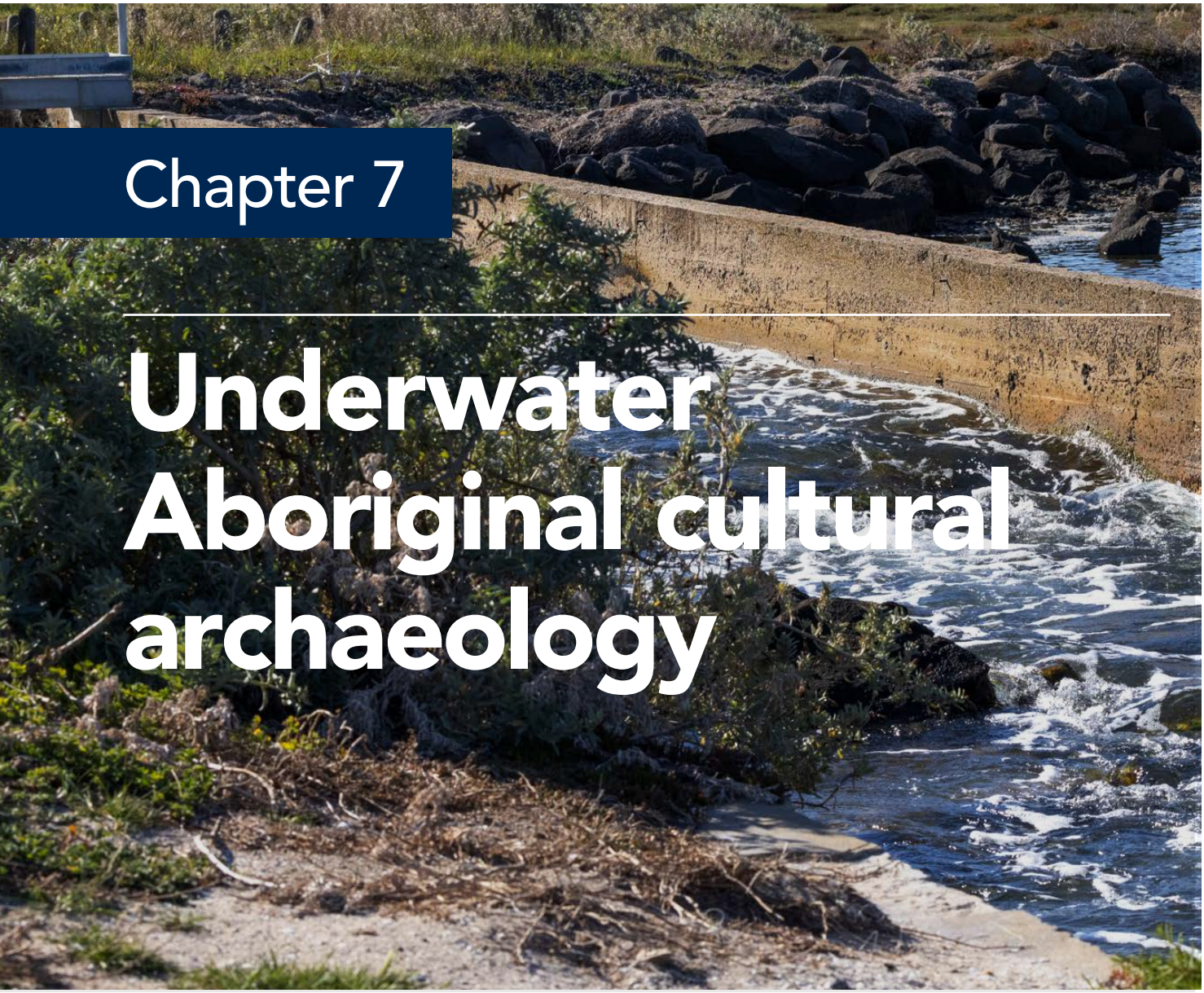


Chapter 7

Underwater Aboriginal cultural archaeology

An assessment was completed of the potential impacts on Aboriginal cultural heritage from the project as part of the Environment Effects Statement (EES) (Technical Report O: *Aboriginal cultural heritage impact assessment*, hereafter referred to as the ACH EES study).

It was concluded in the ACH EES study that, with implementation of the Cultural Heritage Management Plan (CHMP) (CHMP 17816) and its associated management conditions, potential impacts on known Aboriginal cultural heritage would be negligible and on unknown Aboriginal places low to moderate (i.e., impacts would not be significant) as the likelihood of encountering unknown Aboriginal cultural heritage either onshore or offshore is highly unlikely.

The ACH EES study (and draft CHMP) noted that during the project inception meeting, the results of the desktop assessment were discussed and the Registered Aboriginal Party (RAP) (Wadawurrung Traditional Owners Aboriginal Corporation (WTOAC)) "agreed that the offshore portion of the activity area would not contain Aboriginal cultural heritage, and that the majority of the onshore activity area was previously substantially disturbed by existing sub-surface utilities".

It was agreed that a standard assessment (archaeological survey) would be conducted for the least disturbed portions of the onshore activity area.

Complex assessments (archaeological excavations) were subsequently undertaken in areas of Aboriginal archaeological sensitivity identified during the survey. During the subsequent results and management conditions meeting, WTOAC indicated that they were satisfied with the methodology and results of the standard and complex assessments. An underwater archaeological assessment was not undertaken as part of the ACH EES study. The Inquiry and Advisory Committee (IAC) acknowledged that during preparation of the CHMP "the impracticality of accessing archaeological values of the bay floor" was accepted by the RAP (WTOAC). (IAC Report No. 1, section 17.4 (v)).

However, the IAC recommended further assessment of the impacts on offshore Aboriginal cultural heritage values for the proposed dredged area, to inform an updated CHMP. The IAC considered that, subject to the outcomes of the further assessment, the project would not impact on any known Aboriginal cultural heritage values and the potential impacts on unknown Aboriginal cultural heritage values could be managed by the updated CHMP and its associated management conditions (IAC Report No. 1, section 17.4 (v)).

This chapter provides a summary of the underwater Aboriginal cultural archaeological assessment that has been undertaken in response to Recommendation 12 in **Table 7-1** of the Minister for Planning's Directions (Minister's Directions) for the project Supplementary Statement.

This chapter summarises the outcomes of the following technical assessment:

- Technical Report E: *Underwater Aboriginal cultural archaeological assessment.*

It should be noted that at the request of WTOAC Technical Report E has been redacted and therefore is not publicly available.

The objectives of this chapter are to:

- Provide a summary of the technical response to Recommendation 12 of the Minister's Directions.
- Provide a summary of the peer review commissioned by Viva Energy and undertaken by La Trobe University and provided to WTOAC for their consideration of potential underwater Aboriginal cultural archaeological impacts,
- Integrate the outcomes of the underwater Aboriginal cultural archaeological assessment with key outcomes of the ACH EES study.

Since preparation of the underwater Aboriginal cultural archaeological assessment, and a subsequent peer review of the study by La Trobe University shared with WTOAC, there is iterative peer review and ongoing discussions between Viva Energy, WTOAC, First Peoples State Relations (FPSR) and the Department of Transport and Planning (DTP) related to the findings of the underwater Aboriginal cultural archaeological assessment.

The peer review conducted by La Trobe University concluded that the overarching interpretation presented in the technical report regarding Corio Bay comprising a submerged former lake and associated lunette landform aligns well with the geophysical and geotechnical data.

The iterative peer review and subsequent feedback provided by WTOAC has raised a number of items for ongoing attention between Viva Energy, WTOAC and regulatory agencies. In general terms, the main items requiring further discussion include:

- Consideration of further definition of the offshore landform, in particular, the presence of terraces in the nearshore area.
- Consideration of whether the presence of terraces would change the study finding that the only Aboriginal artefacts likely to have survived natural processes would be found in more recent lag deposits.
- Use of a maximum date of 35,000 years for people living in the region when there is evidence of earlier occupation and whether that would change the study conclusions.
- The suitability of radiocarbon dating as used in the specialist study due to issues with dating anything older than ~40,000 years.

