

PL 940 Lapse Report



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1 History of the production licence

Summary

PL 940 (Figure 1.1) was awarded as part of the APA 2017 licence round on the 2nd of March 2018. The initial period was set to 7 years (1+2+2+1+1), of which the first decision, reprocess seismic or drop, was 2nd of March 2019. A three month extension was applied for in February 2019 and granted by OED 12th of April 2019.

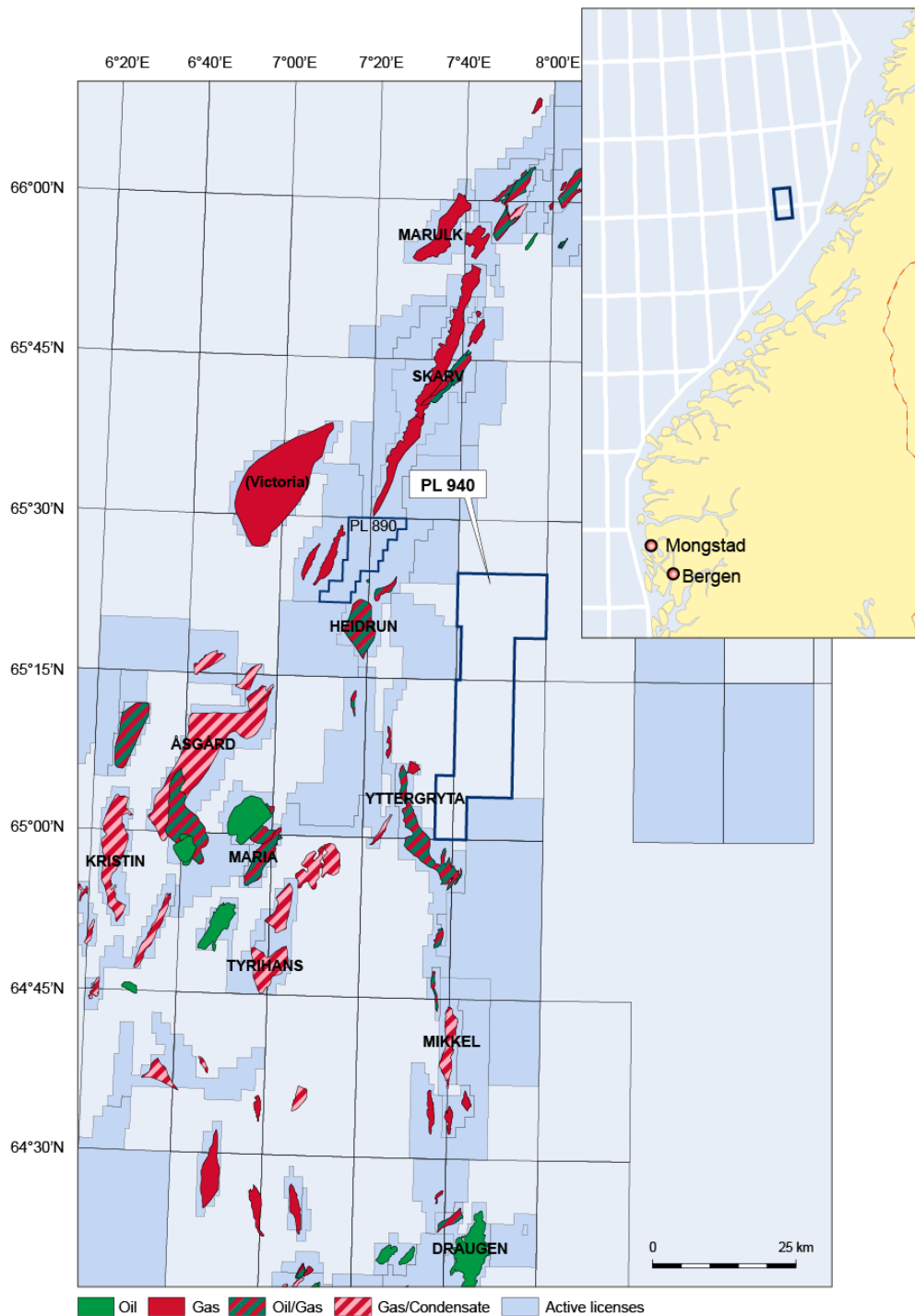


Figure 1.1 PL 940 location map
Part of blocks 6507/9, 6507/11 and 6507/12

The licence had 1 year G&G work to derisk the charge risk into the Brimse prospect. Based on licence work, the migration is not derisked, and the partnership unanimously decided to let PL 940 lapse in regards to the reprocess seismic or drop decision by 2nd of June 2019.

