



UNDERSTANDING THE SUBMERGED CULTURAL LANDSCAPE



Woodside

Since the appearance of Australia's first inhabitants at least 65,000 years ago, sea levels have risen significantly. The submerged landscape around Murujuga was occupied by Indigenous people, and its current islands were connected to the mainland as inland mountains.

In July 2020, the Deep History of Sea Country (DHSC) Project team and the Murujuga Aboriginal Corporation (MAC) announced the discovery of Australia's first sub-tidal Indigenous archaeological finds at two locations in the waters of Murujuga (Burrup Peninsula), confirming that Indigenous artefacts persist in the submerged landscape.

These discoveries were located outside of Woodside's operations and proposed development footprints. However, the study of submerged Indigenous heritage is in its early stages, and Woodside has pro-actively sought to understand the potential heritage values of the submerged cultural landscape for the proposed Scarborough pipeline route. We have engaged with MAC and heritage experts to conduct an archaeological assessment that is the first of its kind in Australia.

Murujuga is a highly significant cultural landscape rich with heritage values, included on Australia's National Heritage list and World Heritage tentative list. It contains one of the largest, densest and most diverse collections of rock art in the world, estimated to contain over a million engravings (petroglyphs) covering a broad range of styles and subjects. The landscape also contains quarries, middens, fish traps, rock shelters, ceremonial sites, artefact scatters, grinding patches and stone arrangements that evidence tens of thousands of years of human occupation. These places are linked through the stories, knowledge and customs that are still held by Traditional Custodians and have significance beyond their archaeological value.

Woodside collaborated with the University of Western Australia's Doctor Mick O'Leary and Professor Jo McDonald, who were involved with the ground-breaking discoveries in Murujuga's waters, to design a research project to assess areas of archaeological prospectivity along the pipeline route within the proposed development area. The project was undertaken in consultation with MAC, who have been separately engaged by Woodside to also conduct ethnographic assessments of cultural values over the submerged landscape.

This research project, in consultation with the Traditional Custodians has concluded that the development proposal is likely to have nil to low impact on archaeological heritage values and that the proposed pipeline route is the preferred route within Mermaid Sound. In particular, the planned Scarborough Development will not impact any submerged igneous rock, which could have the potential to contain as yet undiscovered examples of Murujuga's internationally significant petroglyphs. An executive summary of the research project is available and academic articles are being planned on this research for publication in the near future.

This research provides Woodside greater certainty that impacts to cultural heritage can be avoided for the proposed Scarborough Development. Woodside will continue to work with Traditional Custodians to ensure that cultural values are understood and remain protected through the Scarborough Development.

Woodside continues to engage with Traditional Custodians and MAC on the management and co-existence with Murujuga's cultural heritage.



Woodside

**Scarborough Pipeline Cultural Heritage
Assessment: Establishing Archaeological Potential
and Significance**

April 2021

Final Report

**Report to Woodside Energy Ltd
UWA-2020/GR000028**

EXECUTIVE SUMMARY



THE UNIVERSITY OF
**WESTERN
AUSTRALIA**



Centre for
Rock Art Research
+ Management

EXECUTIVE SUMMARY

Woodside Energy Ltd (WEL)'s proposed Scarborough development requires the laying of a 430 km long export pipeline from an offshore facility located 375 km NW of the Burrup Peninsula to existing onshore infrastructure at Dampier.

The recent discovery (Benjamin et al., 2020) of two locations with Aboriginal underwater cultural heritage (UCH) approximately 5 km east of the proposed Scarborough pipeline development envelope has demonstrated the potential for UCH to exist on the NW Shelf and highlighted the need to assess the potential impacts of offshore developments on submerged heritage landscapes.

WEL engaged The University of Western Australia's School of Earth Sciences and The Centre for Rock Art Research + Management (CRAR+M) to undertake a desktop underwater cultural heritage assessment along the 190 km long section of pipeline that crosses the continental shelf in consultation with the Murujuga Aboriginal Corporation (MAC). This assessment addresses the potential for Aboriginal heritage only and does not consider shipwrecks or historic UCH. The study builds on scientific evidence that people first arrived in Australia some 65,000 years ago. At this time, sea levels were around 100m lower than today. The First Australians occupied and exploited an evolving continental shelf landscape before sea level rose and stabilized around 7,000 years ago, flooding the cultural landscape that had been lived upon by thousands of generations of people.