After consideration of these items and others raised in the peer review and acknowledging the validity of a number of the items raised, the independent specialist confirmed that the original study conclusions remained appropriate. Further discussion on these matters is found in **Section 7.4**.

Notwithstanding this, it is acknowledged that WTOAC believes that any discovery would be of high significance/value and that establishing a final view of this, and identifying management measures, will need to occur at a future date as part of the CHMP process.

On the basis that it is not yet possible to develop mitigation measures for any potential impacts, Viva Energy has committed to working with WTOAC to further assess impacts and develop management and mitigation measures. This commitment has been incorporated into the project EMF.

On the basis that the updated underwater Aboriginal cultural archaeological study, incorporating peer review inputs, maintains the original conclusions, Viva Energy believes that in collaboration with WTOAC, consideration of the items requiring further discussion can continue in parallel with the Supplementary Statement assessment. The CHMP approval process provides an ongoing vehicle for agreed management and mitigation measures to be addressed.

Overview

The Minister's Direction relevant to the underwater Aboriginal cultural archaeological assessment was Recommendation 12, which required an underwater Aboriginal cultural archaeological assessment for the proposed dredging areas to inform an updated CHMP, and review and update of mitigation measures and the Incorporated Document to include any necessary changes to implement the updated CHMP. Since the arrival of people into Australia approximately 65,000 years ago, rivers and lakes would have provided useful resources. At least two million square kilometres of Australian landscape have since been inundated by post-glacial sea-level rise, submerging these ancient landscapes and any associated cultural heritage features and values.

As the full extent and depth of these submerged landscapes cannot be inspected, archaeologists develop predictive models to assess the likelihood that these submerged landscapes, and associated landforms, have Aboriginal cultural heritage features and values.

The underwater Aboriginal cultural archaeological assessment involved development of an archaeological predictive model which allowed for the archaeological potential of the activity area to be established. This assessment has determined that the activity area is situated within a drowned playa lake, with Point Henry Spit to the east being a submerged lunette dune. The results of the predictive model suggest that any potential archaeological sites within the activity area have not survived with any appreciable integrity. However, there is potential for stone artefacts to be present within erosional lag deposits that may have formed within depressions and other low points at a distance from their original location.

It was concluded that there is a low risk of consequential impact from the project to stone artefacts within lag deposits predicted as being potentially present in the activity area. The updated CHMP would outline the updated mitigation measures to include any necessary management processes to be followed during construction (refer to MM-AH01).

7.1 Methodology

7.1.1 Minister's Directions

Table 7-1 of the Minister's Directions consolidates the recommendations for further work to inform the Supplementary Statement. The Minister's Direction relevant to the supplementary underwater Aboriginal cultural archaeological assessment is presented in **Table 7-1** below.

Table 7-1 Minister's Direction relevant to the supplementary underwater Aboriginal cultural archaeological assessment

Recommendation	Description	Section addressed
Recommendation 12	Undertake a cultural values assessment to identify intangible values relevant to the project (both onshore and offshore in Corio Bay) and an underwater Aboriginal cultural archaeological assessment for the proposed dredging areas to inform an updated cultural heritage management plan. Review and update mitigation measures and incorporated document to include any necessary changes to implement the updated cultural heritage management plan when approved.	**Section 7.3**

This chapter addresses impacts to tangible cultural heritage only. Intangible cultural heritage is being considered through a separate cultural values assessment (CVA), in partnership with WTOAC that will inform the CHMP for the project. As this process is ongoing, this chapter does not incorporate the outcomes of the CVA.

A summary of the tasks that were undertaken to address the item of further work relevant to this chapter (i.e., undertake an underwater Aboriginal cultural archaeological assessment for the proposed dredging areas to inform an updated CHMP) is provided below:

- Using published information on the climate of the late Pleistocene, data on changing sea levels, available geophysical and geotechnical data, including six piston cores collected and analysed for this supplementary study, and a desktop study including interrogation of the Victorian Aboriginal Heritage Register, an underwater archaeological predictive model was developed that comprised three key elements:
  - The identification of submerged landforms.
  - The occurrence of archaeological site types with the landforms, and their environments over time, using terrestrial analogues.
  - The presence and current condition of the associated archaeological site types.
- Further detail on the methodology for preparing the predictive model is provided in **7.1.1.1**
- Assess cultural heritage value of archaeological site types
- Assess potential underwater Aboriginal cultural archaeology impacts.
- Identify any additional mitigation measures for consideration by WTOAC for potential inclusion in the CHMP, if necessary.

7.1.1.1 Preparing the predictive model

While the discipline of submerged First Nations archaeology is in its early stages in Australia, in the northern hemisphere numerous projects have developed systematic approaches to predictive modelling for the discovery and subsequent investigation of submerged terrestrial archaeology. These models adopt a number of key elements which have been applied to the methodology of this assessment.

The predictive model used in this study is an empirical tool for assessing the potential for, and significance of, Aboriginal cultural archaeological sites being present within a range of submerged landscape contexts. This approach has been developed through a collaboration between the authors of the study report.

The terms 'landscapes' and 'landforms' are used in this chapter and are distinct terms. Landscapes are broad spatial areas that encompass various landforms, whereas landforms are singular geomorphic features within a landscape.

An overview of the process for preparing the archaeological predictive model for this assessment is shown in **Figure 7-1**.

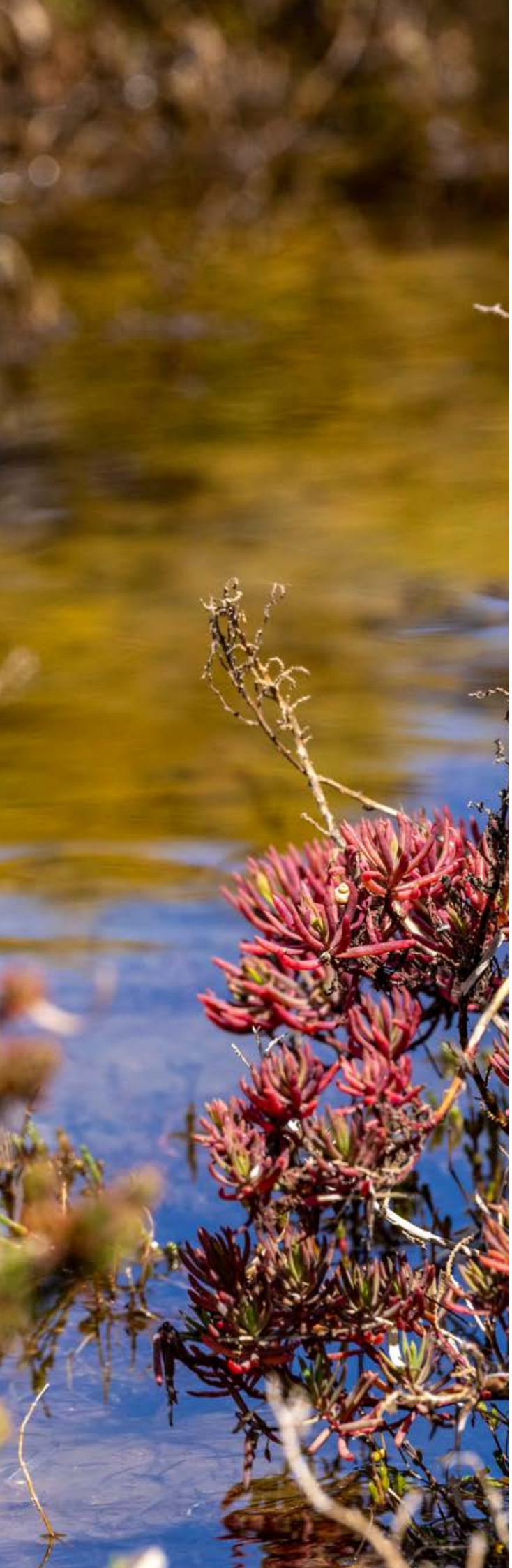
Figure 7-1 Overview of the process for preparing the archaeological predictive model

7.1.1.2 Impact assessment method

The impact assessment method, as modified for underwater cultural heritage, has three components, namely:

- Magnitude or scale of impact on an underwater cultural heritage site.
- Significance or consequence of the impact on the cultural heritage values of a site. This is determined by the magnitude of the impact and cultural heritage sensitivity of the site.
- Probability of impact on an underwater cultural heritage site.

