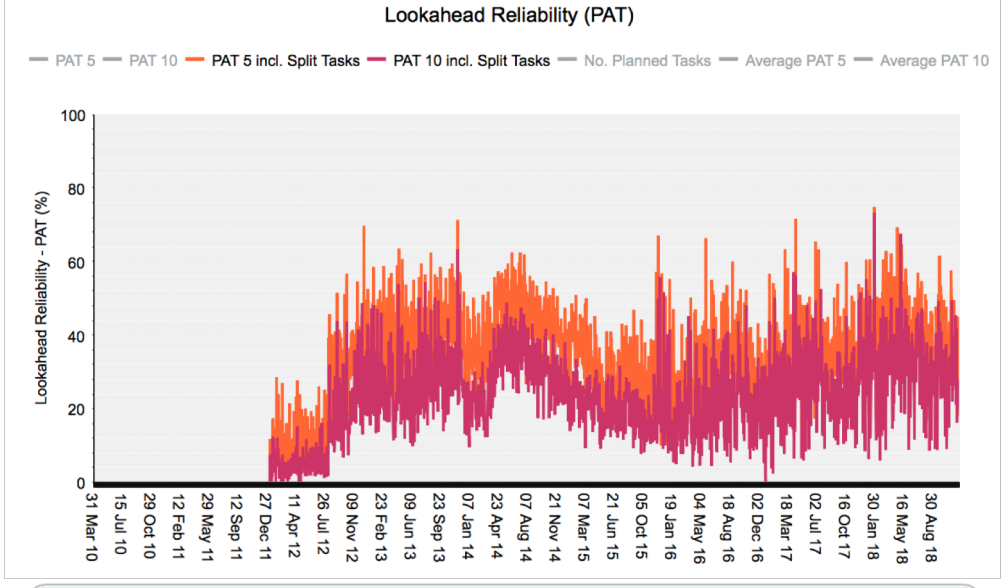
Well Factory Results

A Radically Improved Way of Working

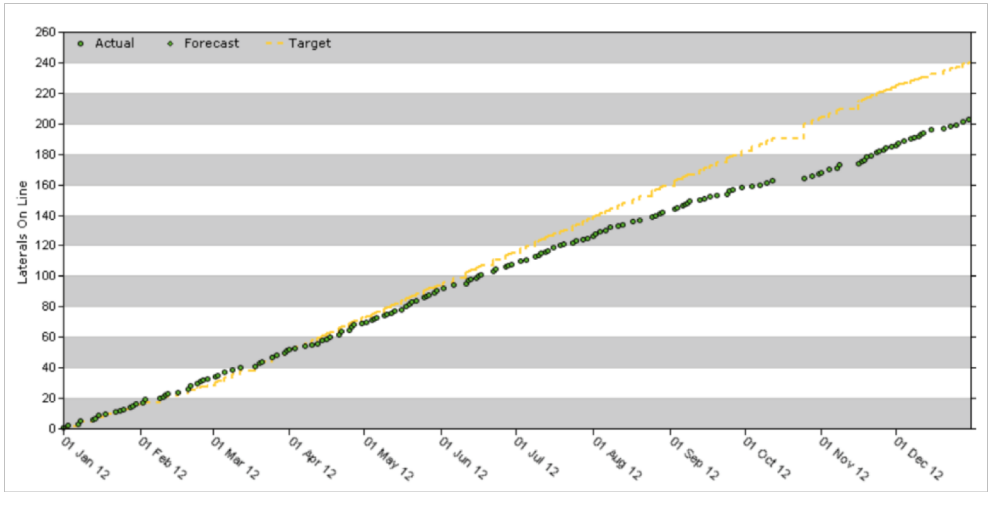
Notable Reduction in Variability for all Teams



