681347

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BP PETROLEUM DEVELOPMENT LTD., NORWAY U.A.

DEN NORSKE STATS OLJESELKAP A/S

DRILLING PROGRAMME

WELL 29/6-1

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ENCLOSURE - LOCATION & GEOLOGICAL PROGNOSIS

BASIC WELL DATA

Production Licence Number:	043
Well Number:	29/6-1
Location:	Geographical Long. 60° 32' 18" N Lat. 01° 59' 23" E U.T.M (Central Meridian 3° E) 444560 E 6711945 N SP 302 Seismic Line BP80 - 021 Final rig location to be determined by Satellite Navigation.
Tolerance in Positioning Rig:	Within a radius of 75 m from programmed location.
Well Type:	Exploration
Drilling Rig:	Sedco 707
Total Depth:	50 m into Triassic red brown mudstone ca. 4700 mss
Water Depth:	128 m
KB to Sea Level:	25 m (to be verified on location - dependant on drilling draft)

INTRODUCTION

This programme is written to bring together in one plan all of the various elements pertinent to the actual drilling operation.

It is the responsibility of all personnel involved to ensure that the programme is adhered to.

It is possible that due to situations encountered some amendments may be required.

However, it is emphazised that no major deviations from this programme may be made without prior approval of the Norwegian Petroleum Directorate.

Any amendments will be duly authorized and forwarded to supervisory staff for action.

Reference is made in this drilling programme to the BP "Operations Manual" and "Safety Regulations Manual". These manuals should be read in conjunction with this programme.

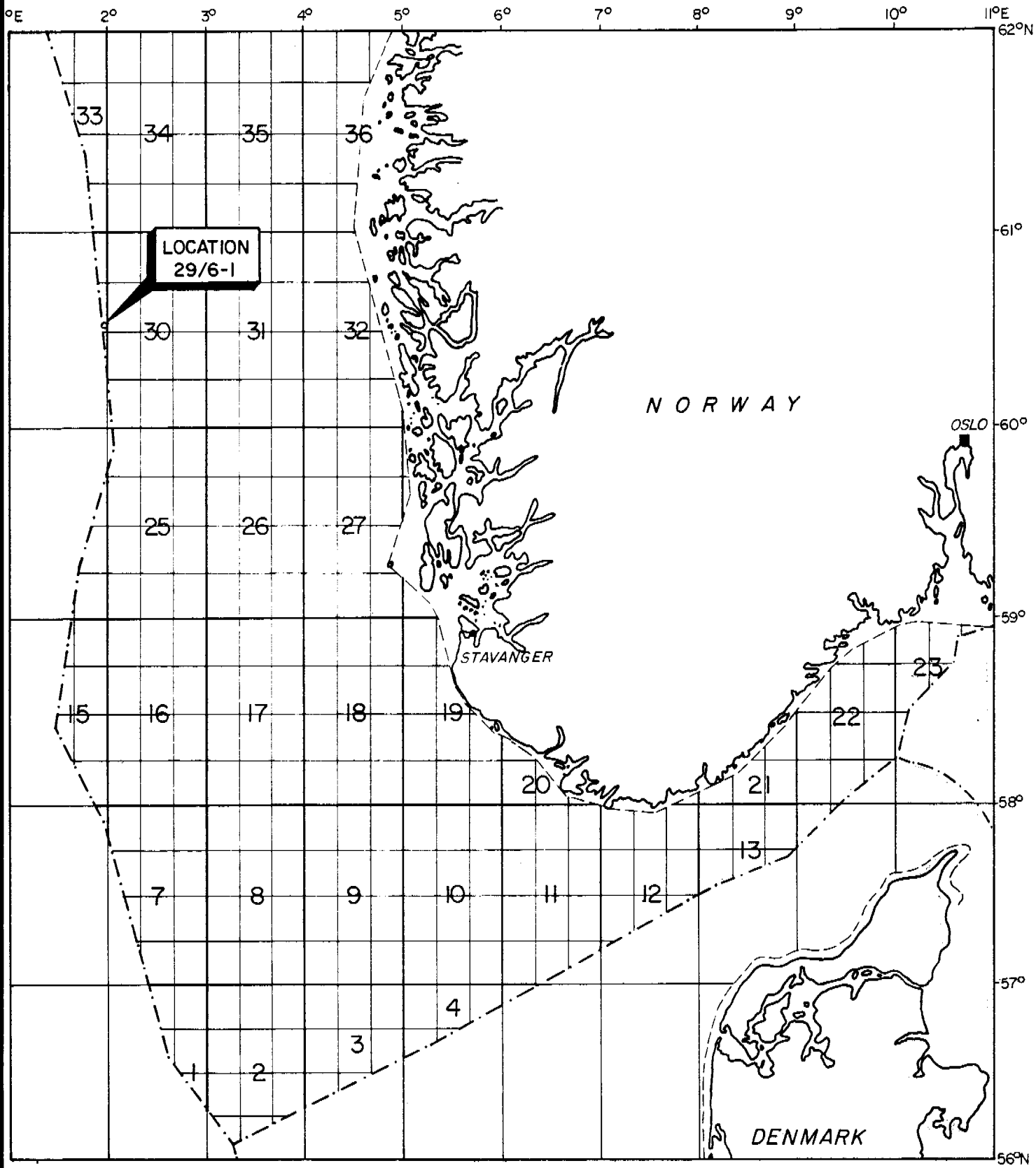
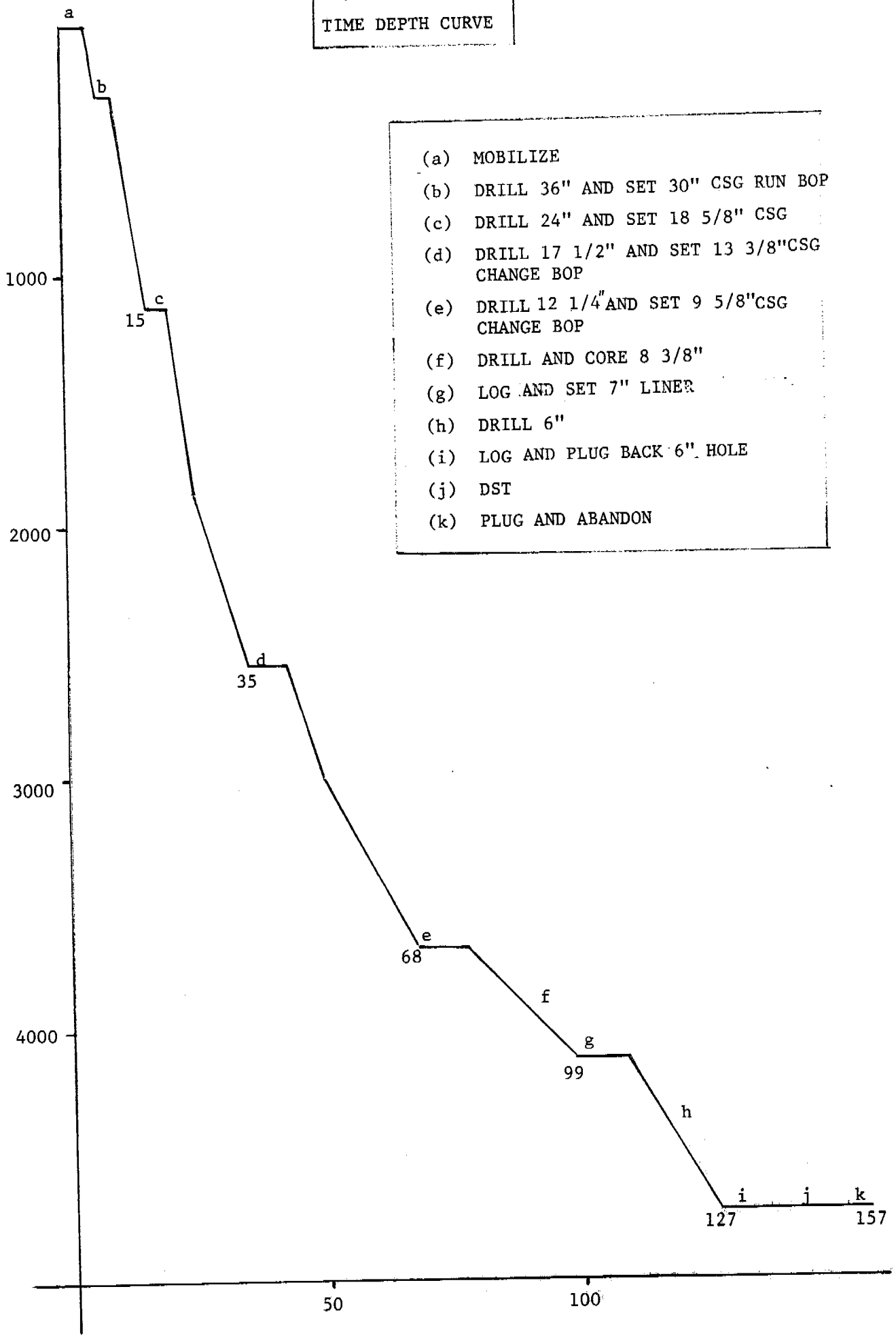


FIGURE 1

BP PETROLEUM DEVELOPMENT LTD. NORWAY	
Ref:	
Author: G. PIDCOCK	
Date: JUNE 1981	Drg No: 5413

29/6-1 FIGURE 2
TIME DEPTH CURVE



(a) MOBILIZE
(b) DRILL 36" AND SET 30" CSG RUN BOP
(c) DRILL 24" AND SET 18 5/8" CSG
(d) DRILL 17 1/2" AND SET 13 3/8"CSG CHANGE BOP
(e) DRILL 12 1/4" AND SET 9 5/8"CSG CHANGE BOP
(f) DRILL AND CORE 8 3/8"
(g) LOG AND SET 7" LINER
(h) DRILL 6"
(i) LOG AND PLUG BACK 6" HOLE
(j) DST
(k) PLUG AND ABANDON

SECTION 3

GEOLOGICAL SUMMARY

Introduction

Well 29/6-1 will test the Brent and Statfjord sandstones on an easterly dipping fault segment. This fault segment is one of four which comprise the prospect in the SW corner of the Licence 043. Two of the fault segments have already been shown to contain gas condensate by by wells 30/4-2, 30/7-6 and 30/7-8.

29/6-1 will be the third well to be drilled in Licence 043 and is intended as the final commitment well.

Stratigraphy

The stratigraphy of the Tertiary and Cretaceous section can be confidently predicted using data from nearby wells 30/4-2, 30/7-6 and 30/7-8.

The Cretaceous mudstones and thin limestones below 2355 m brt are expected to be overpressured.

Beneath the Base Cretaceous unconformity (3695 m brt) the stratigraphy is much more speculative. The Upper Jurassic Humber Group is estimated to be about 105 m thick however it could be between 40 m and 250 m thick. The Brent formation is predicted to be 260 m thick and the Dunlin and Statfjord Formations 280 m and 335 m respectively.

Objectives

The primary target of the well is the Brent Formation sandstones. Top Brent is predicted at 3800 m brt however this estimate is very uncertain because a seismic horizon corresponding to Top Brent can not be recognized. The Brent Formation is expected to be gas condensate bearing.

The Statfjord Formation sandstones are a secondary target. They are predicted at 4340 m brt and are expected to be penetrated close to the GWC.

Potential reservoir sandstones are also predicted in the Tertiary sequence but they are expected to be water wet. Minor hydrocarbon bearing sandstones may be encountered within the Dunlin Formation but they are thought to be thin and of poor reservoir quality.

Location (SP 302 on seismic line BP 80-043-021)

29/6-1 is located within closure at Top Brent Formation and close to the spill point of closure at Top Statfjord Formation.

Termination of well

It is planned that the well be terminated 50 m into the Cormorant Formation red-brown mudstones. This TD is prognosed at 4725 m brt. If however the Statfjord Formation is found to be water bearing then the well will be terminated 50 m into the Statfjord at approximately 4390 m brt.

WELL LOCATION 29/6-a
GEOLOGICAL FORECAST

SCALE 1:10,000 — LOCATION

Stratigraphic Unit	DEPTHS (mbKB)	Target	Graphic Log	M & Ft (METRES SUBSEA)	SEISMIC EVENT	LITHOLOGY	DRILLING PROBLEMS
QUAT.	153				SEA BED		
TERTIARY ROGALAND GP FRIGG FM	1830			250 / 1000		SAND fine to medium grained with glauconite and shell fragments.	
TERTIARY MONTROSE GROUP	2355		G	500 / 2000		Occasional interbeds of CLAY green, soft, silty.	
			G	750		Occasional LIGNITE beds.	
			G	3000			
				1000		MUDSTONE grey green, soft, slightly micaceous, non calcareous, with SILTSTONE brown, very argillaceous.	
				4000 / 1250			
				1500 / 5000		SANDSTONE very fine grained, occasional calcite cemented.	
				1750	GOLDEN-BROWN	MUDSTONE grey, soft with stringers of dolomitic LIMESTONE	
				6000		SANDSTONE fine to medium grained, occasionally cemented with calcite.	
				2000		MUDSTONE grey, occasionally varicoloured, tuffaceous.	
				7000		Interbedded SANDSTONES fine to medium grained, well cemented with calcite and MUDSTONE grey, soft, calcareous.	
				2250	YELLOW		
CRETACEOUS SHETLAND GROUP	2355			8000		MUDSTONE grey soft, sticky, very calcareous, silty, with stringers LIMESTONE white, buff, occasionally dolomitic, occasionally sandy.	OVERPRESSURING IN SHALES STARTS APPROX 2350 mbrt
				2500			
				9000 / 2750			
				3000 / 10000		Occasional DOLOMITE stringers, brown, hard.	
				3250			
				11000			
				3500	LIGHT BLUE		
	3635				RED		
	3695			12000			
HUMBER GP				3750		MUDSTONE dark grey to black, hard, calcareous, carbonaceous.	
BRENT FM	?3800			1300 / 4000		SANDSTONE medium to coarse grained, commonly micaceous, occasionally calcite cemented with interbeds of MUDSTONE grey, hard, very micaceous, carbonaceous with COAL beds.	
	?4060						
JURASSIC DUNLIN FM				4250 / 1400		MUDSTONE grey, hard, subfissile, with occasional beds SANDSTONE/ SILTSTONE argillaceous, micaceous.	
	4340				PURPLE		
STATFJORD FM				4500		SANDSTONE medium to coarse grained with interbeds MUDSTONE grey to grey green, hard, silty, non calcareous.	
	?4675						
TRIASSIC CORMORANT FM						MUDSTONE red brown, soft, silty. SANDSTONE very fine to medium grained.	