The final outcome of the assessment is a level of risk for an event of consequence (i.e., risk of consequential impact). This is determined by comparing the probability of an impact occurring against the assessed sensitivity of a site.



7.1.2 Study area

The study area (hereafter referred to as the 'activity area') for the underwater Aboriginal cultural archaeological assessment includes the proposed berth and turning basin dredged area and the proposed seawater transfer pipe alignment, as shown in **Figure 7-2**. The activity area for this supplementary study is within the activity area defined for the ACH EES study and CHMP.

7.2 Summary of the Aboriginal cultural heritage EES study

In accordance with Recommendation 12 in **Table 7-1** of the Minister's Directions, the focus of the supplementary underwater Aboriginal cultural archaeological assessment was to assess the proposed area to be dredged to inform an updated CHMP.

In the accordance with the requirements of the *Aboriginal Heritage Act 2006* and Aboriginal Heritage Regulations 2018, the ACH EES study and preparation of the draft CHMP (CHMP17816) involved background desktop research, interviews with Traditional Owners, ground surveys (i.e., standard assessment) and archaeological excavation (i.e., complex assessment). A map of the activity area is shown in **Figure 7-3.**

One new Aboriginal place was identified in the onshore activity area during the complex assessment. No ground disturbing works are proposed to occur within the Aboriginal place, with residual impacts on known Aboriginal cultural heritage considered negligible following implementation of the CHMP, and its associated management conditions. It was concluded that due to the extensive investigations undertaken as part of the CHMP it is highly unlikely that unknown Aboriginal cultural heritage places would be present within the activity area both onshore and offshore, and any potential impact to such places is considered to be low to moderate (i.e., impacts would not be significant) depending on the significance of the place.

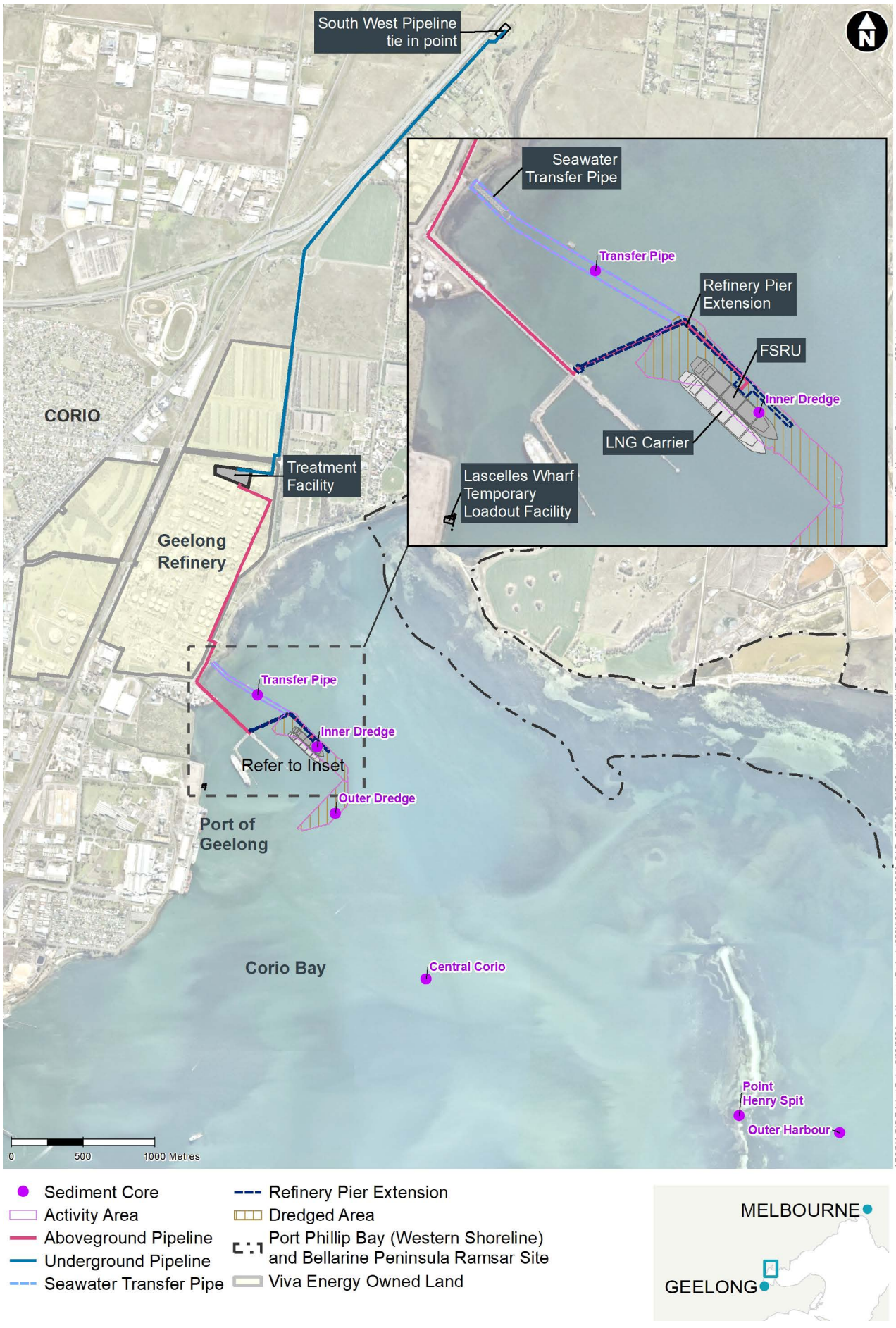


Figure 7-2 Underwater Aboriginal cultural archaeological assessment activity area and sediment core locations

Figure 7-3 Activity area for ACH EES study

7.3 Outcomes of the underwater Aboriginal cultural archaeological assessment

The following sections present the outcomes of Technical Report E: Supplementary underwater Aboriginal cultural archaeological assessment in response to Recommendation 12 of the Minister's Directions.

7.3.1 Climatology

To inform the predictive model and enable the nature of the submerged terrestrial landscape within the study area to be assessed as described in **Section 7.3.3.1**, it is necessary to understand the environmental changes that occurred within Port Phillip and Corio bays during the period of human occupation of south-east Australia.

The glacial-interglacial cycles that have influenced the present-day geomorphology are summarised in **Figure 7-4** below.

Modelling of the evolving geographies of southern Victoria shows that for much of the past 35,000 years Corio Bay formed part of a broad terrestrial drainage basin, until Port Phillip and Corio bays became slowly inundated by marine waters during the post last glacial maximum (LGM) deglaciation approximately 11,000 to 9,000 years ago. A drier climate between 2,800 and 1,000 years ago led to a period where both bays dried out due to a sand bar blocking the entrance to Port Phillip Bay. Both bays were rapidly inundated again following a breach in the blocking sandbar approximately 1,000 years ago. The reconstructed southern Victorian landscape corresponding to the eight defined sea level phases of the past 35,000 years are shown in **Figure 7-5**.

