# PL 994

Relinquishment report





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PL 994

### **1** History of the production licence

PL 994 is located on the Tampen Spur, covering parts of Blocks 34/1, -2, -4 and -5, and was awarded on 01.03.2019 to a license group consisting of Neptune Energy Norge AS (O), DNO Norge AS and Petrolia NOCO AS. The 2019 Awards in Predefined Areas (APA 2018) application was delivered by Neptune Energy.

### **General License Information**

#### Table 1.1 Key license information

PL 994	
Awarded	01.03 2019
DoD (Drill and Drop)	01.12 2023
License period	7 years (initial)
License area	90 km <sup>2</sup>

### Licence extensions

Three licence extensions have been granted over the licence period:

- 1 year extension application to investigate additional prospectivity: SMIL application submitted 16.02.21. Approved 22.02.21
- 1 year extension application in order to acquire and integrate modern dual azimuth broadband seismic data: SMIL application submitted 23.12.21. Approved 13.01.22
- 9 month extension application in order to fully integrate the CGG DAZ final data into the licence evaluation (delayed delivery). SMIL application submitted 20.01.23. Approved 10.02.23

### Work Programme

#### Table 1.2 Status Work Programme

Work Programme Items	Status
Purchase and reprocess 3D seismic	Fulfilled
G&G studies	Fulfilled
Assessment of license prospectivity	Fulfilled



### **License Meetings**

During the life of the license, a number of meetings took place and are documented in License2Share (L2S).

#### Table 1.3 License meeting overview

Date	Management Committee Meeting	Exploration Committee Meeting
10 04 2019	X	X
14 08 2019		X
25 10 2019		X
26 11 2019	X	X
08 01 2020	X	X
19 03 2020		X
24 03 2020	X	X
27 04 2020		X
31 08 2020		X
16 11 2020	X	X
17 12 2020	X	X
08 04 2021	X	X
06 10 2022		X
24 11 2021	X	X
06 12 2022	X	X
27 09 2023		X
31 08 2023	X	X

### **Reason for Surrendering**

The geological and geophysical evaluation performed through the initial license period did not identify any prospects that showed a risk and volume potential that fulfilled the technical economical criteria's to justify a positive drill decision.



### 2 Database overviews

The PL994 license common database was approved after ECMC meeting #1 (Figure 2.1). The CGG23M01\_NVG21PH2 dual azimuth was later added to the common database.

### 2.1 Seismic data

Over the license history the license group have reprocessed the survey CGG17M01\_NEP19M03\_PL994 and later purchased the multi-client survey CGG23M01 DAZ survey in 2022. The reason for the latest addition is due to that the initial reprocessing was deemed to be of such a poor quality that it was not possible to fully de risk the identified prospectivity.

CGG17M01\_NEP19M03\_PL994 consists of two vintage datasets, the SUN13001 shot in North-West/South-East direction for SUNCOR Energy in 2013 and the CGG17M01 shot North-South for CGG multi-client in 2015-2016. Both datasets arrived pre-processed by another contractor with SUN13001 generally being noisier which is due to simpler processing flow previously applied. SUN13001 and CGG17M01 produce on average similar image however some steeply dipping events in the area of interest are better sampled by SUN13001. The CGG23M01 DAZ 3D has a state-of-the-art workflow, incorporating latest developments in

signal processing (for de-ghosting and de-multiple). Likewise, the imaging models are supported by multi-layer tomography and Time-Lag Full Waveform Inversion (TLFWI) using both azimuths simultaneously to invert the full wave-field, including reflections. The East-West azimuth provides subsurface illumination which is complementary to the North-South survey, deploying a triple-source configuration for dense wave-field sampling and multi-sensor towed streamers (IsoMetrix). In addition the East-West azimuth is also shot in a optimal direction as most of the faults are trending North-South in the licensed area.

CGG23M01 DAZ 3D results have shown significant uplift in structural and fault imaging at all levels, with improvements in signal-to noise and event coherency, seismic bandwidth and resolution. Increased wavelet stability and stationarity supports better seismic-to-well ties and the amplitude fidelity offers higher confidence in reservoir characterisation. These improvements have resulted in a better interpretation of the deep pre-BCU targets.