PROPOSED TD 4725 mbrt

Fig. 3

BP PETROLEUM DEVELOPMENT LTD. NORWAY	
Ref: 29/6-a/W20	
Author: D.G. DALTON	
Date: JUNE 81	Drg No: 5336

TABLE 1

SEISMIC FORECAST FOR WELL 29/6-1

LOCATION: LINE BP 80-043-021 SP 302

WATER DEPTH: APPROX. 128 m

RTE: ESTIMATED 25 m

SEISMIC HORIZON	SECTION TIME (m secs)	INTERVAL THICKNESS (meters)	ESTIMATED DEPTH (meters BRT)	GEOLOGICAL CORRELATION
GOLDEN BROWN	1780	525	1830	TOP FRIGG FM
YELLOW	2175	1280	2355	TOP SHETLAND GP
LIGHT BLUE	3080	1340	3635	TOP FORMATION 'A'
RED	3100	645	3695	BASE CRETACEOUS
VIOLET	3545		4340	TOP STATFJORD FM

SECTION 4

PRESSURE PREDICTION AND CASING DESIGN

Pore pressures and fracture pressures have been estimated for well 29/6-1 from an evaluation of data obtained while drilling 30/4-1 and 30/4-2 and from other wells in the area. A pressure profile is shown in Fig. 3.

Pore pressures in the tertiary are expected to be normal to around 1650 m. One slightly overpressured zone 1.10 SG eq. is expected to be present from 1650 m to 2000 m. The Paleocene sands below 2000 m are normally pressured.

From the top of the cretaceous at ca. 2355 m the pore pressure increases rapidly from 1.05 SG eq. to 1.62 SG eq. at 3000 m. The 13 3/8" casing will be set about 200 m below the top of this transition zone at such a depth where the formation strength will support the mud weight required for the next section of hole. The pore pressure below 3000 m is estimated to remain constant towards the base of the Cretaceous. A rise in pore pressure is estimated at the base of the Cretaceous to 1.75 SG at a depth of 3695 m. The 9 5/8" casing shoe will be set just below this in the top of the Jurassic, Kimmeridge Clay formation, but it could be set as high as 3670 m if hole conditions dictate.
At the top of the Brent sandstone the pore pressures is estimated to be 2.01 SG. From this maximum value at ca. 3800 m the pore pressure decreases slightly due to a gas/water column in the Brent. The 7" liner will be set just below the Brent sand in the Dunlin formation and the well completed to TD in 6" hole.

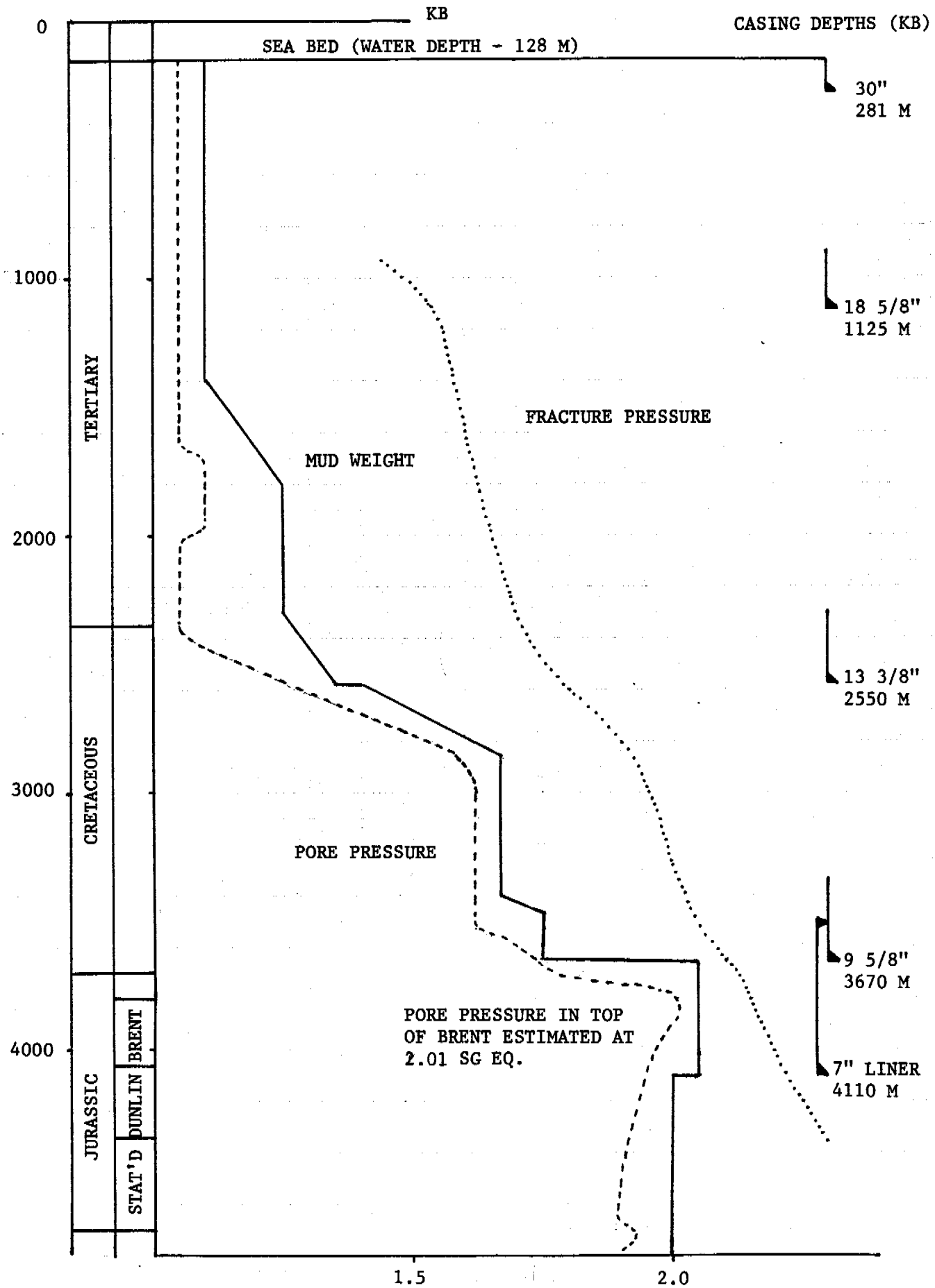
The pore pressure is expected to continue its gradual decline and a value of 1.93 SG eq. has been estimated in the top of the Statfjord formation at ca. 4340 m. The pore pressure decreases slightly through the Triassic shales except for a slightly over pressured section around 4700 m if the well is penetrated this deep.

The fracture gradient increases typically with the pore pressure. A value of 1.52 SG is predicted around 1125 m below the 18 5/8" shoe. The 13 3/8" shoe should be deep enough at 2550 m to attain a leak-off of 1.80 SG.

The most critical area is likely to be around the 9 5/8" shoe where a fracture gradient of 2.10 SG is estimated against a pore pressure of 2.01 SG. Great care must be taken during trips not to upset this fine ballance and ECD and Gel strengths must be monitored closely.

Formation strengths will be taken after drilling out each casing shoe (18 5/8" onwards).

29/6-1 FIGURE 4
ESTIMATED PORE PRESSURES
FRACTURE PRESSURES &
MUD WEIGHTS



CASING DESIGN

1. Basic Data

KB to Sea Level (a)	25 M	(82 FT)
Water Depth	128 M	(420 FT)
KB to Sea Bed	153 M	(502 FT)
Sea Water Gradient	1.028 SG	(.445 PSI/FT)
Normal Formation Gradient	1.044 SG	(.452 PSI/FT)
Fresh Water Gradient	1.00 SG	(.433 PSI/FT)
Hydrostatic Pressure due to sea water	187 PSI	

2. Design factors used in the casing design

Tension - 1.75 for the weight of the casing in air.

Burst - 1.1 over the wellhead pressure of a column of gas with a bottom hole pressure equivalent to the formation fracture pressure at the shoe of the last string of casing.

Collapse - Generally 1.0. However, it should be noted that under normal circumstances the casing will never be empty. Also since casing strings will be cemented over most of their length, collapse factors as low as 0.80 are acceptable.

(a) To be verified on location - dependant on drilling draft.

30" Conductor Design

The 30" conductor is required to be set at a depth such that the formation strength will support a column of mud to the flow line while drilling the 24" hole. It is also required to prevent caving of poorly consolidated sands near the sea bed.

Conductor set at d' BSB where fracture pressure at shoe = mud weight to R.T. Fracture gradient in region of shoe is estimated at 0.6 psi/ft BSB. Mud weight for next hole section = 1.1 SG. (0.476 psi/ft).

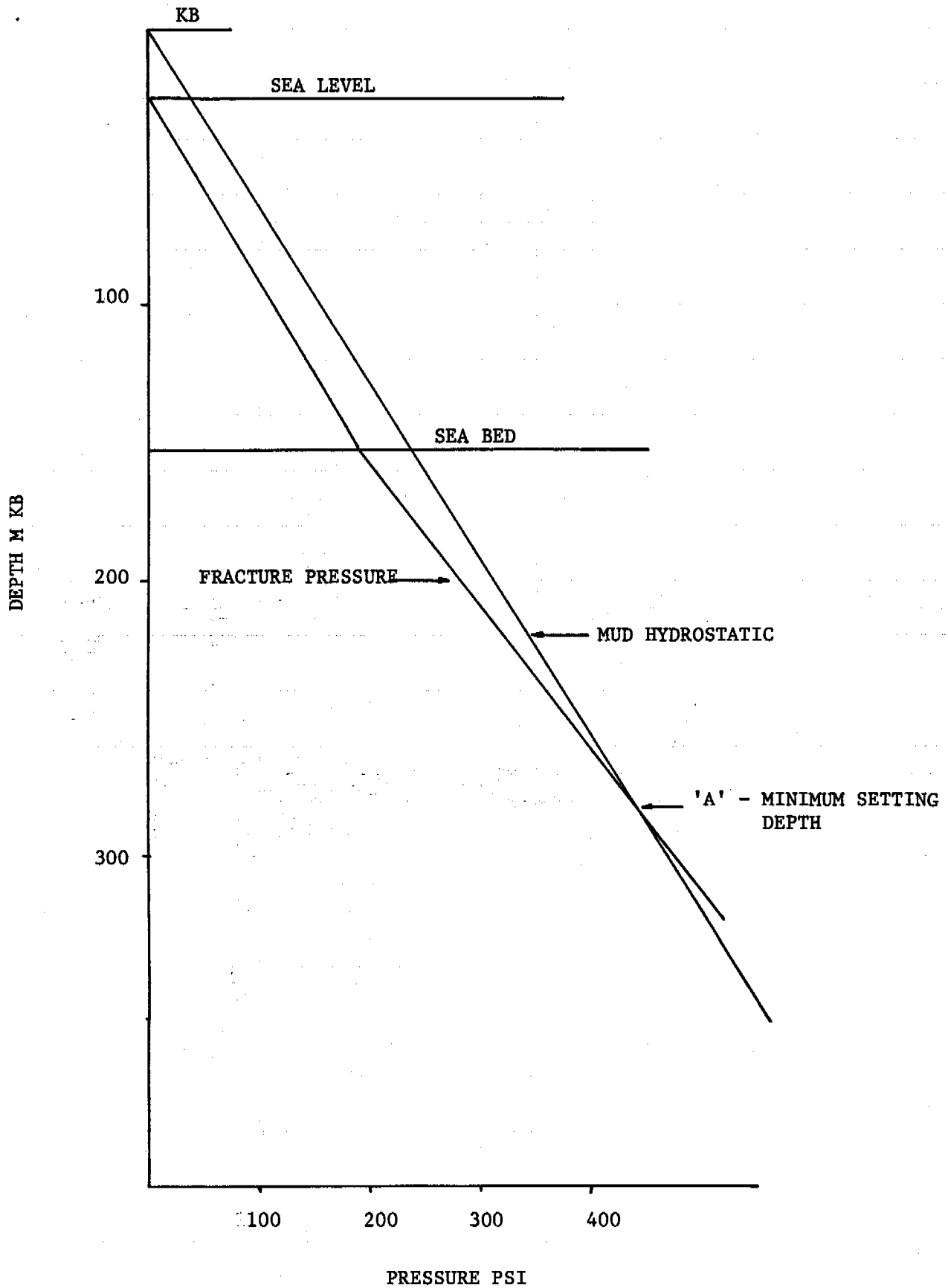
$$(0.6 \times d) + 187 = 0.476\ (d + 502)$$
$$0.124d = 51.95$$
$$d = 419' \text{ BSB}$$
$$= 128 \text{ m BSB}$$
$$= \underline{281 \text{ m KB}}$$

The conductor will therefore be set at 281 m min. BKB, depending on actual pipe measurements (point 'A on Fig. 5)

PIPE - 30" x 1" wall, 310 lb/ft line pipe with Vetco 'R' connectors.
(Ensure 'O' rings are fitted to pin end of connector).