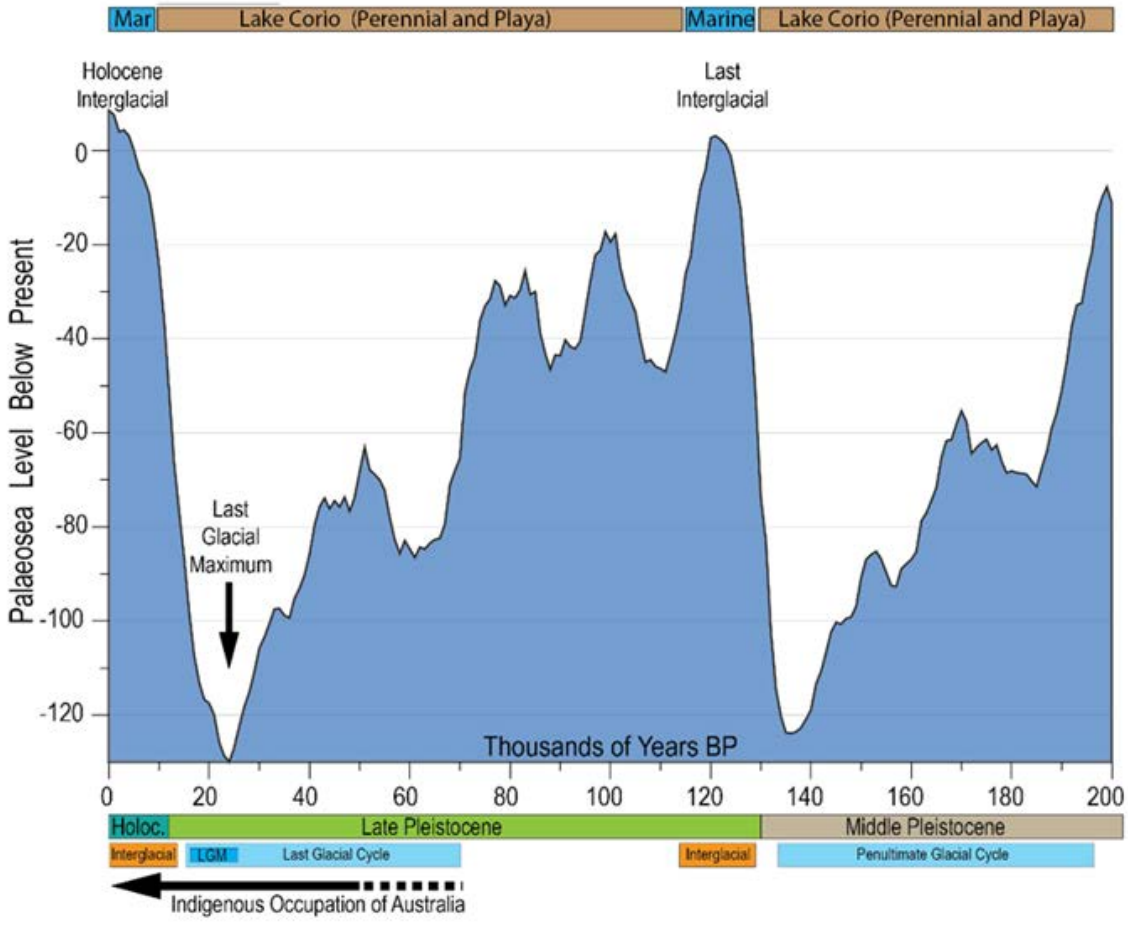


Figure 7-4 Glacial-interglacial cycles

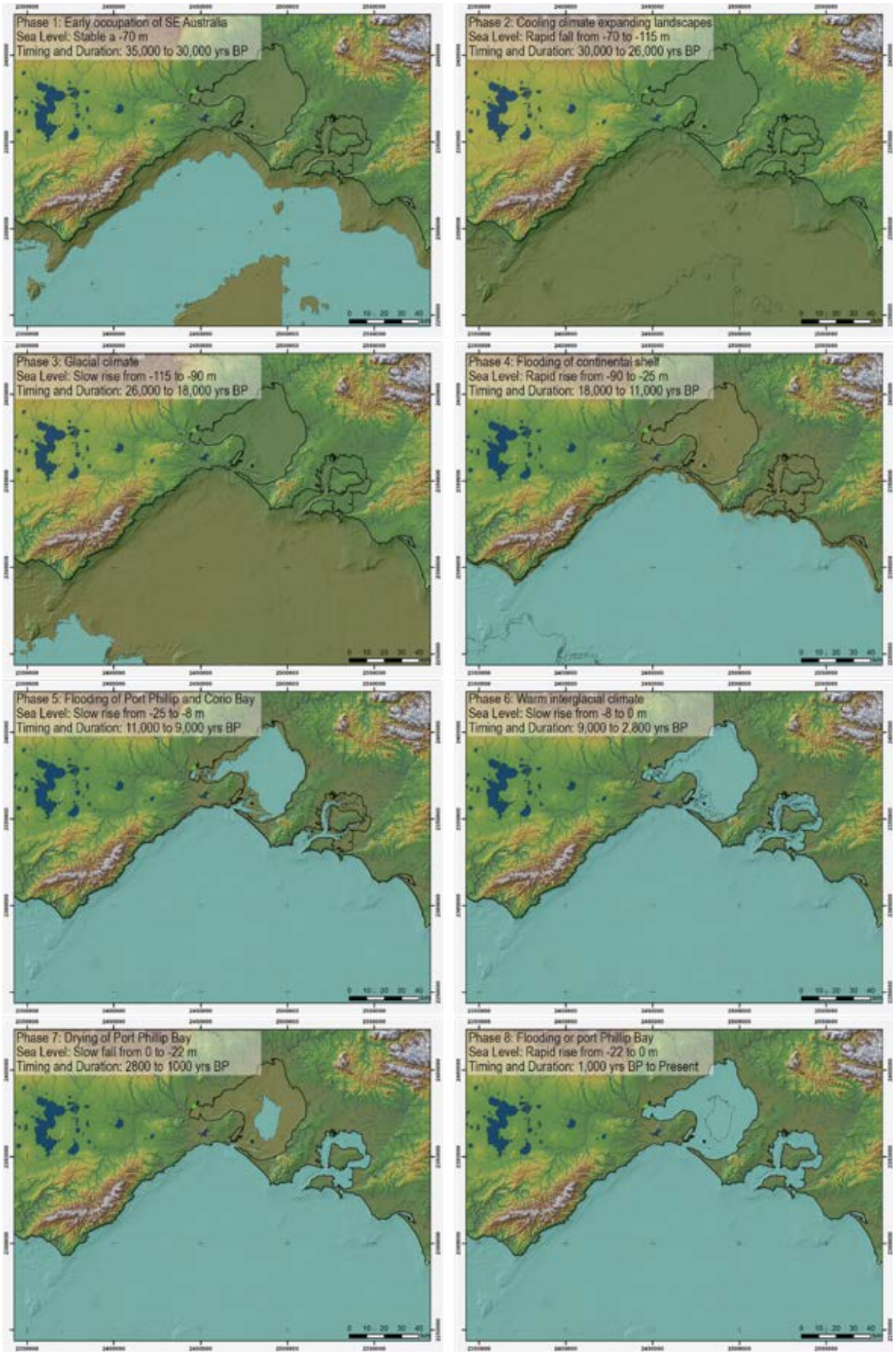


Figure 7-5 The evolving geographies of southern Victoria in response to sea level change (Figure produced by Cosmos Archaeology). The activity area in the north-west of Corio Bay is indicated by a green dot.

