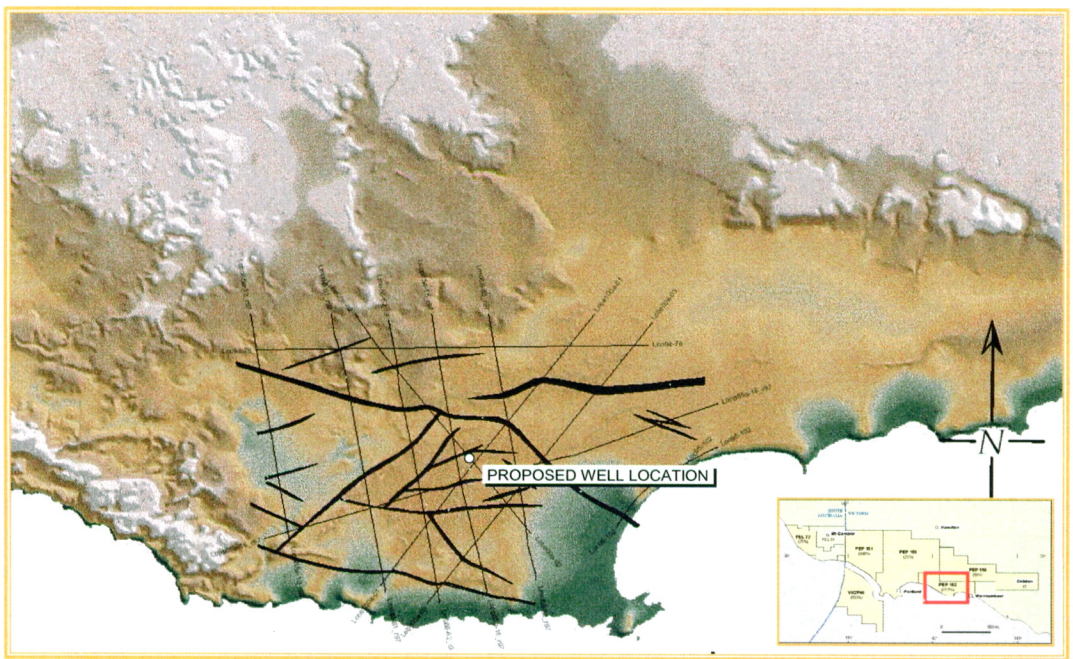
Well Proposal

Port Fairy-1 (W1346)

PROPOSED PORT FAIRY NO 1

WELL PROPOSAL



PEP 152 - ONSHORE OTWAY BASIN
SOUTHWEST VICTORIA

Prepared by
ESSENTIAL PETROLEUM RESOURCES LTD
On behalf of
ORIGIN ENERGY PETROLEUM PTY LTD
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SUMMARY

The Port Fairy 1 prospect is located in PEP 152 in the onshore Victorian Otway Basin. The prospect is a simple northeast trending anticline exhibiting minor keystone style, crestal faulting. The prospect was formed in response to Late Cretaceous to early Tertiary east-west wrenching. The primary objective is sandstone in the Flaxman/Waarre Formation with the Belfast Mudstone forming the seal. A secondary objective is the Nullawarre Greensand within the Belfast Mudstone.

The well is located approximately 2 kilometres north of Port Fairy township on seismic line obe00a-02 at Shot Point 390. The prospect is approximately 12 kilometres south of the Portland to Port Campbell gas pipeline.

The well will be a vertical well drilled to approximately 1550 m into the Eumeralla Formation and is located in a near crestal location on the structure.

The main target reservoir is sandstone in either the Flaxman Formation or the Waarre Formation and the main risk on the prospect is considered to be the presence of sufficient sandstone to form a reservoir. The presence of seal, structure and hydrocarbon charge are all considered to be a low risk. The well is assessed to have a risk of 1 in 4.6.

The assessed recoverable reserves of gas are minimum 16 BCF, most likely 26 BCF and maximum 37 BCF.

1. INTRODUCTION

Port Fairy No 1 is proposed as an exploration well in PEP 152 in the onshore Otway Basin, Victoria. The well will test a four-way dip anticlinal structure located just to the north of the Port Fairy Township. The primary objective is sand within the Flaxman or Waarre Formations sealed by the Belfast Mudstone and the secondary objective is sand within the Nullawarre Greensand member of the Belfast Mudstone sealed by the upper Belfast Mudstone. The PEP 152 Joint Venture recently recorded 22.6km of seismic over the Port Fairy prospect to validate the closure and up-grade the prospect to drillable status.