FIGURE 5

30" CONDUCTOR DESIGN



18 5/8" Casing Design

The 18 5/8" casing is required to be set at such a depth at which formation strength will support the ECD of the mud required to drill to the 13 3/8" casing seat.

Hydrocarbons are possible in lower Eocene/Upper Paleocene from ca. 1815 m KB but any reservoirs in the 17 1/2" hole section should be normally pressured.

The following data has been used in the casing design:

a) The fracture pressure gradient in the region of the casing shoe is estimated at 0.65 psi/ft (1.50 SG).

b) Mud weight in which the casing will be run is 1.10 SG.

c) Maximum mud weight anticipated for 17 1/2" hole section (ECD) is 1.4 SG (0.606 psi/ft).

Setting Depth

From Figure 6, the minimum setting is 553 m KB (400 m BSB). However, actual setting depth will be to ensure that all Upper Tertiary sands are cased off to prevent losses while drilling the 17 1/2" hole. On Geological Forecast the base of the sand is ca. 1100 m BKB. The casing will be set 25 m min. below the sand ca. 1125 m BKB (997 m BSB).

Burst

Based on fracture gradient at shoe less a gas gradient to surface (0.1 psi/ft).

Burst pressure	= 3691 x 0.65 - 3271 x 0.1	= 2072 psi
Rated burst pressure of pipe	= 2250 psi	
Design factor	= 1.09	

Collapse

Rated	= 630 psi
Adjusted for tension and buoyancy	= 480 psi

The casing will be run in 1.1 SG mud (0.476 psi/ft). If the mud level inside the casing were to fall, the collapse pressure would be exceeded when the level reached 'Y' feet RKB i.e. where mud hydrostatic pressure = collapse rating of casing.

'Y' x 0.476 = 480

'Y' = 1008 ft = 307 m

Note:

a) The driller responsible must be aware that this situation can occur and therefore must ensure that the casing is filled at regular intervals. A string weight chart will be provided by the drilling engineer as a secondary check.

b) When cementing ensure that displacement mud is of sufficient density to prevent casing collapse when cement is in place.

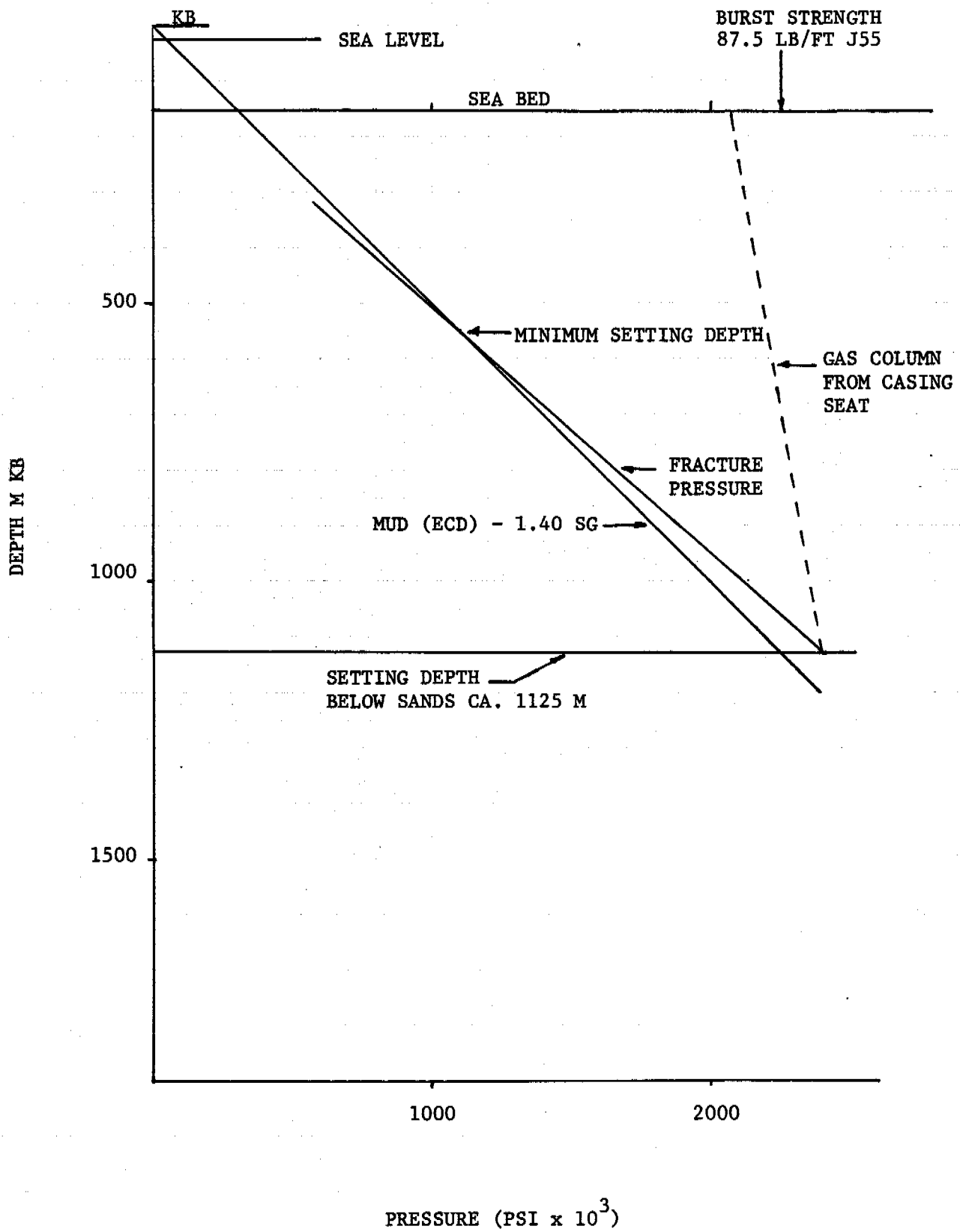
Tension

This string will be run on HWDP/DP.

Weight of casing in air: 977 x 3.281 x 87.5	=	286.226 lbs
Rating, 87.5 lbs/ft, J55, Buttress	=	1.329.000 lbs
Design factor	=	4.64

FIGURE 6

18 5/8" CASING DESIGN



13 3/8" Casing Design

The intermediate string of 13 3/8" casing is required to case off the Tertiary, and be set into the Upper Cretaceous at such a depth where formation strength will support the mud weight required for the next section of hole.

The following data has been used in the casing design:

a) The setting depth of the next casing string will be in the Lower Cretaceous at approximately 3670 metres BKB.

b) Bottom hole pressure at 9 5/8" casing seat estimated at 1.70 - 1.72 SG equivalent mud weight.

c) The 13 3/8" casing will be run in 1.35 SG mud weight max. (0.584 psi/ft).

d) Maximum mud weight in 12 1/4" hole - 1.76 SG (0.762 psi/ft).

e) Formation fracture gradient in region of 13 3/8" shoe estimated to be 0.78 psi/ft. (1.80 SG).

f) Casing grades to be used are 72 lb/ft. N80 Buttress and P110, Vam.

Setting depth

The minimum setting depth is where the fracture pressure at the shoe will support the mud weight required for the next section of hole.

This depth is shown as Point A in Fig. 7 - 2440 m KB.

The maximum setting depth is where the formation fracture pressure, less a gas gradient equals the rated burst pressure of the casing at the sea bed.

Burst rating of casing (P110)	=	7400 psi
With safety factor	=	6727 psi
Burst rating at sea bed	=	6727 + 182
	=	6909 psi

This depth is shown as Point B in Fig. 7 - 2860 m KB.

In practical terms as the 13 3/8" will be set at a maximum depth of 2550 m BKB (8366'), 2400 m BSB (7874'), approximately 190 m below the top of the Cretaceous. Thin overpressured gas bearing limestones are predicted below 2625 m BKB. The casing must be set before entering these limestones but also set as deep as possible to ensure adequate formation strength to drill the next section of hole.

Hence close attention must be given to the pressure indicators.

Burst

Burst pressure at top of string = Fracture pressure - Gas gradient from casing seat to sea bed
= (8366 x 0.78) - 0.1 x 7874
= 5738 psi

The burst rating of the two available casing grades with a 1.1 design factor are:

13 3/8", 72 lb/ft N80 Buttress = 4891 psi
13 3/8", 72 lb/ft P110 Vam = 6727 psi

The change over point between the two grades is at the point where the allowable burst plus the pressure of the mud in the annulus equals the internal pressure:

$$4891 \text{ psi} + X \times 0.584 \text{ psi/ft} = 5738 + 0.1 \text{ psi/ft} \times X$$

$$X = 1750 \text{ ft} = 533 \text{ m below sea bed}$$

To allow for casing wear 633 m P110 will be run with the changeover point at 786 m BKB.

Collapse

Collapse rating 13 3/8" 72 lb/ft N80 = 2670 psi
Adjusted for tension and buoyancy = 1869 psi

The casing will be run in 1.35 SG mud (0.584 psi/ft). If the mud level inside the casing were to fall, the collapse pressure would be exceeded when the level reached 'Y' feet BKB, i.e. where mud hydrostatic pressure = collapse rating of casing.

$$Y \times 0.584 = 1869$$

$$Y = 3200' = \underline{975 \text{ m}}$$

Tension

Weight of casing in air:

2550 x 3.281 x 72 = 602,391 lbs

Joint strength of top joint

(72 lb/ft, P110) = 2.433,000 lbs

Design factor = 4.04

Casing string

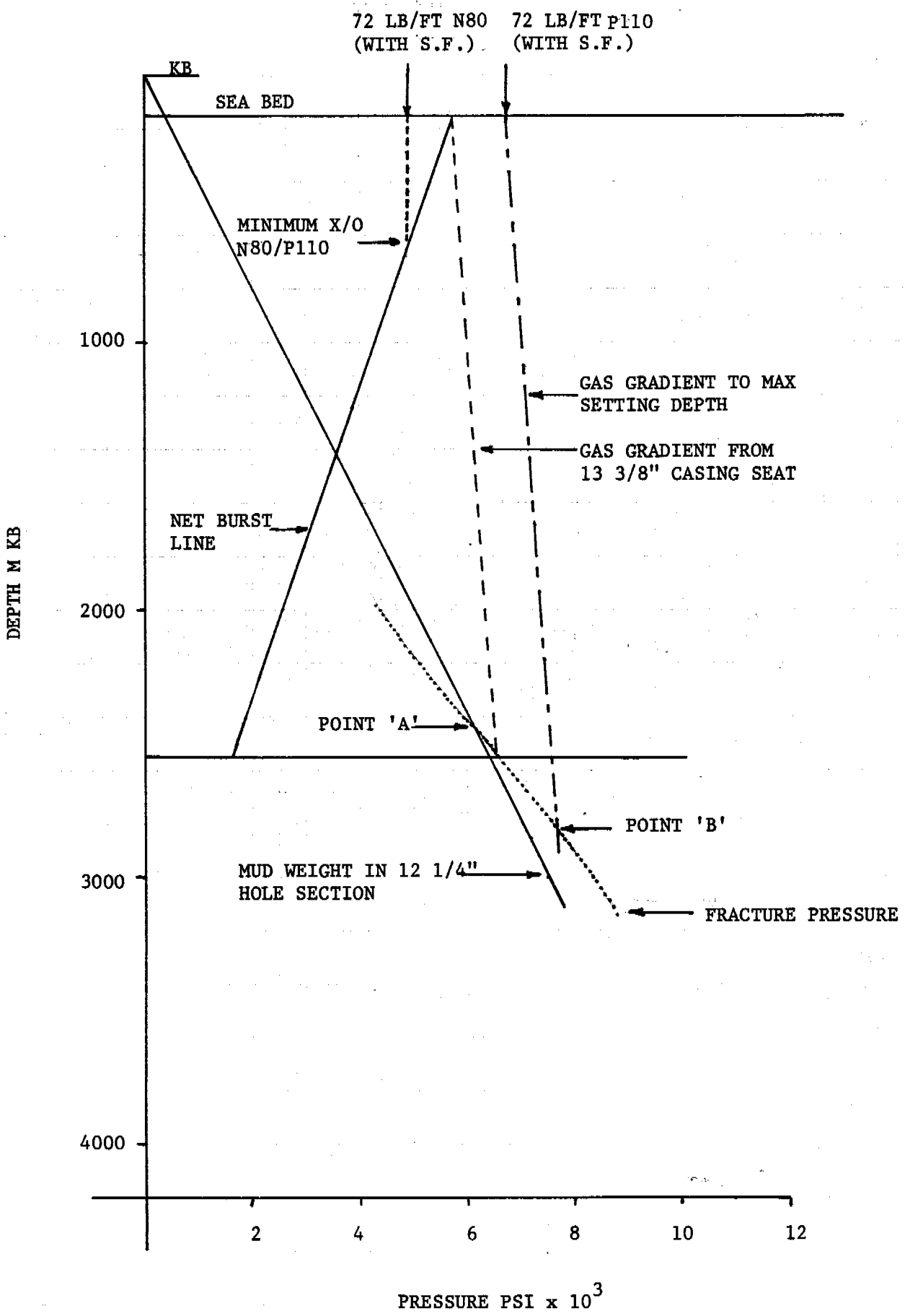
Sea bed to 791 m KB, 72 lb/ft, P110 Buttress, burst 7400 psi. collapse 2880 psi.

