

The Waitsia Field

Onshore North Perth Basin, Western Australia

N. Tupper, E. Matthews, G. Cooper, A. Furniss, T. Hicks and S. Hunt



APPEA Conference, Brisbane

6 June 2016

Photograph by Roger Xiang

Disclaimer



This presentation may contain forward looking statements that are subject to risk factors associated with the oil and gas businesses. It is believed that the expectations reflected in these statements are reasonable but they may be affected by a variety of variables and changes in underlying assumptions which could cause actual results or trends to differ materially, including but not limited to: price fluctuations, actual demand, currency fluctuations, drilling and production results, reserve estimates, loss of market, industry competition, environmental risks, physical risks, legislative, fiscal and regulatory developments, economic and financial market conditions in various countries and regions, political risks, project delay or advancement, approvals and cost estimates.

This presentation may also contain non-IFRS measures that are unaudited but are derived from and reconciled to the audited accounts. All references to dollars, cents or \$ in this presentation are to Australian currency, unless otherwise stated.

Reserves and Resources. The reserves and resources in this presentation are based on and fairly represent information and supporting documentation prepared by and under the supervision of qualified petroleum reserves and resource evaluators: Dr. Suzanne Hunt, AWE Manager for Engineering and Development, and Mr. Andrew Furniss, AWE General Manager for Exploration and Geoscience. Dr. Hunt, a Petroleum Engineer with a Ph.D. in Geomechanics, is a member of the Society of Petroleum Engineer Engineers and has over 19 years' experience in the petroleum sector in geoscience, field development planning, reserves estimation, production and facilities engineering. Mr. Furniss, a member of the Society of Petroleum Engineers and the American Association of Petroleum Geologists, holds an MSc in Exploration Geophysics and a BSc (Hons) in Geological Sciences and has over 25 years' of industry experience in strategic planning, portfolio management, prospect evaluation, technical due diligence and peer review, reserves and resource assessment, the application of advanced geophysical technology and business development. Both have consented in writing to the inclusion of this information in the format and context in which it appears.

AWE follows the Society of Petroleum Engineers – Petroleum Resources Management System (SPE-PRMS) guidelines with respect to the definition of different classes of reserves and resources.

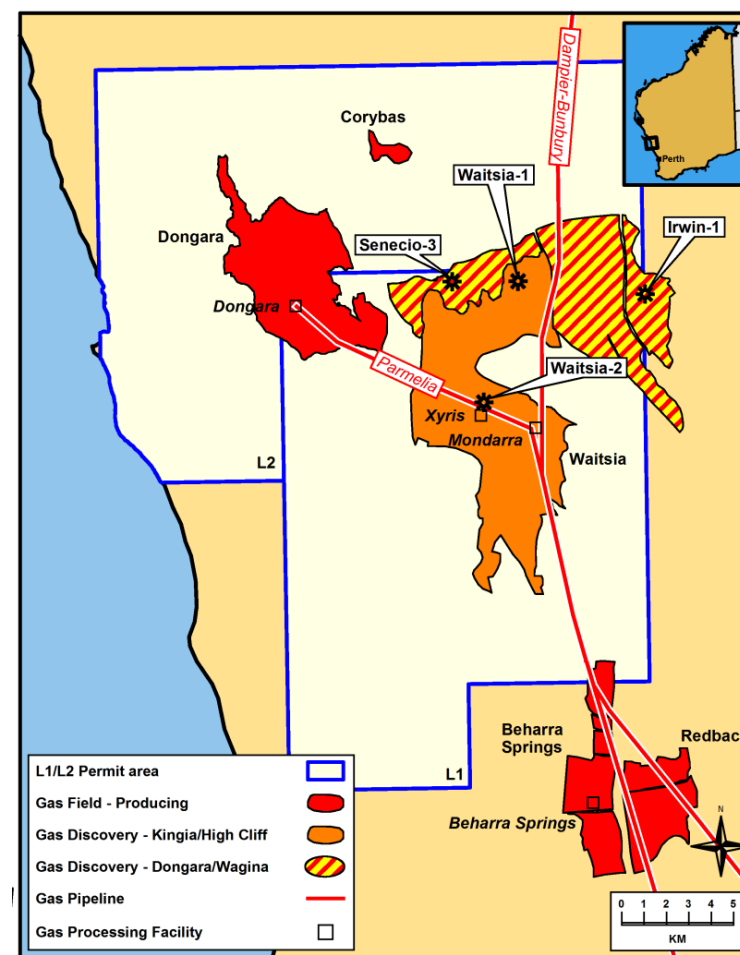
Agenda

1. Overview
2. Exploration History & Geological Setting
3. Field Description
4. Development Plan & Reserves
5. Conclusions



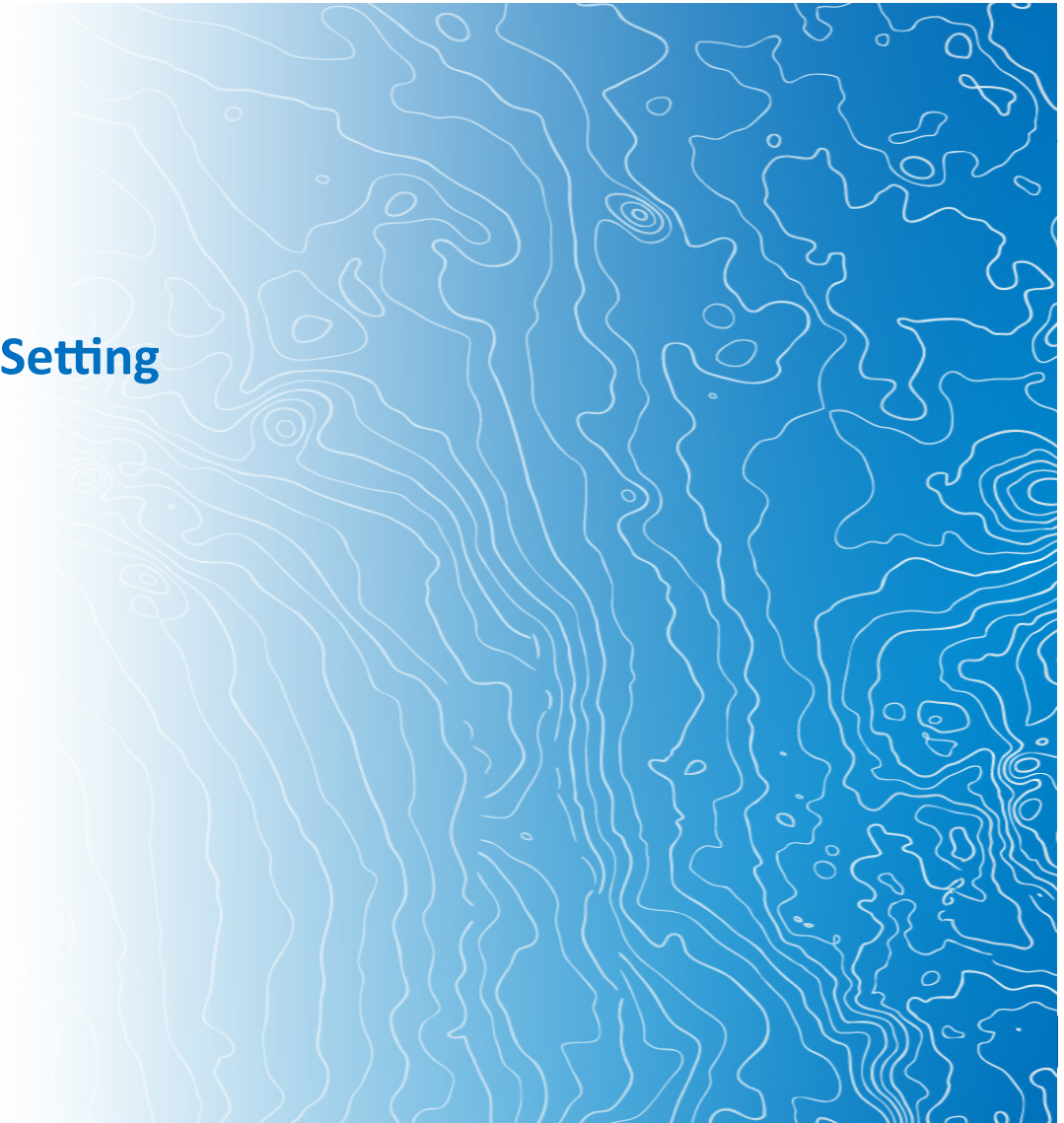
Waitsia Overview

- Largest conventional onshore discovery in 30 years
- Licence L1/L2 – 300 km north of Perth
- AWE operator (50%) with Origin Energy (50%)
- Discovered by deepening of Senecio-3 in 2014
- Appraised by Waitsia-1 & Waitsia-2 in 2015
- Early development via existing facilities & pipelines
- Production start-up 3Q calendar year 2016
- Exciting exploration & appraisal follow-up potential