2. GEOGRAPHICAL LOCATION

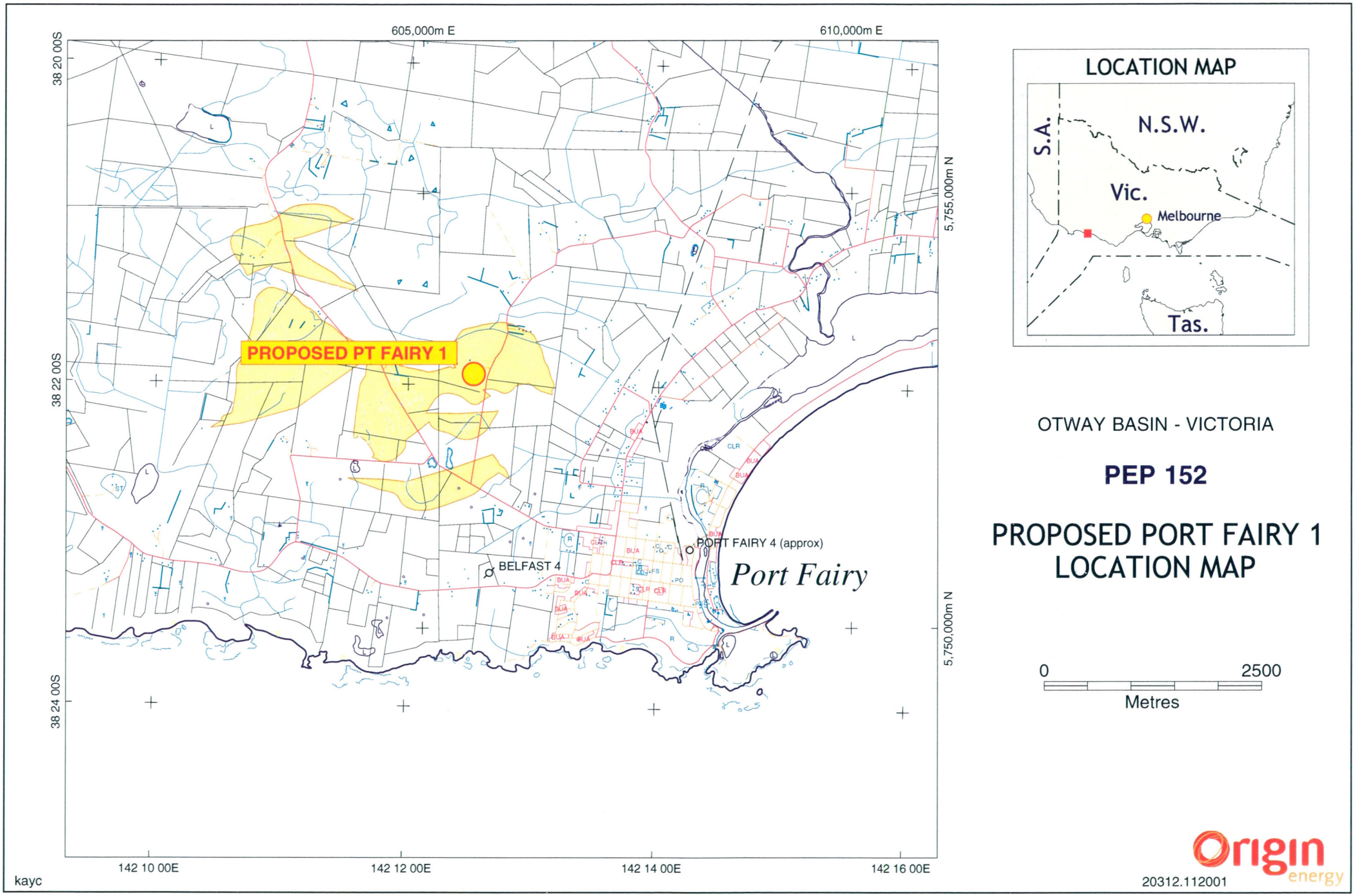
The Port Fairy No 1 well surface location is SP 390 on seismic line obe00a-02 (Figure 1). The location is approximately 2 kilometres north of Belfast 4, a Victorian Government stratigraphic and water bore drilled in 1959. Belfast 4 provides stratigraphic control for the well. The location is approximately 12 kilometres south of the Portland to Port Campbell gas pipeline.

Coordinates for the well are:

AMG Zone 54	
Easting	606059.34
Northing	5753266.74
Latitude	38 deg. 21 min. 44.50 sec.
Longitude	142 deg. 12 min. 50.31 sec.
Elevation	5 m AMSL (preliminary)

2.1 Well depth

The well will be drilled to test for the presence of hydrocarbons in possible sands in the Waarre Formation overlying the Eumeralla Formation. The total depth of the well will be 1550m or a depth sufficient to provide wireline logs across the Waarre Formation/Eumeralla Formation contact.



