11 Surface Water, Wastewater and Flooding

11.1 Introduction

An assessment of the surface water, wastewater and flooding aspects associated with the Project has been conducted. This chapter provides a summary of this assessment which is provided in full in **Appendix E Water Management Report**.

11.2 Scope of the Assessment

The Director General's Requirements (DGRs) (refer to **Appendix A**) requested that consideration be given to surface water, wastewater and flooding, and that the EIS include the following:

- an assessment of the potential soil, groundwater and surface water impacts of the development;
- the identification of any water licencing requirements or other approvals under the *Water Act 1912* and/or the *Water Management Act 2000*;
- a demonstration that water for the development can be obtained from an appropriate authorised and reliable water supply in accordance with the operating rules of the relevant Water Sharing Plans;
- a detailed description of the mitigation and management controls that would be put in place to manage erosion and sediment, stormwater, spills and acid sulphate soil (if present);
- ways to reduce water supply and increase water reuse; and
- potential impacts of flooding, with consideration of climate change and projected sea level rises.

Impacts related to potential soil, groundwater and acid sulfate soils are discussed in **Chapter 9 Soils, Groundwater and Contamination**.

This chapter summarises the findings of a number of technical studies for surface water, wastewater and flooding. These assessments are provided in full in **Appendix E Water Management Report** and summarised in this chapter. They include the following:

- flooding;
- stormwater;
- water supply and usage including;
  - cooling water;
  - amenity and commercial water use; and
  - fire water;
- oily water generation and management; and
- loss control.

11.3 Legislation and Planning Policy

Protection of the Environment Operations Act 1997 (PoEO Act)

The Site operates under Environment Protection Licence (EPL) No 837 (refer to **Appendix B Environment Protection Licence**). The EPL contains conditions regulating a range of Site operations with potential to impact on the environment. These conditions include for the management of impacts on surface waters.

The Site would continue to operate under this EPL during the construction and operation phases of the Project. Upon completion of the construction phase of the Project, in consultation with the EPA, the EPL would be modified to meet the requirements of the finished product terminal.

The EPL licence nominates environmental monitoring and/or permissible discharge points with corresponding identification numbers. The EPL sets treatment/monitoring requirements and may require additional studies and/or investigations to be undertaken. These are periodically implemented through the addition of requirements for Pollution Studies and Reduction Programs (PRP) included as conditions of the EPL by the EPA. Recently Caltex was required to complete a stormwater management plan for the Site (EPL Condition U10.1 PRP U24.1). This was submitted to the EPA in October 2012. This plan committed Caltex to implementing a stormwater management strategy and completing a number of stormwater management measures in a staged manner. This plan and its proposed measures are an important consideration for this assessment.

State Environmental Planning Policy No.71– Coastal Protection

SEPP No. 71 - Coastal Protection (SEPP 71) aims to protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coast through the preservation of a range of coastal assets. The policy aims to:

- guide development in the NSW coastal zone so that it is appropriate and suitably located;
- ensure that there is a consistent and strategic approach to coastal planning and management; and
- ensure there is a clear development assessment framework for the coastal zone.

The Site is outside the defined 'coastal zone' areas under the SEPP. Although the Site falls outside this area, two of the Site's existing outfalls have the potential to have an impact on land to which SEPP 71 applies. The EIS will consider the aims of the SEPP to ensure that the coastal zone is managed in accordance with the principles of ecologically sustainable development.

Water Quality Objectives

Water Quality Objectives are the environmental values and long-term goals for consideration when assessing and managing the likely impact of activities on waterways. These objectives are set out within the Australian and New Zealand Environment Conservation Council (ANZECC) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (2000) ('the ANZECC Guidelines'). The water quality objectives have been developed for both fresh and estuarine and marine water. They are not intended to be applied directly as regulatory criteria, limits or conditions, but offer guidance to industry, the community, planning authorities or regulators when making decisions affecting the future of a waterway (DECCW 2009).

The Water Quality Objectives for Estuaries within the Georges River CMA are:

- aquatic ecosystems - to maintain or improve the ecological condition of waters;
- primary contact recreation - to maintain or improve water quality so that it is suitable for activities such as swimming and other direct water contact sports;
- secondary contact recreation - to maintain or improve water quality so it is suitable for activities such as boating and fishing where there is less bodily contact with the waters;
- visual amenity - to maintain or improve water quality so that it looks clean and is free of surface films and debris; and
- aquatic foods (cooked) - to maintain or improve water quality for the production of aquatic foods for human consumption (whether derived from aquaculture or recreational, commercial or indigenous fishing).

The Tasman Sea, to which treated effluent for the Site is discharged, is classified as a marine water environment. The Marine Water Quality Water Objectives/Environmental Values for the Sydney Metropolitan and Hawkesbury-Nepean area which includes the areas under Sutherland Shire Council are:

- Aquatic ecosystem health – to maintain or improve the ecological condition of oceans waters;
- Primary contact recreational – to maintain or improve ocean water quality so that it is suitable for activities such as swimming and other direct water contact sports;
- Secondary contact recreation – to maintain or improve ocean water quality so it is suitable activities such as boating and fishing where there is less bodily contact with the waters;
- Visual amenity – to maintain or improve water quality so that it looks clean and is free of surface films and debris; and
- Aquatic foods – to maintain or improve ocean water quality for the production of aquatic foods for human consumption (whether derived from aquaculture or recreational, commercial or indigenous fishing).

The EPL for the Site does not nominate stormwater discharge quality criteria. Therefore, the water quality objectives for receiving waters, and the potential impact of discharges from the Site, have been considered. This is discussed further in **Section 11.5.3**.

11.4 Method of Assessment

This chapter and the assessments within **Appendix E Water Management Report** have been based on a number of data sources. These included:

- Environment Protection Licence No. 837 and associated Pollution Reduction Programs;
- Design, layout and system information for the Project and Site from Caltex;
- publicly available Catchment Management Authority (CMA) and NSW Government information including information from the Botany Bay Water Quality Improvement Program, Water Quality Objectives and data on surrounding areas;
- Marton Park Wetland Management Plan (Molino Stewart Pty Ltd, 2009);
- Caltex's Stormwater Management Plan (2012) for the Site;

- existing surface water and wastewater studies of the Site (GHD, 1992, 1993);
- Kurnell Township Flood Study Final Report (WMAwater, 2009); and
- aerial and satellite imagery.

A Principal Hydrologist from URS conducted a visual inspection of the Site on 5 November 2012. This inspection was conducted on a clear day with an average temperature of 21 degrees.

To assess the impacts of the Project, the following legislation, guidance and standards were used:

- the statutory planning framework and appropriate legislative context (refer to **Section 11.3** and **Chapter 5 Legislation and Planning Policy**);
- the National Water Quality Management Standards and Guidelines;
- *Floodplain Development Manual – the Management of Flood Liable Land* (DIPNR, 2005); and
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy*, ANZECC 2000.

The assessment is predominantly qualitative in nature; however some quantitative data has been used where applicable.

Flooding impacts on the Site have been projected using available information from a flood study conducted of the Kurnell catchment by WMAWater for the Sutherland Shire Council in 2009 (WMAWater, 2009). While detailed topographic level survey information, sufficient to develop contours, was available for the north western portion of the Site (in the vicinity of the wastewater treatment plant (refer to **Figure 1-2**)), for the remainder of the Site there was not enough topographical information to create a model of the existing surface. However, surveyed spot levels were available to allow consideration of the potential for flooding within the Site. Therefore the Site was divided into two sections for the flood assessment.

11.5 Existing Environment

11.5.1 The Local Catchment

The Site is located on the Kurnell Peninsula surrounded by marine and estuarine surface water bodies, which in addition to land, constitute the receiving environments for surface water discharges from the Site. The main water bodies in proximity to the Site include the Tasman Sea, Botany Bay, Quibray Bay, Weeney Bay, and the Marton Park Wetland area (refer to **Figure 11-1**).

The Site falls within the Botany Bay catchment. The Botany Bay catchment extends across an area of 1,165 km^2. This catchment lies within Hawkesbury-Nepean Catchment Management Authority (HNCMA) area. The Botany Bay Catchment has four main sub-catchments, based on the major river systems and other areas which drain to it. These are the:

- Georges River catchment;
- Cooks River catchment;
- Woronora catchment; and
- Botany Bay (direct discharge) catchment.

Legend

- Captain Cook Drive
- Minor Roads
- The Site
- Project Area
- Towra Point Aquatic Reserve ^
- National Park
- Towra Point Nature Reserve

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Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

0 250 500 1,000 Meters

Source: Aerial Imagery from Bing Maps © 2010 Microsoft Corporation and its data suppliers.
^ Office of Environment and Heritage (OEH)
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SITE SETTING AND SURROUNDING ENVIRONMENT

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The Site is located in the catchment area that drains directly to Botany Bay. A substantial part of the catchment is highly developed with almost 40% of its area being used for urban, industrial or commercial purposes. Pollutants of concern within the catchment area include nitrogen, phosphorus and total suspended solids.

In order to facilitate a more accurate assessment of the Project impacts, the main catchments of Botany Bay have been further divided into sub-catchments, based on smaller drainage areas and drainage lines.

The sub-catchments that apply to the Site are named differently in different documents. Therefore the Site falls within either the Mill Creek sub-catchment or Kurnell sub-catchment. Information from the Kurnell sub-catchment has been used to understand the existing pollutant loads from the area immediately around the Site.

The surface waters and related environments in proximity to the Site have varying environmental values and sensitivities. The Project Area is close to areas of significant ecological value including:

- Botany Bay;
- Quibray Bay;
- Towra Point Nature Reserve (including Ramsar wetland area);
- Towra Point Aquatic Reserve;
- SEPP 71 Coastal Protection Zone;
- Marton Park Wetland (a Groundwater Dependent Ecosystem); and
- Kamay Botany Bay National Park.

11.5.2 Stormwater Management

Stormwater generated on the Site is collected in the Site's stormwater system, treated where necessary and discharged off-site to two receiving water bodies, Quibray Bay and Botany Bay. The key water quality management strategy adopted by the Site has been to prevent, to the extent practicable, interaction between petroleum hydrocarbons and stormwater. Consequently the stormwater system only collects runoff from areas of the Site that have been designated low risk with respect to interaction with petroleum products, such as roadways and building roofs.

The Site has a separate oily water system to handle water that is or may be impacted by petroleum products, including a proportion of stormwater runoff collected from areas where there may be interaction with petroleum products such as tanks bunds and refinery process areas.

Topography within the Site is generally flat, although steeper areas exist on the eastern boundary. Soils within the Site are sandy and overly sandstone bedrock. Stormwater runoff generally flows from the eastern boundary through pipes and open channels towards the northwest into the Quibray Bay, Botany Bay, and some Caltex owned land adjacent to the Site and Marton Park. Some stormwater flows onto the Site across the eastern Site boundary from the Kamay Botany Bay National Park.

There are seven main catchment areas on the existing Site, as shown in **Figure 11-2 and Table 11-1**.

Table 11-1 Stormwater Drainage System Catchments

Catchment	Location Description
A	Eastern and northern area of the Site which includes the large eastern tank area.
B	Central area of the Site which contains majority of the refinery process areas as well as offices, cafe, workshops and store houses; and western part of the Site which contains wastewater treatment plant, western tank area, LPG loading area and storage plant, the Quibray Bay Stormwater Retention Basin and parking area.
C	Northern corner of the Site which includes main offices, former staff houses, gardens, employee car park and wetland.
D	An area between the CLOR and the refinery which contains a flare stack and concrete channel.
E	South western corner of the Site occupied by the now decommissioned CLOR, and which contains yard office, workshop, laboratory, maintenance, process units and tank compounds.
F	South eastern corner of the Site, which predominately comprises relatively undeveloped land and a small area of tank compound, the landfarm area (which is a bioremediation site), a recycling area, and a sludge lagoon.
G	North eastern undeveloped area mostly outside of the Site boundary, which is part of the Kamay Botany National Park.

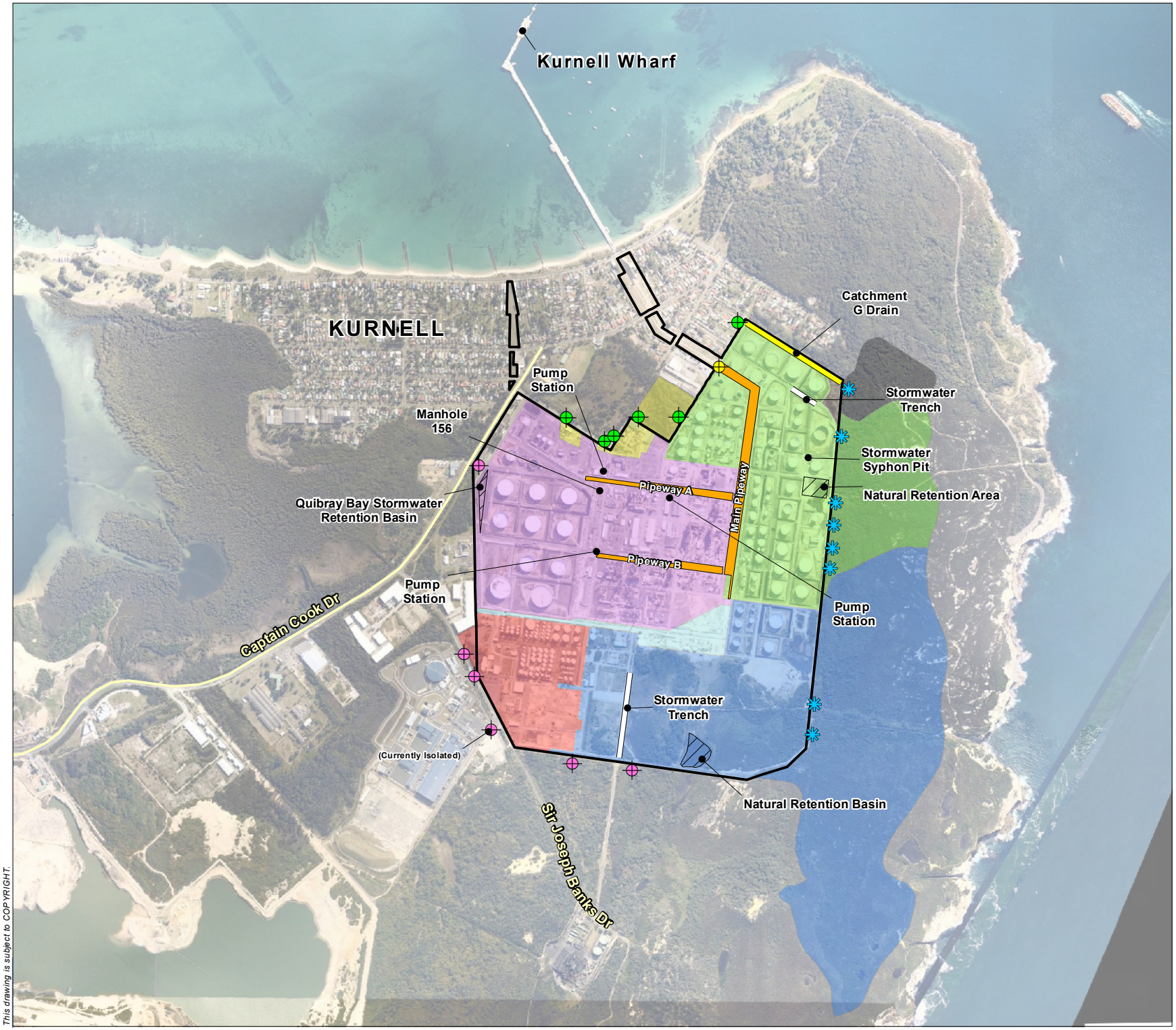
There are various retention, retarding and treatment systems incorporated into the Site's stormwater system. The specific stormwater retention, treatment and disposal systems in each catchment are discussed in detail in **Table 3-3** of **Appendix E Water Management Report**.

The main Site catchments with the potential for interaction between petroleum products and stormwater are Catchments A and B, primarily along the pipeways. The systems incorporated into the stormwater system to regulate flow and discharge rates and prevent discharge of impacted stormwater from the Site are as follows:

- provision for isolation of drainage in pipeways;
- installation of manually operated skimmer pumps at pump transfer points (pumping to the oily water sewer system);
- ability to redirect stormwater to the intermediate sewer (Catchment B only);
- retention in an on-site retention basin (Catchment B only);
- discharge via siphon systems; and
- treatment in oil/water/solids separators.

Stormwater from the Site is discharged, ultimately, to three receiving environments. These include:

- discharge by open drainage lines to Quibray Bay through a narrow strip of the Towra Point Nature Reserve and the mangrove wetland;
- discharge into Botany Bay at Silver Beach near the wharf; and
- discharge to Marton Park Wetland primarily by infiltration.



Legend

- The Site
- Pipeway

Inflow Pt

- From Kamay Botany Bay National Park

Discharge:

- To Botany Bay
- To Marton Park
- To Quibray Bay

Catchments

- Catchment A
- Catchment B
- Catchment C
- Catchment D
- Catchment E
- Catchment F
- Catchment G
- Stormwater Trench
- Catchment G Drain

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Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
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EXISTING STORMWATER CATCHMENT AREAS AND DISCHARGE AND INFLOW POINTS

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Figure: 11-2

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A detailed description of the discharge arrangements from each catchment is summarised is **Table 3-3** of **Appendix E Water Management Report**.

Until recently when the CLOR was operating, runoff from parts of this area (Catchment E) was treated in a manner similar to that described above for Catchments A and B. The CLOR has ceased operation and is currently being demolished. Runoff from this area is no longer treated prior to offsite discharge, except any water that collects in the former CLOR oily water sewer system, which is now pumped to the refinery oily water sewer system for treatment in the wastewater treatment plant (WWTP).

Catchments B, D, E & F, comprise in the order of 70% of the total Site catchment area. These catchments all discharge ultimately to Quibray Bay via aboveground drainage lines passing through a narrow strip of the Towra Point Nature Reserve and the mangrove wetland on the northern side of Quibray Bay. Quibray Bay (and surrounds) is therefore the main receiving environment and is also the most environmentally sensitive of the current stormwater receiving environments.

11.5.3 Stormwater Quality

The stormwater discharge quality from the Site is not currently measured, although a daily visual check is conducted. There is, consequently, no data available on the majority of stormwater quality discharged from the Site.

The current stormwater treatment system is designed to address suspended solids (settleable) and phase separated petroleum hydrocarbons. The stormwater treatment systems on Site do not generally address dissolved phase hydrocarbons, or dissolved organics more generally, although some limited removal of volatile dissolved phase species might be expected from retention systems. Some dissolved phase species removal would be expected in wetland systems.

It is expected that when stormwater flows are within the hydraulic and treatment capacity of the Site's systems, the stormwater quality would exhibit similar characteristics to stormwater runoff from urban areas. This assessment is based on:

- the nature of the Site's existing infrastructure, products, and activities within the stormwater system catchments;
- the fact that the Site's stormwater management system separates stormwater and oily water; and
- the reduced risk of discharging impacted stormwater as a result of retention treatment of stormwater for the removal of oil and sediment.

11.5.4 Oily Water Management

The existing Oily Water Management System (OWMS) at the Site collects process effluent and stormwater from areas of the Site where there is potential for interaction of water flows with petroleum products. Oily water from a range of sources is collected in the Site's oily water sewer system and is transferred to the wastewater treatment plant (WWTP).

Oily water is treated in the WWTP. The treatment process utilises physical, chemical and biological treatment to treat the oily water. Section 6.2.3 of **Appendix E Water Management Report** describes the WWTP treatment process.

Treated effluent is discharged to the Tasman Sea via the Yena Gap outfall under conditions of the Site EPL (refer to **Appendix A DGRs**).

Although Tabbigai Gap (EPA Identification No. 3) and the associated monitoring point (EPA Identification No 28) are still listed as licenced discharge and monitoring points, the associated infrastructure was removed as part of the CLOR decommissioning. Therefore it is expected that this EPL identification point will be removed from the EPL in a future amendment.

11.5.5 Flood Risk

The Site lies at the south eastern portion of the Kurnell township catchment. According to the *Kurnell Township Flood Study Final Report* (WMAwater, 2009), prepared on behalf of Sutherland Shire Council, Kurnell is susceptible to flooding from both rainfall and tidal inundation. Kurnell's localised depression and low lying topography can make it vulnerable to extensive flooding (WMAwater, 2009).

Flooding within the Kurnell Catchment may occur as a result of the following factors, which may occur in combination or in isolation:

- high tide or storm surge which causes water levels to elevate in Botany Bay and Quibray Bay;
- intense rainfall which causes water levels to elevate within the open channel that runs beside Captain Cook Drive and along roads and through private property. The rise in water level may also be affected constrictions, e.g. culverts, blockages, fences and buildings;
- local runoff ponding in low lying areas that has limited potential for drainage. Flooding may be exacerbated by inadequate or blocked local drainage provisions and restricted overland flow paths; and
- tsunami impact on the east coast of Australia from a tsunami arising from subduction zone earthquakes in the Pacific.

Since 1958 the largest flood event in the area occurred on 11 March 1975. The area also experienced tidal flooding on 25 May 1974, corresponding to the largest recorded tidal event (Babister and Retallick, 2012).

No flood modelling for the Site has been completed. The *Kurnell Township Flood Study Final Report* (WMAwater, 2009) provided flood modelling for the township of Kurnell but stops short of including the Site. This study concluded that Captain Cook Drive, near the western boundary of the Site will be overtopped during the 1% year (also known as a 1 in 100 year) Annual Exceedance Probability (AEP) flood. Similarly provisional hydraulic hazard mapping of the Kurnell Township indicated that most of the areas which were classified as High risk from flooding are wetlands (including part of the Quibray Bay wetlands and Marton Park wetlands) located near the western boundary of the Site.

The impacts of flood events on the Site were not directly assessed in either the WMAwater 2009 or subsequent 2012 study. The Site is elevated above the surrounding low lying areas on the western and northern boundaries, and the on-site bunding around petroleum products storage areas effectively increases the flood height that would need to be present for any interaction between petroleum products and flood waters to occur.

11.5.6 Stormwater Management Plan

Despite the on-site stormwater management measures, in June 2010, March 2011 and April 2011 oily water was discharged from the Site during periods of exceptionally high rainfall. This occurred due to localised flooding in Catchment B and was inadvertently discharged through the cooling water outfall point. Given the occurrence of these incidents, the ability of the Site's stormwater system to withstand flood events has required assessment.

The flooding incidents of 2010/11 were found to be caused by heavy rainfall resulting in localised flooding at the WWTP and adjacent properties. This resulted in oily water being discharged off-site.

In response the EPA imposed a further requirement for additional stormwater improvement investigations within *PRP U24.1: Stormwater Catchment and Management Plan.*

Caltex have prepared a Stormwater Management Plan (SMP) in response to this PRP to prevent the discharge of contaminated waters from the Site at all times. Given the direct relevance to Caltex's commitment to implementing future improvements, the SMP was considered as part of this assessment.

The SMP prepared for the Site committed Caltex to implementing a stormwater management strategy and completing a number of stormwater management measures in a staged manner.

In summary, the strategy and related actions nominated in the plan were as follows:

1. Ongoing maintenance of the existing stormwater system (ongoing).
2. Implement a number of projects to improve the infrastructure, reduce the potential for the Site to flood, and prevent contaminated stormwater leaving the Site (commenced in 2012).
3. Work with the NSW Office of Environment and Heritage (OEH), NSW EPA and Sutherland Shire Council to divert to flow of stormwater from the National Park away from the Site's stormwater system to the Sutherland Shire Council's stormwater infrastructure (commenced in 2012).
4. Carry out stormwater flow monitoring from 2013 through to 2014.
5. Updating the Site's stormwater system performance model to account for the changes to the stormwater system infrastructure that can then be used as a tool to assess future modifications, as necessary (will commence once Strategy Item 2 has been finished).

Catchments A and B, the main Site catchments in which the review and improvement measures are focussed, are within the Project Area. The Project would be a consideration in relation to the implementation of stormwater system improvements. As implied within Strategy Item 5, the updated hydraulic and Site stormwater model would be utilised as a tool to assess the impact of any proposed stormwater system modifications associated with the Project.

11.5.7 Water Supply and Usage

The Site consumes approximately 6 Ml of potable water per day for operations and 1 Ml per day for amenities. Currently the water is supplied to the Site by Sydney Water and is potable. The Site currently sources water from the Sydney Water municipal supply, and so is not subject of any water licensing requirements or other approvals under the *Water Act 1912* and/or the *Water Management Act 2000*, including any obligations associated with a Water Sharing Plan.

Industrial water demands represent the majority of the overall Site water demand (approximately 6 Ml per day). Most of the water is consumed in the refinery operations. If required, with Sydney Waters' permission, potable water can also be used in the emergency power generator.

Firewater usage on Site represents approximately 6% of the potable water that is currently used for process and amenity purposes. This usage is not normally for actual fire incidents, rather it is the consumption associated with pump, hydrant, monitor and other system testing that is regularly conducted, as well as fire training conducted on fire training ground and elsewhere on the Site. Firewater can also be drawn from the seawater cooling system, however potable water is the primary supply with seawater available as backup.

The Site's cooling water system utilises seawater which is pumped from Botany Bay by any of the five electric driven pumps located at the pumphouse on the Kurnell Wharf. This seawater is pumped to two Saltwater Tanks on-site prior to use. A screen system is installed on the suction side of the pumps to minimise the amount of foreign matter and marine growth entering the saltwater system. Chlorine (gas), an oxidising biocide, is injected into the cooling water at the wharf to minimise the growth of fouling organisms. The cooling water flows from the two saltwater tanks by gravity, by means of pipeways and independent take-offs, to most refinery process units.

Cooling water leaving the refinery process units is separated into two streams – clean and intermediate cooling water effluent, depending on its potential to contain product in the event of a leak or other upset.

The clean cooling water effluent discharges directly into the Botany Bay outfall. Remaining cooling water streams are classified as intermediate effluents. These streams are sent to the intermediate oil/water separators for treatment before discharging to the same location as the clean cooling water outfall.

The Site's EPL requires that cooling water discharge quality monitoring is conducted. Results for Annual Return Periods 2010-2011 and 2011-2012 indicate that the cooling water discharge quality is below the respective EPL concentration limits for chlorine residual and temperature (refer to Section 7.2.4 of **Appendix E Water Management Report**). A study by Underwood *et al*. in 1991 looked at the effect of the cooling water discharge the sandy soft sediments fauna and concluded that the impacts from the cooling water discharge (if any), was small, or had no biological significance. In 2000, a further study by URS concluded that the discharge of cooling water is unlikely to pose an unacceptable risk to the Botany Bay ecosystem.

11.5.8 Domestic Wastewater

Domestic wastewater, also referred to as sewage, sanitary effluent, and septic effluent, comprising grey and black water wastewater streams, is generally derived from toilets and showers and other domestic water. This wastewater stream is currently sent to the Sydney Water sewerage system for treatment at the Cronulla Treatment Plant.

The discharge volume is not generally metered but in 2001 the total annual domestic wastewater load was about 52 Ml (determined over the month of November 2001 and extrapolated to approximate annual contributions). The load would have reduced significantly since 2001, as the CLOR is no longer operational and Site staff numbers have reduced. The most recent assessment of quality, conducted in 2001 as part of the Septic Effluent Study, did not indicate variation from typical domestic wastewater quality.

11.5.9 Loss Control

The primary and secondary containment systems to prevent loss of petroleum products at the Site are the tanks and their bunds respectively. Caltex has a programme focussed on the maintenance of integrity of its primary containment systems, i.e. bulk storage tanks, and prevention of loss of containment from these tanks and associated transfer systems.

Some of the bunds present within the existing Site are earthen with bitumen or shotcrete lined bund walls. Caltex is currently undertaking a review of the condition and capacity of the tanks bunds in the Project Area. Caltex has committed that the bunding capacity for tanks retained in service would comply with the requirements of *AS1940*.

All of the tanks and bunds on the Site are subject to Caltex's existing comprehensive inspection, maintenance and repair program.

In the reasonably unlikely event of a significant spill, the Site has significant contingency arrangements. Initially any spill would be contained in the bunds and normally sent to the oily water system. The oily water system has WWTP diverting capability and supplementary containment capacity to contain spilt product.

Any firewater used in response to an incident would be similarly managed, where impacted firewater would be contained in the bunded area before being manually drained to the oily water treatment system in accordance with standard Site procedures.

In the event that a significant loss of containment occurs and product escapes a bund, or is released in, or enters a pipeway, the spill can still potentially be contained and stormwater treated. In effect, the stormwater system storage capacity (along with the aforementioned storage capacity within the oily water system) represents tertiary containment capacity.

11.6 Impact Assessment

11.6.1 Stormwater

Construction Phase

The construction activities would predominantly occur within Catchment A and Catchment B. The construction phase of the Project is expected to have minimal impact on the quality of stormwater discharged from the Site.

Much of the construction activity that would be undertaken in the Project area would involve upgrades to tanks and pipework, and associated excavation and earthworks activities. Potential impacts on stormwater associated with the construction stage of the Project would be related to erosion, sedimentation impacts and possible interaction of stormwater with hydrocarbon impacted soils. In considering the potential magnitude of these impacts, the minor nature of the ground disturbing activities was considered. However, if these impacts are not managed properly, the construction works could potentially increase sediment loads or contamination in local surface water. **Section 11.7** outlines how these potential impacts could be managed and avoided.

Activities such as tank cleaning would occur in bunded areas and any washwater generated would be directed to the oily water system, in line with existing procedures. There would be no interaction with the stormwater system and therefore no impact on surrounding surface water receptors.

Operational Phase

The Site stormwater catchments that are within the Project Area are (refer to **Figure 11-2**):

- Catchment A – all of the existing catchment except a small area in the south west corner;
- Catchment B – the western part of the catchment comprising the western tanks area; the wastewater treatment plant, as well as Pipeway A and a small area in the north east corner; and
- Catchment G – the part that falls within the Site and excluding the eastern part that falls within Kamay Botany Bay National Park.

Following the completion of the construction phase of the Project, the existing Site stormwater system would remain intact, retaining both the stormwater retention and treatment systems. The Sites stormwater receiving environments would not change, however only Botany Bay, Quibray Bay and Marton Park Wetland would receive stormwater from the Project Area.

Within Catchments A and B, the stormwater system is not likely to change, except where modifications are needed to fulfil the requirements of the SMP. Stormwater arising from the Project Area during the operation of the Project is anticipated to be similar in quality to that currently experienced.

Overall, the Project would be expected to have the following impacts in relation to stormwater:

- No significant change in the volume of stormwater discharged from the Project Area to Quibray Bay from Catchment B. There may be changes in the discharge volume from Catchment B arising from works associated with the eventual demolition and remediation of the refinery infrastructure. This would be addressed as a separate approval at a later stage and does not form a part of this Project (refer to **Chapter 4 Project Description**).
- Consequential reduction in the overall contaminant load from the Catchments A and B, which would reduce the cumulative impact, if any, of the discharges to the respective receiving environments.

The implementation of the SMP would allow for the quantification of the current stormwater systems hydraulic performance and capacity. It would also allow for quantification of the impacts of potential modifications to the system arising from actual and potential improvements to the system.

The SMP modelling would allow assessment of the adequacy of the existing stormwater treatment systems relative to their hydraulic capacity.

Impacts of the Project on stormwater quality would not be quantified as no quality measurement of stormwater has been or is proposed to be conducted. However, as noted above, it is likely that the quality of the stormwater would be improved due the removal of refinery process areas and associated product transfers.

Off-site Stormwater Interceptions and Groundwater Interaction

During the operation of the Project, the interactions between off-site stormwater flows and groundwater flows within the Project Area would be largely unchanged due to limited ground works associated with the Project. Implementation of the SMP could however influence both stormwater inflows and groundwater interactions within the Project Area.

11.6.2 Oily Water Management

The Site's Oily Water Management System (OWMS) collects process effluent and stormwater from areas of the Site where there is potential interaction with petroleum products. This is then transferred to the Waste Water Treatment Plant (WWTP). Treated effluent is discharged to the Tasman Sea via the Yena Gap outfall under conditions of the Site's EPL.

The oily water characteristics and load arising from the Project Area once the Project is operational would not differ significantly from that currently generated from the same area. Tank bunded areas and tank water drains would remain largely unchanged and flow from these areas would continue to be treated in the WWTP. The Site would continue to handle ballast and pipe wash water, though the quantities may vary from those currently handled.

There would be a significant impact on the overall oily water sewer system from the shutdown of the refinery. The overall volume and contaminant load would reduce substantially. Due to significant reduction of wastewater volume and contaminant load, the existing WWTP would need to be reassessed to determine the potential for related changes in efficiency and performance.

Caltex and the EPA have initiated discussions on this issue, and have an 'in principal' agreement with the following approach:

- the existing WWTP would be retained for treatment of oily water for the construction of the Project and the beginning phases of the operation of the Project. It would be operated under the current EPL conditions;
- in consultation with the EPA, a PRP condition, would be developed and included in the terminal EPL, and it would:
  - apply when the terminal is operational;
  - characterise the terminal wastewater streams;
  - identify and assess terminal wastewater management options;
  - recommend preferred options; and
  - confirm applicable EPL conditions, including those related to discharge points, quality and monitoring; and
- continue consultation with the EPA.

The treated wastewater effluent would continue to discharge to Yena Gap in accordance with the current EPL conditions. These conditions may be revised following the process outlined above.

11.6.3 Flooding

Previous studies and reports have indicated that the areas around the Site are susceptible to flooding from both rainfall and tidal inundation, and this would be exacerbated by climate induced sea level rise.

The Site is elevated above the surrounding low lying areas on the western and northern boundaries, and the on-site bunding around petroleum products storage areas effectively increases the flood height (by up to 3 m) that would need to be present for any interaction between petroleum products and flood waters to occur.

As described in **Section 11.4**, the level of flood assessment that can be completed for the Site varies. Therefore in order to enable the most robust assessment possible, the Site was divided into two areas:

- Area 1 – the north west of the Site; and
- Area 2 – the remainder of the Site.

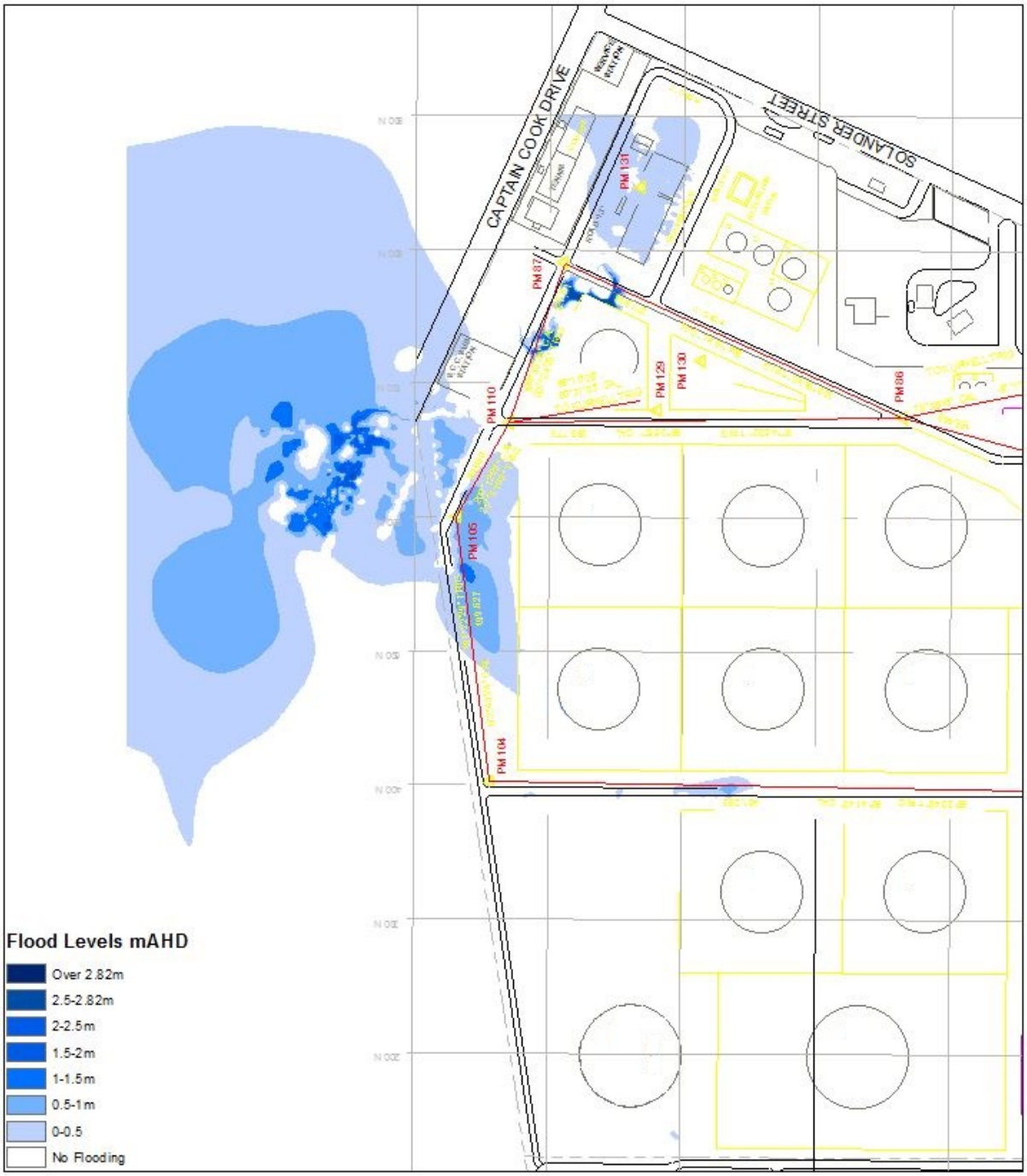
This approach allowed the most accurate data relating to any one section of the Site to be used for the assessment of the flood risk in that area.