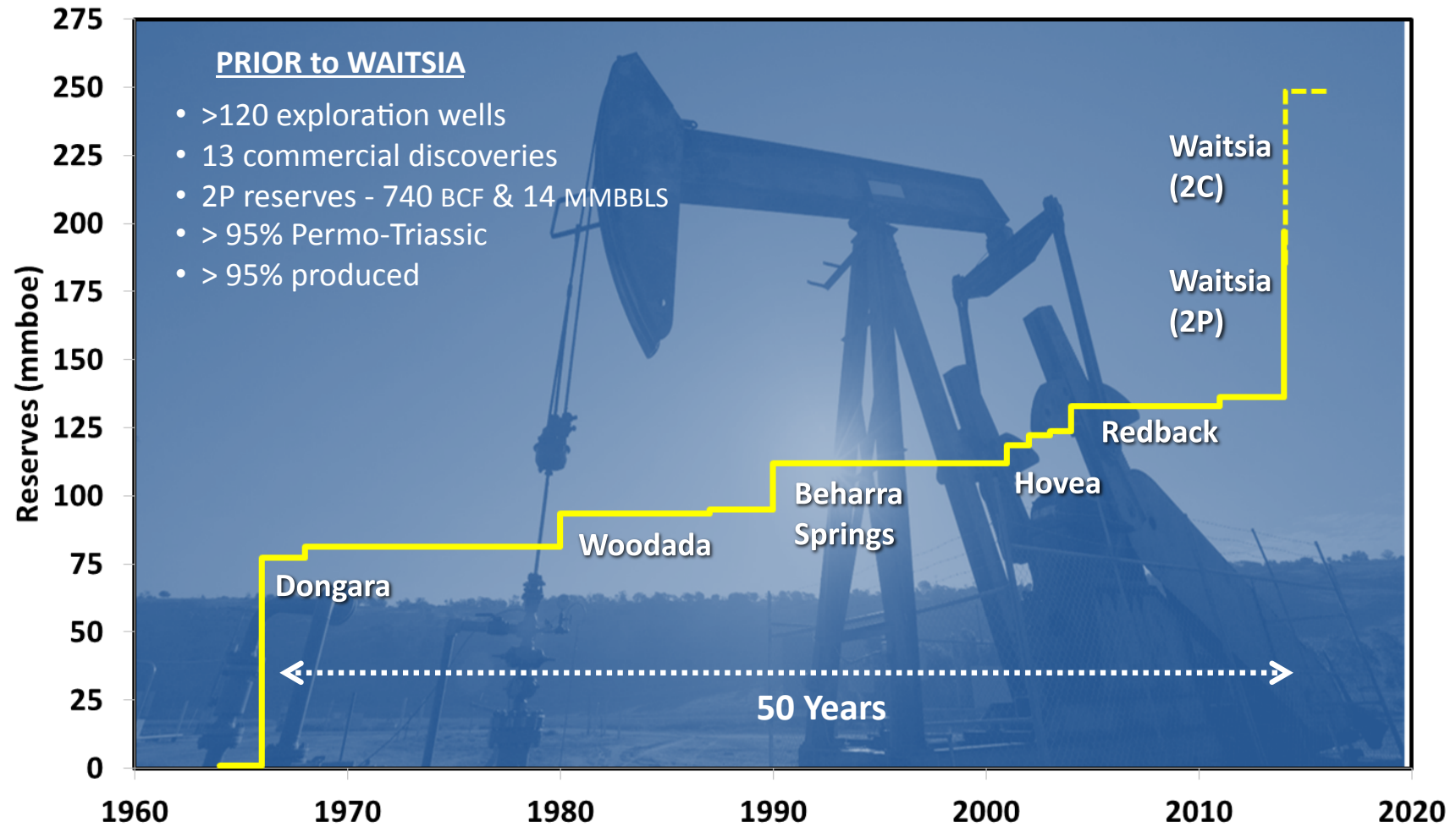


Agenda

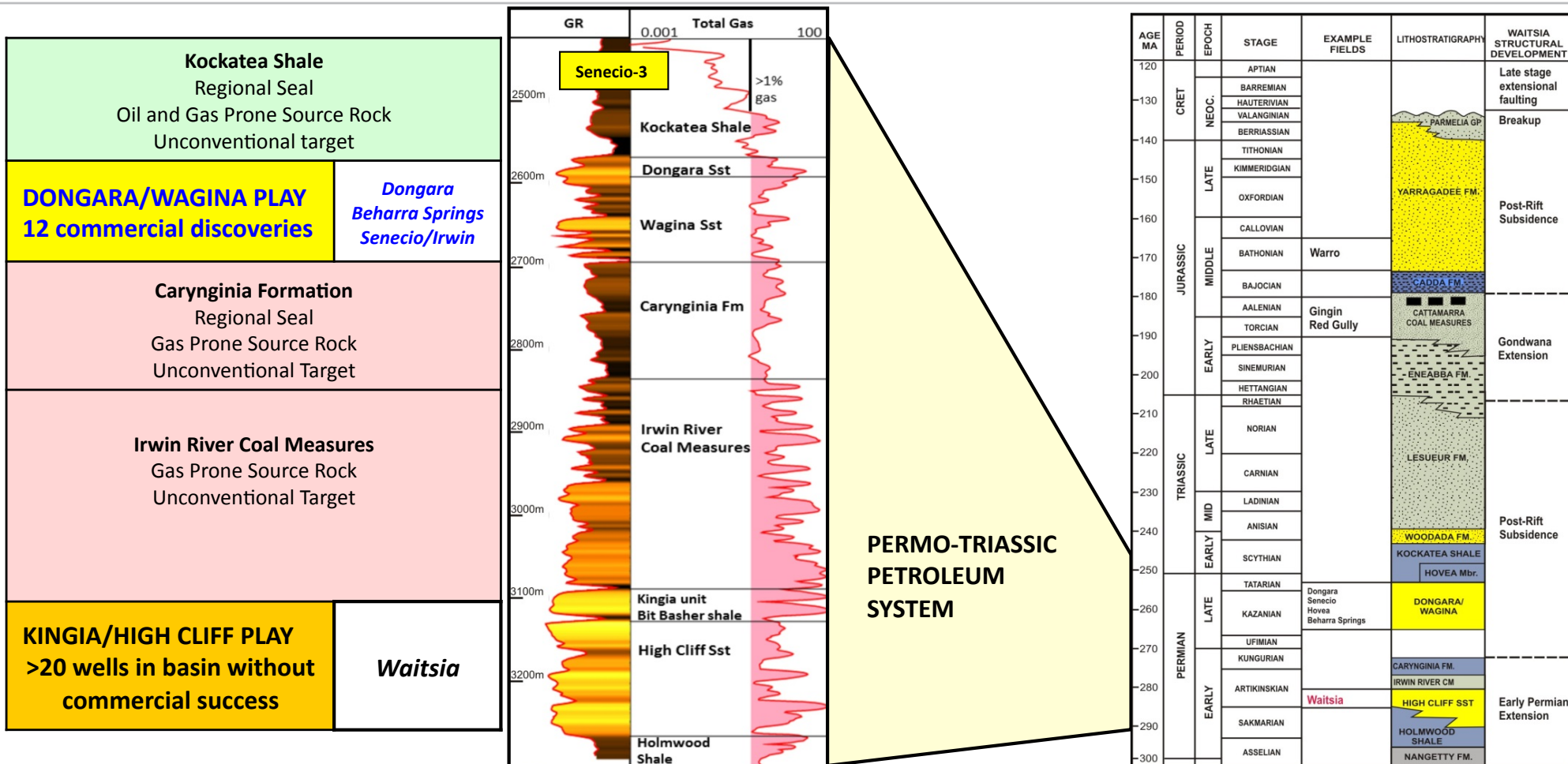
1. Overview
- 2. Exploration History & Geological Setting**
3. Field Description
4. Development Plan & Reserves
5. Conclusions