Participants

Suncor Energy Norge AS, with 60% equity, is operator of the licence with partner OMV (Norge) AS, with 40% interest.

Work Commitment

The work commitment of G&G studies to derisk charge has been fulfilled.

Meetings held

MC meetings were held at least once and EC meetings twice a year, in accordance with JOA article 2.1. These meetings were combined ECMC meetings and in addition EC work sessions were organised. Below is a list of the meetings held during the licence term:

1. ECMC start-up meeting on 05/04/2018 at Suncor office in Stavanger
2. ECMC meeting on 03/10/2018 at Suncor office in Stavanger
3. Work meeting regarding seismic data quality on 18/10/2018 at Suncor office in Stavanger
4. EC workshop on 04/02/2019 at Suncor office in Stavanger

Reasons for licence lapse

The migration into Ellingråsa Graben and the Brimse prospect was reevaluated based on geological studies. To explain lack of HC accumulation in the 4-way closure located near the wet 6507/12-1 well, structural reconstruction was performed. No significant structural changes through time along potential HC migration routes to the Brimse prospect were observed. Most likely Middle/Upper Jurassic migration path to the Brimse prospect would be through the wet 6507/12-1 well. Fluid inclusion proves some migrated hydrocarbons in 6507/12-1, however no paleo-accumulation. This could indicate limited charge or top/lateral seal failure. Based on these cumulative observations, the migration is not derisked and the recommendation is to drop the licence.

No secondary prospectivity is observed.

2 Database overview

2.1 Seismic data

The seismic data, HT07 and all underlying 3D datasets for PGS Megamerge used for G&G studies, are public. In the northern part of the licence, where there are no 3D seismic coverage, public 2D data is used (Table 2.1 and Figure 2.1).

Table 2.1 PL 940 seismic database

Seismic Survey	NPDID	Survey Type	Survey Year	Company-responsible	Processing	Status	Comments
HT07	4440	3D	2007	Fugro-Geoteam AS	PSTM	Multi-client	Full stack
PGS MegaSurvey	-	3D	¹⁾	PGS Geophysical AS	PSTM	Multi-client	Full stack
HTE99	3982	2D	1999	Geoteam Exploration AS	PSTM	Multi-client	Full stack
HTM99	3983	2D	1999	Geoteam Exploration AS	PSTM	Multi-client	Full stack
ST8102	2460	2D	1981	Den norske stats oljeselskap a.s	PSTM	Licence	Full stack

¹⁾ MegaSurvey Version 2.0 (2013)

2.2 Well data

All well data in the vicinity of the licence, have been released and therefore no wells needed to be purchased/traded for the common database.

Wellbores used in the evaluation of charge in the Ellingråsa Graben are listed in Table 2.2 and their location is shown in Figure 2.1

Table 2.2 PL 940 well database

Well	NPDID
6406/3-2	863
6406/3-8T2	6350
6407/1-3	29
6407/2-2	16
6407/2-3	935
6407/6-3	1024
6407/6-5	3921
6507/11-1	68
6507/11-2	51
6507/11-3	470
6507/11-5 S	3193
6507/11-6	4321
6507/11-8	5562
6507/12-1	202
6507/12-2	437
6507/12-3	485
6507/7-2	464
6507/8-5	1749

3 Results from geological studies

Three proprietary studies were performed as part of the licence work to evaluate charge into the Ellingråsa Graben. The geological studies are described below with the integration of the findings at the end.

Brimse structural assessment: Tectonic Evolution, Fault Seal & Hydrocarbons Migration Analysis (Terractiva, 2019)

- A robust structural assessment to evaluate the tectonic evolution of the Ellingråsa Graben and Brimse prospect through time, including 3D sequential back-stripping and fault seal analysis. A consistent structural framework linked to trap generation, syn-tectonic sedimentation and structural controls on the migration into the prospect area was the outcome.