Area 1 – North West of the Site

Detailed level survey information was available in the north western portion of the Site in the vicinity of the wastewater treatment plant. Using this available information it was possible to project the adjacent 1% year (also known as a 1 in 100 year) Annual Exceedance Probability (AEP) flood level into this area of the Site.

The results of this assessment for this area of the Site show that there is a relatively shallow depth of flooding within Area 1, near the intersection of Captain Cook Drive and Solander Street (refer to **Figure 11-3**). This is consistent with recent experience of flooding in that area. The area of flooding within the this part of the Site is limited and would not overtop any bunds within the surveyed area.

Figure 11-3 Flood Projection (2.82 m AHD) on the North West of the Site



Area 2 – Remainder of the Site

Within Area 2 there was not enough information to create a model of the existing ground surface. Instead, information on flood depths and peak flooding levels from the areas surrounding the Site were projected onto the Site. Along most of the western boundary of the Site, the 1% AEP event peak flood level is about 2.82 m AHD, however, in the north west corner of the Site, near Gate 5, the peak level is about 4.25 m, and even higher in the north east corner. In order to reflect this variation in the recorded peak flood level the Site was divided into three sections (refer to Section 4.2.2.2 in **Appendix E Water Management Report**).

The resulting flooding assessment indicated that while the majority of the Site would remain above the adopted flood levels, there was the possibility of some minor flooding (<0.1 m depth) across the western Site boundary, north of Gate 5 and within the area occupied by the first row of tanks in the north eastern corner of the Site. It is expected that the existing bunding would be sufficient to prevent interaction with flood waters given the predicted depth of <0.1 m).

The Project is not expected to change the flood risk profile in the Project Area nor the ability of the Site to accommodate high rainfall events and/or broader flooding events from that which currently exists. However, due to the coarse nature of the exsiting information and therefore the assessment, a future review would be completed that focussed on the northern parts of the Site to better understand the actual flood risk.

Flood Risk Category

Sutherland Shire Council (SSC) has planning controls relating to flood risk levels and requires that infrastructure standards and safety measures be suitable for the associated risk level. SSC places limitations on the type of buildings that are allowed in areas of 'medium risk', approximately lower than 3.6 m AHD. In order to assess the Project's compliance with this control, the level of 3.6 m AHD was compared to ground level spot levels within the Site.

The only area of the Site that was identified as 'medium risk' based on available ground level data was in the corner of Captain Cook Drive and Solander Street. A small area immediately near the intersection of Cook Street and Solander Street is also marginally below 3.6 m AHD and therefore in the 'medium risk' category. The remainder of the Site is higher than 3.6 m AHD and therefore not in the 'medium risk' category as defined by SSC. As indicated previously, the product tank bunds in the medium risk area are all of a height well in excess of the nominated risk level.

11.6.4 Water Supply and Usage

Construction

Water supply would be required during the construction phase for a range of uses including:

- construction use;
- tank cleaning; and
- general workforce amenities.

This water would be potable water supplied by Sydney Water. Existing supply infrastructure would be utilised. The overall Site water demand during the construction period would not be expected to exceed that of current Site usage.

Operational Phase

Once operational, the Project would have a much lower overall potable water usage than the current operation as the main refinery processes that utilised potable water would cease. The workforce would also decrease, so the potable water used for amenities would decrease proportionately. Following the shutdown of the refinery operations, potable water consumption would reduce by approximately 90%. The existing potable water distribution infrastructure on the Site would be left largely intact.

Potable water would continue to be supplied from municipal supply by Sydney Water and therefore no licensing requirements or other approvals under the *Water Act 1912* and/or the *Water Management Act 2000*, including any obligations associated with a Water Sharing Plan, would apply.

Options to reduce water consumption through the implementation of efficiency measures, such as usage avoidance, reuse and recycling, have been considered, however to date limited opportunities have been identified. No water efficiency measures have currently been identified to be implemented under the Project. Potential water efficiency measures would continue to be considered during the further design stages of the Project, and if viable, would be implemented.

With the closure of the refining operation at the Site, the cooling water system used for the purpose of removing heat generated from the refinery process would cease operation. This includes the daily cooling water pumping and effluent discharge to Botany Bay. This would eliminate any negligible environmental impacts to water quality in Botany Bay and local ecology caused by this process.

The retirement of the cooling water system would mean seawater would no longer be available as back-up fire water supply. Maximum firewater demand and storage was determined by R4Risk (2012) as part of the Fire Safety Study (FSS) (refer to Section 9.3 of **Appendix E Water Management Report**). A maximum firewater demand case was identified and assessed assuming a full-surface tank fire, to allow estimation of the maximum fire water storage volume to be maintained. The assessment indicated the 16 Ml firewater storage available on-site significantly exceeds the maximum firewater storage requirement. The performance of the current firewater system has been deemed adequate to satisfy demand under the proposed Project (R4Risk, 2012).

The fire water requirement for fire equipment testing, however, has not been estimated. Nonetheless, the requirement is expected to be less than is currently required (347 kL/d), as usage for refinery equipment would be no longer required.

11.6.5 Domestic Wastewater

The Project would utilise the existing wastewater infrastructure to service the continuing needs of Site amenities. The amount of sewage generated would be expected to decrease significantly following the shutdown of the refinery operations and proportional reduction in the workforce. Amenity water would continue to be pumped to the Sydney Water sewerage system for treatment at the Cronulla Treatment Plant. The overall load would reduce, approximately proportional to the reduction of the Site workforce.

11.6.6 Loss Control

The measures and processes currently in place at the Site to prevent any loss of contaminant would be maintained throughout the construction and operation phases of the Project. Caltex has committed that the bunding capacity for tanks retained in service would comply with the requirements of *AS1940*.

In addition, some improvements to monitoring would be initiated to ensure that if a loss of containment into a bund occurs it is detected early and contingency actions can be taken promptly.

The measures for tanks containing low flash materials[1] include:

- explosive vapour detectors within the bunds;
- triple infrared scanners on tank roofs; and
- CCTV in conjunction with infrared cameras as a confirmation for alarms.

All tanks on-site would be subject to:

- an automated high level shut off system[2]; and
- continuance of a comprehensive inspection/repair program.

Caltex's focus during the construction and operation of the Project would be on inspections, maintenance and spill prevention within the tank and tank bund areas. Extensive spill prevention measures would continue to be incorporated into the operation of the Project as outlined above.

Any tank floors that are rebuilt during the Project and during the ongoing operation of the terminal would incorporate a tank underfloor liner.

The primary loss control strategy to be continued by Caltex for the Project can be summarised as follows:

- primary focus on ensuring that a spill does not occur from the primary containment systems (i.e. tank and transfer systems);
- if a spill occurs it is detected quickly and responded to rapidly;
- it is contained in normally isolated adequately sized bunds; and
- supplementary capacity and tertiary containment systems are available outside of the bunds in the oily water sewer and stormwater management systems.

The stormwater systems within Catchments A and B (within which the Project Area is located) have the following important features:

- the pipeways are isolatable, allowing spill containment and providing additional storage capacity;
- they have manually operated skimmer pumps for product removal to the oily water system;
- each catchment has a syphon system and API oil/water separator to control discharge stormwater rate and quality; and
- Catchment B has the Quibray Bay Stormwater Retention Basin and overflow capacity, providing additional storage.

[1] The flash point of a chemical is the lowest temperature where it will evaporate enough fluid to form a combustible concentration of gas. The flash point is an indication of how easy a chemical may burn.

[2] This includes multiple high level detection instruments wired to an automatic valve which closes the tank inlet after a defined fill height has been reached.

11.7 Mitigation

11.7.1 Construction Phase

Appropriate construction phase procedures would be used to minimise soil erosion, sedimentation and contamination of nearby surface waters. A number of interrelated measures to help avoid or manage impacts on soils and groundwater have been detailed in **Chapter 9 Soils, Contamination and Groundwater**. These measures would also help manage potential impacts on surface water receptors. Key amongst these would be to complete all construction works in line with 'The Blue Book' *Managing Urban Stormwater – Soils and Construction Volume 1 and 2* (Landcom, 2004).

Measures to manage potential impacts on surface water receptors would be detailed within the CEMP for the Project. These measures would be included in the Soil and Erosion Management Plan for the Project. These plans would include the following measures:

- All materials would be stockpiled in accordance with 'The Blue Book' *Managing Urban Stormwater – Soils and Construction Volume 1 and 2* (Landcom, 2004). Principal controls would include the following:
  - silt fences would be installed around stockpiles to reduce erosion and the movement of suspended solids as necessary;
  - soil stockpiles and any polluted materials would be stored in designated areas which are not in close proximity to any stormwater drainage systems;
  - regular inspection of erosion control structures and bunded areas; and
  - regular inspection of containment areas, drainage lines and interception measures.
- Clean materials would be separated from contaminated materials.
- Suspected contaminated materials would then be classified in accordance with *NSW (2009) Waste Classification Guidelines: Part 1: Classifying Waste*, batched, further tested (where required) and either stored on the Site or disposed of in a timely manner.
- Soil erosion and sedimentation devices would remain in place until the disturbed ground surface is restored. These devices would also capture any gross pollutants.

11.7.2 Operational Phase

Stormwater

Kurnell Refinery is an operational industrial facility and as such operates under an Environment Protection Licence. In 2010 and 2011, heavy rainfall resulted in flooding at the WWTP which in turn resulted in oily water being discharged off-site. In response the EPA imposed a requirement for additional stormwater improvement investigations within *PRP U24.1: Stormwater Catchment and Management Plan.*

Caltex prepared a SMP in response to this PRP. This plan was prepared and submitted as required on 5 October 2012. The SMP committed Caltex to implementing a stormwater management strategy and completing a number of stormwater management measures in a staged manner. The measures within the SMP are outlined in greater detail in Section 11.5.6 and Section 3.2.6 of **Appendix E Water Management Report**.

Caltex is in the process of developing a stormwater management strategy for the Site to implement the requirements of the SMP.

Whilst no significant stormwater impacts are expected as a result of the Project, it has been recognised that the stormwater system at the Site requires improvement in order to ensure that contamination does not spread from the Site to the surrounding surface water receptors (in extreme weather conditions). Therefore the key measure to manage and mitigate future stormwater impacts on the Site would be the successful implementation of the SMP in consultation with EPA.

Flooding

The Project is not expected to change the flood risk profile in the Project Area nor would it change the ability to accommodate high rainfall events and/or broader flooding events from that which currently exists.

The implementation of the SMP and further changes to the stormwater system following completion of the Project and following any future demolition or remediation works would result in changes to flood risk on the Site. As such, Caltex will reassess the flood risk during the remediation works to ensure that any future flood risks to the Site are understood and appropriately managed.

Oily Water Management

Caltex are also in discussion with the EPA regarding the future of the OWMS at the Site. The reduction in process water from the refinery would mean that the existing WWTP would need to be reassessed to determine the potential for related changes in efficiency and performance. Caltex and the EPA have initiated discussions on this issue, and have an 'in principal' agreement in line with the approach outlined in **Section 11.6.2**.

At present treated effluent from the WWTP is discharged to the Tasman Sea via the Yena Gap outfall. The existing EPL for the Site requires this discharge is subject to quality monitoring to determine compliance with concentration limits. Whilst a permanent solution is found for the OWMS for the Site, Caltex have committed to managing the WWTP discharge within EPL limits. This commitment would ensure that the Project would not cause a greater impact on the quality of the receiving waters than the current operation.

11.8 Summary

In a number of areas, the potential impacts of the Project on water related issues would be positive when compared to the existing operations at the Site. The Project is likely to result in significantly less potable water use and would also result in a reduction in domestic waste. The retirement of the seawater cooling system would ensure that any negligible impacts associated with this process are also removed. Any potential impacts to stormwater quality during construction can be successful managed and a number of additional loss control management systems would help ensure that the risk of contamination is reduced.

Stormwater captured on-site during operation would be managed through the existing systems and separated into clean or contaminated streams as required. The Site would still discharge stormwater into the same off-site areas and the quality of the stormwater would largely remain the same. Impacts related to flooding would remain the same as present, however the current measures on Site would be reviewed in line with the SMP, and flood risk would be reassessed in the future.

The management of stormwater and flooding at the Site would continue to be studied and improved as the measures within the SMP are completed and implemented. The key measure to manage and mitigate future stormwater impacts on the Site would be the successful implementation of the SMP in consultation with EPA. Equally, any wastewater discharges from the WWTP would remain within existing EPA limits to ensure no additional adverse impacts.

Table 11-2 presents the relevant management and mitigation measures for this chapter. The management and mitigation measures for construction provided under **Section 11.7.1** above have been summarised in **Chapter 9 Soils, Groundwater and Contamination** and **Chapter 17 Waste Management**. Therefore some of these management and mitigation measures are not reiterated in **Table 11-2**.

Table 11-2 Management and Mitigation Measures – Surface Water, Wastewater and Flooding

Management and Mitigation Measures	Implementation		
	Design	Construction	Operation
The Construction Environmental Management Plan (CEMP) for the Project would include a Soil and Erosion Management Plan. This plan would include the following measures: • All materials would be stockpiled in accordance with 'The Blue Book' Managing Urban Stormwater – Soils and Construction Volume 1 and 2 (Landcom, 2004); • Silt fences would be installed around stockpiles to reduce erosion and the movement of suspended solids as necessary; • Soil stockpiles and any polluted materials would be stored in designated areas which are not in close proximity to any stormwater drainage systems; • Erosion control structures, bunded areas, containment areas, drainage lines and interception measures would be subject to regular inspection; • Clean materials would be separated from contaminated materials; and • Soil erosion and sedimentation devices would remain in place until the disturbed ground surface is restored. These devices would also capture any gross pollutants.		✓	
Caltex would continue to implement the measures within the Stormwater Management Plan for the Site. This plan has been produced in response to Environment Protection Licence No. 837, PRP U24.1: Stormwater Catchment and Management Plan. The SMP has committed Caltex to implementing a Stormwater Management Strategy and completing a number of stormwater management measures in a staged manner. Measures include: • Ongoing maintenance of the existing stormwater system; • Implementation of a number of projects to improve the infrastructure, reduce the potential for the refinery to flood, and prevent contaminated stormwater leaving the refinery premises; • Working with the NSW Office of Environment and Heritage (OEH), NSW EPA and Sutherland Shire Council to divert to flow of stormwater from the National Park away from the Site's stormwater system to the Sutherland Shire Council's stormwater infrastructure; • Carrying out stormwater flow monitoring; and • Updating the Site's stormwater system performance model to account for the changes to the stormwater system infrastructure that can then be used as a tool to assess future modifications, as necessary. This work would be completed in consultation with NSW EPA.	✓	✓	✓

Management and Mitigation Measures	Implementation		
	Design	Construction	Operation
Discharges from the Wastewater Treatment Plant would be within existing EPL limits during construction and operation. Any required change to this Oily Water Management System would be discussed and agreed with NSW EPA.	✓	✓	
The measures and processes currently in place at the Site to prevent any loss of contaminant would be maintained throughout the construction and operation phases of the Project. All bunds on tanks which are retained in service would meet the capacity requirements of Australian Standard *AS1940* during the operation of the Project.		✓	✓
Improvements to monitoring would be initiated to ensure that if a loss of containment into a bund occurs it is detected early and contingency actions can be taken promptly. The measures for tanks containing low flash materials include: • explosive vapour detectors within the bunds; • triple infrared scanners on tank roofs; and • CCTV in conjunction with infrared cameras as a confirmation for alarms. All tanks on-site would be subject to: • an automated high level shut off system; and • continuance of a comprehensive inspection/repair program.		✓	
Caltex will reassess the Site's flood risk during the future remediation works that would be completed once the converstion works are complete to ensure that any future flood risks to the Site following conversion, demolition and remediation are understood and appropriately managed.			✓

12 Noise and Vibration

12.1 Introduction

The following chapter assesses the likely noise and vibration impacts resulting from the Project. A Noise and Vibration Impact Assessment (NVIA) was completed by acoustic consultants Wilkinson Murray. This report has been included as **Appendix F**. This chapter is based on the findings of the NVIA.

12.2 Scope of the Assessment

The DGRs for the Project (refer to **Appendix A**) require the EIS to include:

- *an assessment of all construction, operational and transportation noise impacts on surrounding residential receivers;*
- *any vibration impacts from construction and operation;*
- *cumulative impacts of other developments both on the site and in the vicinity of the site; and*
- *details of the proposed noise management and monitoring measures.*

Subsequent communications with the EPA noted that the assessment should include:

- *identification of all potential noise sources associated with the conversion works. This may include any demolition, construction and operational noises from the project and associated shipping movements;*
- *identify the location of all sensitive receptors;*
- *the proposed hours of construction and operation of the conversion works;*
- *an assessment of compliance with the project specific noise levels as determined using the above guidelines; and*
- *any proposed mitigation, monitoring and management measures which are necessary to achieve the above outcome.*

These requirements are addressed in **Appendix F Noise and Vibration Impact Assessment** and summarised in this chapter.

Due to the distances between the potential sensitive receptors and the proposed works the likelihood of a vibration impact associated with the Project is minimal and as such no further assessment has been conducted.

12.3 Glossary of Technical Terms

A range of acoustic parameters and technical terms are used in this assessment. To assist in understanding the technical content, a brief description of the acoustic terms used within this chapter is provided below:

- dB (Decibel): A unit of sound level measurement that uses a logarithmic scale.
- “A” Frequency Weighting: The method of comparing an electrical signal with a noise measuring instrument to simulate the way the human ear responds to a range of acoustic frequencies. The symbol to show this parameter has been included in the measurement is “A” (e.g. LA_{eq}).

- Background Noise: Background noise is the term used to describe the level of noise measured in the absence of the noise under investigation. It is measured statistically as the A-weighted noise level exceeded for ninety per cent of a sample period. This is represented as the L_{A90} noise level. The measurement sample time may be indicated in the form L_{A90},t where t is the measurement sample time i.e. $L_{A90,15\ min}$.
- Assessment Background Level (ABL): The background level representing each assessment period (day, evening and night) which is determined for each 24-hour period of monitoring.
- Rating Background Level (RBL): The overall background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24-hour period used for the assessment background level). The rating background level is the level used for assessment purposes. Where the rating background level is found to be less than 30dB(A), then it is set to 30dB(A).
- L_{Aeq}: A weighted equivalent continuous noise level that is used as the constant level of noise that would have the same energy content as the varying noise signal being measured. The letter "A" denotes that the A-weighting has been included and "eq" indicates that an equivalent level has been calculated. This is referred to as the ambient noise level. The measurement sample time may be indicated in the form $L_{Aeq,t}$ where t is the measurement sample time i.e. $L_{Aeq,15\ min.}$
- Tonality: Noise containing a prominent frequency and characterised by a definite pitch.
- Peak Particle Velocity (PPV): The instantaneous sum of the velocity vectors (measured in millimetres per second) of the ground movement caused by the passage of vibration from blasting.
- Linear Peak (LIN Peak): The maximum level of air pressure fluctuation measured in decibels without frequency weighting (see 'A Frequency Weighting' above).
- Perception of Sound: Audible sound ranges from the threshold of hearing at 0dB to the threshold of pain at 130dB and over. A change of 1dB or 2dB in the level of a sound is difficult for most people to detect, whilst a 3dB to 5dB change corresponds to small but noticeable change in volume. An increase of about 8 – 10dB is required before the sound subjectively appears to be significantly louder.
- Sound Pressure (SPL): Sound pressure is the measure of the level or loudness of sound. Like sound power level, it is measured in logarithmic units. The symbol used for sound pressure level is SPL, and it is generally specified in dB. 0dB is taken as the threshold of human hearing. Some examples of SPL are provided in **Table 12-1**.

Table 12-1 Sound Pressure Levels of Some Common Sources

Sound Pressure Level (dB)	Sound Source	Typical Subjective Description
120	Riveter; rock concert, close to speakers; ship's engine room	Intolerable
100 – 110	Grinding; sawing, Punch press and wood planers, at operator's position; pneumatic hammer or drilling (at 2 m)	Very noisy
70 – 80	Kerbside of busy highway; shouting; Loud radio or TV	Noisy
50 – 60	Office, department store, restaurant, conversational speech	Moderate
40 – 50	Private office; Quiet residential area	Quiet
30 – 40	Unoccupied theatre; quiet bedroom at night	
20 – 30	Unoccupied recording studio; Leaves rustling	Very quiet
0 – 10	Hearing threshold, excellent ears at frequency of maximum sensitivity	

12.4 Legislation and Planning Policy

NSW Protection of the Environment Operations Act 1997

The *NSW Protection of the Environment Operations Act 1997* (PoEO Act) includes a single licencing arrangement for a range of pollutants including noise. Under this Act certain scheduled activities are licenced, as is the case of the Kurnell Refinery operation. These activities require the operator to obtain an Environmental Protection Licence (EPL). The current operation is subject to approved noise limits as presented in the Site's Environment Protection Licence (no. 837). This licence defines operating noise limits that must be observed when working on the Site. This Act therefore serves to regulate noise pollution.

12.5 Method of Assessment

12.5.1 Overview

This assessment has been undertaken in accordance with the guidance noted below and has involved:

- review of the applicable noise criteria, legislation and Director General's Requirements;
- understanding the existing acoustic environment of the study area;
- identification of noise sensitive receptors;
- setting of Project specific noise criteria;
- prediction of operation and construction noise and comparison with the nominated noise criteria; and
- recommendation of necessary mitigation measures to achieve satisfactory noise criteria performance.

12.5.2 Guidance

Potential noise impacts associated with the proposed construction and operational activities have been assessed in accordance with the following guidelines:

- *NSW Industrial Noise Policy* (EPA, 2000) (INP) for the assessment of the operational noise;
- *Application Notes – NSW Industrial Noise Policy* (OEH, 2011);
- *NSW Road Traffic Noise Policy* (EPA, 2011) (RTNP) for the assessment of the off-site traffic noise on public roads;
- *Update of Noise Database for Prediction of Noise on Construction and Pen Sites* (DEFRA, 2005);
- *Construction Noise Handbook* (Federal Highway Administration, 2006);
- *NSW Interim Construction Noise Guidelines* (ICNG, DECC 2009) for the assessment of the noise from construction of the Project; and
- *Assessing Vibration: A Technical Guideline* (DEC, 2006) for the assessment of the vibration from construction of the Project.

12.5.3 Noise Assessment Criteria

Overview

The current operation at the Site is subject to approved noise limits as presented in the Environment Protection Licence (EPL) (No. 837) for the Site (refer to **Appendix B Environment Protection Licence**).

The Industrial Noise Policy (INP) is used to guide the assessment operational noise activities, while construction activities are assessed against the *Interim Construction Noise Guideline (ICNG)*. Both operational noise and construction noise activities are also assessed against the approved noise limits contained within the existing EPL.

Construction Noise

The criteria set out in the ICNG have been used as a basis for assessment of the potential construction noise impact of the Project. The ICNG was developed by the NSW EPA and took into consideration the fact that construction is temporary, noisy and difficult to ameliorate. Therefore, the ICNG was developed in order to identify and utilise the range of work practices most suited to minimising noise arising from construction, rather than focusing only on achieving a specific noise level.

The ICNG recommends that standard construction work hours should generally be as follows:

- Monday to Friday 7.00am to 6.00pm;
- Saturday 8.00am to 1.00pm; and
- No work on Sundays or public holiday.

Table 12-2 summarises the construction noise specified in the guideline.

Table 12-2 Construction Noise Criteria - Noise at Residences

Time of Day	Management Level $L_{Aeq\ (15\ min)}$	How to Apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays	Noise affected RBL + 10dB (A)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dB (A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.

Time of Day	Management Level $L_{Aeq\ (15\ min)}$	How to Apply
Outside recommended standard hours	Noise affected RBL + 5dB (A)	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dB (A) above the specified noise affected level, the proponent should negotiate suitable work arrangements and mitigation measures with the community.

For commercial or industrial land the ICNG recommends the following noise management levels:

- industrial premises: external $_{LAeq\ (15\ min)}$ 75 dB(A); and
- offices, retail outlets: external $L_{Aeq\ (15\ min)}$ 70 dB(A).

Traffic Noise Criteria

Criteria for assessment of road traffic noise impacts are specified in the *NSW Road Traffic Noise Policy* (RTNP). The relevant applicable criteria for assessment of the Project are summarised in **Table 12-3.**

Based on the RTNP, the goal noise levels at the residential receptors for this Project are:

- $L_{Aeq,15hr}$ day 60 dB(A); and
- $L_{Aeq,9hr}$ night 55 dB(A).

Theses limits only apply to off-site road traffic noise, and do not apply to vehicle movements within the Site. For the purpose of this assessment any noise generated by on-site vehicle movements while on the Site is considered as construction industrial noise and assessed in accordance with the Industrial Noise Policy (INP).

Table 12-3 RTNP Criteria for Road Traffic Noise

Type of Development	Assessment Criteria – dB(A)	
	Daytime (07:00-22:00)	Night (22:00-07:00)
Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,15\ hour}$ 60 (external)	$L_{Aeq,9\ hour}$ 55 (external)
Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq,1\ hour}$ 55 (external)	$L_{Aeq,1\ hour}$ 50 (external)

Where the criteria are already assessed as exceeding as a result of existing traffic, any increase in the total traffic noise level should be limited to 2 dB above the existing traffic noise levels. A 2 dB increase is not typically considered to be a noticeable change in noise levels.

Existing Operational Noise Limits

The existing EPL for the Kurnell Refinery provides the following operational noise limits for the Site:

L6.1 Noise from the premises must not exceed:

a) an L_{A10} (15 minute) noise emission criterion of 70 dB(A) (7:00 to 2200) seven days a week; and

b) an L_{A10} (15 minute) noise emission criterion of 65 dB(A) at all other times.

The EPL also provides number of other noise specific conditions for the measurement and assessment of noise generated by operations on the Site. These are provided in detail in **Section 6.1** of **Appendix F Noise and Vibration Impact Assessment** and **Appendix B Environment Protection Licence**. The EPL uses the L_{A10} descriptor as this was used as standard when the EPL was issued prior to the introduction of the INP (EPA 2000). For the purpose of this assessment, it is conservatively assumed that the $L_{A10,15min}$ criteria (found within the EPL) is equivalent to the $L_{Aeq,15min}$ criteria. Typically a $L_{Aeq,15min}$ noise level from an industrial site is up to 3 dB lower than the $L_{A10,15min}$ noise level, therefore this assumption helps ensure a conservative assessment of noise.

Operational Noise

The Industrial Noise Policy (INP) provides the framework for deriving operational noise limits. The policy sets out two criteria to assess the potential operational noise impacts of industrial sources.

The first criterion “Intrusiveness” is used to assess short-term intrusive noise impacts at sensitive receptors (e.g. residents). The intrusiveness criterion is established by adding 5 dB(A) to the background noise levels (RBL). Where the RBL in the evening exceeds that in the daytime, the project-specific noise level was determined so that the intrusive noise level for evening was set at no greater than the intrusive noise level for daytime.

The second criterion “Amenity” is used to maintain noise level amenity for particular land uses for residences and other land uses. While the intrusiveness criterion is based on a typical worst case 15 minute period, the amenity criterion is expressed as an $L_{Aeq,period}$ noise level over the whole assessment period considered (day, evening or night).

The potentially affected residences near the Site are in areas that are classified as either “urban industrial interface” or urban. To be conservative the urban “acceptable” amenity criteria has been used in this assessment. The recommended acceptable “urban” noise levels are 60 dB(A), 50 dB(A) and 45 dB(A) LAeq,period for daytime, evening and night time periods, respectively.

Where noise levels from existing industrial sources are close to or above the acceptable levels, the amenity criterion is adjusted on a sliding scale so that overall overall noise levels do not exceed the acceptable level with the addition of the new noise source.

12.5.4 Noise Modelling

The ‘Cadna A’ computer acoustics model program using ISO 9613 noise prediction algorithm was used to model the acoustic impacts of the Project. The Cadna A modelling software is accepted by the EPA for use in environmental noise assessments. For the purpose of this modelling assessment, predictions assumed 24 hour operation of the equipment.

INP default meteorological parameters have been used to predict noise levels at each receptor. It is a conservative approach, in that it is likely to predict the upper range of increases in noise levels due to meteorological conditions (refer to **Section 7** of **Appendix F Noise and Vibration Impact Assessment**).

The Project has been modelled for the two following scenarios:

- initial construction phase involving the installation of new plant and refurbishment of tanks; and
- the typical worst-case scenario when new plant is operating concurrently.

12.6 Existing Environment

12.6.1 Noise monitoring data

The existing physical environment on the Site is outlined in **Chapter 3 Project Location and Existing Environment**. The acoustic environment on the Kurnell Peninsula is characterised mainly by industrial sources, however other activities also contribute to the existing noise environment. Marine activities in Botany Bay and aircraft noise from the Sydney (Kingsford Smith) Airport have potential to influence the acoustic baseline. Other noise sources include local traffic, ocean waves and local fauna.

In order to accurately assess the acoustic baseline it is necessary to establish a Rating Background Level (RBL). Due to the number of noise studies undertaken on the Kurnell Peninsula and Botany Bay in recent years, existing noise data was used in order to determine the RBL. The following documents have been referred to in this assessment:

- Environmental Assessment, Botany Bay Cable Project. (Wilkinson Murray, 2006);
- Caltex Jet Fuel Pipeline, Construction Noise and Vibration Assessment. (Renzo Tonin Associates, 2011);
- The Kurnell Port and Berthing Project Noise and Vibration Assessment (URS, 2012); and
- 2011 Computer Noise Update Project Caltex Refineries (NSW) Pty Ltd (HFP Acoustic Consultants Corp, 2011).

Table 12-4 summarises the relevant information from the above reports. The ambient noise levels are presented in the form of a Rating Background Level (RBL), which is defined in the INP. Monitoring locations are shown on **Figure 12-1**.

Table 12-4 Existing Noise Levels at Kurnell, L_{A90}

Monitoring Location	Reference	Monitoring Type	Location	Raing Background Noise Levels, L_{A90}			Ambient Noise Levels, L_{Aeq}		
				Day 0700-1800h (dB(A))	Evening 1800-2200h (dB(A))	Night 2200-0700h (dB(A))	Day 0700-1800h	Evening 1800-2200h	Night 2200-0700h
M1	Botany Bay Cable Project (Jul 2006)	Long-term noise logging	10 Prince Charles Parade	41	42	40	57*	54*	49*
M2	Noise update Project Caltex Refineries (2011)	Long-term noise logging	48 Prince Charles Parade	40	43	41	50	51	50
M3	Noise update Project Caltex Refineries (2011)	Long-term noise logging	39 Polo Street	40	40	41	54	52	51
M4	Jet Fuel Pipeline (April 2011)	Long-term noise logging	15 Cook Street	41	43	39	Not provided	Not provided	Not provided
M5	Noise update Project Caltex Refineries (2011)	Long-term noise logging	35 Cook Street	40	40	38	55	53	53
M6	Kurnell Port and Berthing (Dec 2012)	Long-term noise logging	Ranger's House	41	43	41	55*	57*	51*
M7	Noise update Project Caltex Refineries (2011)	Long-term noise logging	11 Tasman Street	40	39	36	53	52	51
M8	Noise update Project Caltex Refineries (2011)	Long-term noise logging	1 Silver Beach Road	44	40	40	52	50	50

Monitoring Location	Reference	Monitoring Type	Location	Raing Background Noise Levels, L_{A90}			Ambient Noise Levels, L_{Aeq}		
				Day 0700-1800h (dB(A))	Evening 1800-2200h (dB(A))	Night 2200-0700h (dB(A))	Day 0700-1800h	Evening 1800-2200h	Night 2200-0700h
M9	Noise update Project Caltex Refineries (2011)	Long-term noise logging	31 Silver Beach Road	47	49	38	55	54	51
M10	Noise update Project Caltex Refineries (2011)	Long-term noise logging	30D Cook Street	36	35	30	44	39	36

** Dominated by surf noise*.

12.6.2 Sensitive receptors

Sensitive noise receptors were identified considering the location of the Project Area and available information. The following groups of receptors were identified and are shown on **Figure 12-1**:

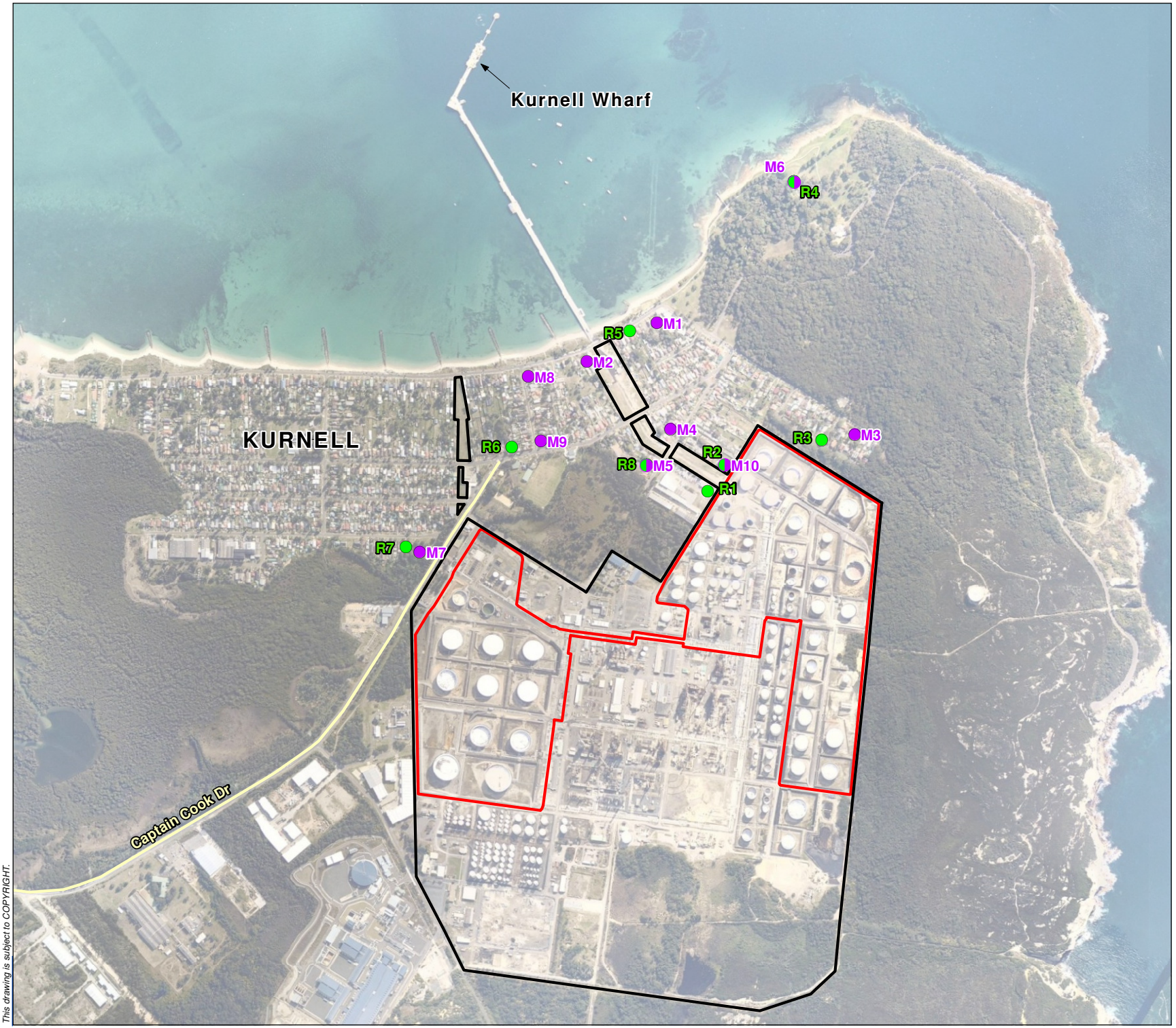
- Receptor 1 (R1): 44-64 Cook Street (Industrial Premises) Industrial premises adjacent to the Site to the west and sharing a common boundary;
- Receptor 2 (R2): 30D Cook Street (Residential) Residential property adjacent to the Site to the west and sharing a common boundary;
- Receptor 3 (R3): Reserve Road (Residential) Residential properties north of the Site;
- Receptor 4 (R4): Rangers' House (Residential) located towards the northern end of the National Park;
- Receptor 5 (R5): Prince Charles Parade (Residential) Residential properties south of the refinery wharf;
- Receptor 6 (R6): Corner of Captain Cook Drive and Silver Beach Rd (Residential) Residential properties north of the Site;
- Receptor 7 (R7): Tasman Street (Residential) Residential property west of the Site. and
- Receptor 8 (R8): 35 Cook Street (Residential) Residential property west of the Site.