This study is focused on the pipelay route and its development envelope beginning at the Burrup Peninsula and ending at the edge of the continental shelf. The project team has used a variety of existing geophysical datasets to recreate the submerged landscape.

The predictive model first required the reconstruction of the submerged landscapes. This reconstruction was based on: (1) geological data, (2) geophysical data (3) geochronological data and (4) palaeosea-level data.

The landscape features and their cultural potential were assessed in the context of likely human occupation and activity occurring as the landscape evolved. Terrestrial heritage records have been used to predict the potential for UCH to exist within the recreated submerged landforms, and the likelihood of any such sites surviving inundation (Figure 1).

On this basis the likelihood and scientific significance of prospective UCH sites existing within a reconstructed cultural landscape was determined. Cultural significance will be addressed separately by MAC. For prospective cultural landscapes, the likelihood of occurrence and scientific significance was then numerically scored within a heritage risk / sensitivity matrix to provide an overall heritage impact risk value.

The predictive model identifies that more durable site types (those more resistant to erosion), in association with identifiable high value coastal landforms, palaeoriver and tidal channels and limestone karst waterholes, would include artefact scatters cemented in beach rock and deflation surfaces; indurated mound middens; stone arrangements, rock shelters, and water holes. Geophysical surveys did not identify

any igneous rock outcrops along the pipeline route: therefore, there is no potential threat from the development envelope to submerged rock art.

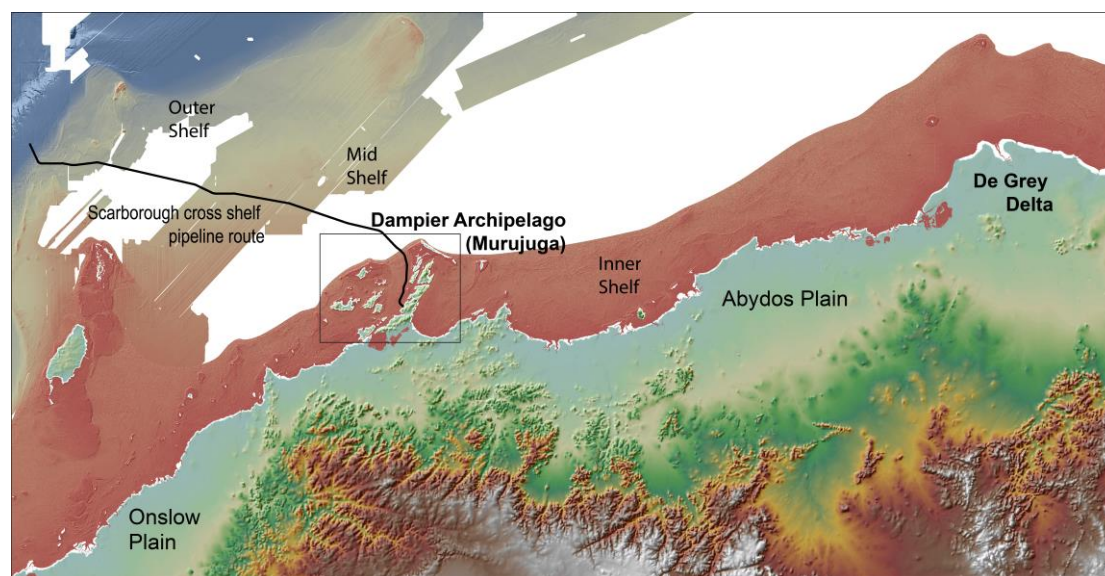


Figure 1 - Onshore Analogues of Submerged Landscapes

The UWA researchers had two meetings with the Murujuga Aboriginal Corporation's Circle of Elders. The first meeting outlined the proposed scope of the UHC assessment and agreed on the approach being undertaken; at the second meeting researchers presented the findings and discussed recommendations. In both of these meetings there was lively interest around the possibility of certain submerged features being identified by this study: palaeo-river channels, submerged springs and mounds identified within the broader submerged (and subdued) landscape. These meetings have clarified that such features are central to connections the community has curated regarding song lines.

