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DRILLING OPTIMISATION ON THE NORWEGIAN CONTINENTAL SHELF

OPPORTUNITIES IN WELL DESIGN PRACTICE

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UNIVERSITY OF STAVANGER
MSc. Petroleum Engineering – Dissertation

To Paul, Jo'Ann, Hugh and Annika.

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This body of work serves as partial satisfaction of the requirements of the Master of Science (Petroleum Engineering) degree programme, at the University of Stavanger. I trust this work will be of interest to practising or aspiring Drilling Engineers, whose work concerns the Norwegian Continental Shelf, or Drilling Optimisation as a broader subject area.

Patrick Harris
Stavanger 2018

Executive Summary

The purpose of this thesis was to attempt to provide evidence that Norway's drilling fraternity is long overdue for a re-think in the way it drills wells. In so doing, the author has chosen to focus on slim well drilling as a means of reducing drill costs. It was postulated that slim well drilling could lead to much lower drilling investment costs. This body of work therefore focuses on the regulatory, economic and technical implications of slim hole drilling in Norway.

The study examined the historical trends of drilling optimisation, particularly in light of the recent downturn. It was discovered that drilling investment costs in Norway have increased three-fold since the year 2000 with drilling and wells contributing 50% of that overall investment (>NOK100B per year). Whilst there has indeed been some improvement in efficiency since 2014, there is still a major issue with hidden NPT and overall rig crew efficiency. There are, however, some exciting developments in play for slimming down explorations wells in Norway, with the possibility of even drilling with a single casing string being considered.

To attempt to indicate that slim wells are indeed possible, six hypothetical exploration wells were examined. Two in the North Sea, another two in the Norwegian Sea and the remainder in the Barents Sea. These regions were chosen to give the broadest possible outlook for the opportunities and challenges at play for the Norwegian sector. For each region, one conventional well design and one slender well proposal was analysed and despite an absence of some data, realistic assumptions were made based on publically available data from Norwegian operators.

From a technical standpoint, our analysis concluded the following:

- For each conventional well presented, it was technically possible to remove one or two casing strings, with no lost production and well integrity remaining intact;
- The limiting technical factor in slim well design is kick tolerance. All slim hole options required changes to casing set depth and hole size due to kick tolerance;
- Due to recent advances in downhole technology, the use of tools such as alternate-flow through casing shoes mean ECD's are not the problem they would otherwise be. By under-reaming certain hole sections and using managed pressure drilling, ECD's can be further reduced, as can annular pressures during cementing;

In assessing the technical merits of slim well drilling, an economic model was developed for each of the six drill proposals. A number of realistic assumptions were made based on ballpark materials pricing and some limited drill cost data from an undisclosed operator. Our economic analysis concluded the following:

- Simply slimming down a well, all casing depths remaining equal may not necessarily be economically beneficial. This will depend entirely on operating time;
- Material cost savings, while significant, only play a minute role in reducing wellbore costs. These savings will fluctuate depending on the operating company's competitive market advantage in securing lower per-unit material costs;
- The primary cost driver of economically successful slim well drilling is rig crew performance;

The study rounds-up with an expose of the current opportunities and challenges facing industry today. Whilst it is easy to show evidence of the techno-economic merits of slim hole drilling, it was thought prudent to examine the current industry appetite for these sorts of wells, in light of the challenges which need to be overcome before commercialisation of slim hole drilling can occur. The biggest roadblocks currently hindering the commercial success of slim hole drilling are the preventive drilling rig certification costs for new rigs in Norway and the current state of the local OCTG market. A number of recommendations to industry were presented:

- Standardisation of drilling rig certification processes and regulations between Denmark, Norway and the UK (North Sea sector);
- Standardisation of manufacturing, operating and documenting practises across industry;
- The implementation of rig crew performance incentive schemes, which are particularly important given that the economic merits of slim wells hinge on a high performing crew;
- Implementing risk sharing models to ensure a more stable flow of income/expense, as well as reviewing the ways in which rig costs are set;
- “Going digital”. Implementing digital well planning to drive down costs.

In closing, this thesis concludes that slim wells are a lucrative option for Norwegian operating companies, in that they are technically sound for the Norwegian Continental Shelf and economically viable given a prevalence of the conditions outlined above.

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ARO – Asset Retirement Obligation
BHA – Bottom-hole assembly
BOP – Blowout preventer
CAPEX – Capital expenditure
DP – Drill pipe
ECD – Equivalent circulating density
EMW – Equivalent mud weight
FFP – Fit for purpose
Green Test – Pressure testing wet cement
Grey Test – Pressure testing cured cement
HSE – Health, safety and environment
JHA – Job hazard analysis
LOT – Leak-off test
Mud Window – Range of equivalent densities or pressures that avoids drilling problems
NOK – Norwegian Krone
NPT – Non-productive time
OBM – Oil-based mud
OCTG – Oil Country Tubular Goods
OD – Outer diameter
Oil Price – Price of oil per barrel
OPEX – Operating expenditure
PDC – Poly-crystalline diamond compact (drill bit)
PJSM – Pre-job safety meeting
ROP – Rate of penetration
RT – Rotary table (aka. Kelly bushing)
SOP – Standard operating procedure
SPE – Society of Petroleum Engineers
TVD – True vertical depth
WBM – Water-based mud
WOB – Weight on bit
WTI – West Texas Intermediate

Chapter 1: Introduction

Oil and gas exploration is complex in its very nature. It is an industry that epitomises the phrase "high risk, high reward". In keeping with this theme, we note that drilling operations today, constitute the highest overall contribution to project capital expenditure. A project may well be deemed economically viable or not purely based on its drill costs. As Drilling Engineers, it is hence our overarching responsibility to not only deliver highly productive wells with lifelong integrity, but to deliver the same with one eye on our shareholders and one on our pocket.

For the past decade, the advent of more stringent regulations, brought about for a number of technical, social and economic reasons, have stymied the industry's ability to deliver wellbores at a comparatively low cost. In Norway, where operators produce hydrocarbons in one of the World's most challenging regions, these issues are more boldly exemplified. It is the Author's hypothesis that drilling operations on the Norwegian Continental Shelf are long overdue for a re-think and stand in need of optimisation to reduce wellbore costs.

This body of work will focus on the opportunities that may exist for optimised drilling on the Norwegian Continental Shelf. The text opens with an historical account of drilling optimisation as a broader subject area and subsequently proceeds with an expose and critique of Norwegian regulations concerning oil and gas drilling. Of particular focus is the effect the regulations have had on industry efficiency and well designs today. Against this backdrop, the most recent developments in slim or slender well drilling are presented, along with an overview of innovative reduced casing drilling.

The study builds on these theoretical fundamentals and innovative ideas to present new options for wellbore architecture on the Norwegian Continental Shelf. Options for each of the three major regions of the Shelf (i.e. North Sea, Norwegian Sea, Barents Sea) are presented (limited to exploration wells) from a technical and economic standpoint. A synopsis of the major risk factors, along with technical, market and regulatory concerns is subsequently outlined.

We close with a number of recommendations for Norwegian operators and State Regulators. It is the Author's intention that this study be used to optimise drilling operations in both Norway and around the world, thereby making wellbore operations more cost-effective. The author hypothesises that slender well drilling is a techno-economically viable option for Norwegian operating companies. This body of work will investigate this claim.

Chapter 2: Background

2.1 The History and Development of Drilling Optimisation

The topic of drilling optimisation is nothing new – the concept has been in existence since 1967, where the first techniques were applied (James L. Lummus (Pan American Petroleum Corp.), 1970). As a broader subject area, drilling optimisation seeks ultimately, to cut capital and operating expenditure (CAPEX and OPEX) by addition, removal or innovation of various technical facets of the drilling process.

According to Lummus, with the development of the rotary drilling rig from its initial conception during the early period of the 20th century, to where it is today, the drilling process has gone from a highly labour intensive percussion type process, to its modern day scientific approach. The timeline can be divided in four distinct periods:

1. The Conception Period (1900 – 1920): The foundation of modern day drilling, which began not long after the first discoveries of oil in North America;
2. The Development Period (1920 – 1948): The transformation of first-generation rigs to what would be most closely related to their current form;
3. The Scientific Period (1948 – 1968): The introduction of modern science into the drilling process and the first attempts of looking at drilling through an academic lens;
4. The Automation Period (1968 onwards): The inception of automated processes into modern day rigs.

Whilst Lummus makes number of valid arguments pertaining to the development rotary drilling, he argues that the Scientific and Automation Periods leapfrog one another even to this day. It could be argued further that automation is a relative term. With the developments made in modern computing and control systems, it is fair to argue that the Automation period may not have even begun. This is because the modern day interpretation of automation entails a much more literal definition of the term, than was the case in the early 70's.

Irrespective of what one might surmise about our current period of rotary drilling, what is evidently clear is that the present appetite for optimised (and ultimately cost-effective) drilling processes is pegged to the oil price[1]. To illustrate this point, Figure 1 below shows the price of WTI oil over the past 20 years.

[1] This is a key concept, since it will feed this work's arguments surrounding the need for drill cost reduction on the Norwegian Continental Shelf in future chapters.

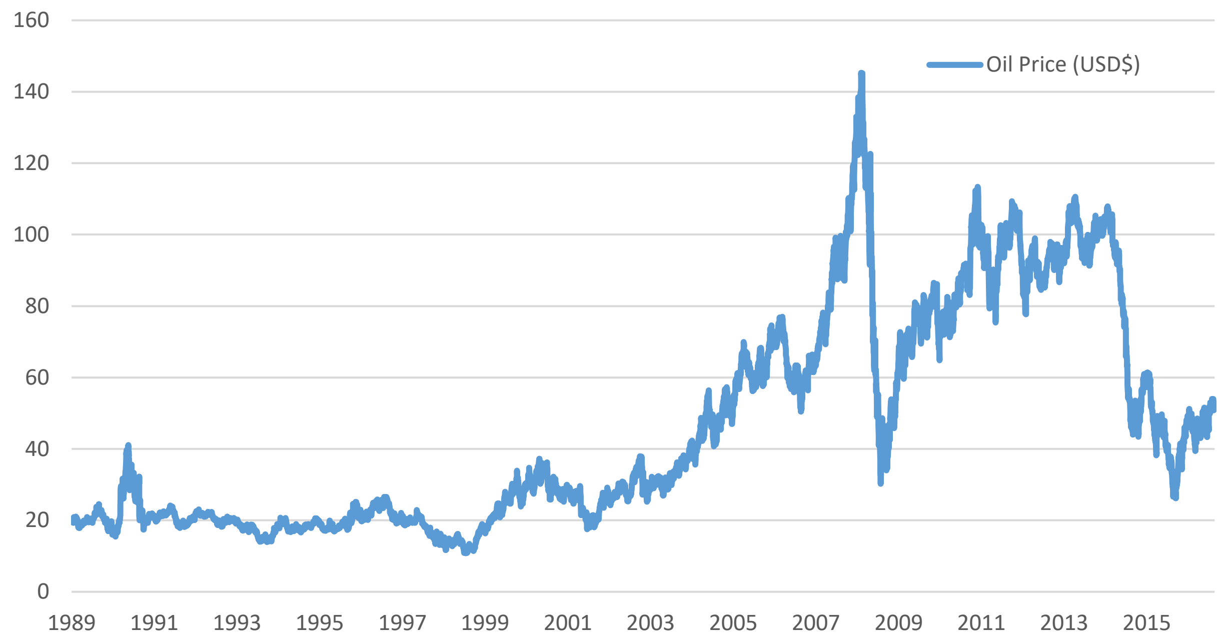


Figure 1 - WTI Oil Price History (Federal Reserve of St. Louis, 2018)[2]

The change in industry appetite for optimised drilling is easily understood when considering macro-economic oil-price trends. Put simply: when prices (and bottom lines) are up, the industry pays little attention to innovation and optimised drilling, since corporate scorecards do not underscore the need for what is perceived in these times as unnecessary expenditure. Conversely, when prices and profits are down, what typically follows is an industry-wide panic and a strong push for cheaper wells with higher productivity, driven by an often short-term shareholder-appeasing view.

However, this concept, while broadly applicable on some small level, fails to consider the effect of production rates and overall corporate vision on how one entity may view optimised drilling over another and, thus, how these processes ultimately mature. Let us consider a hypothetical well drilled in Saudi Arabia's Ghawar field, which produces some four to five million boe[3]/day. Historically, wells drilled in this field have such a rapid payback period, coupled with a high oil price and positive reserves replacement ratio, that the need for cost-saving drilling solutions has not been present. However, let us now consider a well drilled in Central Australia, where the average production rate per well falls in the range of 300-3000 boe/day. With high water cuts, coupled with some of World's highest labour costs[4], for some of the smaller operators, each new well is make-or-break.

It is easy to see how the payback period of a new drill may serve to either mask or highlight the push for optimised drilling. In the Saudi Arabian example, if one assumed a one-month payback period on a new drill, the emphasis on cost control for that new drill is much lower than for the

[2] Data downloaded as .csv file, showing oil price development from 1989 to present day.
[3] "boe" stands for "barrel of oil equivalent". The term exists to summarise total wellbore fluid production equivalent to the amount of energy found in one barrel of oil. (Investopedia, 2017)
[4] Cooper Basin average rig spread rate ranges from USD$60-150M per day, with an approximate CAPEX of USD$500M-1MM. (Note: M = thousand).

Central Australian example, where that payback period might range from say two to five years. However, with the natural decline in production from some of the World's major oilfields over the next decade, combined with volatile oil prices, innovative and cost-saving drilling methods will almost certainly be overdue for a renaissance.

2.2 Well Design on the Norwegian Continental Shelf

The Norwegian Continental Shelf is one of the World's most challenging regions in which to explore for hydrocarbons. From the early days of oil exploration in the North Sea sector, to the present day new frontiers of the Arctic, the region has demanded both strong intellectual and financial investment.

2.2.1 Geological Overview of the Norwegian Continental Shelf

Hydrocarbon exploration on the Norwegian Continental Shelf is presently restricted to the North Sea, Norwegian Sea and Barents Sea regions. The geological conditions in these regions are highly favourable for oil and gas development and production. Hydrocarbons formed by plankton organisms, which sank to the bottom of the ocean some 140-200 million years ago. This phenomenon was the beginning of what would ultimately prove to be one of the World's most hydrocarbon-rich regions. This plankton was converted to oil and gas as it underwent diagenetic pressure and temperature changes. This process typically occurs between temperatures of 60 to 120 degrees Celsius and has been well documented by Nadeau et. al., when the Golden Zone concept was coined (Nadeau, 2011). In order for hydrocarbons to accumulate, there needs to be an active source rock, migration pathway and ultimately a cap rock. These three main geological conditions are all found on the Norwegian Continental Shelf (Grønnestad, 2014). In Norway, most oil and gas producing reservoirs are Middle Jurassic (mostly within the Golden Zone), with commercially marginal fields outside of this zone. In the UK sector, by means of contrast, the highest reservoir temperature is 235 degrees Celsius.

Table 1 & 2, shown below, summarise a number of key reservoir properties for Norway's major oil and gas fields.

Field	Res. Type	Dep. System	Res. Fluid	Age	Res depth (m)	Avg P (bar)
Draugen	Sandstone	Shallow Marine	Oil	Late Jurassic	1600	163
Snorre	Sandstone	Fluvial	Oil	Late Jurassic	2700	375
Grane	Sandstone	Shallow Marine	Oil	Paleocene	1700	176
Valhall	Chalk	Deep Marine	Oil	Cretaceous	2400	450
Goliat	Sandstone	Shallow Marine	Oil and Gas	Triassic	1100-1800	160
Ormen Lange	Sandstone	Deep Marine	Gas	Paleocene	2800	290
Kristin	Sandstone	Shallow Marine	Gas	Jurassic	4600	900

Field	Avg T (c)	NTG	Porosity	Sw	GOR	Bo/Bg	RF
Draugen	70	0.97	0.30	0.20	60	1.30	0.70
Snorre	97	0.40	0.20	0.43	150	1.34	0.50
Grane	77	0.98	0.33	0.10	90	1.10	0.65
Valhall	90	0.95	0.40	0.33	120	1.54	0.40
Goliat	45	0.60	0.25	0.30	93	1.30	0.30
Ormen Lange	90	0.80	0.30	0.25	5000	0.005	0.70
Kristin	170	0.35	0.15	0.70	1200	0.004	0.30

Table 1 & Table 2 - Key reservoir properties of major fields on the NCS (Nadeau, 2016)

2.2.2 Summary of NCS Present Day Wellbore Profiles

Aadnøy, in the second edition of his book, Modern Well Design, presents a schematic of typical wellbore profiles drilled in Norway today, as shown in Figure 2 (Aadnøy, 2010). We notice these profiles contain a minimum of five casing strings. These well designs have evolved from the increasing complexity of wells drilled in Norway and new technologies allowing boundaries to be pushed further than ever.

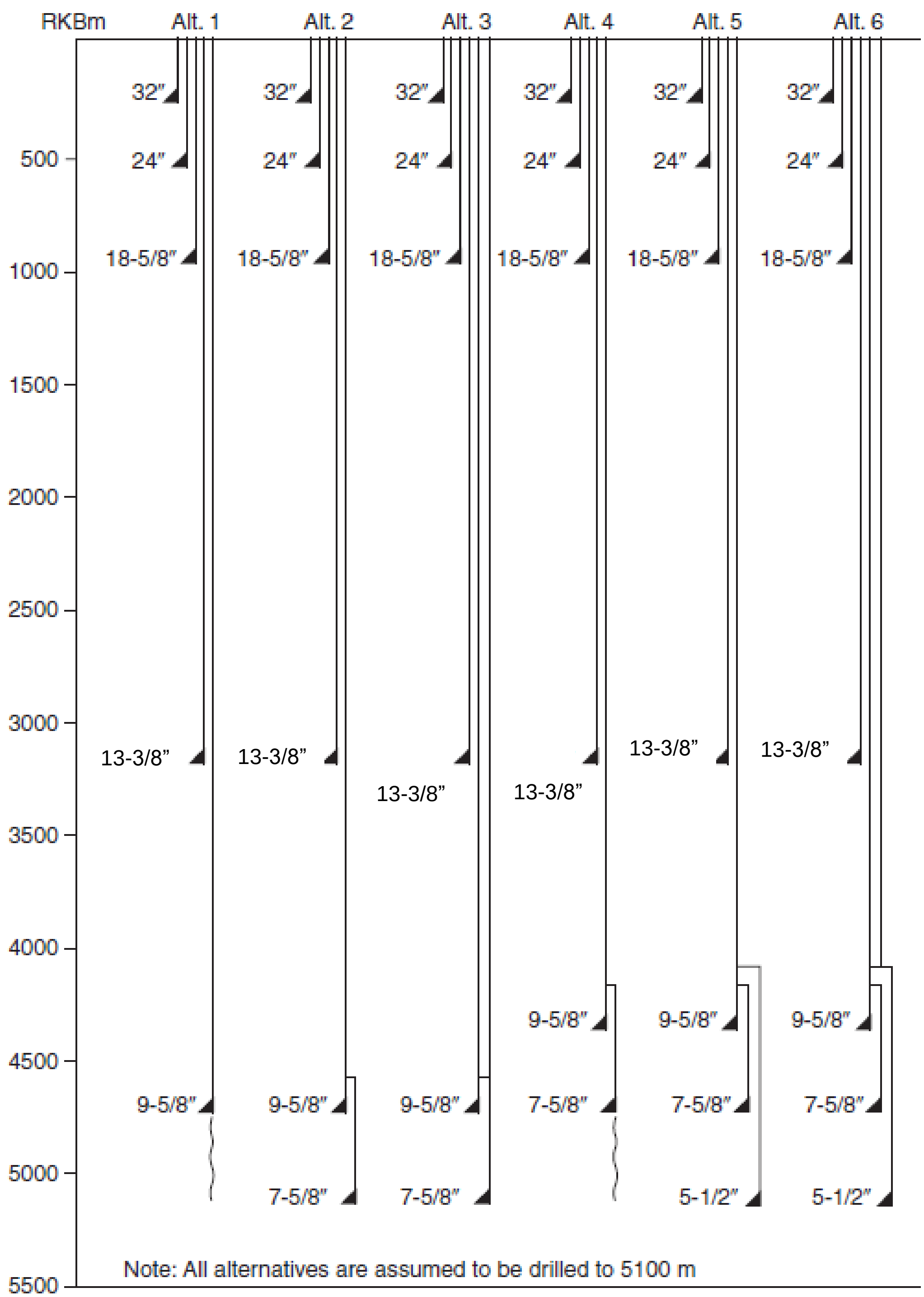


Figure 2 - Common Casing Profiles on the Norwegian Continental Shelf (Aadnøy, 2010)[5]

[5] This figure has been edited. 14” casing strings have been replaced with 13-3/8” casing strings, since 14” casing strings are presently uncommon.

2.2.3 Norway's Need for Cost-Effective Drilling

2.2.3.1 A Brief History of NORSOK D-010

In order to put drilling optimisation into context for the Norwegian sector, it is essential to understand how NORSOK standards have changed the way wells are drilled. This section will present a brief history of well integrity standardisation in Norway and outline how NORSOK D-010 has reshaped oil and gas well drilling, and at what cost to operators. Subsequently, a critique of the standard will be presented with proposed changes.

Activity on the Norwegian Continental Shelf during the early nineties was characterised by low oil prices and high operating costs. Around the same time, the Asian financial crisis drove world oil prices to near USD$10/bbl[6]. The drop in oil prices, combined with rampant project budget blowouts and increased market volatility underscored the need for industry to become more cost effective (Norsk olje & gass, Norsk Industri, Norges Rederiforbund, 2016). The birth and incubation of NORSOK D-010 is well documented by Energy Global (et. al). In 1993, the Norwegian oil and gas industry sought to develop an initiative called NORSOK, with the aim being to increase Norway's international competitiveness in oil and gas exploration and production and reduce wellbore costs significantly. The drive to standardisation came about because of a change in Norwegian Petroleum Directorate (NPD) regulations from being prescriptive (i.e. "Thou shalt…") to loosely instructive, (i.e. "You should…") and some would argue, more functional. This gave operators more leeway for innovation, whilst at the same time ensuring a more rigid adherence to local legal requirements (Energy Global, 2014).

As a means of ensuring industry-wide compliance with the newly minted standard, the NPD stipulated usage of NORSOK D-010 into Norwegian oil and gas regulations. In doing so, the burden of proof of compliance shifted to the operators, rather than the state, where D-010 was being underutilised or neglected. However, to appease industry, interested parties of the Norwegian oil and gas sector were invited to undertake regular reviews of the standard to ensure its currency[7].

Fast forward to 2010, and the Deep Water Horizon disaster. The Macondo blowout brought an increased focus on wellbore integrity into the limelight and triggered a revision to D-010. The new revision (fourth), which was eventually introduced in 2013, provided a greater focus on barrier establishment during plug and abandonment operations. The revision also covered additional well barrier elements and managed pressure drilling, which were both untouched in previous revisions. The standard, in its current form, is an all-encompassing wellbore integrity standard with a heavy focus on barrier control and operational HSE, and is being adapted worldwide (Energy Global, 2014).

2.2.3.2 NORSOK's Effect on Wellbore Economics

The changes brought about by D-010's introduction have been well documented. Nina Samad, in her 2017 Master's Thesis[8] presented an encompassing response from industry to the changes the standard has brought about. In general, the changes presented in the fourth revision have boosted technological innovation and created a general openness to new methods, but at increased cost to operators (Samad, 2017).

[6] The Asian financial crisis was a series of currency devaluations and other events that spread through many Asian markets during the nineties (Investopedia, 2017)
[7] NORSOK D-010 standard is today in its fourth revision.
[8] Master's Thesis – NTNU – Spring 2017. See bibliography for further details.

In the study conducted by Samad, which looked to gauge industry response to NORSOK D-010, one noteworthy mention is that the majority of the operators indicated that the standards had done little to change their current operating practises. Norske Shell AS indicated that further to adherence to the standard, they had incorporated D-010 into their own internal wellbore operations manual. They also indicated that their global operations had become more risk-focused and less restrictive. ConocoPhillips were upbeat about the D-010 standards, with their hope being an increased attention paid to wellbore integrity. They did however, point to the change in wellbore costs being down to technology rather than regulations. These responses point to a general positive outlook on the regulations, but provide little evidence of any regulatory effect on wellbore costs.

OG21 Technology Group presented an opposing opinion, in their October 2014 presentation surrounding drilling technology improvement potential at the turning of the oil price. The presentation outlined a number of key points surrounding regulatory effects on drilling competitiveness:

- Investment costs on the NCS have increased three-fold since the year 2000 with drilling and wells contributing 50% of that overall investment (>NOK100B per year);
- The NCS is maturing, with the average field size and reserves per well decreasing. As cost continue to increase, new well targets may be sub-economic with resources unable to be converted to reserves;
- If costs were reduced, wellbore profitability would improve.

In order to put these conflicting opinions into context, it is important to think about plug and abandonment operations. Returning briefly to Samad’s study, Statoil (now Equinor) in their response, whilst praising in the D-010 standard, did report that there was a clear trend that D-010 has increased Asset Retirement Obligation (ARO). Their analysis indicated that P&A costs would need to come down by some 50%, as opposed to broad budgets allowing for 25% increasing wellbore profitability (Samad, 2017). This is an important point, since before 2012, plug and abandonment at Statoil (now Equinor) (and indeed the Lion’s share of NCS operators) was hardly the fore frontal issue it is today. This points to a bigger issue – wellbore design today on the NCS is heavily focused around planning a well for plug and abandonment, rather than optimising the drill costs[9]. OG21 interviewed 21 industry experts as part of their study, who indicated that Norwegian regulations and standards have potentially limited the rig market with a negative impact on rig intake and costs and pointed to a culture of “time doesn’t matter” having evolved in Norway (OG21, 2014).

2.2.3.3 Decreased Efficiency and the Need for Optimised Drilling in Norway

As discussed in the foregoing, there has been a decline in drilling efficiency on the Norwegian Continental Shelf over the past decade. The best illustration of this point comes courtesy of the NPD, Statoil (now Equinor) and Petoro as presented in OG21’s report, as shown in Figure 3, below.

[9] Important to note that NPT and rig rates, whilst not critical to our study of NORSOK D-010, are indeed accountable to some degree for decrease profitability on the NCS.

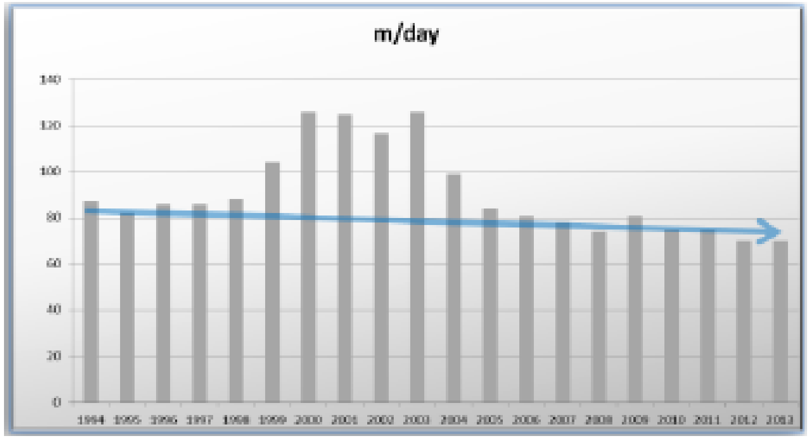


Figure 3 - Drilling efficiency on the NCS since 1994 (OG21, 2014)

We note that the number of metres drilled per day on average has steadily decreased over the past decade. This is a key metric for drilling performance because it is independent of wellbore cost, or rig rates. However, this is not the only metric that illustrates poor efficiency. We note from Figure 4 (OG21, 2014) a steep increase in the time used in key phases of the drilling process from 1992 to the present day. One of the most noteworthy features is the alarming increase in on-bottom drill times for the 17-1/2" and 12-1/4" hole sections – sections that, in theory, should be quickest to drill. Increased complexity in the face of ever-constant development of technology cannot be an excuse for poor efficiency. Since time itself is the biggest overall contributing factor to high wellbore costs, a picture, it seems, truly does paint a thousand words in highlighting the present-day problem.

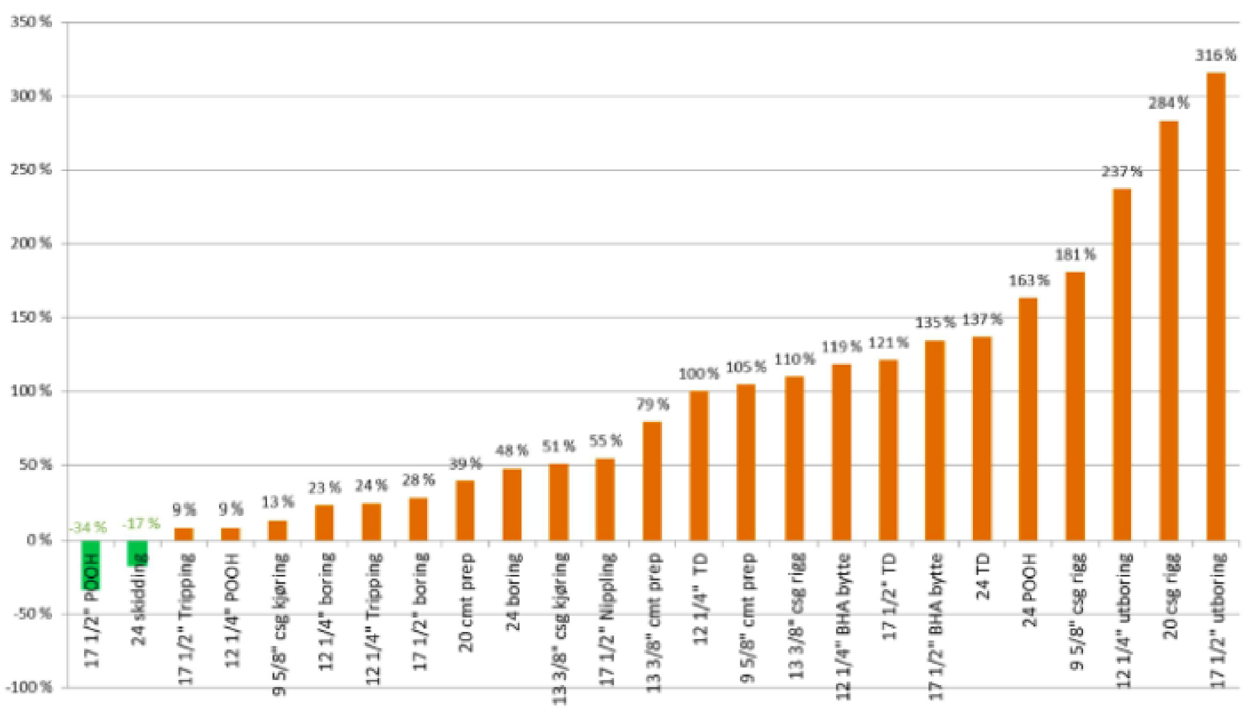


Figure 4 - Increased time usage in wellbore operations from 1992 to present (OG21, 2014)

In understanding this figure, it is imperative to point out a number of key facts. This figure was produced in 2014, before the downturn in oil prices. The data was collected from an application developed by Austrian company, proNova, which measures real-time rig data and reports crew KPI's. In a recent interview conducted with (Petoro, 2018), in Stavanger, it was indicated that these figures may have in fact declined by around 50% since 2014. However, it was also mentioned that whilst this is a welcome change, there has still been little-to-no improvement in "hidden" non-productive time, i.e. efficiency. During times the data was being collected, there has been a marked improvement in performance. However, during times where monitoring was disconnected, the same levels of performance have reportedly not been seen.

The decline in efficiency can be attributed to the increased regulatory constraints and a renewed focus on HSE, which, while having made well operations generally safer, has introduced the need for longer operating times and the need for more tasks to be performed (OG21, 2014). Top-down pressure on wellsite HSE reporting has increased the time taken for routine paperwork, created more "steps" which stifle drilling performance optimisation. This has introduced a culture of "reporting for the sake of reporting". It is important, nevertheless, to acknowledge the benefits and need for a mainstay HSE culture in wellbore operations. However, regulations being as they are, the only way to optimise wellbore costs is through the refinement and innovation of well design practises and improvement in crew performance (this last point is discussed further in Chapter 4).

Let us take this argument one step further and revert focus back to Norway, but through a broader macro-economic lens. Petoro conducted a field study of cost inflation and its effect on value deterioration on oil and gas assets on the NCS (OG21, 2014). The study showed that for the field case examined, a mere six percent increase in either investment or OPEX would reduce field life by up to 12 years. Figure 5, depicted below, depicts this phenomenon.

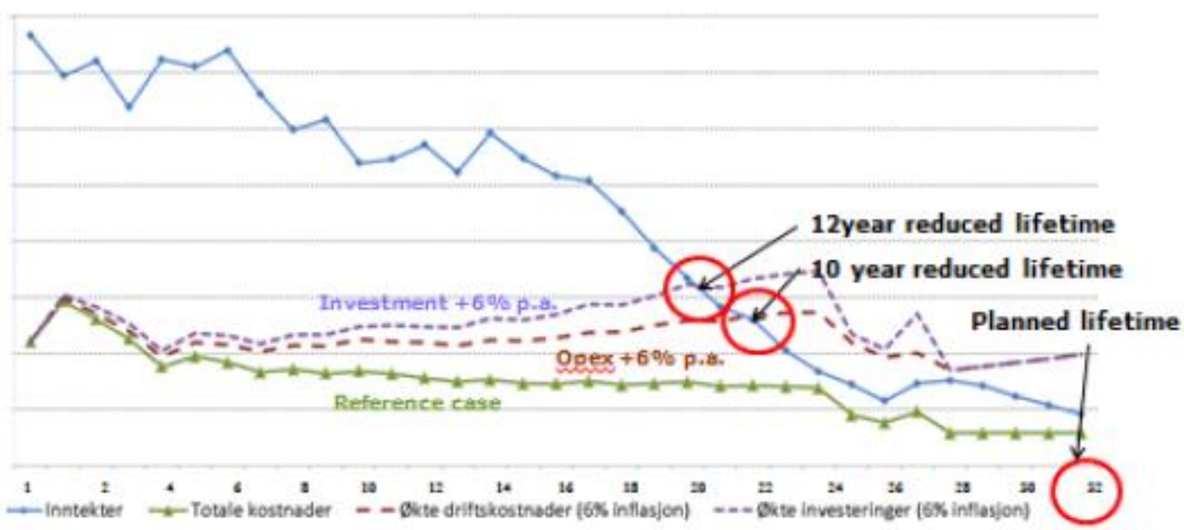


Figure 5 - Petoro field study for asset depreciation due to cost inflation (OG21, 2014)

When evaluating this study against the backdrop of wellbore decline and the maturation of the NCS, we start to understand the importance of cheaper wells. Figure 6, courtesy of Petoro, shows the average reserves per well and a forward prognosis of same. In the context of Figure 4, one understands the implications of increasing wellbore costs in Norway with declining production payback. Chapter 3 of this body of work will further explore the opportunities for innovation and cost-saving in Norwegian wellbore operations. A discussion will subsequently be presented in Chapter 4, where the challenges of said proposals will be evaluated in the context of the foregoing.

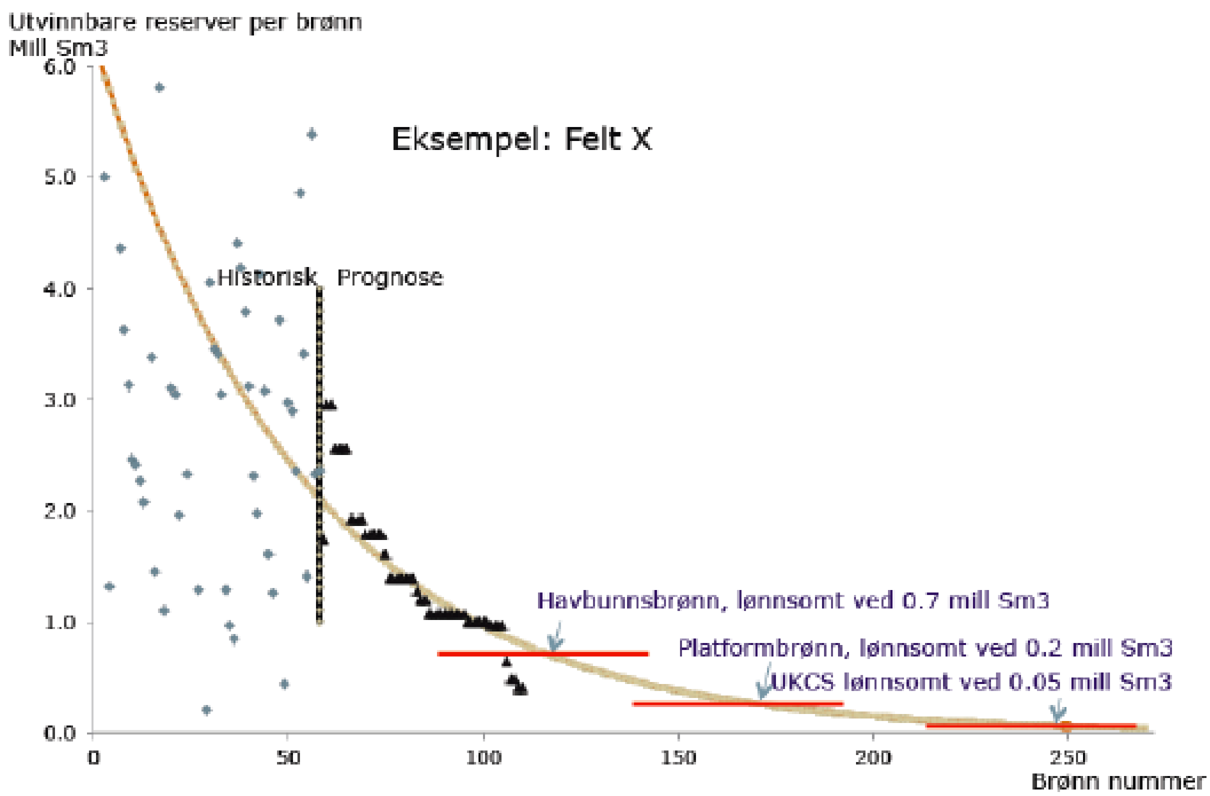


Figure 6 - Average resources per well on the NCS (OG21, 2014)

2.3 Drilling Optimisation – Opportunities, Challenges and Limitations

This section of our theory review will take on a technical focus and examine some of the current and future technologies and opportunities to optimise drilling on the NCS.

2.3.1 Developments in Slender Well Design

2.3.1.1 Slender Well Design Concept[10]

The concept is simple. We drill wells with smaller diameter casing strings and reduce the annular clearances between each string. We save money and reduce HSE risk. However, in proving the concept techno-economically viable, there are a myriad of considerations, which are discussed herein.

Slimming down oil and gas wells has long been the desire of many an operator, for its economic merits. The concepts, technologies and challenges were examined by (Howlett, et al., 2006) in their study of new slender well construction technology. Among the biggest restrictions to slimming down well designs is the selection of the optimum pipe size. When planning a new well, its lifetime needs to be considered in light of its potential productivity. Production Engineers ideally want the largest possible production tubing or casing diameter to minimise frictional pressure

[10] Note: Throughout this work, for the purposes of simplicity, “slender” and “slim” are used interchangeably when referencing well architecture.

losses, thereby optimising flowrates. However, this is not always possible due to economic restrictions. Many operators often conclude that economic merits do not stack up against additional work involved to commercialise slender well drilling. This is usually due to the upfront costs of rig modifications, OCTG market restrictions and overall project risk. In commercialising slender well technology, Howlett et. al.'s study considered it essential that any slender wellbore architecture needed to provide flexibility in design, whilst allowing for optimum pipe sizes across zones of interest (Howlett, et al., 2006).

It is important to distinguish between slim hole and slender hole design. Slender well design is simply a reduction in annular clearance between casing strings. This can be used in tandem with reduced casing sizes providing technical requirement are met and annular clearances are within the allowable API guidelines (or local equivalents). This for the purposes of our analysis, slender wells are discussed in their slim form, hence merging the nomenclature. Figure 7, shown below, clearly illustrates the possibilities of slimming down well designs and was the result of field trials conducted by Howlet et. al.

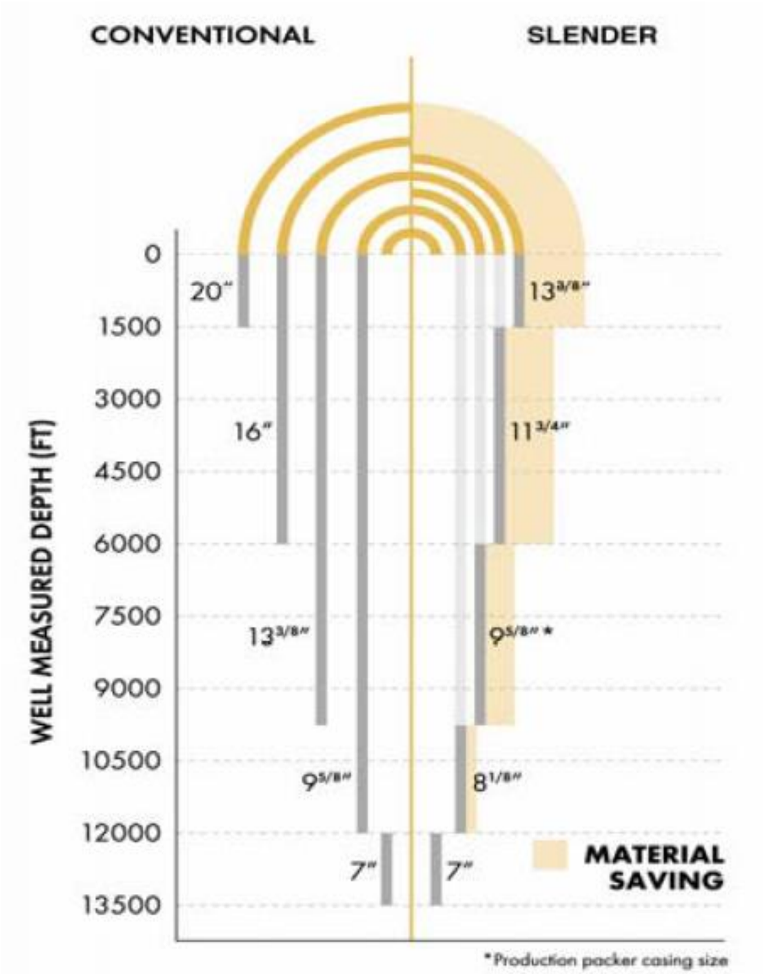


Figure 7 - Comparison of slender vs. conventional well construction (Howlett, et al., 2006)

The benefits of slender well design are noteworthy. Among others, the key advantages are:

- Economically beneficial due to lower casing costs, lower volumes of drilling fluid required and overall reduced rig and logistical expenditure;
- Improved HSE performance due to handling of smaller/lighter equipment, combined with a lower risk of transportation issues. Also worth noting is the increased burst and collapse strengths, typically associated with smaller diameter casing strings;
- Operators can still keep “one in the back pocket”, in case contingency strings need to be run, since liners can be spaced over troublesome areas;
- Since there are few overlapping casing strings, we reduce the potential for leak paths at the top of the well, thereby simplifying our abandonment process.

However, there are of course challenges that come with slender wells, chief among which are:

- Surging and swabbing
- High ECD’s
- Centralisation and good quality cementing

When we think about slender well designs, one immediate concern is the restricted annular clearance experience when running casing strings in hole. This in turn, presents a high risk of surge and swab, particularly when using highly viscous, or thixotropic drilling fluids in tandem with tight mud windows. In order to abate the issue of surge and swab, a flow diversion shoe was designed. The flow diversion shoe allows for standard flow rates during operations. Subsequently, by increasing the flowrate to some predetermined rate, the flow is then diverted to an inner annulus created by an inner tubing string (Hunting Energy Services, 2016). The inner annular space allows fluid to flow through outlets, thus avoiding full flow through the borehole-liner/casing annulus. Figure 8, courtesy of Howlett et. at., depicts this concept.

Figure 8 - Inner annulus tool on field trial, which is run inside casing (Howlett, et al., 2006)

The artificial inner annulus adds a new path of least resistance, which allows passage of cuttings and debris, whilst simultaneously allowing fluid flow in the conventional manner. The reduced fluid volume in the conventional annulus abates the surge and swab effect, but there is, however, lingering concern surrounding ECD's given the reduced annular clearance.

A common method of avoiding high ECD's in slender wellbore operations is to drill the next hole section will large wellbore diameters. This typically requires a bi-centred drill bit or under-reaming capabilities. General experience in these operations has widened substantially over the past decade, and is commonly used in many regions of the world to alleviate differential sticking in problem formations. It follows that larger wellbore diameters will give lower (or more acceptable) ECD's and ideally mitigate wellbore stability issues when running casing/liners into narrow sections (Howlett, et al., 2006).

With running narrow casing strings into enlarged wellbore sections, comes the challenge of centralisation. Whilst Howlett, et. al. argue that bi-centred non-rotating bow spring centralisers are a good option, history is littered with examples of poor standoff and patchy cement quality when using bow spring centralisers. One of the main issues with non-rotating centralisers is exactly that – they are non-rotatable. It has been shown both scientifically and empirically that rotation and reciprocation of casing strings during primary cementing ultimately leads to better quality cement jobs. Whilst this may not be the case for liners (where bi-centre bow springs may be a good option), rotatable, moulded solid-body centralisers (or similar) have typically shown the best results, particularly in troublesome wells.

Another important consideration, often overlooked, but particularly critical for slender wells, is drifting and strapping casing, as well as its running practises. During transportation, where there is no good reason for this to occur as often as it does, some casing always gets damaged en route to site. Whether loaded onto trucks or barges, the casing needs adequate protection from damage. Whatever the unloading method once on location, it is essential that the casing is subjected to as little transfer as possible, to lower the risk of damage. This may seem trivial, but the impacts can be very costly as will be shown shortly. When strapping and drifting the casing, assuming there is no damage during transportation, it is likely the casing will be in-gauge, with no defects present. During casing running, failing to adhere to these practises, in tandem with poor running procedures can lead to impassable sections of casing due to damage. This is ever more pronounced in slim wells, since the annular clearances are much finer than for conventional wells. The results, therefore, of being careless with transport and inaccurately strapping and drifting casing, could see the need to abandon and side-track sections of the wellbore, at a significant cost to the operator (Byrom, 2007).

2.3.1.2 Wellbore Stability and its Importance to Slim and Slender Wells

Of primary concern with this paradigm shift in well design is wellbore stability. During drilling, mud weight selection is just as crucial as mud chemistry. Unhindered drilling operations will require a deep understanding of prevailing geologic conditions and wellbore pressures. Geomechanical studies will help to determine the minimum and maximum principal stresses, which will in turn shape the safe drilling window. Assuming both of these phenomena are well understood and implemented effectively, drilling of the 8-1/2” open hole section will logically proceed unabated.

Since wellbore stability is strongly time-dependent, it is important to qualify the merits of this design in light of time. There is much literature surrounding borehole stability, however one such account that excellently summarises its mechanics was written by (Caenn, et al., 2011), in Composition and Properties of Drilling and Completions Fluids[11]. When we drill a well, the horizontal stresses are relieved and the hole will subsequently contract. The contraction will continue until the radial stress at its wall is equal to the pressure of the mud column, minus the pore pressure. The load is then transferred to a zone of hoop stresses that create tangential shear stresses around the borehole wall. If this strain caused by stress-relief of the rock does not exceed the elastic limit, the change in wellbore diameter will typically go unnoticed to the driller. If, however the elastic limit is exceeded and plastic deformation occurs, the deformation will be permanent. At this point, reaming out of hole will abate any difficulties and remove the deformed rock. An excellent summary of the failure modes of a borehole is shown in Figure 9.

[11] Regularly dubbed the “Mud Bible” by many senior industry experts.

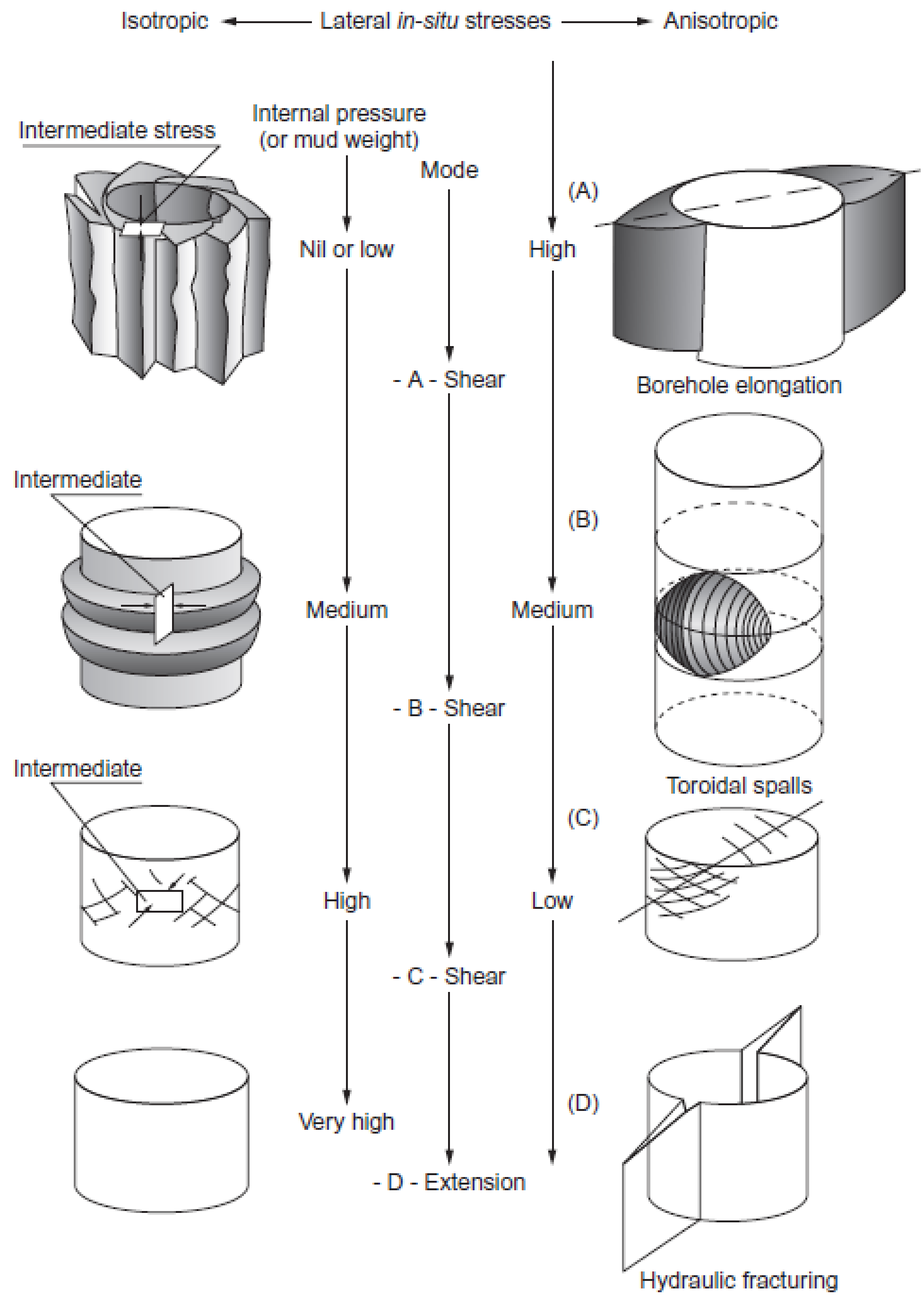


Figure 9 - Failure mechanisms around a typical wellbore (Maury & Sauzay, 1987)

The key take-away in assessing borehole mechanics in light of slim well design is to understand that this rock deformation is time-dependent. The time in question needs to be well understood before drilling barefoot completions or slim and slender wells and will vary from rock to rock, depending on the wellbore in-situ stresses. It follows that the drilling fluid, which provides maximum stability, varies from region to region. This is particularly true when it comes to shales, since shale hydration is one of the biggest (and most easily avoidable) contributors to instability. Chemical wellbore instability is worst in WBM due to the problems surrounding shale hydration, whereas OBM does not hydrate shales. Before formulating the optimum mud chemistry to minimise downhole issues, it is critical to collect as much information as possible about the geology, stress history and areal faulting. This also includes the collection of pore and fracture pressure curves and modelling of minimum and maximum horizontal stress. These data are typically derived from offset well reports and well logs. Where this data is unavailable, it is prudent to test samples of potential problem formations to determine the optimum saline solution. Further information regarding mud chemistry and formulation is available from Caenn, et al., but is beyond the scope of this text (Caenn, et al., 2011).

2.3.1.3 Well Control during Slim Hole Drilling

Well control is essential in the drilling of any wellbore which contains hydrocarbons. It is one of the critical elements of any casing design and is typically the last word in casing set depth selection. For slim hole drilling, however, the importance of well control is more pronounced, given the smaller diameters. Small influx volumes in slim wells can result in large influx heights. This means high pressures along the vertical profile of the wellbore. Hence, kicks tolerances may often be lower than would otherwise be desirable, thereby underscoring the need for full alertness in kick detection, while drilling (Maurer Engineering Inc., 1993 - 1995).

Shook R., et. al. (Maurer Engineering Inc., 1993 - 1995), presented in their paper on Slim-Hole Drilling and Completion Barriers, the fundamentals of slim hole well control.

<u>Differential Sticking</u>

Differential sticking is a condition wherein the drillstring becomes stuck along the axis of the wellbore. Differential sticking occurs when high contact forces caused by depleted zones, or high wellbore pressures are exerted over a long section of the drillstring (Schlumberger, 2011). Differential sticking becomes ever more risky in slim wells due to the smaller annular clearances. Factors that relate to slim well drilling include high wellbore pressures, thick mud cakes and larger relative pipe diameters (which yield a greater contact area). Efforts to minimise contact area include designing downhole tools using spirals, heavy weight drill pipe with upsets or by adding clamp-on stabilisers, or other offset tools (Maurer Engineering Inc., 1993 - 1995).

<u>Kick Detection</u>

The major variance between conventional and slim well drilling, as far as kick tolerance is concerned, is that the smaller annular space means a given volume of kick will occupy a greater height. A greater height of lighter fluid will result in a sharper decrease in hydrostatic pressure on the kicking formation (Maurer Engineering Inc., 1993 - 1995). This is represented below in the Kick Tolerance section, where we see the difference in maximum allowable influx volumes for reduced annular clearances.

For slim wells, kick detection is critical, since much smaller kick volumes in slim wells can have the same negative effects are larger volumes in conventional wells. Therefore, early detection is paramount to avoiding loss of well control. Conventional well control techniques have called for a quick shut-in and monitoring of annular pressures while slowly circulating the kick out of hole and increasing the mud weight. These techniques rely on low annular friction pressures and assume they are a very low percentage of the total system pressure loss. For slim wells, annular pressure drops can represent 90% of the total system pressure drop. Because of this, Shook R., et. al., suggest dynamic well control techniques, or modified versions of the Driller’s Method (Maurer Engineering Inc., 1993 - 1995).

<u>Kick Tolerance</u>

Kick tolerance is defined as the maximum volume of kick influx that can be shut-in and circulated out of the wellbore without breaking down the weak point (formation below the casing shoe) (Redmann Jr., 1991). Lapeyrouse, in the Driller's go-to handbook, Formulas for Calculations for Drilling, Production and Workover, along with Jin and Li, 2016, both presented an excellent summary of calculating kick tolerance and their formulae are summarised below (assuming oilfield units):

First and foremost, the kick intensity needs to be determined. This is calculated as the difference between the maximum anticipated formation pressure and the planned mud weight:

$$Kick\ Intensity = EMW_{Formation\ Pressure-Max} - EMW_{Planned\ Mud\ Weight}$$

Equation 1 - Kick intensity

Once kick intensity is determined, we calculate the maximum allowable shut in casing pressure (MASICP), as follows:

$$MASICP = \left(EMW_{LOT} - EMW_{Planned\ Mud\ Weight}\right) \times TVD_{Casing\ Shoe} \times 0.052$$

Equation 2 - Maximum allowable casing shut-in pressure

Using the MASICP and the kick intensity, we proceed to calculate the influx height. In order to achieve this, knowledge of the gas influx gradient is required.

$$Influx\ Height = \frac{\left[MASICP - (Kick\ Intensity \times TVD_{Casing\ Shoe} \times 0.052)\right]}{\left(EMW_{Current\ Mud\ Weight} \times 0.052\right) - EMW_{Gas\ Influx}}$$

Equation 3 - Hydrocarbon influx height

Next, the influx volume around the BHA, based on influx height is required. This is determined as follows:

$$Influx\ Volume_{BHA} = Influx\ Height \times Capacity_{Annular_{BHA-Hole}}$$

Equation 4 - Influx volume around the BHA

Where the annular capacity between the BHA and open hole is shown by (units: bbl/ft):

$$Capacity_{Annular_{BHA-Hole}} = \frac{\left(Diameter_{BHA}^2 - Diameter_{Open\ Hole}^2\right)}{1029.4}$$

Equation 5 - Annular capacity - open hole and BHA

As the kick volume often exceeds the confines of the open hole and BHA annular space, we perform the same volumetric calculation and determine the influx volume at the shoe, based on the height.

$$Influx\ Volume_{Casing\ Shoe} = Influx\ Height \times Capacity_{Annular_{DP-Hole}}$$

Equation 6 - Influx volume at the casing shoe

Where the annular capacity between the drill pipe and open hole is (units: bbl/ft):

$$Capacity_{Annular_{DP-Hole}} = \frac{\left(Diameter_{DP}^2 - Diameter_{Open\ Hole}^2\right)}{1029.4}$$

Equation 7 - Annular capacity - open hole and drill pipe

Based on the influx volume at the shoe, we then apply Boyle's Law (NASA - Glenn Research Center, 2015) to calculate the influx volume at the bottom.

$$Influx\ Volume_{Bottom} = \frac{(Influx\ Volume_{Casing\ Shoe} \times Leak\ off\ Pressure_{Casing\ Shoe})}{EMW_{Formation\ Pressure}}$$

Equation 8 - Influx volume at bottom

We now compare the two values for influx volume (the casing shoe and on-bottom). The smaller of the two is the kick tolerance. Calculations above adapted from (Jin & Li, 2016), (Lapeyrouse, 2002)

Consider the following example shown in Table 3, which neatly illustrates the effect slim wells have on kick tolerance. In this example, we will compare the difference in kick tolerance by changing a given well design from 8-1/2" open hole production section to 6-3/4". We will alter the BHA accordingly based on readily available OCTG sizes for drill pipe and collar[12].

Kick Zone Parameters:	**Conventional**	**Slim**	
Openhole Size ?	8.5	6.75	inch
Measured Depth ?	3353	3353	m
Vertical Depth ?	3353	3353	m
Horizontal Length (>87 deg) ?	0	0	m
Tangent Angle Above Horizontal ?	0	0	deg
Min Pore Pressure Gradient ?	1.318	1.318	sg
Max Pore Pressure Gradient ?	1.498	1.498	sg
Kick Zone Temperature ?	349	349	deg.F
Weak Point Parameters:			
Vertical Depth ?	1067	1067	m
Section Angle (<87 deg) ?	0	0	deg
Min Fracture Gradient / EMW ?	1.690	1.690	sg
Max Fracture Gradient / EMW ?	1.797	1.797	sg
Weak Point Temperature ?	190	190	deg.F
Other Parameters:			

[12] The NORSOK D-010 requirement for kick tolerances is 4m^3 (Standards Norway, 2013), which in practice means both of these well designs would be disqualified. This example is purely for illustration purposes.

Drill Collar OD ?	6.750	5.000	inch
Drill Collar Length ?	182.9	182.9	m
Drillpipe OD ?	5.5	3.5	inch
Surface Pressure Safety Factor ?	100	100	psi
Mud Weight in Hole ?	1.558	1.558	sg
Annular Capacity Around BHA:	0.0850	0.0655	bbl/m
Annular Capacity Around DP:	0.1338	0.1062	bbl/m
At Min Fracture Gradient:			
Gas Gradient at Weak Point	0.1036	0.1036	sg
For Min Pore Pressure:			
Max Allowable Gas Height:	600.9	600.9	m
Kick Tolerance:	50.6	40.2	bbl
For Max Pore Pressure:			
Max Allowable Gas Height:	186.4	186.4	m
Kick Tolerance:	14.4	11.4	bbl
At Max Fracture Gradient:			
Gas Gradient at Weak Point	0.1099	0.1099	sg
For Min Pore Pressure:			
Max Allowable Gas Height:	683.0	683.0	m
Kick Tolerance:	61.1	48.4	bbl
For Max Pore Pressure:			
Max Allowable Gas Height:	266.7	266.7	m
Kick Tolerance:	21.9	17.3	bbl

Table 3 - Comparison of kick tolerances for slim vs. conventional well profiles

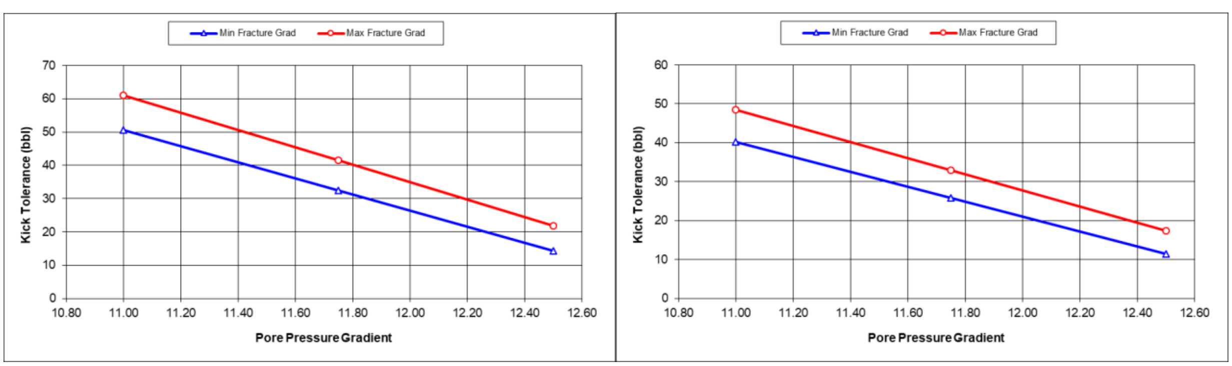


Figure 10 - Kick tolerance comparison for conventional vs. slim well

The results of this quick comparison are clear. Slimming down from 8-1/2” to 6-3/4” reduces the kick tolerance by 10-20%. Whilst this is one specific example, the overriding theory proves true for all other cases.

As regards well control design, the biggest difference between conventional and slim well control design is the effect of ECD’s, drilling fluid rheology and reduced annular clearance. During slim well drilling, smaller diameters yield larger annular friction pressures. This in turn, increases the ECD while drilling. This means that kick detection becomes more difficult since the higher ECD’s give the illusion of being overbalanced, while this may not be in the case hydrostatically. When circulation is broken, a kick can very quickly migrate in an uncontrolled manner up the wellbore. In this case, a drilling break may not be as effective an indicator as is the case for conventional drilling.

BHA becomes an important consideration during slim well design. The idea is to minimise the use of drill collars, which implies the use of PDC bits that require less WOB, potentially in tandem with a mud motor to provide extra rotary speed and replace some of the collars. The reason for this is that conventional application of drill collars in slim wells creates not only high annular friction pressures, but also increases the risk of swab and surge. Where too many collars are run, swabbing and surging kicks become likely, with or without circulation.

When designing the drilling fluid, the rheology should be tailored to the prevailing conditions, but formulated to achieve laminar flow. This is desirable since it will give lower ECD’s due to lower annular friction pressure. If possible, the addition of a lubricating agent has been show in some studies to reduce annular friction pressures further still (Maurer Engineering Inc., 1993 - 1995).

It should be noted that the use of Managed Pressure Drilling would be a very effective method of controlling ECD’s, particularly when used in conjunction with an ECD reduction tool (Bansal, et al., 2007).

2.3.1.4 Recent Developments in Slender Well Design on the Norwegian Continental Shelf

One of the earliest studies to take place in Norway, which looked at slimming down floating explorations wells was conducted by (Stene, 1996). Saga Petroleum (now Equinor) in 1996, initiated a feasibility study, to assess the possibilities of scaling down floating exploration drilling operations, as had been achieved onshore. The project ultimately did not go ahead due to high fluctuations in rig rates, but over the next 20 years, the industry subsequently reached a point of having some slim exploration wells, but few if-any appraisal and production wells.

There has, to-date, been a large undertaking by industry to slim down exploration wells, however one study proves that there is certainly more to be done. AkerBP ASA in 2017, at the Drilling Engineers Association, Norway, presented the latest developments in slim well design for exploration wells on the NCS and outlined proposal for future work (AkerBP, 2017). The conventional design of exploration wells typically involved four casing strings (as depicted in Figure 11, below), ranging from 30” conductors to a 9-5/8” liner, with an 8-1/2” open hole barefoot completion. Whilst this design as proved robust and safe, it is time consuming and presents high operations risk (due to the number of wellbore sections).

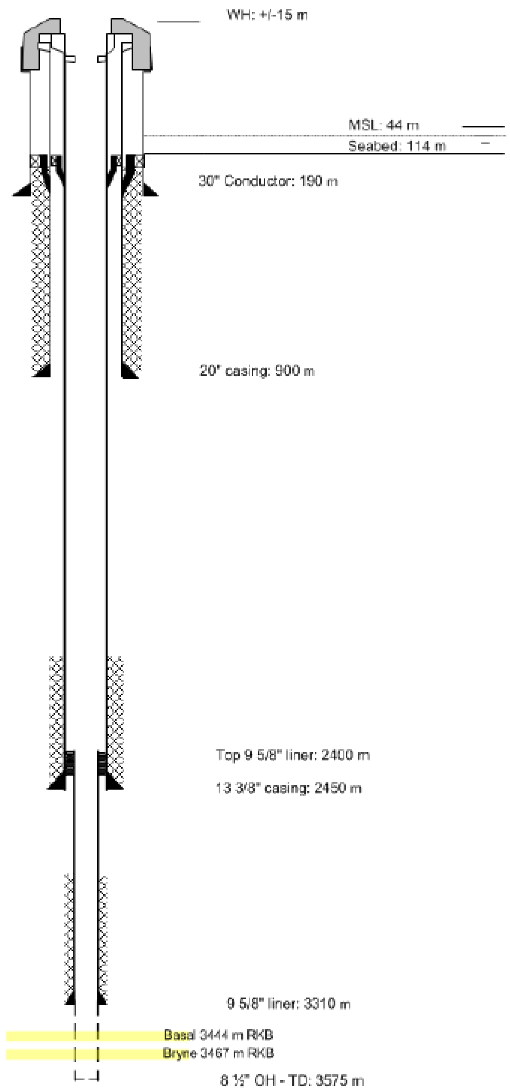


Figure 11 - Conventional Exploration Well Design on the NCS (AkerBP, 2017)

AkerBP's study outlined future well cost improvements, by analysing the Ivar Aasen Geopilot wells. This was the first significant step toward slim well drilling as it looked to skip the 9-5/8" production casing altogether and simply drill a 8-1/2" section out from the 13-3/8" casing and complete barefoot (shown in Figure 12). Of foremost concern to the proposed design was blowout analysis and wellbore stability.

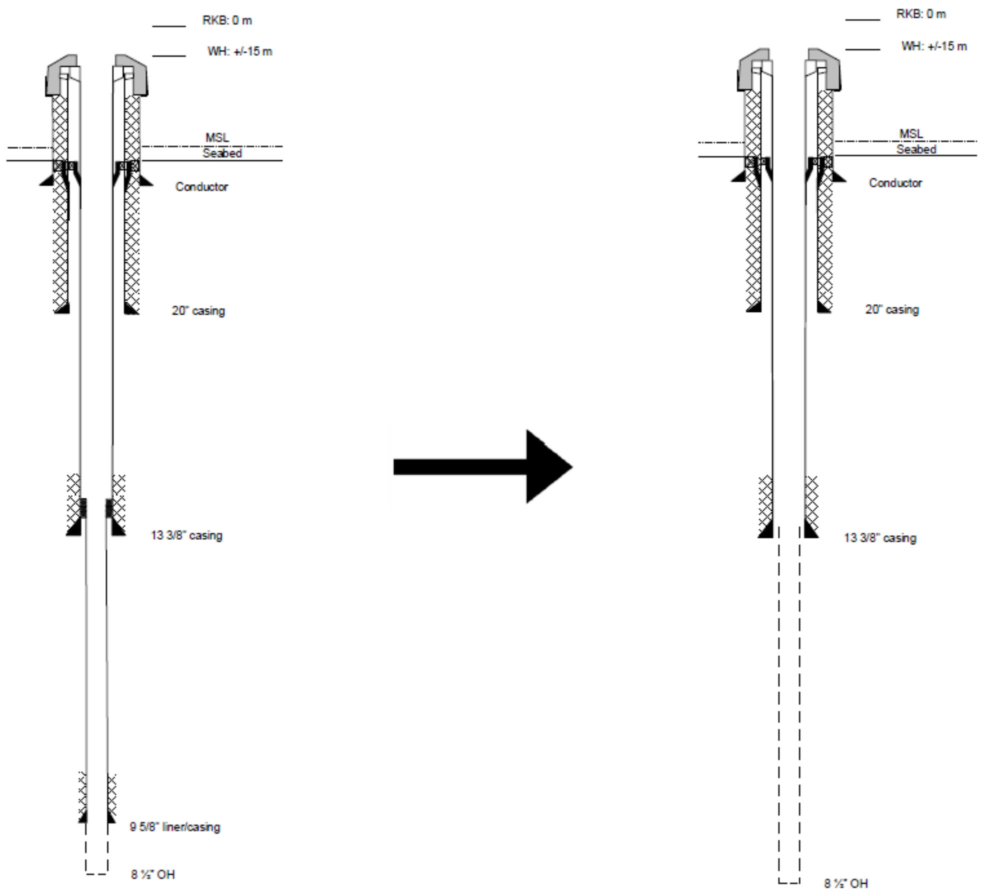


Figure 12 - Removal of 9-5/8" casing string (AkerBP, 2017)

The results of this trial yielded improvements in operational performance on the Ivar Aasen field.

- Two weeks open hole logging;
- Data acquisition within budget;
- Initially planned for three bores over two wells and ended up with five.

One noteworthy aspect of this new design is the top-hole experience. After installing the conductor section, pilot holes with +/- 6 bar hydrostatic head were drilled (abnormally high) and conductors set between 200 and 350 mTVDRT. This lead to rapid top-hole losses and seepage from seabed generating craters, spread all around the rig. As a means of improving on these issues, a gas dispersion study was conducted and it was concluded to set the conductor deeper in formations with improved integrity. The conductors were then run as 30” x 20” down to 450 mTVDRT, with a 16” contingency liner available in case of shallow gas (see Figure 13) (AkerBP, 2017).

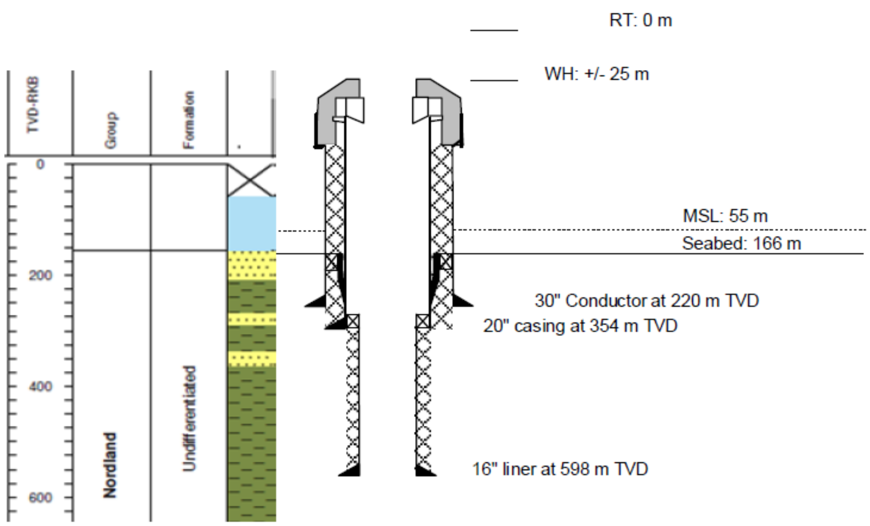


Figure 13 - Deep dual-conductor option with contingent liner (AkerBP, 2017)

The surface hole section was drilled with 13-3/8” casing, with a 9-5/8” string as a backup, in case of abnormal pore pressures or stability issues. Whilst this is a sensible design choice for proof of concept, problems are likely to arise due to lower than optimal annular velocities when flowing from open hole into the 13-3/8” casing. These low velocities (which will likely be sub-critical velocities for cuttings lift) will cause cuttings and downhole debris to accumulate at the 13-3/8” casing shoe. If left unswept, in the long term, this could lead to stuck pipe with negative knock-on effects. A more prudent solution may be to case the well with a smaller diameter string, however this may be uneconomic depending on the prevailing market for OCTG and wellheads (AkerBP, 2017). AkerBP took is currently looking to take this study further and take the wellbore design from two casing strings down to one. This will be discussed in the next sub-section.

2.3.1.5 Future Opportunities for NCS Slim Well Design – One Casing String?

The future opportunities for slim well design, as proposed by AkerBP’s aforementioned study, are a nice segue into the forthcoming section on well design with fewer casing strings. Field trials are currently underway to evaluation the potential of drilling exploration wells with one casing string. Whilst this may seem a bizarre idea to the seasoned Drilling Engineer, AkerBP have set out their vision for the project[13], as presented in Figure 14, below.

[13] At time of writing, the final well design was under review

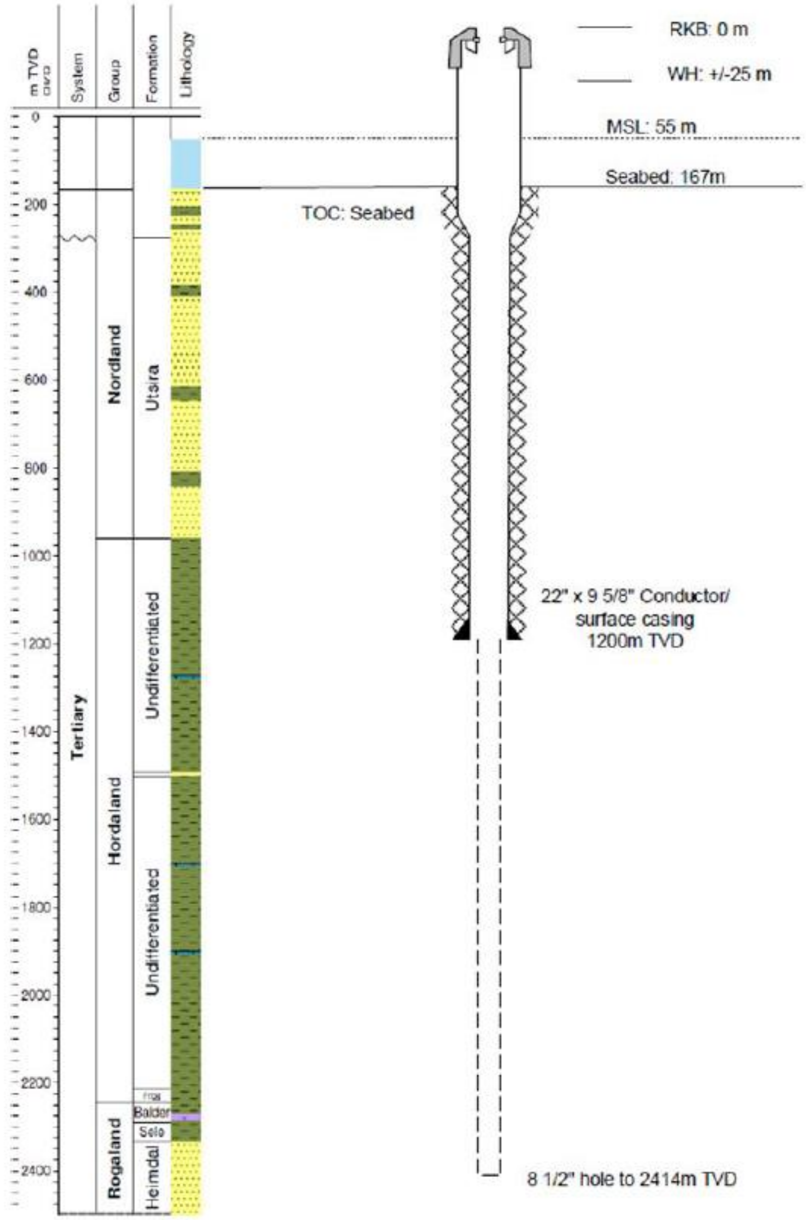


Figure 14 - Vision for single-string exploration drilling (AkerBP, 2017)

The design toys with the idea of drilling a 12-1/4” surface hole section, with an under-reamed 26-30” section for the conductor to sit within, although the study indicates that splitting the two sections could be an option. A backup 7” liner would be used in case of wellbore stability issues in the production hole section.

Continuing with our discussion on single casing string options, let us now shift focus to some of the recent developments in production well technology in Norway, which have the potential to further the ideas proposed by AkerBP. One such innovation is the Conductor Anchor Node, or CAN system. This is a pre-installed wellbore foundation, whose aim is to replace conventional conductors. The CAN may also serve as a single production well template for drilling of slender wells.

CAN installation typically requires a DP-compatible vessel, an AHC Crane >150 tonnes, a work ROV and surveying services (for the purposes of landing). A pilot hole of say 50mMDRT is typically drilled in the desired region to evaluate the prevailing soil strength. The soil strength is then input into models, which determine the required conductor length. Subsequently, the conductor is jetted into the formation by means of reverse suction of fluids and displacement of soil. The picture below shows a typical CAN and a cross sectional representation post-installation (Figure 15) (NeoDrill, 2016).

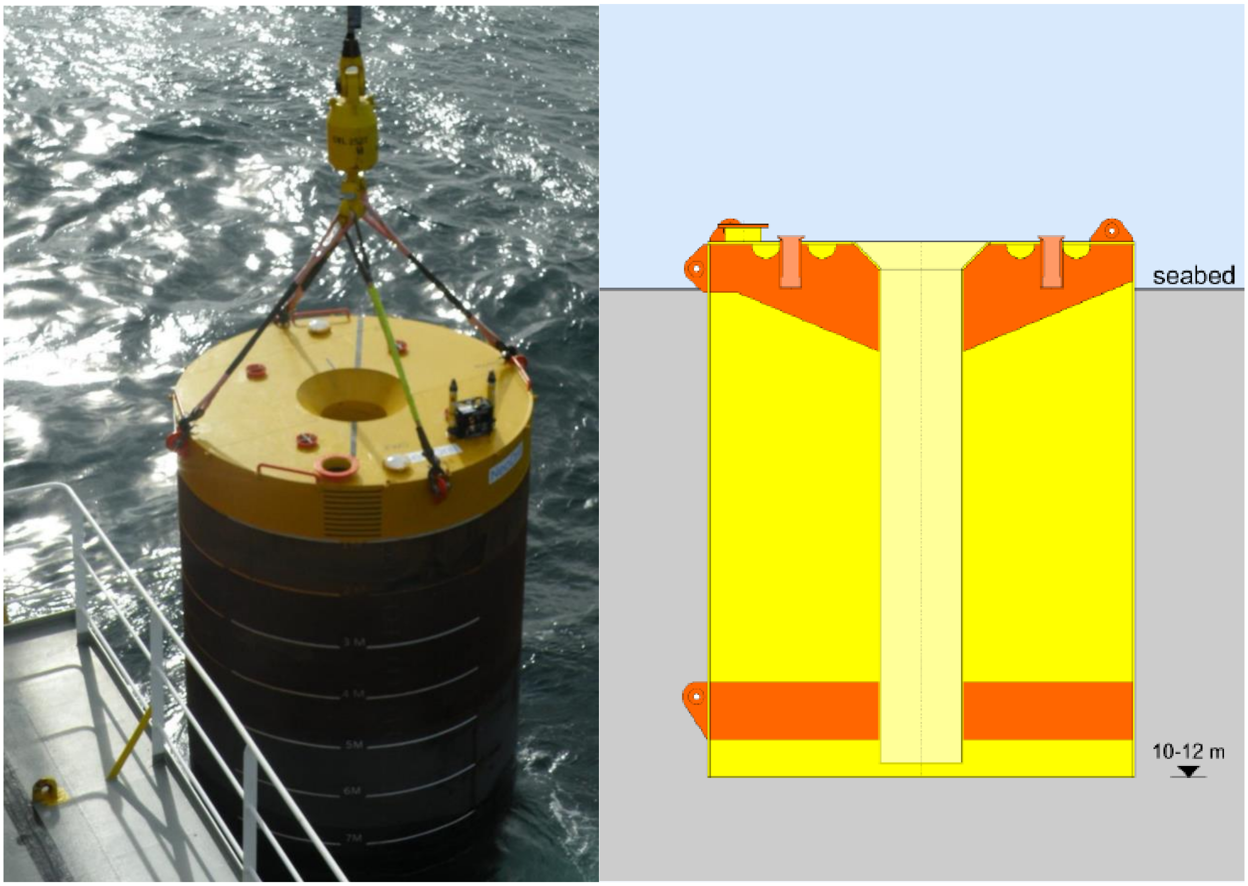


Figure 15 - Conductor Anchor Node installation (NeoDrill, 2016)

A Centrica case study was detailed in a 2017 SPE Drilling Operations article by (Kopperud, et al., 2017). The study detailed the pilot test of the CAN system on Centrica's Ivory Deepwater Exploration Well in the Norwegian Sea. Their overriding strategy was to do as much up-front work as possible before rig-arrival. This would ultimately save time and reduce the risk of delays due to weather, logistics etc. NeoDrill was contracted for provision and installation of the CAN. A 50mMDRT offset pilot hole was drilled and analysis of the drilling and soil samples concluded that the CAN would need only be 50m in length. A summary of the main conclusion of the run is presented below, and is taken from (Kopperud, et al., 2017):

- The Ivory drilling operations demonstrated that combining the CAN with a short jetted conductor was a successful means of achieving an effective dual-derrick operation in the riserless well section.

- Significant time efficiency was achieved in this part of the well. With 4.6 rig days between well spudding inside the CAN and landing the BOP, 7.3 days were saved compared with the expected P50 time plan.
- Upfront preparation of detailed operational procedures, involving key operational personnel, is critical for executing an efficient riserless operation with a dual-derrick rig.
- Conductor Anchor Node Optimizes Efficiency of Riserless Deepwater Exploration Drilling

The study highlights the key benefits of using such a system and one can clearly see its broader applications. Installing the CAN on a template for production well drilling can not only reduce operation times, but can be used in tandem with AkerBP's aforementioned study (where soil conditions allow) to proceed directly to running 13-3/8" or 9-5/8" casing (depending on contingency casing options). This could even be done by drilling with casing, thereby saving an unnecessary trip. Although, in doing so, the economics and risk/rewards of such an operation need to be evaluated in the technical context of the prevailing conditions and wellbore costs.

The following section looks at recent developments in mono-diameter well construction and presents options for removing unnecessary casing strings.

2.3.2 Well Design with Fewer Casing Strings

This section will focus on expandable casing technology and some of the opportunities and challenges surrounding its application. Expandable casing presents an exciting opportunity for industry to cut wellbore costs and increase wellbore production, however, its limitations and cost means it is still a fringe idea, yet to make its mark on the mainstream market. However, given a favourable economic climate, this technology will have wide-reaching applications. (Shen, 2007) presented an excellent overview of the opportunities which exist with monodiameter wells.

When we think about well geometry, we are typically used to seeing casing sizes proceed largest to smallest. There are well established technical and HSE reasons for this and this sort of profile has been an industry mainstay since we first introduced the concept of wellbore casing and cementing. Monobore wells, on the other hand, are exactly as the name suggests. Production casing is cementing in place as per normal operating procedure, however this time, the casing diameter is "opened-up" by means of a running tool and the outcome is a mono-diameter well. Often times, this string can be used as a production conduit, else a tubing string may be run if desirable. The diagram below (Figure 16) depicts this concept and shows the differences between convention and monodiameter well profiles.

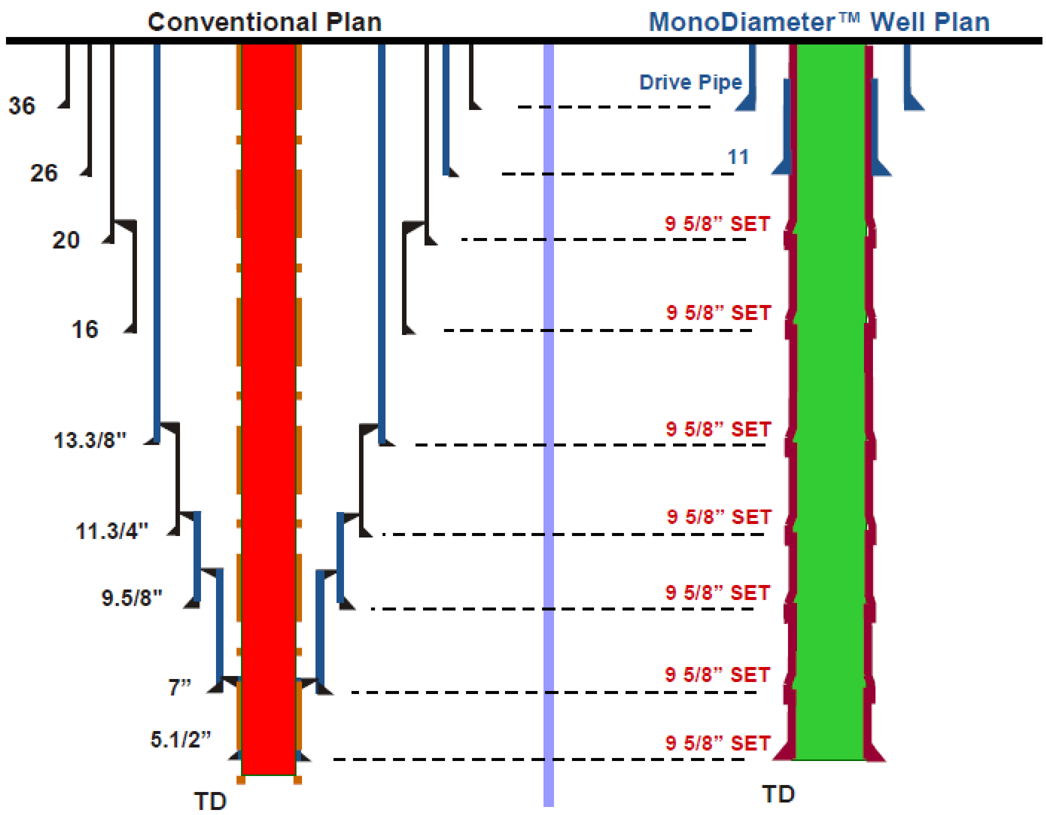


Figure 16 - Conventional vs monodiameter wellbore architecture (Smith, 2004)

The benefits and economic impacts of monodiameter wells were presented by (Campo, et al., 2003). The time and cost savings with monodiameter drilling and mostly due to the reduction in overall wellbore costs. We also see improved net present value since preservation of higher wellbore completions diameters can allow for higher and sustained production rates. Major benefits include, among others:

- Reduced materials costs due to smaller diameter (i.e. lower mud usage, decreased cuttings and fluids disposal costs) – hence reduced environmental impact;
- Higher production rates for development of deeper reservoirs due to larger diameters;
- Broader options for increasing the number of wells from the given infrastructure.

Technically speaking, a monobore geometry is obtained in one of the following manners, as proposed by (Shen, 2007):

1. Drilling with one hole size right through to TD (improbable, highly risky and would almost certainly never be sanctioned);
2. Employ under-reamers and bi-centred drill bits, with use of a solid expandable tubular to open up the casing diameter, post-installation.

There are varying methods of expanding casing and they are presented in the diagram below (Figure 17).

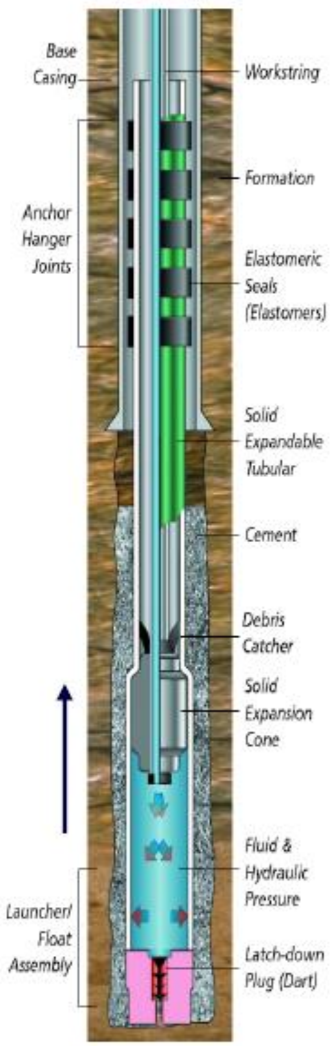
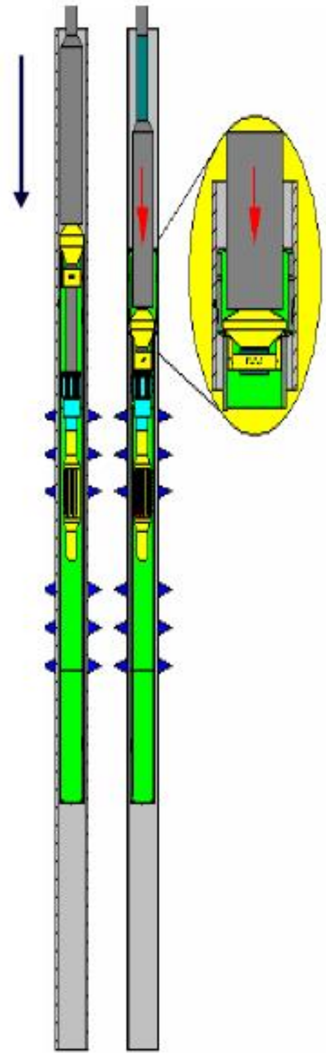
Enventure	Baker EX Patch	Weatherford
• Fixed cone, bottom to top, pressurizes. 	• Flex cone, top to bottom, drillpipe piston 	• Fixed cone, bottom to top, pressurizes. **for open hole**  Relax position expand position **for cased hole** • Flex roller, top to bottom, rotary and weight forces  **Homco Patch**

Figure 17 - Comparison of casing expansion methods (Shen, 2007)

Installing expandable tubulars, unfortunately, comes at a high risk, mainly due to their material properties. Of major concern is casing collapse strength deration, as one surmises from the foregoing figure. It is estimated that expansion of casing reduces the burst and collapse resistance some 50-60%. The point is to expand the casing beyond its elastic limit, such that it is now plastically deformed. The degree of expansion places the plastic strain either close to the elastic region, or close to the point of fracture. The sides will bulge because the material is no longer strong enough to support the load without shape change, hence the lateral expansion. Due to imperfections in the steel, expansion of casing can exacerbate otherwise benign micro-fractures, which may render the steel useless in providing a load resistance (Shen, 2007). Therefore, when running this technology, it is important to consider the load scenarios very carefully and run workbench trials before running the casing in hole. One particular limiting factor, and one which is very hard to simulate, is the effect of temperature. The expansion of steel downhole, in combination with high temperature with de-rate an already de-rated casing string and could further accentuate any steel imperfections.

Chapter 3: Technical Analysis

In this Chapter, we will build on the ideas and opportunities previously outlined to present a number of different options for well design on the Norwegian Continental Shelf. The primary purpose of this chapter is simply to show viability of the slender well design concept from a technical standpoint. Our analysis will focus on the three major regions of the shelf, namely; the Barents Sea, North Sea and Norwegian Sea. For each region, current exploration well design practises are presented, as well as new options for slender wellbore architecture. The section proceeds with technical commentary and risk assessment and finishes with an economic comparison of each initiative to outline the potential cost savings. Chapter 4 will discuss some of the qualitative, regulatory and market challenges surrounding these proposals and offer suggestions for the industry on slender wellbore architecture.

Note:

- *All technical analysis henceforth is presented in Mixed API units;*
- *Decimal points are represented by ".", rather than ",", as is commonplace in Norway;*
- *Analysis has been undertaken using Pro Well Plan and Halliburton Landmark software suites.*

3.1 Regional Overview

This section will present the results of a number of studies conducted to demonstrate the potential and opportunities that abound in slender well design for Norway. Due to the lack of available wellbore pressure data, three different pore/fracture pressure profiles (one for each region) have been developed based on publically available data[14]. Reasonable assumptions have been made in consultation with both industry and academia to ensure the curves are somewhat representative of what one might expect from each region.

3.1.1 Barents Sea

The Barents Sea is located in an intracratonic setting between the Norwegian mainland and Svalbard (NPD, 2017). The Norwegian Petroleum Directorate estimates that the region holds almost half of nation's undiscovered 18 billion bbl of hydrocarbons (ThermoFisher Scientific, 2016). Figure 18 below shows a geological overview of the Barents Sea region.

[14] Some wellbore data is publically available from the Norwegian Petroleum Directorate

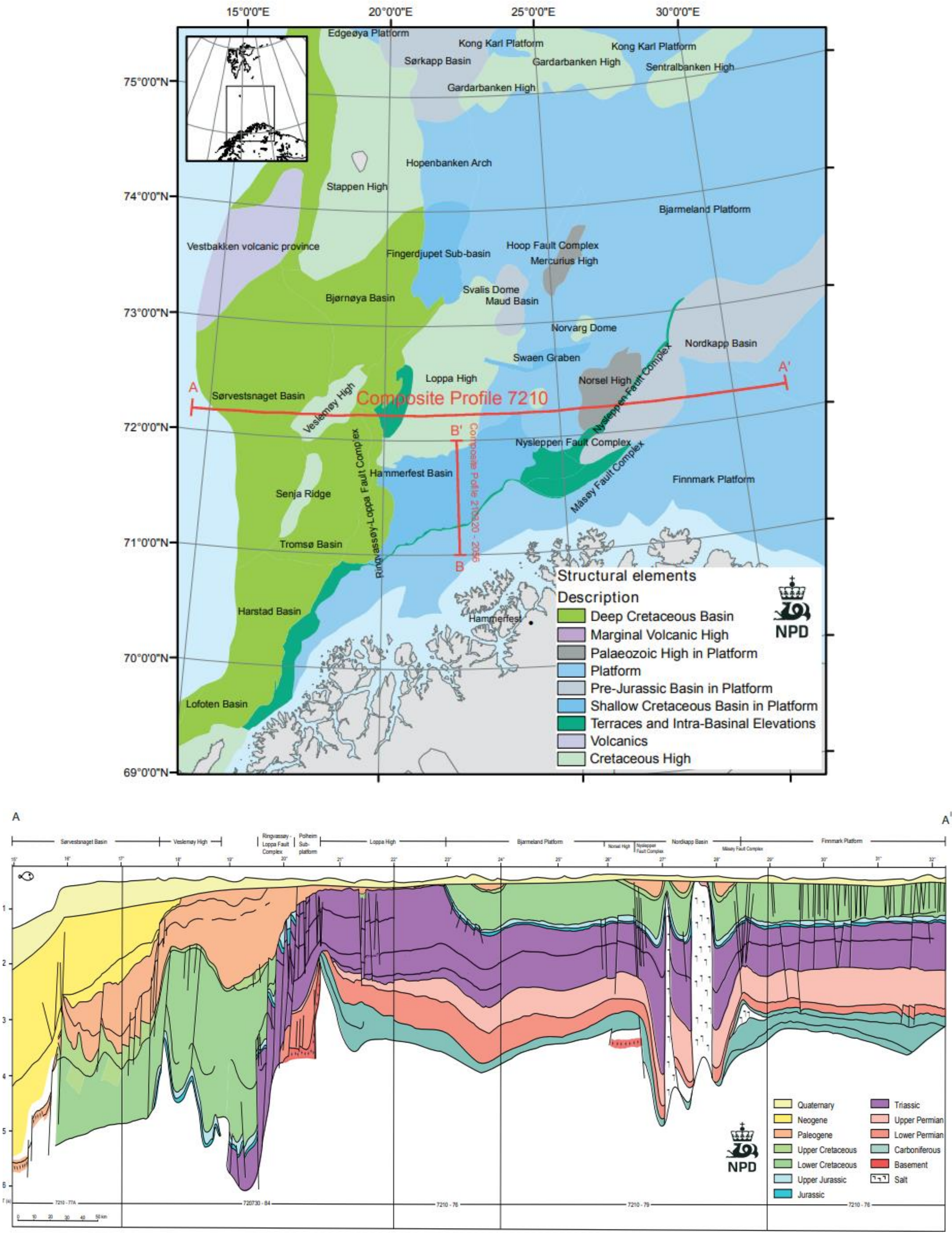


Figure 18 - Geological overview of the Barents Sea (NPD, 2017)

The Barents Sea covers an area some seven times the size of the North Sea. The shelf itself is quite deep, with water depths ranging from 200 to 500m. The maximum depth in the Norwegian trench is 513 m. Seabed temperatures range from -2 to 3 degC, with wellbore temperatures typically as appears in Figure 19, below[15]. Due to the warm ocean currents, the Barents Sea has a much milder climate than its latitude would otherwise suggest. However, with the winters, brings near total inaccessibility to a good portion of the northern region (Khatmulin, 2014).

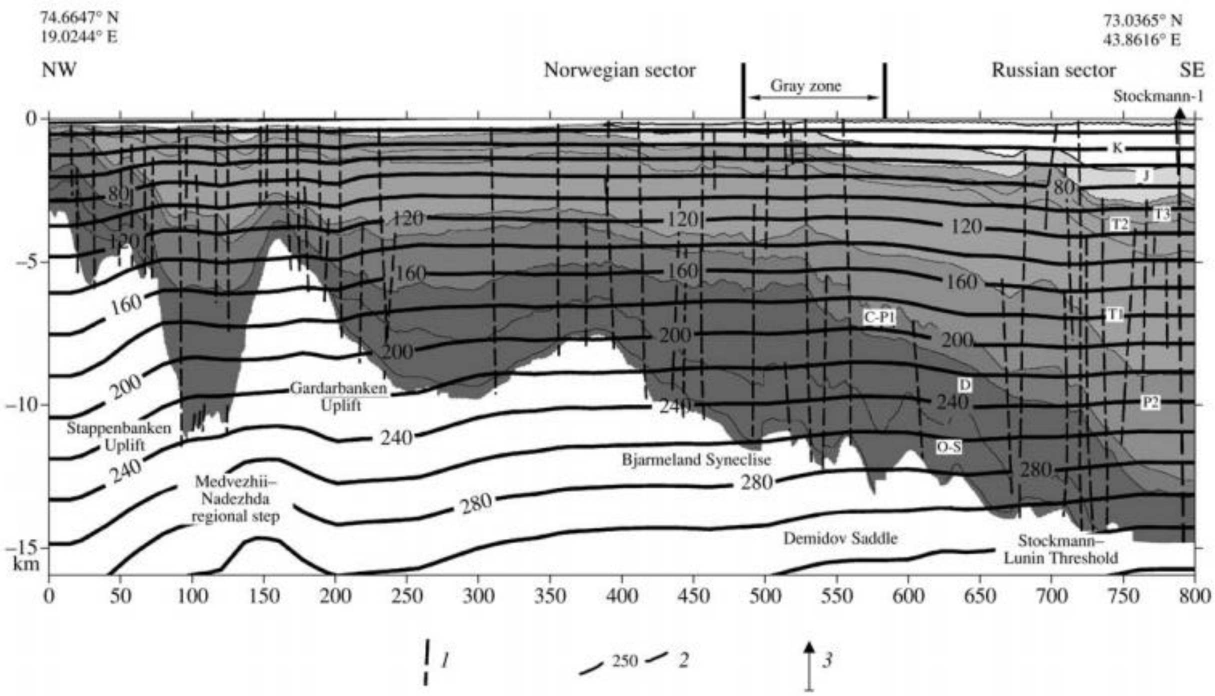


Figure 19 - Barents Sea downhole temperature profile (Khutorski, et al., 2008)

The Barents Sea well was selected from a region of high activity, the location for which is shown below in Figure 20.

[15] The solid black lines indicate downhole temperatures in degC.

Figure 20 - Barents Sea study wellbore location

The pore/fracture pressure profile for the Barents Sea region is presented below in Figure 21. Figure 22 depicts some publically available pore pressure data from the Diskos Database

(Directorate, 2018), which in addition to the NPD online database, helped formulate the downhole pressure profiles.

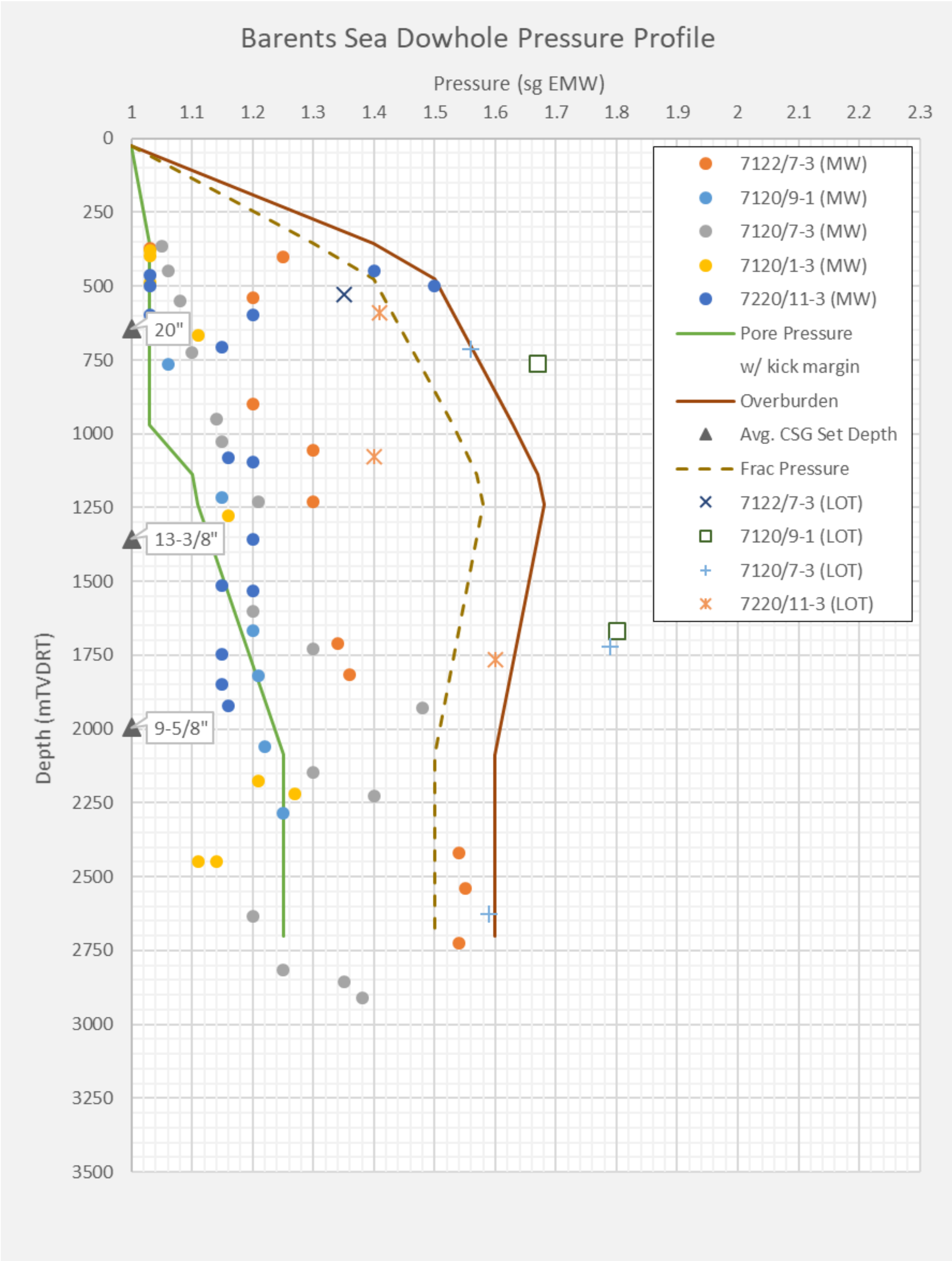
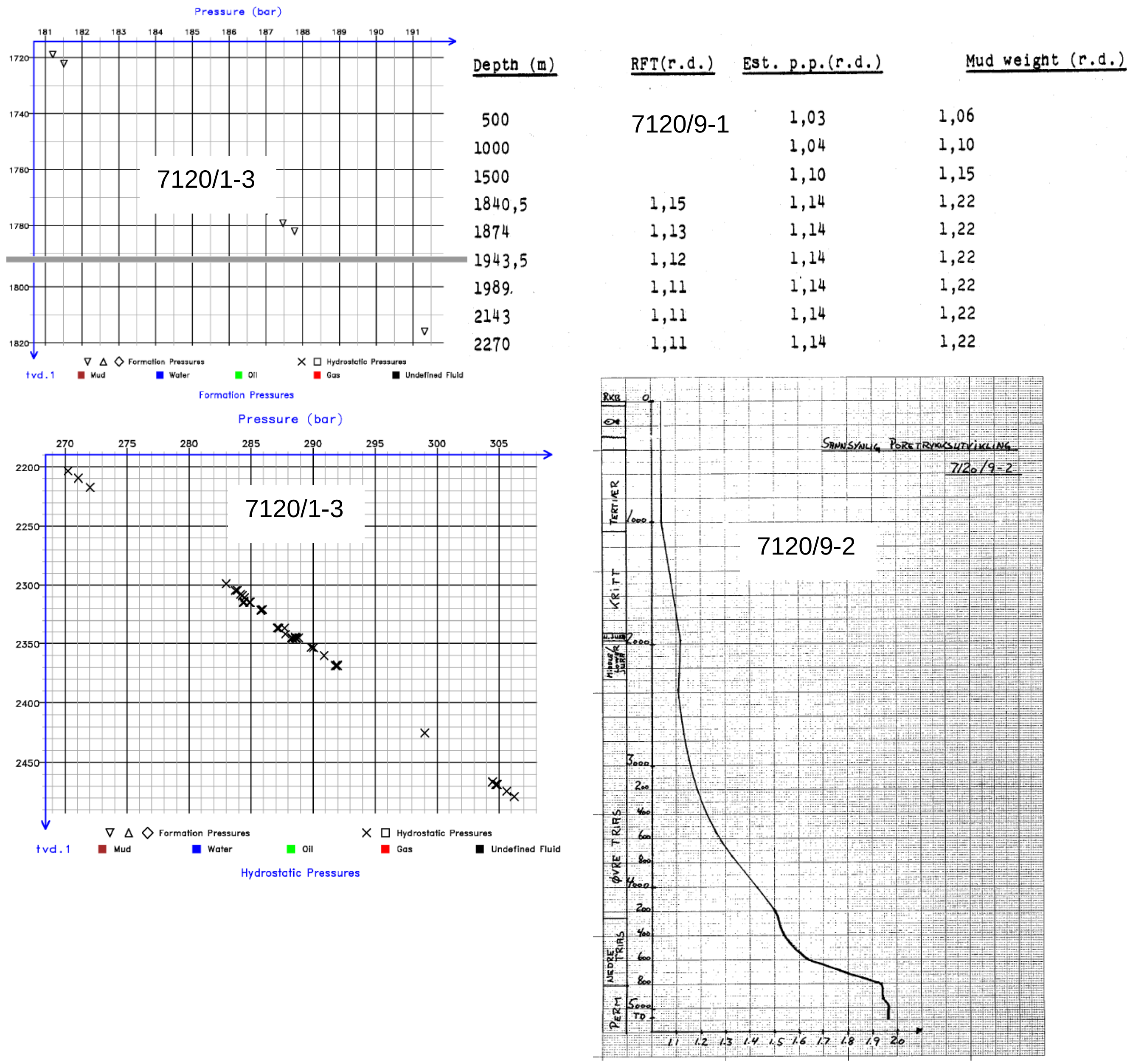


Figure 21 - Barents Sea Sample Pressure Profile, normalised to MSL



Depth (m)	RFT(r.d.)	Est. p.p.(r.d.)	Mud weight (r.d.)
500		1,03	1,06
1000		1,04	1,10
1500		1,10	1,15
1840,5	1,15	1,14	1,22
1874	1,13	1,14	1,22
1943,5	1,12	1,14	1,22
1989	1,11	1,14	1,22
2143	1,11	1,14	1,22
2270	1,11	1,14	1,22

Figure 22 - Pore pressure data for selected Barents Sea wells (Directorate, 2018)

3.1.2 Norwegian Sea

A structural map of the Norwegian Sea is shown below in Figure 23. The Norwegian sea lies between the North Sea and the Barents Sea. The wide variance of water depths and rough sea conditions pose significant challenges for drilling operations (Genova, 2005). Whereas drilling a depths past 500m has been conducted regularly, only few gas fields have been commercially exploited. The deepest project is the Ormen Lange development, with a water depth of 800-1100m. Seabed temperatures range from 0 to -2 degC, which causes problems with hydrate formations. Downhole temperatures can reach up to 170 degC with formation pressures of up to 900 bar, as was noted on the Kristin development (Norsk Petroleum, 2016).

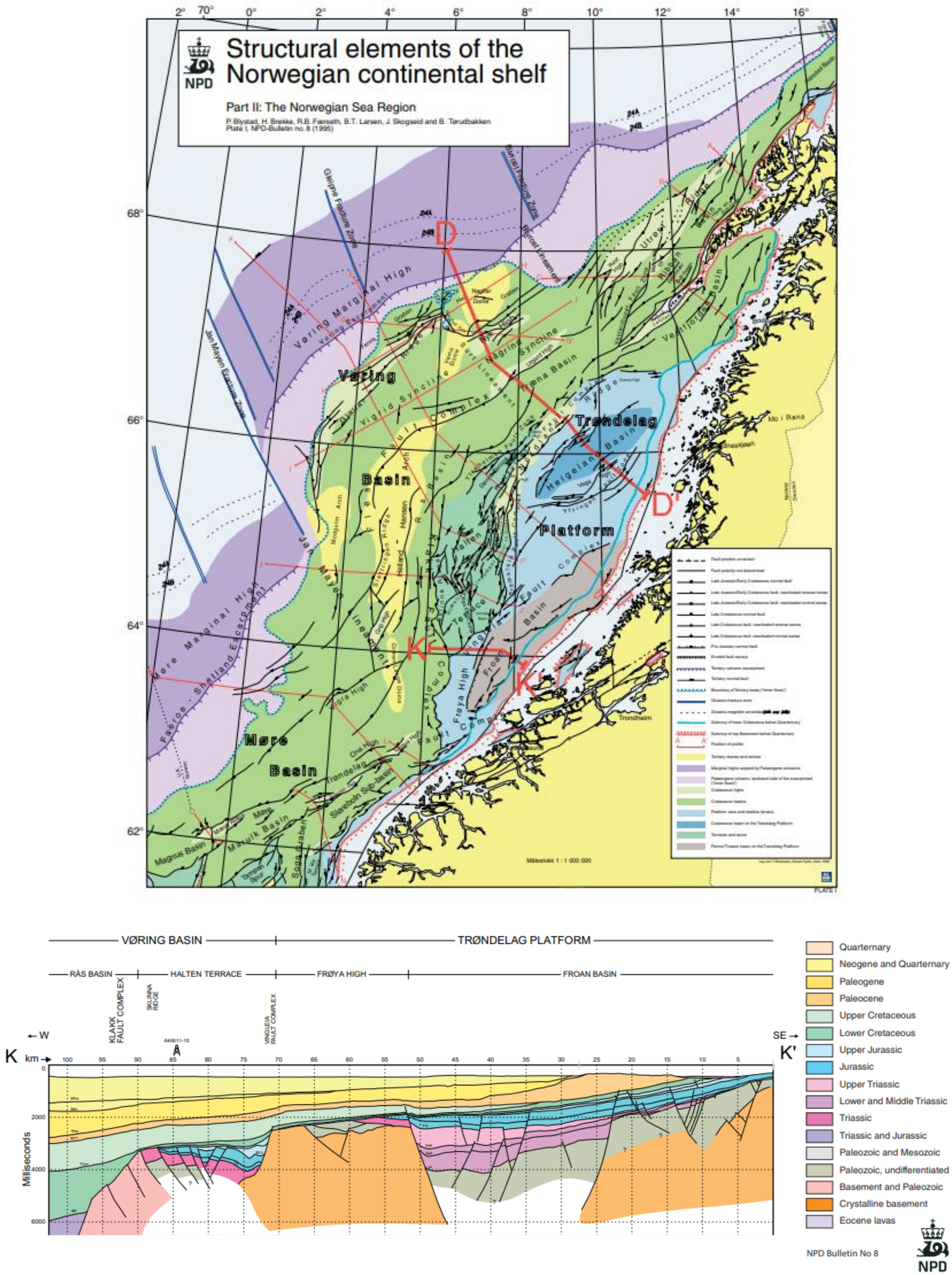


Figure 23 - Geological overview of the Norwegian Sea (NPD, 2017)

The location of the Norwegian Sea study well is shown below in Figure 24.

Figure 24 - Norwegian Sea study well location

The pore/fracture pressure profile for the Norwegian Sea region is presented below in Figure 25. Figure 26 presents some publically available pore pressure data from the Diskos Database (Directorate, 2018), which in addition to the NPD online database, helped formulate the downhole pressure profiles.

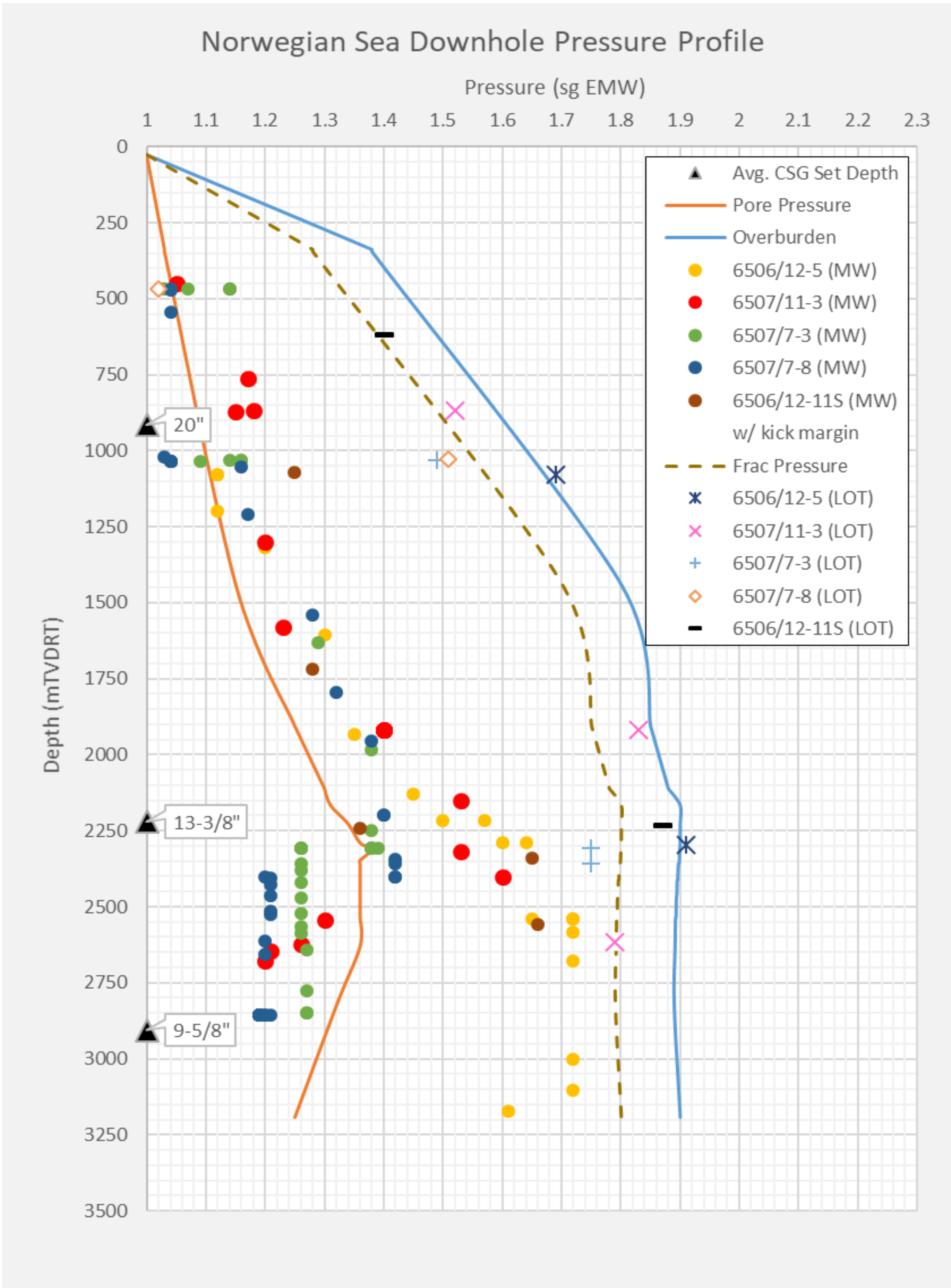


Figure 25 - Norwegian Sea Sample Pressure Profile, normalised to MSL

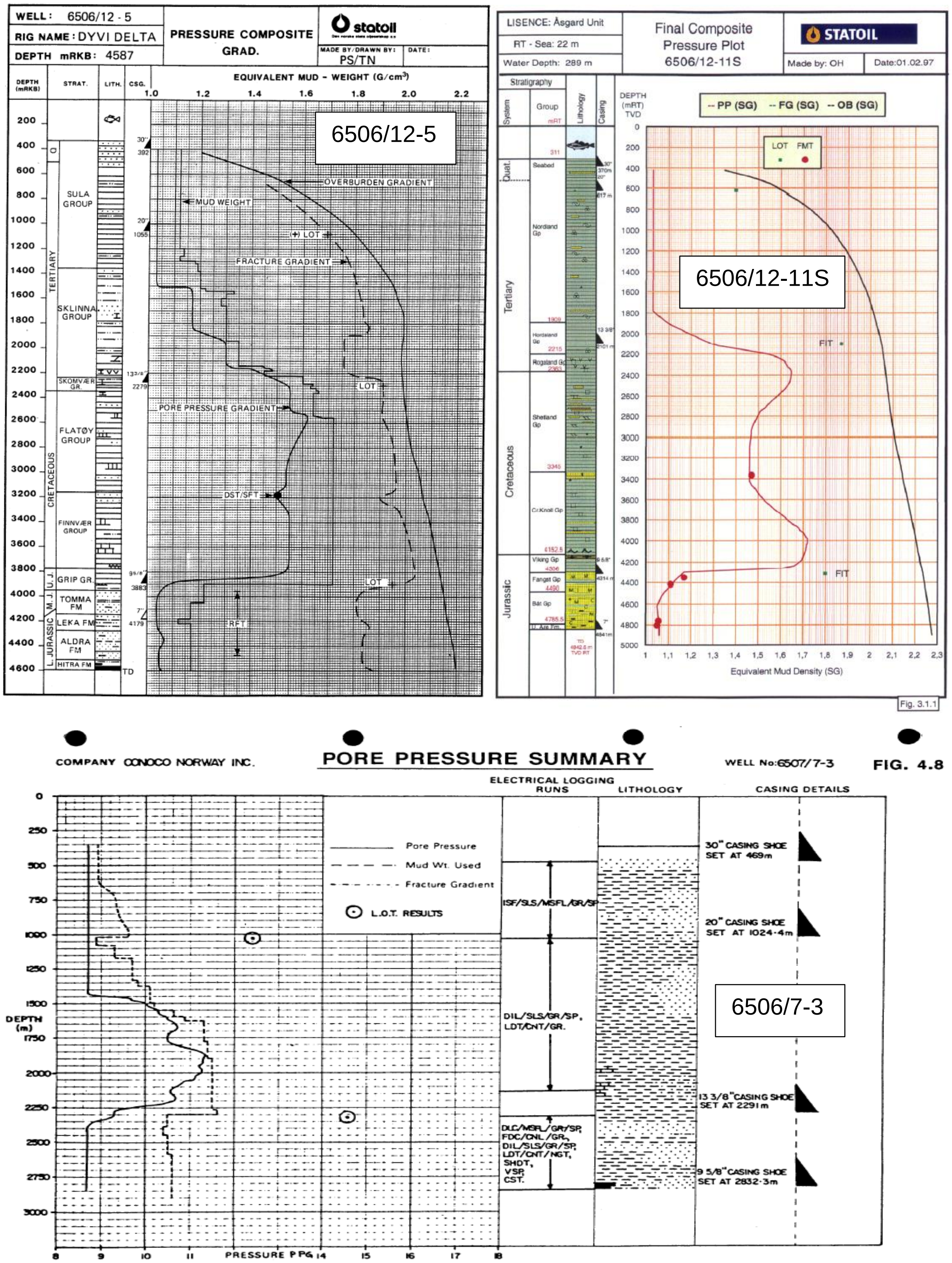


Figure 26 - Pore pressure data for selected Norwegian Sea wells (Directorate, 2018)

3.1.3 North Sea

The North Sea is the most heavily explored oil and gas producing region in Norway. The region is also very important for the UK. The basic structural framework of the North Sea is the result of Upper Jurassic/Lower Cretaceous rifting. The majority of the region has a water depth of between 100 and 200m, whereas some wells have been drilled in increasingly deeper water. The region is slightly overpressured, with few regions that would be classified as HPHT. This is because of the volume of production throughout the region over the past 50 years. Wells are typically 100-200 degC in temperature at total depth (NPD, 2017). A depiction of the region is shown below in Figure 27.

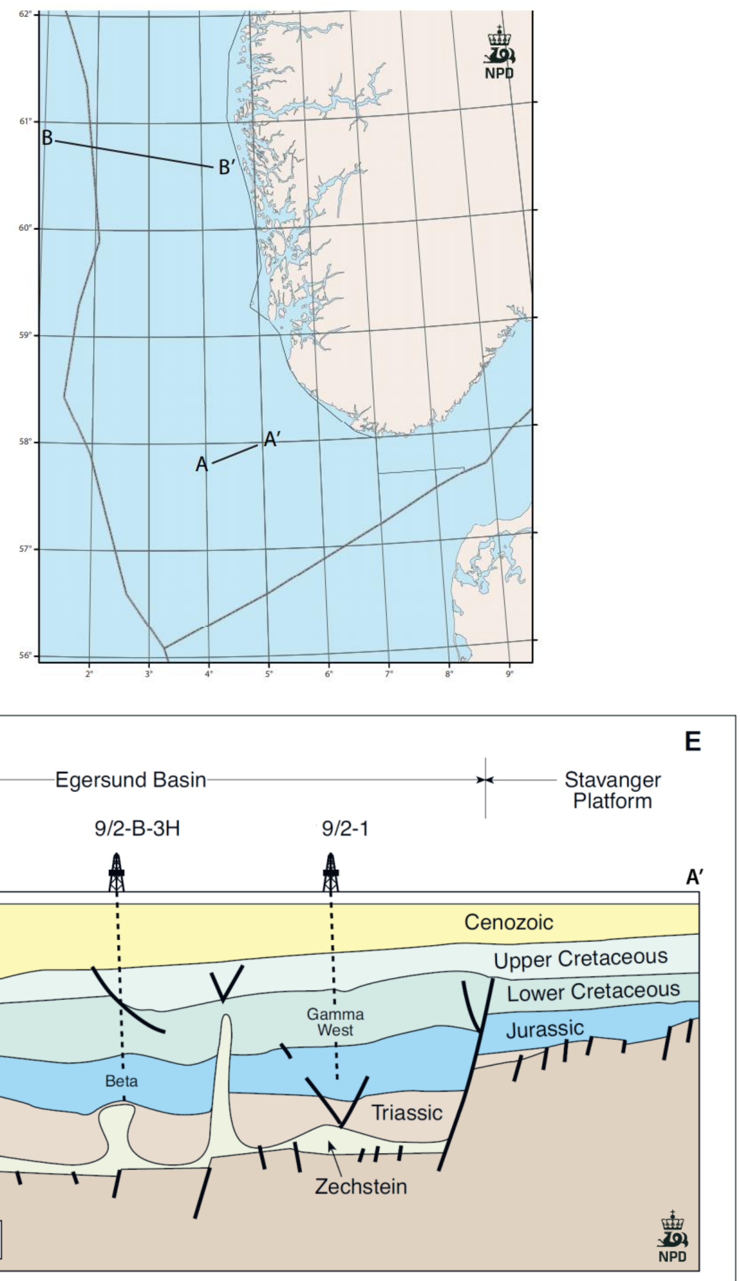


Figure 27 - North Sea geological overview (NPD, 2017)

The location of the North Sea study well is shown below, in Figure 28.

Figure 28 - North Sea study well location

The pore/fracture pressure profile for the North Sea study well is presented below in Figure 29. Figure 30 presents some publically available pore pressure data from the Diskos Database

(Directorate, 2018), which in addition to the NPD online database, helped formulate the downhole pressure profiles.