In order to create an RBL for the Project, the ambient acoustic environment at each identified receptor location has been extrapolated from the existing monitoring data above. **Table 12-5** presents the RBL for each of the identified receptors and demonstrates how each of these RBL values was calculated.

Table 12-5 Rating Background Noise Levels, L_{A90}

Receptor Number	Sensitive Receptor	Rating Background Noise Levels, L_{A90}			Ambient Noise Levels, L_{Aeq}			Comments
		Day 0700 – 1800h	Evening 1800-2200h	Night 2200-0700h	Day 0700 – 1800h	Evening 1800-2200h	Night 2200-0700h	
R1 & R2	30D Cook Street	36	35	30	44	39	36	Based on M10
R3	Reserve Road	40	40	41	54	52	51	Based on M3.
R4	Ranger's House	41	43	41	55**	57**	51**	Based on M6.
R5	Prince Charles Parade*	40	40	40	50	51	50	Based on the lowest measured levels from M1, M2 and M8.
R6	Corner of Captain Cook Drive and Silver Beach Rd	47	49	38	52	50	50	Based on the lowest measured levels M9.
R7	Tasman Street	40	39	36	53	52	51	Based on M7.
R8	Cook St	40	40	38	55	53	53	Based on the lowest measured level from M4 and M5.

** For Prince Charles Parade the daytime RBLs are based on the attended measurements undertaken in 2012. **Dominated by Surf Noise*



Legend

- Approximate Location of Noise Monitoring Locations
- Approximate Location of Noise Sensitive Receptors
- Captain Cook Drive
- The Site
- Project Area

N
W E
S

Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

0 100 200 400 Meters

Source: Aerial Imagery - Nearmap Hypertiles 2012

PATH: T:\JOBS\43177836\Workspaces\

FILE NO: 43177836.019

DRAWN: STB APPROVED: RO DATE: 1/03/2013

CALTEX (REFINERIES)
NSW PTY LTD

KURNELL REFINERY
CONVERSION

LOCATIONS OF SENSITIVE NOISE RECEPTORS AND PREVIOUS MONITORING LOCATIONS

URS Figure: 12-1
Rev. A A4

12.7 Impact Assessment

12.7.1 Construction Impacts

Construction Noise Criteria

The majority of the conversion works for the Project would typically be completed between 7.00am to 10.00pm seven days a week. Some works consistent with Caltex's existing day-to-day operational and maintenance procedures would occur over a 24 hour period as regulated by the Environmental Protection Licence (No. 837) (EPL) for the Site. As discussed in **Chapter 4 Project Description**, in 2014 the refinery plant would be be shut down, depressurised, de-inventoried and left *in situ* in a staged manner. The shut down and depressurisation of the refinery plant is a process that occurs as part of the T&I program on a rotating basis as part of the maintenance program for the Site. Caltex has extensive documented procedures which are used routinely during T&I activities. These procedures enable noise emissions of this process to be monitoried and managed in compliance with the relevant EPL.

Based on the ICNG (refer to **Table 12-2**), **Table 12-6** presents the Project-specific construction noise criteria for the identified receptors associated with the Project.

Table 12-6 Project Specific Construction Noise Criteria

Receptor Number	Receptor Location	Day 0700-1800h $L_{Aeq,15min}$ (dB(A))	Out of hours 18:00h 22:00h $L_{Aeq,15min}$ (dB(A))	Out of hours 22:00h 7:00h $L_{Aeq,15min}$ (dB(A))
R1	Cook Street (Industrial Premises)	75		
R2	30 D Cook Street (Residential Premises)	46	40	35
R3	Reserve Road (Residential Premises)	50	45	45
R4	Ranger's House (Residential Premises)	51	46	46
R5	Prince Charles Parade (Residential Premises)	50	45	45
R6	Corner of Torres Street and Silver Beach Rd (Residential Premises)	57	52	43
R7	Tasman Street (Residential Premises)	50	44	41
R8	Cook Street (Residential Premises)	50	45	43

Construction Noise Impacts

The likely acoustic impact of the construction phase of the Project has been calculated based on the type of plant that is anticipated to be used in the construction process, and the frequency with which the plant would be used during the construction. **Table 12-7** provides details of this plant and its anticipated usage factor (i.e. the small generator would be used 50% of the time). The assessment has assumed that all plant would be working concurrently during the construction period to provide a worst case scenario.

Table 12-7 Project Construction Plant

Item	Overall $LA_{eq(15\ minutes)}$ Sound Power Level (dB(A))	Usage Factor (%)
Miscellaneous hand tools x 3	100	40
Compressor for Pneumatic tools	93	40
Small Generator	93	50
Concrete Pump	106	20
Concrete Truck	105	40
Mobile Crane	104	16
Vacuum Truck	106	20
Excavator	108	20
Reversing Alarm for large trucks	106	5

Note: All plant and equipment acquired by Caltex would meet its purchasing policy of "85dBA at the source".

Based on **Table 12-7** and the description of construction activities in **Chapter 4 Project Description**, **Table 12-8** below presents the predicted level of acoustic impact of the Project at each identified receptor location during the construction phase.

The construction noise levels resulting from the Project are predicted to be below the daytime construction noise criteria at all receptors. For out of hours construction work noise levels as a result of the Project are predicted to be below evening and night construction noise criteria at all receivers except R2 and R3, for which where minor exceedances of up to 5 dB have been prodicted.

However, as the construction activities are going be taking place while the refinery is still in operation, the existing noise environment in addition to the construction noise levels is required to be considered.

The current noise levels for the Site with all plant operating are summarised and discussed in **Section 12.7.3**. The predicted construction noise levels presented in **Table 12-8** are at least 10 dB below the existing noise levels. Therefore, the noise contribution from the proposed construction activities have an acoustically insignificant contribution to the existing noise levels. Cumulatively, the additional construction noise levels and the current noise levels for the Site would also meet the Site's current EPL noise limits.

The predicted levels at the boundary of the Site are below the EPL daytime and night time noise limits and as such the limits would comply with EPL limits at all the closest residential receivers.

It should be noted that the majority of the conversion works would typically be completed between 7.00am to 10.00pm seven days a week, with some works consistent with Caltex's existing maintenance procedures occurring over a 24 hour period.

Table 12-8 Predicted L_{eq} Construction Noise Levels, dB(A)

Receptor	Description	Predicted L_{Aeq} Noise Level	Day 0700-1800h $L_{Aeq,15min}$ (dB(A))	Out of hours 18:00h 22:00h $L_{Aeq,15min}$ (dB(A))	Out of hours 22:00h 7:00h $L_{Aeq,15min}$ (dB(A))	Complies (Yes/No)
R1	Cook Street (Industrial Premises)	44	75			Yes
R2	Cook Street (Residential Premises)	40	46	40	35	Yes/Yes/No
R3	Reserve Road (Residential Premises)	49	50	45	45	Yes/No/No
R4	Rangers' House (Residential Premises)	28	51	46	46	Yes/Yes/Yes
R5	Prince Charles Parade (Residential Premises)	34	50	45	45	Yes/Yes/Yes
R6	Corner of Torres Street and Silver Beach Rd (Residential Premises)	36	57	52	43	Yes/Yes/Yes
R7	Tasman Street (Residential Premises)	38	50	44	41	Yes/Yes/Yes
R8	Cook Street (Residential Premises)	39	50	45	43	Yes/Yes/Yes

12.7.2 Construction Traffic Impacts

During construction, vehicles would access the Project Area from Captain Cook Drive, which is the major access road to the Kurnell Peninsula on the southern shore of Botany Bay and connects the Project Site to the wider Sydney road network. It has three lanes in each direction west of Gannons Road with a median strip separating each carriageway, reducing to two lanes in each direction and divided carriageways between Gannons Road and Woolooware Road, and further decreasing to an undivided carriageway with one lane in each direction east of Woolooware Road to Kurnell.

Traffic generated by the Project would include the following vehicles:

- construction vehicles, 10 trucks (10 daily return trips) maximum would be required at the Site during the construction phase. These vehicles would typically include cranes and semi-trailers etc;
- equipment and material delivery vehicles, 10 trucks (10 daily return trips) maximum would be required to deliver the construction equipment and materials to the Site; and
- construction personnel, 140 additional personnel (140 daily return trips) on average would be required at the Site during the construction phase. This is in addition to approximately 40 existing employees that would assist with construction duties during the peak construction phase.

The existing traffic noise levels along the Captain Cook Drive already exceed the noise criteria of 60 and 55 dB(A) for the day and night, respectively. Captain Cook Drive east of Gannons Road had an average annual daily traffic flow of 38,810 (two-way) vehicles per day in 2012. Given these traffic volumes, the additional noise contribution from traffic generated by the Project construction would be negligible at residences on Captain Cook Drive (that is, less than a 2 dB increase).

12.7.3 Operational Impacts

Operation Project Specific Noise Levels (PSNL)

The *INP* states that the lowest of the two intrusive and amenity noise criteria be used as the Project Specific Noise Levels for the Project. The Project Specific Noise Levels are highlighted in "bold" in **Table 12-9**. Refer to **Section 12.5.3** for a description of how the Project Specific Noise Levels were determined.

Table 12-9 Project Specific Operational Noise Criteria

Receptor Number	Receptor Location	Time Period	Intrusiveness Criterion $L_{Aeq,15min}$ (dB(A))	Amenity Criterion $L_{Aeq,period}$ (dB(A))*
R1	Cook Street (Industrial Premises)	When in use	-	**70**
R2	30D Cook Street (Residential Premises)	Daytime (7.00 am–6.00 pm)	**41**	60
		Evening (6.00 pm–10.00 pm)	**40**	50
		Night Time (10.00 pm–7.00 am)	**35**	45
R3	Reserve Road (Residential Premises)	Daytime (7.00 am–6.00 pm)	**45**	59
		Evening (6.00 pm–10.00 pm)	45	**42**
		Night Time (10.00 pm–7.00 am)	45	**41**
R4	Ranger's House (Residential Premises)	Daytime (7.00 am–6.00 pm)	**46**	60
		Evening (6.00 pm–10.00 pm)	**46**	50
		Night Time (10.00 pm–7.00 am)	46	**45**
R5	Prince Charles Parade (Residential Premises)	Daytime (7.00 am–6.00 pm)	**45**	60
		Evening (6.00 pm–10.00 pm)	**45**	50
		Night Time (10.00 pm–7.00 am)	**45**	45
R6	Corner of Captain Cook Drive and Silver Beach Rd (Residential Premises)	Daytime (7.00 am–6.00 pm)	**52**	58
		Evening (6.00 pm–10.00 pm)	52	**44**
		Night Time (10.00 pm–7.00 am)	43	**41**
R7	Tasman Street (Residential Premises)	Daytime (7.00 am–6.00 pm)	**45**	60
		Evening (6.00 pm–10.00 pm)	44	**42**
		Night Time (10.00 pm–7.00 am)	**41**	41
R8	Cook Street (Residential Premises)	Daytime (7.00 am–6.00 pm)	**45**	59
		Evening (6.00 pm–10.00 pm)	45	**43**
		Night Time (10.00 pm–7.00 am)	43	**43**

*Note: *As the operational noise levels are relatively constant from the facility it is conservatively assumed that the $L_{Aeq,\ period}$ and $L_{Aeq,15minute}$ noise levels are the same.*

Operational Noise Impacts

Operational acoustic impacts were assessed against the INP Noise criteria. The likely acoustic impact of the operational phase of the Project has been calculated based on the new plant to be installed and the frequency that the plant would be employed. **Table 12-10** presents this plant and its anticipated usage factor. For the purposes of the assessment it was assumed that all plant would be operating concurrently following the shutdown of the refinery in the second half of 2014.

Table 12-10 Project Operation Plant

Item	Overall $LA_{eq(15\ minutes)}$ Sound Power Level (dB(A))	Usage Factor (%)
Ship	105	100
Product Pump	93	30
Slop Pump	81	30
Diesel additives injection system	90	5
Chemical drum and dosing pump	80	5
Compressors	90	40

Note: All plant and equipment acquired by Caltex would meet its purchasing policy of "85dB(A) at the source".

Noise levels experienced by a receptor at relatively large distances from a source can vary considerably under different meteorological conditions, particularly at night under temperature inversion conditions. Prevailing wind and air temperature gradients will change over the course of the day and night time periods; hence noise levels at receptors will change even when the source noise level is constant.

For projects in coastal areas, the INP recommends the following default meteorological conditions that enhance noise levels:

- Moderate (F-class stability category) inversions: 3^{o}C/100 m inversion strength and source-to-receptor wind drainage of 2 m/s where applicable. As the area is relatively flat, drainage winds are not considered applicable for this area; and
- Gradient wind: Source-to-receptor gradient wind of 3 m/s.

Based on **Table 12-10** and the description of activities in **Chapter 4 Project Description**, **Table 12-11** presents the predicted level of acoustic impact of the Project at each identified receptor location during the operational phase. It should be noted that the cessation of refining operations at the Site would reduce noise levels substantially at the Site. Operational noise levels have been modelled assuming that all new plant is running concurrently following the shutdown of the refinery in the second half of 2014.

Table 12-11 Predicted L_{Aeq} Noise Levels – Operation – dB(A)

Receptor	Description	Predicted L_{Aeq} Noise Level			INP Noise Criteria (Day/Evening/ Night)	Complies (Yes/No)
		Calm	3 m/s down wind	3°C/100 m inversion strength		
R1	Cook Street (Industrial Premises)	29	31	31	70	Yes
R2	30 D Cook Street (Residential Premises)	31	33	33	41/40/35	Yes/Yes/Yes
R3	Reserve Road (Residential Premises)	25	29	29	45/45/45	Yes/Yes/Yes
R4	Ranger's House (Residential Premises)	33	38	38	46/46/45	Yes/Yes/Yes
R5	Prince Charles Parade (Residential Premises)	34	39	39	45/45/45	Yes/Yes/Yes
R6	Corner of Captain Cook Drive and Silver Beach Rd (Residential Premises)	31	36	36	52/44/41	Yes/Yes/Yes
R7	Tasman Street (Residential Premises)	34	39	39	45/42/41	Yes/Yes/Yes
R8	Cook Street (Residential Premises)	35	39	39	45/43/43	Yes/Yes/Yes

Note: If R1 was a residential receptor it would also comply with residential criteria.

The operational noise levels as a result of the Project are predicted to comply with the daytime, evening and night time operational noise criteria at all receptors. Therefore, no impacts are expected at any of the identified sensitive receptors as a result of operational noise resulting from the Project.

12.7.4 Operational Traffic Impacts

During the operational stage of the Project, Caltex would import finished products via the two fixed berths at the existing wharf and the sub berth located in Botany Bay. The major product distribution systems would continue as normal, with product being pumped under Botany Bay to the Banksmeadow Terminal, the Sydney/Newcastle pipeline or the Joint User Hydrant Installation (JUHI) at Sydney Airport for further distribution. Routine road transport of products from the Site would cease.

There would be a reduction in employees on site following the cessation of refining operation and the introduced high levels of automation of the terminal. It is anticipated approximately 100 employees would provide routine operational or supporting services to the terminal. These employees would operate in a shift arrangement 24 hours a day, 7 days a week. Up to an additional 90 people would be required at the Site during maintenance shutdown periods during the operation of the terminal, which are periodic and for short time frames (8-12 weeks).

Given the reduction in employees and cessation of road haulage at the Site, the number of vehicles generated by the operational phase of the Project would be significantly fewer than the existing number of vehicles generated by refining operations. This would result in a reduction in traffic volumes along Captain Cook Drive and subsequently lower levels of traffic noise. Therefore the operational phase of the Project would have a positive impact on sensitive noise receptors along Captain Cook Drive.

12.8 Mitigation

As the Project is not expected to adversely impact on the acoustic amenity of surrounding receptors, no specific mitigation measures are required. However, as a precautionary approach, a number of mitigation measures would be included to manage any potential construction noise risks moving forward. Measures would include:

- Provision of a Noise Management Plan as part of the CEMP for the Project. This plan would outline:
  - the locations of noise sensitive receptors;
  - construction noise monitoring procedures; and
  - construction equipment maintenance to ensure good working order.
- Activities that are undertaken that are in line with the existing maintenance proceedures on the Site (such as the shut down, depressurisation and de-inventory of the refinery infrastructure) would be undertaken in line with existing Caltex proceedures to ensure any noise emissions are monitored and managed in compliance with the relevant EPL.
- Awareness training for staff and contractors in environmental noise issues including:
  - minimising the use of horn signals and maintaining a low volume. Alternative methods of communication would be considered;
  - avoiding any unnecessary noise when carrying out manual operations and when operating plant; and
  - switching off any equipment not in use for extended periods during construction work.
- The majority of the conversion works for the Project would typically be completed between 7.00am to 10.00pm seven days a week. Some works consistent with Caltex's existing day-to-day operational and maintenance procedures would occur over a 24 hour period as regulated by the Environmental Protection Licence (No. 837) (EPL) for the Site.
- Prior to operation of the new terminal, Caltex would agree appropriate noise limits (if required) for the Site with the EPA.
- Community consultation with local residents and building owners to assist in the alleviation of community concerns. Previous experience on similar projects has demonstrated that affected noise sensitive receptors may be willing to endure higher construction noise levels for a shorter duration if they have been provided with sufficient warning in the place of intermittent but extended periods of construction noise at lower levels. These existing 24 hour Community Concerns Hotline would continue to be operated for the Project; and
- Maintaining a suitable complaint register. Should noise complaints be received, noise monitoring would be undertaken at the locations concerned. Reasonable and feasible measures would be implemented to reduce noise impacts. All complaints would be managed through the existing feedback process at the Site.

Equally Caltex's current approach to managing complaints (from noise or otherwise) would continue. As discussed above, this approach includes a 24-hour hotline number for the local community. This number forms part of an established community complaints process where the community complaint or enquiry is emailed and texted to an Operations representative, the Shift Manager, the Environment Protection Superintendent, the Community Relations and Communication Advisor, amongst other refinery personnel. The complaint is responded to and investigated to determine the source of the noise and then, if required, operational adjustments are made to mitigate the noise. The resident is generally updated on the action(s) taken and asked about whether they consider that the operational adjustments have been effective.

12.9 Cumulative Impacts

12.9.1 Introduction

The noise assessment has also considered the cumulative impacts of the Project with other proposed works in proximity to the Site (refer to Section 10 of **Appendix F Noise and Vibration Impact Assessment**).

Caltex are proposing dredging work and upgrades to the Kurnell Port and Berthing Facility (SSD-5353). These upgrades have been described in the Caltex Kurnell Port and Berthing Facility Environmental Impact Statement (URS, 2013) (Kurnell Port and Berthing Project). There is potential for cumulative construction noise impacts between the Port and Berthing Facility Project and the Kurnell Refinery Conversion Project as both projects are likely to occur between the 3rd quarter of 2013 and the second half of 2014.

12.9.2 Construction Noise

The construction impacts from the Kurnell Port and Berthing Project have identified potential impacts at residences on Prince Charles Parade and the Rangers' House as these are the closest residential receivers. Maximum construction noise levels including piling and impulsive noise sources where predicted to be between 56 and 49 dB(A) for day time construction works (URS, 2013).

Construction noise levels for the proposed Project are identified in **Section 12.7.1** and show predicted construction noise levels of 34 dB(A) at Prince Charles Parade and 28 dB(A) at the Rangers' House. It can therefore be concluded that the predicted noise contribution from the proposed Project would have an acoustically insignificant contribution to the construction noise levels from the Kurnell Port and Berthing Project.

12.9.3 Construction Traffic Noise

The predicted construction vehicle generation relating to Kurnell Port and Berthing Project was also assessed cumulatively with the likely construction vehicles from this Project. Due to the anticipated small volume of vehicle movements from both the Kurnell Port and Berthing Project and the Project along Captain Cook Drive, cumulative road traffic noise impacts during construction would be less than 2 dB and as such considered negligible impact.

12.9.4 Operational Noise

The most accurate current noise levels for the Site with all plant operating including the refinery are presented in **Table 12-12** as summarised in a report by HFP Acoustic Consultants for the Site's pollution reduction program (HFP, 2011). From these predictions it can be concluded that the existing refining operation meets its EPL noise limits.

Table 12-12 Estimated Site Noise Levels with all Refinery Plant Operating, (HFP, 2011)

#	Receiver	Predicted L_{Aeq} Noise Level 3 m/s Southerly wind
R1	Cook Street (Industrial Premises)	57
R2	30D Cook Street (Residential Premises)	57
R3	Reserve Road (Residential Premises)	57-53
R4	Ranger's House (Residential Premises)	<45
R5	Prince Charles Parade (Residential Premises)	50
R6	Corner of Captain Cook Drive and Silver Beach Rd (Residential Premises)	55
R7	Tasman Street (Residential Premises)	55
R8	Cook Street (Residential Premises)	52

The predicted operational noise levels presented in **Section 12.7.3** are at least 10 dB below the existing noise levels. Therefore, the predicted noise contribution from the proposed Project would have an acoustically insignificant contribution to the existing noise levels. As such, in the short-term when the refinery is still operating, the cumulative noise levels from the Site including the Project would not change from those levels presented in **Table 12-12**.

Further, the additional Project noise levels and the current noise levels for the Site with all plant operating including the refinery would also meet the Site's current EPL noise limits.

Following cessation of refining at the Site, operational noise would reduce substantially and operational noise levels as a result of the Project would remain. These are predicted to be below the INP daytime, evening and night time noise criteria at the closest receivers.

It can therefore be concluded that no cumulative noise impact is predicted due to the construction or operation of the Project.

12.10 Summary

As the Project is not expected to adversely impact on the acoustic amenity of surrounding receptors, no specific mitigation measures are required. However, as a precautionary approach, a number of mitigation measures would be included to manage any potential impacts.

The proposed mitigation and management measures to be implemented during the construction and operation of the Project are summarised in **Table 12-13**.

Table 12-13 Management and Mitigation Measures - Noise

Management and Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
The CEMP for the Project would include a Noise Management Plan (NMP). The NMP would outline: • the locations of noise sensitive receptors; • construction noise monitoring procedures; and • construction equipment maintenance to ensure good working order.		✓	
Low-noise plant and equipment would be selected, where practicable, in order to minimise potential for noise and vibration. All equipment would be regularly checked to ensure that the mufflers and other noise reduction equipment are working correctly.		✓	
Community consultation with local residents would be undertaken to assist in the alleviation of community concerns. A complaints register is maintained and managed in line with the existing feedback process at the Site.		✓	✓
Any noise complaint(s) would be investigated immediately. Reasonable and feasible measures would to be implemented to reduce noise impacts.		✓	✓
Construction equipment would be located to reduce noise emission to sensitive receptors, where practicable.		✓	
The majority of the conversion works for the Project would typically be completed between 7.00am to 10.00pm seven days a week. Some works consistent with Caltex's existing day-to-day operational and maintenance procedures would occur over a 24 hour period as regulated by the Environmental Protection Licence (No. 837) (EPL) for the Site.		✓	
Construction staff and contractors would undergo training in environmental noise issues including: • minimising the use of horn signals and maintaining a low volume. Alternative methods of communication should be considered; • avoiding any unnecessary noise when carrying out manual operations and when operating plant; and • switching off any equipment not in use for extended periods during construction work.		✓	
Should any unexpected construction activities occur which could potentially generate significant noise not described in this report, monitoring would be undertaken to ensure construction noise emission levels do not exceed EPL limits.		✓	

13 Air Quality and Odour

13.1 Introduction

This chapter presents a summary of the air quality impact assessment (AQIA) undertaken to assess the otential air quality impacts associated with the Project. The AQIA is provided in full in **Appendix G Air Quality Impact Assessment**.

13.2 Scope of Assessment

The Director General's Requirements (DGRs) (refer to **Appendix A**) requested that consideration be given to the potential air quality impacts of the Project, and that the EIS include the following:

- *"a quantitative assessment of the air quality and odour impacts of the development on surrounding receivers, including impacts from construction, operation and road transportation; and*
- *details of the proposed management and monitoring measures."*

The NSW Environment Protection Authority (EPA) also requested that impacts on air quality and odour associated with the Project be considered. The EPA require the EIS to undertake dispersion modelling where there is a risk of adverse impacts or where there is sufficient uncertainty to warrant a rigorous numerical impact assessment.

To meet these requirements, an assessment of the potential air quality impacts of the Project has been completed. The AQIA has incorporated the following elements:

- a review of activities proposed as part of conversion works and terminal operation;
- identification of key pollutants and emission sources associated with identified activities;
- a review of regulatory framework for air emissions including impact assessment criteria;
- preparation of an emissions inventory for the operational phase of the Project;
- atmospheric dispersion modelling of emissions from the operational phase of the Project;
- comparison of model predictions against impact assessment criteria; and
- proposed mitigation and monitoring measures relative to the Project.

13.3 Legislation and Planning Policy

Protection of the Environment Operations Act 1997

Part 5.4 of the *Protection of the Environment Operations Act 1997* (PoEO Act) defines air pollution.

The PoEO Act enables the NSW Government to:

- make protection of the environment policies to prevent or minimise air pollution;
- allocate responsibilities for environmental protection between the state Government and local councils;
- provide a range of tools to address air pollution including orders and directions concerning clean-up and prevention notices;

- enable a function for notices to be issued to maintain and operate equipment in a proper and efficient manner; and
- make it an offence to carry out various activities that cause the emission of air pollution and/or breach the conditions of an order, direction or notice.

Two principal regulations have been formed under the PoEO Act, one of which is relevant to this assessment and is discussed below.

Protection of the Environment Operations (Clean Air) Regulation 2010

The *Protection of the Environment Operations (Clean Air) Regulation 2010* sets the legislative context for air emissions associated with industrial and commercial developments. This Regulation is relevant to the proposed works as it sets out management responsibilities to minimise adverse air quality impacts.

13.4 Method of Assessment

13.4.1 Introduction

There are three types of criteria relevant to air emissions associated with the Project. These are:

- **Air Impact Assessment Criteria** – ambient criteria designed for use in air dispersion modelling and air quality impact assessments for new or modified emission sources;
- **Ambient Air Quality Standards** – regional standards against which ambient air quality monitoring results may be assessed; and
- **Emission Standards** – which specify maximum allowable in-stack pollutant concentrations as specified for particular industrial activities and plant types.

A combination of Emission Standards and Air Impact Assessment Criteria are typically used to evaluate the expected impact of air emissions on local air quality, and the effectiveness of plant design and associated emission controls. The wider objective of these criteria is to ensure that the resulting regional ambient air quality meets the relevant Ambient Air Quality Standards.

In addition, Ambient Air Quality Standards constitute an additional range of Criteria which can be used to provide additional context to modelling predictions.

13.4.2 Emissions and Odour

Key Pollutants

The products that are and would be stored on Site comprise a range of mixtures of organic compounds, including VOCs that have potentially adverse impacts on human health and amenity[1] and therefore the area of key relevance to this assessment. The compounds identified in *Toxicological Profile for Total*

[1] A consideration of Semi-Volatile Organic Compounds (SVOCs) as Polycyclic Aromatic Hydrocarbons (PAHs) was performed, however release modes from sources at the Site were found to be non-conducive to of PAH (B[a]P TEQ) emissions. Tank emission calculations were performed for SVOCs as PAHs (B[a]P TEQ) in accordance with the Potency Equivalency Factors [PEFs] provided in the *Approved Methods* in conjunction with product composition, and Total VOC emissions. Raoult's law was used to estimate B[a]P emissions as a fraction of total VOC emissions. As part of this calculation, all non-naphthalene PAHs were conservatively assumed to be present as 7,12 dimethylbenzanthracene (the PAH with the highest product of PEF and vapour pressure). These emissions were found to be in the order of ~1 g B[a]P/year which is considered negligible relative to levels associated with potentially adverse air quality impacts.

Petroleum Hydrocarbons (TPH) (ATSDR, 1999a) have been adopted as key pollutants for the assessment. These include:

- BTEX, consisting of:
  - Benzene;
  - Toluene;
  - Ethylbenzene;
  - Xylenes; and
- n-Hexane.

In addition, URS conducted a review of the Site's 2010-2011 tank emissions profile. This review confirmed that the compounds identified in ATSDR (1999a) were correct.

Petroleum hydrocarbons also possess a characteristic hydrocarbon odour typically associated with transport fuels. Sulphurous compounds such as mercaptans and hydrogen sulphide are also odorous gases present in petroleum hydrocarbons in small quantities.

Due to improvements in Australian fuel standards there has been a significant reduction in the amount of sulphur present in transport fuels and therefore it is expected that high levels of sulphur-based odorants would be only present in fuel oil.

Odour

In recent times, odour has been a key issue of community concern near to the Site. Odour complaints have typically numbered between 50 and 60 complaints per year. As a result of this, there is a large amount of existing baseline information about Site odour available therefore a quantitative assessment of odour has not been undertaken within this AQIA.

Caltex propose to manage odour from the Project through the odour reduction programs that are currently undertaken through the Environment Protection Licence (EPL) for the Site (EPL no. 837). A discussion of these programs is provided in **Section 7** of **Appendix G Air Quality Impact Assessment** and summarised in **Section 13.7.2**.

13.4.3 Impact Assessment Criteria

Impact assessment criteria relevant to the Project have been taken from the *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW* (the *Approved Methods*) (OEH, 2005). The pollutants relevant to this assessment are listed in **Table 13-1**.

Table 13-1 OEH Impact Assessment Criteria

Substance	Averaging Period	Impact Assessment Criteria		Criterion Type
		($\mu g/m^3$)	(ppb)	
Benzene	1 hour	29	9	Toxic
Toluene	1 hour	360	90	Odorous
Ethylbenzene	1 hour	8,000	1,800	Toxic
Xylenes	1 hour	190	40	Odorous
n-Hexane	1 hour	3,200	900	Toxic

Ambient Air Quality Standards

Ambient Air Quality Standards have been taken from the National Environment Protection (Air Toxics) Measure (NEPC, 2004). This document provides health investigation levels for a range of substances, some of which are relevant to the Project.

Whilst these standards are not intended directly for use in impact assessment, nor are they a specific regulatory requirement for the Project, the sources from which the criteria are developed are considered relevant and useful in the context of this assessment. Specifically, these criteria are available as long-term (annual) averages, therefore offering improved compatibility with the assessment of exposure to pollutants with chronic health effects (e.g. Benzene). **Table 13-2** provides a summary of the long-term National Environment Protection Measure (NEPM) monitoring investigation levels and assumed background levels for substances considered in this assessment.

Table 13-2 NEPM Monitoring Investigation Levels

Substance	Averaging Period	Monitoring Investigation Level	
		(µg/m^3)*	(ppb)
Benzene	Annual	9.6	3
Toluene	Annual	377	100
Xylenes	Annual	870	200

Note: *Converted from volumetric units at a temperature of 25°C and pressure of 1 atmosphere.

Emissions Standards

NSW emission standards relevant to the Project are limited to those contained in Part 6, Clause 63, *Control of Volatile Organic Liquids (VOLs) – Control Equipment for Large Storage Tanks.* Clause 63 applies to large storage tanks (i.e. >150 kL capacity) used to store VOLs[2].

Of the liquids that would be handled on the Site, gasoline products would be classified as VOLs, whilst fuel oil, jet fuel and diesel would not meet this classification.

13.4.4 Quantitative Assessment

Construction Impacts

The Project, as described in **Chapter 4 Project Description**, was reviewed in the context of potential emissions to air.

As discussed in **Chapter 4 Project Description**, in 2014 the refinery plant would be be shut down, depressurised, de-inventoried and left *in situ* in a staged manner. The shut down and depressurisation of the refinery plant is a process that occurs as part of the T&I program on a rotational basis as part of the maintenance program for the Site. Caltex has extensive documented procedures which are used routinely during T&I activities. These procedures enable air emissions from this process to be monitoried and managed in compliance with the EPL. Therefore any air emmissions from this process would be managed under the relevant EPL and do not require assessment as part of this Project.

[2] Those liquids with a vapour pressure greater than 25.8 mm Hg (~3.4 kPa) at storage conditions.

Given the minor scale and progressive nature of the construction activities, the potential for works to adversely impact air quality is considered small. Hence a quantitative assessment of these activities has not been undertaken. This is discussed further in **Section 13.6.1**.

Operational Impacts

Dispersion Modelling

Quantitative air quality assessments are undertaken using computer based dispersion models. These models rely on the input of accurate meteorological, baseline air quality and emission source data to calculate the worst-case dispersion of a particular emission across a study area. Three dispersion models are generally endorsed by OEH for use in AQIAs. These are AUSPLUME, TAPM and CALPUFF. The AUSPLUME model has been selected for the assessment and is considered to be appropriate for the operation of the Project for the following reasons:

- emission from the site occur at ground-level and are non-buoyant;
- receptors of key interest are located in the near-field range; and
- on-site meteorological monitoring data is available, and is sited in an area considered representative of key emission sources and receptors.

Receptor Locations

Modelling has been conducted for a receptor grid of 81 x 81 receptor points at 50 m resolution, which equates to a receptor grid of 4 x 4 km. The extent of this modelling domain encompasses the Site and surrounding areas of interest on the Kurnell peninsula as shown in **Figure 13-1**.

Figure 13-2 shows the location of eleven 'discrete receptors'. The selected discrete receptors are residential locations along the northern and north-eastern boundary of the Site that have been selected as a simple means of screening the modelling results at areas which are routinely occupied.

Meteorological Data

A site-specific meteorological dataset was prepared using meteorological data that has been collected at the Site and synoptic meteorological databases. This was done to calculate the meteorological parameters that are required for the dispersion model. Further detail and analysis of this process is provided in Appendix A of **Appendix G Air Quality Impact Assessment**.

Figure 13-1 Site and surrounding areas of interest

(Aerial image sourced from Google Earth Pro)

Figure 13-2 Discrete receptor locations

Site Boundary

(Aerial image sourced from Google Earth Pro)

13.4.5 Other Assessment Parameters

Emission Sources

The products that are and would be stored on Site comprise a range of mixtures of organic compounds, including VOCs that have potentially adverse impacts on human health and amenity. During the operational phase of the Project, in the absence of combustion processes at the Site due to the cessation of refining, emission sources are primarily limited to those arising through fugitive volatilisation of hydrocarbon materials during importation, storage and exportation from the Site.

Based on the proposed works, the following potential emission sources were identified:

- **Storage tanks -** of the approximately 100 storage tanks existing on the Site, Caltex propose to retain approximately half of these in service for the storage of products and slop oil (excluding tanks associated with the Waste Water Treatment Plant (WWTP).
- **Product transfer infrastructure -** fugitive emissions would occur from equipment that is used to move products around the Site including fugitive losses from plant items such as pump (seals), valve collars and pipe flanges.
- **Land farm -** is used to treat sludges that are generated from operational activities on the Site. Dozers are used to turn the material on a near daily basis, and material is turned and stored in stockpiles within the land farm. As part of this process, VOCs are released from the land farm material to the atmosphere.