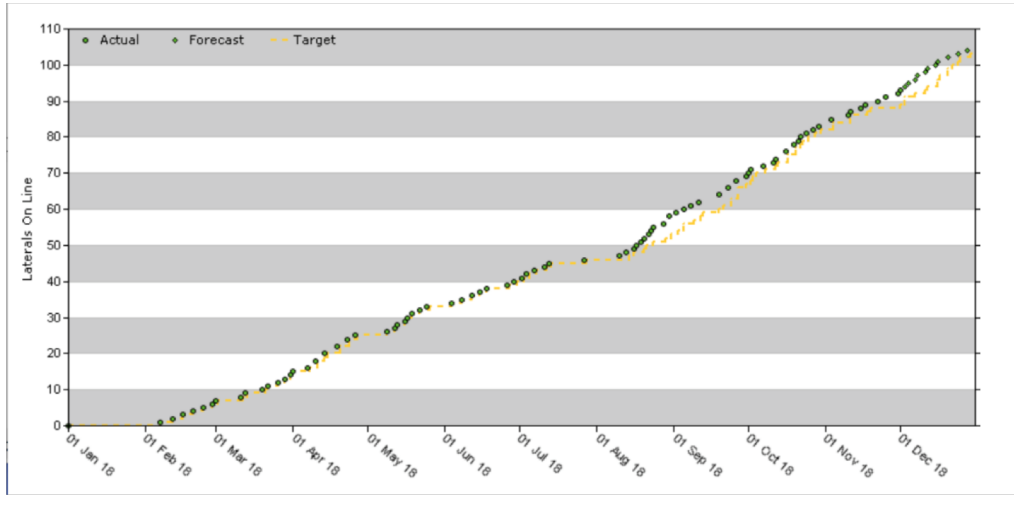
Lookahead Reliability: Standard Work & Last Planners