Seismic survey	NPDID	Туре	Quality
CGG23M01_NVG21PH2* (Figure 2.1)	7984; 8128; 8179; 8194; 8195; 8196; 8252; 8332	3D	Very Good
CGG17M01_NEP19M03_PL994 Multi Azimuth* Figure 2.1	7789, 14006, 15001, 15003, 15007, 16001	3D	Poor
CGG17M01_NEP19M03_PL994 PSDM Kirchhoff (CGG17M01 data only)*	14006, 15001, 15003, 15007, 16001	3D	Poor
CGG17M001	14006, 15001, 15003, 15007, 16001	3D	Moderate
SUN13001 3D	7789	3D	Moderate

#### Table 2.1 Seismic database

\* Reported in DISKOS

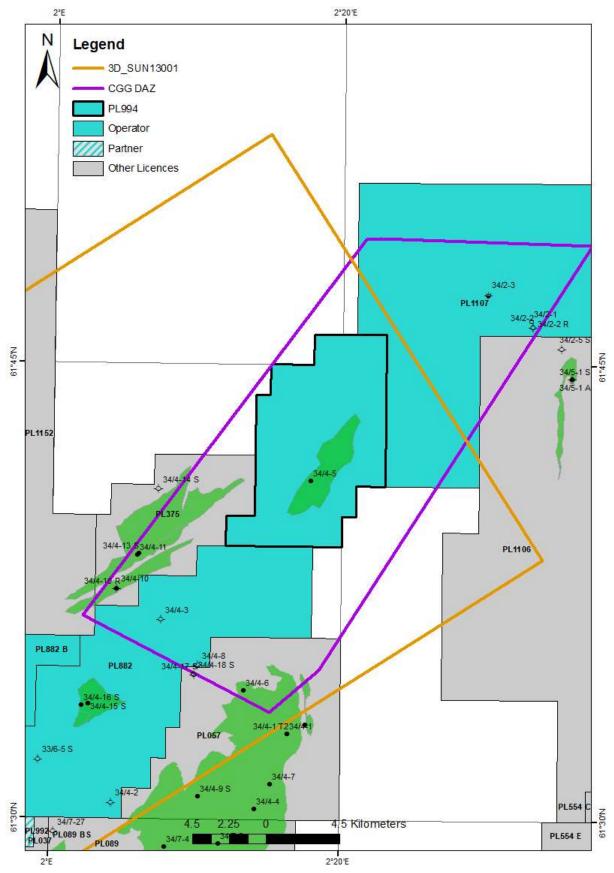


Figure 2.1 Seismic common database in PL994



### 2.2 Well data

The wells presented in Table 2.2 have been used for studies and evaluation of the prospectivity in PL994.

### Table 2.2 Common Well database

Well Name	NPDID	Purpose (Bio=Biostrat, R=Rock Physics, G=Geology, GC = Geochemistry
34/2-2 R	497	G,
34/2-3	421	G, R, GC
34/4-4	41	G, R
34/4-5	37	G, R, GC
34/4-6	875	G, R
34/4-9 S	2931	G, R
34/7-20	1967	G
34/7-21	2026	G
34/7-21 A	2068	G
34/7-26 A	3329	G



### 3 Results of geological and geophysical studies

A number of G&G studies were performed in the licence. Table 3.1 provides a summary.