- **Waste water treatment plant -** Caltex operate a WWTP which is capable of treating approximately 15 ML/day using physical, chemical and biological processes to treat wastewater prior to ocean outfall discharge. Emission estimates performed by Caltex indicate that VOC emissions from the WWTP are unlikely to be significant in the context of emissions from the Site[3], and have therefore not been incorporated into the quantitative component of this assessment.
- **Shipping -** resulting from ship loading activities and emissions associated with the combustion of fuels whilst at berths.

Emissions have been represented in AUSPLUME as volume sources. Volume sources represent a generic method of representing fugitive emissions, such as those that are released into an aerodynamic wake (e.g. fugitive emissions from storage tanks). **Figure 13-2** shows the location of identified discrete receptors and emission sources.

13.5 Existing Environment

13.5.1 Climate and Meteorology

The dispersion of pollutants in the atmosphere is predominantly driven by local wind conditions. Meteorological data was collected on the Site and was used for the assessment in conjunction with synoptic meteorological databases. A review of meteorological monitoring on the Kurnell peninsula identified the following Automatic Weather Stations (AWS):

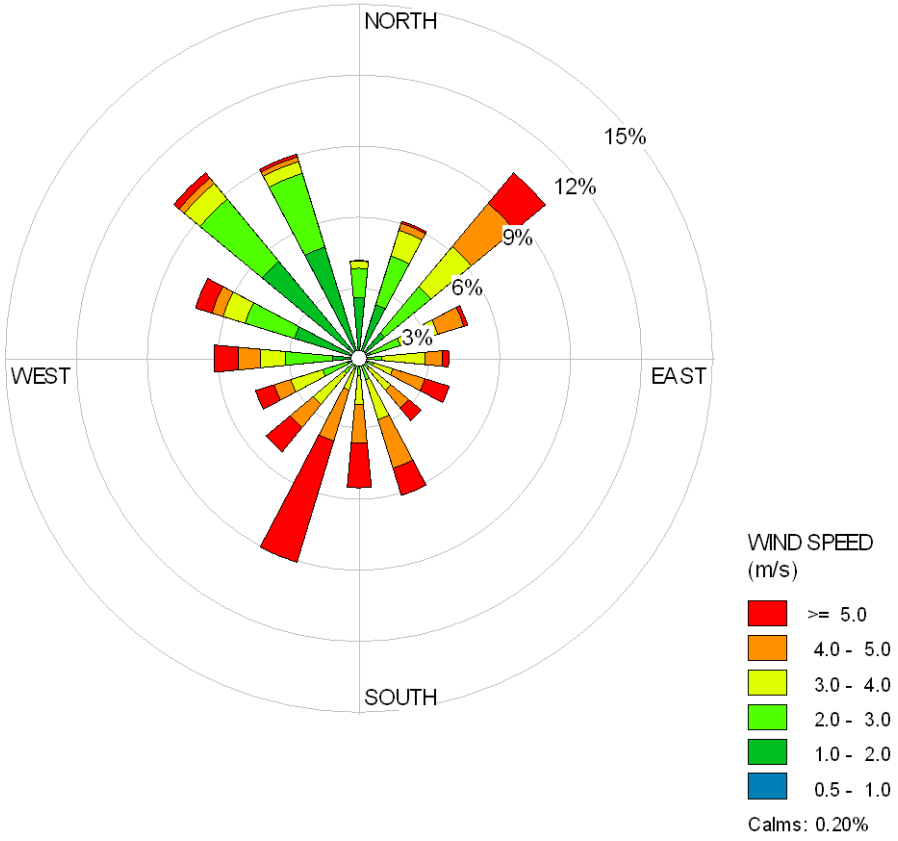
- Bureau of Meteorology (BoM) Kurnell;
- Caltex Kurnell Refining Performance Improvement Program (RPIP); and
- Caltex Lubricating Oil Refinery.

The BoM Sydney Airport AWS was also identified as a nearby source of long term meteorological records, relevant to the review of regional meteorological trends.

Terrain across the peninsula is generally low-lying with the exception of eastern-most portion of the headland where a ridge runs on a north/south alignment. The eastern boundary of the Site is bound by this ridge where elevations reach approximately 40 m above sea level. Winds at the Site are typical for coastal winds in the Sydney region, however higher than average wind speeds may be present due to the exposed nature of the peninsula. Some sheltering of easterly winds has potential to be present due to the ridge to the east of the Site. Five years of meteorological data (2007 to 2011 inclusive) were reviewed, and 2008 was selected as being representative of meteorological patterns across all years. **Figure 13-3** shows the wind rose for the Site from 2008. Winds are shown to be well distributed in all directions, with the slight accentuation of north easterly sea breezes, south-south westerly and north-westerly winds, as common to the coastal areas of Sydney.

[3] Caltex routinely estimate Total VOC losses based on WWTP biological oxygen demand. Typically, these VOCs are estimated to constitute approximately 0.01% of Total VOCs from storage tanks under terminal operation.

Figure 13-3 Wind rose for 2008



13.5.2 Existing Air Quality

The existing air quality in the vicinity of the Site has been reviewed in order to establish general trends in pollutants and identify appropriate background values for use in this assessment. NEPC (2010) contains a summary of monitoring conducted as part of the NEPM Air Toxics program. The data from the Turrella monitoring station was selected as most representative of the current conditions as it is the closest to the Site. This area is densely-populated, and located on heavy arterial traffic routes including the M5 motorway. Whilst monitoring data from this location is unlikely to be directly reflective of background air quality in Kurnell, its use is considered appropriate as a representation of background air quality.

Table 13-3 provides a summary of the long-term NEPM monitoring investigation levels and assumed background levels for substances considered in this assessment.

Table 13-3 NEPM monitoring investigation levels and assumed background levels

Substance	Averaging Period	Monitoring Investigation Level		Assumed Background Level (Turrella Monitoring Station)	
		($\mu g/m^3$)*	(ppb)	($\mu g/m^3$)*	(ppb)
Benzene	Annual	9.6	3	1.2	0.38
Toluene	Annual	377	100	6.8	1.8
Xylenes	Annual	870	200	5.2	1.2

Note: *Converted from volumetric units at a temperature of 25°C and pressure of 1 atmosphere.

13.6 Impact Assessment

13.6.1 Construction Impacts

As discussed in **Section 13.4.4**, given the scale of the construction phase of the Project in relation to the existing operations on the Site, the potential for construction activities to adversely impact air quality is considered small. The following potentially emissive activities were identified:

- Volatile Organic Compound (VOC) emissions from the draining and cleaning of tanks;
- particulate emissions from metal fabrication: cutting, grinding and welding during tank and piping modifications;
- combustion emissions from portable plant items (e.g. generators and compressors);
- VOC emissions from painting of tanks and piping; and
- Particulate/VOC emissions from excavations, concrete cutting and concreting (as required for the installation of items such as pump foundations).

Potential air quality impacts would be managed through the implementation of an Air Quality Management Plan (AQMP) which would be incorporated into the Construction Environmental Management Plan (CEMP) for the Project. Mitigation measures suitable for incorporation into the CEMP have been provided in **Section 13.7**.

13.6.2 Operational Impacts

Change in Emissions Profile

The closure of refining operations would result a significant change in the emissions profile for the facility. Of key significance is the retirement of stationary combustion sources on the Site and associated classes of pollutant emissions, which include oxides of nitrogen (NO_x), carbon monoxide, sulphur dioxide, hydrogen sulphide and particulate matter.

Table 13-4 and **Figure 13-4** show the change in emission profile relative to the 2010/2011 NPI reporting year (the base year). This reporting year is considered to be the most recent year in which the refinery (including CLOR) was operating at near to full capacity.

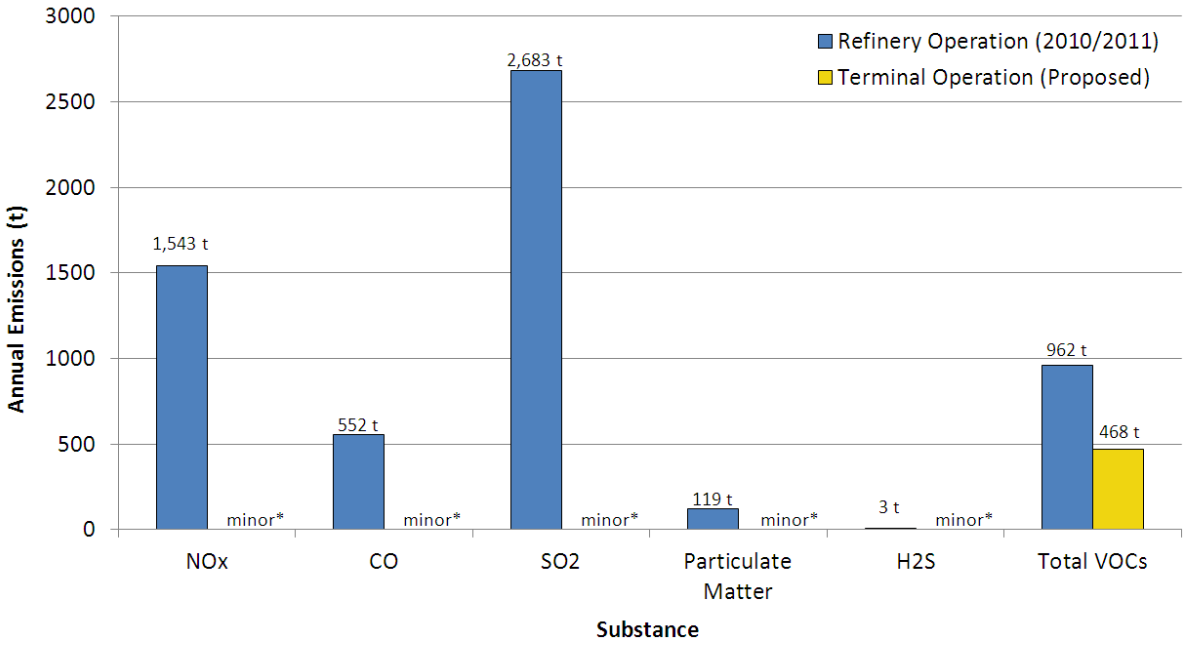
Table 13-4 Change in Emissions Profile Associated with Conversion of the Site

Pollutant	Site Emissions (t/annum)	
	Refinery Operation (Base Year)	Terminal Operation
Oxides of Nitrogen (NO_x)	1,543	Minor*
Carbon Monoxide	552	
Sulphur Dioxide	2,683	
Particulate Matter	119	
Hydrogen Sulphide	3	
Volatile Organic Compounds (VOCs)	962	468

Note: *Emissions have not been estimated, but would be primarily limited to those from vehicles and other mobile plant on the Site.

Relative to refinery operation, total VOC emissions are anticipated to halve in quantity under the proposed terminal operations. These reductions are due to a range of changes proposed as part of the Project. Total VOC emissions from storage tanks were estimated at 705 t for the current operation, as compared to 453 t under the proposed terminal operation. This is primarily associated with the removal of storage requirements for crude oil and intermediate products. In addition, the closure of the refinery process would result in a reduction of 142 t/year of VOCs when compared to the existing operation. These emissions were from both point sources (86 t) and fugitive sources (55 t) associated with the current refinery operations.

Figure 13-4 Change in Emissions Profile with Conversion of the Site



In addition, it is expected that with the retirement of refinery sources and associated plant, emissions of hydrogen sulphide (which possesses a potent rotten egg-like odour) would be significantly reduced. It is noted that these estimated reductions in emissions of VOCs and combustion pollutants would be a beneficial outcome of the Project.

Odour

As discussed in **Section 13.4.2,** odour has been a key issue of community concern near to the existing Site. It is expected that the closure of the refinery component of the Site would result in a significant reduction in the emission of odorous sulphur and VOC-based compounds. In addition, with the change in emissions profile, the sensitivity of nearby receptors to odour may also be modified. Whilst a significant reduction in odour emissions is expected, it is not anticipated that odour issues would be completely eliminated as part of the Project.

Given the established understanding of odour matters around the Site, a quantitative assessment of odour has not been undertaken within this AQIA. Noting this, Caltex propose to continue to manage odour through the odour reduction program that is currently implemented through the EPL for the Site (EPL no. 837). These measures are discussed in **Section 13.7.2**.

Emissions Estimation

This section provides an overview of the emission estimations from the operational phase of the Project. The emissions were estimated for each of the emission sources identified in **Section 13.4.3** and the operational emissions profile for the proposed operation of the Project.

Storage Tanks

Based on the estimated annual throughput of Products during the operational phase of the Project, Caltex is able to calculate predicted fugitive emissions from storage tanks at the Site on a tank by tank basis using a computer model called (TANKS). The predicted fugitive emissions of VOCs from the tanks is summarised in **Table 13-5**.

Table 13-5 Summary of Site Tank VOC Emission Estimates

Source	Emissions (kg/year)					
	Benzene	Toluene	Ethylbenzene	Xylenes	n-Hexane	Total VOCs
Tanks	2,968	6,426	603	2,928	6,450	452,608

Product Transfer Infrastructure

During operation of the Project, fugitive emissions have potential to occur from equipment that is used to move product around the Site. This includes fugitive losses from plant items such as pumps (seals), valves and pipes. The quantity of infrastructure on the Site means that the estimation of such losses is a complex exercise. In order to simplify this estimate, the “Yardlines” Total VOC emission estimate from the 2010/2011 NPI reporting year has been used. To provide a simple and conservative means of incorporating these emissions into the assessment, it has been assumed that they originate entirely from the OMC. This simplification is considered appropriate given that the OMC is the location of the piping manifolds and pumps, and is likely to constitute a significant proportion of the total Yardlines emissions.

Table 13-6 provides a summary of the Yardlines emissions estimates.

Table 13-6 Estimates of Yardlines Emission Estimates

Source	Emissions (kg/year)					
	Benzene	Toluene	Ethylbenzene	Xylenes	n-Hexane	Total VOCs
Yardlines	103	1,001	20	1,032	198	11,492

Land Farm

Land farm emissions have been estimated based on the source emission testing that was performed in 2005 using Isolation Flux Hoods (IFH's) by Coffey Geosciences P/L (Coffey, 2005). IFH sampling was conducted at three separate locations on the land farm. **Table 13-7** shows the estimates of land farm surface emissions.

Table 13-7 Summary of land farm surface emissions estimates

Source	Emissions (kg/year)					
	Benzene	Toluene	Ethylbenzene	Xylenes	n-Hexane	Total VOCs
Land Farm	3.5	1.6	5.3	41	113	4,369

Summary of Emissions

Table 13-8 presents a summary of emission estimates from the operation of the Project. Storage tanks were estimated to be the primary emission source, constituting approximately 97% of annual Total VOC emissions from the Site.

Table 13-8 Summary of emission estimates from terminal operations

Source	Emissions (kg/year)					
	Benzene	Toluene	Ethylbenzene	Xylenes	n-Hexane	Total VOCs
Tanks	2,968	6,426	603	2,928	6,450	452,608
Yardlines	103	1,001	20	1,032	198	11,492
Land Farm	3.5	1.6	5.3	41	113	4,369
Total	**3,074**	**7,429**	**628**	**4,002***	**6,760***	**468,469**

** It is noted that these totals are slightly different to actual totals from the numbers above. This slight discrepancy is due to rounding up or down when these figures were summarised.*

Dispersion Modelling Results

The results of the dispersion modelling were compared against OEH impact assessment criteria and the NEPM criteria identified in **Section 13.4.2**.

Short Term Model Predictions

Table 13-9 shows a summary of short-term model predictions as the 99.9th percentile 1 hour averages. These criteria are incremental, meaning that they apply to the incremental impact from emissions from the pollutant source alone. All concentrations at receptors R1 to R11 and at the Site boundary are compliant with the OEH impact assessment criterions. Concentrations for all substances other than benzene were less than 10% of OEH impact assessment criteria. Benzene was less than half of the OEH criterion at the Site boundary, with an estimated incremental impact of 13.5 µg/m^3 on the eastern boundary of the Site. As Benzene is predicted to present the largest potential impact, the predicted 99.9th percentile 1 hour average benzene concentration during the operational phase of the Project is shown in **Figure 13-5**.

Table 13-9 Predicted 99.9th percentile 1 hour average concentrations

Receptor	Model Prediction (µg/m³)				
	Benzene	Toluene	Ethylbenzene	Xylenes	n-Hexane
R1	2.2	6.2	0.6	4.1	4.5
R2	2.5	5.9	0.7	4.0	4.2
R3	2.6	6.7	0.7	4.0	4.6
R4	3.0	7.5	0.8	4.2	5.7
R5	4.9	12.5	1.6	8.3	8.2
R6	8.5	20.1	3.9	14.7	12.8
R7	9.6	20.6	4.9	12.0	13.0
R8	9.2	20.5	3.7	10.2	18.0
R9	7.7	18.5	2.1	8.3	15.2
R10	8.5	21.6	2.4	9.3	17.9
R11	8.8	23.3	2.2	11.6	20.2
Maximum (R1-R11)	**9.6**	**23.3**	**4.9**	**14.7**	**20.2**
Maximum (off-Site)*	**13.5**	**35**	**5**	**19**	**37**
Impact Assessment Criterion	**29**	**360**	**8,000**	**190**	**3,200**

Note:*Off-site concentrations estimated using kriging interpolation method.

Long Term Model Predictions

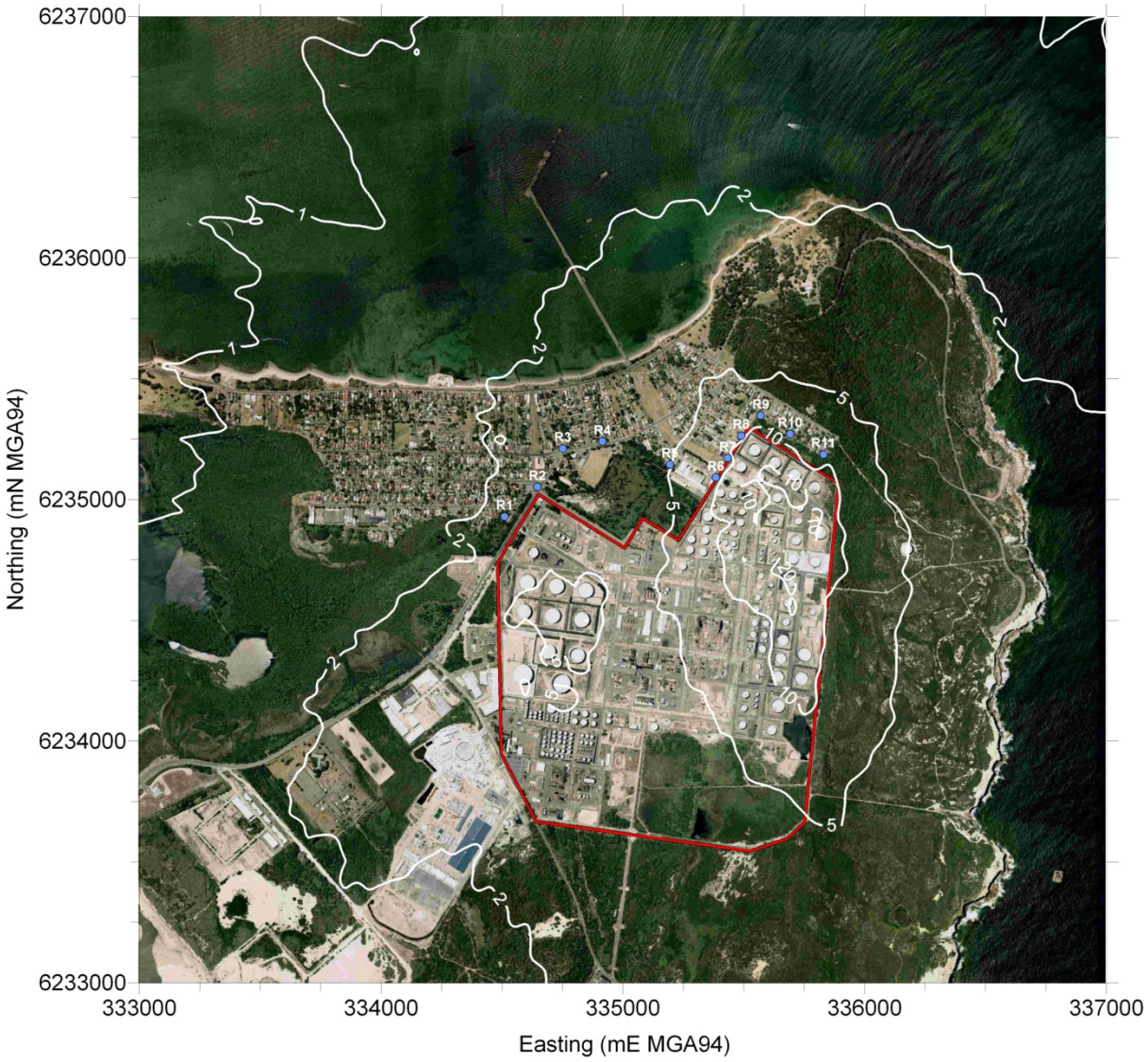
Table 13-10 presents a summary of long term model predictions as annual averages. These criteria have been applied to the cumulative impact from emissions from the pollutant and background levels.

From **Table 13-10**, it can be concluded that concentrations at receptors R1 to R11 and at the Site boundary are below the NEPM (Air Toxics) criteria. Emissions from the Site make a minor contribution to predicted cumulative (i.e. the Site and wider background) concentrations. A contour plot for an annual average prediction of benzene concentration is presented in **Figure 13-6**.

Table 13-10 Predicted annual average concentrations

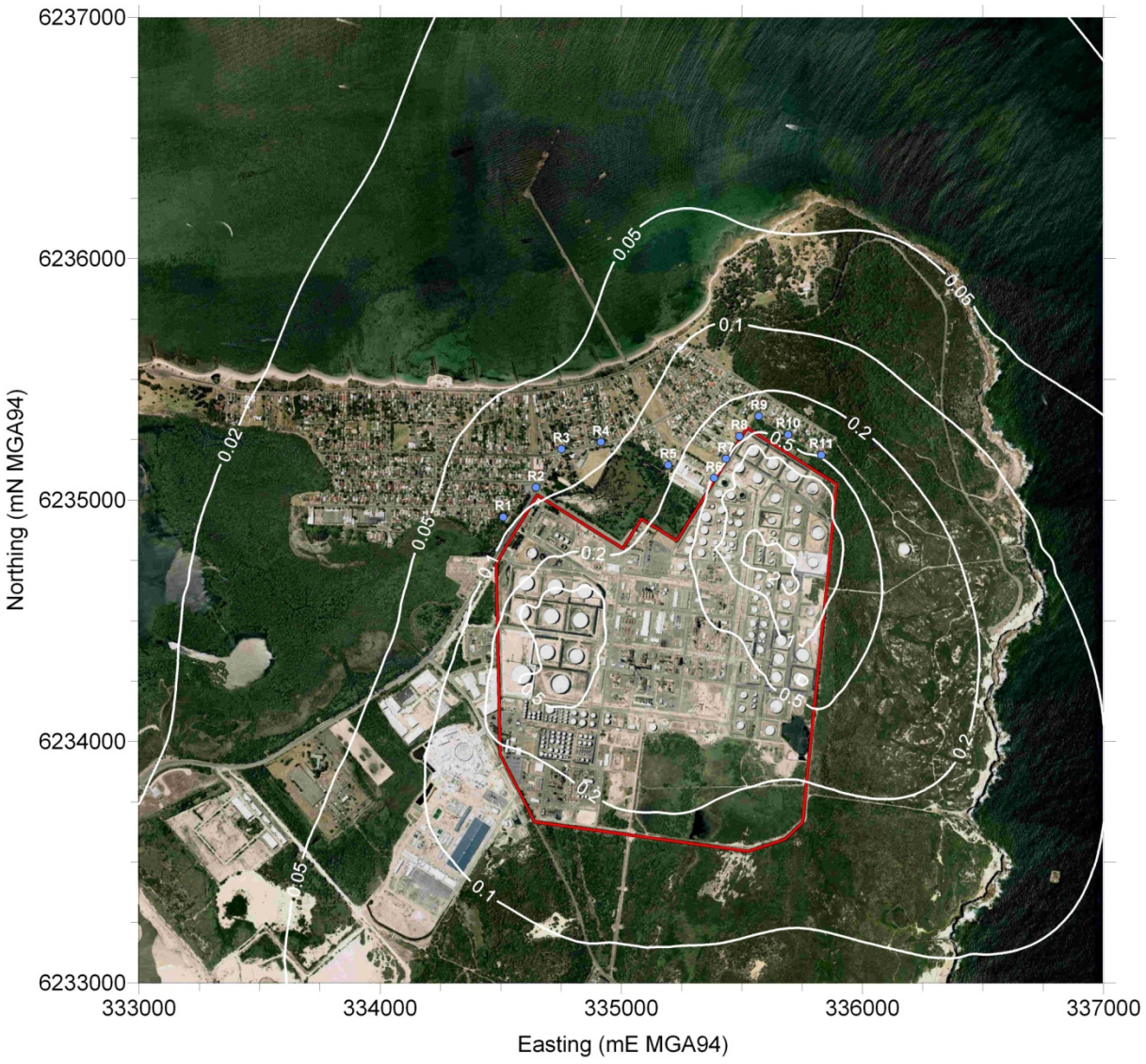
Receptor	Model Prediction (µg/m³)		
	Benzene	Toluene	Xylenes
R1	0.1	0.2	0.1
R2	0.1	0.2	0.1
R3	0.1	0.2	0.1
R4	0.1	0.2	0.1
R5	0.2	0.4	0.2
R6	0.5	1.0	0.6
R7	0.5	0.9	0.5
R8	0.4	0.8	0.4
R9	0.3	0.7	0.3
R10	0.4	1.0	0.4
R11	0.5	1.2	0.5
Maximum R1-R11	0.5	1.2	0.6
Background Concentration	**1.2**	**6.8**	**5.2**
Maximum R1-R11 (Including Background)	1.7	8.0	5.8
NEPM (Air Toxics) Criterion	**9.6**	**377**	**870**

Figure 13-5 **Predicted 99.9th percentile 1 hour average benzene concentration**



Concentration contours shown in ug/m3
(Aerial image sourced from Google Earth Pro)

Figure 13-6 Predicted annual average benzene concentration



Concentration contours shown in ug/m3

(Aerial image sourced from Google Earth Pro)

Impact Assessment Conclusion

The results of the dispersion modelling show that the key pollution sources for the Project do not exceed OEH and NEPM criteria. Based on the information reviewed and the assessment performed, the potential for the Project to result in adverse air quality impacts during operation is considered to be low.

Additionally, relative to existing operations, total VOC emissions are anticipated to halve in quantity during the operational phase of the Project. These reductions are due to a range of changes proposed as part of the Project. Total VOC emissions storage tanks were estimated at 705 t/year for the current operations (base year), as compared to 453 t/year under the Project Operation. This is primarily associated with the removal of storage requirements for crude oil and intermediate products. In addition, the closure of the refining operations would result in a reduction of 142 t/year of VOCs against the base year.

Equally emissions of NO_x, carbon monoxide, sulphur dioxide, particulate matter and hydrogen sulphide would all significantly reduce following the cessation of refining at the Site, resulting in a beneficial outcome to local air quality.

13.7 Mitigation

13.7.1 Construction Mitigation

As discussed previously, given the minor scale and progressive nature of the conversion activities, the potential for these operations to adversely impact air quality is considered small, and most appropriately managed through the implementation of an Air Quality Management Plan (AQMP) to be included under the CEMP. The AQMP will include the following:

- Daily activities would be reviewed in the context of potential air emissions and mitigation measures;
- Activities undertaken in line with the existing maintenance procedures on the Site (e.g. the shut down, depressurisation and de-inventory of the refinery infrastructure) would be managed and monitored to be complient with the relevant EPL in order to ensure no adverse air emissions.
- Workers would maintain a visual awareness of dust emissions, and a general awareness of potential odour emissions. During activities with the potential to create dust emissions, a designated worker would continuously monitor downwind emissions and call a halt to activities if the wind direction is towards the community or other sensitive on-site receiver locations (e.g. offices, car parks);
- Vehicle movements on unsealed areas would be minimised, and vehicles would travel on designated roadways where feasible;
- Where there is the potential for dust or odour generation, trucks carrying spoil loads would be covered.Tailgates on all trucks would be securely fixed prior to loading and immediately after unloading of materials. Loads would be less than the height of the side and tailboards of the trucks;
- Soil adhering to the undercarriage and wheels of trucks would be removed prior to departure from the works area where there is the potential for sediment to enter drains or for dust generation;
- Vehicles traveling at speed would avoid generating excessive amounts of dust. The maximum speed of vehicles in construction areas would be 10km/hr, and 25 km/hr elsewhere in the refinery;
- Construction activities would be minimised or ceased during undesirable weather conditions or forecasts (e.g. periods of high winds) near sensitive receptors or when offensive odours are noticed by receptors;
- Plant, equipment and vehicles shall be maintained and operated in accordance with the manufacturers specifications to minimise the emission of air pollutants and offensive odours and minimise the generation of dust;
- Plant or equipment would not to be left/parked with the motors running when not in use;
- Excavated soils would be assessed for odour as/if they are stockpiled, and would be controlled in order to manage potential odour or dust emissions;
- The effectiveness of any dust controls implemented would be visibly assessed and adjustments made accordingly;
- All concrete cutting and coring would to be undertaken using “wet tools”; and

- If excess dust is observed, due to extreme weather conditions or construction activities (e.g. high winds, surface dirt accumulation, etc.), work would cease or be phased down while the cause is being actively investigated and suppression measures are implemented.

13.7.2 Operational Mitigation

Caltex currently implements a range of management programs in order to address emissions from the Site under refinery operation. These programs would continue into the operational phase of the Project albeit in a modified form. Details of the programs proposed by Caltex are provided in the sections below.

Odour Reduction Program

An odour reduction program (ORP) is in the process of being introduced as part of the current EPL for the Site. The ORP involves a two stage process wherein stage one assesses odours associated with the operation, while stage two implements measures that would reduce odour from the Site. It is proposed that the ORP assessment program will be carried out as designed but that the implementation of any required mitigation measures would be adapted in order to target odour emission sources that are of potential significance for the Project.

Land Farm

As part of the Environment Protection Licence's Pollution Reduction Program (PRP), Caltex is committed to evaluate alternative options for the sustainable management of oily wastes/sludges that will facilitate Caltex to cease land farming at the premises.

Caltex is in the process of developing a management plan for the landfarm; incorporating options for the long term remediation, in line with, and as part of the Site's remediation plan. The land farm management plan will also include a review of terminal related oily wastes/sludges and their management in a sustainable manner.

Land farm management and waste management during the Project would be included in the CEMP for this project.

Tank Sleeve System

Caltex is in the process of implementing a trial program investigating the use of sleeves on the guidepoles on EFRTs. In view of the Project, Caltex has proposed not to carry out a trial program but to start the implementation of tank sleeves on all EFRTs that would be in gasoline service. These works would start during Project construction and would continue during the operational phase.

The guidepoles on EFRTs have been identified as one of the highest sources of VOC emissions from tanks. To reduce these emissions, a sleeve consisting of a transition box and a flexible enclosure that encapsulates the whole guidepole is attached to the floating roof. Preliminary assessments of the effectiveness of these sleeves have indicated that VOC emissions from EFRTs can be reduced by 50%. It is also noted that in order to maintain a conservative assessment of the impacts of the Project on air quality, modelling within this AQIA has assumed that the tank sleeves would be absent.

Leak Detection and Repair

Caltex have a well-established Leak Detection and Repair (LDAR) Program at the Site, a requirement of the current Site EPL. The LDAR Program is a monitoring program that involves technicians monitoring components such as valves and pumps in order to detect hydrocarbon leaks, which are a known source of odour. Caltex propose to continue the LDAR Program for the Project whilst the refinery is in operation.

Following the shutdown of refinery operations the LDAR program would be modified to a tanks and lines monitoring program due to the reduction in potentially emissive infrastructure at the Site.

13.8 Summary

A number of mitigation measures have been suggested to ensure that impacts during construction and operation of the Project are minimised as far as is practically possible. These are summarised in **Table 13-11**.

Table 13-11 Management and Mitigation measures - Air Quality and Odour

Management and Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Dust emissions from the construction phase of the Project would be monitored by construction staff. A designated worker would continuously monitor downwind emissions to the community or local residents and call a halt to activities if sensitive receptors are likely to be affected by airborne particulate matter. Should significant impacts be likely, appropriate measures would be taken to mitigate any adverse air quality effects.		✓	
Within the refinery, construction vehicles would only travel on designated roads and would be limited to a maximum speed of 10 km/hr in construction areas, and 25 km/hr elsewhere.		✓	
Where there is the potential for dust or odour generation, trucks carrying spoil loads would be covered and all tailgates would be securely fastened. Vehicles would not be loaded higher than the sides and tailboard.		✓	
Construction activities would be limited during high wind events if sensitive receptors are likely to be significantly impacted.		✓	
Construction plant would be maintained and operated in line with the manufacturer's specifications in order to minimise the emission of air pollutants and offensive odours. Plant and construction vehicles would be turned off when not in use.		✓	
Stockpiled material would be assessed for the potential for causing odorous or particulate emissions. If air pollutants and offensive odours are likely, controls would be put into place to manage any adverse affects.		✓	
All concrete cutting and coring would to be undertaken using "wet tools".		✓	
An odour reduction program would be implemented in accordance with the existing EPL.			✓
The guidepoles on the EFRTs in gasolise service would be fitted with sleeves.		✓	✓
Caltex's Leak Detection and Repair (LDAR) Program would continue during Project construction and operation.		✓	✓

14 Greenhouse Gas

14.1 Introduction

This chapter assesses the potential impact of greenhouse gas (GHG) emissions associated with the Project.

14.2 Scope of Assessment

The Director General's Requirements (DGRs) have requested that GHG be assessed, including:

- *a quantitative analysis of the Scope 1, 2 and 3 greenhouse gas emissions of the development;*
- *a qualitative analysis of the impacts of these emissions; and*
- *details of the measures that would be employed to improve energy efficiency.*

Given the DGRs, the scope of the GHG assessment includes the following:

- a quantitative estimate of GHG emissions associated with the Site's operation as a finished product terminal;
- a comparison of these emissions with the current operation of the Site as a refinery, to outline potential changes in the GHG emissions profile for the Site; and
- a list of mitigation measures that would be implemented during the construction and operation of the Site to reduce GHG and their effects.

14.3 Legislation and Planning Policy

14.3.1 International Policy

Policy relating to the assessment of greenhouse gases (GHGs) within Australia is based on international approaches and guidance as described in the Kyoto Protocol, and international agreement created under the United Nations Framework Convention on Climate Change (UNFCCC), that sets binding obligations on industrialised countries to reduce emissions of greenhouse gases. The Kyoto Protocol was ratified by Australia in December 2007.

14.3.2 Commonwealth Legislation and Policy

The Project would need to operate in accordance with the following Commonwealth policies and legislation:

- *Clean Energy Legislation Amendment Act (CELA) 2012; and*
- *National Greenhouse and Energy Reporting (NGER) Act 2007.*

The NGER Act establishes a national framework for Australian corporations to report Scope 1 and Scope 2 GHG emissions, reductions, removals and offset, and energy consumption and production from 1 July 2008. With more than 50 sites around Australia, Caltex's operations have been reporting under the NGER Act. As of the 5 March 2012, Caltex Australia Limited reported 1,869,326 t $CO_{2\text{-}e}$ total Scope 1 GHG

emissions, and 315,115 t CO_{2-e} total Scope 2 GHG emissions.[1] The CELA Act was passed in June 2012. The CELA Act makes amendments to the *Clean Energy Act 2011* and related legislation establishing the Government's carbon pricing mechanism. Companies operating large emitting facilities will be subject to the carbon pricing mechanisms operating in Australia (i.e. those companies whose facilities emit over 25,000 tonnes of CO_{2-e} emissions each year).