OTWAY BASIN - VICTORIA

PEP 152

PROPOSED PORT FAIRY 1 LOCATION MAP

0 2500
Metres

20312.112001

Origin energy

Pe 909163 - colour Ø01

909163 007

3. PERMIT OVERVIEW

PEP 152 is located within the coastal strip extending about 10 to 20 kilometres inland between Portland in the west and Warnambool in the east in the Victorian part of the onshore Otway Basin. The Permit contains a thick Early Cretaceous section of Eumeralla Group within the Koroit Trough and is bounded to the north by the east – west trending Tyrendarra Fault. The permit contains prospective Crayfish Group sandstone at depths of 3000 to 4000m and prospective Late Cretaceous Sherbrook Group and early Tertiary Wangerrip Group sediments.

4. PREVIOUS WORK IN THE PERMIT

4.1 Seismic Surveys

Approximately 1430 kilometres of conventional 2D seismic has been acquired in PEP 152 (Table 1). The data ranges from very poor to excellent. The most recent seismic over the Port Fairy prospect was the Spring Creek survey acquired in 2000 and the prospect was mapped using data from the 1985, 1988 and 2000 surveys.

Table 1. Seismic Acquired in PEP 152

Year	Survey Name & Company	Kms
1958	Portland and Port Campbell / Frome Broken Hill	232.0
1962	Yambuk-Portland / Frome Broken Hill	47.0
1964	Koroit / Frome Broken Hill	13.0
1966	Port Fairy-Nelson / Shell Development Australia	63.0
1969	Hawkesdale / Frome Broken Hill Shell	10.0
1970	Portland-Macarthur / Frome Broken Hill Shell	38.0
1971	Nelson-Koroit / Frome Broken Hill Shell	56.0
1973	Coastal Strip / Frome Broken Hill Shell	98.0
1985	Toolong / Beach Petroleum	264.0
1985	Windemere to Port Fairy / Minora	59.0
1988	St. Helens/ Phoenix	100.0
1989	Shamrock / Phoenix	12.0
1990	Orford / Minora Resources	50.0
1991	Moyne / Phoenix Oil & Gas	10.0
1992	Otway Basin / Gas & Fuel Exploration	16.0
1993	Kaloola / Minora Resources	12.0
1994	Greenacres / Gas & Fuel Exploration	14.0
1995	Tower Hill / Cultus Petroleum	112.0
1997	Cartcarrong / Cultus Petroleum	56.0
1998	Mumblin./.Cultus Petroleum	57.0
2000	Spring Creek / Origin Energy Resources	22.6
	Total	**1341.6**

4.2 Previous Wells and Exploration Results

A total of four exploration wells have been drilled in the permit. In addition there are ten stratigraphic/water bores drilled by the Geological Survey of Victoria between 1959 and the late nineteen seventies. Windermere 1 well, drilled northwest of Port Fairy in PEP 159, recovered oil from the Heathfield sand (Table 3) that lies within the Pretty Hill petroleum system. There is a large east-west oriented basement fault, the Tyrendarra Fault, against which Windermere 1 is located. Potential source rocks for the oil in Windermere 1 well are the Casterton Beds at the base of the Crayfish Group and the Killara Coals at the base of the Eumeralla Group. It is assumed that hydrocarbons generated in the deeper sections of the permit have migrated vertically up the fault and into the shallower reservoirs.

Table 2. Wells Drilled within PEP 152

Name	Company	Date	Type	Shows
Belfast 4	GSV	1959	Stratigraphic	
Belfast 11	GSV		Stratigraphic	
Bootahpool 2	GSV		Stratigraphic	
Codrington 1	GSV		Stratigraphic	
Eumeralla 1	Frome	1962	Exploration	oil shows
Koroit 10	GSV		Stratigraphic	
Meerai 3	GSV		Stratigraphic	
Shaw 1	Minora	1992	Exploration	
Tyrendarra 13	GSV		Stratigraphic	
Wangoom 6	GSV	1961	Stratigraphic	
Windermere 1	Minora	1987	Exploration	oil rec'd
Windermere 2	Minora	1989	Exploration	oil shows
Yangery 1	GSV	1960	Stratigraphic	
Yambuk 2	GSV		Stratigraphic	

To the east of the permit Santos and Beach Petroleum have found gas in the Naylor, Penryn, Lavers and McIntee wells in PEP 154. The reservoir in these wells is the Waarre Formation with Belfast Mudstone as the seal. To the west of the permit in PEP 150 biodegraded oil was found in the Pebble Point Formation in the Lindon 1 exploration well (Tabassi and Davey, 1986).

5. REGIONAL GEOLOGY

5.1 Structural Setting

The northwest trending Koroit and Windermere Troughs underlie the permit. There is a northeast-southwest zone of compression, the Port Fairy Compression Zone, trending through the permit. There are a number of prospects and leads overlying and associated with the compression zone. The Port Fairy, Tower and Taurus prospects all have the capacity to reservoir gas and Pleasant Park and Orford prospects each have the capacity to reservoir oil and or gas given their proximity to the Tyrendarra Fault. The Port Fairy prospect is a four-way dip closed feature and does not rely on fault sealing to trap hydrocarbons. Each of the

other prospects is reliant to some degree on fault seal to reservoir hydrocarbons.

