

# Buffalo project update

## 5 September 2017



Following Carnarvon Petroleum Limited's ASX announcement regarding the Buffalo project contingent resources on Monday 28 September 2017, we have received a number of queries about various aspects of the project. For the benefit of all shareholders, we would like to cover the key questions and responses in this project update:

- **How could such a significant volume of oil have been missed by the previous operators?**
  - A lot has changed technology wise since the previous field operations commenced nearly two decades ago. We're now able to extract far more precise detail from seismic data and the Full Waveform Inversion ("FWI") processing we applied to Buffalo is one of these step changes that has allowed us to better image the Buffalo field structure compared with what was available to the previous operators.
- **How does FWI work?**
  - Seismic data is a key tool used by the oil industry to map geologic structure at depth and to aid the identification of hydrocarbon traps. Seismic involves sound waves travelling down into the earth and bouncing back (like an echo) from layers in the subsurface. The time taken by the reflected sound is dependent on both the depth of the reflector and the velocity of sound in the rocks through which it travels. Variations in velocity cause the sound raypath to bend (or 'refract') and significant work is needed to uncomplicate the 'image' of the subsurface. A simple optical analogy would be looking through an old window glass where uneven thicknesses distort the appearance of objects on the other side.
  - At Buffalo, the field lies under a major velocity anomaly caused by significant water bottom topography, which laterally juxtaposes relatively slow water (~1500m/sec) against faster rocks below the seabed (~2500m/sec), and this causes major imaging challenges because of severe raypath bending and travel time discrepancies.
  - With vastly increased computer power, the right tools (particularly 'FWI') have become available, and enable us to more reliably image the reservoir targets: it is much like replacing that old irregular pane of glass with a nice new one.
- **What is the status of the facilities in the previous Buffalo field?**
  - The FPSO, flowlines, wells and small platform have all been properly abandoned and removed from the site. Any redevelopment of the field will effectively be a new development, although it is possible that the original anchors for the FPSO may be reused.
- **What is the oil quality?**
  - The Buffalo oil is a low viscosity, low GOR (gas-oil ratio), light 53° API oil that generally attracts a high price compared with the Tapis and Brent reference crudes.
- **What is the possibility of a gas cap?**
  - No gas cap is expected in the Buffalo field redevelopment. The Buffalo oil is very undersaturated for gas with a GOR of 110 scf/stb, and a low bubble point of about 500 psia, which is a long way below the field reservoir pressure (~4,777 psia). This is also supported

by observations of the historical production, and the absence of gas caps in any well intersections in the nearby fields at Laminaria, Corallina and Kitan.

- **Is there a water drive?**
  - The field is supported by a strong aquifer that maintains reservoir pressure, and provides excellent sweep of the reservoirs. The effectiveness of the aquifer is evidenced by observation of just a ~40 psia pressure drop (from virgin pressure of ~4,777 psia at the OOWC) when the Buffalo-9 well was drilled: This was after the field had produced around 13 million barrels of oil.
  
- **How do you explain that the Buffalo-9 well had issues with early water influx?**
  - The Buffalo-9 well was drilled after some 13 million barrels of oil had been produced from the field from the Buffalo-3 and Buffalo-5 wells. Buffalo-9 drilled through an interval of low oil saturation reservoir sands before drilling through a shale layer into oil-saturated reservoir. Carnarvon's current reservoir simulation shows that the Buffalo-9 well, being near the western extremity of the field, drilled through a zone that had been swept by water influx from the west caused by the earlier production from Buffalo-3 and Buffalo-5 wells.
  
- **What is the quality of the reservoir like?**
  - The reservoir sands at Buffalo are part of a deltaic depositional system that can be readily correlated over long distances. At Buffalo, the reservoir sands have excellent permeabilities ranging from 30 mD to over 2000 mD. To put these permeabilities into context, the initial flow rates from the first two wells were significant at around 50,000 barrels of oil per day.
  
- **What is the minimum economic pool size?**
  - Based on scoping economics, the Buffalo field redevelopment is economic on a standalone basis at 1C volumes using an oil price of US\$50 per barrel.
  
- **What is Carnarvon doing now and planning to do going forward?**
  - Work on the seismic data and reservoir modelling continues for the purpose of supporting development planning. The development planning is now a key focus for the team with a broad array of inputs being worked through, including those from the regulators with whom we are currently engaged, namely:
    - NOPTA in regard to moving towards a production license at the appropriate time, and
    - NOPSEMA in regard to environmental and operational matters that are to be addressed before any field activities commence.

We appreciate the interest of our shareholders and interested investors in the Buffalo redevelopment project. Our intention is to refine our redevelopment plans and economics and provide further updates on these in the coming months.