In addition to this legislation additional Commonwealth initiatives are in place to support reductions in carbon emissions and encourage market development of cleaner and more efficient energy production. The Clean Energy Future (CEF) initiative, promotes the adoption of polices and measures that will work towards a clean energy future for Australia, while Energy Efficiency Opportunities (EEO) initiative promotes opportunities to improve energy efficiency. Caltex Australia Limited has been an active member in the EEO Program, reporting GHG emissions from 2006 to 2011 from the Lytton and Kurnell Refineries. As a result of this program a number of measures to improve energy efficiency have been identified. This is discussed in **Section 14.5.2**.

14.3.3 NSW State Policy

NSW Greenhouse and Climate Change Action Plan

This Action Plan was released in November 2005 and provides a strategic approach to addressing climate change issues in NSW between 2005 and 2008, and beyond. The plan sets out actions to reduce GHG emission by the NSW Government. It also sets out measures through which the NSW Government would work with stakeholders in order to reduce GHG emissions from their activities.

Recently the NSW 2021 plan (discussed below) was released. It describes the NSW Government's agenda for addressing climate change issues in NSW.

NSW Greenhouse Gas Reduction Scheme (GGAS)

The NSW Greenhouse Gas Reduction Scheme (GGAS) is a mandatory greenhouse gas emissions trading scheme that aims to reduce GHG emissions associated with the production and use of electricity. It was put in place in 2002 through amendments to the *Electricity Supply Act 1995* and the *Electricity Supply Regulation 2001*, and commenced operation on 1 January 2003.

On 5 April 2012, the Minister for Resources and Energy announced the closure of GGAS, effective 1 July 2012, due to the commencement of the Commonwealth carbon pricing mechanism.

NSW 2021 – A Plan to Make NSW Number One

The NSW 2021 plan includes the NSW Government's key targets in relation to addressing GHGs and climate change issues. These include:

- completion of fine-scale climate change projections for NSW, making them available to local councils and the public by 2014; and
- work with government agencies and universities to deliver improved climate projections for NSW and the ACT.

[1] Information reported to the Greenhouse and Energy Data Officer, publically available at http://www.climatechange.gov.au/en/government/initiatives/national-greenhouse-energy-reporting/publication-of-data/nger-greenhouse-energy-information-2010-11.aspx

NSW 2021 also identifies goals and targets that support practical action to tackle climate change issues in NSW including:

- introducing a target for 20% renewable energy by 2020; and
- assistance for businesses and households to realise annual energy savings of 16,000 gigawatt-hours by 2020 compared with 'business as usual' trends.

14.4 Method of Assessment

14.4.1 Greenhouse Gases

GHGs in the earth's atmosphere absorb and radiate infrared radiation (heat) reflected from the earth's surface. The most abundant of these gases are carbon dioxide (CO_2) and water (H_2O). Other naturally occurring greenhouse gases such as methane (CH_4) and nitrous oxide (N_2O) are present in the atmosphere in much smaller quantities.

The less abundant GHGs (e.g. CH_4 and N_2O) are much more efficient in trapping infrared radiation than CO_2. Global Warming Potential (GWP) is a measure of how "efficient" a greenhouse gas is in trapping infrared radiation, and is defined as the ratio of infrared radiation trapped by one kilogram of non-CO_2 greenhouse gas compared to one kilogram of CO_2, over a defined time frame. For example, over a 100 year time-frame, methane traps approximately 21 times as much infrared radiation as CO_2, and nitrous oxide traps approximately 310 times as much infrared radiation as CO_2. When compiling greenhouse gas inventories, this difference in greenhouse potential is accounted for by converting the mass of each non-CO_2 greenhouse gas emitted into a CO_2 equivalent ($CO_{2\text{-}e}$) amount, using the GWP for each particular non-CO_2 gas.

14.4.2 Estimating GHG Contributions

Greenhouse gas emission estimates for the Project have been based on:

- The Australian National Greenhouse Accounts Factors (DCCEE,2012a); and
- Project specific activity data (e.g. electricity consumption, and liquid fuel combustion).

Quantitative GHG emission estimations have focused on Scope 1 and Scope 2 emissions (as outlined in **Section 14.2**). Emissions have been defined as Scope 1, Scope 2 or Scope 3 in accordance with the detail provided below.

Scope 1 Direct Greenhouse Gas Emissions:

Direct greenhouse gas emissions are defined as those emissions that occur from sources that are owned or controlled by the entity (in this case Caltex). Direct greenhouse gas emissions principally result from the following types of activities:

- generation of electricity, heat or steam, i.e. combustion of fuels in stationary sources;
- physical or chemical processing, e.g. manufacture of cement, aluminium, etc.;
- transportation of materials, products, waste and employees, e.g. combustion of fuels in mobile combustion sources, e.g. motor vehicles, trains, ships, aeroplanes; and
- fugitive emissions, i.e. intentional or unintentional releases from equipment.

Scope 2 Energy Product Use Indirect Greenhouse Gas Emissions

Scope 2 emissions are indirect emissions from the use of energy products (e.g. electricity, steam/heat) purchased or otherwise brought into the Site. Scope 2 emissions physically occur at the facility where the energy product is generated.

Scope 3 Other Indirect Greenhouse Gas Emissions

Scope 3 emissions are defined as those emissions that are a consequence of the Project activities but do not occur from sources owned or controlled by the project initiator. Some examples of Scope 3 activities provided are:

- extraction, processing and transport of materials or fuels; or
- use of sold products and services.

Scope 3 emissions associated with the use of sold products such as fuels are reportable as Scope 1 emissions from the facilities that consume the fuels.

14.4.3 GHG Assessment

The assessment of GHG emissions has been completed by quantitatively estimating emissions associated with the current use of the Site with the proposed operation of the facility as a finished product terminal. These two scenarios are as follows:

- **Existing Operation.** Incorporating activity data for the 2010-2011 reporting year. This includes electricity consumption data from the now decommissioned Caltex Lubricating Oil Refinery (CLOR); and
- **Proposed Operation.** Incorporating estimates of activity data for the future operations of the Site as a finished product terminal. and as well as following the decommissioning of the CLOR.

GHG emissions associated with these two scenarios are likely to occur from the combustion of fuels (Scope 1) and consumption of purchased electricity from the grid (Scope 2). Predictions of GHG emissions from these sources in the existing scenario have been estimated from emission factors and Caltex provided records of fuel and electricity consumption for the 2010 – 2011 financial year. Predictions of GHG emissions for the proposed scenario have been estimated based on emission factors and assumptions of anticipated fuel and electricity consumption.

Given that the facility would continue to provide approximately the same liquid fuel products to the NSW and ACT markets, the downstream (Scope 3) emissions associated with the combustion of these produces are expected to remain at similar levels between the two scenarios. Therefore these Scope 3 emissions have not been quantified.

14.5 Existing Environment

14.5.1 Australia and NSW

Existing accounts of greenhouse gases provided by the Department of Climate Change and Energy Efficiency (DCCEE 2012b) estimate that approximately 559.7 Mega tonnes (Mt) of $CO_{2\text{-}e}$ was emitted in Australia during the 2009-2010 financial year. A breakdown of the individual state and territory contributions is shown in **Table 14-1** below.

Table 14-1 Australian State and Territory GHG Emissions 2009-10 (DCCEE 2012b)

State or Territory	Total Emissions (Mt CO_{2-e})	% of Total
NSW	157.4	28.1 %
Queensland	157.3	28.1 %
Victoria	117.9	21.1 %
Western Australia	74.3	13.3 %
South Australia	29.3	5.2 %
Northern Territory	14.7	2.6 %
Tasmania	7.6	1.4 %
Australian Capital Territory	1.2	0.2 %
External Territories	< 0.1	< 0.1 %
Total	**559.7**	**100 %**

In New South Wales, the energy sector reported the highest contribution to the 2009-2010 inventory with 119.4 Mt CO_{2-e} emitted compared to the state total of 157.4 MT CO_{2-e}.

14.5.2 Kurnell Refinery

GHG emissions associated with the existing refining operations have been estimated to be 965,180 t CO_{2-e} (refer to **Section 14.6.2**), which represents approximately 0.6 % of the NSW inventory.

Ongoing commitments to energy reductions by Caltex through the EEO program have identified a number of opportunities at the Site for energy savings (refer to **Section 14.3.2**). Savings have been estimated as potentially being up to 1,120,845 GJ (7 % of the energy consumed as a Scope 1 source) per annum.

14.6 Impact Assessment

14.6.1 Construction Phase

The additional direct GHG emissions (Scope 1) generated during the construction phase of the Project would originate from the combustion of fuels in construction equipment. Diesel would be the primary fuel used in construction equipment such as delivery trucks and cranes. Emissions from electricity use (Scope 2) are expected to be negligible as construction equipment is predominately fuel based. Indirect emissions (Scope 3) would be present in the form of embedded emissions associated with the construction material, e.g. steel and concrete.

Given the proposed retention of infrastructure at the Site, GHG emissions during the construction phase are considered immaterial when compared to the GHG emissions associated with the current refining operations (a known energy intensive operation). Hence GHG emissions during construction have not been quantified.

14.6.2 Operational Phase

Table 14-2 provides a summary comparison of the estimation of GHG emissions for the two scenarios considered; refer to **Section 14.4.3** for a description of these scenarios. The table includes the activity data and emission factors utilised in the estimation of these emissions.

There would be a significant decrease in emissions from the existing operation scenario to the proposed operation scenario, from 965.2 kilo tonnes to 23.6 kilo tonnes of $CO_{2\text{-}e}$ respectively. This is mainly attributable to the cessation of refining activities on the Site, however a portion is attributable to the now decommissioned CLOR. This represents a positive impact from the Project.

The estimated GHG emissions associated with the proposed operation scenario represents approximately 0.02 % of the NSW inventory, and as a consequence has a minor impact on the overall GHG inventory of the State.

Table 14-2 GHG Emission Estimates for the Scenarios Considered

Source	Emission Factor[1]		Activity Data[2]			GHG Emissions (t CO_{2-e})	
	Value	Units	Existing Operation (2010 – 2011)	Proposed Operation (2016 +)	Units	Existing Operation (2010 – 2011)	Proposed Operation (2016 +)
Scope 1 – Direct Emissions							
Diesel	69.5	kg CO_{2-e} / GJ	18,828	2,285	GJ	1,309	159
Fuel Oil	73.13	kg CO_{2-e} / GJ	216,153	0	GJ	15,807	0
Natural Gas	51.33	kg CO_{2-e} / GJ	214,454	0	GJ	11,008	0
Fuel Gas & Flare Gas	51.33	kg CO_{2-e} / GJ	15,524,758	0	GJ	796,886	0
Scope 2 – Indirect Emissions							
Purchased Electricity	0.88	kg CO_{2-e} / kWh	159,285,026	26,692,735	kWh	140,171	23,490
					Total Scope 1 and 2 Emissions	**965,180**	**23,649**

Notes:
[1] Emission factors adopted from DCCEE (2012a)
[2] 2010-2011 and 2011-2012 activity data supplied by Caltex. Fuel quantities were converted from tonnes to GJ based on the following energy contents:

- Diesel: 45.7 GJ/tonne
- Fuel Oil: 43.8 GJ/tonne
- Natural Gas: 53.6 GJ/tonne

No fuel oil, natural gas or flare gas would be combusted during operation of the Project. Caltex estimate that approximately 50 tonnes/yr of diesel would be consumed by on-site vehicles during the operation of the Project.
Electrical tracing would be used to keep fuel oil at a constant temperature, i.e. no natural gas fired boilers are required.
Electricity use for the future scenario assumed to be 20 % of current usage (i.e. 2011- 2012 data), as per Rowe (2012).

14.7 Mitigation

Mitigation measures for potential GHG saving opportunities would be included within the Construction Environmental Management Plan (CEMP) for the construction phase. These would include procedures for the maintenance and inspection of all construction equipment to ensure equipment is of an appropriate size for the nature of the works, and is working in an efficient manner, so as to minimise GHG production from their use. In addition local supplier and/or facilities would be utilised where reasonable and feasible to minimise vehicle kilometres travelled, so as to minimise GHG from material transport.

GHG emissions during operation of the Project have been estimated to be approximately 2.5 % of emissions from the existing operation scenario. This is a significant reduction in GHG production and is considered minor (i.e. less than 0.05%) within the context of total NSW GHG emissions reported in 2009 – 2010 (refer to **Table 14-1**).

Identification of energy efficiency saving opportunities associated with the operation of the Project would be conducted during the detailed design phase.

14.8 Summary

The GHG assessment has concluded that GHG emissions would significantly reduce from the operation of the Site as a finished product terminal compared to the existing operating scenario. A large portion of the GHG reductions would be expected to be a direct result of the cessation of refining operations; however a portion of the GHG savings would be attributable to the now decommissioned CLOR.

Table 14-3 outlines the mitigation measures to be implemented throughout the Project.

Table 14-3 Management and Mitigation Measures– Greenhouse Gas

Mitigation Measure	Implementation		
	Design	Construction	Operation
Equipment would be inspected and maintained to ensure efficient running, minimising GHG production, and so it is appropriately sized for the task in hand.	✓	✓	
Local supplies and/or facilities would be utilised to minimise vehicle kilometres travelled (where reasonable and feasible).	✓	✓	
Energy efficiency opportunities would be identified and implemented (where reasonable and feasible) during construction and operation of the Project.	✓	✓	✓

15 Socio-Economic

15.1 Introduction

This chapter provides the socio-economic assessment that has been undertaken for the Project to address the requirements of the Director General's Requirements (DGRs).

15.2 Scope of the Assessment

The DGRs state that the assessment should follow appropriate methodologies as indicated by the "*Draft Economic Evaluation in Environmental Impact Assessment*" (PlanningNSW, 2003).

A desktop assessment has been undertaken of local and state level impacts of the Project, and actions to mitigate any negative impacts have been outlined.

15.3 Method of Assessment

15.3.1 Overview

The following tasks have been undertaken in order to understand the socio economic impacts related to the Project:

- baseline description – the study area is defined, with a profile of demographic characteristics of the local area and region, along with a description of the current economic activities with the existing refinery operation.
- project description – a summary of the Project's potential impact on the local/state economy are presented. Construction and operational phases of the Project are described in terms of capital investment and employment. A breakdown of the source of inputs is provided.
- impact assessment - using the information gathered on aggregate expenditures, and associated breakdowns between capital and labour and local expenditure, a regional impact assessment has been undertaken of the consequential changes. These changes are indicated in terms of aggregate investments and employment changes.
- impact mitigation description - measures to minimise potential adverse impacts of the Project are described including opportunities to maximise the beneficial impacts including retraining and redeployment opportunities that might be available during transition phases of the Project.

15.3.2 Study Area

The Site is located on the Kurnell Peninsula within the Sutherland Shire Local Government Area (SSLGA), approximately 15 km south of Sydney's CBD. Data held by Caltex indicates that approximately 70 per cent (%) of refinery staff reside in the SSLGA. Therefore to provide a benchmark and comparison of the primary impact area against other local areas, data has been presented for the Local Government Area of Sutherland Shire (LGA 17150) (referred to as the 'study area'), Greater Sydney, and for NSW as a whole.

15.3.3 Demographic Analysis

The statistical demographic analysis is largely based on results of the most recent census data from the Australian Bureau of Statistics (ABS, 2011).

15.3.4 Economic Evaluation

The "*Draft Economic Evaluation in Environmental Impact Assessment*" EIA guidelines, published by PlanningNSW in 2003 (referred to as 'the guidelines' for this chapter), were recommended by the NSW Department of Planning and Infrastructure (DP&I) as the basis for defining a methodology to undertake this socio-economic impact assessment. This assessment follows those guidelines by including the economic assessment as a distinct component of the EIS.

The guidelines suggest that the main aims of an economic analysis should be to:

- assess whether specific development proposals are desirable on economic efficiency grounds;
- provide a framework for the evaluation of feasible alternatives (options); and
- assist in the design of economically efficient environmental mitigation and protection measures.

Additional information that may be a necessary includes:

- regional or state-wide economic impacts; and
- financial aspects of the proposal including the pricing of outputs or services supplied by the development.

Table 15-1 outlines the assessment requirements and methods suggested by the guidelines for the associated analyses.

Table 15-1 Assessment Requirements for Consideration

	When undertaken	Reasons for undertaking	Possible methods
Economic Efficiency Analysis	Always	Economic efficiency	Benefit-Cost Analysis, Cost Effectiveness Analysis
Economic Impact Analysis	Sometimes	Economic and distributional impacts	Input-Output Analysis, Computable General Equilibrium Analysis
Financial Analysis	Sometimes	Financial viability	Discounted cash-flow or other
Fiscal Analysis	Sometimes	Fiscal impacts	Fiscal assessment, pricing and funding costs

Source: PlanningNSW, (2003)

As outlined in **Chapter 2 Project Need and Alternatives**, this Project is being undertaken following Caltex's review of their refining operations in May 2011.

This Project is being proposed on the basis of economic efficiency and continuing to supply a reliable source of finished product to NSW. This has been based on Caltex's internal assessment of economic efficiency. This is not provided within this EIS as the information is commercial-in-confidence.

This EIS assesses the economic impacts of the Project using Input-Output Analysis, as recommended under the draft guidelines published by PlanningNSW (2003). This has been supplemented with some socio-demographic profiling of the workforce and the area in which most of the workers reside.

Financial analysis has also been undertaken but this has not been provided as the information is commercial-in-confidence.

Fiscal analysis is not warranted for this assessment as Caltex is not seeking public funding to facilitate the Project.

15.3.5 Input-Output Analysis

The Input-Output tables for the Australian economy produced by the ABS (ABS, undated) provide the means to estimate the impact of the Project on the local economy. These tables are constructed by categorising the Australian economy into 109 industry sectors. They provide a detailed dissection of intermediate transactions within these sectors and the ability to describe the supply and use of the products of the total economy.

The Input-Output tables also enable the derivation of multipliers. Multipliers are summary measures used for predicting the total impact on all industries in an economy, and of changes in the demand for the output of any one industry, such as the changes in demand that would result from investment into the Project by Caltex. Several types of multipliers can be derived to capture different levels of associated activity within an economy as a result of a change in demand in one sector.[1]

An 18 sector Input-Output table of the Australian economy was derived from the 109 Sector Table published by the ABS. Multipliers for each of these sectors were then derived based on the methodology employed by the ABS.

Given the nature of the proposed investment by Caltex, the Construction and Manufacturing sectors were selected as being most representative of the construction and operational stages of the Project. For the Construction and Manufacturing sectors, the derived Type 1a multipliers are 1.65 and 1.55 respectively. The use of Type 1a multiplier limits the potential to overestimate the overall economic impact on the Australian economy of an increase in demand for the output of a particular sector.

15.4 Existing Environment

15.4.1 The Site

History and Recent Viability

The Site was commissioned in 1956 and is currently used for the receipt of crude oil and some refined products as well as the refining of crude oil delivered to the refinery via ships from Botany Bay.

Caltex initiated a review of their refining operations in May 2011, as refineries throughout Australia were competitively disadvantaged and were consequently losing money.

The Kurnell and Lytton refineries in their current configuration are relatively small and are disadvantaged compared to the modern, larger scale and more efficient refineries in the Asian region. This disadvantage has been exacerbated by the on-going strength of the Australian dollar, lower Caltex refining margins and increasing costs on the 'as is' refining business. "*The two refineries lost more than A$200 million ($208 million) in 2011, most of which was attributable to Kurnell. In the first half of 2012, refining recorded an operating loss of A$53 million, with Kurnell's poor result offset by a small profit at Lytton, Caltex said in late August*" (Platts.com, 2012).

As a result of the refining review, Caltex is proposing to close the Kurnell Refinery and convert the Site to a finished product terminal (the 'Project'). The Project is required to support the safe, reliable supply of fuel to Caltex's marketing operations, and more broadly to ensure supply reliability of petroleum fuels to the NSW and ACT economy.

[1] ABS (undated), Catalogue No 5246.0, Information Paper; Australian National Accounts; Introduction to Input-Output Multipliers.

In arriving at this proposal, several alternatives were considered, including the performance of the Kurnell and Lytton refineries and various levels of investment in refining plant. The decision to close the refinery and convert the Site to a terminal was made following consideration of a wide range of criteria, including financial metrics, the level of risks involved in the alternatives, the impact on the marketing operations, the company's competitive position, Caltex's funding capacity and the feasibility to execute (including Caltex's internal capabilities and resourcing constraints). The Project was considered to be the only viable alternative.

National context of production volumes from Kurnell Refinery

The Kurnell Refinery has a production capacity of 135,000 barrels per day (b/d). Caltex (Kurnell) supplies around 40% of all transport fuels in NSW and posted sales of 15.7 billion litres in 2011. The company currently sources around 55% of its sales volume from its own refineries, but that would fall to 25% once (if approved) the refinery shuts down in 2014. Caltex estimated recently that imports would grow from 23% of the market in 2010 to 54% in 2015 and 60% in 2020 (Platts.com, 2012).

The closure of the refinery leaves Australia with five operating oil refineries, each with capacity of around 100,000 b/d. In addition to Lytton (Qld), the remaining refineries are owned by BP (Kwinana and Bulwer Island), ExxonMobil (Altona) and Shell (Geelong). The Australian petroleum products market totalled 53 billion litres in 2011, according to figures from the Bureau of Resources and Energy Economics. The (Australian) market is around 1 million b/d, making it small in comparison to Asia Pacific's total demand of 28 million b/d (Platts.com, 2012).

Residence location of Kurnell Refinery workers

The majority of staff live near the Site (with about 70% living within the study area (Sutherland Shire) and are employed on a full time basis.

Current Operational Workforce

As of October 2012 there were approximately 410 Caltex employees working at the Kurnell Refinery. There were also approximately 475 contractors employed by over 30 different contract companies (Caltex does not hold demographic or salary information for contractors). Maintenance shutdowns occur two to three times each year for up to 8 - 12 weeks at a time. During these periods there may be up to an additional 500 contractors working at the refinery – which equates to about 205 Full Time Equivalents (FTE).

15.4.2 Socio-Demographic Analysis

Selected demographic and income data

Table 15-2 shows that the median age of people in the study area is some three years older than for Greater Sydney, and one year older than for NSW as a whole. **Table 15-2** also shows that personal income and family income in study area is higher than for Greater Sydney and NSW. However, median mortgages and rents within the Sutherland Shire are also higher.

Table 15-2 Selected Demographics for the Study Area, Greater Sydney and NSW

Selected Medians and Averages	Sutherland Shire (study area)	Greater Sydney	NSW
Median age of persons	39	36	38
Median total personal income ($/weekly)	718	619	561
Median total family income ($/weekly)	2,014	1,683	1,477
Median total household income ($/weekly)	1,674	1,447	1,237
Median mortgage repayment ($/monthly)	2,400	2,167	1,993
Median rent ($/weekly)	370	351	300
Average number of persons per bedroom	1.1	1.2	1.1
Average household size	2.7	2.7	2.6

Source: ABS 2011 Census of Population and Housing

Household weekly income for family households

Table 15-3 shows the weekly income for family households across a number of income categories. The proportion of families in the higher income brackets is higher in the study area than for Greater Sydney or for NSW.

Table 15-3 Household Weekly Income for Family Households

Total Household Weekly Income for Family Households	Sutherland Shire (study area)	Greater Sydney	NSW
$1-$199	0.8%	1.2%	1.3%
$200-$299	0.4%	0.8%	0.8%
$300-$399	0.8%	1.4%	1.6%
$400-$599	5.3%	7.3%	9.3%
$600-$799	5.9%	7.4%	8.9%
$800-$999	6.8%	7.4%	8.6%
$1,000-$1,249	6.5%	8.0%	8.7%
$1,250-$1,499	7.0%	7.9%	8.4%
$1,500-$1,999	13.8%	13.9%	14.0%
$2,000-$2,499	14.0%	12.4%	11.7%
$2,500-$2,999	13.6%	11.4%	9.8%
$3,000-$3,499	11.1%	8.5%	7.2%
$3,500-$3,999	5.3%	4.4%	3.5%
$4,000 or more	8.8%	8.2%	6.1%

Source: ABS 2011 Census of Population and Housing

Education and training profile

Table 15-4 and **Table 15-5** provide a summary of education and training qualifications in the study area. **Table 15-4** presents the highest year of school completed and **Table 15-5** presents the levels of non-school qualification achieved. The proportion of people in the study area who have completed year 12 is lower than the mean for Greater Sydney but higher than for NSW. The proportion with year 10 as the highest level achieved is higher in the study area than Greater Sydney and NSW as a whole. People with postgraduate degree qualifications are proportionally less in the study area than either Greater Sydney or NSW, as are those with bachelor degrees. However, the proportion with advanced diplomas, diplomas, or certificate qualifications is higher than in those other areas.

Table 15-4 Highest Year of School Completed

Highest year of school completed	Sutherland Shire (study area)	Greater Sydney	NSW
Year 12 or equivalent	56.7%	60.1%	52.0%
Year 11 or equivalent	5.1%	5.7%	6.5%
Year 10 or equivalent	28.8%	21.5%	26.4%
Year 9 or equivalent	5.8%	6.0%	7.9%
Year 8 or below	3.2%	5.2%	6.1%
Did not go to school	0.4%	1.4%	1.1%

Source: ABS 2011 Census of Population and Housing

Table 15-5 Non-School Qualification

Non School Qualification	Sutherland Shire (study area)	Greater Sydney	NSW
Postgraduate Degree Level	6.7%	11.7%	9.5%
Graduate Diploma and Graduate Certificate	3.2%	3.3%	3.2%
Bachelor Degree Level:	27.4%	34.1%	30.2%
Advanced Diploma and Diploma Level:	19.4%	16.6%	16.1%
Certificate Level:	36.9%	27.7%	34.1%

Source: ABS 2011 Census of Population and Housing

Labour force and employment indicators

The type of employment provided by the Kurnell Refinery is split between managerial, professional and technical occupations with some additional staff employed in the service sector.

The number of people employed in the study area was approximately 104,000 in 2011 (refer to **Table 15-6**). The mix of employment undertaken/available by people living in the study area compared against those living in the Greater Sydney area and across NSW and provided in **Table 15-7**. The proportional mix of occupations for people living in the study area is shown to differ from the Greater Sydney area and NSW means. There are less managers, professionals, and clerical and administrative workers, but more technicians and trade workers, and sales workers.

Table 15-6 Employment Numbers

Employed	Sutherland Shire (study area)	Greater Sydney	NSW
Full-time	70,369	1,358,191	2,007,925
Part-time	33,836	584,777	939,464
Total employed	104,205	1,942,968	2,947,389

Table 15-7 Occupation

Occupation	Sutherland Shire (study area)	Greater Sydney	NSW
Managers	11.7%	14.0%	13.5%
Professionals	20.7%	27.0%	23.0%
Technicians and trades workers	14.1%	10.9%	13.2%
Community and personal service workers	11.6%	8.8%	9.6%
Clerical and administrative workers	15.7%	17.1%	15.2%
Sales workers	13.6%	9.2%	9.4%
Machinery operators and drivers	4.1%	5.4%	6.3%
Labourers	7.7%	6.4%	8.6%

Source: ABS 2011 Census of Population and Housing

Table 15-8 shows the age of the labour force on the Site, in the study area, in Greater Sydney and in NSW. The Site has a proportionally older workforce than the study area and employs proportionally less people in the younger age groups from 15 – 29 years.

Table 15-8 Age of Labour Force

Age of Labour Force	Site (number of employees)	Sutherland Shire (study area)	Greater Sydney	NSW
15-19 years	0.2% (1)	8.6%	4.2%	5.1%
20-24 years	2.5% (11)	10.4%	9.2%	9.3%
25-29 years	5.3% (23)	8.9%	12.0%	10.9%
30-34 years	10.4% (45)	8.7%	12.2%	11.0%
35-39 years	10.8% (47)	10.3%	12.2%	11.6%
40-44 years	13.1% (57)	10.7%	11.7%	11.6%
45-49 years	12.9% (56)	11.1%	11.4%	11.7%
50-54 years	16.4% (74)	11.5%	10.4%	11.0%
55-59 years	15.2% (66)	9.2%	8.1%	8.7%
60-64 years	11.3% (49)	6.4%	5.4%	5.8%
65-69 years	1.8% (8)	2.8%	2.1%	2.2%
70-74 years	0% (0)	0.9%	0.7%	0.7%
75 years and over	0% (0)	0.5%	0.3%	0.4%

Source: ABS 2011 Census of Population and Housing

Table 15-9 presents labour force data from the 2011 Census. As at the time of the Census, the unemployment rate in the study area (3.5%) was lower than for Greater Sydney (5.7%) and NSW as a whole (5.9%). The work force participation rate in the study area was also higher with 29% not in the labour force (as a per cent of people 15 years and over), whereas the rate was 32.4% for Greater Sydney and 34.6% for NSW.

Table 15-9 Labour Force Status

Labour force status	Sutherland Shire (study area)	Greater Sydney	NSW
Employed, working:			
Full-time	61.4%	62.1%	60.2%
Part-time	29.5%	26.7%	28.2%
Employed, away from work	3.7%	3.4%	3.6%
Hours worked not stated	1.7%	2.1%	2.1%
Total	96.5%	94.3%	94.1%
Unemployed, looking for:			
Full-time work	2.0%	3.3%	3.5%
Part-time work	1.6%	2.4%	2.4%
Total	3.5%	5.7%	5.9%
Total labour force	100.0%	100.0%	100.0%
Not in the labour force (% of people 15 yrs and over)	29.0%	32.4%	34.6%

Source: ABS 2011 Census of Population and Housing

Table 15-10 presents the proportion of unemployed looking for full or part-time work. The figures were lower in the study area across all age groups when compared to Greater Sydney and NSW totals. The highest rate for the study area was in the 15-19 years age group.

Table 15-10 Unemployed Looking for Full or Part-Time Work by Age Group

Unemployed looking for full or part-time work by age group	Sutherland Shire (study area)	Greater Sydney	NSW
15-19	0.7%	0.9%	1.0%
20-24	0.6%	1.0%	1.0%
25-34	0.5%	1.2%	1.2%
35-44	0.6%	1.0%	1.1%
45-54	0.6%	0.9%	0.9%
55-64	0.4%	0.6%	0.6%
65-74	0.1%	0.1%	0.1%
75-84	0.0%	0.0%	0.0%
85 years plus	0.0%	0.0%	0.0%
Total	3.5%	5.7%	5.9%

Source: ABS 2011 Census of Population and Housing

15.5 Impact Assessment

15.5.1 Introduction

This section provides an assessment of the potential economic impacts from the Project on the study area. These include impacts on employment and the local economy during the construction and operational phases of the Project. No changes to landownership or land use are expected as a result of this Project.

The multipliers used for the impact assessment were Type 1a multipliers for the Manufacturing and Construction sectors - a Manufacturing Sector multiplier of 1.55, and a Construction Sector multiplier of 1.65.Construction

Workforce

The construction phase of the Project would involve expenditure over five to seven years and would generate associated employment. It is expected that the proposed works would be carried out over a 54 month period. The number of staff employed on Site would fluctuate during the construction phase. A timeline of workforce numbers for the existing Site, and those projected during the construction and operation of the Project are presented in **Table 15-11**, along with estimates of the annual value of salaries paid to workers (Caltex employees, contractors, and construction workers).

Table 15-11 Kurnell Employees (Historical and Projected Numbers)

	2012[2]	2013	2014[3]	2015	2016	2017
Caltex Employees	410	400	450[4]	40	45	45
Contractors	475	475	475	40	55	55
Project Construction	-	140	140	100	90	-
Total	**885**	**1,015**	**1,065**	**180[5]**	**190**	**100**
Maintenance Shutdown Periods[1]	500 (200 FTE)	0	0	0	90 (36 FTE)	90 (36 FTE)
Total FTE (inc. Maintenance Activities)	**1,085**	**1,015**	**1,065**	**180**	**226**	**136**
Indicative value of salaries ($m)	125	129	138	18	23	14

[1] Maintenance shutdown periods are periodic and for short time frames (8-12 weeks) two or three times a year. A FTE is assumed to be 40% of the number employed part time over shut down periods.
[2] Current employee numbers at the Site.
[3] 2014 would be the peak construction period. Additional personnel brought to the Site for the Project construction would be a maximum of 140 personnel.
[4] Additional Caltex Employees in 2014 would be staff hired for terminal operations.
[5] The large reduction in numbers between 2014 and 2015 follows the cessation of refining at the Site. The increase in workforce numbers between 2015 and 2016 represents a gradual stabilisation of the terminal operational workforce.

The Project would employ approximately 140 construction staff during the first peak construction phase, in the first 24 months. This number would decrease to approximately 90 construction staff during the final twelve months of the construction phase of the Project. During approximately the first 24 months of construction, the Site would still be operating in its current mode as both a refinery and a terminal. Cessation of refinery operations would occur in the second half of 2014 and this would be followed by the further conversion of some tanks within the Project Area to hold finished products. Additional conversion

works would continue until December 2016 when the proposed conversion activities would be completed. Eventually the Site would operate wholly as a terminal (URS, 2012a). At present there are no plans to cease terminal operations at the Site (refer to **Chapter 4 Project Description**).

Capital expenditure

Caltex expects to incur costs of about $430 million associated with the cessation of refining operations at the Site. This total includes land based and port and berthing works, as well as redundancies, retraining and supporting works. Of this amount, Caltex plans to invest $350 million in the conversion and expansion of current import facilities at Kurnell (of which $230 million is land based works, and $120 million is for port and berthing works), with the remaining $80 million dollars being spent on redundancies, retraining and supporting works.

The estimated capital investment in the Project (land based works) is approximately $230 million broken down between local, Australian and overseas markets as follows:

- Local (NSW) - $166 million;
- Australian (non NSW) - $2 million; and
- Overseas - $62 million.

It is assumed that this expenditure would occur between 2013 and 2016.

The Project would generate a positive economic impact within the local community through the creation of local employment opportunities during the construction phase. Given the characteristics of the labour force in the study area, it is anticipated that the workforce required could be primarily sourced from the study area and Greater Sydney. The direct spending within the local economy would have a positive impact on local services and businesses during construction.

Impact of Construction Expenditure on the NSW Economy

Using the expenditure information provided by Caltex, especially the share of labour and capital that are to be sourced locally, together with the derived Type 1a multipliers for the Manufacturing and Construction sectors, the total impact of the proposed expenditure on the local regional economy can be calculated. Given the employment of some 140 construction staff at an annual cost of $100,000, the estimated expenditure of $14.0 million on labour sourced from NSW would result in a total value to the NSW economy of $23.1 million in 2013 (using the Construction Sector multiplier of 1.65). The aggregate direct value of construction wages over the project is $47.0 million which would have a multiplied total value of $77.6 million over the four years of construction.

With respect to the proposed capital expenditure of $230 million, it is necessary to make adjustments for the share of materials/capital that would be sourced from outside the state. Supplied data suggests some $166 million would be spent in NSW. Using the multiplier for the Construction Sector of 1.65, the total impact of this expenditure is calculated at $273.9 million. When combined with the total impact of labour expenditure of $77.55 million over the four year construction period, the total impact of the Project on NSW during the construction phase is calculated at $351.5 million.

15.5.2 Operational

Workforce

With the removal of the refining operation at the Site, the number of employees would decrease. The final operational workforce is currently being determined. However, it is anticipated approximately 100 employees, would provide routine operational or supporting services to the terminal. These employees would operate in a shift arrangement 24 hours a day, 7 days a week. Up to an additional 90 people would be required at the Site during maintenance shutdown periods during the operation of the terminal, which are periodic and for short time frames (8-12 weeks). These 90 part time employment phases are assumed to equate to 36 FTE positions. The total FTE for the new operation is estimated at 136 with an annual salary of $13.6 million.

Existing employment at the Site is currently concentrated mostly around activities associated with the refining and processing units. These activities would be discontinued following cessation of refining operations. There would also be a reduction in contract labour as most of this effort is expended in the processing areas.

Impact of Operation change on the NSW Economy

The current value of salaries for Caltex employees, and contractors, at the Site is approximately $125 million (see **Table 15-11**). By 2017, it is expected that the terminal at Kurnell would require staffing of approximately 136 FTE employees at a cost of $14 million. These numbers indicate a reduction of more than 949 full time equivalent (FTE) salaries valued at near to $111 million annually. Using the Manufacturing Sector multiplier of 1.55, the economic impact of this reduction is estimated to be approximately $172.0 million annually on the NSW economy. The ongoing value of operational employment expenditure of the proposed terminal to the NSW economy is estimated to be approximately $21.7 million per annum.