It was reiterated to the Circle of Elders that no such submerged paleo-features, which can be identified elsewhere on the continental shelf, are located within or near the pipeline development envelope.

The survey results have been considered in three broad geomorphic zones (Figure 2), the:

- inner shelf from 0 to 30km along the route and at 0-35 meters below sea level (mbsl) which includes Mermaid Sound;
- middle shelf from 30km to 155km along route at 35 to 75 mbsl; and,
- outer shelf from 155 km to 190 km along route at 75 to 120 mbsl.

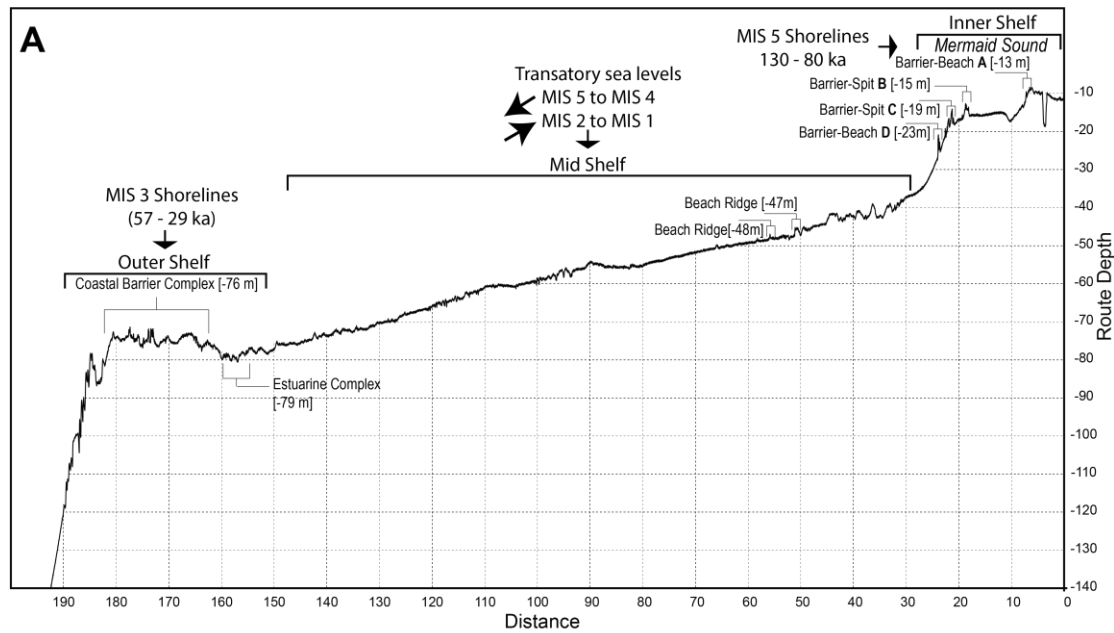


Figure 2 - Geomorphic Zones

The inner shelf (Mermaid Sound), while mostly covered in recent marine sediments, hosts four well-preserved coastal barrier formations (Figure 2 and Figure 4). Age dating was possible only on the innermost barrier. Radiocarbon dating of shoreline deposits were at the limits of the radiocarbon method. U-series age dating of these same stratigraphic horizons returned a series of ages ranging from 95,000 to 260,000 years BP. The three outer barriers of the Dampier Archipelago have been assigned ages by reference to known ancient sea-levels (Figure 3).

The mid shelf along route is characterized by a very broad featureless landscape. During periods of lower sea levels, this mid shelf would have been part of an extensive alluvial plain similar to the current Abydos or Onslow Plains (Figure 1).

This zone’s older Pleistocene land surface is covered by a 0.5-2.0-metre-thick layer of recent marine sediments, possibly burying subdued landscape features. Two minor beach-ridge features were observed (at -46 and -47 mbsl). No material was available to date these features, but ancient sea-levels suggests that these likely formed at the end of the last interglacial (80,000 years ago) prior to human arrival into Australia.