Fluid inclusion study of key wells (FIT, 2019)

- Fluid inclusion of 4 wells are analysed for hydrocarbon bearing zones.

Regional geochemistry study (IGI, 2019)

- Regional geochemistry study was performed to explain complexity and understand impact on charge risk of licence prospectivity.

Results from 3D backstripping do not show significant structural changes through time, in neither gradient nor polarity along potential HC migration routes. The most likely Middle/Upper Jurassic migration path into the Brimse prospect would be through the 4-way closure located near the wet 6507/12-1 well. The fluid inclusion study shows a strong microseep in the wet 6507/12-1 well in Ellingråsa Graben, which could indicate deeper charge. Fetch areas and abundance of charge are however still uncertain. The regional geochemistry study shows a complex pattern of migrated hydrocarbon, and that all fluids in Midgard and Ellingråsa Graben are mixtures with end-members from marine Spekk Fm to coaly Åre Fm.

The 6507/12-1 well, where hydrocarbons appear to have migrated through, can be explained by limited deep charge or top and/or lateral seal failure. Neither of these explanations derisks charge into the Brimse prospect.

4 Prospect update report

The main opportunity in the APA 2017 application was the Brimse prospect (Figure 4.1). The Brimse prospect is defined as a faulted rollover anticline forming a 4 way dip closure with crestal faulting. The orientation of the trap is north-south, and the crest is at 1900 mTVDSS (Figure 4.2). The Brimse prospect comprises shallow marine deposits of the Fangst Gp, sealed by Middle-Upper Jurassic Melke and Spekk Fms and Cretaceous shales (Figure 4.3). The charge concept is oil from the Gimсан Basin by fill-spill migration through the Midgard Field and into the Ellingråsa Graben. Most of the expulsion took place subsequent to formation of the Late Jurassic-Cretaceous structures.