Exploration history – onshore North Perth Basin AWE

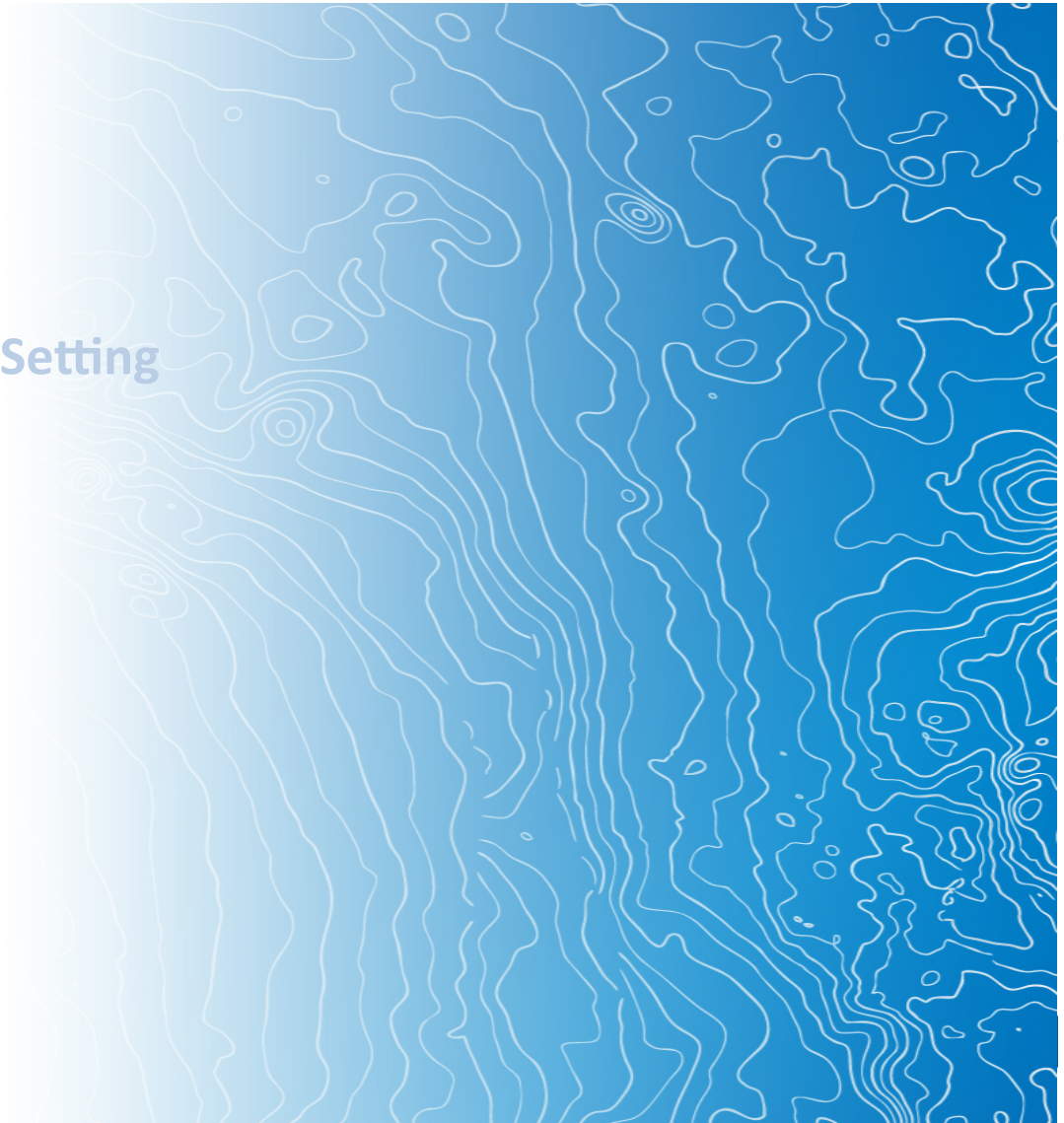


Permo-Triassic petroleum system & plays



Agenda

1. Overview
2. Exploration History & Geological Setting
- 3. Field Description**
4. Development Plan & Reserves
5. Conclusions

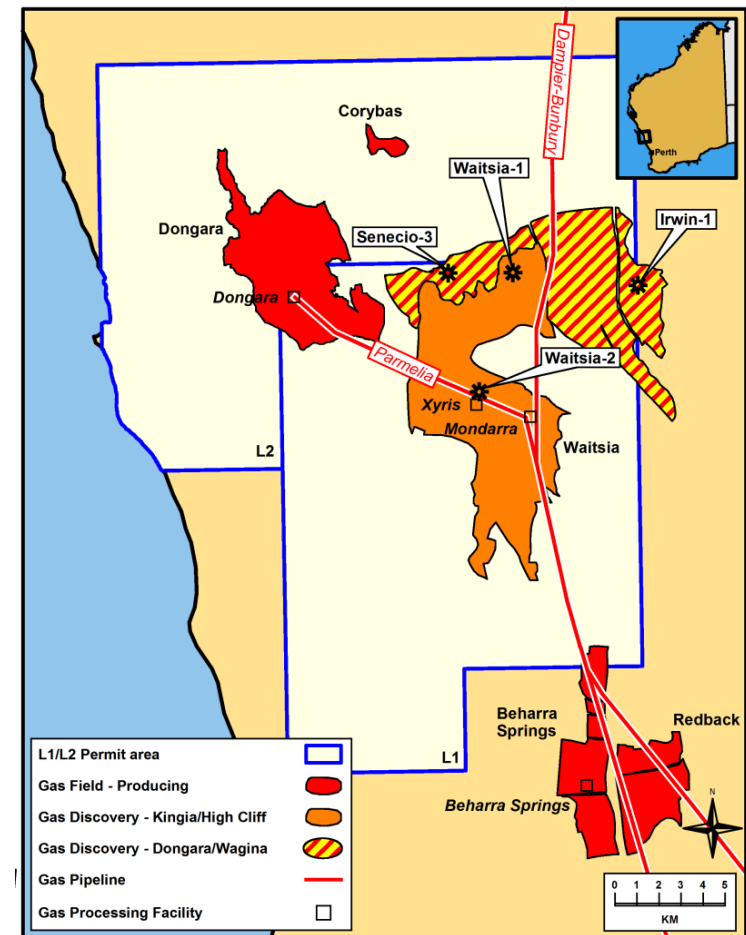


Discovery sequence

Date	Activity	Result
2005	Senecio-1/2	<ul style="list-style-type: none"> Dongara TIGHT GAS discovery
2013	Irwin 3D	<ul style="list-style-type: none"> Improved mapping – Senecio 1/2 in local fault zone
2014	Senecio-3	<ul style="list-style-type: none"> Dongara better quality reservoir (not tested) Well deepened due to very high gas shows Kingia/High Cliff CONVENTIONAL GAS discovery Testing confirmed high flow potential
2015	Irwin-1	<ul style="list-style-type: none"> Dongara TIGHT GAS discovery (not tested) Kingia secondary target wet as expected but good quality reservoir
	Waitsia-1	<ul style="list-style-type: none"> Confirmed lateral extent of Kingia/High Cliff reservoir Defined GWC Testing further confirmed high flow potential
	Waitsia-2	<ul style="list-style-type: none"> Confirmed field extension to south (not tested)