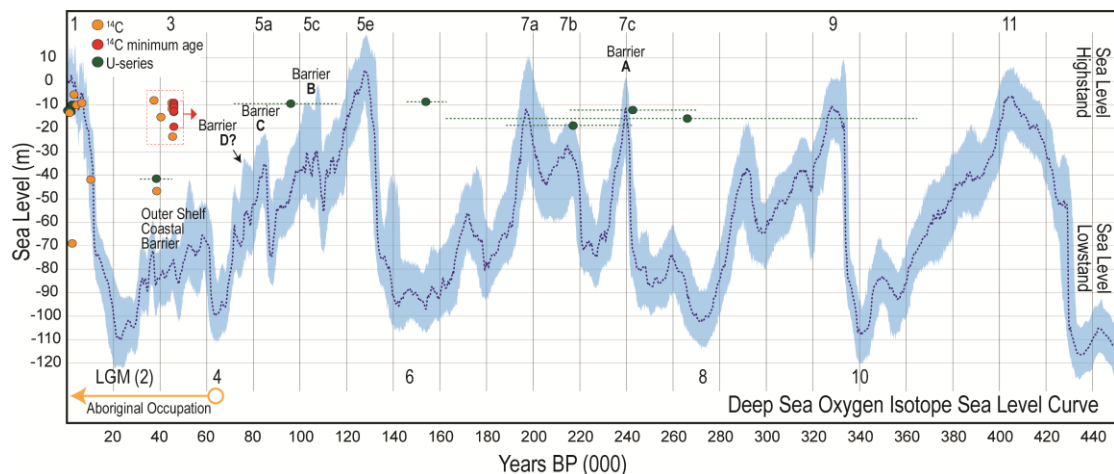


Figure 3 Sea level Change and Assessed Shoreline Age

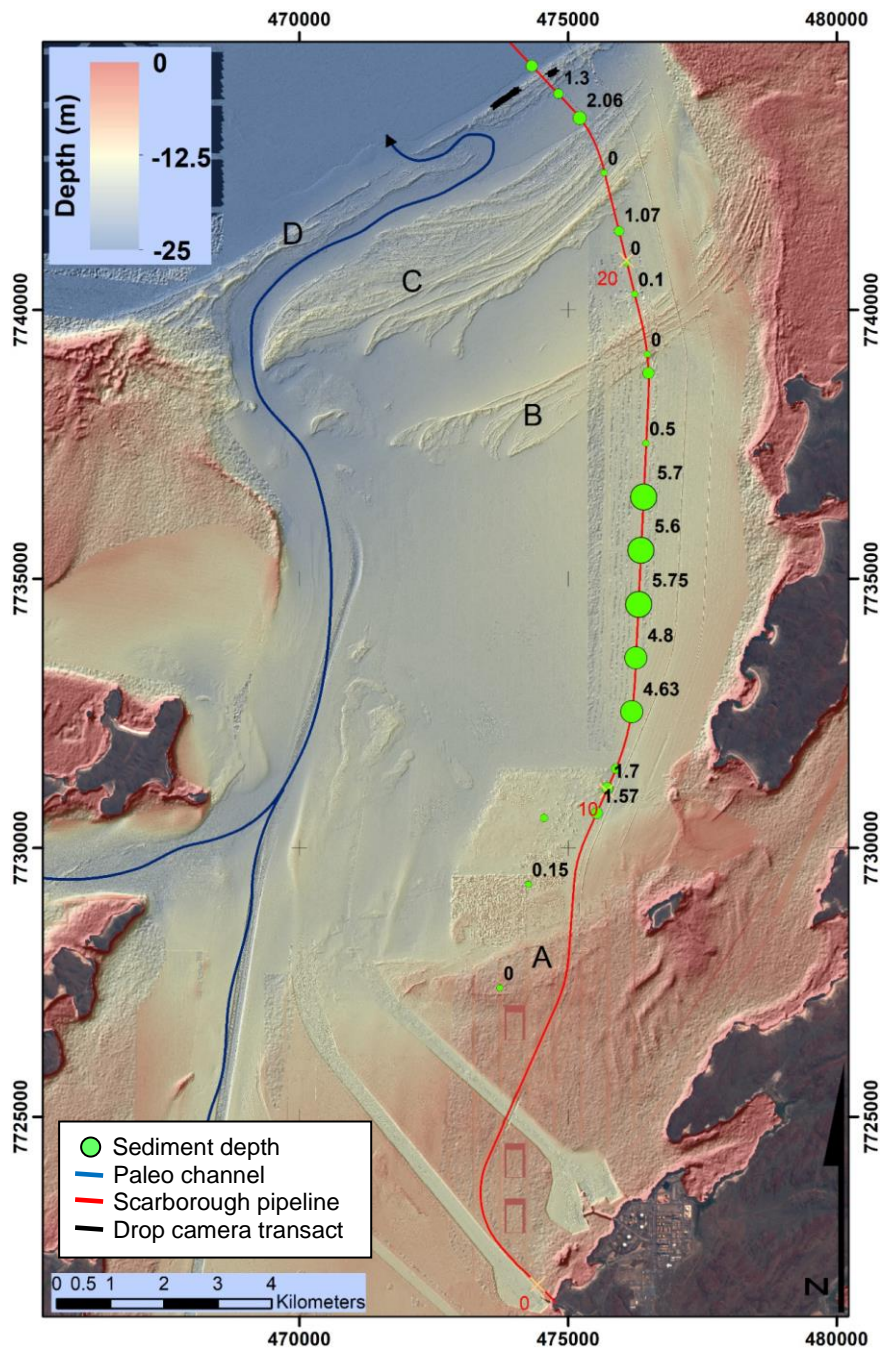


Figure 4 Inner Shelf Assessment

The outer shelf is characterised by a change in slope and more elevated seabed features. Geophysical data revealed a complex barrier-beach/estuarine coast with a regressive barrier up to 3 km wide with 3 - 4m high dunes. The barriers are crossed by a series of up to 1 km wide estuarine tidal channels. No material was available to date these features however when seabed elevations were compared against the past sea level, they correlate with an extensive still stand period from 57,000 to 29,000 years ago. These outer shelf landscapes are believed to have formed during the initial coastal occupation of this continent and are of high scientific significance. A number of prospective coastal landforms were identified outside the pipeline envelope and have the potential to host durable coastal site types preserved in context. The likelihood of cultural material existing in these prospective submerged

landscapes would be high – and the cultural and scientific significance of any such finds would be exceptionally high. It should be noted that ROV video imagery was available for some sections along the outer shelf pipeline route and direct observations show the seabed covered by marine growth making visually identifying UCH challenging, but also providing a thin organo-sedimentary layer preventing the pipe from contacting the original land surface. The depth below sea level makes exploring these landscapes extremely challenging.

This Aboriginal UCH assessment along the proposed Scarborough pipeline route has deployed a range of geophysical techniques and geomorphic core data, to identify a range of now submerged landforms and features. It has developed a predictive model about the potential for UCH to be located within these submerged landscapes.