Impact of Operation change on the Study Area

Impacts of the Project would be most significant in the study area where some 70% of employees reside. Following the shutdown of the refinery it is estimated that there would be a reduction of 949 FTE positions with a direct salary loss of some $111 million annually. This reduction suggests a loss of some 664 positions and direct loss of $77.7 million in wages annually from the workforce in the study area. Out of the total number employed in the area of 104,000 this is a decline of 0.6% in an area with lower than state average unemployment and a higher participation rate. The multiplied impact (using the Manufacturing Sector multiplier of 1.55) on the study area economy is an annual loss of $120.4 million.

Non-salary operational costs

It is expected there would be a 96% reduction in variable costs (utilities and consumables) related to the conversion to terminal operation. The value of this expenditure is commercially sensitive.

15.5.3 Heritage and social values

Potential impacts on heritage values are addressed in **Chapter 18 Heritage** and **Appendix H Heritage Impact Assessment**.

Given the above assessments the Project is not expected to cause notable impacts on heritage or social amenity values.

15.5.4 Other Social values

It is expected that there would be an improvement in local amenity values with the cessation of refining operations as there would be a reduction in noise from the Site, a reduction in surface water impacts, improved air emissions and reduced traffic impacts (refer to **Chapter 11 Surface Water, Wastewater and Flooding**, **Chapters 12 Noise and Vibration, Chapter 13 Air Quality and Odour** and **Chapter 16 Traffic and Transport and Chapter**.

Caltex also consults regularly with the community, updating them on the refinery and responding to any concerns they may have. Caltex would continue this during the construction and operation of the Project (refer to **Chapter 6 Consultation**).

15.6 Mitigation

Caltex would expend approximately $430 million to cover the cost of the Project. This cost would include employee programs (Platts.com, 2012). Caltex has indicated that $80 million dollars is budgeted to be spent on redundancies, retraining and supporting works.

For the period leading up to the shutdown of refining operations, Caltex has developed an employee program named “Stay, Focus & Develop”. The intent of the program is to enable the achievement of safe and reliable operations at the Site, while demonstrating a high level of care for employees as they prepare for the next phase of their lives and careers following the shutdown on the refinery. This program incorporates transitional support through generous redundancy benefits, outplacement support services, careers fairs featuring prospective employers, vocational training allowances, health and wellbeing programs and services, and industry retraining.

15.7 Summary

This Project is being proposed on the basis of economic efficiency and continuing to supply a reliable source of finished product to NSW. This has been based on Caltex’s internal assessment of economic efficiency. This is not provided within this EIS as the information is commercial-in-confidence.

The current value of salaries for Caltex employees, and contractors, at the Site is approximately $125 million. By 2017, it is expected that the terminal at Kurnell would require staffing of approximately 136 FTE employees at a cost of $14 million. These numbers indicate a reduction of more than 949 full time equivalent (FTE) salaries valued at near to $111 million annually. The economic impact of this reduction is estimated to be approximately $172 million annually on the NSW economy.

The ongoing value of operational employment expenditure of the proposed terminal to the NSW economy is estimated to be approximately $21.7 million per annum.

Impacts of the Project would be most significant in the study area where some 70% of employees reside. Following the shutdown of the refinery it is indicated that there would be a reduction of 949 FTE positions with a direct salary loss of some $111 million annually. This suggests a loss of some 664 positions and direct loss of $77.7 million in wages annually from the workforce in study area. Out of the total number employed in the study area of 104,000, this is a decline of 0.6% in an area with lower than state average unemployment and a higher participation rate. The multiplied impact on the study area economy is an annual loss of $120.4 million.

The impact of capital expenditure during the construction phase is $273.9 million. When combined with the impact of labour expenditure during construction of $77.55 million, the total impact of the Project on NSW during the construction phase is calculated at $351.5 million.

No assessment has been undertaken as to how the benefits of economic efficiency improvement to Caltex may flow to the local, NSW and Australian economies.

To help the staff that would no longer be required at the Site move on in their lives and careers, Caltex has implemented an employee program named “Stay, Focus & Develop”. This program would provide transitional support for any affected staff. Caltex has indicated that $80 million dollars is budgeted to be spent on redundancies, retraining and supporting works.

16 Transport and Access

16.1 Introduction

This chapter provides an assessment of the potential traffic and access impacts of the Project during construction and operation.

16.2 Scope of the Assessment

With regards to traffic and access, the DGRs require that the EIS include:

- *accurate predictions of the traffic generated by the development;*
- *a detailed assessment of the potential impacts of the development on the capacity, efficiency and safety of the road network including the cumulative traffic generated by all existing and the proposed development;*
- *details of any upgrades to road infrastructure that would be required due to the development; and*
- *site accesses, internal roads and vehicular parking required as a result of the development.*

In order to understand the effect the Project could have on the road network around the Site (i.e. the 'study area'), the existing transport environment was investigated and analysed. Following this, a transport impact assessment was completed to assess the likely impacts associated with the construction and operation of the Project.

16.3 Method of Assessment

This transport and access assessment involved a detailed desktop analysis using aerial photography. Traffic count data for relevant road locations was obtained from the New South Wales Roads and Maritime Services (RMS) and Sutherland Shire Council databases. This information was used to determine background traffic volumes for the study area. ABS Census Data was used to determine projected population increases, and the Guide to Traffic Engineering Practice – Roadway Capacity (AustRoads, 1988), to determine existing and proposed Level of Service (LOS) and to assess the traffic impact of the Project.

LOS is a performance measure used to describe the performance of an intersection or midblock location. LOS ranges are defined as falling between A, which indicates good intersection performance, to F, which indicates saturated conditions with long queues and delays.

Traffic generation during the construction and operational phases of the Project was estimated from construction vehicle volumes and operational activities provided by Caltex. These traffic volumes were applied to forecasts of the background traffic volumes to determine the proportional increase arising as a result of the Project.

As required by RMS the assessment has been completed in line with the guidance *Guide to Traffic Generating Developments* (RTA, 2002).

The following steps were undertaken as part of the transport and access assessment:

1. Data collection and collation to facilitate reporting of existing conditions. This included a desktop review of information obtained from RMS and Sutherland Shire Council, as well as the use of online resources. The information reviewed included traffic volumes, crash data, school bus routes, stock routes, rail crossings, and road construction standards.
2. The road network environmental values were identified and their sensitivity to changed traffic conditions were analysed.
3. The peak traffic generating years for the construction and operational phases were identified.
4. The background traffic for the peak construction year and operating years were forecast based upon growth rates calculated from the most recent census (2011).
5. The number and type of vehicles likely to be generated during the various phases of the Project were identified based on information provided by Caltex.
6. The magnitude of the Project's potential impacts on the various environmental values was identified.
7. The significance of the Project's impact on the road network environmental values was determined.
8. Mitigation and management measures were identified. These would be incorporated into any future Transport Management Plan (TMP) developed by Caltex as the Project progresses.

16.4 Existing Environment

16.4.1 Existing Highway Network

The Project is located on the southern shore of Botany Bay and is accessed by a main arterial road and local streets. The main arterial road that is located adjacent to the Project is Captain Cook Drive. A location plan showing the surrounding road network can be found in **Figure 16-1**.

Captain Cook Drive is the major access road to the Kurnell Peninsula on the southern shore of Botany Bay from the wider Sydney road network. It connects Taren Point Road to the west (and further to the Princes Highway via The Boulevard) with Prince Charles Parade to the east and the suburb of Kurnell. It has three lanes in each direction west of Gannons Road with a median strip separating each carriageway, reducing to two lanes in each direction and divided carriageways between Gannons Road and Woolooware Road. It further decreases to an undivided carriageway with one lane in each direction east of Woolooware Road to Kurnell.

Therefore the main highways, arterial and sub-arterial roads providing access from the Kurnell Peninsula to the wider region consist of the following:

Freeway/Highway:

- Princes Highway - A major north/south road link.

Arterial:

- Taren Point Road - Running parallel to Princes Highway and crossing the Georges River, connecting the Rockdale and Sutherland local government areas.;
- Kingsway - Connects the Princes Highway to Cronulla.
- Captain Cook Drive. Connects Kurnell to the rest of the Sutherland Shire. The section of Captain Cook Drive between Woolooware Road and Elouera Road is currently being upgraded from two lanes to four lanes of traffic and is scheduled for completion in 2015.[1]

Sub-Arterial:

- Gannons Road. A major road providing access to Woolooware.

The main entrance to the Site is via Solander Street, which is a two lane undivided road exiting from Captain Cook Drive. Vehicle access to the Site is also available from Sir Josephs Banks Drive.

16.4.2 Existing Traffic Generation and Car Parking

Traffic from the Site is generated by employee movements to and from the Site, and movement of approximately 70-90 trucks per week of finished product via road haulage. The official number of employees at the Site at the end of April 2012 was 410 employees and 475 contractors giving a total of 885 workers at the Site during normal working periods. Up to an additional 500 contractors come to Site during maintenance shutdown periods. These periods range from 8-12 weeks in duration.

Information provided by Caltex has confirmed that there exists sufficient employee and visitor car parking for existing operations at the Site.

16.4.3 Existing Traffic Volumes

Table 16-1 provides an outline of the 2005 Annual Average Daily Traffic (AADT) volumes for the traffic count stations relevant to this transport and access assessment, as well as an estimate for 2012 (the existing year). An annual growth rate of 1.3% per annum has been applied to the 2005 data and has been based upon the population increase of Greater Sydney (Statistical Region) between the 2006 and 2011 Census results.

Table 16-1 Most Recent Available AADT Data and 2012 AADT Estimate for Existing Road Network

Traffic Count Station	Road	Location	Base Year	AADT (two-way)	2012 Estimated AADT (two-way) *(1.3% pa growth)*
RMS 36.206	Captain Cook Drive	East of Gannons Road	2005	35,455	38,810

[1] http://www.sutherlandshire.nsw.gov.au/Building_Development/Council_Works_Projects/Current_Works_Projects/Captain_Cook_Drive_Upgrade

Legend

- Roads
- The Site

N
W E
S

0 0.5 1 2 Kilometers

Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

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CALTEX (REFINERIES) NSW PTY LTD

KURNELL REFINERY CONVERSION

ROAD NETWORK

URS Figure: 16-1 Rev. A A4

16.4.4 Existing Level of Service

As outlined in **Section 16.3**, LOS is an index of the operational performance of traffic on a given traffic lane, carriageway, road or intersection, based on service measures such as speed, travel time, delay and degree of saturation during a given flow period. This is measured based upon traffic data such as turning movements counts (for intersections) or AADT volumes (for midblocks - i.e. a location between two adjacent intersections).

The level of service for a particular location is defined at one of six threshold ranges (i.e. LOS A through to LOS F). LOS A implies that traffic is free-flowing and drivers are unaffected by surrounding vehicles, while LOS F implies a condition of 'forced flow' whereby the amount of traffic is above capacity and significant congestion and queuing occurs. The other LOS thresholds from B to E indicate a gradual decline in the operational performance of the particular location until it reaches LOS F.

For the purposes of this assessment, the LOS thresholds for each road segment have been determined, in accordance with the methodology presented in the Guide to Traffic Engineering Practice – Roadway Capacity (AustRoads, 1988). The existing LOS provided in **Table 16-2** has been identified for the midblock AADT volumes outlined in **Table 16-1**.

Table 16-2 Existing LOS

Road	LOS Range (veh / hr, two-way)						2012 Estimated Volume		2012 LOS[3]
	A	B	C	D	E	F	AADT (two-way)	Peak Hour (two-way)[1]	
Captain Cook Drive, east of Gannons Road[2]	-	<2,760	2,760 – 3,679	3,680 – 4,659	4,660 – 6,139	6,140+	38,810	3,881	D

Assumptions:

1) *Peak Hour traffic volumes are assumed to be 10% of the total AADT, and the total volume during the AM and PM peak hour is equal.*
2) *Captain Cook Drive is assumed to have the following: 2 lanes in each direction; divided carriageways; lanes are 3.3m in width; obstructions are located more than 2m from the edgeline, a design speed of 80km/h given the posted speed limit of 70km/h; a heavy vehicle proportion of 10% of all traffic; level terrain; all drivers are commuters; and is considered a suburban environment.*
3) *LOS has been calculated based on AustRoads 'Guide to Traffic Engineering Practice – Roadway Capacity'.*

16.4.5 Accident analysis

Raw crash data was sourced from RMS for the most recent complete available five year period (2007 - 2011). In addition, crash rates per 100 million vehicle kilometres travelled (VKT) for various sections along Captain Cook Drive have also been included. The supplied crash data is summarised in **Table 16-3** and graphically represented on **Figure 16-2**.

Table 16-3 Accident Data for Captain Cook Drive

Road	From	To	Road Type	Crashes (2007 – 2011)	Crashes/ 100 million VKT
Captain Cook Drive	Taren Point Road	Endeavour Road	Urban divided	67	61.2
	Endeavour Road	Elouera Road	Urban divided	47	23.8
	Elouera Road	Lindum Road	Urban undivided	12	16.9
	Lindum Road	Prince Charles Parade	Urban undivided	30	54.8

Figure 16-2 Road Crash Frequency Map

Table 16-3 indicates that crash rates for the assessed road sections vary from 16.9 crashes per 100 million VKT to 61.2 crashes per 100 million VKT, with a weighted average of 36.1 crashes per 100 million VKT for Captain Cook Drive from Taren Point Road to Prince Charles Parade.

By comparison, *Road Safety Engineering Risk Assessment Part 7: Crash Rates Database* (AustRoads, 2010) indicates that a crash rate of 61.86 crashes per 100 million VKT is typical for urban roads with divided sealed carriageways in New South Wales and a crash rate of 82.49 crashes per 100 million VKT is typical for urban roads with undivided sealed carriageways. Each of the four road sections assessed in **Table 16-3** are below the typical crash rates, with only the crash rates reported on the Taren Point Road to Endeavour Road section of Captain Cook Drive being close to that typically observed in New South Wales. The supplied crash rate data therefore indicates that all assessed roads generally performed well over the most recent five year reporting period for which data was available.

16.5 Impact Assessment

16.5.1 Vehicle Routes

Captain Cook Drive is the primary route connecting the Kurnell Peninsula with the wider Sydney road network via:

- Taren Point Road – connecting to the northern regions of Inner Sydney;
- Port Hacking Road – connecting to the M1 and western Sydney region; and
- Kingsway – connecting to the southern regions of Sydney.

The main access to the Site is via Captain Cook Drive and Solander Street as indicated in **Figure 16-1**. This is the proposed route for all vehicle movements generated by the Project.

16.5.2 Construction Traffic Generation

The traffic generated by the Project would incorporate a mix of construction plant vehicles, delivery vehicles and construction personnel movements. A summary of the construction vehicle mix includes:

- construction vehicles - 10 trucks (10 daily return trips) maximum would be required at the Site during the construction phase. These vehicles would typically include cranes and semi-trailers etc.;
- equipment and material delivery vehicles - 10 trucks (10 daily return trips) maximum would be required to deliver the construction equipment and materials to the Site; and
- construction personnel - 140 additional personnel (140 daily return trips) on average would be required at the Site during the construction phase.

For the purposes of this assessment, the largest construction vehicle and plant delivery vehicle would be a semi-trailer of which its dimension and mass would not exceed the maximum unrestricted permissible size on New South Wales (NSW) public roads (B-Double). All personnel are assumed to travel to and from the Site using personal vehicles.

A summary of the likely traffic generation for the Project during the construction phase is provided in **Table 16-4**.

Table 16-4 Staff and Plant Requirements for Construction

Description		*Daily Movements (return trips)*	*Peak Hour Trips[1]*
Heavy Vehicles	Construction Vehicles (Cranes/semi-trailers etc.)	10	2
	Equipment/Material Delivery Vehicles	10	2
Private Vehicles	Construction Personnel*	140	140
TOTAL		***160***	***144***
Heavy Vehicle Proportion		13%	3%

1. Assumptions

- *all personnel would arrive to Site during the AM Peak Hour and depart during the PM Peak Hour;*
- *personnel would utilise their own private vehicle with no use of car-pooling or public transport;*
- *heavy vehicle movements would be evenly distributed throughout the hours of operation (10 hour workdays); and*
- *all plant delivery vehicles are assumed to occur on the same day in order to produce a 'worst-case' scenario.*

**Max number of construction staff in the peak construction year (2014).*

There is sufficient car parking capacity within the Site to accommodate all construction workers during the construction phase.

16.5.3 Construction Phase Traffic Impact

The impact of the Project on the traffic in the area is determined by adding the expected level of traffic generated by the Project (presented in **Table 16-4**) to the background traffic level prediction for the peak construction year of 2014. This assessment will determine whether the Project would have a significant impact on the local road network. **Table 16-5** provides a summary of the impact assessment during the construction phase of the Project.

Table 16-5 Impact Assessment Summary

Road	Pre-Construction		During Construction Phase		
	2014 Background Peak Hour Volume (two-way)	*LOS*	*Peak Hour Trips Generated by Construction Activities*	*Total 2014 Peak Hour Volume*	*LOS*
Captain Cook Drive	3,983	D	44	4,127	D

As indicated in **Table 16-5**, the number of trips generated by construction activities is very minor (approximately 1%) when compared to the background volumes on Captain Cook Drive. As such, the midblock LOS remains unchanged during the construction phase. Therefore it can be concluded that the traffic impact of the Project would be negligible on the road network surrounding the Site.

It should be noted, however, that the road network around the Site already experiences congestion issues during peak periods without inclusion of the vehicles generated by the Project. This is illustrated, in particular, by the fact that the LOS for Captain Cook Drive is currently in the D range. Consequently, construction vehicles utilising these roads during the AM or PM Peak Hour would experience traffic congestion and potential delays.

16.5.4 Operational Phase Traffic Impact

Once the conversion of the Kurnell Refinery is complete, Caltex would import finished products (gasoline, jet fuel, diesel and fuel oil) through the two fixed berths at the Kurnell Wharf and the sub berth located in Botany Bay. This product would be stored in existing and converted tanks.

The major product distribution systems would continue to operate in line with current practice, i.e. product would be pumped under Botany Bay to the Banksmeadow Terminal, the Sydney/Newcastle pipeline or the Joint User Hydrant Installation (JUHI) at Sydney Airport for further distribution. Under typical operation, road transport of products from the Site would cease. However, in exceptional circumstances some road transport of product may be required.

With the cessation of the refining operation at the Site and the high levels of automation of the terminal, the number of employees on Site would reduce. The final operational workforce is currently being determined. However, it is anticipated approximately 100 employees would provide routine operational or supporting services to the terminal. These employees would operate in a shift arrangement 24 hours a day, 7 days a week. Up to an additional 90 people would be required at the Site during maintenance shutdown periods during the operation of the terminal, which are periodic and for short time frames (8-12 weeks).

With the reduction in employees from approximately 900 to approximately 100 and cessation of routine road haulage at the Site, the number of vehicles generated by the Project during its operational phase would be significantly fewer than the number of vehicles generated by the existing refinery operations. This would result in a net reduction in traffic volumes along Captain Cook Drive. Therefore it can be concluded that during operation the Project would result in an improvement to the local traffic environment and a beneficial transport impact.

16.6 Mitigation

The impact assessment has illustrated that there would be a negligible impact on the capacity and operation of the existing road network during the construction phase of the Project, whilst during the operational phase of the Project the Site would result in less traffic on the local road network.

However, in order to manage vehicle activities during both phases of the Project, it is recommended that a Traffic Management Plan be developed to include the following:

- hours of permitted vehicle activity;
- designated routes for construction traffic and defined access points to the Site;
- a community consultation plan to ensure residents in close proximity to the Site are informed of upcoming construction activities and have a point of contact during construction activities;
- designated areas within the Site for truck turning movements, parking, loading and unloading to allow heavy vehicles to enter and leave the Site in a forward direction;
- sequence for implementing traffic management measures should these be required; and
- procedures and/or principles for construction vehicle speed limits and the safe operation of construction vehicles.

Development and implementation of the Traffic Management Plan would be undertaken in consultation with RMS and Sutherland Shire Council. The Traffic Management Plan would be a working document with flexibility to address any traffic issues arising during the construction of the Project.

16.7 Cumulative Impact Assessment

This section considers relevant developments that have been placed on exhibition, but are not yet approved or approved but not yet commissioned, and which are located within a 1 km radius of the Site. Such projects, could give rise to cumulative impacts in combination with the Project-generated construction and operational traffic. **Table 16-6** provides the details of the development identified for consideration in the cumulative impact assessment.

Table 16-6 Relevant Cumulative Developments

Project Name	Location	Description	Expected Construction Dates
Kurnell Port and Berthing Facility Upgrade Works	Botany Bay / Kurnell	Upgrade to the Kurnell port and berthing facility	Q3 2013 – Q2 2015

Sutherland Shire Council and RMS were contacted requesting the details of any additional developments that should be considered as part of this assessment. Neither authority was aware of any additional relevant developments within the surrounding area.

The construction stage of the Kurnell Port and Berthing Facility Upgrade Works are expected to commence in Q3 2013 and continue to Q2 2015. The EIS produced for the Kurnell Port and Berthing Facility Upgrade Works (SSD-5353) noted one period of time when there would be a number of trucks accessing the Kurnell Wharf. There would be nine days between Q3 2014 and Q2 2015 when there would be 100 concrete pouring trucks accessing the Wharf. There could be up to 25 trucks on one day with the remaining days seeing up to nine trucks in one day (URS, 2012).

By the time there is a potential for a cumulative impact of construction traffic between the two projects, the refinery operations at the Site would have ceased (second half of 2014) and the number of workers accessing the Site would have begun to reduce. Therefore, traffic generation from the Project would be significantly lower than at present and the potential for a cumulative impact associated with the construction stage of the Kurnell Port and Berthing Facility Upgrade Works and the Project would be negligible.

16.8 Summary

The transport and access assessment has concluded that the impact that of Project construction traffic on LOS at the nominated road midblock is negligible and that the operational phase would result in a net reduction in traffic generated for the Site. Therefore during operation there is likely to be a positive impact upon the local road network along the Kurnell Peninsula.

The mitigation measures outlined above are summarised and outlined below in **Table 16-7**.

Table 16-7 Management and Mitigation Measures – Traffic and Transport

Mitigation Measure and Commitment	Implementation		
	Design	Construction	Operation
Local Authorities and Kurnell residents would be informed of any Project related work which would affect the road network.		✓	
A Traffic Management Plan would be developed for the construction phase. The Traffic Management Plan would comply with all relevant Regulations and By-Laws and in particular address safe access and egress to the public road network. The Transport Management Plan would include: • hours of permitted vehicle activity; • designated routes for construction traffic and defined access points to the Site; • designated areas within the Site for truck turning movements, parking, loading and unloading to allow heavy vehicles to enter and leave the Site in a forward direction; • sequence for implementing traffic management measures should these be required; and • procedures and/or principles for construction vehicle speed limits and the safe operation of construction vehicles.		✓	

17 Waste Management

17.1 Introduction

The following chapter assesses waste management issues relating to the construction and operational phases of the Project.

17.2 Scope of the Assessment

The DGRs for the Project (refer to **Appendix A**) requested that consideration be given in the EIS to waste including:

- *"Accurate estimates of the quantity and classification of the potential liquid and non-liquid waste streams of the development;*
- *identification of beneficial reuse opportunities for all waste generated by the development; and*
- *a description of the measures that would be implemented to ensure that any waste produced is appropriately handled, processed and disposed of."*

This chapter will identify, quantify and classify potential sources of liquid and non-liquid waste streams generated from the construction and operation of the Project and recommend preferred management strategies for effective storage, reuse/recovery, treatment and/or disposal in-line with applicable standards and regulatory requirements.

17.3 Legislation and Planning Policy

17.3.1 Commonwealth Requirements

National Waste Policy: Less Waste, More Resources (EPHC 2009)

The *National Waste Policy: Less Waste, More Resources* (EPHC, 2009) builds on the 1992 *National Strategy for Ecologically Sustainable Development* (ESD) (COAG, 1992) commitments to improve the range, variety and quality of environmental resources and reduce the environmental impacts of waste disposal. This Policy drives streamlined and accurate business reporting to the National Pollutant Inventory (and under a national product stewardship framework in the future).

National Environment Protection Measures (Implementation) Act 1998

Under the *National Environment Protection Measures (Implementation) Act 1998*, the National Environmental Protection Council (NEPC) was established to set national environmental goals and standards for Australia through the development of National Environment Protection Measures (NEPMs). The following NEPM is relevant to this Project:

The National Environment Protection (National Pollutant Inventory) Measure (NPI)

The *National Pollutant Inventory* (NPI) NEPM (NEPC, 2008) establishes goals to assist in reducing existing and potential impacts of certain substances being emitted to air, land and water. Where the use of an NPI substance triggers the established threshold for that substance, emissions of that substance must be reported to the NPI. Emissions of these substances from various industrial and diffuse sources are reported to the NPI, which is an internet database to provide publicly available information on the types and amounts of certain substances being emitted. In 2008, the NPI NEPM was varied to require mandatory reporting of NPI substances in waste transferred to a destination for containment or final disposal.

Emissions to land, air and water from the Project would be reported annually in accordance with the NPI Guide (DSEWPaC, 2011). The NPI Guide (DSEWPaC, 2011) provides direction and guidance on NPI substances, trigger thresholds and reporting of emissions and transfers of waste. Emission estimation will be carried out in accordance with the most current Emission Estimation Technique Manuals (published online). The Project's emissions would be reported to DSEWPaC and would be publicly accessible via the NPI database at www.npi.gov.au.

17.3.2 NSW State Requirements

Waste Avoidance and Resource Recovery Act 2001

The *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) promotes waste avoidance and resource recovery by providing a framework for the development of strategies and programs such as the extended producer responsibility scheme for industry. It defines the waste hierarchy ensuring that resource management options are considered against the following priorities:

- avoidance including action to use resources efficiently and reduce the amount of waste generated;
- resource recovery including reuse, recycling, reprocessing and energy recovery, consistent with the most efficient use of the recovered resources; and
- disposal including management of all disposal options in the most environmentally responsible manner.

Waste Avoidance and Resource Recovery Strategy 2003 and 2007

The previous NSW Waste Strategy was issued in 2003. It provided a framework for reducing the generation of waste and improving the efficient use of resources. Broad targets included in the strategy aimed at:

- preventing and avoiding waste;
- increasing the recovery and reuse of secondary resources;
- reducing toxic substances in products and materials; and
- reducing litter and dumping.

The 2003 Strategy was superseded in 2007. Whilst this saw the retention of the 2003 targets, it also saw the introduction of a number of key actions and programs that would be implemented by NSW EPA to support meeting these targets. The targets set by the above Strategy can be directly applied to the Project. They require that proposals:

- achieve 76% recovery (the target for the construction and demolition sector);
- avoid using any of the 'priority substances' that are considered toxic; and
- ensure appropriate waste management processes are in place to prevent littering/dumping.

The *Waste Avoidance and Resource Recovery Strategy 2007* recognises the importance of the waste hierarchy to guide effective resource management. It acknowledges, however, that different materials require different approaches. The choice of approach, including re-use, recycling and energy from waste, will depend on a balance of factors including economic and environmental considerations.

Protection of Environment Operations Act 1997

The *Protection of Environment Operations Act 1997* (PoEO Act) defines 'waste' for regulatory purposes and establishes management and licensing requirements along with offence provisions to deliver environmentally appropriate outcomes. The Act also establishes the ability to set various waste management requirements via the regulation.

The Regulation also sets out provisions covering the way waste is managed in terms of storage and transportation as well as reporting and record keeping requirements for waste facilities. It:

- provides for contributions to be paid by the occupiers of licensed waste facilities for each tonne of waste received at the facility or generated in a particular area;
- exempts certain occupiers or types of waste from these contributions; and
- allows deductions to be claimed in relation to certain types of waste.

The Regulation also makes special requirements relating to asbestos and clinical waste.

Protection of the Environment Operations (Waste) Regulation 2005

These regulations enable NSW to issue 'resource recovery exemptions' that allow for the beneficial 'reuse' of wastes via land application or for use as a fuel. These regulations support the principle of 'wastes to resources' where the wastes are fit for beneficial reuse.

Applicants must demonstrate that the waste reuse is genuine, beneficial, and will cause no harm to the environment or human health.

NSW can issue both general and specific resource recovery exemptions. "*A general exemption can be issued for commonly recovered, high-volume and well-characterised waste materials. These exemptions may be used by anyone, without seeking approval from OEH, provided the generators, processors and consumers fully comply with the conditions they impose.*

… Where no general resource recovery exemption is available for the intended use, an application may be made to the Office of Environment and Heritage for a specific exemption, which would then be issued by the agency, if appropriate."

Waste Classification Guidelines

It is the responsibility of those who generate the waste to classify it. To assist waste generators classify the wastes they produce, OEH has developed the "*Waste Classification Guidelines"* (DECCW, 2009) which outline a clear and easy-to-follow, step-by-step process for classifying waste under the current classification system. All waste generated from the Project would be classified in accordance with these guidelines and managed accordingly.

17.3.3 Local Government Requirements

The Project is located within the Sutherland Shire Council Local Government Area (SSC LGA). The *Sutherland Shire Local Environment Plan* (SSLEP) (2006) and *Development Control Plan* (DCP) (2006) outline development requirements which need to be considered for projects within the SSCLGA.

The SSLEP aims to promote an appropriate balance of development and management of the environment that will be ecologically sustainable, socially equitable and economically viable.

Notwithstanding the above, the Site is zoned pursuant to SEPP (Kurnell Peninsula). Therefore, the local zoning provisions of the SSLEP are not applicable to the Project. Refer to **Chapter 5 Legislation and Planning Policy** for further details on the SEPP (Kurnell Peninsula) requirements in relation to the Project.

The DCP 2006 outlines key control measures designed to ensure sustainable development within the SSC LGA. However, this does not specifically outline waste management control measures that would need to be adopted for the Project.

17.4 Method of Assessment

The waste management assessment involved an analysis of the Project to identify potential or likely waste streams and volumes arising from the construction and operation. The assessment has been completed using information provided by Caltex and the requirements of legislation and policy outlined in **Section 17.3**.

17.5 Existing Environment

17.5.1 Existing Waste Management System

Waste generated from Caltex's existing operations at the Site is typically recycled or sent to landfill for appropriate treatment and disposal in accordance with Caltex's Waste Management System (WMS) 2012. The WMS outlines the existing waste management processes currently in place at the Site. Waste generated from the proposed Project would continue to be managed in accordance with the existing system and associated procedures, in particular:

- PROC 5.06.11.001 Kurnell Waste Management;
- PROC 5.06.11.002 Use of Sludge Lagoons;
- PROC 5.06.11.003 Management of Used and Empty Drums; and
- STD 5.06.11.001 Management of Waste Skip Bins in the Kurnell Refinery.

The Site also has conditions on its existing EPL (837) for the management of waste:

- *O5.1 The licensee must ensure that any liquid and/or non-liquid waste generated and/or stored at the premises is assessed and classified in accordance with the NSW (2009) Waste Classification Guidelines as in force from time to time.*
- *O5.2 The licensee must ensure that waste identified for recycling is stored separately from other waste.*

The key existing on-site waste management facilities utilised for management of waste generated from existing operations include:

- *Empty Drum Storage Area:* The Empty Drum Storage Area is used for the storage of empty drums prior to sending them for recycling.
- *Waste Water Treatment Plant (WWTP):* Water treatment involves three stages of treatment from physical to chemical and biological. The unit allows on-site treatment of all effluent, spent caustic waste, second and third flush water from the Polymerisation Plant reactors and a large range of aqueous liquid wastes. Refer to **Chapter 11 Surface Water, Wastewater and Flooding** for further details.

- *Landfarm*: This is used to degrade the hydrocarbon content of oily sludge's, tank bottoms or highly contaminated sand/soil used during a spill. Access to the Landfarm is controlled through the use of a Waste Disposal Permit. No material is to be placed on the Landfarm or hard stand adjacent to it without the authorisation of an approved Waste Disposal Permit.
- *Slop Troughs:* CRN operates a melting trough for the recovery of clean oils for reprocessing.
- *Metal Recycling Area:* This is used to store only uncontaminated metal pieces, which are suitable for on-site reuse, or off-site recycling.

17.6 Impact Assessment

17.6.1 Environmental Values

Waste has the potential to impact ecological function and services, biodiversity, water quality, social value and human health. However, if re-use options are available and utilised, waste can be considered a resource.

The environmental values that have the potential to be impacted by waste are:

- life, health and wellbeing of people;
- diversity of ecological processes and associated ecosystems;
- land use capability, having regard to economic considerations; and
- the management of finite natural resources.

The effective management of waste protects these values during development of the Project.

An Ecological and Human Health Risk Assessment has been undertaken for the Project. This is provided in **Appendix D Human Health and Ecological Risk Assessment** and summarised in **Chapter 10 Human Health and Ecological Risk**.

Management strategies developed for each waste stream have been designed to be consistent with the waste management hierarchy, meet relevant legislation and policy, and to achieve the environmental objectives of the Project.

17.6.2 Waste Streams

The waste impact assessment involved an analysis of the Project to identify potential or likely waste streams and volumes arising from construction and operation of the finished product terminal.

If not managed responsibly, waste generated by the Project has the potential to cause the following impacts:

- water pollution caused by the release or spills of liquid waste, either directly or indirectly via stormwater run-off, to receiving waters from waste contaminated areas/sites;
- land and water (surface and groundwater) contamination as a result of spills or inappropriate storage, handling, transportation and disposal of solid and liquid wastes;
- land and water (surface and groundwater) contamination as a result of spills/overflows from extreme rainfall events;

- increased population of vermin and spread of disease from inappropriate storage and handling of wastes;
- odours caused by improper storage and treatment of putrescible wastes;
- visual amenity impacts caused by poorly executed land clearing activities and inappropriate storage of waste;
- the loss of vegetation and increasing soil sodicity caused by release or spills of wastewater with high total dissolved solids (TDS) concentrations; and
- inefficient and careless use of resources.

Mitigation measures to manage these potential impacts are discussed in **Section 17.7**.

17.6.3 Construction Phase

The construction term for the facility is scheduled to occur over a 54 month period.

The construction workforce is expected to total 140 personnel in addition to the existing workforce on Site (in the peak construction year of 2014) . Conservative estimates for waste generation for the construction phase of the Project are presented in **Table 17-1**. The waste management strategies identified demonstrate the application of the preferred waste management hierarchy in promoting options for on-site reuse, recycling and treatment initiatives.

Table 17-1 Construction Phase Waste Generation and Management

Waste Type	Waste Classification[1]	Estimated Volume[2]	Management Strategy	Final Disposal Arrangements
Excavated Soils (hydrocarbon contamination)	Hazardous waste or General solid waste (non-putrescible)	20 m^3	• To be remediated on-site at the landfarm in accordance with the EPL and current operating procedure.	Retained on-site for reuse.
Excavated Soils (asbestos contamination)	Special Waste	20 m^3	• To be managed on-site. • Stockpiles to be covered and wetted down as required to minimise dust creation and propagation. • All testing and disposal is to be completed in accordance with an asbestos soil management plan. • Only clean fill is to be used for back filling excavations.	Disposal off-site required to appropriately licensed landfill facility once it has been classified in accordance with the DECCW, NSW (2009) *Waste Classification Guidelines*.
Excavated Soils (no contamination)	General solid waste (non-putrescible)	140 m^3	• Soil would be stored on-site for back fill.	Retained on-site for reuse.
Metals (Surplus materials from installation and construction)	General solid waste (non-putrescible)	2 tonnes	• Ferrous bin required. • All metals would be free of hydrocarbons before disposal into the designated bin.	Transported by a licensed contractor (Sell and Parker) to a recycling facility.
Concrete (from construction)	General solid waste (non-putrescible)	2 tonnes	• Waste concrete is to be stockpiled. • Any concrete that is suspected to have been contaminated should be segregated. • Any contaminated waste concrete would be appropriately tested and classified prior to recycling or disposal.	Kurnell Landfill
Asbestos cement products	Special Waste	<1 tonne	• Any Asbestos cement products would be wrapped in plastic by a licenced contractor before disposal in a suitable waste bin. • All material is to be double bagged.	The bin would be picked up by waste contractor (Veolia) to a specialist off-site waste receiving facility for disposal.