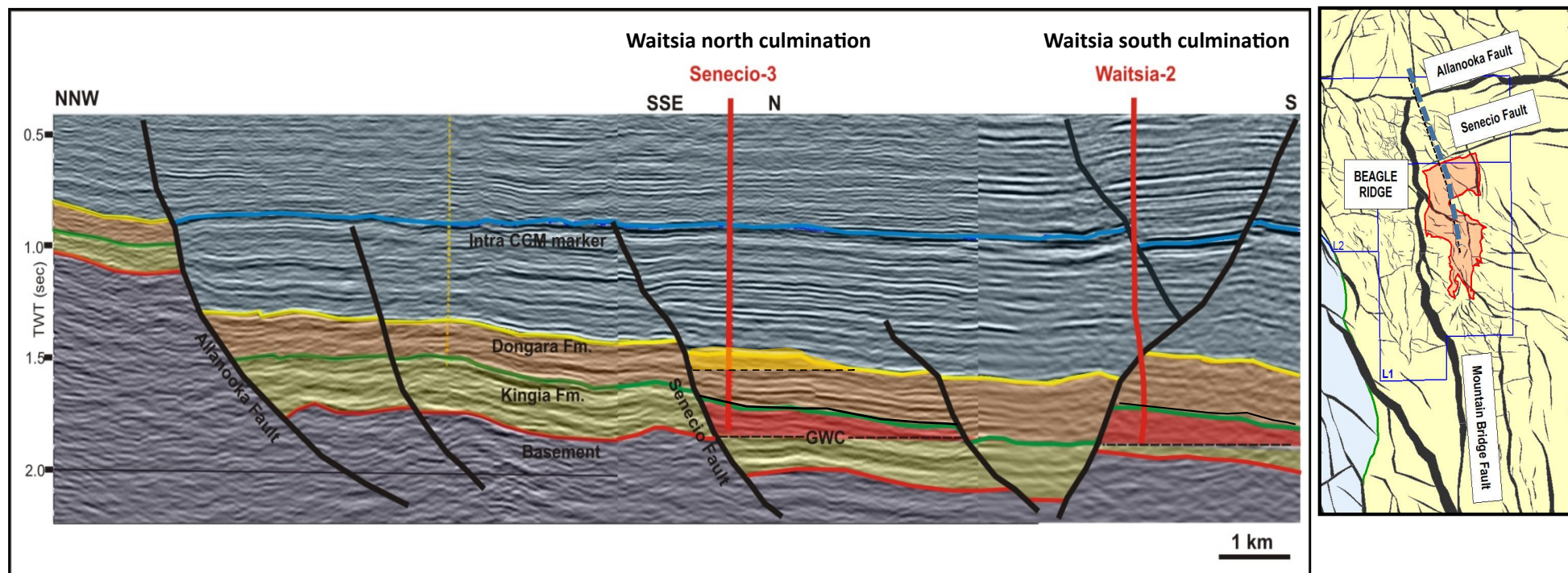
Pre-Senecio-3

- 19 wells drilled for Dongara targets in Waitsia area but terminated before reaching Kingia/High Cliff
- Perceived poor reservoir quality & problem with cross-fault seal

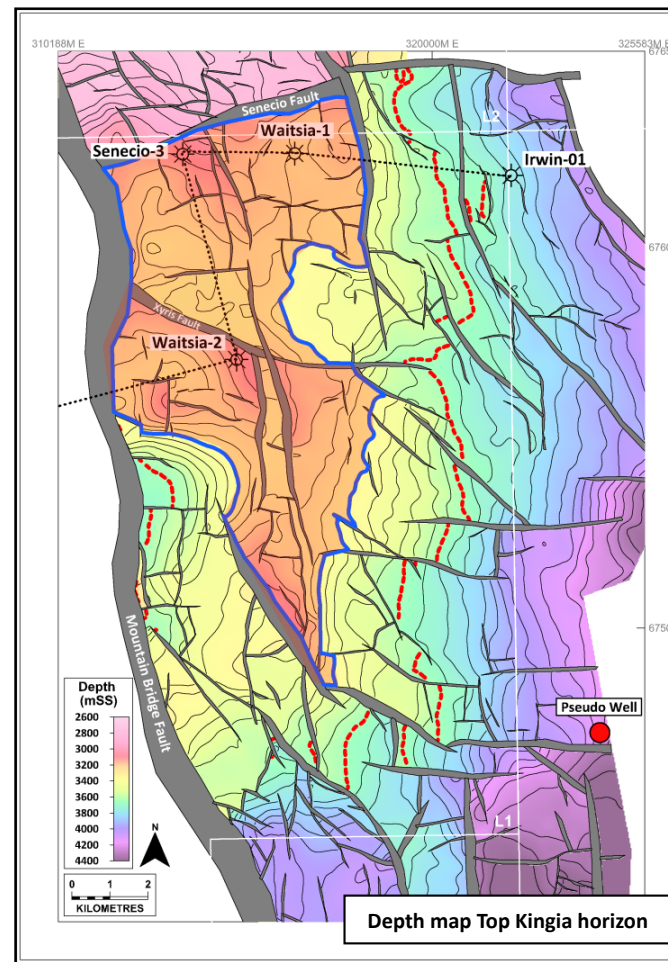
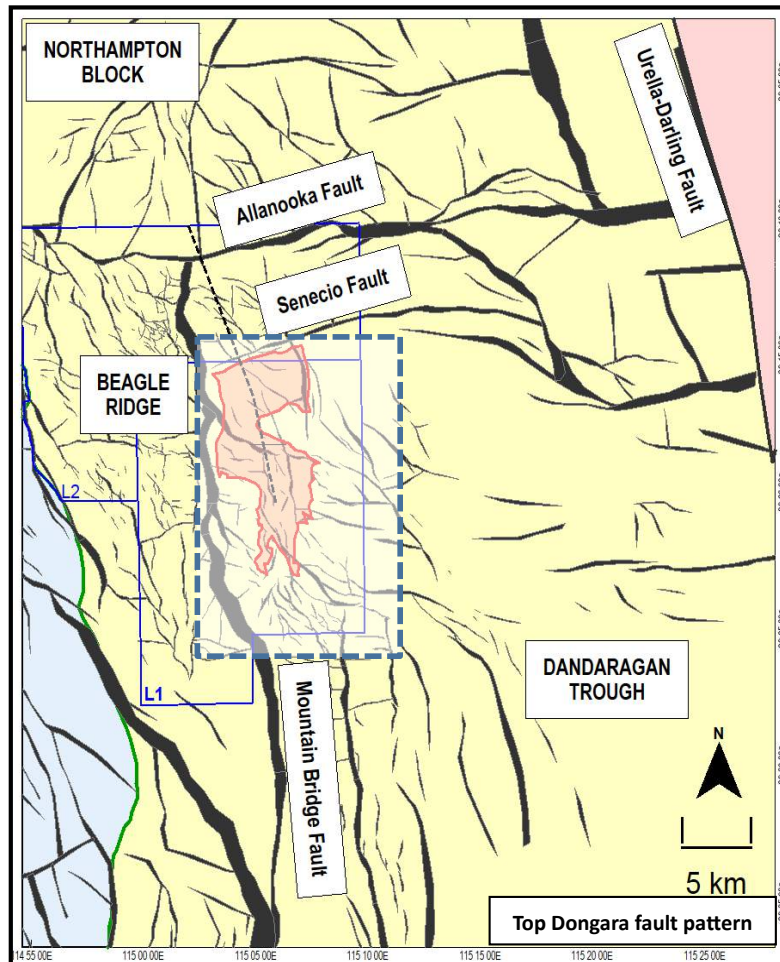


Seismic control

- 3D seismic coverage of varying vintages: 1994-2013.
- Moderate quality but sufficient to map Top Kingia horizon. Current re-processing project.
- Faults initiated in Early Permian with further growth in E-M Jurassic
- Steep planar faults indicative of oblique rifting of basement fabric