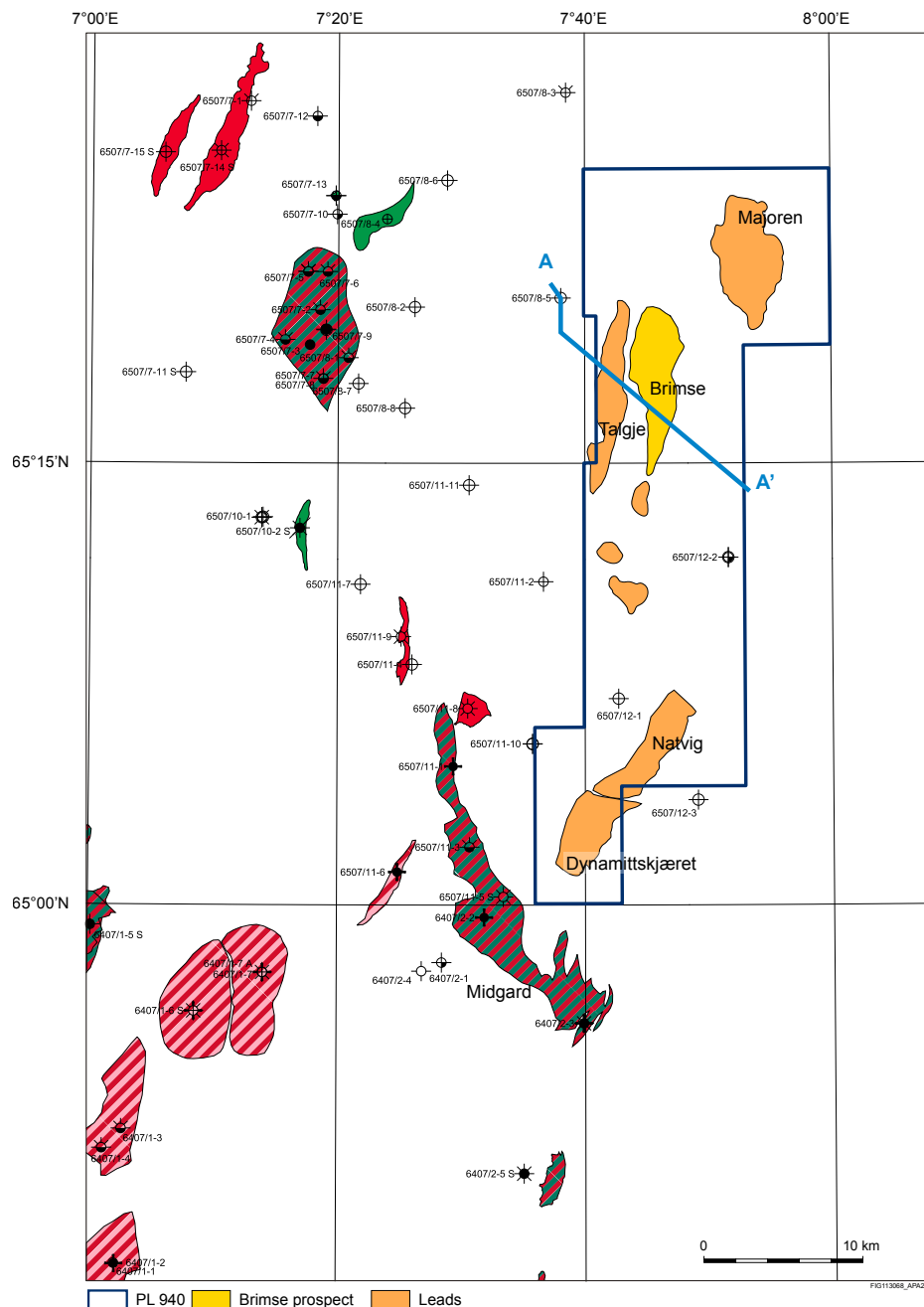


Figure 4.1 Overview map of prospect and leads with position of geoseismic profile
 Licence area with nearest wells, fields and discoveries showing location of NW-SE geoseismic profile (Figure 4.3) over the Brimse prospect