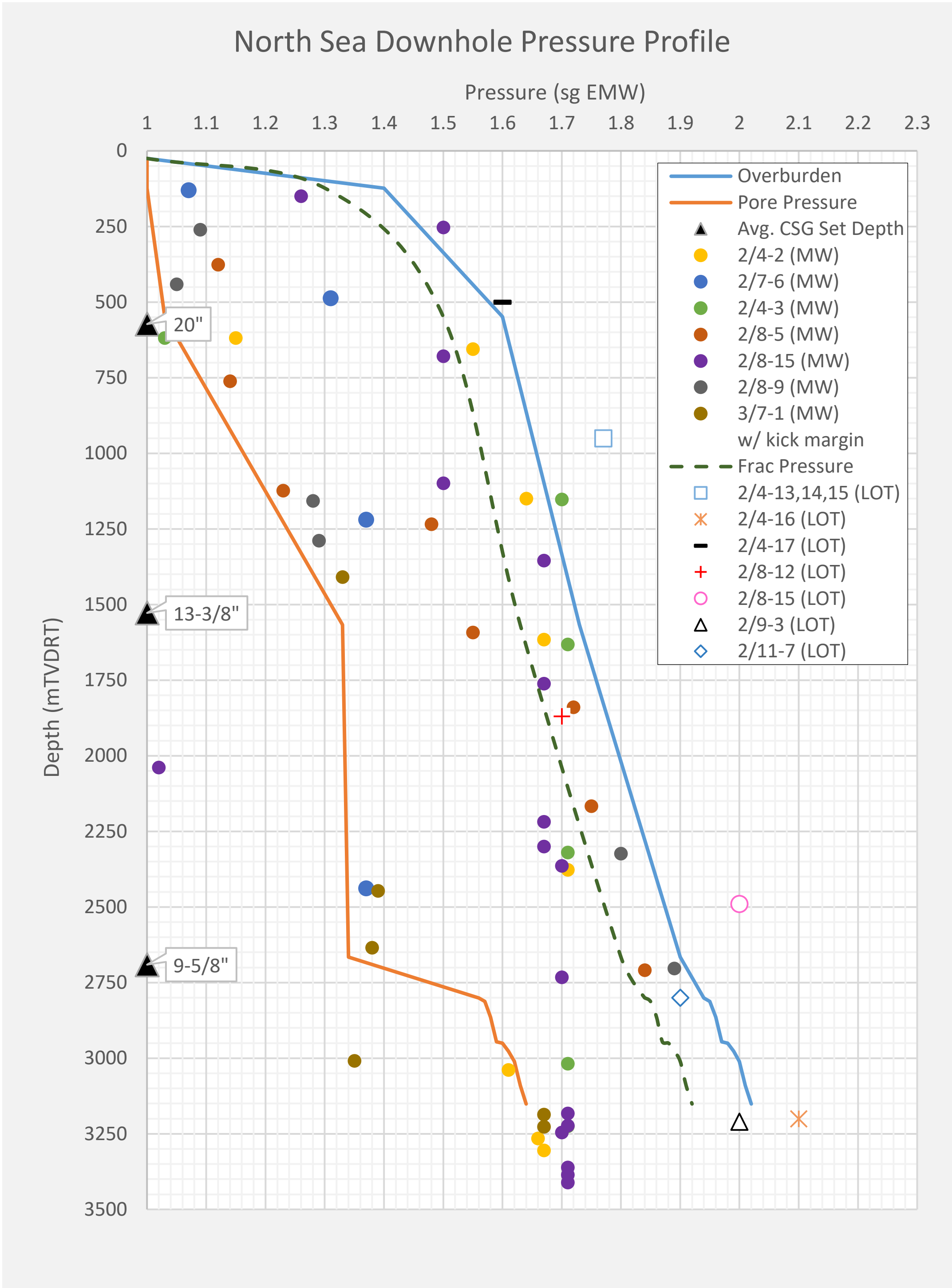


Figure 29 - North Sea study well pressure profile, normalised to MSL

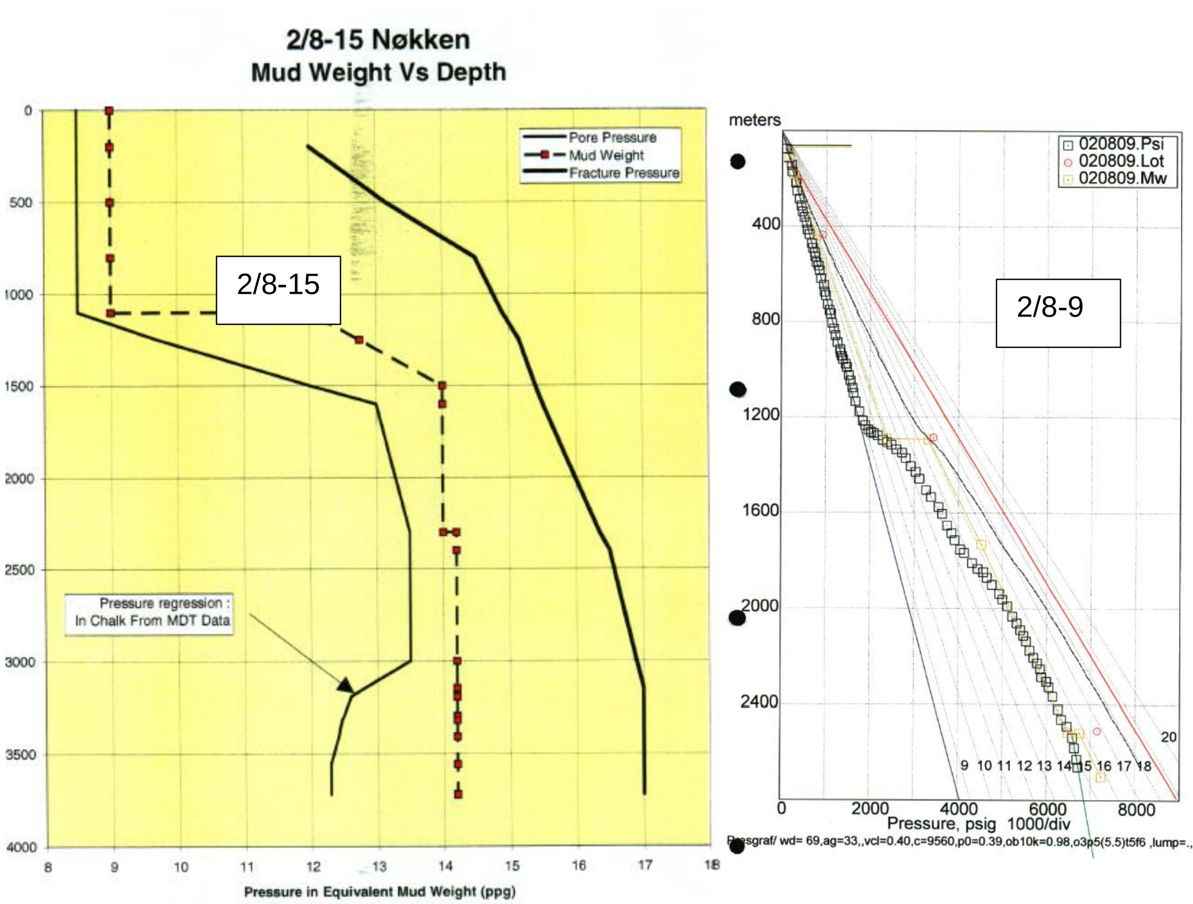


Figure 30 - Pore pressure data for selected North Sea wells (Directorate, 2018)

3.2 Casing Evaluation Criteria

In order to compare our two casing designs for each region, we will use the von Mises stress-derived Triaxial Design Limits plot. Bellarby, 2009, outlined the principles of triaxial casing design. He noted the importance of analysing wellbore tubular designs with reference to both pressure and axial effects. The combination of pressure and axial effects will serve to strengthen or else de-rate casing burst and collapse ratings, depending on the situation. For example: where casing is held in tension, the burst rating will increase by some given amount. Conversely, in the same scenario, the collapse rating will decrease by some amount. From a mathematical standpoint, we express this phenomenon in terms of three (axial, radial and tangential (or hoop)) stresses. (Bellarby, 2009). The most widely used yield criterion in the Petroleum industry is what has come to be known as the von Mises stress (Byrom, 2013). The von Mises stress can be expressed as follows:

$$\sigma_{VME} = \frac{1}{\sqrt{2}}\sqrt{[(\sigma_a - \sigma_t)^2 + (\sigma_t - \sigma_r)^2 + (\sigma_r - \sigma_a)^2]}$$

Equation 9 - von Mises equivalent stress (VME)

Where: σ_a is the axial stress (a combination of tensile, bending and ballooning effects), σ_t is the tangential stress and σ_r is the radial stress.

Since both radial and tangential stresses are a function of differential pressure, this means that triaxial stresses may be plotted on a two-dimensional plane (Bellarby, 2009). The most commonly used visualisation of the von Mises stress is the Design Limits plot. The plot presents as an ellipse, whose boundaries represent the maximum allowable combined pressure and axial stresses (multiplied by the relevant local design factors – outlined below). For each load case, the combined axial/pressure line is plotted onto the ellipse. A casing string is considered "safe", where all load lines fall within the design limits. Bellarby presents a typical design limits plot with the NORSOK design factors, as below in Figure 31.

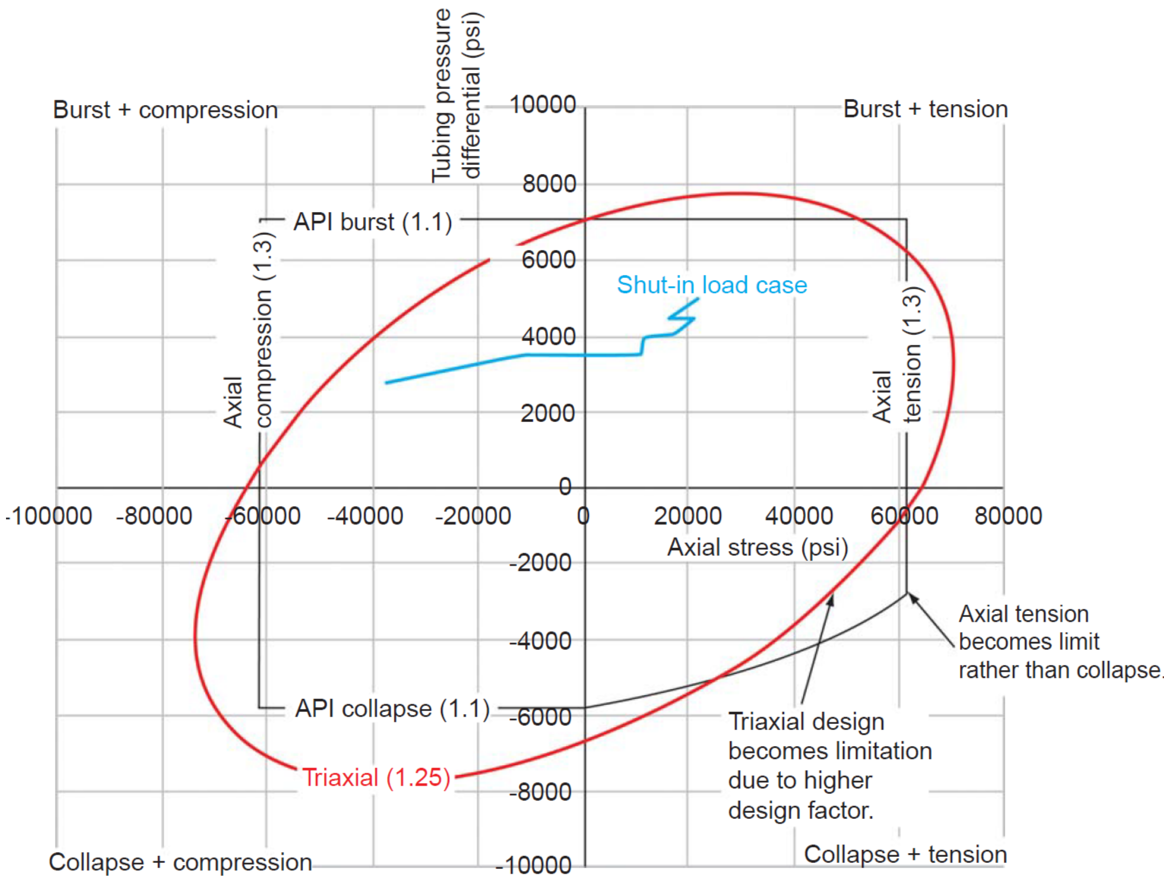


Figure 31 - Typical VME design limits plot with NORSOK design factors (Bellarby, 2009)

3.3 Current Design Practises by Region

For each region, two well designs are provided; one being a conventional design and the other being a slender well design. For the conventional design, an unnamed Norwegian operating company has provided a list of standard tubulars and connections used for wellbore casing and completion, as per its contracts in-place. It will be assumed that this operator is drilling the conventional wells and that their wellbore completions would proceed with those casing strings shown in Table 6 and Table 7 below. Subsequently, the slender well design selects from common API grade casings and makes reasonable assumptions to show that these well designs are indeed possible.

Note: all design reports for each region are displayed at length in Appendix 5.2.

<u>General Assumptions</u>

For all well designs herein, we assume that the aforementioned unnamed company performs all operations. In addition, the general assumptions for the following well designs are:

- Vertical exploration wells are considered. Production wells excluded;
- All designs are calculated using NORSOK D-010 design factors, as depicted below in Table 4;

Parameter	Design factor*	Supplementary requirement/information
Burst	1,10	
Collapse	1,10	
Axial	1,25	For well testing a design factor of 1,50 should be used to cater for pulling the packer free at the end of the test.
Tri-axial	1,25	Tri-axial design factors are not relevant for connections

*The above design factors are based on wall thickness manufacturing tolerance of minus 12,5%.

Table 4 - NORSOK D-010 wellbore design factors (Standards Norway, 2013)

- When designing for burst, collapse and axial loading, the following load cases have been considered, as directed by NORSOK D-010:

Item	Description	Comments
1.	Gas kick	Size/volume and intensity to be defined
2.	Gas filled casing	Applicable to last casing above the reservoir and subsequent casings
3.	Production and/or Injection tubing leaks	Based on WDP. See 7.7.2 for multipurpose wells
4.	Cementing of casing	
5.	Leak testing casing	See 7.7.2 for multipurpose wells
6.	Thermal expansion of fluid in enclosed annuli	Collapse and burst
7.	Dynamic loads from running of casing, including over pull to free stuck casing	
8.	Permanent abandonment	See section 9.3.2

Table 5 - Load cases as required by NORSOK D-010 (Standards Norway, 2013)

- No calculations which require inputs from rig specifications have been performed, since doing so would remove the objectivity of the study;
- The study has only considered vertical exploration/appraisal wells, due to lack of available data to draw reasonable analogues for production wells;
- Fully-packed BHA's are assumed for drilling of each hole section;
- No shallow gas is assumed present to be present;
- The reservoir gas gradient is assumed to be 0.1 psi/ft;
- The reservoir oil gradient is assumed to be 0.276 psi/ft;
- All cement columns (except the conductor strings) have a 150m tail cement;

- Friction factors are 0.3 for all cases;
- Casings de-rated for temperature effects;
- Casing set depths based on allowable kick tolerances (as per NORSOK D-010) and competent formations;
- 50klbs overpull allowance for all strings;
- Casing running speed is assumed to be 1 ft/s for all operations;
- A 25m air gap is assumed for all wells;
- The available casing and connections are as per below for conventional well designs, but unrestricted for slender well designs. This is because the slender wells are assumed to be drilled in a campaign, where equipment is batch ordered and thereby tailored to suit the design criteria.

OD (in)	Weight (lb/ft)	Grade	ID (in)	Drift (in)	Burst (psi)	Collapse (psi)	Axial (lbf)
7	26.00	L-80	6.276	6.151	7,240	5,411	603,929
7	29.00	L-80	6.184	6.059	8,160	7,026	675,954
7	29.00	P-110	6.184	6.059	11,220	8,532	929,437
7	32.00	P-110	6.094	6.000	12,458	10,781	1,024,904
9 5/8	53.50	P-110	8.535	8.500	10,900	7,950	1,710,113
9 7/8	66.40	P-110	8.625	8.469	12,184	10,283	1,997,857
9 7/8	66.40	Q-125	8.625	8.469	13,845	11,135	2,270,292
10 3/4	60.70	P-110	9.66	9.504	9,759	5,877	1,921,994
13 3/8	72.00	P-110	12.347	12.250	7,398	2,882	2,284,443
13 5/8	88.20	P-110	12.375	12.250	8,830	4,574	2,807,798
13 5/8	88.20	Q-125	12.375	12.250	10,034	4,802	3,190,680
14	114.00	P-110	12.4	12.244	11,000	8,132	3,649,274
14	114.00	Q-125	12.4	12.244	12,500	8,646	4,146,902
20	133.00	N-80	18.73	18.543	4,445	1,603	3,090,517

Table 6 - List of standard tubulars as provided by unnamed Norwegian Operator

Name	OD (in)	Weight (lb/ft)	Grade	Conn_OD (in)	Conn_ID (in)	Int yield (psi)	Tensile (lbf)	Compression (lbf)
TSHER	20	133.0	N-80	21.000	18.754	4,450	3,091,000	3,091,000
Vam TOP KB	14	114.0	Q-125	15.282	12.667	12,500	4,147,000	4,147,000
Vam TOP KB	14	114.0	P-110	15.282	12.667	11,000	3,649,000	2,189,000
Vam TOP	13 5/8	88.2	Q-125	14.681	12.443	10,030	3,191,000	1,915,000
Vam TOP	13 5/8	88.2	P-110	14.681	12.443	8,830	2,808,000	1,685,000

Vam 21	13 3/8	72.0	P-110	14.286	12.557	7,400	2,284,000	2,284,000
Vam 21	10 3/4	60.7	P-110	11.711	9.858	9,760	1,922,000	1,922,000
Vam TOP	9 7/8	66.4	P-110	10.949	8.789	12,670	2,072,000	1,243,000
Vam TOP	9 7/8	66.4	Q-125	10.949	10.789	14,400	2,355,000	1,413,000
Vam 21	9 5/8	53.5	P-110	10.542	8.772	10,900	1,710,000	1,710,000
Vam TOP HC	7	32.0	P-110	7.717	6.059	12,460	1,025,000	1,025,000
Vam TOP HC	7	29.0	L-80	7.644	6.118	8,160	676,000	676,000
Vam TOP HC	7	29.0	P-110	7.644	6.118	11,220	929,000	929,000
Vam TOP HC	7	26.0	L-80	7.565	6.281	7,240	604,000	604,000

Table 7 - List of standard connections as provided by unnamed Norwegian Operator

3.3.1 Barents Sea Conventional Well Design

Using the data in the foregoing sections, one is able to construct a wellbore profile and design this in accordance with the available casing and connection inventory specified above. The wellbore schematic (Figure 32) shows the final well design.

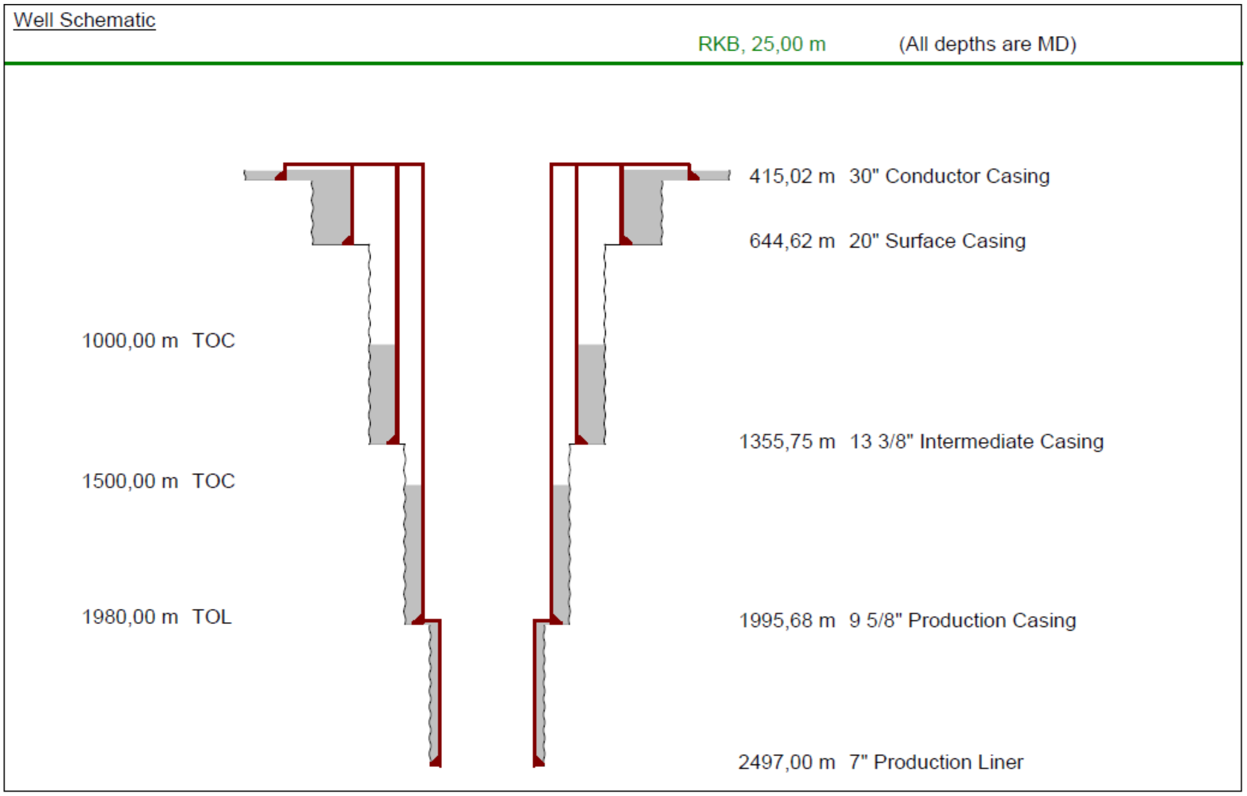


Figure 32 - Barents Sea wellbore schematic (conventional architecture)

3.3.1.1 Basis of Design and Results

Casing Summary	
Conductor Casing	30” 157.5 lb/ft X-42 BTC (Range III)
Surface Casing	20” 113 lb/ft N-80 TSH-ER (Range III)
Intermediate Casing 1	13-3/8” 72 lb/ft P-110 VAM21 (Range III)
Intermediate Casing 2	9-5/8” 53.5 lb/ft P-110 VAM21 (Range III)
Production Liner	7” 29 lb/ft L-80 VAMTOPHC (Range III)

Table 8 - Barents Sea Conventional Well: Casing Summary

The load cases used to design the conventional well are as follows:

<u>30” Conductor</u>

Collapse, burst and axial forces were not considered as part of this analysis, since they are typically not an issue for this casing string.

<u>20” Surface Casing</u>

The collapse criteria assumed collapse during cementing, which assumed wet cement in the annulus and seawater as the displacement fluid. Cement is brought up to surface. Additionally, a fluid drop due to thief zone was assumed as the second worst-case collapse scenario. The inside fluid level drops until the bottom hole pressure is equal to that of a sea water gradient.

The burst criteria assumed the maximum possible internal being equal to the next hole section. An oil gradient has been assumed, since a gas kick is very unlikely. The external profile assumes cement mix water. Two pressure testing scenarios are also presented – a grey test[16] and green test[17]. Both tests are considered since in practice, we often need to conduct green tests where grey tests are not possible. The test pressure is 1650 psi, which is based on the maximum oil to surface pressure.

The axial design criteria assumes the weight of casing and mud as the primary factor. Since this is a vertical well, there are no bending forces incorporated. Pressure testing axial loading has been considered.

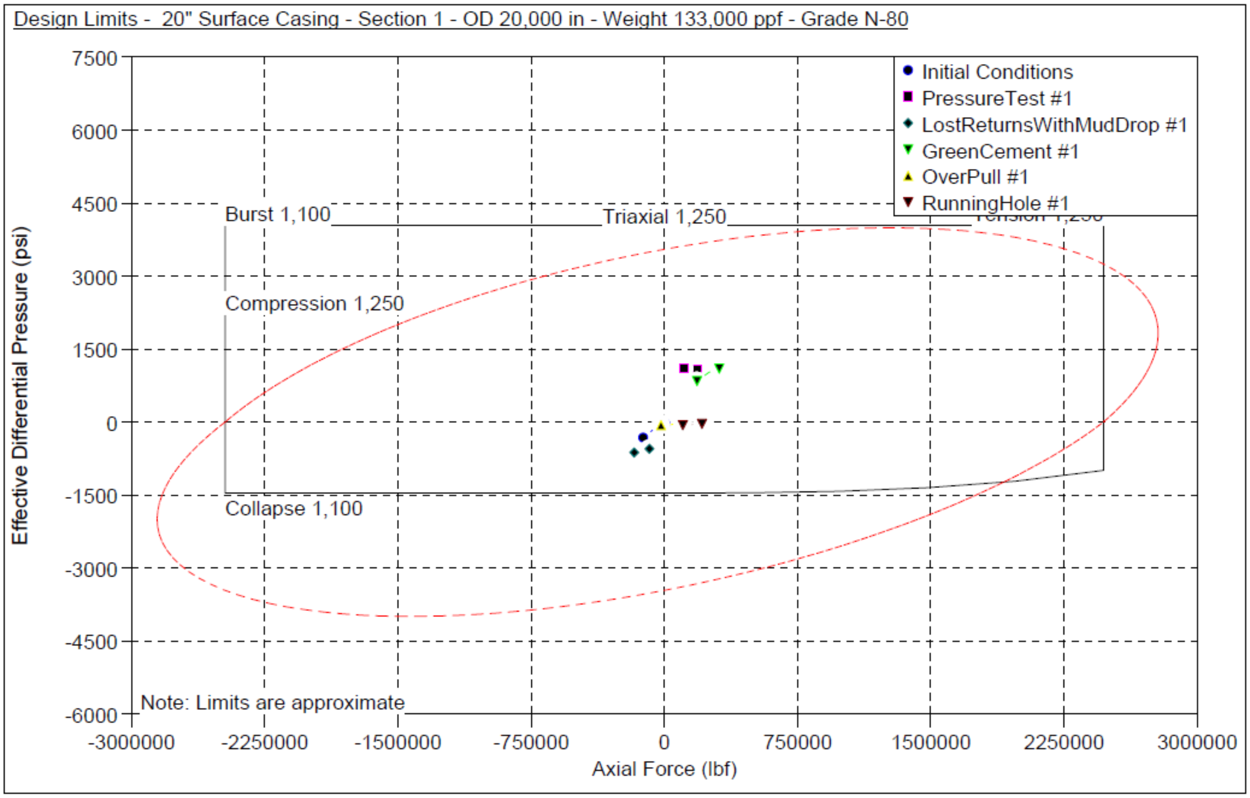


Figure 33 – Design limits plot for 20" surface casing

<u>13-3/8" Intermediate Casing</u>

A fluid drop due to thief zone was assumed as the second worst-case collapse scenario. The inside fluid level drops until the bottom hole pressure is equal to that of a sea water gradient.

The burst design is based once again on an oil-filled casing scenario, with figures adjusted for wear and tear of the pipe. The external pressure assumes the cement mix water, with mud above. The test pressure is 2550 psi, which is based on the maximum oil to surface pressure.

Axial design criteria as per previous string.

---

[16] A grey test refers to a casing pressure test where cement has cured

[17] A green test refers to a casing pressure test which is conducted immediately after the top cement plug (or wiper plug) has landed on the bottom plug (aka. Plug bump)

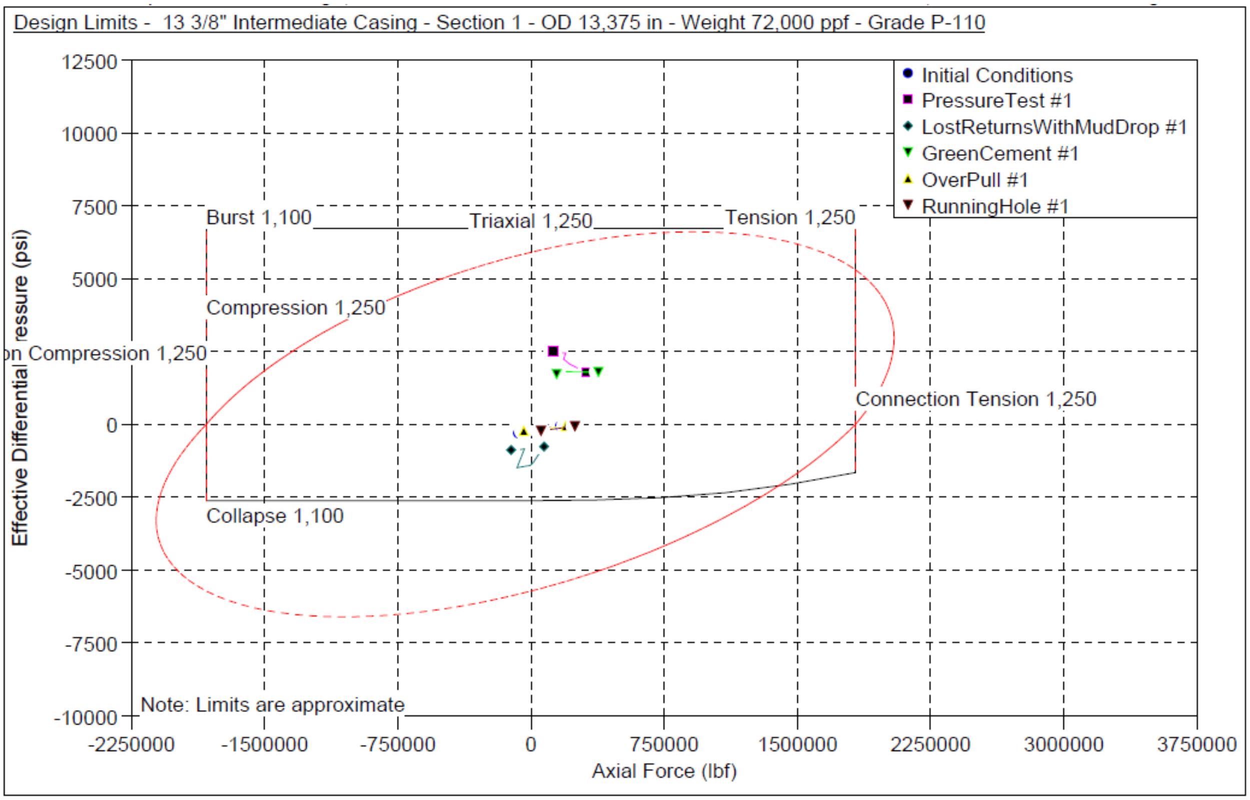


Figure 34 - Design limits plot for 13-3/8" intermediate casing

<u>9-5/8" Intermediate Casing</u>

The collapse loading involves a thief zone as per previous string. The outer profile assumes cement mix water, with mud above. In addition, full evacuation to gas has been assumed as worst-case collapse loading with the same external profile as the thief zone. Calculations are adjusted for slight corrosion (10% reduction in burst/collapse/tensile performance), since this is a post-drill load.

The worst-case burst loading is a shallow tubing leak, which assumes a leak in the production tubing, below the tubing hanger. There is assumed to be kill weight brine in the casing with wellhead gas production pressure above. Calculations incorporate casing wear. The test pressure is 4400 psi, which is based on the maximum gas to surface pressure. All production burst loads assume deteriorated mud in the external profile (8.6 ppg).

The axial design criteria are assumed to be similar to the previous string.

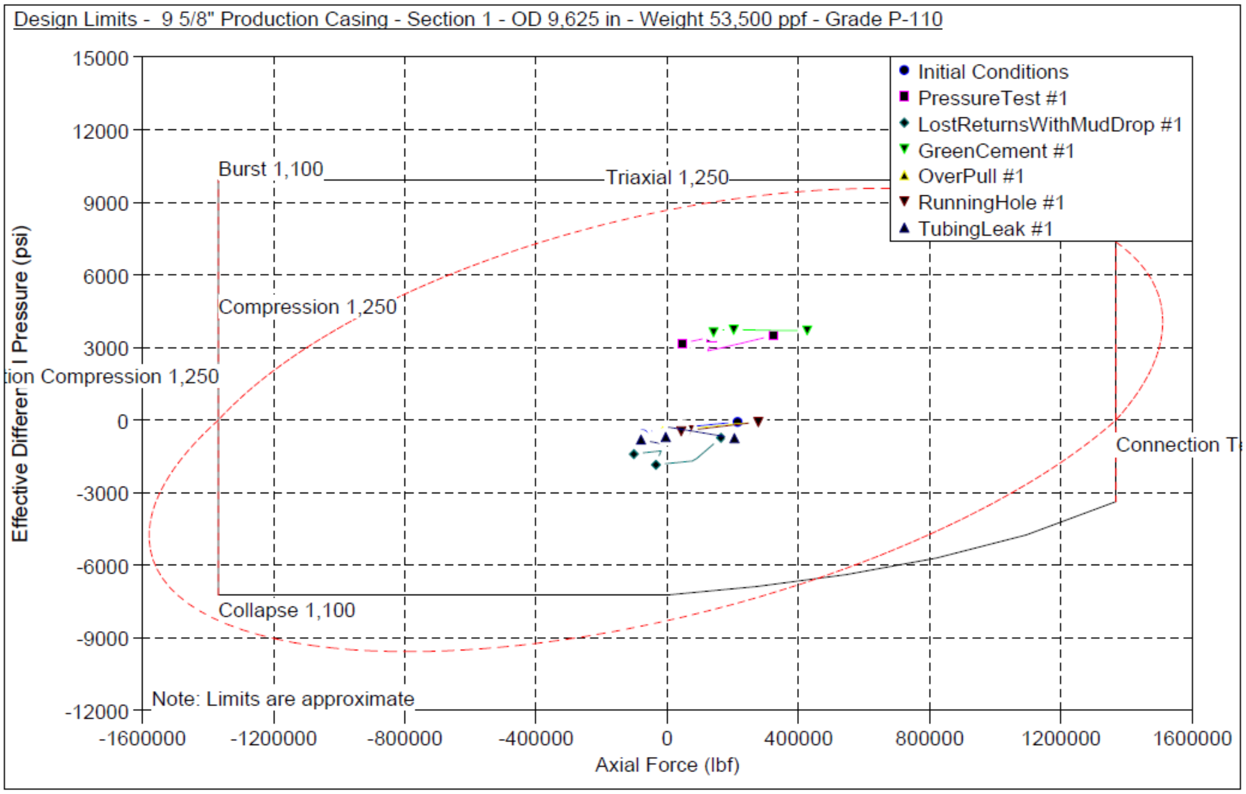


Figure 35 - Design limits plot for 9-5/8" intermediate casing

7" Production Liner

The collapse scenario for the production liner involves formation pressure acting on plugged perforations during normal production. The inner liner is assumed to be filled with produced gas and the external profile is assumed to be formation pressure. Loads adjusted for corrosion (10% reduction in burst/collapse/tensile performance).

The burst criteria is based on bullheading operations. The internal pressure profile is equal to the kill weight mud and the external profile is assumed to be cement mix water. The test pressure is 6600 psi (at liner hanger), which is based on the maximum gas to surface pressure. All production burst loads assume deteriorated mud in the external profile (8.6 ppg).

Note: Shallow tubing leak has been factored in, to the calculations, to allow for flexibility in placing the tubing packer either in the liner, or in the previous casing string.

The axial design is based on casing installation and cementing.

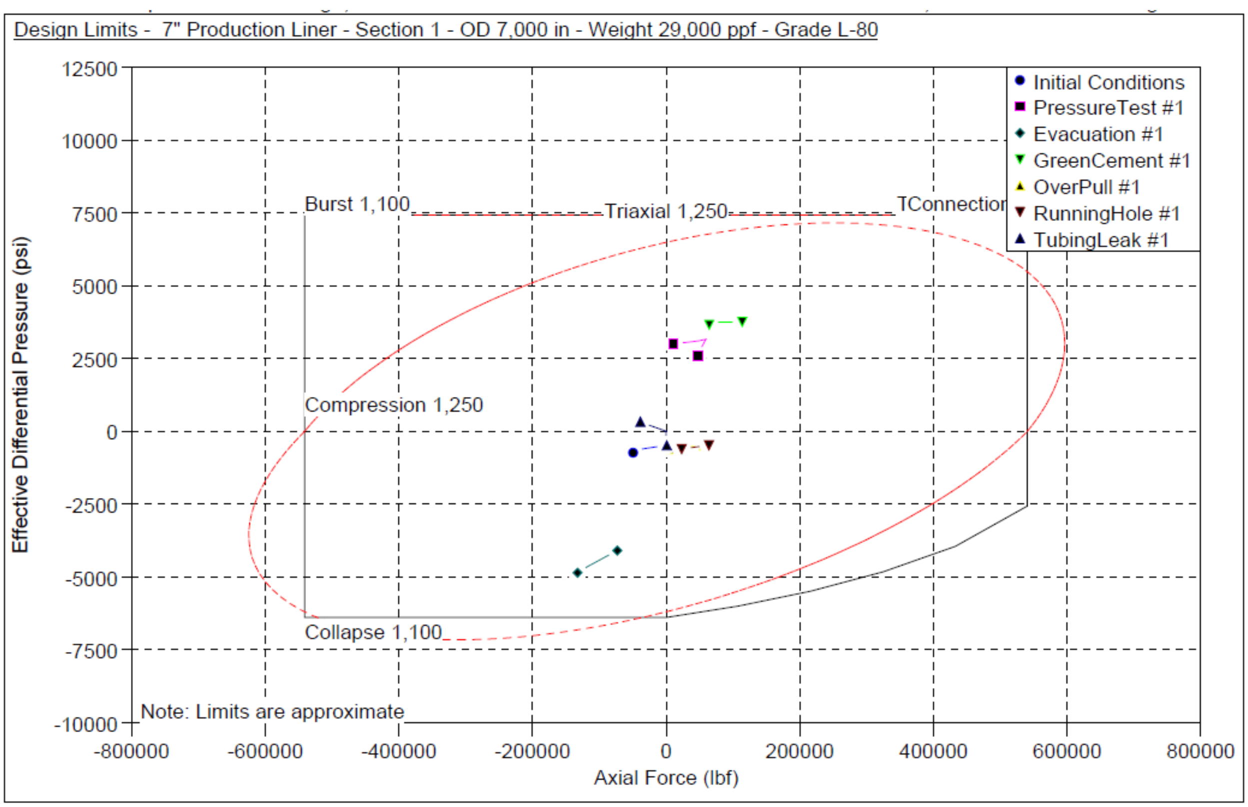


Figure 36 - Design limits plot for 7" production liner

3.3.1.2 Analysis and Discussion

One of the most eye-catching facets of the results is the abundance of "white space" between the load curves and the limit curves. When one considers that this is a realistic well design for a representative pressure profile, we see that the well is in fact overdesigned.

An interesting point to make is the overuse of premium connections[18]. Premium connections allow metal-to-metal sealing and highly improved tensile and collapse ratings[19]. Premium connections are designed for special applications, where the axial or torsional loading usually exceeds that which typical API threads will accommodate, or otherwise where downhole conditions dictate their use (Byrom, 2007). Whilst this is a hypothetical wellbore example, it is worth highlighting the lack of API threaded casing available for design. This argument may be invalid for a highly deviated well, but when looking at a vertical exploration well, the use of standard API threaded casing may be all that is required for shallow strings based on the remote risk of gas migration through three casing strings.

The well is drilled with commonplace large hole sizes to accommodate the respective casing strings. Whilst this reduces the risk of downhole problems when running casing (e.g. becoming stuck), it does introduce the adverse effect of cuttings build-up at the casing shoe. As fluid flows from one hole diameter to a larger, annular velocities will decrease. This is typically not a problem with 8-1/2" open hole into 9-5/8" casing, but can be a problem from 12-1/4" open hole into 17-1/2" casing. The sudden decrease in annular velocity may cause cuttings to fall out of suspension.

[18] Otherwise known as proprietary thread casing connections
[19] Some of the higher end premium connections offer equal tension and collapse performance.

Raising the flow rate may help to abate this issue, but one must be mindful of ECD's and ensure the minimum horizontal stresses is not exceeded. This well design is typical of exploration wells in the Barents Sea, since the casing selection is seldom dictated by the downhole pressure profile.

3.3.2 Norwegian Sea Conventional Well Design

3.3.2.1 Basis of Design and Results

One of the major challenges associated with Norwegian Sea drilling is the variation in water depth. The selected location of the well has taken the waters depths of a 20km radius into account and used the weighted average to establish a baseline. From here, the well design is based on regional practices with reasonable assumptions made throughout. The general well schematic is shown below in Figure 37.

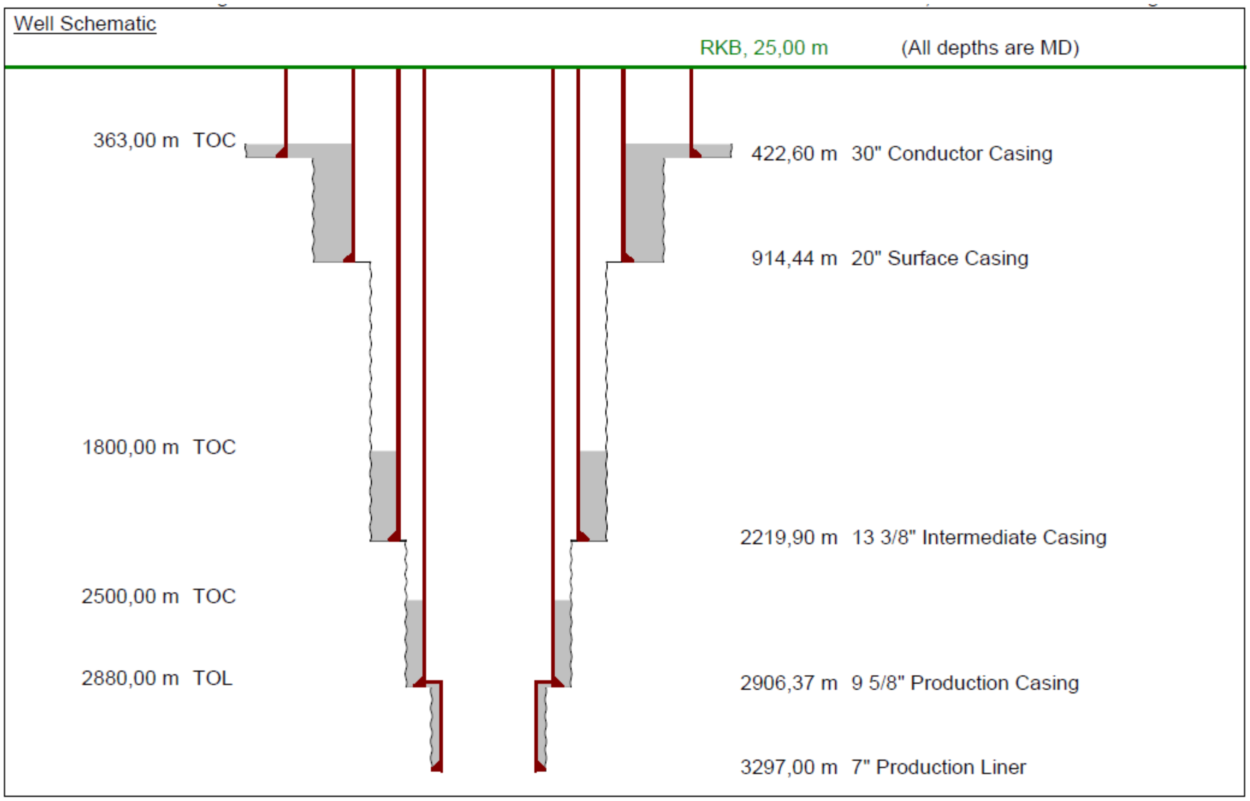


Figure 37 – Norwegian Sea study well general schematic

Casing Summary	
Conductor Casing	30" 157.5 lb/ft X-42 BTC (Range III)
Surface Casing	20" 113 lb/ft N-80 TSH-ER (Range III)
Intermediate Casing 1	13-3/8" 72 lb/ft P-110 VAM21 (Range III)
Intermediate Casing 2	9-5/8" 53.5 lb/ft P-110 VAM21 (Range III)
Production Liner	7" 32 lb/ft P-110 VAMTOPHC (Range III)

Table 9 - Norwegian Sea Conventional Well: Casing Summary

30" Conductor

Collapse, burst and axial forces were not considered as part of this analysis, since they are typically not an issue for this casing string.

<u>20" Surface Casing</u>

The collapse criteria assumed collapse during cementing, which assumed wet cement in the annulus and seawater as the displacement fluid. Cement is brought up to surface. Additionally, a fluid drop due to thief zone was assumed as the second worst-case collapse scenario. The inside fluid level drops until the bottom hole pressure is equal to that of a sea water gradient.

The burst criteria assumed the maximum possible internal being equal to the next hole section. An oil gradient has been assumed, since a gas kick is very unlikely. The external profile assumes cement mix water. Two pressure testing scenarios are also presented – a grey test and green test. Both tests are considered since in practice, we often need to conduct green tests where grey tests are not possible. The test pressure is 2250 psi, which was calculated based on the maximum oil to surface pressure.

The axial design criteria assumes the weight of casing and mud as the primary factor. Since this is a vertical well, there are no bending forces incorporated. Pressure testing axial loading has been considered.

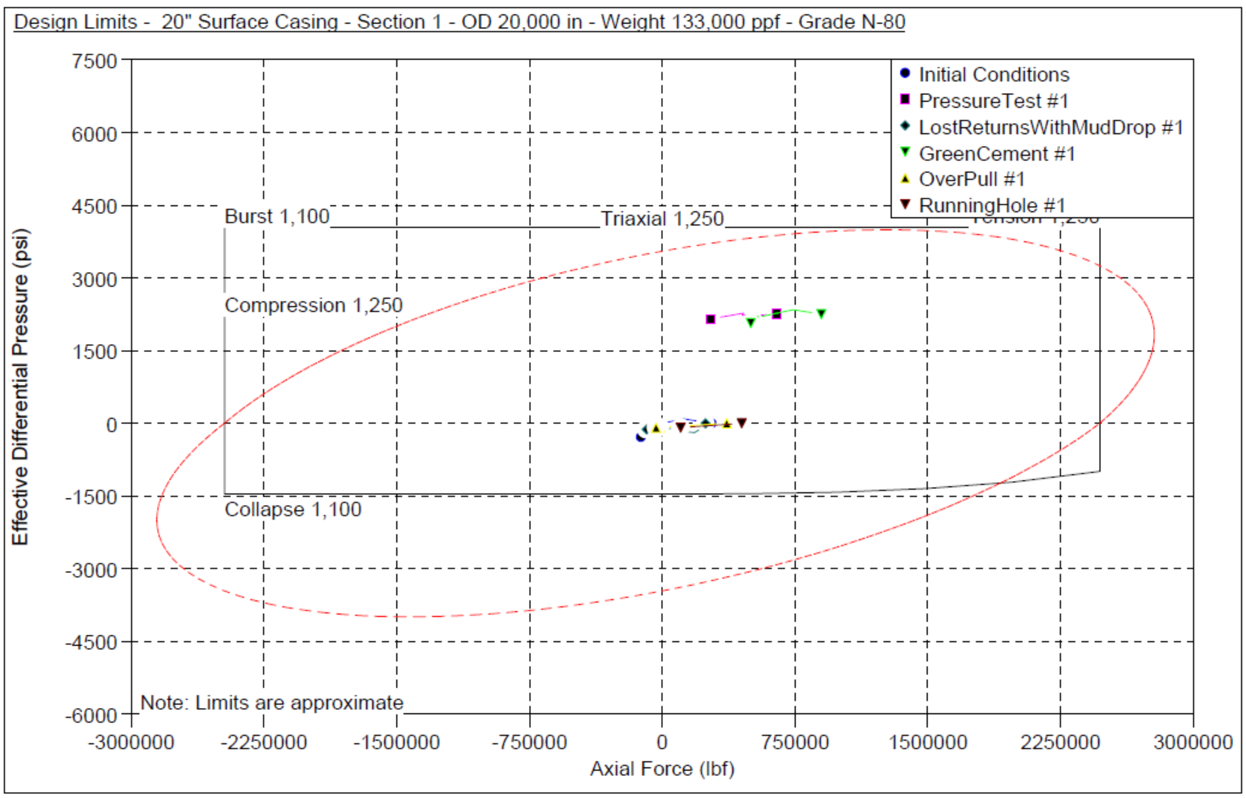


Figure 38 - Design limits plot for 20" surface casing

13-3/8" Intermediate Casing

A fluid drop due to thief zone was assumed as the second worst-case collapse scenario. The inside fluid level drops until the bottom hole pressure is equal to that of a sea water gradient.

The burst design is based once again on an oil-filled casing scenario, with figures adjusted for wear and tear of the pipe. The external pressure assumes the cement mix water, with mud above. The test pressure is 4650 psi, which is based on the maximum pressure.

Axial design criteria as per previous string.

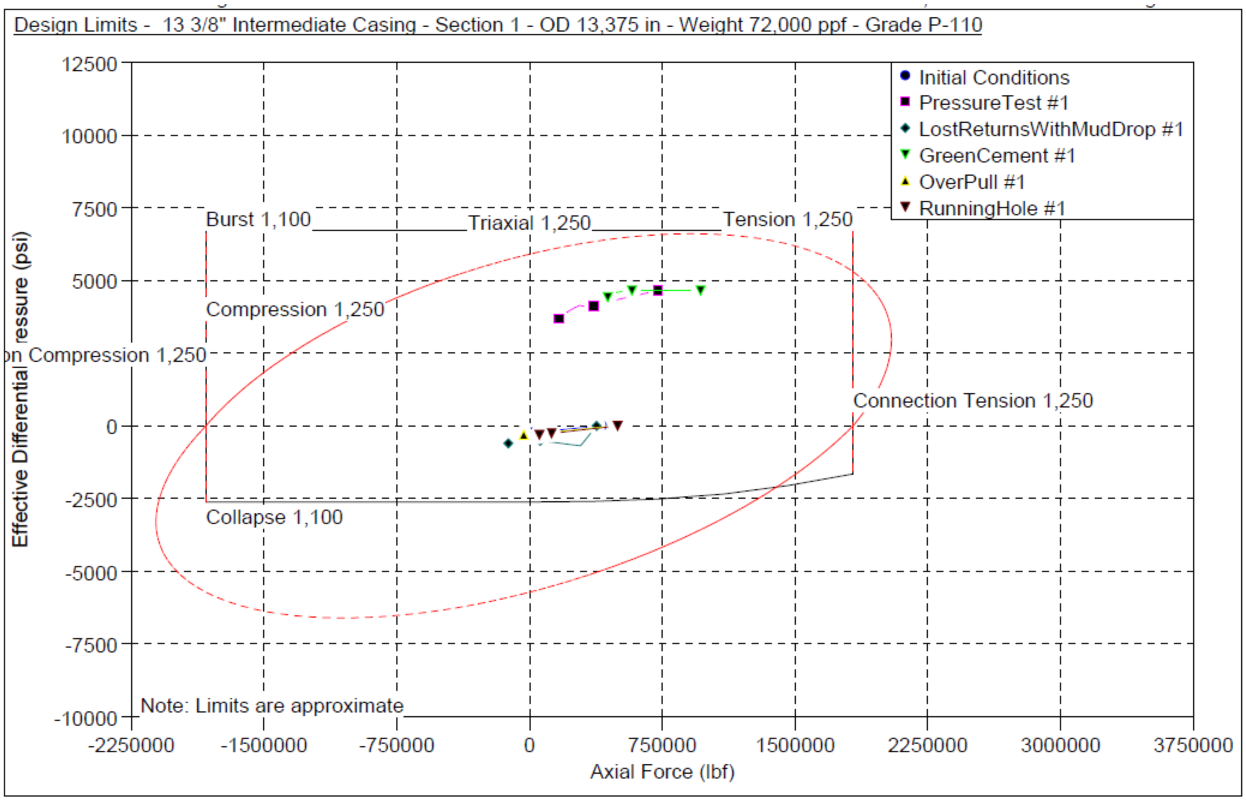


Figure 39 - Design limits plot for 13-3/8" intermediate casing

9-5/8" Intermediate Casing

The collapse loading involves a thief zone as per previous string. The outer profile assumes cement mix water, with mud above. In addition, full evacuation to gas has been assumed as worst-case collapse loading with the same external profile as the thief zone. Calculations are adjusted for slight corrosion (10% reduction in burst/collapse/tensile performance), since this is a post-drill load.

The worst-case burst loading is a shallow tubing leak, which assumes a leak in the production tubing, below the tubing hanger. There is assumed to be kill weight brine in the casing with wellhead gas production pressure above. Calculations incorporate casing wear. The test pressure is 5300 psi, which is based on the maximum gas to surface pressure. All production burst loads assume deteriorated mud in the external profile (8.6 ppg).

The axial design criteria are assumed to be similar to the previous string.

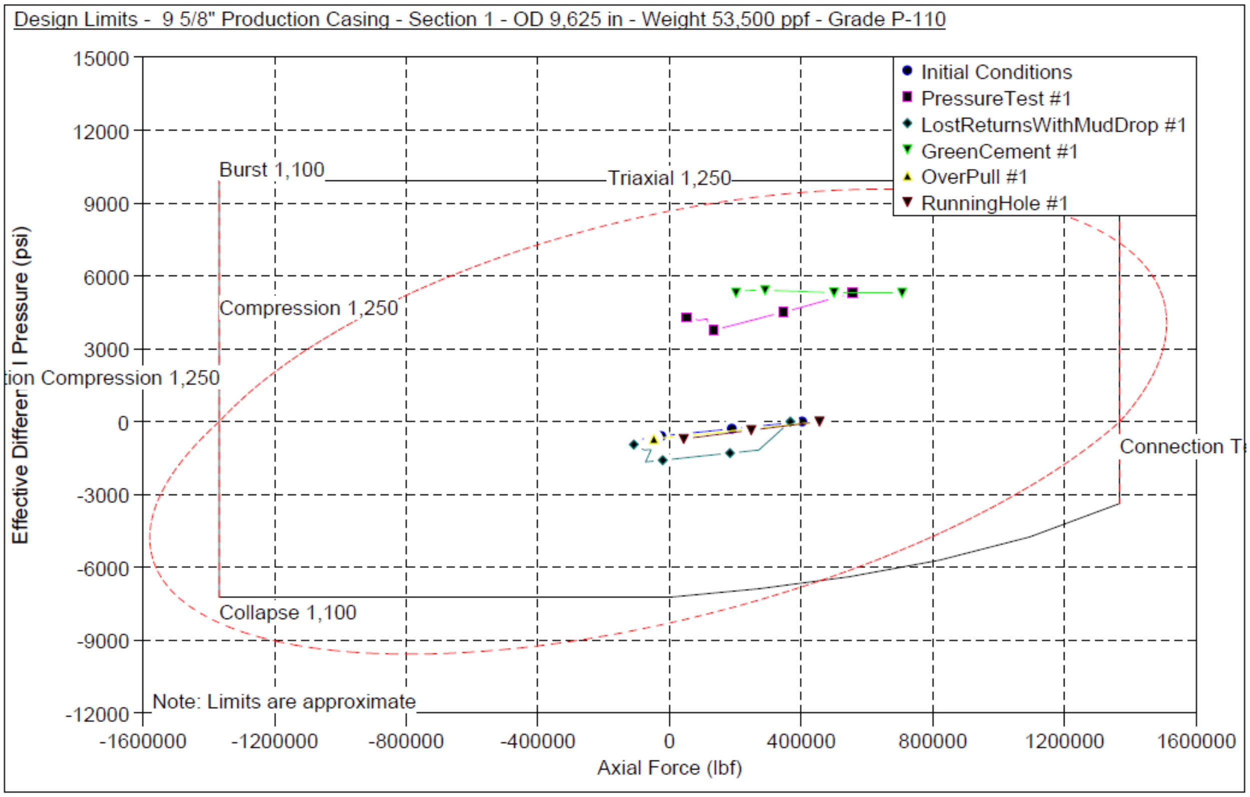


Figure 40 - Design limits plot for 9-5/8" intermediate casing

<u>7" Production Liner</u>

The collapse scenario for the production liner involves formation pressure acting on plugged perforations during normal production. The inner liner is assumed to be filled with produced gas and the external profile is assumed to be formation pressure. Loads adjusted for corrosion.

The burst criteria is based on bullheading operations. The internal pressure profile is equal to the kill weight mud and the external profile is assumed to be cement mix water. The test pressure is 9400 psi (at liner hanger), which is based on the maximum gas to surface pressure. All production burst loads assume deteriorated mud in the external profile (8.6 ppg).

Note: Shallow tubing leak has been factored in, to the calculations, to allow for flexibility in placing the tubing packer either in the liner, or in the previous casing string.

The axial design is based on casing installation and cementing.

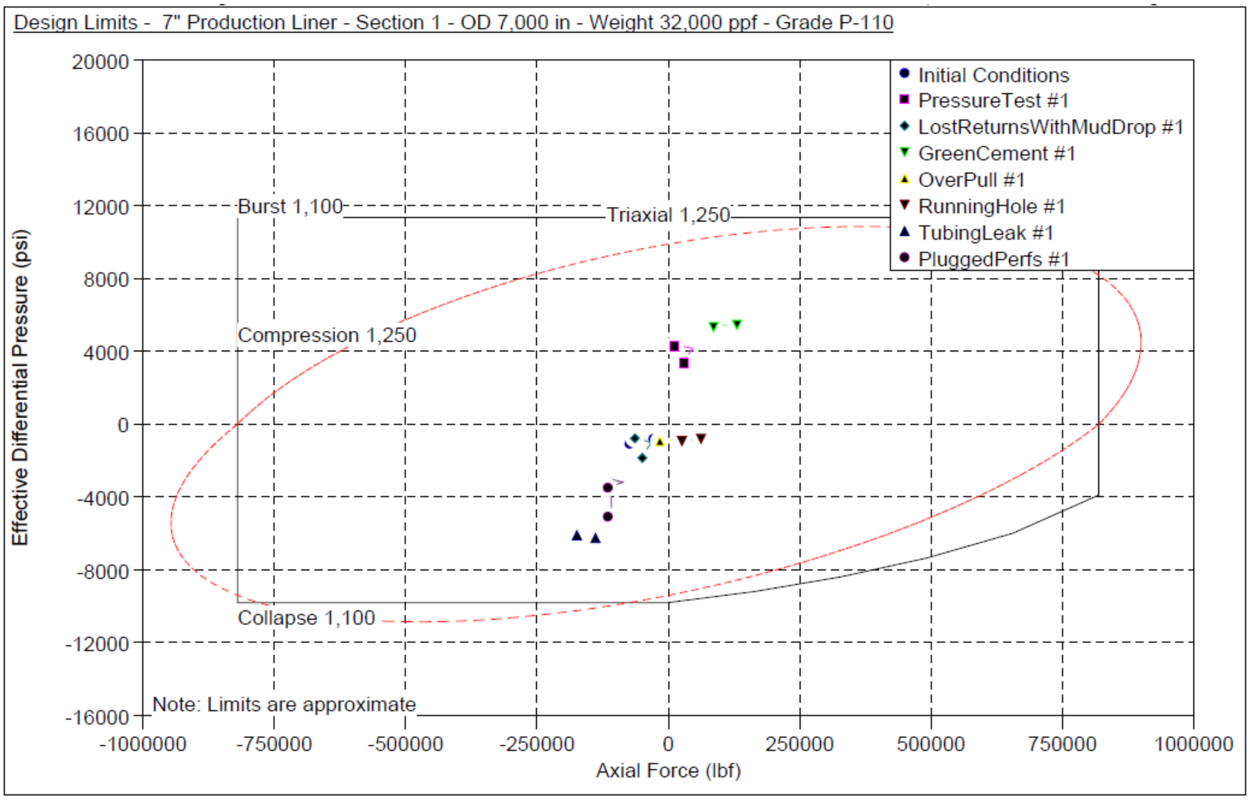


Figure 41 - Design limits plot for 7" production liner

3.3.2.2 Analysis and Discussion

This well is very similar in design to the foregoing Barents Sea example. In this example, however, we notice slightly better design fits, due to the higher pressures experienced downhole and the tighter mud window. The casing design in this instance is overdesigned for compressive effects, and no doubt a lower strength casing may still suffice. The Norwegian Sea is unique for its varying water depths and whilst this analysis has assumed its water depth based on the assumptions stated previously, it would be important to consider the thermal effects for any wells designed in this region. Heat from production fluids interacting with a near sub-zero wellhead will result in cyclic thermal loading.

3.3.3 North Sea Conventional Well Design

3.3.3.1 Basis of Design and Results

The North Sea conventional well design is based on regional similarities for exploration and appraisal wells, with a weighted average water depth. The schematic for the North Sea study well is shown below in Figure 42.

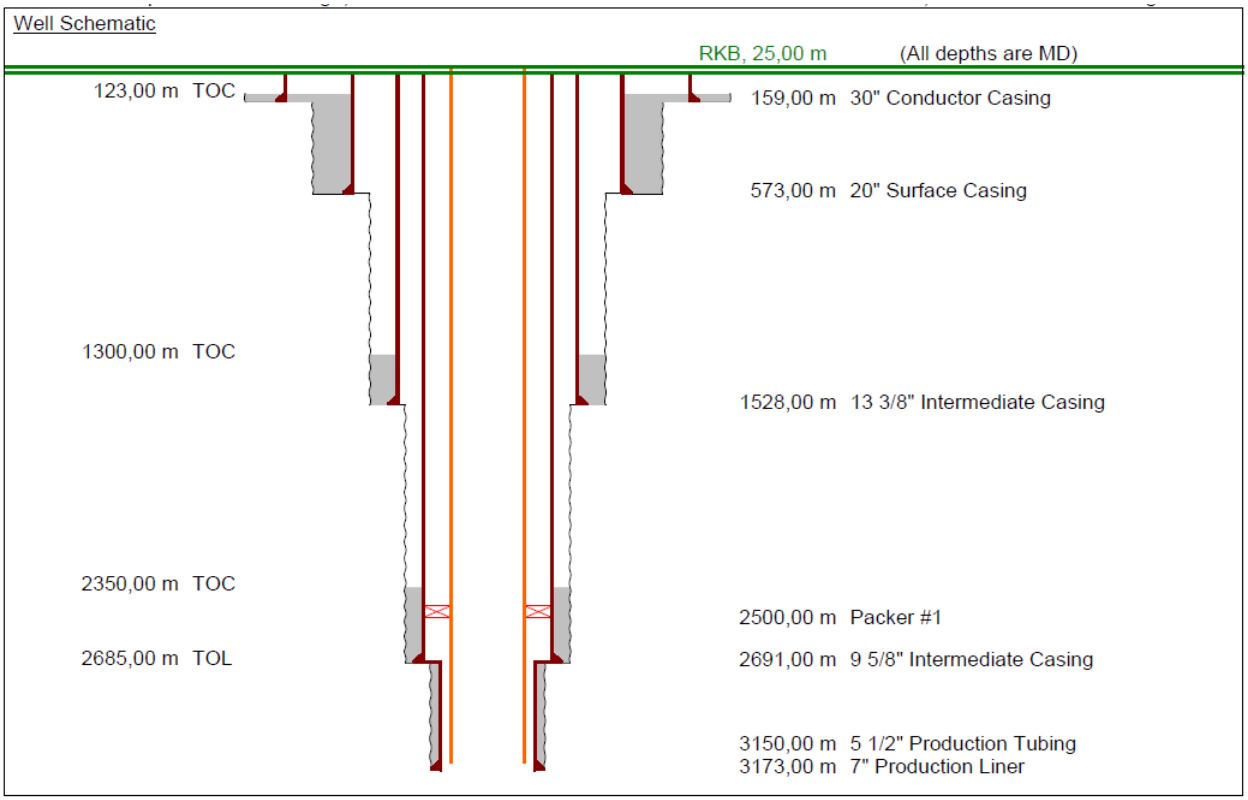


Figure 42 - North Sea study well general schematic

Casing Summary	
Conductor Casing	30” 157.5 lb/ft X-42 BTC (Range III)
Surface Casing	20” 113 lb/ft N-80 TSH-ER (Range III)
Intermediate Casing 1	13-3/8” 72 lb/ft P-110 VAM21 (Range III)
Intermediate Casing 2	9-5/8” 53.5 lb/ft P-110 VAM21 (Range III)
Production Liner	7” 32 lb/ft P-110 VAMTOPHC (Range III)

Table 10 - North Sea Conventional Well: Casing Summary

30” Conductor

Collapse, burst and axial forces were not considered as part of this analysis, since they are typically not an issue for this casing string.

20” Surface Casing

The collapse criteria assumed collapse during cementing, which assumed wet cement in the annulus and seawater as the displacement fluid. Cement is brought up to surface. Additionally, a fluid drop due to thief zone was assumed as the second worst-case collapse scenario. The inside fluid level drops until the bottom hole pressure is equal to that of a sea water gradient.

The burst criteria assumed the maximum possible internal being equal to the next hole section. An oil gradient has been assumed, since a gas kick is very unlikely. The external profile assumes cement mix water. Two pressure testing scenarios are also presented – a grey test and green test. Both tests are considered since in practice, we often need to conduct green tests where grey tests are not possible. The test pressure is 2400 psi, which was calculated based on the maximum oil to surface pressure.

The axial design criteria assumes the weight of casing and mud as the primary factor. Since this is a vertical well, there are no bending forces incorporated. Pressure testing axial loading has been considered.

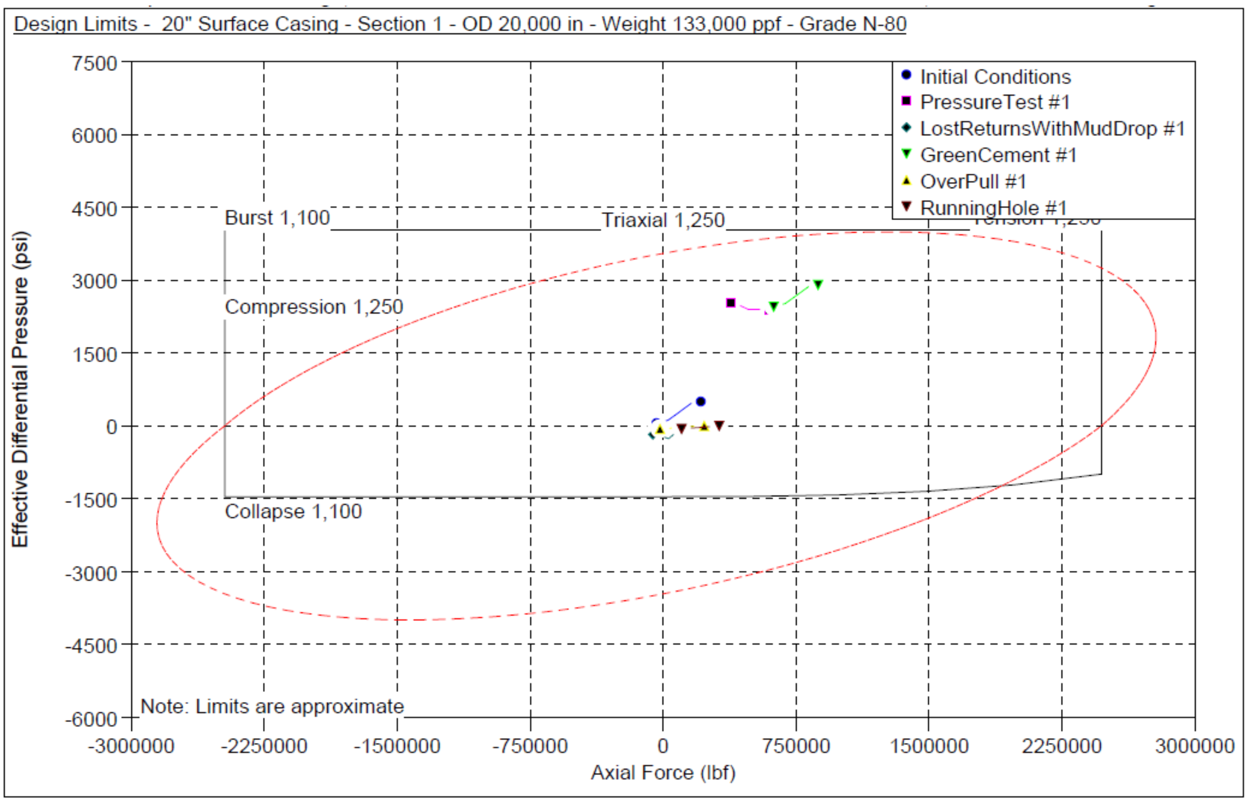


Figure 43 - Design limits plot for 20" surface casing

<u>13-3/8" Intermediate Casing</u>

A fluid drop due to thief zone was assumed as the second worst-case collapse scenario. The inside fluid level drops until the bottom hole pressure is equal to that of a sea water gradient.

The burst design is based once again on an oil-filled casing scenario, with figures adjusted for wear and tear of the pipe. The external pressure assumes the cement mix water, with mud above. The test pressure is 4300 psi, which is based on the maximum pressure.

Axial design criteria as per previous string.

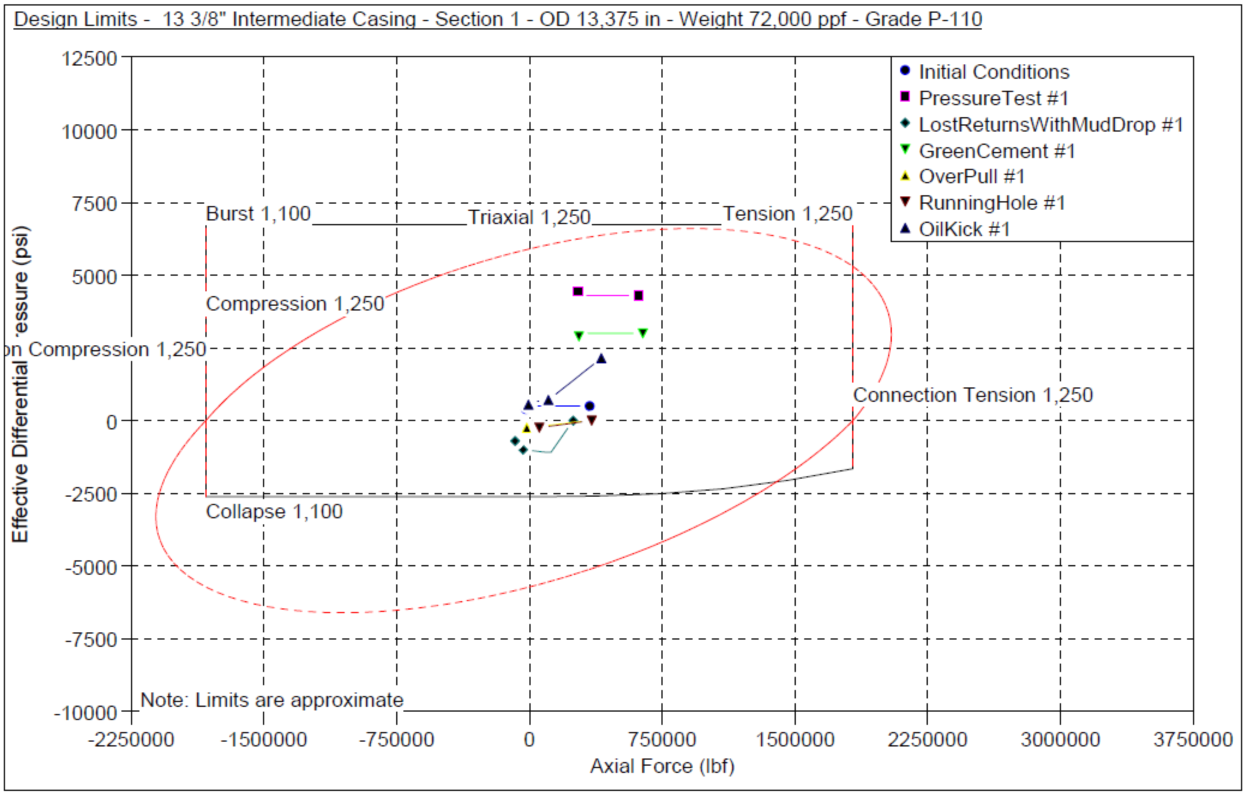


Figure 44 - Design limits plot for 13-3/8" intermediate casing

<u>9-5/8" Intermediate Casing</u>

The collapse loading involves a thief zone as per previous string. The outer profile assumes cement mix water, with mud above. In addition, full evacuation to gas has been assumed as worst-case collapse loading with the same external profile as the thief zone. Calculations are adjusted for slight corrosion (10% reduction in burst/collapse/tensile performance), since this is a post-drill load.

The worst-case burst loading is a shallow tubing leak, which assumes a leak in the production tubing, below the tubing hanger. There is assumed to be kill weight brine in the casing with wellhead gas production pressure above. Calculations incorporate casing wear. The test pressure is 6200 psi, which is based on the maximum gas to surface pressure. All production burst loads assume deteriorated mud in the external profile (8.6 ppg).

The axial design criteria are assumed to be similar to the previous string.

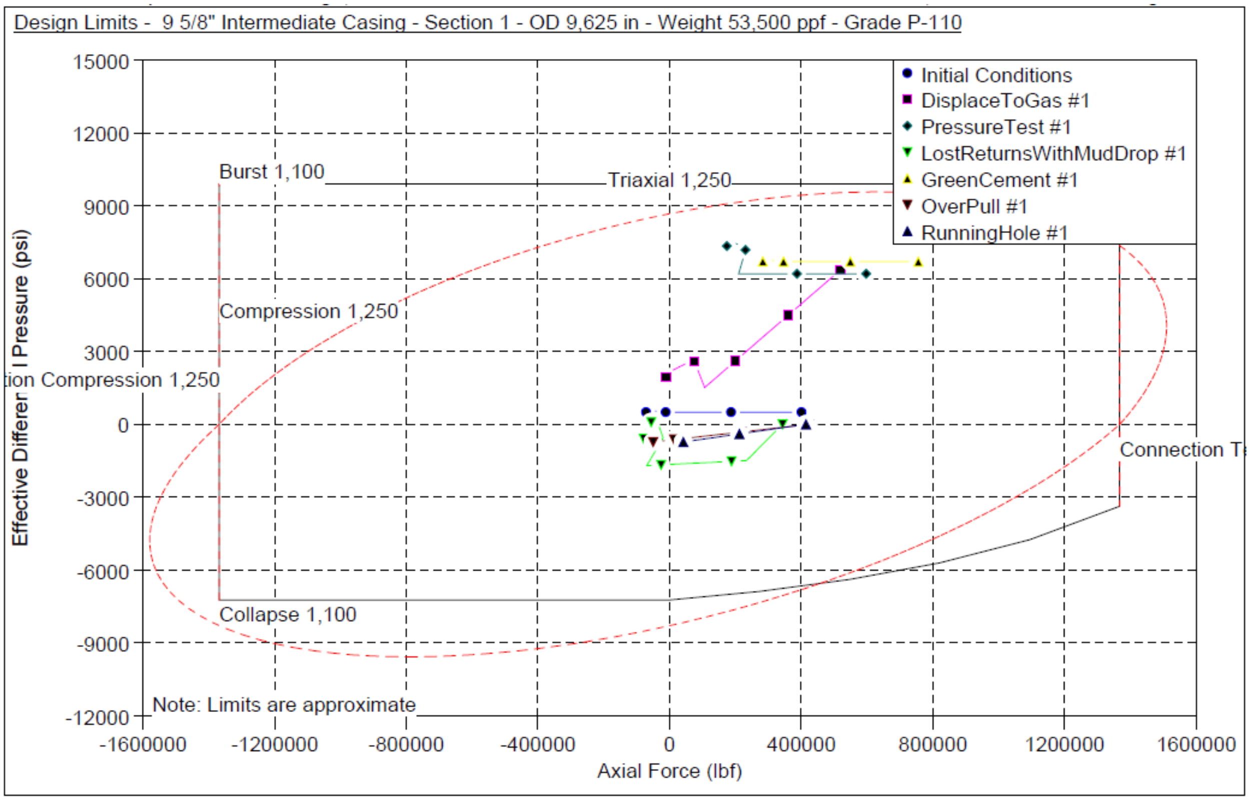


Figure 45 - Design limits plot for 9-5/8" intermediate casing

<u>7" Production Liner</u>

The collapse scenario for the production liner involves formation pressure acting on plugged perforations during normal production. The inner liner is assumed to be filled with produced gas and the external profile is assumed to be formation pressure. Loads adjusted for corrosion.

The burst criteria is based on bullheading operations. The internal pressure profile is equal to the kill weight mud and the external profile is assumed to be cement mix water. The test pressure is 6800 psi (at liner hanger), which is based on the maximum gas to surface pressure. All production burst loads assume deteriorated mud in the external profile (8.6 ppg).

Note: Shallow tubing leak has been factored in, to the calculations, to allow for flexibility in placing the tubing packer either in the liner, or in the previous casing string.

The axial design is based on casing installation and cementing.

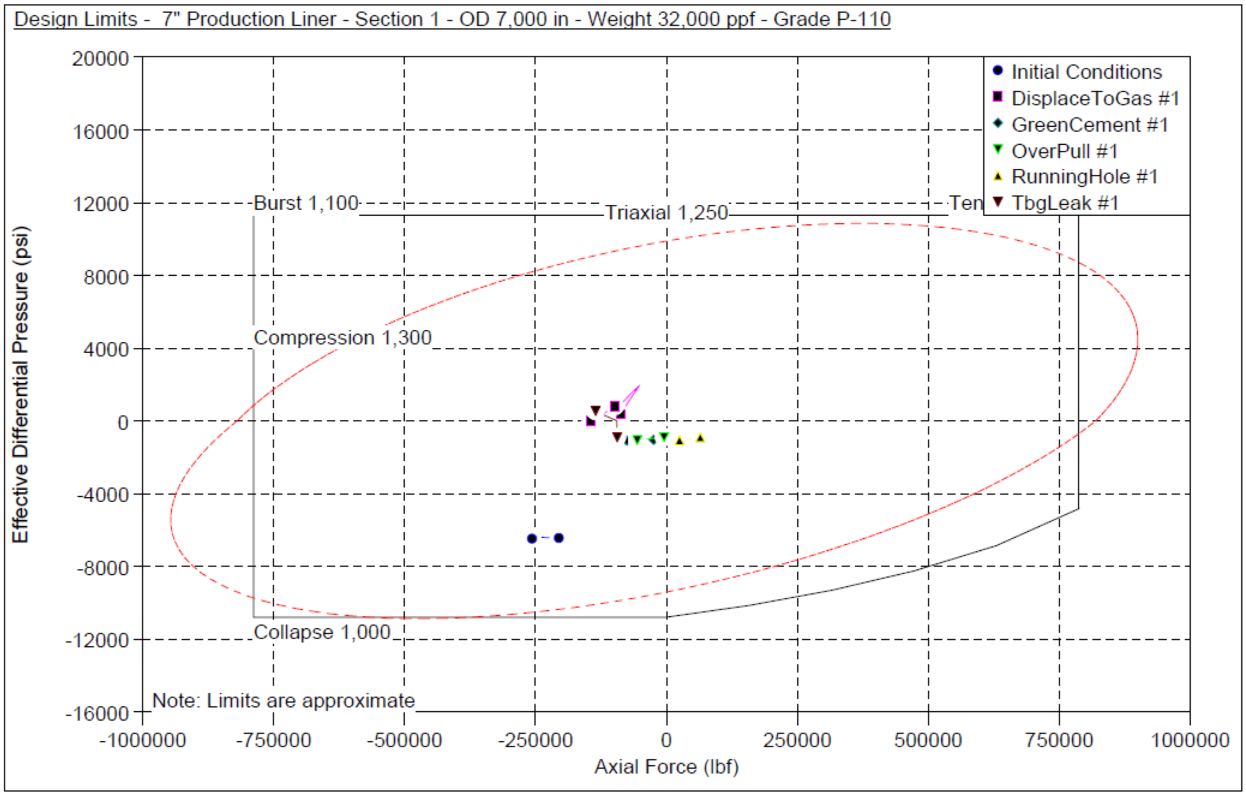


Figure 46 - Design limits plot for 7" production liner

3.3.3.2 Analysis and Discussion

This well is similar to the two other conventional wells, and a similar analysis applies. The casing design in this instance, whilst being the best fit of the three conventional study wells, is still overdesigned for its purposes.

3.4 Slender Well Design Opportunities

3.4.1 General Assumptions

As with the conventional well designs, one design is provided for each region of the Shelf. The purpose of these designs is to demonstrate the technical acceptability of scaling down from the conventional designs to slimmer wellbore profiles. One notes that for each proposed design, the final string is unchanged from 7", thereby leaving production potential unhindered. For each design, the casing is assumed open to selection from all API/proprietary tubulars/connections – i.e. the designs are intended to be "made to measure", rather than calling on one's available inventory. For each design, the von Mises design plots are presented, with a subsequent analysis for each well.

Note: all design reports for each region are displayed at length in Appendix 5.2.

General Assumptions

For all well designs herein, we assume that the aforementioned unnamed company performs all operations. In addition, the general assumptions for the following well designs are:

- All designs are calculated using NORSOK D-010 design factors, as depicted below in Table 11. *Note: the casing loads are unchanged from the conventional designs, so as to allow an "apples-to-apples" comparison*;

Parameter	Design factor*	Supplementary requirement/information
Burst	1,10	
Collapse	1,10	
Axial	1,25	For well testing a design factor of 1,50 should be used to cater for pulling the packer free at the end of the test.
Tri-axial	1,25	Tri-axial design factors are not relevant for connections

*The above design factors are based on wall thickness manufacturing tolerance of minus 12,5%.

Table 11 - NORSOK D-010 wellbore design factors (Standards Norway, 2013)

When designing for burst, collapse and axial loading, the following load cases have been considered, as directed by NORSOK D-010:

Item	Description	Comments
1.	Gas kick	Size/volume and intensity to be defined
2.	Gas filled casing	Applicable to last casing above the reservoir and subsequent casings
3.	Production and/or Injection tubing leaks	Based on WDP. See 7.7.2 for multipurpose wells
4.	Cementing of casing	
5.	Leak testing casing	See 7.7.2 for multipurpose wells
6.	Thermal expansion of fluid in enclosed annuli	Collapse and burst
7.	Dynamic loads from running of casing, including over pull to free stuck casing	
8.	Permanent abandonment	See section 9.3.2

Table 12 - Load cases as required by NORSOK D-010 (Standards Norway, 2013)

- No calculations which require inputs from rig specifications have been performed, since doing so would remove the objectivity of the study;
- The study has only considered vertical exploration/appraisal wells, due to lack of available data to draw reasonable analogues for production wells;
- A flow diversion shoe (discussed in Chapter 2) is assumed to be run for any casing strings where the hole section has been under-reamed, so as to reduce ECD;
- Rotary-steerable BHA's with bi-centred drill bits are assumed for the purposes of ECD calculations where this is required, else fully-packed assemblies are used;
- No shallow gas is assumed present to be present;
- The gas gradient is assumed to be 0.1 psi/ft;
- The oil gradient is assumed to be 0.276 psi/ft;
- All cement columns (except the conductor strings) have a 150m tail cement;
- Friction factors are as per Landmark default settings;

- Casings de-rated for temperature effects;
- Casing corrosion effects (10% reduction in burst/collapse/tensile performance);
- Casing set depths based on allowable kick tolerances (as per NORSOK D-010) and competent formations;
- Casing running speeds are assumed to be 1ft/s for all cases;
- A 25m air gap is assumed for all wells;
- 50klbs overpull allowance for all strings

3.4.2 Barents Sea

3.4.2.1 Basis of Design and Results

The slender well design proposal for the Barents Sea is shown below in Figure 47. Casing loading criterion unchanged from earlier conventional design.

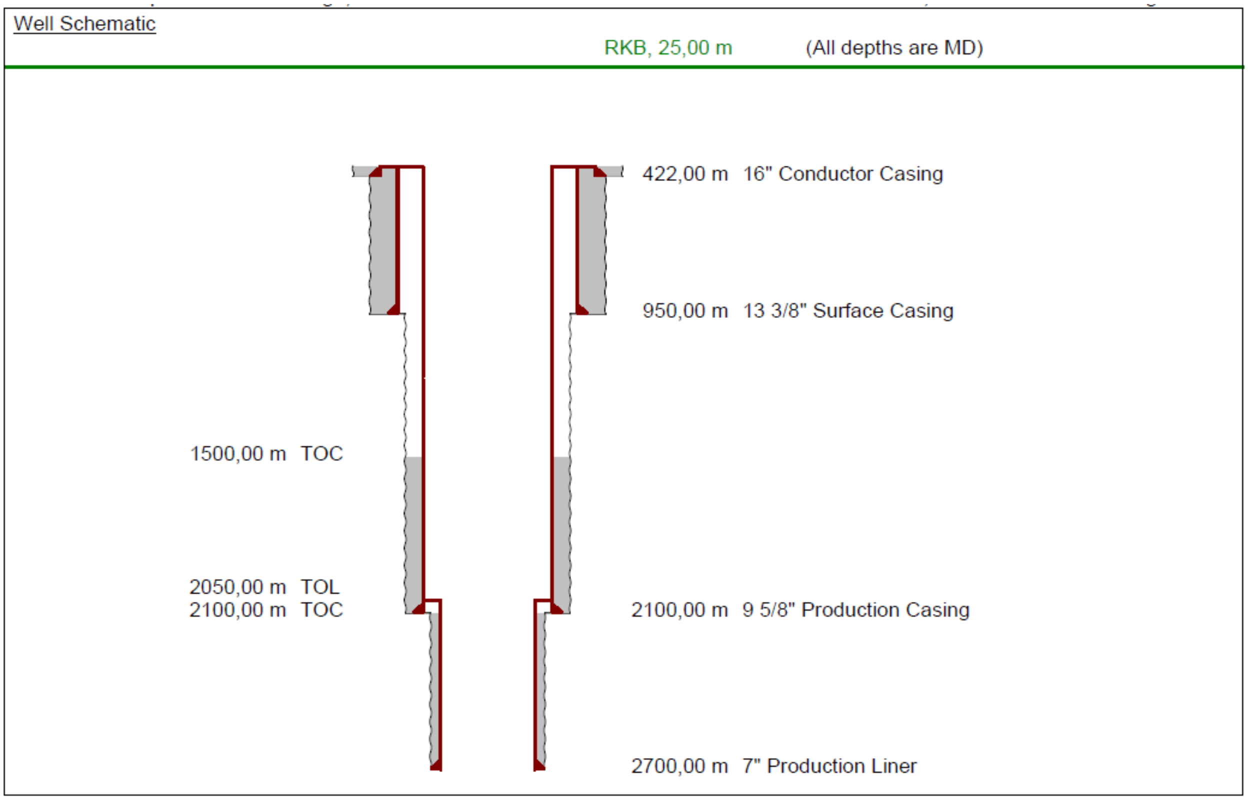


Figure 47 - Barents Sea slender well design proposal

Casing Summary	
Conductor Casing	16” 65 lb/ft H-40 BTC (Range III)
Surface Casing	13-3/8” 54.5 lb/ft J-55 BTC (Range III)
Intermediate Casing	9-5/8” 40 lb/ft M-56 BTC *(or premium if desired)* (Range III) 9-5/8” 47 lb/ft C-75 BTC *(or premium if desired)* (Range III)
Production Liner	7” 29 lb/ft C-75 BTC *(or premium thread if desired)* (Range III)

Table 13 - Barents Sea Slender Well Casing Summary

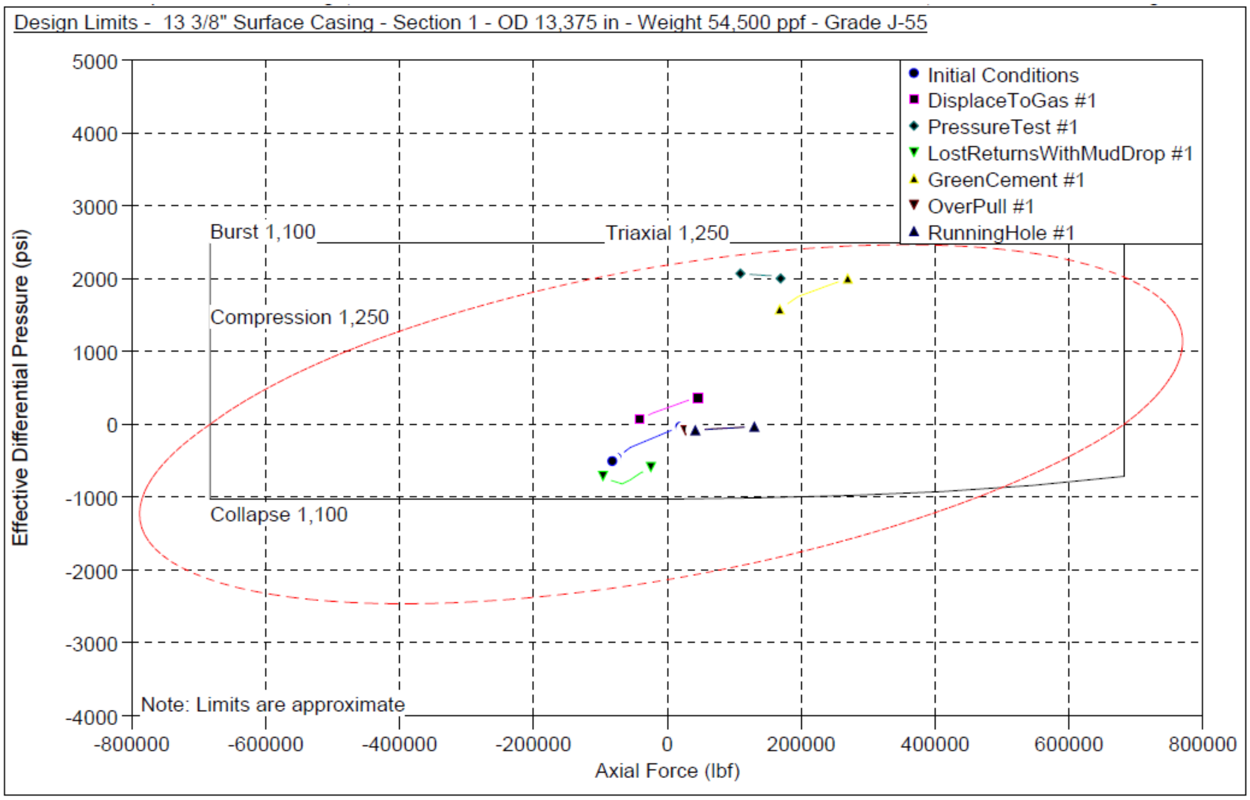


Figure 48 - Design limits plot for 13-3/8" surface casing

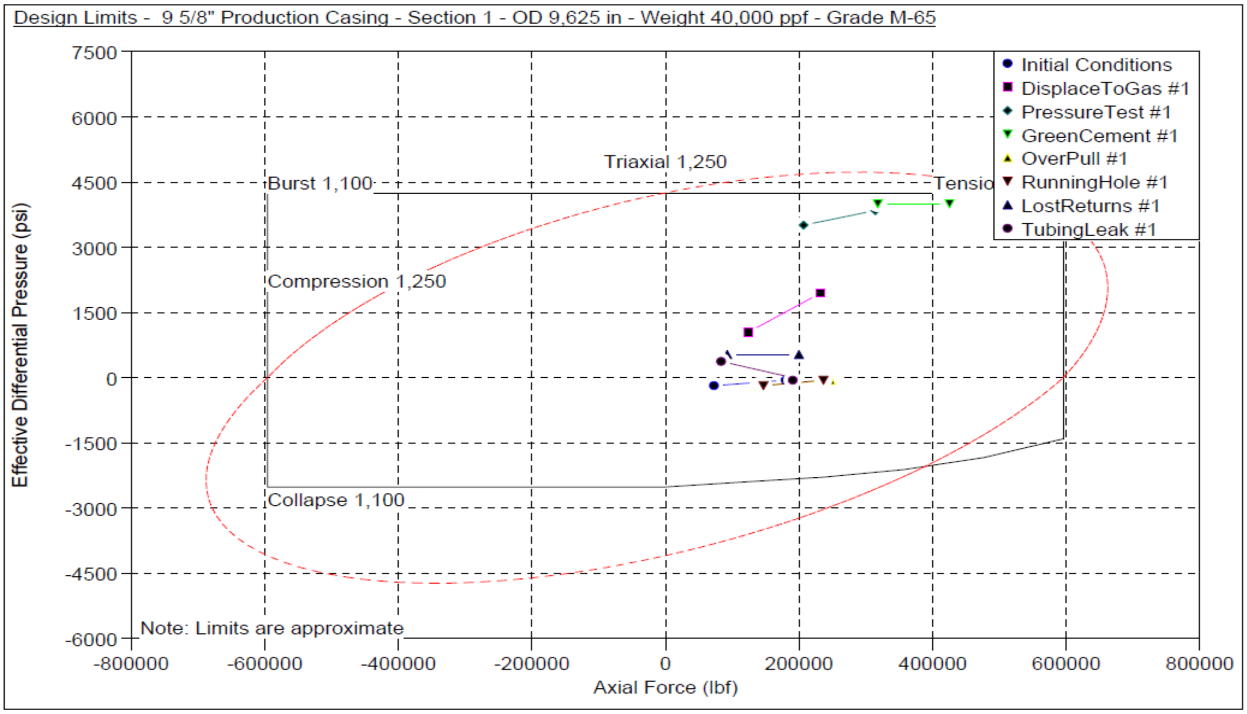


Figure 49 - von Mises design plot for 9-5/8" intermediate casing

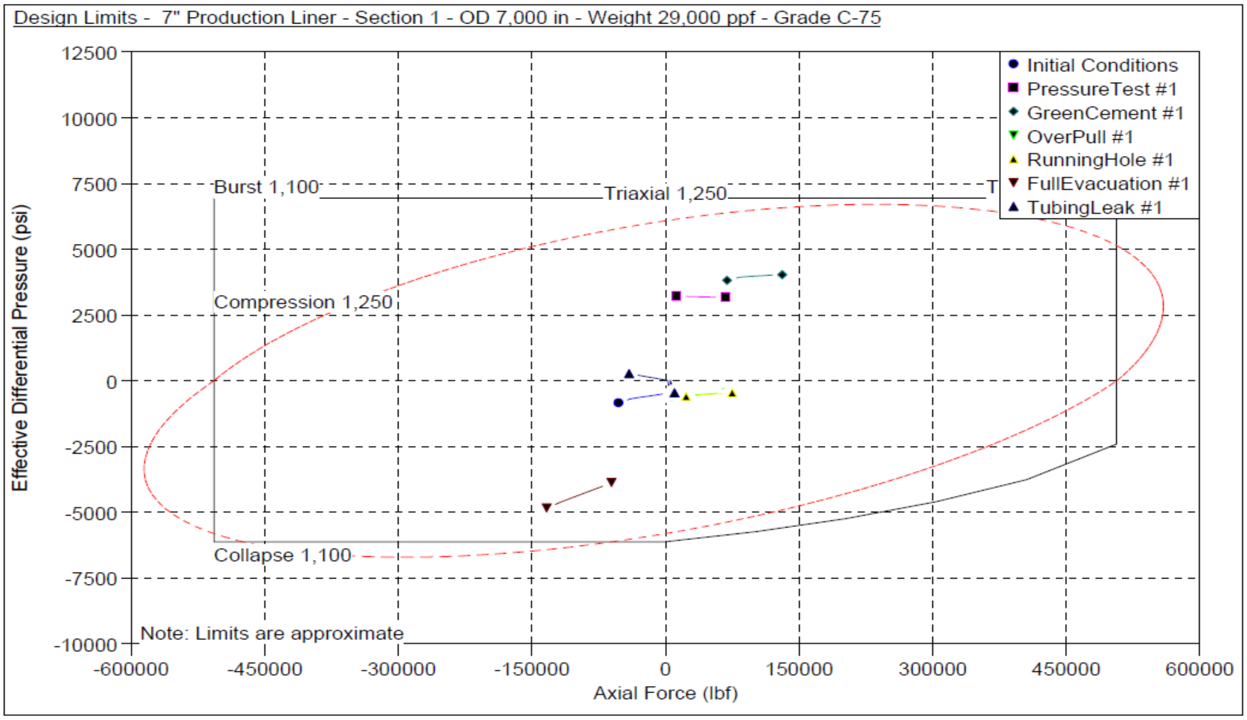


Figure 50 - Design limits plot for 7" production liner

3.4.2.2 Analysis and Discussion

It was decided to set the 13-3/8" surface casing at 950mMDRT. Normally, this would be too long of a surface hole section, but since the water depth dictates a 422mMDRT conductor set depth, we need only drill a 528m surface hole section. Since there is no overpressure, so it is assumed that the section can be drilled with a 9 ppg mud or else as low as possible. It is assumed that seepage losses due to the unconsolidated nature of shallow formations are acceptable.

The 9-5/8" string is designed to handle production loads. The section can be drilled with a 9ppg mud, with gradual weighting-up to 11.5 ppg by section TD. Due to the unconsolidated nature of Barents Sea drilling, it would be recommended to drill this section with an oil based mud or MEG treated mud, to avoid the formation of hydrates, all while paying close attention to mud returns.

The 7" liner running and setting is carries similar design limitations as the conventional design.

This particular well takes us from five casing strings, down to four, with the progression of sizes starting smaller (with the 16" conductor) and finishing with the required 7" production liner. We note that with standard API casing and couplings, it is indeed possible to execute a slimmer version of the Barents Sea standard conventional well. The risk of ECD's is acute, since we use a common progression of casing and hole sizes, whilst starting with a smaller diameter conductor. The use of alternate-path flow tools is unnecessary, since good hole clearance is obtained. Whilst standard API connections have been assumed throughout, the argument could be made to use premium connections, but this would only be required for the 9-5/8" and 7" casing strings (since the risk of formation fluid leaking through to the surface casing is minute), if and only if there gas is the expected produced fluid.

3.4.3 Norwegian Sea

3.4.3.1 Basis of Design and Results

The slender well design proposal for the Norwegian Sea is shown below in Figure 51. Casing loading criterion unchanged from earlier conventional design.

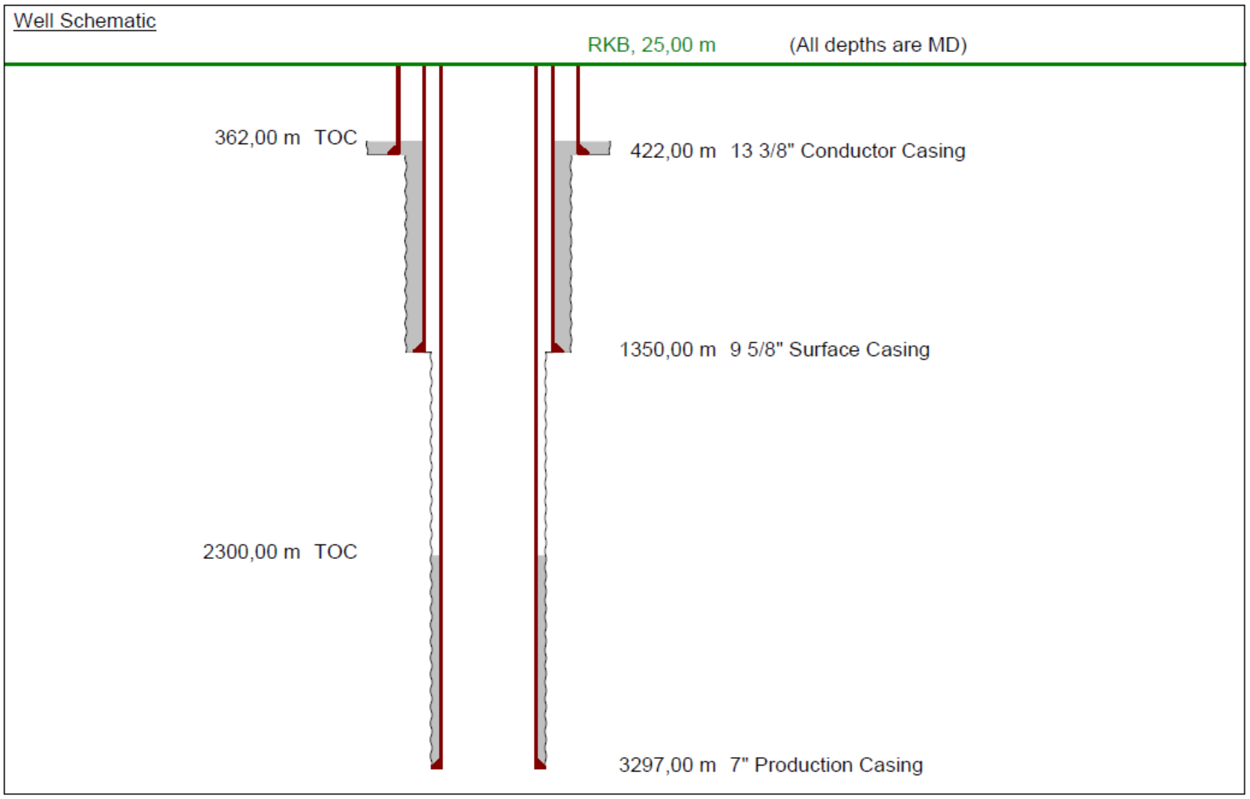


Figure 51 – Norwegian Sea slender well design proposal

Casing Summary	
Conductor Casing	13-3/8” 54.5 lb/ft J-55 BTC (Range III)
Surface Casing	9-5/8” 47 lb/ft P-110 BTC (Range III)
Production Liner	7” 32 lb/ft P-110 BTC *(or premium if desired)* (Range III)

Table 14 - Norwegian Sea Slender Well Casing Summary

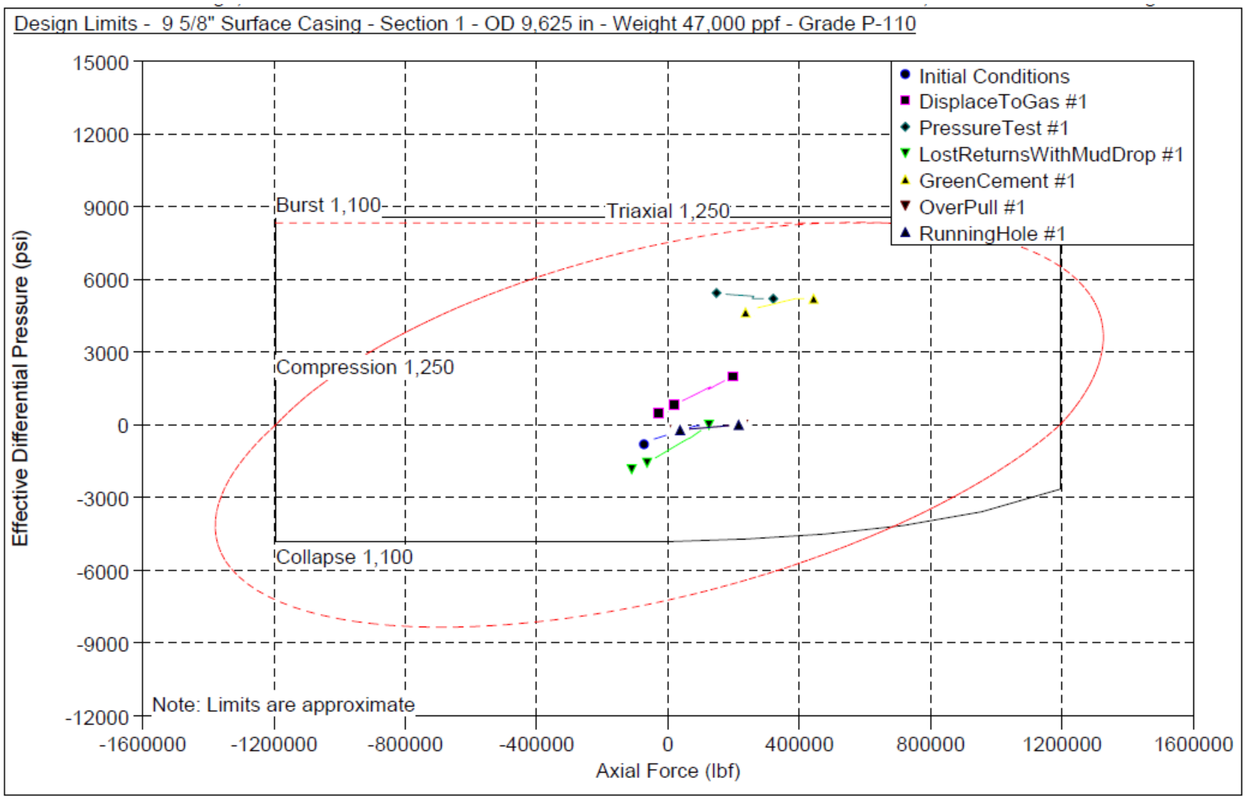


Figure 52 - Design limits plot for 9-5/8" surface casing

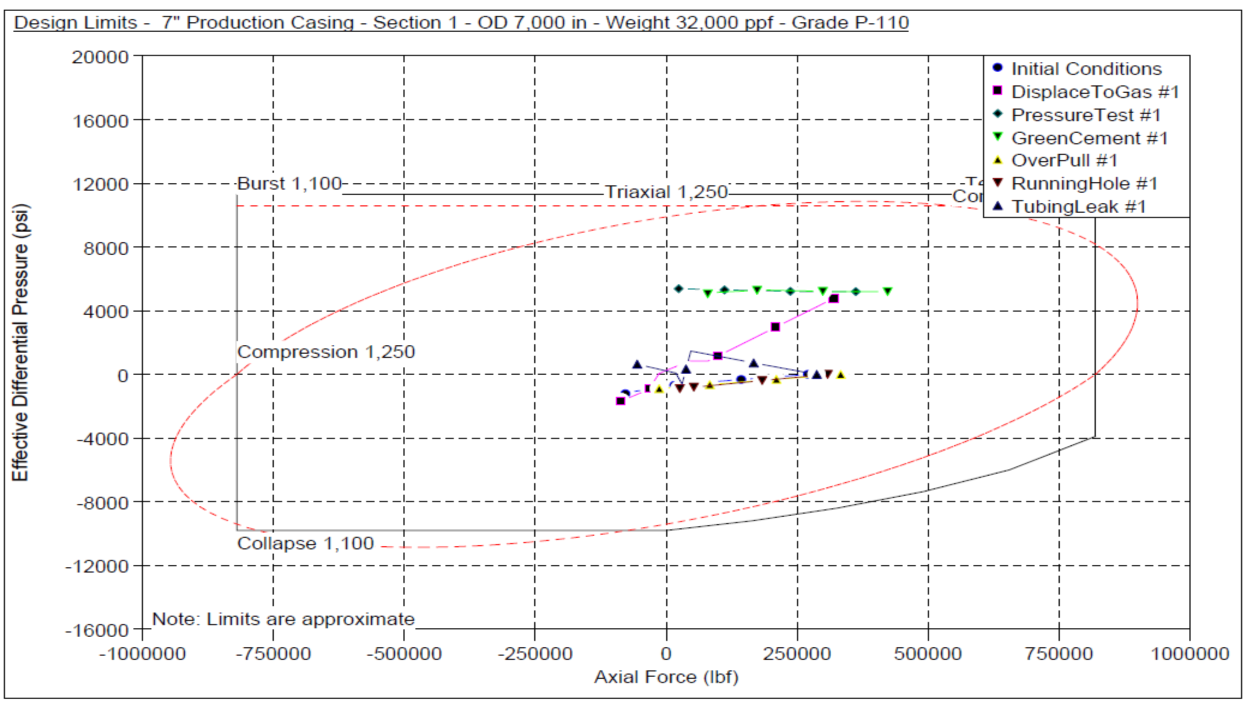


Figure 53 - Design limits plot for 7" production casing

3.4.3.2 Analysis and Discussion

The surface casing is cemented to surface in order to provide structural integrity for the production casing string. This section can be commenced with a 9 ppg mud or ALARP, eventually weighting-up to 10.5 ppg at section TD. The greatest risk with this design is becoming stuck when drilling production hole, or running the production casing. The long hole section may become unstable if left open for long periods of time. Drilling with casing would be a feasible option for this type of well since it would reduce the time between drilling and cementing casing (since borehole instability is time dependent) and hence it would be recommended to weight up drilling fluid by 0.5 ppg before pulling out of hole, if conditions allow. Surface hole casing drilling has been successfully implemented in other offshore markets and has a longstanding history of delivering stable wellbores (Askew, et al., 2011).

This well is the best representation of how fewer casing strings can achieve the same result – less is more. We note that it is indeed possible to achieve this design from a technical standpoint.

3.4.4 North Sea

3.4.4.1 Basis of Design and Results

The slender well design proposal for the North Sea is shown below in Figure 54. Casing loading criterion unchanged from earlier conventional design.

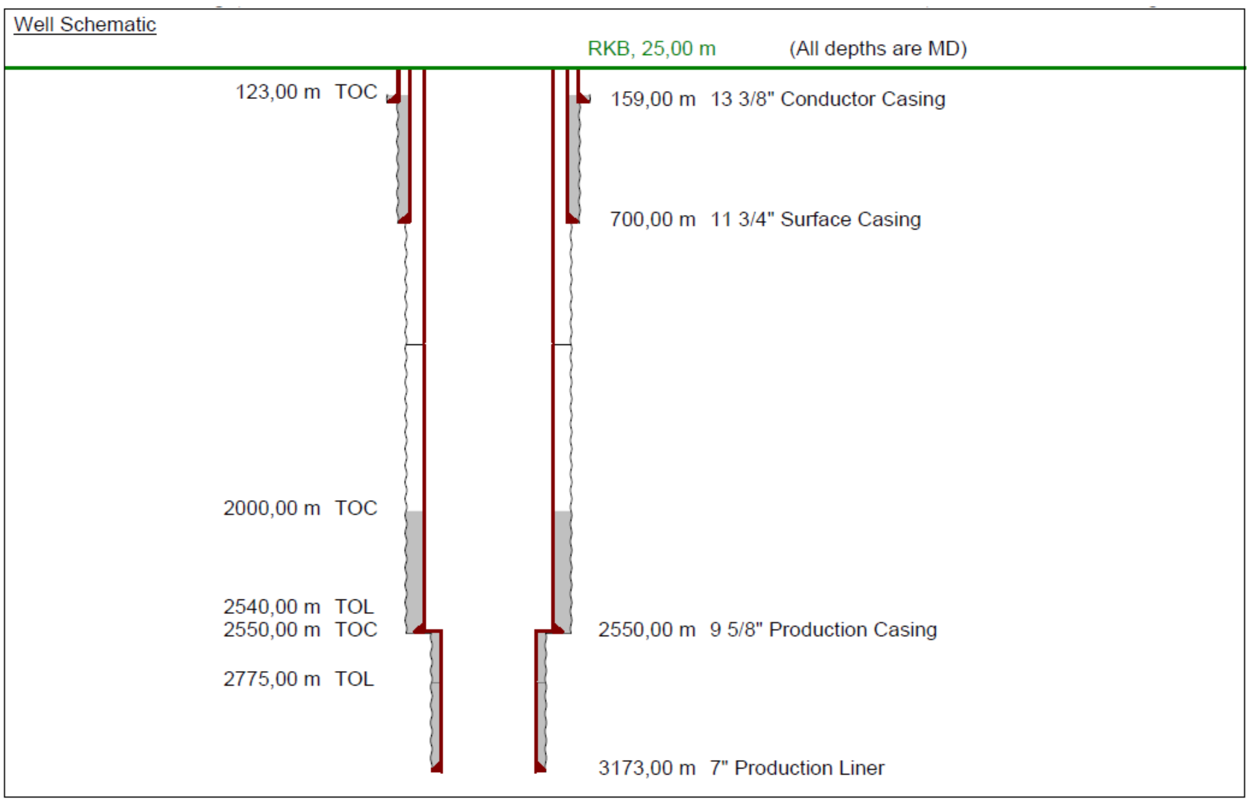


Figure 54 - North Sea slender well design proposal

Casing Summary	
Conductor Casing	13-3/8” 48 lb/ft H-40 BTC (Range III)
Surface Casing	11-3/4” 5 lb/ft J-55 BTC (Range III)
Intermediate Casing	9-5/8” 53.5 lb/ft C-90 BTC *(or premium if desired)* (Range III) 9-5/8” 53.5 lb/ft C-75 BTC *(or premium if desired)* (Range III)
Production Liner	7” 32 lb/ft P-110 BTC *(or premium if desired)* (Range III)

Table 15 - North Sea Slender Well Casing Summary

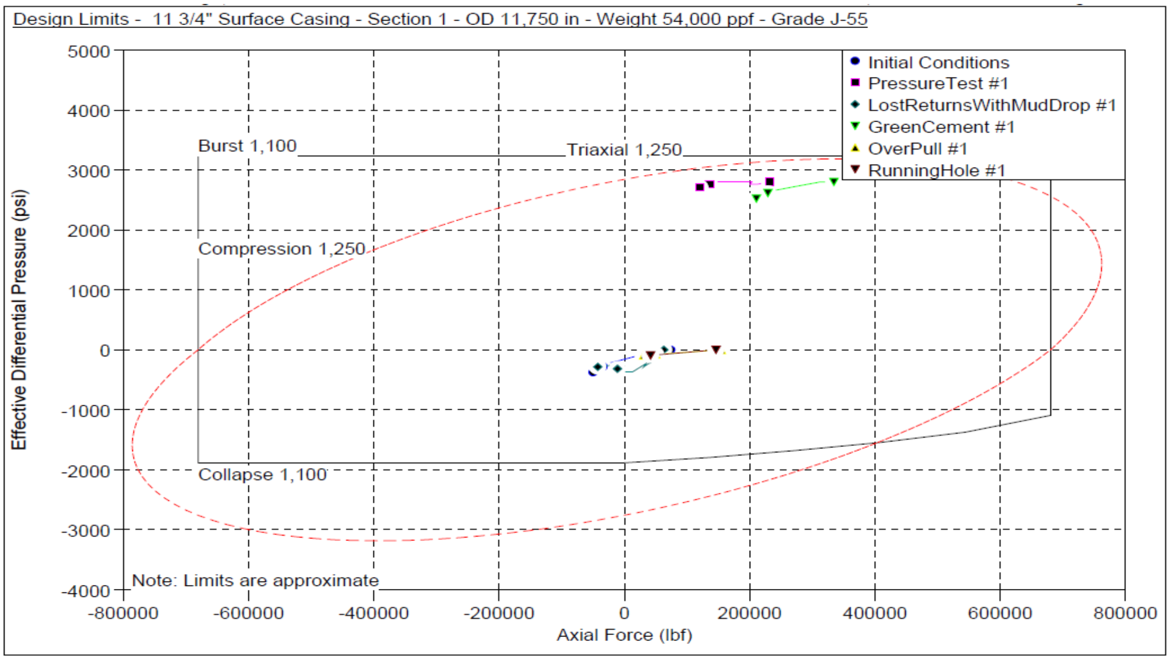


Figure 55 - Design limits plot for 11-3/4" surface casing

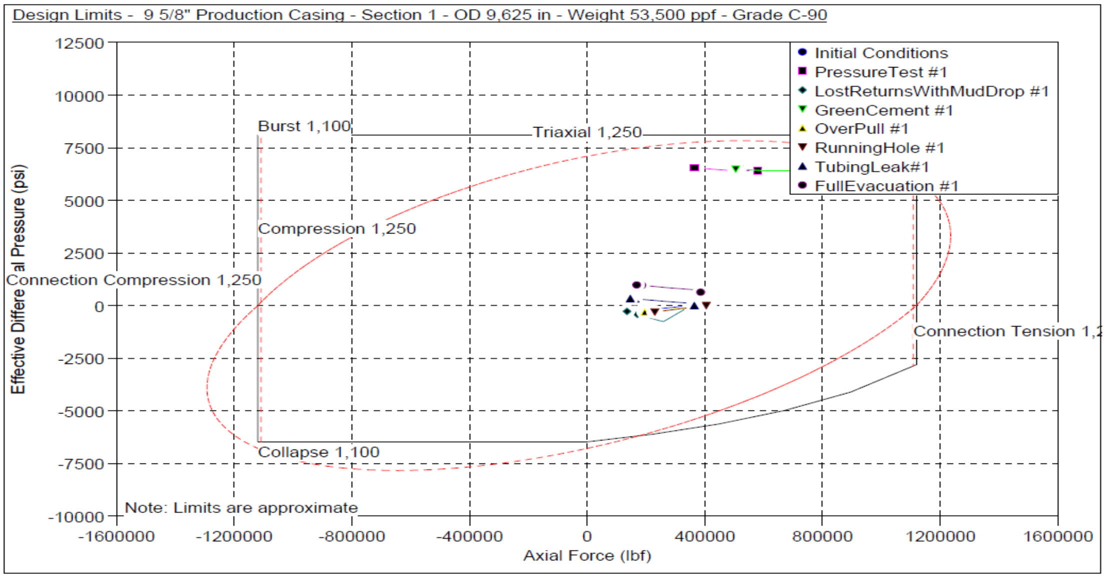


Figure 56 - Design limits plot for 9-5/8” intermediate casing

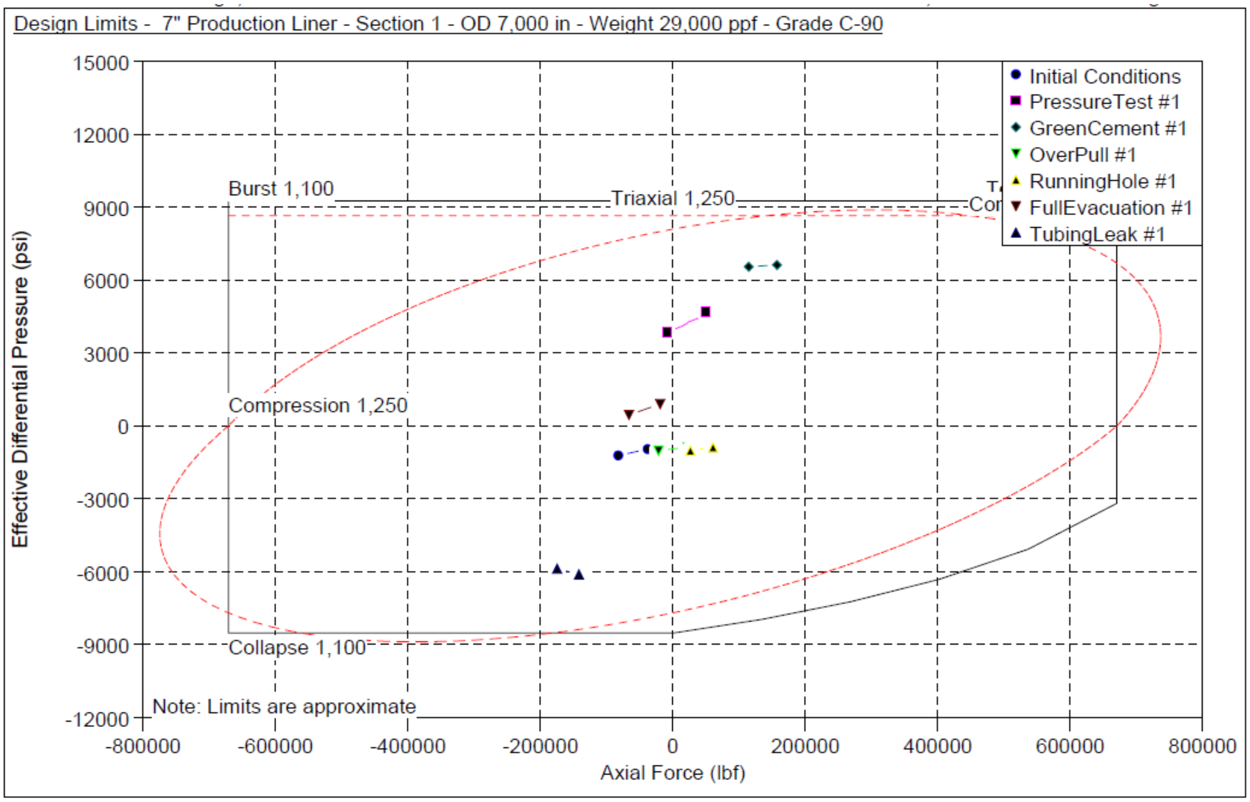


Figure 57 - Design limits plot for 7" production liner

3.4.4.2 Analysis and Discussion

A 13-3/8" conductor sits within a 15" hole section. Because of the short conductor length and low costs of steel, this could easily be upsized to a 16" or 17-1/2" hole without any significant economic impact, if desirable.

The 11-3/4" casing string is run in a 13/1-2" hole section. The main limiting factor with this string was the kick tolerance, which has been the limiting factor is selecting casing set depth. Higher mud weights than would normally be desired are required for this section. Due to the risk of severe losses in shallow, unconsolidated formations, it is recommended to drill this section with casing, using a bi-centred drill bit. This section is under-reamed from the previous 13-3/8" casing string. The tight annular clearance between the concentric casing strings and subsequent open hole, dictate the use of an annular flow diversion tool. This tool has been shown to reduce ECD's by 20% and it is shown that the ECD's in this case do not render the design unfeasible (results of ECD study discussed in section 3.4.7).

For the intermediate casing string, our casing set depth is once again limited by kick tolerance. A standard 12-1/4" hole is under-reamed out of the 11-3/4" casing to run and set the 9-5/8" string. Again, due to the small clearances (though this time, only within the concentric casing strings), the use of an annular flow diversion tool is required. The ECD study shows no issues with this hole section.

The 7" production liner is run in an 8-1/2" as per previous design, with no unique features.

Centralisation is a key issue in this well design. Poor centralisation could lead to excessive casing wear, which would be highly pronounced due to the low annular clearances. In addition, the casing running best practices alluded to in earlier sections need special attention on this well. The North Sea slender design best represent the possibilities in true slim hole drilling, whilst removing unnecessary casing – however its execution would ultimately depend on the Operator's risk appetite. The architecture is a North Sea rendition of the study conducted by (Howlett, et al., 2006). The results show that the design is technically feasible, however this assumes that one achieves a break-even ROP to make the casing-drilling surface hole economically feasible.

3.4.5 Well Control

Well control for slim hole drilling has been discussed previously. Figure 58, below, presents a comprehensive well control flow chart and is highly relevant to slim hole drilling. The risk assessment, ahead, will outline further risks and proposed mitigation strategies.

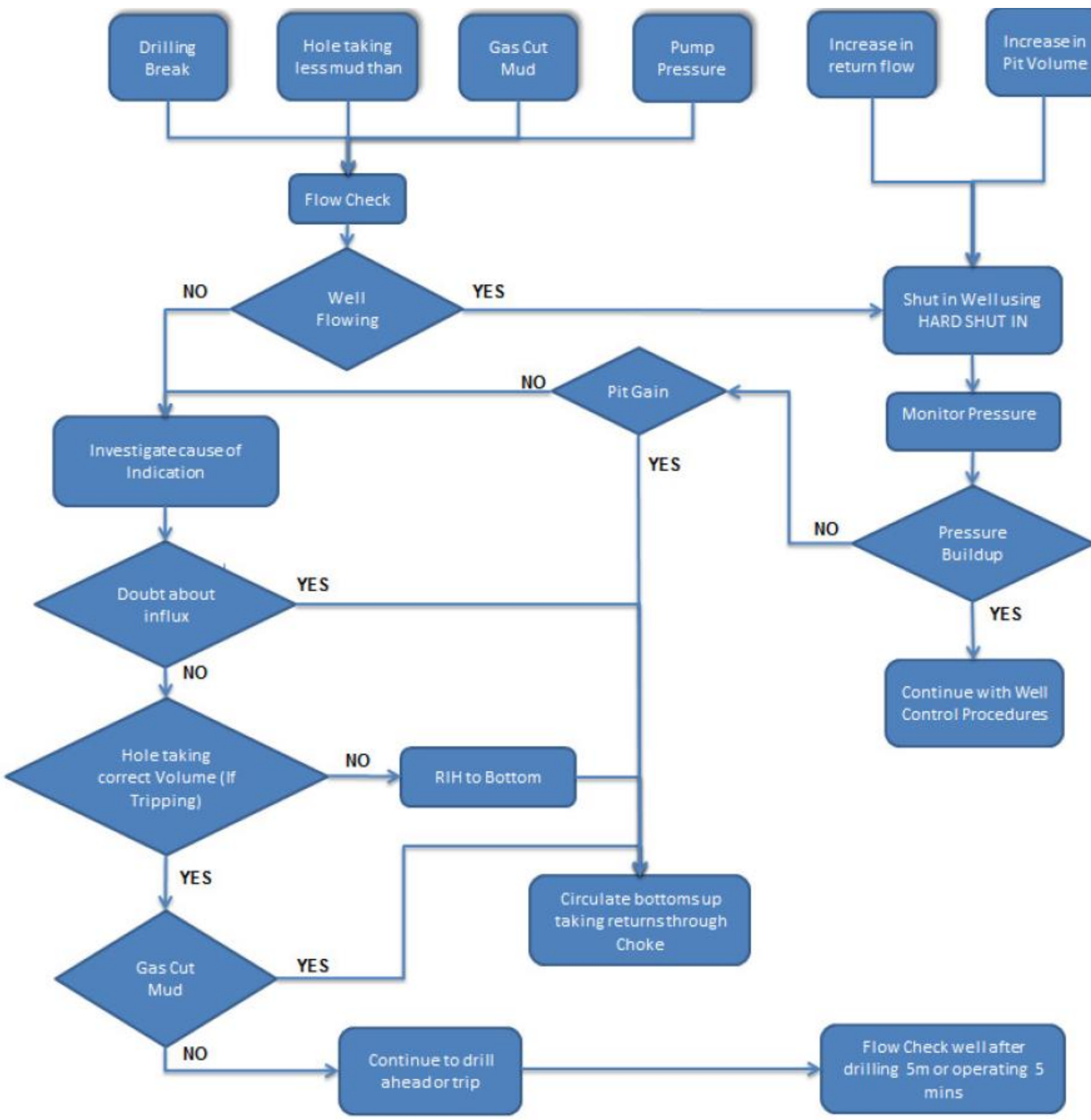


Figure 58 - Well control flow chart (Harness Energy, 2014)

3.4.6 Kick Tolerances

Kick tolerances have been calculated in accordance with section 3.1.14 of NORSOK D-010 (Standards Norway, 2013), which stipulates that kick tolerance should be equal to the equivalent MAASP[20]. Where kick tolerances are too low, adjustments to casing set depths were made. Each conventional design meets the requirements of NORSOK D-010, however it is important to examine the kick tolerances of the slender well proposals. A summary of the kick tolerances for each slender well design is shown below. For each chart, it is shown that the range of kick margins are above the NORSOK D-010 requirement of 4m^3 (or 33.5 bbl). (Standards Norway, 2013). The 4m^3 requirement is shown as a black line on each of the charts.