Table 3.1 Summary of Work Pro	gramme Scope and outcome	
G&G studies	Comments	Outcome
Seismic Reprocessing/Acquisition	Acquisition of 3D_CGG17M01 MAZ reprocessed with 3D_SUN13001 to generate 3D_NEP19M03 CRAM and Kirchhoff volumes. Acquisition and processing of dual azimuth broadband seismic (CGGDAZ21) Phase I received, Phase II due April 2023	CGG23M01 DAZ 3D results have shown significant uplift in structural and fault imaging at all levels and confidence in reservoir characterisation.
Seismic conditioning	Sharp reflections seismic study of CGG17M01 PSTM, Quantitative health check on gathers.	Improved seismic data quality in the early phase of prospect evaluation
Rock physics and AVO modelling	IKON Science rock physics study of 8 key wells relevant for Triassic to Eocene prospectivity.	Incorporated into prospect evaluation allowing for SDA upgrade and downgrade
Seismic data analysis	In-house (3D_NEP19M03 CRAM and CGGDAZ Phase I and II)	Incorporated into prospect evaluation allowing for SDA upgrade and downgrade
Fluid inclusion/Basin modelling	In-house	Improved understanding of the charge and migration in the area
Reservoir study - Triassic and Lower Jurassic	Statfjord & Cook reservoir quality study to derisk reservoir efficiency and understand depositional model further. Skolithos.	Increased the risk on reservoir quality for most of the Pre BCU reservoirs
Core descriptions of key wells	In-house	Improved understanding of the depositional model in the area
Stratigraphy study including biostratigraphy analysis and chemostratigraphy of 3 key wells	Petrostrat	Mature the geological model and increase understanding of Triassic stratigraphy for the main prospect
Petrography study on main controlling factors for reservoir quality within Triassic fluvial sandstones based on 5 key wells	Petrostrat	Improved understanding of the Triassic depositional model
Dipmeter data from 34/4-5 investigated for fault identification	Petrostrat	Improved understanding of the structural evolution of the greater Mort High
Structural geology	Study with Fossen Geo Consulting to validate the structural definition of the Zeta structure and geological model for the main prospect. Structural study Phase II with Fossen Geo Consulting updated on DAZ Phase II seismic to reduce risk of reservoir age in prospect.	Improved understanding of the structural evolution of the greater Mort High
Top seal and retention study	Study performed by Merlin in order to understand the top seal capacity and column height distribution.	Better understanding of the column height distribution for the prospects

### Table 3.1 Summary of Work Programme Scope and outcome



Detailed petrophysical evaluation	In-house	Improved understanding of reservoir parameters for the prospect evaluations
Residual salt analysis to evaluate communication between the Lunde and Statfjord Formations in well 34/4-5	IFE	Improved understanding of the intra reservoir seals/baffles
Evaluation of 34/4-5 S discovery DST and volumes	In-house	Ambiguity of the test data due to short flow duration
Geochemical analysis on core samples from wells 34/4-5 and 34/2-3	With APT	Improved understanding of the geochemical signatures in key wells
Seismic interpretation	Seismic interpretation on identified prospects (3D_NEP19M03 CRAM and CGGDAZ Phase I an II)	Uplift in structural and fault imaging at all levels, with improvements in signal-to noise and event coherency, seismic bandwidth and resolution. Increased wavelet stability and stationarity supports better seismic-to-well ties and the amplitude fidelity offers higher confidence in reservoir characterisation. These improvements have resulted in a better interpretation of the deep pre-BCU targets.
Prospect assessment	Prospect assessment of identified prospects (3D_NEP19M03 CRAM and CGGDAZ Phase I an II)	Volume and risk for entire licence.



### **4 Prospect update report** Prospects and Leads Applied for APA2018

Several prospects and leads were identified at multiple stratigraphic levels in the APA2018 application (Figure 4.1).

### Triassic

The PL994 application focused on the Triassic Beluga Prospect located on the Mort Horst. The Beluga Prospect was tested with the 34/4-5 well several hundreds of meters down dip of the crest. They key uncertainty was the quality and age of the reservoir in the crestal part of the prospect.