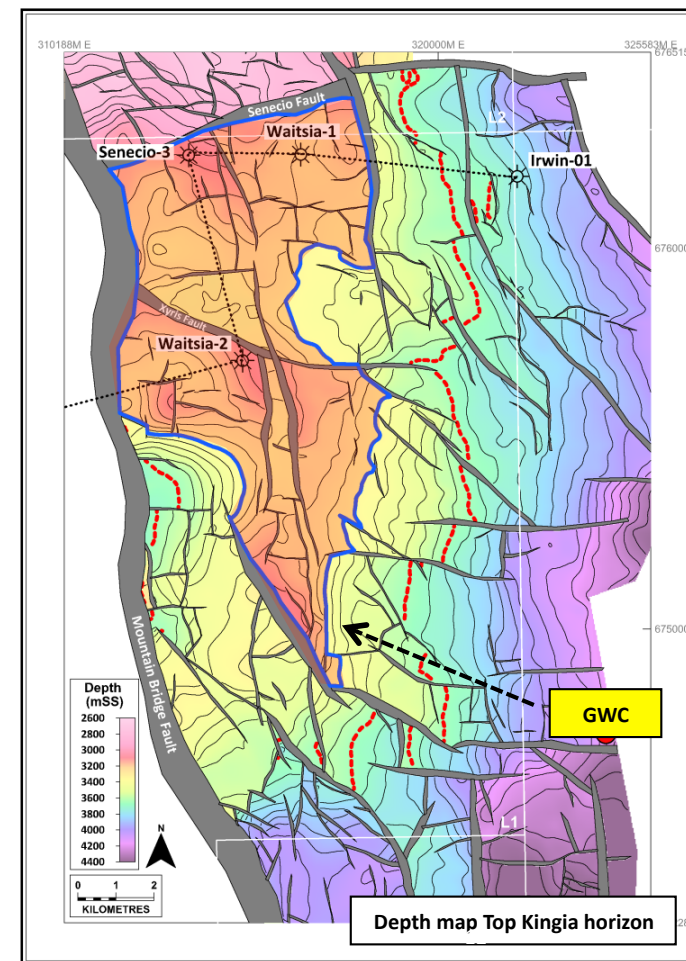
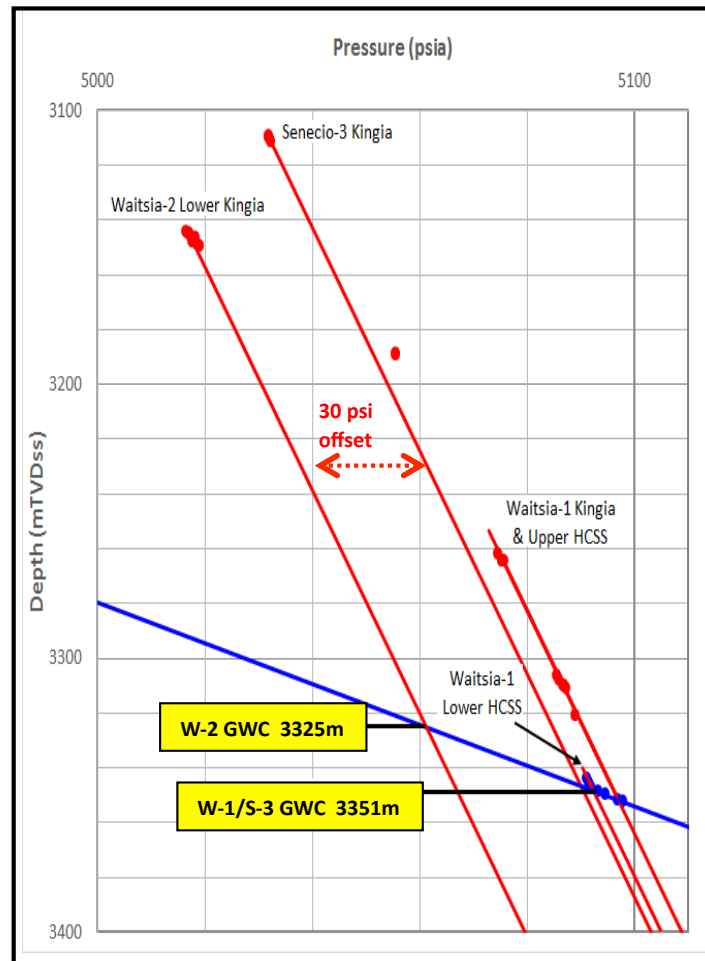
Structure



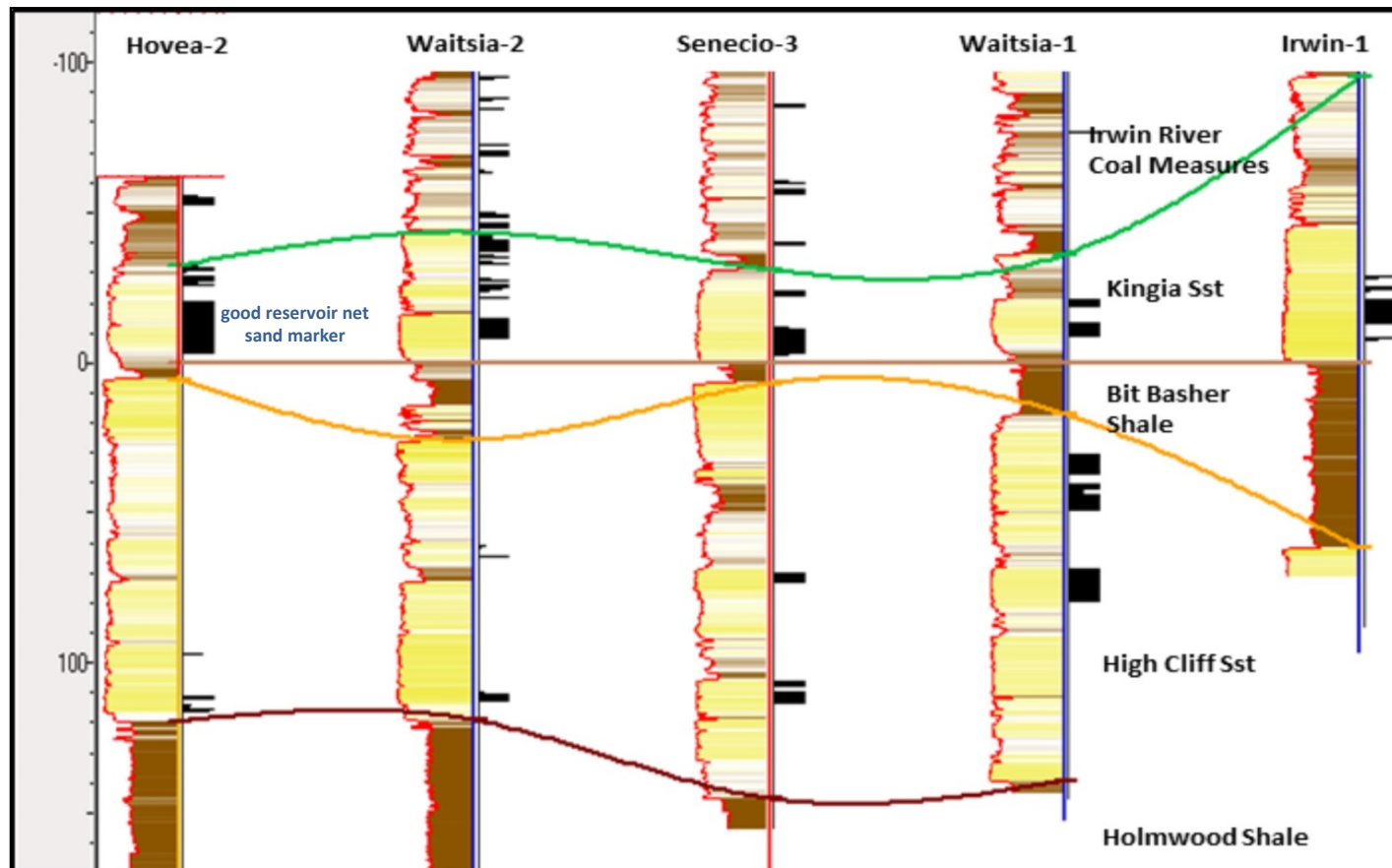
- Low-side fault closure of ~50 km²
- Crest at 3000m with 350m gross gas column
- Trap defined by Mountain Bridge & Senecio faults
- Senecio fault seals despite small throw
- Stress suggests W-E faults prone to re-activation – not the case.