3.4.6.1 Barents Sea

Kick Zone Parameters:		Surface	Intermediate	Production
Open hole Size ?	(inch)	17.5	12.25	8.5
Measured Depth ?	(m)	950	2100	2700.40
Vertical Depth ?	(m)	950	2100	2700.40
Horizontal Length (>87 deg) ?	(m)	0	0	0
Tangent Angle Above Horizontal ?	(deg)	0	0	0
Min Pore Pressure Gradient ?	(ppg)	9.600	10	10
Max Pore Pressure Gradient ?	(ppg)	9.800	10.5	10.5
Kick Zone Temperature ?	(deg.F)	70	150	200
Weak Point Parameters:				
Measured Depth ?	(m)	422	950	2100.0
Vertical Depth ?	(m)	422	950	2100.0
Section Angle (<87 deg) ?	(deg)	0	0	0
Min Fracture Gradient / EMW ?	(ppg)	12.000	12.9	12.9
Max Fracture Gradient / EMW	(ppg)	13.500	13.5	13.5
Weak Point Temperature ?	(deg.F)	40	100	150
Other Parameters:				
Drill Collar OD ?	(inch)	8	6.75	6.75
Drill Collar Length ?	(m)	40	152	182.9
Drill pipe OD ?	(inch)	5.5	5.5	4
Surface Pressure Safety Factor ?	(psi)	100	100	100
Mud Weight in Hole ?	(ppg)	10.500	11.5	11.5
Annular Capacity Around BHA:	(bbl/ft)	0.23530	0.101503	0.0
Annular Capacity Around DP:	(bbl/ft)	0.26808	0.116376	0.1
Circulating MAASP	(psi)	8	126.4055	400.6
Gas Gradient at Weak Point	(psi/ft)	0.0213	0.046745	0.1
At Min Frac Gradient				
For Min Pore Pressure:				
Max Allowable Gas Height:	(m)	90	367	644.3
Kick Tolerance:	(bbl)	**44.5**	**85.2**	**Infinite**
For Max Pore Pressure:				
Max Allowable Gas Height:	(m)	70	268	508.4
Kick Tolerance:	(bbl)	**34.3**	**59.8**	**73.9**
Circulating MAASP	(psi)	116	223.4365	615.2
Gas Gradient at Weak Point	(psi/ft)	0.0243	0.049011	0.1
At Max Frac Gradient				

[20] Calculations made using methodology outlined in theory, Section 2.3.1.3.

For Min Pore Pressure:				
Max Allowable Gas Height:	(m)	153	423	774.8
Kick Tolerance:	(bbl)	**87.3**	**102.8**	**Infinite**
For Max Pore Pressure:				
Max Allowable Gas Height:	(m)	134	323	638.3
Kick Tolerance:	(bbl)	**74.7**	**75.5**	**Infinite**

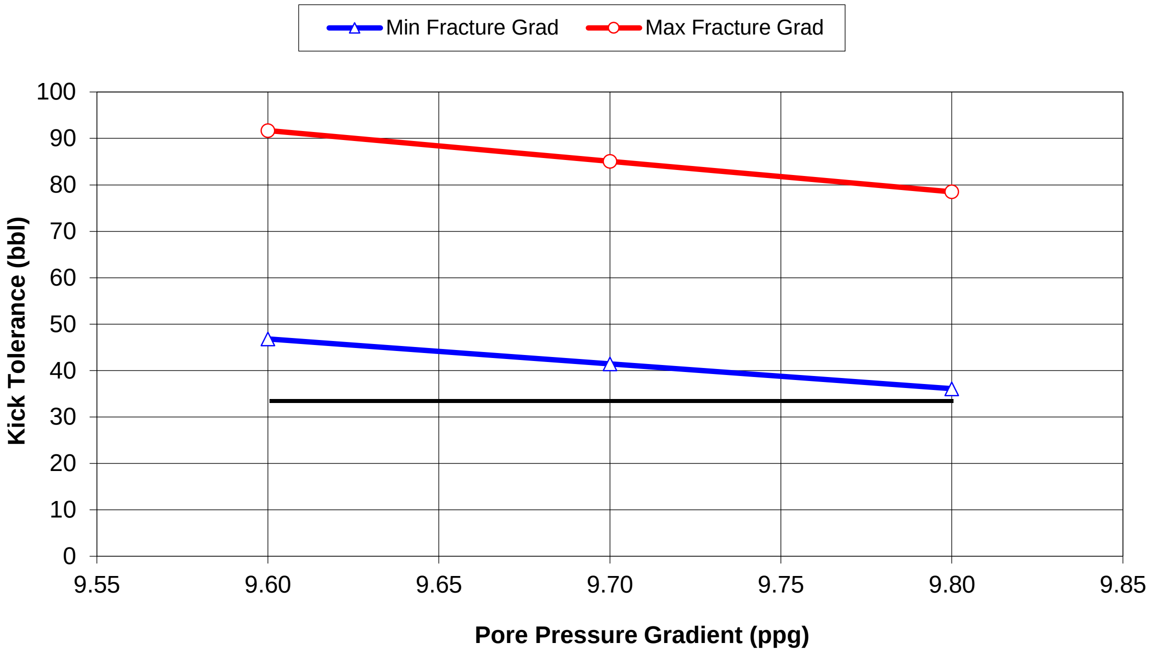


Figure 59 - Barents Sea slender well - surface hole section kick tolerance

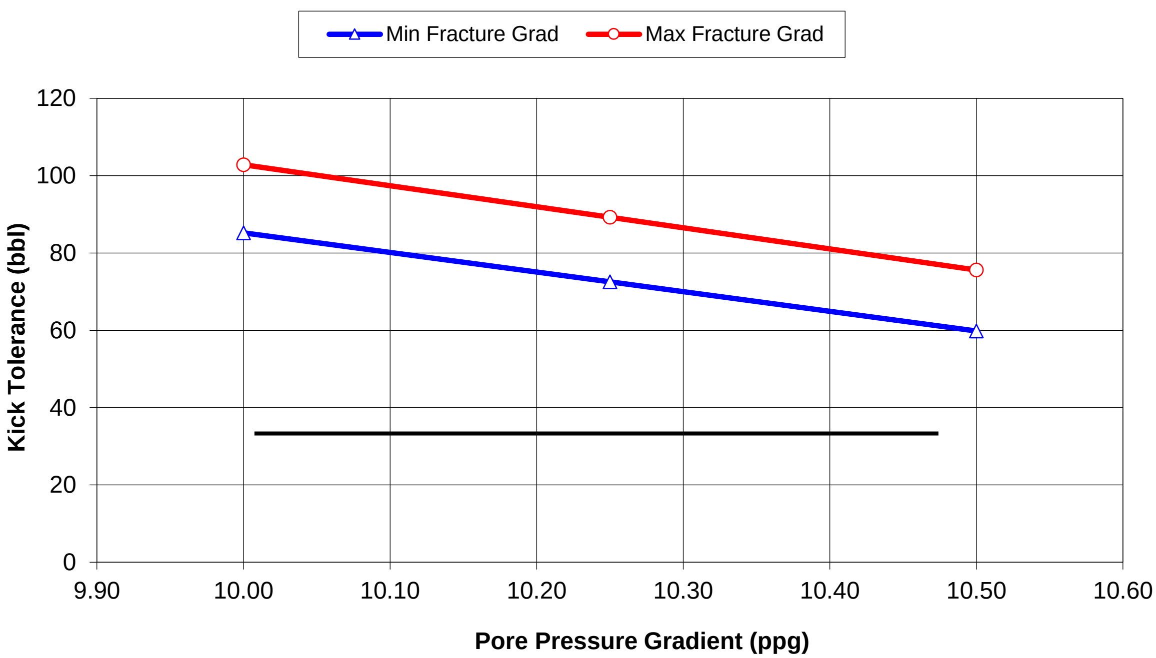


Figure 60 - Barents Sea slender well - intermediate hole section kick tolerance

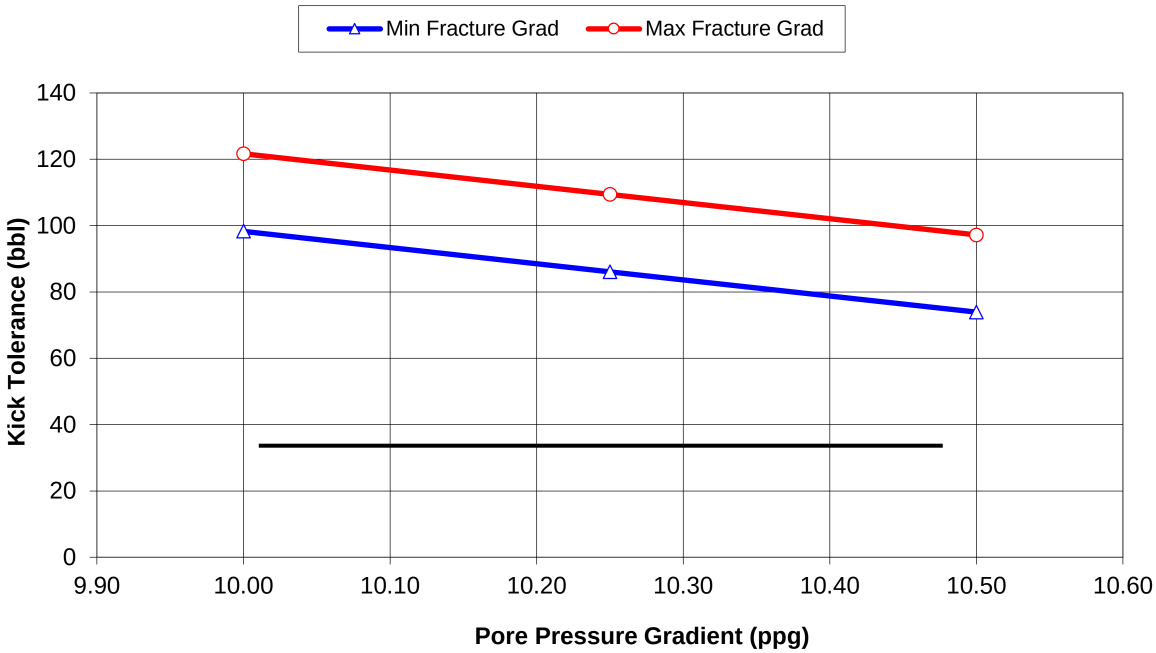


Figure 61 - Barents Sea slender well – production hole section kick tolerance

<u>Discussion</u>

For this wellbore design, all kick tolerances are acceptable as per NORSOK-D010. An ECD check will be conducted ahead to ensure drill-ability of each section.

3.4.6.2 Norwegian Sea

Kick Zone Parameters:		Old Surface	New Surface	Production
Open hole Size ?	(inch)	12.25	12.25	8.5
Measured Depth ?	(m)	1350.20	1649.802	3299.9
Vertical Depth ?	(m)	1350.20	1649.802	3299.9
Horizontal Length (>87 deg) ?	(m)	0	0	0.0
Tangent Angle Above Horizontal ?	(deg)	0	0	0.0
Min Pore Pressure Gradient ?	(ppg)	9.0	9	11.2
Max Pore Pressure Gradient ?	(ppg)	9.6	9.5795	11.5
Kick Zone Temperature ?	(deg.F)	150	150	70.0
Weak Point Parameters:				
Measured Depth ?	(m)	422.13	670.5273	1650.1
Vertical Depth ?	(m)	422.13	670.5273	1650.1
Section Angle (<87 deg) ?	(deg)	0	0	0.0
Min Fracture Gradient / EMW ?	(ppg)	11.662	11.662	14.6
Max Fracture Gradient / EMW	(ppg)	12	12	15.2
Weak Point Temperature ?	(deg.F)	70	70	150.0
Other Parameters:				
Drill Collar OD ?	(inch)	6.75	6.75	6.8
Drill Collar Length ?	(m)	152.39	152.3926	152.4

Drill pipe OD ?	(inch)	5.5	5.5	5.5
Surface Pressure Safety Factor ?	(psi)	100	100	100.0
Mud Weight in Hole ?	(ppg)	10	10	12.0
Annular Capacity Around BHA:	(bbl/ft)	0.10	0.101503	0.0
Annular Capacity Around DP:	(bbl/ft)	0.12	0.116376	0.0
Circulating MAASP	(psi)	19.47	89.76462	624.2
Gas Gradient at Weak Point	(psi/ft)	0.02	0.031537	0.1
At Min Frac Gradient				
For Min Pore Pressure:				
Max Allowable Gas Height:	(m)	151.96	231.7507	601.7
Kick Tolerance:	(bbl)	**27.27**	**56.9298**	**73.1**
For Max Pore Pressure:				
Max Allowable Gas Height:	(m)	70.77	129.9721	519.6
Kick Tolerance:	(bbl)	**11.92**	**33.06034**	**62.1**
Circulating MAASP	(psi)	43.76	128.3569	799.1
Gas Gradient at Weak Point	(psi/ft)	0.02	0.032571	0.1
At Max Frac Gradient				
For Min Pore Pressure:				
Max Allowable Gas Height:	(m)	166.96	256.4208	705.2
Kick Tolerance:	(bbl)	**30.91**	**65.05623**	**86.9**
For Max Pore Pressure:				
Max Allowable Gas Height:	(m)	85.68	154.4262	622.7
Kick Tolerance:	(bbl)	**14.88**	**36.88773**	**75.9**

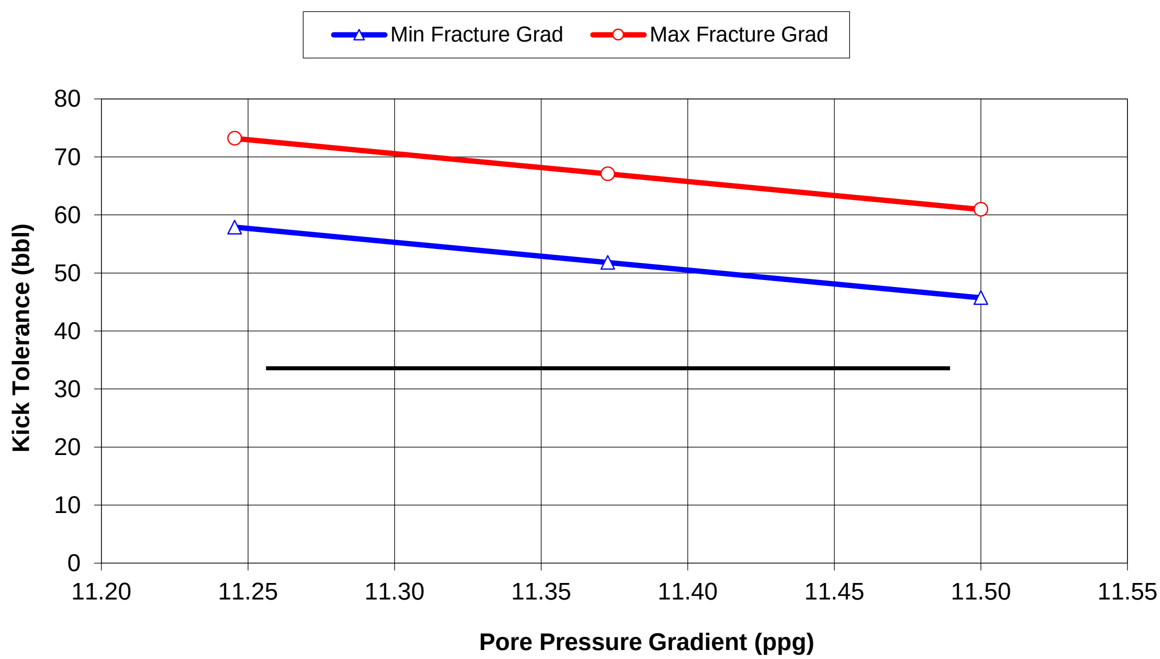


Figure 62 - Norwegian Sea slender well – surface hole (new) section kick tolerance

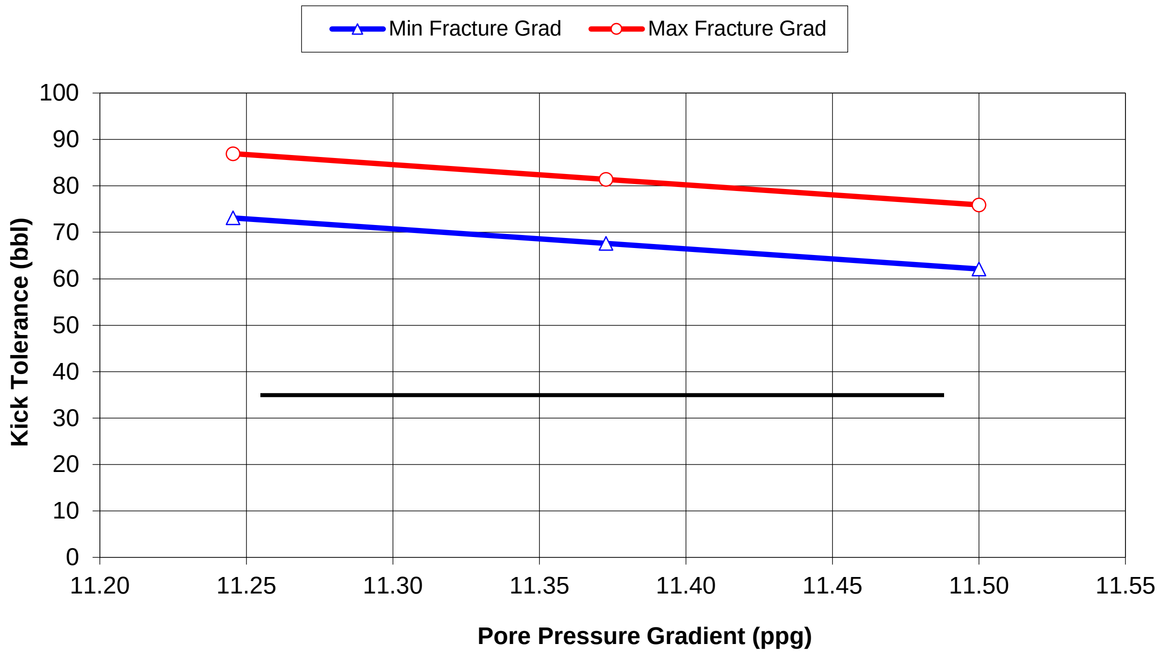


Figure 63 - Norwegian Sea slender well – production hole section kick tolerance

<u>Discussion</u>

The well design initially does not satisfy the requirements of NORSOK D-010. The surface casing kick tolerance in setting casing at 1350mMDRT is too low to be accepted in practise. There are a number of changes that were made to remedy this:

- Increased the conductor set depth (or run a second conductor string): This method gives the largest increase in kick tolerance since the weak point is the driving factor in kick volume calculations;
- Increased the mud weight;
- Increased hole depth;
- Added another casing string.

In our study, we increased both the conductor set depth (to 670mMDRT, hence a 250m conductor string) and the surface hole depth (to 1650mMDRT). This is for two reasons; first, as will be shown in the next section, the ECD's dictate a deeper surface hole and second, we wish to avoid adding another casing string. This change does little to alter the results shown in the von Mises plots and has been taken into account in the economic modelling below. However, these kick tolerance calculations have been performed using a gas density of 0.1 psi/ft. In practice however, the chance of any hydrocarbons being present at these depths is nearly negligible. This means we will have a much higher kick tolerance on the surface casing string since we assume the produced fluid is sea water.

3.4.6.3 North Sea

Kick Zone Parameters:		Surface	Intermediate	Production
Open hole Size ?	(inch)	13.5	12.25	8.5
Measured Depth ?	(m)	701	2550.00	3173.0
Vertical Depth ?	(m)	701	2550.00	3173.0
Horizontal Length (>87 deg) ?	(m)	0	0.00	0.0
Tangent Angle Above Horizontal ?	(deg)	0	0.00	0.0
Min Pore Pressure Gradient ?	(ppg)	8.6	11.00	13.4
Max Pore Pressure Gradient ?	(ppg)	8.6	11.20	13.6
Kick Zone Temperature ?	(deg.F)	150	250.00	270.0
Weak Point Parameters:				
Measured Depth ?	(m)	159	700.00	2550.0
Vertical Depth ?	(m)	159	700.00	2550.0
Section Angle (<87 deg) ?	(deg)	0	0.00	0.0
Min Fracture Gradient / EMW ?	(ppg)	12.2	13.33	15.4
Max Fracture Gradient / EMW	(ppg)	12.5	13.70	15.8
Weak Point Temperature ?	(deg.F)	70	150.00	250.0
Other Parameters:				
Drill Collar OD ?	(inch)	6.75	6.75	6.8
Drill Collar Length ?	(m)	152	152.39	152.4
Drill pipe OD ?	(inch)	4	4.00	4.0
Surface Pressure Safety Factor ?	(psi)	100	100.00	100.0
Mud Weight in Hole ?	(ppg)	10	12.00	12.0
Annular Capacity Around BHA:	(bbl/ft)	0.132	0.10	0.0
Annular Capacity Around DP:	(bbl/ft)	0.161	0.13	0.1
Circulating MAASP	(psi)	40.43	58.29	1380.9
Gas Gradient at Weak Point	(psi/ft)	0.007	0.03	0.1
At Min Frac Gradient				
For Min Pore Pressure:				
Max Allowable Gas Height:	(m)	75.42	253.38	354.4
Kick Tolerance:	(bbl)	**14.79**	**48.31**	**49.2**
For Max Pore Pressure:		0	0.00	0.0
Max Allowable Gas Height:	(m)	75.42	208.70	293.0
Kick Tolerance:	(bbl)	**14.79**	**39.25**	**38.2**
Circulating MAASP	(psi)	32.31	102.64	1550.0
Gas Gradient at Weak Point	(psi/ft)	0.007	0.03	0.1
At Max Frac Gradient				
For Min Pore Pressure:				
Max Allowable Gas Height:	(m)	80.28	276.61	451.4
Kick Tolerance:	(bbl)	**16.14**	**54.29**	**66.6**
For Max Pore Pressure:		0	0.00	0.0
Max Allowable Gas Height:	(m)	80.28	231.87	390.0
Kick Tolerance:	(bbl)	**16.14**	**44.89**	**55.5**

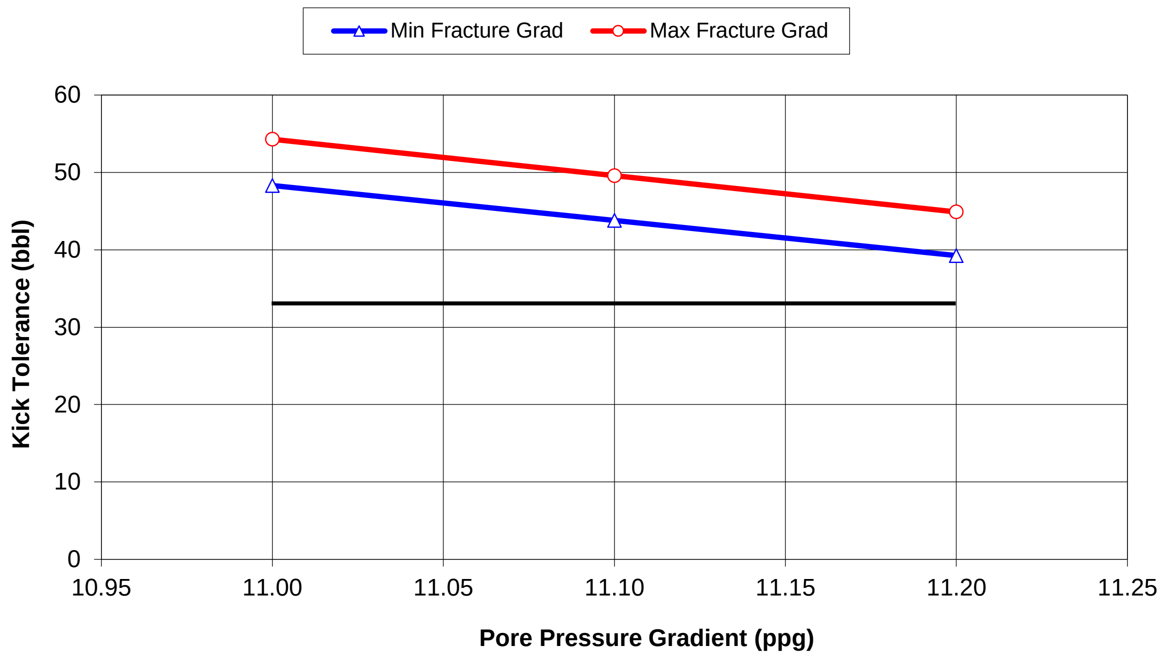


Figure 64 - North Sea slender well – intermediate hole section kick tolerance

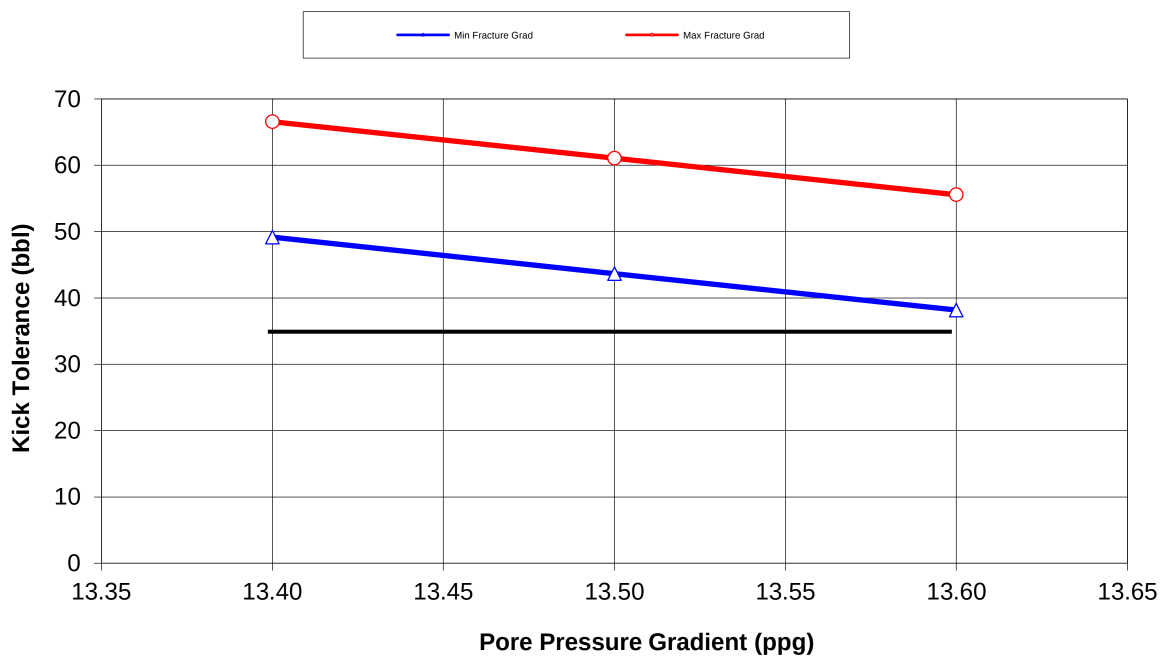


Figure 65 - North Sea slender well - production hole section kick tolerance

Discussion

With the exception of surface hole section, the well meets the criteria set out in NORSOK D-010. In this example, we are once more able to state that since these calculations are performed with a gas gradient of 0.1psi/ft, and since there is unlikely to be any hydrocarbons present near surface, we can neglect this and proceed to drill the surface hole section.

3.4.7 Equivalent Circulating Densities

3.4.7.1 Barents Sea Slender Architecture

We note that there are no ECD issues in the Barents Sea well design. The analysis is presented below[21].

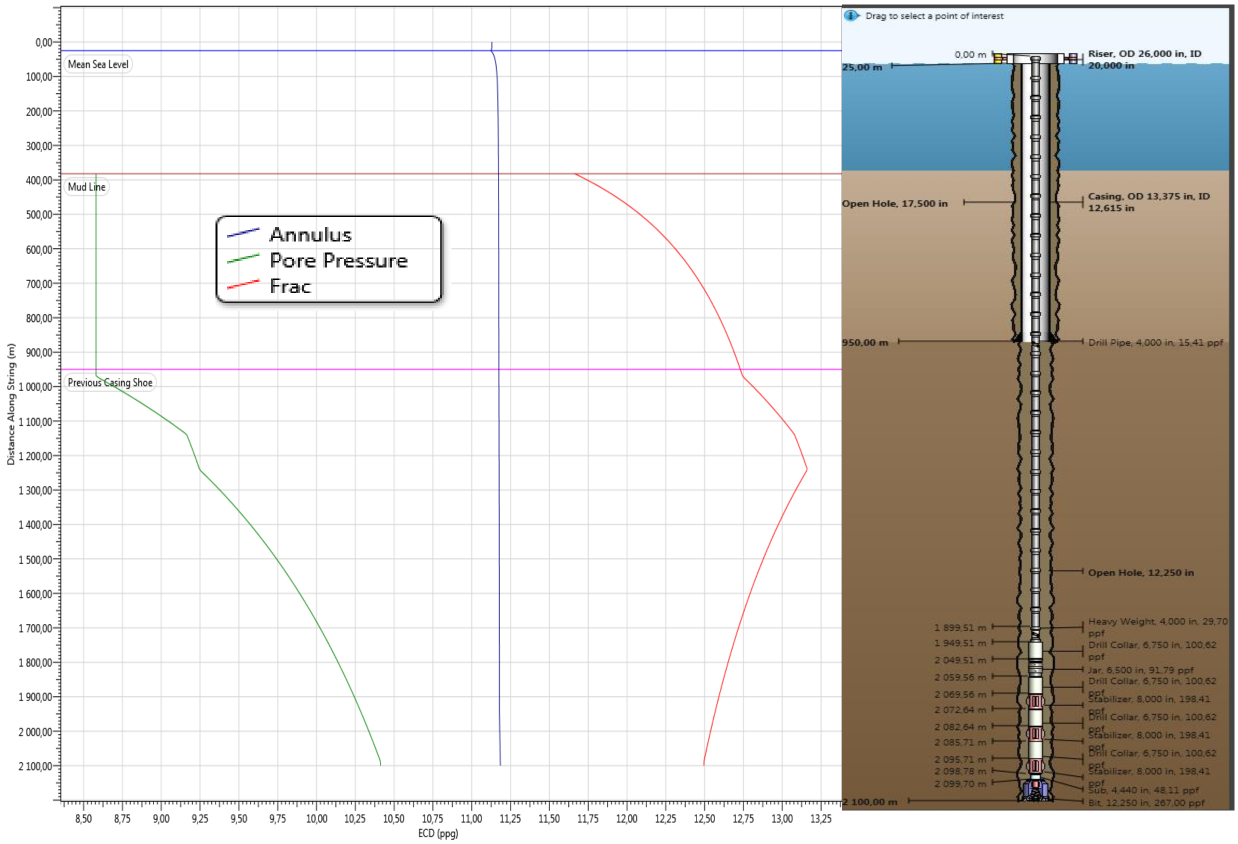


Figure 66 – Estimated ECD: Barents Sea slender well – intermediate hole drilling

[21] All ECD calculations were performed with Halliburton Landmark. Results show screenshots from analysis

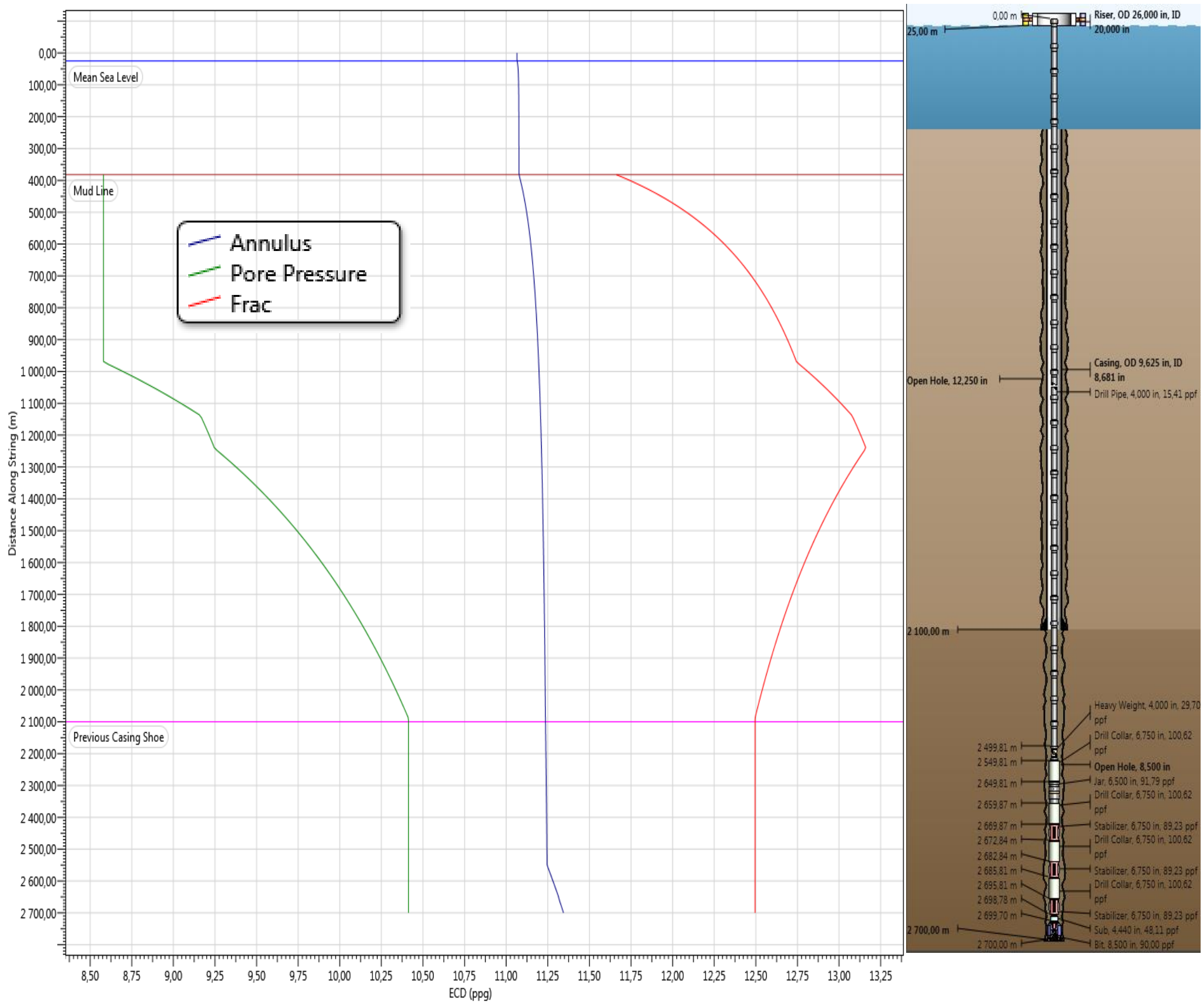


Figure 67 - Estimated ECD: Barents Sea slender well – production hole drilling

3.4.7.2 Norwegian Sea Slender Architecture

The Norwegian Sea downhole pressure profile initially dictated a surface casing set depth of 1350mMDRT. At this depth, we notice the ECD fracturing the formation just below the shoe. It was therefore required to re-run the analysis with a 1650mMDRT surface casing string. This essentially leaves two options; if one were comfortable with the risk of such a long surface hole section, a 10-10.5 ppg surface hole could be drilled (being mindful of possible shallow losses) down to 1650mMDRT. If one were uncomfortable with this option, it would be advisable to set surface casing at 750mMDRT and drill an intermediate hole section to 1650mMDRT. Either way, the economic merits are evident. See analysis below.

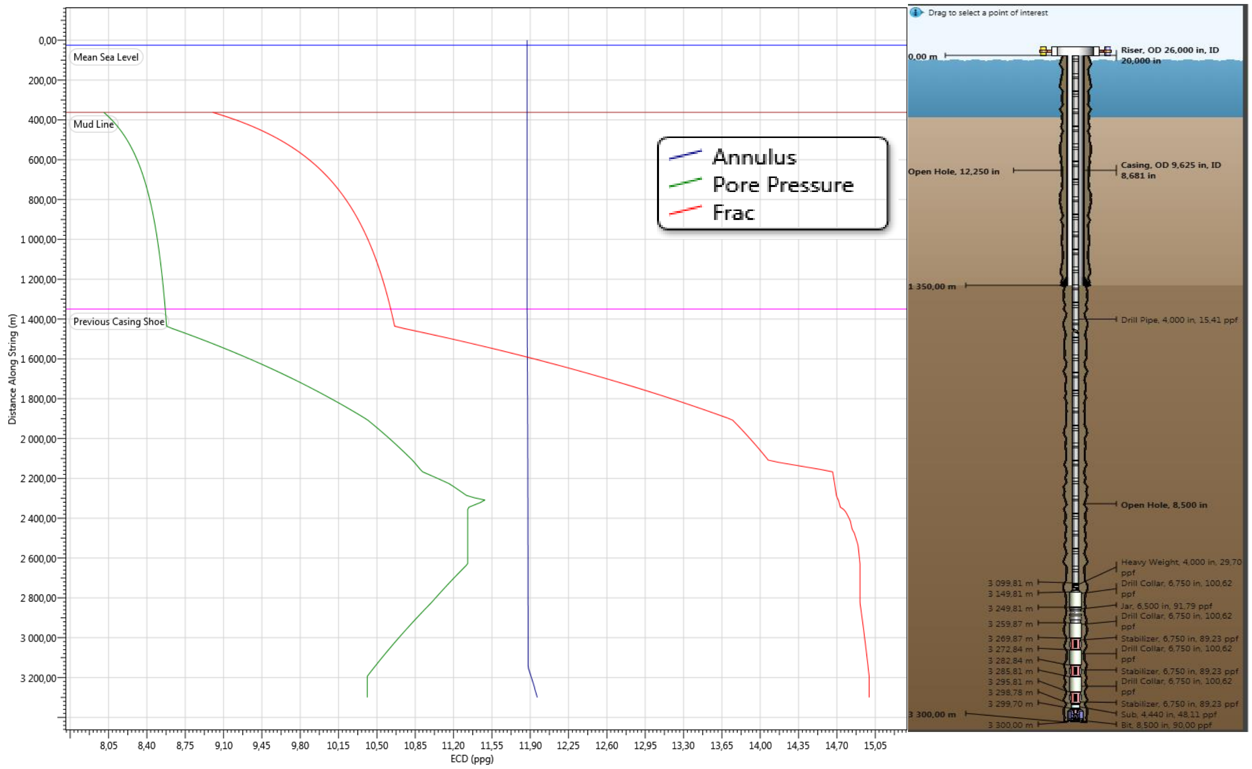


Figure 68 - Estimated ECD: Norwegian Sea slender well w/ original int. casing set depth

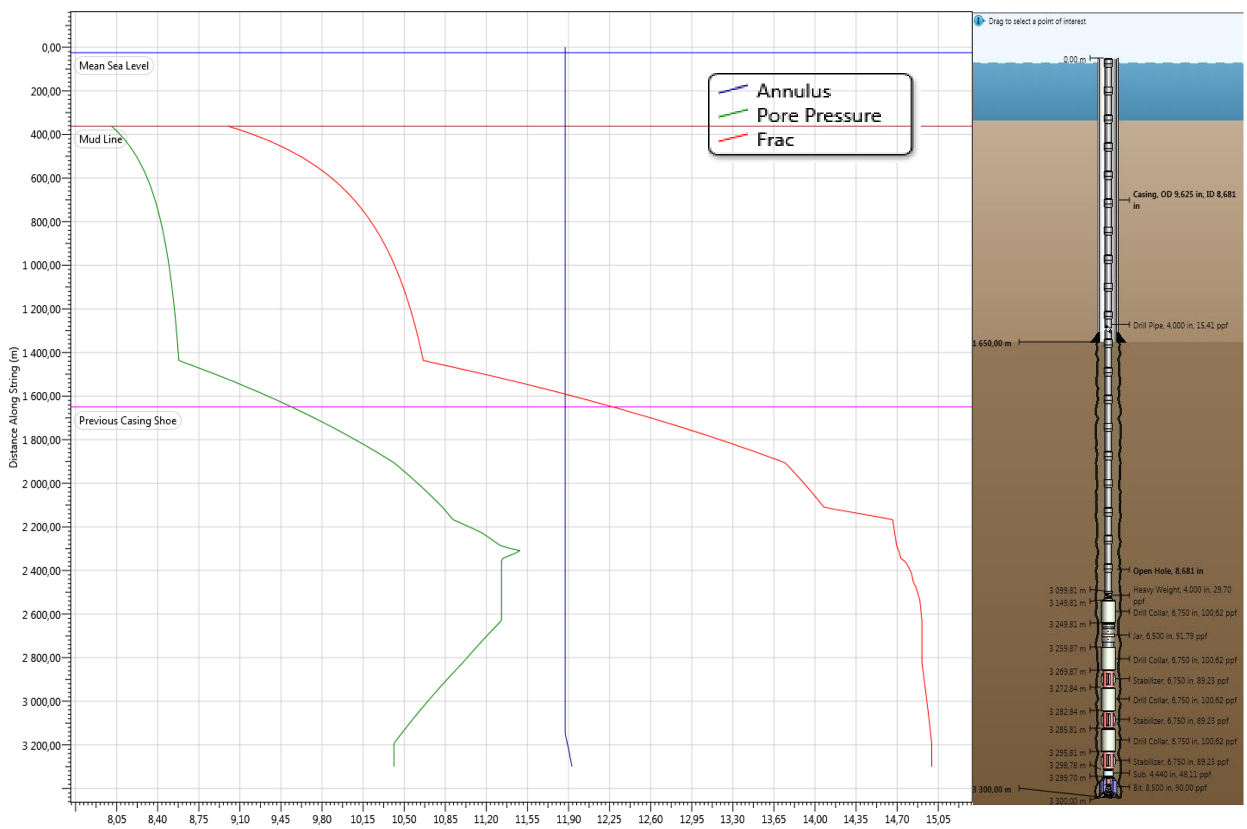


Figure 69 - Estimated ECD: Norwegian Sea slender well w/ deep int. casing set depth

3.4.7.3 North Sea Slender Well Architecture

We note that there are no ECD issues in the North Sea well design. The analysis is presented below.

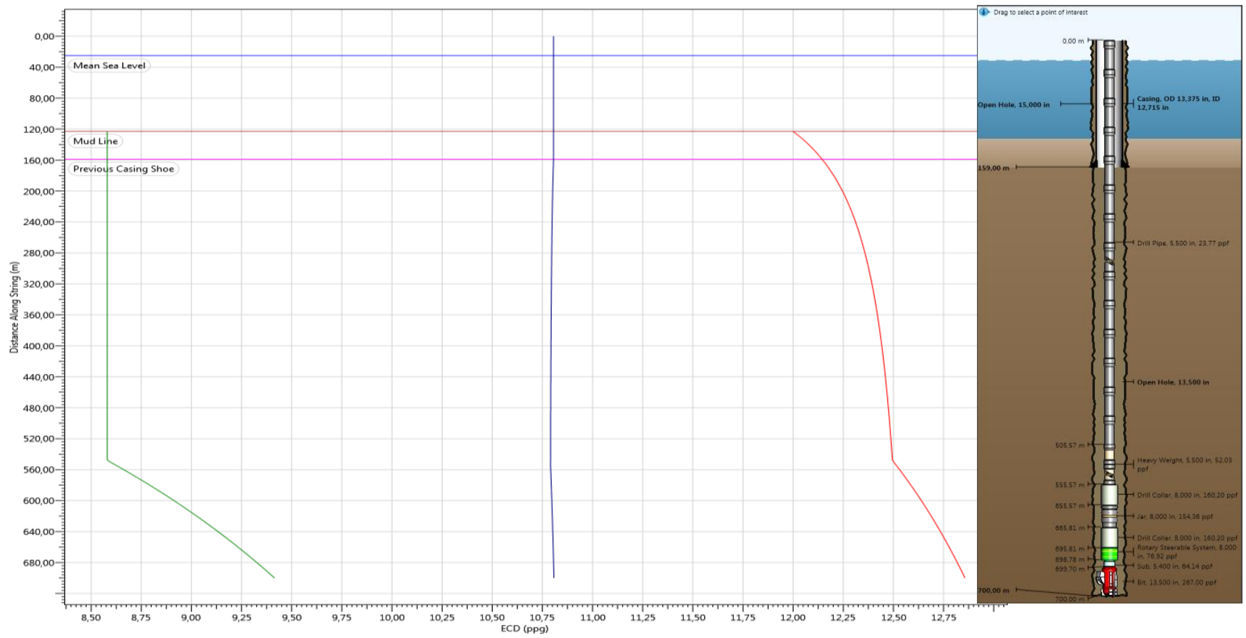


Figure 70 - Estimated ECD: North Sea first intermediate hole section

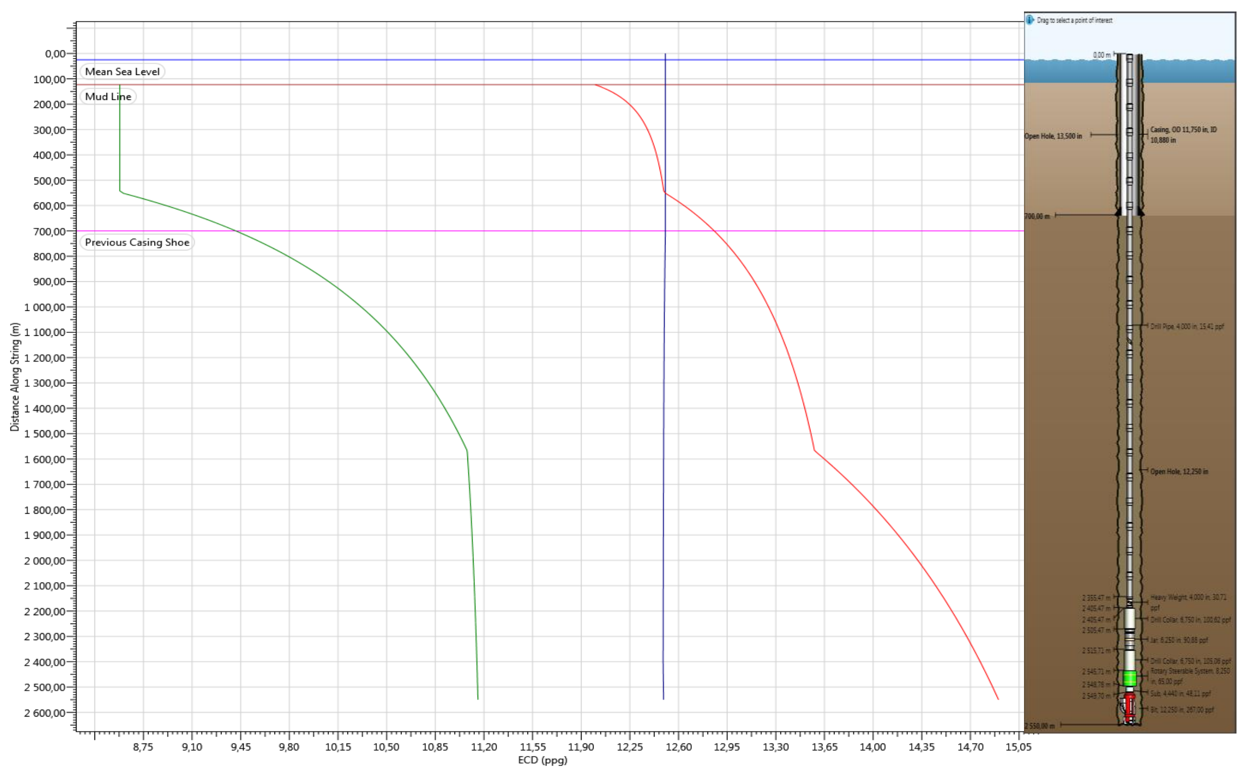


Figure 71 - Estimated ECD: North Sea second intermediate hole section

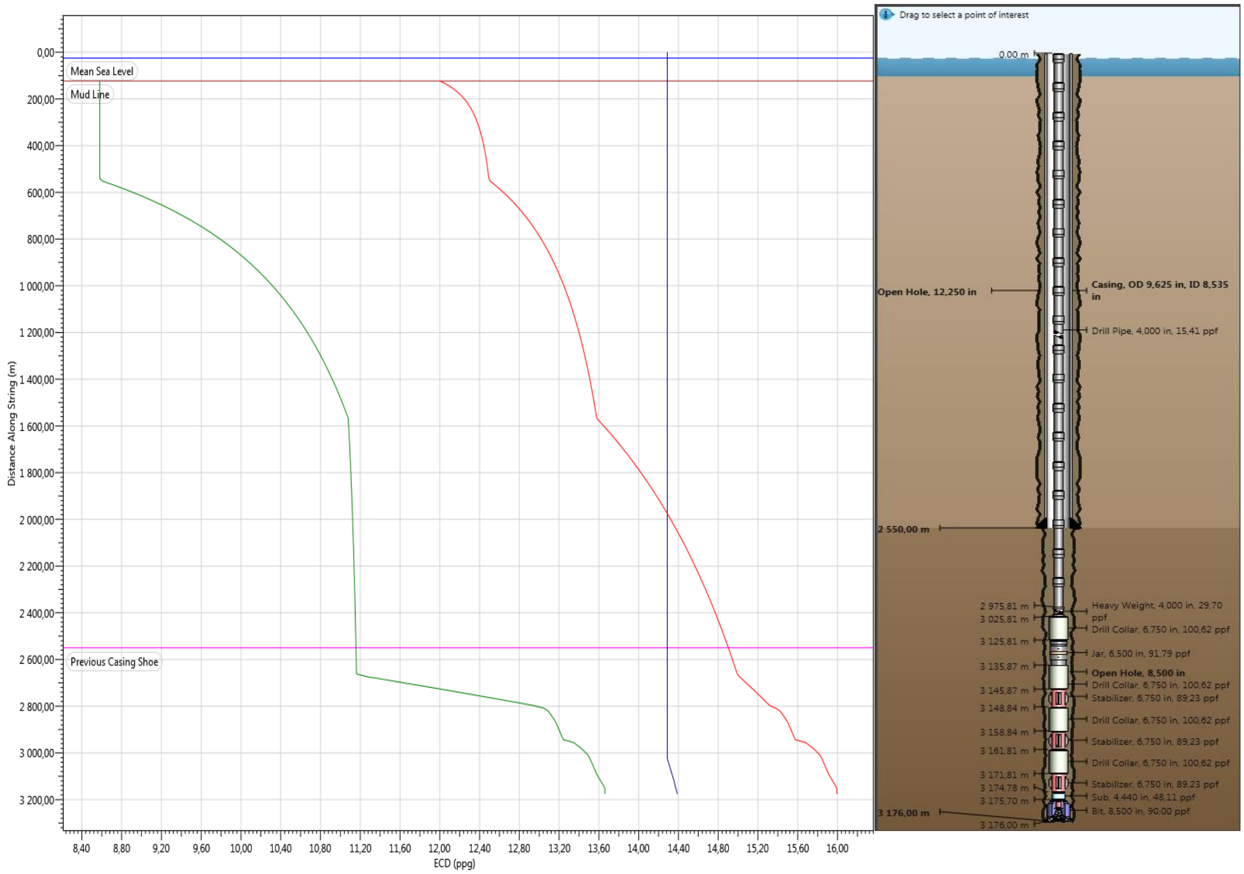


Figure 72 - Estimated ECD: North Sea production hole section

3.5 Economic Considerations

3.5.1 Financial Assumptions

This section will seek to outline the economic merits of slender vs. conventional well designs by presenting deterministic cost estimates for each scenario and comparing the outcomes. The following assumptions closely reflect the economics of an undisclosed operating company in Norway. A full discussion of the overall economic implications is presented in the following sub-section. Where figures are unavailable, realistic assumptions are made. *Note: all figures quotes are in United States Dollars (USD) unless otherwise stated*[22] [23]*.*

- Rig spread rate: $145,000/-
- Assuming dynamically positioned rig, no anchor issues
- Class charges written over five years: $154,000/- (NOK 75MM over 60 months, which amounts to NOK 1.2MM)
- Two days mobilisation: $1.15MM/- (2 x NOK 4.5MM)
- Demobilisation when rig is handed to next well in field: $260,000/- (NOK 2MM)
- DP assumed 2 hours: $58,000/- (2/12 x NOK 4.5MM)

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[22] Exchange rate as at 12/03/2018 (time of writing): 1 Norwegian Krone equals 0.13 US Dollar.
[23] M = thousand, MM = million, B = billion.

- P&A assumed 5 days: $2.9MM/- (5 x NOK 4.5MM)
- Site survey: $1.3MM/- (NOK 10MM)
- Overheads (operator planning and execution costs): $3.2 MM/- (NOK 25MM)
- Reporting: $260,000/- (NOK 2MM)
- Coring (120m/27m = 5 runs, i.e. 2.5 days) = $1.5MM/- (NOK 11.25MM)
- Conductors are all pre-installed and included in the site survey cost (above)
- NPT due to extreme weather: 15% total operating time
- Contingency: 10%
- Estimates consider case and suspend (w/ eventual P&A). Wellbore completion is assumed not to take place – exploration wells

Note: for each estimate presented, a full day-by-day cost breakdown is available in Appendix 5.3.

3.5.2 Barents Sea

The Barents Sea cost estimate for the conventional design is displayed below in Figure 73.

	w/o contingency. Good weather	w/o contingency. Bad weather	w/ contingency. Good weather	w/ contingency. Bad weather
Total Cost to P&A: No Discovery (No evaluation) + Immediate P&A	**$26,877,708**	**$30,909,364**	**$29,565,478**	**$33,597,134**
Total Cost to Case and Suspend: Discovery (w/ Evaluation) + Future P&A	**$29,035,148**	**$33,390,420**	**$31,938,663**	**$36,293,935**

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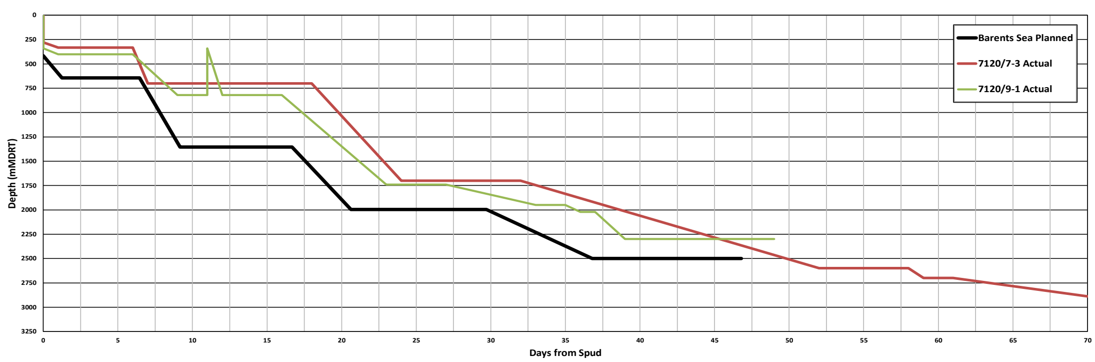
Phase	Detailed Phase Description	Number of Days	Section Cost	Rentals and Personnel (Including Rig Rates)	Lump Sum Material Costs
Predrill	Overheads, class charges, levies, insurance premiums and environmental costs	N/A	$ 2,834,500	$ -	$ -
Pre-spud	Pre-spud includes all rig move costs incl. mobilisation, mooring, DP et al.	2.1 days	$ 431,548	$ 388,839	$ 42,708
Surface Hole to 644 mMDRT	Drill to section TD only	1.3 days	$ 605,179	$ 414,554	$ 190,625
Surface Casing	Includes wiper trip and lay out BHA, rig up casing gear, run casing and cement casing	1.9 days	$ 1,068,268	$ 621,830	$ 446,438
Nipple Up BOP's	Includes full online BOP test	3.3 days	$ 1,373,809	$ 1,105,476	$ 268,333
Intermediate Hole 1 to 1355 mMDRT	Drill to section TD only	4.0 days	$ 1,796,607	$ 1,300,878	$ 495,729
Intermediate Casing 1	Includes wiper trip and lay out BHA, rig up casing gear, run casing and cement casing	3.5 days	$ 2,151,500	$ 1,150,250	$ 1,001,250
LOT and Test	Includes full online BOP test	2.8 days	$ 995,893	$ 912,018	$ 83,875
Intermediate Hole 2 to 1995 mMDRT	Drill to section TD only	6.9 days	$ 2,889,107	$ 2,259,420	$ 629,688
Intermediate Casing 2	Includes wiper trip and lay out BHA, rig up casing gear, run casing and cement casing	3.7 days	$ 2,270,190	$ 1,205,024	$ 1,065,167
LOT and Test	Includes full online BOP test	2.5 days	$ 975,357	$ 829,107	$ 146,250
Production Hole to 2497 mMDRT	Drill production hole to section TD plus any additional evaluation while drilling i.e. coring	7.1 days	$ 2,594,345	$ 2,349,137	$ 245,208
Evaluation	Includes wiper trip and layout BHA. Applicable to wireline logging - not coring	5.4 days	$ 2,157,440	$ 1,796,399	$ 361,042
Production Liner	Includes wiper trip during and post-logging, then running and cementing casing	4.3 days	$ 2,381,357	$ 1,409,482	$ 971,875
Rig Release	Requires final tree installation and release of the rig	0.3 days	$ 460,048	$ 110,548	$ 349,500
TOTALS		**48.9 days**	**$ 24,985,148**	**$ 15,852,960**	**$ 6,297,688**



Assumptions and Scope Change
• Performance: common drilling and casing running speeds for both wells in addition to equal inter-section work (BOP N/U, testing, logging etc.); • No bit trips; • Wiper trip TD to surface on second intermediate and production hole sections (30 hours for intermediate section, 15 hours for production section); • 10 days post-drilled TD time (incl. logging and coring for production hole section & casing and cementing assuming discovery); • P&A assumed as lump-sum cost as detailed above; • Evaluation in intermediate hole sections (Quad-Combo or equivalent). No surface hole logging; • CBL for second intermediate casing and production liner only; • No DST's/MDT's (omitted from offset well TVD curves), coring assumed as lump sum cost; • Drill times commensurate with offset wells. Offset wells have been curtailed at drilled TD, with 10 days added for post drill activities.

Incremental Costs From a Standard Well

Activity / Item	Time	Cost
Coring (120m / 27m = 5 runs)	2.5 days	$ 1,150,000
Plug and Abandonment	5.0 days	$ 2,900,000
		$ -
		$ -
		$ -
TOTAL	**7.50 days**	**$ 4,050,000**

Cost Category	Total Cost
Mobilisation / Demobilisation Costs	$ 1,410,000
Staff Salaries	$ 488,750
Overhead Allocation	$ 3,200,000
Rig Costs	$ 10,438,542
HSE and Auditing	$ 1,300,000
Evaluation	$ 5,204,375
Subsea Works	$ 58,000
Communications	$ 284,438
Transport	$ 1,321,875
Casing and Accessories	$ 1,316,750
Wellhead	$ 1,110,000
Cementing	$ 910,000
Mud	$ 609,375
Miscellaneous Equipment	$ 276,144
Drilling Tools & Equipment	$ 395,400
Class Charges	$ 154,000
Field Professional Services	$ 557,500
CONTINGENCY OF 10%	**$ 2,903,515**
TOTAL (Assuming Good Weather)	**$ 31,938,663**

Figure 73 - Barents Sea conventional study well cost estimate

The cost estimate for the slender well design is presented below. Due to the lack of economic data for materials and services, it is important to note the following assumptions and scaling factors:

- Casing price reductions have been assumed as a percentage of change in OD from the conventional to slender well design. Likewise with wellheads. Service charges remain unchanged;
- The mud chemical costs are assumed to decrease proportionally to the change in wellbore volume from the conventional to slender design (section by section), whereas cement chemical costs assumed to decrease proportionally to change in annular volume. Service charges remain unchanged;
- Drill bit charges assumed to reduce proportionally to hole OD changes;
- No change to any evaluation costs;
- Personnel charges remain unchanged;

The scaling factors are shown in Table 16.

Casing

	Surface	Intermediate	Production
Original casing OD (in)	20	13 3/8	7
New casing OD (in)	13 3/8	9 5/8	7
% change	67%	72%	100%

Wellheads

	Surface	Intermediate	Production
Original casing OD (in)	20	13 3/8	7
New casing OD (in)	13 3/8	9 5/8	7
% change	67%	72%	100%

Mud

	Surface	Intermediate	Production
Original hole OD (in)	26	17 1/2	8 1/2
Original depth interval (m)	230	710	505
Original Volume (bbl)	496	693	116
New hole OD (in)	17 1/2	12 1/4	8 1/2
New depth (m)	528	1150	400
New Volume (bbl)	515	550	92
% change	104%	79%	79%

Cement

	Surface	Intermediate	Production
Original hole OD (in)	26	17 1/2	8 1/2
Original casing OD (in)	20	13 3/8	7
Original annular capacity (bbl/ft)	0.27	0.12	0.02
Original depth (m)	645	1355	2500

Original TOC (m)	415	1000	1980
Original CMT vol (bbl)	202	144	39
New hole OD (in)	17 1/2	12 1/4	8 1/2
New casing OD (in)	13 3/8	9 5/8	7
New annular capacity (b/ft)	0.12	0.06	0.02
New depth (m)	950	2100	2500
New TOC (m)	422	1500	2100
New CMT vol (bbl)	214	110	30
% change	106%	76%	77%

Bits

	Surface	Intermediate	Production
Original hole OD (in)	26	17 1/2	8 1/2
New hole OD (in)	17 1/2	12 1/4	8 1/2
% change	67%	70%	100%

Table 16 - Scaling factors for Barents Sea slender well

The Barents Sea cost estimate for the slender design is displayed below in Figure 74.

	w/o contingency. Good weather	w/o contingency. Bad weather	w/ contingency. Good weather	w/ contingency. Bad weather
Total Cost to P&A: No Discovery (No evaluation) + Immediate P&A	**$24,141,253**	**$27,762,441**	**$26,555,379**	**$30,176,567**
Total Cost to Case and Suspend: Discovery (w/ Evaluation) + Future P&A	**$26,340,374**	**$30,291,430**	**$28,974,412**	**$32,925,468**

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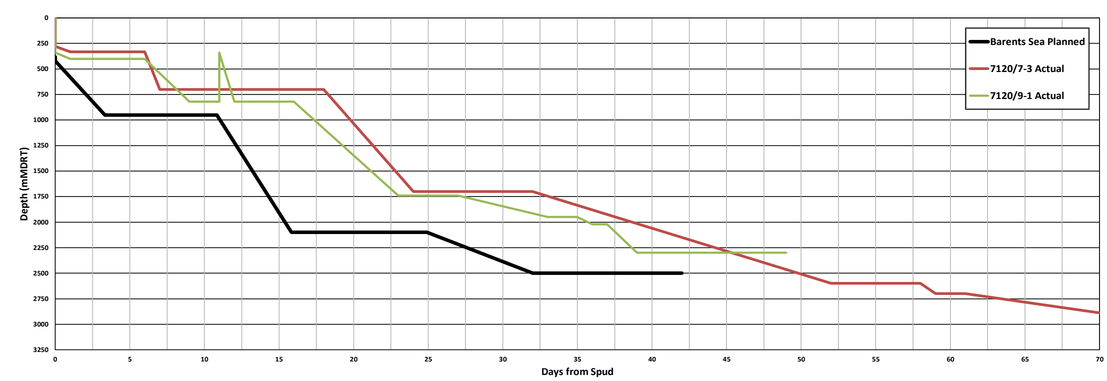
Phase	Detailed Phase Description	Number of Days	Section Cost	Rentals and Personnel (Including Rig Rates)	Lump Sum Material Costs
Predrill	Overheads, class charges, levies, insurance premiums and environmental costs	N/A	$ 2,834,500	$ -	$ -
Pre-spud	Pre-spud includes all rig move costs incl. mobilisation, mooring, DP et al.	2.1 days	$ 447,579	$ 404,870	$ 42,708
Surface Hole to 950 mMDRT	Drill to section TD only	4.6 days	$ 2,039,324	$ 1,541,548	$ 497,777
Surface Casing	Includes wiper trip and lay out BHA, rig up casing gear, run casing and cement casing	3.5 days	$ 1,882,329	$ 1,177,182	$ 705,147
LOT and Test	Includes full online BOP test	2.8 days	$ 1,017,054	$ 933,179	$ 83,875
Intermediate Hole to 2100 mMDRT	Drill to section TD only	7.9 days	$ 3,284,371	$ 2,662,674	$ 621,698
Intermediate Casing	Includes wiper trip and lay out BHA, rig up casing gear, run casing and cement casing	3.7 days	$ 2,173,248	$ 1,233,238	$ 940,010
LOT and Test	Includes full online BOP test	2.5 days	$ 994,594	$ 848,344	$ 146,250
Production Hole to 2497 mMDRT	Drill production hole to section TD plus any additional evaluation while drilling i.e. coring	7.1 days	$ 2,637,415	$ 2,403,642	$ 233,773
Evaluation	Includes wiper trip and layout BHA. Applicable to wireline logging - not coring	5.4 days	$ 2,199,121	$ 1,838,079	$ 361,042
Production Liner	Includes wiper trip during and post-logging, then running and cementing casing	4.3 days	$ 2,318,227	$ 1,442,185	$ 876,041
Rig Release	Requires final tree installation and release of the rig	0.3 days	$ 462,613	$ 113,113	$ 349,500
TOTALS		**44.1 days**	**$ 22,290,374**	**$ 14,598,054**	**$ 4,857,820**



Assumptions and Scope Change

- Performance: common drilling and casing running speeds for both wells in addition to equal inter-section work (BOP N/U, testing, logging etc.);
- No bit trips;
- Wiper trip TD to surface on second intermediate and production hole sections (30 hours for intermediate section, 15 hours for production section);
- 10 days post-drilled TD time (incl. logging and coring for production hole section & casing and cementing assuming discovery);
- P&A assumed as lump-sum cost as detailed above;
- Evaluation in intermediate hole sections (Quad-Combo or equivalent). No surface hole logging;
- CBL for second intermediate casing and production liner only;
- No DST's/MDT's (omitted from offset well TVD curves), coring assumed as lump sum cost;
- Drill times commensurate with offset wells. Offset wells have been curtailed at drilled TD, with 10 days added for post drill activities.

Incremental Costs From a Standard Well

Activity / Item	Time	Cost
Coring (120m / 27m = 5 runs)	2.5 days	$ 1,150,000
Plug and Abandonment	5.0 days	$ 2,900,000
		$ -
		$ -
		$ -
TOTAL	**7.50 days**	**$ 4,050,000**

Cost Category	Total Cost
Mobilisation / Demobilisation Costs	$ 1,410,000
Staff Salaries	$ 440,833
Overhead Allocation	$ 3,200,000
Rig Costs	$ 9,425,000
HSE and Auditing	$ 1,300,000
Evaluation	$ 5,180,417
Subsea Works	$ 58,000
Communications	$ 282,042
Transport	$ 1,202,083
Casing and Accessories	$ 705,850
Wellhead	$ 825,888
Cementing	$ 686,156
Mud	$ 460,583
Miscellaneous Equipment	$ 249,071
Drilling Tools & Equipment	$ 265,451
Class Charges	$ 154,000
Field Professional Services	$ 495,000
CONTINGENCY OF 10%	**$ 2,634,037**
TOTAL (Assuming Good Weather)	**$ 28,974,412**

Figure 74 - Barents Sea slender study well cost estimate

Also presented is a cost/time comparison for two options. See Figure 75 and Figure 76.

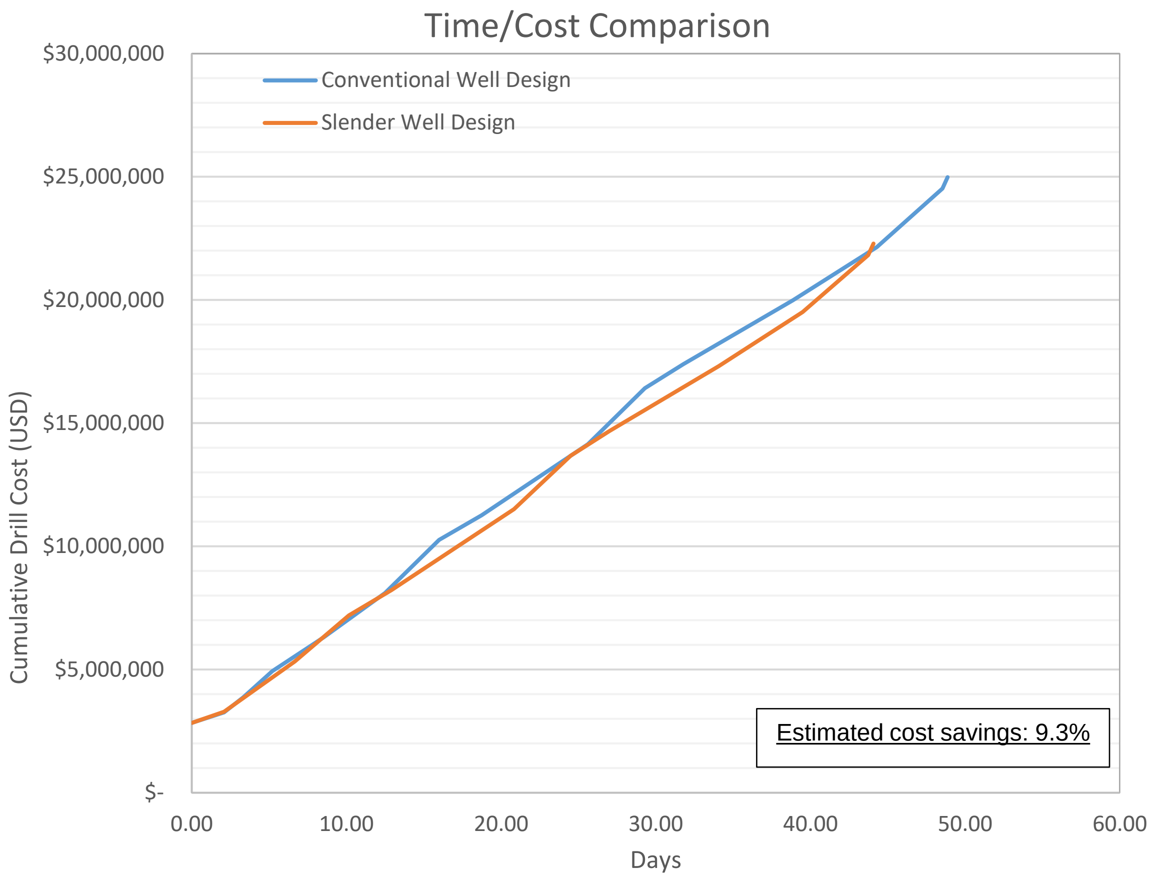


Figure 75 - Barents Sea time/cost comparison

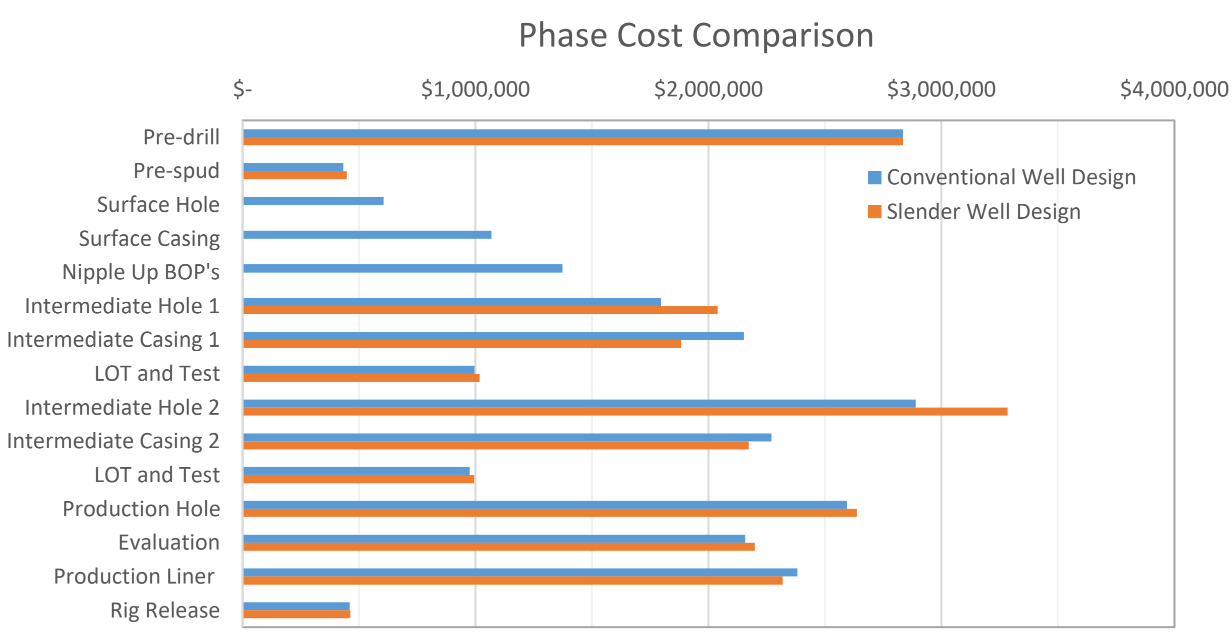


Figure 76 - Barents Sea phase cost breakdown

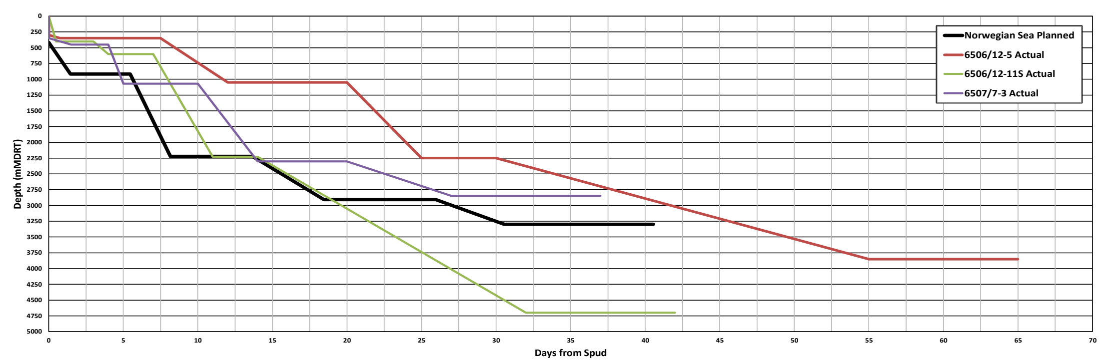
3.5.3 Norwegian Sea

The Norwegian Sea cost estimate for the conventional design is displayed below in Figure 77.

	w/o contingency. Good weather	w/o contingency. Bad weather	w/ contingency. Good weather	w/ contingency. Bad weather
Total Cost to P&A: No Discovery (No evaluation) + Immediate P&A	**$25,558,594**	**$29,392,383**	**$28,114,453**	**$31,948,243**
Total Cost to Case and Suspend: Discovery (w/ Evaluation) + Future P&A	**$27,772,260**	**$31,938,099**	**$30,549,486**	**$34,715,326**

Revision 0

Phase	Detailed Phase Description	Number of Days	Section Cost	Rentals and Personnel (Including Rig Rates)	Lump Sum Material Costs
Predrill	Overheads, class charges, levies, insurance premiums and environmental costs	N/A	$ 2,834,500	$ -	$ -
Pre-spud	Pre-spud includes all rig move costs incl. mobilisation, mooring, DP et al.	2.1 days	$ 453,173	$ 410,465	$ 42,708
Surface Hole to 915 mMDRT	Drill to section TD only	1.5 days	$ 693,679	$ 498,784	$ 194,896
Surface Casing	Includes wiper trip and lay out BHA, rig up casing gear, run casing and cement casing	1.7 days	$ 1,118,538	$ 570,038	$ 548,500
Nipple Up BOP's	Includes full online BOP test	2.3 days	$ 1,045,887	$ 798,054	$ 247,833
Intermediate Hole 1 to 2220 mMDRT	Drill to section TD only	4.0 days	$ 1,837,695	$ 1,341,966	$ 495,729
Intermediate Casing 1	Includes wiper trip and lay out BHA, rig up casing gear, run casing and cement casing	2.6 days	$ 2,101,268	$ 875,809	$ 1,225,458
LOT and Test	Includes full online BOP test	1.7 days	$ 620,872	$ 570,038	$ 50,833
Intermediate Hole 2 to 2906 mMDRT	Drill to section TD only	6.9 days	$ 2,960,471	$ 2,330,783	$ 629,688
Intermediate Casing 2	Includes wiper trip and lay out BHA, rig up casing gear, run casing and cement casing	2.9 days	$ 2,207,309	$ 988,817	$ 1,218,492
LOT and Test	Includes full online BOP test	2.5 days	$ 1,001,308	$ 855,058	$ 146,250
Production Hole to 3300 mMDRT	Drill production hole to section TD plus any additional evaluation while drilling i.e. coring	4.6 days	$ 1,761,564	$ 1,567,606	$ 193,958
Evaluation	Includes wiper trip and layout BHA. Applicable to wireline logging - not coring	5.4 days	$ 2,213,666	$ 1,852,625	$ 361,042
Production Liner	Includes wiper trip during and post-logging, then running and cementing casing	4.3 days	$ 2,408,823	$ 1,453,598	$ 955,225
Rig Release	Requires final tree installation and release of the rig	0.3 days	$ 463,508	$ 114,008	$ 349,500
TOTALS		**42.6 days**	**$ 23,722,260**	**$ 14,227,648**	**$ 6,660,113**



Assumptions and Scope Change

- Performance: common drilling and casing running speeds for both wells in addition to equal inter-section work (BOP N/U, testing, logging etc.);
- No bit trips;
- Wiper trip TD to surface on second intermediate and production hole sections (30 hours for intermediate section, 15 hours for production section);
- 10 days post-drilled TD time (incl. logging and coring for production hole section & casing and cementing assuming discovery);
- P&A assumed as lump-sum cost as detailed above;
- Evaluation in intermediate hole sections (Quad-Combo or equivalent). No surface hole logging;
- CBL for second intermediate casing and production liner only;
- No DST's/MDT's (omitted from offset well TVD curves), coring assumed as lump sum cost;
- Drill times commensurate with offset wells. Offset wells have been curtailed at drilled TD, with 10 days added for post drill activities.

Incremental Costs From a Standard Well

Activity / Item	Time	Cost
Coring (120m / 27m = 5 runs)	2.5 days	$ 1,150,000
Plug and Abandonment	5.0 days	$ 2,900,000
		$ -
		$ -
		$ -
TOTAL	**7.50 days**	**$ 4,050,000**

Cost Category	Total Cost
Mobilisation / Demobilisation Costs	$ 1,410,000
Staff Salaries	$ 426,250
Overhead Allocation	$ 3,200,000
Rig Costs	$ 9,067,292
HSE and Auditing	$ 1,300,000
Evaluation	$ 5,173,125
Subsea Works	$ 58,000
Communications	$ 281,313
Transport	$ 1,165,625
Casing and Accessories	$ 1,834,800
Wellhead	$ 1,110,000
Cementing	$ 910,000
Mud	$ 578,125
Miscellaneous Equipment	$ 240,831
Drilling Tools & Equipment	$ 375,400
Class Charges	$ 154,000
Field Professional Services	$ 487,500
CONTINGENCY OF 10%	**$ 2,777,226**
TOTAL (Assuming Good Weather)	**$ 30,549,486**

Figure 77 - Norwegian Sea conventional study well cost estimate

The cost estimate for the slender option is presented below, together with the appropriate scaling factors (which draw on the same assumptions outlined in 3.5.2.

The scaling factors are shown below in Table 17, and the cost estimate shown in Figure 78. Note there is no need to scale the production hole section, since there is no change in hole size and negligible change in casing specifications.

Wellheads and Casing

	Surface
Original casing OD (in)	20
New casing OD (in)	9 5/8
% change	48%

Mud

	Surface
Original hole OD (in)	26
Original depth interval (m)	492
Original Volume (bbl)	1060
New hole OD (in)	12 1/4
New depth (m)	928
New Volume (bbl)	444
% change	42%

Cement

	Surface
Original hole OD (in)	26
Original casing OD (in)	20
Original annular capacity (b/ft)	0.27
Original depth (m)	914
Original TOC (m)	363
Original CMT vol (bbl)	485
New hole OD (in)	12 1/4
New casing OD (in)	9 5/8
New annular capacity (b/ft)	0.06
New depth (m)	1350
New TOC (m)	363
New CMT vol (bbl)	181
% change	37%

Bits

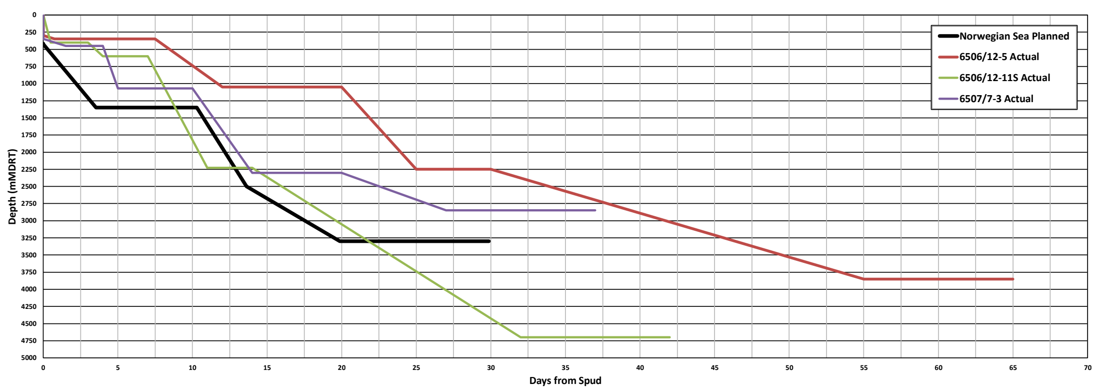
	Surface
Original hole OD (in)	26
New hole OD (in)	12 1/4
% change	47%

Table 17 - Scaling factors for Norwegian Sea slender well design cost estimate

	w/o contingency. Good weather	w/o contingency. Bad weather	w/ contingency. Good weather	w/ contingency. Bad weather
Total Cost to P&A: No Discovery (No evaluation) + Immediate P&A	**$19,418,070**	**$22,330,780**	**$21,359,877**	**$24,272,587**
Total Cost to Case and Suspend: Discovery (w/ Evaluation) + Future P&A	**$21,778,490**	**$25,045,263**	**$23,956,338**	**$27,223,112**

Revision 0

Phase	Detailed Phase Description	Number of Days	Section Cost	Rentals and Personnel (Including Rig Rates)	Lump Sum Material Costs
Predrill	Overheads, class charges, levies, insurance premiums and environmental costs	N/A	$ 2,834,500	$ -	$ -
Pre-spud	Pre-spud includes all rig move costs incl. mobilisation, mooring, DP et al.	2.1 days	$ 509,617	$ 466,908	$ 42,708
Surface Hole to 1350 mMDRT	Drill to section TD only	4.8 days	$ 2,205,937	$ 1,754,306	$ 451,631
Surface Casing	Includes wiper trip and lay out BHA, rig up casing gear, run casing and cement casing	2.6 days	$ 1,523,744	$ 945,800	$ 577,944
LOT and Test	Includes full online BOP test	2.9 days	$ 1,165,547	$ 1,076,588	$ 88,958
Production Hole to 3300 mMDRT	Drill production hole to section TD plus any additional evaluation while drilling i.e. coring	9.6 days	$ 3,778,820	$ 3,537,361	$ 241,458
Evaluation	Includes wiper trip and layout BHA. Applicable to wireline logging - not coring	5.4 days	$ 2,360,420	$ 1,999,378	$ 361,042
Production Casing	Includes wiper trip during and post-logging, then running and cementing casing	4.3 days	$ 2,547,368	$ 1,568,743	$ 978,625
Rig Release	Requires final tree installation and release of the rig	0.3 days	$ 802,539	$ 123,039	$ 679,500
TOTALS		**32.0 days**	**$ 17,728,490**	**$ 11,472,123**	**$ 3,421,867**



Assumptions and Scope Change

- Performance: common drilling and casing running speeds for both wells in addition to equal inter-section work (BOP N/U, testing, logging etc.);
- No bit trips;
- Wiper trip TD to surface on second intermediate and production hole sections (30 hours for intermediate section, 15 hours for production section);
- 10 days post-drilled TD time (incl. logging and coring for production hole section & casing and cementing assuming discovery);
- P&A assumed as lump-sum cost as detailed above;
- Evaluation in intermediate hole sections (Quad-Combo or equivalent). No surface hole logging;
- CBL for second intermediate casing and production liner only;
- No DST's/MDT's (omitted from offset well TVD curves), coring assumed as lump sum cost;
- Drill times commensurate with offset wells. Offset wells have been curtailed at drilled TD, with 10 days added for post drill activities.

Incremental Costs From a Standard Well

Activity / Item	Time	Cost
Coring (120m / 27m = 5 runs)	2.5 days	$ 1,150,000
Plug and Abandonment	5.0 days	$ 2,900,000
		$ -
		$ -
		$ -
TOTAL	**7.50 days**	**$ 4,050,000**

Cost Category	Total Cost
Mobilisation / Demobilisation Costs	$ 1,410,000
Staff Salaries	$ 319,583
Overhead Allocation	$ 3,200,000
Rig Costs	$ 6,671,875
HSE and Auditing	$ 1,300,000
Evaluation	$ 4,799,792
Subsea Works	$ 58,000
Communications	$ 275,979
Transport	$ 898,958
Casing and Accessories	$ 658,208
Wellhead	$ 406,250
Cementing	$ 532,361
Mud	$ 347,008
Miscellaneous Equipment	$ 180,565
Drilling Tools & Equipment	$ 179,536
Class Charges	$ 154,000
Field Professional Services	$ 386,375
CONTINGENCY OF 10%	**$ 2,177,849**
TOTAL (Assuming Good Weather)	**$ 23,956,338**

Figure 78 - Norwegian Sea slender well drill cost estimate

Also presented is a cost/time comparison for two options. See Figure 79 and Figure 80.

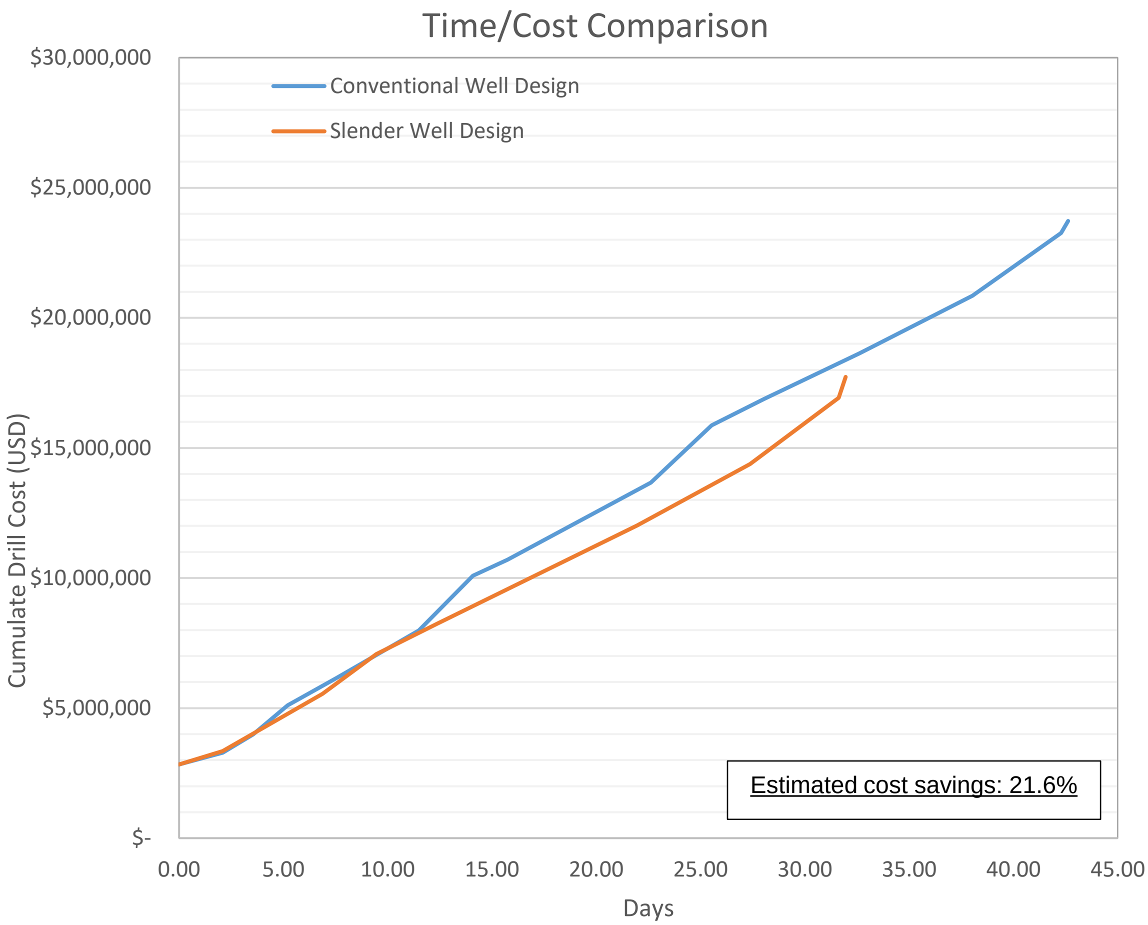


Figure 79 - Norwegian Sea Slender time/cost comparison

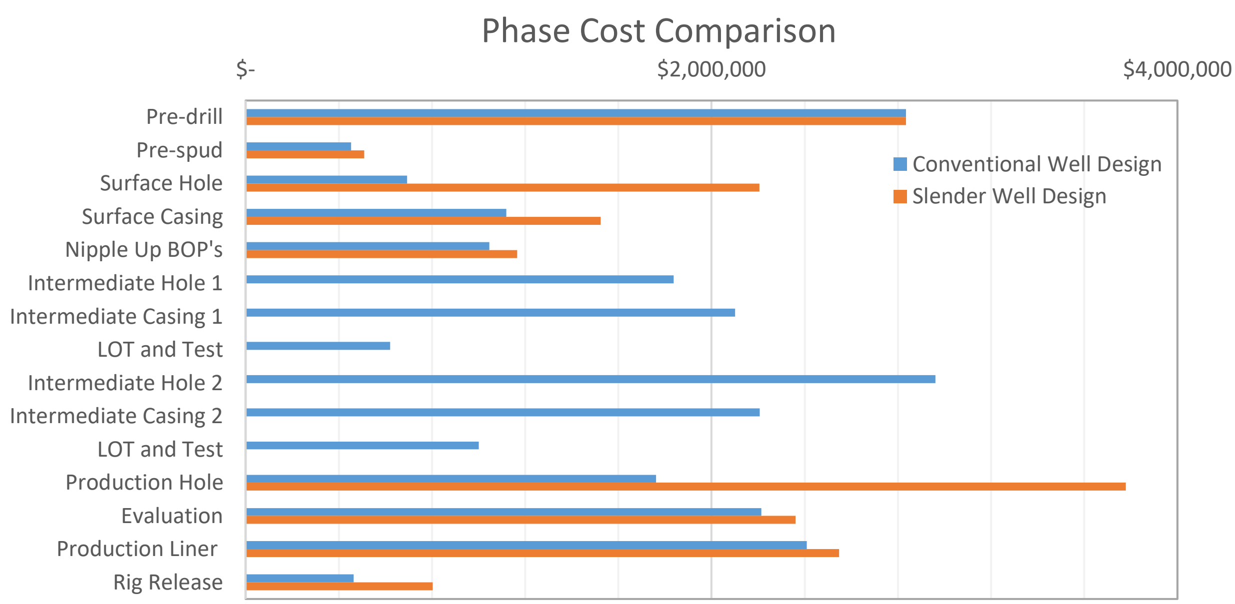


Figure 80 - Norwegian Sea slender well phase/cost comparison

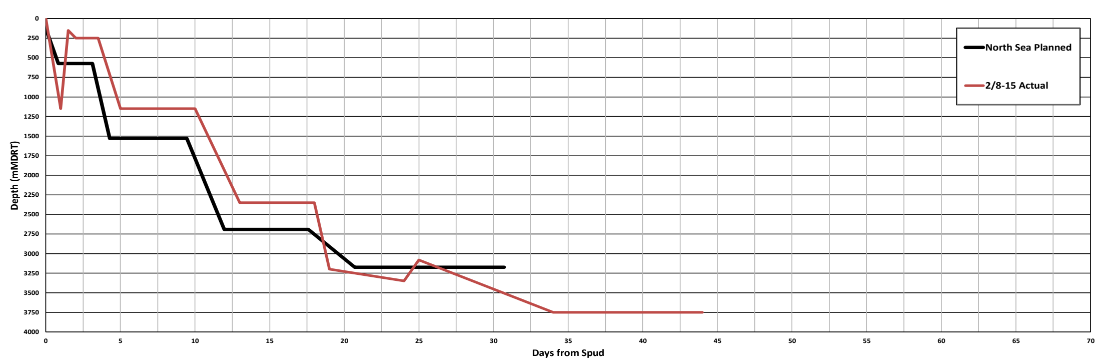
3.5.4 North Sea

The Norwegian Sea cost estimate for the conventional design is displayed below in Figure 81.

	w/o contingency. Good weather	w/o contingency. Bad weather	w/ contingency. Good weather	w/ contingency. Bad weather
Total Cost to P&A: No Discovery (No evaluation) + Immediate P&A	**$22,225,352**	**$25,559,155**	**$24,447,887**	**$27,781,690**
Total Cost to Case and Suspend: Discovery (w/ Evaluation) + Future P&A	**$24,570,869**	**$28,256,499**	**$27,027,956**	**$30,713,586**

Revision 0

Phase	Detailed Phase Description	Number of Days	Section Cost	Rentals and Personnel (Including Rig Rates)	Lump Sum Material Costs
Predrill	Overheads, class charges, levies, insurance premiums and environmental costs	N/A	$ 2,834,500	$ -	$ -
Pre-spud	Pre-spud includes all rig move costs incl. mobilisation, mooring, DP et al.	2.1 days	$ 503,885	$ 461,176	$ 42,708
Surface Hole to 573 mMDRT	Drill to section TD only	0.8 days	$ 487,387	$ 305,304	$ 182,083
Surface Casing	Includes wiper trip and lay out BHA, rig up casing gear, run casing and cement casing	1.0 days	$ 775,517	$ 381,630	$ 393,888
Nipple Up BOP's	Includes full online BOP test	1.3 days	$ 683,581	$ 457,956	$ 225,625
Intermediate Hole 1 to 1528 mMDRT	Drill to section TD only	2.4 days	$ 1,326,839	$ 878,131	$ 448,708
Intermediate Casing 1	Includes wiper trip and lay out BHA, rig up casing gear, run casing and cement casing	1.8 days	$ 1,655,152	$ 666,168	$ 988,983
LOT and Test	Includes full online BOP test	2.1 days	$ 826,801	$ 763,260	$ 63,542
Intermediate Hole 2 to 2691 mMDRT	Drill to section TD only	4.2 days	$ 2,061,103	$ 1,514,019	$ 547,083
Intermediate Casing 2	Includes wiper trip and lay out BHA, rig up casing gear, run casing and cement casing	2.1 days	$ 1,900,418	$ 757,010	$ 1,143,408
LOT and Test	Includes full online BOP test	1.9 days	$ 814,121	$ 686,934	$ 127,188
Production Hole to 3173 mMDRT	Drill production hole to section TD plus any additional evaluation while drilling i.e. coring	3.1 days	$ 1,308,952	$ 1,144,889	$ 164,063
Evaluation	Includes wiper trip and layout BHA. Applicable to wireline logging - not coring	5.4 days	$ 2,345,517	$ 1,984,475	$ 361,042
Production Liner	Includes wiper trip during and post-logging, then running and cementing casing	4.3 days	$ 2,525,475	$ 1,557,050	$ 968,425
Rig Release	Requires final tree installation and release of the rig	0.3 days	$ 471,622	$ 122,122	$ 349,500
TOTALS		**32.8 days**	**$ 20,520,869**	**$ 11,680,123**	**$ 6,006,246**



Assumptions and Scope Change

• Performance: common drilling and casing running speeds for both wells in addition to equal inter-section work (BOP N/U, testing, logging etc.);
• No bit trips;
• Wiper trip TD to surface on second intermediate and production hole sections (30 hours for intermediate section, 15 hours for production section);
• 10 days post-drilled TD time (incl. logging and coring for production hole section & casing and cementing assuming discovery);
• P&A assumed as lump-sum cost as detailed above;
• Evaluation in intermediate hole sections (Quad-Combo or equivalent). No surface hole logging;
• CBL for second intermediate casing and production liner only;
• No DST's/MDT's (omitted from offset well TVD curves), coring assumed as lump sum cost;
• Drill times commensurate with offset wells. Offset wells have been curtailed at drilled TD, with 10 days added for post drill activities.

Incremental Costs From a Standard Well

Activity / Item	Time	Cost
Coring (120m / 27m = 5 runs)	2.5 days	$ 1,150,000
Plug and Abandonment	5.0 days	$ 2,900,000
		$ -
		$ -
		$ -
TOTAL	**7.50 days**	**$ 4,050,000**

Cost Category	Total Cost
Mobilisation / Demobilisation Costs	$ 1,410,000
Staff Salaries	$ 327,917
Overhead Allocation	$ 3,200,000
Rig Costs	$ 6,892,708
HSE and Auditing	$ 1,300,000
Evaluation	$ 5,123,958
Subsea Works	$ 58,000
Communications	$ 276,396
Transport	$ 919,792
Casing and Accessories	$ 1,442,933
Wellhead	$ 1,110,000
Cementing	$ 910,000
Mud	$ 528,958
Miscellaneous Equipment	$ 185,273
Drilling Tools & Equipment	$ 343,933
Class Charges	$ 154,000
Field Professional Services	$ 387,000
CONTINGENCY OF 10%	**$ 2,457,087**
TOTAL (Assuming Good Weather)	**$ 27,027,956**

Figure 81 - North Sea conventional study well cost estimate

As previous, the scaling factors for the North Sea estimate are presented below in Table 18.

Casing

	Surface	Intermediate	Production
Original casing OD (in)	20	13 3/8	7
New casing OD (in)	11 3/4	9 5/8	7
% change	59%	72%	100%

Wellheads

	Surface	Intermediate	Production
Original casing OD (in)	20	13 3/8	7
New casing OD (in)	11 3/4	9 5/8	7
% change	59%	72%	100%

Mud

	Surface	Intermediate	Production
Original hole OD (in)	26	17 1/2	8 1/2
Original depth interval (m)	414	1369	623
Original Volume (bbl)	892	1336	143
New hole OD (in)	13 1/2	12 1/4	8 1/2
New depth (m)	541	1850	623
New Volume (bbl)	314	885	143
% change	35%	66%	100%

Cement

	Surface	Intermediate	Production
Original hole OD (in)	26	17 1/2	8 1/2
Original casing OD (in)	20	13 3/8	7
Original annular capacity (b/ft)	0.27	0.12	0.02
Original depth (m)	573	1528	3173
Original TOC (m)	123	1300	2550
Original CMT vol (bbl)	396	93	46
New hole OD (in)	13 1/2	12 1/4	8 1/2
New casing OD (in)	11 3/4	9 5/8	7
New annular capacity (b/ft)	0.04	0.06	0.02
New depth (m)	700	2550	3173
New TOC (m)	123	2000	2550
New CMT vol (bbl)	81	101	46
% change	21%	109%	100%

Bits

	Surface	Intermediate	Production
Original hole OD (in)	26	17 1/2	8 1/2
New hole OD (in)	13 1/2	12 1/4	8 1/2
% change	52%	70%	100%

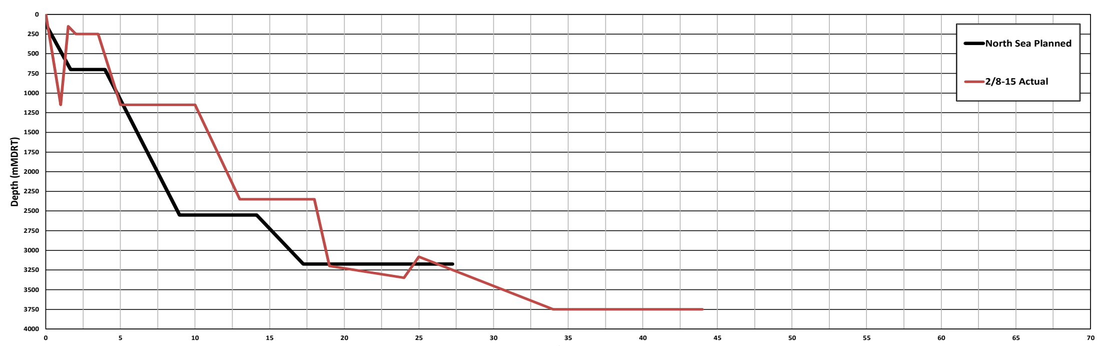
Table 18 - Scaling factors for North Sea slender design cost estimate

The cost estimate for the North Sea slender well design is shown below in . In addition to the assumptions stated above and herein, there is an addition US$2000/- per day for directional services and 2 x US$2000/- per day for directional drilling engineers. US$20,000/- has been allowed for pre-well directional drilling mobilisation charges. These charges are due to the need for RSS services and under-reaming in the surface and intermediate hole sections.

	w/o contingency. Good weather	w/o contingency. Bad weather	w/ contingency. Good weather	w/ contingency. Bad weather
Total Cost to P&A: No Discovery (No evaluation) + Immediate P&A	**$19,096,772**	**$21,961,287**	**$21,006,449**	**$23,870,965**
Total Cost to Case and Suspend: Discovery (w/ Evaluation) + Future P&A	**$21,537,838**	**$24,768,514**	**$23,691,622**	**$26,922,297**

Revision 0

Phase	**Detailed Phase Description**	**Number of Days**	**Section Cost**	**Rentals and Personnel (Including Rig Rates)**	**Lump Sum Material Costs**
Predrill	Overheads, class charges, levies, insurance premiums and environmental costs	N/A	$ 2,854,500	$ -	$ -
Pre-spud	Pre-spud includes all rig move costs incl. mobilisation, mooring, DP et al.	2.1 days	$ 540,634	$ 497,926	$ 42,708
Surface Hole to 700 mMDRT	Drill to section TD only	1.7 days	$ 745,659	$ 640,008	$ 105,651
Surface Casing	Includes wiper trip and lay out BHA, rig up casing gear, run casing and cement casing	1.0 days	$ 693,430	$ 400,005	$ 293,425
Nipple Up BOP's	Includes full online BOP test	1.3 days	$ 623,131	$ 480,006	$ 143,125
Intermediate Hole 1 to 2550 mMDRT	Drill to section TD only	6.3 days	$ 2,863,903	$ 2,381,278	$ 482,625
Intermediate Casing 1	Includes wiper trip and lay out BHA, rig up casing gear, run casing and cement casing	1.8 days	$ 1,700,750	$ 698,508	$ 1,002,242
LOT and Test	Includes full online BOP test	2.1 days	$ 863,551	$ 800,009	$ 63,542
Production Hole to 3173 mMDRT	Drill production hole to section TD plus any additional evaluation while drilling i.e. coring	3.1 days	$ 1,352,117	$ 1,200,014	$ 152,103
Evaluation	Includes wiper trip and layout BHA. Applicable to wireline logging - not coring	5.4 days	$ 2,441,066	$ 2,080,025	$ 361,042
Production Liner	Includes wiper trip during and post-logging, then running and cementing casing	4.3 days	$ 2,331,594	$ 1,632,019	$ 699,575
Rig Release	Requires final tree installation and release of the rig	0.3 days	$ 477,502	$ 128,002	$ 349,500
TOTALS		**29.3 days**	**$ 17,487,838**	**$ 10,937,800**	**$ 3,695,538**



Assumptions and Scope Change

- Performance: common drilling and casing running speeds for both wells in addition to equal inter-section work (BOP N/U, testing, logging etc.);
- No bit trips;
- Wiper trip TD to surface on second intermediate and production hole sections (30 hours for intermediate section, 15 hours for production section);
- 10 days post-drilled TD time (incl. logging and coring for production hole section & casing and cementing assuming discovery);
- P&A assumed as lump-sum cost as detailed above;
- Evaluation in intermediate hole sections (Quad-Combo or equivalent). No surface hole logging;
- CBL for second intermediate casing and production liner only;
- No DST's/MDT's (omitted from offset well TVD curves), coring assumed as lump sum cost;
- Drill times commensurate with offset wells. Offset wells have been curtailed at drilled TD, with 10 days added for post drill activities.

Incremental Costs From a Standard Well

Activity / Item	**Time**	**Cost**
Coring (120m / 27m = 5 runs)	2.5 days	$ 1,150,000
Plug and Abandonment	5.0 days	$ 2,900,000
		$ -
		$ -
		$ -
TOTAL	**7.50 days**	**$ 4,050,000**

Cost Category	**Total Cost**
Mobilisation / Demobilisation Costs	$ 1,410,000
Staff Salaries	$ 293,333
Overhead Allocation	$ 3,200,000
Rig Costs	$ 6,106,250
HSE and Auditing	$ 1,300,000
Evaluation	$ 4,786,667
Subsea Works	$ 58,000
Communications	$ 274,667
Transport	$ 833,333
Casing and Accessories	$ 926,631
Wellhead	$ 643,388
Cementing	$ 374,495
Mud	$ 259,653
Miscellaneous Equipment	$ 165,733
Drilling Tools & Equipment	$ 398,938
Class Charges	$ 154,000
Field Professional Services	$ 352,750
CONTINGENCY OF 10%	**$ 2,153,784**
TOTAL (Assuming Good Weather)	**$ 23,691,622**

Figure 82 - North Sea slender well drill cost estimate

The time/cost and phase cost comparisons for the North Sea slender well are shown below in Figure 83 and Figure 84.

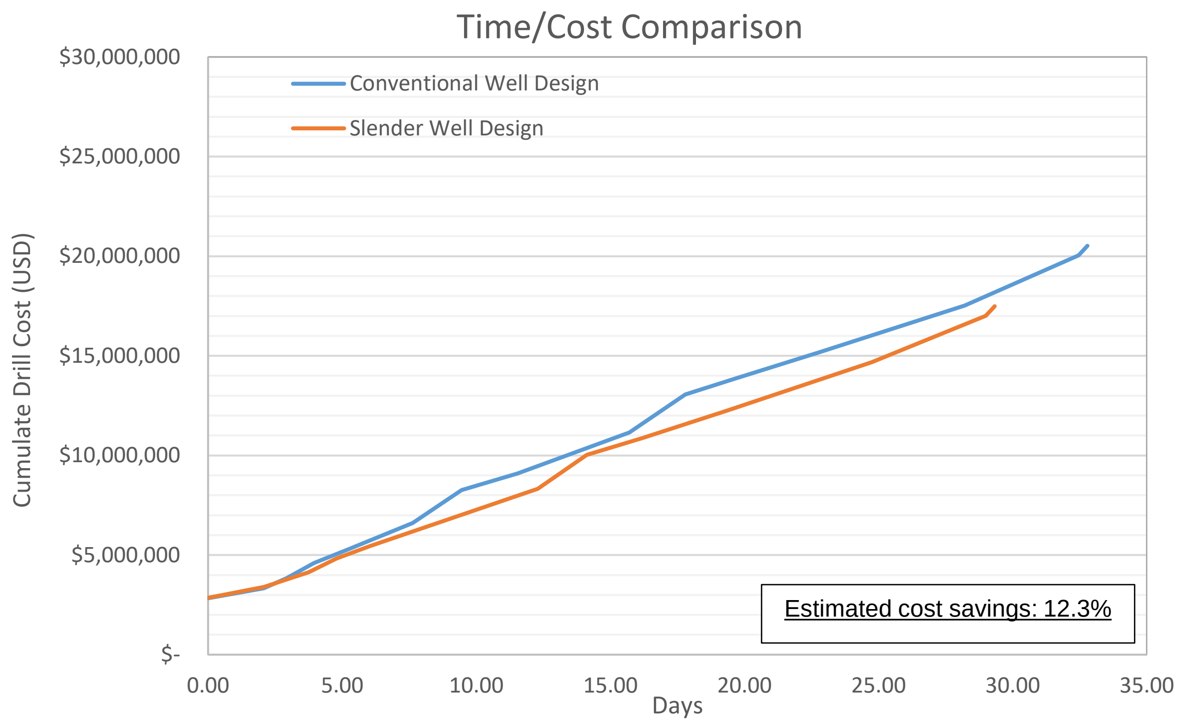


Figure 83 - North Sea slender well time/cost comparison

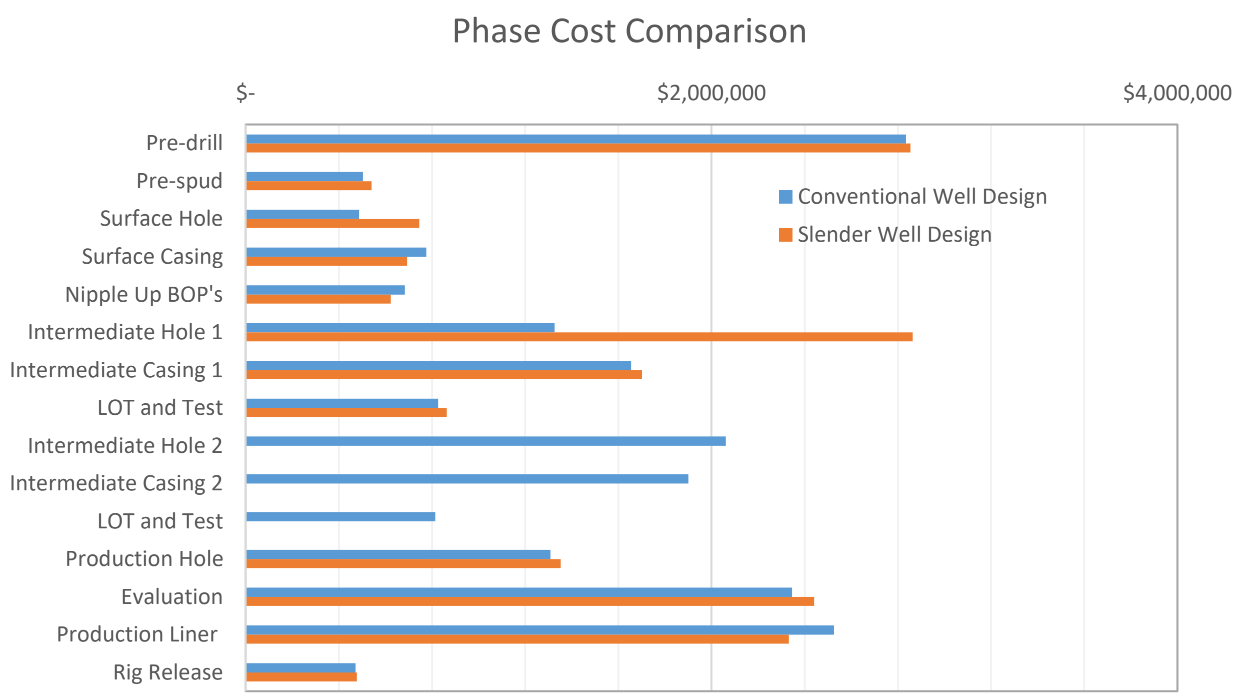


Figure 84 - North Sea slender well phase cost comparison

3.5.5 Discussion

The upshot of this study is that slender wells are indeed cheaper than their conventional counterparts. However, this conclusion does not accurately represent the full picture. The author hypothesised at the commencement of this thesis that the saving in material costs (regardless of the number of casing strings) would be the primary cost driver for cheaper wellbores by slimming down. This shall be examined more thoroughly below.

Upon closer inspection, we note that some phases are more expensive for slender wells than for conventional wells. One might argue that this is simply the result of the new slender well section being deeper and thereby taking longer to drill. When we examine the phase cost comparisons for each well at similar hole depths, however, we notice that there is very little difference in costs (with savings ranging from 2-5%). The primary cost saving comes from removing one or two sections of casing. This is obvious, but it begs the question: what happens when we slim down our wells and in fact require the same number of casing strings? What then becomes of our economics and is there any benefit to this practise? What is the primary cost driver?

To attempt to resolve this question, let us examine Figure 85 below, which depicts the differences in material costs on a phase-by-phase basis. We notice that there is much to be saved on a phase-by-phase basis from a materials standpoint. However, looking again at our overall phase cost comparisons in Figure 76, Figure 80 and Figure 84, we still do not seem to be reaping the economic benefits so desired. While the majority of phases see cheaper material costs for slender wells, some of those same phases can be overall more expensive when considering total drill costs. Therefore, we conclude that material costs alone cannot be the primary cost driver of making slender wells economically viable.

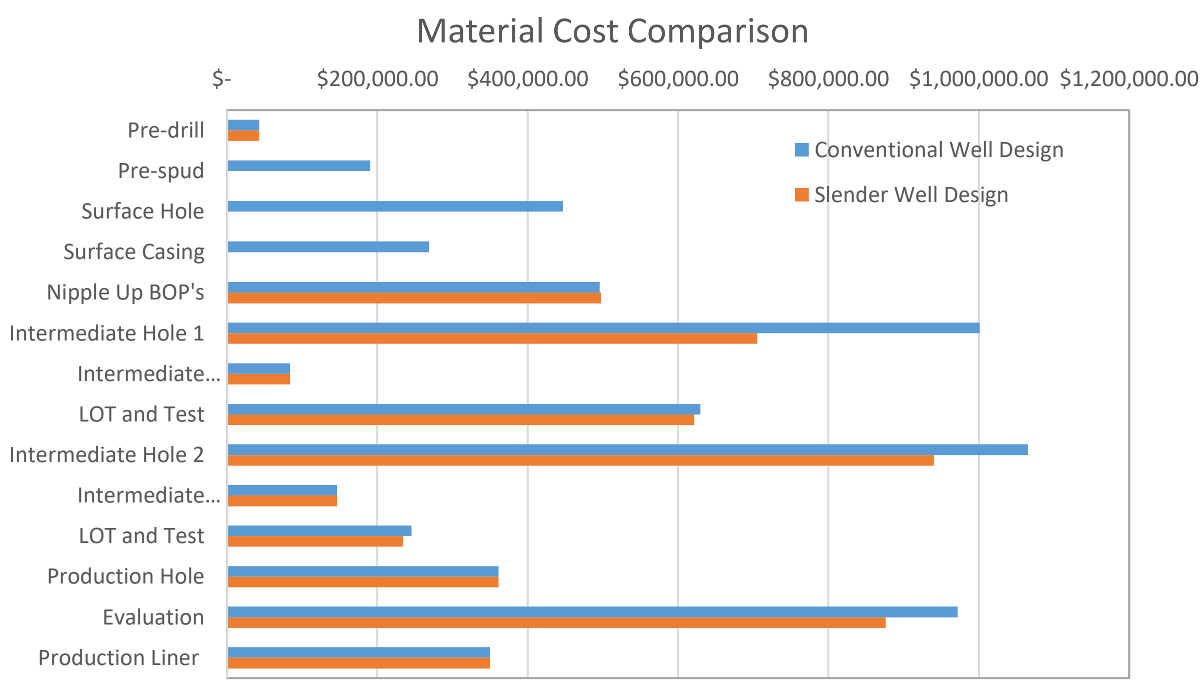


Figure 85 – Average material cost comparison for all wells

Before proceeding, it is worth making a note about market pricing and its effect on material costs. These cost estimates are based on the assumption that material costs decrease linearly with either hole/annular volume, casing size or hole diameter. In practise however, this is often not the case. Different operating companies will be able to secure different pricing for tubulars and wellheads depending on a few factors (among others):

- The relationships that the operating company has built with its vendors;
- Market capitalisation of the operating company;
- The size of the project (i.e. one usually is able to obtain a lower cost per unit material for a 20 well campaign rather than a five well campaign);
- Whether or not equipment is ordered on a consignment basis.

OCTG vendors and service companies often stock commonly used materials, thereby reducing their per-unit purchase cost. This is because it is desirable to avoid excessive slow-moving-stock costs. In our case, the casing strings and connections listed in Table 6 and Table 7 may well be cheaply available, whereas ordering slim casing may be more expensive than simply using OCTG in one's warehouse, since consignment orders may be required. This is because they are and have been widely used for decades. However, given a long campaign and a commitment to use slimmer casing strings, the net effect will be a long-term saving in material costs, which will offset a short-term loss. *These concepts will be discussed in greater depth in Chapter 4.*

When drilling a well, there are broadly speaking, two types of costs; recurring costs (summarily known as "spread rate") and one-off daily costs. Material costs tend to straddle both categories (e.g. mud chemical costs are loosely pegged to drill time and particularly wellbore conditions, whereas casing costs are purely on-off expenses at the time of running). Recurring costs however, are fixed and typically much higher than our one-off costs. Therefore, if we assume for a moment that all of our slender wells were drilled with similar casing set depths and the same number of strings, our cost savings would be a function of two factors: material and volume reduction (one-off costs) and time. Nevertheless, since we have ruled out material costs, time must be the overriding factor.

Why time? To illustrate the importance of time to our analysis, let us look at Figure 86 below, which shows the variance in time/depth performance for similar wells drilled by the same (or similar) rigs in one field (Directorate, 2018)[24]. What stands out is not so much the variance in ROP's, but rather the variance in flat time (e.g. nippling-up BOP's, LOT's etc.). Given that these wells were drilled under very similar conditions, with either the same or a very similar rig, it stands to reason that their end-of-well final costs will vary based solely on drill time. Since material costs are masked by the drill costs (pegged to time) for slim well drilling, the driving factor in making slim wells economic must be rig crew performance. A poor performing crew could easily tarnish the merits of slim well drilling, thereby making the extra risk unnecessary. Conversely, a high performing crew may produce the opposite effect. The variance in drill times highlights the importance of crew performance in wellbore economics. In order to substantiate this argument, a field comparison from an unnamed Australian onshore operator has been included. The chart shows variance in rig crew performance for one rig in one onshore field, with NPT excluded.

[24] For an "apples-to-apples" comparison, NPT has been removed from the time/depths curves.

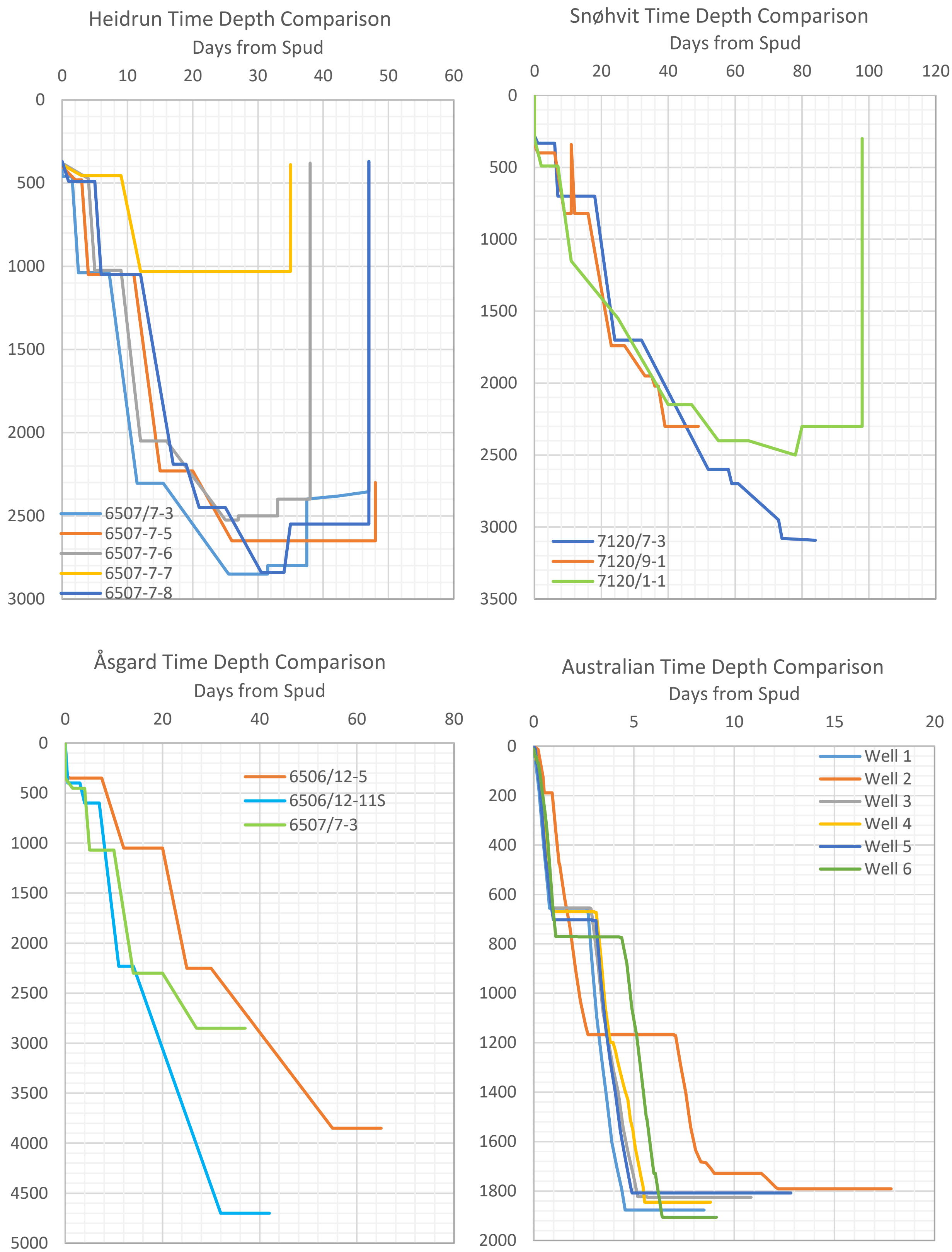


Figure 86 - Time/Depth curves for Norwegian & Australian fields (Directorate, 2018)

In a recent interview with Petoro (Petoro, 2018), it was highlighted that one of the key challenges facing the Norwegian section is to reduce "hidden NPT", or to state otherwise – improve efficiency. The charts above are a clear example of how efficiency and hence, reducing hidden NPT could lead to improved wellbore economics. Even where performance seems not to vary in any significant manner, it is worth pointing out that today's spread rate for offshore drilling in Norway is roughly ~US$580,000[25]. This equates to ~US$24,200 per hour. Therefore, we can clearly see the effect of hidden NPT on our wellbore costs.

To conclude our economic analysis of slender wells, we are able to draw the following conclusions:

- Yes – drilling slender wells, with reduced casing strings is (obviously) cheaper than drilling conventional wells;
- Simply slimming down a well, all casing points remaining equal may not necessarily be economically beneficial. This will depend entirely on operating time;
- Material cost savings, while significant, only play a minute role in reducing wellbore costs. These savings will fluctuate depending on the operating company's competitive market advantage in securing lower per-unit material costs;
- The primary cost driver of economically successful slender well drilling is rig crew performance;
    - High performing rig crews will allow a more clear view of the material cost savings;
    - Poor performing rig crews will mask any benefits gained by slimming down wells.

Note: in Chapter 4, we will analyse a number of ways which Norwegian operators can improve rig crew performance.

3.6 Risk Assessment

In this section, a number of key risk factors are analysed with respect to slim well drilling. The section will present a risk matrix and register which is applicable to these types of wells. The risk matrix has been adapted from DNV-RP-G101 (DNV GL, 2010).

The risk matrix selected for our analysis is presented below in Figure 87. This is a commonly applied type of matrix, which any operating company could "plug in and play".

---

[25] Figure taken from drill cost estimate for an unnamed Norwegian operating company.

			Consequence				
		HEALTH AND SAFETY	First Aid Injury	Medical Treatment	Lost time Injury	Permanent Disability	Fatality
		FINANCIAL IMPACT	Up to $100k	$100k - $1M	$1M - $10M	$10M - $25M	$25M +
		REPUTATION	Minimal impact on business reputation, land holder only	Some impact on business reputation, local community exposure	Moderate impact on business reputation, local media exposure	Significant impact on business reputation, national media exposure	Critical impact on reputation, international media exposure
		ENVIRONMENT	Incident. No breach of regulations. Minimal and short term impact to any local environment.	Minor breach of regulations / resulting in notification to regulator. Localised, short term, recoverable minor impact on flora and fauna.	Serious breach of regulations / resulting in reporting to regulator, investigation, environment notice or fines. Significant localised but short term environmental impact.	Major breach of legislation resulting in prosecution or litigation and regulatory intervention. Serious and long term ecological impact and environmental harm.	Significant compliance breach resulting in prosecution / class action or loss of licence. Severe environmental harm with widespread or permanent
			1 **Insignificant**	**2** **Minor**	**3** **Moderate**	**4** **Major**	**5** **Catastrophic**
Likelihood	A common event that is likely to occur in the industry many times per year	**A Highly Likely**	**Intermediate A1**	**Intermediate A2**	**High A3**	**Extreme A4**	**Extreme A5**
	An event likely to occur more than once a year in the industry	**B Likely**	**Low B1**	**Intermediate B2**	**Intermediate B3**	**High B4**	**Extreme B5**
	An event that may occur in the industry over 10 years	**C Possible**	**Low C1**	**Low C2**	**Intermediate C3**	**Intermediate C4**	**High C5**
	An event not likely to occur in the industry over 10 years	**D Unlikely**	**Negligible D1**	**Negligible D2**	**Low D3**	**Low D4**	**Intermediate D5**
	An event that has not previously been experienced in the industry but may occur in exceptional circumstances	**E Remote**	**Negligible E1**	**Negligible E2**	**Low E3**	**Low E4**	**Intermediate E5**

Figure 87 - Risk matrix (DNV GL, 2010)

A few key notes regarding the risk register below (Table 19):

- No operation (or indeed any activity in our daily lives) is free from risk;
- Risk cannot be eliminated, only controlled. There must be an acceptable level of risk for any in-field operation;
- The register is not intended to replace a complete wellbore drilling risk register, but rather serve as a complement to the same, with a focus purely on slim well drilling;
- A number of risks presented herein draw on Gibson's paper on the Advantages and Requisite Considerations of Slim-Hole Drilling (Gibson, 2016).