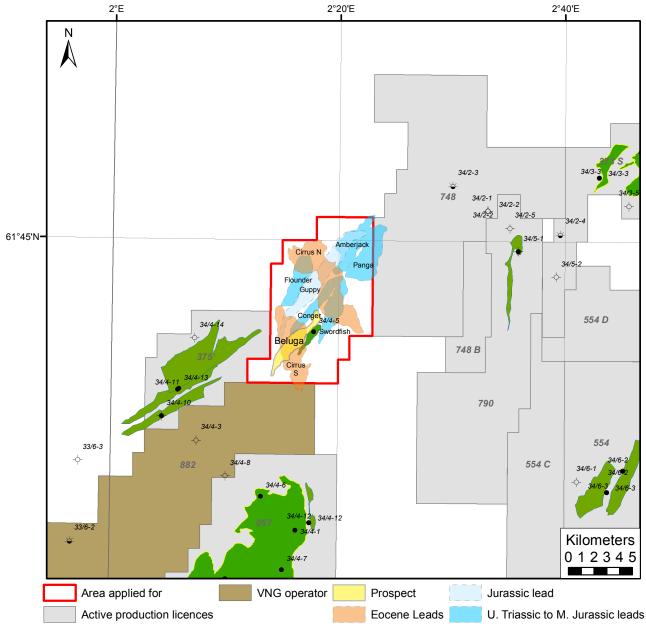


Figure 4.1 Prospectivity identified at APA2018 application submittal



### **Eocene injectites**

Seismic anomalies interpreted as intrusive injectites are observed in the Eocene succession (Cirrus North- and Cirrus South Leads) northeast and southwest of Well 34/4-5. The actual extent, thickness and reservoir quality was of great uncertainty. Seismic interpretation and modelling showed that it should be able to determine hydrocarbon presence with high quality seismic data.

### **Upper Jurassic**

The Guppy Lead was identified by seismic amplitude anomalies, associated with onlapping geometries to the Top Heather - Base Syn-rift reflector on the Morth Horst.

### Lower Jurassic to Upper Triassic

Upper Triassic to Lower Jurassic lead (Swordfish) are analogous to that tested by Well 34/4-5, down faulted from the Mort Horst on adjacent fault terraces within the area applied for. Preaward seismic interpretation was challenging in these areas, however they are prognosed to contain sediments of the Cook Formation and Statfjord Group. The main risk is on reservoir quality and fault seal. Additional Lower Jurassic and Triassic leads were identified to the northeast (Amberjack and Panga) with trap definition and reservoir quality being the main risk.

### **Prospects Mapped after Award**

Following the post award geological and geophysical evaluation of the prospectivity in PL994, based on risk and volume potential the Beluga Lower Lunde prospect is considered as the main prospect in PL994 (Figure 4.2). The Beluga Prospect located on the Mort Horst, north of the Snorre Field in the Tampen area. The Beluga Prospect is potentially a missed opportunity as the structural high was drilled by Well 34/4-5 (Zeta) in 1984 on 2D seismic data. The current interpretation on modern seismic data is that the well tested a small structure down-faulted from the crest of the Mort Horst. The well drilled through a large fault and into Triassic sediments of the footwall (Figure 4.3 and Figure 4.4). The Beluga Lower Lunde Prospect is identified on this footwall, in untested Triassic stratigraphy up-dip of the well. Top seal is Cretaceous shales. Hydrocarbon charge is proven by the well with shows in the Triassic section. The up dip in the Beluga Prospect reservoir is assumed to be of Lower Lunde Formation age.

The Beluga Prospect is a 4-way closure with limited recoverable resources 0.59-3.24 MSm3 o. e. (P90-P10) due to the wide range in reservoir properties and hydrocarbon contact distribution (Table 4.1).

Well 34/4-5 discovered oil in the Lower Jurassic Dunlin Group (Zeta Cook, Table 4.2) and in the Statfjord Group (Zeta Statfjord, Table 4.3). Both hydrocarbon bearing intervals had challenging reservoir properties either due to the depositional environment or/and closeness to the main bounding fault to the West. Additional uncertainty is recognized for the Zeta Statfjord as the lower part of the reservoir section is faulted out. Away from the well seismic mapping indicates a thicker reservoir presence. Even though the Zeta Statfjord and the Zeta Cook are tested by the 34/4-5 well, significant uncertainty remains and the volume potential is considered to be low.

The injectite leads (Cirrus North and South) were mapped out on modern seismic. The rock physics work concluded that all the injectite complexes within PL994 have the characteristics of being water wet. With these observation the risk increased significantly.



The Upper Jurassic anomalies (Guppy Lead) on the flank of the Mort High were re-evaluated after the award and concluded that the risk of reservoir presence/quality within the Upper Jurassic wedges remain high.