Composition & gas-water contacts

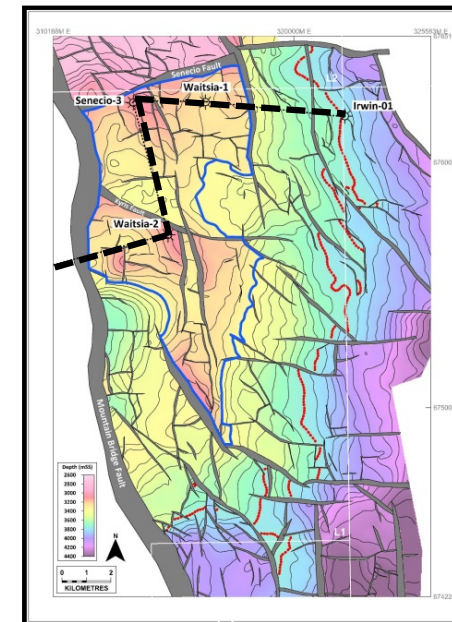
- Full suite of log, core & test data
- Waitsia is 93% CH₄ with low CO₂
- GWC defined by pressure & log data
- South culmination GWC possibly higher than North



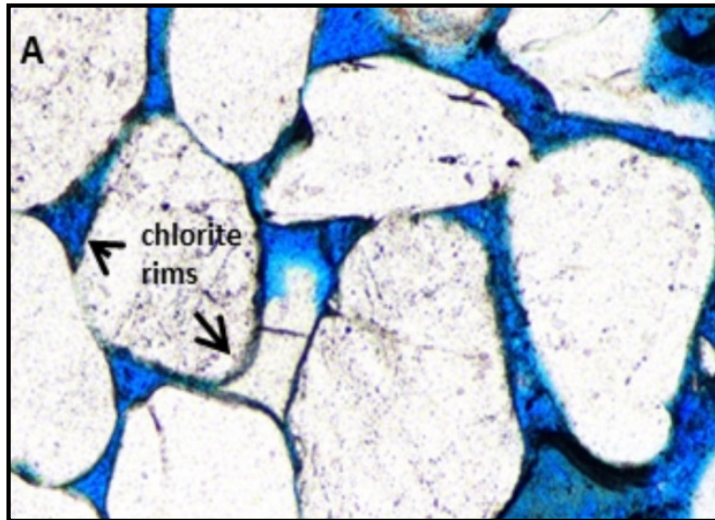
Kingia & High Cliff correlation



- Gross thickness 150-200m
- Beach & shoreface setting
- Quartz sand composition
- Intervals of good porosity >11% in Kingia & High Cliff



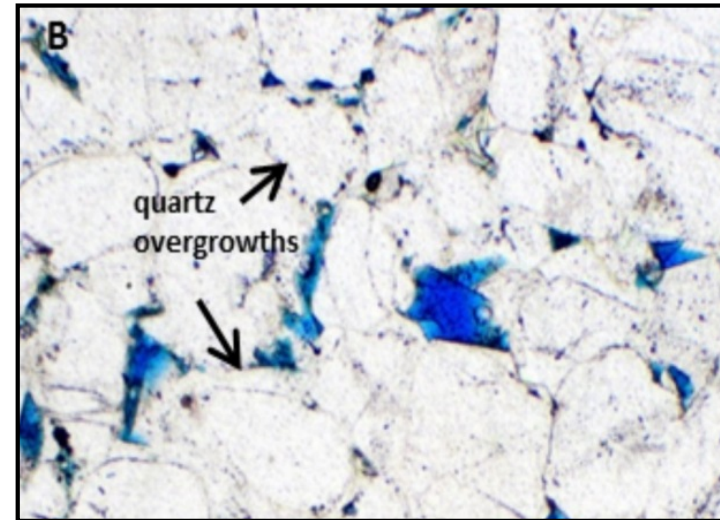
Kingia & High Cliff reservoir characterisation



Field of view 1.75 cm

GOOD RESERVOIR

- Clay rims prevent quartz cement
- Abundant preserved porosity (blue)
- >11% porosity
- 1-1000 mD permeability



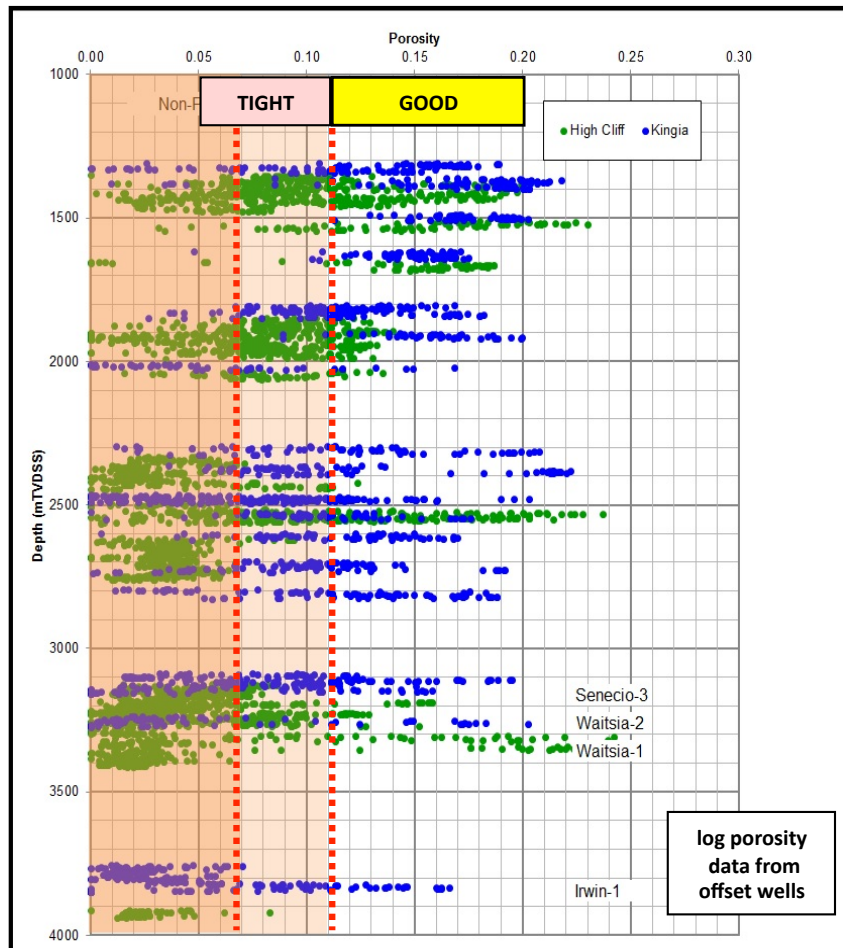
field of view 3.5cm

TIGHT RESERVOIR

- Pervasive quartz cement
- Less remaining porosity (blue)
- 7-11% porosity*
- 0.1-1 mD permeability