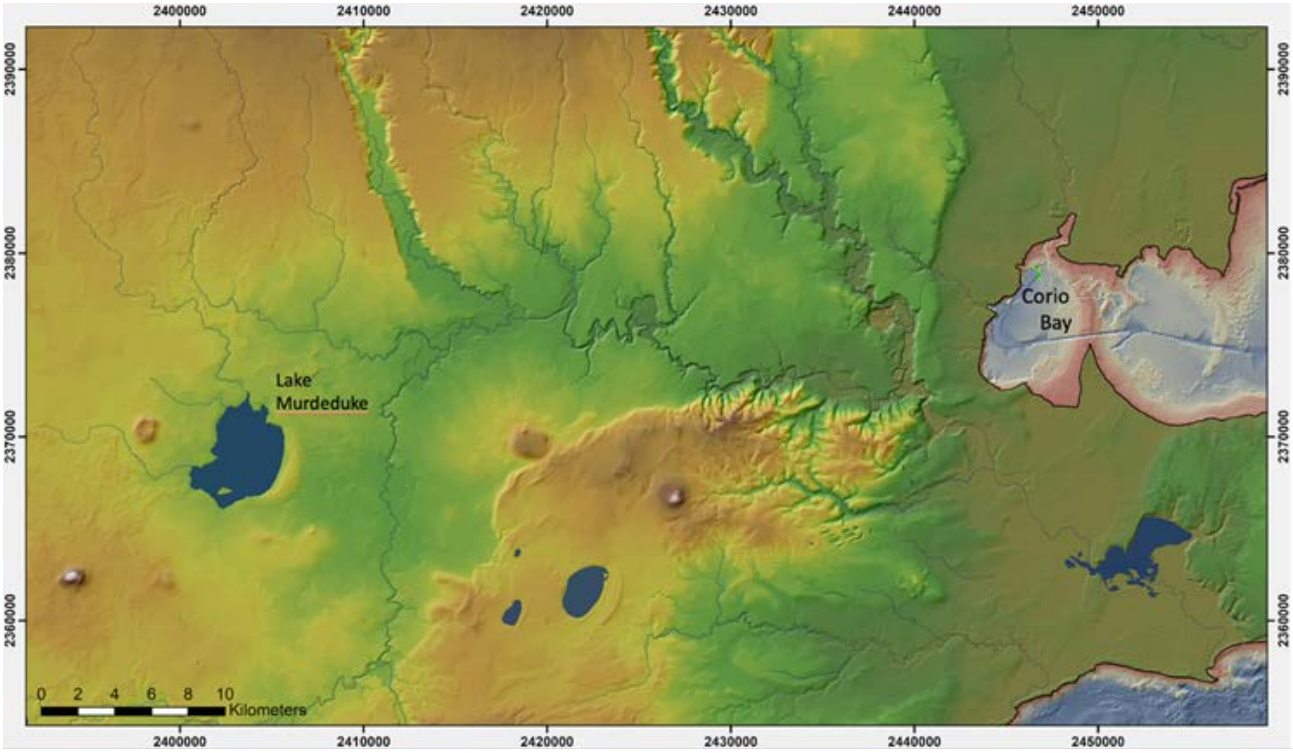


Figure 7-6 Corio Bay in comparison with Lake Murdeduke. *(Figure produced by Cosmos Archaeology using Vicmap Elevation (2024))*

7.3.2 Terrestrial Aboriginal cultural archaeological sites in the vicinity of the activity area

A desktop study of known terrestrial Aboriginal cultural archaeological sites surrounding northern Corio Bay identified a number of types of sites which could potentially occur in the submerged activity area.

Sites identified consisted primarily of stone artefacts (41 sites). Other terrestrial sites identified were shell middens (11 sites), potential fish traps (two sites) and one unrecorded mound. The closest terrestrial sites to the activity area are shell middens located on the adjacent foreshore reserve. Radiocarbon dating suggests that shell middens or shell occurrences located around Corio Bay may be naturally occurring and not man-made if located less than two to three metres above the present sea level (with the exception of the middens located on the bluff at Moorpanyal Park shown in **Figure 7-5** approximately one km south-west of the activity area).

No Aboriginal cultural archaeological sites have been recorded within the activity area and there are no known submerged Aboriginal cultural archaeological sites in Corio Bay

7.3.3 Predictive Model

7.3.3.1 Submerged landscape reconstruction

The geomorphology of Corio Bay is similar to Lake Murdeduke, a playa lake about 50km west of Corio Bay. Corio Bay is characterised by a similar broad shallow depression with the crescent shaped ridge on its eastern edge, interpreted as being a submerged lunette. **Figure 7-6** compares Corio Bay to Lake Murdeduke.

The interpretation of Corio Bay as a likely drowned playa lake helped determine where to conduct sediment sampling from the sea bed for further examination and analysis. The objective was to assist in confirming whether Corio Bay is a drowned playa lake as well as establish the position of the late Pleistocene land surface (that could potentially have contained Aboriginal archaeological sites), whether it retains its original form or whether there has been any erosion or reworking of this land surface post Holocene inundation.

In November 2023, one piston core sediment sample was extracted from what appeared to be the submerged lunette at what is known as the

Port Henry Spit, two sediment cores were taken on either side of the Point Henry Spit in Corio Bay and the Outer Harbour and three sediment cores were taken from the activity area, i.e., within the project's proposed dredge area and seawater transfer pipe shallow trench near Refinery Pier.

To assist with the interpretation of the submerged terrestrial landscape, eight shell samples were radiocarbon dated from the cores taken from the Point Henry Spit and the inner and outer dredge area locations. Noting that there was no readily accessible material suitable for dating in the seawater transfer pipe core. The objective was to obtain dates across the interface between the Holocene marine sediments representing the late Pleistocene land surface and early marine inundation sedimentary deposits.

Examination of the targeted sediment cores determined that the activity area is situated within a drowned playa lake, with Point Henry Spit to the east being a submerged lunette dune.

The assessment of each of the cores revealed an anomaly whereby there is a missing layer of late Pleistocene sediments at the transition to the Holocene. This gap indicates that sediments from the end of the Pleistocene are not present where they would be expected to be. Understanding this absence is important for reconstructing past environmental conditions and for interpreting the geological history of the area.

Radiocarbon dating of shell samples from the cores indicates that last interglacial shelly material has been eroded and transported into the bay from around Limeburners Bay by extreme water flow events.The late Pleistocene lakebed surface has been disturbed through a combination of wave action and likely discharges from paleo-Hovells Creek. This level of disturbance of the terminal Pleistocene lakebed sedimentary layers is expected to have occurred across the area proposed to be dredged and the seawater transfer pipe alignment.

The geophysical investigation identified that the proposed dredge area and seawater transfer pipe shallow trench was a lakebed before it was inundated.

The morphology of Corio Bay is such that it forms an isolation basin during periods of lower sea levels. The isolation basin is fed locally by two creek systems, Hovells Creek and Cowies Creek. During periods of low sea levels, high precipitation would result in the basin filling and under extended drought conditions, the basin would dry.

The presence of a crescent shaped sand bar on the eastern side of Corio Bay is interpreted as a lunette. These typically form along the eastern margins of playa lake systems but they require the combination of a dry lake bed and strong westerly winds in order to form.

Sediment cores taken from central Corio Bay revealed laminated muds which typically occur in lake-type environments and require the lake to be filled in order to be deposited. The presence of both a lunette and laminated muds point to a lake system that experienced both high lake levels and dry lakebed conditions.

Predictions about the physical environment within the proposed dredge area and seawater transfer pipe shallow trench were established by correlating the interpretation of the submerged landscape with the different climate/sea level phases across the past 35,000 years (refer to **Section 7.3.1**).

It is predicted that both the dredge and seawater transfer pipe areas were lake bed, or mostly lake bed (and lake edge toward the north-west) both prior to and after the LGM (between 26,000 and 18,000 years ago), and up until marine inundation about 11,000 to 9,000 years ago.