Type / Phase	Activity, Product or Service	Hazards / What ifs? (Energy Source)	Associated Risks / Contributing Factors	Consequence	Likelihood	Risk Level	Current Controls	Risk reduction measures	Updated Consequence	Updated Likelihood	Residual Risk	Risk Owner	Responsible?
Cementing	Cementing operations in slender wells	Excessive ECDs due to low annular clearance between hole and casing	Formation breakdown Poor cement quality Loss of well integrity Future remdediation	**Major**	**Likely**	**High B4**	Cementing program ECD modelling	Under-reaming to improve cement quality and reduce annular pressure losses	**Major**	**Unlikely**	**Low D4**	Drilling Engineer	Cementing Crew Driller 3P bit provider
Completions and Workover	New completion or workover design	Slim wells may lead to excessive loads New design does not cover full range of anticipated production rates	Deferred production Lost time Financial loss	**Minor**	**Possible**	**Extreme B5**	Signed Well Spec forms - tubing pumps selected Slimhole completions options report	Input from 3P equipment providers. CWOP	**Minor**	**Possible**	**Intermediate D5**	Completions Engineer Completions Super	Company Man Driller
Drilling	Directional drilling operations in slim wells	Downhole equipment limitations when using smaller diameter tools/tubulars, which leads to: Poor ROPs Poor directiona	Sidetracking Technical failure (drill target not achieved)	**Major**	**Possible**	**Intermediate C4**	Directional modelling (in-house and 3rd party) Pre-qualification of contractors 3P equipment certification processes	Coordination with subsurface asset teams to better understand downhole conditions Directional drilling crews on-site for any DD operations	**Major**	**Unlikely**	**Low E4**	Drilling Engineer DD crews	DD crews Driller

		l control Sub-optimal drilling parameters											
	Under-reaming operations	Formation breakdown in unconsolidated sections	Lost time Poor cement quality	**Minor**	**Possible**	**Extreme B5**	Underreaming guidelines 3P bit provider on-site during UR ops Drilling program SOP's JHA's	Detailed geomechanics studies to assess formation strengths - adjust drill parameters accordingly Regular hole cleaning	**Minor**	**Remote**	**Intermediate D5**	Drilling Engineer Drilling Superintendent	Driller 3P bit provider
	Drilling ahead with slim drilling equipment	Excessive torque on slender equipment Stick slip caused by high torque in low-clearance sections	Parting of tubulars Fishing job Damage to equipment Lost time	**Moderate**	**Likely**	**Intermediate C4**	Drilling Program outlining drill procedures Drilling supervision on-site SOP's	Soft-torque rotary table / TD Modern rigs: use of auto-torque dampener to adjust parameters during periods of excessive torque	**Moderate**	**Unlikely**	**Low D4**	Drilling Engineer Drilling Superintendent Company Man Driller	Driller Company Man
Evaluation	Running smaller diameter logging tools	Lower than normal tensile strengths in tight formations: Lost tools downhole	Fishing Breach of environmental regulations (if R/A sources involved)	**Major**	**Possible**	**Intermediate C3**	Wireline program included within Drilling Program Max pull to 50% of cable weak point	Wiper trip always before running logging tools in-hole PJSM with WL crews Use of jars and flywheels on all	**Major**	**Unlikely**	**Low D3**	Drilling Engineer Company Man	WL logging crews

								logging runs					
	Calibration of WL data	Current software interpretation charts/algorithms optimised for conventional wellbore sizes. Slim wells require new correlations	Innaccurate downhole data Incorrectly selected perforation intervals Lost production Sidetracking	**Major**	**Likely**	**High B4**	System of checks and balances by subsurface asset teams and third party interpretation providers Empirical analogues	Development of experimental interpretation charts for the prevailing conditions, together with operator and service company	**Major**	**Unlikely**	**Low D4**	Subsurface	Subsurface WL logging provider
	Coring operations in slim open hole sections	Swabing and surging due to excessive running speeds in tandem with a very low annular clearance	Uncontrolled release of fluids Loss of core samples or unrepresentative samples Blowout Loss of rig / well Crew injuries of death	**Major**	**Possible**	**Intermediate A2**	3P pre-qualification Min/max trip speeds dictated in the drilling program	Thinning of drilling fluid prior to running coring tools to avoid excessive gels and well control issues	**Major**	**Remote**	**Negligible D2**	Mud Engineer Coring Crew Drilling Engineer	Coring Crew Mud Engineer
Hydraulics	Drilling hydraulics - cuttings lift, wellbore stability, hole cleaning	High rotational speeds in sedimentary formations with slender well equipment	Pack-off Wellbore wall breakdown Differential sticking	**Moderate**	**Possible**	**Intermediate C4**	Mud Engineer on-site Dedicated drilling fluids program Set drilling parameters	Ensuring laminar flow in soft sedimentary formations Uniform annular velocity profile	**Moderate**	**Unlikely**	**Low D4**	Drilling Engineer Drilling Superintendent Mud Engineer	Mud Engineer Rig Crew

	Drilling hydraulics - eccentric pipe rotations in slim hole drilling	Uncontrolled eccentricity in drill pipe rotation, thereby inducing high pressure losses	Formation breakdown due to excessive ECD's	**Minor**	**Likely**	**Low C2**	Drilling Progam Detailed mud specifications Experienced crews, best practices	On-site pre-spud meetings Pre-tour breifings Instructions to driller Crew training	**Minor**	**Unlikely**	**Negligible E2**	Drilling Engineer Drilling Superintendent Company Man Driller	Driller
	Increasing mud weights in slim hole sections using conventional chemicals	Use of coarse grained agents for weighting-up	Deposition and buildup of fines onto borehole wall Increase ECD's and annular pressures Stuck pipe Fishing	**Moderate**	**Likely**	**Intermediate B3**	Mud program Mud Engineer on-site	Use of finer weighting agents	**Moderate**	**Possible**	**Low D3**	Drilling Engineer Mud Engineer Derrickman	Derrickman Mud Engineer
	Swelling clays in slim wells (very small annular clearance)	Swelling clays due to poor mud parameters	Pack-off Differential Sticking Loss of tubulars Fishing	**Moderate**	**Possible**	**Intermediate B3**	Mud program Mud Engineer on-site	Salinity study to ensure compatibility between salinity of prevailing shale and drilling fluid	**Moderate**	**Unlikely**	**Intermediate C3**	Drilling Engineer Mud Engineer Derrickman	Mud Engineer Rig Crew
Planning	Introduction of slim hole drilling into a region where it has previously not been done	Drilling program not executed correctly. Unfamiliar rig crews	Cold crews: crew competencies with specific equipment, or with new rig if desired	**Major**	**Likely**	**High B4**	FFP and On site supervision Drilling Supervisor Prequalifications for crew SOPs JHA's Experience review and transfer	Crew icebreaker DWOP HSE on site inspectors Crew training to handle smaller diameter pipe (most notably for overpull	**Major**	**Unlikely**	**Low D4**	Drilling Engineer Drilling Superintendent	OIM Company Man Toolpusher

								limitations due to tensile strength differences					
	Backup fishing tools available on-hand	Loss of equipment downhole without immediate access to fishing equipment and personnel	Lost time waiting on personnel and equipment	**Minor**	**Highly Likely**	**Intermediate B3**	Dependent on operating company	Slim hole overshot fishing tools for slim BHA/WL/Coring etc. readily available on-site, with fishing crew able to be hot-shot to rig ASAP	**Minor**	**Unlikely**	**Low D3**	Drilling Engineer Drilling Superintendent Company Man	Fishing Crews Company Man
	Tool string design (drill pipe / casing / etc.)	Tool joint failure due to excessive vibrations (particularly prevalent for highly deviated wells) Excessive wellbore pressure during shut-in on conventional pipe in slim holes	Fishing Failed tubulars Blowout Loss of well / rig Deaths	**Catastrophic**	**Likely**	**High A3**	Tensile/compressional stress modelling Casing design 3P modelling of tubular runs SOPs JHAs	Use of premium connections if conditions dictate (metal-to-metal sealing) Use small external upset on connections Well control modelling for premium threaded connections	**Catastrophic**	**Unlikely**	**Low D3**	Drilling Engineer	Drilling Engineer Drilling Superintendent Company Man Rig Crews

	Drilling fluid design in slim wells	Poor drilling hydraulics Differential Sticking Fishing	Loss of well	**Major**	**Likely**	**Intermediate C4**	Mud program Fluid modelling	Maintain thin, hard filter cake at BHT Minimise the use of LG solids by utilising solids control equipment or aggressive dumping (although costly) Tension meters on all WL runs Use of TD and power swivel	**Major**	**Unlikely**	**Low D4**	Drilling Engineer Company Man Mud Engineer	Mud Engineer Rig Crew Company Man
	Transport of casing to site	Casing is damaged en route to site, or else damaged due to poor storage on-site Casing is poorly handled when running in hole	Waiting on equipment Lost time Financial damage Loss of well	**Major**	**Possible**	**Intermediate C4**	Third party chain of responsibility for transport of tubular goods	Backup joints readily available on-site. As minimal handling of tubulars as possible See "Running Tubulars - Running casing into slim hole/casing sections	**Major**	**Unlikely**	**Low D4**	Logistics Coordinator 3P transport crews Drilling Superintendent	3P transport crew Company Man Rig crews
Running Tubulars	Excessive overpull on tubulars during drilling operati	Crews unfamiliar with running practices for smaller diameter tubulars	Parting of tubulars Fishing job Damage to equipment Lost time	**Moderate**	**Likely**	**Low C2**	Drilling Program outlining drill procedures Drilling supervision on-site SOP's	Drilling Superintendent on-site for first two wells Crew training	**Moderate**	**Unlikely**	**Low C2**	Drilling Engineer Drilling Superintendent	Drilling Superintendent Toolpusher Company Man Rig Crew

	ons or while running casing (use of slimmer and normal tubulars)												
	Setting and removing tubulars in/fron slips	Unfamiliarity with lower tubular loads Lost tubing downhole	Fishing	**Moderate**	**Possible**	**Intermediate B2**	SOP's Correct slip-dies on-site Written instructions to driller	Crew training for handling smaller tubulars	**Moderate**	**Unlikely**	**Negligible D2**	Drilling Engineer Drilling Superintendent Company Man Driller	Driller Company Man
	Running casing into slim hole/casing sections	High ECD's due to low annular clearance	Formation breakdown Lost well integrity Stuck tools Fishing	**Moderate**	**Highly Likely**	**Intermediate C3**	Trip speed schedule ECD modelling Mud Program SOPs JHAs	Use of annular flow-through diversion tool to reduce ECD's	**Moderate**	**Unlikely**	**Low D3**	Drilling Engineer Drilling Superintendent	Driller Company Man
	Running tubulars in and out of hole in depleted section	Differential sticking	Sidetracking Technical failure (drill target not achieved)	**Major**	**Likely**	**High B4**	Mud program Diff sticking modelling Drilling Program SOPs	Constant pipe movement where possible LCM for depleted sections Pipe-free pills readily available on-site Diff sticking contingency plan	**Major**	**Unlikely**	**Low D4**	Drilling Engineer Drilling Superintendent Company Man	Driller Company Man
	Running casing into slim	Impassable sections of casing Poor	Loss of well Financial and reputatio	**Major**	**Possible**	**Extreme B5**	Strapping and drifting best practices SOPs	Backup joints readily available on-site.	**Major**	**Unlikely**	**Intermediate D5**	Logistics Coordinator 3P transport crews Drilling	3P transport crew Company Man Rig crews

	hole/casing sections	transport, storage and running practices	nal damage				JHAs PJSMs Drilling program - casing running practices	As minimal handling of tubulars as possible				Superintendent	
Well Control	Well control during normal drilling	Drilling slim well sections with very small annular clearances. Low kick tolerances	Uncontrolled release of fluids Blowout Loss of rig / well Crew injuries of death	**Catastrophic**	**Likely**	**Intermediate C4**	Drilling Superintendent on-site for first two wells Company man supervising drilling Well control plan and contingency On-site kick detection gauges (pit gain measurements etc.) JHA's SOP's	All personnel from Assistant Driller upwards possessing Well Control ticket (IADC/IWCF supervisors' level) Enhanced crew training matrix	**Catastrophic**	**Unlikely**	**Low D4**	Drilling Engineer Drilling Superintendent Company Man Driller	Drilling Superintendent Toolpusher Company Man Rig Crew
	Well control while running tubulars	Swabing and surging due to excessive running speeds in tandem with a very low annular clearance	Uncontrolled release of fluids Blowout Loss of rig / wellCrew injuries of death	**Catastrophic**	**Likely**	**High B4**	Drilling Superintendent on-site for first two wellsCompany man supervising drillingWell control plan and contingency	Hard shut-in methodImproved kick detection systemsTrip speed modelling. Trip speed schedule (max/min) communicated to driller. Use of auto-drill features on modern rigs to max out at too-high a	**Catastrophic**	**Unlikely**	**Low D4**	Drilling EngineerDrilling SuperintendentCompany ManDriller	Drilling SuperintendentToolpusherCompany ManRig Crew

								pull/run speed Mud:Avoid progressive gelation Keep YP/PV ALARP					
	Contingency planning: Losing a given hole section, drilling a slimmer relief section	Lower open-hole production potential Higher annular pressures	Financial loss Deferred production Lost well control	**Major**	**Possible**	**Intermediate C3**	Drilling Program outlining drill procedures Drilling supervision on-site SOP's	Well control contingency plan Agreed upon back-up strings	**Major**	**Unlikely**	**Low D3**	Drilling Engineer Asset teams	Driller

Table 19 - Slim hole drilling risk register

Chapter 4: Industry Opportunities and Limitations

To close this study, we will now consider the current market forces and industry state of play, as it relates to slim hole drilling. It would be very easy to state that the techno-economic merits of slim hole drilling imply that an operator could simply commence this sort of work, say tomorrow. However, there are a number of mitigating factors, which need to be discussed, and an equal number of solutions to those same factors that will be proposed.

4.1 Limitations on Slim Well Drilling in Norway

4.1.1 Regulatory Restrictions on Rig Supply

One of the largest considerations when planning a slim well is the choice of rig. Currently, the choice of rigs in Norway would be considered too large to drill these sorts of wells. This is because the rigs on the market were brought in and compliance-cleared for conventional wells. It is indeed possible to drill slim wells with these size rigs, but for many operators this would be akin to "shooting a fly with an RPG", for want of a better phrase. Considering our previous section on the economics of slim hole design, the success of these wells hinge on crew performance and hence, drill costs. Using a conventional rig to drill a slim well, where this has not previously been done may well prove uneconomic. This is one of the key reasons that these types of wells are not currently being drilled in Norway.

In attempting to commercialise slim wells, one might propose bringing in a fit-for-purpose rig. However, in Norway, this is not as a simple as it sounds. To explain why, let us briefly digress. (Oftedal, 2016) was recently published in an article detailing the prevailing economic differences in the rig market between the UK and Norway. For many major companies operating in the North Sea, it would be highly desirable to be able to move rigs freely between the UK and Norwegian sectors. This would improve rig utilization rates, would decrease operating costs and in so doing, would avoid rigs and crews working sporadically. Simple though this sounds, it is a prohibitively expensive process due to Norwegian HSE regulations mandating several hundred million Kroner to bring rigs up to local standards (HSE SUT – samsvarsuttalelse), which often leads to three to four months of inactive service.

Consider this: Two rigs are drilling the same type of well, at the same time. One sits in the UK North Sea and the other, a mere stone's throw away, sits in the Norwegian North Sea. It is equally safe to work on both rigs and the wells being drilled are equally challenging. However, even if we are talking about the same rig, made by the same manufacturer, the operator on the Norwegian side will have to take the rig out of service for many months and spend many millions of dollars to do what the exact same rig is doing on the UK side. Due to the bureaucratic nature of Norwegian regulations, daily life will vary drastically depending which side of the proverbial fence you sit. Oftedal, in the piece mentioned above, stresses that the levels of bureaucracy have reached the point where paperwork can often take so long as to delay operations (Oftedal, 2016).

Reverting our focus back to slim wells, we can see how simply bringing on a new rig may be a very risky and costly decision for operators. Since a slim wells' economic success depends on the performance of its rig crew, an operator may well be hesitant to invest in these sorts of wells where the risk may not justify doing so. Should the industry remain in this current state, it is unlikely that slim well drilling will take off in any significant manner. There are a number of recommendations that will be discussed ahead, which aim to assist industry in commercialising slim well drilling.

4.1.2 Market Restrictions

An important consideration in our analysis is the market for wellbore materials and consumables. We have shown in our analysis (see Figure 85) that there is much to be saved in material costs with slim well design. In practice however, oil companies in Norway cannot simply order these materials tomorrow and see the immediate cost benefits. To explain why, it is important to discuss some fundamentals of oil and gas supply chain management. When an operator wishes to drill a well, it will order the equipment it needs from a given supplier, who will then deliver that same equipment to site or the operator's warehouse. Operators will seldom drill just one well at a time, but will drill similar wells in a campaign fashion. In campaign drilling, operators are often able to secure lower per-unit costs on the equipment they need. When multiple operating companies do this, for one given region, there tends to be a handful of commonly applied well designs that are implemented. Equipment suppliers, with this knowledge, will tailor their stock to suit the current well design practises. For conventional well designs at least, this means that equipment is readily and (relatively) cheaply available for operators, since suppliers usually have equipment locally available.

In Norway, slim wells (from an equipment standpoint) are a completely different kettle of fish and require equipment that is either uncommon or else not readily available. Bespoke, long-lead items of this nature will often need to be manufactured abroad (OCTG are typically sourced from Japan) and shipped into Norway. This makes it highly likely that the first batch of slim wells drilled in Norway may well be more expensive than their conventional counterparts.

This is an important point, since it speaks to an operators' line of sight for the market. An operator with a short-term industry outlook may be uncomfortable with this sort of investment. This operator may understand that their current well architecture is indeed over-designed, but since much of this equipment is readily and cheaply available in their warehouse, they may be more inclined to accept an overdesigned well in lieu of a risky investment. An operator with a longer-term view of profits may instead opt to make the investment in slim hole drilling. This operator is willing to take a loss on the first one or two campaigns of slim wells, but understands that in the long term, re-stocking their warehouses with slimmer, fit-for-purpose equipment will ultimately offset the initial loss. There is currently little industry appetite for the latter, since the majority of operators are often unwilling to delve into new investments until they are proven by larger (or the largest) local operators.

4.2 Opportunities and Industry Recommendations

4.2.1 Streamlining of Rig Requirements for Drilling (DK/NO/UK)

Oftedal, 2016, outlined a number of recommendations for industry to improve their drill costs. In addition, a recent interview with Petoro unveiled a number of opportunities for improved wellbore operations on the Norwegian Continental Shelf.

Oftedal asserts that the market forces behind rig rates do not reflect the current state of the North Sea's rig fleet (particularly the UK sector, which has a much older fleet than Norway). For the last few decades, rig rates have fluctuated in line with the oil price. As the oil price increases and there is more drilling activity, rig rates hike accordingly. The converse has been true. However, while the rig rates have changed, the hard product has not. Oftedal notes that rigs which are some 30-40 years old have been priced at near half a million dollars a day, while similar rigs of a much younger age are priced equally (Oftedal, 2016). Many of the older rigs in North Sea fleets have been retrofit to match prevailing regulations, thereby resulting in gradually increasing NPT for rig repairs, whilst their younger counterparts do not face this problem. In order to improve rig pricing, the challenge facing industry is to develop a pricing structure that is not dominated by supply and demand. Bringing fairer controls to rig pricing will help improve drill times and lower drilling investment costs.

Another viable option to increase rig utilisation, which is currently being discussed, is a common North Sea operating area, shared by Denmark, Norway and the UK. This would imply a tri-partisan regulatory input on drilling rig HSE standards. In so doing, rigs would be able to move freely between each country's territorial waters. Considering our slim wells, we can see how this would be cost effective, since smaller more effective rigs would be able to be mobilised from the UK sector with ease (Petoro, 2018). One concern that remains, however, is the stringency of new regulations on newly built rigs entering the common North Sea area. It is currently unclear whether they would make slim wells more or less attractive.

4.2.2 Industry Standardisation

One of the most fore frontal issues in industry today is standardisation. This is particularly true given the recent recession. Amid high operating costs and low oil prices, the general feeling among operators has been that they may not be able to realise future field developments. Equinor provides one example of how standardisation can benefit industry. Through collaboration with Aker Solutions, it has standardised subsea tree maintenance. Through this process, Aker and Equinor have developed processes to provide more efficient maintenance and refurbishment to subsea trees. This has taken the process from one year down to 17 weeks. The concept came about in 2011 when Equinor agreed to treat its tree maintenance program for its 17 trees as a collective project, rather than having individual projects for each tree. This meant that parts and equipment could be ordered some six months ahead of time, thereby allowing for more cost-effective planning (Criscione, 2016).

Another aspect of the industry that is in need of an overhaul (and one, which is particularly cumbersome as far as Norway is concerned) is the eye watering levels of bureaucracy and documentation. It was highlighted by Tord Lien, Norwegian Minister of Petroleum and Energy, that there has been a ten-fold increase in topside documentation in the past ten years. Some of the more complex subsea projects can involve up to 80,000 documents (Criscione, 2016). There are a number of initiatives in motion, such as those coordinated by DNV GL, who have initiated a joint industry project aiming to reduce these same volumes of paperwork in industry and improving efficiency.

Finally, to illustrate the need for industry standardisation, let us examine a quote. In a recent DNV GL interview, Margareth Øvrum, EVP for technology, Projects and Drilling for Statoil (now Equinor), stated:

"We tend to make things complex. There are more regulations than ever before and we ask for more documentation, which drives up engineering hours. Statoil itself has comprehensive technical requirements. The supply chain has things to improve on, as do we. And there is certainly potential to improve how we manage the interfaces between all parties as well.

"We are working in more remote areas and in deeper waters than before. An increase in cost is to be expected, but we have to turn this trend around. If we don't, the subsea industry will be priced out of the game." (Øvrum, 2017)

4.2.3 Performance Incentive Schemes

In our analysis, we have concluded that the economic success of slim wells hinges most critically on rig crew performance. In Norway, prevailing social mores (Janteloven), whilst being successful in fostering social cohesion and underscoring what it means to be Norwegian, have (in some circumstances) created a business environment that stymies global competitiveness. This is because the benchmarks of corporate performance are based on the collective, rather than the individual. Put simply: no one individual or group should strive to put themselves above the level of the collective group, or team. Whilst the author is not intending on writing a social studies piece, this is in fact a very important concept for slim well drilling.

In Australia, the UK and US, drill crews are commonly paid bonuses based on their individual (or team) performance measures against other crews on the same rig. For example, an operating company may be willing to pay bonuses to rig crews if a well is drilled within a certain period. Alternatively, rewards may be doled out based on average trip speeds, rig move times, or any other important metric. These performance incentive schemes are purely meritocratic and reward the best performing individuals. Ultimately, operating companies have seen much success in implementing these programs.

This begs the question of Norway. These sorts of performance incentive schemes are presently uncommon in Norwegian waters, due mostly to the prevailing social conditions (above) mandating that all levels of performance should be compensated equally, with no one group or individual being placed above others[26]. However, where rig crew performance is concerned, this is counter-productive and the author asserts that rig crew performance incentives would have a net positive effect on the bottom-lines of both operator and rig crew member.

Incubating the right performance incentive plan need not be arduous, nor complex. There are a number of key elements outlined by Border States (a leading supply chain corporation to the US electric utility industry), which, if implemented, would lead to improved rig crew performance (and eventually, commercially viable slim wells) (Border States, Supply Chain Solutions, 2017).

1. Measureable goals

Whether instigating in incentive scheme to mandate that wells are drilled in a certain number of days, or that casing is run at a certain number of joints per hour; whatever the goal, it needs to be both physically achievable and measureable. For example: it would be pointless to set a goal as being "delivery of a safe and successful well", since there is no measureable definition in place for what is safe and what is successful for this well. On the other hand: setting a goal of drilling

[26] Whether or not these type of performance incentive programmes would be in keeping with the national psyche in Norway is beyond the scope of this body of work.

production hole in six days with no lost time injuries is a much clearer and directly measureable goal.

2. Rewards schemes should be a pure meritocracy, with no room for luck

This goes to fairness. Rewarding performance on the back of pure luck defeats the merits of a performance incentive scheme. This practice will ultimately demoralise crews to a greater extent than if there was no scheme in place to begin with.

3. Performance incentive schemes cannot come at the expense of HSE

No operation is worth doing if HSE is compromised. Performance incentive schemes need close monitoring to ensure that efficiency breeds speed, rather than the illusion of speed breeding efficiency. The latter will always lead to negative HSE consequences. Therefore, to maintain checks and balances on performance incentive schemes, measureable HSE targets need to be in place to ensure HSE integrity.

Each operating company will implement these schemes differently, as befits their own circumstances. In a recent interview with Petoro, it was indicated that some operators in Norway are trialling these practices and so far, are seeing positive results (Petoro, 2018).

4.2.4 Risk Sharing Models

McKinsey recently published an article detailing a number of strategies to transform the oil and gas supply chain (McKinsey & Company, 2017). They noted that new revenue models have emerged across industry, including performance-based contracts which combine equipment and services. In addition, these models stipulate a bi-partisan participation in project financing, thereby increasing the amount of flexibility operators have in reducing their costs. Whilst this places a heavier burden on oilfield service providers, McKinsey indicated that this could lead to more stable cash flow.

As an example, GE recently signed a deal with Diamond Offshore, where GE would maintain ownership of a number of BOPs and guarantee their performance through payments tied to the rig's activity. This shifts the burden to GE, while allowing for up-front financing. Where slim well drilling is concerned, the increased risk of these sorts of wells could be shared) or imparted to some degree) to the service companies (McKinsey & Company, 2017).

4.2.5 Digital & Automated Well Planning

In closing, it is worth mentioning one important development, which, while not directly relevant to slim hole drilling, does have massive potential in revolutionising industry and eventually optimising drill costs (which is the broader aim of this thesis). We speak of course about digital well planning.

With the advent of Data Science and the latest big corporate buzzwords such as "big data" and "digitalisation" being on the end of every Executive's lips, it is worth postulating how these concepts will optimise the well delivery process. Pro Well Plan, one of Norway's newest frontrunners in the drilling start-up space, is making much headway in this area. With digital well planning, computer based algorithms instruct computers to follow set rules, instead of writing documents of governance and experience transfer reports. A digital well plan is made automatically when a dataset is applied. The dataset consists of all well information, and the computer implements the appropriate algorithms to make plans, risk matrices, schematics, barrier diagrams and decision reports. In so doing, this has the end user performing data analysis, rather than data entry (Tvedt, 2017).

Digital well planning will eventually remove the elements of human error and incorporate wider datasets to allow wells to be drilled more efficiently. As live well data changes, so too will wellbore models, which will be able to continuously update and learn. Looking long term, the implications of automation and digitalisation will eventually lead to lower overheads, improved HSE (due to mitigated human-machine interface) and finally, lower wellbore costs. Digitalisation is an important step in the industry's long-overdue push for innovation.

Chapter 5: Conclusions

This body of work has proved the techno-economic benefits and possibilities of slender well design for the Norwegian Continental Shelf. For each region of the Norwegian Continental Shelf, it has been shown (by analysing hypothetical wells typical of these areas) that slim well architecture is technically sound, given the requirements set out in NORSOK-D010 and best practices.

One of the prime concerns for slim well drilling that was examined is maintaining well control. Each well design has been shown to have an acceptable kick tolerance. Modern day rigs, being equipped with excellent kick detection instruments, would be well suited to maintain control of these sorts of wellbore sections. One of the main issues identified with well control in slim well drilling is the reduced annular space. In our designs, the annular space is either maintained through under-reaming, or else becomes a non-issue, since rather than slimming down a given hole section, we remove it, thereby employing commonly-used hole sizes, though fewer of them. In this regard, well control is no greater an issue for our slim wells than it is for any other conventional well design.

Thinking more about annular clearance, another issue that was analysed was the effect of ECD's in slim wells. It was shown that the use of under-reaming in our North Sea design was able to abate the issue of excessively high ECD's during drilling or cementing. In addition, it was shown that since our reduced casing string designs do not employ casing and hole sizes out of the ordinary, ECD's are no bigger an issue in slim wells than they are in conventional wells.

The economic analysis of slim well drilling turned up a number of interesting conclusions. Whilst there is indeed much to be saved in material costs, this saving is overshadowed by often-preventive rig operating spread rates. Since rig rates are linked to operating time, which is a function of crew performance, it can be deduced that commercialising slim well drilling is only possible given a consistently high performing rig crew.

Finally, a number of roadblocks and regulatory issues have been presented, with a number of solutions proposed to allow Norwegian operators to reap the benefits of slim hole drilling. The analysis concluded that the current economic climate may not be conducing to drilling these types of wells thanks to the excessively high drilling rig certification and on boarding costs in Norway, combined with the current OCTG market. It was shown that through cross-border standardisation of regulations and risk, introduction of performance incentive programs and implementation of digital well planning, these challenges could be overcome.

Recommended Future Work

<u>Use of Proprietary Data</u>

It is recommended to perform a full techo-economic analysis of the concepts outlined in this body of work to analyse or else trial slim well designs for given operating company using their wellbore and drill cost data. Some potential future projects may include (but are not limited to):

- Comparison of conventional wells drilled versus what might have been possible with slim well design for one or more operators;

- Analysis of proprietary well cost data to ascertain the limits on the claim that rig crew performance is the driving factor in slim well economic viability;
- Trialling the results of this body of work for a new drill in Norway.

Production Wells

This body of work is unique to exploration wells. It would be important to determine the merits of slim well drilling for production wells, particularly those that are highly deviated. Some potential future projects may include (but are not limited to):

- Studying the effects of deviation on the technical viability of slim well drilling;
- What role, if any, does slim well drilling play in the economic viability of a producing field?

Regulatory Review

One major focus are of this thesis has been the stymieing effect that Norwegian regulations have on cost effective drilling. A full review of drilling regulations in Norway with a view to improve Norway's global competitiveness and cost-effectiveness in drilling operations is recommended. Some potential future projects may include (but are not limited to):

- A critique of NORSOK D-010 from an industry perspective, as it relates to optimised drilling. To what degree do Norwegian regulations hinder cost-effective drilling?
- A critique of the psyche of the Norwegian drilling fraternity and its efficiency. What, if anything, is to be improved to make the industry more globally competitive, what can be learned from overseas successes and what is to be avoided?

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challenges-outweigh-the-potential/
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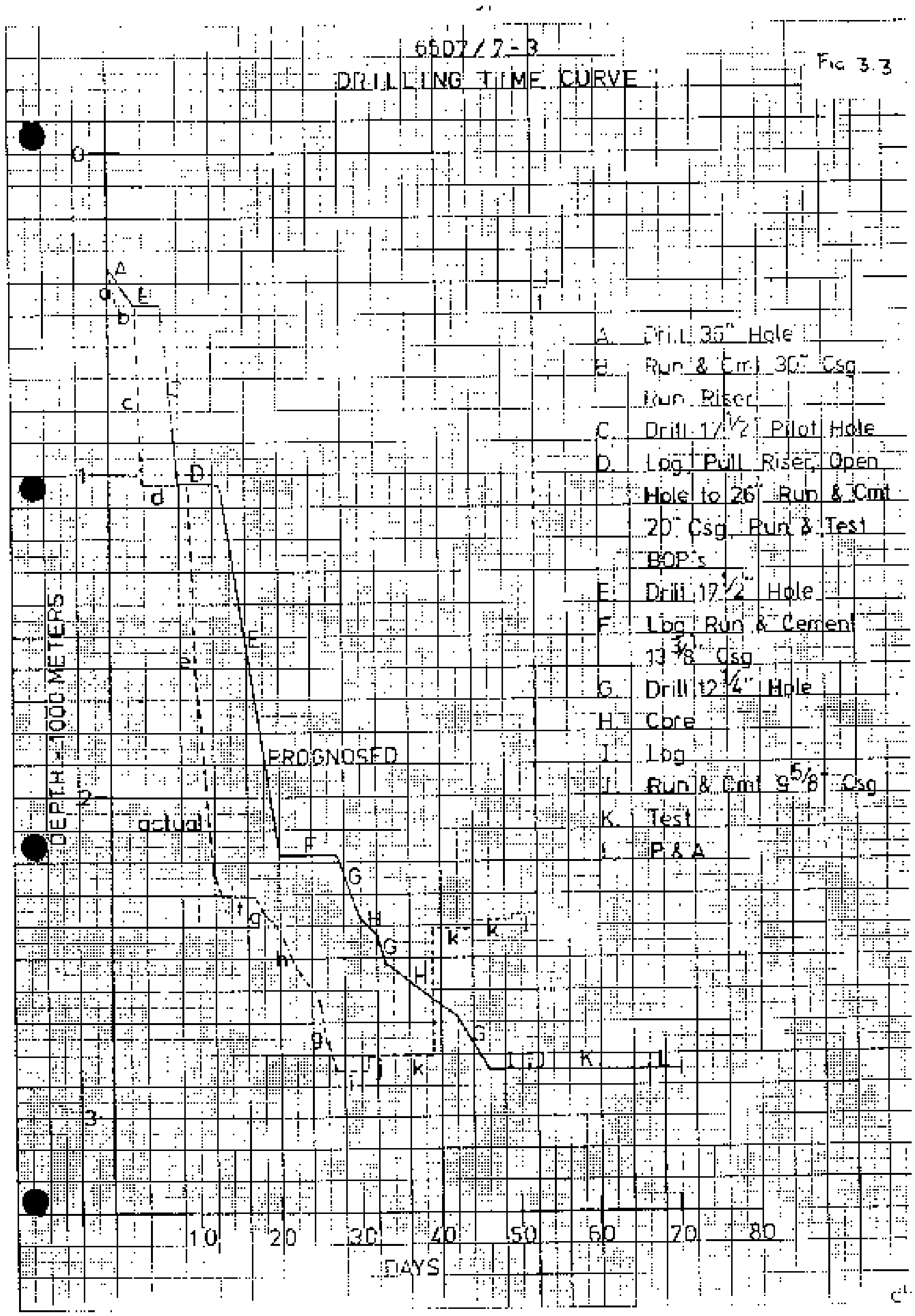
Appendix

5.1 Time Depth Curves by Field

5.1.1 Heidrun

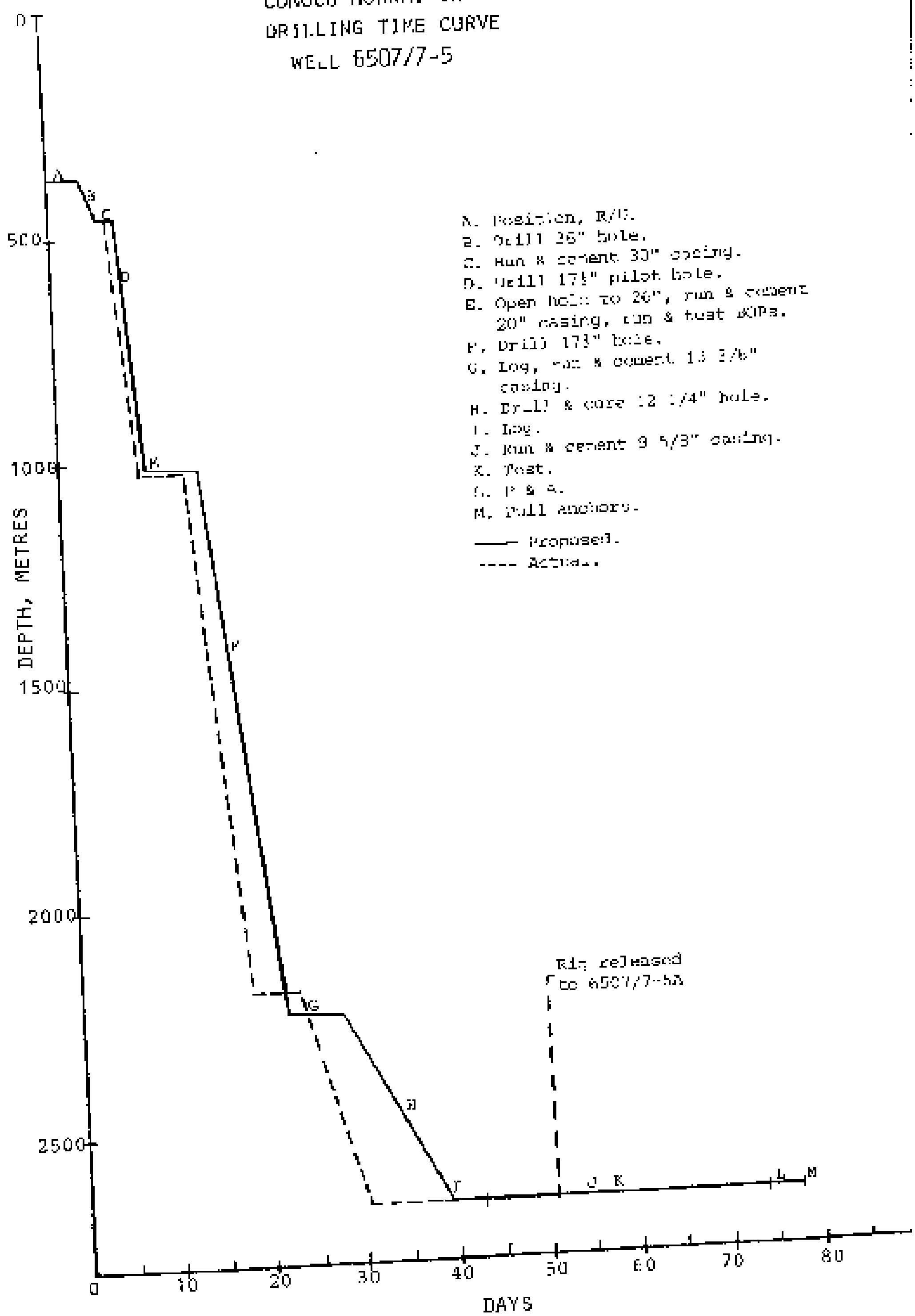


- 36 -

CONOCO NORWAY INC.

DRILLING TIME CURVE

WELL 6507/7-5

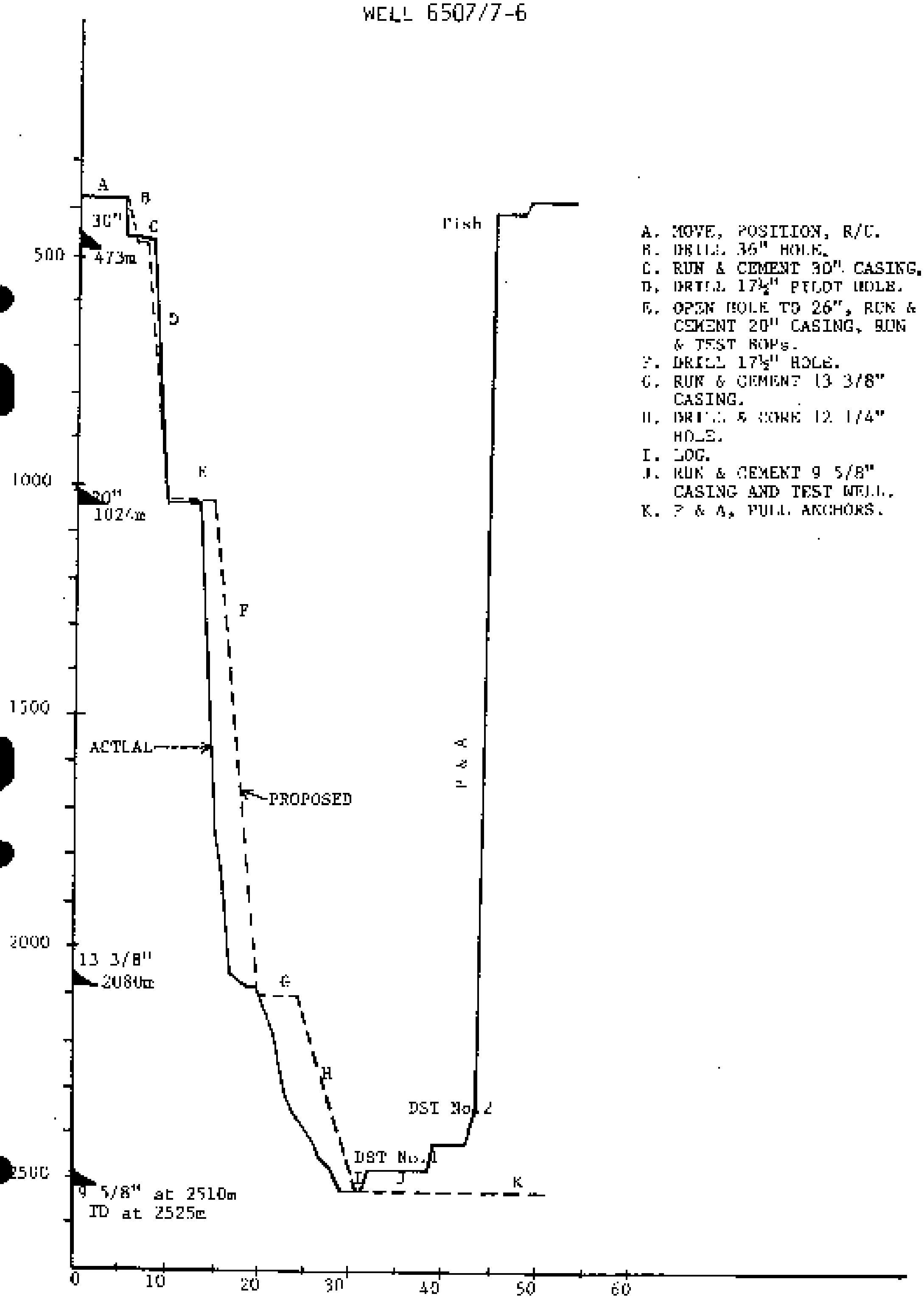


\- 40 -

CONOCO NORWAY INC.

DRILLING TIME CURVE

WELL 6507/7-6

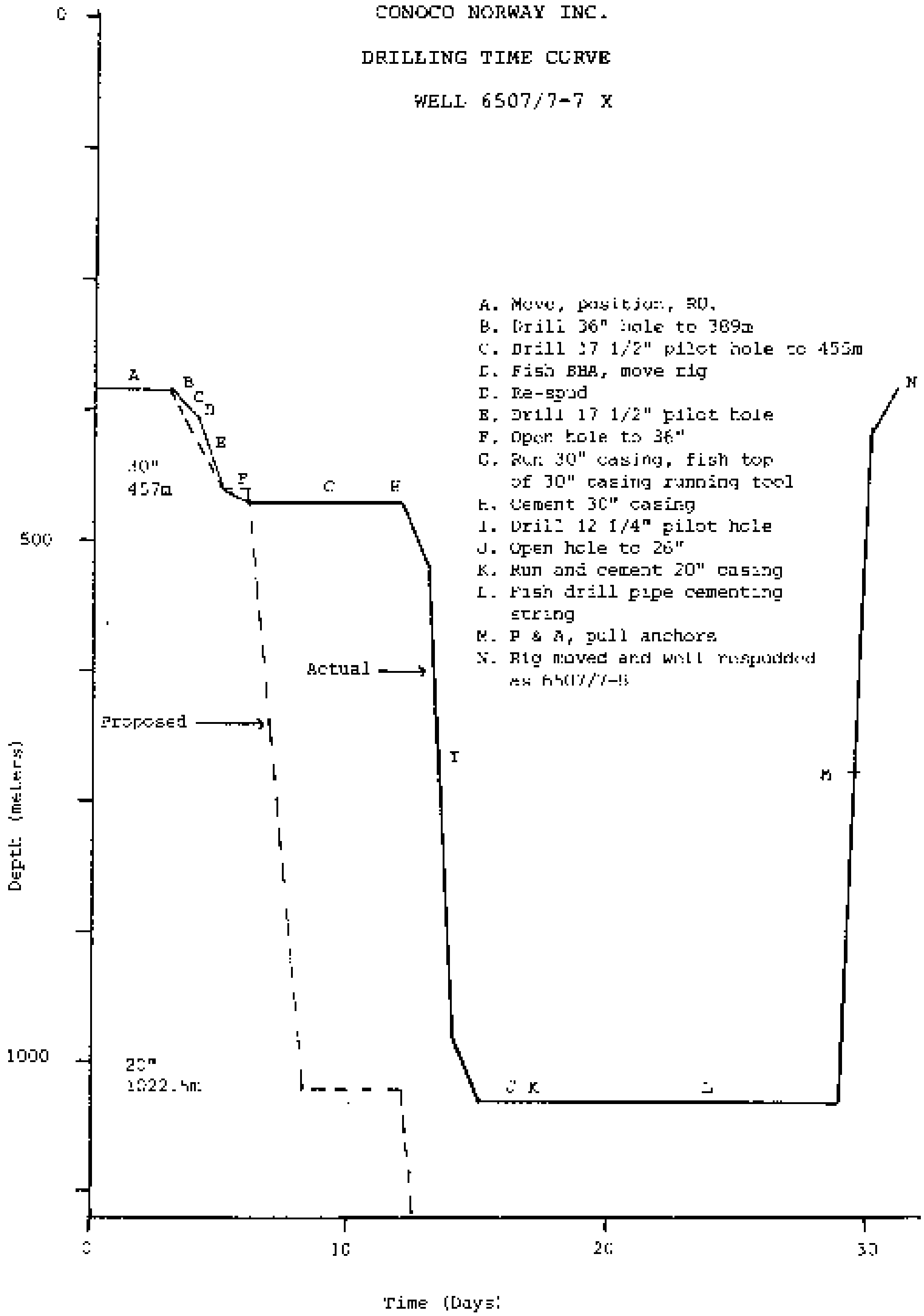


Page 30

CONOCO NORWAY INC.

DRILLING TIME CURVE

WELL 6507/7-7 X



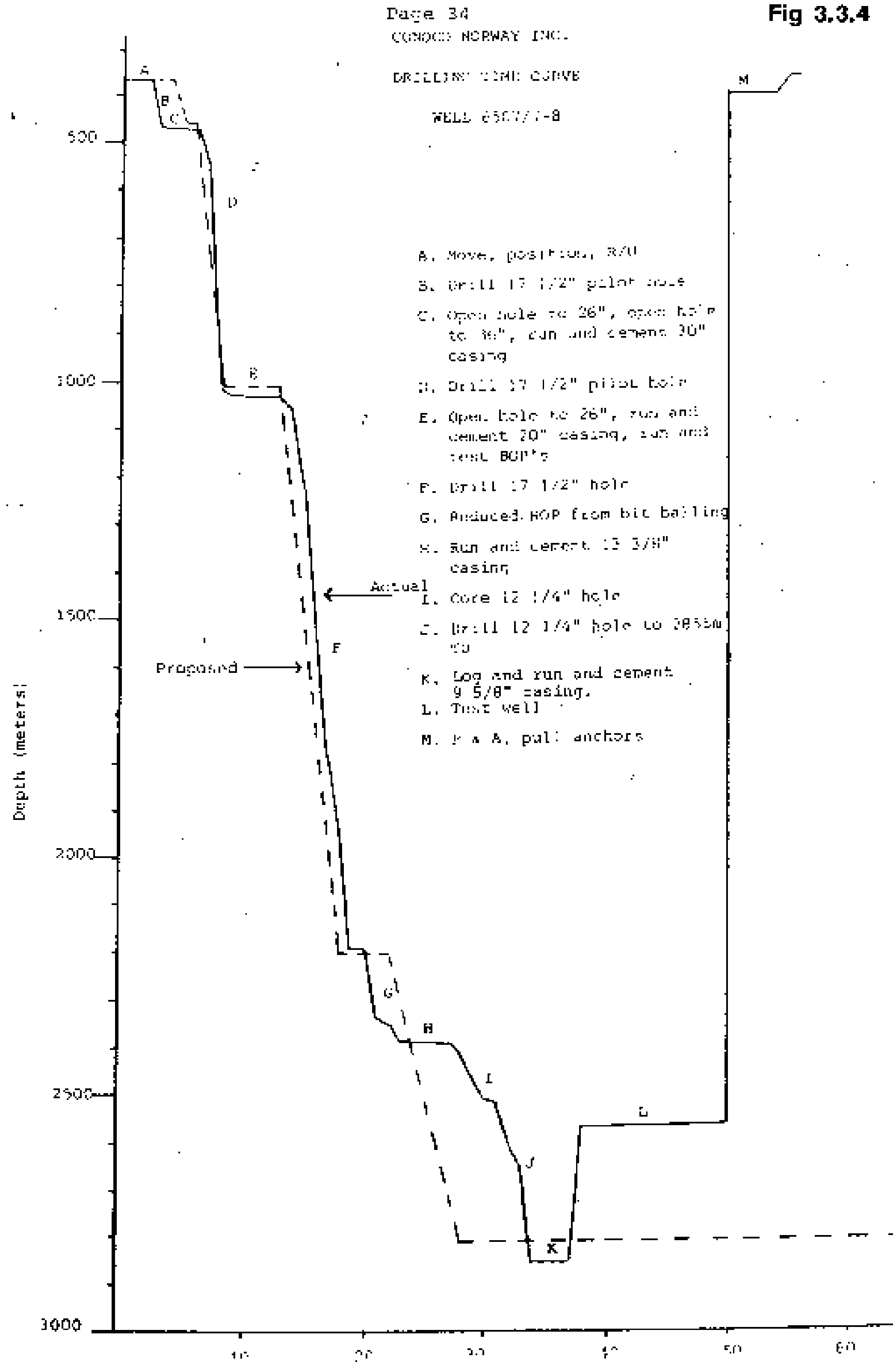
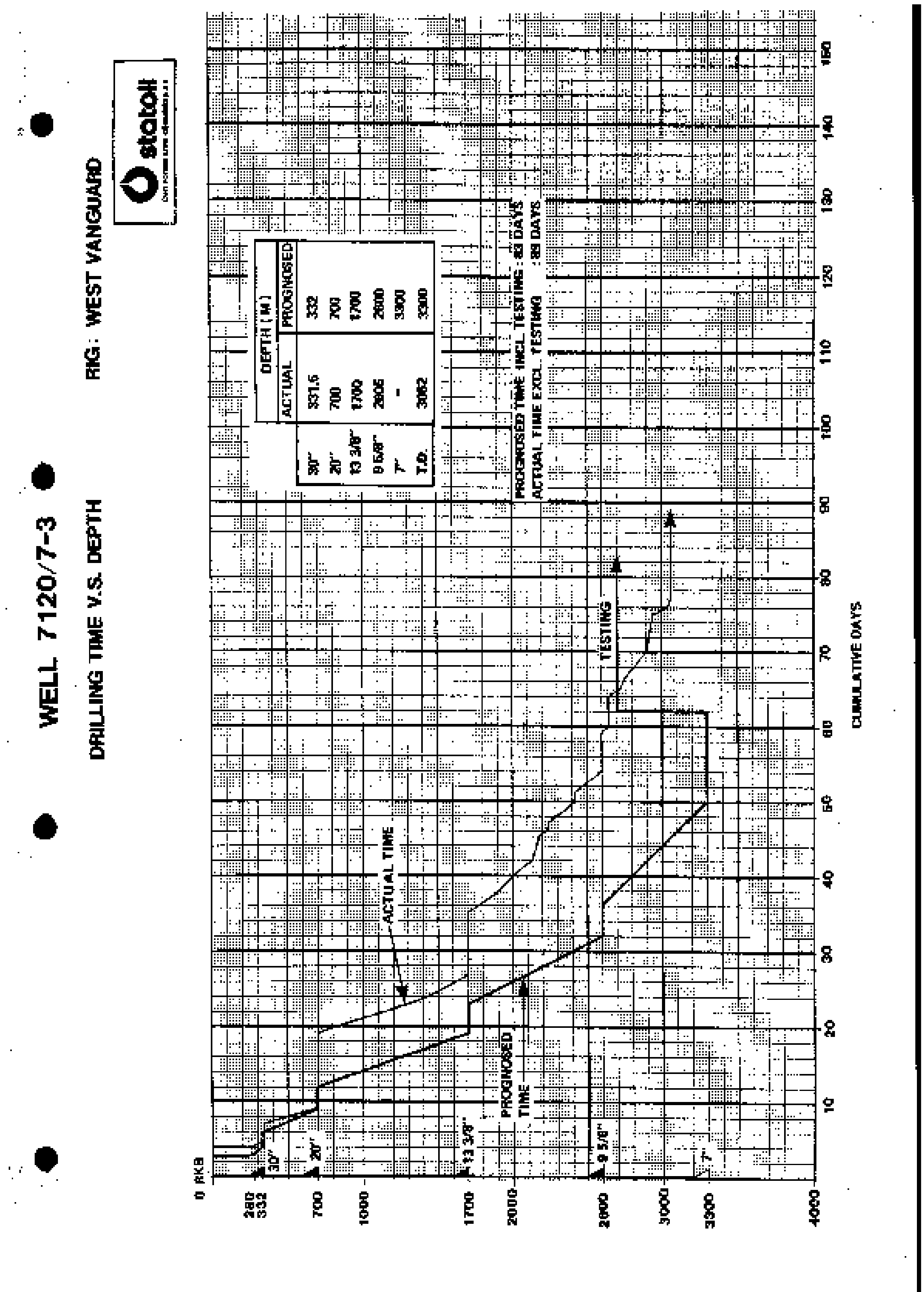
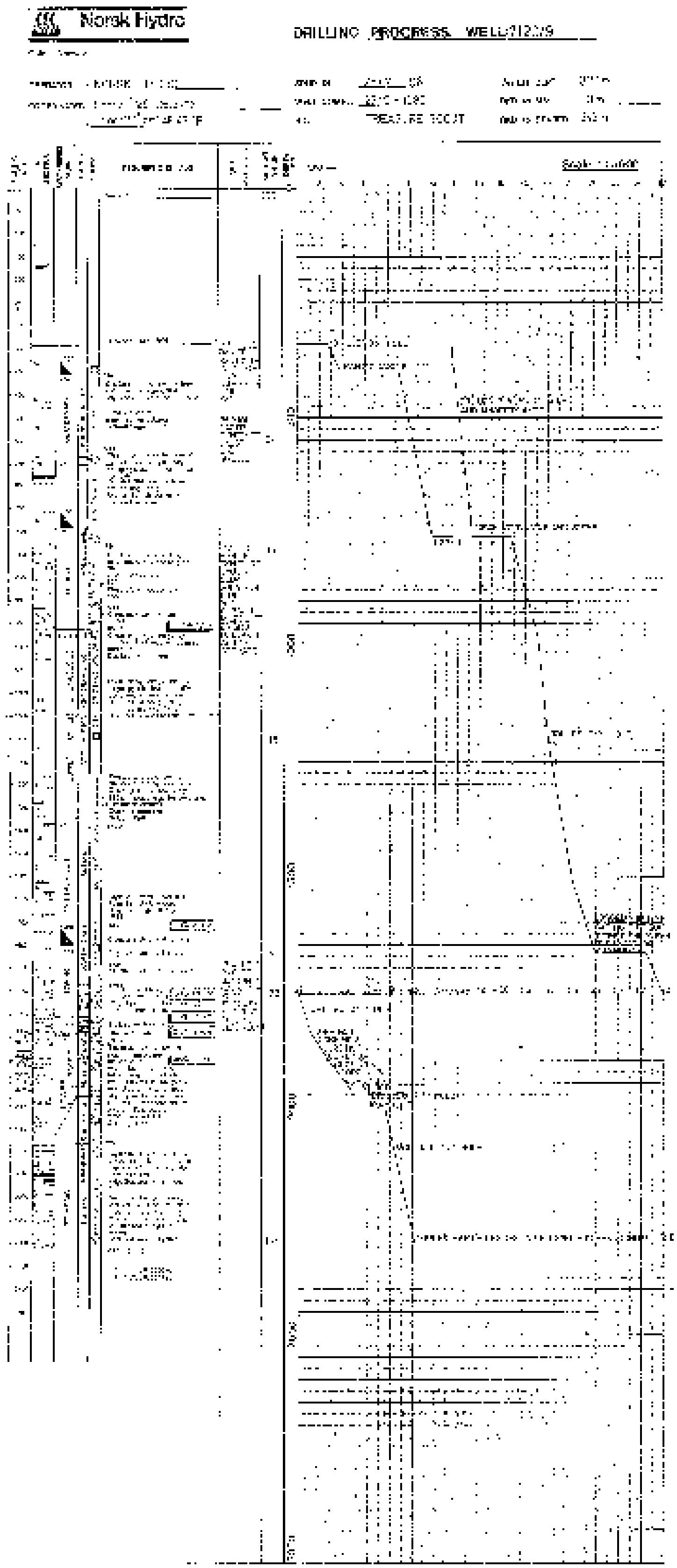

Page 34
CONOCO NORWAY INC.
WELL
A. Move, position
B. Drill 17 1/2" pilot hole
C. Open hole to 26", run and cement 30" casing
D. Drill 17 1/2" pilot hole
E. Open hole to 26", run and cement 20" casing, run and test BOP's
F. Drill 17 1/2" hole
G. Reduced ROP from bit balling
H. Run and cement 13 3/8" casing
I. Core 12 1/4" hole
J. Drill 12 1/4" hole
K. Log and run and cement 9 5/8" casing.
L. Test well
M. P & A, pull anchors
Actual
Proposed
Depth (meters)
500
1000
1500
2000
2500
3000
50
60

Fig 3.3.4

5.1.2 Snøvit


WELL 7120/7-3
DRILLING TIME V.S. DEPTH
RIG: WEST VANGUARD
statoil
DEPTH (M)
ACTUAL PROGNOSED
30" 331.5 332
20" 700 700
13 3/8" 1700 1700
9 5/8" 2805 2800
7" - 3300
T.D. 3062 3300
PROGNOSED TIME INCL. TESTING : 83 DAYS
ACTUAL TIME EXCL. TESTING : 89 DAYS
ACTUAL TIME
PROGNOSED TIME
TESTING
CUMULATIVE DAYS
0 RKB


Norsk Hydro
DRILLING PROGRESS WELL
TREASURE SCOUT

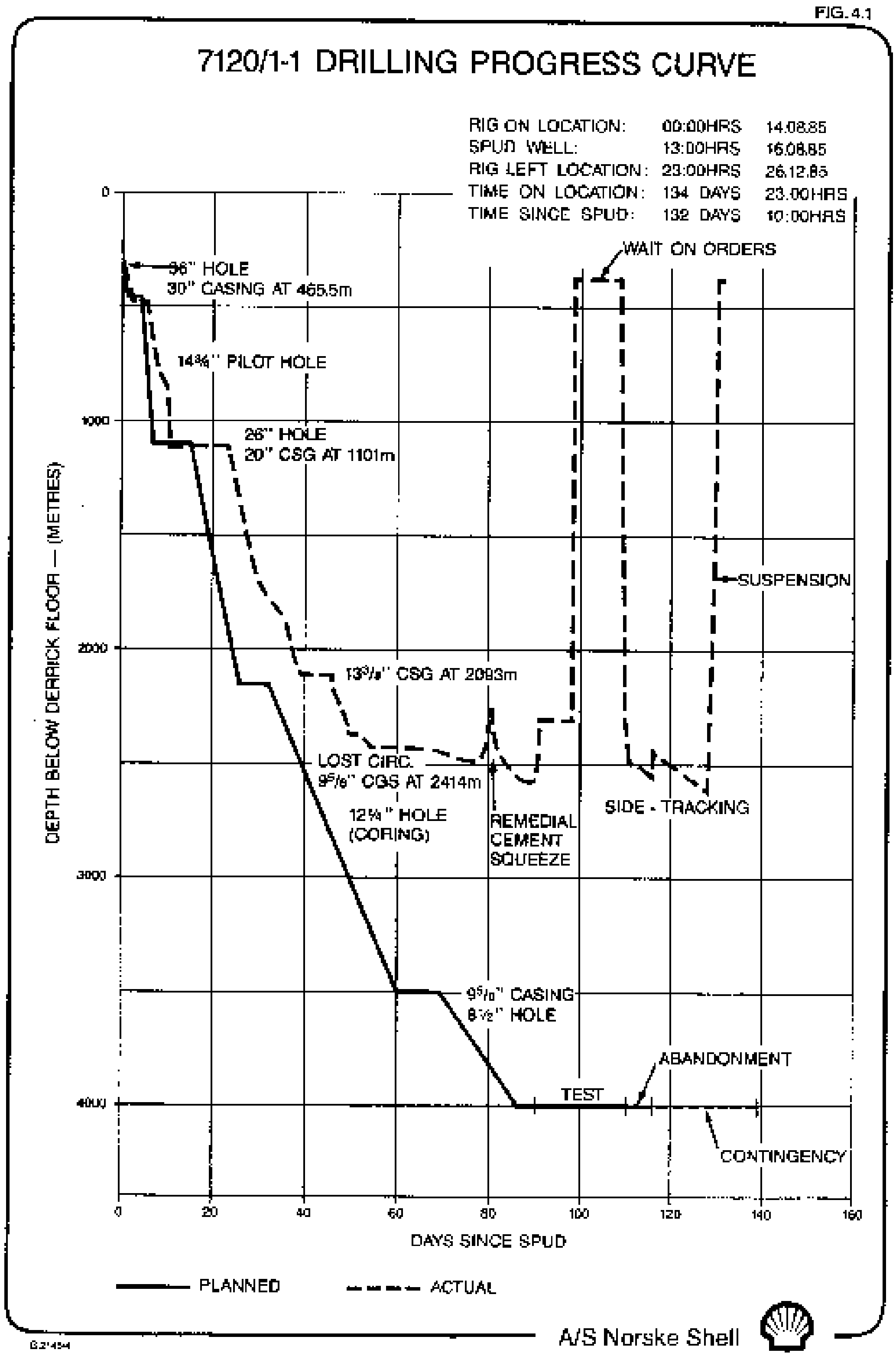
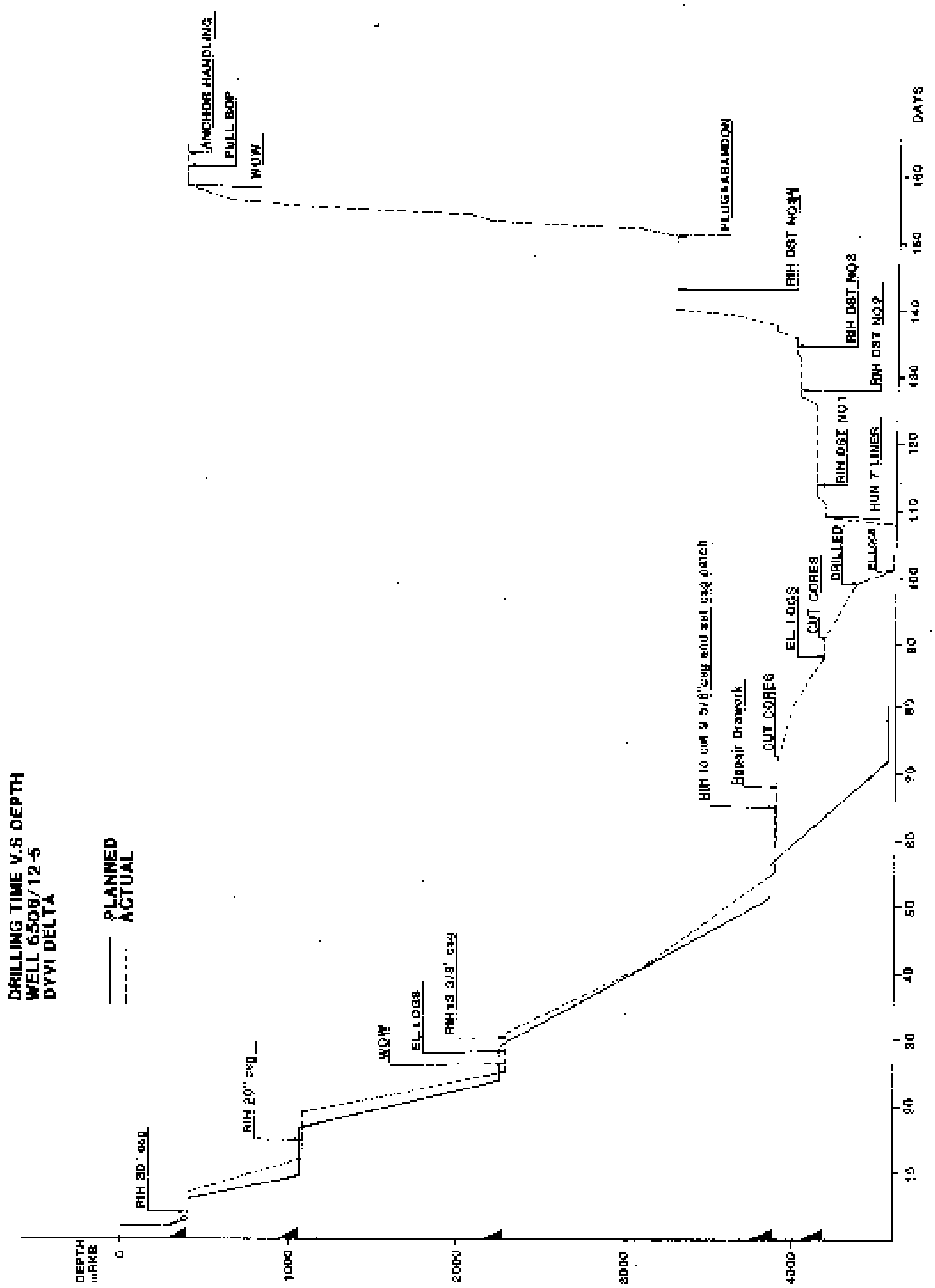
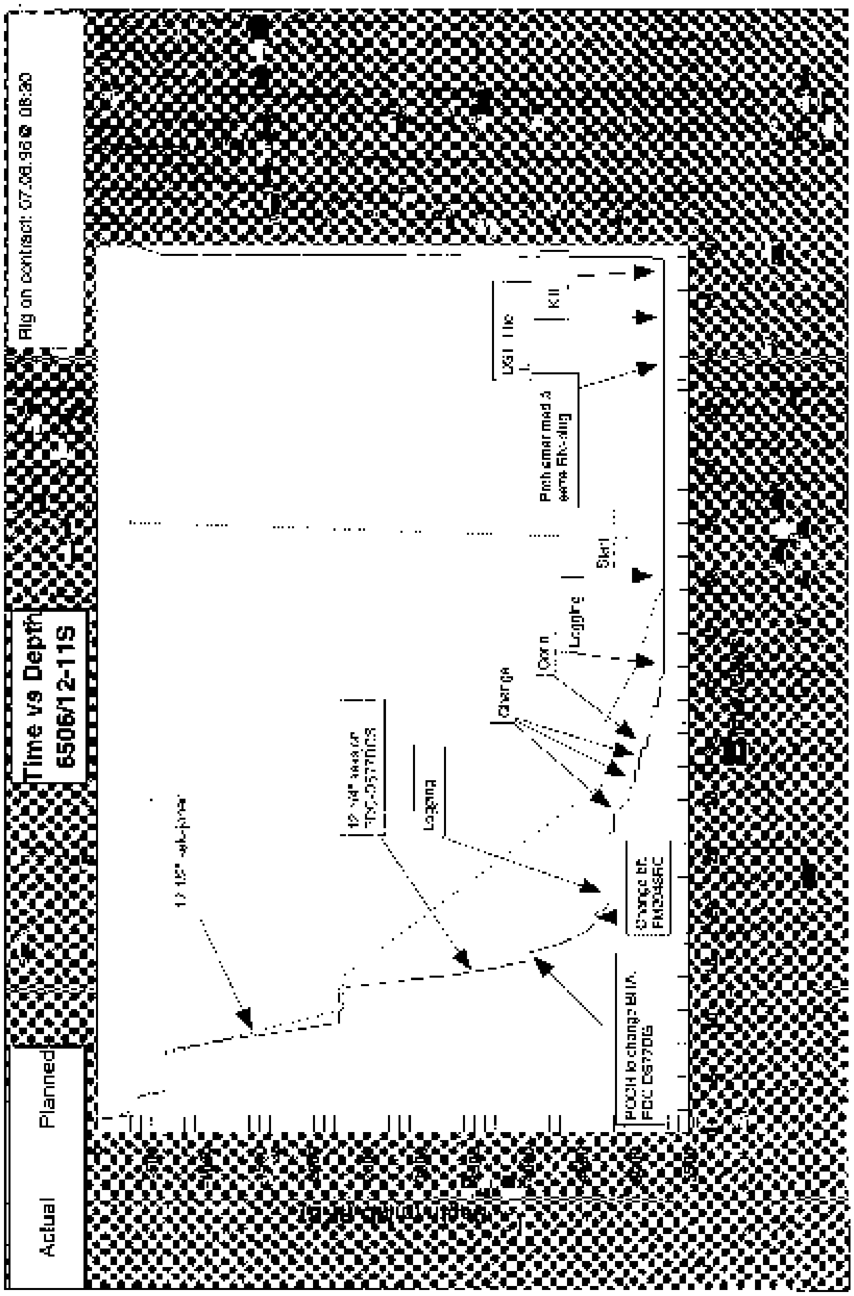


FIG. 4.1
7120/1-1 DRILLING PROGRESS CURVE
RIG ON LOCATION: 00:00HRS 14.08.85
SPUD WELL: 13:00HRS 16.08.85
RIG LEFT LOCATION: 23:00HRS 26.12.85
TIME ON LOCATION: 134 DAYS 23.00HRS
TIME SINCE SPUD: 132 DAYS 10:00HRS
WAIT ON ORDERS
36" HOLE
30" CASING AT 465.5m
14¾" PILOT HOLE
26" HOLE
20" CSG AT 1101m
SUSPENSION
13⅜" CSG AT 2093m
LOST CIRC.
9⅝" CGS AT 2414m
12¼" HOLE
(CORING)
REMEDIAL
CEMENT
SQUEEZE
SIDE - TRACKING
9⅝" CASING
8½" HOLE
ABANDONMENT
TEST
CONTINGENCY
DEPTH BELOW DERRICK FLOOR — (METRES)
0
1000
2000
3000
4000
0 20 40 60 80 100 120 140 160
DAYS SINCE SPUD
PLANNED
ACTUAL
A/S Norske Shell
G21454

5.1.3 Åsgard


DRILLING TIME V.S DEPTH
WELL 6508/12-5
DYVI DELTA
PLANNED
ACTUAL
DEPTH mRKB
DAYS
ANCHOR HANDLING
PULL BOP
WOW
PLUG&ABANDON
CUT CORES
EL LOGS
DRILLED
RUN 7" LINER
Repair Drawwork

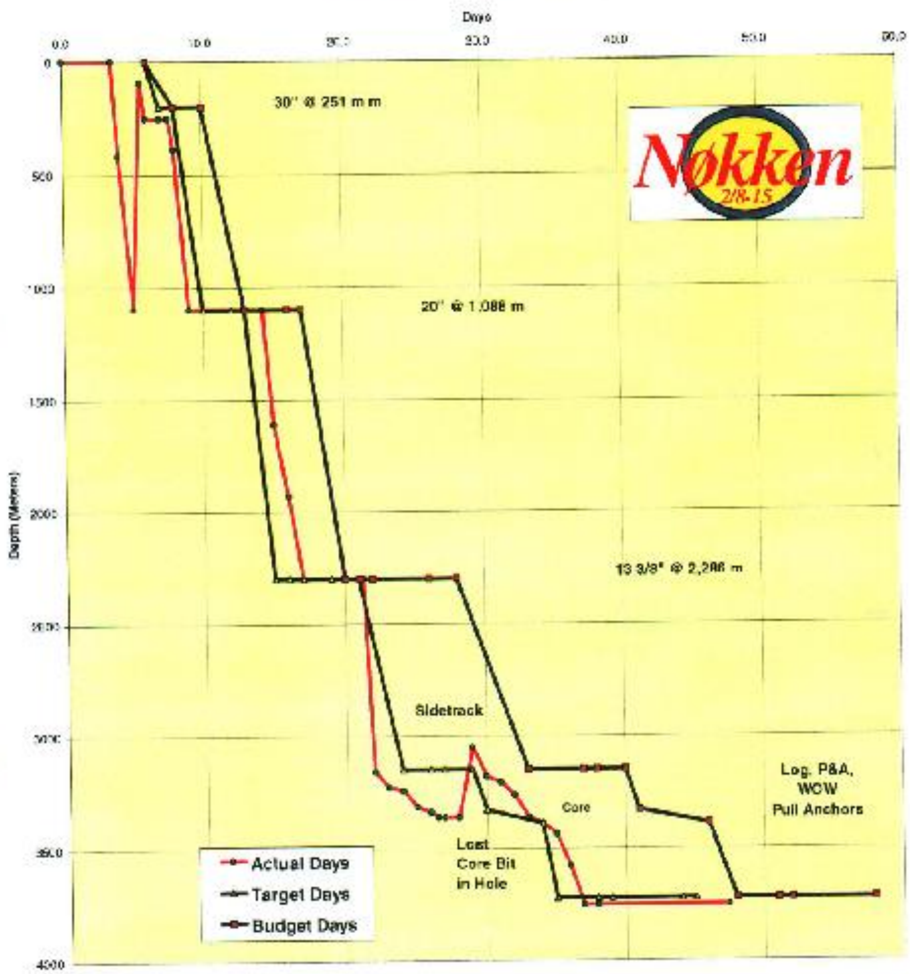

Rig on contract: 07.08.96 @ 08:30
Time vs Depth
6506/12-11S
Actual
Planned
Logging
Change

5.1.4 Eldfisk

2/8-15 T2 Final Well Report	47	21/05/96

8.9. Days vs. Depth Curve

Well 2/8-15 Days Vs Depth



5.2 Well Design Reports from Landmark™

5.2.1 Barents Sea

5.2.1.1 Conventional Well Design

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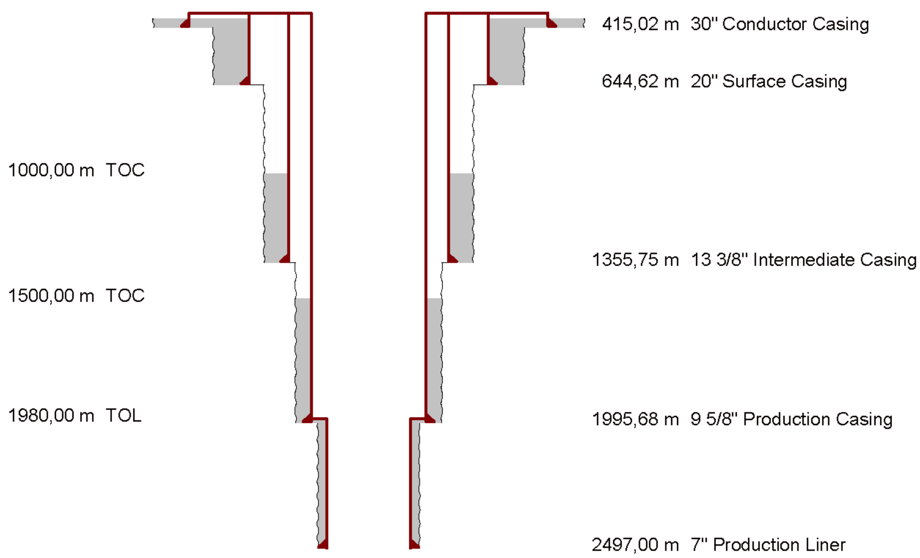
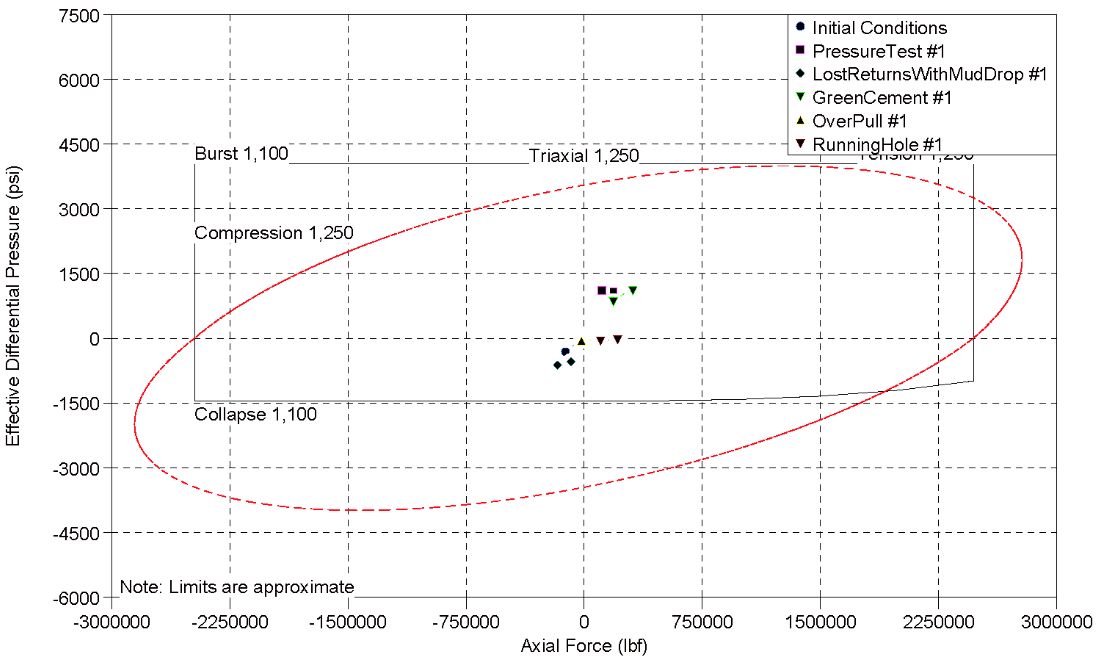
Well Schematic

RKB, 25,00 m (All depths are MD)



Design Limits - 20" Surface Casing - Section 1 - OD 20,000 in - Weight 133,000 ppf - Grade N-80



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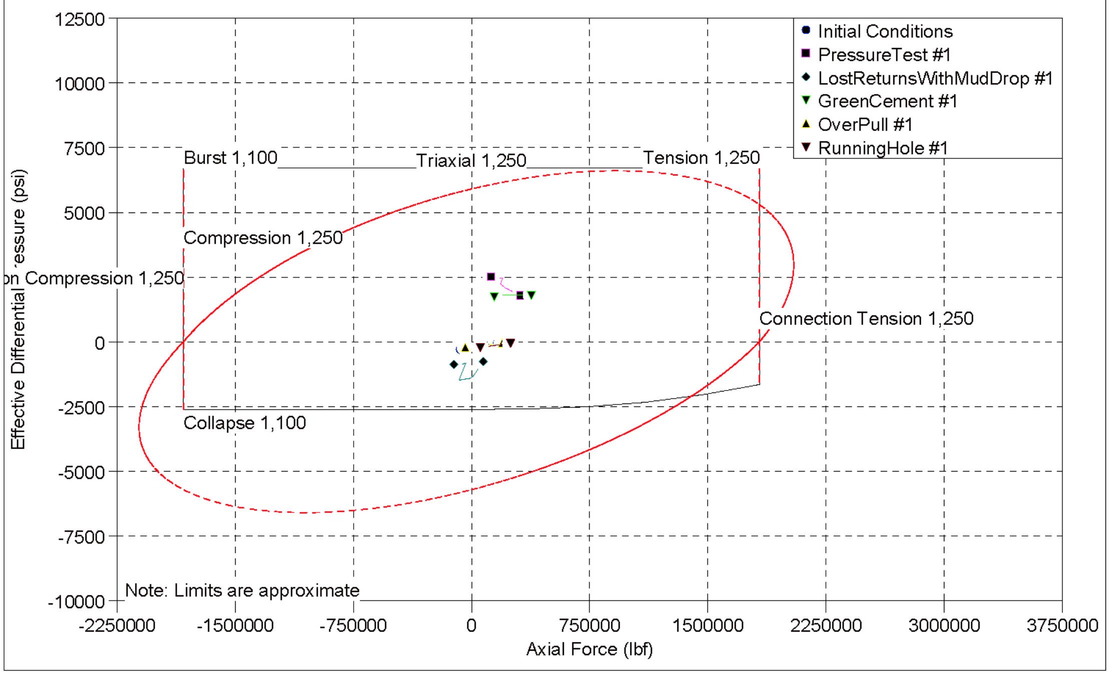
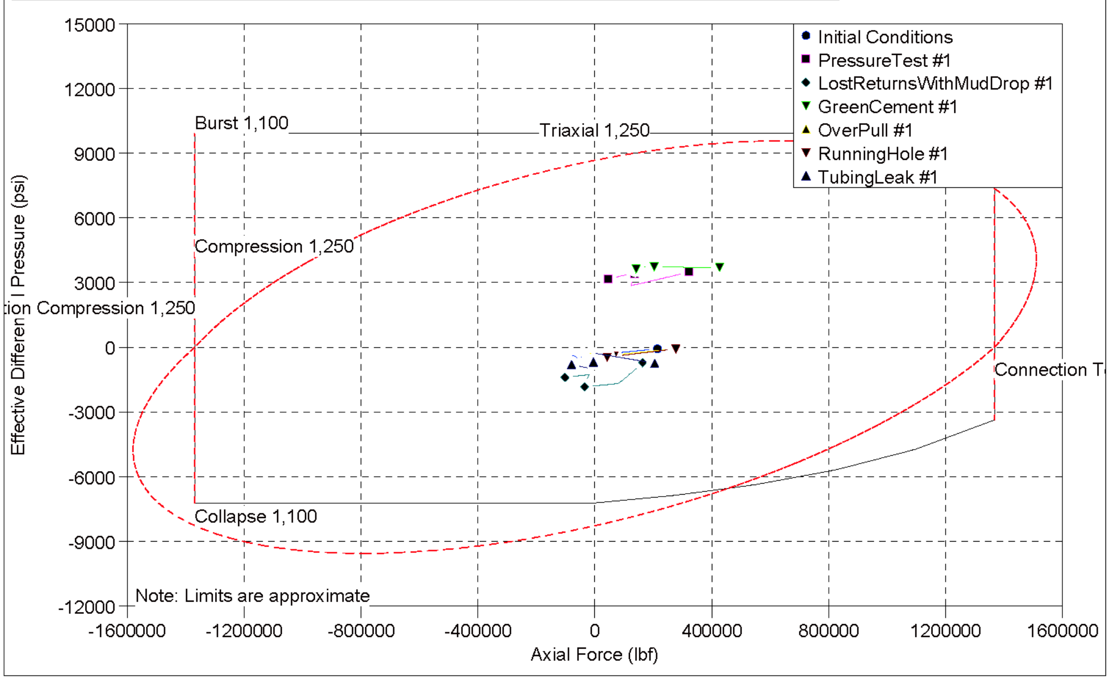
Design Limits - 13 3/8" Intermediate Casing - Section 1 - OD 13,375 in - Weight 72,000 ppf - Grade P-110



Design Limits - 9 5/8" Production Casing - Section 1 - OD 9,625 in - Weight 53,500 ppf - Grade P-110



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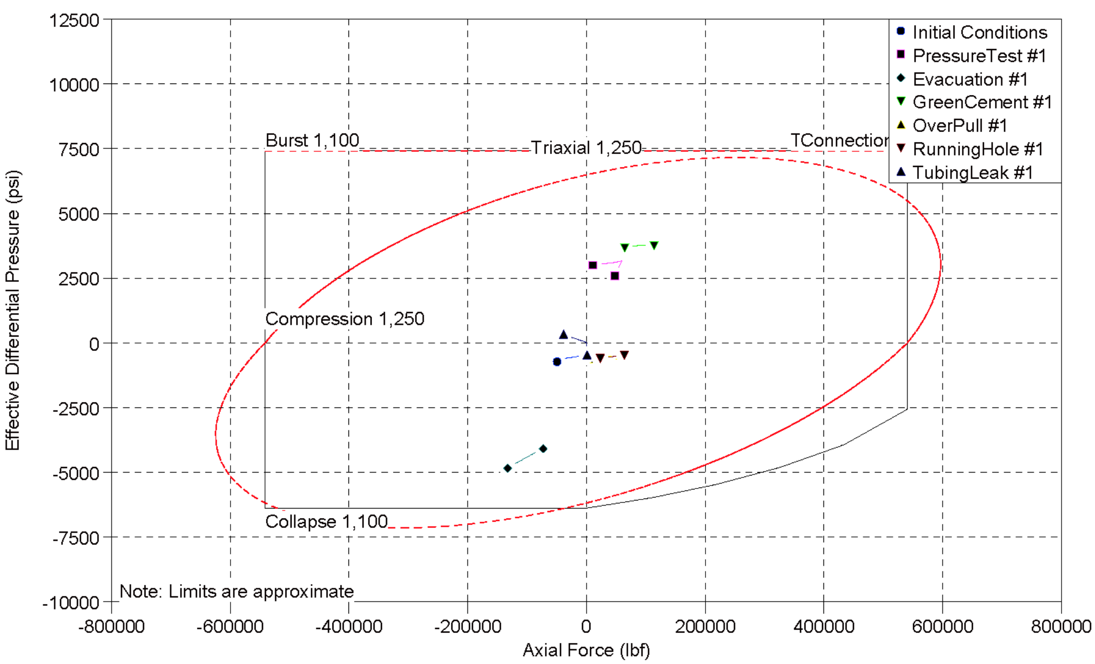
Design Limits - 7" Production Liner - Section 1 - OD 7,000 in - Weight 29,000 ppf - Grade L-80



Ratings Summary - 30" Conductor Casing

	String Section	Pipe Body OD (in)	Pipe Body Weight (ppf)	Pipe Body Grade	Connection Name	Connection Grade	Ratings Burst (psi)	Ratings Collapse (psi)	Ratings Tension (lbf)	Ratings Compression (lbf
1	1	30,000	157,500	X-42	<N/A>		1225,00	224,86	1946217	1946217
2										
3	L = Connection Leak									
4	B = Connection Burst									
5	F = Connection Fracture									
6	J = Connection Jump-out									
7	Y = Connection Yield									
8	C = Connection									

Ratings Summary - 20" Surface Casing

	String Section	Pipe Body OD (in)	Pipe Body Weight (ppf)	Pipe Body Grade	Connection Name	Connection Grade	Ratings Burst (psi)	Ratings Collapse (psi)	Ratings Tension (lbf)	Ratings Compression (lbf
1	1	20,000	133,000	N-80	TSH ER	N-80	4445,00	1603,35	3090517	3090517
2										
3	L = Connection Leak									
4	B = Connection Burst									
5	F = Connection Fracture									
6	J = Connection Jump-out									
7	Y = Connection Yield									
8	C = Connection									

Ratings Summary - 13 3/8" Intermediate Casing

	String Section	Pipe Body OD (in)	Pipe Body Weight (ppf)	Pipe Body Grade	Connection Name	Connection Grade	Ratings Burst (psi)	Ratings Collapse (psi)	Ratings Tension (lbf)	Ratings Compression (lbf
1	1	13,375	72,000	P-110	Vam 21	P-110	7397,76	2882,28	C 2284000	C 2284000
2										
3	L = Connection Leak									
4	B = Connection Burst									
5	F = Connection Fracture									
6	J = Connection Jump-out									
7	Y = Connection Yield									
8	C = Connection									

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Ratings Summary - 9 5/8" Production Casing

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	9,625	53,500	P-110	Vam 21	P-110	10900,00	7950,02	C 1710000	C 1710000
2										
3	**L = Connection Leak**									
4	**B = Connection Burst**									
5	**F = Connection Fracture**									
6	**J = Connection Jump-out**									
7	**Y = Connection Yield**									
8	**C = Connection**									

Ratings Summary - 7" Production Liner

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	7,000	29,000	L-80	Vam TOP HC	L-80	C 8160,00	7025,60	675954	675954
2										
3	**L = Connection Leak**									
4	**B = Connection Burst**									
5	**F = Connection Fracture**									
6	**J = Connection Jump-out**									
7	**Y = Connection Yield**									
8	**C = Connection**									

Casing Load Summary - Initial Conditions - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	357,04	6848	0,00	0,0	0,0	42,80	547,65	547,66
2	1	414,99	-18442	0,00	0,0	0,0	41,65	636,55	671,14
3	1	415,05	-18468	0,00	0,0	0,0	41,65	636,65	671,27
4	1	609,60	-103361	0,00	0,0	0,0	51,18	935,06	1150,41
5	1	644,59	-118629	0,00	0,0	0,0	52,90	988,73	1244,64

Casing Load Summary - PressureTest #1 - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	357,04	184681	0,00	0,0	0,0	42,80	1623,31	547,64
2	1	414,99	166495	0,00	0,0	0,0	41,65	1708,26	629,93
3	1	415,05	175114	0,00	0,0	0,0	41,65	1708,35	584,22
4	1	609,60	120436	0,00	0,0	0,0	51,18	1993,51	891,42
5	1	644,59	112884	0,00	0,0	0,0	52,90	2044,80	942,59

Casing Load Summary - LostReturnsWithMudDrop #1 - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	357,04	-83692	0,00	0,0	0,0	42,80	0,00	547,65
2	1	414,99	-116938	0,00	0,0	0,0	41,62	0,00	636,55
3	1	415,05	-107101	0,00	0,0	0,0	41,62	0,00	584,22
4	1	609,60	-165022	0,00	0,0	0,0	51,20	267,50	891,42
5	1	644,59	-168774	0,00	0,0	0,0	52,92	342,04	942,59

Casing Load Summary - GreenCement #1 - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	357,04	309929	0,00	0,0	0,0	42,80	1647,65	547,66
2	1	414,99	284639	0,00	0,0	0,0	41,65	1736,55	671,14
3	1	415,05	284612	0,00	0,0	0,0	41,65	1736,64	671,27
4	1	609,60	199720	0,00	0,0	0,0	51,18	2035,06	1150,41
5	1	644,59	184451	0,00	0,0	0,0	52,90	2088,73	1244,64

Casing Load Summary - OverPull #1 - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	357,04	107265	0,00	0,0	0,0	42,80	547,65	547,65
2	1	414,99	81975	0,00	0,0	0,0	41,65	636,55	636,55
3	1	415,05	81949	0,00	0,0	0,0	41,65	636,65	636,65
4	1	609,60	-2944	0,00	0,0	0,0	51,18	935,06	935,06
5	1	644,59	-18212	0,00	0,0	0,0	52,90	988,73	988,73

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Casing Load Summary - RunningHole #1 - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	357,04	212754	0,00	0,0	0,0	42,80	547,65	547,65
2	1	414,99	190899	0,00	0,0	0,0	41,65	636,55	636,55
3	1	415,05	190876	0,00	0,0	0,0	41,65	636,65	636,65
4	1	609,60	117511	0,00	0,0	0,0	51,18	935,06	935,06
5	1	644,59	104317	0,00	0,0	0,0	52,90	988,73	988,73

Casing Load Summary - Initial Conditions - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	357,04	164063	0,00	0,0	0,0	42,80	760,62	760,62
2	1	609,60	104401	0,00	0,0	0,0	51,18	1298,70	1298,70
3	1	644,59	96135	0,00	0,0	0,0	52,93	1373,25	1373,25
4	1	644,65	96121	0,00	0,0	0,0	52,93	1373,38	1373,37
5	1	914,40	32401	0,00	0,0	0,0	66,22	1948,05	1948,05
6	1	999,96	12187	0,00	0,0	0,0	70,40	2130,34	2130,34
7	1	1000,02	12173	0,00	0,0	0,0	70,40	2130,47	2130,47
8	1	1219,20	-39599	0,00	0,0	0,0	81,20	2597,40	2604,97
9	1	1355,72	-71848	0,00	0,0	0,0	87,90	2888,24	2972,59

Casing Load Summary - PressureTest #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	357,04	311836	0,00	0,0	0,0	42,80	2560,63	778,37
2	1	609,60	252174	0,00	0,0	0,0	51,18	3098,70	1136,94
3	1	644,59	243908	0,00	0,0	0,0	52,93	3173,25	1186,62
4	1	644,65	243894	0,00	0,0	0,0	52,93	3173,38	1186,71
5	1	762,00	216174	0,02	0,2	0,0	58,70	3423,38	1353,31
6	1	914,40	180174	0,26	11,6	0,0	66,22	3748,05	1569,67
7	1	999,96	159960	0,40	21,8	0,0	70,40	3930,34	1691,15
8	1	1000,02	196124	0,00	0,0	0,0	70,40	3930,47	1482,32
9	1	1219,20	147590	0,00	0,0	0,0	81,20	4397,40	1917,99
10	1	1355,72	123212	0,00	0,0	0,0	87,90	4688,24	2192,64
11									
12	**Additional Pickup to Prevent Buckling = 73694 lbf**								

Casing Load Summary - LostReturnsWithMudDrop #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	357,04	73669	0,00	0,0	0,0	42,80	0,00	760,62
2	1	609,60	14007	0,00	0,0	0,0	51,20	0,00	1298,70
3	1	644,59	5742	0,00	0,0	0,0	52,92	20,21	1373,24
4	1	644,65	5727	0,00	0,0	0,0	52,92	20,26	1373,37
5	1	914,40	-57993	0,00	0,0	0,0	66,19	522,25	1948,05
6	1	999,96	-78206	0,00	0,0	0,0	70,40	697,26	2130,35
7	1	1000,02	-36157	0,00	0,0	0,0	70,40	697,39	1482,32
8	1	1219,20	-85938	0,00	0,0	0,0	81,19	1145,62	1917,99
9	1	1355,72	-111256	0,00	0,0	0,0	87,91	1424,84	2192,64

Casing Load Summary - GreenCement #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	357,04	379582	0,00	0,0	0,0	42,80	2560,62	760,62
2	1	609,60	319920	0,00	0,0	0,0	51,18	3098,70	1298,70
3	1	644,59	311654	0,00	0,0	0,0	52,93	3173,25	1373,25
4	1	644,65	311640	0,00	0,0	0,0	52,93	3173,38	1373,37
5	1	914,40	247920	0,00	0,0	0,0	66,22	3748,05	1948,05
6	1	999,96	227706	0,00	0,0	0,0	70,40	3930,34	2130,34
7	1	1000,02	227692	0,00	0,0	0,0	70,40	3930,47	2130,47
8	1	1219,20	175920	0,00	0,0	0,0	81,20	4397,40	2604,97
9	1	1355,72	143671	0,00	0,0	0,0	87,90	4688,24	2972,59

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Casing Load Summary - OverPull #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	357,04	195918	0,00	0,0	0,0	42,80	760,63	760,63
2	1	609,60	136256	0,00	0,0	0,0	51,18	1298,70	1298,70
3	1	644,59	127990	0,00	0,0	0,0	52,93	1373,25	1373,25
4	1	644,65	127976	0,00	0,0	0,0	52,93	1373,38	1373,38
5	1	914,40	64256	0,00	0,0	0,0	66,22	1948,05	1948,05
6	1	999,96	44042	0,00	0,0	0,0	70,40	2130,34	2130,34
7	1	1000,02	44028	0,00	0,0	0,0	70,40	2130,47	2130,47
8	1	1219,20	-7744	0,00	0,0	0,0	81,20	2597,40	2597,40
9	1	1355,72	-39993	0,00	0,0	0,0	87,90	2888,24	2888,24

Casing Load Summary - RunningHole #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	357,04	247804	0,00	0,0	0,0	42,80	760,63	760,63
2	1	609,60	199316	0,00	0,0	0,0	51,18	1298,70	1298,70
3	1	644,59	192599	0,00	0,0	0,0	52,93	1373,25	1373,25
4	1	644,65	192587	0,00	0,0	0,0	52,93	1373,38	1373,38
5	1	914,40	140802	0,00	0,0	0,0	66,22	1948,05	1948,05
6	1	999,96	124374	0,00	0,0	0,0	70,40	2130,34	2130,34
7	1	1000,02	124363	0,00	0,0	0,0	70,40	2130,47	2130,47
8	1	1219,20	82287	0,00	0,0	0,0	81,20	2597,40	2597,40
9	1	1355,72	56079	0,00	0,0	0,0	87,90	2888,24	2888,24

Casing Load Summary - Initial Conditions - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	357,04	214949	0,00	0,0	0,0	42,80	730,20	730,20
2	1	609,60	170617	0,00	0,0	0,0	51,18	1246,75	1246,75
3	1	914,40	117117	0,00	0,0	0,0	66,22	1870,13	1870,13
4	1	1219,20	63617	0,00	0,0	0,0	81,20	2493,50	2493,50
5	1	1355,72	39654	0,00	0,0	0,0	87,89	2772,71	2772,71
6	1	1355,78	39644	0,00	0,0	0,0	87,89	2772,84	2772,84
7	1	1499,98	14335	0,00	0,0	0,0	95,00	3067,74	3067,74
8	1	1500,04	14324	0,00	0,0	0,0	95,00	3067,86	3067,86
9	1	1524,00	10117	0,00	0,0	0,0	96,20	3116,88	3118,93
10	1	1828,80	-43383	0,00	0,0	0,0	111,24	3740,26	3768,28
11	1	1981,20	-70133	0,00	0,0	0,0	118,66	4051,95	4169,17
12	1	1995,65	-72675	0,00	0,0	0,0	119,40	4081,50	4208,08

Casing Load Summary - PressureTest #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	357,04	323493	0,00	0,0	0,0	42,80	4223,31	730,20
2	1	609,60	279160	0,00	0,0	0,0	51,18	4593,51	1246,76
3	1	914,40	225660	0,00	0,0	0,0	66,22	5040,26	1870,13
4	1	1219,20	172160	0,00	0,0	0,0	81,20	5487,01	2493,51
5	1	1355,72	148198	0,00	0,0	0,0	87,89	5687,11	2772,72
6	1	1355,78	148187	0,00	0,0	0,0	87,89	5687,20	2772,84
7	1	1499,98	122878	0,00	0,0	0,0	95,00	5898,54	3067,74
8	1	1500,04	136694	0,00	0,0	0,0	95,00	5898,63	2490,73
9	1	1524,00	132078	0,00	0,0	0,0	96,20	5933,76	2540,24
10	1	1828,80	73396	0,00	0,0	0,0	111,24	6380,52	3169,87
11	1	1981,20	47352	0,00	0,0	0,0	118,66	6603,89	3484,68
12	1	1995,65	44919	0,00	0,0	0,0	119,40	6625,07	3514,53

Casing Load Summary - LostReturnsWithMudDrop #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	357,04	163809	0,00	0,0	0,0	42,80	0,00	730,20
2	1	609,60	119477	0,00	0,0	0,0	51,20	0,00	1246,76
3	1	914,40	65977	0,00	0,0	0,0	66,19	181,63	1870,13
4	1	1219,20	12477	0,00	0,0	0,0	81,19	805,01	2493,51
5	1	1355,72	-11486	0,00	0,0	0,0	87,91	1084,22	2772,72
6	1	1355,78	-11496	0,00	0,0	0,0	87,91	1084,35	2772,84
7	1	1499,98	-36805	0,00	0,0	0,0	95,00	1379,24	3067,74
8	1	1500,04	-18451	0,00	0,0	0,0	95,00	1379,37	2490,73
9	1	1524,00	-22529	0,00	0,0	0,0	96,18	1428,39	2540,24
10	1	1828,80	-75119	0,00	0,0	0,0	111,18	2051,77	3169,87
11	1	1981,20	-98137	0,00	0,0	0,0	118,68	2363,45	3484,68
12	1	1995,65	-100324	0,00	0,0	0,0	119,39	2393,00	3514,53

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Casing Load Summary - GreenCement #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	357,04	426638	0,00	0,0	0,0	42,80	4430,20	730,20
2	1	609,60	382306	0,00	0,0	0,0	51,18	4946,75	1246,75
3	1	914,40	328806	0,00	0,0	0,0	66,22	5570,13	1870,13
4	1	1219,20	275306	0,00	0,0	0,0	81,20	6193,50	2493,50
5	1	1355,72	251343	0,00	0,0	0,0	87,89	6472,71	2772,71
6	1	1355,78	251333	0,00	0,0	0,0	87,89	6472,84	2772,84
7	1	1499,98	226024	0,00	0,0	0,0	95,00	6767,74	3067,74
8	1	1500,04	226013	0,00	0,0	0,0	95,00	6767,86	3067,86
9	1	1524,00	221806	0,00	0,0	0,0	96,20	6816,88	3118,93
10	1	1828,80	168306	0,00	0,0	0,0	111,24	7440,26	3768,28
11	1	1981,20	141556	0,00	0,0	0,0	118,66	7751,95	4169,17
12	1	1995,65	139014	0,00	0,0	0,0	119,40	7781,50	4208,08

Casing Load Summary - OverPull #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	357,04	274162	0,00	0,0	0,0	42,80	730,20	730,20
2	1	609,60	229830	0,00	0,0	0,0	51,18	1246,76	1246,76
3	1	914,40	176330	0,00	0,0	0,0	66,22	1870,13	1870,13
4	1	1219,20	122830	0,00	0,0	0,0	81,20	2493,51	2493,51
5	1	1355,72	98867	0,00	0,0	0,0	87,89	2772,72	2772,72
6	1	1355,78	98856	0,00	0,0	0,0	87,89	2772,84	2772,84
7	1	1499,98	73548	0,00	0,0	0,0	95,00	3067,73	3067,73
8	1	1500,04	73537	0,00	0,0	0,0	95,00	3067,85	3067,85
9	1	1524,00	69330	0,00	0,0	0,0	96,20	3116,87	3116,87
10	1	1828,80	15830	0,00	0,0	0,0	111,24	3740,25	3740,25
11	1	1981,20	-10920	0,00	0,0	0,0	118,66	4051,94	4051,94
12	1	1995,65	-13462	0,00	0,0	0,0	119,40	4081,50	4081,50

Casing Load Summary - RunningHole #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	357,04	277498	0,00	0,0	0,0	42,80	730,20	730,20
2	1	609,60	241196	0,00	0,0	0,0	51,18	1246,76	1246,76
3	1	914,40	197387	0,00	0,0	0,0	66,22	1870,13	1870,13
4	1	1219,20	153579	0,00	0,0	0,0	81,20	2493,51	2493,51
5	1	1355,72	133957	0,00	0,0	0,0	87,89	2772,72	2772,72
6	1	1355,78	133948	0,00	0,0	0,0	87,89	2772,84	2772,84
7	1	1499,98	113224	0,00	0,0	0,0	95,00	3067,73	3067,73
8	1	1500,04	113215	0,00	0,0	0,0	95,00	3067,85	3067,85
9	1	1524,00	109770	0,00	0,0	0,0	96,20	3116,87	3116,87
10	1	1828,80	65961	0,00	0,0	0,0	111,24	3740,25	3740,25
11	1	1981,20	44057	0,00	0,0	0,0	118,66	4051,94	4051,94
12	1	1995,65	41980	0,00	0,0	0,0	119,40	4081,50	4081,50

Casing Load Summary - TubingLeak #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	357,04	204808	0,00	0,0	0,0	42,80	0,06	745,81
2	1	609,60	160476	0,00	0,0	0,0	51,18	516,62	1104,39
3	1	914,40	106976	0,00	0,0	0,0	66,22	1139,99	1537,12
4	1	1219,20	53476	0,00	0,0	0,0	81,20	1763,37	1969,85
5	1	1355,72	29513	0,00	0,0	0,0	87,89	2042,58	2163,66
6	1	1355,78	29502	0,00	0,0	0,0	87,89	2042,70	2163,75
7	1	1499,98	4194	0,00	0,0	0,0	95,00	2337,60	2368,46
8	1	1500,04	-10738	0,00	0,0	0,0	95,00	2337,73	3067,84
9	1	1524,00	-14202	0,00	0,0	0,0	96,20	2386,75	3101,87
10	1	1828,80	-58226	0,00	0,0	0,0	111,24	3010,12	3534,60
11	1	1981,20	-76941	0,00	0,0	0,0	118,66	3321,80	3750,96
12	1	1995,65	-78679	0,00	0,0	0,0	119,40	3351,36	3771,48

Casing Load Summary - Initial Conditions - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	1980,04	1093	0,00	0,0	0,0	118,60	4049,55	4049,55
2	1	1981,20	978	0,00	0,0	0,0	118,66	4051,95	4052,05
3	1	1995,65	-399	0,00	0,0	0,0	119,38	4081,50	4082,83
4	1	1995,71	-399	0,00	0,0	0,0	119,39	4081,62	4082,96
5	1	2133,60	-13522	0,00	0,0	0,0	126,18	4363,63	4376,72
6	1	2438,40	-42522	0,00	0,0	0,0	141,22	4987,00	5077,48
7	1	2496,98	-48097	0,00	0,0	0,0	144,10	5106,80	5235,20

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Casing Load Summary - PressureTest #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	1980,04	47094	0,00	0,0	0,0	118,60	6602,18	4049,53
2	1	1981,20	46987	0,00	0,0	0,0	118,66	6603,89	4051,20
3	1	1995,65	45695	0,00	0,0	0,0	119,38	6625,07	4071,71
4	1	1995,71	58560	0,00	0,0	0,0	119,39	6625,16	3514,65
5	1	2133,60	44508	0,00	0,0	0,0	126,18	6827,27	3786,36
6	1	2438,40	16016	0,00	0,0	0,0	141,22	7274,02	4327,27
7	1	2496,98	11070	0,00	0,0	0,0	144,10	7359,87	4431,21

Casing Load Summary - Evacuation #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	1980,04	-71851	0,00	0,0	0,0	118,62	3,37	4049,53
2	1	1981,20	-71988	0,00	0,0	0,0	118,67	3,38	4051,20
3	1	1995,65	-73640	0,00	0,0	0,0	119,38	3,40	4071,71
4	1	1995,71	-73641	0,00	0,0	0,0	119,39	3,40	4071,79
5	1	2133,60	-89555	0,00	0,0	0,0	126,17	3,64	4267,56
6	1	2438,40	-123520	0,00	0,0	0,0	141,17	4,16	4700,28
7	1	2496,98	-129536	0,00	0,0	0,0	144,05	4,27	4783,44

Casing Load Summary - GreenCement #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	1980,04	112222	0,00	0,0	0,0	118,60	7749,55	4049,55
2	1	1981,20	112108	0,00	0,0	0,0	118,66	7751,95	4052,05
3	1	1995,65	110730	0,00	0,0	0,0	119,38	7781,50	4082,83
4	1	1995,71	110730	0,00	0,0	0,0	119,39	7781,62	4082,96
5	1	2133,60	97608	0,00	0,0	0,0	126,18	8063,63	4376,72
6	1	2438,40	68608	0,00	0,0	0,0	141,22	8687,00	5077,48
7	1	2496,98	63033	0,00	0,0	0,0	144,10	8806,80	5235,20

Casing Load Summary - OverPull #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	1980,04	56035	0,00	0,0	0,0	118,60	4049,55	4049,55
2	1	1981,20	55921	0,00	0,0	0,0	118,66	4051,95	4051,95
3	1	1995,65	54543	0,00	0,0	0,0	119,38	4081,50	4081,50
4	1	1995,71	54543	0,00	0,0	0,0	119,39	4081,62	4081,62
5	1	2133,60	41421	0,00	0,0	0,0	126,18	4363,63	4363,63
6	1	2438,40	12421	0,00	0,0	0,0	141,22	4987,01	4987,01
7	1	2496,98	6846	0,00	0,0	0,0	144,10	5106,80	5106,80

Casing Load Summary - RunningHole #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	1980,04	63067	0,00	0,0	0,0	118,60	4049,55	4049,55
2	1	1981,20	62976	0,00	0,0	0,0	118,66	4051,95	4051,95
3	1	1995,65	61850	0,00	0,0	0,0	119,38	4081,50	4081,50
4	1	1995,71	61846	0,00	0,0	0,0	119,39	4081,62	4081,62
5	1	2133,60	51109	0,00	0,0	0,0	126,18	4363,63	4363,63
6	1	2438,40	27376	0,00	0,0	0,0	141,22	4987,01	4987,01
7	1	2496,98	22816	0,00	0,0	0,0	144,10	5106,80	5106,80

Casing Load Summary - TubingLeak #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	1980,04	1065	0,00	0,0	0,0	118,62	4049,55	4049,53
2	1	1981,20	972	0,00	0,0	0,0	118,67	4051,94	4051,20
3	1	1995,65	-149	0,00	0,0	0,0	119,38	4081,50	4071,71
4	1	1995,71	-148	0,00	0,0	0,0	119,39	4081,62	4071,79
5	1	2133,60	-10983	0,00	0,0	0,0	126,17	4363,63	4267,56
6	1	2438,40	-33723	0,00	0,0	0,0	141,17	4987,01	4700,29
7	1	2496,98	-37583	0,00	0,0	0,0	144,05	5106,80	4783,44

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Safety Factor Summary - Initial Conditions - 20" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	357,04	80000,0	800,0	D 100+	N/A	100+	46,082	M 100+
2	1	414,99	80000,0	800,0	100+	N/A	100+	21,374	100+
3	1	415,05	80000,0	800,0	100+	N/A	100+	21,362	100+
4	1	447,39	80000,0	929,4	86,074	N/A	100+	16,447	CM 94,852
5	1	609,60	80000,0	3461,7	23,110	N/A	100+	5,836	CM 29,895
6	1	644,59	80000,0	4112,6	19,452	N/A	100+	5,031	CM 26,047
7									
8	**Burst and Axial Flags**								
9	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
10									
11	**Axial Flags**								
12	**Default = Tension, M = Compression**								
13									
14	**Triaxial Flags**								
15	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
16									
17	**Envelope Flags**								
18	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - PressureTest #1 - 20" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	357,04	80000,0	17606,9	4,544	N/A	4,132	100+	16,734
2	1	414,99	80000,0	17736,0	4,511	N/A	4,122	100+	18,562
3	1	415,05	80000,0	18496,6	4,325	N/A	3,954	100+	17,649
4	1	609,60	80000,0	18386,9	4,351	N/A	4,033	100+	25,661
5	1	644,59	80000,0	18429,5	4,341	N/A	4,033	100+	27,378
6									
7	**Burst and Axial Flags**								
8	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
9									
10	**Axial Flags**								
11	**Default = Tension, M = Compression**								
12									
13	**Triaxial Flags**								
14	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
15									
16	**Envelope Flags**								
17	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - LostReturnsWithMudDrop #1 - 20" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	357,04	80000,0	9247,1	8,651	N/A	100+	2,928	CM 36,921
2	1	414,99	80000,0	10599,5	7,548	N/A	100+	2,519	CM 26,424
3	1	415,05	80000,0	9729,6	8,222	N/A	100+	2,744	CM 28,851
4	1	492,59	80000,0	11557,8	6,922	N/A	100+	2,280	CM 20,550
5	1	609,60	80000,0	10158,1	7,876	N/A	100+	2,502	CM 18,725
6	1	644,59	80000,0	9748,8	8,206	N/A	100+	2,577	CM 18,308
7									
8	**Burst and Axial Flags**								
9	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
10									
11	**Axial Flags**								
12	**Default = Tension, M = Compression**								
13									
14	**Triaxial Flags**								
15	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
16									
17	**Envelope Flags**								
18	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - GreenCement #1 - 20" Surface Casing

String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	357,04	80000,0	17642,0	4,535	N/A	4,041	100+	9,972
1	414,99	80000,0	17097,1	4,679	N/A	4,172	100+	10,858
1	415,05	80000,0	17096,5	4,679	N/A	4,172	100+	10,859
1	609,60	80000,0	14216,5	5,627	N/A	5,025	100+	15,474
1	644,59	80000,0	13565,5	N 5,897	N/A	5,266	100+	16,754

Burst and Axial Flags
Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection

Axial Flags
Default = Tension, M = Compression

Triaxial Flags
Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending

Envelope Flags
EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection

Safety Factor Summary - OverPull #1 - 20" Surface Casing

String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	357,04	80000,0	3324,2	D 24,066	N/A	100+	46,105	28,812
1	414,99	80000,0	2758,5	D 29,001	N/A	100+	39,666	37,701
1	415,05	80000,0	2757,9	D 29,007	N/A	100+	39,660	37,713
1	609,60	80000,0	858,8	D 93,148	N/A	100+	27,003	100+
1	644,59	80000,0	800,0	D 100+	N/A	100+	25,537	100+

Burst and Axial Flags
Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection

Axial Flags
Default = Tension, M = Compression

Triaxial Flags
Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending

Envelope Flags
EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection

Safety Factor Summary - RunningHole #1 - 20" Surface Casing

String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	357,04	80000,0	6054,9	D 13,213	N/A	100+	46,104	14,526
1	414,99	80000,0	5578,0	D 14,342	N/A	100+	39,666	16,189
1	415,05	80000,0	5577,5	D 14,343	N/A	100+	39,660	16,191
1	609,60	80000,0	3976,9	D 20,116	N/A	100+	27,003	26,300
1	644,59	80000,0	3689,0	D 21,686	N/A	100+	25,537	29,626

Burst and Axial Flags
Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection

Axial Flags
Default = Tension, M = Compression

Triaxial Flags
Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending

Envelope Flags
EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection

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Safety Factor Summary - Initial Conditions - 13 3/8" Intermediate Casing

	String	MD	Yield Strength	VME Stress	Absolute Safety Factors				
	Section	(m)	(psi)	(psi)	Triaxial	Envelope	Burst	Collapse	Axial
1	1	357,04	110000,0	8660,5	D 12,701	N/A	100+	49,189	C 13,930
2	1	609,60	110000,0	6325,7	D 17,389	N/A	100+	28,843	C 21,890
3	1	644,59	110000,0	6002,2	D 18,326	N/A	100+	27,281	C 23,773
4	1	644,65	110000,0	6001,7	D 18,328	N/A	100+	27,279	C 23,776
5	1	914,40	110000,0	3508,1	D 31,356	N/A	100+	19,246	C 70,535
6	1	999,96	109920,6	2717,2	D 40,454	N/A	100+	17,602	M 100+
7	1	1000,02	109920,5	2716,6	D 40,463	N/A	100+	17,600	M 100+
8	1	1138,49	109694,6	1436,5	D 76,360	N/A	100+	15,461	CM 100+
9	1	1219,20	109563,2	1095,6	100+	N/A	100+	13,909	CM 57,383
10	1	1355,72	109341,3	1126,6	97,058	N/A	100+	9,407	CM 31,563
11									

12 **Burst and Axial Flags**
13 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
14
15 **Axial Flags**
16 **Default = Tension, M = Compression**
17
18 **Triaxial Flags**
19 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
20
21 **Envelope Flags**
22 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - PressureTest #1 - 13 3/8" Intermediate Casing

	String	MD	Yield Strength	VME Stress	Absolute Safety Factors				
	Section	(m)	(psi)	(psi)	Triaxial	Envelope	Burst	Collapse	Axial
1	1	357,04	110000,0	24061,3	4,572	N/A	4,151	100+	C 7,329
2	1	609,60	110000,0	26141,2	4,208	N/A	3,771	100+	C 9,063
3	1	644,59	110000,0	26474,7	4,155	N/A	3,724	100+	C 9,370
4	1	644,65	110000,0	26475,3	4,155	N/A	3,724	100+	C 9,370
5	1	762,00	110000,0	27667,4	N 3,976	N/A	3,574	100+	C 10,514
6	1	914,40	110000,0	29463,0	N 3,734	N/A	3,396	100+	C 11,650
7	1	999,96	109920,6	30575,1	N 3,595	N/A	3,301	100+	C 12,393
8	1	1000,02	109920,5	33076,0	3,323	N/A	3,020	100+	C 11,644
9	1	1219,20	109563,2	33895,0	3,232	N/A	2,972	100+	C 15,423
10	1	1355,72	109341,3	34343,1	3,184	N/A	2,947	100+	C 18,437
11									

12 **Burst and Axial Flags**
13 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
14
15 **Axial Flags**
16 **Default = Tension, M = Compression**
17
18 **Triaxial Flags**
19 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
20
21 **Envelope Flags**
22 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - LostReturnsWithMudDrop #1 - 13 3/8" Intermediate Casing

	String	MD	Yield Strength	VME Stress	Absolute Safety Factors				
	Section	(m)	(psi)	(psi)	Triaxial	Envelope	Burst	Collapse	Axial
1	1	357,04	110000,0	13822,8	7,958	N/A	100+	3,787	C 31,022
2	1	609,60	110000,0	20328,3	5,411	N/A	100+	2,219	M 100+
3	1	644,59	110000,0	20968,6	5,246	N/A	100+	2,128	M 100+
4	1	644,65	110000,0	20969,4	5,246	N/A	100+	2,128	M 100+
5	1	762,00	110000,0	21326,8	5,158	N/A	100+	2,017	CM 100+
6	1	914,40	110000,0	20895,8	5,264	N/A	100+	1,966	CM 39,339
7	1	999,96	109920,5	20687,5	5,313	N/A	100+	1,939	CM 29,150
8	1	1000,02	109920,4	11591,0	9,483	N/A	100+	3,437	CM 63,050
9	1	1219,20	109563,5	10706,3	10,234	N/A	100+	3,350	CM 26,442
10	1	1355,72	109341,1	10419,8	10,494	N/A	100+	3,285	CM 20,383
11									

12 **Burst and Axial Flags**
13 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
14
15 **Axial Flags**
16 **Default = Tension, M = Compression**
17
18 **Triaxial Flags**
19 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
20
21 **Envelope Flags**
22 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - GreenCement #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	357,04	110000,0	24983,2	4,403	N/A	4,110	100+	6,022
2	1	609,60	110000,0	24433,0	4,502	N/A	4,110	100+	C 7,144
3	1	644,59	110000,0	24373,4	4,513	N/A	4,110	100+	C 7,333
4	1	644,65	110000,0	24373,3	4,513	N/A	4,110	100+	C 7,333
5	1	914,40	110000,0	24055,7	4,573	N/A	4,110	100+	C 9,218
6	1	999,96	109920,6	24008,2	4,578	N/A	4,107	100+	C 10,029
7	1	1000,02	109920,5	24008,2	4,578	N/A	4,107	100+	C 10,030
8	1	1205,76	109584,0	24000,6	4,566	N/A	4,094	100+	C 12,712
9	1	1219,20	109563,2	23902,3	4,584	N/A	4,111	100+	C 12,939
10	1	1355,72	109341,3	22916,9	N 4,771	N/A	4,286	100+	C 15,811
11									

11
12 **Burst and Axial Flags**
13 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
14
15 **Axial Flags**
16 **Default = Tension, M = Compression**
17
18 **Triaxial Flags**
19 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
20
21 **Envelope Flags**
22 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - OverPull #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	357,04	110000,0	10194,3	D 10,790	N/A	100+	49,149	C 11,665
2	1	609,60	110000,0	7859,6	D 13,996	N/A	100+	28,826	C 16,773
3	1	644,59	110000,0	7536,1	D 14,596	N/A	100+	27,266	C 17,856
4	1	644,65	110000,0	7535,6	D 14,597	N/A	100+	27,263	C 17,858
5	1	914,40	110000,0	5042,0	D 21,817	N/A	100+	19,240	C 35,567
6	1	999,96	109920,6	4251,0	D 25,857	N/A	100+	17,597	C 51,853
7	1	1000,02	109920,5	4250,5	D 25,861	N/A	100+	17,596	C 51,870
8	1	1219,20	109563,2	2224,5	D 49,253	N/A	100+	14,436	100+
9	1	1355,72	109341,3	1093,4	D 100+	N/A	100+	12,982	CM 56,702
10									

11 **Burst and Axial Flags**
12 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
13
14 **Axial Flags**
15 **Default = Tension, M = Compression**
16
17 **Triaxial Flags**
18 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
19
20 **Envelope Flags**
21 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - RunningHole #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	357,04	110000,0	12692,7	D 8,666	N/A	100+	49,071	C 9,223
2	1	609,60	110000,0	10896,0	D 10,095	N/A	100+	28,783	C 11,466
3	1	644,59	110000,0	10647,1	D 10,331	N/A	100+	27,225	C 11,866
4	1	644,65	110000,0	10646,7	D 10,332	N/A	100+	27,223	C 11,867
5	1	914,40	110000,0	8727,8	D 12,603	N/A	100+	19,216	C 16,231
6	1	999,96	109920,6	8119,1	D 13,539	N/A	100+	17,576	C 18,362
7	1	1000,02	109920,5	8118,7	D 13,539	N/A	100+	17,575	C 18,363
8	1	1219,20	109563,2	6559,6	D 16,703	N/A	100+	14,423	C 27,663
9	1	1355,72	109341,3	5588,5	D 19,566	N/A	100+	12,974	C 40,509
10									

11 **Burst and Axial Flags**
12 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
13
14 **Axial Flags**
15 **Default = Tension, M = Compression**
16
17 **Triaxial Flags**
18 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
19
20 **Envelope Flags**
21 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - Initial Conditions - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	357,04	110000,0	14556,3	D 7,557	N/A	100+	92,647	7,961
2	1	609,60	110000,0	12221,3	D 9,001	N/A	100+	54,734	10,029
3	1	914,40	110000,0	9403,4	D 11,698	N/A	100+	36,848	14,611
4	1	1219,20	109563,2	6585,5	D 16,637	N/A	100+	27,828	C 26,789
5	1	1355,72	109341,7	5323,3	D 20,540	N/A	100+	25,096	C 42,890
6	1	1355,78	109341,6	5322,8	D 20,542	N/A	100+	25,095	C 42,902
7	1	1499,98	109106,3	3989,8	D 27,347	N/A	100+	22,747	C 100+
8	1	1500,04	109106,2	3989,2	D 27,350	N/A	100+	22,746	C 100+
9	1	1524,00	109066,5	3778,5	28,865	N/A	100+	22,269	M 100+
10	1	1676,40	108817,6	2442,3	44,554	N/A	100+	19,610	CM 100+
11	1	1828,80	108568,7	1128,3	96,225	N/A	100+	17,493	CM 38,927
12	1	1845,69	108542,5	1085,4	100+	N/A	100+	17,286	CM 36,429
13	1	1981,20	108323,0	1090,2	99,364	N/A	100+	13,697	CM 24,025
14	1	1995,65	108298,6	1166,6	92,832	N/A	100+	13,400	CM 23,178
15									
16	**Burst and Axial Flags**								
17	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
18									
19	**Axial Flags**								
20	**Default = Tension, M = Compression**								
21									
22	**Triaxial Flags**								
23	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
24									
25	**Envelope Flags**								
26	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - PressureTest #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	357,04	110000,0	32768,3	3,357	N/A	3,120	100+	5,290
2	1	609,60	110000,0	31143,4	3,532	N/A	3,257	100+	6,130
3	1	914,40	110000,0	29277,1	3,757	N/A	3,438	100+	7,583
4	1	1219,20	109563,2	27534,0	3,979	N/A	3,627	100+	9,900
5	1	1355,72	109341,7	26799,6	4,080	N/A	3,718	100+	11,477
6	1	1355,78	109341,6	26799,3	4,080	N/A	3,718	100+	11,478
7	1	1499,98	109106,3	26058,7	4,187	N/A	3,819	100+	13,812
8	1	1500,04	109106,2	31520,4	3,461	N/A	3,172	100+	12,416
9	1	1524,00	109066,5	31409,5	3,472	N/A	3,185	100+	12,846
10	1	1828,80	108568,7	30114,9	3,605	N/A	3,351	100+	C 23,009
11	1	1981,20	108323,0	29502,4	3,672	N/A	3,441	100+	C 35,583
12	1	1995,65	108298,6	29445,8	N 3,678	N/A	3,450	100+	C 37,500
13									
14	**Burst and Axial Flags**								
15	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
16									
17	**Axial Flags**								
18	**Default = Tension, M = Compression**								
19									
20	**Triaxial Flags**								
21	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
22									
23	**Envelope Flags**								
24	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - LostReturnsWithMudDrop #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	357,04	110000,0	15900,4	6,918	N/A	100+	10,597	10,446
2	1	609,60	110000,0	18331,1	6,001	N/A	100+	6,257	14,322
3	1	857,01	110000,0	20852,5	5,275	N/A	100+	4,634	C 22,498
4	1	914,40	110000,0	20502,1	5,365	N/A	100+	4,606	C 25,934
5	1	1219,20	109563,5	18783,4	5,833	N/A	100+	4,451	M 100+
6	1	1355,72	109341,1	18103,1	6,040	N/A	100+	4,377	100+
7	1	1355,78	109341,0	18102,8	6,040	N/A	100+	4,377	100+
8	1	1371,60	109315,3	18028,1	6,064	N/A	100+	4,368	CM 100+
9	1	1499,98	109106,2	17454,8	6,251	N/A	100+	4,293	CM 46,111
10	1	1500,04	109106,1	11897,5	9,170	N/A	100+	6,248	CM 91,978
11	1	1524,00	109067,1	11795,0	9,247	N/A	100+	6,217	CM 75,303
12	1	1828,80	108570,7	10754,6	10,095	N/A	100+	5,850	CM 22,481
13	1	1981,20	108322,5	10502,8	10,314	N/A	100+	5,681	M 17,170
14	1	1995,65	108299,0	10485,1	10,329	N/A	100+	5,666	M 16,792
15									
16	**Burst and Axial Flags**								
17	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
18									
19	**Axial Flags**								
20	**Default = Tension, M = Compression**								
21									
22	**Triaxial Flags**								
23	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
24									
25	**Envelope Flags**								
26	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - GreenCement #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	357,04	110000,0	36153,6	3,043	N/A	2,946	100+	4,011
2	1	609,60	110000,0	35431,9	3,105	N/A	2,946	100+	4,476
3	1	914,40	110000,0	34750,5	3,165	N/A	2,946	100+	5,204
4	1	1219,20	109563,2	34287,8	3,195	N/A	2,934	100+	6,191
5	1	1355,72	109341,7	34154,0	3,201	N/A	2,928	100+	6,767
6	1	1355,78	109341,6	34153,9	3,201	N/A	2,928	100+	6,768
7	1	1499,98	109106,3	34062,9	3,203	N/A	2,922	100+	7,509
8	1	1500,04	109106,2	34062,8	3,203	N/A	2,922	100+	7,509
9	1	1524,00	109066,5	34034,4	3,205	N/A	2,923	100+	7,649
10	1	1828,80	108568,7	33786,9	3,213	N/A	2,930	100+	10,035
11	1	1981,20	108323,0	33015,3	3,281	N/A	2,996	100+	11,904
12	1	1995,65	108298,6	32935,1	3,288	N/A	3,003	100+	12,118
13									
14	**Burst and Axial Flags**								
15	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
16									
17	**Axial Flags**								
18	**Default = Tension, M = Compression**								
19									
20	**Triaxial Flags**								
21	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
22									
23	**Envelope Flags**								
24	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - OverPull #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	357,04	110000,0	18365,0	D 5,990	N/A	100+	91,496	6,241
2	1	609,60	110000,0	16030,0	D 6,862	N/A	100+	54,097	7,445
3	1	914,40	110000,0	13212,1	D 8,326	N/A	100+	36,450	9,704
4	1	1219,20	109563,2	10394,2	D 10,541	N/A	100+	27,548	13,876
5	1	1355,72	109341,7	9132,1	D 11,973	N/A	100+	24,851	17,204
6	1	1355,78	109341,6	9131,5	D 11,974	N/A	100+	24,850	17,206
7	1	1499,98	109106,3	7798,5	D 13,991	N/A	100+	22,532	C 23,075
8	1	1500,04	109106,2	7797,9	D 13,992	N/A	100+	22,531	C 23,079
9	1	1524,00	109066,5	7576,3	D 14,396	N/A	100+	22,188	C 24,470
10	1	1828,80	108568,7	4758,4	D 22,816	N/A	100+	18,605	C 100+
11	1	1981,20	108323,0	3349,5	D 32,340	N/A	100+	17,196	100+
12	1	1995,65	108298,6	3215,5	D 33,680	N/A	100+	17,069	100+
13									