This study concludes, based on a purely scientific assessment, that the proposed Scarborough pipeline development will have nil or very low impact on any heritage values within the inner shelf (including the Dampier Archipelago). The ages (i.e., formed prior to 65,000 years BP) of the four submerged barrier formations crossed by the pipeline corridor, makes it unlikely that these prospective features will contain UCH. The route intersects no other prospective submerged features (palaeochannels, waterholes, clay pan features or igneous rock outcrops) which have been observed in other parts of the Dampier Archipelago. The proposed development envelope is the preferred pipeline route within Mermaid Sound.

The proposed pipeline crosses a middle shelf landscape of low or no likelihood to yield UCH material of scientific significance.

The outer shelf does possess a highly prospective cultural landscape with the potential to yield in situ material evidence of scientific and cultural significance. However, the pipeline route itself does not cross any culturally significant landforms or features. Direct seabed observations along the pipeline envelope show much of this landscape covered by sediments and sessile organisms. This, combined with the depth below sea level, means that there is no opportunity to identify what, if any, heritage is buried beneath this active surface. While there are landforms and features on the outer shelf with a higher likelihood of hosting indigenous UCH and would benefit from further archaeological investigations, again these have not been identified within the proposed pipeline route.

The report has been peer reviewed by Dr. Ian Goodwin (ClimaLab/University of NSW) who focussed on paleo-environmental reconstruction, geochronology and age dating reliability, and Mr. Cosmos Coroneos (Cosmos Archaeology) focussing on archaeological modelling and site prediction as well as geochronology and age dating reliability).