**Subsequently revised to 5-11% since publication*

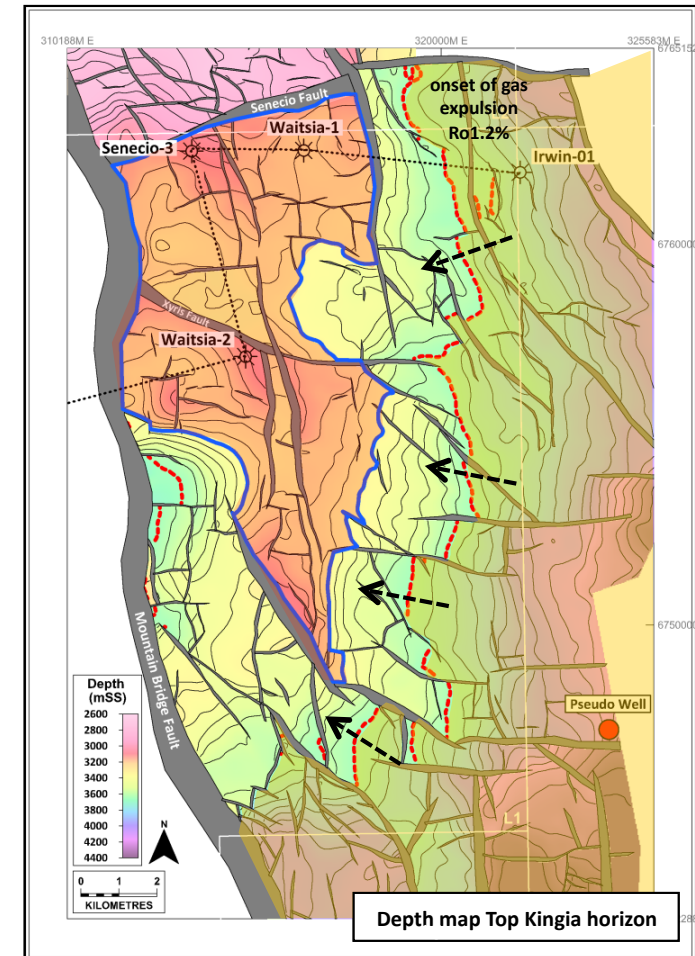
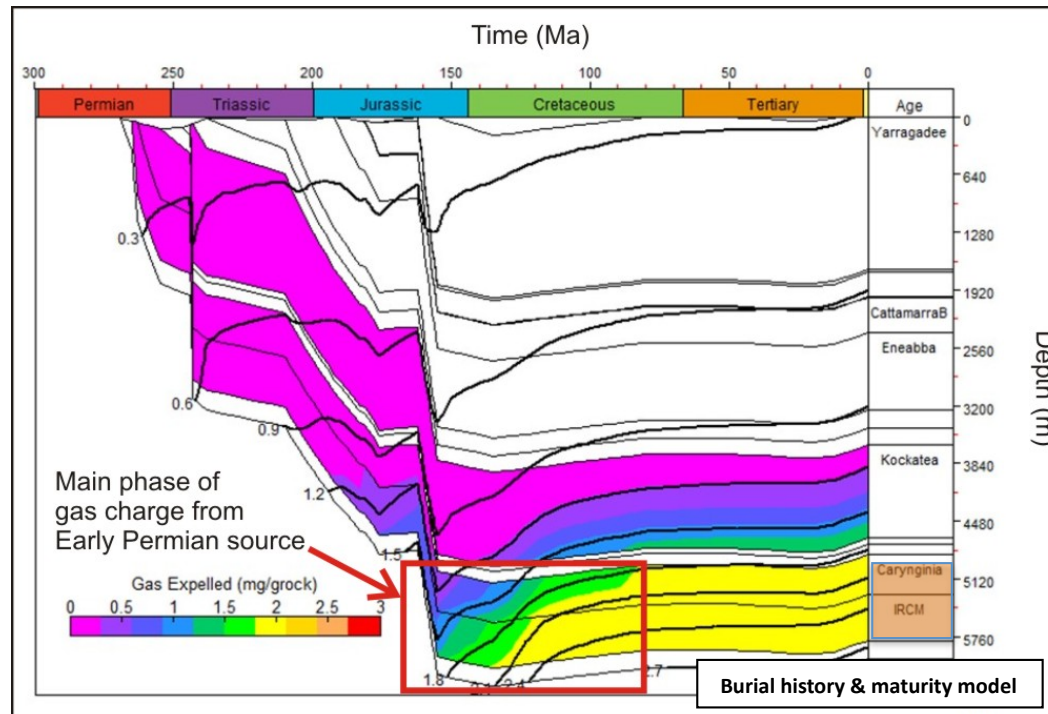
Good reservoir is diagenetically controlled



- Porosity controlled by diagenesis NOT depth
- Clay rim formation not understood but likely to be influenced by depositional environment
- Most Kingia wells have some good reservoir – deepest to date 3750m
- High Cliff more variable
- Wagina reservoir in Beharra Springs field is a direct analogue

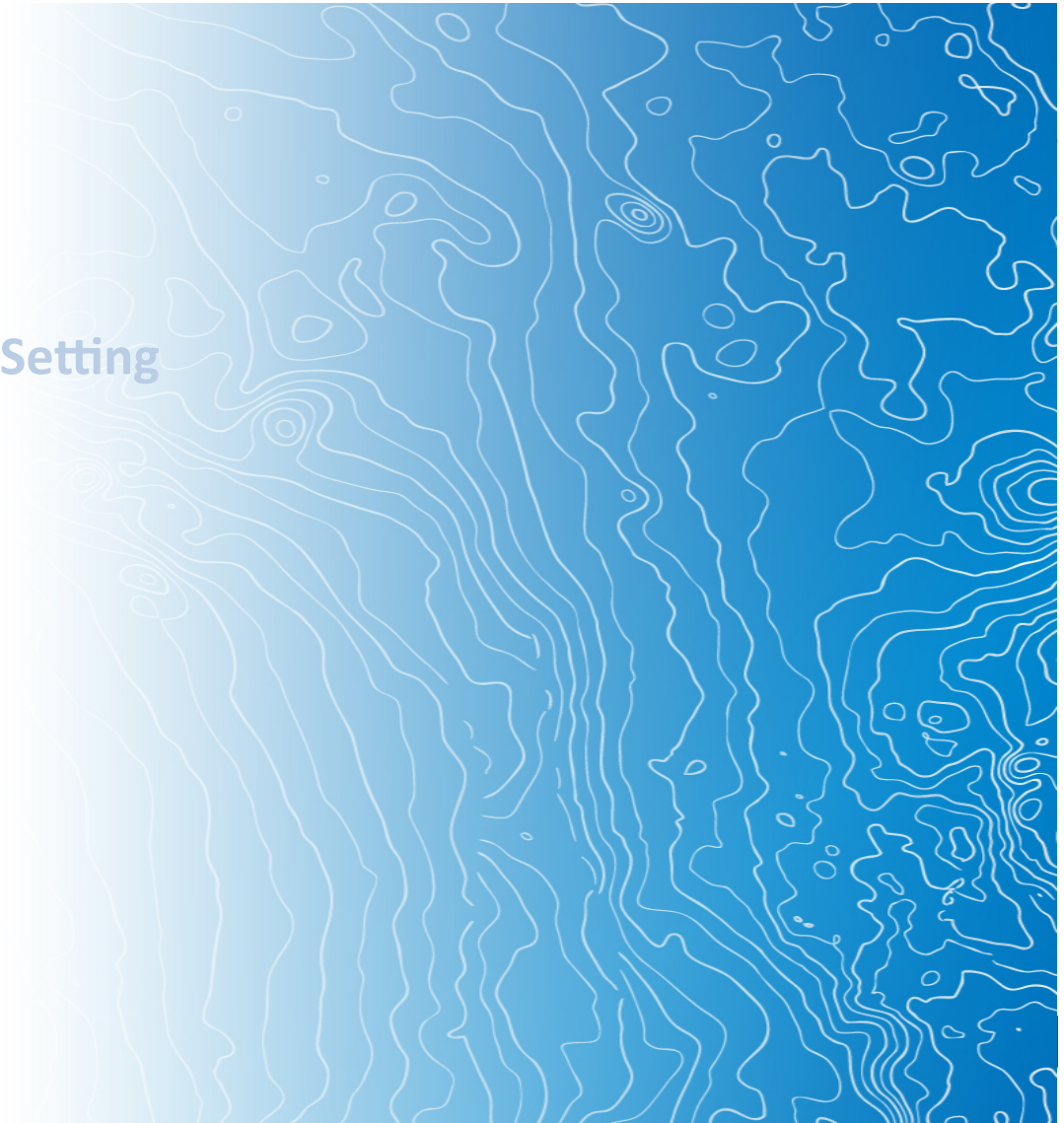
Charge model

- Early Permian source rocks are mature down dip from Waitsia
- Expulsion occurred during maximum burial & heat flow in Late Jurassic to Mid Cretaceous



Agenda

1. Overview
2. Exploration History & Geological Setting
3. Field Description
- 4. Development Plan & Reserves**
5. Conclusions



Development planning

STAGE 1: DEVELOPMENT & APPRAISAL

- Connect existing wells to Xyris Production Facility for early sales & to establish drainage efficiency
- First gas 3Q 2016 calendar year
- Planning to drill 2 further appraisal wells to define reserves