14 **Burst and Axial Flags**
15 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
16
17 **Axial Flags**
18 **Default = Tension, M = Compression**
19
20 **Triaxial Flags**
21 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
22
23 **Envelope Flags**
24 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - RunningHole #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	357,04	110000,0	18579,6	D 5,920	N/A	100+	91,429	6,166
2	1	609,60	110000,0	16761,1	D 6,563	N/A	100+	53,969	7,094
3	1	914,40	110000,0	14566,6	D 7,552	N/A	100+	36,301	8,669
4	1	1219,20	109563,2	12372,1	D 8,856	N/A	100+	27,394	11,098
5	1	1355,72	109341,7	11389,1	D 9,601	N/A	100+	24,697	12,697
6	1	1355,78	109341,6	11388,7	D 9,601	N/A	100+	24,695	12,698
7	1	1499,98	109106,3	10350,6	D 10,541	N/A	100+	22,378	14,990
8	1	1500,04	109106,2	10350,1	D 10,542	N/A	100+	22,377	14,991
9	1	1524,00	109066,5	10177,5	D 10,716	N/A	100+	22,035	15,456
10	1	1828,80	108568,7	7983,0	D 13,600	N/A	100+	18,455	C 25,602
11	1	1981,20	108323,0	6885,8	D 15,731	N/A	100+	17,077	C 38,245
12	1	1995,65	108298,6	6781,7	D 15,969	N/A	100+	16,957	C 40,128
13									

14 **Burst and Axial Flags**
15 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
16
17 **Axial Flags**
18 **Default = Tension, M = Compression**
19
20 **Triaxial Flags**
21 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
22
23 **Envelope Flags**
24 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - TubingLeak #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	357,04	110000,0	18454,3	5,961	N/A	100+	10,294	8,355
2	1	609,60	110000,0	14969,0	7,349	N/A	100+	11,981	10,663
3	1	914,40	110000,0	10767,4	10,216	N/A	100+	14,856	15,996
4	1	1066,80	109810,0	8670,3	12,665	N/A	100+	16,829	C 21,291
5	1	1219,20	109563,2	6579,1	16,653	N/A	100+	19,379	C 31,869
6	1	1355,72	109341,7	4717,0	23,180	N/A	100+	22,397	C 57,629
7	1	1355,78	109341,6	4716,2	23,184	N/A	100+	22,398	C 57,650
8	1	1499,98	109106,3	2785,6	39,168	N/A	100+	26,776	M 100+
9	1	1500,04	109106,2	8693,5	12,550	N/A	100+	7,961	100+
10	1	1524,00	109066,5	8426,8	12,943	N/A	100+	8,035	CM 100+
11	1	1828,80	108568,7	5240,0	20,719	N/A	100+	9,129	CM 29,004
12	1	1981,20	108323,0	3999,5	27,084	N/A	100+	9,798	CM 21,899
13	1	1995,65	108298,6	3898,1	27,783	N/A	100+	9,866	CM 21,410
14									

15 **Burst and Axial Flags**
16 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
17
18 **Axial Flags**
19 **Default = Tension, M = Compression**
20
21 **Triaxial Flags**
22 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
23
24 **Envelope Flags**
25 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - Initial Conditions - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	1980,04	78781,8	4178,8	D 18,853	N/A	100+	14,730	M 100+
2	1	1981,20	78780,4	4168,2	D 18,900	N/A	100+	14,719	M 100+
3	1	1995,65	78763,0	4041,1	19,491	N/A	100+	14,580	100+
4	1	1995,71	78762,9	4041,2	19,490	N/A	100+	14,579	100+
5	1	2133,60	78599,4	2833,3	27,741	N/A	100+	13,314	M 49,144
6	1	2438,40	78237,3	912,8	85,713	N/A	100+	10,308	M 15,556
7	1	2496,98	78168,0	1151,4	67,890	N/A	100+	9,564	M 13,740
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - PressureTest #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	1980,04	78781,8	22859,9	3,446	N/A	3,148	100+	14,143
2	1	1981,20	78780,4	22860,9	3,446	N/A	3,148	100+	14,175
3	1	1995,65	78763,0	22873,2	3,443	N/A	3,146	100+	14,573
4	1	1995,71	78762,9	27941,7	2,819	N/A	2,583	100+	11,371
5	1	2133,60	78599,4	27444,8	2,864	N/A	2,636	100+	14,930
6	1	2438,40	78237,3	27049,2	2,892	N/A	2,708	100+	41,301
7	1	2496,98	78168,0	26986,1	N 2,897	N/A	2,722	100+	59,690
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - Evacuation #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	1980,04	78781,4	38264,3	2,059	N/A	100+	1,719	M 9,270
2	1	1981,20	78780,0	38275,9	2,058	N/A	100+	1,719	M 9,252
3	1	1995,65	78762,9	38420,5	2,050	N/A	100+	1,710	M 9,043
4	1	1995,71	78762,9	38421,4	2,050	N/A	100+	1,710	M 9,042
5	1	2133,60	78599,5	39823,2	1,974	N/A	100+	1,629	M 7,420
6	1	2438,40	78238,5	43107,0	1,815	N/A	100+	1,475	M 5,355
7	1	2496,98	78169,1	43770,0	1,786	N/A	100+	1,448	M 5,102
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - GreenCement #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	1980,04	78781,8	33158,2	2,376	N/A	2,172	100+	5,935
2	1	1981,20	78780,4	33156,7	2,376	N/A	2,172	100+	5,941
3	1	1995,65	78763,0	33138,6	2,377	N/A	2,172	100+	6,014
4	1	1995,71	78762,9	33138,5	2,377	N/A	2,172	100+	6,014
5	1	2133,60	78599,4	32990,4	2,382	N/A	2,174	100+	6,808
6	1	2438,40	78237,3	32345,4	2,419	N/A	2,211	100+	9,641
7	1	2496,98	78168,0	32028,3	2,441	N/A	2,232	100+	10,484
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - OverPull #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	1980,04	78781,8	10681,3	D 7,376	N/A	100+	14,293	11,886
2	1	1981,20	78780,4	10670,2	D 7,383	N/A	100+	14,286	11,910
3	1	1995,65	78763,0	10536,7	D 7,475	N/A	100+	14,191	12,209
4	1	1995,71	78762,9	10536,8	D 7,475	N/A	100+	14,191	12,209
5	1	2133,60	78599,4	9265,8	D 8,483	N/A	100+	13,357	16,043
6	1	2438,40	78237,3	6457,0	D 12,117	N/A	100+	11,837	53,252
7	1	2496,98	78168,0	5916,9	D 13,211	N/A	100+	11,586	96,538
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - RunningHole #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	1980,04	78781,8	11513,5	D 6,843	N/A	100+	14,232	10,561
2	1	1981,20	78780,4	11505,1	D 6,847	N/A	100+	14,225	10,576
3	1	1995,65	78763,0	11401,5	D 6,908	N/A	100+	14,129	10,766
4	1	1995,71	78762,9	11401,0	D 6,908	N/A	100+	14,129	10,767
5	1	2133,60	78599,4	10412,4	D 7,549	N/A	100+	13,281	13,002
6	1	2438,40	78237,3	8227,0	D 9,510	N/A	100+	11,742	24,162
7	1	2496,98	78168,0	7807,0	D 10,013	N/A	100+	11,488	28,965
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - TubingLeak #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	1980,04	78781,4	4175,5	D 18,868	N/A	100+	14,731	M 100+
2	1	1981,20	78780,0	4163,1	D 18,924	N/A	100+	14,745	M 100+
3	1	1995,65	78762,9	4014,2	19,621	N/A	100+	14,928	100+
4	1	1995,71	78762,9	4014,3	19,621	N/A	100+	14,928	100+
5	1	2133,60	78599,5	2707,5	29,030	N/A	83,450	16,836	M 60,504
6	1	2438,40	78238,5	2610,7	29,969	N/A	27,833	23,506	M 19,614
7	1	2496,98	78169,1	3064,7	N 25,506	N/A	24,658	25,451	M 17,584
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Movement Summary - Initial Conditions - 20" Surface Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

Movement Summary - PressureTest #1 - 20" Surface Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

Movement Summary - LostReturnsWithMudDrop #1 - 20" Surface Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

Movement Summary - GreenCement #1 - 20" Surface Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

Movement Summary - OverPull #1 - 20" Surface Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

Movement Summary - RunningHole #1 - 20" Surface Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

Movement Summary - Initial Conditions - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	357,04	1000,00	0,000	0,000	0,000	0,000	0,000	0,00

Movement Summary - PressureTest #1 - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	357,04	1000,00	0,152	-0,001	-0,152	0,000	0,000	250,26

Movement Summary - LostReturnsWithMudDrop #1 - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	357,04	1000,00	-0,093	0,000	0,093	0,000	0,000	0,00

Movement Summary - GreenCement #1 - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	357,04	1000,00	0,089	0,000	0,000	0,000	0,089	0,00

Movement Summary - OverPull #1 - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	357,04	1000,00	0,032	0,000	0,000	0,000	0,032*	0,00
2								
3	*** Surface displacement due to pickup (+) or slackoff (-)**							

Movement Summary - RunningHole #1 - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No results available for this load case							
4								
5								

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Movement Summary - Initial Conditions - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	357,04	1500,00	0,000	0,000	0,000	0,000	0,000	0,00

Movement Summary - PressureTest #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	357,04	1500,00	0,266	0,000	-0,266	0,000	0,000	0,00

Movement Summary - LostReturnsWithMudDrop #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	357,04	1500,00	-0,125	0,000	0,125	0,000	0,000	0,00

Movement Summary - GreenCement #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	357,04	1500,00	0,208	0,000	0,000	0,000	0,208	0,00

Movement Summary - OverPull #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	357,04	1500,00	0,176	0,000	0,000	0,000	0,176*	0,00
2								
3	*** Surface displacement due to pickup (+) or slackoff (-)**							

Movement Summary - RunningHole #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No results available for this load case							
4								
5								

Movement Summary - TubingLeak #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	357,04	1500,00	-0,061	0,000	0,061	0,000	0,000	0,00

Movement Summary - Initial Conditions - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

Movement Summary - PressureTest #1 - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

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Movement Summary - Evacuation #1 - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	No length changes - Pipe is fully cemented							
2								
3								
4								
5								

Movement Summary - GreenCement #1 - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	No length changes - Pipe is fully cemented							
2								
3								
4								
5								

Movement Summary - OverPull #1 - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	No length changes - Pipe is fully cemented							
2								
3								
4								
5								

Movement Summary - RunningHole #1 - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	No length changes - Pipe is fully cemented							
2								
3								
4								
5								

Movement Summary - TubingLeak #1 - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	No length changes - Pipe is fully cemented							
2								
3								
4								
5								

5.2.1.2 Slender Well Design

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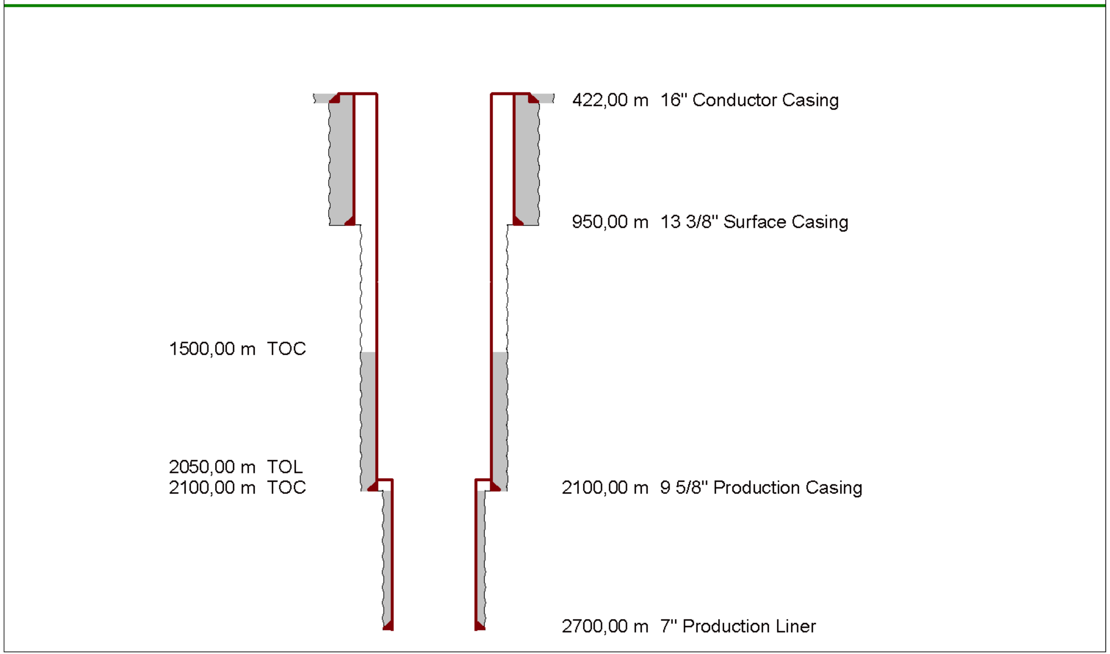
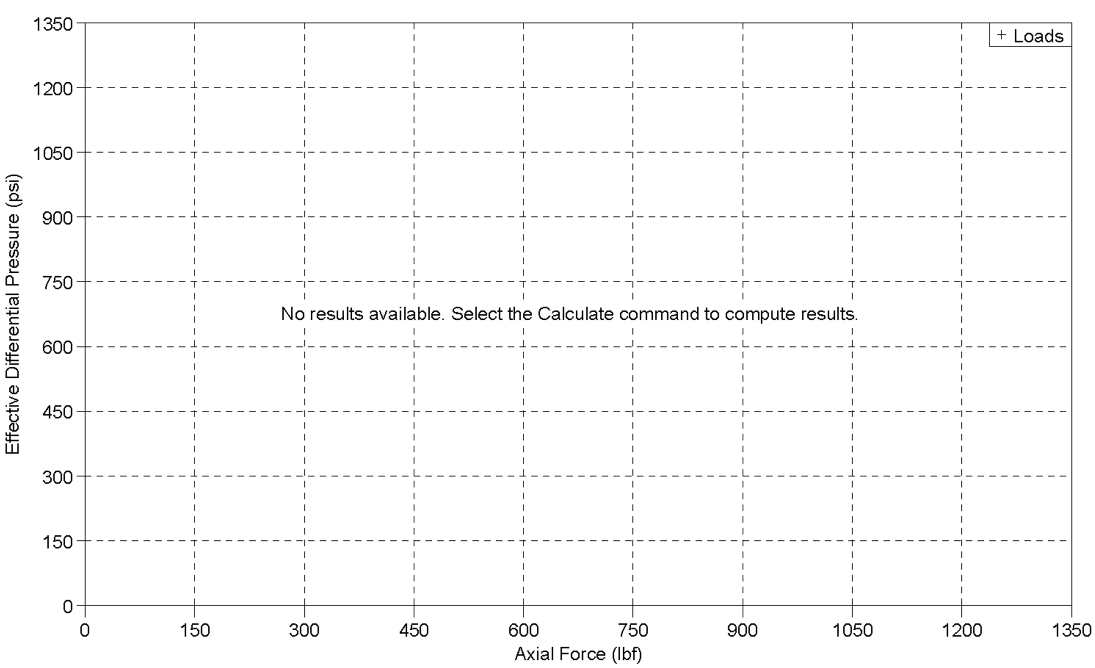
Well Schematic

RKB, 25,00 m (All depths are MD)



Design Limits - 16" Conductor Casing - Section 1 - OD 16,000 in - Weight 65,000 ppf - Grade H-40



Conventional Well Design WELLCAT 5000.1.13.1

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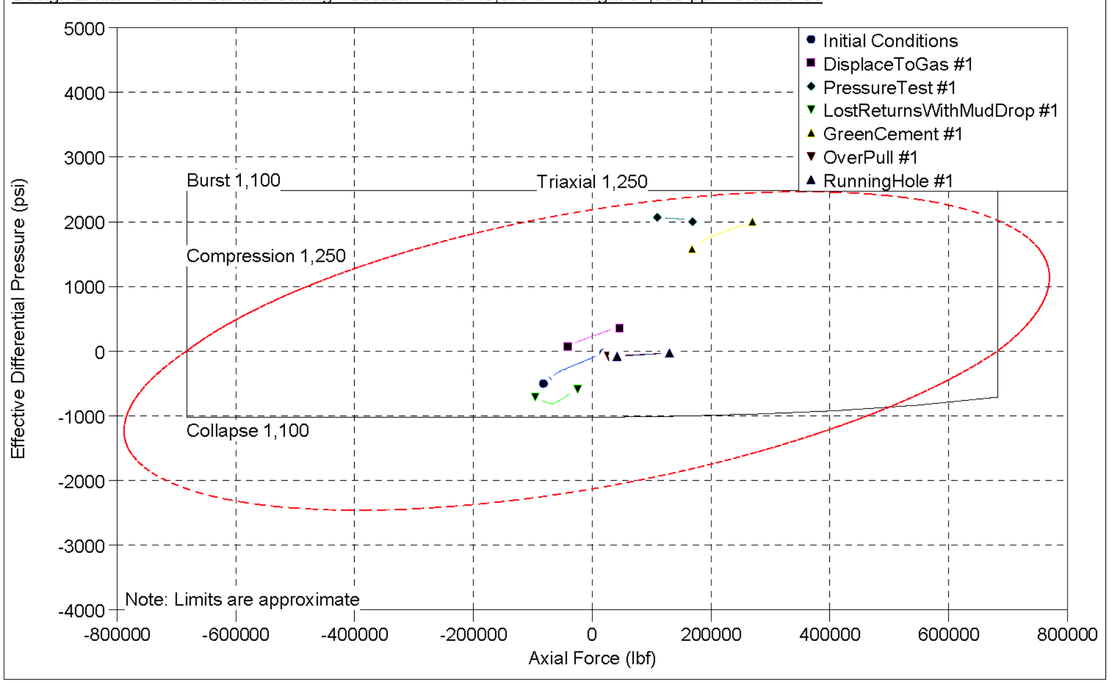
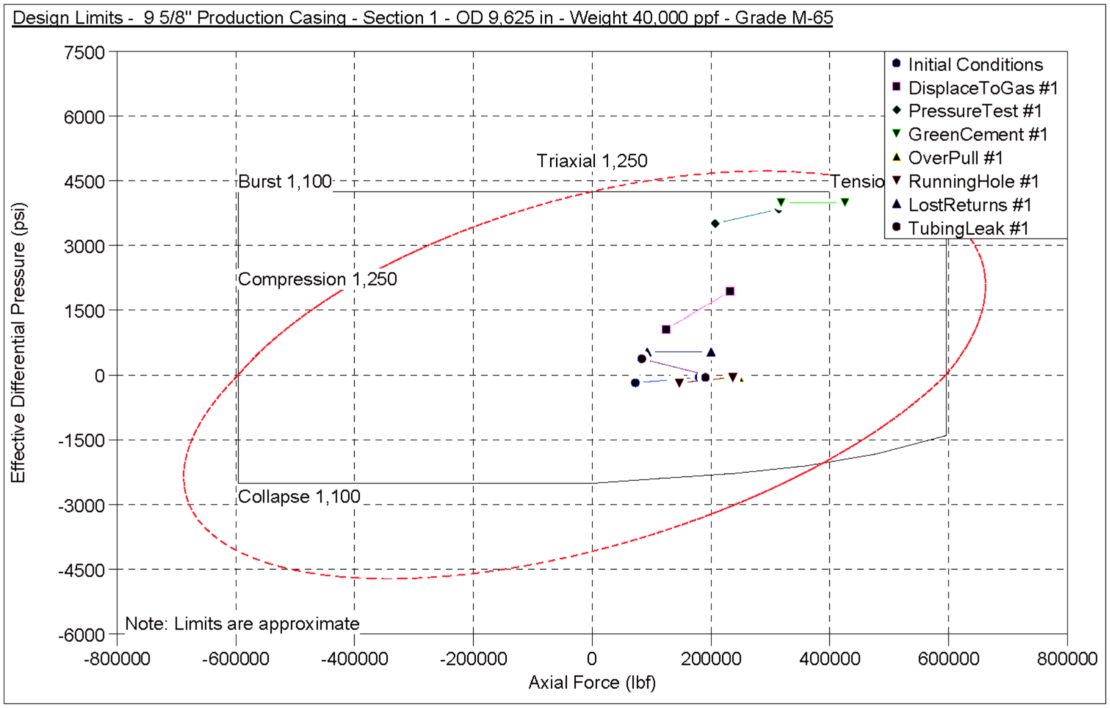
Design Limits - 13 3/8" Surface Casing - Section 1 - OD 13,375 in - Weight 54,500 ppf - Grade J-55



Design Limits - 9 5/8" Production Casing - Section 1 - OD 9,625 in - Weight 40,000 ppf - Grade M-65



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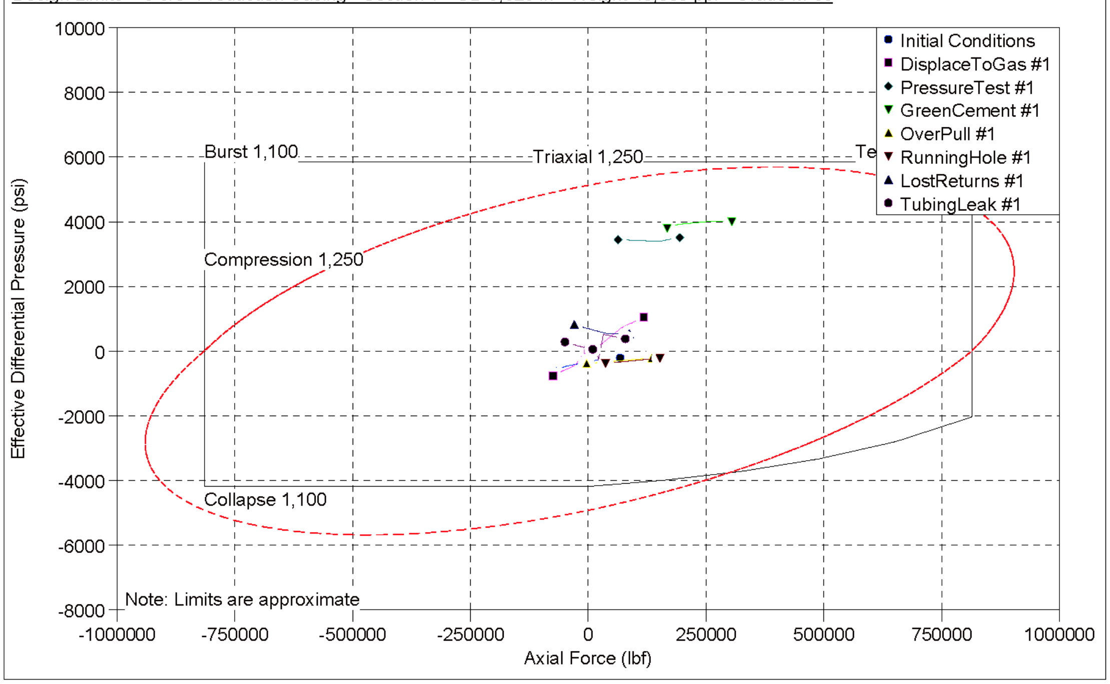
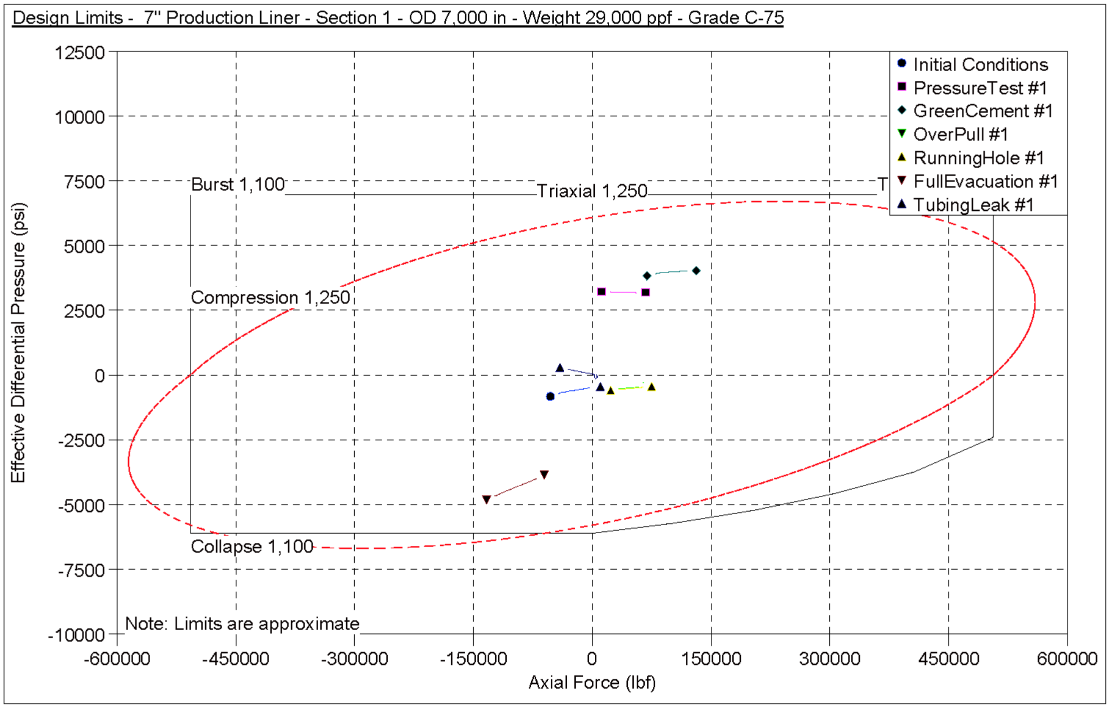
Design Limits - 9 5/8" Production Casing - Section 1 - OD 9,625 in - Weight 40,000 ppf - Grade M-65



Design Limits - 7" Production Liner - Section 1 - OD 7,000 in - Weight 29,000 ppf - Grade C-75



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Ratings Summary - 16" Conductor Casing

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	16,000	65,000	H-40	BTC	H-40	1640,62	634,03	736311	736311
2										
3	L = Connection Leak									
4	B = Connection Burst									
5	F = Connection Fracture									
6	J = Connection Jump-out									
7	Y = Connection Yield									
8	C = Connection									

Ratings Summary - 13 3/8" Surface Casing

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	13,375	54,500	J-55	BTC	J-55	2734,58	1130,82	853242	853242
2										
3	L = Connection Leak									
4	B = Connection Burst									
5	F = Connection Fracture									
6	J = Connection Jump-out									
7	Y = Connection Yield									
8	C = Connection									

Ratings Summary - 9 5/8" Production Casing

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	9,625	40,000	M-65	BTC	M-65	4668,18	2766,20	744495	744495
2	2	9,625	47,000	C-75	BTC	C-75	6436,36	4611,29	1017927	1017927
3										
4	L = Connection Leak									
5	B = Connection Burst									
6	F = Connection Fracture									
7	J = Connection Jump-out									
8	Y = Connection Yield									
9	C = Connection									

Ratings Summary - 7" Production Liner

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	7,000	29,000	C-75	BTC	C-75	7650,00	6729,05	633707	633707
2										
3	L = Connection Leak									
4	B = Connection Burst									
5	F = Connection Fracture									
6	J = Connection Jump-out									
7	Y = Connection Yield									
8	C = Connection									

Casing Load Summary - Initial Conditions - 16" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	382,04	-7503	0,00	0,1	0,0	35,00	586,00	559,99
2	1	421,97	-16019	0,00	0,0	0,0	36,40	647,25	667,54

Casing Load Summary - PressureTest #1 - 16" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	382,04	52267	0,00	0,1	0,0	35,00	1159,95	585,99
2	1	421,97	49577	0,00	0,0	0,0	36,40	1218,49	642,70

Casing Load Summary - LostReturnsWithMudDrop #1 - 16" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	382,04	-24420	0,00	0,1	0,0	35,00	430,11	558,65
2	1	421,97	-27180	0,00	0,0	0,0	36,44	491,36	617,05

Casing Load Summary - OverPull #1 - 16" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	382,04	16590	0,00	0,0	0,0	35,00	585,99	585,99
2	1	421,97	8073	0,00	0,0	0,0	36,40	647,25	647,25

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Casing Load Summary - RunningHole #1 - 16" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	382,04	57096	0,00	0,0	0,0	35,00	585,99	585,99
2	1	421,97	49707	0,00	0,0	0,0	36,40	647,25	647,25

Casing Load Summary - Initial Conditions - 13 3/8" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	382,04	19474	0,00	0,0	0,0	35,00	586,00	586,01
2	1	421,97	12333	0,00	0,0	0,0	36,47	647,26	671,10
3	1	422,03	12322	0,00	0,0	0,0	36,47	647,35	671,23
4	1	609,60	-21216	0,00	0,0	0,0	43,25	935,06	1070,83
5	1	914,40	-75716	0,00	0,0	0,0	54,23	1402,60	1784,52
6	1	949,97	-82077	0,00	0,0	0,0	55,50	1457,15	1880,31

Casing Load Summary - DisplaceToGas #1 - 13 3/8" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	382,04	46242	0,00	0,0	0,0	35,00	942,90	585,99
2	1	421,97	39703	0,00	0,0	0,0	36,44	979,06	642,69
3	1	422,03	41855	0,00	0,0	0,0	36,44	979,12	617,13
4	1	609,60	10038	0,00	0,0	0,0	43,22	1148,96	891,42
5	1	914,40	-36347	0,00	0,0	0,0	54,23	1424,96	1337,13
6	1	949,97	-40702	0,00	0,0	0,0	55,51	1457,17	1389,13

Casing Load Summary - PressureTest #1 - 13 3/8" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	382,04	169462	0,00	0,0	0,0	35,00	2585,99	585,99
2	1	421,97	164710	0,00	0,0	0,0	36,47	2647,25	642,69
3	1	422,03	166868	0,00	0,0	0,0	36,47	2647,35	617,13
4	1	609,60	143892	0,00	0,0	0,0	43,25	2935,07	891,42
5	1	914,40	111983	0,00	0,0	0,0	54,23	3402,60	1337,13
6	1	949,97	109310	0,00	0,0	0,0	55,50	3457,15	1389,13

Casing Load Summary - LostReturnsWithMudDrop #1 - 13 3/8" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	382,04	-24471	0,00	0,0	0,0	35,00	0,00	586,00
2	1	421,97	-34102	0,00	0,0	0,0	36,44	0,00	647,26
3	1	422,03	-31573	0,00	0,0	0,0	36,44	0,00	617,13
4	1	609,60	-69489	0,00	0,0	0,0	43,22	82,43	891,42
5	1	914,40	-94174	0,00	0,0	0,0	54,23	653,86	1337,13
6	1	949,97	-95946	0,00	0,0	0,0	55,51	720,54	1389,13

Casing Load Summary - GreenCement #1 - 13 3/8" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	382,04	269448	0,00	0,0	0,0	35,00	2586,00	586,01
2	1	421,97	262307	0,00	0,0	0,0	36,47	2647,26	671,10
3	1	422,03	262296	0,00	0,0	0,0	36,47	2647,35	671,23
4	1	609,60	228757	0,00	0,0	0,0	43,25	2935,06	1070,83
5	1	914,40	174257	0,00	0,0	0,0	54,23	3402,60	1784,52
6	1	949,97	167897	0,00	0,0	0,0	55,50	3457,15	1880,31

Casing Load Summary - OverPull #1 - 13 3/8" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	382,04	128938	0,00	0,0	0,0	35,00	585,99	585,99
2	1	421,97	121797	0,00	0,0	0,0	36,47	647,25	647,25
3	1	422,03	121786	0,00	0,0	0,0	36,47	647,35	647,35
4	1	609,60	88247	0,00	0,0	0,0	43,25	935,07	935,07
5	1	914,40	33747	0,00	0,0	0,0	54,23	1402,60	1402,60
6	1	949,97	27387	0,00	0,0	0,0	55,50	1457,15	1457,15

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Casing Load Summary - RunningHole #1 - 13 3/8" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	382,04	129927	0,00	0,0	0,0	35,00	585,99	585,99
2	1	421,97	123737	0,00	0,0	0,0	36,47	647,25	647,25
3	1	422,03	123727	0,00	0,0	0,0	36,47	647,35	647,35
4	1	609,60	94652	0,00	0,0	0,0	43,25	935,07	935,07
5	1	914,40	47405	0,00	0,0	0,0	54,23	1402,60	1402,60
6	1	949,97	41891	0,00	0,0	0,0	55,50	1457,15	1457,15

Casing Load Summary - Initial Conditions - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	382,04	180148	0,00	0,0	0,0	35,00	716,22	716,22
2	1	609,60	150283	0,00	0,0	0,0	43,25	1142,86	1142,86
3	1	914,40	110283	0,00	0,0	0,0	54,23	1714,28	1714,28
4	1	949,97	105615	0,00	0,0	0,0	55,53	1780,97	1780,97
5	1	950,03	105607	0,00	0,0	0,0	55,53	1781,08	1781,08
6	1	1199,97	72806	0,00	0,0	0,0	64,50	2249,66	2249,66
7	2	1200,03	68031	0,00	0,0	0,0	64,50	2249,78	2249,78
8	2	1219,20	65076	0,00	0,0	0,0	65,20	2285,71	2285,71
9	2	1499,98	21781	0,00	0,0	0,0	75,30	2812,09	2812,09
10	2	1500,04	21772	0,00	0,0	0,0	75,30	2812,21	2812,22
11	2	1524,00	18076	0,00	0,0	0,0	76,18	2857,14	2863,28
12	2	1828,80	-28924	0,00	0,0	0,0	87,26	3428,57	3512,62
13	2	2099,98	-70743	0,00	0,0	0,0	97,00	3936,94	4174,68

Casing Load Summary - DisplaceToGas #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	382,04	231711	0,00	0,0	0,0	35,00	2657,55	716,20
2	1	609,60	201846	0,00	0,0	0,0	43,22	2732,21	1039,29
3	1	914,40	161846	0,00	0,0	0,0	54,23	2832,21	1472,01
4	1	949,97	157178	0,00	0,0	0,0	55,51	2843,88	1522,51
5	1	950,03	157170	0,00	0,0	0,0	55,51	2843,90	1522,60
6	1	1199,97	124369	0,00	0,0	0,0	64,54	2925,91	1877,44
7	2	1200,03	118162	0,00	0,0	0,0	64,54	2925,93	1877,52
8	2	1219,20	115206	0,00	0,0	0,0	65,23	2932,21	1904,74
9	2	1499,98	71912	0,00	0,0	0,0	75,37	3024,33	2303,35
10	2	1500,04	29110	0,00	0,0	0,0	75,37	3024,35	2812,19
11	2	1524,00	24879	0,00	0,0	0,0	76,24	3032,21	2846,22
12	2	1828,80	-29343	0,00	0,0	0,0	87,25	3132,21	3278,95
13	2	2099,98	-73962	0,00	0,0	0,0	97,03	3221,18	3663,93

Casing Load Summary - PressureTest #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	382,04	314144	0,00	0,0	0,0	35,00	4559,95	716,22
2	1	609,60	284280	0,00	0,0	0,0	43,25	4893,51	1142,85
3	1	914,40	244280	0,00	0,0	0,0	54,23	5340,26	1714,28
4	1	949,97	239612	0,00	0,0	0,0	55,53	5392,40	1780,96
5	1	950,03	239604	0,00	0,0	0,0	55,53	5392,49	1781,08
6	1	1199,97	206803	0,00	0,0	0,0	64,50	5758,82	2249,65
7	2	1200,03	194594	0,00	0,0	0,0	64,50	5758,91	2249,77
8	2	1219,20	191638	0,00	0,0	0,0	65,20	5787,01	2285,70
9	2	1499,98	148343	0,15	1,3	0,0	75,30	6198,54	2812,07
10	2	1500,04	142034	0,00	0,0	0,0	75,30	6198,63	2812,19
11	2	1524,00	138733	0,00	0,0	0,0	76,18	6233,77	2846,22
12	2	1828,80	96762	0,00	0,0	0,0	87,26	6680,52	3278,95
13	2	2099,98	63100	0,00	0,0	0,0	97,00	7077,98	3663,93
14									
15	**Additional Pickup to Prevent Buckling = 13956 lbf**								

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Casing Load Summary - GreenCement #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	382,04	425372	0,00	0,0	0,0	35,00	4716,22	716,22
2	1	609,60	395507	0,00	0,0	0,0	43,25	5142,86	1142,86
3	1	914,40	355507	0,00	0,0	0,0	54,23	5714,28	1714,28
4	1	949,97	350839	0,00	0,0	0,0	55,53	5780,97	1780,97
5	1	950,03	350831	0,00	0,0	0,0	55,53	5781,08	1781,08
6	1	1199,97	318030	0,00	0,0	0,0	64,50	6249,66	2249,66
7	2	1200,03	304781	0,00	0,0	0,0	64,50	6249,77	2249,78
8	2	1219,20	301825	0,00	0,0	0,0	65,20	6285,71	2285,71
9	2	1499,98	258531	0,00	0,0	0,0	75,30	6812,09	2812,09
10	2	1500,04	258521	0,00	0,0	0,0	75,30	6812,21	2812,22
11	2	1524,00	254825	0,00	0,0	0,0	76,18	6857,14	2863,28
12	2	1828,80	207825	0,00	0,0	0,0	87,26	7428,57	3512,62
13	2	2099,98	166007	0,00	0,0	0,0	97,00	7936,94	4174,68

Casing Load Summary - OverPull #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	382,04	247449	0,00	0,0	0,0	35,00	716,22	716,22
2	1	609,60	217584	0,00	0,0	0,0	43,25	1142,86	1142,86
3	1	914,40	177584	0,00	0,0	0,0	54,23	1714,29	1714,29
4	1	949,97	172916	0,00	0,0	0,0	55,53	1780,97	1780,97
5	1	950,03	172908	0,00	0,0	0,0	55,53	1781,09	1781,09
6	1	1199,97	140108	0,00	0,0	0,0	64,50	2249,66	2249,66
7	2	1200,03	135333	0,00	0,0	0,0	64,50	2249,78	2249,78
8	2	1219,20	132377	0,00	0,0	0,0	65,20	2285,71	2285,71
9	2	1499,98	89082	0,00	0,0	0,0	75,30	2812,09	2812,09
10	2	1500,04	89073	0,00	0,0	0,0	75,30	2812,20	2812,20
11	2	1524,00	85377	0,00	0,0	0,0	76,18	2857,14	2857,14
12	2	1828,80	38377	0,00	0,0	0,0	87,26	3428,57	3428,57
13	2	2099,98	-3442	0,00	0,0	0,0	97,00	3936,94	3936,94

Casing Load Summary - RunningHole #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	382,04	236585	0,00	0,0	0,0	35,00	716,22	716,22
2	1	609,60	211607	0,00	0,0	0,0	43,25	1142,86	1142,86
3	1	914,40	178152	0,00	0,0	0,0	54,23	1714,29	1714,29
4	1	949,97	174248	0,00	0,0	0,0	55,53	1780,97	1780,97
5	1	950,03	174241	0,00	0,0	0,0	55,53	1781,09	1781,09
6	1	1199,97	146807	0,00	0,0	0,0	64,50	2249,66	2249,66
7	2	1200,03	152520	0,00	0,0	0,0	64,50	2249,78	2249,78
8	2	1219,20	150052	0,00	0,0	0,0	65,20	2285,71	2285,71
9	2	1499,98	113902	0,00	0,0	0,0	75,30	2812,09	2812,09
10	2	1500,04	113894	0,00	0,0	0,0	75,30	2812,20	2812,20
11	2	1524,00	110808	0,00	0,0	0,0	76,18	2857,14	2857,14
12	2	1828,80	71563	0,00	0,0	0,0	87,26	3428,57	3428,57
13	2	2099,98	36649	0,00	0,0	0,0	97,00	3936,94	3936,94

Casing Load Summary - LostReturns #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	382,04	199937	0,00	0,0	0,0	35,00	1251,29	716,22
2	1	609,60	170072	0,00	0,0	0,0	43,25	1677,93	1142,85
3	1	914,40	130072	0,00	0,0	0,0	54,23	2249,36	1714,28
4	1	949,97	125404	0,00	0,0	0,0	55,53	2316,04	1780,96
5	1	950,03	125396	0,00	0,0	0,0	55,53	2316,16	1781,08
6	1	1199,97	92596	0,00	0,0	0,0	64,50	2784,74	2249,65
7	2	1200,03	86687	0,00	0,0	0,0	64,50	2784,85	2249,77
8	2	1219,20	83731	0,00	0,0	0,0	65,20	2820,79	2285,70
9	2	1499,98	40437	0,00	0,0	0,0	75,30	3347,16	2812,07
10	2	1500,04	40775	0,00	0,0	0,0	75,30	3347,28	2812,19
11	2	1524,00	37823	0,00	0,0	0,0	76,18	3392,21	2846,22
12	2	1828,80	279	0,00	0,0	0,0	87,26	3963,64	3278,95
13	2	2099,98	-29444	0,00	0,0	0,0	97,00	4472,02	3663,93

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Casing Load Summary - TubingLeak #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	382,04	190880	0,00	0,0	0,0	35,00	716,22	716,20
2	1	609,60	161015	0,00	0,0	0,0	43,22	1142,86	1039,29
3	1	914,40	121015	0,00	0,0	0,0	54,23	1714,28	1472,01
4	1	949,97	116347	0,00	0,0	0,0	55,51	1780,97	1522,51
5	1	950,03	116339	0,00	0,0	0,0	55,51	1781,08	1522,60
6	1	1199,97	83539	0,00	0,0	0,0	64,54	2249,66	1877,44
7	2	1200,03	78764	0,00	0,0	0,0	64,54	2249,78	1877,52
8	2	1219,20	75808	0,00	0,0	0,0	65,23	2285,71	1904,74
9	2	1499,98	32514	0,00	0,0	0,0	75,37	2812,09	2303,35
10	2	1500,04	21578	0,00	0,0	0,0	75,37	2812,20	2812,19
11	2	1524,00	18663	0,00	0,0	0,0	76,24	2857,14	2846,22
12	2	1828,80	-18819	0,00	0,0	0,0	87,25	3428,57	3278,95
13	2	2099,98	-48543	0,00	0,0	0,0	97,03	3936,94	3663,93

Casing Load Summary - Initial Conditions - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	2050,02	9919	0,00	0,0	0,0	95,20	3843,33	3843,33
2	1	2099,98	5162	0,00	0,0	0,0	97,00	3936,94	3936,94
3	1	2100,04	5162	0,00	0,0	0,0	97,00	3937,06	3937,06
4	1	2133,60	1965	0,00	0,0	0,0	98,23	4000,00	4008,58
5	1	2438,40	-27035	0,00	0,0	0,0	109,21	4571,42	4657,93
6	1	2699,98	-51925	0,00	0,0	0,0	118,70	5061,80	5299,54

Casing Load Summary - PressureTest #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	2050,02	66708	0,00	0,0	0,0	95,20	7004,78	3843,33
2	1	2099,98	61951	0,00	0,0	0,0	97,00	7077,97	3936,95
3	1	2100,04	61767	0,00	0,0	0,0	97,00	7078,06	3937,05
4	1	2133,60	58873	0,00	0,0	0,0	98,23	7127,27	3984,71
5	1	2438,40	32628	0,00	0,0	0,0	109,21	7574,02	4417,44
6	1	2699,98	12051	0,00	0,0	0,0	118,70	7957,42	4788,79

Casing Load Summary - GreenCement #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	2050,02	130060	0,00	0,0	0,0	95,20	7843,33	3843,33
2	1	2099,98	125302	0,00	0,0	0,0	97,00	7936,94	3936,94
3	1	2100,04	125302	0,00	0,0	0,0	97,00	7937,06	3937,06
4	1	2133,60	122105	0,00	0,0	0,0	98,23	8000,00	4008,58
5	1	2438,40	93105	0,00	0,0	0,0	109,21	8571,42	4657,93
6	1	2699,98	68216	0,00	0,0	0,0	118,70	9061,80	5299,54

Casing Load Summary - OverPull #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	2050,02	69070	0,00	0,0	0,0	95,20	3843,32	3843,32
2	1	2099,98	64313	0,00	0,0	0,0	97,00	3936,94	3936,94
3	1	2100,04	64313	0,00	0,0	0,0	97,00	3937,06	3937,06
4	1	2133,60	61116	0,00	0,0	0,0	98,23	4000,00	4000,00
5	1	2438,40	32116	0,00	0,0	0,0	109,21	4571,43	4571,43
6	1	2699,98	7226	0,00	0,0	0,0	118,70	5061,80	5061,80

Casing Load Summary - RunningHole #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	2050,02	74359	0,00	0,0	0,0	95,20	3843,32	3843,32
2	1	2099,98	70398	0,00	0,0	0,0	97,00	3936,94	3936,94
3	1	2100,04	70393	0,00	0,0	0,0	97,00	3937,06	3937,06
4	1	2133,60	67731	0,00	0,0	0,0	98,23	4000,00	4000,00
5	1	2438,40	43559	0,00	0,0	0,0	109,21	4571,43	4571,43
6	1	2699,98	22816	0,00	0,0	0,0	118,70	5061,80	5061,80

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Casing Load Summary - FullEvacuation #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	2050,02	-60121	0,00	0,0	0,0	95,20	3,49	3843,33
2	1	2099,98	-64879	0,00	0,0	0,0	97,00	3,58	3936,95
3	1	2100,04	-65723	0,00	0,0	0,0	97,00	3,58	3937,05
4	1	2133,60	-69503	0,00	0,0	0,0	98,23	3,64	3984,71
5	1	2438,40	-103789	0,00	0,0	0,0	109,21	4,16	4417,44
6	1	2699,98	-131267	0,00	0,0	0,0	118,70	4,63	4788,79

Casing Load Summary - TubingLeak #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	2050,02	10182	0,00	0,0	0,0	95,20	3843,32	3843,31
2	1	2099,98	5425	0,00	0,0	0,0	97,00	3936,94	3914,21
3	1	2100,04	5162	0,00	0,0	0,0	97,00	3937,06	3937,05
4	1	2133,60	2517	0,00	0,0	0,0	98,23	4000,00	3984,71
5	1	2438,40	-21482	0,00	0,0	0,0	109,21	4571,42	4417,44
6	1	2699,98	-40131	0,00	0,0	0,0	118,70	5061,81	4788,79

Safety Factor Summary - Initial Conditions - 16" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	40000,0	586,2	N 68,232	N/A	63,089	100+	M 91,961
2	1	421,97	40000,0	438,7	91,171	N/A	100+	12,524	M 45,634
3									
4	**Burst and Axial Flags**								
5	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
6									
7	**Axial Flags**								
8	**Default = Tension, M = Compression**								
9									
10	**Triaxial Flags**								
11	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
12									
13	**Envelope Flags**								
14	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - PressureTest #1 - 16" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	40000,0	12772,2	N 3,132	N/A	2,858	100+	13,960
2	1	421,97	40000,0	12833,3	N 3,117	N/A	2,849	100+	14,823
3									
4	**Burst and Axial Flags**								
5	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
6									
7	**Axial Flags**								
8	**Default = Tension, M = Compression**								
9									
10	**Triaxial Flags**								
11	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
12									
13	**Envelope Flags**								
14	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - LostReturnsWithMudDrop #1 - 16" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	40000,0	2865,4	13,960	N/A	100+	4,264	M 29,554
2	1	421,97	40000,0	2771,8	14,431	N/A	100+	4,263	M 26,982
3									
4	**Burst and Axial Flags**								
5	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
6									
7	**Axial Flags**								
8	**Default = Tension, M = Compression**								
9									
10	**Triaxial Flags**								
11	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
12									
13	**Envelope Flags**								
14	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - OverPull #1 - 16" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	40000,0	1487,2	D 26,895	N/A	100+	23,081	44,409
2	1	421,97	40000,0	1085,8	D 36,839	N/A	100+	20,897	91,259
3									
4	**Burst and Axial Flags**								
5	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
6									
7	**Axial Flags**								
8	**Default = Tension, M = Compression**								
9									
10	**Triaxial Flags**								
11	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
12									
13	**Envelope Flags**								
14	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - RunningHole #1 - 16" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	40000,0	3687,7	D 10,847	N/A	100+	23,064	12,904
2	1	421,97	40000,0	3347,5	D 11,949	N/A	100+	20,885	14,822
3									
4	**Burst and Axial Flags**								
5	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
6									
7	**Axial Flags**								
8	**Default = Tension, M = Compression**								
9									
10	**Triaxial Flags**								
11	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
12									
13	**Envelope Flags**								
14	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - Initial Conditions - 13 3/8" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	55000,0	1841,5	D 29,867	N/A	100+	33,887	43,840
2	1	421,97	55000,0	1740,9	31,592	N/A	100+	18,637	69,224
3	1	422,03	55000,0	1740,9	31,593	N/A	100+	18,624	69,285
4	1	609,60	55000,0	2611,0	21,064	N/A	100+	5,987	M 40,240
5	1	914,40	55000,0	6837,4	8,044	N/A	100+	2,450	M 11,276
6	1	949,97	55000,0	7577,0	7,259	N/A	100+	2,235	M 10,402
7									
8	**Burst and Axial Flags**								
9	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
10									
11	**Axial Flags**								
12	**Default = Tension, M = Compression**								
13									
14	**Triaxial Flags**								
15	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
16									
17	**Envelope Flags**								
18	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - DisplaceToGas #1 - 13 3/8" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	55000,0	6379,7	8,621	N/A	7,662	100+	18,463
2	1	421,97	55000,0	6008,7	9,153	N/A	8,130	100+	21,503
3	1	422,03	55000,0	6466,0	8,506	N/A	7,555	100+	20,398
4	1	609,60	55000,0	4680,0	11,752	N/A	10,618	100+	85,051
5	1	914,40	55000,0	2405,8	22,862	N/A	31,133	100+	M 23,489
6	1	949,97	55000,0	2228,6	24,679	N/A	40,193	76,604	M 20,976
7									

8 **Burst and Axial Flags**
9 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
10
11 **Axial Flags**
12 **Default = Tension, M = Compression**
13
14 **Triaxial Flags**
15 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
16
17 **Envelope Flags**
18 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - PressureTest #1 - 13 3/8" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	55000,0	36426,0	1,510	N/A	1,367	100+	5,038
2	1	421,97	55000,0	36564,0	1,504	N/A	1,364	100+	5,183
3	1	422,03	55000,0	37038,0	1,485	N/A	1,347	100+	5,116
4	1	609,60	55000,0	37564,8	1,464	N/A	1,338	100+	5,933
5	1	914,40	55000,0	38408,2	1,432	N/A	1,324	100+	7,624
6	1	949,97	55000,0	38492,1	1,429	N/A	1,322	100+	7,810
7									

8 **Burst and Axial Flags**
9 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
10
11 **Axial Flags**
12 **Default = Tension, M = Compression**
13
14 **Triaxial Flags**
15 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
16
17 **Envelope Flags**
18 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - LostReturnsWithMudDrop #1 - 13 3/8" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	55000,0	11380,0	4,833	N/A	100+	1,930	M 34,888
2	1	421,97	55000,0	12397,9	4,436	N/A	100+	1,747	M 25,035
3	1	422,03	55000,0	11842,9	4,644	N/A	100+	1,833	M 27,041
4	1	592,01	55000,0	15150,3	3,630	N/A	100+	1,381	M 12,655
5	1	609,60	55000,0	14979,3	3,672	N/A	100+	1,390	M 12,286
6	1	914,40	55000,0	12312,9	4,467	N/A	100+	1,570	M 9,066
7	1	949,97	55000,0	12027,8	4,573	N/A	100+	1,594	M 8,898
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - GreenCement #1 - 13 3/8" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	55000,0	35730,1	1,539	N/A	1,367	100+	3,169
2	1	421,97	55000,0	35307,9	1,558	N/A	1,384	100+	3,255
3	1	422,03	55000,0	35307,3	1,558	N/A	1,384	100+	3,255
4	1	609,60	55000,0	33334,8	1,650	N/A	1,467	100+	3,732
5	1	914,40	55000,0	28974,8	N 1,898	N/A	1,690	100+	4,897
6	1	949,97	55000,0	28235,5	N 1,948	N/A	1,734	100+	5,085
7									
8	**Burst and Axial Flags**								
9	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
10									
11	**Axial Flags**								
12	**Default = Tension, M = Compression**								
13									
14	**Triaxial Flags**								
15	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
16									
17	**Envelope Flags**								
18	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - OverPull #1 - 13 3/8" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	55000,0	8897,2	D 6,182	N/A	100+	33,434	6,621
2	1	421,97	55000,0	8498,2	D 6,472	N/A	100+	30,305	7,010
3	1	422,03	55000,0	8497,6	D 6,472	N/A	100+	30,301	7,010
4	1	609,60	55000,0	6623,4	D 8,304	N/A	100+	21,082	9,675
5	1	914,40	55000,0	3577,9	D 15,372	N/A	100+	14,146	25,299
6	1	949,97	55000,0	3222,5	D 17,068	N/A	100+	13,625	31,174
7									
8	**Burst and Axial Flags**								
9	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
10									
11	**Axial Flags**								
12	**Default = Tension, M = Compression**								
13									
14	**Triaxial Flags**								
15	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
16									
17	**Envelope Flags**								
18	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - RunningHole #1 - 13 3/8" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	55000,0	8961,0	D 6,138	N/A	100+	33,428	6,571
2	1	421,97	55000,0	8623,2	D 6,378	N/A	100+	30,296	6,900
3	1	422,03	55000,0	8622,7	D 6,379	N/A	100+	30,291	6,900
4	1	609,60	55000,0	7036,3	D 7,817	N/A	100+	21,064	9,020
5	1	914,40	55000,0	4458,3	D 12,337	N/A	100+	14,126	18,010
6	1	949,97	55000,0	4157,4	D 13,229	N/A	100+	13,605	20,380
7									
8	**Burst and Axial Flags**								
9	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
10									
11	**Axial Flags**								
12	**Default = Tension, M = Compression**								
13									
14	**Triaxial Flags**								
15	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
16									
17	**Envelope Flags**								
18	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - Initial Conditions - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	65000,0	16444,3	D 3,953	N/A	100+	43,951	4,135
2	1	609,60	65000,0	14263,5	D 4,557	N/A	100+	27,847	4,957
3	1	914,40	65000,0	11342,7	D 5,731	N/A	100+	18,799	6,755
4	1	949,97	65000,0	11001,8	D 5,908	N/A	100+	18,119	7,053
5	1	950,03	65000,0	11001,2	D 5,908	N/A	100+	18,118	7,054
6	1	1199,97	65000,0	8606,1	D 7,553	N/A	100+	14,535	10,232
7	2	1200,03	75000,0	7262,2	D 10,327	N/A	100+	20,536	14,972
8	2	1219,20	75000,0	7080,4	D 10,593	N/A	100+	20,230	15,652
9	2	1499,98	74835,3	4416,9	D 16,943	N/A	100+	16,616	46,660
10	2	1500,04	74835,2	4416,3	D 16,945	N/A	100+	16,615	46,680
11	2	1524,00	74815,4	4226,7	17,700	N/A	100+	16,017	56,210
12	2	1828,80	74565,4	2014,5	37,014	N/A	100+	10,943	M 35,010
13	2	1949,99	74467,4	1480,0	50,317	N/A	100+	9,706	M 21,240
14	2	2099,98	74345,5	2512,5	29,590	N/A	100+	7,362	M 14,272
15									

16 **Burst and Axial Flags**
17 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
18
19 **Axial Flags**
20 **Default = Tension, M = Compression**
21
22 **Triaxial Flags**
23 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
24
25 **Envelope Flags**
26 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - DisplaceToGas #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	65000,0	23825,7	2,728	N/A	2,405	100+	3,215
2	1	609,60	65000,0	20955,3	3,102	N/A	2,757	100+	3,691
3	1	914,40	65000,0	17124,0	3,796	N/A	3,432	100+	4,603
4	1	949,97	65000,0	16678,3	3,897	N/A	3,533	100+	4,740
5	1	950,03	65000,0	16677,5	3,897	N/A	3,533	100+	4,740
6	1	1199,97	65000,0	13558,3	4,794	N/A	4,452	100+	5,990
7	2	1200,03	75000,0	12237,4	6,129	N/A	6,139	100+	8,620
8	2	1219,20	75000,0	12002,0	6,249	N/A	6,264	100+	8,841
9	2	1499,98	74833,7	8559,3	8,743	N/A	8,907	100+	14,132
10	2	1500,04	74833,7	4476,6	16,717	N/A	30,271	54,155	34,911
11	2	1524,00	74814,1	4216,8	17,742	N/A	34,520	41,100	40,838
12	2	1828,80	74565,7	2422,0	30,787	N/A	100+	10,133	M 34,511
13	2	2099,98	74344,7	4691,5	15,847	N/A	100+	6,054	M 13,650
14									

15 **Burst and Axial Flags**
16 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
17
18 **Axial Flags**
19 **Default = Tension, M = Compression**
20
21 **Triaxial Flags**
22 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
23
24 **Envelope Flags**
25 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - PressureTest #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	65000,0	42963,5	1,513	N/A	1,214	100+	2,371
2	1	609,60	65000,0	41685,2	1,559	N/A	1,245	100+	2,620
3	1	914,40	65000,0	40060,7	1,623	N/A	1,287	100+	3,050
4	1	949,97	65000,0	39878,2	1,630	N/A	1,293	100+	3,109
5	1	950,03	65000,0	39877,9	1,630	N/A	1,293	100+	3,109
6	1	1199,97	65000,0	38640,4	1,682	N/A	1,330	100+	3,602
7	2	1200,03	75000,0	37021,1	2,026	N/A	1,834	100+	5,234
8	2	1219,20	75000,0	36943,6	2,030	N/A	1,838	100+	5,315
9	2	1499,98	74835,3	35904,3	N 2,084	N/A	1,896	100+	6,663
10	2	1500,04	74835,2	35923,7	2,083	N/A	1,896	100+	7,155
11	2	1524,00	74815,4	35959,5	2,081	N/A	1,895	100+	7,324
12	2	1828,80	74565,4	36522,4	2,042	N/A	1,881	100+	10,465
13	2	2099,98	74345,5	37118,9	N 2,003	N/A	1,869	100+	16,000
14									
15	**Burst and Axial Flags**								
16	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
17									
18	**Axial Flags**								
19	**Default = Tension, M = Compression**								
20									
21	**Triaxial Flags**								
22	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
23									
24	**Envelope Flags**								
25	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - GreenCement #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	65000,0	46982,6	1,383	N/A	1,167	100+	1,751
2	1	609,60	65000,0	46264,4	1,405	N/A	1,167	100+	1,884
3	1	914,40	65000,0	45448,9	1,430	N/A	1,167	100+	2,095
4	1	949,97	65000,0	45365,1	1,433	N/A	1,167	100+	2,123
5	1	950,03	65000,0	45364,9	1,433	N/A	1,167	100+	2,123
6	1	1199,97	65000,0	44844,3	1,449	N/A	1,167	100+	2,342
7	2	1200,03	75000,0	42399,2	1,769	N/A	1,609	100+	3,342
8	2	1219,20	75000,0	42380,9	1,770	N/A	1,609	100+	3,375
9	2	1499,98	74835,3	42201,9	1,773	N/A	1,606	100+	3,931
10	2	1500,04	74835,2	42201,8	1,773	N/A	1,606	100+	3,931
11	2	1524,00	74815,4	42130,9	1,776	N/A	1,608	100+	3,987
12	2	1828,80	74565,4	41303,2	1,805	N/A	1,634	100+	4,873
13	2	2099,98	74345,5	39762,4	1,870	N/A	1,696	100+	6,082
14									
15	**Burst and Axial Flags**								
16	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
17									
18	**Axial Flags**								
19	**Default = Tension, M = Compression**								
20									
21	**Triaxial Flags**								
22	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
23									
24	**Envelope Flags**								
25	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - OverPull #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	65000,0	22320,1	D 2,912	N/A	100+	42,621	3,011
2	1	609,60	65000,0	20139,4	D 3,228	N/A	100+	27,108	3,424
3	1	914,40	65000,0	17218,5	D 3,775	N/A	100+	18,381	4,195
4	1	949,97	65000,0	16877,7	D 3,851	N/A	100+	17,724	4,308
5	1	950,03	65000,0	16877,1	D 3,851	N/A	100+	17,723	4,308
6	1	1199,97	65000,0	14482,0	D 4,488	N/A	100+	14,195	5,317
7	2	1200,03	75000,0	12220,8	D 6,137	N/A	100+	20,115	7,526
8	2	1219,20	75000,0	12039,0	D 6,230	N/A	100+	19,818	7,694
9	2	1499,98	74835,3	9375,5	D 7,982	N/A	100+	16,310	11,409
10	2	1500,04	74835,2	9374,9	D 7,982	N/A	100+	16,309	11,410
11	2	1524,00	74815,4	9147,5	D 8,179	N/A	100+	16,068	11,901
12	2	1828,80	74565,4	6256,1	D 11,919	N/A	100+	13,545	26,387
13	2	2099,98	74345,5	3683,3	D 20,184	N/A	100+	11,895	100+
14									
15	**Burst and Axial Flags**								
16	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
17									
18	**Axial Flags**								
19	**Default = Tension, M = Compression**								
20									
21	**Triaxial Flags**								
22	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
23									
24	**Envelope Flags**								
25	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - RunningHole #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	65000,0	21371,6	D 3,041	N/A	100+	42,860	3,149
2	1	609,60	65000,0	19617,5	D 3,313	N/A	100+	27,182	3,520
3	1	914,40	65000,0	17268,1	D 3,764	N/A	100+	18,377	4,182
4	1	949,97	65000,0	16993,9	D 3,825	N/A	100+	17,715	4,275
5	1	950,03	65000,0	16993,4	D 3,825	N/A	100+	17,714	4,275
6	1	1199,97	65000,0	15066,9	D 4,314	N/A	100+	14,163	5,074
7	2	1200,03	75000,0	13487,2	D 5,561	N/A	100+	19,998	6,678
8	2	1219,20	75000,0	13341,3	D 5,622	N/A	100+	19,700	6,788
9	2	1499,98	74835,3	11204,2	D 6,679	N/A	100+	16,186	8,923
10	2	1500,04	74835,2	11203,7	D 6,680	N/A	100+	16,185	8,923
11	2	1524,00	74815,4	11021,3	D 6,788	N/A	100+	15,944	9,169
12	2	1828,80	74565,4	8701,2	D 8,570	N/A	100+	13,421	14,150
13	2	2099,98	74345,5	6637,2	D 11,201	N/A	100+	11,784	27,549
14									
15	**Burst and Axial Flags**								
16	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
17									
18	**Axial Flags**								
19	**Default = Tension, M = Compression**								
20									
21	**Triaxial Flags**								
22	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
23									
24	**Envelope Flags**								
25	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - LostReturns #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	65000,0	16401,1	3,963	N/A	8,724	100+	3,726
2	1	609,60	65000,0	14387,0	4,518	N/A	8,724	100+	4,380
3	1	914,40	65000,0	11782,7	5,517	N/A	8,724	100+	5,727
4	1	949,97	65000,0	11488,7	5,658	N/A	8,724	100+	5,940
5	1	950,03	65000,0	11488,2	5,658	N/A	8,724	100+	5,941
6	1	1199,97	65000,0	9511,0	6,834	N/A	8,724	100+	8,045
7	2	1200,03	75000,0	8173,8	9,176	N/A	12,029	100+	11,750
8	2	1219,20	75000,0	8043,2	9,325	N/A	12,029	100+	12,164
9	2	1499,98	74835,3	6422,6	11,652	N/A	12,002	100+	25,133
10	2	1500,04	74835,2	6434,6	11,630	N/A	12,002	100+	24,924
11	2	1524,00	74815,4	6426,0	11,643	N/A	11,759	100+	26,863
12	2	1828,80	74565,4	7221,6	10,325	N/A	9,346	100+	M 100+
13	2	2099,98	74345,5	8913,2	N 8,341	N/A	7,895	100+	M 34,287
14									
15	**Burst and Axial Flags**								
16	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
17									
18	**Axial Flags**								
19	**Default = Tension, M = Compression**								
20									
21	**Triaxial Flags**								
22	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
23									
24	**Envelope Flags**								
25	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - TubingLeak #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	382,04	65000,0	17381,2	D 3,740	N/A	100+	43,772	3,903
2	1	609,60	65000,0	14587,2	4,456	N/A	45,072	100+	4,627
3	1	914,40	65000,0	11066,5	5,874	N/A	19,268	100+	6,156
4	1	949,97	65000,0	10682,5	6,085	N/A	18,062	100+	6,403
5	1	950,03	65000,0	10681,8	6,085	N/A	18,060	100+	6,403
6	1	1199,97	65000,0	8264,7	7,865	N/A	12,541	100+	8,917
7	2	1200,03	75000,0	6992,4	10,726	N/A	17,290	100+	12,932
8	2	1219,20	75000,0	6852,7	10,945	N/A	16,895	100+	13,436
9	2	1499,98	74833,7	5764,4	12,982	N/A	12,624	100+	31,257
10	2	1500,04	74833,7	4402,0	D 17,000	N/A	100+	16,617	47,098
11	2	1524,00	74814,1	4167,3	17,953	N/A	100+	17,028	54,440
12	2	1676,40	74689,9	2776,4	26,901	N/A	79,854	20,192	100+
13	2	1828,80	74565,7	1941,2	38,412	N/A	42,769	24,643	M 53,810
14	2	2099,98	74344,7	3159,3	N 23,532	N/A	23,369	40,605	M 20,797
15									
16	**Burst and Axial Flags**								
17	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
18									
19	**Axial Flags**								
20	**Default = Tension, M = Compression**								
21									
22	**Triaxial Flags**								
23	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
24									
25	**Envelope Flags**								
26	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - Initial Conditions - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	2050,02	74386,1	5017,2	D 14,826	N/A	100+	14,861	63,403
2	1	2099,98	74345,5	4547,8	D 16,347	N/A	100+	14,541	100+
3	1	2100,04	74345,5	4548,0	D 16,347	N/A	100+	14,540	100+
4	1	2133,60	74317,7	4277,6	17,374	N/A	100+	14,074	M 100+
5	1	2438,40	74070,0	1976,5	37,475	N/A	100+	10,777	M 23,164
6	1	2549,99	73979,9	1379,5	53,627	N/A	100+	9,920	M 16,611
7	1	2699,98	73855,8	2131,8	34,644	N/A	100+	8,048	M 12,025
8									

8
9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - PressureTest #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	2050,02	74386,1	28320,5	2,627	N/A	2,400	100+	9,428
2	1	2099,98	74345,5	28160,2	2,640	N/A	2,414	100+	10,146
3	1	2100,04	74345,5	28161,5	2,640	N/A	2,414	100+	10,176
4	1	2133,60	74317,7	28196,5	2,636	N/A	2,412	100+	10,672
5	1	2438,40	74070,0	28657,6	2,585	N/A	2,393	100+	19,193
6	1	2699,98	73855,8	29196,6	N 2,530	N/A	2,377	100+	51,809
7									

8 **Burst and Axial Flags**
9 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
10
11 **Axial Flags**
12 **Default = Tension, M = Compression**
13
14 **Triaxial Flags**
15 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
16
17 **Envelope Flags**
18 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - GreenCement #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	2050,02	74386,1	35879,1	2,073	N/A	1,897	100+	4,835
2	1	2099,98	74345,5	35848,4	2,074	N/A	1,896	100+	5,016
3	1	2100,04	74345,5	35848,4	2,074	N/A	1,896	100+	5,016
4	1	2133,60	74317,7	35756,8	2,078	N/A	1,899	100+	5,146
5	1	2438,40	74070,0	35018,1	2,115	N/A	1,931	100+	6,726
6	1	2699,98	73855,8	33738,0	2,189	N/A	2,002	100+	9,153
7									

8 **Burst and Axial Flags**
9 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
10
11 **Axial Flags**
12 **Default = Tension, M = Compression**
13
14 **Triaxial Flags**
15 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
16
17 **Envelope Flags**
18 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - OverPull #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	2050,02	74386,1	12017,7	D 6,190	N/A	100+	14,328	9,105
2	1	2099,98	74345,5	11548,4	D 6,438	N/A	100+	14,027	9,773
3	1	2100,04	74345,5	11548,5	D 6,438	N/A	100+	14,026	9,773
4	1	2133,60	74317,7	11233,1	D 6,616	N/A	100+	13,831	10,281
5	1	2438,40	74070,0	8372,3	D 8,847	N/A	100+	12,298	19,499
6	1	2699,98	73855,8	5917,0	D 12,482	N/A	100+	11,246	86,409
7									

8 **Burst and Axial Flags**
9 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
10
11 **Axial Flags**
12 **Default = Tension, M = Compression**
13
14 **Triaxial Flags**
15 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
16
17 **Envelope Flags**
18 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - RunningHole #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	2050,02	74386,1	12643,6	D 5,883	N/A	100+	14,276	8,458
2	1	2099,98	74345,5	12268,5	D 6,060	N/A	100+	13,969	8,929
3	1	2100,04	74345,5	12268,1	D 6,060	N/A	100+	13,969	8,929
4	1	2133,60	74317,7	12015,9	D 6,185	N/A	100+	13,770	9,277
5	1	2438,40	74070,0	9726,6	D 7,615	N/A	100+	12,211	14,376
6	1	2699,98	73855,8	7762,0	D 9,515	N/A	100+	11,145	27,368
7									

8 **Burst and Axial Flags**
9 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
10
11 **Axial Flags**
12 **Default = Tension, M = Compression**
13
14 **Triaxial Flags**
15 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
16
17 **Envelope Flags**
18 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - FullEvacuation #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	2050,02	74386,1	36633,7	2,031	N/A	100+	1,743	M 10,460
2	1	2099,98	74345,5	37392,5	1,988	N/A	100+	1,701	M 9,688
3	1	2100,04	74345,5	37359,9	1,990	N/A	100+	1,701	M 9,564
4	1	2133,60	74317,7	37694,9	1,972	N/A	100+	1,680	M 9,040
5	1	2438,40	74070,0	40860,7	1,813	N/A	100+	1,512	M 6,034
6	1	2699,98	73855,8	43775,8	1,687	N/A	100+	1,392	M 4,757
7									

8 **Burst and Axial Flags**
9 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
10
11 **Axial Flags**
12 **Default = Tension, M = Compression**
13
14 **Triaxial Flags**
15 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
16
17 **Envelope Flags**
18 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - TubingLeak #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	2050,02	74386,1	5048,3	D 14,735	N/A	100+	14,859	61,767
2	1	2099,98	74345,5	4466,1	16,647	N/A	100+	15,296	100+
3	1	2100,04	74345,5	4547,9	D 16,347	N/A	100+	14,540	100+
4	1	2133,60	74317,7	4221,1	17,606	N/A	100+	14,814	M 100+
5	1	2286,00	74193,8	2829,4	26,222	N/A	89,411	16,105	M 66,151
6	1	2438,40	74070,0	1849,3	40,053	N/A	49,063	17,617	M 29,152
7	1	2699,98	73855,8	2678,1	N 27,578	N/A	27,593	21,013	M 15,559
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Movement Summary - Initial Conditions - 16" Conductor Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

Movement Summary - PressureTest #1 - 16" Conductor Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

Movement Summary - LostReturnsWithMudDrop #1 - 16" Conductor Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

Movement Summary - OverPull #1 - 16" Conductor Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

Movement Summary - RunningHole #1 - 16" Conductor Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

Movement Summary - Initial Conditions - 13 3/8" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	No length changes - Pipe is fully cemented							
2								
3								
4								
5								

Movement Summary - DisplaceToGas #1 - 13 3/8" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	No length changes - Pipe is fully cemented							
2								
3								
4								
5								

Movement Summary - PressureTest #1 - 13 3/8" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	No length changes - Pipe is fully cemented							
2								
3								
4								
5								

Movement Summary - LostReturnsWithMudDrop #1 - 13 3/8" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	No length changes - Pipe is fully cemented							
2								
3								
4								
5								

Movement Summary - GreenCement #1 - 13 3/8" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	No length changes - Pipe is fully cemented							
2								
3								
4								
5								

Movement Summary - OverPull #1 - 13 3/8" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	No length changes - Pipe is fully cemented							
2								
3								
4								
5								

Movement Summary - RunningHole #1 - 13 3/8" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	No length changes - Pipe is fully cemented							
2								
3								
4								
5								

Movement Summary - Initial Conditions - 9 5/8" Production Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	382,04	1500,00	0,000	0,000	0,000	0,000	0,000	0,00

Movement Summary - DisplaceToGas #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	382,04	1500,00	0,126	0,000	-0,126	0,000	0,000	0,00

Movement Summary - PressureTest #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	382,04	1500,00	0,412	0,000	-0,412	0,000	0,000	133,24

Movement Summary - GreenCement #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	382,04	1500,00	0,303	0,000	0,000	0,000	0,303	0,00

Movement Summary - OverPull #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	382,04	1500,00	0,230	0,000	0,000	0,000	0,230*	0,00
2								
3	* Surface displacement due to pickup (+) or slackoff (-)							

Movement Summary - RunningHole #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No results available for this load case							
4								
5								

Movement Summary - LostReturns #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	382,04	1500,00	0,061	0,000	-0,061	0,000	0,000	0,00

Movement Summary - TubingLeak #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	382,04	1500,00	0,000	0,000	0,000	0,000	0,000	0,00

Movement Summary - Initial Conditions - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	2050,02	2100,00	0,000	0,000	0,000	0,000	0,000	0,00

Movement Summary - PressureTest #1 - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	2050,02	2100,00	0,011	0,000	-0,011	0,000	0,000	0,00

Movement Summary - GreenCement #1 - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	2050,02	2100,00	0,009	0,000	0,000	0,000	0,009	0,00

Movement Summary - OverPull #1 - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	2050,02	2100,00	0,128	0,000	0,000	0,000	0,128*	0,00
2								
3	* Surface displacement due to pickup (+) or slackoff (-)							

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Movement Summary - RunningHole #1 - 7" Production Liner

	MD (m)		Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
	Top	Base						
1	No results available for this load case							
2								
3								
4								
5								

Movement Summary - FullEvacuation #1 - 7" Production Liner

	MD (m)		Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
	Top	Base						
1	2050,02	2100,00	-0,014	0,000	0,014	0,000	0,000	0,00

Movement Summary - TubingLeak #1 - 7" Production Liner

	MD (m)		Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
	Top	Base						
1	2050,02	2100,00	0,000	0,000	0,000	0,000	0,000	0,00

5.2.2 Norwegian Sea

5.2.2.1 Conventional Well Design

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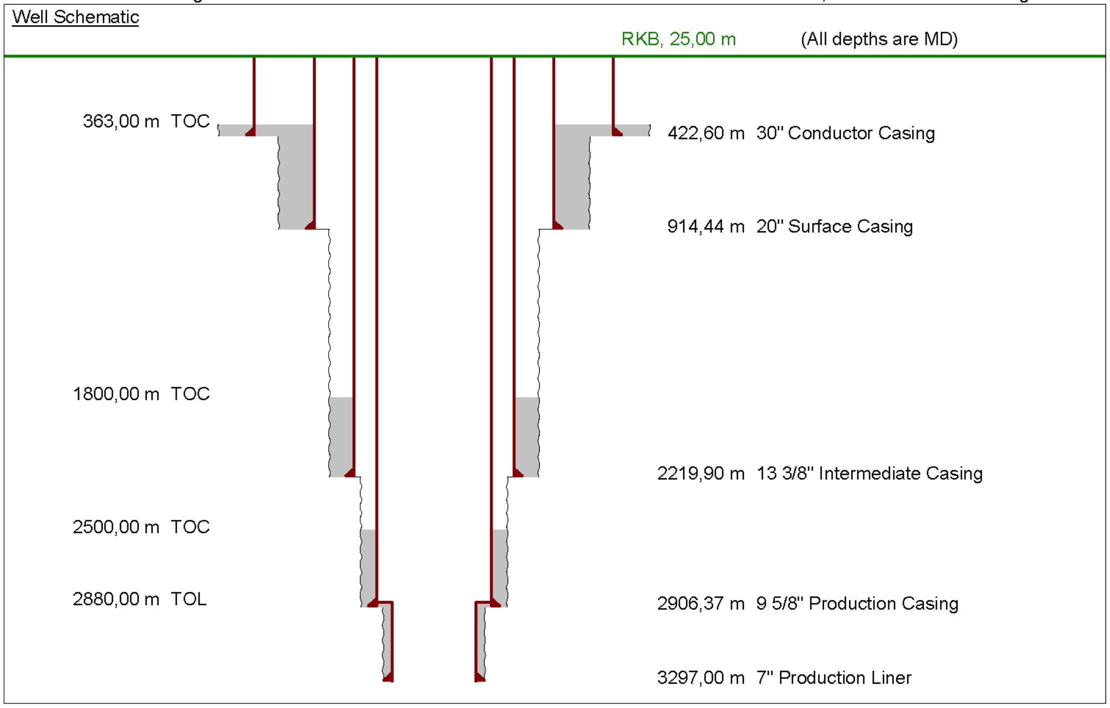
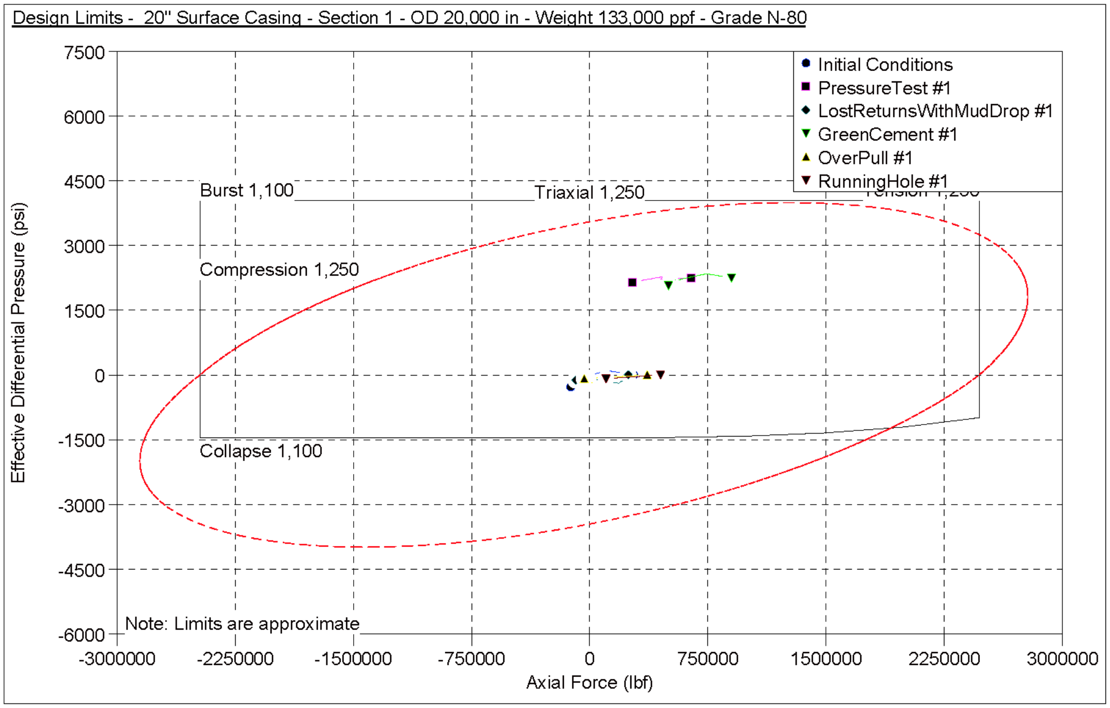
Well Schematic



Design Limits - 20" Surface Casing - Section 1 - OD 20,000 in - Weight 133,000 ppf - Grade N-80



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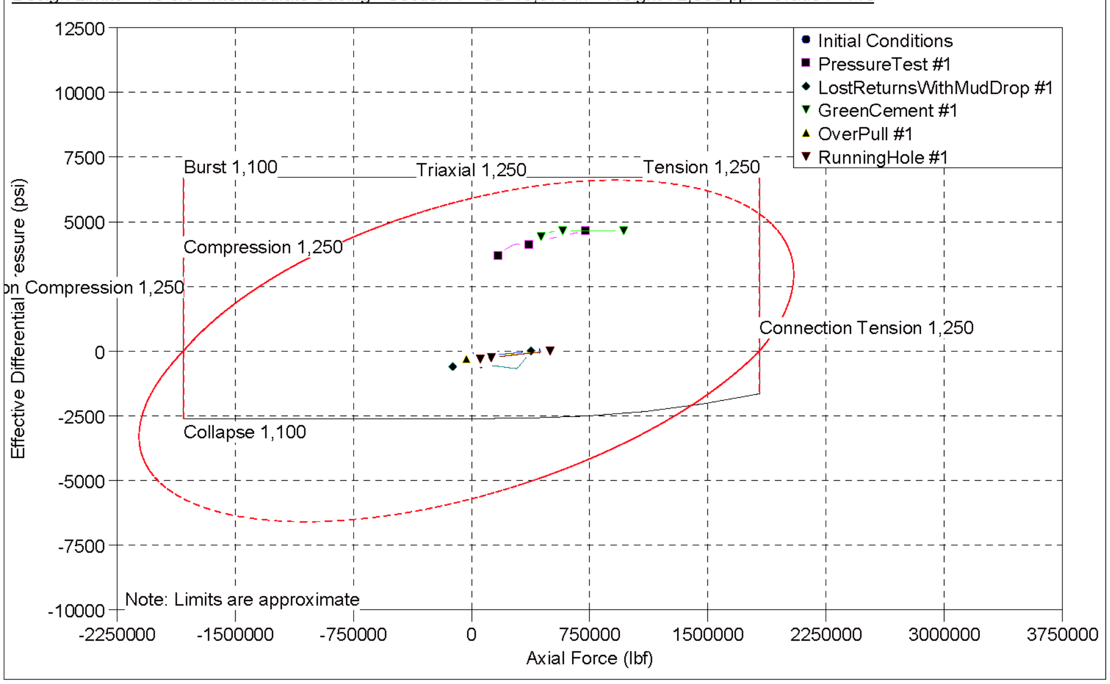
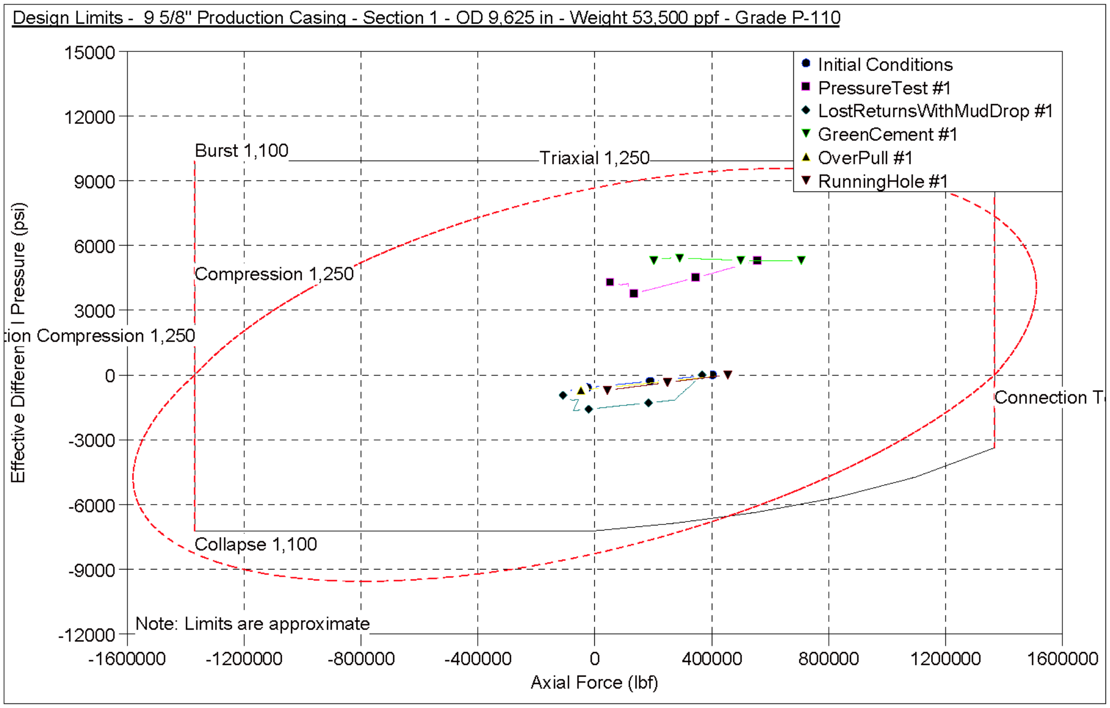
Design Limits - 13 3/8" Intermediate Casing - Section 1 - OD 13,375 in - Weight 72,000 ppf - Grade P-110



Design Limits - 9 5/8" Production Casing - Section 1 - OD 9,625 in - Weight 53,500 ppf - Grade P-110



Conventional Well Design WELLCAT 5000.1.13.1

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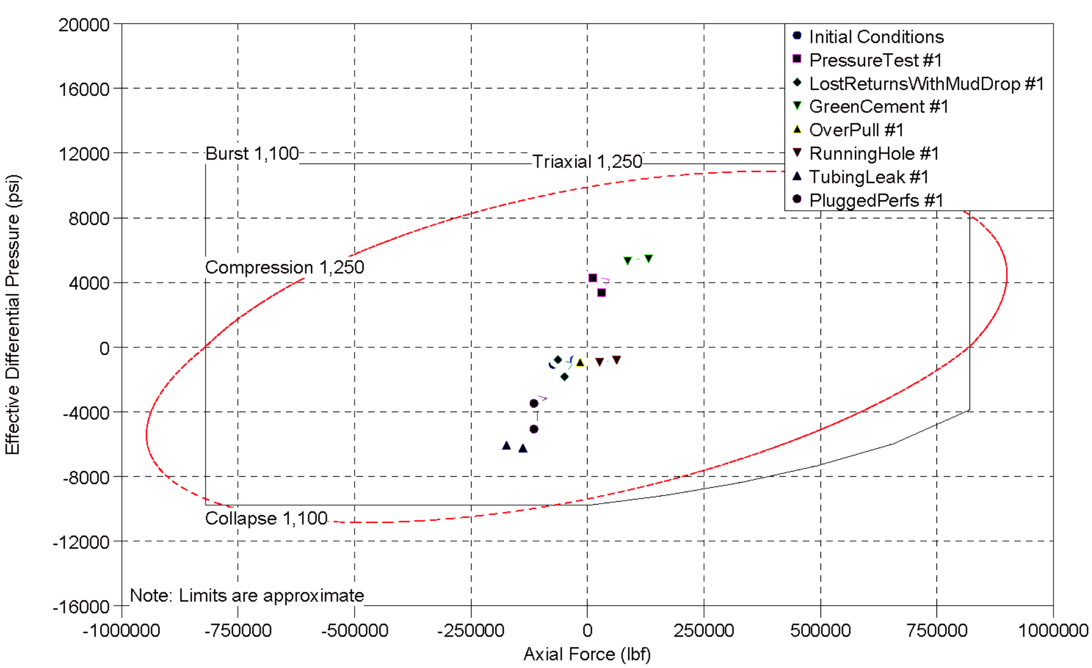
Design Limits - 7" Production Liner - Section 1 - OD 7,000 in - Weight 32,000 ppf - Grade P-110



Ratings Summary - 30" Conductor Casing

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	30,000	157,500	X-42	<N/A>		1225,00	224,86	1946217	1946217
2										
3	L = Connection Leak									
4	B = Connection Burst									
5	F = Connection Fracture									
6	J = Connection Jump-out									
7	Y = Connection Yield									
8	C = Connection									

Ratings Summary - 20" Surface Casing

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	20,000	133,000	N-80	TSH ER	N-80	4445,00	1603,35	3090517	3090517
2										
3	L = Connection Leak									
4	B = Connection Burst									
5	F = Connection Fracture									
6	J = Connection Jump-out									
7	Y = Connection Yield									
8	C = Connection									

Ratings Summary - 13 3/8" Intermediate Casing

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	13,375	72,000	P-110	Vam 21	P-110	7397,76	2882,28	C 2284000	C 2284000
2										
3	L = Connection Leak									
4	B = Connection Burst									
5	F = Connection Fracture									
6	J = Connection Jump-out									
7	Y = Connection Yield									
8	C = Connection									

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Ratings Summary - 9 5/8" Production Casing

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	9,625	53,500	P-110	Vam 21	P-110	10900,00	7950,02	C 1710000	C 1710000
2										
3	**L = Connection Leak**									
4	**B = Connection Burst**									
5	**F = Connection Fracture**									
6	**J = Connection Jump-out**									
7	**Y = Connection Yield**									
8	**C = Connection**									

Ratings Summary - 7" Production Liner

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	7,000	32,000	P-110	Vam TOP HC	P-110	12457,50	10780,84	1024904	1024904
2										
3	**L = Connection Leak**									
4	**B = Connection Burst**									
5	**F = Connection Fracture**									
6	**J = Connection Jump-out**									
7	**Y = Connection Yield**									
8	**C = Connection**									

Casing Load Summary - Initial Conditions - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	279344	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	268462	0,00	0,0	0,0	49,00	44,68	38,30
3	1	304,80	146358	0,00	0,0	0,0	37,39	545,45	467,53
4	1	362,01	121399	0,00	0,0	0,0	35,00	647,82	555,27
5	1	362,96	120976	0,00	0,0	0,0	35,05	649,56	556,75
6	1	363,02	120949	0,00	0,0	0,0	35,05	649,66	556,86
7	1	422,57	94969	0,00	0,0	0,0	38,02	756,21	683,71
8	1	422,64	94943	0,00	0,0	0,0	38,02	756,32	683,84
9	1	609,60	13358	0,00	0,0	0,0	47,18	1090,90	1082,16
10	1	914,40	-119642	0,00	0,0	0,0	62,20	1636,36	1815,85
11	1	914,40	-119646	0,00	0,0	0,0	62,20	1636,37	1815,88

Casing Load Summary - PressureTest #1 - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	646069	0,00	0,0	0,0	50,00	2250,05	0,05
2	1	24,96	635187	0,00	0,0	0,0	49,00	2286,60	38,30
3	1	95,83	604262	0,02	1,9	0,0	46,05	2390,48	147,01
4	1	143,74	583353	0,07	10,3	0,0	44,05	2460,71	220,51
5	1	152,40	579583	0,08	12,3	0,0	43,70	2473,38	233,76
6	1	304,80	513083	0,24	61,3	0,0	37,39	2696,75	467,53
7	1	362,01	488124	0,29	85,3	0,0	35,00	2780,59	555,27
8	1	362,96	487701	0,30	85,7	0,0	35,05	2782,01	556,76
9	1	363,02	473484	0,00	0,0	0,0	35,05	2782,10	556,84
10	1	422,57	452286	0,00	0,0	0,0	38,02	2869,37	641,38
11	1	422,64	460383	0,00	0,0	0,0	38,02	2869,46	598,41
12	1	609,60	383151	0,00	0,0	0,0	47,18	3143,50	920,54
13	1	914,40	273140	0,00	0,0	0,0	62,20	3590,26	1445,69
14	1	914,40	273138	0,00	0,0	0,0	62,20	3590,28	1445,71
15									
16	**Additional Pickup to Prevent Buckling = 108389 lbf**								

Casing Load Summary - LostReturnsWithMudDrop #1 - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	244836	0,00	0,0	0,0	50,00	0,00	0,05
2	1	24,96	233954	0,00	0,0	0,0	50,00	0,00	38,30
3	1	304,80	111849	0,00	0,0	0,0	37,54	319,92	467,53
4	1	362,01	86890	0,00	0,0	0,0	35,00	422,28	555,27
5	1	362,96	86468	0,00	0,0	0,0	35,05	424,01	556,76
6	1	363,02	83677	0,00	0,0	0,0	35,05	424,12	556,85
7	1	422,57	64688	0,00	0,0	0,0	37,98	530,67	648,18
8	1	422,64	74071	0,00	0,0	0,0	37,98	530,78	598,41
9	1	609,60	6489	0,00	0,0	0,0	47,19	865,37	920,54
10	1	914,40	-87075	0,00	0,0	0,0	62,19	1410,83	1445,69
11	1	914,40	-87077	0,00	0,0	0,0	62,19	1410,84	1445,71

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Casing Load Summary - GreenCement #1 - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	899282	0,00	0,0	0,0	50,00	2250,05	0,05
2	1	24,96	888400	0,00	0,0	0,0	49,00	2294,68	38,30
3	1	304,80	766295	0,00	0,0	0,0	37,39	2795,45	467,53
4	1	362,01	741337	0,00	0,0	0,0	35,00	2897,82	555,27
5	1	362,96	740914	0,00	0,0	0,0	35,05	2899,55	556,75
6	1	363,02	740887	0,00	0,0	0,0	35,05	2899,66	556,86
7	1	422,57	714907	0,00	0,0	0,0	38,02	3006,21	683,71
8	1	422,64	714880	0,00	0,0	0,0	38,02	3006,31	683,84
9	1	609,60	633295	0,00	0,0	0,0	47,18	3340,91	1082,16
10	1	914,40	500295	0,00	0,0	0,0	62,20	3886,36	1815,85
11	1	914,40	500291	0,00	0,0	0,0	62,20	3886,37	1815,88

Casing Load Summary - OverPull #1 - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	364790	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	353908	0,00	0,0	0,0	49,00	38,31	38,31
3	1	304,80	231803	0,00	0,0	0,0	37,39	467,53	467,53
4	1	362,01	206844	0,00	0,0	0,0	35,00	555,27	555,27
5	1	362,96	206421	0,00	0,0	0,0	35,05	556,75	556,75
6	1	363,02	206395	0,00	0,0	0,0	35,05	556,85	556,85
7	1	422,57	180414	0,00	0,0	0,0	38,02	648,17	648,17
8	1	422,64	180388	0,00	0,0	0,0	38,02	648,27	648,27
9	1	609,60	98803	0,00	0,0	0,0	47,18	935,06	935,06
10	1	914,40	-34197	0,00	0,0	0,0	62,20	1402,60	1402,60
11	1	914,40	-34201	0,00	0,0	0,0	62,20	1402,61	1402,61

Casing Load Summary - RunningHole #1 - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	449124	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	439720	0,00	0,0	0,0	49,00	38,31	38,31
3	1	304,80	334197	0,00	0,0	0,0	37,39	467,53	467,53
4	1	362,01	312628	0,00	0,0	0,0	35,00	555,27	555,27
5	1	362,96	312262	0,00	0,0	0,0	35,05	556,75	556,75
6	1	363,02	312239	0,00	0,0	0,0	35,05	556,85	556,85
7	1	422,57	289787	0,00	0,0	0,0	38,02	648,17	648,17
8	1	422,64	289764	0,00	0,0	0,0	38,02	648,27	648,27
9	1	609,60	219259	0,00	0,0	0,0	47,18	935,06	935,06
10	1	914,40	104320	0,00	0,0	0,0	62,20	1402,60	1402,60
11	1	914,40	104317	0,00	0,0	0,0	62,20	1402,61	1402,61

Casing Load Summary - Initial Conditions - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	409896	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	404005	0,00	0,0	0,0	49,00	44,68	44,68
3	1	304,80	337904	0,00	0,0	0,0	37,39	545,46	545,46
4	1	362,01	324392	0,00	0,0	0,0	35,00	647,82	647,82
5	1	609,60	265904	0,00	0,0	0,0	47,18	1090,91	1090,91
6	1	914,40	193902	0,00	0,0	0,0	62,22	1636,37	1636,38
7	1	914,46	193887	0,00	0,0	0,0	62,22	1636,48	1636,48
8	1	1219,20	121904	0,00	0,0	0,0	77,16	2181,82	2181,82
9	1	1524,00	49904	0,00	0,0	0,0	92,20	2727,27	2727,27
10	1	1799,97	-15293	0,00	0,0	0,0	105,80	3221,14	3221,14
11	1	1800,03	-15293	0,00	0,0	0,0	105,80	3221,24	3221,26
12	1	1828,80	-22096	0,00	0,0	0,0	107,14	3272,72	3282,54
13	1	2133,60	-94096	0,00	0,0	0,0	122,18	3818,18	3967,71
14	1	2219,86	-114483	0,00	0,0	0,0	126,40	3972,56	4200,03

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Casing Load Summary - PressureTest #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	724315	0,00	0,0	0,0	50,00	4650,04	0,05
2	1	24,96	718424	0,00	0,0	0,0	49,00	4686,60	44,68
3	1	304,80	652322	0,00	0,0	0,0	37,39	5096,75	545,46
4	1	362,01	638811	0,00	0,0	0,0	35,00	5180,58	647,82
5	1	609,60	580322	0,00	0,0	0,0	47,18	5543,51	1090,91
6	1	914,40	508320	0,00	0,0	0,0	62,22	5990,27	1636,38
7	1	914,46	508306	0,00	0,0	0,0	62,22	5990,36	1636,49
8	1	1066,80	472322	0,02	0,2	0,0	69,68	6213,63	1909,09
9	1	1219,20	436322	0,15	5,1	0,0	77,16	6437,01	2181,82
10	1	1371,60	400322	0,29	13,2	0,0	84,68	6660,39	2454,55
11	1	1524,00	364322	0,42	23,4	0,0	92,20	6883,76	2727,28
12	1	1676,40	328322	0,56	35,5	0,0	99,72	7107,14	3000,00
13	1	1799,97	299126	0,66	46,4	0,0	105,80	7288,26	3221,14
14	1	1800,03	283031	0,00	0,0	0,0	105,80	7288,35	3148,36
15	1	1828,80	275364	0,00	0,0	0,0	107,14	7330,52	3211,96
16	1	2133,60	191793	0,00	0,0	0,0	122,18	7777,27	3950,36
17	1	2219,86	166913	0,00	0,0	0,0	126,40	7903,71	4212,09
18									
19	**Additional Pickup to Prevent Buckling = 122249 lbf**								

Casing Load Summary - LostReturnsWithMudDrop #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	379298	0,00	0,0	0,0	50,00	0,00	0,05
2	1	24,96	373407	0,00	0,0	0,0	50,00	0,00	44,68
3	1	304,80	307305	0,00	0,0	0,0	37,54	1,49	545,46
4	1	362,01	293794	0,00	0,0	0,0	35,00	7,52	647,82
5	1	609,60	235305	0,00	0,0	0,0	47,19	483,34	1090,91
6	1	914,40	163303	0,00	0,0	0,0	62,19	1132,72	1636,38
7	1	914,46	163289	0,00	0,0	0,0	62,19	1132,85	1636,49
8	1	1219,20	91305	0,00	0,0	0,0	77,19	1782,04	2181,82
9	1	1524,00	19305	0,00	0,0	0,0	92,19	2431,39	2727,28
10	1	1799,97	-45892	0,00	0,0	0,0	105,77	3019,33	3221,14
11	1	1800,03	-23534	0,00	0,0	0,0	105,77	3019,46	3148,36
12	1	1828,80	-30025	0,00	0,0	0,0	107,19	3080,75	3211,96
13	1	2133,60	-99005	0,00	0,0	0,0	122,19	3730,10	3950,36
14	1	2219,86	-119889	0,00	0,0	0,0	126,44	3913,89	4212,09

Casing Load Summary - GreenCement #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	966653	0,00	0,0	0,0	50,00	4650,06	0,05
2	1	24,96	960762	0,00	0,0	0,0	49,00	4694,68	44,68
3	1	304,80	894661	0,00	0,0	0,0	37,39	5195,46	545,46
4	1	362,01	881149	0,00	0,0	0,0	35,00	5297,82	647,82
5	1	609,60	822661	0,00	0,0	0,0	47,18	5740,91	1090,91
6	1	914,40	750659	0,00	0,0	0,0	62,22	6286,37	1636,38
7	1	914,46	750644	0,00	0,0	0,0	62,22	6286,48	1636,48
8	1	1219,20	678661	0,00	0,0	0,0	77,16	6831,81	2181,82
9	1	1524,00	606661	0,00	0,0	0,0	92,20	7377,27	2727,27
10	1	1799,97	541464	0,00	0,0	0,0	105,80	7871,14	3221,14
11	1	1800,03	541464	0,00	0,0	0,0	105,80	7871,24	3221,26
12	1	1828,80	534661	0,00	0,0	0,0	107,14	7922,72	3282,54
13	1	2133,60	462661	0,00	0,0	0,0	122,18	8468,18	3967,71
14	1	2219,86	442275	0,00	0,0	0,0	126,40	8622,57	4200,03

Casing Load Summary - OverPull #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	491863	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	485972	0,00	0,0	0,0	49,00	44,68	44,68
3	1	304,80	419870	0,00	0,0	0,0	37,39	545,45	545,45
4	1	362,01	406358	0,00	0,0	0,0	35,00	647,81	647,81
5	1	609,60	347870	0,00	0,0	0,0	47,18	1090,90	1090,90
6	1	914,40	275868	0,00	0,0	0,0	62,22	1636,38	1636,38
7	1	914,46	275853	0,00	0,0	0,0	62,22	1636,49	1636,49
8	1	1219,20	203870	0,00	0,0	0,0	77,16	2181,82	2181,82
9	1	1524,00	131870	0,00	0,0	0,0	92,20	2727,27	2727,27
10	1	1799,97	66673	0,00	0,0	0,0	105,80	3221,13	3221,13
11	1	1800,03	66673	0,00	0,0	0,0	105,80	3221,24	3221,24
12	1	1828,80	59870	0,00	0,0	0,0	107,14	3272,72	3272,72
13	1	2133,60	-12130	0,00	0,0	0,0	122,18	3818,18	3818,18
14	1	2219,86	-32516	0,00	0,0	0,0	126,40	3972,56	3972,56

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Casing Load Summary - RunningHole #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	497951	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	492987	0,00	0,0	0,0	49,00	44,68	44,68
3	1	304,80	437285	0,00	0,0	0,0	37,39	545,45	545,45
4	1	362,01	425899	0,00	0,0	0,0	35,00	647,81	647,81
5	1	609,60	376612	0,00	0,0	0,0	47,18	1090,90	1090,90
6	1	914,40	315938	0,00	0,0	0,0	62,22	1636,38	1636,38
7	1	914,46	315926	0,00	0,0	0,0	62,22	1636,49	1636,49
8	1	1219,20	255268	0,00	0,0	0,0	77,16	2181,82	2181,82
9	1	1524,00	194596	0,00	0,0	0,0	92,20	2727,27	2727,27
10	1	1799,97	139663	0,00	0,0	0,0	105,80	3221,13	3221,13
11	1	1800,03	139651	0,00	0,0	0,0	105,80	3221,24	3221,24
12	1	1828,80	133924	0,00	0,0	0,0	107,14	3272,72	3272,72
13	1	2133,60	73251	0,00	0,0	0,0	122,18	3818,18	3818,18
14	1	2219,86	56079	0,00	0,0	0,0	126,40	3972,56	3972,56

Casing Load Summary - Initial Conditions - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	403245	0,00	0,0	0,0	50,00	0,06	0,06
2	1	24,96	398868	0,00	0,0	0,0	49,00	53,19	53,19
3	1	304,80	349751	0,00	0,0	0,0	37,39	649,35	649,35
4	1	362,01	339711	0,00	0,0	0,0	35,00	771,21	771,21
5	1	609,60	296251	0,00	0,0	0,0	47,18	1298,70	1298,70
6	1	914,40	242751	0,00	0,0	0,0	62,22	1948,05	1948,05
7	1	1219,20	189251	0,00	0,0	0,0	77,16	2597,40	2597,40
8	1	1524,00	135751	0,00	0,0	0,0	92,20	3246,75	3246,75
9	1	1828,80	82251	0,00	0,0	0,0	107,14	3896,10	3896,10
10	1	2133,60	28751	0,00	0,0	0,0	122,18	4545,45	4545,45
11	1	2219,86	13603	0,00	0,0	0,0	126,39	4729,24	4729,24
12	1	2219,92	13603	0,00	0,0	0,0	126,40	4729,37	4729,37
13	1	2438,40	-24749	0,00	0,0	0,0	137,19	5194,80	5194,80
14	1	2499,97	-35562	0,00	0,0	0,0	140,20	5325,97	5325,97
15	1	2500,03	-35562	0,00	0,0	0,0	140,20	5326,10	5326,10
16	1	2743,20	-78249	0,00	0,0	0,0	152,16	5844,15	5885,60
17	1	2906,33	-106890	0,00	0,0	0,0	160,20	6191,71	6337,64

Casing Load Summary - PressureTest #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	556666	0,00	0,0	0,0	50,00	5300,04	0,06
2	1	24,96	552289	0,00	0,0	0,0	49,00	5336,60	53,19
3	1	304,80	503172	0,00	0,0	0,0	37,39	5746,75	649,35
4	1	362,01	493132	0,00	0,0	0,0	35,00	5830,59	771,21
5	1	609,60	449672	0,00	0,0	0,0	47,18	6193,51	1298,70
6	1	914,40	396172	0,00	0,0	0,0	62,22	6640,26	1948,05
7	1	1219,20	342672	0,00	0,0	0,0	77,16	7087,01	2597,40
8	1	1524,00	289172	0,00	0,0	0,0	92,20	7533,77	3246,75
9	1	1828,80	235672	0,00	0,0	0,0	107,14	7980,51	3896,10
10	1	2133,60	182172	0,00	0,0	0,0	122,18	8427,27	4545,45
11	1	2219,86	167024	0,00	0,0	0,0	126,39	8553,72	4729,24
12	1	2219,92	167024	0,00	0,0	0,0	126,40	8553,81	4729,37
13	1	2438,40	128672	0,00	0,0	0,0	137,19	8874,02	5194,80
14	1	2499,97	117859	0,07	0,5	0,0	140,20	8964,27	5325,97
15	1	2500,03	110907	0,00	0,0	0,0	140,20	8964,36	4827,06
16	1	2743,20	70876	0,00	0,0	0,0	152,16	9320,77	5203,45
17	1	2906,33	50698	0,00	0,0	0,0	160,20	9559,90	5376,38
18									
19	**Additional Pickup to Prevent Buckling = 7504 lbf**								

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Casing Load Summary - LostReturnsWithMudDrop #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi)	
								Internal	External
1	1	0,03	367427	0,00	0,0	0,0	50,00	0,00	0,06
2	1	24,96	363050	0,00	0,0	0,0	50,00	0,00	53,19
3	1	304,80	313933	0,00	0,0	0,0	37,54	0,00	649,35
4	1	362,01	303893	0,00	0,0	0,0	35,00	0,00	771,21
5	1	609,60	260433	0,00	0,0	0,0	47,19	125,70	1298,70
6	1	914,40	206933	0,00	0,0	0,0	62,19	773,98	1948,05
7	1	1219,20	153433	0,00	0,0	0,0	77,19	1423,33	2597,40
8	1	1524,00	99933	0,00	0,0	0,0	92,19	2072,68	3246,75
9	1	1828,80	46433	0,00	0,0	0,0	107,19	2722,03	3896,10
10	1	2133,60	-7067	0,00	0,0	0,0	122,19	3371,38	4545,45
11	1	2219,86	-22215	0,00	0,0	0,0	126,44	3555,17	4729,24
12	1	2219,92	-22215	0,00	0,0	0,0	126,45	3555,30	4729,37
13	1	2438,40	-60567	0,00	0,0	0,0	137,19	4020,73	5194,80
14	1	2499,97	-71380	0,00	0,0	0,0	140,23	4151,90	5325,97
15	1	2500,03	-54375	0,00	0,0	0,0	140,23	4152,03	4827,06
16	1	2743,20	-88884	0,00	0,0	0,0	152,20	4670,08	5203,45
17	1	2906,33	-105314	0,00	0,0	0,0	160,23	5017,63	5376,38

Casing Load Summary - GreenCement #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi)	
								Internal	External
1	1	0,03	706476	0,00	0,0	0,0	50,00	5300,06	0,06
2	1	24,96	702098	0,00	0,0	0,0	49,00	5353,19	53,19
3	1	304,80	652981	0,00	0,0	0,0	37,39	5949,35	649,35
4	1	362,01	642941	0,00	0,0	0,0	35,00	6071,21	771,21
5	1	609,60	599481	0,00	0,0	0,0	47,18	6598,70	1298,70
6	1	914,40	545981	0,00	0,0	0,0	62,22	7248,05	1948,05
7	1	1219,20	492481	0,00	0,0	0,0	77,16	7897,40	2597,40
8	1	1524,00	438981	0,00	0,0	0,0	92,20	8546,75	3246,75
9	1	1828,80	385481	0,00	0,0	0,0	107,14	9196,10	3896,10
10	1	2133,60	331981	0,00	0,0	0,0	122,18	9845,45	4545,45
11	1	2219,86	316833	0,00	0,0	0,0	126,39	10029,24	4729,24
12	1	2219,92	316833	0,00	0,0	0,0	126,40	10029,37	4729,37
13	1	2438,40	278481	0,00	0,0	0,0	137,19	10494,80	5194,80
14	1	2499,97	267669	0,00	0,0	0,0	140,20	10625,96	5325,97
15	1	2500,03	267669	0,00	0,0	0,0	140,20	10626,10	5326,10
16	1	2743,20	224981	0,00	0,0	0,0	152,16	11144,15	5885,60
17	1	2906,33	196341	0,00	0,0	0,0	160,20	11491,71	6337,64

Casing Load Summary - OverPull #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi)	
								Internal	External
1	1	0,03	463866	0,00	0,0	0,0	50,00	0,06	0,06
2	1	24,96	459489	0,00	0,0	0,0	49,00	53,19	53,19
3	1	304,80	410372	0,00	0,0	0,0	37,39	649,35	649,35
4	1	362,01	400332	0,00	0,0	0,0	35,00	771,21	771,21
5	1	609,60	356872	0,00	0,0	0,0	47,18	1298,70	1298,70
6	1	914,40	303372	0,00	0,0	0,0	62,22	1948,05	1948,05
7	1	1219,20	249872	0,00	0,0	0,0	77,16	2597,40	2597,40
8	1	1524,00	196372	0,00	0,0	0,0	92,20	3246,75	3246,75
9	1	1828,80	142872	0,00	0,0	0,0	107,14	3896,09	3896,09
10	1	2133,60	89371	0,00	0,0	0,0	122,18	4545,45	4545,45
11	1	2219,86	74223	0,00	0,0	0,0	126,39	4729,24	4729,24
12	1	2219,92	74223	0,00	0,0	0,0	126,40	4729,37	4729,37
13	1	2438,40	35871	0,00	0,0	0,0	137,19	5194,80	5194,80
14	1	2499,97	25059	0,00	0,0	0,0	140,20	5325,97	5325,97
15	1	2500,03	25059	0,00	0,0	0,0	140,20	5326,10	5326,10
16	1	2743,20	-17629	0,00	0,0	0,0	152,16	5844,15	5844,15
17	1	2906,33	-46269	0,00	0,0	0,0	160,20	6191,71	6191,71

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Casing Load Summary - RunningHole #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	455851	0,00	0,0	0,0	50,00	0,06	0,06
2	1	24,96	452300	0,00	0,0	0,0	49,00	53,19	53,19
3	1	304,80	412451	0,00	0,0	0,0	37,39	649,35	649,35
4	1	362,01	404305	0,00	0,0	0,0	35,00	771,21	771,21
5	1	609,60	369046	0,00	0,0	0,0	47,18	1298,70	1298,70
6	1	914,40	325641	0,00	0,0	0,0	62,22	1948,05	1948,05
7	1	1219,20	282236	0,00	0,0	0,0	77,16	2597,40	2597,40
8	1	1524,00	238831	0,00	0,0	0,0	92,20	3246,75	3246,75
9	1	1828,80	195426	0,00	0,0	0,0	107,14	3896,09	3896,09
10	1	2133,60	152021	0,00	0,0	0,0	122,18	4545,45	4545,45
11	1	2219,86	139736	0,00	0,0	0,0	126,39	4729,24	4729,24
12	1	2219,92	139727	0,00	0,0	0,0	126,40	4729,37	4729,37
13	1	2438,40	108616	0,00	0,0	0,0	137,19	5194,80	5194,80
14	1	2499,97	99849	0,00	0,0	0,0	140,20	5325,97	5325,97
15	1	2500,03	99840	0,00	0,0	0,0	140,20	5326,10	5326,10
16	1	2743,20	65211	0,00	0,0	0,0	152,16	5844,15	5844,15
17	1	2906,33	41980	0,00	0,0	0,0	160,20	6191,71	6191,71

Casing Load Summary - Initial Conditions - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	2880,02	-27357	0,00	0,0	0,0	158,90	6135,65	6135,66
2	1	2880,15	-27373	0,00	0,0	0,0	158,91	6135,91	6135,94
3	1	2906,33	-30125	0,00	0,0	0,0	160,22	6191,70	6196,19
4	1	2906,39	-30125	0,00	0,0	0,0	160,22	6191,83	6196,33
5	1	2906,51	-30141	0,00	0,0	0,0	160,23	6192,09	6196,61
6	1	3048,00	-44995	0,00	0,0	0,0	167,20	6493,50	6522,14
7	1	3296,96	-71137	0,00	0,0	0,0	179,40	7023,91	7171,65

Casing Load Summary - PressureTest #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	2880,02	29575	0,00	0,0	0,0	158,90	9388,80	6135,63
2	1	2880,15	29560	0,00	0,0	0,0	158,91	9388,97	6135,81
3	1	2906,33	27015	0,00	0,0	0,0	160,22	9426,15	6172,98
4	1	2906,39	45410	0,00	0,0	0,0	160,22	9426,24	5376,44
5	1	2906,51	45396	0,00	0,0	0,0	160,23	9426,41	5376,56
6	1	3048,00	32994	0,00	0,0	0,0	167,20	9627,27	5519,71
7	1	3296,96	11106	0,00	0,0	0,0	179,40	9980,74	5850,92

Casing Load Summary - LostReturnsWithMudDrop #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	2880,02	-47963	0,00	0,0	0,0	158,93	4961,58	6135,65
2	1	2880,15	-47978	0,00	0,0	0,0	158,94	4961,85	6135,91
3	1	2906,33	-50588	0,00	0,0	0,0	160,23	5017,63	6191,70
4	1	2906,39	-31760	0,00	0,0	0,0	160,23	5017,76	5376,44
5	1	2906,51	-31771	0,00	0,0	0,0	160,24	5018,02	5376,56
6	1	3048,00	-42392	0,00	0,0	0,0	167,20	5319,43	5519,71
7	1	3296,96	-61287	0,00	0,0	0,0	179,45	5849,84	5850,92

Casing Load Summary - GreenCement #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	2880,02	127229	0,00	0,0	0,0	158,90	11435,65	6135,66
2	1	2880,15	127213	0,00	0,0	0,0	158,91	11435,91	6135,94
3	1	2906,33	124461	0,00	0,0	0,0	160,22	11491,70	6196,19
4	1	2906,39	124461	0,00	0,0	0,0	160,22	11491,83	6196,33
5	1	2906,51	124445	0,00	0,0	0,0	160,23	11492,09	6196,61
6	1	3048,00	109591	0,00	0,0	0,0	167,20	11793,50	6522,14
7	1	3296,96	83450	0,00	0,0	0,0	179,40	12323,91	7171,65

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Casing Load Summary - OverPull #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	2880,02	28331	0,00	0,0	0,0	158,90	6135,65	6135,65
2	1	2880,15	28315	0,00	0,0	0,0	158,91	6135,91	6135,91
3	1	2906,33	25562	0,00	0,0	0,0	160,22	6191,70	6191,70
4	1	2906,39	25562	0,00	0,0	0,0	160,22	6191,83	6191,83
5	1	2906,51	25546	0,00	0,0	0,0	160,23	6192,09	6192,09
6	1	3048,00	10693	0,00	0,0	0,0	167,20	6493,50	6493,50
7	1	3296,96	-15449	0,00	0,0	0,0	179,40	7023,91	7023,91

Casing Load Summary - RunningHole #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	2880,02	60656	0,00	0,0	0,0	158,90	6135,65	6135,65
2	1	2880,15	60646	0,00	0,0	0,0	158,91	6135,91	6135,91
3	1	2906,33	58417	0,00	0,0	0,0	160,22	6191,70	6191,70
4	1	2906,39	58411	0,00	0,0	0,0	160,22	6191,83	6191,83
5	1	2906,51	58401	0,00	0,0	0,0	160,23	6192,09	6192,09
6	1	3048,00	46356	0,00	0,0	0,0	167,20	6493,50	6493,50
7	1	3296,96	25159	0,00	0,0	0,0	179,40	7023,91	7023,91

Casing Load Summary - TubingLeak #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	2880,02	-134731	0,00	0,0	0,0	158,90	0,07	6135,63
2	1	2880,15	-134744	0,00	0,0	0,0	158,91	0,33	6135,81
3	1	2906,33	-136964	0,00	0,0	0,0	160,22	56,11	6172,98
4	1	2906,39	-136963	0,00	0,0	0,0	160,22	56,24	6173,07
5	1	2906,51	-136976	0,00	0,0	0,0	160,23	56,50	6173,25
6	1	3048,00	-148951	0,00	0,0	0,0	167,20	357,91	6374,10
7	1	3296,96	-168257	0,00	0,0	0,0	179,40	888,32	6727,57

Casing Load Summary - PluggedPerfs #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	2880,02	-111632	0,00	0,0	0,0	158,90	1319,88	6135,55
2	1	2880,15	-111650	0,00	0,0	0,0	158,91	1319,92	6135,81
3	1	2906,33	-114697	0,00	0,0	0,0	160,22	1328,51	6172,99
4	1	2906,39	-105282	0,00	0,0	0,0	160,22	1328,53	5761,31
5	1	2906,51	-105152	0,00	0,0	0,0	160,23	1328,57	4126,41
6	1	3048,00	-83890	0,00	0,0	0,0	167,20	1374,97	4327,27
7	1	3296,96	-111048	0,00	0,0	0,0	179,40	1456,64	4680,74

Safety Factor Summary - Initial Conditions - 20" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	80000,0	7230,9	D 11,064	N/A	100+	100+	11,070
2	1	24,96	80000,0	6935,6	11,535	N/A	100+	100+	11,519
3	1	304,80	80000,0	3822,6	20,928	N/A	57,042	100+	21,129
4	1	362,01	80000,0	3287,5	24,335	N/A	48,026	100+	25,473
5	1	362,96	80000,0	3279,0	24,397	N/A	47,898	100+	25,562
6	1	363,02	80000,0	3278,5	24,401	N/A	47,899	100+	25,568
7	1	422,57	80000,0	2796,5	28,608	N/A	61,312	100+	32,562
8	1	422,64	80000,0	2796,0	28,613	N/A	61,329	100+	32,571
9	1	609,60	80000,0	1363,0	58,696	N/A	100+	26,489	M 100+
10	1	762,00	80000,0	800,0	100+	N/A	100+	12,353	CM 58,181
11	1	914,40	80000,0	2884,6	27,734	N/A	100+	5,657	CM 25,843
12	1	914,40	80000,0	2884,7	27,732	N/A	100+	5,657	CM 25,842
13									

14 **Burst and Axial Flags**
15 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
16
17 **Axial Flags**
18 **Default = Tension, M = Compression**
19
20 **Triaxial Flags**
21 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
22
23 **Envelope Flags**
24 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - PressureTest #1 - 20'' Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	80000,0	36118,9	2,215	N/A	1,976	100+	4,786
2	1	24,96	80000,0	36104,2	2,216	N/A	1,977	100+	4,868
3	1	95,83	80000,0	36078,3	N 2,217	N/A	1,981	100+	5,085
4	1	304,80	80000,0	36177,8	N 2,211	N/A	1,994	100+	5,593
5	1	362,01	80000,0	36243,4	N 2,207	N/A	1,997	100+	5,750
6	1	362,96	80000,0	36243,4	N 2,207	N/A	1,998	100+	5,753
7	1	363,02	80000,0	36105,3	2,216	N/A	1,998	100+	6,531
8	1	422,57	80000,0	36226,5	2,208	N/A	1,995	100+	6,837
9	1	422,64	80000,0	36938,6	2,166	N/A	1,957	100+	6,717
10	1	609,60	80000,0	36421,4	2,197	N/A	2,000	100+	8,071
11	1	914,40	80000,0	35588,1	2,248	N/A	2,073	100+	11,322
12	1	914,40	80000,0	35588,1	2,248	N/A	2,073	100+	11,322
13									
14	**Burst and Axial Flags**								
15	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
16									
17	**Axial Flags**								
18	**Default = Tension, M = Compression**								
19									
20	**Triaxial Flags**								
21	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
22									
23	**Envelope Flags**								
24	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - LostReturnsWithMudDrop #1 - 20'' Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	80000,0	6338,1	D 12,622	N/A	100+	100+	12,630
2	1	24,96	80000,0	6439,8	12,423	N/A	100+	41,858	13,218
3	1	143,74	80000,0	7163,9	11,167	N/A	100+	8,404	16,980
4	1	304,80	80000,0	5156,7	15,514	N/A	100+	9,548	27,648
5	1	362,01	80000,0	4446,9	17,990	N/A	100+	10,033	35,589
6	1	362,96	80000,0	4434,9	18,039	N/A	100+	10,041	35,763
7	1	363,02	80000,0	4371,4	18,301	N/A	100+	10,042	36,956
8	1	422,57	80000,0	3793,6	21,088	N/A	100+	10,604	47,804
9	1	422,64	80000,0	3259,8	24,542	N/A	100+	15,822	41,749
10	1	609,60	80000,0	1779,3	44,961	N/A	100+	14,560	M 100+
11	1	762,00	80000,0	800,0	100+	N/A	100+	13,671	CM 64,525
12	1	914,40	80000,0	800,0	100+	N/A	100+	12,883	CM 35,508
13	1	914,40	80000,0	800,0	100+	N/A	100+	12,883	CM 35,507
14									
15	**Burst and Axial Flags**								
16	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
17									
18	**Axial Flags**								
19	**Default = Tension, M = Compression**								
20									
21	**Triaxial Flags**								
22	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
23									
24	**Envelope Flags**								
25	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - GreenCement #1 - 20" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	80000,0	36376,8	2,199	N/A	1,976	100+	3,439
2	1	24,96	80000,0	36441,2	2,195	N/A	1,970	100+	3,481
3	1	304,80	80000,0	37336,4	2,143	N/A	1,909	100+	4,035
4	1	362,01	80000,0	37557,4	2,130	N/A	1,898	100+	4,171
5	1	362,96	80000,0	37561,3	2,130	N/A	1,897	100+	4,174
6	1	363,02	80000,0	37561,2	2,130	N/A	1,897	100+	4,174
7	1	422,57	80000,0	37233,7	2,149	N/A	1,914	100+	4,326
8	1	422,64	80000,0	37233,4	2,149	N/A	1,914	100+	4,326
9	1	609,60	80000,0	36230,6	2,208	N/A	1,968	100+	4,883
10	1	914,40	80000,0	33275,1	N 2,404	N/A	2,147	100+	6,181
11	1	914,40	80000,0	33275,1	N 2,404	N/A	2,147	100+	6,181
12									
13	**Burst and Axial Flags**								
14	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
15									
16	**Axial Flags**								
17	**Default = Tension, M = Compression**								
18									
19	**Triaxial Flags**								
20	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
21									
22	**Envelope Flags**								
23	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - OverPull #1 - 20" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	80000,0	9442,8	D 8,472	N/A	100+	100+	8,477
2	1	24,96	80000,0	9199,3	D 8,696	N/A	100+	100+	8,738
3	1	304,80	80000,0	6467,8	D 12,369	N/A	100+	54,002	13,341
4	1	362,01	80000,0	5909,5	D 13,538	N/A	100+	45,472	14,950
5	1	362,96	80000,0	5900,0	D 13,559	N/A	100+	45,350	14,981
6	1	363,02	80000,0	5899,4	D 13,561	N/A	100+	45,343	14,983
7	1	422,57	80000,0	5318,3	D 15,043	N/A	100+	38,955	17,140
8	1	422,64	80000,0	5317,7	D 15,044	N/A	100+	38,949	17,143
9	1	609,60	80000,0	3492,6	D 22,906	N/A	100+	27,003	31,298
10	1	914,40	80000,0	800,0	D 100+	N/A	100+	18,002	CM 90,413
11	1	914,40	80000,0	800,0	D 100+	N/A	100+	18,002	CM 90,403
12									
13	**Burst and Axial Flags**								
14	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
15									
16	**Axial Flags**								
17	**Default = Tension, M = Compression**								
18									
19	**Triaxial Flags**								
20	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
21									
22	**Envelope Flags**								
23	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - RunningHole #1 - 20" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	80000,0	11625,8	D 6,881	N/A	100+	100+	6,885
2	1	24,96	80000,0	11420,6	D 7,005	N/A	100+	100+	7,033
3	1	304,80	80000,0	9118,3	D 8,774	N/A	100+	53,967	9,253
4	1	362,01	80000,0	8647,7	D 9,251	N/A	100+	45,449	9,892
5	1	362,96	80000,0	8639,8	D 9,260	N/A	100+	45,327	9,903
6	1	363,02	80000,0	8639,3	D 9,260	N/A	100+	45,320	9,904
7	1	422,57	80000,0	8149,4	D 9,817	N/A	100+	38,941	10,671
8	1	422,64	80000,0	8148,9	D 9,817	N/A	100+	38,935	10,672
9	1	609,60	80000,0	6610,6	D 12,102	N/A	100+	27,002	14,104
10	1	914,40	80000,0	4102,9	D 19,498	N/A	100+	18,002	29,643
11	1	914,40	80000,0	4102,9	D 19,499	N/A	100+	18,002	29,644
12									
13	**Burst and Axial Flags**								
14	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
15									
16	**Axial Flags**								
17	**Default = Tension, M = Compression**								
18									
19	**Triaxial Flags**								
20	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
21									
22	**Envelope Flags**								
23	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - Initial Conditions - 13 3/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	19737,1	D 5,573	N/A	100+	100+	5,573
2	1	24,96	110000,0	19498,1	D 5,642	N/A	100+	100+	5,654
3	1	290,63	110000,0	16951,7	D 6,489	N/A	100+	71,487	C 6,693
4	1	304,80	110000,0	16816,0	D 6,541	N/A	100+	68,176	C 6,759
5	1	362,01	110000,0	16267,7	D 6,762	N/A	100+	57,440	C 7,041
6	1	609,60	110000,0	13894,5	D 7,917	N/A	100+	34,193	C 8,590
7	1	914,40	110000,0	10973,0	D 10,025	N/A	100+	22,846	C 11,779
8	1	914,46	110000,0	10972,4	D 10,025	N/A	100+	22,845	C 11,780
9	1	1219,20	110000,0	8051,6	D 13,662	N/A	100+	17,163	C 18,736
10	1	1524,00	110000,0	5130,2	D 21,442	N/A	100+	13,745	C 45,768
11	1	1799,97	110000,0	2484,7	D 44,271	N/A	100+	11,642	100+
12	1	1800,03	110000,0	2484,9	D 44,267	N/A	100+	11,641	100+
13	1	1828,80	110000,0	2288,0	48,076	N/A	100+	11,028	CM 100+
14	1	2069,90	110000,0	1367,3	80,448	N/A	100+	7,651	CM 28,843
15	1	2133,60	110000,0	2040,1	53,920	N/A	100+	6,506	CM 24,231
16	1	2219,86	110000,0	3038,3	36,205	N/A	100+	5,410	CM 19,915
17									