2012 Delivery of Wells Online



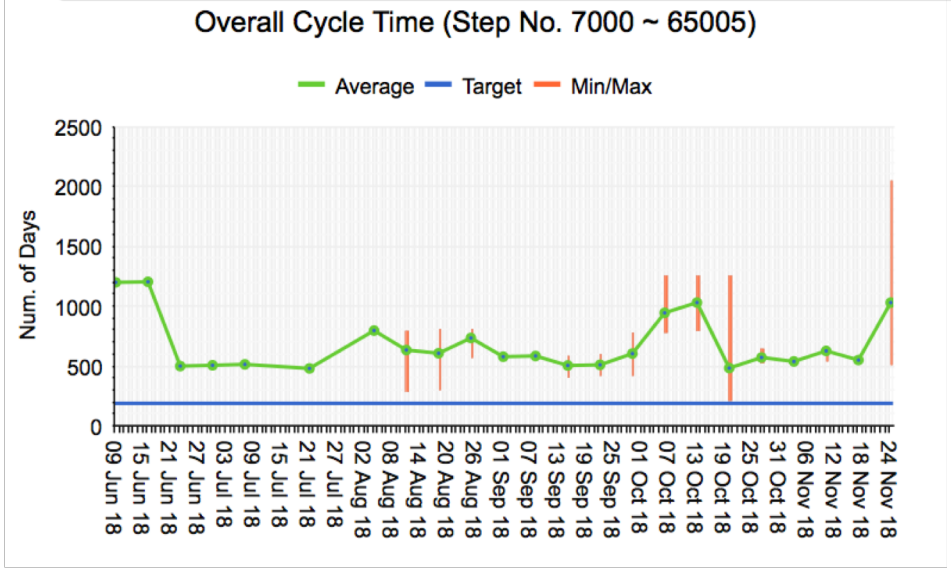
2018 Delivery of Wells Online



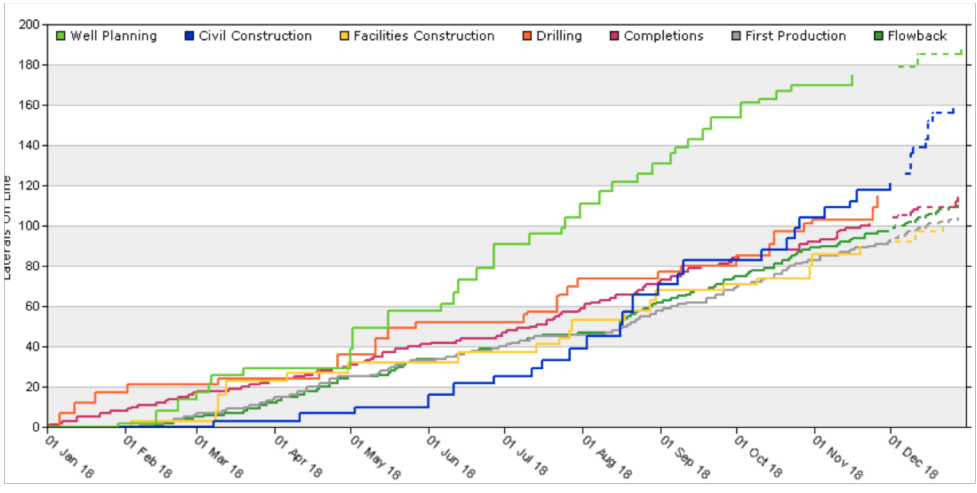
Well Factory Results

How Are We Doing?

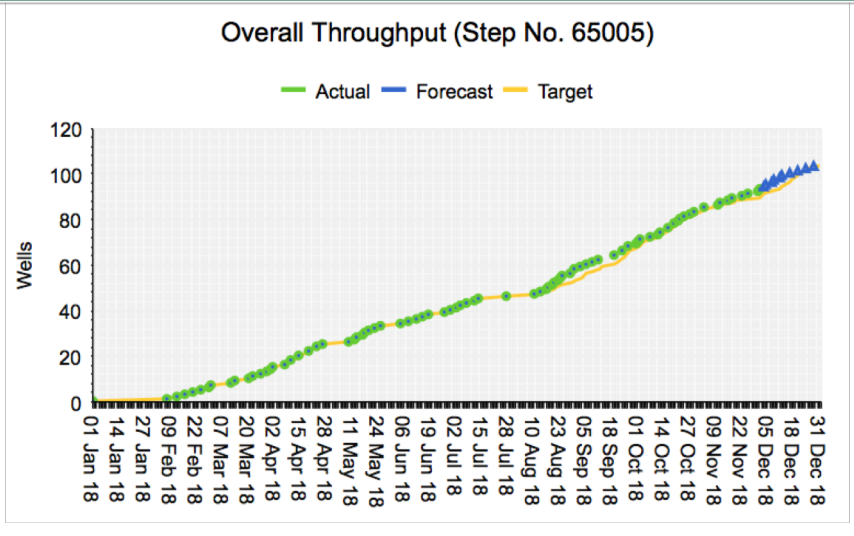
Cycle Time



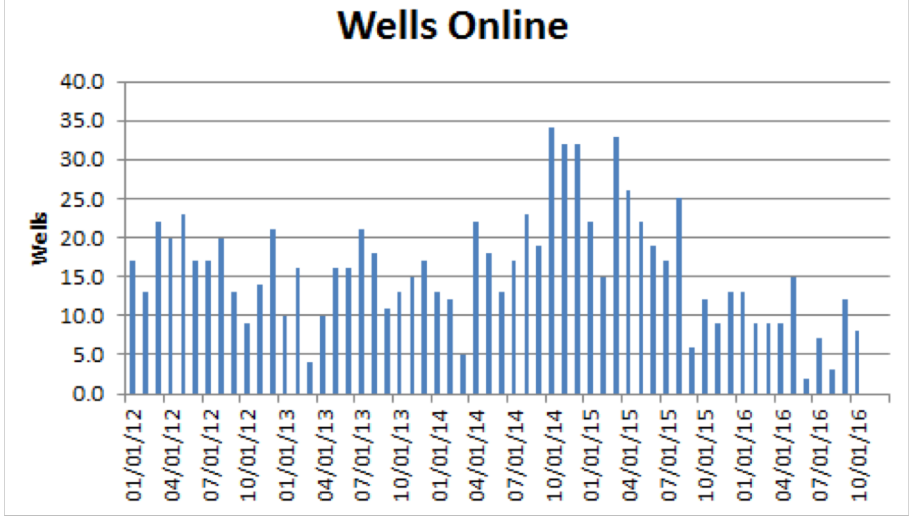
Functional Throughput



Overall Throughput



Delivery - Wells Online



Question and Answer