Since then they have been seabed, except for a period of being a dry lake bed, or mostly dry lake bed (and lake edge toward the north-west), when the entrance to Port Phillip Bay was blocked between 2,800 and 1,000 years ago. The seawater transfer pipe location is partly characterised by a series of terraces which could have been shore edge areas when water levels in Corio Bay were lower or when the lake was dry and there were intermittent flows from Hovells Creek.

7.3.3.2 Potential presence and condition of archaeological site types

Several Aboriginal archaeological investigations have previously been undertaken within the volcanic landscapes of the Corangamite Basin, Western Victoria. These landscapes, in particular that of Lake Murdeduke, provide similar early landforms to the playa lake and lunette development identified within Corio Bay. A total of six stone artefact scatters have been recorded at Lake Murdeduke, one on the lunette to the east and the others along Mia Mia Creek at the northern end of the lake. There is also the possibility that eels were caught at Lake Murdeduke with potential evidence of a rock trap at Mia Mia Creek (VAHR records).

Section 7.3.2 and **Figure 7-6** describe the recorded archaeological site types surrounding northern Corio Bay.

Many Aboriginal archaeological sites have been recorded around the margins or shorelines of drying or perennial lakes in Victoria, in close proximity to any watercourses which feed into the lakes, and along or within lunettes which fringe the eastern side of the playa lakes. Little or no Aboriginal cultural heritage has been located on the dry lake beds. If Aboriginal cultural heritage has been located on a lakebed, it has generally not been considered in-situ, but rather deposited there due to erosion.

The use of the playa lake within Corio Bay would have been variable. At certain times since human occupation its surface was submerged and other times subaerial. At certain times it would have contained fresh water with varying salinity and more than once it has become a seabed. All these different physical states would have stimulated differing cultural behaviour which could have left an archaeological record.

Based on the findings of the submerged landscape reconstruction in **Section 7.3.3.1** the following submerged landforms have been identified as being present within the activity area (Step C):

- Shore edge in marine environment.
- Seabed.
- Lake bed of a playa lake both dry and underwater.
- Western lake edge of a playa lake both fresh and saline.

Based on the examination of comparable terrestrial analogues in the vicinity, a number of site types were identified which could be associated with the submerged landforms within the activity area (Step E).

Each site type was assigned a frequency of occurrence rating (Step F) based on the number of recorded sites in an analogous landform, duration of suitable environmental conditions and availability of resources. The predominant archaeological site types that could have occurred in the activity area are predicted to be stone artefacts, followed by shell middens (during those transitory times when parts of the area formed a shoreline in a marine environment). Site types such as fish and eel traps, and mounds may have been constructed in the activity area, but this is considered very unlikely to have occurred.

As described in **Section 7.3.3.1**, evidence indicates that the surface of the late Pleistocene lake bed has been truncated, that is, re-worked by marine inundation as well as waters emanating from the Hovells Creek watercourse which passed near or, perhaps through parts of the activity area. This interpretation has therefore resulted in a predicted likelihood of site presence and condition rating of Very low confidence that archaeological sites within the activity area have survived intact (Step H).

Any artefacts present in the activity area would potentially be within erosional lag deposits that may have formed within depressions and other low points at a distance from their original location. Lag deposits could consist of stone artefacts which have been removed from their primary context through wind, river or tidal processes.

Though not an archaeological site as such, lag deposits could be distributed throughout the activity area and could contain a relatively high number of stone artefacts (Step F). Furthermore, lag deposits are considered to have high durability (Step G) as these will keep re-forming in high energy environments, resulting in a predicted likelihood rating of Medium confidence for the presence and preservation of lag deposits containing stone artefacts within the activity area (Step H).

Table 7-2 summarises the findings of the predictive modelling, including the four landforms identified and the archaeological site types associated with those landforms. **Table 7-3** also presents the expected condition of the site types and the likelihood of sites being in a condition where archaeological value is recognisable.

Table 7-2 Likelihood of Aboriginal archaeological site presence and condition in the activity area.

Submerged landform	Aboriginal archaeological site	Likelihood of presence and conservation
Lakebed, underwater	Eel trap	Very low confidence
Lakebed, exposed	Stone artefact scatter	Very low confidence
Western lake edge, dry or submerged	Stone artefact scatter	Very low confidence
Seabed	Fish trap	Very low confidence
	Stone artefact in lag deposit	Medium confidence
Marine shoreline	Stone artefact scatter	Very low confidence
	Shell midden	Very low confidence
	Mound	Very low confidence

7.3.4 Cultural heritage sensitivity

Cultural heritage sensitivity combines the findings of the archaeological predictive model as described in **Section 7.3.2** and the assessed cultural heritage significance.

The cultural heritage sensitivity rating for each type of Aboriginal archaeological site refers to the product of the level of confidence of a site being present and preserved, and the potential cultural heritage significance of a particular site. The sensitivity rating system ranges from Not sensitive to Extremely sensitive (with Sensitive as the middle rating).

As discussed above in **Section 7.3.2**, for all predicted site types potentially occurring in the activity area apart from a lag deposit containing stone artefacts there is very low confidence of the site being present and preserved. There is medium confidence of lag deposits being present and intact.

Consultation with WTOAC is ongoing and will further inform the social, historical, spiritual and aesthetic significance of underwater Aboriginal cultural archaeology, in addition to the predicted occurrence of sites. A CVA is being developed in partnership with WTOAC to understand the intangible values and connection to Country. Completion of a CVA is consistent with the aspirations and objectives of the Paleert Tjaara Dja: Wadawarrung Country Plan 2020.

Cultural heritage significance gradings are based on terrestrial sites. The terrestrial site grading system for cultural heritage significance ranges from Very Low for artefacts within modern secondary deposits to Outstanding for unique or rare site types. It is expected that any surviving sites discovered would have high scientific and historical significance as they would be the first of their kind in south-eastern Australia.

Noting that assessment of the significance of the cultural heritage values of the predicted archaeological sites can only be preliminary as neither the presence nor condition of the predicted sites has been confirmed. The potential cultural heritage significance of all predicted sites is graded in this assessment as either Medium or High. It is noted that WTOAC has an expressed view that any discovery would be of High significance.

Table 7-3 Assessment of cultural heritage sensitivity of potential Aboriginal archaeological sites

Submerged landform	Aboriginal archaeological site	Scientific / archaeological criteria	Significance	Likelihood of presence and preservation	Cultural heritage sensitivity
Bed of playa lake, underwater	Eel trap	The significance of these site types are generally equivalent to those on land but would likely have elevated values on the basis that they are associated with an older inundated Pleistocene landscape	High	Very low confidence	Sensitive
Bed of playa lake, exposed	Stone artefact scatter		Medium	Very low confidence	Sensitive
Western lake edge, dry or submerged	Stone artefact scatter		High	Very low confidence	Sensitive
Seabed	Fish trap		High	Very low confidence	Sensitive
	Stone artefact in lag deposit		Medium	Medium confidence	Sensitive
Shore associated with marine body	Stone artefact scatter		High	Very low confidence	Sensitive
	Shell midden		High	Very low confidence	Sensitive
	Mound		High	Very low confidence	Sensitive

Consequently, any type of Aboriginal archaeological site discovered, including stone artefacts in lag deposits that have formed since inundation, would be considered to have a cultural heritage sensitivity rating of Sensitive due to the potential archaeological and scientific significance.

7.3.5 Impact assessment

7.3.5.1 Construction impacts

The construction activities which may impact underwater Aboriginal cultural archaeology within the dredged area and seawater transfer pipe alignment are dredging, piling for the extension to Refinery Pier, and pipe trench excavation.