Burst and Axial Flags
Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection

Axial Flags
Default = Tension, M = Compression

Triaxial Flags
Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending

Envelope Flags
EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection

Safety Factor Summary - PressureTest #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	62075,6	1,772	N/A	1,591	100+	3,154
2	1	24,96	110000,0	61957,3	1,775	N/A	1,594	100+	3,180
3	1	304,80	110000,0	60665,3	1,813	N/A	1,625	100+	3,502
4	1	362,01	110000,0	60409,5	1,821	N/A	1,632	100+	3,576
5	1	609,60	110000,0	59336,7	1,854	N/A	1,661	100+	3,937
6	1	914,40	110000,0	58095,4	1,893	N/A	1,699	100+	4,494
7	1	914,46	110000,0	58095,2	1,893	N/A	1,699	100+	4,494
8	1	1219,20	110000,0	56986,0	N 1,930	N/A	1,739	100+	5,127
9	1	1524,00	110000,0	56062,4	N 1,962	N/A	1,780	100+	5,860
10	1	1799,97	110000,0	55379,3	N 1,986	N/A	1,819	100+	C 6,729
11	1	1800,03	110000,0	56239,3	1,956	N/A	1,787	100+	C 8,070
12	1	1828,80	110000,0	55991,1	1,965	N/A	1,796	100+	C 8,294
13	1	2133,60	110000,0	52487,2	2,096	N/A	1,933	100+	C 11,909
14	1	2219,86	110000,0	50745,0	N 2,168	N/A	2,004	100+	C 13,683
15									

Burst and Axial Flags
Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection

Axial Flags
Default = Tension, M = Compression

Triaxial Flags
Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending

Envelope Flags
EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection

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Safety Factor Summary - LostReturnsWithMudDrop #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	18264,1	D 6,023	N/A	100+	100+	6,023
2	1	24,96	110000,0	18333,5	6,000	N/A	100+	63,850	6,118
3	1	152,40	110000,0	18980,0	5,796	N/A	100+	10,477	C 6,653
4	1	304,80	110000,0	20320,3	5,413	N/A	100+	5,261	C 7,432
5	1	362,01	110000,0	20900,9	5,263	N/A	100+	4,469	C 7,774
6	1	387,52	110000,0	21180,0	5,194	N/A	100+	4,187	C 7,937
7	1	609,60	110000,0	18368,3	5,989	N/A	100+	4,451	C 9,707
8	1	914,40	110000,0	14515,6	7,578	N/A	100+	4,868	C 13,986
9	1	914,46	110000,0	14514,8	7,578	N/A	100+	4,868	C 13,988
10	1	1219,20	110000,0	10677,9	10,302	N/A	100+	5,365	C 25,015
11	1	1524,00	110000,0	6879,2	15,990	N/A	100+	5,970	C 100+
12	1	1799,97	110000,0	3579,3	30,733	N/A	100+	6,643	CM 49,682
13	1	1800,03	110000,0	3351,5	32,821	N/A	100+	7,985	CM 96,880
14	1	1828,80	110000,0	3170,2	34,699	N/A	100+	7,832	CM 75,936
15	1	1981,20	110000,0	2688,8	40,910	N/A	100+	6,746	CM 34,948
16	1	2133,60	110000,0	3007,7	36,572	N/A	100+	5,685	CM 23,029
17	1	2219,86	110000,0	3997,3	27,519	N/A	100+	4,812	CM 19,016
18									
19	**Burst and Axial Flags**								
20	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
21									
22	**Axial Flags**								
23	**Default = Tension, M = Compression**								
24									
25	**Triaxial Flags**								
26	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
27									
28	**Envelope Flags**								
29	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - GreenCement #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	63852,5	1,723	N/A	1,591	100+	2,363
2	1	24,96	110000,0	63795,2	1,724	N/A	1,591	100+	2,378
3	1	304,80	110000,0	63210,6	1,740	N/A	1,591	100+	2,553
4	1	362,01	110000,0	63104,5	1,743	N/A	1,591	100+	2,593
5	1	457,20	110000,0	62938,1	1,748	N/A	1,591	100+	2,660
6	1	609,60	110000,0	62698,3	1,754	N/A	1,591	100+	2,777
7	1	914,40	110000,0	62318,8	1,765	N/A	1,591	100+	3,043
8	1	914,46	110000,0	62318,7	1,765	N/A	1,591	100+	3,043
9	1	1219,20	110000,0	62074,8	1,772	N/A	1,591	100+	3,366
10	1	1524,00	110000,0	61967,6	1,775	N/A	1,591	100+	3,766
11	1	1799,97	110000,0	61989,3	1,775	N/A	1,591	100+	4,219
12	1	1800,03	110000,0	61989,1	1,775	N/A	1,591	100+	4,219
13	1	1828,80	110000,0	61864,7	1,778	N/A	1,594	100+	4,273
14	1	2133,60	110000,0	60094,9	1,830	N/A	1,644	100+	4,938
15	1	2219,86	110000,0	59074,1	1,862	N/A	1,673	100+	5,165
16									
17	**Burst and Axial Flags**								
18	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
19									
20	**Axial Flags**								
21	**Default = Tension, M = Compression**								
22									
23	**Triaxial Flags**								
24	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
25									
26	**Envelope Flags**								
27	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - OverPull #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	23683,9	D 4,645	N/A	100+	100+	4,644
2	1	24,96	110000,0	23444,8	D 4,692	N/A	100+	100+	4,701
3	1	304,80	110000,0	20762,7	D 5,298	N/A	100+	67,873	5,441
4	1	362,01	110000,0	20214,5	D 5,442	N/A	100+	57,196	5,622
5	1	609,60	110000,0	17841,3	D 6,165	N/A	100+	34,072	C 6,566
6	1	914,40	110000,0	14919,8	D 7,373	N/A	100+	22,786	C 8,279
7	1	914,46	110000,0	14919,2	D 7,373	N/A	100+	22,784	C 8,280
8	1	1219,20	110000,0	11998,4	D 9,168	N/A	100+	17,130	C 11,203
9	1	1524,00	110000,0	9076,9	D 12,119	N/A	100+	13,728	C 17,320
10	1	1799,97	110000,0	6431,5	D 17,103	N/A	100+	11,635	C 34,257
11	1	1800,03	110000,0	6431,6	D 17,103	N/A	100+	11,635	C 34,257
12	1	1828,80	110000,0	6155,5	D 17,870	N/A	100+	11,453	C 38,149
13	1	2133,60	110000,0	3234,1	D 34,013	N/A	100+	9,822	100+
14	1	2165,79	110000,0	2925,4	D 37,601	N/A	100+	9,676	CM 100+
15	1	2219,86	110000,0	2406,8	D 45,703	N/A	100+	9,440	CM 70,119
16									
17	**Burst and Axial Flags**								
18	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
19									
20	**Axial Flags**								
21	**Default = Tension, M = Compression**								
22									
23	**Triaxial Flags**								
24	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
25									
26	**Envelope Flags**								
27	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - RunningHole #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	23977,0	D 4,588	N/A	100+	100+	4,588
2	1	24,96	110000,0	23782,6	D 4,625	N/A	100+	100+	4,634
3	1	304,80	110000,0	21601,3	D 5,092	N/A	100+	67,799	5,224
4	1	362,01	110000,0	21155,4	D 5,200	N/A	100+	57,128	5,364
5	1	609,60	110000,0	19225,3	D 5,722	N/A	100+	34,021	6,066
6	1	762,00	110000,0	18037,3	D 6,098	N/A	100+	27,259	C 6,596
7	1	914,40	110000,0	16849,2	D 6,528	N/A	100+	22,748	C 7,229
8	1	914,46	110000,0	16848,7	D 6,529	N/A	100+	22,747	C 7,230
9	1	1219,20	110000,0	14473,3	D 7,600	N/A	100+	17,102	C 8,947
10	1	1524,00	110000,0	12097,3	D 9,093	N/A	100+	13,708	C 11,737
11	1	1799,97	110000,0	9946,0	D 11,060	N/A	100+	11,621	C 16,354
12	1	1800,03	110000,0	9945,6	D 11,060	N/A	100+	11,621	C 16,355
13	1	1828,80	110000,0	9721,3	D 11,315	N/A	100+	11,439	C 17,055
14	1	2133,60	110000,0	7345,3	D 14,976	N/A	100+	9,815	C 31,180
15	1	2219,86	110000,0	6672,8	D 16,485	N/A	100+	9,435	C 40,728
16									
17	**Burst and Axial Flags**								
18	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
19									
20	**Axial Flags**								
21	**Default = Tension, M = Compression**								
22									
23	**Triaxial Flags**								
24	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
25									
26	**Envelope Flags**								
27	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - Initial Conditions - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	25937,8	D 4,241	N/A	100+	100+	4,243
2	1	24,96	110000,0	25709,4	D 4,279	N/A	100+	100+	4,290
3	1	304,80	110000,0	23146,2	D 4,752	N/A	100+	100+	4,892
4	1	362,01	110000,0	22622,3	D 4,862	N/A	100+	85,324	5,037
5	1	609,60	110000,0	20354,3	D 5,404	N/A	100+	51,190	5,776
6	1	914,40	110000,0	17562,4	D 6,263	N/A	100+	34,529	7,049
7	1	1219,20	109696,8	14770,4	D 7,427	N/A	100+	26,138	9,017
8	1	1524,00	109198,9	11978,6	D 9,116	N/A	100+	21,069	12,513
9	1	1828,80	108704,3	9186,7	D 11,833	N/A	100+	17,680	C 20,558
10	1	2133,60	108206,6	6394,7	D 16,921	N/A	100+	15,252	C 58,542
11	1	2219,86	108067,0	5604,2	D 19,283	N/A	100+	14,684	C 100+
12	1	2219,92	108067,0	5604,3	D 19,283	N/A	100+	14,684	C 100+
13	1	2438,40	107709,6	3602,8	D 29,896	N/A	100+	13,373	CM 67,695
14	1	2499,97	107610,1	3038,5	D 35,416	N/A	100+	13,038	CM 47,069
15	1	2500,03	107610,0	3038,7	D 35,414	N/A	100+	13,037	CM 47,069
16	1	2743,20	107214,1	1099,1	97,545	N/A	100+	11,160	CM 21,313
17	1	2756,37	107192,4	1071,9	100+	N/A	100+	11,074	CM 20,697
18	1	2906,33	106948,1	1344,9	79,519	N/A	100+	9,253	M 15,564
19									
20	**Burst and Axial Flags**								
21	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
22									
23	**Axial Flags**								
24	**Default = Tension, M = Compression**								
25									
26	**Triaxial Flags**								
27	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
28									
29	**Envelope Flags**								
30	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - PressureTest #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	50430,6	2,181	N/A	2,057	100+	3,074
2	1	24,96	110000,0	50243,0	2,189	N/A	2,063	100+	3,098
3	1	304,80	110000,0	48156,7	2,284	N/A	2,138	100+	3,401
4	1	362,01	110000,0	47734,5	2,304	N/A	2,154	100+	3,470
5	1	609,60	110000,0	45925,7	2,395	N/A	2,227	100+	3,805
6	1	914,40	110000,0	43744,5	2,515	N/A	2,323	100+	4,319
7	1	1219,20	109696,8	41620,9	2,636	N/A	2,421	100+	4,980
8	1	1524,00	109198,9	39564,2	2,760	N/A	2,524	100+	5,874
9	1	1828,80	108704,3	37585,2	2,892	N/A	2,637	100+	7,175
10	1	2133,60	108206,6	35697,1	3,031	N/A	2,762	100+	9,240
11	1	2219,86	108067,0	35181,2	3,072	N/A	2,800	100+	10,065
12	1	2219,92	108067,0	35180,9	3,072	N/A	2,800	100+	10,065
13	1	2438,40	107709,6	33915,7	N 3,176	N/A	2,901	100+	12,989
14	1	2499,97	107610,1	33580,9	N 3,204	N/A	2,931	100+	13,932
15	1	2500,03	107610,0	38492,9	2,796	N/A	2,577	100+	15,093
16	1	2743,20	107214,1	38691,2	2,771	N/A	2,580	100+	C 23,530
17	1	2906,33	106948,1	39597,2	N 2,701	N/A	2,533	100+	C 32,811
18									
19	**Burst and Axial Flags**								
20	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
21									
22	**Axial Flags**								
23	**Default = Tension, M = Compression**								
24									
25	**Triaxial Flags**								
26	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
27									
28	**Envelope Flags**								
29	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - LostReturnsWithMudDrop #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	23634,2	D 4,654	N/A	100+	100+	4,657
2	1	24,96	110000,0	23639,8	4,653	N/A	100+	100+	4,713
3	1	304,80	110000,0	24382,7	4,511	N/A	100+	11,547	5,451
4	1	362,01	110000,0	24682,1	4,457	N/A	100+	9,745	5,631
5	1	609,60	110000,0	25498,3	4,314	N/A	100+	6,392	6,570
6	1	914,40	110000,0	23007,5	4,781	N/A	100+	6,082	8,269
7	1	1219,20	109695,8	20583,8	5,329	N/A	100+	5,797	11,122
8	1	1524,00	109199,3	18265,4	5,978	N/A	100+	5,534	16,998
9	1	1676,40	108951,0	17159,3	6,349	N/A	100+	5,411	C 23,157
10	1	1828,80	108702,7	16098,2	6,752	N/A	100+	5,294	C 36,415
11	1	2133,60	108206,1	14151,5	7,646	N/A	100+	5,069	100+
12	1	2219,86	108065,6	13653,7	7,915	N/A	100+	4,998	CM 75,666
13	1	2219,92	108065,5	13653,8	7,915	N/A	100+	4,998	CM 75,666
14	1	2438,40	107709,5	12528,8	8,597	N/A	100+	4,828	CM 27,662
15	1	2499,97	107609,2	12252,1	8,783	N/A	100+	4,783	CM 23,450
16	1	2500,03	107609,1	7515,9	14,318	N/A	100+	6,866	CM 30,783
17	1	2743,20	107213,0	5218,9	20,543	N/A	100+	7,389	M 18,764
18	1	2906,33	106947,2	3302,1	32,388	N/A	100+	8,456	M 15,796
19									
20	**Burst and Axial Flags**								
21	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
22									
23	**Axial Flags**								
24	**Default = Tension, M = Compression**								
25									
26	**Triaxial Flags**								
27	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
28									
29	**Envelope Flags**								
30	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - GreenCement #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	53722,1	2,048	N/A	2,057	100+	2,422
2	1	24,96	110000,0	53626,4	2,051	N/A	2,057	100+	2,437
3	1	304,80	110000,0	52608,4	2,091	N/A	2,057	100+	2,621
4	1	362,01	110000,0	52413,3	2,099	N/A	2,057	100+	2,661
5	1	609,60	110000,0	51621,7	2,131	N/A	2,057	100+	2,854
6	1	914,40	110000,0	50769,6	2,167	N/A	2,057	100+	3,134
7	1	1219,20	109696,8	50058,9	2,191	N/A	2,051	100+	3,465
8	1	1524,00	109198,9	49495,5	2,206	N/A	2,042	100+	3,870
9	1	1828,80	108704,3	49084,9	2,215	N/A	2,032	100+	4,387
10	1	2133,60	108206,6	48830,7	2,216	N/A	2,023	100+	5,070
11	1	2219,86	108067,0	48787,4	2,215	N/A	2,020	100+	5,306
12	1	2219,92	108067,0	48787,5	2,215	N/A	2,020	100+	5,306
13	1	2438,40	107709,6	48735,3	2,210	N/A	2,014	100+	6,017
14	1	2499,97	107610,1	48735,4	2,208	N/A	2,012	100+	6,254
15	1	2500,03	107610,0	48735,4	2,208	N/A	2,012	100+	6,254
16	1	2743,20	107214,1	48408,1	2,215	N/A	2,020	100+	7,413
17	1	2906,33	106948,1	47503,4	2,251	N/A	2,056	100+	8,473
18									
19	**Burst and Axial Flags**								
20	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
21									
22	**Axial Flags**								
23	**Default = Tension, M = Compression**								
24									
25	**Triaxial Flags**								
26	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
27									
28	**Envelope Flags**								
29	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - OverPull #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	29837,1	D 3,687	N/A	100+	100+	3,689
2	1	24,96	110000,0	29608,7	D 3,715	N/A	100+	100+	3,724
3	1	304,80	110000,0	27045,5	D 4,067	N/A	100+	99,526	4,170
4	1	362,01	110000,0	26521,6	D 4,148	N/A	100+	84,025	4,274
5	1	609,60	110000,0	24253,6	D 4,535	N/A	100+	50,457	4,795
6	1	914,40	110000,0	21461,7	D 5,125	N/A	100+	34,071	5,640
7	1	1219,20	109696,8	18669,8	D 5,876	N/A	100+	25,815	6,829
8	1	1524,00	109198,9	15877,8	D 6,877	N/A	100+	20,826	8,650
9	1	1828,80	108704,3	13085,9	D 8,307	N/A	100+	17,490	11,836
10	1	2133,60	108206,6	10294,0	D 10,512	N/A	100+	15,098	18,834
11	1	2219,86	108067,0	9503,4	D 11,371	N/A	100+	14,539	C 22,647
12	1	2219,92	108067,0	9503,6	D 11,371	N/A	100+	14,539	C 22,647
13	1	2438,40	107709,6	7502,1	D 14,357	N/A	100+	13,298	C 46,706
14	1	2499,97	107610,1	6937,8	D 15,511	N/A	100+	12,987	C 66,796
15	1	2500,03	107610,0	6937,9	D 15,510	N/A	100+	12,986	C 66,796
16	1	2743,20	107214,1	4710,2	D 22,762	N/A	100+	11,859	CM 94,602
17	1	2906,33	106948,1	3215,5	D 33,260	N/A	100+	11,179	CM 35,954
18									

19 **Burst and Axial Flags**
20 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
21
22 **Axial Flags**
23 **Default = Tension, M = Compression**
24
25 **Triaxial Flags**
26 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
27
28 **Envelope Flags**
29 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - RunningHole #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	29321,6	D 3,752	N/A	100+	100+	3,754
2	1	24,96	110000,0	29146,3	D 3,774	N/A	100+	100+	3,783
3	1	304,80	110000,0	27179,2	D 4,047	N/A	100+	99,470	4,149
4	1	362,01	110000,0	26777,2	D 4,108	N/A	100+	83,937	4,232
5	1	609,60	110000,0	25036,7	D 4,394	N/A	100+	50,303	4,637
6	1	914,40	110000,0	22894,1	D 4,805	N/A	100+	33,894	5,255
7	1	1219,20	109696,8	20751,5	D 5,286	N/A	100+	25,632	6,046
8	1	1524,00	109198,9	18608,9	D 5,868	N/A	100+	20,644	7,112
9	1	1828,80	108704,3	16466,4	D 6,602	N/A	100+	17,312	8,653
10	1	2133,60	108206,6	14323,8	D 7,554	N/A	100+	14,927	11,072
11	1	2219,86	108067,0	13717,4	D 7,878	N/A	100+	14,369	12,030
12	1	2219,92	108067,0	13716,9	D 7,878	N/A	100+	14,369	12,031
13	1	2438,40	107709,6	12181,2	D 8,842	N/A	100+	13,133	15,426
14	1	2499,97	107610,1	11748,4	D 9,160	N/A	100+	12,823	16,765
15	1	2500,03	107610,0	11748,0	D 9,160	N/A	100+	12,823	16,766
16	1	2630,00	107398,2	10834,4	D 9,913	N/A	100+	12,216	C 20,540
17	1	2743,20	107214,1	10038,7	D 10,680	N/A	100+	11,734	C 25,574
18	1	2906,33	106948,1	8891,9	D 12,028	N/A	100+	11,104	C 39,628
19									

20 **Burst and Axial Flags**
21 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
22
23 **Axial Flags**
24 **Default = Tension, M = Compression**
25
26 **Triaxial Flags**
27 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
28
29 **Envelope Flags**
30 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - Initial Conditions - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	2880,02	106991,0	3199,5	D 33,440	N/A	100+	13,330	M 36,461
2	1	2880,15	106990,8	3198,1	D 33,454	N/A	100+	13,329	M 36,440
3	1	2906,33	106947,4	2979,7	35,893	N/A	100+	13,132	M 33,097
4	1	2906,39	106947,3	2979,8	35,890	N/A	100+	13,131	M 33,097
5	1	2906,51	106947,1	2978,5	35,907	N/A	100+	13,131	M 33,079
6	1	3048,00	106716,3	1813,3	58,853	N/A	100+	12,159	M 22,112
7	1	3147,00	106555,8	1065,6	100+	N/A	100+	11,559	M 17,935
8	1	3296,96	106312,5	1200,4	88,567	N/A	100+	9,973	M 13,933
9									
10	**Burst and Axial Flags**								
11	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
12									
13	**Axial Flags**								
14	**Default = Tension, M = Compression**								
15									
16	**Triaxial Flags**								
17	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
18									
19	**Envelope Flags**								
20	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - PressureTest #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	2880,02	106991,0	26504,0	4,037	N/A	3,725	100+	33,727
2	1	2880,15	106990,8	26504,2	4,037	N/A	3,725	100+	33,744
3	1	2906,33	106947,4	26528,9	4,031	N/A	3,723	100+	36,908
4	1	2906,39	106947,3	33155,5	3,226	N/A	2,991	100+	21,957
5	1	2906,51	106947,1	33156,2	3,226	N/A	2,991	100+	21,963
6	1	3048,00	106716,3	33841,7	3,153	N/A	2,942	100+	30,154
7	1	3192,99	106479,6	34586,7	3,079	N/A	2,894	100+	48,019
8	1	3296,96	106312,5	34455,5	N 3,085	N/A	2,915	100+	89,233
9									
10	**Burst and Axial Flags**								
11	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
12									
13	**Axial Flags**								
14	**Default = Tension, M = Compression**								
15									
16	**Triaxial Flags**								
17	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
18									
19	**Envelope Flags**								
20	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - LostReturnsWithMudDrop #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	2880,02	106990,0	10897,3	9,818	N/A	100+	5,828	M 20,796
2	1	2880,15	106989,8	10896,7	9,819	N/A	100+	5,828	M 20,790
3	1	2906,33	106947,1	10789,2	9,912	N/A	100+	5,804	M 19,709
4	1	2906,39	106947,0	4388,9	24,368	N/A	100+	10,497	M 31,394
5	1	2906,51	106946,8	4386,9	24,378	N/A	100+	10,498	M 31,383
6	1	3048,00	106716,3	2355,6	45,303	N/A	100+	11,890	M 23,469
7	1	3147,00	106555,1	1065,6	100+	N/A	100+	13,108	M 19,940
8	1	3296,96	106310,8	1063,1	DN 100+	N/A	100+	13,901	M 16,171
9									
10	**Burst and Axial Flags**								
11	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
12									
13	**Axial Flags**								
14	**Default = Tension, M = Compression**								
15									
16	**Triaxial Flags**								
17	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
18									
19	**Envelope Flags**								
20	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - GreenCement #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	2880,02	106991,0	42962,4	2,490	N/A	2,286	100+	7,840
2	1	2880,15	106990,8	42962,3	2,490	N/A	2,286	100+	7,841
3	1	2906,33	106947,4	42925,1	2,491	N/A	2,287	100+	8,011
4	1	2906,39	106947,3	42925,0	2,491	N/A	2,287	100+	8,011
5	1	2906,51	106947,1	42924,9	2,491	N/A	2,287	100+	8,012
6	1	3048,00	106716,3	42743,9	2,497	N/A	2,293	100+	9,078
7	1	3296,96	106312,5	41859,8	2,540	N/A	2,337	100+	11,877
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - OverPull #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	2880,02	106991,0	9176,2	D 11,660	N/A	100+	13,198	35,208
2	1	2880,15	106990,8	9174,8	D 11,661	N/A	100+	13,198	35,228
3	1	2906,33	106947,4	8935,1	D 11,969	N/A	100+	13,088	39,005
4	1	2906,39	106947,3	8935,3	D 11,969	N/A	100+	13,088	39,005
5	1	2906,51	106947,1	8933,8	D 11,971	N/A	100+	13,087	39,029
6	1	3048,00	106716,3	7641,1	D 13,966	N/A	100+	12,527	93,044
7	1	3296,96	106312,5	5365,8	D 19,813	N/A	100+	11,594	M 64,156
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - RunningHole #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	2880,02	106991,0	12645,6	D 8,461	N/A	100+	13,039	16,445
2	1	2880,15	106990,8	12644,7	D 8,461	N/A	100+	13,039	16,447
3	1	2906,33	106947,4	12461,3	D 8,582	N/A	100+	12,929	17,068
4	1	2906,39	106947,3	12460,8	D 8,583	N/A	100+	12,928	17,070
5	1	2906,51	106947,1	12460,0	D 8,583	N/A	100+	12,928	17,073
6	1	3048,00	106716,3	11468,6	D 9,305	N/A	100+	12,366	21,462
7	1	3296,96	106312,5	9724,1	D 10,933	N/A	100+	11,492	39,395
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - TubingLeak #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	2880,02	106991,0	51736,9	2,068	N/A	100+	1,725	M 7,403
2	1	2880,15	106990,8	51735,8	2,068	N/A	100+	1,725	M 7,403
3	1	2906,33	106947,4	51517,0	2,076	N/A	100+	1,728	M 7,280
4	1	2906,39	106947,3	51516,7	2,076	N/A	100+	1,728	M 7,280
5	1	2906,51	106947,1	51515,6	2,076	N/A	100+	1,728	M 7,279
6	1	3048,00	106716,3	50350,2	2,119	N/A	100+	1,743	M 6,679
7	1	3296,96	106312,5	48410,3	2,196	N/A	100+	1,770	M 5,891
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - PluggedPerfs #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	2880,02	106991,0	40802,1	2,622	N/A	100+	2,123	M 8,935
2	1	2880,15	106990,8	40803,6	2,622	N/A	100+	2,123	M 8,934
3	1	2906,33	106947,4	40972,3	2,610	N/A	100+	2,110	M 8,693
4	1	2906,39	106947,3	37512,4	2,851	N/A	100+	2,298	M 9,470
5	1	2906,51	106947,1	22895,0	4,671	N/A	100+	3,563	M 9,482
6	1	3048,00	106716,3	24718,2	4,317	N/A	100+	3,376	M 11,860
7	1	3296,96	106312,5	26540,8	4,006	N/A	100+	3,089	M 8,925
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Movement Summary - Initial Conditions - 20" Surface Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	363,00	0,000	0,000	0,000	0,000	0,000	0,00

Movement Summary - PressureTest #1 - 20" Surface Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	363,00	0,115	-0,001	-0,113	0,000	0,000	290,03

Movement Summary - LostReturnsWithMudDrop #1 - 20" Surface Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	363,00	-0,011	0,000	0,010	0,001	0,000	0,00

Movement Summary - GreenCement #1 - 20" Surface Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	363,00	0,078	0,000	0,000	0,000	0,078	0,00

Movement Summary - OverPull #1 - 20" Surface Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	363,00	0,016	0,000	0,000	0,000	0,016*	0,00
2								

3 *** Surface displacement due to pickup (+) or slackoff (-)**

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Movement Summary - RunningHole #1 - 20" Surface Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	No results available for this load case							
2								
3								
4								
5								

Movement Summary - Initial Conditions - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	1800,00	0,000	0,000	0,000	0,000	0,000	0,00

Movement Summary - PressureTest #1 - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	1800,00	0,908	-0,004	-0,905	0,000	0,000	754,56

Movement Summary - LostReturnsWithMudDrop #1 - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	1800,00	-0,089	0,000	0,088	0,001	0,000	0,00

Movement Summary - GreenCement #1 - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	1800,00	0,643	0,000	0,000	0,000	0,643	0,00

Movement Summary - OverPull #1 - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	1800,00	0,178	0,000	0,000	0,000	0,178*	0,00
2								
3	*** Surface displacement due to pickup (+) or slackoff (-)**							

Movement Summary - RunningHole #1 - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	No results available for this load case							
2								
3								
4								
5								

Movement Summary - Initial Conditions - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2500,00	0,000	0,000	0,000	0,000	0,000	0,00

Movement Summary - PressureTest #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2500,00	0,822	0,000	-0,822	0,000	0,000	71,83

Movement Summary - LostReturnsWithMudDrop #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2500,00	-0,194	0,000	0,192	0,001	0,000	0,00

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Movement Summary - GreenCement #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2500,00	0,650	0,000	0,000	0,000	0,650	0,00

Movement Summary - OverPull #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2500,00	0,312	0,000	0,000	0,000	0,312*	0,00
2								
3	*** Surface displacement due to pickup (+) or slackoff (-)**							

Movement Summary - RunningHole #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No results available for this load case							
4								
5								

Movement Summary - Initial Conditions - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

Movement Summary - PressureTest #1 - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

Movement Summary - LostReturnsWithMudDrop #1 - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

Movement Summary - GreenCement #1 - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

Movement Summary - OverPull #1 - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No length changes - Pipe is fully cemented							
4								
5								

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Movement Summary - RunningHole #1 - 7" Production Liner

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	No length changes - Pipe is fully cemented							
2								
3								
4								
5								

Movement Summary - TubingLeak #1 - 7" Production Liner

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	No length changes - Pipe is fully cemented							
2								
3								
4								
5								

Movement Summary - PluggedPerfs #1 - 7" Production Liner

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	No length changes - Pipe is fully cemented							
2								
3								
4								
5								

5.2.2.2 Slender Well Design

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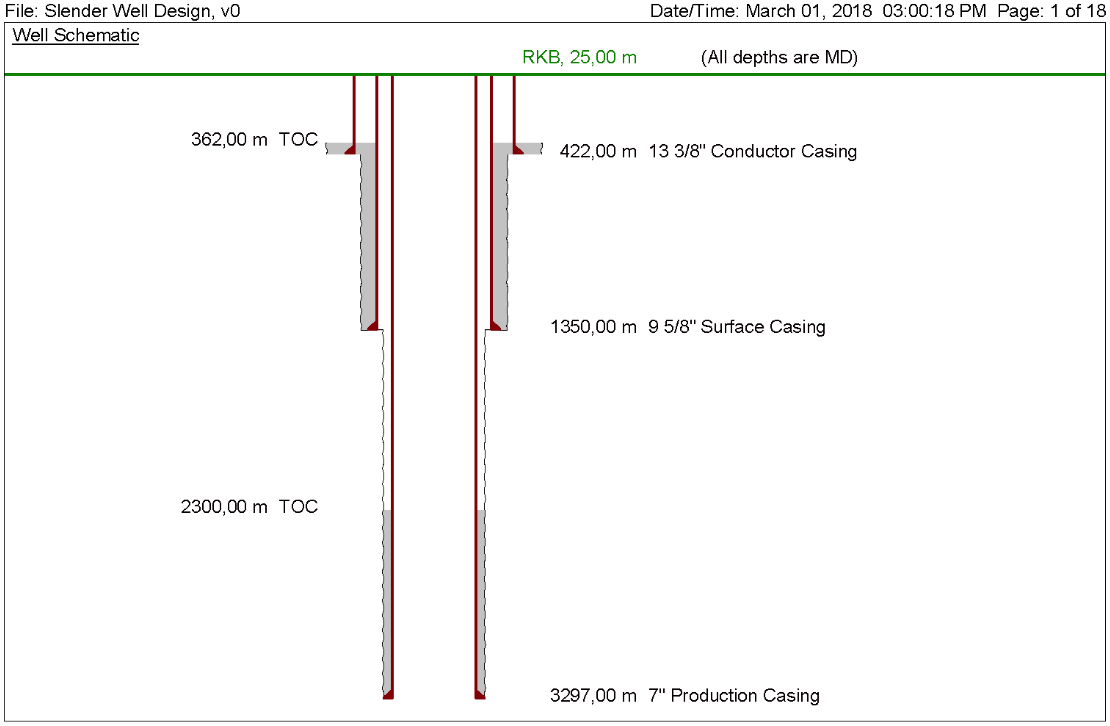

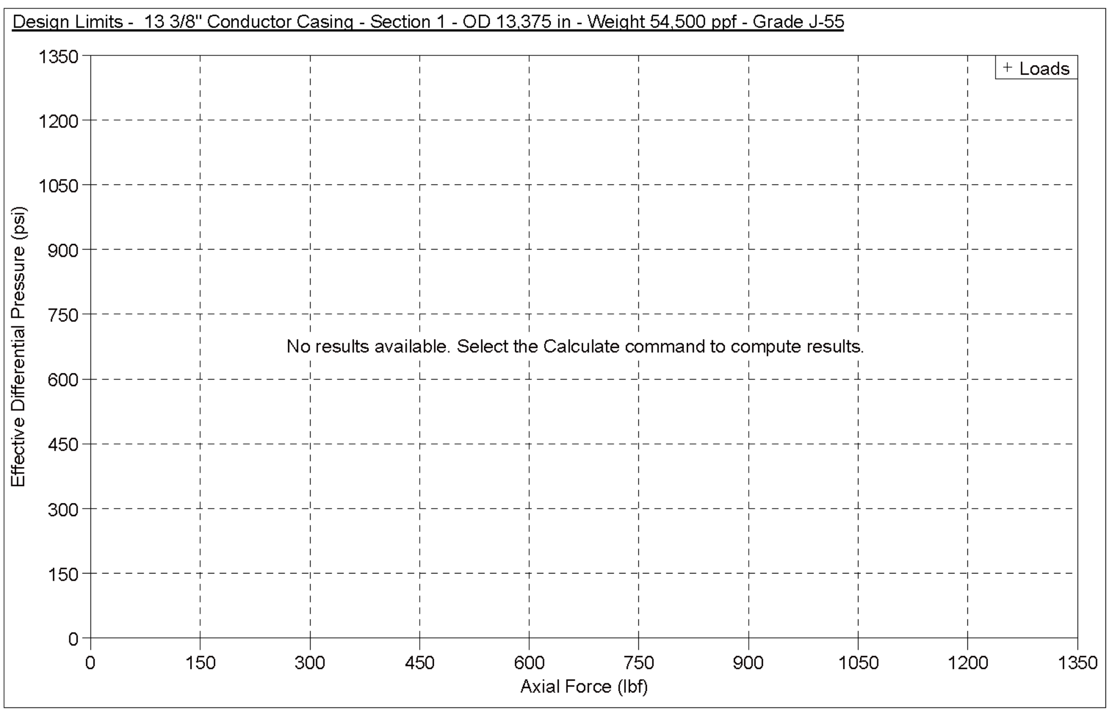

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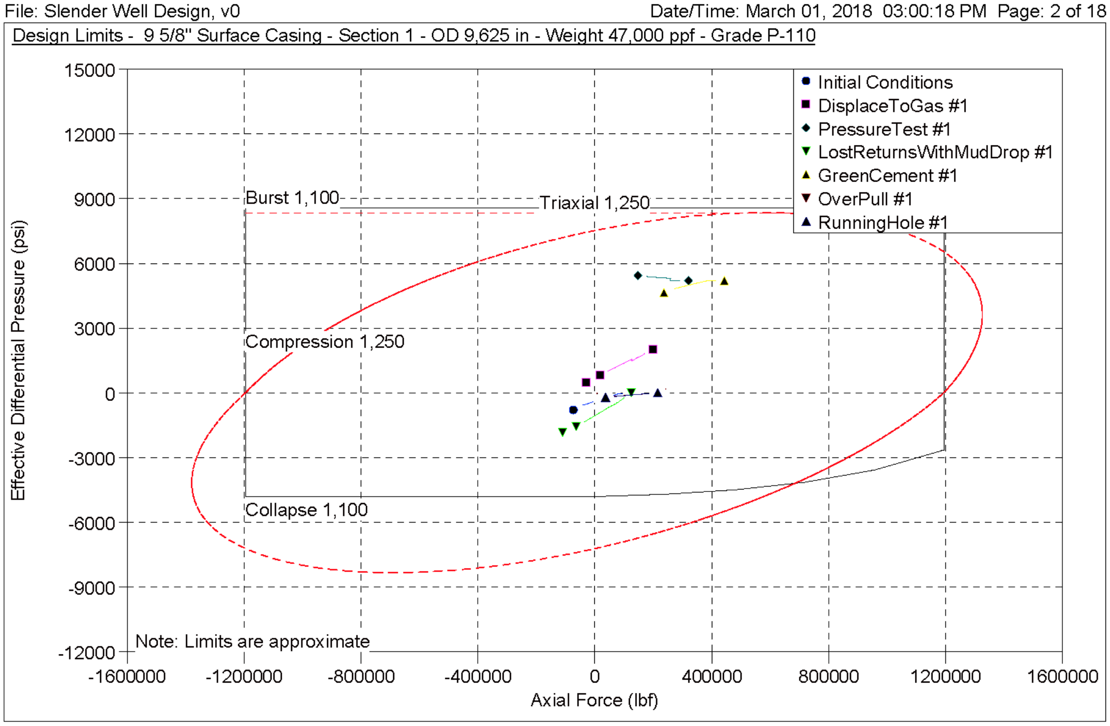

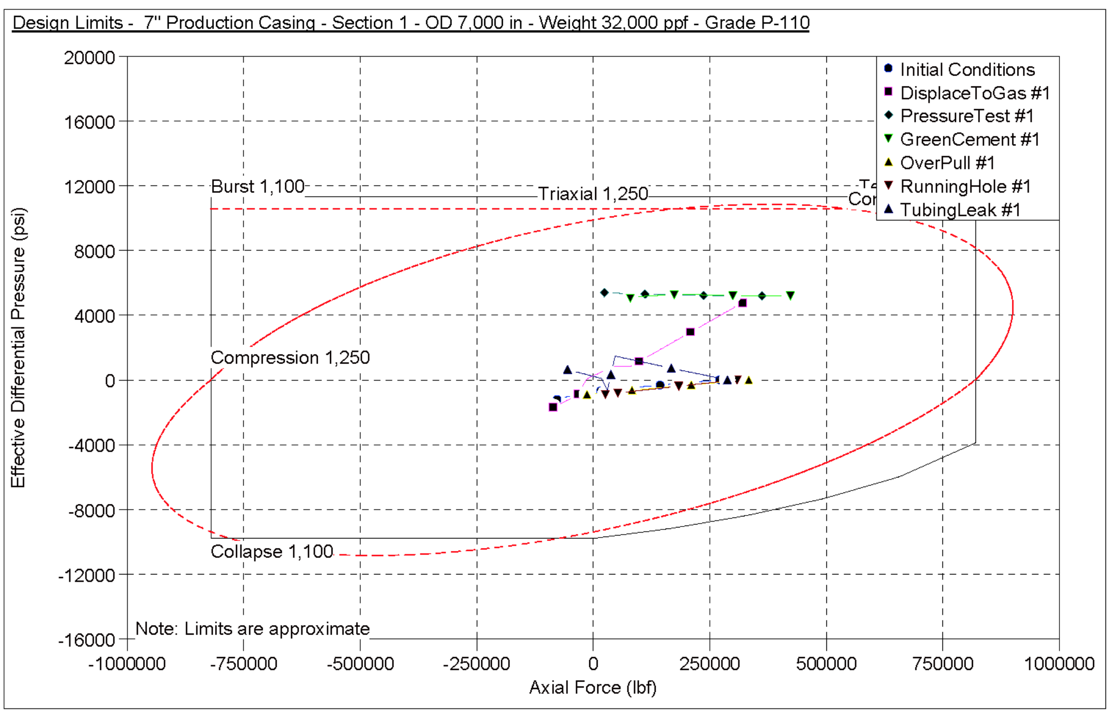

Ratings Summary - 13 3/8" Conductor Casing

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	13,375	54,500	J-55	BTC	K-55	2734,58	1130,82	853242	853242
2										
3	**L = Connection Leak**									
4	**B = Connection Burst**									
5	**F = Connection Fracture**									
6	**J = Connection Jump-out**									
7	**Y = Connection Yield**									
8	**C = Connection**									

Ratings Summary - 9 5/8" Surface Casing

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	9,625	47,000	P-110	BTC	P-110	L 9160,78	5296,42	1492959	1492959
2										
3	**L = Connection Leak**									
4	**B = Connection Burst**									
5	**F = Connection Fracture**									
6	**J = Connection Jump-out**									
7	**Y = Connection Yield**									
8	**C = Connection**									

Ratings Summary - 7" Production Casing

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	7,000	32,000	P-110	BTC	P-110	B 11634,34	10780,84	1024904	1024904
2										
3	**L = Connection Leak**									
4	**B = Connection Burst**									
5	**F = Connection Fracture**									
6	**J = Connection Jump-out**									
7	**Y = Connection Yield**									
8	**C = Connection**									

Casing Load Summary - Initial Conditions - 13 3/8" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi)	
								Internal	External
1	1	0,03	55621	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	51162	0,00	0,0	0,0	49,00	38,30	38,30
3	1	304,80	1126	0,00	0,0	0,0	37,39	467,53	467,54
4	1	361,98	-9096	0,00	0,0	0,0	35,00	555,22	555,22
5	1	362,04	-9107	0,00	0,0	0,0	35,00	555,32	555,35
6	1	421,97	-19824	0,00	0,0	0,0	38,00	647,25	716,76
7									
8	**Additional Pickup to Prevent Buckling = 482 lbf**								

Casing Load Summary - PressureTest #1 - 13 3/8" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi)	
								Internal	External
1	1	0,03	179804	0,16	4,6	0,0	50,00	1600,05	0,04
2	1	24,96	175345	0,20	6,0	0,0	49,00	1638,30	36,59
3	1	152,40	152560	0,37	15,3	0,0	43,70	1833,77	223,38
4	1	304,80	125310	0,57	29,6	0,0	37,39	2067,53	446,76
5	1	361,98	115088	0,64	35,8	0,0	35,00	2155,22	530,55
6	1	362,04	110887	0,00	0,0	0,0	35,00	2155,32	555,32
7	1	421,97	106364	0,00	0,0	0,0	38,00	2247,25	643,17
8									
9	**Additional Pickup to Prevent Buckling = 82896 lbf**								

Casing Load Summary - LostReturnsWithMudDrop #1 - 13 3/8" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi)	
								Internal	External
1	1	0,03	33201	0,00	0,0	0,0	50,00	0,00	0,05
2	1	24,96	28742	0,00	0,0	0,0	50,00	0,00	38,30
3	1	304,80	-21294	0,00	0,0	0,0	37,54	0,00	467,53
4	1	361,98	-31516	0,00	0,0	0,0	35,00	0,00	555,22
5	1	362,04	-50749	0,00	0,0	0,0	35,00	0,00	555,32
6	1	421,97	-62353	0,00	0,0	0,0	37,95	0,00	647,25

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Casing Load Summary - OverPull #1 - 13 3/8" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	85396	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	80937	0,00	0,0	0,0	49,00	38,30	38,30
3	1	304,80	30902	0,00	0,0	0,0	37,39	467,53	467,53
4	1	361,98	20679	0,00	0,0	0,0	35,00	555,23	555,23
5	1	362,04	20669	0,00	0,0	0,0	35,00	555,32	555,32
6	1	421,97	9951	0,00	0,0	0,0	38,00	647,25	647,25

Casing Load Summary - RunningHole #1 - 13 3/8" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	107296	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	103430	0,00	0,0	0,0	49,00	38,30	38,30
3	1	304,80	60053	0,00	0,0	0,0	37,39	467,53	467,53
4	1	361,98	51192	0,00	0,0	0,0	35,00	555,23	555,23
5	1	362,04	51182	0,00	0,0	0,0	35,00	555,32	555,32
6	1	421,97	41891	0,00	0,0	0,0	38,00	647,25	647,25

Casing Load Summary - Initial Conditions - 9 5/8" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	135595	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	131749	0,00	0,0	0,0	49,00	40,43	40,43
3	1	304,80	88600	0,00	0,0	0,0	37,39	493,51	493,51
4	1	361,98	79784	0,00	0,0	0,0	35,00	586,07	586,07
5	1	362,04	79775	0,00	0,0	0,0	35,00	586,17	586,18
6	1	421,97	70532	0,00	0,0	0,0	37,99	683,21	713,88
7	1	422,03	70523	0,00	0,0	0,0	37,99	683,31	714,01
8	1	609,60	41600	0,00	0,0	0,0	47,18	987,01	1113,61
9	1	914,40	-5400	0,00	0,0	0,0	62,22	1480,52	1762,96
10	1	1200,00	-49440	0,00	0,0	0,0	76,20	1942,94	2371,41
11	1	1219,20	-52400	0,00	0,0	0,0	77,16	1974,02	2423,11
12	1	1349,96	-72565	0,00	0,0	0,0	83,60	2185,75	2775,25

Casing Load Summary - DisplaceToGas #1 - 9 5/8" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	198568	0,00	0,0	0,0	50,00	2002,00	0,04
2	1	24,96	194723	0,00	0,0	0,0	50,00	2010,18	35,45
3	1	304,80	151573	0,00	0,0	0,0	37,54	2101,99	432,73
4	1	361,98	142758	0,00	0,0	0,0	35,00	2120,74	513,89
5	1	362,04	134273	0,00	0,0	0,0	35,00	2120,76	586,16
6	1	421,97	124256	0,00	0,0	0,0	37,95	2140,43	671,26
7	1	422,03	128070	0,00	0,0	0,0	37,95	2140,45	583,71
8	1	609,60	95613	0,00	0,0	0,0	47,19	2201,99	864,16
9	1	914,40	43119	0,00	0,0	0,0	62,19	2301,99	1319,91
10	1	1200,00	-5512	0,00	0,0	0,0	76,24	2395,69	1746,94
11	1	1219,20	-8545	0,00	0,0	0,0	77,19	2401,99	1775,65
12	1	1349,96	-28334	0,00	0,0	0,0	83,63	2444,89	1971,17

Casing Load Summary - PressureTest #1 - 9 5/8" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	320909	0,00	0,0	0,0	50,00	5200,05	0,05
2	1	24,96	317064	0,00	0,0	0,0	49,00	5240,43	40,43
3	1	152,40	297415	0,08	0,6	0,0	43,70	5446,75	246,75
4	1	304,80	273967	0,33	4,5	0,0	37,39	5693,51	493,51
5	1	361,98	265207	0,42	6,5	0,0	35,00	5786,07	586,07
6	1	362,04	264442	0,00	0,0	0,0	35,00	5786,17	586,16
7	1	421,97	257057	0,00	0,0	0,0	37,99	5883,21	671,26
8	1	422,03	260877	0,00	0,0	0,0	37,99	5883,31	583,71
9	1	609,60	237154	0,00	0,0	0,0	47,18	6187,01	864,16
10	1	914,40	198606	0,00	0,0	0,0	62,22	6680,52	1319,91
11	1	1200,00	163025	0,00	0,0	0,0	76,20	7142,94	1746,94
12	1	1219,20	160888	0,00	0,0	0,0	77,16	7174,02	1775,65
13	1	1349,96	147201	0,00	0,0	0,0	83,60	7385,75	1971,17
14									
15	**Additional Pickup to Prevent Buckling = 35298 lbf**								

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Casing Load Summary - LostReturnsWithMudDrop #1 - 9 5/8" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	125000	0,00	0,0	0,0	50,00	0,00	0,04
2	1	24,96	121155	0,00	0,0	0,0	50,00	0,00	36,60
3	1	304,80	78005	0,00	0,0	0,0	37,54	0,00	446,76
4	1	361,98	69190	0,00	0,0	0,0	35,00	0,00	530,55
5	1	362,04	58959	0,00	0,0	0,0	35,00	0,00	586,16
6	1	421,97	48124	0,00	0,0	0,0	37,95	0,00	674,02
7	1	422,03	48111	0,00	0,0	0,0	37,95	0,00	674,11
8	1	609,60	13710	0,00	0,0	0,0	47,19	0,00	949,04
9	1	914,40	-41943	0,00	0,0	0,0	62,19	0,00	1395,79
10	1	1200,00	-92561	0,00	0,0	0,0	76,24	0,00	1814,40
11	1	1219,20	-95269	0,00	0,0	0,0	77,19	15,23	1842,54
12	1	1349,96	-109878	0,00	0,0	0,0	83,63	226,23	2034,21

Casing Load Summary - GreenCement #1 - 9 5/8" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	443370	0,00	0,0	0,0	50,00	5200,05	0,05
2	1	24,96	439524	0,00	0,0	0,0	49,00	5240,43	40,43
3	1	304,80	396374	0,00	0,0	0,0	37,39	5693,51	493,51
4	1	361,98	387559	0,00	0,0	0,0	35,00	5786,07	586,07
5	1	362,04	387550	0,00	0,0	0,0	35,00	5786,17	586,18
6	1	421,97	378307	0,00	0,0	0,0	37,99	5883,21	713,88
7	1	422,03	378298	0,00	0,0	0,0	37,99	5883,31	714,01
8	1	609,60	349374	0,00	0,0	0,0	47,18	6187,01	1113,61
9	1	914,40	302374	0,00	0,0	0,0	62,22	6680,52	1762,96
10	1	1200,00	258335	0,00	0,0	0,0	76,20	7142,94	2371,41
11	1	1219,20	255374	0,00	0,0	0,0	77,16	7174,02	2423,11
12	1	1349,96	235210	0,00	0,0	0,0	83,60	7385,75	2775,25

Casing Load Summary - OverPull #1 - 9 5/8" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	228491	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	224646	0,00	0,0	0,0	49,00	40,43	40,43
3	1	304,80	181496	0,00	0,0	0,0	37,39	493,51	493,51
4	1	361,98	172681	0,00	0,0	0,0	35,00	586,07	586,07
5	1	362,04	172671	0,00	0,0	0,0	35,00	586,17	586,17
6	1	421,97	163429	0,00	0,0	0,0	37,99	683,21	683,21
7	1	422,03	163420	0,00	0,0	0,0	37,99	683,31	683,31
8	1	609,60	134496	0,00	0,0	0,0	47,18	987,01	987,01
9	1	914,40	87496	0,00	0,0	0,0	62,22	1480,51	1480,51
10	1	1200,00	43457	0,00	0,0	0,0	76,20	1942,93	1942,93
11	1	1219,20	40496	0,00	0,0	0,0	77,16	1974,02	1974,02
12	1	1349,96	20332	0,00	0,0	0,0	83,60	2185,75	2185,75

Casing Load Summary - RunningHole #1 - 9 5/8" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	215144	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	211847	0,00	0,0	0,0	49,00	40,43	40,43
3	1	304,80	174846	0,00	0,0	0,0	37,39	493,51	493,51
4	1	361,98	167287	0,00	0,0	0,0	35,00	586,07	586,07
5	1	362,04	167279	0,00	0,0	0,0	35,00	586,17	586,17
6	1	421,97	159354	0,00	0,0	0,0	37,99	683,21	683,21
7	1	422,03	159346	0,00	0,0	0,0	37,99	683,31	683,31
8	1	609,60	134544	0,00	0,0	0,0	47,18	987,01	987,01
9	1	914,40	94242	0,00	0,0	0,0	62,22	1480,51	1480,51
10	1	1200,00	56479	0,00	0,0	0,0	76,20	1942,93	1942,93
11	1	1219,20	53940	0,00	0,0	0,0	77,16	1974,02	1974,02
12	1	1349,96	36649	0,00	0,0	0,0	83,60	2185,75	2185,75

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Casing Load Summary - Initial Conditions - 7" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	271235	0,00	0,0	0,0	50,00	0,06	0,06
2	1	24,96	268616	0,00	0,0	0,0	49,00	51,07	51,07
3	1	304,80	239238	0,00	0,0	0,0	37,39	623,38	623,37
4	1	362,01	233233	0,00	0,0	0,0	35,00	740,36	740,36
5	1	609,60	207238	0,00	0,0	0,0	47,18	1246,75	1246,75
6	1	914,40	175238	0,00	0,0	0,0	62,22	1870,13	1870,13
7	1	1219,20	143238	0,00	0,0	0,0	77,16	2493,50	2493,50
8	1	1349,96	129509	0,00	0,0	0,0	83,60	2760,95	2760,95
9	1	1350,02	129503	0,00	0,0	0,0	83,60	2761,07	2761,07
10	1	1524,00	111238	0,00	0,0	0,0	92,20	3116,88	3116,88
11	1	1828,80	79238	0,00	0,0	0,0	107,14	3740,25	3740,25
12	1	2133,60	47238	0,00	0,0	0,0	122,18	4363,63	4363,63
13	1	2299,96	29768	0,00	0,0	0,0	130,40	4703,89	4703,89
14	1	2300,02	29768	0,00	0,0	0,0	130,40	4704,01	4704,02
15	1	2438,40	15238	0,00	0,0	0,0	137,19	4987,01	5022,39
16	1	2743,20	-16762	0,00	0,0	0,0	152,16	5610,38	5723,69
17	1	3048,00	-48762	0,00	0,0	0,0	167,20	6233,76	6424,99
18	1	3296,96	-74904	0,00	0,0	0,0	179,40	6742,95	7056,62

Casing Load Summary - DisplaceToGas #1 - 7" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	320093	0,00	0,0	0,0	50,00	4773,63	0,06
2	1	24,96	317475	0,00	0,0	0,0	50,00	4781,81	51,07
3	1	304,80	288097	0,00	0,0	0,0	37,54	4873,62	623,38
4	1	362,01	282092	0,00	0,0	0,0	35,00	4892,38	740,36
5	1	609,60	256097	0,00	0,0	0,0	47,19	4973,62	1246,75
6	1	914,40	224097	0,00	0,0	0,0	62,19	5073,62	1870,13
7	1	1219,20	192097	0,00	0,0	0,0	77,19	5173,62	2493,50
8	1	1349,96	178368	0,00	0,0	0,0	83,63	5216,52	2760,95
9	1	1350,02	178361	0,00	0,0	0,0	83,63	5216,54	2761,07
10	1	1524,00	160097	0,00	0,0	0,0	92,19	5273,62	3116,88
11	1	1828,80	128097	0,00	0,0	0,0	107,19	5373,62	3740,25
12	1	2133,60	96097	0,00	0,0	0,0	122,19	5473,62	4363,63
13	1	2299,96	78627	0,00	0,0	0,0	130,38	5528,20	4703,89
14	1	2300,02	44225	0,00	0,0	0,0	130,38	5528,22	4704,01
15	1	2438,40	26295	0,00	0,0	0,0	137,19	5573,62	4987,01
16	1	2743,20	-13001	0,00	0,0	0,0	152,20	5673,62	5610,38
17	1	3048,00	-52419	0,00	0,0	0,0	167,20	5773,62	6233,76
18	1	3296,96	-83296	0,00	0,0	0,0	179,45	5855,30	6742,95

Casing Load Summary - PressureTest #1 - 7" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	362236	0,00	0,0	0,0	50,00	5200,06	0,06
2	1	24,96	359618	0,00	0,0	0,0	49,00	5251,07	51,07
3	1	304,80	330240	0,00	0,0	0,0	37,39	5823,37	623,38
4	1	362,01	324234	0,00	0,0	0,0	35,00	5940,36	740,36
5	1	609,60	298240	0,00	0,0	0,0	47,18	6446,75	1246,75
6	1	914,40	266240	0,00	0,0	0,0	62,22	7070,13	1870,13
7	1	1219,20	234240	0,00	0,0	0,0	77,16	7693,50	2493,50
8	1	1349,96	220511	0,00	0,0	0,0	83,60	7960,95	2760,95
9	1	1350,02	220504	0,00	0,0	0,0	83,60	7961,08	2761,07
10	1	1524,00	202240	0,00	0,0	0,0	92,20	8316,88	3116,88
11	1	1828,80	170240	0,00	0,0	0,0	107,14	8940,25	3740,25
12	1	2133,60	138240	0,00	0,0	0,0	122,18	9563,63	4363,63
13	1	2299,96	120770	0,00	0,0	0,0	130,40	9903,89	4703,89
14	1	2300,02	120770	0,00	0,0	0,0	130,40	9904,01	4704,01
15	1	2438,40	107057	0,00	0,0	0,0	137,19	10187,01	4987,01
16	1	2743,20	76856	0,00	0,0	0,0	152,16	10810,38	5610,38
17	1	3048,00	46655	0,00	0,0	0,0	167,20	11433,76	6233,76
18	1	3296,96	23341	0,00	0,0	0,0	179,40	11942,95	6742,95

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Casing Load Summary - GreenCement #1 - 7" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	422904	0,00	0,0	0,0	50,00	5200,06	0,06
2	1	24,96	420286	0,00	0,0	0,0	49,00	5251,07	51,07
3	1	304,80	390907	0,00	0,0	0,0	37,39	5823,38	623,37
4	1	362,01	384902	0,00	0,0	0,0	35,00	5940,36	740,36
5	1	609,60	358907	0,00	0,0	0,0	47,18	6446,75	1246,75
6	1	914,40	326907	0,00	0,0	0,0	62,22	7070,13	1870,13
7	1	1219,20	294907	0,00	0,0	0,0	77,16	7693,50	2493,50
8	1	1349,96	281178	0,00	0,0	0,0	83,60	7960,95	2760,95
9	1	1350,02	281172	0,00	0,0	0,0	83,60	7961,07	2761,07
10	1	1524,00	262907	0,00	0,0	0,0	92,20	8316,88	3116,88
11	1	1828,80	230907	0,00	0,0	0,0	107,14	8940,25	3740,25
12	1	2133,60	198907	0,00	0,0	0,0	122,18	9563,63	4363,63
13	1	2299,96	181438	0,00	0,0	0,0	130,40	9903,89	4703,89
14	1	2300,02	181438	0,00	0,0	0,0	130,40	9904,01	4704,02
15	1	2438,40	166907	0,00	0,0	0,0	137,19	10187,01	5022,39
16	1	2743,20	134907	0,00	0,0	0,0	152,16	10810,38	5723,69
17	1	3048,00	102907	0,00	0,0	0,0	167,20	11433,76	6424,99
18	1	3296,96	76766	0,00	0,0	0,0	179,40	11942,95	7056,62

Casing Load Summary - OverPull #1 - 7" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	333308	0,00	0,0	0,0	50,00	0,06	0,06
2	1	24,96	330689	0,00	0,0	0,0	49,00	51,07	51,07
3	1	304,80	301311	0,00	0,0	0,0	37,39	623,38	623,38
4	1	362,01	295306	0,00	0,0	0,0	35,00	740,36	740,36
5	1	609,60	269311	0,00	0,0	0,0	47,18	1246,75	1246,75
6	1	914,40	237311	0,00	0,0	0,0	62,22	1870,13	1870,13
7	1	1219,20	205311	0,00	0,0	0,0	77,16	2493,50	2493,50
8	1	1349,96	191582	0,00	0,0	0,0	83,60	2760,95	2760,95
9	1	1350,02	191576	0,00	0,0	0,0	83,60	2761,08	2761,08
10	1	1524,00	173311	0,00	0,0	0,0	92,20	3116,88	3116,88
11	1	1828,80	141311	0,00	0,0	0,0	107,14	3740,26	3740,26
12	1	2133,60	109311	0,00	0,0	0,0	122,18	4363,63	4363,63
13	1	2299,96	91841	0,00	0,0	0,0	130,40	4703,89	4703,89
14	1	2300,02	91841	0,00	0,0	0,0	130,40	4704,01	4704,01
15	1	2438,40	77311	0,00	0,0	0,0	137,19	4987,01	4987,01
16	1	2743,20	45311	0,00	0,0	0,0	152,16	5610,38	5610,38
17	1	3048,00	13311	0,00	0,0	0,0	167,20	6233,76	6233,76
18	1	3296,96	-12831	0,00	0,0	0,0	179,40	6742,95	6742,95

Casing Load Summary - RunningHole #1 - 7" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	308469	0,00	0,0	0,0	50,00	0,06	0,06
2	1	24,96	306326	0,00	0,0	0,0	49,00	51,07	51,07
3	1	304,80	282280	0,00	0,0	0,0	37,39	623,38	623,38
4	1	362,01	277365	0,00	0,0	0,0	35,00	740,36	740,36
5	1	609,60	256088	0,00	0,0	0,0	47,18	1246,75	1246,75
6	1	914,40	229896	0,00	0,0	0,0	62,22	1870,13	1870,13
7	1	1219,20	203705	0,00	0,0	0,0	77,16	2493,50	2493,50
8	1	1349,96	192467	0,00	0,0	0,0	83,60	2760,95	2760,95
9	1	1350,02	192462	0,00	0,0	0,0	83,60	2761,08	2761,08
10	1	1524,00	177513	0,00	0,0	0,0	92,20	3116,88	3116,88
11	1	1828,80	151321	0,00	0,0	0,0	107,14	3740,26	3740,26
12	1	2133,60	125129	0,00	0,0	0,0	122,18	4363,63	4363,63
13	1	2299,96	110833	0,00	0,0	0,0	130,40	4703,89	4703,89
14	1	2300,02	110828	0,00	0,0	0,0	130,40	4704,01	4704,01
15	1	2438,40	98937	0,00	0,0	0,0	137,19	4987,01	4987,01
16	1	2743,20	72745	0,00	0,0	0,0	152,16	5610,38	5610,38
17	1	3048,00	46554	0,00	0,0	0,0	167,20	6233,76	6233,76
18	1	3296,96	25159	0,00	0,0	0,0	179,40	6742,95	6742,95

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Casing Load Summary - TubingLeak #1 - 7" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	287721	0,00	0,0	0,0	50,00	0,06	0,04
2	1	24,96	285102	0,00	0,0	0,0	50,00	51,07	35,45
3	1	304,80	255724	0,00	0,0	0,0	37,54	623,38	432,72
4	1	362,01	249719	0,00	0,0	0,0	35,00	740,36	513,93
5	1	609,60	223724	0,00	0,0	0,0	47,19	1246,75	865,45
6	1	914,40	191724	0,00	0,0	0,0	62,19	1870,13	1298,18
7	1	1219,20	159724	0,00	0,0	0,0	77,19	2493,50	1730,90
8	1	1349,96	145995	0,00	0,0	0,0	83,63	2760,95	1916,56
9	1	1350,02	145988	0,00	0,0	0,0	83,63	2761,08	1916,64
10	1	1524,00	127724	0,00	0,0	0,0	92,19	3116,88	2163,63
11	1	1828,80	95724	0,00	0,0	0,0	107,19	3740,26	2596,36
12	1	2133,60	63724	0,00	0,0	0,0	122,19	4363,63	3029,08
13	1	2299,96	46254	0,00	0,0	0,0	130,38	4703,89	3265,28
14	1	2300,02	29802	0,00	0,0	0,0	130,38	4704,01	4703,99
15	1	2438,40	18028	0,00	0,0	0,0	137,19	4987,01	4900,44
16	1	2743,20	-7707	0,00	0,0	0,0	152,20	5610,38	5333,17
17	1	3048,00	-33563	0,00	0,0	0,0	167,20	6233,76	5765,89
18	1	3296,96	-53363	0,00	0,0	0,0	179,45	6742,95	6119,36

Safety Factor Summary - Initial Conditions - 13 3/8" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	55000,0	3585,3	D 15,340	N/A	100+	100+	15,350
2	1	24,96	55000,0	3336,1	D 16,486	N/A	100+	100+	16,687
3	1	304,80	55000,0	550,0	D 100+	N/A	100+	42,561	M 100+
4	1	361,98	55000,0	550,0	DN 100+	N/A	100+	35,846	M 92,074
5	1	362,04	55000,0	550,0	DN 100+	N/A	100+	35,800	M 91,952
6	1	421,97	55000,0	1244,7	44,188	N/A	100+	10,641	M 42,970
7									
8	**Burst and Axial Flags**								
9	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
10									
11	**Axial Flags**								
12	**Default = Tension, M = Compression**								
13									
14	**Triaxial Flags**								
15	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
16									
17	**Envelope Flags**								
18	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - PressureTest #1 - 13 3/8" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	55000,0	28826,0	N 1,908	N/A	1,709	100+	4,561
2	1	24,96	55000,0	28904,8	N 1,903	N/A	1,707	100+	4,634
3	1	304,80	55000,0	30071,1	N 1,829	N/A	1,687	100+	5,652
4	1	361,98	55000,0	30370,0	N 1,811	N/A	1,683	100+	5,918
5	1	362,04	55000,0	29474,8	N 1,866	N/A	1,709	100+	7,687
6	1	421,97	55000,0	29603,3	N 1,858	N/A	1,705	100+	8,023
7									
8	**Burst and Axial Flags**								
9	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
10									
11	**Axial Flags**								
12	**Default = Tension, M = Compression**								
13									
14	**Triaxial Flags**								
15	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
16									
17	**Envelope Flags**								
18	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - LostReturnsWithMudDrop #1 - 13 3/8" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	55000,0	2140,6	D 25,694	N/A	100+	100+	25,715
2	1	24,96	55000,0	2349,5	23,410	N/A	100+	29,451	29,705
3	1	304,80	55000,0	9035,3	6,087	N/A	100+	2,419	M 40,094
4	1	361,98	55000,0	10583,1	5,197	N/A	100+	2,037	M 27,090
5	1	362,04	55000,0	10221,2	5,381	N/A	100+	2,037	M 16,764
6	1	421,97	55000,0	11863,0	4,636	N/A	100+	1,747	M 13,683
7									

8 **Burst and Axial Flags**
9 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
10
11 **Axial Flags**
12 **Default = Tension, M = Compression**
13
14 **Triaxial Flags**
15 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
16
17 **Envelope Flags**
18 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - OverPull #1 - 13 3/8" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	55000,0	5504,6	D 9,992	N/A	100+	100+	9,998
2	1	24,96	55000,0	5255,4	D 10,465	N/A	100+	100+	10,548
3	1	304,80	55000,0	2459,4	D 22,363	N/A	100+	42,450	27,628
4	1	361,98	55000,0	1888,2	D 29,128	N/A	100+	35,781	41,285
5	1	362,04	55000,0	1887,6	D 29,138	N/A	100+	35,775	41,307
6	1	421,97	55000,0	1288,7	D 42,679	N/A	100+	30,723	85,794
7									

8 **Burst and Axial Flags**
9 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
10
11 **Axial Flags**
12 **Default = Tension, M = Compression**
13
14 **Triaxial Flags**
15 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
16
17 **Envelope Flags**
18 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - RunningHole #1 - 13 3/8" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	55000,0	6916,3	D 7,952	N/A	100+	100+	7,957
2	1	24,96	55000,0	6705,3	D 8,202	N/A	100+	100+	8,254
3	1	304,80	55000,0	4338,5	D 12,677	N/A	100+	42,316	14,217
4	1	361,98	55000,0	3855,0	D 14,267	N/A	100+	35,669	16,678
5	1	362,04	55000,0	3854,5	D 14,269	N/A	100+	35,663	16,681
6	1	421,97	55000,0	3347,5	D 16,430	N/A	100+	30,629	20,380
7									

8 **Burst and Axial Flags**
9 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
10
11 **Axial Flags**
12 **Default = Tension, M = Compression**
13
14 **Triaxial Flags**
15 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
16
17 **Envelope Flags**
18 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - Initial Conditions - 9 5/8" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	9990,5	D 11,010	N/A	100+	100+	11,017
2	1	24,96	110000,0	9747,5	D 11,285	N/A	100+	100+	11,339
3	1	304,80	110000,0	7021,4	D 15,666	N/A	100+	100+	16,861
4	1	361,98	110000,0	6464,4	D 17,016	N/A	100+	91,619	18,724
5	1	362,04	110000,0	6463,9	D 17,017	N/A	100+	91,578	18,726
6	1	421,97	110000,0	6075,2	18,106	N/A	100+	53,957	21,180
7	1	422,03	110000,0	6074,8	18,108	N/A	100+	53,935	21,183
8	1	609,60	110000,0	5004,0	21,982	N/A	100+	23,643	35,910
9	1	914,40	110000,0	4088,9	26,902	N/A	100+	12,386	100+
10	1	1200,00	109728,6	4608,1	23,812	N/A	100+	8,553	M 30,141
11	1	1219,20	109696,8	4810,2	22,805	N/A	100+	8,238	M 28,430
12	1	1349,96	109483,7	6230,2	17,573	N/A	100+	6,583	M 20,490
13									

14 **Burst and Axial Flags**
15 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
16
17 **Axial Flags**
18 **Default = Tension, M = Compression**
19
20 **Triaxial Flags**
21 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
22
23 **Envelope Flags**
24 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - DisplaceToGas #1 - 9 5/8" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	21571,1	5,099	N/A	L 4,576	100+	7,523
2	1	24,96	110000,0	21267,7	5,172	N/A	L 4,639	100+	7,672
3	1	304,80	110000,0	17872,5	6,155	N/A	L 5,488	100+	9,856
4	1	361,98	110000,0	17181,5	6,402	N/A	L 5,701	100+	10,464
5	1	362,04	110000,0	16399,5	6,708	N/A	L 5,969	100+	11,126
6	1	421,97	110000,0	15668,0	7,021	N/A	L 6,235	100+	12,022
7	1	422,03	110000,0	16547,6	6,647	N/A	L 5,885	100+	11,664
8	1	609,60	110000,0	14148,7	7,775	N/A	L 6,848	100+	15,624
9	1	914,40	110000,0	10366,8	10,611	N/A	L 9,328	100+	34,645
10	1	1200,00	109727,1	7115,4	15,421	N/A	L 14,086	100+	100+
11	1	1219,20	109695,8	6912,0	15,870	N/A	L 14,585	100+	100+
12	1	1349,96	109482,8	5597,4	19,560	N/A	L 19,247	100+	M 52,475
13									

14 **Burst and Axial Flags**
15 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
16
17 **Axial Flags**
18 **Default = Tension, M = Compression**
19
20 **Triaxial Flags**
21 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
22
23 **Envelope Flags**
24 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - PressureTest #1 - 9 5/8" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	54899,3	2,004	N/A	L 1,762	100+	4,655
2	1	24,96	110000,0	54912,3	2,003	N/A	L 1,762	100+	4,712
3	1	152,40	110000,0	55008,3	N 2,000	N/A	L 1,762	100+	4,983
4	1	304,80	110000,0	55198,7	N 1,993	N/A	L 1,762	100+	5,274
5	1	361,98	110000,0	55287,5	N 1,990	N/A	L 1,762	100+	5,392
6	1	362,04	110000,0	55197,9	1,993	N/A	L 1,762	100+	5,649
7	1	421,97	110000,0	55385,5	1,986	N/A	L 1,758	100+	5,811
8	1	422,03	110000,0	56334,0	1,953	N/A	L 1,729	100+	5,726
9	1	609,60	110000,0	56799,4	1,937	N/A	L 1,721	100+	6,299
10	1	914,40	110000,0	57643,0	1,908	N/A	L 1,709	100+	7,522
11	1	1200,00	109728,6	58518,5	1,875	N/A	L 1,694	100+	9,141
12	1	1219,20	109696,8	58576,0	1,873	N/A	L 1,692	100+	9,260
13	1	1349,96	109483,7	58959,4	1,857	N/A	L 1,684	100+	10,101
14									
15	**Burst and Axial Flags**								
16	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
17									
18	**Axial Flags**								
19	**Default = Tension, M = Compression**								
20									
21	**Triaxial Flags**								
22	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
23									
24	**Envelope Flags**								
25	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - LostReturnsWithMudDrop #1 - 9 5/8" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	9210,1	D 11,943	N/A	100+	100+	11,951
2	1	24,96	110000,0	9157,4	12,012	N/A	100+	100+	12,330
3	1	152,40	110000,0	9146,9	12,026	N/A	100+	23,532	14,717
4	1	304,80	110000,0	9689,0	11,353	N/A	100+	11,790	19,151
5	1	361,98	110000,0	10031,9	10,965	N/A	100+	9,935	21,591
6	1	362,04	110000,0	10039,9	10,956	N/A	100+	8,999	25,337
7	1	421,97	110000,0	10440,7	10,536	N/A	100+	7,833	31,042
8	1	422,03	110000,0	10441,0	10,535	N/A	100+	7,832	31,050
9	1	609,60	110000,0	12091,1	9,098	N/A	100+	5,577	100+
10	1	914,40	110000,0	15678,5	7,016	N/A	100+	3,795	M 35,616
11	1	1200,00	109727,1	19591,6	5,601	N/A	100+	2,918	M 16,099
12	1	1219,20	109695,8	19702,2	5,568	N/A	100+	2,895	M 15,637
13	1	1318,81	109533,6	19553,3	5,602	N/A	100+	2,873	M 13,932
14	1	1349,96	109482,8	19319,3	5,667	N/A	100+	2,892	M 13,532
15									
16	**Burst and Axial Flags**								
17	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
18									
19	**Axial Flags**								
20	**Default = Tension, M = Compression**								
21									
22	**Triaxial Flags**								
23	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
24									
25	**Envelope Flags**								
26	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - GreenCement #1 - 9 5/8" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	55178,1	1,994	N/A	L 1,762	100+	3,369
2	1	24,96	110000,0	55151,3	1,995	N/A	L 1,762	100+	3,399
3	1	304,80	110000,0	54923,2	2,003	N/A	L 1,762	100+	3,769
4	1	361,98	110000,0	54893,1	2,004	N/A	L 1,762	100+	3,855
5	1	362,04	110000,0	54892,9	2,004	N/A	L 1,762	100+	3,855
6	1	421,97	110000,0	54552,0	2,016	N/A	L 1,772	100+	3,949
7	1	422,03	110000,0	54551,7	2,016	N/A	L 1,772	100+	3,949
8	1	609,60	110000,0	53502,6	2,056	N/A	L 1,806	100+	4,276
9	1	914,40	110000,0	51858,6	2,121	N/A	L 1,863	100+	4,940
10	1	1200,00	109728,6	50391,5	2,178	N/A	L 1,915	100+	5,768
11	1	1219,20	109696,8	50178,0	2,186	N/A	L 1,923	100+	5,834
12	1	1349,96	109483,7	48727,2	2,247	N/A	L 1,978	100+	6,321
13									
14	**Burst and Axial Flags**								
15	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
16									
17	**Axial Flags**								
18	**Default = Tension, M = Compression**								
19									
20	**Triaxial Flags**								
21	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
22									
23	**Envelope Flags**								
24	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - OverPull #1 - 9 5/8" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	16834,9	D 6,534	N/A	100+	100+	6,538
2	1	24,96	110000,0	16592,0	D 6,630	N/A	100+	100+	6,650
3	1	304,80	110000,0	13865,9	D 7,933	N/A	100+	100+	8,231
4	1	361,98	110000,0	13308,9	D 8,265	N/A	100+	90,806	8,651
5	1	362,04	110000,0	13308,3	D 8,266	N/A	100+	90,790	8,651
6	1	421,97	110000,0	12724,4	D 8,645	N/A	100+	77,972	9,141
7	1	422,03	110000,0	12723,8	D 8,645	N/A	100+	77,961	9,141
8	1	609,60	110000,0	10896,5	D 10,095	N/A	100+	54,133	11,107
9	1	914,40	110000,0	7927,1	D 13,876	N/A	100+	36,244	17,073
10	1	1200,00	109728,6	5144,7	D 21,328	N/A	100+	27,700	34,291
11	1	1219,20	109696,8	4957,7	D 22,127	N/A	100+	27,268	36,787
12	1	1349,96	109483,7	3683,7	D 29,721	N/A	100+	24,653	73,129
13									
14	**Burst and Axial Flags**								
15	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
16									
17	**Axial Flags**								
18	**Default = Tension, M = Compression**								
19									
20	**Triaxial Flags**								
21	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
22									
23	**Envelope Flags**								
24	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Conventional Well Design WELLCAT 5000.1.13.1

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Safety Factor Summary - RunningHole #1 - 9 5/8" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	15851,5	D 6,939	N/A	100+	100+	6,944
2	1	24,96	110000,0	15648,9	D 7,029	N/A	100+	100+	7,052
3	1	304,80	110000,0	13375,9	D 8,224	N/A	100+	100+	8,544
4	1	361,98	110000,0	12911,5	D 8,520	N/A	100+	90,859	8,930
5	1	362,04	110000,0	12911,0	D 8,520	N/A	100+	90,844	8,930
6	1	421,97	110000,0	12424,1	D 8,854	N/A	100+	78,006	9,374
7	1	422,03	110000,0	12423,6	D 8,854	N/A	100+	77,995	9,375
8	1	609,60	110000,0	10900,0	D 10,092	N/A	100+	54,133	11,103
9	1	914,40	110000,0	8424,1	D 13,058	N/A	100+	36,223	15,851
10	1	1200,00	109728,6	6104,2	D 17,976	N/A	100+	27,673	26,385
11	1	1219,20	109696,8	5948,2	D 18,442	N/A	100+	27,240	27,618
12	1	1349,96	109483,7	4886,0	D 22,408	N/A	100+	24,624	40,569
13									
14	**Burst and Axial Flags**								
15	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
16									
17	**Axial Flags**								
18	**Default = Tension, M = Compression**								
19									
20	**Triaxial Flags**								
21	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
22									
23	**Envelope Flags**								
24	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - Initial Conditions - 7" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	29110,6	D 3,779	N/A	100+	100+	3,781
2	1	24,96	110000,0	28880,6	D 3,809	N/A	100+	100+	3,818
3	1	304,80	110000,0	26299,8	D 4,183	N/A	100+	100+	4,287
4	1	362,01	110000,0	25772,3	D 4,268	N/A	100+	100+	4,397
5	1	609,60	110000,0	23488,8	D 4,683	N/A	100+	61,389	4,949
6	1	914,40	110000,0	20677,7	D 5,320	N/A	100+	41,572	5,852
7	1	1219,20	109696,8	17866,6	D 6,140	N/A	100+	31,574	7,140
8	1	1349,96	109483,7	16660,6	D 6,571	N/A	100+	28,646	7,881
9	1	1350,02	109483,6	16660,0	D 6,572	N/A	100+	28,644	7,882
10	1	1524,00	109198,9	15055,5	D 7,253	N/A	100+	25,524	9,152
11	1	1828,80	108704,3	12244,5	D 8,878	N/A	100+	21,477	12,790
12	1	2133,60	108206,6	9433,4	D 11,471	N/A	100+	18,575	21,356
13	1	2299,96	107934,5	7898,7	D 13,665	N/A	100+	17,311	33,803
14	1	2300,02	107934,4	7898,9	D 13,664	N/A	100+	17,310	33,803
15	1	2438,40	107709,6	6794,0	15,854	N/A	100+	15,537	65,899
16	1	2743,20	107214,1	4437,7	24,160	N/A	100+	12,628	M 59,631
17	1	3048,00	106716,3	2448,4	43,587	N/A	100+	10,588	M 20,403
18	1	3147,00	106555,8	2071,8	51,432	N/A	100+	10,058	M 16,793
19	1	3296,96	106312,5	2548,4	41,717	N/A	100+	8,884	M 13,232
20									
21	**Burst and Axial Flags**								
22	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
23									
24	**Axial Flags**								
25	**Default = Tension, M = Compression**								
26									
27	**Triaxial Flags**								
28	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
29									
30	**Envelope Flags**								
31	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - DisplaceToGas #1 - 7" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	42179,1	2,608	N/A	B 2,437	100+	3,204
2	1	24,96	110000,0	41831,9	2,630	N/A	B 2,459	100+	3,230
3	1	304,80	110000,0	37945,4	2,899	N/A	B 2,737	100+	3,560
4	1	362,01	110000,0	37153,4	2,961	N/A	B 2,802	100+	3,635
5	1	609,60	110000,0	33736,7	3,261	N/A	B 3,122	100+	4,004
6	1	914,40	110000,0	29564,1	3,721	N/A	B 3,632	100+	4,576
7	1	1219,20	109695,8	25445,4	4,311	N/A	B 4,329	100+	5,324
8	1	1349,96	109482,8	23702,0	4,619	N/A	B 4,716	100+	5,722
9	1	1350,02	109482,7	23701,2	4,619	N/A	B 4,716	100+	5,723
10	1	1524,00	109199,3	21411,9	5,100	N/A	B 5,355	100+	6,359
11	1	1828,80	108702,7	17522,3	6,204	N/A	B 7,039	100+	7,911
12	1	2133,60	108206,1	13898,1	7,786	N/A	B 10,311	100+	10,498
13	1	2299,96	107935,1	12117,8	8,907	N/A	B 13,849	100+	12,798
14	1	2300,02	107935,0	9263,9	11,651	N/A	B 13,851	100+	22,753
15	1	2438,40	107709,5	7384,9	14,585	N/A	B 19,420	78,185	38,188
16	1	2590,80	107461,3	5486,4	19,587	N/A	B 34,980	26,290	M 100+
17	1	2743,20	107213,0	4015,1	26,703	N/A	100+	15,796	M 76,879
18	1	2895,60	106964,7	3526,1	30,335	N/A	100+	11,268	M 30,453
19	1	3048,00	106716,4	4382,6	24,350	N/A	100+	8,752	M 18,980
20	1	3296,96	106310,8	7274,3	14,615	N/A	100+	6,405	M 11,899
21									
22	**Burst and Axial Flags**								
23	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
24									
25	**Axial Flags**								
26	**Default = Tension, M = Compression**								
27									
28	**Triaxial Flags**								
29	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
30									
31	**Envelope Flags**								
32	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - PressureTest #1 - 7" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	46544,9	2,363	N/A	B 2,237	100+	2,831
2	1	24,96	110000,0	46447,8	2,368	N/A	B 2,237	100+	2,852
3	1	304,80	110000,0	45424,1	2,422	N/A	B 2,237	100+	3,105
4	1	362,01	110000,0	45230,2	2,432	N/A	B 2,237	100+	3,163
5	1	609,60	110000,0	44453,0	2,475	N/A	B 2,237	100+	3,439
6	1	914,40	110000,0	43641,6	2,521	N/A	B 2,237	100+	3,852
7	1	1219,20	109696,8	42999,0	2,551	N/A	B 2,231	100+	4,366
8	1	1349,96	109483,7	42777,0	2,559	N/A	B 2,227	100+	4,629
9	1	1350,02	109483,6	42776,9	2,559	N/A	B 2,227	100+	4,629
10	1	1524,00	109198,9	42532,8	2,567	N/A	B 2,221	100+	5,034
11	1	1828,80	108704,3	42248,9	2,573	N/A	B 2,211	100+	5,953
12	1	2133,60	108206,6	42151,0	2,567	N/A	B 2,201	100+	7,297
13	1	2299,96	107934,5	42176,6	2,559	N/A	B 2,195	100+	8,332
14	1	2300,02	107934,4	42176,6	2,559	N/A	B 2,195	100+	8,332
15	1	2438,40	107709,6	42234,8	2,550	N/A	B 2,191	100+	9,380
16	1	2743,20	107214,1	42480,0	2,524	N/A	B 2,181	100+	13,005
17	1	3048,00	106716,3	42883,9	2,488	N/A	B 2,171	100+	21,325
18	1	3296,96	106312,5	43295,7	N 2,456	N/A	B 2,162	100+	42,461
19									
20	**Burst and Axial Flags**								
21	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
22									
23	**Axial Flags**								
24	**Default = Tension, M = Compression**								
25									
26	**Triaxial Flags**								
27	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
28									
29	**Envelope Flags**								
30	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - GreenCement #1 - 7" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	49657,9	2,215	N/A	B 2,237	100+	2,425
2	1	24,96	110000,0	49536,7	2,221	N/A	B 2,237	100+	2,440
3	1	304,80	110000,0	48231,0	2,281	N/A	B 2,237	100+	2,623
4	1	362,01	110000,0	47976,8	2,293	N/A	B 2,237	100+	2,664
5	1	609,60	110000,0	46929,1	2,344	N/A	B 2,237	100+	2,857
6	1	914,40	110000,0	45763,0	2,404	N/A	B 2,237	100+	3,137
7	1	1219,20	109696,8	44743,3	2,452	N/A	B 2,231	100+	3,468
8	1	1349,96	109483,7	44353,3	2,468	N/A	B 2,227	100+	3,630
9	1	1350,02	109483,6	44353,2	2,468	N/A	B 2,227	100+	3,630
10	1	1524,00	109198,9	43880,4	2,489	N/A	B 2,221	100+	3,872
11	1	1828,80	108704,3	43183,5	2,517	N/A	B 2,211	100+	4,389
12	1	2133,60	108206,6	42660,8	2,536	N/A	B 2,201	100+	5,072
13	1	2299,96	107934,5	42451,3	2,543	N/A	B 2,195	100+	5,546
14	1	2300,02	107934,4	42451,2	2,543	N/A	B 2,195	100+	5,546
15	1	2438,40	107709,6	42048,2	2,562	N/A	B 2,206	100+	6,016
16	1	2743,20	107214,1	41259,1	2,599	N/A	B 2,229	100+	7,409
17	1	3048,00	106716,3	40612,2	2,628	N/A	B 2,253	100+	9,668
18	1	3296,96	106312,5	39699,3	2,678	N/A	B 2,301	100+	12,911
19									
20	**Burst and Axial Flags**								
21	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
22									
23	**Axial Flags**								
24	**Default = Tension, M = Compression**								
25									
26	**Triaxial Flags**								
27	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
28									
29	**Envelope Flags**								
30	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - OverPull #1 - 7" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	35772,7	D 3,075	N/A	100+	100+	3,077
2	1	24,96	110000,0	35542,7	D 3,095	N/A	100+	100+	3,101
3	1	304,80	110000,0	32961,9	D 3,337	N/A	100+	100+	3,404
4	1	362,01	110000,0	32434,4	D 3,391	N/A	100+	98,416	3,473
5	1	609,60	110000,0	30150,8	D 3,648	N/A	100+	59,355	3,808
6	1	914,40	110000,0	27339,8	D 4,023	N/A	100+	40,285	4,321
7	1	1219,20	109696,8	24528,7	D 4,472	N/A	100+	30,655	4,981
8	1	1349,96	109483,7	23322,7	D 4,694	N/A	100+	27,833	5,328
9	1	1350,02	109483,6	23322,1	D 4,694	N/A	100+	27,832	5,328
10	1	1524,00	109198,9	21717,6	D 5,028	N/A	100+	24,824	5,874
11	1	1828,80	108704,3	18906,6	D 5,750	N/A	100+	20,923	7,172
12	1	2133,60	108206,6	16095,5	D 6,723	N/A	100+	18,124	9,229
13	1	2299,96	107934,5	14560,8	D 7,413	N/A	100+	16,904	10,957
14	1	2300,02	107934,4	14560,9	D 7,413	N/A	100+	16,904	10,957
15	1	2438,40	107709,6	13284,4	D 8,108	N/A	100+	16,014	12,989
16	1	2743,20	107214,1	10473,4	D 10,237	N/A	100+	14,365	22,060
17	1	3048,00	106716,3	7662,3	D 13,927	N/A	100+	13,037	74,744
18	1	3296,96	106312,5	5365,8	D 19,813	N/A	100+	12,077	M 77,246
19									
20	**Burst and Axial Flags**								
21	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
22									
23	**Axial Flags**								
24	**Default = Tension, M = Compression**								
25									
26	**Triaxial Flags**								
27	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
28									
29	**Envelope Flags**								
30	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - RunningHole #1 - 7" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	33106,8	D 3,323	N/A	100+	100+	3,325
2	1	24,96	110000,0	32927,9	D 3,341	N/A	100+	100+	3,348
3	1	304,80	110000,0	30919,4	D 3,558	N/A	100+	100+	3,633
4	1	362,01	110000,0	30508,8	D 3,606	N/A	100+	99,484	3,697
5	1	609,60	110000,0	28731,7	D 3,829	N/A	100+	59,805	4,005
6	1	914,40	110000,0	26544,0	D 4,144	N/A	100+	40,446	4,461
7	1	1219,20	109696,8	24356,3	D 4,504	N/A	100+	30,680	5,020
8	1	1349,96	109483,7	23417,7	D 4,675	N/A	100+	27,821	5,303
9	1	1350,02	109483,6	23417,3	D 4,675	N/A	100+	27,820	5,303
10	1	1524,00	109198,9	22168,6	D 4,926	N/A	100+	24,774	5,735
11	1	1828,80	108704,3	19980,9	D 5,440	N/A	100+	20,828	6,697
12	1	2133,60	108206,6	17793,2	D 6,081	N/A	100+	18,001	8,062
13	1	2299,96	107934,5	16599,1	D 6,502	N/A	100+	16,771	9,079
14	1	2300,02	107934,4	16598,7	D 6,503	N/A	100+	16,770	9,080
15	1	2438,40	107709,6	15605,5	D 6,902	N/A	100+	15,874	10,150
16	1	2743,20	107214,1	13417,8	D 7,990	N/A	100+	14,214	13,740
17	1	3048,00	106716,3	11230,1	D 9,503	N/A	100+	12,880	21,371
18	1	3296,96	106312,5	9443,1	D 11,258	N/A	100+	11,970	39,394
19									
20	**Burst and Axial Flags**								
21	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
22									
23	**Axial Flags**								
24	**Default = Tension, M = Compression**								
25									
26	**Triaxial Flags**								
27	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
28									
29	**Envelope Flags**								
30	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - TubingLeak #1 - 7" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	30879,9	D 3,562	N/A	100+	100+	3,564
2	1	24,96	110000,0	30577,2	3,597	N/A	100+	100+	3,597
3	1	304,80	110000,0	27220,9	4,041	N/A	B 61,024	100+	4,010
4	1	362,01	110000,0	26545,5	4,144	N/A	B 51,382	100+	4,107
5	1	609,60	110000,0	23676,3	4,646	N/A	B 30,512	100+	4,584
6	1	914,40	110000,0	20306,7	5,417	N/A	B 20,342	100+	5,349
7	1	1219,20	109695,8	17215,2	6,372	N/A	B 15,214	100+	6,403
8	1	1349,96	109482,8	16014,6	6,836	N/A	B 13,714	100+	6,991
9	1	1350,02	109482,7	16014,1	6,837	N/A	B 13,713	100+	6,992
10	1	1524,00	109199,3	14579,8	7,490	N/A	B 12,116	100+	7,971
11	1	1828,80	108702,7	12687,8	8,567	N/A	B 10,051	100+	10,587
12	1	2133,60	108206,1	11899,5	9,093	N/A	B 8,576	100+	15,831
13	1	2299,96	107935,1	12025,1	8,976	N/A	B 7,935	100+	21,755
14	1	2300,02	107935,0	7902,4	D 13,659	N/A	100+	17,311	33,765
15	1	2438,40	107709,5	6554,4	16,433	N/A	100+	18,909	55,700
16	1	2590,80	107461,3	5210,7	20,623	N/A	B 62,486	21,033	M 100+
17	1	2743,20	107213,0	4147,3	25,851	N/A	B 40,905	23,613	100+
18	1	3048,00	106716,4	3818,2	27,950	N/A	B 24,124	31,175	M 29,643
19	1	3296,96	106310,8	5401,1	N 19,683	N/A	B 18,031	42,306	M 18,573
20									
21	**Burst and Axial Flags**								
22	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
23									
24	**Axial Flags**								
25	**Default = Tension, M = Compression**								
26									
27	**Triaxial Flags**								
28	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
29									
30	**Envelope Flags**								
31	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Movement Summary - Initial Conditions - 13 3/8" Conductor Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	362,00	0,000	0,000	0,000	0,000	0,000	3,14

Movement Summary - PressureTest #1 - 13 3/8" Conductor Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	362,00	0,097	-0,002	-0,094	0,000	0,000	362,00

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Movement Summary - LostReturnsWithMudDrop #1 - 13 3/8" Conductor Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	0,03	362,00	-0,017	0,000	0,016	0,001	0,000	0,00

Movement Summary - OverPull #1 - 13 3/8" Conductor Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	0,03	362,00	0,018	0,000	0,000	0,000	0,018*	0,00
2								
3	* Surface displacement due to pickup (+) or slackoff (-)							

Movement Summary - RunningHole #1 - 13 3/8" Conductor Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1								
2								
3	No results available for this load case							
4								
5								

Movement Summary - Initial Conditions - 9 5/8" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	0,03	362,00	0,000	0,000	0,000	0,000	0,000	0,00

Movement Summary - DisplaceToGas #1 - 9 5/8" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	0,03	362,00	0,056	0,000	-0,057	0,001	0,000	0,00

Movement Summary - PressureTest #1 - 9 5/8" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	0,03	362,00	0,165	-0,001	-0,164	0,000	0,000	262,63

Movement Summary - LostReturnsWithMudDrop #1 - 9 5/8" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	0,03	362,00	-0,009	0,000	0,008	0,001	0,000	0,00

Movement Summary - GreenCement #1 - 9 5/8" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	0,03	362,00	0,109	0,000	0,000	0,000	0,109	0,00

Movement Summary - OverPull #1 - 9 5/8" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	0,03	362,00	0,166	0,000	0,000	0,000	0,166*	0,00
2								
3	* Surface displacement due to pickup (+) or slackoff (-)							

Movement Summary - RunningHole #1 - 9 5/8" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1								
2								
3	No results available for this load case							
4								
5								

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Movement Summary - Initial Conditions - 7" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2300,00	0,000	0,000	0,000	0,000	0,000	0,00

Movement Summary - DisplaceToGas #1 - 7" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2300,00	0,402	0,000	-0,403	0,001	0,000	0,00

Movement Summary - PressureTest #1 - 7" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2300,00	0,749	0,000	-0,749	0,000	0,000	0,00

Movement Summary - GreenCement #1 - 7" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2300,00	0,499	0,000	0,000	0,000	0,499	0,00

Movement Summary - OverPull #1 - 7" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2300,00	0,590	0,000	0,000	0,000	0,590*	0,00
2								
3	*** Surface displacement due to pickup (+) or slackoff (-)**							

Movement Summary - RunningHole #1 - 7" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No results available for this load case							
4								
5								

Movement Summary - TubingLeak #1 - 7" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2300,00	0,135	0,000	-0,137	0,001	0,000	0,00

5.2.3 North Sea

5.2.3.1 Conventional Well Design

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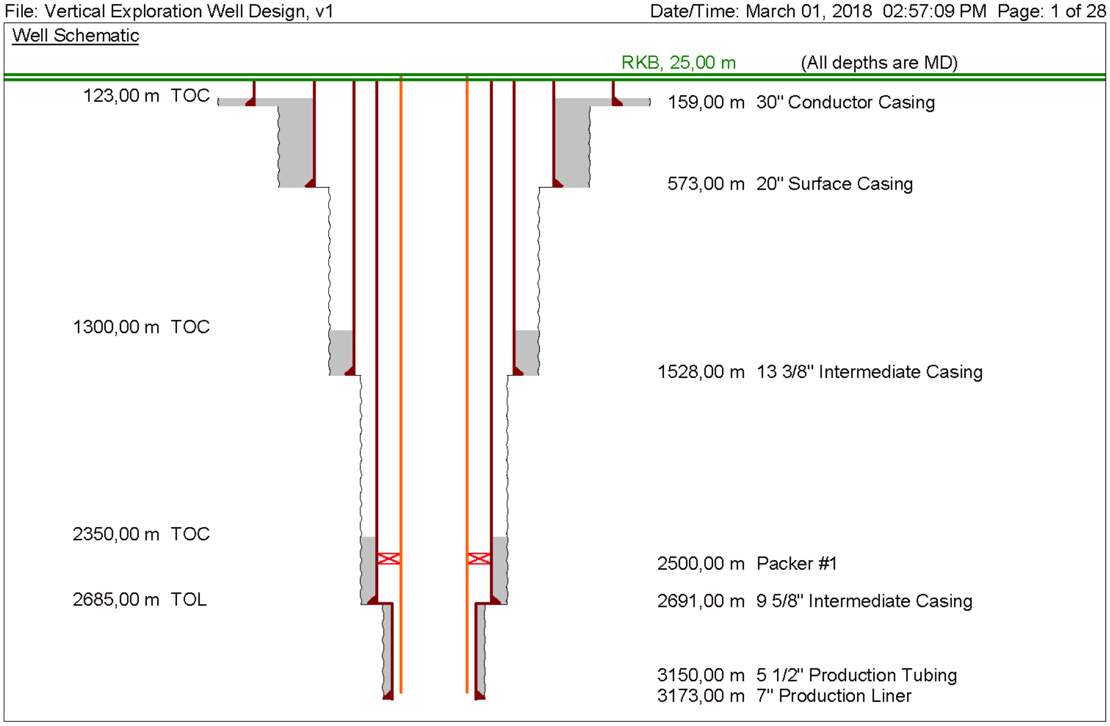

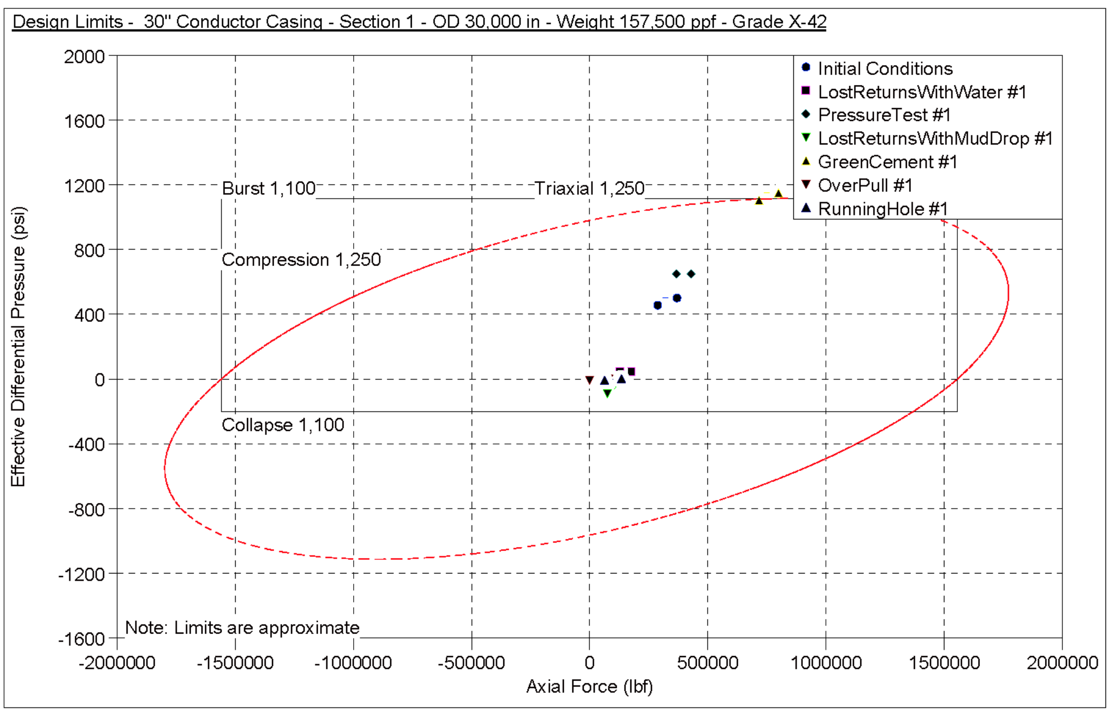

Conventional Well Design WELLCAT 5000.1.13.1

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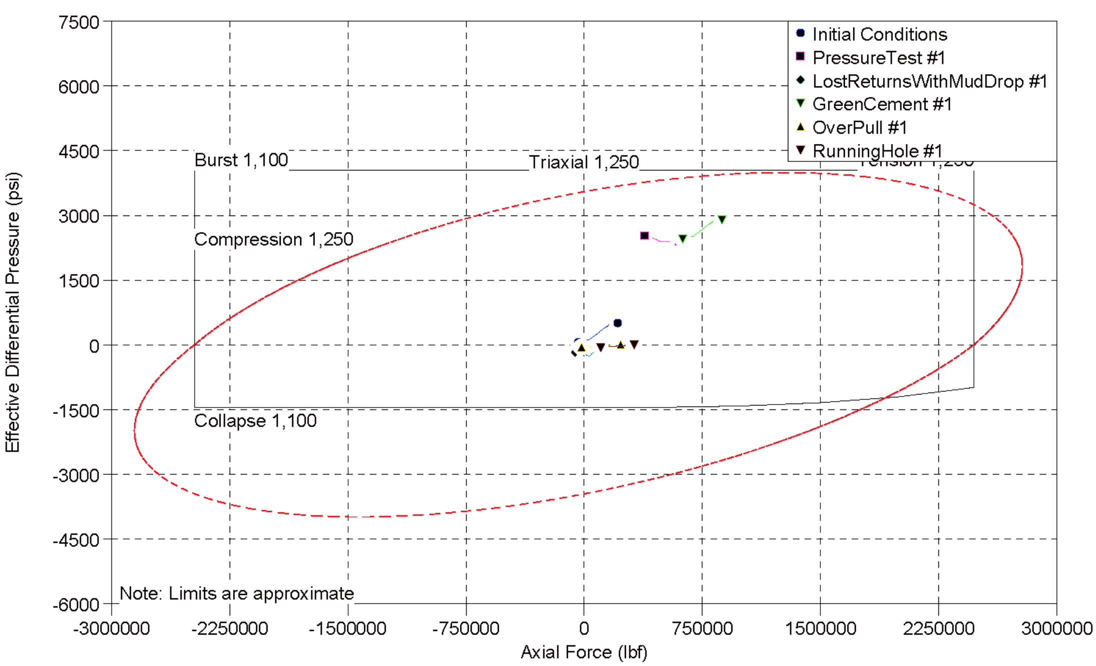
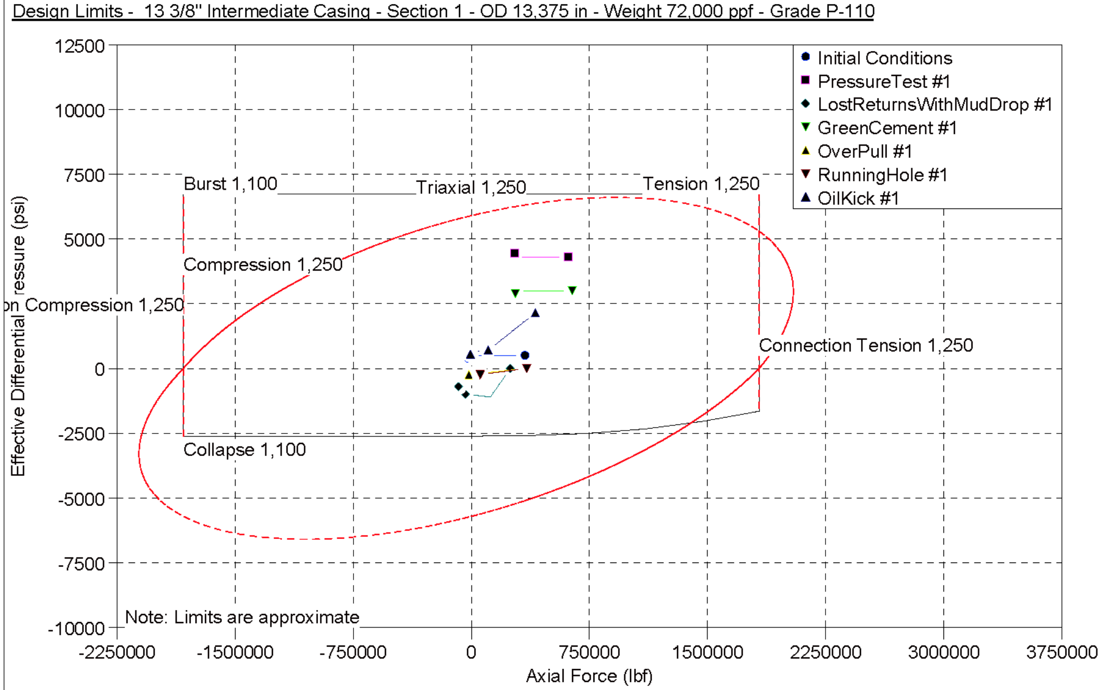
Design Limits - 20" Surface Casing - Section 1 - OD 20,000 in - Weight 133,000 ppf - Grade N-80



Design Limits - 13 3/8" Intermediate Casing - Section 1 - OD 13,375 in - Weight 72,000 ppf - Grade P-110



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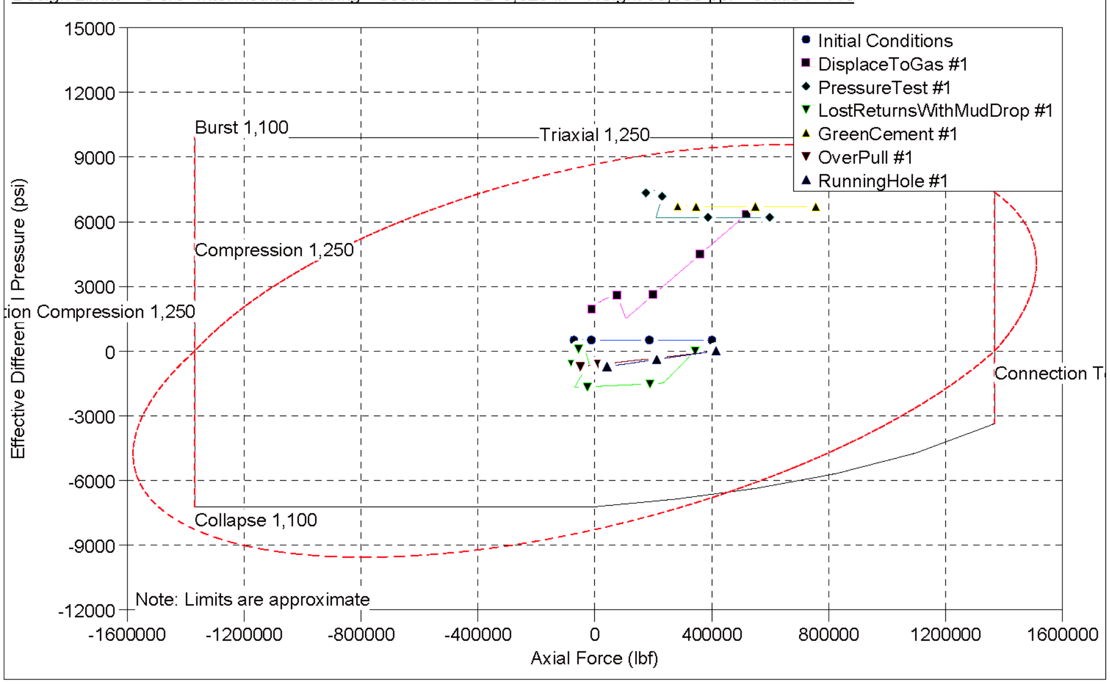
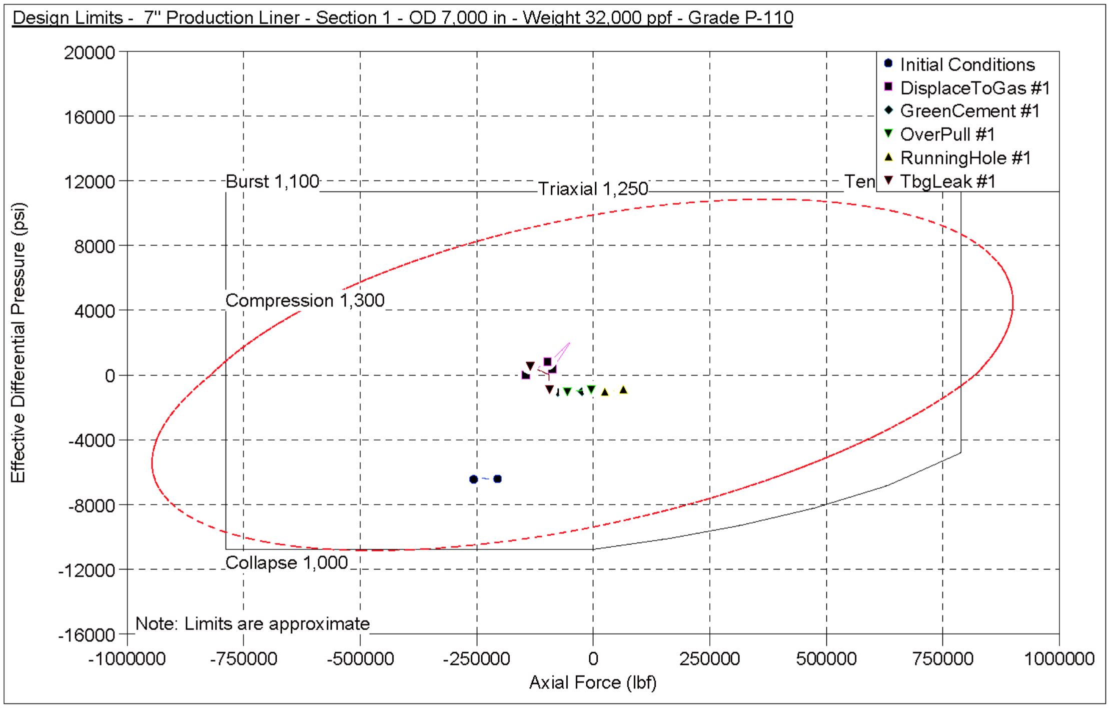
Design Limits - 9 5/8" Intermediate Casing - Section 1 - OD 9,625 in - Weight 53,500 ppf - Grade P-110



Design Limits - 7" Production Liner - Section 1 - OD 7,000 in - Weight 32,000 ppf - Grade P-110



Conventional Well Design WELLCAT 5000.1.13.1

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Ratings Summary - 30" Conductor Casing

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	30,000	157,500	X-42	<N/A>		1225,00	224,86	1946217	1946217
2										
3	**L = Connection Leak**									
4	**B = Connection Burst**									
5	**F = Connection Fracture**									
6	**J = Connection Jump-out**									
7	**Y = Connection Yield**									
8	**C = Connection**									

Ratings Summary - 20" Surface Casing

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	20,000	133,000	N-80	TSH ER	N-80	4445,00	1603,35	3090517	3090517
2										
3	**L = Connection Leak**									
4	**B = Connection Burst**									
5	**F = Connection Fracture**									
6	**J = Connection Jump-out**									
7	**Y = Connection Yield**									
8	**C = Connection**									

Ratings Summary - 13 3/8" Intermediate Casing

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	13,375	72,000	P-110	Vam 21	P-110	7397,76	2882,28	C 2284000	C 2284000
2										
3	**L = Connection Leak**									
4	**B = Connection Burst**									
5	**F = Connection Fracture**									
6	**J = Connection Jump-out**									
7	**Y = Connection Yield**									
8	**C = Connection**									

Ratings Summary - 9 5/8" Intermediate Casing

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	9,625	53,500	P-110	Vam 21	P-110	10900,00	7950,02	C 1710000	C 1710000
2										
3	**L = Connection Leak**									
4	**B = Connection Burst**									
5	**F = Connection Fracture**									
6	**J = Connection Jump-out**									
7	**Y = Connection Yield**									
8	**C = Connection**									

Ratings Summary - 7" Production Liner

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	7,000	32,000	P-110	Vam TOP HC	P-110	12457,50	10780,84	1024904	1024904
2										
3	**L = Connection Leak**									
4	**B = Connection Burst**									
5	**F = Connection Fracture**									
6	**J = Connection Jump-out**									
7	**Y = Connection Yield**									
8	**C = Connection**									

Casing Load Summary - Initial Conditions - 30" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi)	
								Internal	External
1	1	0,03	369455	0,00	0,0	0,0	50,00	500,04	0,04
2	1	24,96	356568	0,00	0,0	0,0	46,92	535,44	35,44
3	1	122,96	305929	0,01	1,4	0,0	35,00	674,58	174,58
4	1	123,02	305898	0,01	1,4	0,0	35,00	674,66	174,70
5	1	158,98	287327	0,00	0,2	0,0	37,40	725,69	271,49
6									
7	**Additional Pickup to Prevent Buckling = 16241 lbf**								

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Casing Load Summary - LostReturnsWithWater #1 - 30" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	174733	0,00	0,0	0,0	50,00	45,85	0,04
2	1	24,96	161846	0,00	0,0	0,0	50,00	81,26	35,45
3	1	122,96	111207	0,00	0,0	0,0	35,00	220,39	174,58
4	1	123,02	125927	0,01	1,4	0,0	35,00	220,47	174,67
5	1	158,98	126761	0,00	0,2	0,0	37,40	271,50	225,69

Casing Load Summary - PressureTest #1 - 30" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	429424	0,00	0,0	0,0	50,00	650,04	0,04
2	1	24,96	416537	0,00	0,8	0,0	46,92	685,45	35,45
3	1	73,06	391684	0,02	4,1	0,0	41,09	753,73	103,73
4	1	91,32	382245	0,03	5,7	0,0	38,84	779,67	129,66
5	1	122,96	365898	0,04	8,9	0,0	35,00	824,58	174,58
6	1	123,02	365376	0,01	1,4	0,0	35,00	824,67	174,67
7	1	158,98	366182	0,00	0,2	0,0	37,40	875,69	225,69
8									
9	**Additional Pickup to Prevent Buckling = 55872 lbf**								

Casing Load Summary - LostReturnsWithMudDrop #1 - 30" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	127799	0,00	0,0	0,0	50,00	0,00	0,04
2	1	24,96	114912	0,00	0,0	0,0	50,00	0,00	35,45
3	1	122,96	64273	0,00	0,0	0,0	35,00	76,94	174,58
4	1	123,02	69088	0,01	1,4	0,0	35,00	77,05	174,67
5	1	158,98	73971	0,00	0,2	0,0	37,40	138,30	225,69

Casing Load Summary - GreenCement #1 - 30" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	798793	0,00	0,0	0,0	50,00	1150,04	0,04
2	1	24,96	785906	0,00	0,0	0,0	46,92	1185,44	35,44
3	1	73,06	761053	0,00	0,0	0,0	41,09	1253,73	103,73
4	1	91,32	751614	0,00	0,1	0,0	38,84	1279,67	129,67
5	1	122,96	735267	0,01	1,4	0,0	35,00	1324,58	174,58
6	1	123,02	735236	0,01	1,4	0,0	35,00	1324,66	174,70
7	1	158,98	716665	0,00	0,0	0,0	37,40	1375,69	271,49

Casing Load Summary - OverPull #1 - 30" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	81625	0,00	0,0	0,0	50,00	0,04	0,04
2	1	24,96	68738	0,00	0,0	0,0	46,92	35,45	35,45
3	1	122,96	18099	0,00	0,0	0,0	35,00	174,58	174,58
4	1	123,02	18067	0,00	0,0	0,0	35,00	174,67	174,67
5	1	158,98	-503	0,00	0,0	0,0	37,40	225,69	225,69

Casing Load Summary - RunningHole #1 - 30" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	134243	0,00	0,0	0,0	50,00	0,04	0,04
2	1	24,96	122997	0,00	0,0	0,0	46,92	35,45	35,45
3	1	122,96	78805	0,00	0,0	0,0	35,00	174,58	174,58
4	1	123,02	78777	0,00	0,0	0,0	35,00	174,67	174,67
5	1	158,98	62571	0,00	0,0	0,0	37,40	225,69	225,69

Casing Load Summary - Initial Conditions - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	213040	0,00	0,0	0,0	50,00	500,04	0,05
2	1	24,96	202158	0,00	0,0	0,0	46,92	535,44	42,56
3	1	122,96	159395	0,00	0,0	0,0	35,00	674,58	209,58
4	1	123,02	159369	0,00	0,0	0,0	35,00	674,67	209,71
5	1	158,98	143687	0,00	0,0	0,0	37,40	729,80	306,49
6	1	159,04	143660	0,00	0,0	0,0	37,40	729,89	306,65
7	1	304,80	80053	0,00	0,0	0,0	47,12	953,49	699,19
8	1	572,96	-36963	0,00	0,0	0,0	65,00	1390,39	1336,98

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Casing Load Summary - PressureTest #1 - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi)	
								Internal	External
1	1	0,03	544771	0,33	101,7	0,1	50,00	2400,05	0,05
2	1	24,96	533978	0,36	113,9	0,1	46,92	2442,56	42,55
3	1	122,96	491712	0,46	166,0	0,2	35,00	2609,58	209,58
4	1	123,02	479275	0,00	0,0	0,0	35,00	2609,69	209,67
5	1	158,98	473212	0,00	0,0	0,0	37,40	2670,93	260,70
6	1	159,04	473219	0,00	0,0	0,0	37,40	2671,04	260,78
7	1	304,80	448693	0,00	0,0	0,0	47,12	2919,48	467,73
8	1	572,96	383460	0,00	0,0	0,0	65,00	3376,53	848,46
9									
10	**Additional Pickup to Prevent Buckling = 176516 lbf**								

Casing Load Summary - LostReturnsWithMudDrop #1 - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi)	
								Internal	External
1	1	0,03	103716	0,00	0,0	0,0	50,00	0,00	0,05
2	1	24,96	92834	0,00	0,0	0,0	50,00	0,00	42,55
3	1	122,96	50072	0,00	0,0	0,0	35,00	0,00	209,58
4	1	123,02	47839	0,00	0,0	0,0	35,00	0,00	209,68
5	1	158,98	31567	0,00	0,0	0,0	37,40	10,96	270,94
6	1	159,04	31569	0,00	0,0	0,0	37,40	11,07	271,04
7	1	304,80	6956	0,00	0,0	0,0	47,11	305,76	519,48
8	1	572,96	-57388	0,00	0,0	0,0	64,97	854,21	976,53

Casing Load Summary - GreenCement #1 - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi)	
								Internal	External
1	1	0,03	874306	0,00	0,0	0,0	50,00	2900,04	0,05
2	1	24,96	863424	0,00	0,0	0,0	46,92	2935,44	42,56
3	1	122,96	820662	0,00	0,0	0,0	35,00	3074,58	209,58
4	1	123,02	820636	0,00	0,0	0,0	35,00	3074,67	209,71
5	1	158,98	804953	0,00	0,0	0,0	37,40	3129,80	306,49
6	1	159,04	804927	0,00	0,0	0,0	37,40	3129,89	306,65
7	1	304,80	741320	0,00	0,0	0,0	47,12	3353,49	699,19
8	1	572,96	624304	0,00	0,0	0,0	65,00	3790,39	1336,98

Casing Load Summary - OverPull #1 - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi)	
								Internal	External
1	1	0,03	232259	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	221377	0,00	0,0	0,0	46,92	42,56	42,56
3	1	122,96	178615	0,00	0,0	0,0	35,00	209,58	209,58
4	1	123,02	178588	0,00	0,0	0,0	35,00	209,69	209,69
5	1	158,98	162906	0,00	0,0	0,0	37,40	270,93	270,93
6	1	159,04	162879	0,00	0,0	0,0	37,40	271,04	271,04
7	1	304,80	99272	0,00	0,0	0,0	47,12	519,48	519,48
8	1	572,96	-17744	0,00	0,0	0,0	65,00	976,53	976,53

Casing Load Summary - RunningHole #1 - 20" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi)	
								Internal	External
1	1	0,03	316596	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	307356	0,00	0,0	0,0	46,92	42,56	42,56
3	1	122,96	271046	0,00	0,0	0,0	35,00	209,58	209,58
4	1	123,02	271024	0,00	0,0	0,0	35,00	209,69	209,69
5	1	158,98	257708	0,00	0,0	0,0	37,40	270,93	270,93
6	1	159,04	257686	0,00	0,0	0,0	37,40	271,04	271,04
7	1	304,80	203676	0,00	0,0	0,0	47,12	519,48	519,48
8	1	572,96	104316	0,00	0,0	0,0	65,00	976,53	976,53

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Casing Load Summary - Initial Conditions - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	341302	0,00	0,0	0,0	50,00	500,06	0,06
2	1	24,96	335411	0,00	0,0	0,0	46,92	551,07	51,07
3	1	122,99	312254	0,00	0,0	0,0	35,00	751,56	251,56
4	1	304,80	269309	0,00	0,0	0,0	47,12	1123,37	623,37
5	1	572,96	205962	0,00	0,0	0,0	65,00	1671,83	1171,83
6	1	573,02	205948	0,00	0,0	0,0	65,00	1671,96	1171,95
7	1	609,60	197309	0,00	0,0	0,0	67,44	1746,75	1246,75
8	1	914,40	125309	0,00	0,0	0,0	87,66	2370,13	1870,12
9	1	1219,20	53309	0,00	0,0	0,0	107,98	2993,51	2493,51
10	1	1299,97	34230	0,00	0,0	0,0	113,36	3158,70	2658,70
11	1	1300,03	34216	0,00	0,0	0,0	113,37	3158,82	2658,82
12	1	1524,00	-18691	0,00	0,0	0,0	128,33	3616,88	3218,08
13	1	1527,96	-19635	0,00	0,0	0,0	128,60	3625,00	3228,77

Casing Load Summary - PressureTest #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	616181	0,00	0,0	0,0	50,00	4300,06	0,06
2	1	24,96	610290	0,00	0,0	0,0	46,92	4351,07	51,07
3	1	122,99	587133	0,00	0,0	0,0	35,00	4551,56	251,56
4	1	304,80	544188	0,00	0,0	0,0	47,12	4923,38	623,38
5	1	533,19	490236	0,01	0,2	0,0	62,35	5390,50	1090,49
6	1	572,96	480842	0,07	1,8	0,0	65,00	5471,83	1171,83
7	1	573,02	480827	0,05	1,1	0,0	65,00	5471,96	1171,95
8	1	609,60	472194	0,09	2,4	0,0	67,44	5546,75	1246,75
9	1	762,00	436274	0,25	11,0	0,0	77,60	5858,44	1558,43
10	1	914,40	400547	0,41	22,9	0,1	87,66	6170,13	1870,12
11	1	1066,80	365135	0,57	37,2	0,1	97,82	6481,81	2181,80
12	1	1219,20	330152	0,73	53,5	0,2	107,98	6793,50	2493,49
13	1	1299,97	311819	0,81	62,7	0,3	113,36	6958,70	2658,68
14	1	1300,03	307210	0,00	0,0	0,0	113,37	6958,82	2658,80
15	1	1524,00	274640	0,00	0,0	0,0	128,33	7416,88	2976,77
16	1	1527,96	274123	0,00	0,0	0,0	128,60	7425,00	2982,41
17									
18	**Additional Pickup to Prevent Buckling = 150404 lbf**								

Casing Load Summary - LostReturnsWithMudDrop #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	247619	0,00	0,0	0,0	50,00	0,00	0,06
2	1	24,96	241728	0,00	0,0	0,0	50,00	0,00	51,07
3	1	122,99	218572	0,00	0,0	0,0	35,00	0,00	251,56
4	1	304,80	175627	0,00	0,0	0,0	47,11	0,00	623,38
5	1	572,96	112280	0,00	0,0	0,0	64,97	87,21	1171,84
6	1	573,02	112265	0,00	0,0	0,0	64,97	87,34	1171,96
7	1	609,60	103627	0,00	0,0	0,0	67,40	167,53	1246,76
8	1	914,40	31627	0,00	0,0	0,0	87,70	892,39	1870,13
9	1	1219,20	-40373	0,00	0,0	0,0	108,00	1619,67	2493,51
10	1	1299,97	-59453	0,00	0,0	0,0	113,37	1812,39	2658,70
11	1	1300,03	-40184	0,00	0,0	0,0	113,38	1812,53	2393,58
12	1	1524,00	-80241	0,00	0,0	0,0	128,29	2346,94	2867,78
13	1	1527,96	-80873	0,00	0,0	0,0	128,56	2356,41	2876,18

Casing Load Summary - GreenCement #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	640634	0,00	0,0	0,0	50,00	3000,06	0,06
2	1	24,96	634743	0,00	0,0	0,0	46,92	3051,07	51,07
3	1	122,99	611586	0,00	0,0	0,0	35,00	3251,56	251,56
4	1	304,80	568641	0,00	0,0	0,0	47,12	3623,37	623,37
5	1	572,96	505294	0,00	0,0	0,0	65,00	4171,83	1171,83
6	1	573,02	505280	0,00	0,0	0,0	65,00	4171,96	1171,95
7	1	609,60	496641	0,00	0,0	0,0	67,44	4246,75	1246,75
8	1	914,40	424641	0,00	0,0	0,0	87,66	4870,13	1870,12
9	1	1219,20	352641	0,00	0,0	0,0	107,98	5493,51	2493,51
10	1	1299,97	333562	0,00	0,0	0,0	113,36	5658,70	2658,70
11	1	1300,03	333547	0,00	0,0	0,0	113,37	5658,82	2658,82
12	1	1524,00	280641	0,00	0,0	0,0	128,33	6116,88	3218,08
13	1	1527,96	279696	0,00	0,0	0,0	128,60	6125,00	3228,77