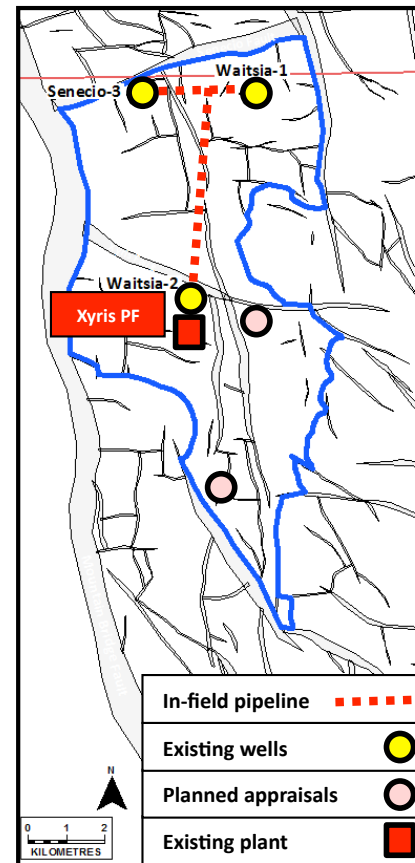
STAGE 2: DEVELOPMENT CONCEPT

- Full field development of good quality reservoir
- Plateau rate ~100 TJ/D from approx. 6 initial wells (includes 3 appraisal wells already drilled)
- Total of 15-20 production wells to maintain plateau over 20+ year field life - tied to centralised processing facility with regional hubs

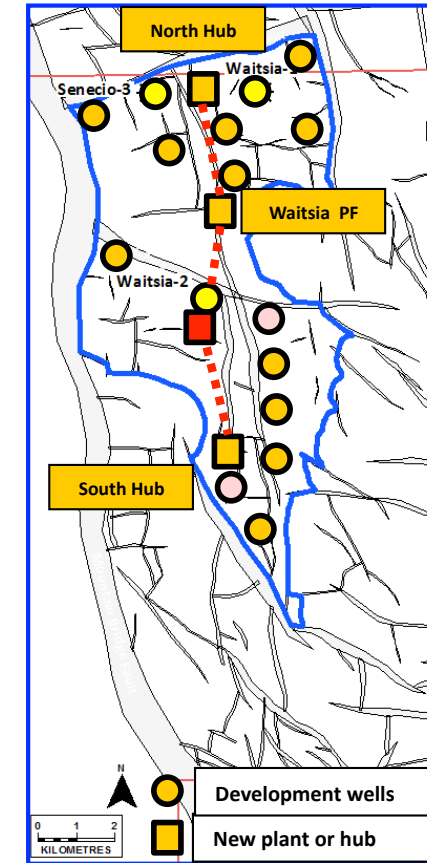
FUTURE STAGES

- Progressive development of tight gas contingent resources & unconventional prospective resources

STAGE 1: DEVELOPMENT & APPRAISAL



STAGE 2: DEVELOPMENT CONCEPT



Development concept & appraisal well locations subject to joint venture and regulatory approval

Reserves & contingent resources



August 2015

- Reserves & Contingent Resources reported following drilling of Waitsia-1 & Waitsia 2

21st August 2015 AWE ASX Release

Reservoir Interval	Gross Reserves (BCF)			Gross Contingent Resources (BCF)		
	1P	2P	3P	1C	2C	3C
Kingia/High Cliff (Good Reservoir)	101	178	242	110	149	203
Kingia/High Cliff (Tight Reservoir)				110	157	204
TOTAL (2P / 2C)	178			306		

June 2016

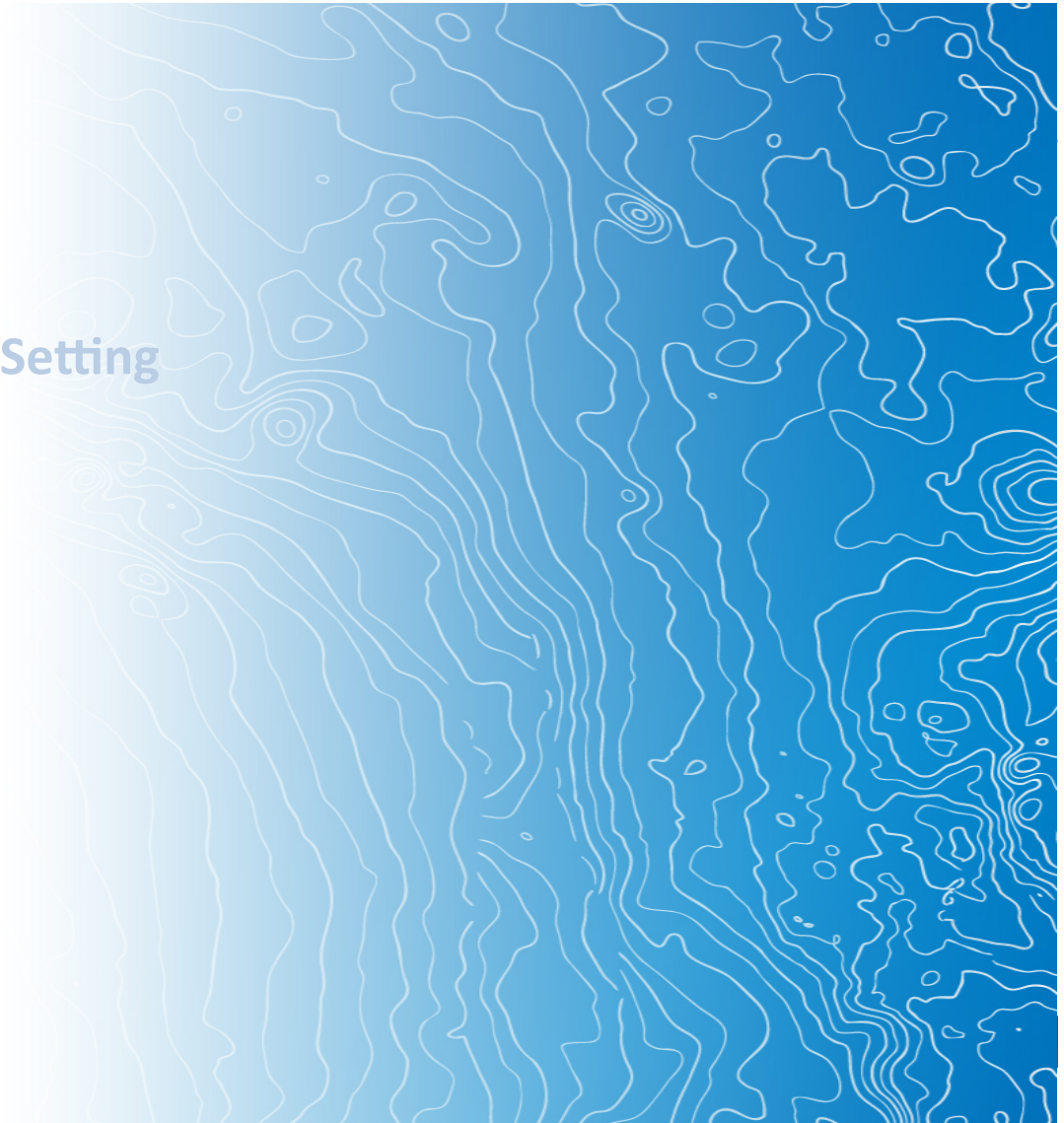
- Reserves & Contingent Resources reported following integration of core data, flow test data and dynamic simulation modelling

3rd June 2016 AWE ASX Release

Reservoir Interval	Gross Reserves (BCF)			Gross Contingent Resources (BCF)		
	1P	2P	3P	1C	2C	3C
Kingia	151	272	467	97	180	405
High Cliff	35	72	133	37	106	246
TOTAL (2P / 2C)	344			286		

Agenda

1. Overview
2. Exploration History & Geological Setting
3. Field Description
4. Development Plan & Reserves
5. **Conclusions**



Conclusions

- Largest conventional onshore Australian discovery in 30 years
- Material development with access to existing infrastructure & markets
- New play has re-invigorated Perth Basin exploration & development
- Positive for Mid West & WA – regional economic benefits; diversity of gas supply; royalties
- Incentive for continued exploration in other onshore Australian basins



Acknowledgements



Management of AWE & Origin for permission to publish and supporting the decision to deepen Senecio-3



Waitsia Stage-1A Flowline under construction May 2016