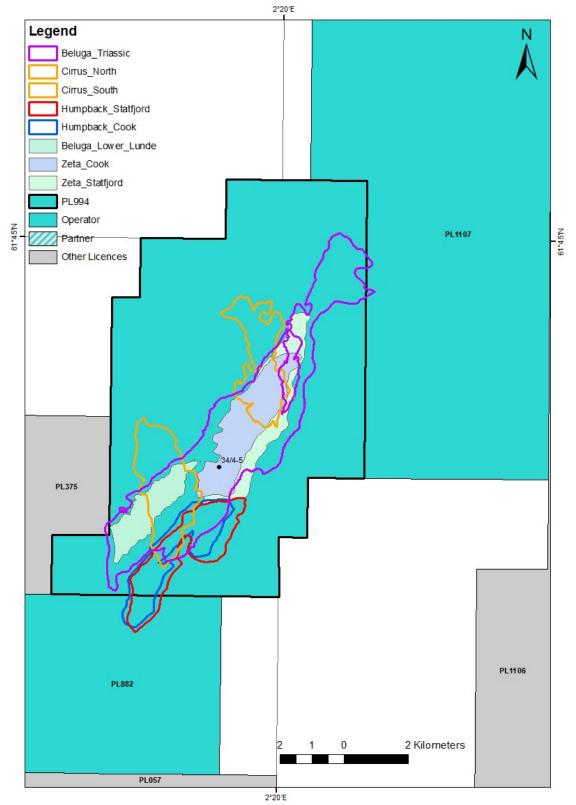


Figure 4.2 Post award prospectivity in PL994



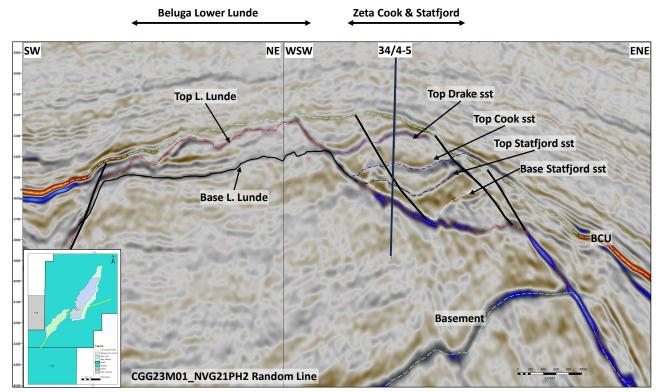
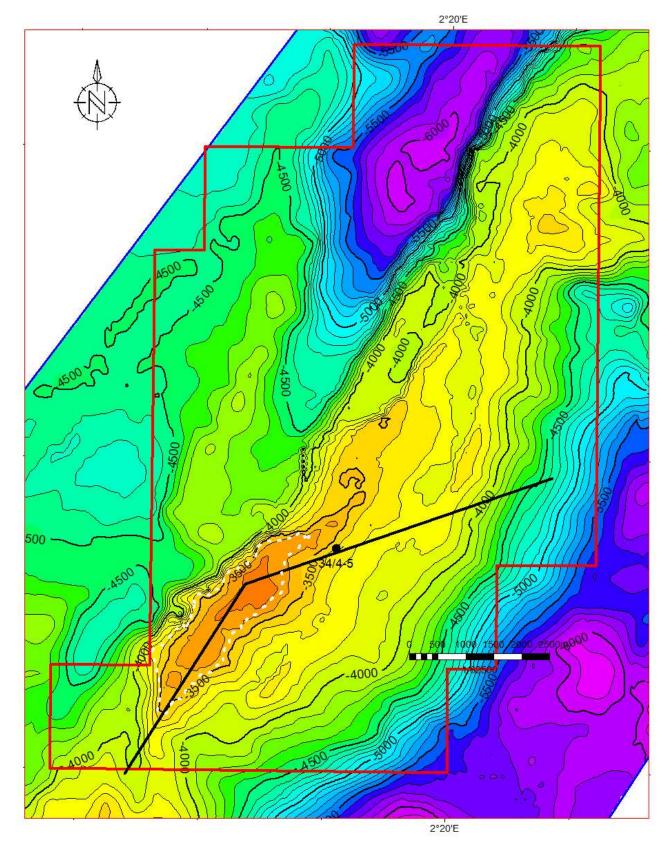


Figure 4.3 Seismic line through the Beluga Lower Lunde prospect and the 34/4-5 Zeta discovery

Line location is shown in Figure 4.4.