791 m to 2550 m KB, 72 lb/ft, N80, Buttress, burst 5380 psi, collapse 2670 psi.

All casing drifted for 12 1/4" bits.

FIGURE 7

13 3/8" CASING DESIGN



9 5/8" Casing Design

The casing will be set in the top of the Jurassic forecast at 3695 m if hole conditions dictate it may be set at a higher point ca. 3670 m. This is used for the design as being the "worst case".

The following data has been used in the casing string design:

a) Top of the Jurassic sandstone is estimated at 3795 m RKB.

b) Pore pressure in top of sandstone estimated at 10837 psi (0.853 psi/ft).

c) Total depth of 8 3/8" hole could be to T.D at 4700 m BKB.

d) Formation fracture gradient in the region of the 9 5/8" shoe is estimated to be 2.10 SG eq. (0.91 psi/ft) = 10957 psi.

e) Mud weight in which the casing will be run is 1.76 SG (0.762 psi/ft).

f) Max. mud weight in the 8 3/8" hole 2.05 SG.

g) Casing grade to be 53.5 lb/ft XT 155, VAM.

Setting Depth

The minimum setting depth is where the fracture pressure at the shoe will support the mud weight required for the next section of hole. This can be seen from Fig. 8 as 3550 m BKB. The casing will be set at ca. 3670 m BKB.

Burst

Burst pressure at top of string = fracture pressure - gas gradient from casing seat to s/b
= 10957 - 3517 x 3.281 x 0.1
= 9804 psi

Burst rating of Casing Available:

9 5/8" x 53.5 lb/ft XT155, VAM - 15360 psi
with 1.1 safety factor - 13964 psi

Collapse

Collapse rating of 53.5 lb/ft XT155 casing = 9020 psi

Hydrostatic pressure due to annulus mud column = 0.762 x 12041
= 9175

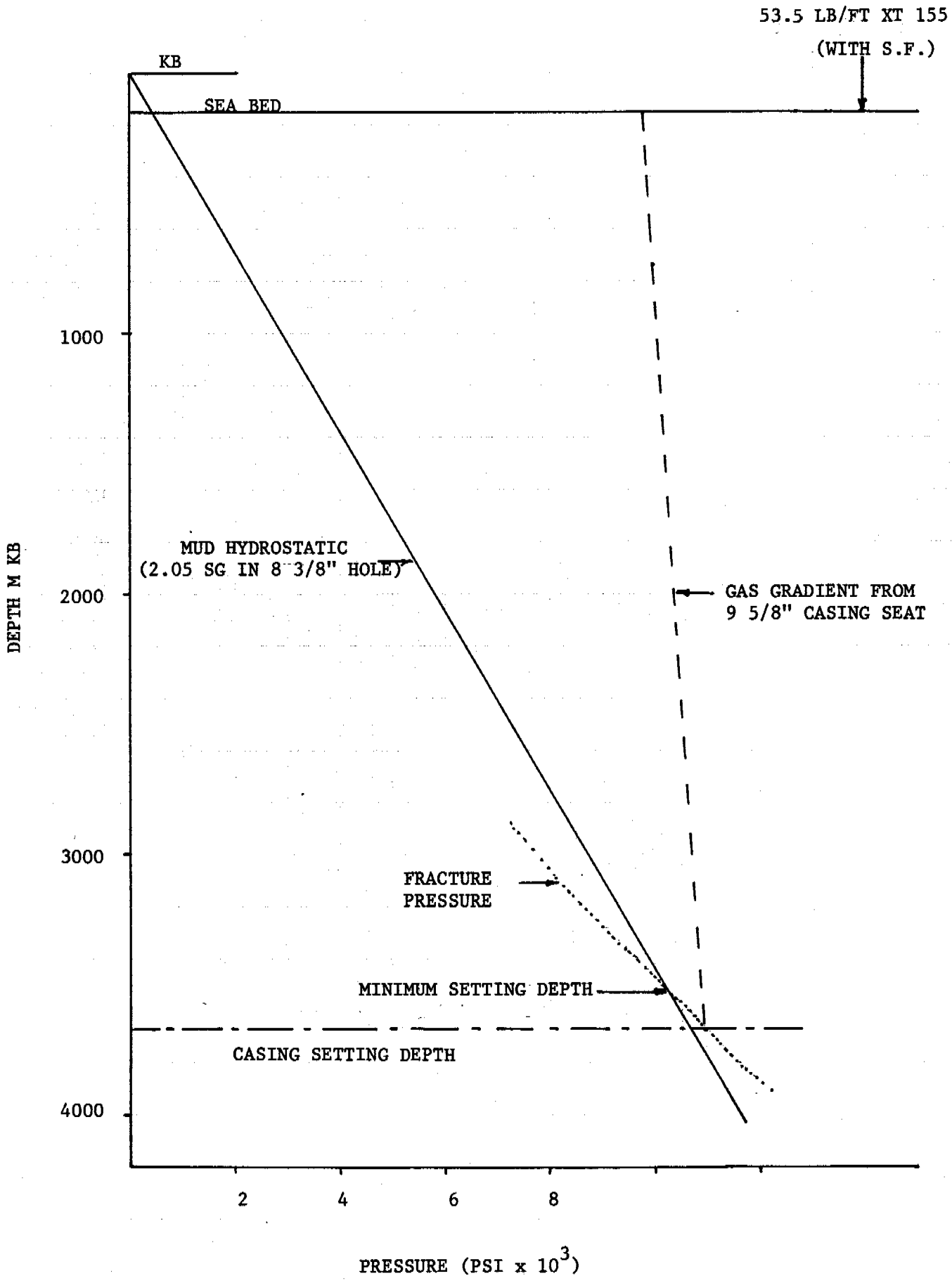
Assuming hole is empty, design factor = $\frac{9020}{9175}$ = 0.983

Tension

String weight in air = 3670 x 3.281 x 53.5 = 644.208
Joint strength of 53.5 lb/ft XT155 VAM = 2.323.000
Design factor = 3.61

FIGURE 8

9 5/8" CASING DESIGN



7" Liner Design

A 7" liner will be required in order to case off the high pressure productive sands in the Brent formation before drilling the lower pressured Dunlin and Statfjord formations.

The following data has been used in the liner design.

a) Top of the Dunlin formation is estimated at 4060 m.

b) Top of the Statfjord sand is estimated at 4340 m with a formation pressure of 12000 psi.

c) The mud weight in which casing will be run 2.05 SG

d) Formation fracture gradient in the region of the 7" shoe is estimated to 2.25 SG (0.974 psi/ft).

d) The liner overlap will be 200 m inside the 9 5/8" shoe at 3470 m.

Setting Depth

The setting depth of the liner will be such that the whole of the Brent formation and far enough into the Dunlin formation to provide a good footing for the shoe (say 50 m). The shoe depth will hence be at 4110 m.

Burst pressure at the top of the liner.

= Fracture at shoe - gas column - mud hydrostatic behind 9 5/8" casing

= 4110 x 3.281 x 0.974 - 640 x 3.281 x 0.1 - 3470 x 3.281 x 0.762

= 13,134 - 210 - 8675

= 4249 psi

Liner available

7" P110 x 29 lb/ft Vam	Burst	11,220
	Collapse	8,510

Collapse

The liner will be run in 2.05 SG (0.887 psi/ft) mud if the level inside were to fall. The collapse pressure would be exceeded when the level reached 'Y' feet BKB i.e. where mud hydrostatic pressure = collapse rating of casing.

$$Y \times 0.887 = 8510$$

$$Y = 9594' = 2924 \text{ m.}$$

Therefore core must be taken to fill drill-pipe when running 7" liner.

Tension

Not applicable.

Tie back

Should drilling operations require the liner to be tied back to surface then a separate design for this string will be issued.

TABLE 2

SUMMARY OF CASING STRINGS

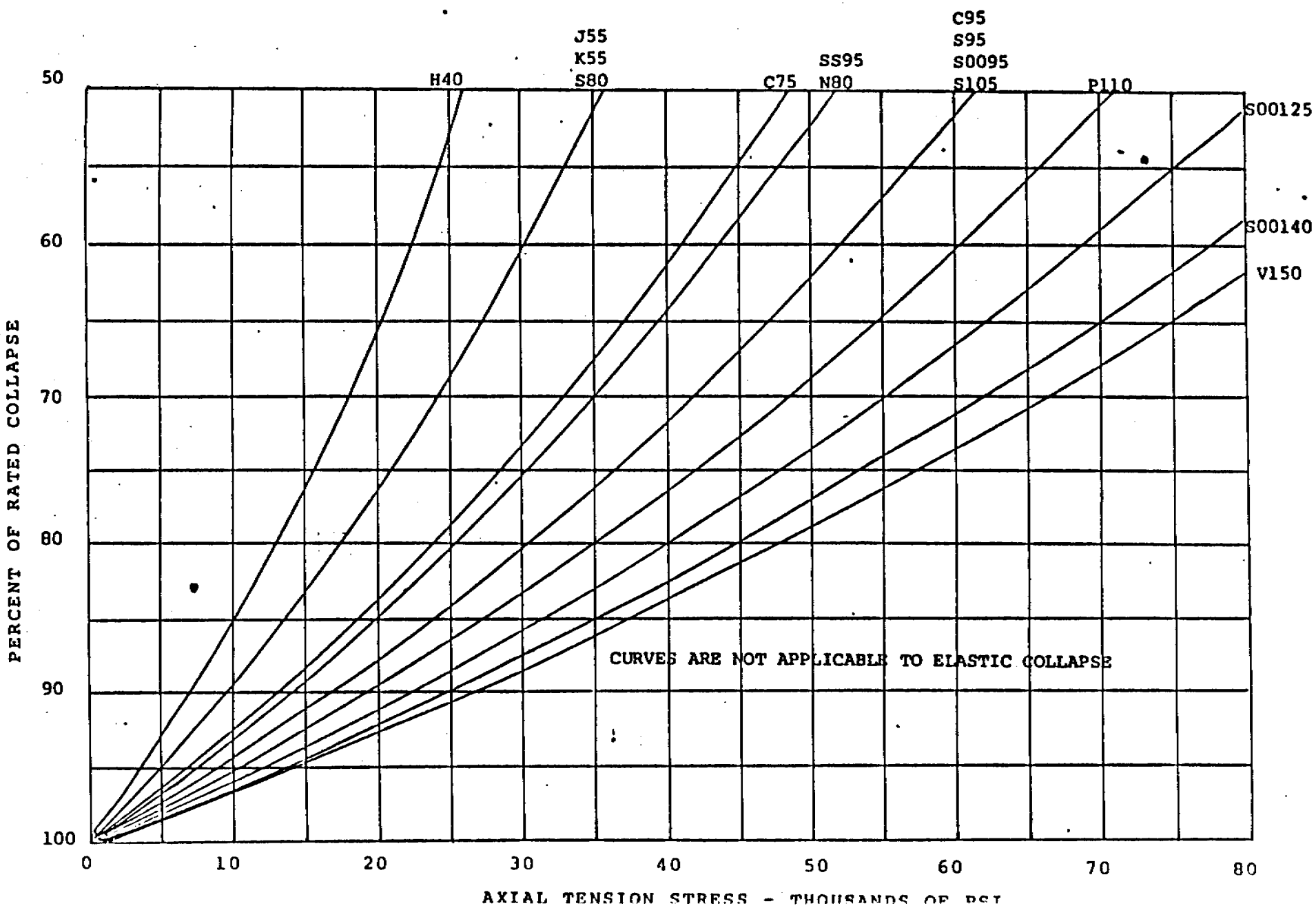
STRING	HOLE SIZE	SHOE DEPTH M KB	WEIGHT LB/FT	GRADE	CONNECTION
30" Conductor	36"	281	1" wall		Vetco 'R'
18 5/8"	24"	1125	87.5	J55	Buttress
13 3/8"	17 1/2"	2550	72	P110	VAM
			72	N80	Buttress
9 5/8"	12 1/4"	3670*	53.5	XT155	VAM
7" Liner	8 3/8"	4110	29	P110	VAM

* Dependant on hole conditions

EFFECT OF TENSILE LOADING ON CASING COLLAPSE

FIGURE 9

BASED ON FORMULA 1.1.5.1 API 5C3 1ST EDITION 12-71. HENCKY von NISES THEORY & HOLMQUIST NADAI PUBLICATION 11-39



GENERAL DRILLING PROCEDURES

Pre-spud

(1) Run sea bed tag plate on HWDP. Correct depth for tidal variations. Record depth at M.S.L.