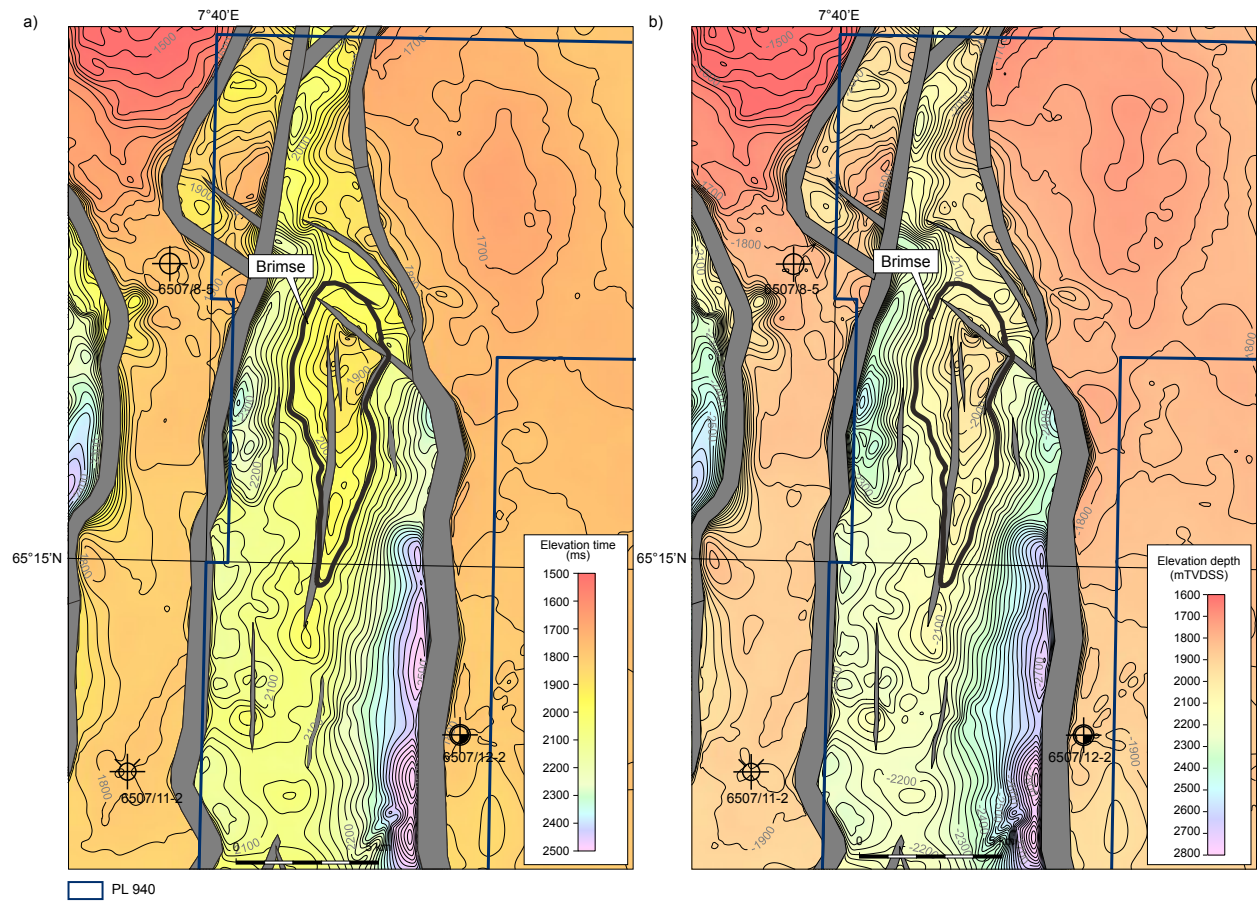


Figure 4.2 Top Fangst Gp structure maps in time and depth
 a) time (ms) map b) depth (mTVDSS) map. Contour interval every 25 ms and 25 m.