### **Figure 4.4 Top Lower Lunde depth structure map (m)** Contour interval is set to 100 m.

The black line represents the location of the seismic line shown in Figure 4.3.

### Table 4.1 NPD table 4

Beluga Lower Lunde Prospect

Block	Block 34/5	Prospect name	Beluga Lower Lund	Beluga Lower Lund Discovery/Prosp/Lead	Prospect	Prosp ID (or New!)	NPD will insert value	NPD will insert value NPD approved (Y/N)	
Play name	Play name NPD will insert value	New Play (Y/N)		Outside play (Y/N)					
Oil, Gas or O&G case:	Oil	Reported by company Neptune Energy		Reference document			ŝ	Assessment year	2023
This is case no.:	1 of 1	Structural element		Type of trap	Structural	Water depth [m MSL] (>0)	380	Seismic database (2D/3D)	30
Resources IN PLACE and RECOVERABLE		Main phase			10. 	Associated phase			
Volumes, this case	10 - 00 - 00	Low (P90)	Base, Mode	Base, Mean	High (P10)	Low (P90)	Base, Mode	Base, Mean	High (P10)
lo olaca rasourcas	Oil [10 <sup>6</sup> Sm <sup>3</sup> ] (>0.00)	2.18	3.77	3.77 5.89 10.30	10.30				
in place resources	Gas [10 <sup>a</sup> Sm <sup>3</sup> ] (>0.00)					-	1.04	1.77	3.24
Recoverable resources	Oil [10 <sup>6</sup> Sm <sup>3</sup> ] (>0.00)	0.31	0.51	0.51 0.98 1.84	1.84				
	Gas [10° Sm <sup>3</sup> ] (>0.00)					0.09 0.15	0.15	0.29	0.57
Reservoir Chrono (from)	Norian	Reservoir litho (from) Lunde Fm		Source Rock, chrono primary	Tthonian	Source Rock, litho primary	Draupne Fm	Seal, Chrono	Barremian
Reservoir Chrono (to)	Carnian	Reservoir litho (to)	Lomvi Fm	Source Rock, chrono secondary Oxfordian	Oxfordian	Source Rock, litho secondary Heather Fm	Heather Fm	Seal, Litho	Asgard Fm
Probability [fraction]					11 ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) (				
fotal (oil + gas + oil & gas case ) (0.00-1.00)	0.42	Oil case (0.00-1.00)	0.42	Gas case (0.00-1.00)		Oil & Gas case (0.00-1.00)			
Reservoir (P1) (0.00-1.00)	0.70	Trap (P2) (0.00-1.00) 1.00		Charge (P3) (0.00-1.00)	1.00	Retention (P4) (0.00-1.00)	0.60		
Parametres:	Low (P90)	Base	(P10)	Comments Top and Base was used for reservoir thickness.	ted for reservoir t	thickness.		7.5.55	
Depth to top of prospect [m MSL] (> 0)		3210		55					
Area of closure [km <sup>2</sup> ] (> 0.0)	1.1		2.6						
Reservoir thickness [m] (> 0)									
HC column in prospect [m] (> 0)	146								
Gross rock vol. [10 <sup>a</sup> m <sup>3</sup> ] (> 0.000)	0.206								
Net / Gross [fraction] (0:00-1.00)	0.40	_							
Porosity [fraction] (0.00-1.00)	0.17								
Permeability [mD] (> 0.0)									
Water Saturation [fraction] (0.00-1.00)	0.43		0.25						
Bg [Rm3/Sm3] (< 1.0000)			1						
1/Bo [Sm3/Rm3] (< 1.00)	0.81		0.65						
GOR, free gas [Sm <sup>3</sup> /Sm <sup>3</sup> ] (> 0)									
GOR, oil [Sm <sup>3</sup> /Sm <sup>3</sup> ] (> 0)	101	158	248						
Recov. factor, oil main phase [fraction] (0.00-1.00)	0.20	0.30							
Recov. factor. gas ass. phase [fraction] (0.00-1.00)	0.20								
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)	108			Innrapp, av geolog-init:	NPD will insert val	NPD will insert value Registrent - init:	NPD will insert value	Kart oppdatert	NPD will insert value
Pressure, top res [bar] (>0)	630			Dato:	NPD will insert val	NPD will insert value Registrert Dato:	NPD will insert value	Kart dato	NPD will insert value
Cold a fit with the MIC and when a second second						196 - 296	-	A Province of the second s	