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Casing Load Summary - OverPull #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	346021	0,00	0,0	0,0	50,00	0,06	0,06
2	1	24,96	340130	0,00	0,0	0,0	46,92	51,07	51,07
3	1	122,99	316973	0,00	0,0	0,0	35,00	251,56	251,56
4	1	304,80	274028	0,00	0,0	0,0	47,12	623,38	623,38
5	1	572,96	210681	0,00	0,0	0,0	65,00	1171,84	1171,84
6	1	573,02	210667	0,00	0,0	0,0	65,00	1171,96	1171,96
7	1	609,60	202028	0,00	0,0	0,0	67,44	1246,75	1246,75
8	1	914,40	130028	0,00	0,0	0,0	87,66	1870,13	1870,13
9	1	1219,20	58028	0,00	0,0	0,0	107,98	2493,51	2493,51
10	1	1299,97	38949	0,00	0,0	0,0	113,36	2658,70	2658,70
11	1	1300,03	38935	0,00	0,0	0,0	113,37	2658,82	2658,82
12	1	1524,00	-13972	0,00	0,0	0,0	128,33	3116,88	3116,88
13	1	1527,96	-14916	0,00	0,0	0,0	128,60	3125,00	3125,00

Casing Load Summary - RunningHole #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	352111	0,00	0,0	0,0	50,00	0,06	0,06
2	1	24,96	347280	0,00	0,0	0,0	46,92	51,07	51,07
3	1	122,99	328287	0,00	0,0	0,0	35,00	251,56	251,56
4	1	304,80	293063	0,00	0,0	0,0	47,12	623,38	623,38
5	1	572,96	241106	0,00	0,0	0,0	65,00	1171,84	1171,84
6	1	573,02	241095	0,00	0,0	0,0	65,00	1171,96	1171,96
7	1	609,60	234009	0,00	0,0	0,0	67,44	1246,75	1246,75
8	1	914,40	174955	0,00	0,0	0,0	87,66	1870,13	1870,13
9	1	1219,20	115901	0,00	0,0	0,0	107,98	2493,51	2493,51
10	1	1299,97	100253	0,00	0,0	0,0	113,36	2658,70	2658,70
11	1	1300,03	100241	0,00	0,0	0,0	113,37	2658,82	2658,82
12	1	1524,00	56847	0,00	0,0	0,0	128,33	3116,88	3116,88
13	1	1527,96	56079	0,00	0,0	0,0	128,60	3125,00	3125,00

Casing Load Summary - OilKick #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	406511	0,00	0,0	0,0	50,00	2148,52	0,06
2	1	24,96	400620	0,00	0,0	0,0	46,92	2171,10	51,07
3	1	122,99	377463	0,00	0,0	0,0	35,00	2259,87	251,56
4	1	304,80	334518	0,00	0,0	0,0	47,12	2424,49	623,38
5	1	572,96	271171	0,00	0,0	0,0	65,00	2667,32	1171,83
6	1	573,02	271157	0,00	0,0	0,0	65,00	2667,37	1171,95
7	1	609,60	262518	0,00	0,0	0,0	67,44	2700,49	1246,75
8	1	914,40	190518	0,00	0,0	0,0	87,66	2976,49	1870,12
9	1	1219,20	118518	0,00	0,0	0,0	107,98	3252,49	2493,49
10	1	1299,97	99439	0,00	0,0	0,0	113,36	3325,63	2658,68
11	1	1300,03	46204	0,00	0,0	0,0	113,37	3325,68	2658,80
12	1	1524,00	-4699	0,00	0,0	0,0	128,33	3528,49	2976,77
13	1	1527,96	-5542	0,00	0,0	0,0	128,60	3532,08	2982,41

Casing Load Summary - Initial Conditions - 9 5/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	401312	0,00	0,0	0,0	50,00	500,07	0,07
2	1	24,96	396934	0,00	0,0	0,0	46,92	559,58	59,58
3	1	122,99	379728	0,00	0,0	0,0	35,00	793,48	293,48
4	1	304,80	347817	0,00	0,0	0,0	47,12	1227,27	727,27
5	1	609,60	294317	0,00	0,0	0,0	67,44	1954,54	1454,55
6	1	914,40	240817	0,00	0,0	0,0	87,66	2681,82	2181,82
7	1	1219,20	187317	0,00	0,0	0,0	107,98	3409,08	2909,09
8	1	1524,00	133817	0,00	0,0	0,0	128,30	4136,36	3636,36
9	1	1527,96	133115	0,00	0,0	0,0	128,56	4145,83	3645,83
10	1	1528,02	133115	0,00	0,0	0,0	128,57	4145,98	3645,98
11	1	1828,80	80317	0,00	0,0	0,0	148,62	4863,63	4363,63
12	1	2133,60	26817	0,00	0,0	0,0	168,94	5590,90	5090,91
13	1	2349,98	-11167	0,00	0,0	0,0	183,36	6107,18	5607,18
14	1	2350,04	-11167	0,00	0,0	0,0	183,37	6107,32	5607,31
15	1	2438,40	-26683	0,00	0,0	0,0	189,16	6318,18	5795,57
16	1	2690,96	-71021	0,00	0,0	0,0	206,00	6920,83	6418,00

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Casing Load Summary - DisplaceToGas #1 - 9 5/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	519268	0,00	0,0	0,0	50,00	6352,76	0,07
2	1	24,96	514890	0,00	0,0	0,0	50,00	6360,94	59,58
3	1	122,99	497684	0,00	0,0	0,0	35,00	6393,10	293,49
4	1	304,80	465773	0,00	0,0	0,0	47,11	6452,75	727,28
5	1	609,60	412273	0,00	0,0	0,0	67,40	6552,75	1454,55
6	1	914,40	358773	0,00	0,0	0,0	87,70	6652,75	2181,82
7	1	1219,20	305273	0,00	0,0	0,0	108,00	6752,75	2909,09
8	1	1524,00	251773	0,00	0,0	0,0	128,29	6852,75	3636,36
9	1	1527,96	251071	0,00	0,0	0,0	128,55	6854,05	3645,83
10	1	1528,02	251071	0,00	0,0	0,0	128,56	6854,07	3645,98
11	1	1828,80	198273	0,00	0,0	0,0	148,59	6952,75	4363,64
12	1	2133,60	144773	0,00	0,0	0,0	168,89	7052,75	5090,91
13	1	2349,98	106790	0,00	0,0	0,0	183,29	7123,74	5607,18
14	1	2350,04	73850	0,00	0,0	0,0	183,30	7123,76	4464,32
15	1	2438,40	52643	0,00	0,0	0,0	189,18	7152,75	4634,23
16	1	2690,96	-10596	0,00	0,0	0,0	206,00	7235,61	5281,14

Casing Load Summary - PressureTest #1 - 9 5/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	597418	0,00	0,0	0,0	50,00	6200,07	0,07
2	1	24,96	593040	0,00	0,0	0,0	46,92	6259,58	59,58
3	1	122,99	575834	0,00	0,0	0,0	35,00	6493,48	293,49
4	1	304,80	543923	0,00	0,0	0,0	47,12	6927,27	727,28
5	1	609,60	490423	0,00	0,0	0,0	67,44	7654,54	1454,55
6	1	914,40	436923	0,00	0,0	0,0	87,66	8381,82	2181,82
7	1	1219,20	383423	0,00	0,0	0,0	107,98	9109,09	2909,09
8	1	1524,00	329923	0,00	0,0	0,0	128,30	9836,36	3636,36
9	1	1527,96	329221	0,00	0,0	0,0	128,56	9845,83	3645,83
10	1	1528,02	329221	0,00	0,0	0,0	128,57	9845,98	3645,98
11	1	1828,80	276423	0,10	0,8	0,0	148,62	10563,63	4363,64
12	1	1981,20	249673	0,30	4,1	0,0	158,78	10927,27	4727,27
13	1	2133,60	222923	0,49	8,8	0,0	168,94	11290,91	5090,91
14	1	2286,00	196173	0,69	14,6	0,0	179,10	11654,55	5454,54
15	1	2349,98	184940	0,77	17,4	0,0	183,36	11807,18	5607,18
16	1	2350,04	234401	0,00	0,0	0,0	183,37	11807,32	4464,32
17	1	2438,40	219686	0,00	0,0	0,0	189,16	12018,18	4634,23
18	1	2690,96	174280	0,00	0,0	0,0	206,00	12620,83	5281,14
19									
20	**Additional Pickup to Prevent Buckling = 83048 lbf**								

Casing Load Summary - LostReturnsWithMudDrop #1 - 9 5/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	343559	0,00	0,0	0,0	50,00	0,00	0,07
2	1	24,96	339182	0,00	0,0	0,0	50,00	0,00	59,58
3	1	122,99	321975	0,00	0,0	0,0	35,00	0,00	293,49
4	1	304,80	290065	0,00	0,0	0,0	47,11	0,00	727,28
5	1	609,60	236565	0,00	0,0	0,0	67,40	5,64	1454,55
6	1	914,40	183065	0,00	0,0	0,0	87,70	739,52	2181,82
7	1	1219,20	129565	0,00	0,0	0,0	108,00	1518,74	2909,09
8	1	1524,00	76065	0,00	0,0	0,0	128,29	2297,96	3636,36
9	1	1527,96	75363	0,00	0,0	0,0	128,55	2308,11	3645,83
10	1	1528,02	75363	0,00	0,0	0,0	128,56	2308,26	3645,98
11	1	1828,80	22565	0,00	0,0	0,0	148,59	3077,18	4363,64
12	1	2133,60	-30935	0,00	0,0	0,0	168,89	3856,40	5090,91
13	1	2349,98	-68919	0,00	0,0	0,0	183,29	4409,55	5607,18
14	1	2350,04	-19318	0,00	0,0	0,0	183,30	4409,70	4464,32
15	1	2438,40	-33765	0,00	0,0	0,0	189,18	4635,62	4634,23
16	1	2690,96	-77683	0,00	0,0	0,0	206,00	5281,31	5281,14

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Casing Load Summary - GreenCement #1 - 9 5/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	756034	0,00	0,0	0,0	50,00	6700,07	0,07
2	1	24,96	751657	0,00	0,0	0,0	46,92	6759,58	59,58
3	1	122,99	734450	0,00	0,0	0,0	35,00	6993,48	293,48
4	1	304,80	702539	0,00	0,0	0,0	47,12	7427,27	727,27
5	1	609,60	649039	0,00	0,0	0,0	67,44	8154,54	1454,55
6	1	914,40	595539	0,00	0,0	0,0	87,66	8881,82	2181,82
7	1	1219,20	542039	0,00	0,0	0,0	107,98	9609,08	2909,09
8	1	1524,00	488539	0,00	0,0	0,0	128,30	10336,36	3636,36
9	1	1527,96	487837	0,00	0,0	0,0	128,56	10345,83	3645,83
10	1	1528,02	487837	0,00	0,0	0,0	128,57	10345,98	3645,98
11	1	1828,80	435039	0,00	0,0	0,0	148,62	11063,63	4363,63
12	1	2133,60	381539	0,00	0,0	0,0	168,94	11790,90	5090,91
13	1	2349,98	343556	0,00	0,0	0,0	183,36	12307,18	5607,18
14	1	2350,04	343556	0,00	0,0	0,0	183,37	12307,32	5607,31
15	1	2438,40	328039	0,00	0,0	0,0	189,16	12518,18	5795,57
16	1	2690,96	283702	0,00	0,0	0,0	206,00	13120,83	6418,00

Casing Load Summary - OverPull #1 - 9 5/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	422500	0,00	0,0	0,0	50,00	0,07	0,07
2	1	24,96	418123	0,00	0,0	0,0	46,92	59,58	59,58
3	1	122,99	400916	0,00	0,0	0,0	35,00	293,48	293,48
4	1	304,80	369006	0,00	0,0	0,0	47,12	727,27	727,27
5	1	609,60	315506	0,00	0,0	0,0	67,44	1454,54	1454,54
6	1	914,40	262006	0,00	0,0	0,0	87,66	2181,82	2181,82
7	1	1219,20	208506	0,00	0,0	0,0	107,98	2909,09	2909,09
8	1	1524,00	155006	0,00	0,0	0,0	128,30	3636,36	3636,36
9	1	1527,96	154304	0,00	0,0	0,0	128,56	3645,83	3645,83
10	1	1528,02	154304	0,00	0,0	0,0	128,57	3645,98	3645,98
11	1	1828,80	101506	0,00	0,0	0,0	148,62	4363,63	4363,63
12	1	2133,60	48006	0,00	0,0	0,0	168,94	5090,91	5090,91
13	1	2349,98	10022	0,00	0,0	0,0	183,36	5607,18	5607,18
14	1	2350,04	10022	0,00	0,0	0,0	183,37	5607,32	5607,32
15	1	2438,40	-5494	0,00	0,0	0,0	189,16	5818,18	5818,18
16	1	2690,96	-49832	0,00	0,0	0,0	206,00	6420,83	6420,83

Casing Load Summary - RunningHole #1 - 9 5/8" Intermediate Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	414487	0,00	0,0	0,0	50,00	0,07	0,07
2	1	24,96	411034	0,00	0,0	0,0	46,92	59,58	59,58
3	1	122,99	397464	0,00	0,0	0,0	35,00	293,48	293,48
4	1	304,80	372297	0,00	0,0	0,0	47,12	727,27	727,27
5	1	609,60	330104	0,00	0,0	0,0	67,44	1454,54	1454,54
6	1	914,40	287910	0,00	0,0	0,0	87,66	2181,82	2181,82
7	1	1219,20	245717	0,00	0,0	0,0	107,98	2909,09	2909,09
8	1	1524,00	203523	0,00	0,0	0,0	128,30	3636,36	3636,36
9	1	1527,96	202974	0,00	0,0	0,0	128,56	3645,83	3645,83
10	1	1528,02	202966	0,00	0,0	0,0	128,57	3645,98	3645,98
11	1	1828,80	161330	0,00	0,0	0,0	148,62	4363,63	4363,63
12	1	2133,60	119136	0,00	0,0	0,0	168,94	5090,91	5090,91
13	1	2349,98	89185	0,00	0,0	0,0	183,36	5607,18	5607,18
14	1	2350,04	89176	0,00	0,0	0,0	183,37	5607,32	5607,32
15	1	2438,40	76943	0,00	0,0	0,0	189,16	5818,18	5818,18
16	1	2690,96	41980	0,00	0,0	0,0	206,00	6420,83	6420,83

Casing Load Summary - Initial Conditions - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	2685,04	-205222	0,00	0,0	0,0	205,60	500,08	6864,25
2	1	2690,96	-205852	0,00	0,0	0,0	206,00	515,26	6876,90
3	1	2691,02	-205852	0,00	0,0	0,0	206,00	515,41	6877,04
4	1	2743,20	-211333	0,00	0,0	0,0	209,48	648,79	6988,18
5	1	3048,00	-243333	0,00	0,0	0,0	229,80	1428,01	7651,60
6	1	3150,99	-254146	0,00	0,0	0,0	236,67	1691,33	7928,96
7	1	3172,97	-256456	0,00	0,0	0,0	238,10	1747,49	7988,12

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Casing Load Summary - DisplaceToGas #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	2685,04	-87387	0,00	0,0	0,0	205,60	7233,67	6864,23
2	1	2690,96	-87794	0,00	0,0	0,0	206,00	7235,61	6857,22
3	1	2691,02	-51412	0,00	0,0	0,0	206,00	7235,63	5281,65
4	1	2743,20	-66451	0,00	0,0	0,0	209,48	7252,75	5718,97
5	1	3048,00	-125266	0,00	0,0	0,0	229,78	7352,75	7030,76
6	1	3150,99	-140570	0,00	0,0	0,0	236,64	7386,54	7336,54
7	1	3172,97	-143780	0,00	0,0	0,0	238,10	7393,75	7387,69

Casing Load Summary - GreenCement #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	2685,04	-24386	0,00	0,0	0,0	205,60	6700,08	6864,25
2	1	2690,96	-25016	0,00	0,0	0,0	206,00	6715,26	6876,90
3	1	2691,02	-25016	0,00	0,0	0,0	206,00	6715,41	6877,04
4	1	2743,20	-30496	0,00	0,0	0,0	209,48	6848,79	6988,18
5	1	3048,00	-62496	0,00	0,0	0,0	229,80	7628,01	7651,60
6	1	3150,99	-73310	0,00	0,0	0,0	236,67	7891,33	7928,96
7	1	3172,97	-75619	0,00	0,0	0,0	238,10	7947,49	7988,12

Casing Load Summary - OverPull #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	2685,04	-4352	0,00	0,0	0,0	205,60	6864,27	6864,27
2	1	2690,96	-4982	0,00	0,0	0,0	206,00	6879,45	6879,45
3	1	2691,02	-4982	0,00	0,0	0,0	206,00	6879,61	6879,61
4	1	2743,20	-10462	0,00	0,0	0,0	209,48	7012,98	7012,98
5	1	3048,00	-42462	0,00	0,0	0,0	229,80	7792,20	7792,20
6	1	3150,99	-53276	0,00	0,0	0,0	236,67	8055,52	8055,52
7	1	3172,97	-55585	0,00	0,0	0,0	238,10	8111,68	8111,68

Casing Load Summary - RunningHole #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	2685,04	64764	0,00	0,0	0,0	205,60	6864,27	6864,27
2	1	2690,96	64282	0,00	0,0	0,0	206,00	6879,45	6879,45
3	1	2691,02	64277	0,00	0,0	0,0	206,00	6879,61	6879,61
4	1	2743,20	60042	0,00	0,0	0,0	209,48	7012,98	7012,98
5	1	3048,00	35303	0,00	0,0	0,0	229,80	7792,20	7792,20
6	1	3150,99	26942	0,00	0,0	0,0	236,67	8055,52	8055,52
7	1	3172,97	25159	0,00	0,0	0,0	238,10	8111,68	8111,68

Casing Load Summary - TbgLeak #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	2685,04	-93847	0,00	0,0	0,0	205,60	6864,27	6864,24
2	1	2690,96	-94379	0,00	0,0	0,0	206,00	6879,45	6872,67
3	1	2691,02	-94378	0,00	0,0	0,0	206,00	6879,61	6872,75
4	1	2743,20	-99002	0,00	0,0	0,0	209,48	7012,98	6946,82
5	1	3048,00	-125675	0,00	0,0	0,0	229,80	7792,20	7379,54
6	1	3150,99	-133462	0,00	0,0	0,0	236,67	8055,52	7525,78
7	1	3172,97	-135125	0,00	0,0	0,0	238,10	8111,68	7556,97

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Safety Factor Summary - Initial Conditions - 30" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	42000,0	15067,4	2,787	N/A	2,450	100+	5,268
2	1	24,96	42000,0	15073,0	2,786	N/A	2,450	100+	5,458
3	1	91,32	42000,0	15107,4	N 2,780	N/A	2,450	100+	6,031
4	1	122,96	42000,0	15139,5	N 2,774	N/A	2,450	100+	6,293
5	1	123,02	42000,0	15138,4	N 2,774	N/A	2,450	100+	6,293
6	1	158,98	42000,0	13721,5	N 3,061	N/A	2,697	100+	6,754
7									

7
8 **Burst and Axial Flags**
9 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
10
11 **Axial Flags**
12 **Default = Tension, M = Compression**
13
14 **Triaxial Flags**
15 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
16
17 **Envelope Flags**
18 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - LostReturnsWithWater #1 - 30" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	42000,0	3320,2	12,650	N/A	26,741	100+	11,138
2	1	24,96	42000,0	3101,1	13,544	N/A	26,741	100+	12,025
3	1	91,32	42000,0	2539,1	16,541	N/A	26,739	100+	15,258
4	1	122,96	42000,0	2286,9	18,366	N/A	26,742	100+	17,501
5	1	123,02	42000,0	2606,6	16,113	N/A	26,744	100+	15,054
6	1	158,98	42000,0	2620,1	16,030	N/A	26,741	100+	15,256
7									

8 **Burst and Axial Flags**
9 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
10
11 **Axial Flags**
12 **Default = Tension, M = Compression**
13
14 **Triaxial Flags**
15 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
16
17 **Envelope Flags**
18 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - PressureTest #1 - 30" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	42000,0	19634,7	2,139	N/A	1,885	100+	4,532
2	1	24,96	42000,0	19657,4	N 2,137	N/A	1,885	100+	4,647
3	1	91,32	42000,0	19739,6	N 2,128	N/A	1,885	100+	4,981
4	1	122,96	42000,0	19788,0	N 2,123	N/A	1,885	100+	5,158
5	1	123,02	42000,0	19766,6	N 2,125	N/A	1,885	100+	5,278
6	1	158,98	42000,0	19750,8	N 2,126	N/A	1,885	100+	5,303
7									

8 **Burst and Axial Flags**
9 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
10
11 **Axial Flags**
12 **Default = Tension, M = Compression**
13
14 **Triaxial Flags**
15 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
16
17 **Envelope Flags**
18 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - LostReturnsWithMudDrop #1 - 30" Conductor Casing

String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
				Triaxial	Envelope	Burst	Collapse	Axial
1	0,03	42000,0	2758,7	D 15,225	N/A	100+	100+	15,229
1	24,96	42000,0	3275,5	12,823	N/A	100+	6,344	16,937
1	91,32	42000,0	4838,6	8,680	N/A	100+	2,094	24,141
1	122,96	42000,0	4319,3	9,724	N/A	100+	2,244	30,281
1	123,02	42000,0	4447,9	9,443	N/A	100+	2,244	26,864
1	158,98	42000,0	4199,6	10,001	N/A	100+	2,444	26,025

Burst and Axial Flags
Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection

Axial Flags
Default = Tension, M = Compression

Triaxial Flags
Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending

Envelope Flags
EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection

Safety Factor Summary - GreenCement #1 - 30" Conductor Casing

String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
				Triaxial	Envelope	Burst	Collapse	Axial
1	0,03	42000,0	34688,9	1,211*	N/A	1,065*	100+	2,436
1	24,96	42000,0	34701,1	1,210*	N/A	1,065*	100+	2,476
1	73,06	42000,0	34729,3	1,209*	N/A	1,065*	100+	2,557
1	91,32	42000,0	34742,3	N 1,209*	N/A	1,065*	100+	2,588
1	122,96	42000,0	34771,1	N 1,208*	N/A	1,065*	100+	2,635
1	123,02	42000,0	34771,1	N 1,208*	N/A	1,065*	100+	2,635
1	152,40	42000,0	33613,4	N 1,249*	N/A	1,101	100+	2,700
1	158,98	42000,0	33354,5	N 1,259	N/A	1,109	100+	2,716

*** Safety factor < Design factor**

Burst and Axial Flags
Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection

Axial Flags
Default = Tension, M = Compression

Triaxial Flags
Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending

Envelope Flags
EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection

Safety Factor Summary - OverPull #1 - 30" Conductor Casing

String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
				Triaxial	Envelope	Burst	Collapse	Axial
1	0,03	42000,0	1761,5	D 23,843	N/A	100+	100+	23,843
1	24,96	42000,0	1518,8	D 27,653	N/A	100+	100+	28,313
1	122,96	42000,0	565,2	D 74,316	N/A	100+	38,640	100+
1	123,02	42000,0	564,6	D 74,394	N/A	100+	38,621	100+
1	158,98	42000,0	420,0	D 100+	N/A	100+	29,890	M 100+

Burst and Axial Flags
Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection

Axial Flags
Default = Tension, M = Compression

Triaxial Flags
Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending

Envelope Flags
EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection

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Safety Factor Summary - RunningHole #1 - 30" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	42000,0	2897,0	D 14,498	N/A	100+	100+	14,498
2	1	24,96	42000,0	2689,7	D 15,615	N/A	100+	100+	15,823
3	1	122,96	42000,0	1875,2	D 22,398	N/A	100+	38,640	24,697
4	1	123,02	42000,0	1874,7	D 22,404	N/A	100+	38,621	24,705
5	1	158,98	42000,0	1576,0	D 26,650	N/A	100+	29,890	31,104
6									
7	**Burst and Axial Flags**								
8	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
9									
10	**Axial Flags**								
11	**Default = Tension, M = Compression**								
12									
13	**Triaxial Flags**								
14	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
15									
16	**Envelope Flags**								
17	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - Initial Conditions - 20" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	80000,0	8134,8	9,834	N/A	8,890	100+	14,516
2	1	24,96	80000,0	7993,3	10,008	N/A	9,018	100+	15,297
3	1	122,96	80000,0	7471,3	10,708	N/A	9,559	100+	19,401
4	1	123,02	80000,0	7470,5	10,709	N/A	9,560	100+	19,404
5	1	158,98	80000,0	6807,1	11,752	N/A	10,501	100+	21,522
6	1	159,04	80000,0	6806,0	11,754	N/A	10,502	100+	21,526
7	1	304,80	80000,0	4131,9	19,362	N/A	17,479	100+	38,629
8	1	572,96	80000,0	858,3	93,208	N/A	83,235	45,959	CM 83,647
9									
10	**Burst and Axial Flags**								
11	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
12									
13	**Axial Flags**								
14	**Default = Tension, M = Compression**								
15									
16	**Triaxial Flags**								
17	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
18									
19	**Envelope Flags**								
20	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - PressureTest #1 - 20" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	80000,0	39119,8	N 2,045	N/A	1,852	100+	5,149
2	1	24,96	80000,0	39183,0	N 2,042	N/A	1,852	100+	5,204
3	1	122,96	80000,0	39459,4	N 2,027	N/A	1,852	100+	5,434
4	1	123,02	80000,0	39144,0	2,044	N/A	1,852	100+	6,452
5	1	158,98	80000,0	39340,3	2,034	N/A	1,844	100+	6,535
6	1	159,04	80000,0	39340,6	2,034	N/A	1,844	100+	6,535
7	1	304,80	80000,0	40143,6	1,993	N/A	1,813	100+	6,892
8	1	572,96	80000,0	41768,2	1,915	N/A	1,758	100+	8,064
9									
10	**Burst and Axial Flags**								
11	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
12									
13	**Axial Flags**								
14	**Default = Tension, M = Compression**								
15									
16	**Triaxial Flags**								
17	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
18									
19	**Envelope Flags**								
20	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - LostReturnsWithMudDrop #1 - 20" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	80000,0	2685,2	D 29,793	N/A	100+	100+	29,816
2	1	24,96	80000,0	2878,9	27,788	N/A	100+	37,678	33,311
3	1	122,96	80000,0	4664,8	17,150	N/A	100+	7,650	61,759
4	1	123,02	80000,0	4626,8	17,291	N/A	100+	7,647	64,642
5	1	158,98	80000,0	5275,7	15,164	N/A	100+	6,151	97,964
6	1	159,04	80000,0	5275,7	15,164	N/A	100+	6,151	97,956
7	1	171,91	80000,0	5236,1	15,279	N/A	100+	6,139	100+
8	1	304,80	80000,0	4220,4	18,956	N/A	100+	6,877	M 100+
9	1	572,96	80000,0	2024,0	39,526	N/A	100+	9,081	CM 53,877
10									
11	**Burst and Axial Flags**								
12	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
13									
14	**Axial Flags**								
15	**Default = Tension, M = Compression**								
16									
17	**Triaxial Flags**								
18	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
19									
20	**Envelope Flags**								
21	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - GreenCement #1 - 20" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	80000,0	46510,4	1,720	N/A	1,533	100+	3,537
2	1	24,96	80000,0	46401,9	1,724	N/A	1,537	100+	3,582
3	1	122,96	80000,0	45983,6	1,740	N/A	1,551	100+	3,768
4	1	123,02	80000,0	45982,9	1,740	N/A	1,552	100+	3,768
5	1	158,98	80000,0	45314,3	1,765	N/A	1,574	100+	3,842
6	1	159,04	80000,0	45313,2	1,765	N/A	1,574	100+	3,842
7	1	304,80	80000,0	42601,3	1,878	N/A	1,675	100+	4,171
8	1	572,96	80000,0	39428,9	2,029	N/A	1,812	100+	4,953
9									
10	**Burst and Axial Flags**								
11	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
12									
13	**Axial Flags**								
14	**Default = Tension, M = Compression**								
15									
16	**Triaxial Flags**								
17	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
18									
19	**Envelope Flags**								
20	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - OverPull #1 - 20" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	80000,0	6012,2	D 13,306	N/A	100+	100+	13,314
2	1	24,96	80000,0	5773,0	D 13,858	N/A	100+	100+	13,969
3	1	122,96	80000,0	4833,1	D 16,553	N/A	100+	100+	17,313
4	1	123,02	80000,0	4832,5	D 16,555	N/A	100+	100+	17,316
5	1	158,98	80000,0	4487,8	D 17,826	N/A	100+	93,195	18,983
6	1	159,04	80000,0	4487,2	D 17,828	N/A	100+	93,159	18,986
7	1	304,80	80000,0	3089,2	D 25,897	N/A	100+	48,606	31,151
8	1	572,96	80000,0	800,0	D 100+	N/A	100+	25,856	100+
9									
10	**Burst and Axial Flags**								
11	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
12									
13	**Axial Flags**								
14	**Default = Tension, M = Compression**								
15									
16	**Triaxial Flags**								
17	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
18									
19	**Envelope Flags**								
20	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - RunningHole #1 - 20" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	80000,0	8195,3	D 9,762	N/A	100+	100+	9,768
2	1	24,96	80000,0	7998,6	D 10,002	N/A	100+	100+	10,061
3	1	122,96	80000,0	7225,7	D 11,072	N/A	100+	100+	11,409
4	1	123,02	80000,0	7225,2	D 11,072	N/A	100+	100+	11,410
5	1	158,98	80000,0	6941,8	D 11,524	N/A	100+	93,178	12,000
6	1	159,04	80000,0	6941,3	D 11,525	N/A	100+	93,142	12,001
7	1	304,80	80000,0	5791,7	D 13,813	N/A	100+	48,605	15,183
8	1	572,96	80000,0	3676,8	D 21,758	N/A	100+	25,856	29,644
9									
10	**Burst and Axial Flags**								
11	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
12									
13	**Axial Flags**								
14	**Default = Tension, M = Compression**								
15									
16	**Triaxial Flags**								
17	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
18									
19	**Envelope Flags**								
20	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - Initial Conditions - 13 3/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	14685,8	7,490	N/A	14,796	100+	C 6,692
2	1	24,96	110000,0	14478,9	7,597	N/A	14,796	100+	C 6,810
3	1	122,99	110000,0	13673,4	8,045	N/A	14,795	100+	C 7,315
4	1	304,80	110000,0	12220,3	9,001	N/A	14,796	100+	C 8,481
5	1	572,96	110000,0	10214,5	10,769	N/A	14,796	100+	C 11,089
6	1	573,02	110000,0	10214,1	10,769	N/A	14,796	100+	C 11,090
7	1	609,60	110000,0	9958,0	11,046	N/A	14,796	100+	C 11,576
8	1	914,40	110000,0	8072,2	13,627	N/A	14,795	100+	C 18,227
9	1	1219,20	110000,0	6879,5	15,990	N/A	14,796	100+	C 42,844
10	1	1299,97	110000,0	6731,4	16,341	N/A	14,796	100+	C 66,725
11	1	1300,03	110000,0	6731,3	16,341	N/A	14,796	100+	C 66,753
12	1	1524,00	110000,0	5325,7	20,655	N/A	18,550	100+	CM 100+
13	1	1527,96	110000,0	5292,7	N 20,783	N/A	18,670	100+	CM 100+
14									
15	**Burst and Axial Flags**								
16	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
17									
18	**Axial Flags**								
19	**Default = Tension, M = Compression**								
20									
21	**Triaxial Flags**								
22	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
23									
24	**Envelope Flags**								
25	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - PressureTest #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	57305,3	1,920	N/A	1,720	100+	3,707
2	1	24,96	110000,0	57302,2	1,920	N/A	1,720	100+	3,743
3	1	122,99	110000,0	57299,0	1,920	N/A	1,720	100+	3,891
4	1	304,80	110000,0	57331,7	1,919	N/A	1,720	100+	4,198
5	1	533,19	110000,0	57447,3	N 1,915	N/A	1,720	100+	4,652
6	1	572,96	110000,0	57486,3	N 1,913	N/A	1,720	100+	4,710
7	1	573,02	110000,0	57483,3	N 1,914	N/A	1,720	100+	4,719
8	1	609,60	110000,0	57519,3	N 1,912	N/A	1,720	100+	4,781
9	1	914,40	110000,0	57961,9	N 1,898	N/A	1,720	100+	5,367
10	1	1219,20	110000,0	58616,6	N 1,877	N/A	1,720	100+	6,101
11	1	1299,97	110000,0	58820,4	N 1,870	N/A	1,720	100+	6,327
12	1	1300,03	110000,0	58408,1	1,883	N/A	1,720	100+	C 7,435
13	1	1524,00	110000,0	60690,0	1,812	N/A	1,666	100+	C 8,316
14	1	1527,96	110000,0	60729,9	N 1,811	N/A	1,665	100+	C 8,332
15									
16	**Burst and Axial Flags**								
17	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
18									
19	**Axial Flags**								
20	**Default = Tension, M = Compression**								
21									
22	**Triaxial Flags**								
23	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
24									
25	**Envelope Flags**								
26	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - LostReturnsWithMudDrop #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	11923,7	D 9,225	N/A	100+	100+	C 9,224
2	1	24,96	110000,0	12051,6	9,127	N/A	100+	56,186	C 9,449
3	1	122,99	110000,0	12902,9	8,525	N/A	100+	11,414	C 10,450
4	1	304,80	110000,0	15640,6	7,033	N/A	100+	4,612	C 13,005
5	1	572,96	110000,0	20009,4	5,497	N/A	100+	2,638	C 20,342
6	1	573,02	110000,0	20008,9	5,498	N/A	100+	2,638	C 20,345
7	1	609,60	110000,0	19697,3	5,585	N/A	100+	2,636	C 22,041
8	1	914,40	110000,0	16385,8	6,713	N/A	100+	2,754	C 72,218
9	1	1219,20	110000,0	13286,3	8,279	N/A	100+	2,887	CM 56,473
10	1	1299,97	110000,0	12529,8	8,779	N/A	100+	2,924	CM 38,350
11	1	1300,03	110000,0	8879,8	12,388	N/A	100+	4,001	CM 56,740
12	1	1524,00	110000,0	7373,6	14,918	N/A	100+	4,110	CM 28,414
13	1	1527,96	110000,0	7350,5	14,965	N/A	100+	4,112	CM 28,190
14									
15	**Burst and Axial Flags**								
16	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
17									
18	**Axial Flags**								
19	**Default = Tension, M = Compression**								
20									
21	**Triaxial Flags**								
22	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
23									
24	**Envelope Flags**								
25	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - GreenCement #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	41400,3	2,657	N/A	2,466	100+	3,566
2	1	24,96	110000,0	41340,5	2,661	N/A	2,466	100+	3,599
3	1	122,99	110000,0	41117,0	2,675	N/A	2,466	100+	3,735
4	1	304,80	110000,0	40753,5	2,699	N/A	2,466	100+	4,017
5	1	572,96	110000,0	40341,7	2,727	N/A	2,466	100+	4,521
6	1	573,02	110000,0	40341,7	2,727	N/A	2,466	100+	4,521
7	1	609,60	110000,0	40297,2	2,730	N/A	2,466	100+	4,600
8	1	914,40	110000,0	40038,3	2,747	N/A	2,466	100+	5,380
9	1	1219,20	110000,0	39980,2	2,751	N/A	2,466	100+	6,478
10	1	1299,97	110000,0	39998,7	2,750	N/A	2,466	100+	C 6,847
11	1	1300,03	110000,0	39998,7	2,750	N/A	2,466	100+	C 6,848
12	1	1524,00	110000,0	38719,4	2,841	N/A	2,552	100+	C 8,139
13	1	1527,96	110000,0	38686,1	N 2,843	N/A	2,554	100+	C 8,166
14									

15 **Burst and Axial Flags**
16 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
17
18 **Axial Flags**
19 **Default = Tension, M = Compression**
20
21 **Triaxial Flags**
22 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
23
24 **Envelope Flags**
25 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - OverPull #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	16661,4	D 6,602	N/A	100+	100+	C 6,601
2	1	24,96	110000,0	16428,8	D 6,696	N/A	100+	100+	C 6,715
3	1	122,99	110000,0	15514,2	D 7,090	N/A	100+	100+	C 7,206
4	1	304,80	110000,0	13818,2	D 7,961	N/A	100+	59,817	C 8,335
5	1	572,96	110000,0	11316,4	D 9,720	N/A	100+	31,888	C 10,841
6	1	573,02	110000,0	11315,8	D 9,721	N/A	100+	31,885	C 10,842
7	1	609,60	110000,0	10974,7	D 10,023	N/A	100+	29,980	C 11,305
8	1	914,40	110000,0	8131,1	D 13,528	N/A	100+	20,020	C 17,565
9	1	1219,20	110000,0	5287,6	D 20,803	N/A	100+	15,032	C 39,360
10	1	1299,97	110000,0	4534,1	D 24,261	N/A	100+	14,101	C 58,641
11	1	1300,03	110000,0	4533,5	D 24,264	N/A	100+	14,100	C 58,663
12	1	1371,60	110000,0	3865,8	D 28,454	N/A	100+	13,366	C 100+
13	1	1524,00	110000,0	2444,1	D 45,007	N/A	100+	12,031	100+
14	1	1527,96	110000,0	2406,7	D 45,705	N/A	100+	12,000	100+
15									

16 **Burst and Axial Flags**
17 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
18
19 **Axial Flags**
20 **Default = Tension, M = Compression**
21
22 **Triaxial Flags**
23 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
24
25 **Envelope Flags**
26 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - RunningHole #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	16954,7	D 6,488	N/A	100+	100+	6,488
2	1	24,96	110000,0	16773,0	D 6,558	N/A	100+	100+	C 6,577
3	1	122,99	110000,0	16059,0	D 6,850	N/A	100+	100+	C 6,957
4	1	304,80	110000,0	14734,8	D 7,465	N/A	100+	59,772	C 7,794
5	1	572,96	110000,0	12781,4	D 8,606	N/A	100+	31,858	C 9,473
6	1	573,02	110000,0	12781,0	D 8,607	N/A	100+	31,855	C 9,473
7	1	609,60	110000,0	12514,6	D 8,790	N/A	100+	29,951	C 9,760
8	1	914,40	110000,0	10294,4	D 10,685	N/A	100+	20,001	C 13,055
9	1	1219,20	110000,0	8074,3	D 13,623	N/A	100+	15,019	C 19,706
10	1	1299,97	110000,0	7486,0	D 14,694	N/A	100+	14,090	C 22,782
11	1	1300,03	110000,0	7485,5	D 14,695	N/A	100+	14,089	C 22,785
12	1	1524,00	110000,0	5854,1	D 18,790	N/A	100+	12,026	C 40,178
13	1	1527,96	110000,0	5825,2	D 18,883	N/A	100+	11,994	C 40,729
14									

15 **Burst and Axial Flags**
16 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
17
18 **Axial Flags**
19 **Default = Tension, M = Compression**
20
21 **Triaxial Flags**
22 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
23
24 **Envelope Flags**
25 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - OilKick #1 - 13 3/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	29095,9	3,781	N/A	3,443	100+	5,620
2	1	24,96	110000,0	28715,7	3,831	N/A	3,489	100+	5,702
3	1	122,99	110000,0	27221,4	4,041	N/A	3,684	100+	6,052
4	1	304,80	110000,0	24451,4	4,499	N/A	4,107	100+	C 6,828
5	1	572,96	110000,0	20369,5	5,400	N/A	4,947	100+	C 8,423
6	1	573,02	110000,0	20368,6	5,400	N/A	4,947	100+	C 8,423
7	1	609,60	110000,0	19812,4	5,552	N/A	5,089	100+	C 8,700
8	1	914,40	110000,0	15185,0	7,244	N/A	6,687	100+	C 11,988
9	1	1219,20	110000,0	10584,2	10,393	N/A	9,747	100+	C 19,271
10	1	1299,97	110000,0	9374,4	11,734	N/A	11,092	100+	C 22,969
11	1	1300,03	110000,0	8896,3	12,365	N/A	11,093	100+	C 49,433
12	1	1378,00	110000,0	8353,6	13,168	N/A	11,803	100+	C 86,721
13	1	1524,00	110000,0	7411,9	14,841	N/A	13,409	100+	100+
14	1	1527,96	110000,0	7387,7	N 14,890	N/A	13,458	100+	100+
15									

16 **Burst and Axial Flags**
17 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
18
19 **Axial Flags**
20 **Default = Tension, M = Compression**
21
22 **Triaxial Flags**
23 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
24
25 **Envelope Flags**
26 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - Initial Conditions - 9 5/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	24101,6	4,564	N/A	21,800	100+	4,261
2	1	24,96	110000,0	23883,7	4,606	N/A	21,800	100+	4,308
3	1	122,99	110000,0	23027,8	4,777	N/A	21,800	100+	4,504
4	1	304,80	110000,0	21444,0	5,130	N/A	21,800	100+	4,917
5	1	609,60	110000,0	18802,1	5,850	N/A	21,800	100+	5,810
6	1	914,40	110000,0	16184,1	6,797	N/A	21,800	100+	7,101
7	1	1219,20	110000,0	13603,8	8,086	N/A	21,800	100+	9,130
8	1	1524,00	110000,0	11087,5	9,921	N/A	21,800	100+	12,779
9	1	1527,96	110000,0	11055,0	9,950	N/A	21,800	100+	12,847
10	1	1528,02	110000,0	11055,2	9,950	N/A	21,800	100+	12,847
11	1	1828,80	110000,0	8691,0	12,657	N/A	21,800	100+	C 21,291
12	1	2133,60	110000,0	6547,2	16,801	N/A	21,800	59,463	C 63,766
13	1	2349,98	110000,0	5349,3	20,563	N/A	21,800	41,489	100+
14	1	2350,04	110000,0	5349,4	20,563	N/A	21,800	41,487	100+
15	1	2438,40	110000,0	5141,2	21,396	N/A	20,857	41,211	CM 64,085
16	1	2541,00	110000,0	5105,7	21,545	N/A	19,860	40,894	CM 38,262
17	1	2690,96	110000,0	4634,5	N 23,735	N/A	21,677	28,299	CM 24,076
18									
19	**Burst and Axial Flags**								
20	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
21									
22	**Axial Flags**								
23	**Default = Tension, M = Compression**								
24									
25	**Triaxial Flags**								
26	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
27									
28	**Envelope Flags**								
29	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - DisplaceToGas #1 - 9 5/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	58724,4	1,873	N/A	1,716	100+	3,293
2	1	24,96	110000,0	58254,9	1,888	N/A	1,730	100+	3,321
3	1	122,99	110000,0	56409,7	1,950	N/A	1,787	100+	3,436
4	1	304,80	110000,0	52989,5	2,076	N/A	1,904	100+	3,672
5	1	609,60	110000,0	47262,1	2,327	N/A	2,138	100+	4,148
6	1	914,40	110000,0	41545,8	2,648	N/A	2,438	100+	4,767
7	1	1219,20	110000,0	35846,1	3,069	N/A	2,836	100+	5,602
8	1	1524,00	110000,0	30172,2	3,646	N/A	3,389	100+	6,792
9	1	1527,96	110000,0	30098,5	3,655	N/A	3,398	100+	6,811
10	1	1528,02	110000,0	30097,5	3,655	N/A	3,398	100+	6,811
11	1	1828,80	110000,0	24542,3	4,482	N/A	4,210	100+	8,625
12	1	2133,60	110000,0	18995,4	5,791	N/A	5,556	100+	11,812
13	1	2349,98	110000,0	15158,0	7,257	N/A	7,187	100+	16,014
14	1	2350,04	110000,0	24556,8	4,479	N/A	4,099	100+	C 23,155
15	1	2438,40	110000,0	23330,8	4,715	N/A	4,328	100+	C 32,483
16	1	2590,80	110000,0	21255,1	5,175	N/A	4,790	100+	C 96,513
17	1	2690,96	110000,0	18373,8	N 5,987	N/A	5,577	100+	100+
18									
19	**Burst and Axial Flags**								
20	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
21									
22	**Axial Flags**								
23	**Default = Tension, M = Compression**								
24									
25	**Triaxial Flags**								
26	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
27									
28	**Envelope Flags**								
29	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - PressureTest #1 - 9 5/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	58200,9	1,890	N/A	1,758	100+	2,863
2	1	24,96	110000,0	58156,7	1,891	N/A	1,758	100+	2,884
3	1	122,99	110000,0	57990,5	1,897	N/A	1,758	100+	2,970
4	1	304,80	110000,0	57716,0	1,906	N/A	1,758	100+	3,144
5	1	609,60	110000,0	57355,6	1,918	N/A	1,758	100+	3,487
6	1	914,40	110000,0	57121,9	1,926	N/A	1,758	100+	3,914
7	1	1219,20	110000,0	57016,6	1,929	N/A	1,758	100+	4,460
8	1	1524,00	110000,0	57040,5	1,928	N/A	1,758	100+	5,183
9	1	1527,96	110000,0	57041,6	1,928	N/A	1,758	100+	5,194
10	1	1528,02	110000,0	57041,6	1,928	N/A	1,758	100+	5,194
11	1	1828,80	110000,0	57208,2	N 1,923	N/A	1,758	100+	6,116
12	1	2133,60	110000,0	57597,7	N 1,910	N/A	1,758	100+	7,155
13	1	2349,98	110000,0	57995,5	N 1,897	N/A	1,758	100+	8,137
14	1	2350,04	110000,0	68595,7	1,604	N/A	1,484	100+	7,296
15	1	2438,40	110000,0	69139,9	1,591	N/A	1,476	100+	7,784
16	1	2665,99	110000,0	70573,9	1,559	N/A	1,455	100+	9,345
17	1	2690,96	110000,0	69165,0	N 1,590	N/A	1,485	100+	9,812
18									
19	**Burst and Axial Flags**								
20	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
21									
22	**Axial Flags**								
23	**Default = Tension, M = Compression**								
24									
25	**Triaxial Flags**								
26	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
27									
28	**Envelope Flags**								
29	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - LostReturnsWithMudDrop #1 - 9 5/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	22099,0	D 4,978	N/A	100+	100+	4,978
2	1	24,96	110000,0	22140,1	4,968	N/A	100+	100+	5,042
3	1	122,99	110000,0	22431,3	4,904	N/A	100+	25,492	5,311
4	1	304,80	110000,0	23490,7	4,683	N/A	100+	10,363	5,896
5	1	609,60	110000,0	26505,9	4,150	N/A	100+	5,260	7,229
6	1	914,40	110000,0	24140,9	4,557	N/A	100+	5,051	9,342
7	1	1219,20	110000,0	21458,1	5,126	N/A	100+	4,982	13,199
8	1	1524,00	110000,0	18863,6	5,831	N/A	100+	4,914	C 22,481
9	1	1527,96	110000,0	18830,3	5,842	N/A	100+	4,913	C 22,690
10	1	1528,02	110000,0	18830,3	5,842	N/A	100+	4,913	C 22,690
11	1	1828,80	110000,0	16399,4	6,708	N/A	100+	4,846	C 75,783
12	1	2133,60	110000,0	14133,7	7,783	N/A	100+	4,757	CM 55,276
13	1	2349,98	110000,0	12704,3	8,658	N/A	100+	4,685	CM 24,812
14	1	2350,04	110000,0	3493,3	31,489	N/A	100+	14,350	CM 88,518
15	1	2438,40	110000,0	2456,4	44,782	N/A	100+	15,184	CM 50,644
16	1	2590,80	110000,0	1229,5	89,470	N/A	100+	16,875	CM 29,983
17	1	2665,99	110000,0	1339,3	82,129	N/A	74,833	17,857	CM 24,738
18	1	2690,96	110000,0	1100,0	D 100+	N/A	100+	13,296	CM 22,011
19									
20	**Burst and Axial Flags**								
21	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
22									
23	**Axial Flags**								
24	**Default = Tension, M = Compression**								
25									
26	**Triaxial Flags**								
27	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
28									
29	**Envelope Flags**								
30	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - GreenCement #1 - 9 5/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	64699,4	1,700	N/A	1,627	100+	2,262
2	1	24,96	110000,0	64631,9	1,702	N/A	1,627	100+	2,275
3	1	122,99	110000,0	64373,4	1,709	N/A	1,627	100+	2,328
4	1	304,80	110000,0	63922,8	1,721	N/A	1,627	100+	2,434
5	1	609,60	110000,0	63253,1	1,739	N/A	1,627	100+	2,635
6	1	914,40	110000,0	62693,9	1,755	N/A	1,627	100+	2,872
7	1	1219,20	110000,0	62248,0	1,767	N/A	1,627	100+	3,155
8	1	1524,00	110000,0	61918,1	1,777	N/A	1,627	100+	3,500
9	1	1527,96	110000,0	61914,5	1,777	N/A	1,627	100+	3,505
10	1	1528,02	110000,0	61914,6	1,777	N/A	1,627	100+	3,505
11	1	1828,80	110000,0	61705,9	1,783	N/A	1,627	100+	3,931
12	1	2133,60	110000,0	61612,5	1,785	N/A	1,627	100+	4,482
13	1	2286,00	110000,0	61610,6	1,785	N/A	1,627	100+	4,820
14	1	2349,98	110000,0	61618,8	1,785	N/A	1,627	100+	4,978
15	1	2350,04	110000,0	61618,9	1,785	N/A	1,627	100+	4,978
16	1	2438,40	110000,0	61850,4	1,778	N/A	1,621	100+	5,213
17	1	2541,00	110000,0	62135,4	1,770	N/A	1,615	100+	5,516
18	1	2690,96	110000,0	61777,8	1,781	N/A	1,626	100+	6,028
19									
20	**Burst and Axial Flags**								
21	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
22									
23	**Axial Flags**								
24	**Default = Tension, M = Compression**								
25									
26	**Triaxial Flags**								
27	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
28									
29	**Envelope Flags**								
30	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - OverPull #1 - 9 5/8" Intermediate Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	110000,0	27176,4	D 4,048	N/A	100+	100+	4,048
2	1	24,96	110000,0	26954,3	D 4,081	N/A	100+	100+	4,090
3	1	122,99	110000,0	26081,5	D 4,218	N/A	100+	100+	4,266
4	1	304,80	110000,0	24462,7	D 4,497	N/A	100+	89,800	4,634
5	1	609,60	110000,0	21748,7	D 5,058	N/A	100+	45,489	5,420
6	1	914,40	110000,0	19034,7	D 5,779	N/A	100+	30,693	6,527
7	1	1219,20	110000,0	16320,7	D 6,740	N/A	100+	23,278	8,202
8	1	1524,00	110000,0	13606,7	D 8,084	N/A	100+	18,816	11,033
9	1	1527,96	110000,0	13571,0	D 8,106	N/A	100+	18,769	11,083
10	1	1528,02	110000,0	13571,2	D 8,105	N/A	100+	18,768	11,083
11	1	1828,80	110000,0	10892,7	D 10,098	N/A	100+	15,830	16,847
12	1	1981,20	110000,0	9535,7	D 11,536	N/A	100+	14,678	C 22,874
13	1	2133,60	110000,0	8178,7	D 13,450	N/A	100+	13,689	C 35,621
14	1	2349,98	110000,0	6251,8	D 17,595	N/A	100+	12,501	M 100+
15	1	2350,04	110000,0	6251,9	D 17,595	N/A	100+	12,501	M 100+
16	1	2438,40	110000,0	5464,7	D 20,129	N/A	100+	12,066	100+
17	1	2541,00	110000,0	4551,2	D 24,170	N/A	100+	11,579	CM 72,757
18	1	2690,96	110000,0	3215,5	D 34,210	N/A	100+	10,933	CM 34,315
19									
20	**Burst and Axial Flags**								
21	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
22									
23	**Axial Flags**								
24	**Default = Tension, M = Compression**								
25									
26	**Triaxial Flags**								
27	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
28									
29	**Envelope Flags**								
30	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - RunningHole #1 - 9 5/8" Intermediate Casing

String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
				Triaxial	Envelope	Burst	Collapse	Axial
1	0,03	110000,0	26660,9	D 4,126	N/A	100+	100+	4,126
1	24,96	110000,0	26498,4	D 4,151	N/A	100+	100+	4,161
1	122,99	110000,0	25859,4	D 4,254	N/A	100+	100+	4,303
1	304,80	110000,0	24674,4	D 4,458	N/A	100+	89,725	4,593
1	609,60	110000,0	22687,7	D 4,848	N/A	100+	45,332	5,181
1	914,40	110000,0	20700,9	D 5,314	N/A	100+	30,518	5,940
1	1219,20	110000,0	18714,2	D 5,878	N/A	100+	23,100	6,960
1	1524,00	110000,0	16727,5	D 6,576	N/A	100+	18,641	8,403
1	1527,96	110000,0	16701,6	D 6,586	N/A	100+	18,595	8,425
1	1528,02	110000,0	16701,2	D 6,586	N/A	100+	18,594	8,426
1	1828,80	110000,0	14740,7	D 7,462	N/A	100+	15,661	10,600
1	2133,60	110000,0	12754,0	D 8,625	N/A	100+	13,527	14,354
1	2349,98	110000,0	11343,7	D 9,697	N/A	100+	12,345	19,175
1	2350,04	110000,0	11343,3	D 9,697	N/A	100+	12,345	19,177
1	2438,40	110000,0	10767,3	D 10,216	N/A	100+	11,922	C 22,224
1	2690,96	110000,0	9121,0	D 12,060	N/A	100+	10,864	C 40,734

Burst and Axial Flags
Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection

Axial Flags
Default = Tension, M = Compression

Triaxial Flags
Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending

Envelope Flags
EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection

Safety Factor Summary - Initial Conditions - 7" Production Liner

String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
				Triaxial	Envelope	Burst	Collapse	Axial
1	2685,04	110000,0	52244,5	2,105	N/A	100+	1,677	M 4,994
1	2690,96	110000,0	52214,2	2,107	N/A	100+	1,677	M 4,979
1	2691,02	110000,0	52214,0	2,107	N/A	100+	1,677	M 4,979
1	2743,20	110000,0	51951,0	2,117	N/A	100+	1,678	M 4,850
1	3023,01	110000,0	50633,4	2,172	N/A	100+	1,685	M 4,258
1	3048,00	110000,0	50642,9	2,172	N/A	100+	1,682	M 4,212
1	3150,99	110000,0	50690,3	2,170	N/A	100+	1,670	M 4,033
1	3172,97	110000,0	50702,3	2,170	N/A	100+	1,667	M 3,996

Burst and Axial Flags
Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection

Axial Flags
Default = Tension, M = Compression

Triaxial Flags
Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending

Envelope Flags
EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection

Safety Factor Summary - DisplaceToGas #1 - 7" Production Liner

String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
				Triaxial	Envelope	Burst	Collapse	Axial
1	2685,04	110000,0	4896,7	22,464	N/A	33,722	19,020	M 11,728
1	2690,96	110000,0	5007,3	21,968	N/A	32,923	19,317	M 11,674
1	2691,02	110000,0	17493,7	6,288	N/A	6,376	100+	M 19,935
1	2743,20	110000,0	14296,1	7,694	N/A	8,122	100+	M 15,423
1	3048,00	110000,0	8034,3	13,691	N/A	38,691	17,121	M 8,182
1	3150,99	110000,0	7944,8	13,846	N/A	100+	11,899	M 7,291
1	3172,97	110000,0	8066,3	N 13,637	N/A	100+	11,337	M 7,128

Burst and Axial Flags
Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection

Axial Flags
Default = Tension, M = Compression

Triaxial Flags
Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending

Envelope Flags
EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection

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Safety Factor Summary - GreenCement #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	2685,04	110000,0	5030,4	21,867	N/A	100+	10,453	M 42,029
2	1	2690,96	110000,0	4963,0	22,164	N/A	100+	10,459	M 40,971
3	1	2691,02	110000,0	4963,0	22,164	N/A	100+	10,459	M 40,971
4	1	2743,20	110000,0	4376,5	25,134	N/A	100+	10,509	M 33,608
5	1	3048,00	110000,0	1100,0	100+	N/A	100+	10,665	M 16,400
6	1	3150,99	110000,0	1100,0	100+	N/A	100+	10,180	M 13,980
7	1	3172,97	110000,0	1100,0	100+	N/A	100+	10,083	M 13,553
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - OverPull #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	2685,04	110000,0	6397,1	D 17,195	N/A	100+	12,135	100+
2	1	2690,96	110000,0	6344,7	D 17,337	N/A	100+	12,108	100+
3	1	2691,02	110000,0	6344,9	D 17,337	N/A	100+	12,108	100+
4	1	2743,20	110000,0	5890,1	D 18,675	N/A	100+	11,877	M 97,965
5	1	3048,00	110000,0	3234,9	D 34,005	N/A	100+	10,690	M 24,137
6	1	3150,99	110000,0	2337,6	D 47,057	N/A	100+	10,340	M 19,238
7	1	3172,97	110000,0	2145,9	D 51,261	N/A	100+	10,269	M 18,438
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - RunningHole #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	2685,04	110000,0	13815,0	D 7,962	N/A	100+	11,862	15,825
2	1	2690,96	110000,0	13778,5	D 7,983	N/A	100+	11,838	15,944
3	1	2691,02	110000,0	13778,1	D 7,984	N/A	100+	11,838	15,945
4	1	2743,20	110000,0	13457,0	D 8,174	N/A	100+	11,631	17,070
5	1	3048,00	110000,0	11581,0	D 9,498	N/A	100+	10,562	29,032
6	1	3150,99	110000,0	10947,0	D 10,048	N/A	100+	10,247	38,041
7	1	3172,97	110000,0	10811,8	D 10,174	N/A	100+	10,182	40,737
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - TbgLeak #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	2685,04	110000,0	3208,1	D 34,288	N/A	100+	12,135	M 10,921
2	1	2690,96	110000,0	3282,1	33,515	N/A	100+	12,201	M 10,859
3	1	2691,02	110000,0	3282,2	33,514	N/A	100+	12,202	M 10,859
4	1	2743,20	110000,0	3958,7	27,787	N/A	100+	12,811	M 10,352
5	1	3048,00	110000,0	8328,6	13,208	N/A	30,190	18,092	M 8,155
6	1	3150,99	110000,0	9744,8	11,288	N/A	23,517	21,021	M 7,679
7	1	3172,97	110000,0	10049,1	N 10,946	N/A	22,458	21,772	M 7,585
8									

9 **Burst and Axial Flags**
10 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
11
12 **Axial Flags**
13 **Default = Tension, M = Compression**
14
15 **Triaxial Flags**
16 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
17
18 **Envelope Flags**
19 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Movement Summary - Initial Conditions - 30" Conductor Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	123,00	0,000	0,000	0,000	0,000	0,000	36,05

Movement Summary - LostReturnsWithWater #1 - 30" Conductor Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	123,00	-0,017	0,000	0,016	0,001	0,000	0,00

Movement Summary - PressureTest #1 - 30" Conductor Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	123,00	0,005	0,000	-0,005	0,000	0,000	122,77

Movement Summary - LostReturnsWithMudDrop #1 - 30" Conductor Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	123,00	-0,021	0,000	0,020	0,001	0,000	0,00

Movement Summary - GreenCement #1 - 30" Conductor Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	123,00	0,015	0,000	0,000	0,000	0,015	36,05

Movement Summary - OverPull #1 - 30" Conductor Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	123,00	0,001	0,000	0,000	0,000	0,001*	0,00
2								

3 *** Surface displacement due to pickup (+) or slackoff (-)**

Movement Summary - RunningHole #1 - 30" Conductor Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1–5	No results available for this load case							

Movement Summary - Initial Conditions - 20" Surface Casing

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	123,00	0,000	0,000	0,000	0,000	0,000	0,00

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Movement Summary - PressureTest #1 - 20" Surface Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	123,00	0,035	-0,002	-0,034	0,000	0,000	123,00

Movement Summary - LostReturnsWithMudDrop #1 - 20" Surface Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	123,00	-0,012	0,000	0,010	0,001	0,000	0,00

Movement Summary - GreenCement #1 - 20" Surface Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	123,00	0,028	0,000	0,000	0,000	0,028	0,00

Movement Summary - OverPull #1 - 20" Surface Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	123,00	0,010	0,000	0,000	0,000	0,010*	0,00
2								
3	*** Surface displacement due to pickup (+) or slackoff (-)**							

Movement Summary - RunningHole #1 - 20" Surface Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No results available for this load case							
4								
5								

Movement Summary - Initial Conditions - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	1300,00	0,000	0,000	0,000	0,000	0,000	0,00

Movement Summary - PressureTest #1 - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	1300,00	0,574	-0,005	-0,570	0,000	0,000	776,96

Movement Summary - LostReturnsWithMudDrop #1 - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	1300,00	-0,196	0,000	0,195	0,001	0,000	0,00

Movement Summary - GreenCement #1 - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	1300,00	0,250	0,000	0,000	0,000	0,250	0,00

Movement Summary - OverPull #1 - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	1300,00	0,123	0,000	0,000	0,000	0,123*	0,00
2								
3	*** Surface displacement due to pickup (+) or slackoff (-)**							

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Movement Summary - RunningHole #1 - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1–5	No results available for this load case							

Movement Summary - OilKick #1 - 13 3/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	1300,00	0,136	0,000	-0,136	0,000	0,000	0,00

Movement Summary - Initial Conditions - 9 5/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2350,00	0,000	0,000	0,000	0,000	0,000	0,00

Movement Summary - DisplaceToGas #1 - 9 5/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2350,00	0,593	0,000	-0,594	0,001	0,000	0,00

Movement Summary - PressureTest #1 - 9 5/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2350,00	0,988	-0,002	-0,986	0,000	0,000	596,76

Movement Summary - LostReturnsWithMudDrop #1 - 9 5/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2350,00	-0,292	0,000	0,291	0,001	0,000	0,00

Movement Summary - GreenCement #1 - 9 5/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2350,00	0,715	0,000	0,000	0,000	0,715	0,00

Movement Summary - OverPull #1 - 9 5/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2350,00	0,288	0,000	0,000	0,000	0,288*	0,00
2								
3	*** Surface displacement due to pickup (+) or slackoff (-)**							

Movement Summary - RunningHole #1 - 9 5/8" Intermediate Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1–5	No results available for this load case							

Movement Summary - Initial Conditions - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1–5	No length changes - Pipe is fully cemented							

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Movement Summary - DisplaceToGas #1 - 7" Production Liner

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3				No length changes - Pipe is fully cemented				
4								
5								

Movement Summary - GreenCement #1 - 7" Production Liner

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3				No length changes - Pipe is fully cemented				
4								
5								

Movement Summary - OverPull #1 - 7" Production Liner

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3				No length changes - Pipe is fully cemented				
4								
5								

Movement Summary - RunningHole #1 - 7" Production Liner

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3				No length changes - Pipe is fully cemented				
4								
5								

Movement Summary - TbgLeak #1 - 7" Production Liner

	MD (m) Top	Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3				No length changes - Pipe is fully cemented				
4								
5								

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5.2.3.2 Slender Well Design

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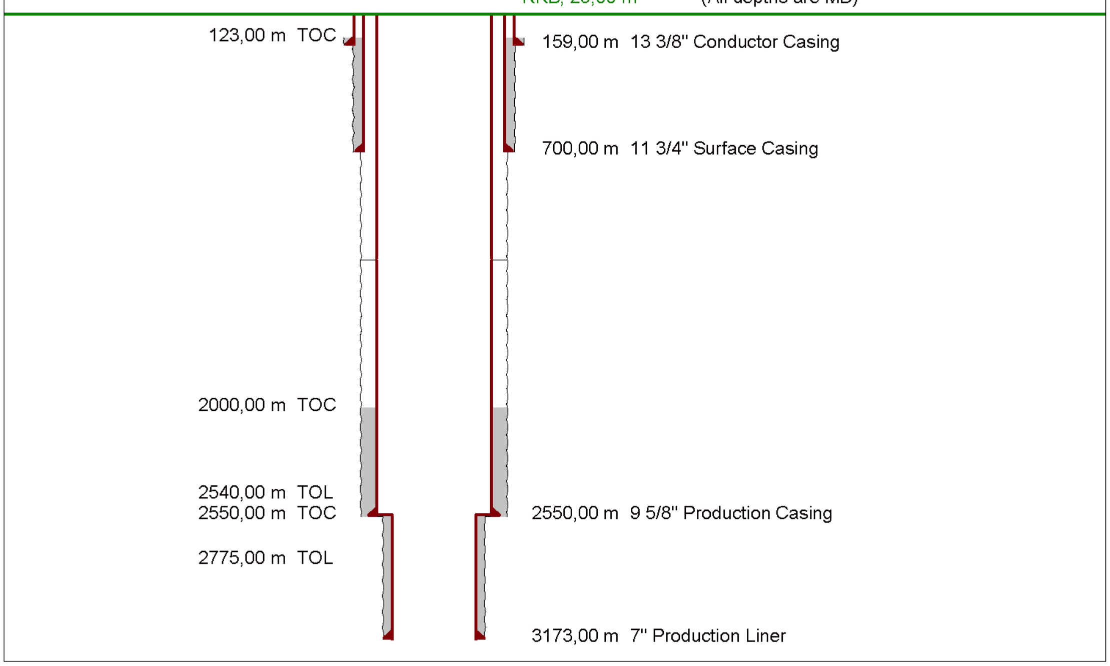
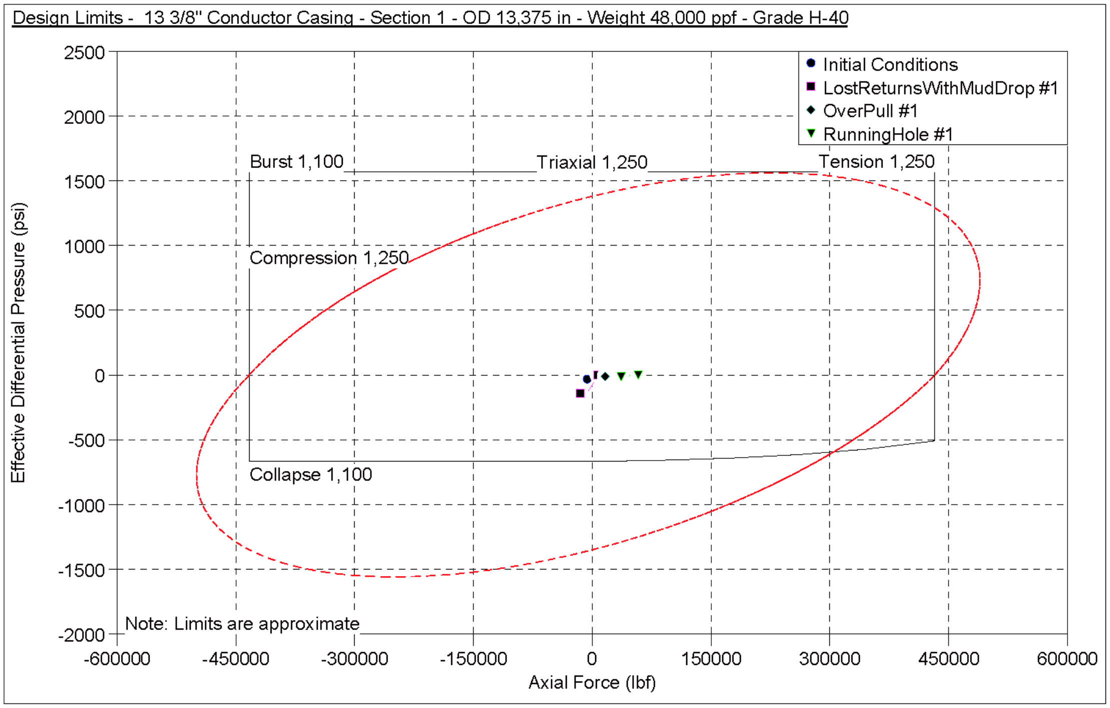
Well Schematic



Design Limits - 13 3/8" Conductor Casing - Section 1 - OD 13,375 in - Weight 48,000 ppf - Grade H-40



Slender Well Design WELLCAT 5000.1.13.1

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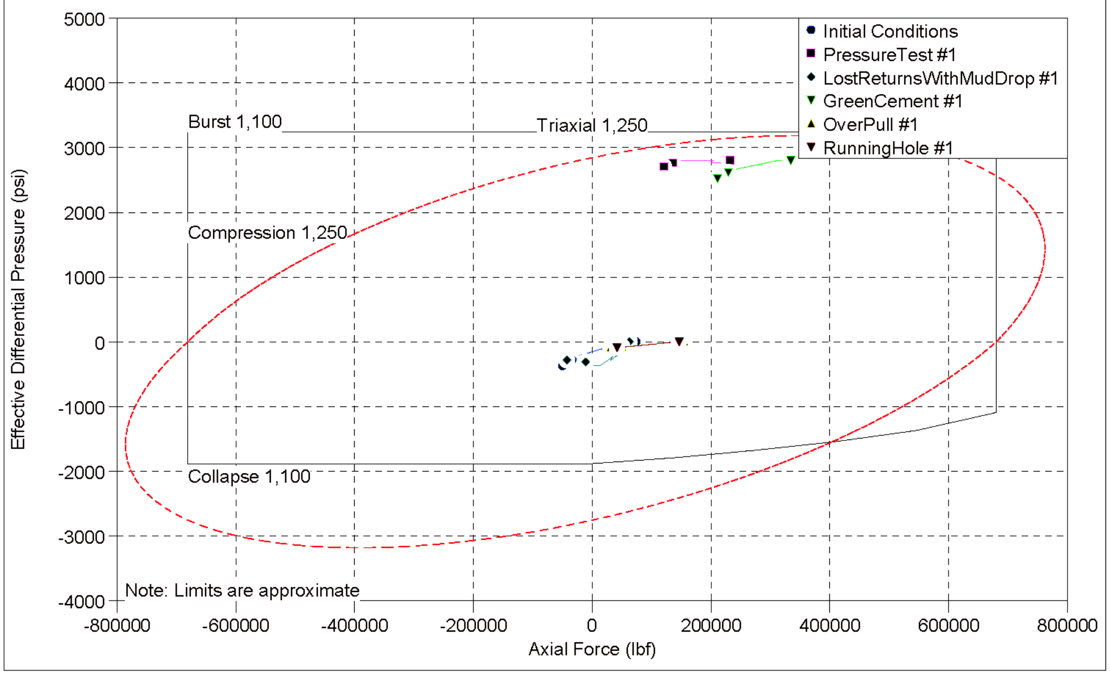
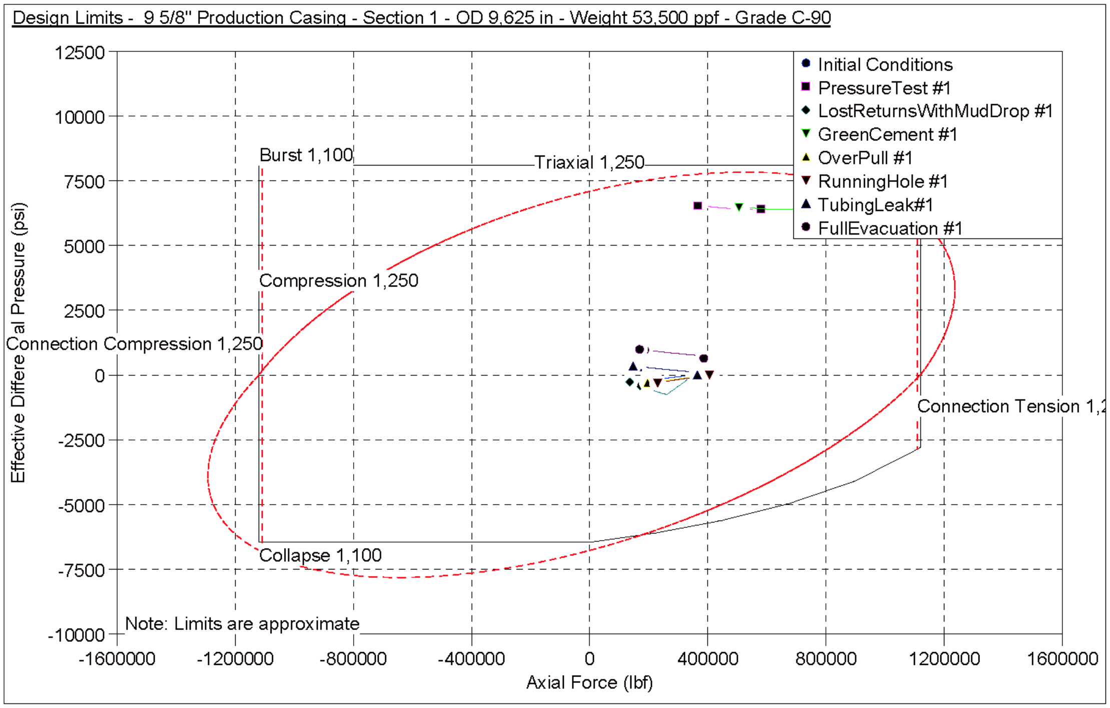
Design Limits - 11 3/4" Surface Casing - Section 1 - OD 11,750 in - Weight 54,000 ppf - Grade J-55



Design Limits - 9 5/8" Production Casing - Section 1 - OD 9,625 in - Weight 53,500 ppf - Grade C-90



Slender Well Design WELLCAT 5000.1.13.1

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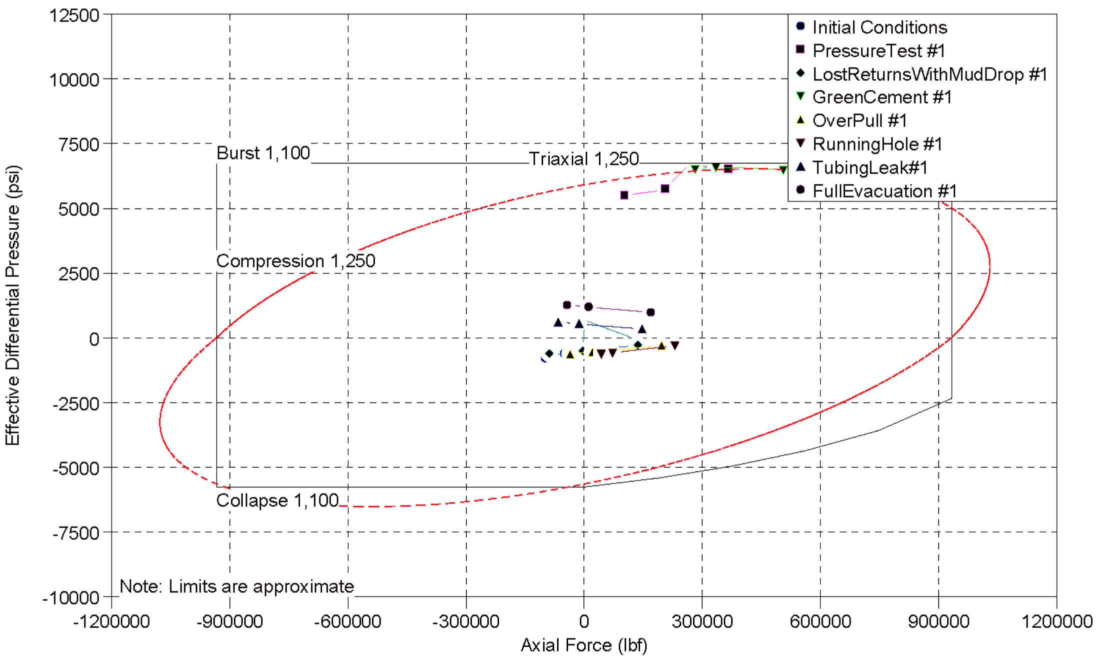
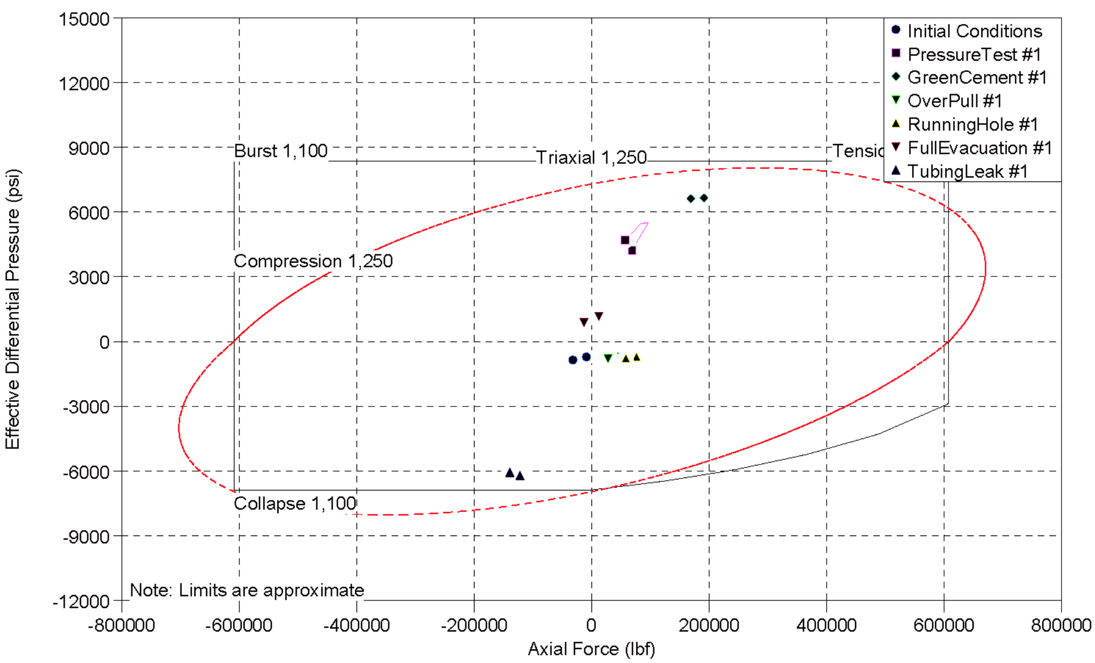
Design Limits - 9 5/8" Production Casing - Section 1 - OD 9,625 in - Weight 53,500 ppf - Grade C-90



Design Limits - 7" Production Liner - Section 1 - OD 7,000 in - Weight 29,000 ppf - Grade C-90



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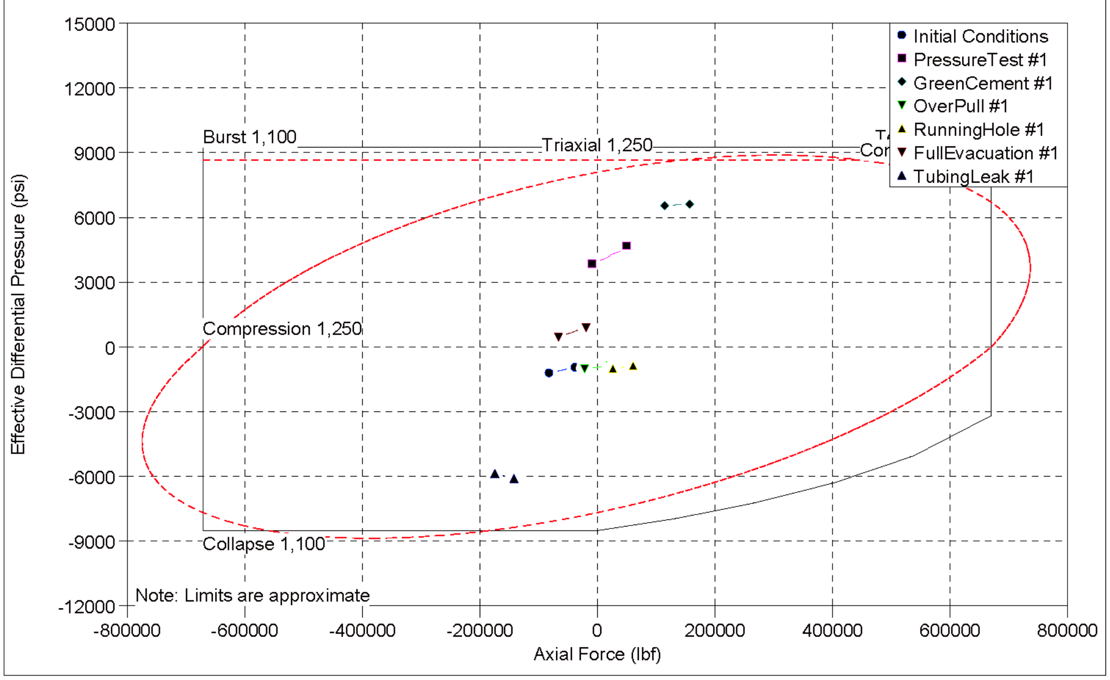
Design Limits - 7" Production Liner - Section 1 - OD 7,000 in - Weight 29,000 ppf - Grade C-90



Ratings Summary - 13 3/8" Conductor Casing

	String Section	Pipe Body OD (in)	Pipe Body Weight (ppf)	Pipe Body Grade	Connection Name	Connection Grade	Ratings Burst (psi)	Ratings Collapse (psi)	Ratings Tension (lbf)	Ratings Compression (lbf
1	1	13,375	48,000	H-40	BTC	H-40	1727,10	736,01	540963	540963
2										
3	L = Connection Leak									
4	B = Connection Burst									
5	F = Connection Fracture									
6	J = Connection Jump-out									
7	Y = Connection Yield									
8	C = Connection									

Ratings Summary - 11 3/4" Surface Casing

	String Section	Pipe Body OD (in)	Pipe Body Weight (ppf)	Pipe Body Grade	Connection Name	Connection Grade	Ratings Burst (psi)	Ratings Collapse (psi)	Ratings Tension (lbf)	Ratings Compression (lbf
1	1	11,750	54,000	J-55	BTC	J-55	3563,30	2073,23	850465	850465
2										
3	L = Connection Leak									
4	B = Connection Burst									
5	F = Connection Fracture									
6	J = Connection Jump-out									
7	Y = Connection Yield									
8	C = Connection									

Ratings Summary - 9 5/8" Production Casing

	String Section	Pipe Body OD (in)	Pipe Body Weight (ppf)	Pipe Body Grade	Connection Name	Connection Grade	Ratings Burst (psi)	Ratings Collapse (psi)	Ratings Tension (lbf)	Ratings Compression (lbf
1	1	9,625	53,500	C-90	BTC	C-90	8918,18	7114,64	F 1385719	F 1385719
2	2	9,625	53,500	C-75	BTC	C-75	7431,82	6348,33	1165986	1165986
3										
4	L = Connection Leak									
5	B = Connection Burst									
6	F = Connection Fracture									
7	J = Connection Jump-out									
8	Y = Connection Yield									
9	C = Connection									

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Ratings Summary - 7" Production Liner

	String	Pipe Body			Connection		Ratings			
	Section	OD (in)	Weight (ppf)	Grade	Name	Grade	Burst (psi)	Collapse (psi)	Tension (lbf)	Compression (lbf
1	1	7,000	29,000	C-90	BTC	C-90	9180,00	7579,34	760448	760448
2	2	7,000	32,000	C-90	BTC	C-90	B 9519,00	9376,45	838558	838558
3										
4	**L = Connection Leak**									
5	**B = Connection Burst**									
6	**F = Connection Fracture**									
7	**J = Connection Jump-out**									
8	**Y = Connection Yield**									
9	**C = Connection**									

Casing Load Summary - Initial Conditions - 13 3/8" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	18704	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	14777	0,00	0,0	0,0	46,92	38,30	38,30
3	1	122,96	-656	0,00	0,0	0,0	35,00	188,62	188,62
4	1	123,02	-666	0,00	0,0	0,0	35,00	188,72	188,73
5	1	158,98	-6325	0,00	0,0	0,0	37,40	243,84	265,30

Casing Load Summary - LostReturnsWithMudDrop #1 - 13 3/8" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	7583	0,00	0,0	0,0	50,00	0,00	0,05
2	1	24,96	3656	0,00	0,0	0,0	50,00	0,00	38,30
3	1	122,96	-11777	0,00	0,0	0,0	35,00	40,72	188,62
4	1	123,02	-11929	0,00	0,0	0,0	35,00	40,83	188,72
5	1	158,98	-15078	0,00	0,0	0,0	37,40	105,15	243,84

Casing Load Summary - OverPull #1 - 13 3/8" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	41724	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	37796	0,00	0,0	0,0	46,92	38,30	38,30
3	1	122,96	22363	0,00	0,0	0,0	35,00	188,62	188,62
4	1	123,02	22354	0,00	0,0	0,0	35,00	188,71	188,71
5	1	158,98	16694	0,00	0,0	0,0	37,40	243,84	243,84

Casing Load Summary - RunningHole #1 - 13 3/8" Conductor Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	58252	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	54842	0,00	0,0	0,0	46,92	38,30	38,30
3	1	122,96	41442	0,00	0,0	0,0	35,00	188,62	188,62
4	1	123,02	41433	0,00	0,0	0,0	35,00	188,71	188,71
5	1	158,98	36519	0,00	0,0	0,0	37,40	243,84	243,84

Casing Load Summary - Initial Conditions - 11 3/4" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	74151	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	69733	0,00	0,0	0,0	46,92	44,68	44,68
3	1	122,96	52371	0,00	0,0	0,0	35,00	220,06	220,06
4	1	123,02	52360	0,00	0,0	0,0	35,00	220,16	220,17
5	1	158,98	45993	0,00	0,0	0,0	37,40	284,48	296,74
6	1	159,04	45982	0,00	0,0	0,0	37,40	284,59	296,87
7	1	304,80	20156	0,00	0,0	0,0	47,12	545,45	607,43
8	1	609,60	-33844	0,00	0,0	0,0	67,44	1090,91	1290,30
9	1	699,97	-49854	0,00	0,0	0,0	73,40	1252,62	1533,65

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Casing Load Summary - PressureTest #1 - 11 3/4" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	229370	0,07	0,4	0,0	50,00	2800,05	0,05
2	1	24,96	224952	0,08	0,5	0,0	46,92	2836,60	44,68
3	1	122,96	207590	0,10	0,8	0,0	35,00	2980,24	220,06
4	1	123,02	206331	0,00	0,0	0,0	35,00	2980,33	220,15
5	1	158,98	200976	0,00	0,0	0,0	37,40	3033,00	271,15
6	1	159,04	203798	0,00	0,0	0,0	37,40	3033,09	227,75
7	1	304,80	181558	0,00	0,0	0,0	47,12	3246,75	442,71
8	1	609,60	134663	0,00	0,0	0,0	67,44	3693,51	931,76
9	1	699,97	120404	0,00	0,0	0,0	73,40	3825,97	1123,10
10									
11	**Additional Pickup to Prevent Buckling = 45763 lbf**								

Casing Load Summary - LostReturnsWithMudDrop #1 - 11 3/4" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	63116	0,00	0,0	0,0	50,00	0,00	0,05
2	1	24,96	58697	0,00	0,0	0,0	50,00	0,00	44,68
3	1	122,96	41335	0,00	0,0	0,0	35,00	0,00	220,06
4	1	123,02	40077	0,00	0,0	0,0	35,00	0,00	220,16
5	1	158,98	30934	0,00	0,0	0,0	37,40	0,00	284,45
6	1	159,04	34610	0,00	0,0	0,0	37,40	0,00	227,75
7	1	304,80	5085	0,00	0,0	0,0	47,11	82,36	442,71
8	1	609,60	-31371	0,00	0,0	0,0	67,40	714,93	931,76
9	1	699,97	-42471	0,00	0,0	0,0	73,42	907,46	1123,10

Casing Load Summary - GreenCement #1 - 11 3/4" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	334470	0,00	0,0	0,0	50,00	2800,05	0,05
2	1	24,96	330052	0,00	0,0	0,0	46,92	2844,68	44,68
3	1	122,96	312690	0,00	0,0	0,0	35,00	3020,05	220,06
4	1	123,02	312679	0,00	0,0	0,0	35,00	3020,16	220,17
5	1	158,98	306312	0,00	0,0	0,0	37,40	3084,48	296,74
6	1	159,04	306301	0,00	0,0	0,0	37,40	3084,59	296,87
7	1	304,80	280475	0,00	0,0	0,0	47,12	3345,45	607,43
8	1	609,60	226475	0,00	0,0	0,0	67,44	3890,91	1290,30
9	1	699,97	210465	0,00	0,0	0,0	73,40	4052,62	1533,65

Casing Load Summary - OverPull #1 - 11 3/4" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	154629	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	150211	0,00	0,0	0,0	46,92	44,69	44,69
3	1	122,96	132849	0,00	0,0	0,0	35,00	220,06	220,06
4	1	123,02	132838	0,00	0,0	0,0	35,00	220,17	220,17
5	1	158,98	126471	0,00	0,0	0,0	37,40	284,48	284,48
6	1	159,04	126460	0,00	0,0	0,0	37,40	284,59	284,59
7	1	304,80	100635	0,00	0,0	0,0	47,12	545,45	545,45
8	1	609,60	46635	0,00	0,0	0,0	67,44	1090,91	1090,91
9	1	699,97	30624	0,00	0,0	0,0	73,40	1252,62	1252,62

Casing Load Summary - RunningHole #1 - 11 3/4" Surface Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	146391	0,00	0,0	0,0	50,00	0,05	0,05
2	1	24,96	142663	0,00	0,0	0,0	46,92	44,69	44,69
3	1	122,96	128013	0,00	0,0	0,0	35,00	220,06	220,06
4	1	123,02	128004	0,00	0,0	0,0	35,00	220,17	220,17
5	1	158,98	122631	0,00	0,0	0,0	37,40	284,48	284,48
6	1	159,04	122622	0,00	0,0	0,0	37,40	284,59	284,59
7	1	304,80	100830	0,00	0,0	0,0	47,12	545,45	545,45
8	1	609,60	55264	0,00	0,0	0,0	67,44	1090,91	1090,91
9	1	699,97	41755	0,00	0,0	0,0	73,40	1252,62	1252,62

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Casing Load Summary - Initial Conditions - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	352018	0,00	0,0	0,0	50,00	0,06	0,06
2	1	24,96	347640	0,00	0,0	0,0	46,92	53,19	53,19
3	1	122,99	330434	0,00	0,0	0,0	35,00	262,04	262,04
4	1	304,80	298523	0,00	0,0	0,0	47,12	649,35	649,35
5	1	609,60	245023	0,00	0,0	0,0	67,44	1298,70	1298,70
6	1	699,97	229161	0,00	0,0	0,0	73,46	1491,23	1491,23
7	1	700,03	229150	0,00	0,0	0,0	73,47	1491,36	1491,36
8	1	914,40	191523	0,00	0,0	0,0	87,66	1948,05	1948,05
9	1	1219,20	138023	0,00	0,0	0,0	107,98	2597,40	2597,40
10	1	1249,95	132622	0,00	0,0	0,0	110,03	2662,95	2662,95
11	2	1250,02	132612	0,00	0,0	0,0	110,04	2663,08	2663,08
12	2	1524,00	84523	0,00	0,0	0,0	128,30	3246,75	3246,75
13	2	1828,80	31023	0,00	0,0	0,0	148,62	3896,10	3896,10
14	2	1999,98	973	0,00	0,0	0,0	160,03	4260,77	4260,77
15	2	2000,04	973	0,00	0,0	0,0	160,04	4260,90	4260,90
16	2	2133,60	-22477	0,00	0,0	0,0	168,94	4545,45	4568,22
17	2	2400,00	-69237	0,00	0,0	0,0	186,70	5112,99	5181,17
18	2	2438,40	-75977	0,00	0,0	0,0	189,16	5194,80	5284,57
19	2	2549,96	-95565	0,00	0,0	0,0	196,60	5432,48	5585,01

Casing Load Summary - PressureTest #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	580549	0,00	0,0	0,0	50,00	6400,04	0,04
2	1	24,96	576171	0,00	0,0	0,0	46,92	6436,60	35,45
3	1	122,99	558964	0,00	0,0	0,0	35,00	6580,28	174,62
4	1	304,80	527054	0,00	0,0	0,0	47,12	6846,75	432,72
5	1	609,60	473554	0,00	0,0	0,0	67,44	7293,51	865,45
6	1	699,97	457692	0,00	0,0	0,0	73,46	7425,96	993,75
7	1	700,03	457681	0,00	0,0	0,0	73,47	7426,05	993,84
8	1	914,40	420054	0,00	0,0	0,0	87,66	7740,26	1298,18
9	1	1219,20	366554	0,00	0,0	0,0	107,98	8187,01	1730,90
10	1	1249,95	361153	0,00	0,0	0,0	110,03	8232,11	1774,59
11	2	1250,02	361142	0,00	0,0	0,0	110,04	8232,20	1774,68
12	2	1371,60	339804	0,00	0,0	0,0	118,14	8410,39	1947,27
13	2	1524,00	313054	0,22	2,6	0,0	128,30	8633,76	2163,63
14	2	1676,40	286304	0,44	7,5	0,0	138,46	8857,14	2380,00
15	2	1828,80	259554	0,66	13,8	0,0	148,62	9080,52	2596,36
16	2	1981,20	232804	0,89	21,3	0,0	158,78	9303,90	2812,72
17	2	1999,98	229504	0,91	22,3	0,0	160,03	9331,41	2839,37
18	2	2000,04	195534	0,00	0,0	0,0	160,04	9331,50	3791,39
19	2	2133,60	171241	0,00	0,0	0,0	168,94	9527,27	4048,20
20	2	2400,00	122987	0,00	0,0	0,0	186,70	9917,74	4560,40
21	2	2438,40	116483	0,00	0,0	0,0	189,16	9974,02	4634,22
22	2	2549,96	98093	0,00	0,0	0,0	196,60	10137,55	4848,73
23									
24	**Additional Pickup to Prevent Buckling = 98395 lbf**								

Casing Load Summary - LostReturnsWithMudDrop #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	353424	0,00	0,0	0,0	50,00	0,00	0,04
2	1	24,96	349047	0,00	0,0	0,0	50,00	0,00	35,45
3	1	122,99	331840	0,00	0,0	0,0	35,00	0,00	174,62
4	1	304,80	299930	0,00	0,0	0,0	47,11	0,00	432,72
5	1	609,60	246430	0,00	0,0	0,0	67,40	167,53	865,45
6	1	699,97	230567	0,00	0,0	0,0	73,42	380,75	993,75
7	1	700,03	230557	0,00	0,0	0,0	73,43	380,90	993,84
8	1	914,40	192930	0,00	0,0	0,0	87,70	892,39	1298,18
9	1	1219,20	139430	0,00	0,0	0,0	108,00	1619,67	1730,90
10	1	1249,95	134029	0,00	0,0	0,0	110,04	1693,09	1774,59
11	2	1250,02	134018	0,00	0,0	0,0	110,05	1693,23	1774,68
12	2	1524,00	85930	0,00	0,0	0,0	128,29	2346,94	2163,63
13	2	1828,80	32430	0,00	0,0	0,0	148,59	3074,21	2596,36
14	2	1999,98	2380	0,00	0,0	0,0	159,99	3482,63	2839,37
15	2	2000,04	-5101	0,00	0,0	0,0	160,00	3482,78	3791,39
16	2	2133,60	-25141	0,00	0,0	0,0	168,89	3801,48	4048,20
17	2	2400,00	-65000	0,00	0,0	0,0	186,63	4437,13	4560,40
18	2	2438,40	-70507	0,00	0,0	0,0	189,18	4528,76	4634,22
19	2	2549,96	-85354	0,00	0,0	0,0	196,61	4794,97	4848,73

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Casing Load Summary - GreenCement #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	718183	0,00	0,0	0,0	50,00	6400,06	0,06
2	1	24,96	713805	0,00	0,0	0,0	46,92	6453,19	53,19
3	1	122,99	696599	0,00	0,0	0,0	35,00	6662,04	262,04
4	1	304,80	664688	0,00	0,0	0,0	47,12	7049,35	649,35
5	1	609,60	611188	0,00	0,0	0,0	67,44	7698,70	1298,70
6	1	699,97	595326	0,00	0,0	0,0	73,46	7891,23	1491,23
7	1	700,03	595315	0,00	0,0	0,0	73,47	7891,36	1491,36
8	1	914,40	557688	0,00	0,0	0,0	87,66	8348,05	1948,05
9	1	1219,20	504188	0,00	0,0	0,0	107,98	8997,40	2597,40
10	1	1249,95	498787	0,00	0,0	0,0	110,03	9062,95	2662,95
11	2	1250,02	498777	0,00	0,0	0,0	110,04	9063,08	2663,08
12	2	1371,60	477438	0,00	0,0	0,0	118,14	9322,07	2922,08
13	2	1524,00	450688	0,00	0,0	0,0	128,30	9646,75	3246,75
14	2	1676,40	423938	0,00	0,0	0,0	138,46	9971,42	3571,43
15	2	1828,80	397188	0,00	0,0	0,0	148,62	10296,10	3896,10
16	2	1981,20	370438	0,00	0,0	0,0	158,78	10620,78	4220,78
17	2	1999,98	367138	0,00	0,0	0,0	160,03	10660,77	4260,77
18	2	2000,04	367138	0,00	0,0	0,0	160,04	10660,89	4260,90
19	2	2133,60	343688	0,00	0,0	0,0	168,94	10945,45	4568,22
20	2	2286,00	316938	0,00	0,0	0,0	179,10	11270,13	4918,87
21	2	2400,00	296928	0,00	0,0	0,0	186,70	11512,99	5181,17
22	2	2438,40	290188	0,00	0,0	0,0	189,16	11594,80	5284,57
23	2	2549,96	270600	0,00	0,0	0,0	196,60	11832,49	5585,01

Casing Load Summary - OverPull #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	413118	0,00	0,0	0,0	50,00	0,06	0,06
2	1	24,96	408740	0,00	0,0	0,0	46,92	53,20	53,20
3	1	122,99	391534	0,00	0,0	0,0	35,00	262,04	262,04
4	1	304,80	359623	0,00	0,0	0,0	47,12	649,35	649,35
5	1	609,60	306123	0,00	0,0	0,0	67,44	1298,70	1298,70
6	1	699,97	290261	0,00	0,0	0,0	73,46	1491,23	1491,23
7	1	700,03	290250	0,00	0,0	0,0	73,47	1491,36	1491,36
8	1	914,40	252623	0,00	0,0	0,0	87,66	1948,05	1948,05
9	1	1219,20	199123	0,00	0,0	0,0	107,98	2597,40	2597,40
10	1	1249,95	193722	0,00	0,0	0,0	110,03	2662,95	2662,95
11	2	1250,02	193712	0,00	0,0	0,0	110,04	2663,08	2663,08
12	2	1524,00	145623	0,00	0,0	0,0	128,30	3246,74	3246,74
13	2	1828,80	92123	0,00	0,0	0,0	148,62	3896,10	3896,10
14	2	1999,98	62073	0,00	0,0	0,0	160,03	4260,76	4260,76
15	2	2000,04	62073	0,00	0,0	0,0	160,04	4260,89	4260,89
16	2	2133,60	38623	0,00	0,0	0,0	168,94	4545,45	4545,45
17	2	2400,00	-8137	0,00	0,0	0,0	186,70	5112,99	5112,99
18	2	2438,40	-14877	0,00	0,0	0,0	189,16	5194,80	5194,80
19	2	2549,96	-34465	0,00	0,0	0,0	196,60	5432,48	5432,48

Casing Load Summary - RunningHole #1 - 9 5/8" Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	0,03	405103	0,00	0,0	0,0	50,00	0,06	0,06
2	1	24,96	401551	0,00	0,0	0,0	46,92	53,20	53,20
3	1	122,99	387591	0,00	0,0	0,0	35,00	262,04	262,04
4	1	304,80	361702	0,00	0,0	0,0	47,12	649,35	649,35
5	1	609,60	318297	0,00	0,0	0,0	67,44	1298,70	1298,70
6	1	699,97	305428	0,00	0,0	0,0	73,46	1491,23	1491,23
7	1	700,03	305419	0,00	0,0	0,0	73,47	1491,36	1491,36
8	1	914,40	274892	0,00	0,0	0,0	87,66	1948,05	1948,05
9	1	1219,20	231487	0,00	0,0	0,0	107,98	2597,40	2597,40
10	1	1249,95	227106	0,00	0,0	0,0	110,03	2662,95	2662,95
11	2	1250,02	227097	0,00	0,0	0,0	110,04	2663,08	2663,08
12	2	1524,00	188082	0,00	0,0	0,0	128,30	3246,74	3246,74
13	2	1828,80	144678	0,00	0,0	0,0	148,62	3896,10	3896,10
14	2	1999,98	120302	0,00	0,0	0,0	160,03	4260,76	4260,76
15	2	2000,04	120294	0,00	0,0	0,0	160,04	4260,89	4260,89
16	2	2133,60	101273	0,00	0,0	0,0	168,94	4545,45	4545,45
17	2	2400,00	63336	0,00	0,0	0,0	186,70	5112,99	5112,99
18	2	2438,40	57868	0,00	0,0	0,0	189,16	5194,80	5194,80
19	2	2549,96	41980	0,00	0,0	0,0	196,60	5432,48	5432,48

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Casing Load Summary - TubingLeak#1 - 9 5/8'' Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	364417	0,00	0,0	0,0	50,00	0,06	0,00
2	1	24,96	360040	0,00	0,0	0,0	46,92	53,20	0,00
3	1	122,99	342833	0,00	0,0	0,0	35,00	262,04	143,64
4	1	304,80	310922	0,00	0,0	0,0	47,12	649,35	496,09
5	1	609,60	257422	0,00	0,0	0,0	67,44	1298,70	1087,00
6	1	699,97	241560	0,00	0,0	0,0	73,46	1491,23	1262,19
7	1	700,03	241550	0,00	0,0	0,0	73,47	1491,36	1262,31
8	1	914,40	203922	0,00	0,0	0,0	87,66	1948,05	1677,90
9	1	1219,20	150422	0,00	0,0	0,0	107,98	2597,40	2268,81
10	1	1249,95	145022	0,00	0,0	0,0	110,03	2662,95	2328,46
11	2	1250,02	145011	0,00	0,0	0,0	110,04	2663,08	2328,58
12	2	1524,00	96922	0,00	0,0	0,0	128,30	3246,74	2859,72
13	2	1828,80	43422	0,00	0,0	0,0	148,62	3896,10	3450,62
14	2	1999,98	13373	0,00	0,0	0,0	160,03	4260,76	3782,46
15	2	2000,04	21855	0,00	0,0	0,0	160,04	4260,89	3782,58
16	2	2133,60	516	0,00	0,0	0,0	168,94	4545,45	4041,53
17	2	2400,00	-41845	0,00	0,0	0,0	186,70	5112,99	4557,99
18	2	2438,40	-47500	0,00	0,0	0,0	189,16	5194,80	4632,43
19	2	2549,96	-63423	0,00	0,0	0,0	196,60	5432,48	4848,73

Casing Load Summary - FullEvacuation #1 - 9 5/8'' Production Casing

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	0,03	386170	0,00	0,0	0,0	50,00	633,76	0,00
2	1	24,96	381793	0,00	0,0	0,0	46,92	686,89	0,00
3	1	122,99	364586	0,00	0,0	0,0	35,00	895,73	143,64
4	1	304,80	332676	0,00	0,0	0,0	47,12	1283,04	496,09
5	1	609,60	279176	0,00	0,0	0,0	67,44	1932,39	1087,00
6	1	699,97	263314	0,00	0,0	0,0	73,46	2124,92	1262,19
7	1	700,03	263303	0,00	0,0	0,0	73,47	2125,05	1262,31
8	1	914,40	225676	0,00	0,0	0,0	87,66	2581,74	1677,90
9	1	1219,20	172176	0,00	0,0	0,0	107,98	3231,09	2268,81
10	1	1249,95	166775	0,00	0,0	0,0	110,03	3296,64	2328,46
11	2	1250,02	166764	0,00	0,0	0,0	110,04	3296,77	2328,58
12	2	1524,00	118676	0,00	0,0	0,0	128,30	3880,44	2859,72
13	2	1828,80	65176	0,00	0,0	0,0	148,62	4529,79	3450,62
14	2	1999,98	35126	0,00	0,0	0,0	160,03	4894,45	3782,46
15	2	2000,04	43608	0,00	0,0	0,0	160,04	4894,58	3782,58
16	2	2133,60	22269	0,00	0,0	0,0	168,94	5179,14	4041,53
17	2	2400,00	-20092	0,00	0,0	0,0	186,70	5746,69	4557,99
18	2	2438,40	-25747	0,00	0,0	0,0	189,16	5828,49	4632,43
19	2	2549,96	-41669	0,00	0,0	0,0	196,60	6066,18	4848,73

Casing Load Summary - Initial Conditions - 7'' Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	2540,02	-8011	0,00	0,0	0,0	196,00	6060,67	6060,67
2	1	2549,96	-8963	0,00	0,0	0,0	196,60	6084,39	6084,39
3	1	2550,02	-8963	0,00	0,0	0,0	196,60	6084,53	6084,54
4	1	2743,20	-27345	0,00	0,0	0,0	209,48	6545,45	6604,72
5	1	2774,96	-30370	0,00	0,0	0,0	211,60	6621,25	6690,27
6	2	2775,02	-36117	0,00	0,0	0,0	211,60	6621,40	6690,43
7	2	3048,00	-64778	0,00	0,0	0,0	229,80	7272,72	7425,49
8	2	3172,97	-77902	0,00	0,0	0,0	238,10	7570,91	7762,02

Casing Load Summary - PressureTest #1 - 7'' Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	External
1	1	2540,02	65266	0,11	0,2	0,0	196,00	10122,98	6060,67
2	1	2549,96	64315	0,11	0,2	0,0	196,60	10137,55	6084,39
3	1	2550,02	92334	0,00	0,0	0,0	196,60	10137,64	4848,85
4	1	2743,20	62945	0,00	0,0	0,0	209,48	10420,77	5718,97
5	1	2774,96	55219	0,00	0,0	0,0	211,60	10467,34	5985,29
6	2	2775,02	47460	0,00	0,0	0,0	211,60	10467,43	5985,80
7	2	3048,00	7247	0,00	0,0	0,0	229,80	10867,53	7030,76
8	2	3172,97	-8361	0,00	0,0	0,0	238,10	11050,70	7387,69
9									
10	**Additional Pickup to Prevent Buckling = 6169 lbf**								

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Casing Load Summary - GreenCement #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	2540,02	184213	0,00	0,0	0,0	196,00	12460,67	6060,67
2	1	2549,96	183262	0,00	0,0	0,0	196,60	12484,39	6084,39
3	1	2550,02	183262	0,00	0,0	0,0	196,60	12484,53	6084,54
4	1	2743,20	164880	0,00	0,0	0,0	209,48	12945,45	6604,72
5	1	2774,96	161854	0,00	0,0	0,0	211,60	13021,25	6690,27
6	2	2775,02	150553	0,00	0,0	0,0	211,60	13021,40	6690,43
7	2	3048,00	121892	0,00	0,0	0,0	229,80	13672,72	7425,49
8	2	3172,97	108769	0,00	0,0	0,0	238,10	13970,91	7762,02

Casing Load Summary - OverPull #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	2540,02	49344	0,00	0,0	0,0	196,00	6060,67	6060,67
2	1	2549,96	48393	0,00	0,0	0,0	196,60	6084,39	6084,39
3	1	2550,02	48393	0,00	0,0	0,0	196,60	6084,53	6084,53
4	1	2743,20	30011	0,00	0,0	0,0	209,48	6545,44	6545,44
5	1	2774,96	26985	0,00	0,0	0,0	211,60	6621,25	6621,25
6	2	2775,02	21239	0,00	0,0	0,0	211,60	6621,40	6621,40
7	2	3048,00	-7423	0,00	0,0	0,0	229,80	7272,72	7272,72
8	2	3172,97	-20546	0,00	0,0	0,0	238,10	7570,91	7570,91

Casing Load Summary - RunningHole #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	2540,02	73369	0,00	0,0	0,0	196,00	6060,67	6060,67
2	1	2549,96	72623	0,00	0,0	0,0	196,60	6084,39	6084,39
3	1	2550,02	72619	0,00	0,0	0,0	196,60	6084,53	6084,53
4	1	2743,20	58134	0,00	0,0	0,0	209,48	6545,44	6545,44
5	1	2774,96	55752	0,00	0,0	0,0	211,60	6621,25	6621,25
6	2	2775,02	58091	0,00	0,0	0,0	211,60	6621,40	6621,40
7	2	3048,00	35501	0,00	0,0	0,0	229,80	7272,72	7272,72
8	2	3172,97	25159	0,00	0,0	0,0	238,10	7570,91	7570,91

Casing Load Summary - FullEvacuation #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	2540,02	12197	0,00	0,0	0,0	196,00	7186,09	6060,64
2	1	2549,96	11246	0,00	0,0	0,0	196,60	7189,35	6074,75
3	1	2550,02	10948	0,00	0,0	0,0	196,60	7189,37	6084,50
4	1	2743,20	-8919	0,00	0,0	0,0	209,48	7252,75	6358,75
5	1	2774,96	-12189	0,00	0,0	0,0	211,60	7263,17	6403,85
6	2	2775,02	-18270	0,00	0,0	0,0	211,60	7263,19	6403,94
7	2	3048,00	-48738	0,00	0,0	0,0	229,80	7352,75	6791,48
8	2	3172,97	-62688	0,00	0,0	0,0	238,10	7393,75	6968,90

Casing Load Summary - TubingLeak #1 - 7" Production Liner

	String Section	MD (m)	Axial Force (lbf)	Dogleg (°/100ft)	Torque (ft-lbf)	Friction Force (lbf/ft)	Temperature (°F)	Pressure (psi) Internal	Pressure (psi) External
1	1	2540,02	-117118	0,00	0,0	0,0	196,00	0,07	6060,64
2	1	2549,96	-118070	0,00	0,0	0,0	196,60	23,79	6074,75
3	1	2550,02	-118180	0,00	0,0	0,0	196,60	23,94	6084,50
4	1	2743,20	-130884	0,00	0,0	0,0	209,48	484,85	6358,75
5	1	2774,96	-132975	0,00	0,0	0,0	211,60	560,65	6403,85
6	2	2775,02	-135564	0,00	0,0	0,0	211,60	560,80	6403,94
7	2	3048,00	-156201	0,00	0,0	0,0	229,80	1212,12	6791,48
8	2	3172,97	-165650	0,00	0,0	0,0	238,10	1510,31	6968,90

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Safety Factor Summary - Initial Conditions - 13 3/8" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	40000,0	1383,1	D 28,921	N/A	100+	100+	28,939
2	1	24,96	40000,0	1130,9	D 35,369	N/A	100+	100+	36,630
3	1	122,96	40000,0	400,0	D 100+	N/A	100+	79,080	100+
4	1	123,02	40000,0	400,0	D 100+	N/A	100+	78,887	100+
5	1	152,40	40000,0	400,0	100+	N/A	100+	25,317	M 100+
6	1	158,98	40000,0	440,8	90,748	N/A	100+	21,982	M 85,576
7									

8 **Burst and Axial Flags**
9 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
10
11 **Axial Flags**
12 **Default = Tension, M = Compression**
13
14 **Triaxial Flags**
15 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
16
17 **Envelope Flags**
18 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - LostReturnsWithMudDrop #1 - 13 3/8" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	40000,0	561,3	D 71,269	N/A	100+	100+	71,381
2	1	24,96	40000,0	1067,8	37,462	N/A	100+	19,210	M 100+
3	1	109,61	40000,0	3288,7	12,163	N/A	100+	4,838	M 55,964
4	1	122,96	40000,0	3168,4	12,625	N/A	100+	4,910	M 45,960
5	1	123,02	40000,0	3165,0	12,638	N/A	100+	4,910	M 45,377
6	1	158,98	40000,0	2912,5	13,734	N/A	100+	5,116	M 35,900
7									

8 **Burst and Axial Flags**
9 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
10
11 **Axial Flags**
12 **Default = Tension, M = Compression**
13
14 **Triaxial Flags**
15 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
16
17 **Envelope Flags**
18 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - OverPull #1 - 13 3/8" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	40000,0	3085,1	D 12,965	N/A	100+	100+	12,973
2	1	24,96	40000,0	2833,0	D 14,119	N/A	100+	100+	14,321
3	1	122,96	40000,0	1842,2	D 21,713	N/A	100+	78,877	24,204
4	1	123,02	40000,0	1841,6	D 21,721	N/A	100+	78,838	24,215
5	1	158,98	40000,0	1478,2	D 27,060	N/A	100+	61,057	32,424
6									

7 **Burst and Axial Flags**
8 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
9
10 **Axial Flags**
11 **Default = Tension, M = Compression**
12
13 **Triaxial Flags**
14 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
15
16 **Envelope Flags**
17 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - RunningHole #1 - 13 3/8" Conductor Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	40000,0	4307,3	D 9,287	N/A	100+	100+	9,292
2	1	24,96	40000,0	4093,4	D 9,772	N/A	100+	100+	9,870
3	1	122,96	40000,0	3252,9	D 12,297	N/A	100+	78,667	13,061
4	1	123,02	40000,0	3252,4	D 12,299	N/A	100+	78,628	13,064
5	1	158,98	40000,0	2944,1	D 13,586	N/A	100+	60,896	14,822
6									
7	**Burst and Axial Flags**								
8	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
9									
10	**Axial Flags**								
11	**Default = Tension, M = Compression**								
12									
13	**Triaxial Flags**								
14	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
15									
16	**Envelope Flags**								
17	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - Initial Conditions - 11 3/4" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	55000,0	4795,4	D 11,469	N/A	100+	100+	11,476
2	1	24,96	55000,0	4554,3	D 12,077	N/A	100+	100+	12,203
3	1	122,96	55000,0	3606,9	D 15,249	N/A	100+	100+	16,249
4	1	123,02	55000,0	3606,3	D 15,251	N/A	100+	100+	16,252
5	1	158,98	55000,0	3360,9	16,365	N/A	100+	61,337	18,502
6	1	159,04	55000,0	3360,4	16,367	N/A	100+	61,284	18,507
7	1	304,80	55000,0	2494,7	22,047	N/A	100+	20,136	42,219
8	1	457,20	55000,0	2031,2	27,078	N/A	100+	11,885	M 100+
9	1	609,60	55000,0	2798,2	19,656	N/A	100+	7,402	M 25,144
10	1	699,97	54910,7	3891,6	14,110	N/A	100+	5,544	M 17,041
11									
12	**Burst and Axial Flags**								
13	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
14									
15	**Axial Flags**								
16	**Default = Tension, M = Compression**								
17									
18	**Triaxial Flags**								
19	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
20									
21	**Envelope Flags**								
22	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - PressureTest #1 - 11 3/4" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	55000,0	38985,0	N 1,411	N/A	1,273	100+	3,666
2	1	24,96	55000,0	38899,5	N 1,414	N/A	1,276	100+	3,733
3	1	122,96	55000,0	38577,5	N 1,426	N/A	1,291	100+	4,021
4	1	123,02	55000,0	38553,1	1,427	N/A	1,291	100+	4,124
5	1	158,98	55000,0	38622,5	1,424	N/A	1,290	100+	4,234
6	1	159,04	55000,0	39241,5	1,402	N/A	1,270	100+	4,176
7	1	304,80	55000,0	39432,8	1,395	N/A	1,271	100+	4,687
8	1	609,60	55000,0	39347,8	1,398	N/A	1,290	100+	6,319
9	1	699,97	54910,7	38640,9	1,421	N/A	1,316	100+	7,056
10									
11	**Burst and Axial Flags**								
12	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
13									
14	**Axial Flags**								
15	**Default = Tension, M = Compression**								
16									
17	**Triaxial Flags**								
18	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
19									
20	**Envelope Flags**								
21	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - LostReturnsWithMudDrop #1 - 11 3/4" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	55000,0	4082,1	D 13,473	N/A	100+	100+	13,483
2	1	24,96	55000,0	4198,0	13,102	N/A	100+	45,543	14,498
3	1	122,96	55000,0	5371,4	10,239	N/A	100+	9,302	20,587
4	1	123,02	55000,0	5306,0	10,366	N/A	100+	9,302	21,234
5	1	158,98	55000,0	5802,3	9,479	N/A	100+	7,221	27,509
6	1	159,04	55000,0	5132,3	10,716	N/A	100+	9,008	24,587
7	1	255,00	55000,0	6353,5	8,657	N/A	100+	5,594	65,363
8	1	304,80	55000,0	5964,4	9,221	N/A	100+	5,651	M 100+
9	1	609,60	55000,0	3024,1	18,187	N/A	100+	7,688	M 27,126
10	1	699,97	54910,3	2981,2	18,419	N/A	100+	7,327	M 20,004
11									

12 **Burst and Axial Flags**
13 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
14
15 **Axial Flags**
16 **Default = Tension, M = Compression**
17
18 **Triaxial Flags**
19 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
20
21 **Envelope Flags**
22 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - GreenCement #1 - 11 3/4" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	55000,0	38737,7	1,420	N/A	1,273	100+	2,544
2	1	24,96	55000,0	38725,4	1,420	N/A	1,273	100+	2,578
3	1	122,96	55000,0	38691,6	1,421	N/A	1,273	100+	2,721
4	1	123,02	55000,0	38691,4	1,422	N/A	1,273	100+	2,722
5	1	158,98	55000,0	38517,2	1,428	N/A	1,278	100+	2,778
6	1	159,04	55000,0	38516,9	1,428	N/A	1,278	100+	2,778
7	1	304,80	55000,0	37826,5	1,454	N/A	1,301	100+	3,034
8	1	609,60	55000,0	35994,0	1,528	N/A	1,370	100+	3,757
9	1	699,97	54910,7	34883,3	1,574	N/A	1,412	100+	4,037
10									

11 **Burst and Axial Flags**
12 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
13
14 **Axial Flags**
15 **Default = Tension, M = Compression**
16
17 **Triaxial Flags**
18 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
19
20 **Envelope Flags**
21 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - OverPull #1 - 11 3/4" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	55000,0	9999,9	D 5,500	N/A	100+	100+	5,503
2	1	24,96	55000,0	9758,8	D 5,636	N/A	100+	100+	5,665
3	1	122,96	55000,0	8811,4	D 6,242	N/A	100+	100+	6,406
4	1	123,02	55000,0	8810,8	D 6,242	N/A	100+	100+	6,406
5	1	158,98	55000,0	8463,3	D 6,499	N/A	100+	94,181	6,729
6	1	159,04	55000,0	8462,8	D 6,499	N/A	100+	94,146	6,729
7	1	304,80	55000,0	7053,5	D 7,798	N/A	100+	49,625	8,456
8	1	609,60	55000,0	4106,8	D 13,393	N/A	100+	25,299	18,248
9	1	699,97	54910,7	3233,1	D 16,984	N/A	100+	22,130	27,742
10									

11 **Burst and Axial Flags**
12 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
13
14 **Axial Flags**
15 **Default = Tension, M = Compression**
16
17 **Triaxial Flags**
18 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
19
20 **Envelope Flags**
21 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - RunningHole #1 - 11 3/4" Surface Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	55000,0	9467,2	D 5,810	N/A	100+	100+	5,813
2	1	24,96	55000,0	9270,7	D 5,933	N/A	100+	100+	5,965
3	1	122,96	55000,0	8498,6	D 6,472	N/A	100+	100+	6,648
4	1	123,02	55000,0	8498,1	D 6,472	N/A	100+	100+	6,648
5	1	158,98	55000,0	8215,0	D 6,695	N/A	100+	94,329	6,939
6	1	159,04	55000,0	8214,5	D 6,695	N/A	100+	94,293	6,940
7	1	304,80	55000,0	7066,1	D 7,784	N/A	100+	49,621	8,440
8	1	609,60	55000,0	4664,8	D 11,790	N/A	100+	25,225	15,398
9	1	699,97	54910,7	3952,9	D 13,891	N/A	100+	22,049	20,347
10									
11	**Burst and Axial Flags**								
12	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
13									
14	**Axial Flags**								
15	**Default = Tension, M = Compression**								
16									
17	**Triaxial Flags**								
18	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
19									
20	**Envelope Flags**								
21	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - Initial Conditions - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	90000,0	22642,8	D 3,975	N/A	100+	100+	F 3,938
2	1	24,96	90000,0	22414,3	D 4,015	N/A	100+	100+	F 3,988
3	1	122,99	90000,0	21516,4	D 4,183	N/A	100+	100+	F 4,195
4	1	304,80	90000,0	19851,1	D 4,534	N/A	100+	89,189	F 4,644
5	1	609,60	90000,0	17059,2	D 5,276	N/A	100+	45,392	F 5,658
6	1	699,97	89852,0	16231,4	D 5,536	N/A	100+	39,682	F 6,039
7	1	700,03	89851,9	16230,9	D 5,536	N/A	100+	39,679	F 6,040
8	1	914,40	89467,5	14267,3	D 6,271	N/A	100+	30,631	F 7,195
9	1	1219,20	88917,2	11475,4	D 7,749	N/A	100+	23,228	F 9,923
10	1	1249,95	88861,7	11193,5	D 7,939	N/A	100+	22,680	F 10,320
11	2	1250,02	74051,3	11193,0	D 6,616	N/A	100+	20,008	8,687
12	2	1524,00	73639,1	8683,5	D 8,480	N/A	100+	16,624	13,553
13	2	1828,80	73180,4	5891,6	D 12,421	N/A	100+	14,034	36,695
14	2	1999,98	72922,9	4323,3	D 16,867	N/A	100+	12,918	M 100+
15	2	2000,04	72922,8	4323,5	D 16,867	N/A	100+	12,918	M 100+
16	2	2133,60	72721,9	3227,3	22,533	N/A	100+	11,579	M 50,329
17	2	2400,00	72321,0	1198,4	60,346	N/A	100+	9,581	M 16,249
18	2	2438,40	72265,5	1138,7	63,466	N/A	100+	9,141	M 14,796
19	2	2549,96	72097,6	1405,7	51,289	N/A	100+	8,061	M 11,735
20									
21	**Burst and Axial Flags**								
22	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
23									
24	**Axial Flags**								
25	**Default = Tension, M = Compression**								
26									
27	**Triaxial Flags**								
28	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
29									
30	**Envelope Flags**								
31	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - PressureTest #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	90000,0	59654,0	1,509	N/A	1,393	100+	F 2,388
2	1	24,96	90000,0	59623,9	1,509	N/A	1,393	100+	F 2,406
3	1	122,99	90000,0	59515,4	1,512	N/A	1,392	100+	F 2,480
4	1	304,80	90000,0	59357,3	1,516	N/A	1,390	100+	F 2,630
5	1	609,60	90000,0	59218,5	1,520	N/A	1,387	100+	F 2,927
6	1	699,97	89852,0	59207,9	1,518	N/A	1,384	100+	F 3,024
7	1	700,03	89851,9	59207,9	1,518	N/A	1,384	100+	F 3,024
8	1	914,40	89467,5	59238,8	1,510	N/A	1,376	100+	F 3,281
9	1	1219,20	88917,2	59418,2	1,496	N/A	1,365	100+	F 3,736
10	1	1249,95	88861,7	59445,1	1,495	N/A	1,364	100+	F 3,790
11	2	1250,02	74051,3	59445,1	1,246*	N/A	1,136	100+	3,190
12	2	1371,60	73868,4	59567,1	1,240*	N/A	1,133	100+	3,382
13	2	1524,00	73639,1	59796,2	N 1,231*	N/A	1,128	100+	3,577
14	2	1676,40	73409,8	60083,3	N 1,222*	N/A	1,123	100+	3,797
15	2	1828,80	73180,4	60434,8	N 1,211*	N/A	1,118	100+	4,048
16	2	1981,20	72951,1	60848,4	N 1,199*	N/A	1,114	100+	4,335
17	2	1999,98	72922,9	60906,1	N 1,197*	N/A	1,113	100+	4,374
18	2	2000,04	72922,8	51491,9	1,416	N/A	1,304	100+	5,801
19	2	2133,60	72721,9	51100,8	1,423	N/A	1,315	100+	6,606
20	2	2400,00	72321,0	50392,1	1,435	N/A	1,338	100+	9,147
21	2	2438,40	72265,5	50291,9	1,437	N/A	1,341	100+	9,651
22	2	2549,96	72097,6	50001,8	N 1,442	N/A	1,351	100+	11,433
23									
24	*** Safety factor < Design factor**								
25									
26	**Burst and Axial Flags**								
27	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
28									
29	**Axial Flags**								
30	**Default = Tension, M = Compression**								
31									
32	**Triaxial Flags**								
33	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
34									
35	**Envelope Flags**								
36	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - LostReturnsWithMudDrop #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	90000,0	22733,4	D 3,959	N/A	100+	100+	F 3,922
2	1	24,96	90000,0	22642,1	3,975	N/A	100+	100+	F 3,972
3	1	122,99	90000,0	22329,7	4,031	N/A	100+	37,120	F 4,177
4	1	304,80	90000,0	21953,1	4,100	N/A	100+	15,150	F 4,622
5	1	533,19	90000,0	21869,6	4,115	N/A	100+	8,777	F 5,335
6	1	609,60	90000,0	20741,4	4,339	N/A	100+	9,308	F 5,625
7	1	699,97	89853,2	19306,9	4,654	N/A	100+	10,209	F 6,003
8	1	700,03	89853,1	19305,9	4,654	N/A	100+	10,210	F 6,003
9	1	914,40	89466,5	15900,4	5,627	N/A	100+	13,327	F 7,143
10	1	1219,20	88916,8	11225,4	7,921	N/A	100+	23,178	F 9,823
11	1	1249,95	88861,3	10772,9	8,249	N/A	100+	25,022	F 10,212
12	2	1250,02	74051,0	10772,0	6,874	N/A	100+	22,076	8,595
13	2	1524,00	73639,2	7103,9	10,366	N/A	39,808	74,076	13,331
14	2	1828,80	73181,1	5117,5	14,300	N/A	15,175	100+	35,104
15	2	1999,98	72923,9	5919,0	12,320	N/A	11,234	100+	M 100+
16	2	2000,04	72923,8	5570,1	13,092	N/A	100+	8,869	100+
17	2	2133,60	72723,0	4166,0	17,456	N/A	100+	9,190	M 44,997
18	2	2400,00	72322,7	1453,8	49,747	N/A	100+	9,910	M 17,308
19	2	2438,40	72265,0	1116,6	64,719	N/A	100+	10,024	M 15,944
20	2	2549,96	72097,3	721,0	N 100+	N/A	100+	10,370	M 13,139
21									
22	**Burst and Axial Flags**								
23	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
24									
25	**Axial Flags**								
26	**Default = Tension, M = Compression**								
27									
28	**Triaxial Flags**								
29	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
30									
31	**Envelope Flags**								
32	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - GreenCement #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	90000,0	61724,3	1,458	N/A	1,393	100+	F 1,930
2	1	24,96	90000,0	61655,8	1,460	N/A	1,393	100+	F 1,942
3	1	122,99	90000,0	61393,9	1,466	N/A	1,393	100+	F 1,990
4	1	304,80	90000,0	60940,4	1,477	N/A	1,393	100+	F 2,086
5	1	609,60	90000,0	60275,7	1,493	N/A	1,393	100+	F 2,268
6	1	699,97	89852,0	60102,1	1,495	N/A	1,391	100+	F 2,325
7	1	700,03	89851,9	60102,0	1,495	N/A	1,391	100+	F 2,325
8	1	914,40	89467,5	59734,0	1,498	N/A	1,385	100+	F 2,471
9	1	1219,20	88917,2	59319,1	1,499	N/A	1,377	100+	F 2,716
10	1	1249,95	88861,7	59284,4	1,499	N/A	1,376	100+	F 2,744
11	2	1250,02	74051,3	59284,3	1,249*	N/A	1,147	100+	2,310
12	2	1371,60	73868,4	59160,0	1,249*	N/A	1,144	100+	2,407
13	2	1524,00	73639,1	59033,4	1,247*	N/A	1,140	100+	2,542
14	2	1676,40	73409,8	58939,7	1,246*	N/A	1,137	100+	2,694
15	2	1828,80	73180,4	58878,8	1,243*	N/A	1,133	100+	2,866
16	2	1981,20	72951,1	58851,1	1,240*	N/A	1,129	100+	3,063
17	2	1999,98	72922,9	58850,0	1,239*	N/A	1,129	100+	3,090
18	2	2000,04	72922,8	58850,0	1,239*	N/A	1,129	100+	3,090
19	2	2133,60	72721,9	58645,4	1,240*	N/A	1,130	100+	3,292
20	2	2286,00	72492,5	58437,4	1,241*	N/A	1,131	100+	3,558
21	2	2400,00	72321,0	58299,7	1,241*	N/A	1,132	100+	3,789
22	2	2438,40	72265,5	58114,2	1,244*	N/A	1,135	100+	3,874
23	2	2549,96	72097,6	57581,0	1,252	N/A	1,144	100+	4,145
24									