The impact assessment method also includes a probability of impact factor. The inclusion of probability is necessary as the assessment of underwater cultural heritage is reliant on the interpretation of geotechnical and geophysical data. The limitations of these data collection methods mean that the presence or absence of underwater cultural heritage sites cannot be stated with certainty.

The terms used to describe the probability of impact, which are used in this chapter, are:

- Certain (100%)
- Highly probable (85 to 99 %)
- Probable (50 to 84%)
- Improbable (25 to 49%)
- Highly improbable (1 to 14%)
- Almost impossible (< 1%).

The consequence of an impact on an archaeological site is a combination of the assessed potential cultural heritage significance of a site (discussed in **Section 7.3.4** above) and the magnitude of impact. The magnitude of an impact refers to the level of loss of the physical integrity of an archaeological site which results in the reduction of its cultural heritage value. The grading of magnitude of impact ranges from Negligible (no discernible alteration to existing natural or anthropological processes impacting the site) to Major (complete loss of an archaeological site). A Moderate magnitude of impact to a site of Medium significance would have a lesser consequence than a Moderate magnitude of impact to a site of Outstanding significance.

Consistent with the preliminary assessment of the significance of the cultural heritage values of the predicted archaeological sites in **Section 7.3.4** and in line with the proposed approach of WTOAC and Viva Energy collaborating on further assessment of potential impacts, the significance of potential impacts will be confirmed at a later date.

The risk of consequential impact (i.e. risk of an event of consequence) to each of the types of Aboriginal archaeological site identified as potentially occurring within the activity area is determined by comparing the probability of impact against the cultural heritage sensitivity of the site (as discussed in **Section 7.3.4** above).

The probability of impact from piling is considered Almost Impossible to Highly Improbable for any potential site type. The probability of impact from pipe trench excavation and dredging is considered Almost Impossible to Improbable for any potential site type except for stone artefacts in lag deposits for which impact is considered Probable.

As discussed above in **Section 7.3.4**, any potential site type discovered in the activity area including stone artefacts in a lag deposit would be considered to have a cultural heritage sensitivity rating of Sensitive.

Table 7-4 Magnitude and consequence of impact to potential types of Aboriginal archaeological sites

Submerged landform	Aboriginal archaeological site	Significance	Magnitude			Consequence		
			Piling	Trenching	Dredging	Piling	Trenching	Dredging
Bed of playa lake, underwater	Eel trap	High	Minor	Moderate	Major	Low	Moderate	High
Bed of playa lake, exposed	Stone artefact scatter	Medium	Minor	Negligible	Major	Very Low	Very Low	Moderate
Western lake edge, dry or submerged	Stone artefact scatter	High	Minor	Minor	Major	Low	Very Low	High
Seabed	Fish trap	High	Minor	Moderate	Major	Low	Moderate	High
	Stone artefact in lag deposit	Medium	Minor	Negligible	Major	Very Low	Very Low	Moderate
Shore associated with marine body	Stone artefact scatter	High	Minor	Minor	Major	Low	Very Low	High
	Shell midden	High	Minor	Moderate	Major	Low	Moderate	High
	Mound	High	Moderate	Moderate	Major	Moderate	Moderate	High

Table 7-5 Risk of consequential impact to types of Aboriginal archaeological sites

Submerged landform	Aboriginal archaeological site	Cultural heritage sensitivity	Probability of impact			Risk of consequential impact		
			Piling	Trenching	Dredging	Piling	Trenching	Dredging
Bed of playa lake, underwater	Eel trap	Sensitive	Almost impossible	Almost impossible	Almost impossible	Very Low	Very Low	Very Low
Bed of playa lake, exposed	Stone artefact scatter	Sensitive	Highly improbable	Highly improbable	Improbable	Very Low	Very Low	Very Low
Western lake edge, dry or submerged	Stone artefact scatter	Sensitive	Highly improbable	Highly improbable	Highly improbable	Very Low	Very Low	Very Low
Seabed	Fish trap	Sensitive	Almost impossible	Almost impossible	Almost impossible	Very Low	Very Low	Very Low
	Stone artefact in lag deposit	Sensitive	Highly improbable	Probable	Probable	Very Low	Low	Low
Shore associated with marine body	Stone artefact scatter	Sensitive	Highly improbable	Highly improbable	Highly improbable	Very Low	Very Low	Very Low
	Shell midden	Sensitive	Highly improbable	Highly improbable	Highly improbable	Very Low	Very Low	Very Low
	Mound	Sensitive	Almost impossible	Almost impossible	Almost impossible	Very Low	Very Low	Very Low

In summary, combining probability of impact and cultural heritage sensitivity to determine the level of risk for an event of consequence:

- The risk of consequential impact of piling is rated as Very Low.
- The risk of consequential impact of trenching is also rated as Very Low, with the exception of impact on stone artefacts in lag deposits for which the risk is rated as Low. However, the proposed backfilling of the seawater transfer pipe trench with the spoil would result in any excavated artefacts from a lag deposit remaining within the immediate area and therefore the magnitude of such an impact is considered to be Negligible (as shown in **Table 7-4**).
- The risk of consequential impact of dredging is also rated as Very Low with the exception of impact on stone artefacts in lag deposits for which the risk is rated as Low. The consequence of such an impact is considered to be Moderate.

7.3.5.2 Operational impacts

Secondary or long-term indirect impacts associated with the operational phase of a project may affect an underwater archaeological site and potentially reduce the cultural heritage significance of that site. The potential for indirect impact varies according to the nature of the site, and its proximity to the project. Indirect impact as it may relate to underwater cultural heritage may include vibration, settlement, accretion, erosion and visual (impacts that obscure a site by making it less visible).

It was noted in this study that changed conditions on the seabed would not stimulate erosion within the vicinity of the proposed works, and as such were not further addressed in the assessment.

7.3.5.3 Decommissioning impacts

The operational lifespan of the project is a minimum 20 years. At this time the project will be either decommissioned or upgraded to extend its operational lifespan. Requirements at the time will determine the scope of decommissioning activities and impacts. A key objective of decommissioning will be to minimise impacts during the removal of

infrastructure. An important feature of the project is that the Floating Storage and Regasification Unit (FSRU) does not require decommissioning and is able to depart Refinery Pier at any time. The nature, extent and magnitude of underwater cultural heritage impacts would be no greater than those associated with construction. A decommissioning management plan will be prepared before the end of project life to outline how activities will be undertaken, and potential impacts managed. The plan will take account of any legislative changes, updated industry codes or guidelines at that time.

7.4 Peer review

La Trobe Archaeology Research Partnerships (La Trobe University) was engaged by Viva Energy to undertake a peer review of the underwater Aboriginal cultural archaeological assessment. The peer review focused on the interpretation of the geophysical and geotechnical evidence in the predictive model submerged landscape reconstruction. The responses from the technical report's authors to matters raised in the peer review have been provided to WTOAC and incorporated in an updated version of the technical report.

The peer review concluded that the overarching interpretation presented in the technical report regarding Corio Bay comprising a submerged former lake and associated lunette landform aligns well with the geophysical and geotechnical data. The peer review considered however, that there was insufficient data presented for determining the age of the identified landforms, which is important for understanding their archaeological sensitivity and potential for archaeological sites to be present. In particular, the peer review raised concern about the limited understanding of potential lakeshore terrace areas.

With respect to the feedback on the presence of potentially archaeologically sensitive terraces along the seawater transfer pipe alignment, the technical report acknowledged that within 50 m of the terraces identified along the seawater transfer pipe alignment would have been a favourable place for occupation, the density and duration of occupation dependant on the proximity of the shoreline as well as fresh water sources. However, it was concluded that the increased likelihood of sites having formed on the terraces would not change the outcome of the assessment or its conclusions.