Right lateral wrenching is associated with the Tyrendarra fault and similar right lateral wrenching on an east-west fault just to the north of Port Fairy is responsible for the formation of the northeast trending Port Fairy anticline.

5.2 Stratigraphy

The stratigraphy of the onshore Otway basin in Victoria has been described by a number of authors including Bock and Glenie, 1965 and Leslie, 1966. Table 3 presents a summary of the stratigraphy in PEP 152.

6. PROSPECT DESCRIPTION

6.1 Structure

The Port Fairy prospect was first identified on the 1985 seismic lines acquired by Phoenix. Follow up seismic in 1988 confirmed the prospect and the Spring Creek seismic in 2000 brought the prospect to drillable status. Figure 2 is a structure map of the prospect at a scale of 1:20,000 mapped by Essential Petroleum Resources Ltd, one of the joint venture partners in the permit. The prospect is a simple northeast trending four-way dip anticline bounded to the northeast by a major northwest trending, down to the south fault. The structure is bounded to the west by a northeast trending, down to the south fault. The crest of the structure is characterised by small keystone faults which intersect and die out down section within the Eumeralla Group. East west wrenching along a major east west fault just to the north is responsible for the structure. An isopach map of the top Waarre to top Pebble Point horizon shows growth and folding of the structure to be primarily Late Cretaceous in age.

The Port Fairy prospect is illustrated on dip and strike seismic sections (Figures 3 and 4).

6.2 Reservoir

The Waarre sandstone reservoir is the principal reservoir target in the onshore Victorian Otway Basin. The nearest well to the Port Fairy prospect is the Belfast 4 stratigraphic water bore. Belfast 4 encountered approximately 60 metres of Flaxman Formation – Waarre Formation sediments. The well was not wireline logged over this horizon and the proportion of Flaxman Formation to Waarre Formation is not known. Sand was described in cuttings over this interval but an accurate mudlog is not available. A secondary reservoir is the Nullawarre greensand member of the Belfast Mudstone although the Belfast Mudstone overlying this unit is only 14 m thick in Belfast 4.

6.3 Seal

The Belfast 4 well is the type section of the Belfast Mudstone in the Otway Basin. Belfast 4 recorded 122 metres of mudstone and would provide an excellent seal for any hydrocarbons which may be present in sands in either the Flaxmans or Waarre Formation below. The mudstone is medium grey to black with minor clayey siltstone and is observed on the SP and 16 inch resistivity logs in Belfast 4.