Waste Type	Waste Classification[1]	Estimated Volume[2]	Management Strategy	Final Disposal Arrangements
Wash water (as a result of washing concreting tools and equipment)	Liquid waste	500 litres	• No washing of equipment or tools is allowed outside of the designated washing area. Hay bales would be placed in strategic locations to stop any solids from the wash water going into the stormwater system.	Wash water would be sent to the on-site Water Treatment Plant. Treated effluent is discharged to ocean in accordance with EPL conditions. All used hay bales and any solid materials are to be disposed of as general waste.
Excavated road base and asphalt (no contamination)	General solid waste (non-putrescible)	20 m^3	• Materials would be stored on-site for a limited time only - some may be used for back fill.	Disposal off-site required to appropriately licensed landfill facility once it has been classified in accordance with the DECCW, NSW (2009) *Waste Classification Guidelines*.
Excavated road base and asphalt (hydrocarbon contamination)	Hazardous or General solid waste (non-putrescible)	20 m^3	• Store at the back of CLOR in batches. Stockpiles to be covered and wetted down as required to minimise dust creation and propagation. All testing and disposal is to be completed within one month. Only clean fill is to be used for back filling excavations.	Disposal off-site required to appropriately licensed landfill facility once it has been classified in accordance with the DECCW, NSW (2009) *Waste Classification Guidelines*.
Dewatered groundwater (hydrocarbon contamination)	Liquid waste	2,000 litres	• Contaminated groundwater is to be sucked out of excavations with minimal sediment and directed to the American Petroleum Institute (API) oil-water separator for removal of any HC contamination.	API oil-water separator.
Dewatered groundwater (no contamination)	Liquid waste	5,000 litres	• Clean groundwater is to be American Petroleum Institute (API) oil-water separator.	API oil-water separator.
Domestic wastewater	Liquid waste	12 m^3/day, based on 150L/person/day	• Domestic wastewater sent to on-site sewage tank with sewage pump and standby pump. When the sewage level rises to a predetermined level the sewage is discharged into Sydney Water Vacuum Pit.	Refer to **Chapter 11 Surface Water, Wastewater and Flooding** for further details.
General Waste including putrescibles	General solid waste (putrescible)	50 m^3	• Stored in designed skip bins on-site. • No recyclable or contaminated materials are to be placed in this bin.	Waste contractor (i.e. TPI) would pick up the skip bin(s) and take it off-site as required.

Notes: (1) Waste classification would be confirmed prior to disposal in accordance with the DECCW, NSW (2009) *Waste Classification Guidelines*.
(2) Construction stage waste volume estimates provided by Caltex.

17.6.4 Operational Phase

Over the operational life of the Project, waste streams would be generated from industrial activities including maintenance of the Site (i.e. tank, pipeline and pump maintenance), administration activities, and associated services (e.g. water treatment, sewage treatment). Outlined in **Table 17-2** are the key operation waste generated and the proposed management measures.

It is important to note that the Project would result in a significant reduction in operational waste generation compared to the existing operations, due to reduced staffing and ceasing of refinery operations.

Table 17-2 Operational Waste Generation and Management

Waste Type	Waste Classification[1]	Estimated Annual Volumes[2]	Primary Source of waste	Management Strategy
Wastewater	Liquid Waste	Refer to **Chapter 11 Surface Water, Wastewater and Flooding** for details on management of wastewater.		
Fuel oil and diesel slops	Liquid Waste	42 kilolitres	Tank Cleaning Water and Sludge	Oil slops would be sold and exported for reprocessing
Oily waters and sludge	Liquid Waste	55 kilolitres	Sourced from tank water bottoms	Oily waters would be sent to the WWTP, Sludge would be sent to the Landfarm.
Garnet Grit	Hazardous Waste or General solid waste (non-putrescible)	20 tonnes	Sourced from tank bottoms	Sent off-site once it has been classified in accordance with the DECCW, NSW (2009) *Waste Classification Guidelines*.
Used Absorbent	Hazardous Waste or General solid waste (non-putrescible)	<1 tonne	From maintenance activities	Sent off-site for disposal once it has been classified in accordance with the DECCW, NSW (2009) *Waste Classification Guidelines*.
Oily rags and gloves	General solid waste (non-putrescible)	<0.5 tonne	From maintenance activities	Sent off-site for disposal once it has been classified in accordance with the DECCW, NSW (2009) *Waste Classification Guidelines*.
General Waste including putrescibles	General solid waste (putrescible)	45 tonnes	From approx. 100 operation staff (1.25kg/person/day) 365 days per year	Sent off-site for disposal to licensed landfill.

Notes: (1) Waste classification would be confirmed prior to disposal in accordance with the DECCW, NSW (2009) *Waste Classification Guidelines*.
(2) Based on data from NPI transfer for Banksmeadow Terminal provided by Caltex.

17.7 Mitigation

17.7.1 Waste Management

To manage the potential waste impacts during the construction phase a Construction Waste and Resource Management Plan (WRMP) would be produced for the Project. This would be a sub-plan to the CEMP.

During operation the existing WRMP for the Site would be updated to apply to the new Kurnell Terminal operation.

Both the Construction and Operation WRMPs would be based on the following overarching objectives, principles and strategies to deliver effective waste management across the Site.

17.7.2 Waste Management Objectives

The environmental objectives for the management of waste generated from the construction and operation of the Project are to:

- minimise the waste generated throughout the Project life and maximise the reuse and recycling of waste materials produced; and
- store, handle, transport, and dispose of waste in an environmentally responsible manner that does not cause harm or contamination to soil, air or water.

17.7.3 Waste Management Strategy

The waste management hierarchy is a framework for prioritising waste management practices to achieve the best environmental outcome.

The preferred order of adoption is as follows:

1) **Avoid** by identifying appropriate materials and procuring.
2) **Reduce** waste by optimising construction, operation and decommissioning methods.
3) **Reuse** waste by identifying sources that can utilise the waste.
4) **Recycle** waste by identifying facilities that are able to recycle waste.
5) **Recovery** of waste materials, including energy from waste.
6) **Disposal** of waste at an appropriate facility.

The underlying objective of effective waste management is to minimise the impacts to the environmental and social values and to implement sustainability principles. To deliver effective waste management across the Project, a number of strategies would be adopted. These are discussed below.

17.7.4 Waste Minimisation

Waste prevention and minimisation would be addressed, where feasible, through the consideration of alternative materials and products, using efficient production and construction techniques, and the application of sustainable procurement practices including the provisions of contracts encouraging sustainable waste management practices and performance targets for contractors.

During the initial planning and conceptual design phases of the Project waste minimisation measures have been considered and would continue to be incorporated during the detailed design, construction and operations phases of the Project.

Where feasible the generation of waste would be identified and prevented or reduced through measures of substituting inputs for those that generate less waste, increasing the efficiency of raw materials, energy, and water by applying cleaner design practices. The use of pre-fabricated materials and structures where feasible, would play an important role in minimising the generation of waste. Using pre-fabricated components would reduce the volume of some waste streams being generated during the construction phase and facility maintenance.

Cleaner Production

Cleaner production principles are preventive continual environmental protection processes designed to maximise resource efficiency and minimise waste. Cleaner production techniques involve identifying and reducing environmental impacts along the entire life cycle of a project by conserving resources (raw materials, energy and water), eliminating toxic raw materials and reducing the quantity and toxicity of all emissions and wastes.

The following cleaner production techniques have been identified as being applicable to this Project:

- improved operation and maintenance practices to reduce the quantity of resources used and to minimise the amount of waste generated;
- selection and use of the most appropriate technology to reduce the quantity of resources used and to minimise the amount of waste generated;
- segregation of waste to facilitate re-use; and
- closed-loop recycling.

Cleaner production techniques and opportunities during the construction and operational phases of the Project include:

Construction

- adoption of sustainable procurement practices to ensure waste is eliminated before it is generated;
- the adoption of industry best practice construction techniques to ensure that minimum waste volumes are generated during construction works;
- provision of resource efficiency and waste minimisation procedures in contracts to encourage construction contractors consider environmental management objectives;
- procurement of pre-fabricated materials to eliminate off-cuts on-site, and the re-use of concrete formwork where feasible; and
- provision of separate waste containers/skips to ensure waste material segregation and maximise the opportunities for re-use and recycling.

Operational

- identification of appropriate practice and best available technology (BAT) for processing techniques to ensure most efficient use of energy and resources;
- application of most efficient production processes to ensure resourcefulness in the use of energy, water, and natural resources;
- identification and selection of energy efficient equipment at procurement;
- minimisation of waste generated in day-to-day operations and ensuring that process residues are re-used where possible or recycled;
- safe storage and disposal of residual waste and process residues ensuring least amount of harm to surrounding environment; and
- promotion of safe handling procedures of products in line with regulations and industry best practices.

Source Separation

The identification and separation of solid waste would be carried out at point of generation to aid the maximum re-use and recycling of materials. Appropriate containers and bins would be provided for the source separation of materials and to aid the separation of re-usable and recyclable materials.

Waste Re-use

The re-use of waste would be achieved through identifying re-use opportunities on-site and subsequently identifying market demands for waste items. To maximise the re-use opportunities wastes would be segregated. Where feasible, Caltex would work with suppliers and investigate the opportunities for the re-use of packaging materials and surplus materials, such as timber pallets and scrap metal. During the pre-works phase, vegetation and soils from the Site would be cleared, stockpiled, and if possible re-used for any on-site landscaping.

Throughout the Project, investigations would continue looking into re-use opportunities, both on-site and with local businesses/industries. Additionally, the marketability of wastes would be regularly reviewed to ensure potential new and emerging opportunities for waste re-use are identified and maximised.

Waste Recycling

Where practical and considering potential health and hygiene issues, wastes would be collected and segregated on-site and stored in suitable containers before the transport of wastes to approved licensed facilities prior to works being carried out.

The market demand for recyclables would be investigated as volumes of waste materials are generated and an assessment would be undertaken to assess the opportunities for these waste streams. This assessment would consider the availability and capacity of local recycling facilities.

Caltex would work with local industries to encourage them to take advantage of opportunities for re-use and recycling where feasible.

Waste Disposal

The disposal of waste materials would be considered as last resort and where all other avenues have been investigated. Where no other option is available, all waste would be handled and disposed of in a manner that causes the least environmental harm.

General waste would be transported to a local licensed landfill for disposal in line with regulatory requirements. Regulated wastes would be handled by a licensed waste contractor and transported to an appropriate regulated waste facility.

Caltex intends to utilise existing local waste management facilities and would employ licenced waste management companies to manage the identified waste streams arising from the Project.

17.7.5 Waste Monitoring and Auditing

On-site waste monitoring and auditing procedures would be developed for the Project for types of waste streams, volumes produced, and waste management practices during the construction and operational phases of the Project.

The objectives of these procedures would be to provide:

- an assessment of the actual wastes compared to predicted waste streams and volumes;
- monitor, and if required, initiate actions as to fulfil the Project's environmental objectives;
- monitor the potential environmental impacts;
- review the waste transportation records and disposal routes;
- enable positive actions to be taken in the event of incidents or accidents occurring on-site;
- recommend future actions to improve waste management practices; and
- monitor the implementation of the principles of waste management hierarchy.

Inspections of the waste management areas would be conducted on a weekly basis to ensure that correct waste management procedures are being followed, in that all waste materials are appropriately separated, stored and labelled.

New waste streams would be addressed as they arise and assessed to determine the most suitable management measures to use when handling, storing, transporting and disposing of the waste. Unidentifiable waste streams would be analysed and sent for testing in an accredited laboratory to assess the risks associated with handling and disposal of the waste.

17.7.6 Waste Reporting

A database inventory would be used to record and report all waste streams, volumes and management measures for all waste streams arising through the Project. This database would be used to inform internal and external stakeholders, and government agencies on the types and volumes of waste being generated, re-use and recycling rates, and the types and quality of substances emitted to land, water and air.

Caltex would report annually on the waste emissions for the Project in accordance with EPL and NPI reporting requirements.

17.8 Summary

Table 17-3 summarises the management and mitigation measures that would be described in the Construction and Operational WRMPs and implemented to minimise waste impacts and maximise resource efficiency.

Table 17-3 Management and Mitigation Measures

Mitigation Measure and Commitment	Implementation		
	Design	Construction	Operation
The Project would be integrated into existing resource efficiency, waste management and handling, emergency response and preparedness plans for the existing Kurnell Refinery.	✓	✓	✓
Construction and Operation *Waste and Resource Management Plans* (WRMP) would be compiled prior to the each phase commencing.	✓		
The WRMPs would: • identify requirements consistent with the waste and resource hierarchy; • ensure resourcing efficiency is delivered through the design and responsible construction and operational practices; • provide consistent clear direction on waste and resource handling, storage, stockpiling, use and reuse management measures (consistent with current management practices relating to Caltex's Kurnell Waste Management System); • identify disposal and management routes consistent with current management practices as adapted for the Project; • set out clear requirements for meeting legislative and regulatory requirements; • define requirements to support Caltex's sustainable procurement objectives through effective, design, construction, operation and procurement; and • set out processes for disposal, including on-site transfer, management and the necessary associated approvals.	✓	✓	✓
The WRMPs would incorporate the requirements of the waste and resource hierarchy and cleaner production initiatives.	✓	✓	✓
The WRMPs would include a process for auditing, monitoring and reporting, which would include regular inspections off-site activities and the waste management area(s). The WRMPs would be subject to regular auditing and a system would be used to record and report the types, volumes and management measures for all waste and resource arising from/used for the works.	✓	✓	✓
Works-generated waste would be segregated at source and stored in accordance with current Site practices. Site management practices would potentially need adapting to consider additional storage requirements. Regardless, all waste would be stored in suitable containers and designated waste management areas.		✓	✓
Caltex's existing procedures for the disposal of sewage, greywater, hazardous materials, general waste and recyclable materials would be adopted for the Project (and modified if required). This would include using licensed contractors to remove and transport waste from the Site.		✓	✓

18 Heritage

18.1 Introduction

The following chapter considers the potential impacts of the Project on Indigenous (Aboriginal) and non-Indigenous (Historic) heritage values. It provides a summary of the Heritage Impact Assessment (HIA) which is provided in full in **Appendix H Heritage Impact Assessment**.

18.2 Scope of Assessment

The Director General's Requirements (DGRs) (refer to **Appendix A**) requested that consideration be given to heritage, and that the EIS include "*an Aboriginal cultural heritage assessment (including both cultural and archaeological significance), which must demonstrate effective consultation with relevant Aboriginal community groups, and a non-Aboriginal cultural heritage assessment (including both cultural and archaeological significance) which must:*

- *Include a statement of heritage impact (including significance assessment) for the site and any National, State significant or locally significant historic heritage items in the area, including the Kurnell Peninsula Headland; and*
- *Outline any proposed management and mitigation measures.*"

This chapter and **Appendix H Heritage Impact Assessment** meet these requirements.

18.3 Legislation and Planning Policy

18.3.1 Commonwealth Legislation

Australian Heritage and Commission Act 1975

The *Australian Heritage and Commission Act 1975* (AHC Act) established the Register of National Estate (RNE). The RNE now exists as a non-statutory archive of heritage items.

Items in the vicinity of the Project Area that are listed on the RNE are listed below in **Section 18.6**.

Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework for the protection and management of places of national environmental significance. Two instruments exist under the EPBC act, these are:

- the Commonwealth Heritage List (CHL); and
- the National Heritage List (NHL).

The CHL protects heritage items, and places owned or managed by Commonwealth agencies. The NHL protects places that have outstanding value to the nation. Approval from the Federal government is required for actions that would have an impact on items listed on the NHL or the CHL.

Items in the vicinity of the Project Area that are listed on the NHL or the CHL are listed below in **Section 18.6**.

18.3.2 State Legislation and Policy

Heritage Act 1977 (NSW)

This Act ensures the protection of significant heritage places, buildings, works, relics, moveable objects and/or precincts. These include Aboriginal places or objects, items and places of historic heritage significance, and shipwrecks. Where these items have particular importance to the State they are listed on the State Heritage Register (SHR).

Items in the vicinity of the Project Area that are listed on the SHR are listed below in **Section 18.6**.

National Parks and Wildlife Act 1974 (NSW)

This Act provides for the care, control and management of historic sites within the Office and Environment and Heritage (NSW OEH) Estate. This Act also provides for the protection of all Aboriginal places and objects throughout NSW. Aboriginal objects reported to NSW OEH are registered on the Aboriginal Heritage Information Management System (AHIMS).

Items in the vicinity of the Project Area that are registered on the AHIMS are listed below in **Section 18.6**.

State Environmental Planning Policy: Kurnell Peninsula 1989

The State Environmental Planning Policy: Kurnell Peninsula 1989 (SEPP (Kurnell Peninsula)) provides for use of land on the Kurnell Peninsula, aims to conserve the natural environment and "ensure that development is managed having regard to the environmental, cultural and economic significance of the area".

Sections 23A-23D of the SEPP (Kurnell Peninsula) include provisions for the protection of local heritage items, relics and archaeological sites. Archaeological sites and heritage items that are covered by this policy are listed in Schedules 2 and 3 of the SEPP.

Items in the vicinity of the Project Area that are included in the SEPP (Kurnell Peninsula) are listed below in **Section 18.6**.

18.4 Method of Assessment

18.4.1 Overview

The Aboriginal heritage assessment undertaken for this Project is consistent with the provisions of the following guidance and policy documents:

- The Burra Charter (The Australian ICOMOS Charter for the Conservation of Places of Cultural Significance); and
- the *Draft Guidelines For Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC, 2005).

The historic heritage assessment undertaken for this Project is consistent with:

- the Burra Charter (*The Australia ICOMOS charter for the conservation of places of cultural significance*);
- the *NSW Heritage Manual (1996)* (NSW OEH) and associated supplementary publications; and
- the *Significant Impact Guidelines 1.1 Relating to Matters of National Environmental Significance* (Department of Environment, Water, Heritage and the Arts, 2009).

The assessment has involved a detailed desktop review of numerous historical texts, reports, maps and photographs, along with various heritage registers that exist at a Commonwealth, State, local and non-statutory level in order to understand the history of the Kurnell Peninsula. The following resources have been reviewed to compile a list of heritage values within the study area.

- National Heritage List (NHL);
- Commonwealth Heritage List (CHL);
- State Heritage Register (SHR);
- State Heritage Inventory (SHI);
- Aboriginal Heritage Information Management System (AHIMS), Office of Environment and Heritage (OEH);
- Historic Heritage Information Management System (HHIMS), OEH;
- SEPP (Kurnell Peninsula), Schedules 2 and 3;
- Sutherland Shire Heritage Inventory;
- National Trust of Australia (NSW) Register;
- National Trust of Australia (NSW) Industrial Archaeological Sites List (IAS); and
- Register of the National Estate (RNE).

This desktop review was followed by a site inspection of the Project Area, conducted by AMBS Heritage Consultants on 31 October 2012, accompanied by a La Perouse Local Aboriginal Land Council (LALC) representative and a Caltex representative. The inspection was conducted in order to confirm the location and condition of known and potential Aboriginal and historic heritage items, places and archaeological sites within the Project Area.

The findings of the desktop reviews and site inspection were used to build an understanding of the heritage baseline within the Project Area and study area. From this baseline it is possible to assess the potential impacts of the Project on identified cultural heritage values or items, places and archaeological sites.

18.4.2 Assessment of Significance

The assessment of whether an impact is likely to be significant is based on professional judgement and an understanding of how the Project would be likely to impact on the historic, aesthetic, scientific, social or spiritual significance of a heritage item, place, or archaeological site, having regard to the context or intensity of the impacts. Heritage significance or cultural heritage value is embodied in the place itself; its fabric, setting, use, associations, meanings, records, related places and related objects.

An impact is considered ‘significant’ where there is a real chance or possibility that the action would have a major impact on the heritage values of a National heritage place or, in the case of a local heritage item, results in a permanent loss of heritage value. Such impacts are subject to mitigation and consideration of their residual effects. Partial loss of heritage fabric can be considered as a ‘significant’ impact, where the fabric embodies particularly sensitive or important values. Where the potential impacts are serious or irreversible, the precautionary principle and the principle of inter-generational equity apply.

This principal was applied to the Project to determine the impact of the Project.

18.5 Consultation

18.5.1 Aboriginal Heritage

Consultation with the local aboriginal community has been undertaken to:

- provide La Perouse Local Aboriginal Land Council (LALC), as statutory representatives of the local Aboriginal community, with the opportunity to comment on the Aboriginal cultural heritage values of the study area and to be involved in the heritage assessment process;
- identify potential Aboriginal cultural heritage values of the study area;
- integrate potential Aboriginal heritage values and recommendations for management into the assessment report; and
- provide an opportunity for the local Aboriginal community to comment on the outcomes and recommendations of HIA reporting.

Initial consultation was undertaken with La Perouse LALC on 18 October 2012. The LALC was advised of the Project and invited to identify any spiritual, traditional, historical or contemporary associations and attachments that the study area has for the present-day Aboriginal community in accordance with Step 1 of the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005).

Due to the disturbed nature of the Project Area and its continued industrial use, full Aboriginal consultation in accordance with the *Interim Community Consultation Requirements for Applicants* (DEC 2004) has not been undertaken. As Aboriginal cultural heritage values are not likely to be affected by the Project (refer to **Section 18.7.1**) there is no further requirement for Aboriginal consultation or assessment.

18.5.2 Historic Heritage

A meeting was held with the Heritage Branch on 10 January 2013 to discuss the potential heritage impacts of the Project and discuss recommendations for the ongoing management of the Site. These recommendations were incorporated into **Section 18.9** and Section 10 of **Appendix H Heritage Impact Assessment**.

18.6 Existing Environment

18.6.1 Aboriginal Heritage

Aboriginal occupation of the Sydney region is likely to have spanned at least 20,000 years. The Kurnell Peninsula was inhabited by the Gweagal people at the time of European contact. Early European accounts of the area indicate that small groups of Aboriginal people camped near the water, sometimes in bark huts. There is extensive recorded evidence of fishing and shell fishing activity in the area. Radiocarbon dating has been obtained for a number of Aboriginal occupation sites on the Kurnell Peninsula, the majority of which date to within the last 3,000 to 5,000 years.

A search of the AHIMS database, undertaken on 28 August 2012, showed 75 registered Aboriginal sites identified within a 6 km x 7 km area centred on the Project Area. These items are listed in **Table 18-1** and are shown on **Figure 18-1**.

Table 18-1 Registered Aboriginal Heritage Items from within the Study Area

Site Type	Number Present
Artefact Scatter	14
Burial	1
Burial/s, Midden	2
Midden	36
Midden, Open Camp Site	3
Midden, PAD	1
PAD	3
Restricted	3
Rock Engraving	10
Shelter with Art	1
Shelter with Midden	1
Total	**75**

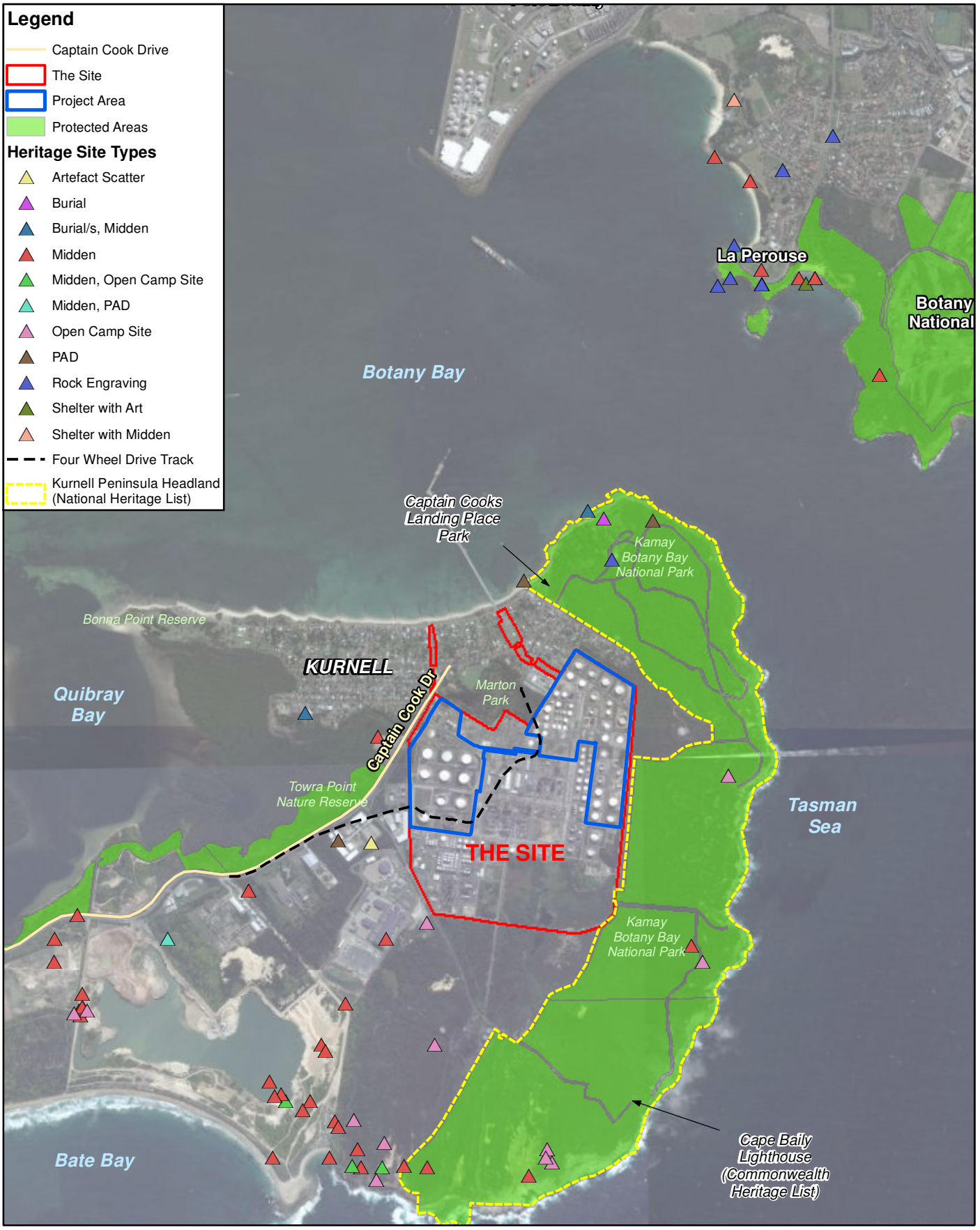
The majority of the identified sites are midden sites, artefact scatters and rock engravings. Subsurface midden material is unlikely to be present within the Project Area due to the high levels of historic ground disturbance involved in the construction and operation of the existing refinery.

18.6.2 Historic Heritage

Following the initial visit of Captain Cook in 1770 and the subsequent visit of the First Fleet in 1788, the Kurnell peninsula was only formally settled by Europeans in 1815. The peninsula was used for farming, timber in the 1800s and for sand extraction in the early 1900s. Fishing was also an important source of income. Around these various industries a small community started to develop.

In the 1950s Caltex commenced building Kurnell Refinery. The work to build the refinery involved draining swamps, clearing scrub and installing roads, water supplies and sewerage facilities. This activity led to the further development of the peninsula and of the village of Kurnell.

Table 18-2 lists all the historic heritage items that are listed on the Kurnell Peninsula. Reference numbers for all the listed items are provided in **Appendix H Heritage Impact Assessment.**



Source: Aerial Imagery from Bing Maps © 2010 Microsoft Corporation and its data suppliers. Heritage Sites and Search Area provided by Australian Museum Business Services (AMBS), 15 January 2012.

Map compiled using MapInfo StreetPro data. © 2011 MapInfo Australia Pty Ltd and PSMA Australia Ltd. URS Australia, MapInfo Australia or PSMA Australia do not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that these companies shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.

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CALTEX (REFINERIES) PTY LTD

KURNELL REFINERY CONVERSION

RECORDED HERITAGE ITEMS

URS

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Figure: **18-1**

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Table 18-2 Items of Historic Heritage Significance from within the Study Area

Item	Primary Address	CHL	NHL	RNE	SHR	SEPP
Kurnell Peninsula Headland	Kurnell Peninsula		✓			
Kamay Botany Bay*	Kurnell Peninsula		✓			
Cape Bailey Lighthouse	Sir Joseph Banks Dr, Kurnell	✓		✓		
Alpha Farm	Botany Bay National Park				✓	✓
Banks Monument	Botany Bay National Park				✓	✓
Captain Cook's Landing Place	Botany Bay National Park			✓	✓	✓
Commemorative Tree Plantings	Botany Bay National Park				✓	
Cook's Monument	Botany Bay National Park				✓	✓
Cook's Well	Botany Bay National Park				✓	✓
Discovery Centre	Botany Bay National Park				✓	
Forby Sutherland Movement	Botany Bay National Park				✓	✓
Foreshore Pines near Flagstaff	Botany Bay National Park				✓	
Foreshore Sea wall – coursed stones	Botany Bay National Park				✓	
Freshwater Steam Plaque	Botany Bay National Park				✓	
Inscription Point Plaque	Botany Bay National Park				✓	
Issac Smith Memorial	Botany Bay National Park				✓	
Kurnell meeting Point Precinct	Botany Bay National Park				✓	
Landing Place Memorial	Botany Bay National Park				✓	
Main Flagstaff	Botany Bay National Park				✓	
Prince's Tree memorial	Botany Bay National Park				✓	
Queen Elizabeth II Tree	Botany Bay National Park				✓	
Solander Memorial	Botany Bay National Park				✓	
Trust Wharf Abutment	Botany Bay National Park				✓	✓
Botany Bay National Park	Cape Solander Drive					✓
Kurnell Monuments	Cape Solander Drive					✓
Solander Monument	Cape Solander Drive					✓
Cook's Watering Hole	Cape Solander Drive					✓
Flagpole	Cape Solander Drive					✓
Yena Track	Cape Solander Drive					✓
Muru Track	Cape Solander Drive					✓
Tabbagai Gap cliff site	Tabbagai Gap					✓
Tabbagai Gap house site	Tabbagai Gap					✓
Four wheel drive track	Captain Cook Drive, Kurnell					✓
Australian Oil Refinery	Sir Joseph Banks Drive, Kurnell					✓

*A listing for the Kamay Botany Bay has been nominated for inclusion in the NHL, if included this listing would include all the values currently listed within the Kurnell Peninsula Headland listing within a broader boundary and would recognise additional associative heritage values, thereby superseding the former listing.

Figure 18-1 shows the location of the aboriginal and historic heritage items (excluding those in Kamay Botany Bay National Park) that have been recorded on the Kurnell Peninsular.

As shown on **Figure 18-1**, there are three identified historic heritage items or places in the immediate vicinity of the Site. The Project Area itself forms part of the locally significant 'Australian Oil Refinery' (as listed on Schedule 2 of the SEPP (Kurnell Peninsula). The locally significant four wheel drive track (Captain Cook Drive) is closely associated with the north-west and south-west boundaries of the Site. However, there is no physical evidence of the track within the boundary of the Site today.

The nationally significant Kurnell Peninsula Headland adjoins the eastern boundary of the Site. Other heritage items on the Kurnell Peninsula are at a distance of at least 300 m or more from the Site and would not be affected by the Project.

18.7 Impact Assessment

18.7.1 Aboriginal Heritage

No Aboriginal archaeological sites, objects or places, or areas of archaeological potential or Aboriginal sensitivity, were identified within the Project Area (refer to **Figure 18-1**).

Due to the extensive disturbance on the Site from industrial development (confirmed following the site inspection conducted with a representative of La Perouse LALC), it is considered highly unlikely that any Aboriginal heritage items remain within the Site.

Therefore, the proposed works are expected to have no impact on any known Aboriginal heritage sites or values during the construction or operation of the Project. As such, the Project would be unlikely to affect the historic significance, aesthetic significance, scientific significance, and social/spiritual significance of any Aboriginal sites or places.

18.7.2 Historic Heritage

Overview

The Project has the potential to impact three historic heritage items. These are:

- Australian Oil Refinery;
- Four-wheel drive track (Captain Cook Drive); and
- Kurnell Peninsula Headland – incorporating a number of historic heritage items.

These are discussed below. The Project is not anticipated to have an impact on any other historic heritage item identified on the NHL, CHL, RNE or SHR in the vicinity of the Site. Caltex is therefore not required to submit a referral under the provisions of the EPBC Act with regards to heritage related MNES.

Kurnell Peninsula Headland

The Project would not impact on the heritage fabric of the NHL Kurnell Peninsula Headland, and there would be no change to the identified historic or social values of the place. The Project would not alter the existing landscape setting of the Kurnell Peninsula Headland or otherwise impact on the existing view corridors associated with the national heritage values of the place. Therefore no adverse impacts from the Project are expected on the NHL Kurnell Peninsula Headland.

Four Wheel Drive Track

There is no physical presence of the original four wheel drive track within the boundary of the Site today. The proposed works would not extend beyond the boundary of the Site. Therefore there in no anticipated impact on the historic significance of this item.

Australian Oil Refinery

The conversion of the refinery to a finished product terminal would have an adverse impact on the technical and scientific values of the Australian Oil Refinery site. Decommissioning the plant would diminish the ability of the Site to demonstrate its technological significance and its historical contribution to development of an oil refining industry in NSW in the mid-twentieth century.

The conversion of all crude oil tanks to finished products tanks and possible discontinuation of use of other speciality tanks would have a minor adverse impact on the technical significance and representative value of the Site, by reducing the functional range of tanks in use. However, the cleaning and/or modification of some of the existing tanks at the Refinery to store finished petroleum products would conserve an element of the historical value of the Site keeping the Site as part of the Australian petroleum industry.

Although the installation of new pipelines along the existing Pipeline Easement, and conversion of an existing pipeline within Pipeline Easement 1 to a new use may have minor impacts on the Australian Oil Refinery site, they are consistent with on-going use of the Site, and necessary to update infrastructure to current operational standards.

18.8 Mitigation

18.8.1 Aboriginal Heritage

Despite the disturbed nature of the Project Area if *in situ* Aboriginal heritage items are found during the construction of the Project, works would cease and notification made to the NSW Heritage Office.

18.8.2 Historic Heritage

Caltex is aware of the heritage significance of the Site and has undertaken a number of measures to document the history of the Site and to present the history to its employees and the local community. For example, in 2005, Caltex produced a DVD capturing 50 years of refining at the Kurnell Refinery.

In addition to this, Caltex also has plans to:

- form an in-house team to manage documentation and interpretation of the history of the refinery prior to its closure, including production of a colour illustrated book on the history of the refinery, targeted at Caltex's employees;
- liaise with the Mitchell Library (NSW State Library) to prepare a photographic record of the Site and people associated with the refinery for inclusion in the library's archives; and
- engage a professional photographer to prepare a photographic exhibition on the refinery.

Caltex maintains a collection of historical material from the Site including photos, hardware, clothing and tools. A site librarian manages the collection of refinery photos and memorabilia for Caltex. This collection is located in a secured area and includes:

- photos covering the history (both plant and people) of the refinery from construction to the present day (some originals, others scanned from originals provided by employees);
- photos from other parts of Caltex including marketing, distribution and the corporate office;
- photos depicting Caltex's and the refinery's involvement in the community;
- past issues of the company magazine, the "Caltex Star", back to the 1950s (issues have also been lodged with the Mitchell Library);
- past issues of refinery newsletters, including the "Look Box", and the "Good Oil", going back to the 1950s;
- film footage from the refinery;
- Caltex and Ampol advertisements (also held by the National Film and Sound Archive in Canberra);
- films about aspects of Australian life produced by Caltex and Ampol in the 1960s and 1970s (when the company was involved in film making);
- various company and Caltex memorabilia dating back to before the refinery's construction including signs, sporting trophies, employee booklets, plaques, old turnover books etc.; and
- original Max Dupain photos of the refinery including images of the Harry Seidler designed refinery houses featuring original furnishings.

Further, as part of the Heritage Impact Assessment and ongoing management of the Site, Caltex has committed to undertaking the following additional measures to manage and mitigate impacts arising from the Project:

- an archival photographic record of the existing fabric and operations of the Refinery would be prepared while the plant is still operational, and during the decommissioning process. The recording would be undertaken in accordance with the Heritage Council guidelines on *Photographic Recording of Heritage Items Using Film or Digital Capture* (2006). The archival recording would be maintained for the appreciation of present and future generations. The recording would be lodged with Sutherland Shire Library and the NSW State Library.
- a Heritage Management Strategy would be prepared for the Australian Oil Refinery site prior to shut-down of the refinery plant, to provide Caltex with a basic framework for the ongoing management of the Site's heritage during present and future works on the Site. The Strategy would include a review of the heritage significance of the overall Site. The review would clarify the extent and relative heritage value of the place by identifying key elements of industrial and built heritage, as well as social values of the refinery, and the relative contribution of these elements to the overall significance of the Site. Recommendations would also address the future assessment and management of memorabilia and other significant items of moveable heritage maintained on-site.