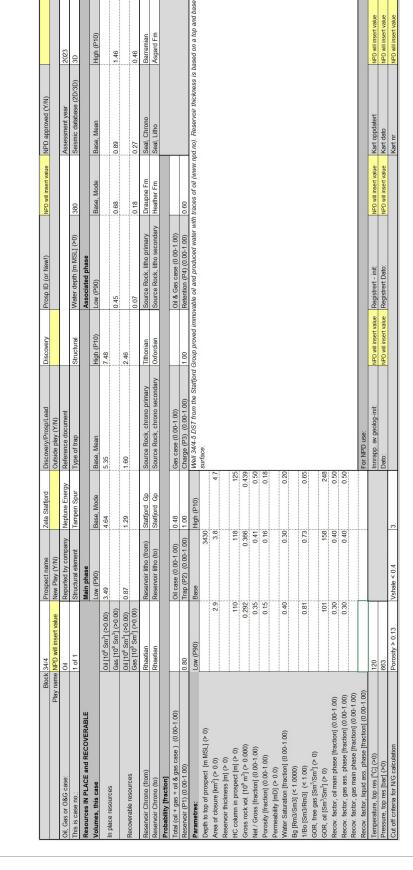
### PL 994

### Table 4.2 NPD table 4

Zeta Cook Discovery

Bloc	Block 34/4	Prospect name	Zeta Cook	Discovery/Prosp/Lead	Discovery	Prosp ID (or New!)	NPD will insert value	NPD approved (Y/N)	
Play nam	Play name NPD will insert value	New Play (Y/N)		Outside play (Y/N)					
Oil, Gas or O&G case:	Oil	Reported by company	Neptune Energy	Reference document				Assessment year	2023
This is case no.:	1 of 1	Structural element	Tampen Spur	Type of trap	Structural	Water depth [m MSL] (>0)	380	Seismic database (2D/3D)	3D
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)
la alaco recursoo	Oil [10 <sup>6</sup> Sm <sup>3</sup> ] (>0.00)	3.08	4.17	4.51	6.16				
	Gas [10 <sup>9</sup> Sm <sup>3</sup> ] (>0.00)					0.39	0.89	0.76	1.21
Dana arahia manunana	Oil [10 <sup>6</sup> Sm <sup>3</sup> ] (>0.00)	0.66	0.92	1.13	1.68				
	Gas [10 <sup>9</sup> Sm <sup>3</sup> ] (>0.00)					0.09	0.14	0.19	0.32
Reservoir Chrono (from)	Pliensbachian	Reservoir litho (from)	Cook Fm	Source Rock, chrono primary	Tithonian	Source Rock, litho primary	Draupne Fm	Seal, Chrono	Barremian
Reservoir Chrono (to)	Toarcian	Reservoir litho (to)	Cook Fm	Source Rock, chrono secondary	Oxfordian	Source Rock, litho secondary	Heather Fm	Seal, Litho	Asgard Fm
Probability [fraction]									
Total (oil + gas + oil & gas case ) (0.00-1.00)	0.50	Oil case (0.00-1.00)		Gas case (0.00-1.00)		Oil & Gas case (0.00-1.00)			
Reservoir (P1) (0.00-1.00)	0.50	Trap (P2) (0.00-1.00)	1.00	Charge (P3) (0.00-1.00)	1.00	Retention (P4) (0.00-1.00)	1.00		
Parametres:	Low (P90)	Base	High (P10)	Comments.					
Depth to top of prospect [m MSL] (> 0)		3310	0						
Area of closure [km <sup>2</sup> ] (> 0.0)	2.3	3.0	0 3.8						
Reservoir thickness [m] (> 0)	27								
HC column in prospect [m] (> 0)	136								
Gross rock vol. [10 <sup>9</sup> m <sup>3</sup> ] (> 0.000)	0.098	0.124	4 0.152						
Net / Gross [fraction] (0.00-1.00)	0.75	0.80	0 0.85	2					
Porosity [fraction] (0.00-1.00)	0.17	0.18							
Permeability [mD] (> 0.0)				1					
Water Saturation [fraction] (0.00-1.00)	0.43	0.35	5 0.27						
Bg [Rm3/Sm3] (< 1.0000)									
1/Bo [Sm3/Rm3] (< 1.00)	0.81	0.73	3 0.65						
GOR, free gas [Sm <sup>3</sup> /Sm <sup>3</sup> ] (> 0)									
GOR, oil [Sm <sup>3</sup> /Sm <sup>3</sup> ] (> 0)	101	158	8 248						
Recov. factor, oil main phase [fraction] (0.00-1.00)	0.17	)	·						
Recov. factor, gas ass. phase [fraction] (0.00-1.00)	0.17								
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)	115			Innrapp. av geolog-init:	NPD will insert value	Registrert - init:	NPD will insert value	Kart oppdatert	NPD will insert value
Pressure, top res [bar] (>0)	610			Dato:	NPD will insert value	Registrent Dato:	NPD will insert value	Kart dato	NPD will insert value
Cut off criteria for N/C calculation	Dorneity > 0.13	Vichalo < 0.4	0					1/	