Essential
Petroleum
Resources
Limited

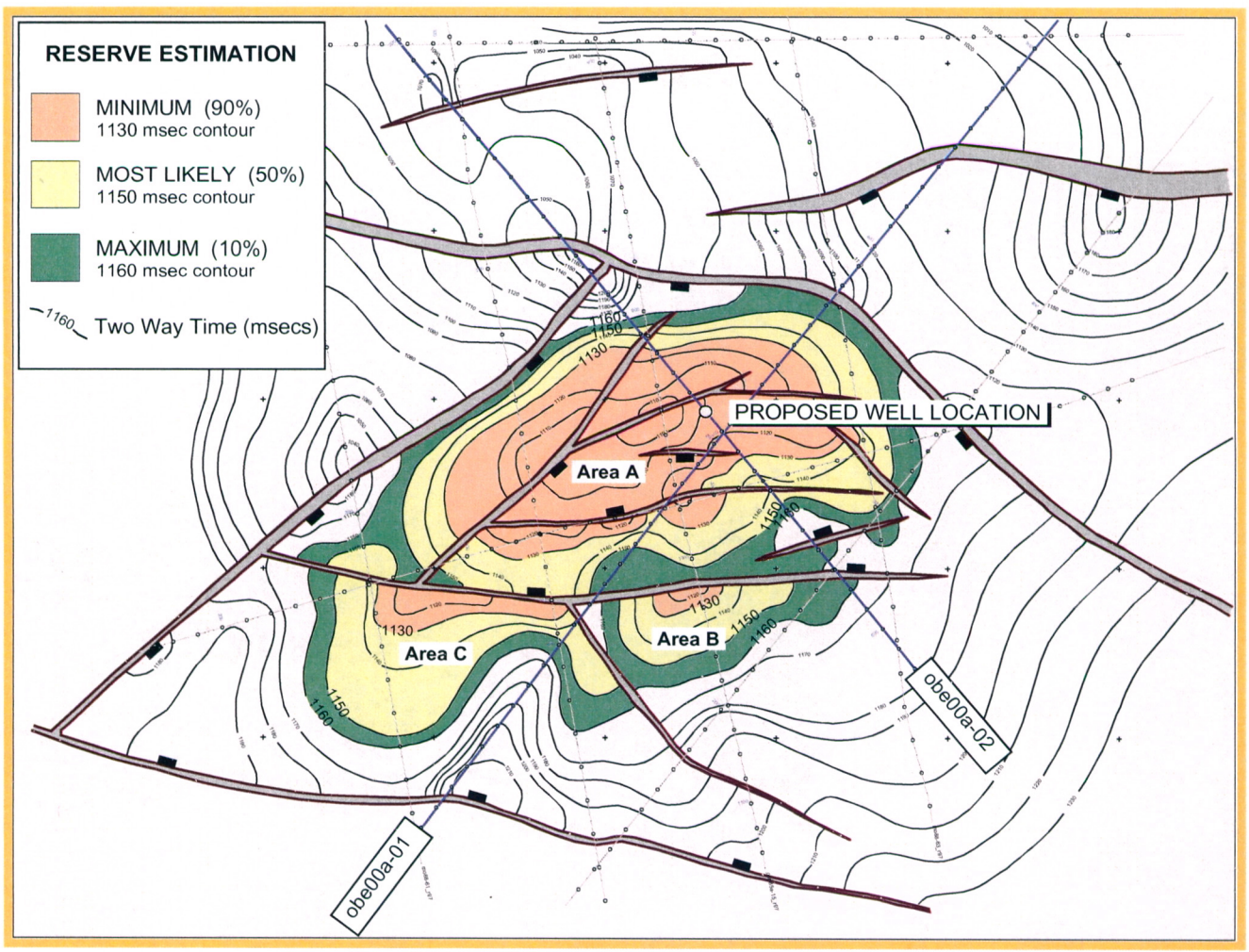


Figure 2. Port Fairy Prospect – Top Waarre Formation map

Essential
Petroleum
Resources
Limited

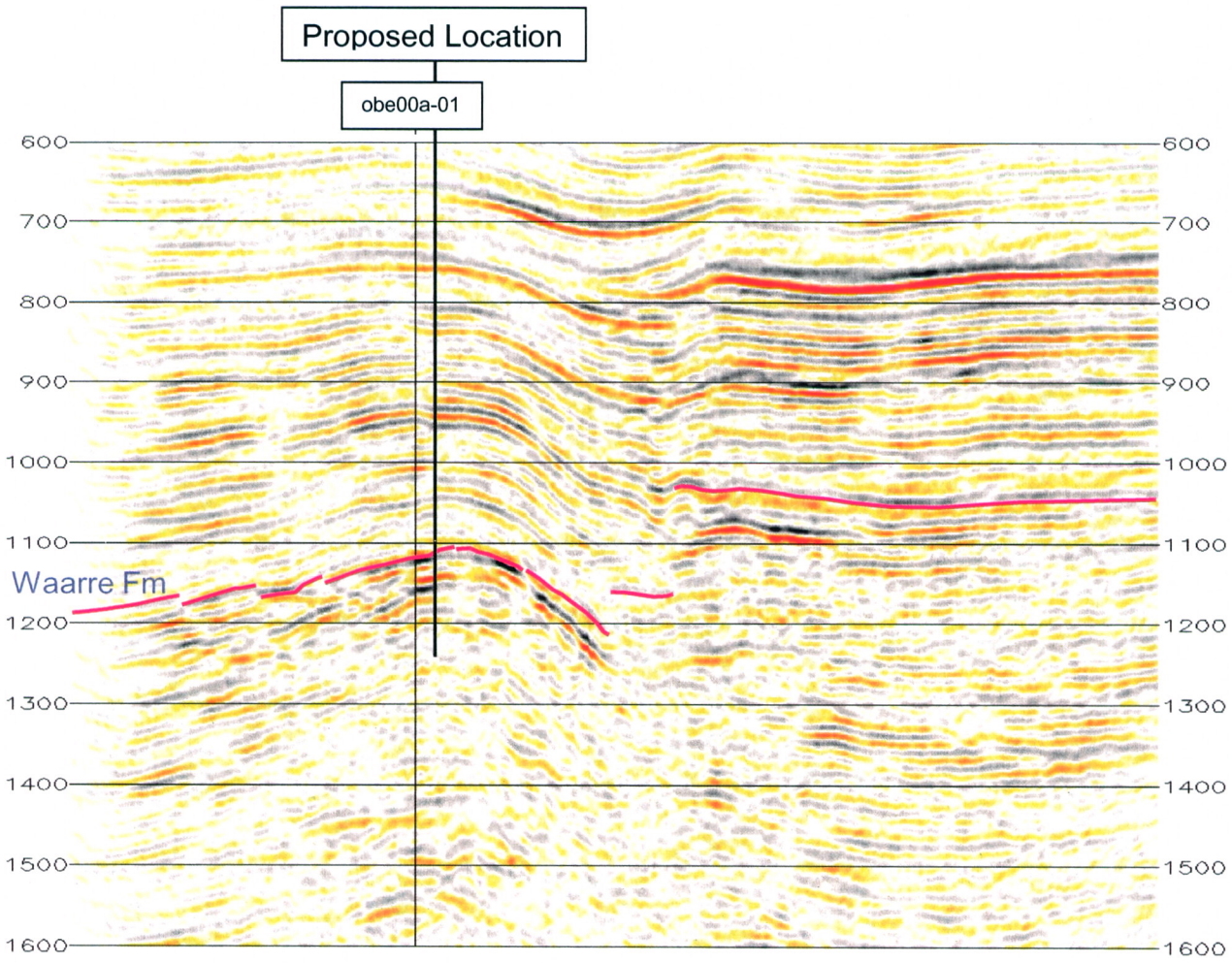


Figure 3. Seismic Dip Line – obe00a-02

Essential
Petroleum
Resources
Limited

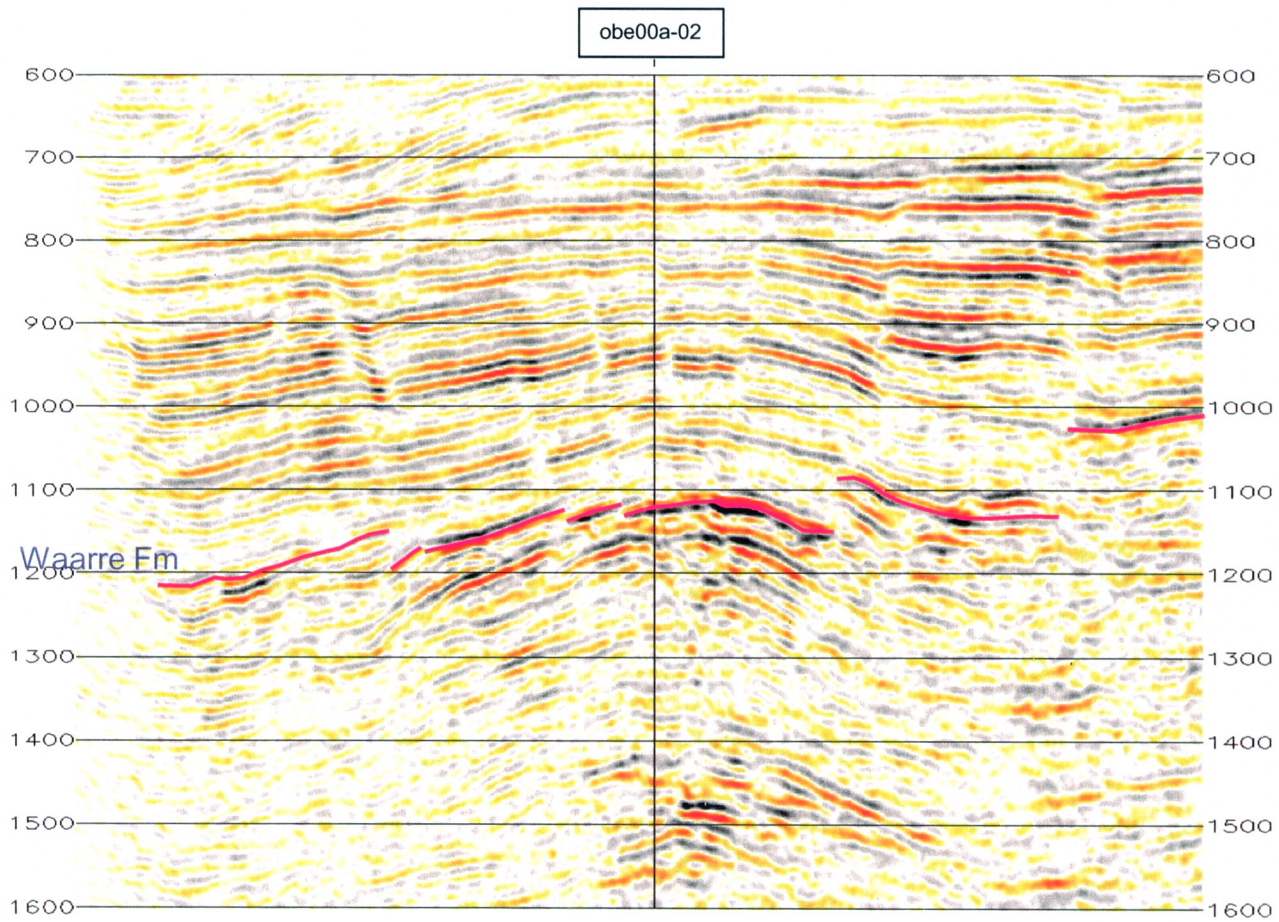


Figure 4. Seismic Strike Line – obe00a-01

6.4 Source Rocks and Migration

The most likely source rocks for the prospect are in the Killara Coal at the base of the Eumeralla Formation. The Killara Coals would now be in the gas window after having passed through the oil window in the Tertiary. Migration from this source is most likely via the northeast and northwest bounding faults. Early structuring (pre Pebble Point Formation) could have allowed oil to migrate into the structure but late stage gas generation may have displaced oil from the structure. Gas is the most likely hydrocarbon to be present. The presence of high amplitudes on seismic sections on Figures 3 and 4 suggest the possibility of gas in the structure.

7. PREDICTED STRATIGRAPHIC SEQUENCE

The depth prognosis for Port Fairy 1 is based on an average Time-Depth curve for wells in PEP 152 and PEP 159. The validity of using the curve was verified by examining the seismic velocities on lines obe00a-01 and 02. Vrms was used to generate interval velocities and the interval velocities were used to convert time to depth. This depth was compared with the area Time-Depth curve and, as the two methods were sufficiently similar, the area Time-Depth curve was used. A depth section of line obe00a-02 was generated and compared to the Belfast 4 well at the proposed location and the depth prognosis for Port Fairy 1 generated.