(2) Run two stands drill collars on HWDP using compensator. Check sea bed penetration using 20,000 lbs. maximum weight. Record penetration. Should sea bed be considered too soft for use of TGB, continue with procedure to spud well.

(3) Run T.G.B. and land at slack tide.

Spud

(1) Run 36" hole opener with 26" pilot bit. Make up 36" stabilizer one drill collar above the hole opener. If no T.G.B. in use, then spud well at slack tide.

(2) Drill 36" hole for 30" conductor using viscous mud slugs to clean hole as required. Restrict circulation rate when T.G.B. in use to minimum until 10 m B.S.B. Then gradually increase circulation rate to maximum.

(3) Circulate hole clean then overfill hole with viscous mud. Short trip to check hole. Pull tools.

30" Conductor

(1) Pick up and run 30" conductor (attach guide ropes to shoe joint to assist in entering guide funnel if T.G.B. in use).

(2) Install guide base on last joint of 30" conductor.

(3) Run conductor/guide base on drill collar/drill pipe handling string with 21 1/4" Autolock connector and cement adapter.

(4) Land guide base on T.G.B. or position guide base about 2 m, maximum 3 m, above sea bed using motion compensator.

(5) Cement conductor with returns to sea bed.

(6) When surface samples set, release handling string. Pull back stinger and wash out wellhead body with sea water. Recover handling string.

24" Hole

(1) Pressure test 21 1/4" 2000 psi BOP stack at surface to 2000 psi prior to running.

(2) Function test all controls from driller's and remote panels.

(3) Run BOP stack on 24" marine riser. Test kill and choke lines as run. Make up ball joint on marine riser and install 24" telescopic joint.

(4) Latch BOP connector on 21 1/4" 2000 psi. Autolock hub using riser tensioners. Apply 50,000 lbs overpull to check connector latched.

(5) Nipple up surface lines.

(6) Run test plug and test BOP connector against rams down kill and choke lines to 500 psi.

(7) Test kill & choke valves to 500 psi. Test annular preventor to 500 psi. (Weekly testing of BOP and surface lines required from now onwards). Install diverter.

(8) Run and set 20" bore protector.

(9) Pick up 24" underreamer with 17 1/2" pilot bit. Run and tag T.O.C. in 30" conductor.

(10) Drill 24" hole with gel/water mud system using desanders and desilters to continuously control solids content. Ensure penetration rate allows for adequate hole cleaning. (Circulation rate of 1100 g.p.m. provides 100 f.p.m. annular velocity in open hole). Avoid overloading annulus with drilled cuttings. Should lost circulation occur, revert to sea water and clean hole with 100 sec viscous slugs.

(11) At casing point circulate hole clean and fill with 100 sec + viscous mud at 1.10 SG POH.

(12) Run logs as required.

18 5/8" Casing

(1) Recover 20" bore protector.

(2) Run 18 5/8" casing on HWDP handling string (casing hanger assembly to be made up prior to running casing). Land hanger with shoe 5 m ± above TD.

(3) Cement casing in single stage to sea bed. Bump plug with 500 psi and hold pressure for 15 minutes. Check floats holding. Ensure casing is always full and mud of sufficient density is used to avoid casing collapse during displacement and when cement is in place.

(4) Release running tool. Flush connector clean. Recover handling string. Flush through kill and choke lines.

(5) Run and set 18 5/8" pack-off unit. Run with particular care through riser coupling and ball joint.

(6) Pick up test plug and 18 5/8" bore protector. Fill handling string with sea water and leave vented to atmosphere. Pressure test down kill or choke lines with pipe rams closed to maximum 500 psi. Recover test plug leaving bore protector in W.H.B.

17 1/2" Hole

(1) Pick up 17 1/2" BHA clean out to T.D. Drill 3 m of new hole. Circulate clean and carry out formation leak-off test.

(2) Drill 17 1/2" hole to 13 3/8" casing depth. Circulate clean. POH.

13 3/8" Casing	(1)	Recover 18 5/8" bore protector.
	(2)	Run 13 3/8" casing as programmed (wellhead and installation tool to be made up prior to running casing).
	(3)	Land casing on 18 5/8" pack-off unit and establish circulation.
	(4)	Carry out cementation as programmed. Bump plugs with 2000 psi and hold for 15 minutes. Check floats are holding.
	(5)	Release running tool and flush connector and wellhead clean. Recover handling string. Flush through kill and choke lines. Displace riser with sea water.
	(6)	Observe well, disconnect, and pull riser with low pressure BOP stack.
12 1/4" hole	(1)	Pressure test 13 5/8" 10,000 psi. BOP stack at surface to full working pressure prior to running.
	(2)	Function test all controls from driller's and remote panels.
	(3)	Run 13 5/8" 10,000 psi. BOP stack with 13 5/8" 10,000 psi. Autolock connector on 16" marine riser. Test kill and choke lines whilst running. Latch BOP connector on 13 5/8" hub using riser tensioners. Apply 50,000 lbs overpull to check connector latched.
	(4)	Nipple up surface lines. Run cemention log.
	(5)	Test BOP connector rams and sideline valves to 10,000 psi, annular preventor to 5000 psi (continue weekly test of BOP and surface lines as per section 15).
	(6)	Run and set bore protector.
	(7)	Pick up 12 1/4" BHA. Clean out to shoe. Pressure test casing to 2000 psi. Clean out to TD. Drill 3 m of new hole and circulate clean. Carry out formation leak-off test.

(8) Drill 12 1/4" hole for 9 5/8" casing

(9) Condition hole and log as required.

9 5/8" Casing

(1) Recover 13 3/8" bore protector.

(2) Run 9 5/8" casing as programmed. Casing hanger assembly and installation tool to be made up prior to running casing.

(3) Land 9 5/8" casing in 13 5/8" wellhead body. Establish circulation.

(4) Cement casing in two stages as per programme. Bump plugs with 3000 psi and hold for 15 minutes. Ensure floats are holding.
Release running tool. Flush connector and wellhead body clean. Flush through kill and choke lines.
Spot 10 bbls water. Recover handling string.

(5) Run and set 9 5/8" 15,000 psi pack-off unit. Run test plug and test mandrel on Grade S drill pipe. Close pipe rams, fill handling string and vent to atmosphere. Test pack-off unit to 10,000 psi maximum. Test pressure to be taken up in increments of 1000 psi to 7000 psi and then increments of 500 psi. Leaks past pack-off have collapse effect on 9 5/8" casing string.

(6) Observe well static. Displace riser to sea water and observe well.

(7) Disconnect and pull marine riser and 13 5/8" 10,000 psi BOP stack.

8 3/8" Hole

(1) Pressure test 11 inch 15,000 psi stack at surface to full working pressure

(2) Function test all controls from driller's and remote panels.

(3) Run 11 inch 15,000 psi. BOP stack with 13 5/8" 10,000 psi. Autolock connector on 16" marine riser. Test kill and choke lines whilst running. Latch 13 5/8" connector onto wellhead using riser tensioners. Care must be taken not to damage extended neck of 9 5/8"

pack-off unit. Hanger pack-off extension provides seal for 13 5/8" 10,000 psi to 11 inch 15,000 psi cross-over.

(4) Apply 50,000 lbs overpull to ensure connector is locked.

(5) Nipple up surface lines. Run cemention log.

(6) Run 9 5/8" test plug and test cross-over to 15,000 psi. Ensure test mandrel and grade S drill pipe used for test.

(7) Test BOP rams and side line valves tc 15,000 psi. Annular preventors to 7000 psi. (Continue weekly tests of BOP and surface lines).

(8) Run and set 9 5/8" bore protector.

(9) Pick up 8 3/8" BHA. Clean out to T.D. Test casing to 3000 psi after drilling DV's and prior to drilling out shoe. Drill 3 m of new hole. Circulate clean. Carry out leak-off test.

(10) Drill 8 3/8" hole to 7" liner depth. Maintain trip speeds at rates to control swab and surge pressures. When tripping in break circulation at 1000 m intervals. Prior to each trip circulate bottoms up and knock out any gas cut mud. Observe well static prior to and during trips.

(11) Condition hole and log as required.

A detailed 7" liner running/test programme will be issued at this time.

6" Hole

(1) Pick up 6" BHA. Clean out to TD. Drill 3 m of new hole. Circulate clean. Carry out leak-off test.

(2) Drill 6" hole to TD. Maintain trip speeds at rates to control swab and surge pressures. When tripping in break circulation at 1000 m intervals. Prior to each trip circulate bottoms up and knock out any gas cut mud. Observe well static prior to and during trips.

(3) Condition hole and log as required.

A detailed liner running/test programme if necessary will be issued at this time.
This will be followed by abandonment/suspension procedures.

NOTE: Supplementary detailed cementing programmes will be issued as required.

SECTION 6

POSSIBLE DRILLING PROBLEMS

Shallow Gas

A recent rig site survey was made to investigate the possibilities for shallow gas in the area of the location. The survey disclosed several areas encompassing course porous deposits 240 to 285 m below sea bed that may contain gas. The actual drilling location does not coincide with one of these areas.

It is however, understood that all precautions will be taken regarding the possibility of striking a shallow gas deposit.

17 1/2" Hole

No significant drilling problems are anticipated in the 17 1/2" hole section. Drilling rates may need to be controlled from the 18 5/8" shoe to ca. 1550 m. A slight pore pressure increase is expected around 1650 m which will necessitate a mud weight increase as programmed in order to avoid tight hole and any unnecessary reaming. Torque and penetration rates may become very erratic through the lower Eocene and Paleocene section, the latter of which may contain hydrocarbons.

Below the top of the Cretaceous at ca. 2355 m. The pore pressure is expected rise and at the point where the 13 3/8" is to be set should be in the region of 1.25 SG

12 1/4" Hole

The pore pressure will continue to rise below the 13 3/8" shoe, with a corresponding increase in mud weight programmed to control this. Gas levels may increase through this section due to the occurrance of limestone stringers. The ROP should show a steady decline after the pore pressure transition has been drilled and it is expected that a turbine and diamond bit will be utilized below 2800 m.

Towards the base of the cretaceous and the TD of this hole section another pore pressure rise is anticipated. Well kicks have occurred from the Turonian limestones below 3600 m on previous wells in this area and a careful watch must be kept on all hole conditions.

8 3/8" Hole

The pore pressure is expected to increase rapidly through the Upper Jurassic shales to an anticipated high of 2.01 SG at the top of the Middle Jurassic, or Brent sand. A mud weight of 2.05 SG is programmed through this inerval.

Extreme care will be required in this section to avoid potential gain/loss situations. Trip speeds must be controlled to prevent excessive swab and surge pressures. Mud properties must be handled carefully to avoid excessive ECD values. Circulation should be established at least every 1000 m while running in the hole to break gels prior to reaching TD. Circulating full bottoms up prior to a bit change will ensure that any gas is off bottom before a trip. This will also allow gas in the mud to be evaluated for pore pressure increases.

6" Hole

With the Brent sands cased off there should be no significant problems drilling to TD. Pore pressures are still high, however, and may show unexpected variations. A diamond bit and turbine are again to be utilized over this section, and varying rates of penetration are expected through this interbedded sequence.

SECTION 7

MUD PROGRAMME

Introduction

It is proposed to use a seawater Gyp/Lignosulphonate system to drill the 17 1/2" hole section, with prehydrated bentonite as a base. Gypsum will be allowed to deplete in the 12 1/4" section with increasing concentrations of Lignosulphonate and Lignite with depth. Additions of Sulphonated resin may be necessary below 3000 m to tighten filtration control.

This system will be maintained to T.D. with increased concentrations of Lignite, Lignosulphonate and resin as hole conditions dictate.

36" Hole

Drill with seawater. Flush hole as necessary with viscous pills. Displace hole prior to running 30" casing with high viscosity mud (100 sec/qt).

Should viscous mud prove insufficient to stabilize the well bore, before running 30" casing a heavy weight pill may be spotted to help reduce fill and/or bridging problems.

Weight - maintain at minimum
Viscosity - 100 sec/qt.
Fluid loss - N.C.

24" Hole

Drill with prehydrated bentonite/seawater mud with returns to surface. The weight should be maintained to a minimum using the solids control equipment.

The hole should be flushed with high viscosity prehydrated bentonite prior to running the 18 5/8" casing, in order to help clean the hole.

Weight - 1.06 - 1.10 SG
Viscosity - 100 sec/qt.
Fluid loss - N.C.

17 1/2" Hole

A Gypsum/Lignosulphonate system will be used in this section, using prehydrated bentonite as a base. The mud should be run as a non-dispersed system for as long as possible, until it is eventually necessary to disperse the system due to solids build up and the need to weight up.

Weight - 1.10 - 1.40 SG
Viscosity - 40 - 60 sec/qt.
Fluid loss - 10 - 15 cc.

12 1/4" Hole

This section will be drilled using the existing mud system as a base. The gypsum content should be allowed to deplete naturally. As temperature increases additions of CMC LV should be discontinued and additions of Lignite made to stabilize rheology and reduce HP/HT fluid loss.

Should hole conditions require greater control towards the base of this section a sulphonated resin should be used in the presence of 200 - 300 ppm calcium for optimized effect.

Weight - 1.40 - 1.76 SG
Viscosity - 40 - 55 sec/qt.
Fluid loss - 6 - 14 cc.