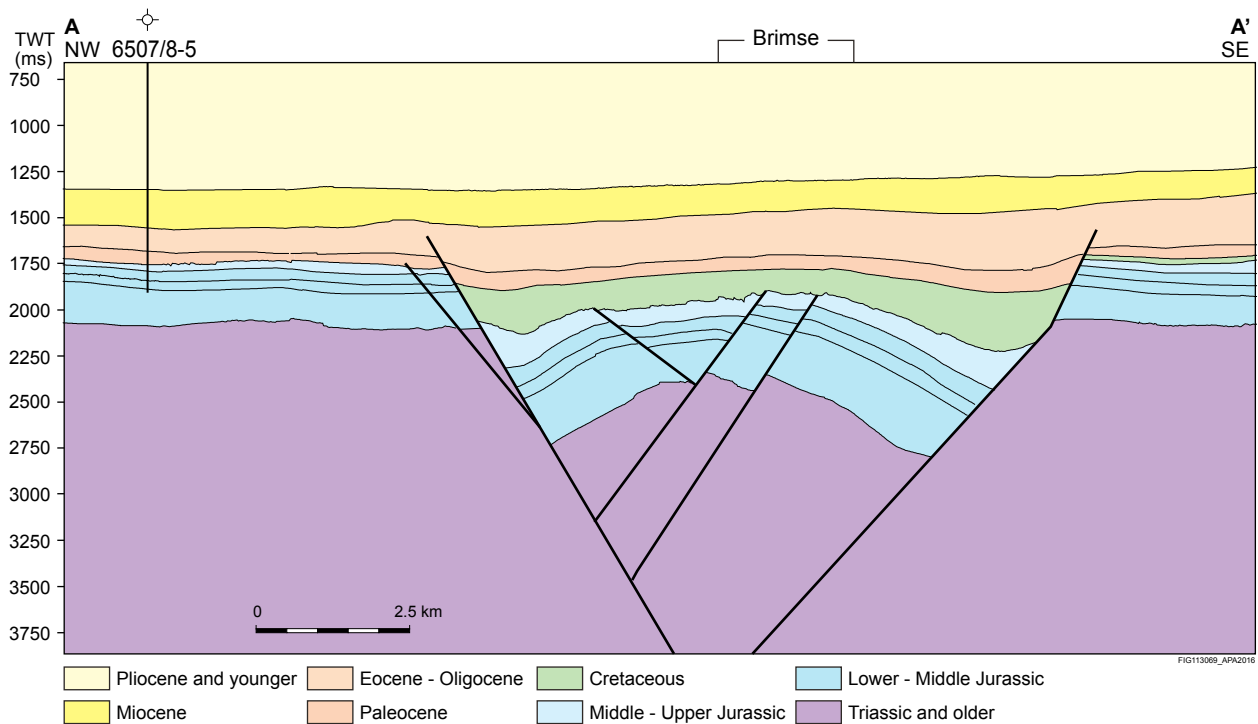
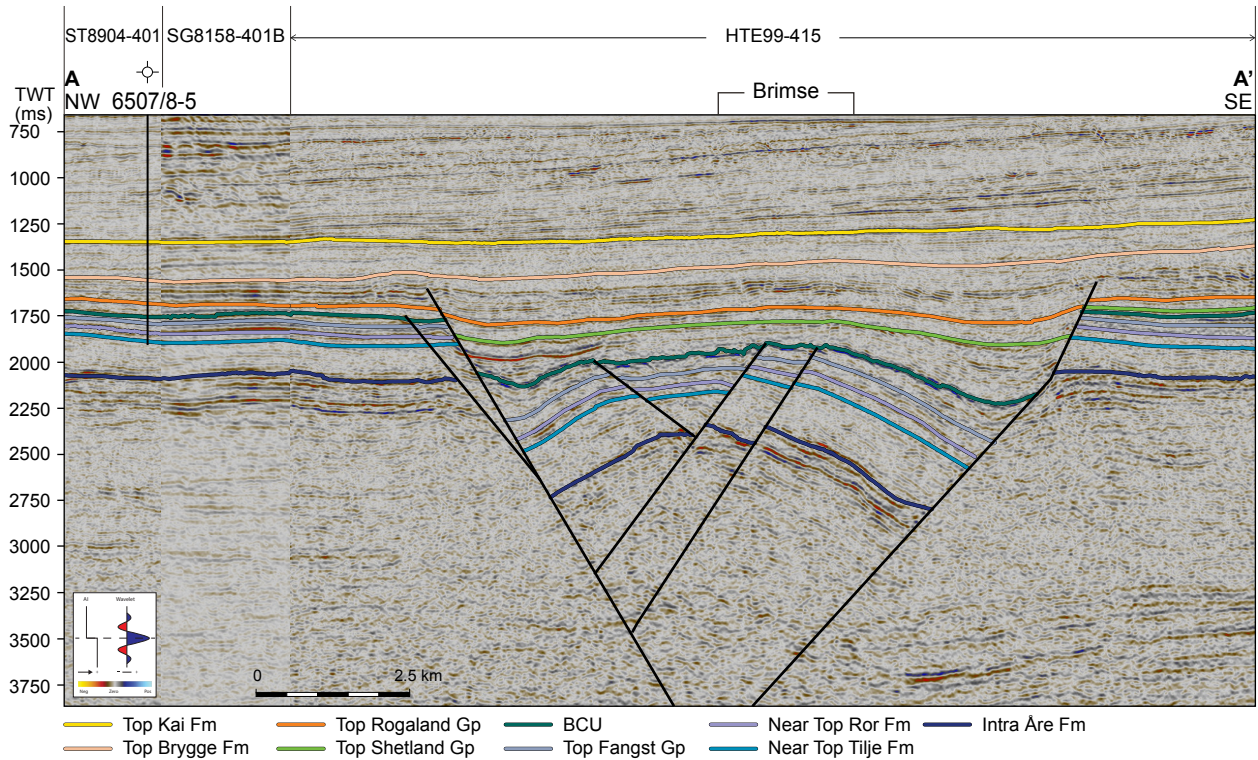


Figure 4.3 Seismic dip line and geological profile over the Brimse prospect

Seismic dip line and corresponding geoseismic section over the Brimse prospect, for location see Figure 4.1

Licence work has focused on derisking migration into the Brimse prospect. Since the studies performed in the licence have not derisked migration, volumes and risk for the Brimse prospect are kept the same as in the APA 2017 application (Table 4.1).