Table 4. Port Fairy 1 Prognosed section

GL: 5 m AMSL (preliminary)

Group	Formation	Depth (mSS)	Thickness (m)
Newer Volcanics	Newer Basalt	10	40
Heytesbury	Port Campbell Lst	50	112
	Gellibrand Marl	162	210
	Clifton Fm	372	12
Nirranda	Narrawaturk Marl	384	20
	Mepunga Fm	404	81
Wangerip	Dilwyn Fm	485	221
	Pember Mudstone	706	64
	Pebble Point Fm	770	33
Sherbrook	Paaratte Fm	803	347
	Belfast Mudstone Upper	1150	14
	Nullawarre Greensand	1164	51
	Belfast Mudstone Lower	1215	122
	Flaxman/Waarre Fm	1337	57
Otway Supergroup	Eumeralla Fm	1394	166
	TD	1560	

The prognosed stratigraphic section in Port Fairy 1 is shown on Table 4, and the following is a general description of the lithology of the anticipated sequence:

Heytesbury Group

Port Campbell Limestone

Limestone white to very light brown, friable to hard, dominantly friable, minor calcilutitic matrix, rare cherty fragments. Good visual porosity.

Gellibrand Marl

Marl, light to medium grey, very soft, very dispersive, trace to common cherty fragments, and trace very fine quartz grains and light green calcarenite.

Nirranda Group

The Nirranda Group sediments comprises of the Narrawaturk Marl and Mepunga Formation.

Narrawaturk Marl

Marl, medium to dark grey, very soft, very dispersive, minor to abundant glauconite, and trace very fine quartz grains.

Mepunga Formation

Sandstones, medium brown, loose, very fine to coarse, dominantly fine grained, poorly sorted, iron oxide stained quartz, abundant, dispersive medium to dark brown argillaceous and silty matrix. Poor to excellent visual porosity, interbedded with dark brown, very soft minor claystone.

Wangerrip Group

Dilwyn Formation