8 3/8" / 6" Hole

This section will be drilled with the existing system. It will be necessary to increase concentrations of Lignite and Lignosulphonate to control HT/HP fluid loss. Additions of sulphonated resin as described above will further improve rheology. Careful control of mud properties is necessary, especially yield point and gel strengths, to avoid losses due to high E.C.D. and surge pressure.

A mud weight reduction below the initial value of 2.04 - 2.05 SG will be possible below the 7" liner enabling easier control of rheology.

Weight - 2.05 - 2.00 SG
Viscosity - 45 - 55 sec/qt.
Fluid loss - 4 - 8 cc.

SECTION 8

CEMENTING PROGRAMME

The following cementing volumes are based on programmed casing setting depths and are to be used as a guide only to volume requirements.

Excesses have been estimated as below but will be confirmed on site from wireline logs where available.

30"	200%
18 5/8"	100%
13 3/8, 9 5/8 and 7"	50%

Slurry design for each section will be verified from laboratory tests carried out by the cementing company prior to each job.

The test data will confirm the slurry blend (additive requirements), density, yield, thickening times, compressive strength and rheological data to calculate displacement rates. This data will be forwarded to the rig site from the Mariero drilling office together with a recommended cementing programme and chemical requirements.

Cementing details

30" Conductor (281 m BKB)

The conductor is to be cemented to sea bed with class G plus extender at 1.62 SG and tailed in with class G plus accelerator at 1.87 SG. The tail-in slurry will cover 20 linear metres in the36"/30" annulus and leave 10 m minimum inside the 30" conductor.

Allow 200% excess for hole washouts.

Estimated volumes of cement

a) Lead slurry 1450 SXS (62 MT)

b) Tail slurry 550 SXS (23.5 MT)

18 5/8" Casing (1 125 m BKB)

The 18 5/8" casing is to be cemented to sea bed with class G plus extender at 1.62 SG and tailed in with class G neat at 1.90 SG. The tail-in slurry will cover 50 linear metres in the 24"/18 5/8" annulus.

Ensure displacement mud is of sufficient density to prevent casing collapse. This will be checked in the office and offshore.

Allow an excess of 100% on open hole calculated volumes.

Estimated volumes of cement

a) Lead slurry 4500 SXS (192 MT)

b) Tail slurry 420 SXS (17.9 MT)

13 3/8" Casing (2550 m BKB)

The 13 3/8" casing will be cemented in two stages with the stage collar set at 100 m $\pm$ below the 18 5/8" shoe. The first stage will be cemented with class G plus extender at 1.62 SG to 100 m below the the stage collar and tailed in with class G neat at 1.90 SG. The tail-in slurry will cover the top of the Frigg sand estimated to be at 1830 m BKB.

The second stage will be cemented with class G plus extender at 1.62 SG to at least 200 m above the 18 5/8" shoe. Ensure that the total cement hydrostatic pressure does not exceed the fracture pressure for both stages of the cemention.
Actual volume of cement to be based on hole size from calliper logs.

Estimated volumes of cement
(allowing 50% excess on calculated open hole volumes)

First stage

a)	Lead slurry	935 SXS	(40 MT)
b)	Tail slurry	2337 SXS	(99.9 MT)

Second stage 482 SXS (20.6 MT)

9 5/8" Casing (3670 m BKB)

The 9 5/8" casing will be cemented in two stages with the stage collar set 100 m $\pm$ below the 13 3/8 shoe. The first stage will be cemented with class G neat at 1.90 SG to 100 m below the stage collar.

The second stage will be cemented with class G plus extender at 1.78 SG to a maximum of 500 m below the sea bed.

Ensure that the total cement hydrostatic pressure does not exceed fracture pressures or drop below pore pressures.

Actual volume to be based on hole size from calliper logs.

Estimated volume of cement
(allowing 50% excess on calculated open hole volume)

First stage - 1205 SXS (51.5 MT)

Second stage- 1650 SXS (70.5 MT)

7" liner (4110 m BKB)

The 7" liner will be cemented over its entire length with densified class G cement at 2.10 SG.

Volume of cement to be based on hole size from calliper logs.

Estimated volume of cement
(allowing 50 % excess on calculated open hole volumes)

- 290 SXS (12.3 MT)

SECTION 9

FORMATION LEAK-OFF TESTS

The purpose of the leak-off test is to obtain an accurate fracture gradient below the casing shoe. This data is used to determine maximum casing setting depths, maximum mud weights for the next section of hole and alternatives to be used during critical well control operations.

After drilling out each string of casing, except the 30", the formation below the shoe will be subjected to a pressure test. This test is primarily designed to check the cement bonding of the shoe to the formation. The value obtained from this test should be at least equal to the anticipated fracture gradient. If the exposed formation or cement will not hold this value, then the casing shoe may need to be squeeze cemented. However, it should be noted that if a permeable formation is drilled after a test has been carried at the casing shoe then the leak-off pressure obtained may no longer be valid, and another test should be carried out.

General Procedures

Shoe bond/formation strength test

Drill out cement and shoe. Drill three metres of new hole. Circulate and condition mud and hole to ensure the mud is at stable weight. Pull back into the casing and close a BOP.
Record the following:-

(a) Casing shoe depth - metres
(b) Drilled depth - metres
(c) Mud weight in hole - S.G.

Using the cementing unit, pump at a slow steady rate (maximum of 1/2 bbl/min). Use chart recorder and accurate gauge to measure pressure. During the test make a plot of pressure versus barrels pumped.

If cement pump is inoperative an acceptable test can be done with a triplex mud pump (where drilling effiency is known), by pumping a few (3/5) strokes at

a time then recording the pressure. A graph of strokes versus pressure can be plotted.

When the leak-off point has been reached, i.e. where the plot begins to deviate from a straight line, stop pumping.
Record the pressure at the leak-off point and the volume of mud pumped.
Bleed off and record the volume of mud returned.

Pressure limitations

Depending on the depth and the anticipated maximum mud weight to be used, the tests will be to leak-off point. However, casing burst pressure and previous casing test pressure must not be exceeded.

Calculations

(a) Minimum test pressure, P_{Tmin}, for projected mud weight (Mp) in next section of hole.

$$P_{Tmin} = Dd \times 1.421 \ (Mp - Mh)$$

(b) For casing burst considerations, maximum allowable pressure

$$P_B = P_{Burst} - D_s \times 1.421 \ (Mh - Ma)$$

From the test results the following is calculated

(a) Maximum mud weight that can be used in open hole (S.G.)

$$M_{Max} = \frac{P_{Test}}{D_d \times 1.421} + Mh$$

(b) Assumed fracture gradient of formations at test depth (psi/ft)

$$FG = M_{Max}\ 0.433$$

(c) Maximum Depth, D_{max}, of open hole that can be drilled using mud of density of Mh

$$D_{max} = D_s \times \frac{(M_{max} \times 0.433 - 0.1)}{(Mh \times 0.433 - 0.1)}$$

Nomenclature

P_{Tmax}	=	Maximum test pressure	psi
P_{Tmin}	=	Minimum test pressure	"
P_B	=	Maximum test pressure for burst consideration	"
P_{Burst}	=	Burst rating of casing	"
P_{Test}	=	Gauge pressure at leak-off from test	"
D_S	=	Depth of casing shoe (TVD)	metres
D_d	=	Vertical depth at which leak off is occuring (if unknown assume DS)	"
D_{max}	=	Maximum depth of open hole (TVD)	"
Mh	=	Weight of mud in hole	S.G.
Ma	=	Weight of mud in annulus	S.G.
Mp	=	Projected mud weight for next section of hole	S.G.
M_{max}	=	Maximum mud weight for next section of hole	S.G.
FG	=	Fracture Gradient	psi/ft.

SECTION 10

HOLE DEVIATION

Reference is made to Parts 6.1.1 - 6.1.3 of the Operations Manual.

Stabilization will be used to maintain the well bore as straight as possible.

Deviational surveys utilising magnetic single shot equipment will be taken from the shoe of the 30" conductor to T.D. at intervals not exceeding 90 m (300 ft.) or on bit changes where practical. The overriding provisions are that the integrity of the well bore is maintained and the safety of the drilling string is not jeopardised.

Back up information will be available from wire line logs and if deemed necessary from multishot surveys run in either open or cased hole.

SECTION 11

PRESSURE DETECTION

The rig will be provided with a full mud logging/drilling technology service. The unit will be installed and operative from the drilling out of the 30" conductor. Normal services will include the compilation and plotting of "d" exponent, "dcs" exponent, fracture gradient, temperature gradient programmes and evaluation of same for abnormal pressure. Control for the programmes will be obtained from actual data obtained from the previous wells drilled in the 30/4 area.

Specification of this service can be found in the Operations Manual, Section 8.1.

SECTION 12

WELL LOGGING PROGRAMME

1. 24" OPEN HOLE

ISF/BHCS/GR/SP	- with GR to seabed.

2. 17 1/2" OPEN HOLE

ISF/BHCS/GR/SP/CAL/MSFL

3. 12 1/4" OPEN HOLE

ISF/BHCS/GR/SP/CAK/MSFL	
CST	- as required
RFT	- as required

4. 18 5/8", 13 3/8" AND 9 5/8" CASED HOLES

Temperature log	- as required

5. 8 3/8" OPEN HOLE

ISF/BHCS/GR/SP
FDC/CNL/GR/CAL
DLL/MSFL/CAL/GR
HDT
RFT
CST

6. 7" CASED HOLE

CBL/VDL/GR/CCL

7. 6" OPEN HOLE

ISF/BHCS/GR/SP
FDC/CNL/GR/CAL
DLL/MSFL/CAL/GR - as required
HDT
Seismic
RFT
CST

SECTION 13

FORMATION TESTING

Cased hole testing may be required to evaluate any Jurassic or Triassic reservoirs.

If testing is required a detailed programme will be issued after evaluation of the cores and logs. Testing procedures will be in accordance with part 9 of the BP Operations Manual, "Drill stem testing regulations and procedures".

SECTION 14

ABANDONMENT/SUSPENSION OF THE WELL

The abandonment or suspension of the well will be carried out in accordance with the regulations as described in Section 25 of the "Regulations for Drilling for Petroleum" issued by the Norwegian Petroleum Directorate.

A specific programme will be prepared and submitted to the Norwegian Petroleum Directorate when the well has reached T.D. and/or after the evaluation of any reservoir/s.

SECTION 15

BOP SPECIFICATIONS & TESTS

(a) LOW PRESSURE BOP STACK

One 21 1/4", 2000 psi. W.P. sub sea stack comprising from top to bottom:-

One Regan riser adapter 21 1/4" x 24"
One Regan Pressure balanced ball joint
One 2000 psi. working pressure Shaffer spherical BOP
One 2000 psi. working pressure National "Auto-lock" riser connector
One 2000 psi. Cameron "Double U" BOP, shear rams in the upper cavity and 5" pipe rams in the lower cavity, c/w wedge locks and two 4 1/8" outlets below each ram cavity.
One 21 1/4" x 2000 psi. W.P. National "Auto-lock" wellhead connector.

Choke Valves

Two each 4 1/8" x 2000 psi. W.P. Cameron type 'F' gate valves c/w Cameron type 'A' 3000 psi. operators.

Sub Sea Accumulator Bottles mounted on Stack

Twelve 10-gallon accumulator bottles.

(b) 10,000 PSI WORKING PRESSURE STACK

One 13 5/8" x 10,000 psi. W.P. sub sea BOP stack comprising from top to bottom:-

One Regan riser adapter 13 5/8" x 24"
One Regan Pressure balanced ball joint
One 13 5/8" x 10,000 psi. Shaffer spherical BOP
One 13 5/8" x 10,000 psi. National Auto-lock riser connector
One 13 5/8" x 10,000 psi. Shaffer Spherical BOP
Two 13 5/8" x 10,000 psi. Cameron "Double U" BOPs with wedge locks rams to be placed in the following positions from 'top to bottom':

Blind Shear Rams
5" Pipe Rams
5" Pipe Rams
Blind Rams

Each preventor to have two 3 1/8" x 10,000 psi. W.P. outlets below each ram cavity.

One 13 5/8" x 10,000 psi W.P. National Auto-lock wellhead connector.

Choke Valves and Kill Valves

Two each 3 1/8" x 10,000 psi W.P. Cameron type 'AF' c/w fail safe operators.

Choke and Kill Lines

Two 3 1/2" O.D. (0.500" wall) 10,000 psi W.P. choke and kill lines integrally installed on marine riser.

Choke and Kill Line Connections

Two 3" bore, 10,000 psi W.P./ 15,000 psi test goosenecks complete with termination subs for top connection to kill and choke lines.
Two 3 1/2" O.D. 2 3/4" I.D., 10,000 psi W.P./ test 15,000 psi coflexip hoses for connecting kill and choke lines to choke manifold.

Sub Sea Accumulators

Eleven 10-gallon accumulator bottles mounted on stack.

(c) 15,000 PSI WORKING PRESSURE STACK

Riser adapter with Regan type CR-1 ball joint nominal 16".

One x 11" x 10,000 psi Hydril type 'GK' annular preventor.
One x lower riser connector 13 3/8" tapered auto-lock.
Two 11" x 15,000 psi W.P. Cameron 'Double U' BOPs.
Rams to be placed in following positions from top to bottom:

Blind Shear Rams
5" Pipe Rams
3 1/2 " Pipe Rams
5" Pipe Rams

One well head connector 13 5/8" auto-lock.