25 *** Safety factor < Design factor**
26
27 **Burst and Axial Flags**
28 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
29
30 **Axial Flags**
31 **Default = Tension, M = Compression**
32
33 **Triaxial Flags**
34 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
35
36 **Envelope Flags**
37 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

Safety Factor Summary - OverPull #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	90000,0	26572,9	D 3,387	N/A	100+	100+	F 3,356
2	1	24,96	90000,0	26344,4	D 3,416	N/A	100+	100+	F 3,392
3	1	122,99	90000,0	25446,5	D 3,537	N/A	100+	100+	F 3,541
4	1	304,80	90000,0	23781,2	D 3,784	N/A	100+	87,236	F 3,855
5	1	609,60	90000,0	20989,3	D 4,288	N/A	100+	44,478	F 4,528
6	1	699,97	89852,0	20161,5	D 4,457	N/A	100+	38,901	F 4,768
7	1	700,03	89851,9	20161,0	D 4,457	N/A	100+	38,898	F 4,768
8	1	914,40	89467,5	18197,4	D 4,917	N/A	100+	30,060	F 5,455
9	1	1219,20	88917,2	15405,5	D 5,772	N/A	100+	22,826	F 6,878
10	1	1249,95	88861,7	15123,6	D 5,876	N/A	100+	22,290	F 7,065
11	2	1250,02	74051,3	15123,1	D 4,897	N/A	100+	19,542	5,947
12	2	1524,00	73639,1	12613,6	D 5,838	N/A	100+	16,267	7,866
13	2	1828,80	73180,4	9821,7	D 7,451	N/A	100+	13,758	12,357
14	2	1999,98	72922,9	8253,4	D 8,835	N/A	100+	12,677	18,275
15	2	2000,04	72922,8	8253,6	D 8,835	N/A	100+	12,677	18,275
16	2	2133,60	72721,9	7029,7	D 10,345	N/A	100+	11,950	29,290
17	2	2400,00	72321,0	4589,5	D 15,758	N/A	100+	10,709	100+
18	2	2438,40	72265,5	4237,8	D 17,052	N/A	100+	10,535	M 75,563
19	2	2549,96	72097,6	3215,5	D 22,422	N/A	100+	10,059	M 32,541
20									

21 **Burst and Axial Flags**
22 **Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**
23
24 **Axial Flags**
25 **Default = Tension, M = Compression**
26
27 **Triaxial Flags**
28 **Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**
29
30 **Envelope Flags**
31 **EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**

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Safety Factor Summary - RunningHole #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	90000,0	26057,3	D 3,454	N/A	100+	100+	F 3,422
2	1	24,96	90000,0	25882,0	D 3,477	N/A	100+	100+	F 3,452
3	1	122,99	90000,0	25192,9	D 3,572	N/A	100+	100+	F 3,577
4	1	304,80	90000,0	23915,0	D 3,763	N/A	100+	87,167	F 3,833
5	1	609,60	90000,0	21772,4	D 4,134	N/A	100+	44,288	F 4,355
6	1	699,97	89852,0	21137,1	D 4,251	N/A	100+	38,698	F 4,531
7	1	700,03	89851,9	21136,7	D 4,251	N/A	100+	38,695	F 4,531
8	1	914,40	89467,5	19629,8	D 4,558	N/A	100+	29,840	F 5,013
9	1	1219,20	88917,2	17487,2	D 5,085	N/A	100+	22,599	F 5,916
10	1	1249,95	88861,7	17270,9	D 5,145	N/A	100+	22,063	F 6,027
11	2	1250,02	74051,3	17270,5	D 4,288	N/A	100+	19,270	5,072
12	2	1524,00	73639,1	15344,7	D 4,799	N/A	100+	15,998	6,091
13	2	1828,80	73180,4	13202,1	D 5,543	N/A	100+	13,499	7,868
14	2	1999,98	72922,9	11998,9	D 6,077	N/A	100+	12,424	9,429
15	2	2000,04	72922,8	11998,4	D 6,078	N/A	100+	12,424	9,430
16	2	2133,60	72721,9	11059,5	D 6,575	N/A	100+	11,703	11,170
17	2	2400,00	72321,0	9186,9	D 7,872	N/A	100+	10,500	17,763
18	2	2438,40	72265,5	8917,0	D 8,104	N/A	100+	10,347	19,426
19	2	2549,96	72097,6	8132,7	D 8,865	N/A	100+	9,930	26,716

Burst and Axial Flags
Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection

Axial Flags
Default = Tension, M = Compression

Triaxial Flags
Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending

Envelope Flags
EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection

Safety Factor Summary - TubingLeak#1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	90000,0	23440,0	D 3,840	N/A	100+	100+	F 3,804
2	1	24,96	90000,0	22934,7	3,924	N/A	100+	100+	F 3,850
3	1	122,99	90000,0	21712,7	4,145	N/A	75,321	100+	F 4,043
4	1	304,80	90000,0	19885,1	4,526	N/A	58,190	100+	F 4,458
5	1	609,60	90000,0	16845,7	5,343	N/A	42,126	100+	F 5,385
6	1	699,97	89852,0	15952,7	5,632	N/A	38,875	100+	F 5,729
7	1	700,03	89851,9	15952,1	5,633	N/A	38,873	100+	F 5,730
8	1	914,40	89467,5	13855,2	6,457	N/A	32,817	100+	F 6,758
9	1	1219,20	88917,2	10953,5	8,118	N/A	26,814	100+	F 9,105
10	1	1249,95	88861,7	10668,3	8,329	N/A	26,325	100+	F 9,438
11	2	1250,02	74051,3	10667,8	6,942	N/A	21,936	100+	7,944
12	2	1524,00	73639,1	8235,0	8,942	N/A	18,854	100+	11,819
13	2	1828,80	73180,4	5956,3	12,286	N/A	16,278	100+	26,217
14	2	1999,98	72922,9	5099,8	14,299	N/A	15,108	100+	84,829
15	2	2000,04	72922,8	5396,7	13,513	N/A	15,107	100+	51,906
16	2	2133,60	72721,9	5009,4	14,517	N/A	14,300	100+	M 100+
17	2	2400,00	72321,0	5130,3	14,097	N/A	12,912	100+	M 26,885
18	2	2438,40	72265,5	5239,8	13,792	N/A	12,733	100+	M 23,666
19	2	2549,96	72097,6	5644,7	N 12,773	N/A	12,238	100+	M 17,683

Burst and Axial Flags
Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection

Axial Flags
Default = Tension, M = Compression

Triaxial Flags
Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending

Envelope Flags
EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection

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Safety Factor Summary - FullEvacuation #1 - 9 5/8" Production Casing

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	0,03	90000,0	22863,8	3,936	N/A	14,072	100+	F 3,590
2	1	24,96	90000,0	22502,8	4,000	N/A	12,984	100+	F 3,631
3	1	122,99	90000,0	21496,9	4,187	N/A	11,858	100+	F 3,802
4	1	304,80	90000,0	19868,4	4,530	N/A	11,333	100+	F 4,167
5	1	609,60	90000,0	17252,2	5,217	N/A	10,549	100+	F 4,965
6	1	699,97	89852,0	16512,3	5,442	N/A	10,320	100+	F 5,256
7	1	700,03	89851,9	16511,8	5,442	N/A	10,320	100+	F 5,256
8	1	914,40	89467,5	14844,1	6,027	N/A	9,809	100+	F 6,106
9	1	1219,20	88917,2	12762,6	6,967	N/A	9,156	100+	F 7,954
10	1	1249,95	88861,7	12577,1	7,065	N/A	9,095	100+	F 8,207
11	2	1250,02	74051,3	12576,7	5,888	N/A	7,579	100+	6,908
12	2	1524,00	73639,1	11191,2	6,580	N/A	7,149	100+	9,653
13	2	1828,80	73180,4	10364,7	7,061	N/A	6,720	100+	17,466
14	2	1999,98	72922,9	10301,2	7,079	N/A	6,498	100+	32,295
15	2	2000,04	72922,8	10381,6	7,024	N/A	6,498	100+	26,013
16	2	2133,60	72721,9	10476,2	6,942	N/A	6,334	100+	50,798
17	2	2400,00	72321,0	11086,8	6,523	N/A	6,029	100+	M 55,995
18	2	2438,40	72265,5	11211,5	6,446	N/A	5,987	100+	M 43,662
19	2	2549,96	72097,6	11610,1	N 6,210	N/A	5,868	100+	M 26,913
20									
21	**Burst and Axial Flags**								
22	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
23									
24	**Axial Flags**								
25	**Default = Tension, M = Compression**								
26									
27	**Triaxial Flags**								
28	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
29									
30	**Envelope Flags**								
31	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - Initial Conditions - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors				
					Triaxial	Envelope	Burst	Collapse	Axial
1	1	2540,02	86533,3	5112,5	D 16,926	N/A	100+	10,469	M 91,319
2	1	2549,96	86517,1	5023,6	D 17,222	N/A	100+	10,427	M 81,610
3	1	2550,02	86517,0	5023,8	D 17,222	N/A	100+	10,426	M 81,610
4	1	2743,20	86168,2	3653,9	23,582	N/A	100+	8,970	M 26,642
5	1	2774,96	86110,9	3439,2	25,038	N/A	100+	8,768	M 23,972
6	2	2775,02	86110,8	3118,7	27,611	N/A	100+	9,812	M 22,228
7	2	3048,00	85617,9	1614,1	53,043	N/A	100+	8,270	M 12,322
8	2	3150,99	85432,0	1518,4	56,265	N/A	100+	7,805	M 10,537
9	2	3172,97	85393,2	1552,7	54,998	N/A	100+	7,712	M 10,219
10									
11	**Burst and Axial Flags**								
12	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
13									
14	**Axial Flags**								
15	**Default = Tension, M = Compression**								
16									
17	**Triaxial Flags**								
18	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
19									
20	**Envelope Flags**								
21	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

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Safety Factor Summary - PressureTest #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	2540,02	86533,3	36491,9	N 2,371	N/A	2,173	100+	10,980
2	1	2549,96	86517,1	36416,0	N 2,376	N/A	2,177	100+	11,117
3	1	2550,02	86517,0	47728,3	1,813	N/A	1,669	100+	7,922
4	1	2743,20	86168,2	42551,8	2,025	N/A	1,869	100+	11,574
5	1	2774,96	86110,9	40568,0	2,123	N/A	1,960	100+	13,184
6	2	2775,02	86110,8	36728,9	2,344	N/A	B 2,032	100+	16,915
7	2	3048,00	85617,9	31734,4	2,698	N/A	B 2,360	100+	100+
8	2	3172,97	85393,2	30504,1	N 2,799	N/A	B 2,466	100+	M 95,204
9									
10	**Burst and Axial Flags**								
11	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
12									
13	**Axial Flags**								
14	**Default = Tension, M = Compression**								
15									
16	**Triaxial Flags**								
17	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
18									
19	**Envelope Flags**								
20	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - GreenCement #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	2540,02	86533,3	57271,2	1,511	N/A	1,379	100+	3,971
2	1	2549,96	86517,1	57269,4	1,511	N/A	1,379	100+	3,991
3	1	2550,02	86517,0	57269,3	1,511	N/A	1,379	100+	3,991
4	1	2743,20	86168,2	56729,0	1,519	N/A	1,386	100+	4,418
5	1	2774,96	86110,9	56643,5	1,520	N/A	1,387	100+	4,498
6	2	2775,02	86110,8	51320,4	1,678	N/A	B 1,439	100+	5,332
7	2	3048,00	85617,9	50700,4	1,689	N/A	B 1,450	100+	6,549
8	2	3172,97	85393,2	50444,5	1,693	N/A	B 1,455	100+	7,319
9									
10	**Burst and Axial Flags**								
11	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
12									
13	**Axial Flags**								
14	**Default = Tension, M = Compression**								
15									
16	**Triaxial Flags**								
17	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
18									
19	**Envelope Flags**								
20	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - OverPull #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors Triaxial	Envelope	Burst	Collapse	Axial
1	1	2540,02	86533,3	11900,5	D 7,271	N/A	100+	10,228	14,826
2	1	2549,96	86517,1	11811,6	D 7,325	N/A	100+	10,192	15,115
3	1	2550,02	86517,0	11811,7	D 7,325	N/A	100+	10,192	15,115
4	1	2743,20	86168,2	10097,1	D 8,534	N/A	100+	9,534	24,275
5	1	2774,96	86110,9	9814,9	D 8,774	N/A	100+	9,435	26,979
6	2	2775,02	86110,8	8900,8	D 9,675	N/A	100+	10,498	37,799
7	2	3048,00	85617,9	6476,0	D 13,221	N/A	100+	9,612	M 100+
8	2	3172,97	85393,2	5365,7	D 15,915	N/A	100+	9,216	M 38,748
9									
10	**Burst and Axial Flags**								
11	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
12									
13	**Axial Flags**								
14	**Default = Tension, M = Compression**								
15									
16	**Triaxial Flags**								
17	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
18									
19	**Envelope Flags**								
20	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - RunningHole #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	2540,02	86533,3	14743,8	D 5,869	N/A	100+	10,100	9,972
2	1	2549,96	86517,1	14679,3	D 5,894	N/A	100+	10,063	10,072
3	1	2550,02	86517,0	14678,9	D 5,894	N/A	100+	10,063	10,073
4	1	2743,20	86168,2	13425,6	D 6,418	N/A	100+	9,401	12,532
5	1	2774,96	86110,9	13219,5	D 6,514	N/A	100+	9,300	13,058
6	2	2775,02	86110,8	12856,0	D 6,698	N/A	100+	10,305	13,820
7	2	3048,00	85617,9	11082,8	D 7,725	N/A	100+	9,450	22,484
8	2	3172,97	85393,2	10271,1	D 8,314	N/A	100+	9,107	31,643
9									
10	**Burst and Axial Flags**								
11	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
12									
13	**Axial Flags**								
14	**Default = Tension, M = Compression**								
15									
16	**Triaxial Flags**								
17	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
18									
19	**Envelope Flags**								
20	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - FullEvacuation #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	2540,02	86533,3	10455,4	8,276	N/A	7,843	100+	59,981
2	1	2549,96	86517,1	10347,6	8,361	N/A	7,917	100+	65,044
3	1	2550,02	86517,0	10267,9	8,426	N/A	7,987	100+	66,809
4	1	2743,20	86168,2	8152,7	10,569	N/A	9,831	100+	M 81,681
5	1	2774,96	86110,9	7811,2	11,024	N/A	10,221	100+	M 59,729
6	2	2775,02	86110,8	7081,9	12,159	N/A	B 10,599	100+	M 43,941
7	2	3048,00	85617,9	4577,6	18,704	N/A	B 16,134	23,177	M 16,378
8	2	3172,97	85393,2	3689,2	N 23,147	N/A	B 21,259	16,971	M 12,699
9									
10	**Burst and Axial Flags**								
11	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
12									
13	**Axial Flags**								
14	**Default = Tension, M = Compression**								
15									
16	**Triaxial Flags**								
17	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
18									
19	**Envelope Flags**								
20	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Safety Factor Summary - TubingLeak #1 - 7" Production Liner

	String Section	MD (m)	Yield Strength (psi)	VME Stress (psi)	Absolute Safety Factors: Triaxial	Envelope	Burst	Collapse	Axial
1	1	2540,02	86533,3	56958,8	1,519	N/A	100+	1,220	M 6,247
2	1	2549,96	86517,1	56834,5	1,522	N/A	100+	1,222	M 6,195
3	1	2550,02	86517,0	56927,6	1,520	N/A	100+	1,220	M 6,189
4	1	2743,20	86168,2	54743,6	1,574	N/A	100+	1,244	M 5,566
5	1	2774,96	86110,9	54387,9	1,583	N/A	100+	1,248	M 5,475
6	2	2775,02	86110,8	49211,5	1,750	N/A	100+	1,536	M 5,922
7	2	3048,00	85617,9	46442,2	1,844	N/A	100+	1,577	M 5,110
8	2	3172,97	85393,2	45209,3	1,889	N/A	100+	1,597	M 4,806
9									
10	**Burst and Axial Flags**								
11	**Default = Pipe Body, L = Connection Leak, B = Connection Burst, F = Connection Fracture, J = Connection Jump-out, Y = Connection Yield, C = Connection**								
12									
13	**Axial Flags**								
14	**Default = Tension, M = Compression**								
15									
16	**Triaxial Flags**								
17	**Default = Inner Wall and Positive Bending OR No Bending, D = Outer wall safety factor, N = Negative Bending**								
18									
19	**Envelope Flags**								
20	**EB = Envelope Burst, EC = Envelope Collapse, N/A = no ISO Connection**								

Movement Summary - Initial Conditions - 13 3/8" Conductor Casing

	MD (m): Top	MD (m): Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	123,00	0,000	0,000	0,000	0,000	0,000	0,00

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Movement Summary - LostReturnsWithMudDrop #1 - 13 3/8" Conductor Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	0,03	123,00	-0,003	0,000	0,002	0,001	0,000	0,00

Movement Summary - OverPull #1 - 13 3/8" Conductor Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	0,03	123,00	0,008	0,000	0,000	0,000	0,008*	0,00
2								
3	* Surface displacement due to pickup (+) or slackoff (-)							

Movement Summary - RunningHole #1 - 13 3/8" Conductor Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1								
2								
3	No results available for this load case							
4								
5								

Movement Summary - Initial Conditions - 11 3/4" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	0,03	123,00	0,000	0,000	0,000	0,000	0,000	0,00

Movement Summary - PressureTest #1 - 11 3/4" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	0,03	123,00	0,041	0,000	-0,041	0,000	0,000	123,00

Movement Summary - LostReturnsWithMudDrop #1 - 11 3/4" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	0,03	123,00	-0,003	0,000	0,002	0,001	0,000	0,00

Movement Summary - GreenCement #1 - 11 3/4" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	0,03	123,00	0,028	0,000	0,000	0,000	0,028	0,00

Movement Summary - OverPull #1 - 11 3/4" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	0,03	123,00	0,075	0,000	0,000	0,000	0,075*	0,00
2								
3	* Surface displacement due to pickup (+) or slackoff (-)							

Movement Summary - RunningHole #1 - 11 3/4" Surface Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1								
2								
3	No results available for this load case							
4								
5								

Movement Summary - Initial Conditions - 9 5/8" Production Casing

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	0,03	2000,00	0,000	0,000	0,000	0,000	0,000	0,00

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Movement Summary - PressureTest #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2000,00	0,980	-0,003	-0,977	0,000	0,000	626,47

Movement Summary - LostReturnsWithMudDrop #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2000,00	0,005	0,000	-0,007	0,001	0,000	0,00

Movement Summary - GreenCement #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2000,00	0,628	0,000	0,000	0,000	0,628	0,00

Movement Summary - OverPull #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2000,00	0,273	0,000	0,000	0,000	0,273*	0,00
2								
3	* Surface displacement due to pickup (+) or slackoff (-)							

Movement Summary - RunningHole #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1								
2								
3	No results available for this load case							
4								
5								

Movement Summary - TubingLeak#1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2000,00	0,053	0,000	-0,053	0,000	0,000	0,00

Movement Summary - FullEvacuation #1 - 9 5/8" Production Casing

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	0,03	2000,00	0,147	0,000	-0,147	0,000	0,000	0,00

Movement Summary - Initial Conditions - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	2540,02	2550,00	0,000	0,000	0,000	0,000	0,000	0,00

Movement Summary - PressureTest #1 - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	2540,02	2550,00	0,003	0,000	-0,003	0,000	0,000	10,00

Movement Summary - GreenCement #1 - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	2540,02	2550,00	0,003	0,000	0,000	0,000	0,003	0,00

Movement Summary - OverPull #1 - 7" Production Liner

	MD (m) Top	MD (m) Base	Hooke's Law (m)	Buckling (m)	Balloon (m)	Thermal (m)	Total (m)	Buckled Length (m)
1	2540,02	2550,00	0,118	0,000	0,000	0,000	0,118*	0,00
2								
3	* Surface displacement due to pickup (+) or slackoff (-)							

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Movement Summary - RunningHole #1 - 7'' Production Liner

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	No results available for this load case							
2								
3								
4								
5								

Movement Summary - FullEvacuation #1 - 7'' Production Liner

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	2540,02	2550,00	0,001	0,000	-0,001	0,000	0,000	0,00

Movement Summary - TubingLeak #1 - 7'' Production Liner

	MD (m)		Hooke's	Buckling	Balloon	Thermal	Total	Buckled
	Top	Base	Law (m)	(m)	(m)	(m)	(m)	Length (m)
1	2540,02	2550,00	-0,004	0,000	0,004	0,000	0,000	0,00

5.3 Drill Cost Estimates

5.3.1 Barents Sea

5.3.1.1 Conventional Well Design

DRILLING COST ESTIMATE

Well Name: Barents Sea

Drilling Rig : 0
Rig X

Permit : 7120

				Phase	Pre-spud		Surface Hole		Surface Casing		Nipple Up BOP's		Intermediate Hole 1		Intermediate Casing 1		LOT a
				Number of days	2.1 days		1.3 days		1.9 days		3.3 days		4.0 days		3.5 days		2.8
				Depth	0 m		645 m		645 m		645 m		1355 m		1355 m		135
Revision 0	Contractor	Unit Cost	Pre-Drill		Unit cost	Sub Total	Unit Cost	Sub Total	Unit Cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost
Staff Salaries																	
Operating Company Personnel		$10,000			$10,000	$20,833	$10,000	$12,500	$10,000	$18,750	$10,000	$33,333	$10,000	$39,583	$10,000	$35,000	$10,000
Overhead Allocation																	
General Overhead Recovery ($3.2MM spread over well)		$65,473			$65,473	$136,402	$65,473	$81,841	$65,473	$122,762	$65,473	$218,244	$65,473	$259,165	$65,473	$229,156	$65,473
Rig Costs																	
Mob / Demob - Initial Mobilisation			$1,150,000		$0		$0		$0		$0		$0		$0		$0
Mob / Demob - Final Demobilisation		$260,000															
Rig Operating Costs		$145,000			$145,000		$145,000	$181,250	$145,000	$271,875	$145,000	$483,333	$145,000	$573,958	$145,000	$507,500	$145,000
Rig Operating Costs - Crew Change Flight (Helicopters)		$10,000			$10,000		$10,000		$10,000		$10,000		$10,000	$39,583	$10,000	$35,000	$10,000
Fuel and Lubricants		$50,000			$50,000	$104,167	$50,000	$62,500	$50,000	$93,750	$50,000	$166,667	$50,000	$197,917	$50,000	$175,000	$50,000
Marine Costs - General Spread Rate		$580,000			$580,000	$1,208,333	$580,000	$725,000	$580,000	$1,087,500	$580,000	$1,933,333	$580,000	$2,295,833	$580,000	$2,030,000	$580,000
HSE and Auditing																	
Site Survey and Inspections			$1,300,000														
Evaluation																	
Mudlogging and Data Handling		$5,000	$20,000		$5,000	$10,417	$5,000	$6,250	$5,000	$9,375	$5,000	$16,667	$5,000	$19,792	$5,000	$17,500	$5,000
Wireline Logging - Open Hole		$250,000												$250,000			
Wireline Logging - Cased Hole - CBL		$70,000															
Subsea Works																	
Dynamic Positioning			$58,000														
Communications																	
Communications - Phone Charges		$500			$500	$1,042	$500	$625	$500	$938	$500	$1,667	$500	$1,979	$500	$1,750	$500
Reporting Costs (US$260k spread over well)		$5,320			$5,320	$11,083	$5,320	$6,650	$5,320	$9,974	$5,320	$17,732	$5,320	$21,057	$5,320	$18,619	$5,320
Transport																	
Transport / Freight - Materials Transport and General Freight		$20,000	$100,000		$20,000	$41,667	$20,000	$25,000	$20,000	$37,500	$20,000	$66,667	$20,000	$79,167	$20,000	$70,000	$20,000
Water Source & Supply Haulage		$5,000			$5,000	$10,417	$5,000	$6,250	$5,000	$9,375	$5,000	$16,667	$5,000	$19,792	$5,000	$17,500	$5,000
Casing and Accessories																	
Surface Casing: 20" 113 lb/ft N-80 TSH-ER (Range III)		$400/m							$400/m	$258,000							
Intermediate Casing : 13-3/8" 72 lb/ft P-110 VAM21 (Range III)		$300/m													$300/m	$406,500	
Intermediate Casing : 9-5/8" 53.5 lb/ft P-110 VAM21 (Range III)		$200/m															
Production Casing : 7" 29 lb/ft L-80 VAMTOPHC (Range III)		$150/m															
Production casing liner system		$15,000															
Casing running contractor - Premium Casing Services		$8,000	$10,000						$8,000	$15,000					$8,000	$28,000	
Casing equipment		$10,000								$10,000						$10,000	
Sealant and brushes			$3,500														
Wellhead																	
Wellhead Equipment - Wellhead Installaiton and Testing		$20,000															
Wellhead Equipment - "A" section		$200,000										$200,000					
Wellhead Equipment - "B" section		$300,000														$300,000	
Wellhead Equipment - "C" Section		$300,000															
Cementing																	
Chemicals (surface, intermediate, production and P&A)										$45,000						$60,000	
Services (surface, intermediate, production and P&A)										$80,000						$90,000	
Mud																	
Chemicals								$85,000						$65,000			
Mud engineer: rig release to rig release (Assuming 2x Mud Men @ US$2k/d)		$3,000			$3,000	$6,250	$3,000	$3,750	$3,000	$5,625	$3,000	$10,000	$3,000	$11,875	$3,000	$10,500	$3,000
Centrifuge / Desander / Desilter		$2,000	$10,000		$2,000	$4,167	$2,000	$2,500	$2,000	$3,750	$2,000	$6,667	$2,000	$7,917	$2,000	$7,000	$2,000
Miscellaneous Equipment																	
Tanks - Additional Water Storage Tanks		$500			$500	$1,042	$500	$625	$500	$938	$500	$1,667	$500	$1,979	$500	$1,750	$500
Office Supplies		$150			$150	$313	$150	$188	$150	$281	$150	$500	$150	$594	$150	$525	$150
Waste Treatment And Disposal - Deliver bin to wellsite, cost of empty the bins		$5,000			$5,000	$10,417	$5,000	$6,250	$5,000	$9,375	$5,000	$16,667	$5,000	$19,792	$5,000	$17,500	$5,000
Drilling Tools & Equipment																	
Drill Bits Purchased								$80,000						$60,000			
Drilling Tools Rental - Survey Tools (e.g. Flodrift, Manless MWD)					$0		$0		$0		$0		$0		$0		$0
Drilling Tools Rental - Drilling Jars Rental		$400	$4,000		$400	$833	$400	$500	$400	$750	$400	$1,333	$400	$1,583	$400	$1,400	$400
Drilling Tools Rental - Redress/Run charges for rentals (spread over well)		$2,000			$2,000	$4,167	$2,000	$2,500	$2,000	$3,750	$2,000	$6,667	$2,000	$7,917	$2,000	$7,000	$2,000
Drilling Tools Rental - Stabilisers		$800			$800	$1,667	$800	$1,000	$800	$1,500	$800	$2,667	$800	$3,167	$800	$2,800	$800
Drilling Tools Rental - Directional Drilling Services																	
Class Charges																	
Class charges written over five years			$154,000														
Field Professional Services																	
Wellsite Geologist (Assuming 2x Geo's @ US$2k/d)		$4,000			$4,000	$8,333	$4,000	$5,000	$4,000	$7,500	$4,000	$13,333	$4,000	$15,833	$4,000	$14,000	$4,000
Safety Adviser (Assuming 2x SA's @ US$1.5k/d		$3,000			$3,000	$6,250	$3,000	$3,750	$3,000	$5,625	$3,000	$10,000	$0		$0		$3,000
Medivac Cost per well			$25,000														
Company Man (1 x day, 1 x night assuming each at US$2.5k/d)		$5,000			$5,000	$10,417	$5,000	$6,250	$5,000	$9,375	$5,000	$16,667	$5,000	$19,792	$5,000	$17,500	$5,000
TOTALS			$2,834,500		$922,143	$1,598,214	$922,143	$1,305,179	$930,543	$2,118,268	$922,143	$3,240,476	$919,143	$4,013,274	$927,443	$4,111,500	$922,143
Phase Totals		Pre-Well Charges	$2,834,500		Pre-spud	$1,598,214	Surface Hole	$1,305,179	Surface Casing	$2,118,268	Nipple Up BOP's	$3,240,476	Intermediate Hole 1	$4,013,274	Intermediate Casing 1	$4,111,500	LOT and Test

DRILLING COST ESTIMATE

Well Name: Barents Sea

Drilling Rig : 0
Rig X

Permit : 7120

		d Test		Intermediate Hole 2		Intermediate Casing 2		LOT and Test		Production Hole		Evaluation		Production Liner		Rig Release			
		days		6.9 days		3.7 days		2.5 days		7.1 days		5.4 days		4.3 days		0.3 days			
		5 m		1995 m		1995 m		1995 m		2500 m		2500 m		2500 m		2500 m			
Revision 0	Contractor	Unit Cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Sub-total	Total
Staff Salaries																			$488,750
Operating Company Personnel		$10,000	$27,500	$10,000	$68,750	$10,000	$36,667	$10,000	$25,000	$10,000	$70,833	$10,000	$54,167	$10,000	$42,500	$10,000	$3,333	$488,750	
Overhead Allocation																			$3,200,000
General Overhead Recovery ($3.2MM spread over well)		$65,473	$180,051	$65,473	$450,128	$65,473	$240,068	$65,473	$163,683	$65,473	$463,768	$65,473	$354,646	$65,473	$278,261	$65,473	$21,824	$3,200,000	
Rig Costs																			$39,218,542
Mob / Demob - Initial Mobilisation				$0		$0		$0		$0		$0		$0		$0		$1,150,000	
Mob / Demob - Final Demobilisation		$260,000															$260,000	$260,000	
Rig Operating Costs		$145,000	$398,750	$145,000	$996,875	$145,000	$531,667	$145,000	$362,500	$145,000	$1,027,083	$145,000	$785,417	$145,000	$616,250	$145,000	$48,333	$6,784,792	
Rig Operating Costs - Crew Change Flight (Helicopters)		$10,000	$27,500	$10,000	$68,750	$10,000	$36,667	$10,000	$25,000	$10,000		$10,000		$10,000		$10,000		$232,500	
Fuel and Lubricants		$50,000	$137,500	$50,000	$343,750	$50,000	$183,333	$50,000	$125,000	$50,000	$354,167	$50,000	$270,833	$50,000	$212,500	$50,000	$16,667	$2,443,750	
Marine Costs - General Spread Rate		$580,000	$1,595,000	$580,000	$3,987,500	$580,000	$2,126,667	$580,000	$1,450,000	$580,000	$4,108,333	$580,000	$3,141,667	$580,000	$2,465,000	$580,000	$193,333	$28,347,500	
HSE and Auditing																			$1,300,000
Site Survey and Inspections																		$1,300,000	
Evaluation																			$1,154,375
Mudlogging and Data Handling		$5,000	$13,750	$5,000	$34,375	$5,000	$18,333	$5,000	$12,500	$5,000	$35,417	$5,000	$27,083	$5,000	$21,250	$5,000	$1,667	$264,375	
Wireline Logging - Open Hole		$250,000			$250,000								$250,000					$750,000	
Wireline Logging - Cased Hole - CBL		$70,000							$70,000								$70,000	$140,000	
Subsea Works																			$58,000
Dynamic Positioning																		$58,000	
Communications																			$284,438
Communications - Phone Charges		$500	$1,375	$500	$3,438	$500	$1,833	$500	$1,250	$500	$3,542	$500	$2,708	$500	$2,125	$500	$167	$24,438	
Reporting Costs (US$260k spread over well)		$5,320	$14,629	$5,320	$36,573	$5,320	$19,506	$5,320	$13,299	$5,320	$37,681	$5,320	$28,815	$5,320	$22,609	$5,320	$1,773	$260,000	
Transport																			$1,321,875
Transport / Freight - Materials Transport and General Freight		$20,000	$55,000	$20,000	$137,500	$20,000	$73,333	$20,000	$50,000	$20,000	$141,667	$20,000	$108,333	$20,000	$85,000	$20,000	$6,667	$1,077,500	
Water Source & Supply Haulage		$5,000	$13,750	$5,000	$34,375	$5,000	$18,333	$5,000	$12,500	$5,000	$35,417	$5,000	$27,083	$5,000	$21,250	$5,000	$1,667	$244,375	
Casing and Accessories																			$1,316,750
Surface Casing: 20" 113 lb/ft N-80 TSH-ER (Range III)		$400/m																$258,000	
Intermediate Casing : 13-3/8" 72 lb/ft P-110 VAM21 (Range III)		$300/m																$406,500	
Intermediate Casing : 9-5/8" 53.5 lb/ft P-110 VAM21 (Range III)		$200/m				$200/m	$399,000											$399,000	
Production Casing : 7" 29 lb/ft L-80 VAMTOPHC (Range III)		$150/m												$150/m	$75,750			$75,750	
Production casing liner system		$15,000													$15,000			$15,000	
Casing running contractor - Premium Casing Services		$8,000				$8,000	$29,333							$8,000	$34,000	$8,000	$2,667	$119,000	
Casing equipment		$10,000					$10,000								$10,000			$40,000	
Sealant and brushes																		$3,500	
Wellhead																			$1,110,000
Wellhead Equipment - Wellhead Installaiton and Testing		$20,000														$10,000	$10,000	$10,000	
Wellhead Equipment - "A" section		$200,000																$200,000	
Wellhead Equipment - "B" section		$300,000																$300,000	
Wellhead Equipment - "C" Section		$300,000					$300,000								$300,000			$600,000	
Cementing																			$910,000
Chemicals (surface, intermediate, production and P&A)							$120,000								$320,000			$545,000	
Services (surface, intermediate, production and P&A)							$95,000								$100,000			$365,000	
Mud																			$609,375
Chemicals					$120,000						$55,000				$30,000			$355,000	
Mud engineer: rig release to rig release (Assuming 2x Mud Men @ US$2k/d)		$3,000	$8,250	$3,000	$20,625	$3,000	$11,000	$3,000	$7,500	$3,000	$21,250	$3,000	$16,250	$3,000	$12,750	$3,000	$1,000	$146,625	
Centrifuge / Desander / Desilter		$2,000	$5,500	$2,000	$13,750	$2,000	$7,333	$2,000	$5,000	$2,000	$14,167	$2,000	$10,833	$2,000	$8,500	$2,000	$667	$107,750	
Miscellaneous Equipment																			$276,144
Tanks - Additional Water Storage Tanks		$500	$1,375	$500	$3,438	$500	$1,833	$500	$1,250	$500	$3,542	$500	$2,708	$500	$2,125	$500	$167	$24,438	
Office Supplies		$150	$413	$150	$1,031	$150	$550	$150	$375	$150	$1,063	$150	$813	$150	$638	$150	$50	$7,331	
Waste Treatment And Disposal - Deliver bin to welsite, cost of empty the bins		$5,000	$13,750	$5,000	$34,375	$5,000	$18,333	$5,000	$12,500	$5,000	$35,417	$5,000	$27,083	$5,000	$21,250	$5,000	$1,667	$244,375	
Drilling Tools & Equipment																			$395,400
Drill Bits Purchased					$50,000						$45,000							$235,000	
Drilling Tools Rental - Survey Tools (e.g. Flodrift, Manless MWD)				$0		$0		$0		$0		$0		$0		$0		$0	
Drilling Tools Rental - Drilling Jars Rental		$400	$1,100	$400	$2,750	$400	$1,467	$400	$1,000	$400	$2,833	$400	$2,167	$400	$1,700	$400	$133	$23,550	
Drilling Tools Rental - Redress/Run charges for rentals (spread over well)		$2,000	$5,500	$2,000	$13,750	$2,000	$7,333	$2,000	$5,000	$2,000	$14,167	$2,000	$10,833	$2,000	$8,500	$2,000	$667	$97,750	
Drilling Tools Rental - Stabilisers		$800	$2,200	$800	$5,500	$800	$2,933	$800	$2,000	$800	$5,667	$800	$4,333	$800	$3,400	$800	$267	$39,100	
Drilling Tools Rental - Directional Drilling Services										$0								$0	
Class Charges																			$154,000
Class charges written over five years																		$154,000	
Field Professional Services																			$557,500
Wellsite Geologist (Assuming 2x Geo's @ US$2k/d)		$4,000	$11,000	$4,000	$27,500	$4,000	$14,667	$4,000	$10,000	$4,000	$28,333	$4,000	$21,667	$4,000	$17,000	$4,000	$1,333	$195,500	
Safety Adviser (Assuming 2x SA's @ US$1.5k/d		$3,000	$8,250	$0		$0		$3,000	$7,500	$3,000	$21,250	$3,000	$16,250	$3,000	$12,750	$3,000	$1,000	$92,625	
Medivac Cost per well																		$25,000	
Company Man (1 x day, 1 x night assuming each at US$2.5k/d)		$5,000	$13,750	$5,000	$34,375	$5,000	$18,333	$5,000	$12,500	$5,000	$35,417	$5,000	$27,083	$5,000	$21,250	$5,000	$1,667	$244,375	
																		$0	
TOTALS			$2,535,893	$919,143	$6,739,107	$927,343	$4,323,524	$922,143	$2,375,357	$922,143	$6,561,012	$922,143	$5,190,774	$930,293	$4,761,357	$940,143	$646,714	$ 52,355,148	$52,355,148
Phase Totals		Pre-Well Charges	$2,535,893	Intermediate Hole 2	$6,739,107	Intermediate Casing 2	$4,323,524	LOT and Test	$2,375,357	Production Hole	$6,561,012	Evaluation	$5,190,774	Production Liner	$4,761,357	Rig Release	$646,714	Total Cost	$52,355,148

5.3.1.2 Slender Well Design

DRILLING COST ESTIMATE

Well Name: Barents Sea

Drilling Rig : 0
Rig X

Permit : 7120

					Phase	Pre-spud		Surface Hole		Surface Casing		LOT and Test		Intermediate Hole	
					Number of days	2.1 days		4.6 days		3.5 days		2.8 days		7.9 days	
					Depth	0 m		950 m		950 m		950 m		2100 m	
Revision 0		Contractor	Unit Cost	Pre-Drill		Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total
Staff Salaries															
	Operating Company Personnel		$10,000			$10,000	$20,833	$10,000	$45,833	$10,000	$35,000	$10,000	$27,500	$10,000	$79,167
Overhead Allocation															
	General Overhead Recovery ($3.2MM spread over well)		$72,590			$72,590	$151,229	$72,590	$332,703	$72,590	$254,064	$72,590	$199,622	$72,590	$574,669
Rig Costs															
	Mob / Demob - Initial Mobilisation			$1,150,000		$0		$0		$0		$0		$0	
	Mob / Demob - Final Demobilisation		$260,000												
	Rig Operating Costs		$145,000			$145,000		$145,000	$664,583	$145,000	$507,500	$145,000	$398,750	$145,000	$1,147,917
	Rig Operating Costs - Crew Change Flight (Helicopters)		$10,000			$10,000		$10,000	$45,833	$10,000	$35,000	$10,000	$27,500	$10,000	$79,167
	Fuel and Lubricants		$50,000			$50,000	$104,167	$50,000	$229,167	$50,000	$175,000	$50,000	$137,500	$50,000	$395,833
	Marine Costs - General Spread Rate		$20,000			$20,000	$41,667	$20,000	$91,667	$20,000	$70,000	$20,000	$55,000	$20,000	$158,333
HSE and Auditing															
	Site Survey and Inspections			$1,300,000											
Evaluation															
	Mudlogging and Data Handling		$5,000	$20,000		$5,000	$10,417	$5,000	$22,917	$5,000	$17,500	$5,000	$13,750	$5,000	$39,583
	Wireline Logging - Open Hole		$250,000						$250,000						$250,000
	Wireline Logging - Cased Hole - CBL		$70,000												
Subsea Works															
	Dynamic Positioning			$58,000											
Communications															
	Communications - Phone Charges		$500			$500	$1,042	$500	$2,292	$500	$1,750	$500	$1,375	$500	$3,958
	Reporting Costs (US$260k spread over well)		$5,898			$5,898	$12,287	$5,898	$27,032	$5,898	$20,643	$5,898	$16,219	$5,898	$46,692
Transport															
	Transport / Freight - Materials Transport and General Freight		$20,000	$100,000		$20,000	$41,667	$20,000	$91,667	$20,000	$70,000	$20,000	$55,000	$20,000	$158,333
	Water Source & Supply Haulage		$5,000			$5,000	$10,417	$5,000	$22,917	$5,000	$17,500	$5,000	$13,750	$5,000	$39,583
Casing and Accessories															
	Surface Casing : 13-3/8" 54.5 lb/ft J-55 BTC (Range III)	$201/m	$201/m							$201/m	$190,950				
	Intermediate Casing : 9-5/8" 40 lb/ft M-56 BTC (or premium if desired) (Range III) 9-5/8" 47 lb/ft C-75 BTC (or premium if desired) (Range III)	$144/m	$144/m												
	Production Casing : 7" 29 lb/ft C-75 BTC (or premium thread if desired) (Range III)	$150/m	$150/m												
	Production casing liner system		$15,000												
	Casing running contractor - Premium Casing Services		$8,000	$10,000						$8,000	$28,000				
	Casing equipment		$10,000								$10,000				
	Sealant and brushes			$3,500											
Wellhead															
	Wellhead Equipment - Wellhead Installaiton and Testing		$20,000												
	Wellhead Equipment - "A" section	$200,000	$133,750												
	Wellhead Equipment - "B" section	$300,000	$215,887.85								$215,888				
	Wellhead Equipment - "C" Section	$300,000	$300,000												
Cementing															
	Chemicals (surface, intermediate, production and P&A)										$63,559				
	Services (surface, intermediate, production and P&A)										$90,000				
Mud															
	Chemicals								$67,600						$95,239
	Mud engineer: rig release to rig release (Assuming 2x Mud Men @ US$2k/d)		$3,000			$3,000	$6,250	$3,000	$13,750	$3,000	$10,500	$3,000	$8,250	$3,000	$23,750
	Centrifuge / Desander / Desilter		$2,000	$10,000		$2,000	$4,167	$2,000	$9,167	$2,000	$7,000	$2,000	$5,500	$2,000	$15,833
Miscellaneous Equipment															
	Tanks - Additional Water Storage Tanks		$500			$500	$1,042	$500	$2,292	$500	$1,750	$500	$1,375	$500	$3,958
	Office Supplies		$150			$150	$313	$150	$688	$150	$525	$150	$413	$150	$1,188
	Waste Treatment And Disposal - Deliver bin to wellsite, cost of empty the bins		$5,000			$5,000	$10,417	$5,000	$22,917	$5,000	$17,500	$5,000	$13,750	$5,000	$39,583
Drilling Tools & Equipment															
	Drill Bits Purchased								$40,385						$35,000
	Drilling Tools Rental - Survey Tools (e.g. Flodrift, Manless MWD)					$0		$0		$0		$0		$0	
	Drilling Tools Rental - Drilling Jars Rental		$400	$4,000		$400	$833	$400	$1,833	$400	$1,400	$400	$1,100	$400	$3,167
	Drilling Tools Rental - Redress/Run charges for rentals (spread over well)		$2,000			$2,000	$4,167	$2,000	$9,167	$2,000	$7,000	$2,000	$5,500	$2,000	$15,833
	Drilling Tools Rental - Stabilisers		$800			$800	$1,667	$800	$3,667	$800	$2,800	$800	$2,200	$800	$6,333
	Drilling Tools Rental - Directional Drilling Services														
Class Charges															
	Class charges written over five years			$154,000											
Field Professional Services															
	Wellsite Geologist (Assuming 2x Geo's @ US$2k/d)		$4,000			$4,000	$8,333	$4,000	$18,333	$4,000	$14,000	$4,000	$11,000	$4,000	$31,667
	Safety Adviser (Assuming 2x SA's @ US$1.5k/d		$3,000			$3,000	$6,250	$0		$0		$3,000	$8,250	$0	
	Medivac Cost per well			$25,000											
	Company Man (1 x day, 1 x night assuming each at US$2.5k/d)		$5,000			$5,000	$10,417	$5,000	$22,917	$5,000	$17,500	$5,000	$13,750	$5,000	$39,583
	TOTALS			**$2,834,500**		$369,838	**$447,579**	$366,838	$2,039,324	$375,039	$1,882,329	$369,838	$1,017,054	$366,838	$3,284,371
	Phase Totals		**Pre-Well Charges**	**$2,834,500**		**Pre-spud**	**$447,579**	**Surface Hole**	**$2,039,324**	**Surface Casing**	**$1,882,329**	**LOT and Test**	**$1,017,054**	**Intermediate Hole**	**$3,284,371**

DRILLING COST ESTIMATE

Well Name: Barents Sea

Drilling Rig : 0
Rig X

Permit : 7120

Revision 0		Contractor	Unit Cost	Intermediate Casing 3.7 days 2100 m		LOT and Test 2.5 days 2100 m		Production Hole 7.1 days 2500 m		Evaluation 5.4 days 2500 m		Production Liner 4.3 days 2500 m		Rig Release 0.3 days 2500 m		Sub-total	Total
				Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total		
Staff Salaries																	$440,833
	Operating Company Personnel		$10,000	$10,000	$36,667	$10,000	$25,000	$10,000	$70,833	$10,000	$54,167	$10,000	$42,500	$10,000	$3,333	$440,833	
Overhead Allocation																	$3,200,000
	General Overhead Recovery ($3.2MM spread over well)		$72,590	$72,590	$266,163	$72,590	$181,474	$72,590	$514,178	$72,590	$393,195	$72,590	$308,507	$72,590	$24,197	$3,200,000	
Rig Costs																	$10,835,000
	Mob / Demob - Initial Mobilisation			$0		$0		$0		$0		$0		$0		$1,150,000	
	Mob / Demob - Final Demobilisation		$260,000												$260,000	$260,000	
	Rig Operating Costs		$145,000	$145,000	$531,667	$145,000	$362,500	$145,000	$1,027,083	$145,000	$785,417	$145,000	$616,250	$145,000	$48,333	$6,090,000	
	Rig Operating Costs - Crew Change Flight (Helicopters)		$10,000	$10,000	$36,667	$10,000	$25,000	$10,000		$10,000		$10,000		$10,000		$249,167	
	Fuel and Lubricants		$50,000	$50,000	$183,333	$50,000	$125,000	$50,000	$354,167	$50,000	$270,833	$50,000	$212,500	$50,000	$16,667	$2,204,167	
	Marine Costs - General Spread Rate		$20,000	$20,000	$73,333	$20,000	$50,000	$20,000	$141,667	$20,000	$108,333	$20,000	$85,000	$20,000	$6,667	$881,667	
HSE and Auditing																	$1,300,000
	Site Survey and Inspections															$1,300,000	
Evaluation																	$1,130,417
	Mudlogging and Data Handling		$5,000	$5,000	$18,333	$5,000	$12,500	$5,000	$35,417	$5,000	$27,083	$5,000	$21,250	$5,000	$1,667	$240,417	
	Wireline Logging - Open Hole		$250,000								$250,000					$750,000	
	Wireline Logging - Cased Hole - CBL		$70,000				$70,000								$70,000	$140,000	
Subsea Works																	$58,000
	Dynamic Positioning															$58,000	
Communications																	$282,042
	Communications - Phone Charges		$500	$500	$1,833	$500	$1,250	$500	$3,542	$500	$2,708	$500	$2,125	$500	$167	$22,042	
	Reporting Costs (US$260k spread over well)		$5,898	$5,898	$21,626	$5,898	$14,745	$5,898	$41,777	$5,898	$31,947	$5,898	$25,066	$5,898	$1,966	$260,000	
Transport																	$1,202,083
	Transport / Freight - Materials Transport and General Freight		$20,000	$20,000	$73,333	$20,000	$50,000	$20,000	$141,667	$20,000	$108,333	$20,000	$85,000	$20,000	$6,667	$981,667	
	Water Source & Supply Haulage		$5,000	$5,000	$18,333	$5,000	$12,500	$5,000	$35,417	$5,000	$27,083	$5,000	$21,250	$5,000	$1,667	$220,417	
Casing and Accessories																	$705,850
																$0	
	Surface Casing : 13-3/8" 54.5 lb/ft J-55 BTC (Range III)	$201/m	$201/m													$190,950	
	Intermediate Casing : 9-5/8" 40 lb/ft M-56 BTC (or premium if desired) (Range III) 9-5/8" 47 lb/ft C-75 BTC (or premium if desired) (Range III)	$144/m	$144/m	$144/m	$302,400											$302,400	
	Production Casing : 7" 29 lb/ft C-75 BTC (or premium thread if desired) (Range III)	$150/m	$150/m									$150/m	$60,000			$60,000	
	Production casing liner system		$15,000										$15,000			$15,000	
	Casing running contractor - Premium Casing Services		$8,000	$8,000	$29,333							$8,000	$34,000	$8,000	$2,667	$104,000	
	Casing equipment		$10,000		$10,000								$10,000			$30,000	
	Sealant and brushes															$3,500	
Wellhead																	$825,888
	Wellhead Equipment - Wellhead Installaiton and Testing		$20,000											$10,000	$10,000	$10,000	
	Wellhead Equipment - "A" section	$200,000	$133,750													$0	
	Wellhead Equipment - "B" section	$300,000	$215,887.85													$215,888	
	Wellhead Equipment - "C" Section	$300,000	$300,000		$300,000								$300,000			$600,000	
Cementing																	$686,156
	Chemicals (surface, intermediate, production and P&A)				$91,443								$246,154			$401,156	
	Services (surface, intermediate, production and P&A)				$95,000								$100,000			$285,000	
Mud																	$460,583
	Chemicals								$43,564				$23,762			$230,167	
	Mud engineer: rig release to rig release (Assuming 2x Mud Men @ US$2k/d)		$3,000	$3,000	$11,000	$3,000	$7,500	$3,000	$21,250	$3,000	$16,250	$3,000	$12,750	$3,000	$1,000	$132,250	
	Centrifuge / Desander / Desilter		$2,000	$2,000	$7,333	$2,000	$5,000	$2,000	$14,167	$2,000	$10,833	$2,000	$8,500	$2,000	$667	$98,167	
Miscellaneous Equipment																	$249,071
	Tanks - Additional Water Storage Tanks		$500	$500	$1,833	$500	$1,250	$500	$3,542	$500	$2,708	$500	$2,125	$500	$167	$22,042	
	Office Supplies		$150	$150	$550	$150	$375	$150	$1,063	$150	$813	$150	$638	$150	$50	$6,613	
	Waste Treatment And Disposal - Deliver bin to wellsite, cost of empty the bins		$5,000	$5,000	$18,333	$5,000	$12,500	$5,000	$35,417	$5,000	$27,083	$5,000	$21,250	$5,000	$1,667	$220,417	
Drilling Tools & Equipment																	$265,451
	Drill Bits Purchased								$45,000							$120,385	
	Drilling Tools Rental - Survey Tools (e.g. Flodrift, Manless MWD)			$0		$0		$0		$0		$0		$0		$0	
	Drilling Tools Rental - Drilling Jars Rental		$400	$400	$1,467	$400	$1,000	$400	$2,833	$400	$2,167	$400	$1,700	$400	$133	$21,633	
	Drilling Tools Rental - Redress/Run charges for rentals (spread over well)		$2,000	$2,000	$7,333	$2,000	$5,000	$2,000	$14,167	$2,000	$10,833	$2,000	$8,500	$2,000	$667	$88,167	
	Drilling Tools Rental - Stabilisers		$800	$800	$2,933	$800	$2,000	$800	$5,667	$800	$4,333	$800	$3,400	$800	$267	$35,267	
	Drilling Tools Rental - Directional Drilling Services							$0								$0	
Class Charges																	$154,000
	Class charges written over five years															$154,000	
Field Professional Services																	$495,000
	Wellsite Geologist (Assuming 2x Geo's @ US$2k/d)		$4,000	$4,000	$14,667	$4,000	$10,000	$4,000	$28,333	$4,000	$21,667	$4,000	$17,000	$4,000	$1,333	$176,333	
	Safety Adviser (Assuming 2x SA's @ US$1.5k/d		$3,000	$0		$3,000	$7,500	$3,000	$21,250	$3,000	$16,250	$3,000	$12,750	$3,000	$1,000	$73,250	
	Medivac Cost per well															$25,000	
	Company Man (1 x day, 1 x night assuming each at US$2.5k/d)		$5,000	$5,000	$18,333	$5,000	$12,500	$5,000	$35,417	$5,000	$27,083	$5,000	$21,250	$5,000	$1,667	$220,417	
																$0	
	TOTALS			$374,982	$2,173,248	$369,838	$994,594	$369,838	$2,637,415	$369,838	$2,199,121	$377,988	**$2,318,227**	$387,838	**$462,613**	**$ 22,290,374**	**$22,290,374**
	Phase Totals		**Pre-Well Charges**	**Intermediate Casing**	**$2,173,248**	**LOT and Test**	**$994,594**	**Production Hole**	**$2,637,415**	**Evaluation**	**$2,199,121**	**Production Liner**	**$2,318,227**	**Rig Release**	**$462,613**	**Total Cost**	**$22,290,374**

5.3.2 Norwegian Sea

5.3.2.1 Conventional Well Design

DRILLING COST ESTIMATE

Well Name: Norwegian Sea

Drilling Rig : 0 Rig X

Permit : 6506

					Phase	Pre-spud		Surface Hole		Surface Casing		Nipple Up BOP's		Intermediate Hole 1		Intermediate Casing 1	
					Number of days	2.1 days		1.5 days		1.7 days		2.3 days		4.0 days		2.6 days	
					Depth	0 m		915 m		915 m		915 m		2220 m		2220 m	
Revision 0		Contractor	Unit Cost	Pre-Drill		Unit cost	Sub Total	Unit Cost	Sub Total	Unit Cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total
Staff Salaries																	
	Operating Company Personnel		$10,000			$10,000	$20,833	$10,000	$14,583	$10,000	$16,667	$10,000	$23,333	$10,000	$39,583	$10,000	$25,833
Overhead Allocation																	
	General Overhead Recovery ($3.2MM spread over well)		$75,073			$75,073	$156,403	$75,073	$109,482	$75,073	$125,122	$75,073	$175,171	$75,073	$297,165	$75,073	$193,939
Rig Costs																	
	Mob / Demob - Initial Mobilisation			$1,150,000		$0		$0		$0		$0		$0		$0	
	Mob / Demob - Final Demobilisation		$260,000														
	Rig Operating Costs		$145,000			$145,000		$145,000	$211,458	$145,000	$241,667	$145,000	$338,333	$145,000	$573,958	$145,000	$374,583
	Rig Operating Costs - Crew Change Flight (Helicopters)		$10,000			$10,000		$10,000		$10,000		$10,000		$10,000	$39,583	$10,000	$25,833
	Fuel and Lubricants		$50,000			$50,000	$104,167	$50,000	$72,917	$50,000	$83,333	$50,000	$116,667	$50,000	$197,917	$50,000	$129,167
	Marine Costs - General Spread Rate		$20,000			$20,000	$41,667	$20,000	$29,167	$20,000	$33,333	$20,000	$46,667	$20,000	$79,167	$20,000	$51,667
HSE and Auditing																	
	Site Survey and Inspections			$1,300,000													
Evaluation																	
	Mudlogging and Data Handling		$5,000	$20,000		$5,000	$10,417	$5,000	$7,292	$5,000	$8,333	$5,000	$11,667	$5,000	$19,792	$5,000	$12,917
	Wireline Logging - Open Hole		$250,000												$250,000		
	Wireline Logging - Cased Hole - CBL		$70,000														
Subsea Works																	
	Dynamic Positioning			$58,000													
Communications																	
	Communications - Phone Charges		$500			$500	$1,042	$500	$729	$500	$833	$500	$1,167	$500	$1,979	$500	$1,292
	Reporting Costs (US$260k spread over well)		$6,100			$6,100	$12,708	$6,100	$8,895	$6,100	$10,166	$6,100	$14,233	$6,100	$24,145	$6,100	$15,758
Transport																	
	Transport / Freight - Materials Transport and General Freight		$20,000	$100,000		$20,000	$41,667	$20,000	$29,167	$20,000	$33,333	$20,000	$46,667	$20,000	$79,167	$20,000	$51,667
	Water Source & Supply Haulage		$5,000			$5,000	$10,417	$5,000	$7,292	$5,000	$8,333	$5,000	$11,667	$5,000	$19,792	$5,000	$12,917
Casing and Accessories																	
	Surface Casing: 20" 113 lb/ft N-80 TSH-ER (Range III)		$400/m							$400/m	$366,000						
	Intermediate Casing : 13-3/8" 72 lb/ft P-110 VAM21 (Range III)		$300/m													$300/m	$666,000
	Intermediate Casing : 9-5/8" 53.5 lb/ft P-110 VAM21 (Range III)		$200/m														
	Production Casing : 7" 29 lb/ft L-80 VAMTOPHC (Range III)		$150/m														
	Production casing liner system		$15,000														
	Casing running contractor - Premium Casing Services		$8,000	$10,000						$8,000	$13,333					$8,000	$20,667
	Casing equipment		$10,000								$10,000						$10,000
	Sealant and brushes			$3,500													
Wellhead																	
	Wellhead Equipment - Wellhead Installaiton and Testing		$20,000														
	Wellhead Equipment - "A" section		$200,000										$200,000				
	Wellhead Equipment - "B" section		$300,000														$300,000
	Wellhead Equipment - "C" Section		$300,000														
Cementing																	
	Chemicals (surface, intermediate, production and P&A)										$45,000						$60,000
	Services (surface, intermediate, production and P&A)										$80,000						$90,000
Mud																	
	Chemicals								$85,000						$65,000		
	Mud engineer: rig release to rig release (Assuming 2x Mud Men @ US$2k/d)		$3,000			$3,000	$6,250	$3,000	$4,375	$3,000	$5,000	$3,000	$7,000	$3,000	$11,875	$3,000	$7,750
	Centrifuge / Desander / Desilter		$2,000	$10,000		$2,000	$4,167	$2,000	$2,917	$2,000	$3,333	$2,000	$4,667	$2,000	$7,917	$2,000	$5,167
Miscellaneous Equipment																	
	Tanks - Additional Water Storage Tanks		$500			$500	$1,042	$500	$729	$500	$833	$500	$1,167	$500	$1,979	$500	$1,292
	Office Supplies		$150			$150	$313	$150	$219	$150	$250	$150	$350	$150	$594	$150	$388
	Waste Treatment And Disposal - Deliver bin to wellsite, cost of empty the bins		$5,000			$5,000	$10,417	$5,000	$7,292	$5,000	$8,333	$5,000	$11,667	$5,000	$19,792	$5,000	$12,917
Drilling Tools & Equipment																	
	Drill Bits Purchased								$80,000						$60,000		
	Drilling Tools Rental - Survey Tools (e.g. Flodrift, Manless MWD)					$0		$0		$0		$0		$0		$0	
	Drilling Tools Rental - Drilling Jars Rental		$400	$4,000		$400	$833	$400	$583	$400	$667	$400	$933	$400	$1,583	$400	$1,033
	Drilling Tools Rental - Redress/Run charges for rentals (spread over well)		$2,000			$2,000	$4,167	$2,000	$2,917	$2,000	$3,333	$2,000	$4,667	$2,000	$7,917	$2,000	$5,167
	Drilling Tools Rental - Stabilisers		$800			$800	$1,667	$800	$1,167	$800	$1,333	$800	$1,867	$800	$3,167	$800	$2,067
	Drilling Tools Rental - Directional Drilling Services																
Class Charges																	
	Class charges written over five years			$154,000													
Field Professional Services																	
	Wellsite Geologist (Assuming 2x Geo's @ US$2k/d)		$4,000			$4,000	$8,333	$4,000	$5,833	$4,000	$6,667	$4,000	$9,333	$4,000	$15,833	$4,000	$10,333
	Safety Adviser (Assuming 2x SA's @ US$1.5k/d		$3,000			$3,000	$6,250	$3,000	$4,375	$3,000	$5,000	$3,000	$7,000	$0		$0	
	Medivac Cost per well			$25,000													
	Company Man (1 x day, 1 x night assuming each at US$2.5k/d)		$5,000			$5,000	$10,417	$5,000	$7,292	$5,000	$8,333	$5,000	$11,667	$5,000	$19,792	$5,000	$12,917
	TOTALS			$2,834,500		$372,523	$453,173	$372,523	$693,679	$380,923	$1,118,538	$372,523	$1,045,887	$369,523	$1,837,695	$377,823	$2,101,268
	Phase Totals		Pre-Well Charges	$2,834,500		Pre-spud	$453,173	Surface Hole	$693,679	Surface Casing	$1,118,538	Nipple Up BOP's	$1,045,887	Intermediate Hole 1	$1,837,695	Intermediate Casing 1	$2,101,268

DRILLING COST ESTIMATE

Well Name: Norwegian Sea

Drilling Rig : 0
Rig X

Permit : 6506

				LOT and Test		Intermediate Hole 2		Intermediate Casing 2		LOT and Test		Production Hole		Evaluation		Production Liner	
				1.7 days		6.9 days		2.9 days		2.5 days		4.6 days		5.4 days		4.3 days	
				2220 m		2906 m		2906 m		2906 m		3300 m		3300 m		3300 m	
Revision 0		Contractor	Unit Cost	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total
Staff Salaries																	
	Operating Company Personnel		$10,000	$10,000	$16,667	$10,000	$68,750	$10,000	$29,167	$10,000	$25,000	$10,000	$45,833	$10,000	$54,167	$10,000	$42,500
Overhead Allocation																	
	General Overhead Recovery ($3.2MM spread over well)		$75,073	$75,073	$125,122	$75,073	$516,129	$75,073	$218,964	$75,073	$187,683	$75,073	$344,086	$75,073	$406,647	$75,073	$319,062
Rig Costs																	
	Mob / Demob - Initial Mobilisation			$0		$0		$0		$0		$0		$0		$0	
	Mob / Demob - Final Demobilisation		$260,000														
	Rig Operating Costs		$145,000	$145,000	$241,667	$145,000	$996,875	$145,000	$422,917	$145,000	$362,500	$145,000	$664,583	$145,000	$785,417	$145,000	$616,250
	Rig Operating Costs - Crew Change Flight (Helicopters)		$10,000	$10,000	$16,667	$10,000	$68,750	$10,000	$29,167	$10,000	$25,000	$10,000		$10,000		$10,000	
	Fuel and Lubricants		$50,000	$50,000	$83,333	$50,000	$343,750	$50,000	$145,833	$50,000	$125,000	$50,000	$229,167	$50,000	$270,833	$50,000	$212,500
	Marine Costs - General Spread Rate		$20,000	$20,000	$33,333	$20,000	$137,500	$20,000	$58,333	$20,000	$50,000	$20,000	$91,667	$20,000	$108,333	$20,000	$85,000
HSE and Auditing																	
	Site Survey and Inspections																
Evaluation																	
	Mudlogging and Data Handling		$5,000	$5,000	$8,333	$5,000	$34,375	$5,000	$14,583	$5,000	$12,500	$5,000	$22,917	$5,000	$27,083	$5,000	$21,250
	Wireline Logging - Open Hole		$250,000				$250,000								$250,000		
	Wireline Logging - Cased Hole - CBL		$70,000								$70,000						
Subsea Works																	
	Dynamic Positioning																
Communications																	
	Communications - Phone Charges		$500	$500	$833	$500	$3,438	$500	$1,458	$500	$1,250	$500	$2,292	$500	$2,708	$500	$2,125
	Reporting Costs (US$260k spread over well)		$6,100	$6,100	$10,166	$6,100	$41,935	$6,100	$17,791	$6,100	$15,249	$6,100	$27,957	$6,100	$33,040	$6,100	$25,924
Transport																	
	Transport / Freight - Materials Transport and General Freight		$20,000	$20,000	$33,333	$20,000	$137,500	$20,000	$58,333	$20,000	$50,000	$20,000	$91,667	$20,000	$108,333	$20,000	$85,000
	Water Source & Supply Haulage		$5,000	$5,000	$8,333	$5,000	$34,375	$5,000	$14,583	$5,000	$12,500	$5,000	$22,917	$5,000	$27,083	$5,000	$21,250
Casing and Accessories																	
	Surface Casing: 20" 113 lb/ft N-80 TSH-ER (Range III)		$400/m														
	Intermediate Casing : 13-3/8" 72 lb/ft P-110 VAM21 (Range III)		$300/m														
	Intermediate Casing : 9-5/8" 53.5 lb/ft P-110 VAM21 (Range III)		$200/m					$200/m	$581,200								
	Production Casing : 7" 29 lb/ft L-80 VAMTOPHC (Range III)		$150/m													$150/m	$59,100
	Production casing liner system		$15,000														$15,000
	Casing running contractor - Premium Casing Services		$8,000					$8,000	$23,333							$8,000	$34,000
	Casing equipment		$10,000						$10,000								$10,000
	Sealant and brushes																
Wellhead																	
	Wellhead Equipment - Wellhead Installaiton and Testing		$20,000														
	Wellhead Equipment - "A" section		$200,000														
	Wellhead Equipment - "B" section		$300,000														
	Wellhead Equipment - "C" Section		$300,000						$300,000								$300,000
Cementing																	
	Chemicals (surface, intermediate, production and P&A)								$120,000								$320,000
	Services (surface, intermediate, production and P&A)								$95,000								$100,000
Mud																	
	Chemicals						$120,000						$55,000				$30,000
	Mud engineer: rig release to rig release (Assuming 2x Mud Men @ US$2k/d)		$3,000	$3,000	$5,000	$3,000	$20,625	$3,000	$8,750	$3,000	$7,500	$3,000	$13,750	$3,000	$16,250	$3,000	$12,750
	Centrifuge / Desander / Desilter		$2,000	$2,000	$3,333	$2,000	$13,750	$2,000	$5,833	$2,000	$5,000	$2,000	$9,167	$2,000	$10,833	$2,000	$8,500
Miscellaneous Equipment																	
	Tanks - Additional Water Storage Tanks		$500	$500	$833	$500	$3,438	$500	$1,458	$500	$1,250	$500	$2,292	$500	$2,708	$500	$2,125
	Office Supplies		$150	$150	$250	$150	$1,031	$150	$438	$150	$375	$150	$688	$150	$813	$150	$638
	Waste Treatment And Disposal - Deliver bin to wellsite, cost of empty the bins		$5,000	$5,000	$8,333	$5,000	$34,375	$5,000	$14,583	$5,000	$12,500	$5,000	$22,917	$5,000	$27,083	$5,000	$21,250
Drilling Tools & Equipment																	
	Drill Bits Purchased						$50,000						$45,000				
	Drilling Tools Rental - Survey Tools (e.g. Flodrift, Manless MWD)			$0		$0		$0		$0		$0		$0		$0	
	Drilling Tools Rental - Drilling Jars Rental		$400	$400	$667	$400	$2,750	$400	$1,167	$400	$1,000	$400	$1,833	$400	$2,167	$400	$1,700
	Drilling Tools Rental - Redress/Run charges for rentals (spread over well)		$2,000	$2,000	$3,333	$2,000	$13,750	$2,000	$5,833	$2,000	$5,000	$2,000	$9,167	$2,000	$10,833	$2,000	$8,500
	Drilling Tools Rental - Stabilisers		$800	$800	$1,333	$800	$5,500	$800	$2,333	$800	$2,000	$800	$3,667	$800	$4,333	$800	$3,400
	Drilling Tools Rental - Directional Drilling Services											$0					
Class Charges																	
	Class charges written over five years																
Field Professional Services																	
	Wellsite Geologist (Assuming 2x Geo's @ US$2k/d)		$4,000	$4,000	$6,667	$4,000	$27,500	$4,000	$11,667	$4,000	$10,000	$4,000	$18,333	$4,000	$21,667	$4,000	$17,000
	Safety Adviser (Assuming 2x SA's @ US$1.5k/d		$3,000	$3,000	$5,000	$0		$0		$3,000	$7,500	$3,000	$13,750	$3,000	$16,250	$3,000	$12,750
	Medivac Cost per well																
	Company Man (1 x day, 1 x night assuming each at US$2.5k/d)		$5,000	$5,000	$8,333	$5,000	$34,375	$5,000	$14,583	$5,000	$12,500	$5,000	$22,917	$5,000	$27,083	$5,000	$21,250
	TOTALS			$372,523	$620,872	$369,523	$2,960,471	$377,723	$2,207,309	$372,523	$1,001,308	$372,523	$1,761,564	$372,523	$2,213,666	$380,673	**$2,408,823**
	Phase Totals		**Pre-Well Charges**	**LOT and Test**	**$620,872**	**Intermediate Hole 2**	**$2,960,471**	**Intermediate Casing 2**	**$2,207,309**	**LOT and Test**	**$1,001,308**	**Production Hole**	**$1,761,564**	**Evaluation**	**$2,213,666**	**Production Liner**	**$2,408,823**

DRILLING COST ESTIMATE

Well Name: Norwegian Sea

Drilling Rig : 0
Rig X

Permit : 6506

				Rig Release			
				0.3 days			
				3300 m			
Revision 0		**Contractor**	**Unit Cost**	**Unit cost**	**Sub Total**	**Sub-total**	**Total**
Staff Salaries							**$426,250**
	Operating Company Personnel		$10,000	$10,000	$3,333	**$426,250**	
Overhead Allocation							**$3,200,000**
	General Overhead Recovery ($3.2MM spread over well)		$75,073	$75,073	$25,024	**$3,200,000**	
Rig Costs							**$10,477,292**
	Mob / Demob - Initial Mobilisation			$0		**$1,150,000**	
	Mob / Demob - Final Demobilisation		$260,000		$260,000	**$260,000**	
	Rig Operating Costs		$145,000	$145,000	$48,333	**$5,878,542**	
	Rig Operating Costs - Crew Change Flight (Helicopters)		$10,000	$10,000		**$205,000**	
	Fuel and Lubricants		$50,000	$50,000	$16,667	**$2,131,250**	
	Marine Costs - General Spread Rate		$20,000	$20,000	$6,667	**$852,500**	
HSE and Auditing							**$1,300,000**
	Site Survey and Inspections					**$1,300,000**	
Evaluation							**$1,123,125**
	Mudlogging and Data Handling		$5,000	$5,000	$1,667	**$233,125**	
	Wireline Logging - Open Hole		$250,000			**$750,000**	
	Wireline Logging - Cased Hole - CBL		$70,000		$70,000	**$140,000**	
Subsea Works							**$58,000**
	Dynamic Positioning					**$58,000**	
Communications							**$281,313**
	Communications - Phone Charges		$500	$500	$167	**$21,313**	
	Reporting Costs (US$260k spread over well)		$6,100	$6,100	$2,033	**$260,000**	
Transport							**$1,165,625**
	Transport / Freight - Materials Transport and General Freight		$20,000	$20,000	$6,667	**$952,500**	
	Water Source & Supply Haulage		$5,000	$5,000	$1,667	**$213,125**	
Casing and Accessories							**$1,834,800**
	Surface Casing: 20" 113 lb/ft N-80 TSH-ER (Range III)		$400/m			**$366,000**	
	Intermediate Casing : 13-3/8" 72 lb/ft P-110 VAM21 (Range III)		$300/m			**$666,000**	
	Intermediate Casing : 9-5/8" 53.5 lb/ft P-110 VAM21 (Range III)		$200/m			**$581,200**	
	Production Casing : 7" 29 lb/ft L-80 VAMTOPHC (Range III)		$150/m			**$59,100**	
	Production casing liner system		$15,000			**$15,000**	
	Casing running contractor - Premium Casing Services		$8,000	$8,000	$2,667	**$104,000**	
	Casing equipment		$10,000			**$40,000**	
	Sealant and brushes					**$3,500**	
Wellhead							**$1,110,000**
	Wellhead Equipment - Wellhead Installaiton and Testing		$20,000	$10,000	$10,000	**$10,000**	
	Wellhead Equipment - "A" section		$200,000			**$200,000**	
	Wellhead Equipment - "B" section		$300,000			**$300,000**	
	Wellhead Equipment - "C" Section		$300,000			**$600,000**	
Cementing							**$910,000**
	Chemicals (surface, intermediate, production and P&A)					**$545,000**	
	Services (surface, intermediate, production and P&A)					**$365,000**	
Mud							**$578,125**
	Chemicals					**$355,000**	
	Mud engineer: rig release to rig release (Assuming 2x Mud Men @ US$2k/d)		$3,000	$3,000	$1,000	**$127,875**	
	Centrifuge / Desander / Desilter		$2,000	$2,000	$667	**$95,250**	
Miscellaneous Equipment							**$240,831**
	Tanks - Additional Water Storage Tanks		$500	$500	$167	**$21,313**	
	Office Supplies		$150	$150	$50	**$6,394**	
	Waste Treatment And Disposal - Deliver bin to wellsite, cost of empty the bins		$5,000	$5,000	$1,667	**$213,125**	
Drilling Tools & Equipment							**$375,400**
	Drill Bits Purchased					**$235,000**	
	Drilling Tools Rental - Survey Tools (e.g. Flodrift, Manless MWD)			$0		**$0**	
	Drilling Tools Rental - Drilling Jars Rental		$400	$400	$133	**$21,050**	
	Drilling Tools Rental - Redress/Run charges for rentals (spread over well)		$2,000	$2,000	$667	**$85,250**	
	Drilling Tools Rental - Stabilisers		$800	$800	$267	**$34,100**	
	Drilling Tools Rental - Directional Drilling Services					**$0**	
Class Charges							**$154,000**
	Class charges written over five years					**$154,000**	
Field Professional Services							**$487,500**
	Wellsite Geologist (Assuming 2x Geo's @ US$2k/d)		$4,000	$4,000	$1,333	**$170,500**	
	Safety Adviser (Assuming 2x SA's @ US$1.5k/d		$3,000	$3,000	$1,000	**$78,875**	
	Medivac Cost per well					**$25,000**	
	Company Man (1 x day, 1 x night assuming each at US$2.5k/d)		$5,000	$5,000	$1,667	**$213,125**	
						$0	
	TOTALS			$390,523	**$463,508**	**$ 23,722,260**	**$23,722,260**
	Phase Totals		**Pre-Well Charges**	**Rig Release**	**$463,508**	**Total Cost**	**$23,722,260**

5.3.2.2 Slender Well Design

DRILLING COST ESTIMATE

Well Name: Norwegian Sea

Drilling Rig : 0 Rig X

Permit : 6506

					Phase	Pre-spud		Surface Hole		Surface Casing		LOT and Test		Production Hole		Evaluation	
					Number of days	2.1 days		4.8 days		2.6 days		2.9 days		9.6 days		5.4 days	
					Depth	0 m		1350 m		1350 m		1350 m		3300 m		3300 m	
Revision 0		Contractor	Unit Cost	Pre-Drill		Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total
Staff Salaries																	
	Operating Company Personnel		$10,000			$10,000	$20,833	$10,000	$47,917	$10,000	$25,833	$10,000	$29,167	$10,000	$95,833	$10,000	$54,167
Overhead Allocation																	
	General Overhead Recovery ($3.2MM spread over well)		$100,130			$100,130	$208,605	$100,130	$479,791	$100,130	$258,670	$100,130	$292,047	$100,130	$959,583	$100,130	$542,373
Rig Costs																	
	Mob / Demob - Initial Mobilisation			$1,150,000		$0		$0		$0		$0		$0		$0	
	Mob / Demob - Final Demobilisation		$260,000														
	Rig Operating Costs		$145,000			$145,000		$145,000	$694,792	$145,000	$374,583	$145,000	$422,917	$145,000	$1,389,583	$145,000	$785,417
	Rig Operating Costs - Crew Change Flight (Helicopters)		$10,000			$10,000		$10,000	$47,917	$10,000	$25,833	$10,000	$29,167	$10,000		$10,000	
	Fuel and Lubricants		$50,000			$50,000	$104,167	$50,000	$239,583	$50,000	$129,167	$50,000	$145,833	$50,000	$479,167	$50,000	$270,833
	Marine Costs - General Spread Rate		$20,000			$20,000	$41,667	$20,000	$95,833	$20,000	$51,667	$20,000	$58,333	$20,000	$191,667	$20,000	$108,333
HSE and Auditing																	
	Site Survey and Inspections			$1,300,000													
Evaluation																	
	Mudlogging and Data Handling		$5,000	$20,000		$5,000	$10,417	$5,000	$23,958	$5,000	$12,917	$5,000	$14,583	$5,000	$47,917	$5,000	$27,083
	Wireline Logging - Open Hole		$250,000						$250,000								$250,000
	Wireline Logging - Cased Hole - CBL		$70,000														
Subsea Works																	
	Dynamic Positioning			$58,000													
Communications																	
	Communications - Phone Charges		$500			$500	$1,042	$500	$2,396	$500	$1,292	$500	$1,458	$500	$4,792	$500	$2,708
	Reporting Costs (US$260k spread over well)		$8,136			$8,136	$16,949	$8,136	$38,983	$8,136	$21,017	$8,136	$23,729	$8,136	$77,966	$8,136	$44,068
Transport																	
	Transport / Freight - Materials Transport and General Freight		$20,000	$100,000		$20,000	$41,667	$20,000	$95,833	$20,000	$51,667	$20,000	$58,333	$20,000	$191,667	$20,000	$108,333
	Water Source & Supply Haulage		$5,000			$5,000	$10,417	$5,000	$23,958	$5,000	$12,917	$5,000	$14,583	$5,000	$47,917	$5,000	$27,083
Casing and Accessories																	
	Surface Casing: 9-5/8" 47 lb/ft P-110 BTC (Range III)	$400/m	$192.50							$193/m	$259,875						
	Intermediate Casing : \									$0/m							
	Intermediate Casing : \																
	Production Casing : 7" 32 lb/ft P-110 BTC (or premium if desired) (Range III)	$150/m	$150/m														
	Production casing liner system		$15,000														
	Casing running contractor - Premium Casing Services		$8,000	$10,000						$8,000	$20,667						
	Casing equipment		$10,000								$10,000						
	Sealant and brushes			$3,500													
Wellhead																	
	Wellhead Equipment - Wellhead Installaiton and Testing		$20,000														
	Wellhead Equipment - "A" section	$200,000	$96,250								$96,250						
	Wellhead Equipment - "B" section	$300,000	$300,000														
	Wellhead Equipment - "C" Section																
Cementing																	
	Chemicals (surface, intermediate, production and P&A)										$22,361						
	Services (surface, intermediate, production and P&A)										$90,000						
Mud																	
	Chemicals								$27,216								
	Mud engineer: rig release to rig release (Assuming 2x Mud Men @ US$2k/d)		$3,000			$3,000	$6,250	$3,000	$14,375	$3,000	$7,750	$3,000	$8,750	$3,000	$28,750	$3,000	$16,250
	Centrifuge / Desander / Desilter		$2,000	$10,000		$2,000	$4,167	$2,000	$9,583	$2,000	$5,167	$2,000	$5,833	$2,000	$19,167	$2,000	$10,833
Miscellaneous Equipment																	
	Tanks - Additional Water Storage Tanks		$500			$500	$1,042	$500	$2,396	$500	$1,292	$500	$1,458	$500	$4,792	$500	$2,708
	Office Supplies		$150			$150	$313	$150	$719	$150	$388	$150	$438	$150	$1,438	$150	$813
	Waste Treatment And Disposal - Deliver bin to wellsite, cost of empty the bins		$5,000			$5,000	$10,417	$5,000	$23,958	$5,000	$12,917	$5,000	$14,583	$5,000	$47,917	$5,000	$27,083
Drilling Tools & Equipment																	
	Drill Bits Purchased								$28,269						$45,000		
	Drilling Tools Rental - Survey Tools (e.g. Flodrift, Manless MWD)					$0		$0		$0		$0		$0		$0	
	Drilling Tools Rental - Drilling Jars Rental		$400	$4,000		$400	$833	$400	$1,917	$400	$1,033	$400	$1,167	$400	$3,833	$400	$2,167
	Drilling Tools Rental - Redress/Run charges for rentals (spread over well)		$2,000			$2,000	$4,167	$2,000	$9,583	$2,000	$5,167	$2,000	$5,833	$2,000	$19,167	$2,000	$10,833
	Drilling Tools Rental - Stabilisers		$800			$800	$1,667	$800	$3,833	$800	$2,067	$800	$2,333	$800	$7,667	$800	$4,333
	Drilling Tools Rental - Directional Drilling Services													$0			
Class Charges																	
	Class charges written over five years			$154,000													
Field Professional Services																	
	Wellsite Geologist (Assuming 2x Geo's @ US$2k/d)		$4,000			$4,000	$8,333	$4,000	$19,167	$4,000	$10,333	$4,000	$11,667	$4,000	$38,333	$4,000	$21,667
	Safety Adviser (Assuming 2x SA's @ US$1.5k/d		$3,000			$3,000	$6,250	$0		$0		$3,000	$8,750	$3,000	$28,750	$3,000	$16,250
	Medivac Cost per well			$25,000													
	Company Man (1 x day, 1 x night assuming each at US$2.5k/d)		$5,000			$5,000	$10,417	$5,000	$23,958	$5,000	$12,917	$5,000	$14,583	$5,000	$47,917	$5,000	$27,083
	TOTALS			**$2,834,500**		$399,616	**$509,617**	$396,616	$2,205,937	$404,808	$1,523,744	$399,616	$1,165,547	$399,616	$3,778,820	$399,616	$2,360,420
	Phase Totals		**Pre-Well Charges**	**$2,834,500**		**Pre-spud**	**$509,617**	**Surface Hole**	**$2,205,937**	**Surface Casing**	**$1,523,744**	**LOT and Test**	**$1,165,547**	**Production Hole**	**$3,778,820**	**Evaluation**	**$2,360,420**

DRILLING COST ESTIMATE

Well Name: Norwegian Sea

Drilling Rig : 0
Rig X

Permit : 6506

				Production Casing		Rig Release			
				4.3 days		0.3 days			
				3300 m		3300 m			
Revision 0		Contractor	Unit Cost	Unit cost	Sub Total	Unit cost	Sub Total	Sub-total	Total
Staff Salaries									$319,583
	Operating Company Personnel		$10,000	$10,000	$42,500	$10,000	$3,333	$319,583	
Overhead Allocation									$3,200,000
	General Overhead Recovery ($3.2MM spread over well)		$100,130	$100,130	$425,554	$100,130	$33,377	$3,200,000	
Rig Costs									$8,081,875
	Mob / Demob - Initial Mobilisation			$0		$0		$1,150,000	
	Mob / Demob - Final Demobilisation		$260,000				$260,000	$260,000	
	Rig Operating Costs		$145,000	$145,000	$616,250	$145,000	$48,333	$4,331,875	
	Rig Operating Costs - Crew Change Flight (Helicopters)		$10,000	$10,000		$10,000		$102,917	
	Fuel and Lubricants		$50,000	$50,000	$212,500	$50,000	$16,667	$1,597,917	
	Marine Costs - General Spread Rate		$20,000	$20,000	$85,000	$20,000	$6,667	$639,167	
HSE and Auditing									$1,300,000
	Site Survey and Inspections							$1,300,000	
Evaluation									$749,792
	Mudlogging and Data Handling		$5,000	$5,000	$21,250	$5,000	$1,667	$179,792	
	Wireline Logging - Open Hole		$250,000					$500,000	
	Wireline Logging - Cased Hole - CBL		$70,000				$70,000	$70,000	
Subsea Works									$58,000
	Dynamic Positioning							$58,000	
Communications									$275,979
	Communications - Phone Charges		$500	$500	$2,125	$500	$167	$15,979	
	Reporting Costs (US$260k spread over well)		$8,136	$8,136	$34,576	$8,136	$2,712	$260,000	
Transport									$898,958
	Transport / Freight - Materials Transport and General Freight		$20,000	$20,000	$85,000	$20,000	$6,667	$739,167	
	Water Source & Supply Haulage		$5,000	$5,000	$21,250	$5,000	$1,667	$159,792	
Casing and Accessories									$658,208
	Surface Casing: 9-5/8" 47 lb/ft P-110 BTC (Range III)	$400/m	$192.50					$259,875	
	Intermediate Casing : \							$0	
	Intermediate Casing : \							$0	
	Production Casing : 7" 32 lb/ft P-110 BTC (or premium if desired) (Range III)	$150/m	$150/m	$150/m	$292,500			$292,500	
	Production casing liner system		$15,000		$15,000			$15,000	
	Casing running contractor - Premium Casing Services		$8,000	$8,000	$34,000	$8,000	$2,667	$67,333	
	Casing equipment		$10,000		$10,000			$20,000	
	Sealant and brushes							$3,500	
Wellhead									$406,250
	Wellhead Equipment - Wellhead Installaiton and Testing		$20,000			$10,000	$10,000	$10,000	
	Wellhead Equipment - "A" section	$200,000	$96,250					$96,250	
	Wellhead Equipment - "B" section	$300,000	$300,000				$300,000	$300,000	
	Wellhead Equipment - "C" Section				$0			$0	
Cementing									$532,361
	Chemicals (surface, intermediate, production and P&A)				$320,000			$342,361	
	Services (surface, intermediate, production and P&A)				$100,000			$190,000	
Mud									$347,008
	Chemicals				$120,000		$30,000	$177,216	
	Mud engineer: rig release to rig release (Assuming 2x Mud Men @ US$2k/d)		$3,000	$3,000	$12,750	$3,000	$1,000	$95,875	
	Centrifuge / Desander / Desilter		$2,000	$2,000	$8,500	$2,000	$667	$73,917	
Miscellaneous Equipment									$180,565
	Tanks - Additional Water Storage Tanks		$500	$500	$2,125	$500	$167	$15,979	
	Office Supplies		$150	$150	$638	$150	$50	$4,794	
	Waste Treatment And Disposal - Deliver bin to wellsite, cost of empty the bins		$5,000	$5,000	$21,250	$5,000	$1,667	$159,792	
Drilling Tools & Equipment									$179,536
	Drill Bits Purchased							$73,269	
	Drilling Tools Rental - Survey Tools (e.g. Flodrift, Manless MWD)			$0		$0		$0	
	Drilling Tools Rental - Drilling Jars Rental		$400	$400	$1,700	$400	$133	$16,783	
	Drilling Tools Rental - Redress/Run charges for rentals (spread over well)		$2,000	$2,000	$8,500	$2,000	$667	$63,917	
	Drilling Tools Rental - Stabilisers		$800	$800	$3,400	$800	$267	$25,567	
	Drilling Tools Rental - Directional Drilling Services							$0	
Class Charges									$154,000
	Class charges written over five years							$154,000	
Field Professional Services									$386,375
	Wellsite Geologist (Assuming 2x Geo's @ US$2k/d)		$4,000	$4,000	$17,000	$4,000	$1,333	$127,833	
	Safety Adviser (Assuming 2x SA's @ US$1.5k/d		$3,000	$3,000	$12,750	$3,000	$1,000	$73,750	
	Medivac Cost per well							$25,000	
	Company Man (1 x day, 1 x night assuming each at US$2.5k/d)		$5,000	$5,000	$21,250	$5,000	$1,667	$159,792	
								$0	
	TOTALS			$407,766	$2,547,368	$417,616	$802,539	$ 17,728,490	$17,728,490
	Phase Totals		Pre-Well Charges	Production Casing	$2,547,368	Rig Release	$802,539	Total Cost	$17,728,490

5.3.3 North Sea

5.3.3.1 Conventional Well Design

DRILLING COST ESTIMATE

Well Name: North Sea

Drilling Rig : 0
Rig X

Permit : 2

Revision 0	Contractor	Unit Cost	Pre-Drill	Phase	Pre-spud		Surface Hole		Surface Casing		Nipple Up BOP's		Intermediate Hole 1		Intermediate Casing 1	
				Number of days	2.1 days		0.8 days		1.0 days		1.3 days		2.4 days		1.8 days	
				Depth	0 m		573 m		573 m		573 m		1528 m		1528 m	
					Unit cost	Sub Total	Unit Cost	Sub Total	Unit Cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total
Staff Salaries																
Operating Company Personnel		$10,000			$10,000	$20,833	$10,000	$8,333	$10,000	$10,417	$10,000	$12,500	$10,000	$24,167	$10,000	$18,333
Overhead Allocation																
General Overhead Recovery ($3.2MM spread over well)		$97,586			$97,586	$203,304	$97,586	$81,321	$97,586	$101,652	$97,586	$121,982	$97,586	$235,832	$97,586	$178,907
Rig Costs																
Mob / Demob - Initial Mobilisation			$1,150,000		$0		$0		$0		$0		$0		$0	
Mob / Demob - Final Demobilisation		$260,000														
Rig Operating Costs		$145,000			$145,000		$145,000	$120,833	$145,000	$151,042	$145,000	$181,250	$145,000	$350,417	$145,000	$265,833
Rig Operating Costs - Crew Change Flight (Helicopters)		$10,000			$10,000		$10,000		$10,000		$10,000		$10,000	$24,167	$10,000	$18,333
Fuel and Lubricants		$50,000			$50,000	$104,167	$50,000	$41,667	$50,000	$52,083	$50,000	$62,500	$50,000	$120,833	$50,000	$91,667
Marine Costs - General Spread Rate		$20,000			$20,000	$41,667	$20,000	$16,667	$20,000	$20,833	$20,000	$25,000	$20,000	$48,333	$20,000	$36,667
HSE and Auditing																
Site Survey and Inspections			$1,300,000													
Evaluation																
Mudlogging and Data Handling		$5,000	$20,000		$5,000	$10,417	$5,000	$4,167	$5,000	$5,208	$5,000	$6,250	$5,000	$12,083	$5,000	$9,167
Wireline Logging - Open Hole		$250,000												$250,000		
Wireline Logging - Cased Hole - CBL		$70,000														
Subsea Works																
Dynamic Positioning			$58,000													
Communications																
Communications - Phone Charges		$500			$500	$1,042	$500	$417	$500	$521	$500	$625	$500	$1,208	$500	$917
Reporting Costs (US$260k spread over well)		$7,929			$7,929	$16,518	$7,929	$6,607	$7,929	$8,259	$7,929	$9,911	$7,929	$19,161	$7,929	$14,536
Transport																
Transport / Freight - Materials Transport and General Freight		$20,000	$100,000		$20,000	$41,667	$20,000	$16,667	$20,000	$20,833	$20,000	$25,000	$20,000	$48,333	$20,000	$36,667
Water Source & Supply Haulage		$5,000			$5,000	$10,417	$5,000	$4,167	$5,000	$5,208	$5,000	$6,250	$5,000	$12,083	$5,000	$9,167
Casing and Accessories																
Surface Casing: 20" 113 lb/ft N-80 TSH-ER (Range III)		$400/m							$400/m	$229,200						
Intermediate Casing : 13-3/8" 72 lb/ft P-110 VAM21 (Range III)		$300/m													$300/m	$458,400
Intermediate Casing : 9-5/8" 53.5 lb/ft P-110 VAM21 (Range III)		$200/m														
Production Casing : 7" 29 lb/ft L-80 VAMTOPHC (Range III)		$150/m														
Production casing liner system		$15,000														
Casing running contractor - Premium Casing Services		$8,000	$10,000						$8,000	$8,333					$8,000	$14,667
Casing equipment		$10,000								$10,000						$10,000
Sealant and brushes			$3,500													
Wellhead																
Wellhead Equipment - Wellhead Installaiton and Testing		$20,000														
Wellhead Equipment - "A" section		$200,000										$200,000				
Wellhead Equipment - "B" section		$300,000														$300,000
Wellhead Equipment - "C" Section		$300,000														
Cementing																
Chemicals (surface, intermediate, production and P&A)										$45,000						$60,000
Services (surface, intermediate, production and P&A)										$80,000						$90,000
Mud																
Chemicals								$85,000						$65,000		
Mud engineer: rig release to rig release (Assuming 2x Mud Men @ US$2k/d)		$3,000			$3,000	$6,250	$3,000	$2,500	$3,000	$3,125	$3,000	$3,750	$3,000	$7,250	$3,000	$5,500
Centrifuge / Desander / Desilter		$2,000	$10,000		$2,000	$4,167	$2,000	$1,667	$2,000	$2,083	$2,000	$2,500	$2,000	$4,833	$2,000	$3,667
Miscellaneous Equipment																
Tanks - Additional Water Storage Tanks		$500			$500	$1,042	$500	$417	$500	$521	$500	$625	$500	$1,208	$500	$917
Office Supplies		$150			$150	$313	$150	$125	$150	$156	$150	$188	$150	$363	$150	$275
Waste Treatment And Disposal - Deliver bin to wellsite, cost of empty the bins		$5,000			$5,000	$10,417	$5,000	$4,167	$5,000	$5,208	$5,000	$6,250	$5,000	$12,083	$5,000	$9,167
Drilling Tools & Equipment																
Drill Bits Purchased								$80,000						$60,000		
Drilling Tools Rental - Survey Tools (e.g. Flodrift, Manless MWD)					$0		$0		$0		$0		$0		$0	
Drilling Tools Rental - Drilling Jars Rental		$400	$4,000		$400	$833	$400	$333	$400	$417	$400	$500	$400	$967	$400	$733
Drilling Tools Rental - Redress/Run charges for rentals (spread over well)		$2,000			$2,000	$4,167	$2,000	$1,667	$2,000	$2,083	$2,000	$2,500	$2,000	$4,833	$2,000	$3,667
Drilling Tools Rental - Stabilisers		$800			$800	$1,667	$800	$667	$800	$833	$800	$1,000	$800	$1,933	$800	$1,467
Drilling Tools Rental - Directional Drilling Services																
Class Charges																
Class charges written over five years			$154,000													
Field Professional Services																
Wellsite Geologist (Assuming 2x Geo's @ US$2k/d)		$4,000			$4,000	$8,333	$4,000	$3,333	$4,000	$4,167	$4,000	$5,000	$4,000	$9,667	$4,000	$7,333
Safety Adviser (Assuming 2x SA's @ US$1.5k/d		$3,000			$3,000	$6,250	$3,000	$2,500	$3,000	$3,125	$3,000	$3,750	$0		$0	
Medivac Cost per well			$25,000													
Company Man (1 x day, 1 x night assuming each at US$2.5k/d)		$5,000			$5,000	$10,417	$5,000	$4,167	$5,000	$5,208	$5,000	$6,250	$5,000	$12,083	$5,000	$9,167
TOTALS			**$2,834,500**		$396,865	**$503,885**	$396,865	**$487,387**	$405,265	**$775,517**	$396,865	**$683,581**	$393,865	$1,326,839	$402,165	$1,655,152
Phase Totals		**Pre-Well Charges**	**$2,834,500**		**Pre-spud**	**$503,885**	**Surface Hole**	**$487,387**	**Surface Casing**	**$775,517**	**Nipple Up BOP's**	**$683,581**	**Intermediate Hole 1**	**$1,326,839**	**Intermediate Casing 1**	**$1,655,152**

DRILLING COST ESTIMATE

Well Name: North Sea

Drilling Rig : 0 Rig X

Permit : 2

				LOT and Test		Intermediate Hole 2		Intermediate Casing 2		LOT and Test		Production Hole		Evaluation		Production Liner	
				2.1 days		4.2 days		2.1 days		1.9 days		3.1 days		5.4 days		4.3 days	
				1528 m		2691 m		2691 m		2691 m		3173 m		3173 m		3173 m	
Revision 0		Contractor	Unit Cost	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total
Staff Salaries																	
	Operating Company Personnel		$10,000	$10,000	$20,833	$10,000	$41,667	$10,000	$20,833	$10,000	$18,750	$10,000	$31,250	$10,000	$54,167	$10,000	$42,500
Overhead Allocation																	
	General Overhead Recovery ($3.2MM spread over well)		$97,586	$97,586	$203,304	$97,586	$406,607	$97,586	$203,304	$97,586	$182,973	$97,586	$304,956	$97,586	$528,590	$97,586	$414,740
Rig Costs																	
	Mob / Demob - Initial Mobilisation			$0		$0		$0		$0		$0		$0		$0	
	Mob / Demob - Final Demobilisation		$260,000														
	Rig Operating Costs		$145,000	$145,000	$302,083	$145,000	$604,167	$145,000	$302,083	$145,000	$271,875	$145,000	$453,125	$145,000	$785,417	$145,000	$616,250
	Rig Operating Costs - Crew Change Flight (Helicopters)		$10,000	$10,000	$20,833	$10,000	$41,667	$10,000	$20,833	$10,000	$18,750	$10,000		$10,000		$10,000	
	Fuel and Lubricants		$50,000	$50,000	$104,167	$50,000	$208,333	$50,000	$104,167	$50,000	$93,750	$50,000	$156,250	$50,000	$270,833	$50,000	$212,500
	Marine Costs - General Spread Rate		$20,000	$20,000	$41,667	$20,000	$83,333	$20,000	$41,667	$20,000	$37,500	$20,000	$62,500	$20,000	$108,333	$20,000	$85,000
HSE and Auditing																	
	Site Survey and Inspections																
Evaluation																	
	Mudlogging and Data Handling		$5,000	$5,000	$10,417	$5,000	$20,833	$5,000	$10,417	$5,000	$9,375	$5,000	$15,625	$5,000	$27,083	$5,000	$21,250
	Wireline Logging - Open Hole		$250,000				$250,000								$250,000		
	Wireline Logging - Cased Hole - CBL		$70,000								$70,000						
Subsea Works																	
	Dynamic Positioning																
Communications																	
	Communications - Phone Charges		$500	$500	$1,042	$500	$2,083	$500	$1,042	$500	$938	$500	$1,563	$500	$2,708	$500	$2,125
	Reporting Costs (US$260k spread over well)		$7,929	$7,929	$16,518	$7,929	$33,037	$7,929	$16,518	$7,929	$14,867	$7,929	$24,778	$7,929	$42,948	$7,929	$33,698
Transport																	
	Transport / Freight - Materials Transport and General Freight		$20,000	$20,000	$41,667	$20,000	$83,333	$20,000	$41,667	$20,000	$37,500	$20,000	$62,500	$20,000	$108,333	$20,000	$85,000
	Water Source & Supply Haulage		$5,000	$5,000	$10,417	$5,000	$20,833	$5,000	$10,417	$5,000	$9,375	$5,000	$15,625	$5,000	$27,083	$5,000	$21,250
Casing and Accessories																	
	Surface Casing: 20" 113 lb/ft N-80 TSH-ER (Range III)		$400/m														
	Intermediate Casing : 13-3/8" 72 lb/ft P-110 VAM21 (Range III)		$300/m														
	Intermediate Casing : 9-5/8" 53.5 lb/ft P-110 VAM21 (Range III)		$200/m					$200/m	$538,200								
	Production Casing : 7" 29 lb/ft L-80 VAMTOPHC (Range III)		$150/m													$150/m	$72,300
	Production casing liner system		$15,000														$15,000
	Casing running contractor - Premium Casing Services		$8,000					$8,000	$16,667							$8,000	$34,000
	Casing equipment		$10,000						$10,000								$10,000
	Sealant and brushes																
Wellhead																	
	Wellhead Equipment - Wellhead Installaiton and Testing		$20,000														
	Wellhead Equipment - "A" section		$200,000														
	Wellhead Equipment - "B" section		$300,000														
	Wellhead Equipment - "C" Section		$300,000						$300,000								$300,000
Cementing																	
	Chemicals (surface, intermediate, production and P&A)								$120,000								$320,000
	Services (surface, intermediate, production and P&A)								$95,000								$100,000
Mud																	
	Chemicals						$120,000						$55,000				$30,000
	Mud engineer: rig release to rig release (Assuming 2x Mud Men @ US$2k/d)		$3,000	$3,000	$6,250	$3,000	$12,500	$3,000	$6,250	$3,000	$5,625	$3,000	$9,375	$3,000	$16,250	$3,000	$12,750
	Centrifuge / Desander / Desilter		$2,000	$2,000	$4,167	$2,000	$8,333	$2,000	$4,167	$2,000	$3,750	$2,000	$6,250	$2,000	$10,833	$2,000	$8,500
Miscellaneous Equipment																	
	Tanks - Additional Water Storage Tanks		$500	$500	$1,042	$500	$2,083	$500	$1,042	$500	$938	$500	$1,563	$500	$2,708	$500	$2,125
	Office Supplies		$150	$150	$313	$150	$625	$150	$313	$150	$281	$150	$469	$150	$813	$150	$638
	Waste Treatment And Disposal - Deliver bin to wellsite, cost of empty the bins		$5,000	$5,000	$10,417	$5,000	$20,833	$5,000	$10,417	$5,000	$9,375	$5,000	$15,625	$5,000	$27,083	$5,000	$21,250
Drilling Tools & Equipment																	
	Drill Bits Purchased						$50,000						$45,000				
	Drilling Tools Rental - Survey Tools (e.g. Flodrift, Manless MWD)			$0		$0		$0		$0		$0		$0		$0	
	Drilling Tools Rental - Drilling Jars Rental		$400	$400	$833	$400	$1,667	$400	$833	$400	$750	$400	$1,250	$400	$2,167	$400	$1,700
	Drilling Tools Rental - Redress/Run charges for rentals (spread over well)		$2,000	$2,000	$4,167	$2,000	$8,333	$2,000	$4,167	$2,000	$3,750	$2,000	$6,250	$2,000	$10,833	$2,000	$8,500
	Drilling Tools Rental - Stabilisers		$800	$800	$1,667	$800	$3,333	$800	$1,667	$800	$1,500	$800	$2,500	$800	$4,333	$800	$3,400
	Drilling Tools Rental - Directional Drilling Services											$0					
Class Charges																	
	Class charges written over five years																
Field Professional Services																	
	Wellsite Geologist (Assuming 2x Geo's @ US$2k/d)		$4,000	$4,000	$8,333	$4,000	$16,667	$4,000	$8,333	$4,000	$7,500	$4,000	$12,500	$4,000	$21,667	$4,000	$17,000
	Safety Adviser (Assuming 2x SA's @ US$1.5k/d		$3,000	$3,000	$6,250	$0		$0		$3,000	$5,625	$3,000	$9,375	$3,000	$16,250	$3,000	$12,750
	Medivac Cost per well																
	Company Man (1 x day, 1 x night assuming each at US$2.5k/d)		$5,000	$5,000	$10,417	$5,000	$20,833	$5,000	$10,417	$5,000	$9,375	$5,000	$15,625	$5,000	$27,083	$5,000	$21,250
	TOTALS			$396,865	$826,801	$393,865	$2,061,103	$402,065	$1,900,418	$396,865	$814,121	$396,865	$1,308,952	$396,865	$2,345,517	$405,015	**$2,525,475**
	Phase Totals		**Pre-Well Charges**	**LOT and Test**	**$826,801**	**Intermediate Hole 2**	**$2,061,103**	**Intermediate Casing 2**	**$1,900,418**	**LOT and Test**	**$814,121**	**Production Hole**	**$1,308,952**	**Evaluation**	**$2,345,517**	**Production Liner**	**$2,525,475**

DRILLING COST ESTIMATE

Well Name: North Sea

Drilling Rig : 0
Rig X

Permit : 2

				Rig Release			
				0.3 days			
				3173 m			
Revision 0		Contractor	Unit Cost	Unit cost	Sub Total	Sub-total	Total
Staff Salaries							$327,917
	Operating Company Personnel		$10,000	$10,000	$3,333	$327,917	
Overhead Allocation							$3,200,000
	General Overhead Recovery ($3.2MM spread over well)		$97,586	$97,586	$32,529	$3,200,000	
Rig Costs							$8,302,708
	Mob / Demob - Initial Mobilisation			$0		$1,150,000	
	Mob / Demob - Final Demobilisation		$260,000		$260,000	$260,000	
	Rig Operating Costs		$145,000	$145,000	$48,333	$4,452,708	
	Rig Operating Costs - Crew Change Flight (Helicopters)		$10,000	$10,000		$144,583	
	Fuel and Lubricants		$50,000	$50,000	$16,667	$1,639,583	
	Marine Costs - General Spread Rate		$20,000	$20,000	$6,667	$655,833	
HSE and Auditing							$1,300,000
	Site Survey and Inspections					$1,300,000	
Evaluation							$1,073,958
	Mudlogging and Data Handling		$5,000	$5,000	$1,667	$183,958	
	Wireline Logging - Open Hole		$250,000			$750,000	
	Wireline Logging - Cased Hole - CBL		$70,000		$70,000	$140,000	
Subsea Works							$58,000
	Dynamic Positioning					$58,000	
Communications							$276,396
	Communications - Phone Charges		$500	$500	$167	$16,396	
	Reporting Costs (US$260k spread over well)		$7,929	$7,929	$2,643	$260,000	
Transport							$919,792
	Transport / Freight - Materials Transport and General Freight		$20,000	$20,000	$6,667	$755,833	
	Water Source & Supply Haulage		$5,000	$5,000	$1,667	$163,958	
Casing and Accessories							$1,442,933
	Surface Casing: 20" 113 lb/ft N-80 TSH-ER (Range III)		$400/m			$229,200	
	Intermediate Casing : 13-3/8" 72 lb/ft P-110 VAM21 (Range III)		$300/m			$458,400	
	Intermediate Casing : 9-5/8" 53.5 lb/ft P-110 VAM21 (Range III)		$200/m			$538,200	
	Production Casing : 7" 29 lb/ft L-80 VAMTOPHC (Range III)		$150/m			$72,300	
	Production casing liner system		$15,000			$15,000	
	Casing running contractor - Premium Casing Services		$8,000	$8,000	$2,667	$86,333	
	Casing equipment		$10,000			$40,000	
	Sealant and brushes					$3,500	
Wellhead							$1,110,000
	Wellhead Equipment - Wellhead Installaiton and Testing		$20,000	$10,000	$10,000	$10,000	
	Wellhead Equipment - "A" section		$200,000			$200,000	
	Wellhead Equipment - "B" section		$300,000			$300,000	
	Wellhead Equipment - "C" Section		$300,000			$600,000	
Cementing							$910,000
	Chemicals (surface, intermediate, production and P&A)					$545,000	
	Services (surface, intermediate, production and P&A)					$365,000	
Mud							$528,958
	Chemicals					$355,000	
	Mud engineer: rig release to rig release (Assuming 2x Mud Men @ US$2k/d)		$3,000	$3,000	$1,000	$98,375	
	Centrifuge / Desander / Desilter		$2,000	$2,000	$667	$75,583	
Miscellaneous Equipment							$185,273
	Tanks - Additional Water Storage Tanks		$500	$500	$167	$16,396	
	Office Supplies		$150	$150	$50	$4,919	
	Waste Treatment And Disposal - Deliver bin to wellsite, cost of empty the bins		$5,000	$5,000	$1,667	$163,958	
Drilling Tools & Equipment							$343,933
	Drill Bits Purchased					$235,000	
	Drilling Tools Rental - Survey Tools (e.g. Flodrift, Manless MWD)			$0		$0	
	Drilling Tools Rental - Drilling Jars Rental		$400	$400	$133	$17,117	
	Drilling Tools Rental - Redress/Run charges for rentals (spread over well)		$2,000	$2,000	$667	$65,583	
	Drilling Tools Rental - Stabilisers		$800	$800	$267	$26,233	
	Drilling Tools Rental - Directional Drilling Services					$0	
Class Charges							$154,000
	Class charges written over five years					$154,000	
Field Professional Services							$387,000
	Wellsite Geologist (Assuming 2x Geo's @ US$2k/d)		$4,000	$4,000	$1,333	$131,167	
	Safety Adviser (Assuming 2x SA's @ US$1.5k/d		$3,000	$3,000	$1,000	$66,875	
	Medivac Cost per well					$25,000	
	Company Man (1 x day, 1 x night assuming each at US$2.5k/d)		$5,000	$5,000	$1,667	$163,958	
						$0	
	TOTALS			$414,865	**$471,622**	**$ 20,520,869**	**$20,520,869**
	Phase Totals		**Pre-Well Charges**	**Rig Release**	**$471,622**	**Total Cost**	**$20,520,869**

5.3.3.2 Slender Well Design

DRILLING COST ESTIMATE

Well Name: North Sea

Drilling Rig : 0
Rig X

Permit : 2

					Phase	Pre-spud		Surface Hole		Surface Casing		Nipple Up BOP's		Intermediate Hole 1		Intermediate Casing 1	
					Number of days	2.1 days		1.7 days		1.0 days		1.3 days		6.3 days		1.8 days	
					Depth	0 m		700 m		700 m		700 m		2550 m		2550 m	
Revision 0		Contractor	Unit Cost	Pre-Drill		Unit cost	Sub Total	Unit Cost	Sub Total	Unit Cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total
Staff Salaries																	
	Operating Company Personnel		$10,000			$10,000	$20,833	$10,000	$16,667	$10,000	$10,417	$10,000	$12,500	$10,000	$62,500	$10,000	$18,333
Overhead Allocation																	
	General Overhead Recovery ($3.2MM spread over well)		$109,091			$109,091	$227,273	$109,091	$181,818	$109,091	$113,636	$109,091	$136,364	$109,091	$681,818	$109,091	$200,000
Rig Costs																	
	Mob / Demob - Initial Mobilisation			$1,150,000		$0		$0		$0		$0		$0		$0	
	Mob / Demob - Final Demobilisation		$260,000														
	Rig Operating Costs		$145,000			$145,000		$145,000	$241,667	$145,000	$151,042	$145,000	$181,250	$145,000	$906,250	$145,000	$265,833
	Rig Operating Costs - Crew Change Flight (Helicopters)		$10,000			$10,000		$10,000		$10,000		$10,000		$10,000	$62,500	$10,000	$18,333
	Fuel and Lubricants		$50,000			$50,000	$104,167	$50,000	$83,333	$50,000	$52,083	$50,000	$62,500	$50,000	$312,500	$50,000	$91,667
	Marine Costs - General Spread Rate		$20,000			$20,000	$41,667	$20,000	$33,333	$20,000	$20,833	$20,000	$25,000	$20,000	$125,000	$20,000	$36,667
HSE and Auditing																	
	Site Survey and Inspections			$1,300,000													
Evaluation																	
	Mudlogging and Data Handling		$5,000	$20,000		$5,000	$10,417	$5,000	$8,333	$5,000	$5,208	$5,000	$6,250	$5,000	$31,250	$5,000	$9,167
	Wireline Logging - Open Hole		$250,000												$250,000		
	Wireline Logging - Cased Hole - CBL		$70,000														
Subsea Works																	
	Dynamic Positioning			$58,000													
Communications																	
	Communications - Phone Charges		$500			$500	$1,042	$500	$833	$500	$521	$500	$625	$500	$3,125	$500	$917
	Reporting Costs (US$260k spread over well)		$8,864			$8,864	$18,466	$8,864	$14,773	$8,864	$9,233	$8,864	$11,080	$8,864	$55,398	$8,864	$16,250
Transport																	
	Transport / Freight - Materials Transport and General Freight		$20,000	$100,000		$20,000	$41,667	$20,000	$33,333	$20,000	$20,833	$20,000	$25,000	$20,000	$125,000	$20,000	$36,667
	Water Source & Supply Haulage		$5,000			$5,000	$10,417	$5,000	$8,333	$5,000	$5,208	$5,000	$6,250	$5,000	$31,250	$5,000	$9,167
Casing and Accessories																	
	Surface Casing: 11-3/4" 5 lb/ft J-55 BTC (Range III)	$400/m	$235/m							$235/m	$164,500						
	Intermediate Casing : 9-5/8" 53.5 lb/ft C-90 BTC (or premium if desired) (Range III)	$300/m	$215.89													$216/m	$550,514
	Production Casing : 7" 32 lb/ft P-110 BTC (or premium if desired) (Range III)	$150/m	$150/m														
	Production casing liner system		$15,000														
	Casing running contractor - Premium Casing Services		$8,000	$10,000						$8,000	$8,333					$8,000	$14,667
	Casing equipment		$10,000								$10,000						$10,000
	Sealant and brushes			$3,500													
Wellhead																	
	Wellhead Equipment - Wellhead Installation and Testing		$20,000														
	Wellhead Equipment - "A" section		$117,500										$117,500				
	Wellhead Equipment - "B" section		$215,888														$215,888
	Wellhead Equipment - "C" Section		$300,000														
Cementing																	
	Chemicals (surface, intermediate, production and P&A)										$9,238						$65,257
	Services (surface, intermediate, production and P&A)										$80,000						$90,000
Mud																	
	Chemicals								$29,946								
	Mud engineer: rig release to rig release (Assuming 2x Mud Men @ US$2k/d)		$3,000			$3,000	$6,250	$3,000	$5,000	$3,000	$3,125	$3,000	$3,750	$3,000	$18,750	$3,000	$5,500
	Centrifuge / Desander / Desilter		$2,000	$10,000		$2,000	$4,167	$2,000	$3,333	$2,000	$2,083	$2,000	$2,500	$2,000	$12,500	$2,000	$3,667
Miscellaneous Equipment																	
	Tanks - Additional Water Storage Tanks		$500			$500	$1,042	$500	$833	$500	$521	$500	$625	$500	$3,125	$500	$917
	Office Supplies		$150			$150	$313	$150	$250	$150	$156	$150	$188	$150	$938	$150	$275
	Waste Treatment And Disposal - Deliver bin to wellsite, cost of empty the bins		$5,000			$5,000	$10,417	$5,000	$8,333	$5,000	$5,208	$5,000	$6,250	$5,000	$31,250	$5,000	$9,167
Drilling Tools & Equipment																	
	Drill Bits Purchased								$41,538						$42,000		
	Drilling Tools Rental - Survey Tools (e.g. Flodrift, Manless MWD)					$0		$0		$0		$0		$0		$0	
	Drilling Tools Rental - Drilling Jars Rental		$400	$4,000		$400	$833	$400	$667	$400	$417	$400	$500	$400	$2,500	$400	$733
	Drilling Tools Rental - Redress/Run charges for rentals (spread over well)		$2,000			$2,000	$4,167	$2,000	$3,333	$2,000	$2,083	$2,000	$2,500	$2,000	$12,500	$2,000	$3,667
	Drilling Tools Rental - RSS		$2,000			$2,000	$4,167	$2,000	$3,333	$2,000	$2,083	$2,000	$2,500	$2,000	$12,500	$2,000	$3,667
	Drilling Tools Rental - Directional Drilling Services		$4,000	$20,000		$4,000	$8,333	$4,000	$6,667	$4,000	$4,167	$4,000	$5,000	$4,000	$25,000	$4,000	$7,333
Class Charges																	
	Class charges written over five years			$154,000													
Field Professional Services																	
	Wellsite Geologist (Assuming 2x Geo's @ US$2k/d)		$4,000			$4,000	$8,333	$4,000	$6,667	$4,000	$4,167	$4,000	$5,000	$4,000	$25,000	$4,000	$7,333
	Safety Adviser (Assuming 2x SA's @ US$1.5k/d		$3,000			$3,000	$6,250	$3,000	$5,000	$3,000	$3,125	$3,000	$3,750	$0		$0	
	Medivac Cost per well			$25,000													
	Company Man (1 x day, 1 x night assuming each at US$2.5k/d)		$5,000			$5,000	$10,417	$5,000	$8,333	$5,000	$5,208	$5,000	$6,250	$5,000	$31,250	$5,000	$9,167
	TOTALS			**$2,854,500**		$414,505	**$540,634**	$414,505	**$745,659**	$422,740	**$693,430**	$414,505	**$623,131**	$411,505	$2,863,903	$419,720	$1,700,750
	Phase Totals		**Pre-Well Charges**	**$2,854,500**		**Pre-spud**	**$540,634**	**Surface Hole**	**$745,659**	**Surface Casing**	**$693,430**	**Nipple Up BOP's**	**$623,131**	**Intermediate Hole 1**	**$2,863,903**	**Intermediate Casing 1**	**$1,700,750**

DRILLING COST ESTIMATE

Well Name: North Sea

Drilling Rig : 0 Rig X

Permit : 2

				LOT and Test		Production Hole		Evaluation		Production Liner		Rig Release			
				2.1 days		3.1 days		5.4 days		4.3 days		0.3 days			
				2550 m		3173 m		3173 m		3173 m		3173 m			
Revision 0		Contractor	Unit Cost	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Unit cost	Sub Total	Sub-total	Total
Staff Salaries															$293,333
	Operating Company Personnel		$10,000	$10,000	$20,833	$10,000	$31,250	$10,000	$54,167	$10,000	$42,500	$10,000	$3,333	$293,333	
Overhead Allocation															$3,200,000
	General Overhead Recovery ($3.2MM spread over well)		$109,091	$109,091	$227,273	$109,091	$340,909	$109,091	$590,909	$109,091	$463,636	$109,091	$36,364	$3,200,000	
Rig Costs															$7,516,250
	Mob / Demob - Initial Mobilisation			$0		$0		$0		$0		$0		$1,150,000	
	Mob / Demob - Final Demobilisation		$260,000										$260,000	$260,000	
	Rig Operating Costs		$145,000	$145,000	$302,083	$145,000	$453,125	$145,000	$785,417	$145,000	$616,250	$145,000	$48,333	$3,951,250	
	Rig Operating Costs - Crew Change Flight (Helicopters)		$10,000	$10,000	$20,833	$10,000		$10,000		$10,000		$10,000		$101,667	
	Fuel and Lubricants		$50,000	$50,000	$104,167	$50,000	$156,250	$50,000	$270,833	$50,000	$212,500	$50,000	$16,667	$1,466,667	
	Marine Costs - General Spread Rate		$20,000	$20,000	$41,667	$20,000	$62,500	$20,000	$108,333	$20,000	$85,000	$20,000	$6,667	$586,667	
HSE and Auditing															$1,300,000
	Site Survey and Inspections													$1,300,000	
Evaluation															$736,667
	Mudlogging and Data Handling		$5,000	$5,000	$10,417	$5,000	$15,625	$5,000	$27,083	$5,000	$21,250	$5,000	$1,667	$166,667	
	Wireline Logging - Open Hole		$250,000						$250,000					$500,000	
	Wireline Logging - Cased Hole - CBL		$70,000										$70,000	$70,000	
Subsea Works															$58,000
	Dynamic Positioning													$58,000	
Communications															$274,667
	Communications - Phone Charges		$500	$500	$1,042	$500	$1,563	$500	$2,708	$500	$2,125	$500	$167	$14,667	
	Reporting Costs (US$260k spread over well)		$8,864	$8,864	$18,466	$8,864	$27,699	$8,864	$48,011	$8,864	$37,670	$8,864	$2,955	$260,000	
Transport															$833,333
	Transport / Freight - Materials Transport and General Freight		$20,000	$20,000	$41,667	$20,000	$62,500	$20,000	$108,333	$20,000	$85,000	$20,000	$6,667	$686,667	
	Water Source & Supply Haulage		$5,000	$5,000	$10,417	$5,000	$15,625	$5,000	$27,083	$5,000	$21,250	$5,000	$1,667	$146,667	
Casing and Accessories															$926,631
	Surface Casing: 11-3/4" 5 lb/ft J-55 BTC (Range III)	$400/m	$235/m											$164,500	
	Intermediate Casing : 9-5/8" 53.5 lb/ft C-90 BTC (or premium if desired) (Range III)	$300/m	$215.89											$550,514	
														$0	
	Production Casing : 7" 32 lb/ft P-110 BTC (or premium if desired) (Range III)	$150/m	$150/m							$150/m	$93,450			$93,450	
	Production casing liner system		$15,000								$15,000			$15,000	
	Casing running contractor - Premium Casing Services		$8,000							$8,000	$34,000	$8,000	$2,667	$69,667	
	Casing equipment		$10,000								$10,000			$30,000	
	Sealant and brushes													$3,500	
Wellhead															$643,388
	Wellhead Equipment - Wellhead Installation and Testing		$20,000									$10,000	$10,000	$10,000	
	Wellhead Equipment - "A" section		$117,500											$117,500	
	Wellhead Equipment - "B" section		$215,888											$215,888	
	Wellhead Equipment - "C" Section		$300,000								$300,000			$300,000	
Cementing															$374,495
	Chemicals (surface, intermediate, production and P&A)										$30,000			$104,495	
	Services (surface, intermediate, production and P&A)										$100,000			$270,000	
Mud															$259,653
	Chemicals						$43,041				$30,000			$102,986	
	Mud engineer: rig release to rig release (Assuming 2x Mud Men @ US$2k/d)		$3,000	$3,000	$6,250	$3,000	$9,375	$3,000	$16,250	$3,000	$12,750	$3,000	$1,000	$88,000	
	Centrifuge / Desander / Desilter		$2,000	$2,000	$4,167	$2,000	$6,250	$2,000	$10,833	$2,000	$8,500	$2,000	$667	$68,667	
Miscellaneous Equipment															$165,733
	Tanks - Additional Water Storage Tanks		$500	$500	$1,042	$500	$1,563	$500	$2,708	$500	$2,125	$500	$167	$14,667	
	Office Supplies		$150	$150	$313	$150	$469	$150	$813	$150	$638	$150	$50	$4,400	
	Waste Treatment And Disposal - Deliver bin to wellsite, cost of empty the bins		$5,000	$5,000	$10,417	$5,000	$15,625	$5,000	$27,083	$5,000	$21,250	$5,000	$1,667	$146,667	
Drilling Tools & Equipment															$398,938
	Drill Bits Purchased						$45,000							$128,538	
	Drilling Tools Rental - Survey Tools (e.g. Flodrift, Manless MWD)			$0		$0		$0		$0		$0		$0	
	Drilling Tools Rental - Drilling Jars Rental		$400	$400	$833	$400	$1,250	$400	$2,167	$400	$1,700	$400	$133	$15,733	
	Drilling Tools Rental - Redress/Run charges for rentals (spread over well)		$2,000	$2,000	$4,167	$2,000	$6,250	$2,000	$10,833	$2,000	$8,500	$2,000	$667	$58,667	
	Drilling Tools Rental - RSS		$2,000	$2,000	$4,167	$2,000	$6,250	$2,000	$10,833	$2,000	$8,500	$2,000	$667	$58,667	
	Drilling Tools Rental - Directional Drilling Services		$4,000	$4,000	$8,333	$4,000	$12,500	$4,000	$21,667	$4,000	$17,000	$4,000	$1,333	$137,333	
Class Charges															$154,000
	Class charges written over five years													$154,000	
Field Professional Services															$352,750
	Wellsite Geologist (Assuming 2x Geo's @ US$2k/d)		$4,000	$4,000	$8,333	$4,000	$12,500	$4,000	$21,667	$4,000	$17,000	$4,000	$1,333	$117,333	
	Safety Adviser (Assuming 2x SA's @ US$1.5k/d		$3,000	$3,000	$6,250	$3,000	$9,375	$3,000	$16,250	$3,000	$12,750	$3,000	$1,000	$63,750	
	Medivac Cost per well													$25,000	
	Company Man (1 x day, 1 x night assuming each at US$2.5k/d)		$5,000	$5,000	$10,417	$5,000	$15,625	$5,000	$27,083	$5,000	$21,250	$5,000	$1,667	$146,667	
														$0	
	TOTALS			$414,505	$863,551	$414,505	$1,352,117	$414,505	$2,441,066	$422,655	$2,331,594	$432,505	$477,502	$ 17,487,838	$17,487,838
	Phase Totals		Pre-Well Charges	LOT and Test	$863,551	Production Hole	$1,352,117	Evaluation	$2,441,066	Production Liner	$2,331,594	Rig Release	$477,502	Total Cost	$17,487,838