### Table 4.3 NPD table 4

PL 994

Zeta Statfjord Discovery

High (P10)

2023 3D

1.46 0.46 Barremian Asgard Fm



NPD will insert value NPD will insert value NPD will insert value





### **5** Technical evaluation

Beluga development solution for the P50 volumetric case (Figure 5.1):

- One 4-slot template with one oil producer (OP)with gas lift (GL) and one water injector (WI)
- Subsea tieback via future Dugong SPS or Dugong PLEM at SNB (Snorre B host platform)
- Beluga start-up Q1 2032 with 10 years of estimated production.

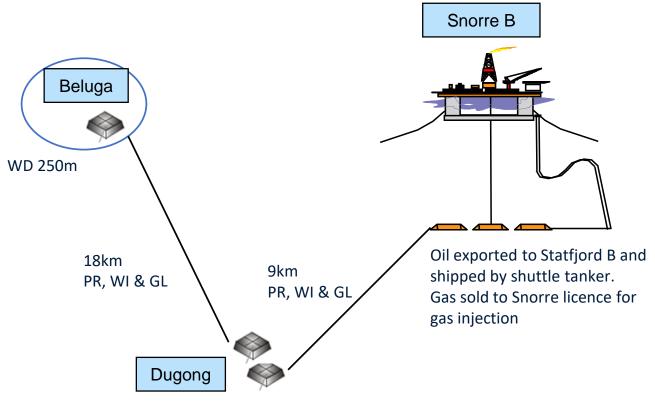


Figure 5.1 Beluga Lower Lunde development concept

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### **6** Conclusion

The prospectivity within the PL 994 has been thoroughly evaluated with the highest quality seismic data and a significant number of studies performed. All leads and prospects identified in the APA and during the license period have been evaluated and considered as non-prospective due to limited volume potential and high risk.

The Beluga prospect is a 4-way closure with limited recoverable resources 0.59-3.24 MSm3 o. e. (P90-P10) due to the wide range in reservoir properties and hydrocarbon contact distribution. The geologic risk is set to 42% with key risk on reservoir and seal. Based on the last technical and economic evaluation, the PL 994 license partners no longer consider Beluga Lower Lunde as a prospect that justifies a positive drill decision and and no further work to derisk.

The Zeta Discovery in the Cook Formation and in the Statfjord Group are sub-economical and also carrying a significant amount of remaining uncertainty regarding reservoir quality away from the discovery well.

The partnership has unanimously agreed to surrender PL 944.

#### PL 994