The Dilwyn Formation is a predominantly sandstone unit with minor siltstone and claystone interbeds. Sandstones are clear to white, light brown, very fine to very coarse, subangular to rounded, poor to moderately sorted, with minor pyrite, trace mica and carbonaceous material, occasional grey quartzite grains, brown dispersive clay matrix. Porosity is fair to excellent. Siltstones are light to moderate brown, soft sandy in part, with trace carbonaceous material and partly argillaceous. Claystones are moderate to dark grey-brown to brown, soft, dispersive, sandy and silty in part, with abundant carbonaceous/coal fragments. Minor coals are dark brown to black, pyritic and lignitic.

Pember Mudstone

Claystone, light to medium brown, medium grey in part, very soft, amorphous, silty and sandy in part and can include a variety of bioclasts, carbonaceous material, glauconite, mica, pyrite, ferruginised clasts and rock fragments.

Pebble Point Formation

The Pebble Point Formation consists of medium to very coarse subangluar to subrounded quartz sandstones with a sideritic and limonitic matrix. The unit becomes more silty and shaley with increased depth.

Sherbrook Group

Paaratte Formation

The Paaratte Formation consists of predominantly sandstones, off-white to light grey, medium to very coarse grained, occasionally pebbly, subrounded to subangular quartz, interbedded with white to light brown very fine to medium glauconite, minor feldspar, in an argillaceous to calcareous matrix and in part strongly dolomitic and or sideritic, tight and highly resistive. Minor interbeds of siltstones are light to medium grey argillaceous, carbonaceous, micaceous dolomitic and calcareous, and in parts grading to silty mudstone and silty dolomite.