Four Cameron type AF 2 9/16" x 15,000 psi failsafe valves.

Sub-sea Accumulators

Eleven 10-gallon accumulator bottles mounted on stack.

Choke- and Kill Lines

Two 3"OD (2 1/2 "ID) 15,000 psi WP. choke and kill lines intergrally installed on marine riser.

Choke- and Kill Line Connections

Two 15,000 psi W.P./22,500 psi test goosenecks complete with termination subs for top connections to kill and choke lines.
Two 2 1/2" ID 15,000 psi W.P./22,500 psi test coflexip hoses for connecting kill and choke lines to choke manifold.

Diverter

For drilling pressured shallow gas sands.
Diverter system complete with panel and controls that can divert kick to either side of rig.

Hydraulic BOP Control System

One Koomey 3,000 psi W.P. 500 gallon capacity system. Thirty 15-gallon bottles mounted on the accumulator unit with an additional interconnected skid containing twenty two eleven gallon bottles. This unit has three 50:1 ratio air driven pumps, one electrically driven 3,000 psi W.P. Triplex pump with 60 H.P. motor.

Master Control Panel

Located at drillers position with controls for all subsea functions.

Mini Remote Panel

Located in toolpushers office with functions as above.

Hydraulic Control Pods

Two model RHCH-13-11-8 Hydraulic control pods with 100 % redundancy.
Two 1200 ft. lengths hydraulic control hoses for BOP functions.

Choke and Kill Manifold

One 10,000 psi W.P. service 3" nominal choke and kill manifold complete with two manual adjustable chokes and two Cameron remote operated chokes.
One x Cameron choke manifold as above for 15,000 psi W.P.

BOP Equipment for Drill String

Two upper kelly cocks 5000 psi W.P.
Two lower kelly cocks 5000 psi W.P.
Two inside BOPs each for 5" D.P.
One hydril drop in valve complete with subs for 5" string.

TESTING PROCEDURES

Reference is made to Part 7 of the 'Operations Manual' for the Company's general policy on BOP testing procedures and other testing requirements.

The following procedures are specific for this well.

(a) The BOP stacks will be pressure tested at surface to full working pressures and held for 15 minutes.

(b) The BOP stacks will be pressure tested when installed on the wellhead body, and prior to any drill stem testing, to full working pressures and held for 15 minutes.

(c) The BOP stacks will be pressure tested weekly or on nearest trip out of hole and the following test pressures will be applied:-

(1) 21 1/4" 2000 psi stack - rams to 500 psi, annulars to 500 psi see Note (1).
(2) 13 5/8" 10,000 psi stack - rams to 7500 psi, annulars to 5000 psi
(3) 11", 15,000 psi stack - rams to 10,000 psi, annulars to 6000 psi.

Function testing of the stack on trips should be carried out as per NPD regulations.

Note (1): Collapse rating of 18 5/8" casing is 630 psi. If cementation is good, cement will be in vicinity of 18 5/8" hanger giving very little liquid volume to compress in case of leaking pack-off. Pressure tests are therefore limited to 500 psi.

Function Testing of Blow-Out Preventors

Reference is made to Section 44, paragraphs 2 and 3 of Norwegian Petroleum Directorate Regulations.

2) Function test of the ram type preventors shall be carried out once each trip. Pipe rams shall be function tested at least once each day. Function test of the bag type preventor shall take place on the drill pipe once a week.

3) Function testing as mentioned in paragraph 2 shall alternately be operated from the different control panels.

SECTION 16

WELL CONTROL PROCEDURES

Reference is made to the 'Operations Manual' which gives specific company policy on the following:-

Part 8 - Well Control Procedures

Section 8.1 Pressure Detection
Section 8.2 Safety Drills
Section 8.3 Well Kick Control Procedures
Section 8.5 Well Killing Procedures

SECTION 17

SAMPLING AND REPORTING REQUIREMENTS

Sampling Requirements

All samples are to be collected, packaged and despatched in accordance with the standing instructions in the Operations Manual, Part 12. Specific instructions are as follows:-

(A) Bit Cuttings. The maximum intervals permissible for collecting samples are:-

i) from first returns to 3000 mss - 10 m interval.

ii) from 3000 mss to 9 5/8" casing point - 5 m interval.

iii) from 9 5/8" casing point to TD - 3 m interval.

The sampling interval may be reduced in any part of the section at the discretion of the rigsite geologist. Samples of bit cuttings at the specified intervals are to comprise:-

i) one set of washed cuttings for the use of the rigsite geologist.

ii) three washed and dried sets prepared at the rigsite, one of which is to be marked "Oljedirektoratet".

iii) a bulk sample suitable for a 12-way split.

iv) a bulk sample for the NPD, packed in accordance with the Operations Manual, Section 12.3.3.

v) a bulk sample for Statoil of approx. 1/2 kg. collected in canvas bags and labelled "Statoil".

(B) Cuttings samples for Palaeontology. The samples are to be collected from first returns to TD at a maximum interval of 10 m.

(C) Cuttings samples for geochemical studies. Canned samples are to be collected at 30 m intervals as per standing instructions from 1.200 m to TD.

(D) Sidewall cores. Sidewall cores are to be taken after the 17 1/2", 12 1/4", 8 3/8" and TD. Logging runs at the discretion of the well site geologist. Samples will be required for reservoir and reservoir fluid studies and palaeontological, geochemcial and lithological control. One set of palynology/kerogen/micorpalaeontology slides from sidewall cores are to be prepared for NPD.

(E) Full hole cores. Conventional cores are to be cut in the anticipated reservoir section and at any point where an unexpected reservoir is encountered. Detailed instructions are as follows:-

i) Middle Jurassic. The Middle Jurassic sandstones are to be cored irrespective of hydrocarbon shows. If water bearing, one 60 ft core will be taken. Core will be continuous whilst hydrocarbons are detected. One aquifer core is to be cut below any hydrocarbon/water contact.

ii) Lower Jurassic. The Lower Jurassic is also to be cored if hydrocarbons are encountered. Coring will be continuous whilst hydrocarbons are detected. One aquifer core is to be cut below any hydrocarbons/water contact.

iii) Unprogrammed Coring. If any interval is encountered in which a hydrocarbon bearing reservoir is indicated, then it is to be cored throughout. One aquifer core is to be cut if justified be a significant thickness of overlying reservoir sand.

(F) Fluid Samples

i) Mud samples are to be collected every 500 m throughout the hole except

a) while coring, when a maximum interval of 10 m is to be used; and

b) below the 9 5/8" shoe when a maximum interval of 25 m is required.

ii) Reservoir fluid samples will be collected in accordance with Section 12.3.3.2 of the Operations Manual and as detailed in the programme issued prior to formation testing. Statoil and NPD fluid sample requirements will also be specified in the test programme.

iii) Samples. One set each of dried cuttings samples and unwashed samples will be despatched by the BP Stavanger Offices on completion of the well.

Norwegian Petroleum Directorate

i) Daily telex. This will be sent by the BP Stavanger Office to:-

F. Aamodt/T.S. Ølberg - telex no. 33100 noped n

ii) Logs. The following logs will be sent by the BP Stavanger Office:

a) 1 sepia and 1 paper print of each Schlumberger log,

b) 1 sepia and 1 paper print of each mud log,

c) 1 sepia and 1 paper print of the litholog.

The addressee is:-

F. Aamodt/T.S. Ølberg
Norwegian Petroleum Directorate
Lagårdsveien 80
P.O. Box 600
4001 STAVANGER

Reporting Requirements

BP

i) Daily telex. A 24 hour report on all operational and geological data is to be sent from the rig to BP Stavanger Offices. The geological telex is to be coded:-

a) below 9 5/8" casing shoe,

b) at any additional time when hydrocarbons are encountered or requested by Operations Geologist.

ii) Logs. All origial films, either Schlumberger or other logs, are to be sent ashore at the first opportunity in order that sepias and prints may be made for rapid distribution. They should be addressed to Senior Petroleum Engineer.

Statoil

i) Daily telex. This will be sent by the BP Stavanger Office to:-

G.T. Sæland - telex no. 33211 stato n.

ii) Logs. The following logs will be sent by the BP Stavanger Office:-

a) 1 sepia of each Schlumberger log,

b) 1 sepia of each mudlog,

c) 1 sepia of the litholog.

The addressee is:-

G.T. Sæland

Statoil
Lagårdsveien 78
P.O. Box 300
4001 STAVANGER

SECTION 18

ORGANISATION

BP Petroleum Development Ltd., Norway

A) The attached organigram outlines those members of BP who will be normally associated with the drilling of well 29/6-1 and their responsibilities.

B) Register of Personnel

A register of personnel on board the drilling unit will be maintained and a daily statement will be transmitted ashore by telex giving the name and employer of each person onboard. This statement will be transmitted at 1500 hours or after the arrival of the helicopter if later than 1500 hours.

C) Personnel Movements

Details of the personnel movements by helicopter will also be maintained be retention of the outgoing and incoming passenger lists.

D) Working Hours

All personnel will work an even-time roster of duty/days off. The normal period of duty will be 12 hours per 24 hour/day.

The following plan outlines the roster schedule for Company, Contractors and Sub Contractors personnel.

BP Shore Based Personnel

Drilling Superintendent)	On call as required
Assistant Superintendent)	" " " "
Drilling Engineer)	Minimum basic 36 1/4
Geologist - P.E.)	hour/week.

BP Offshore Personnel

Drilling Representative	7/7
Drilling Engineers	As required or 7/7
Geologist	As required
Petroleum Engineer	As required

Contractor's Offhsore Personnel

Rig Superintendent	7/7
Asst. Rig Superintendent	7/7
Subsea Equipment Supervisor	7/7
Driller	14/14
Assistant Driller	14/14
Derrickman	14/14
Motorman	14/14
Floorman	14/14
Barge Marine Supervisor	7/7
Watchstander	14/14
Electrician	7/7
Assistant Electrician	14/14
Mechanic	7/7
Assistant Mechanic	14/14
Welder	14/14
Crane Operator	14/14
Roustabout	14/14
Maintenance Roustabouts	14/14
Mud Watcher	14/14
Radio Medics	14/14

Contractor's Shore Base Personnel

Rig Manager	Always available
Materials Man	5 1/2 day/week

Sub-Contractor's Personnel

Even time is continuously employed on board, e.g. Mud Logging Crew.

Others on call as required for the work in hand.

NOTE: Curriculum Vitae of Operators Offshore/Onshore Personnel and Drilling Contractor's personnel are detailed in an appendix separate to this programme.

BP PETROLEUM DEVELOPMENT LTD, NORWAY u.a.

ORGANIZATION CHART

WELL 29/6-1

SHORE BASED

OPS MANAGER
K. Dunne

EXP MANAGER
B.G.Williams

DRILLING SUPT
N.R. Booth

SEN GEOLOGIST
A. Spencer

ASST. DRILLING SUPT.
R. Smith

NSOC - N
Fire Fighting
Emergency Services
Doctors
Hospitals
Helicopter
MRCC
Police
Supply Vessels

Govt Authorities
Oil Directorate
Maritime Directorate
Other Agencies

MARINE & SAFETY
A Asbjørnsen

SUPPLY BASE & MATERIALS
G. Clutterbuck
K. Klette
S. Jensen
J. Holter-Andersen

PET ENGINEERS
N. Hares (S.P.E.)
P. Buckley
A. Svendsen
G. Scotton
T. Darre
B. Abbot
I. Garnes

DRILL ENGINEERS
B. Becker
B. Sætre
H. Norheim
N.H. Lilleløkken

RIG CONTRACTORS SHORE MANAGEMENT

OPS GEOLOGIST
P.O. Mørkeseth

MATERIALS SUPPLY AND TRANSPORT SERVICES

WELL SERVICES
Mud Engineers
Mud Loggers
Cementers
Coring
Diving
Testing
Logging

DRILL SUPERVISORS
R. Towse
C. Henderson
G. Pidcock
D. Harkness
J. Potts

CONTRACTORS RIG PERSONNEL

RIG GEOLOGISTS
B Tveiten
P. Rattey
I. Madland
R Ree

RIG BASED

DRWG. NO. 4454

SECTION 19

TRANSPORT

Reference is made to Part 2, Section 2.4.1 of the 'Operations Manual' for the Company's general policy on transport.

SECTION 20

MAIN CONTRACTORS

Drilling Unit	Sedco 707 Southeastern Drilling Services Ltd. (Aberdeen)
Drilling Contractor	Southeastern Drilling Services Ltd. (Sedco) Craigshaw Road West Tullos Industrial Estate Aberdeen, Scotland
Well Logging	To be advised
Mud Engineering	Dresser Norway A/S P.O. Box 23 4056 Tananger
Cementing	To be advised
Mud Logging	To be advised
Helicopters	Helikopter Service A/S 4033 Forus
Fixed Wing	To be advised
Weather Services	Norwegian Met. Institute P.O. Box 320 Blindern, Oslo 3
Supply Boats	Seaforth Maritime Seaforth Centre Waterloo Quay Aberdeen, Scotland Supply Service A/S Josefinesgt. 37 Oslo 3
Standby Boats	Misje & Co Bergen
R.C.V.	Sub Sea Dolphin A/S P.O. Box 63 4056 Tananger

Note Those services for which the contractor is to be advised are awaiting approval of the award of the contract.