Table 4.1 Prospect data (NPD Table 5)

Table 5: Prospect data (Enclose map)									
Block	6507/9, 11 & 12	Prospect name	Brimse	Discovery/Prosp/Lead	Prospect	Prosp ID (or New!)	NPD will insert value	NPD approved (Y/N)	
Play name	NPD will insert value	New Play (Y/N)		Outside play (Y/N)					
Oil, Gas or O&G case:	Oil	Reported by company	Suncor Energy	Reference document	APA 2017 part of blocks 6507/9, 11 & 12		Assessment year	2017	
This is case no.:	1 of 1	Structural element	Ellingråsa Graben	Type of trap	4WD	Water depth [m MSL] (>0)	330	Seismic database (2D/3D)	2D
Resources IN PLACE and RECOVERABLE		Main phase			Associated phase				
Volumes, this case		Low (P90)	Base, Mode	Base, Mean	High (P10)	Low (P90)	Base, Mode	Base, Mean	High (P10)
In place resources	Oil [10 ⁶ Sm ³] (>0.00)	27.95	46.57	60.78	100.10				
	Gas [10 ⁶ Sm ³] (>0.00)								
Recoverable resources	Oil [10 ⁶ Sm ³] (>0.00)	11.06	19.76	27.23	47.29				
	Gas [10 ⁶ Sm ³] (>0.00)					1.38	2.35	3.55	6.26
Reservoir Chrono (from)	Aalenian	Reservoir litho (from)	Ile Formation	Source Rock, chrono primary	Kimmer-Tithonian	Source Rock, litho primary	Spekk Formation	Seal, Chrono	Tithonian-L.Cretaceous
Reservoir Chrono (to)	Bathonian	Reservoir litho (to)	Garn Formation	Source Rock, chrono secondary	Callovian-Oxfordian	Source Rock, litho secondary	Melke Formation	Seal, Litho	Spekk/L.Cretaceous rock
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	0.17	Oil case (0.00-1.00)	1.00	Gas case (0.00-1.00)	0.00	Oil & Gas case (0.00-1.00)	0.00		
Reservoir (P1) (0.00-1.00)	0.90	Trap (P2) (0.00-1.00)	0.70	Charge (P3) (0.00-1.00)	0.30	Retention (P4) (0.00-1.00)	0.90		
Parametres:		Low (P90)	Base	High (P10)	Comments:				
					Base case parameters = P50				
Depth to top of prospect [m MSL] (> 0)			1900		The calculated pressure at top reservoir is associated with some uncertainty (+/- 5 bar)				
Area of closure [km ²] (> 0.0)	6.3		8.8	14.0					
Reservoir thickness [m] (> 0)	50		100	150					
HC column in prospect [m] (> 0)	125		155	185					
Gross rock vol. [10 ⁹ m ³] (> 0.000)	0.221		0.426	0.732					
Net / Gross [fraction] (0.00-1.00)	0.70		0.80	0.90					
Porosity [fraction] (0.00-1.00)	0.26		0.29	0.32					
Permeability [mD] (> 0.0)	700.0		2300.0	5000.0					
Water Saturation [fraction] (0.00-1.00)	0.30		0.20	0.10					
Bg [Rm3/Sm3] (< 1.0000)									
1/Bo [Sm3/Rm3] (< 1.00)	0.67		0.72	0.78					
GOR, free gas [Sm ³ /Sm ³] (> 0)									
GOR, oil [Sm ³ /Sm ³] (> 0)	166		136	92					
Recov. factor, oil main phase [fraction] (0.00-1.00)	0.30		0.45	0.60					
Recov. factor, gas ass. phase [fraction] (0.00-1.00)			0.45	0.60					
Recov. factor, gas main phase [fraction] (0.00-1.00)									
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)									
For NPD use:									
Temperature, top res [°C] (>0)	75				Innrapp. av geolog-init:	NPD will insert value	Registrert - init:	NPD will insert value	Kart oppdatert
Pressure, top res [bar] (>0)	205				Dato:	NPD will insert value	Registrert Dato:	NPD will insert value	Kart dato
Cut off criteria for N/G calculation	Vshale<=0.4	Porosity>=0.12	Permeability>=1					Kart nr	NPD will insert value

5 Technical evaluation

A complete technical evaluation regarding economical value and possible development solution is not performed due to the low chance of success for the Brimse prospect.

6 Conclusion

The work programme of PL 940 has been fulfilled. Charge into the Brimse prospect is evaluated within the specified timeframe and geological studies are completed. Due to very high charge risk, the partnership is aligned to drop the licence.