Belfast Mudstone

The Belfast Mudstone is considered to be a regional seal to the underlying Flaxman and Waarre sandstones. The Belfast Mudstone is pale grey to black, pyritic, fossiliferous, glauconitic, carbonaceous and micaceous mudstone with fine-grained sandstone and siltstone interbeds. Sandstone interbeds are quartzose, with traces of weathered feldspar, mica, carbonaceous flecks and a green mineral (glauconite or chlorite), and diagenetic siderite, calcite and dolomite cements.

Nullawarre Greensand

Sandstone, white to light grey to green, very fine to medium, subrounded to subangular quartz, minor to abundant glauconite, trace to abundant white argillaceous matrix poor to moderate visible porosity, oolitic, limonitic cement, very hard in part.

Flaxman Formation

Interbedded Siltstone and sandstone. The siltstones are light to medium grey to brown grey, quartzose, argillaceous and in parts carbonaceous, micaceous, feldspathic and calcareous. Sandstones are white to light grey, pale yellow, partly medium to very coarse, partly very fine to medium grained subangular to subrounded, polished, poor to moderately sorted, poorly consolidated, with minor feldspar and lithic grains, trace chlorite, slightly carbonaceous, in a kaolinitic to slightly calcareous matrix.

Waarre Sandstone

The Waarre Sandstone consists of dominantly sandstones with some interbeds of siltstone claystone, and traces of coal. The sandstones are dominantly fine to very coarse grained and are poorly consolidated. The quartz grains occasionally show green inclusions. There is also a white to light grey very fine to fine-grained sandstone consisting of quartz, feldspar and lithic grains in a dominantly kaolinitic matrix, partly tight, and partly with fair to good porosity. The siltstones are light grey, grey brown quartzose, argillaceous, feldspathic, lithic

and partly carbonaceous. The claystones are dark grey to brown carbonaceous, silty and slightly glauconitic.

Otway Super Group

Eurmeralla Formation

The top of the Eumeralla Formation consists dominantly of siltstones and shales. The shales (or claystones) are generally medium grey, medium brown grey, light to medium greenish grey with rare light blue and green-grey; soft to firm, occasionally hard and splintery and partly dispersive. It can be micaceous, carbonaceous and silty with minor sandstone and coal interlaminations. The siltstones are grey and grey green, argillaceous, micaceous, feldspathic, and slightly carbonaceous. The minor sandstones present in the unit are grey green, very fine to fine grained with subrounded quartz, abundant white to brown feldspar, micaceous, lithic, chloritic, with trace orange feldspar in an argillaceous and slightly calcareous matrix.

8. RESERVES

Probabilistic reserves were calculated for the Waarre Sandstone using a Monte Carlo simulation. The input parameters used for the Monte Carlo simulation were calculated on the bases of the available data from the wells drilled in PEP 152 and the adjacent Permits.

Table 5. Reserves estimates – Port Fairy 1

PORT FAIRY PROSPECT - PEP 152
EXPLORATION RISK ASSESSMENT

Parameter		Confidence		
Source Present		0.9		
Source Communication with Reservoir		0.9		
Reservoir Present		0.5		
Seal Present		0.9		
Trap Integrity		0.6		
Risk Product		0.2187		
Assessed Chance of Success	1 in	4.57		
RESERVES ESTIMATION				
MONTE CARLO SIMULATION	Passes	250		
PORT FAIRY PROSPECT				
Waarre Sandstone				
Parameters Used		Min	Most Likely	Max
Confidence		0.9	0.5	0.1
Area of Slab - sq, Km				
Gross Reservoir Thickness – metres				
Or				
Bulk Rock Volume – million cubic metres		42.1	127.8	166.8
Net Reservoir Percentage		30	60	80
Porosity in percent		16	20	25
Free Gas Percentage				
Water Saturation (Sw) in Oil Leg – percent				
Water Saturation (Sw) in Gas Leg - percent		30	35	40
Formation Volume Factor for Oil (Bo)				
Gas Expansion Factor		118	120	122
Degree of fill – percent		100	100	100
Oil Recovery Factor – percent				
Gas Recovery Factor – Percent		60	70	75
RESULTS OF SIMULATION – UNRISKED			Median	
	Confidence Level	0.9	0.5	0.1
Gas Model				
Gas in Place – billions of standard cubic feet		28	33	54
Recoverable Gas - billions of standard cubic feet		15	26	37
		Mode	Mean	
Gas in Place – billions of standard cubic feet		28	40	
Recoverable Gas - billions of standard cubic feet		19	28	

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