SECTION 21

SAFETY

BP Petroleum Development Ltd., Norway U.A. recognises that its activities involve potential hazards, and it is therefore the primary and continuing policy to conduct its activities so as to prevent accidents and danger to health of its employees and to others who may be affected by them.

All Company and Contractors employees associated with the 'Drilling Programme' will adhere to the BP Petroleum Development Ltd., Norway U.A. 'Operations Manual' and 'Safety Regulations Manual'.

Because of the complexity of the operations, it is essential that the principles laid down are adhered to, thus creating the correct attitude towards safe working and the prevention of accidents.

SECTION 22

POLLUTION CONTROL

Reference is made to Part 5, Section 5.5 of the 'Operations Manual' for the company's general policy and resources on pollution.

SECTION 23

OPERATOR'S APPROVAL

The programme has been prepared by BP Petroleum Development Ltd., Norway U.A. on behalf of the partnership for Well 29/6-1.

Signed

..... Drilling Superintendent

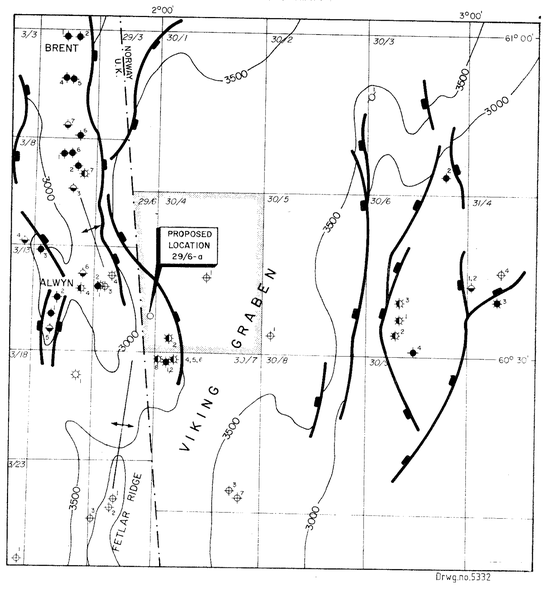
..... Exploration Manager

..... Operations Manager

..... General Manager

Stavanger, _____ (date)

LOCATION MAP



Drwg.no.5332

29/6-a GEOLOGICAL FORECAST

6711946 N 444576 E
LOCATION 60°32'17.97"N 2°23.68"E

SCALE 1:10,000

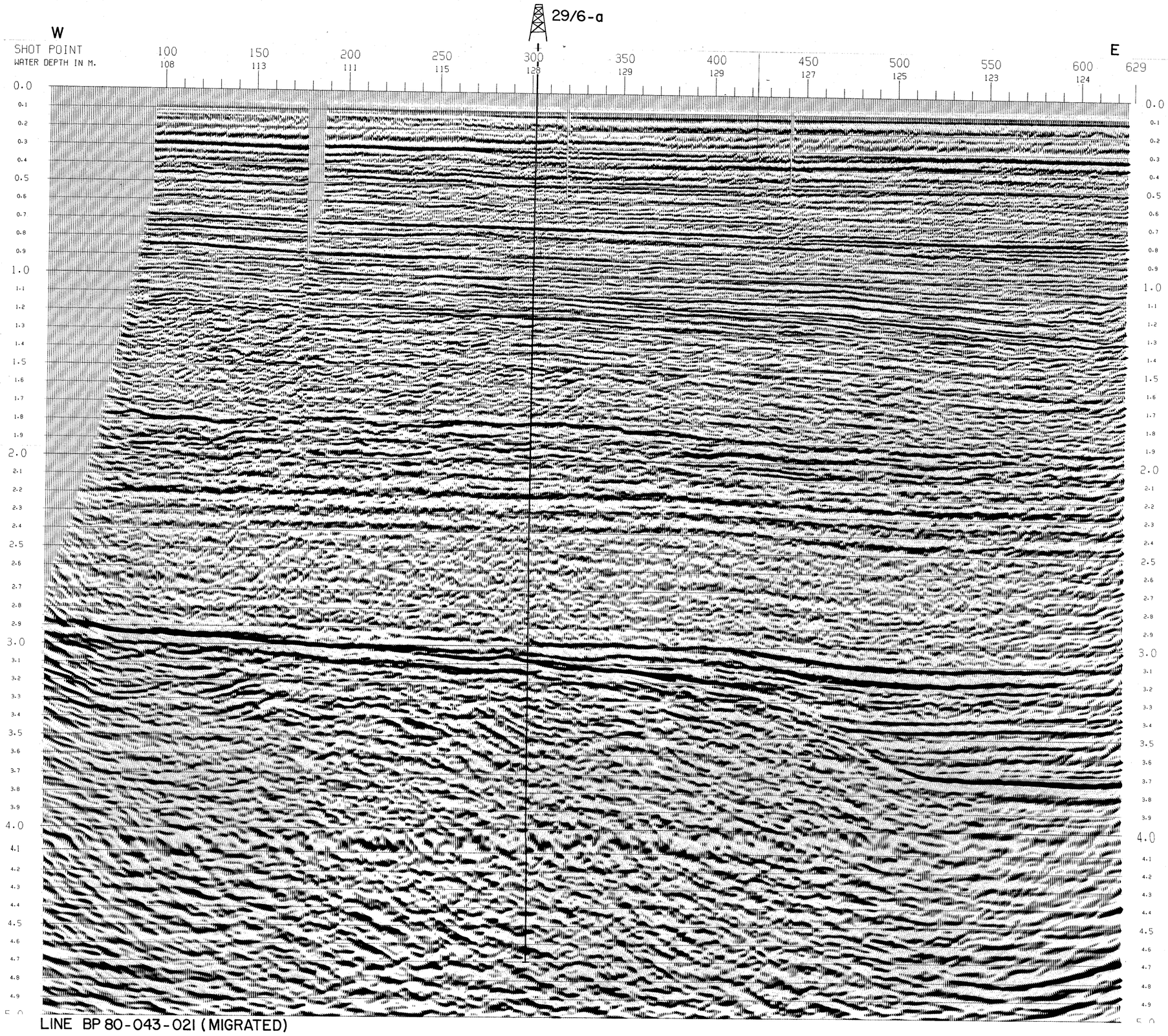
DEPTHS (metres)	Graphic Log	M&Ft	SEISMIC EVENT	LITHOLOGY	DRILLING PROBLEMS
128			SEA BED		
				SAND fine to medium grained with glauconite and shell fragments.	
				Occasional interbeds of CLAY green, soft, silty.	
				Occasional LIGNITE beds.	
				MUDSTONE grey green, soft, slightly micaceous, non calcareous, with SILTSTONE green, very argillaceous.	
				SANDSTONE very fine grained, occasional calcite cemented.	
1805			GOLDEN BROWN	MUDSTONE grey, soft with stringers of dolomitic LIMESTONE	
				SANDSTONE fine to medium grained, occasionally cemented with calcite.	
				MUDSTONE grey, occasionally variegated, tuffaceous.	
				Interbedded SANDSTONES fine to medium grained, well cemented with calcite and MUDSTONE grey, soft, calcareous.	
2330			YELLOW		
				MUDSTONE grey soft, sticky, very calcareous, silty, with stringers LIMESTONE white, buff, occasionally dolomitic, occasionally sandy.	
				Occasional DOLOMITE stringers, brown, hard.	
3610			LIGHT BLUE		
3670			RED	MUDSTONE dark grey to black, hard, calcareous, carbonaceous.	
3775				SANDSTONE medium to coarse grained, commonly micaceous, occasionally calcite cemented with interbeds of MUDSTONE grey, hard, very micaceous, carbonaceous with COAL beds.	
4035				MUDSTONE grey, hard, subfissile, with occasional beds SANDSTONE/ SILTSTONE argillaceous, micaceous.	
4315			PURPLE		
				SANDSTONE medium to coarse grained with interbeds MUDSTONE grey to grey green, hard, silty, non calcareous.	
4650				MUDSTONE red brown, soft, silty. SANDSTONE very fine to medium grained.	
				PROPOSED TD 4700mss	

TERTIARY — MONTROSE GROUP — FRIGG FM
CRETACEOUS — CHALK GP — SHETLAND GP
JURASSIC — HUMBER GP — BRENT FM — DUNLIN FM — STATFJORD FM
TRIASSIC — CORMORANT FM

OVERPRESSURING IN SHALES STARTS APPROX 2300mss

Drwg.no.5336

LINE BP 80-043-021 (MIGRATED)



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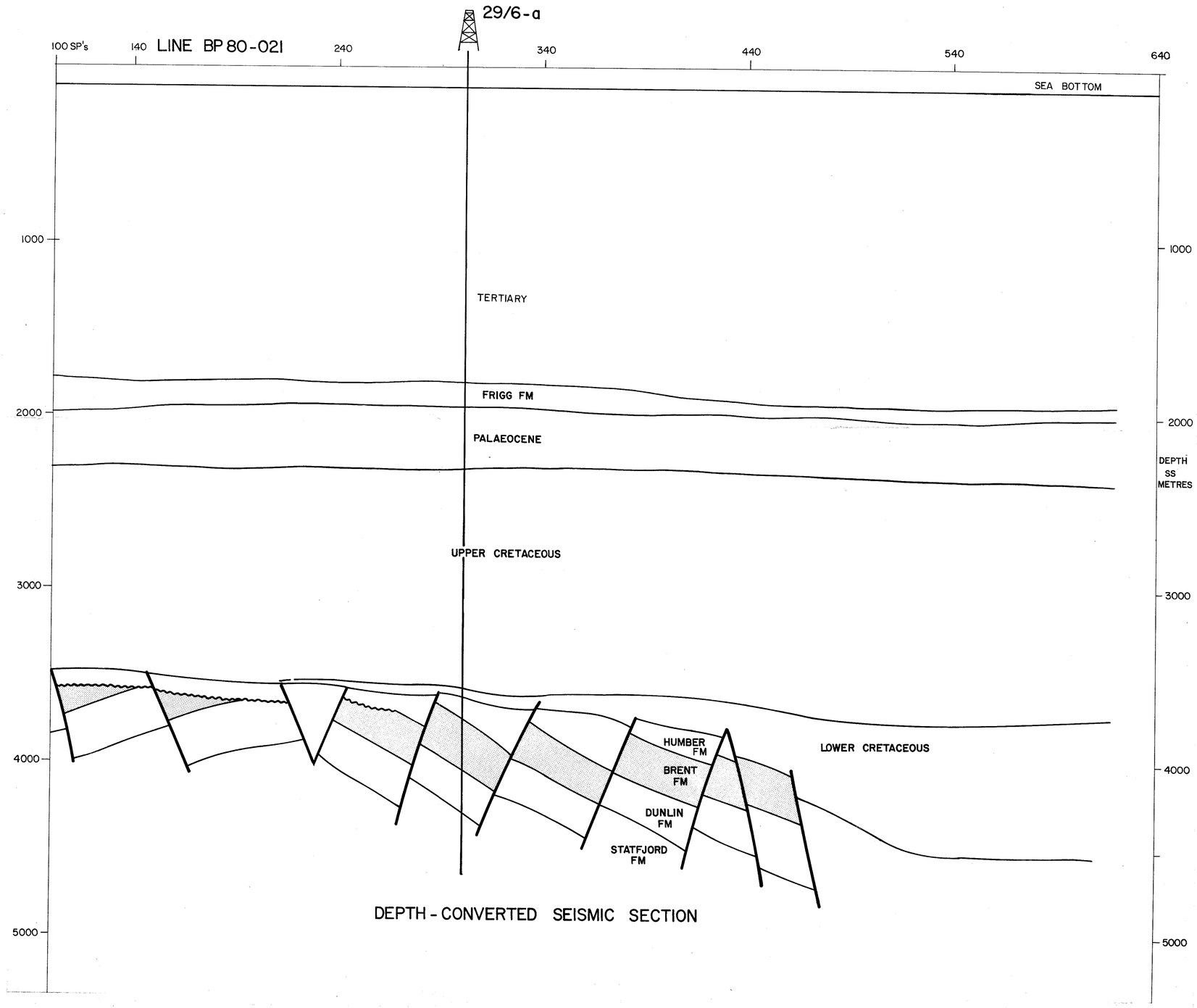

DEPTH - CONVERTED SEISMIC SECTION

UKCS NOCS 043 LICENCE

FORM MAP OF THE TOP BRENT FM.

Form lines contours on Top Brent fm derived from deeper Violet horizon

Form lines contours on Top Brent fm erosional surface, derived from shallower Red horizon

Subcrop of Brent fm at erosional surface in Upper Jurassic

GWC approx 3220ms in 30/4-2, 30/7-6 and 3320ms in 30/7-8

LINE OF SECTION

29/6-a

30/4-2

30/7-6

30/7-8

1: 25,000

0 MILES

0 2 KILOMETRES

UKCS NOCS 043 LICENCE

TIME CONTOURS ON THE VIOLET HORIZON TOP STATFJORD FM.

LINE OF SECTION

29/6-a

30/4-2

30/7-6

30/7-8

Trend of collapsed anticline

ENCL. 1

BP PETROLEUM DEVELOPMENT LTD, NORWAY	
LICENCE 043,β PROSPECT	
PROSPECT MONTAGE 29/6-a DRILLING PROPOSAL	
Ref: 29/6-a/W20	Datum:
Author: Dalton/Ward	Scale:
Date: Sept. 1981	Drg No: 5630.