It was explained that the main purpose of the radiocarbon dating in this assessment was to establish the stratigraphic position and depth of the antecedent Pleistocene land surface and whether archaeological deposits may have survived with a reasonable degree of integrity. The primary purpose of the impact assessment is to predict whether sites have survived intact, or the constituent components are now in lag deposits because this informs firstly the significance of the impact and secondly where these artefacts might be located. It was concluded that fluvial and inundation processes have substantially reduced the likelihood of archaeological sites surviving intact.

The peer review also concluded that cultural materials deposited on the surface of the terraces (lakeshore) and on the lakebed could have been disturbed and formed lag deposits but emphasised the importance of understanding of the age of the terrace deposits in determining the potential for in situ archaeological traces to be present. As outlined in **Section 7.0** of this report, there are ongoing discussions between Viva Energy, WTOAC and regulatory agencies on some of the items raised in the peer review and Viva Energy has committed to ongoing collaboration with WTOAC to further consider these items. To this end, Viva Energy has included a mitigation measure in the project EMF committing to the ongoing collaboration.

7.5 Integrated assessment

The purpose of this section is to integrate the outcomes of the underwater Aboriginal cultural archaeological assessment with the original ACH EES study.

The ACH EES study concluded that, with implementation of the CHMP and its associated management conditions, potential impact on known Aboriginal cultural heritage would be Negligible, and on unknown Aboriginal places, Low to Moderate (i.e., impacts would not be significant) as the likelihood of encountering unknown Aboriginal cultural heritage either onshore or offshore is Highly unlikely.

The results of the desktop assessment undertaken as part of the ACH EES study indicated that it is reasonably unlikely that Aboriginal cultural heritage will be present within the offshore activity area due to extensive disturbance which has occurred from previous dredging campaigns.

The supplementary assessment found that although Corio Bay and the area in the vicinity of the activity area has been subject to disturbance through dredging, the majority of the proposed dredge footprint as well as the trench footprint for the seawater transfer pipe has not been dredged to depths which would impact underwater Aboriginal archaeological sites if present. Therefore, the conclusions made in the ACH EES study with respect to the archaeological potential of the offshore

activity area require updating based on this study.

The supplementary assessment has found that the offshore activity area is situated within a drowned playa lake with Point Henry Spit to the east being a submerged lunette dune.

Geophysical evidence cited by the supplementary study indicates that the surface of the late Pleistocene lake bed has been truncated and re-worked. Therefore, there is very low confidence (i.e., likelihood) that any potential archaeological sites within the activity area have survived with any appreciable integrity, and there would be Very Low risk of consequential impacts from the project.

However, the artefacts that could have comprised such sites within the activity area, and within the vicinity, are thought to potentially be present within erosional lag deposits that may have formed within depressions and other low points at a distance from their original location. There is Medium confidence (i.e. likelihood) that these lag deposits are present within the activity area due to their durability. A Low risk of consequential impacts from the project has been assigned to stone artefacts within erosional lag deposits.

Management measures for stone artefacts in lag deposits, if required, would be developed in consultation with WTOAC and included in the CHMP. Considering the relatively low risk of impact to cultural heritage, the CHMP would outline procedures needed to be followed to avoid or minimise potential impacts. This is consistent with the original EES.

Section 7.6 describes the updates that will be made to the CHMP to include underwater Aboriginal cultural archaeological specific assessments.

7.6 Mitigation measures

As described in **Section 7.0** of this chapter, Viva Energy is committed to ongoing collaboration with WTOAC to address the items raised in the study peer review and from WTOAC inputs. As such, Viva Energy has developed an additional mitigation measure in addition to the original MM-AH01 committing to this ongoing collaboration and included it in the project EMF as outlined below:

MM- AH04 Underwater cultural heritage

Viva Energy will continue to collaborate with WTOAC to identify appropriate measures to avoid or mitigate any potential impacts of the project on underwater cultural heritage in the project area.

Mitigation measure MM-AH01 has been revised to include updating the CHMP (CHMP 17816) following the undertaking of a cultural values assessment and an underwater Aboriginal cultural archaeological assessment, as required by Recommendation 12 in **Table 7-1** of the Minister's Directions. The additional text in MM-AH01 is consistent with the change recommended by the IAC (Report No. 2 Appendix G).

However, it is noted that the CHMP cannot afford protection to intangible cultural heritage unless the values are linked to an Aboriginal Place as defined in the *Aboriginal Heritage Act 2006* (the Act) and Aboriginal Heritage Regulations 2018.

The CHMP will be updated in consultation with the RAP (WTOAC) in accordance with the requirements of the *Aboriginal Heritage Act 2006* and associated regulations prior to submission of the CHMP to WTOAC for evaluation (and a decision to either grant or refuse the CHMP). Refer to Chapter 9: *Environmental Management Framework* for a list of mitigation measures relevant to the further work undertaken for the Supplementary Statement.

7.7 Conclusion

To address Recommendation 12 of the Minister's Directions, the underwater Aboriginal cultural archaeological assessment reconstructed the submerged former landform of Corio Bay which allowed for the archaeological potential of the study area to be established. Aboriginal archaeological sites that are likely to have existed in the former landform were identified and the significance of the sites were inferred to enable assessment.

An underwater archaeological predictive model was developed using published information on the climate of the late Pleistocene and changing sea levels, available geophysical and geotechnical data including six piston cores collected and analysed for this assessment, and interrogation of the Victorian Aboriginal Heritage Register (VAHR).

This assessment has determined that the activity area is situated within a drowned playa lake, with Point Henry Spit to the east being a submerged lunette dune. Since human occupation of south-eastern Australia, this lake has been filled with fresh, saline, or saltwater more often than it has been dry.

Bathymetric and geotechnical evidence, particularly from the piston cores collected and analysed in this study, indicate that the surface of the late Pleistocene lake bed has been altered and reworked by marine inundation and water flow from Hovells Creek watercourse, which likely passed near or through parts of the activity area. Due to this reworking, there is Low confidence in the integrity of

any potential archaeological sites within the activity area. Any artefacts that might have been part of such sites could now be found within erosional lag deposits that formed in depressions and other low points, distant from their original locations. Consequently, it was concluded that there is a Low risk of consequential impact from the project on lag deposits containing stone artefacts potentially present in the activity area.

The underwater Aboriginal cultural archaeological assessment was peer reviewed by independent specialists from La Trobe University which concluded that the overarching interpretation presented in the technical report regarding Corio Bay comprising a submerged former lake and associated lunette landform aligns well with the geophysical and geotechnical data.

However, the peer review raised several items which both the reviewer and WTOAC considered required further discussion. These included the significance or otherwise of nearshore terraces in relation to cultural heritage values, use of a maximum date of 35,000 years for people living in the region when there is evidence of earlier occupation and whether that would change the study conclusions and the suitability of radiocarbon dating for the study.

The technical study specialist provided responses to the items raised in the peer review, and while acknowledging that a number of the items raised were valid, concluded that none of the items changed the assessment that the risk of impacts to underwater cultural heritage is low to very low.

Viva Energy has expressed a commitment to ongoing collaboration with WTOAC to address the items requiring further discussion in parallel with the Supplementary Statement assessment. As such, Viva Energy has made a commitment for collaboration with WTOAC for inclusion in the project EMF. To date, a considerable body of work has been assembled on underwater Aboriginal cultural archaeology related to the project which provides a strong foundation for the next steps.

If the project receives a favourable assessment from the Minister for Planning, the next steps would involve Viva Energy, WTOAC and FPSR developing an agreed approach to addressing the matters considered by WTOAC to require further consideration. Discussions to date have indicated that any further agreed actions could be implemented following the Minister's assessment of the Supplementary Statement and, where relevant, incorporated into the project CHMP as determined by WTOAC in collaboration with Viva Energy and FPSR.

The CHMP will be updated to outline the necessary management processes determined by WTOAC in collaboration with Viva Energy to be followed during construction (refer to MM-AH01).