18.9 Summary

Impacts of the Project on local heritage items would be limited to the impact to the Australian Oil Refinery through decommissioning and conversion of the existing refinery to a finished product terminal. Although decommissioning would have an impact on parts of the listed item, the action would conserve some historical value through the cleaning and/or modification of some of the existing tanks at the Refinery.

The potential discovery of unlisted Aboriginal and/or Historic heritage items would be managed in accordance with the mitigation and management measure listed below. Providing this measure is implemented there would be no further anticipated impact on Aboriginal heritage items from the Project.

Table 18-3 outlines the management and mitigation measures that would be put in place to minimise any adverse impacts on existing and potential heritage items affected by the Project.

Table 18-3 Management and Mitigation Measures - Heritage

Management and Mitigation Measures	Implementation		
	Design	Construction	Operation
An archival photographic record of the existing fabric and operations of the Kurnell refinery would be prepared while the plant is still operational, and during the decommissioning process. The recording would be undertaken in accordance with the Heritage Council guidelines on Photographic Recording of Heritage Items Using Film or Digital Capture (2006). The archival recording would be maintained for the appreciation of present and future generations. To this end, the recording would be lodged with Sutherland Shire Library and the NSW State Library.	✓		
A Heritage Management Strategy would be prepared for the Australian Oil Refinery prior to shut-down of the refinery plant, to provide Caltex with a basic framework for the ongoing management of the Site's heritage during present and future works. The Strategy would include a review of the heritage significance of the overall Site. The review would clarify the extent and relative heritage value of the place by identifying key elements of industrial and built heritage as well as social values of the refinery, and the relative contribution of these elements to the overall significance of the Site. Recommendations would also address the future assessment and management of memorabilia and other significant items of moveable heritage maintained on-site.	✓		
If any further heritage items were discovered throughout the Project, work would cease until an assessment is carried out by a qualified heritage professional.	✓	✓	

19 Ecology

19.1 Introduction

URS Australia Pty Ltd (URS) commissioned Biosis Pty Ltd (Biosis) to undertake a Flora and Fauna Assessment for the Project. This chapter provides a summary of the assessment which is provided in full in **Appendix I Ecology Impact Assessment**.

The Flora and Fauna Assessment describes the existing ecological environment relevant to the Project, and assesses the potential impacts of the proposed works on the ecological values of the local area (assessed as 5 km surrounding the Project Area). A particular emphasis is placed on threatened species, populations and ecological communities. The assessment has been based on a literature and database review and a site investigation.

19.2 Scope of the Assessment

The Flora and Fauna Assessment was undertaken to address the DGRs for the Project, which require the EIS to assess any potential impacts on flora and fauna with specific consideration of:

- *"terrestrial and aquatic ecology, including the surrounding Botany Bay National Park, Towra Point Nature Reserve and Towra Point Aquatic Reserve."*

The objectives of this Flora and Fauna Assessment were to:

- determine ecological impacts that may result due to the Project;
- undertake background research to determine the likelihood for New South Wales (NSW) and/or Commonwealth threatened biota to be present within the Project Area and within a 5 km radius of the Project Area;
- describe the flora and fauna present within the Project Area and understand its general condition;
- map native vegetation and other habitat features (rocky outcrops, noxious weeds, water bodies, hollow-bearing trees, etc.);
- determine presence or absence of threatened NSW and Commonwealth listed threatened biota, listed under the TSC Act, FM Act or EPBC Act considered with the potential to occur. From prior site/area experience the target species will likely include threatened flora, frogs and birds; and
- identify potential implications of the Project and provide recommendations to assist with mitigating any potential impacts.

19.3 Method of Assessment

A literature and database review, field inspection and reporting was undertaken for the assessment. These tasks undertaken are outlined in **Section 19.3.1 to** .**Section 19.3.3** respectively.

19.3.1 Literature and Database Review

Database searches were undertaken for flora and fauna from within 5 km of the Project Area (the 'local area') from the following relevant public databases:

- Protected Matters Search Tool of the Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) for matters protected by the EPBC Act;
- Department of Primary Industries (DPI) Threatened & Protected Species – Records Viewer for Sydney Metro CMA and Hawkesbury Nepean CMA;
- NSW Bionet Atlas of NSW Wildlife Office of Environment and Heritage (OEH);
- PlantNET for Rare or Threatened Australian Plant information (The Royal Botanic Gardens and Domain Trust, 2012); and
- BirdLife Australia, the New Atlas of Australian Birds 1998-2012 (BA).

Additional information was collected from previous reports and other published material relevant to the local area (refer to **Appendix I Ecology Impact Assessment**).

The results of the literature and database review were used to assess the likelihood of threatened biota occurring with within the local area. Those species which were considered to have a medium or high likelihood of occurrence were given further consideration during the field inspection and, if necessary, the impact assessment.

19.3.2 Site Investigation

Flora and fauna surveys for the Project Area were completed on the 30 October 2012.

The flora survey traversed the Project Area using a combination of random meanders (Cropper, 1993) to identify vegetation associations (Specht, 1970), as well as transects to determine the vegetation assemblage and the relevant classification present within the Project Area. The general condition, structure and connectivity of native vegetation was recorded. Notes were made on specific issues such as noxious weeds, evidence of management works and general impacts. Habitat features were also searched for including hollow-bearing trees, coarse woody debris, natural waterbodies, etc.

Targeted surveys were undertaken for the threatened Coast Groundsel *Senecio spathulatus* (endangered, TSC Act) to determine whether it was present, or whether suitable habitat exists for the species within the Project Area. This was triggered by a previous OEH record of the species located within the Site.

The fauna survey aimed to determine if potential habitat for threatened fauna existed within the Project Area. All species of fauna observed during the survey were noted and active searching for fauna was undertaken. This included direct observation, searching under rocks, woody debris and artificial debris, examination of tracks and scats and identifying calls. Particular attention was given to searching for significant species and their habitats. A detailed description of the survey methods used is provided in **Appendix I** of **Appendix I Ecology Impact Assessment**. Fauna species were recorded with a view to characterising the values of the Project Area and the investigation was not intended to provide a comprehensive survey of all fauna that has potential to utilise the Project Area over time. The field inspection aimed to identify potential habitat for threatened fauna species. However, no targeted surveys were undertaken during the Site investigation.

Mapping was compiled using hand-held (uncorrected) Global Positioning System (GPS) units (WGS84) and aerial photo interpretation. Locations of pest species and/or areas of ecological sensitivity were recorded using hand-held (uncorrected) GPS units (generally ± 7 metres accuracy).

19.3.3 Reporting and Assessment

Habitat Suitability Assessment

Following the completion of the desktop review and Site investigation, an assessment of the potential habitats present within the Project Area was undertaken for those threatened species, populations and ecological communities predicted to occur in the local area. This assessment focused on TSC Act, FM Act and EPBC Act listed species, populations and ecological communities and is provided in **Appendix I Ecology Impact Assessment**. This technique aids in the determination of the potential for listed species, populations or communities to occur within the Project Area rather than relying solely on one-off surveys that are subject to seasonal and weather limitations and provide only a snapshot of ecological assemblages present. Threatened biota were ruled out from the assessment if suitable habitat did not exist within the Project Area.

Evaluation of Impact

Assessments of State and Commonwealth listed threatened biota that could be potentially impacted by this Project have been completed. Assessments of threatened biota listed under the NSW TSC Act and FM Act are addressed using the criteria provided in *Threatened Species Assessment Guidelines*, the *Assessment of Significance* (AOS) (DECC, 2008b). Assessments of threatened biota listed under the EPBC Act have been addressed using the criteria provided in DEWHA's (2009) '*Matters of National Environmental Significance, Significant Impact Criteria (SIC) assessment guidelines*'. These assessments are shown in full in **Appendix I Ecology Impact Assessment**.

Key Threatening Processes (KTPs) were also considered during the impact evaluation process. KTPs that are relevant to the Project are discussed in **Section 19.5.3**.

Mitigation measures have been proposed in **Section 19.6** to address any potential adverse impacts of the Project.

19.4 Existing Environment

19.4.1 Ecological Overview

Kurnell Refinery is located on the Kurnell Peninsula south of Botany Bay. The Site falls within the Hawkesbury Nepean Catchment Management Authority (CMA) following its merger with Sydney Metro CMA. The Site is located within the Sydney Basin bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway & Creswell 1995). The original vegetation has been extensively cleared on the Kurnell Peninsula. Only remnant patches of vegetation remain in some of the areas of more significant ecological value including:

- Botany Bay;
- Marton Park Woodland and Wetlands (a Groundwater Dependent Ecosystem which includes fringing Swamp Oak Floodplain Forest);

- Towra Point Nature Reserve (Ramsar wetland);
- Towra Point Aquatic Reserve; and
- Kamay Botany Bay National Park.

These areas are shown on **Figure 19-1**. The Towra Point Nature Reserve, a Ramsar wetland of international significance, is located within 5 km of the Site.

The vegetation and fauna habitat throughout the majority of the Project Area has been highly modified by past and current disturbance related to the Kurnell Refinery, since its development in 1953. The majority of the Project Area is devoid of vegetation and associated habitat due to the highly modified nature of the Site. The vegetation that remains is significantly degraded, providing limited value for native fauna.

19.4.2 Flora

A total of 76 flora species were recorded within the Project Area during the Site investigation, including 28 native species and 48 exotic species of which three were classed as noxious weeds (refer to Appendix A2.1 of **Appendix I Ecology Impact Assessment** for full species list). No threatened flora species, ecological communities or Rare or Threatened Australian Plants (ROTAP) were recorded.

The desktop review identified one threatened flora species as having been previously recorded within the Project Area: Coast Groundsel *Senecio spathulatus*. This species was not recorded with the Project Area during the Site investigation. While the record of this species is mapped within the Project Area, the accuracy associated with this mapping record is approximately 1 km, so it is considered likely that the previous record is actually located somewhere within the adjacent Kamay Botany Bay National Park.

19.4.3 Fauna

A total of 20 fauna species were recorded within the Project Area comprising 19 bird species and one reptile (refer to Appendix A3.1 of **Appendix I Ecology Impact Assessment** for full species list). Three of the birds recorded were introduced species.

The desktop review identified a number of threatened fauna species as having been previously recorded within close proximity to the Project Area. The high number of species is likely as a result of the proximity of the Site to the surrounding Ramsar Wetland, National Park and Nature Reserve, all of which provide substantial habitat for a range of threatened species. The Site itself provides limited habitat resources for threatened biota, given the overall lack of intact vegetation, lack of typical habitat resources, and ongoing disturbance and activities in the Site.

Legend

- Captain Cook Drive
- Silver Beach Aquaculture
- Towra Point Aquatic Reserve ^
- National Park
- Towra Point Nature Reserve
- Project Area
- The Site

Noxious Weeds

- *Chrysanthemoides monilifera subsp. rotunda*
- *Lantana camara*
- *Ricinus communis*

Vegetation

- Eastern boundary disturbed native vegetation
- North-east corner revegetation
- North-west corner planting

Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

0 100 200 400 Meters

Source: *Aerial Imagery - © NearMap '23 October 2013'*
Streets and Protected Area - © Mapinfo Australia Pty Ltd and PSMA Australia Ltd
Vegetation and Noxious Weeds - Biosis Pty Ltd, Figure 6 - 19 November 2012.
^ Office of Environment and Heritage (OEH)

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19.4.4 Vegetation Communities

The Project Area supports three small patches of vegetation:

1. *North West Corner Planting* - adjacent to the existing Waste Water Treatment Plant (WWTP). This patch of vegetation is approximately 0.17 hectares (ha) in size (refer to **Figure 19-1**), and comprises planted trees (including Radiata Pine *Pinus radiata*, Oleander *Nerium oleander* and Swamp Paperbark *Melaleuca ericifolia*) and over managed (mown) exotic grasses and weeds. This area of planting lacks ground and mid story vegetation supporting only highly mobile fauna species which move through the Project Area on occasion.

2. *Eastern Boundary Disturbed Native Vegetation* - this patch of vegetation exists mid-way along the eastern boundary of the Project Area and is approximately 0.55 ha in size (refer to **Figure 19-1**). This patch is bounded on all sides by roadways, tanks and hard stand areas and is disturbed by various site activities resulting in noticeable edge effects. The area was mapped as *Coastal Flats Swamp Mahogany Forest* by SMCMA in 2009 however the vegetation found in this location does not align with this community. The vegetation is likely to have once formed part of the closely adjoining Kamay Botany Bay National Park, and may have previously been considered *Coastal Sand Apple-Bloodwood Forest*, given the presence of diagnostic tree, shrub and ground cover species, as described by SMCMA (2009).

   Vegetation within this patch included Sydney Red Gum *Angophora costata* and Coastal Banksia *Banksia integrifolia*, shrub species; Heath-leaved Banksia *Banksia ericifolia*, Coastal Wattle *Acacia longifolia* subsp. *longifolia*, Sweet Wattle *Acacia suaveolens*, Prickly Moses *Acacia ulicifolia* and Variable Bossiaea *Bossiaea heterophylla* as well as ground cover species; Blue Flax Lily *Dianella caerulea*, Bracken *Pteridium esculentum*, Matt rush *Lomandra longifolia*, Blady Grass *Imperata cylindrica* and Variable Sword-sedge *Lepidosperma laterale*.

   Whilst this patch of vegetation contains the native species listed above, it was considered to be highly disturbed, given the presence of a number of weed species and the low diversity and overall lack of canopy and ground cover species. This patch does have a dense midstorey, which provides good cover for small woodland birds. Located on the eastern boundary of the Project Area, this vegetation is disconnected from the adjacent vegetation within Kamay Botany Bay National Park by a hard surfaced drainage channel approximately 10 m in width.

3. *North East Corner Revegetation* - located in the north eastern corner of the Project Area and approximately 0.60 ha in size (refer to **Figure 19-1**). This area appears to have been revegetated over the last one to two years and is showing good resilience. Within this vegetation, sporadic weeds were seen around the edges including NSW DPI and Sutherland Shire Council listed noxious weed, Bitou Bush *Chrysanthemoides monilifera* subsp. *rotunda*. This sandy exposed area of establishing regeneration provides ideal habitat for small reptiles to bask and shelter. Lying at the boundary of the Site, land this area is close to the adjacent Kamay Botany Bay National Park and may be utilised by mobile reptiles and potentially amphibians.

19.4.5 Habitat Resources

No hollow-bearing trees, coarse woody debris, rock outcrops or natural water bodies were found within the Project Area. The three vegetation patches outlined in **Section 19.4.4** form the primary fauna habitat within the Project Area. Other potential fauna habitat or foraging related assets include; perch structures (i.e. tank infrastructure) for birds of prey and debris, such as concrete blocks in areas around the edges of the Project Area providing sheltering sites for common reptiles and potentially amphibians.

No natural water bodies occur within the Project Area. As such aquatic habitat is limited to a single reservoir of water located at Chisholm Drive at the western extent of the Project Area near Captain Cook Drive. This reservoir has sheer exposed sides, negligible aquatic habitat and does not provide culvert roosting opportunities for microbats. Other water bodies include concrete stormwater drainage channels and pipelines.

Connectivity across the Project Area is limited. However, given that Kamay Botany Bay National Park surrounds a large portion of Project Area, some dispersal is possible. Parts of the stormwater system, such as drainage channels and pipelines that capture and direct stormwater, may also provide dispersal passage for mobile fauna. The catchments within the Project Area which transfer contaminated water may not provide tolerable habitat for highly sensitive amphibian species. Piles of debris and rubble may provide temporary refuge for frogs if they are traversing through the Project Area. However, these areas are often localised and not well connected leaving large exposed areas to be crossed without refuge opportunities.

19.4.6 Threatened Biota

A number of threatened species, populations and/or ecological communities are predicted or known to occur within 5 km of the Project Area. Many of these species are considered unlikely to occur within the Project Area, due to a lack of suitable habitat. The threatened biota considered to have a medium to high likelihood of occurrence is presented in **Table 19-1**.

Table 19-1 Threatened Biota Considered to have the Potential to Occur within the Project Area

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Project Area Relationship
Litoria aurea	Green and Golden Bell Frog	Endangered	Vulnerable	This species has the potential to be found throughout the Project Area on occasion during dispersal, however it is more likely to be found within the eastern boundary vegetation patch and the north-east vegetation area based on their proximity to the adjacent Kamay Botany Bay National Park where historical records exist (refer to **Figure 19-1**).
Crinia tinnula	Wallum Froglet	Vulnerable	Not listed	This species has the potential to be found within the Project Area on occasion during dispersal, however is more likely to be found within the eastern boundary vegetation patch and the north-east vegetation area based on their proximity to the adjacent Kamay Botany Bay National Park where historical records exist (refer to **Figure 19-1**).
Ninox strenua	Powerful Owl	Vulnerable	Not listed	The Powerful Owl may forage across the Project Area; however the primary areas which are likely to support prey species occur within the three vegetated patches shown on **Figure 19-1**.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Project Area Relationship
Tyto longimembris	Eastern Grass Owl	Vulnerable	Not listed	No breeding or preferred foraging resources occur within the Project Area. Given that this species was recorded approximately 1.5 km south of the Project Area within Kamay Botany Bay National Park as recently as 2010, it is possible that this species will move through the Project Area to forage, particularly the eastern and north-eastern vegetation patches shown on **Figure 19-1**.
Epthianura albifrons	White-fronted Chat	Vulnerable	Not listed	No breeding or preferred foraging habitat occurs within the Project Area. The closest records are approximately 500m south within Kamay Botany Bay National Park, however the most recent of these records dates from 1988. More recent records occur within Towra Point Nature Reserve 5 km east of the Project Area. Although unlikely, if individuals from this population were to enter the Project Area, their presence would most likely be associated with the three vegetation patches within the Project Area.
Calamanthus fuliginosus	Striated Field Wren	Endangered	Not listed	No breeding or preferred foraging habitat occurs within the Project Area. The closest records are from approximately 5 km east dating from 2002 (Bird Life Australia data). Although unlikely, if individuals from this population were to enter the Project Area, their presence would most likely be associated with the three vegetation patches within the Project Area.
Pandion cristatus	Osprey	Vulnerable	Not listed	The Osprey was recorded in 2011, 5 km to the east of the Project Area. No foraging or breeding sites occur within the Project Area. However the Project Area contains tall infrastructure suitable as perching habitat for large birds such as the Osprey.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Vulnerable	Not listed	The Eastern Bentwing-bat was recorded in 2010, less than 1 km north of the Project Area. A reservoir of water occurs at Chisholm Drive at the western extent of the Project Area near Captain Cook Drive. This reservoir had sheer exposed sides and does not provide roosting opportunities for microbats. Although the Project Area does not provide preferred foraging habitat, the Eastern Bentwing-bat may forage within the Project Area on occasion within the three vegetated areas.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Project Area Relationship
Myotis macropus	Southern Myotis	Vulnerable	Not listed	The Southern Myotis was recorded in 2009 less than 1 km south west of the Project Area. A reservoir of water occurs at Chisholm Drive at the western extent of the Project Area near Captain Cook Drive. This reservoir had sheer exposed sides and does not provide roosting opportunities. Although it is unlikely to support an abundance of prey, the Southern Myotis may forage over this water body on occasion.
Senecio spathulatus	Coast Groundsel	Endangered	Not listed	Although *S. spathulatus* has been recorded within the Project Area recently, the accuracy of the record is ~1km and given the lack of suitable habitat it is considered likely that the record was located in the adjacent Kamay Botany Bay National Park.
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner (SSFCF)	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner (SSFCF)	Endangered Ecological Community	Not listed	Although a threatened ecological community equating to the SSFCF has been previously mapped at three separate patches within the Project Area, ground truthing of these areas identified one as being un-vegetated and the remaining two not consistent with the final determination of the community. Outside of these areas, no potential habitat for SSFCF was identified within the Project Area.

The Project Area was considered unlikely to support any marine or freshwater threatened species given the lack of suitable habitat resources.

No NSW or Commonwealth listed Threatened Ecological Communities (TEC) were found within the Project Area. SMCMA (2009) mapping indicated that *Coastal Flats Swamp Mahogany Forest* occurs within the Project Area, in three separate patches along the eastern boundary. This SMCMA community, by definition aligns with TSC Act listed TEC, *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions* (*Swamp Sclerophyll Forest on Coastal Floodplains*).

The SMCMA mapping notes that the vegetation in question has not been ground truthed or surveyed and has been interpreted to be present by aerial photograph imagery only. Based on this knowledge, the field survey specifically assessed the potential for the TEC to occur within the Site, in the locations shown on the SMCMA (2009) vegetation mapping of the region. It was determined that the vegetation present within the Site did not comprise the TEC, and instead aligned more closely with *Coastal Sand Apple-Bloodwood Forest*, which the SMCMA mapping shows within the adjoining Kamay Botany Bay National Park. The vegetation present within the Site was considered to align with *Coastal Sand Apple-Bloodwood Forest* given the presence of diagnostic tree, shrub and ground cover species, as described by the SMCMA (2009). *Coastal Sand Apple-Bloodwood Forest* does not align with any TEC under the TSC Act.

19.4.7 Critical Habitat

Habitat critical to the survival of an endangered or critically endangered species, population or ecological community can be identified under the TSC Act and listed on the Register of Critical Habitat kept by the OEH. The Project Area does not contain declared critical habitat as listed under the TSC Act or the OEH Register of Critical Habitat.

The identification of critical habitat for the Register of Critical Habitat, including location and extent information, is a matter of ecological judgement, and is based on the most up-to-date scientific information available to the Threatened Species Scientific Committee and the Minister for DSEWPaC. There are no areas of critical habitat listed under the EPBC Act that are relevant to the Project Area or the surrounding area.

19.4.8 Noxious Weeds

Three noxious weeds, listed by NSW DPI for the Sutherland Shire Council listed under the *Noxious Weed Act 1993* (NW Act) were recorded in the Project Area, including:

- Bitou Bush *Chrysanthemoides monilifera* subsp. rotunda;
- Castor Oil Plant *Ricinus communis*; and
- Lantana *Lantana camara*.

These are all listed as Class 4 noxious weeds by NSW DPI. The requirements for the control of Class 4 noxious weeds, under the NW Act include:

- *'the growth of the plant must be managed in a manner that reduces its numbers, spread and incidence and continuously inhibits its reproduction'*; and
- *'the plant must not be sold propagated or knowingly distributed'*.

The latter requirement is not relevant to Caltex or this Project.

19.5 Impact Assessment

The Project would not result in the removal of any planted or native vegetation. Whilst there are patches of vegetation within the Project Area, these areas would not be cleared or impacted as a result of the proposed works. Given the lack of impacts to vegetation within the Site, the potential for impacts to native biota is considered to be negligible.

The Project is also unlikely to result in any impacts on surrounding water bodies (refer to **Chapter 11 Surface Water, Wastewater and Flooding**). As the Project is expected to have a negligible impact on stormwater flows, a beneficial impact on stormwater quality and a neutral impact on wastewater flows and quality, no adverse impacts on local aquatic biota are expected. Therefore marine and aquatic biota have not been considered further.

19.5.1 Threatened Biota

A number of species listed as migratory under the EPBC Act are predicted to occur within a 5 km buffer of the Project Area. While some of these species would be expected to pass over the Project Area on occasions, or may be resident in the adjacent Kamay Botany Bay National Park or Towra Point Nature Reserve, the Project Area does not provide important habitat for an ecologically significant proportion of any of these species, hence no Commonwealth significant impact criteria assessments were undertaken for listed migratory species.

The results of the habitat suitability assessments (refer to **Appendix I Ecology Impact Assessment**) indicate that two threatened fauna species, one threatened flora species, one threatened ecological community and one Ramsar wetland listed under the TSC and/or EPBC Act have been recorded or are considered as likely to occur within, or be relevant to the Project Area, and which have the potential to be impacted by the Project. Accordingly, assessments aligned with the criteria established in Appendix 3 of the *Guidelines for Threatened Species Assessment* (DEC & DPI 2005) (the NSW assessment of significance) and Commonwealth significant impact criteria assessments for the following threatened biota were undertaken:

1. Green and Golden Bell Frog *Litoria aurea*;
2. Wallum Froglet *Crinia tinnula*;
3. Coast Groundsel *Senecio spathulatus*;
4. Coastal Flats Swamp Mahogany Forest *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner*; and
5. Towra Point Nature Reserve Ramsar Site.

The results of the assessments indicate that no significant impact is considered likely to the Wallum Froglet *Crinia tinnula* or Coast Groundsel *Senecio spathulatus*, given the lack of suitable habitat within the Project Area.

The assessments conclude that it is unlikely that the Project has the potential to significantly impact the Green and Golden Bell Frog given that no potential breeding sites or foraging habitats would be negatively impacted as a result of the proposed works and connectivity around the Project Area would remain the same.

The significant impact criteria assessment concludes that it is unlikely that the proposal has the potential to significantly impact Towra Point Nature Reserve Ramsar Site.

19.5.2 Matters of National Environmental Significance

Three MNES were considered to be potentially relevant for the Flora and Fauna Assessment:

- listed threatened species and communities;
- listed migratory species; and
- Ramsar wetlands of international importance.

Based on the results of the Flora and Fauna Assessment, the Project is unlikely to significantly impact on any MNES, and therefore a Referral to the Minister under the EPBC Act is not required.

19.5.3 Key Threatening Processes

A Key Threatening Process (KTP) is defined under Schedule 3 of the TSC Act as '*a threatening process*' where the process '*threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities*'.

The Project could potentially cause an increase in the following KTPs as listed under the EPBC Act:

- *Anthropogenic climate change* - Greenhouse gas emissions would result from increased traffic to, from and within the Site during construction, however there would be a net reduction in overall traffic movements for the finished product terminal. Also the proposed operation would require significantly less energy to operate than the existing refinery. Overall, the potential impact of this KTP should decrease.
- *Competition and grazing by the feral European rabbit* (*Oryctolagus cuniculus*) - rabbit scats were observed within the Project Area. However, the Project is unlikely to increase the prevalence of rabbits within the Project Area and should not contribute to the increase of this KTP.

The Project could potentially cause an increase in the following KTPs as listed under the TSC Act:

- *Anthropogenic climate change* - Greenhouse gas emissions would result from increased traffic to, from and within the Site during construction. However, there would be a net overall loss in overall traffic movements for the finished product terminal. Also the proposed operation would require significantly less energy to operate than the existing refinery. Overall, the potential impact of this KTP should decrease.
- *Invasion of native plant communities by Chrysanthemoides monilifera (bitou bush and boneseed)* - Bitou Bush *Chrysanthemoides monilifera subsp. rotunda* was recorded within the Project Area. The Project has the potential to increase the presence of Bitou Bush during construction and operation, through the movement of vehicles and increased disturbance within the Project Area. The Project therefore has the potential to cause the spread of this species off-site, through wind and water seed dispersal.
- *Invasion and establishment of exotic vines and* scramblers - construction of the Project has the potential to increase the spread and establishment of exotic vines and scramblers through the disturbance of soils and the spread of seeds. Where exotic vines and scramblers are already present within the Project Area, there is potential for these species to be spread via construction vehicles and natural dispersal into cleared and disturbed areas.

19.5.4 Construction Impacts

A number of impacts have the potential to occur during the construction phase of the Project.

The Project is unlikely to cause direct ecological impacts given the works proposed and the limited vegetation within the Site. Nevertheless, the following direct impacts have the potential to occur as a result of the works:

- temporary and localised alterations to potential habitat for threatened species, including perch locations on tanks, and potential dispersal habitat for threatened amphibians during the construction of the Project;
- increased potential for a number of key threatening processes as listed under the TSC and EPBC Acts (**Section 19.5.3**); and

- potential impacts to the three patches of vegetation on Site. While there would be no clearing of vegetation from within the Project Area, mitigation measures must be implemented to control access to these vegetated areas to limit the potential for accidental impacts.

19.5.5 Operation Impacts

No on-going ecological impacts are expected during the operation of the Project. Once construction works are completed, activity levels on Site are expected to be less than those currently. Environmental management on Site will continue in line with Caltex's current operating procedures and the relevant Environment Protection Licence.

19.6 Mitigation

The following section identifies measures to avoid and mitigate the potential impacts on ecological values associated with the Project. No offset strategy is required for this Project, as the potential impacts are considered to be of low significance.

19.6.1 Impact Avoidance

Impacts on ecology have been avoided by locating the Project footprint in areas lacking ecological values. No vegetation clearing or loss of natural habitat features is envisaged. The three vegetation areas within the Site would not be impacted by the proposed works, nor would there be ongoing impacts to ecological values once construction is complete.

19.6.2 Impact Mitigation

An overview of the ecological mitigation and environmental management measures has been provided below.

Construction Environmental Management

A Construction Environmental Management Plan (CEMP) would be prepared for the construction phase of the Project and would include measures to minimise or avoid impacts on native biota. Management plans, mitigation measures and environmental management measures would be included in the CEMP through the establishment of a Biodiversity and Weed Management Plan (BWMP). The BWMP would be developed and included in the CEMP as a sub-plan to mitigate impacts on biodiversity, and to guide weed control activities throughout construction and operation of the Project. The following strategies and mitigation measures would be incorporated as part of the BWMP:

1. management of weeds;
2. restriction of access to existing vegetated areas;
3. management of sediment, erosion and pollutant run-off; and
4. fauna management.

Management of Weeds

Three noxious weeds were recorded within the Site. In addition, numerous other species of noxious weeds are known to occur within the Sutherland Shire LGA. The BWPM would aim to limit and control the spread of noxious weeds within the Site via the following methods:

- the provision of noxious weed information sheets to construction contractors to help identification of relevant noxious weeds during construction;
- strict stockpiling control and eradication of all noxious weeds as per the NW Act for each weed as per NSW DPI specifications for Sutherland Shire LGA;
- target and control noxious weeds as well as areas of potential new outbreaks including soil stockpiles and any other disturbed areas;
- use of 'frog-friendly' and 'wetland friendly' herbicides such as Roundup Biactive or Weedmaster DUO for the control of noxious weeds. Frogs have been found to be very sensitive to some herbicide products and in particular to the surfactants, or wetting agents used to improve the effectiveness of the chemicals (Mann and Bidwell, 1998); and
- development of monitoring programs for noxious weeds on Site and in the surrounding area, during construction and operation of the Project.

Restriction of Access to Existing Vegetated Areas

While no vegetation clearing is required as part of the Project, existing vegetation on Site should be clearly marked on all Site plans and construction diagrams. It would be made clear that these areas are no-go zones for construction activities related to the Project. Existing vegetation should be clearly fenced off prior to the commencement of construction activities, and should remain fenced off until the completion of works.

Management of Sediment, Erosion and Stormwater Run-off

Sedimentation, erosion and stormwater run-off created from construction activities has the potential to influence water quality and vegetation condition for surrounding communities and catchment areas.

Standard industry measures for sediment runoff on urban developments should be implemented according to the '*The Blue Book* Volumes 1 and 2 (Landcom 2004), and *Managing Urban Stormwater: Soils and Construction Volume 1,* (DECC 2008). Specific sedimentation and stormwater runoff controls should be developed to protect sensitive ecological receptors adjacent to the Site, such as Kamay Botany Bay National Park. These measures have been included in **Chapter 9 Soils, Groundwater and Contamination**.

Fauna Management

While no natural fauna habitat features would be removed as a result of the proposed works, several man-made structures within the Site have the potential to provide habitat for native fauna species, such as perch points and the existing network of pipes and drains. To minimise the potential for impacts to native fauna species during construction works, the following measures are recommended for inclusion in the BWPM:

- if any common species of frogs are found within the Project Area, works should cease until frogs have been relocated to areas outside the area of impact;

- if any threatened frogs e.g. Green and Golden Bell Frog or Wallum Froglet are identified within the Site, works should cease and active searching should be undertaken by a qualified zoologist experienced in the identification and management of the Green and Golden Bell Frog and Wallum Froglet;
- provide all construction workers on Site with identification sheets relating to the two threatened frog species predicted to occur within the Site (refer to **Appendix I Ecology Impact Assessment**);
- all trenches should be inspected prior to works each morning. Any frogs that become trapped within trenches should be assessed by a suitably qualified ecologist and then released into the nearest suitable habitat if uninjured;
- wash down protocols to prevent the spread of amphibian chytrid disease *chytridiomycosis* would be included within the BWPM. Protocols would be consistent with OEH guidelines (DECC, 2008b). Wash down would occur whenever vehicles enter or leave an excavation area;
- wash down protocols of construction vehicles, machinery, tools and footwear to prevent the spread of root-rot fungus (*Phytophthora cinnamomi*) would be included within the BWMP; and
- if fauna are found to be utilising the Site, or a nest, den or roost is found, work in the immediate area is to stop and the animals are to be allowed to move off freely, or relocated by an authorised person to an area outside the construction footprint.

19.7 Summary

Provided the measures outlined above, and summarised in **Table 19-2** below, are incorporated into the CEMP for the Project and implemented during construction, no adverse impacts are likely to occur on the ecological values identified within this assessment.

Table 19-2 Management and Mitigation Measures - Ecology

Management and Mitigation Measures	Implementation		
	Design	Construction	Operation
Management of Weeds			
A Biodiversity and Weed Management Plan (BWMP) would be prepared in order to limit and control the spread of noxious weeds within the Site. It would include the following: • wash down procedures to reduce the spread of weeds via vehicles and machinery; • measures to target potential new weed outbreaks including soil stockpiles and any other disturbed areas; • outline monitoring programs for noxious and problematic weeds on sites and in the surrounding areas; • measures for strict stockpiling control to help eradicate all noxious weeds as per NSW DPI specifications for Sutherland Shire LGA; • include a list of 'frog-friendly' and 'wetland friendly' herbicides such as Roundup Biactive or Weedmaster DUO for the control of noxious weeds; and ensure that only amphibian friendly herbicides are used; • wash down protocols for construction vehicles and machinery to prevent the spread of root-rot fungus (*Phytophthora cinnamomi*); and • all personnel undertaking routine management activities of any noxious weeds should be appropriated trained and all contractors should hold the necessary permits and licenses.	✓	✓	✓

Management and Mitigation Measures	Implementation		
	Design	Construction	Operation
Restriction of Access to Existing Vegetated Areas			
A BWMP would be prepared in order to limit potential impacts to existing vegetation outside of the area of proposed works, but within the Site It would include the following: • existing vegetation on Site would be clearly marked on all Site plans and construction diagrams, with clear indications of no-go zones within all vegetated areas; • existing vegetation would be clearly signposted and fenced off prior to the commencement of construction activities, and should remain fenced off until the completion of works; and • absolutely all works would be limited to the defined construction footprint.	✓	✓	
Ecology- Fauna Management			
To minimise the potential for impacts to native fauna species, the BWMP would be developed and include following measures: • if any frogs are found within the Project Area, works would cease until frogs have been relocated to areas outside the area of impact; • if any threatened frogs e.g. Green and Golden Bell Frog or Wallum Froglet are identified within the Site, works would cease and active searching should be undertaken by a qualified zoologist experienced in the identification and management of the Green and Golden Bell Frog and Wallum Froglet; • all trenches would be inspected prior to works each morning. Any frogs that become trapped within trenches would be assessed by a suitably qualified ecologist or veterinarian and then released into the nearest suitable habitat if uninjured; • identification sheets would be provided to all construction workers on Site for the two threatened frog species predicted to occur within the Site; • wash down protocols to prevent the spread of Amphibian Chytrid Disease (chytridiomycosis) would be implemented at relevant work areas. Protocols would be consistent with OEH guidelines (DECC, 2008b); • 'frog-friendly' and 'wetland friendly' herbicides such as Roundup Biactive or Weedmaster DUO would be used for the control of noxious weeds; and • if fauna are found to be utilising the Site, or a nest, den or roost is found, work in the immediate area is to stop and the animals are to be allowed to move off freely, or relocated by an authorised person to an area outside the construction footprint.	✓	✓	✓

20 Cumulative Impact Assessment

20.1 Introduction

As requested by the DGRs, certain technical assessments have considered not only the impacts of the Project alone, but also the potential cumulative effects of the Project alongside other proposed developments. Where necessary a Cumulative Impact Assessment (CIA) was included in the technical chapters of this EIS. This chapter summarises the findings of those cumulative assessments.

20.2 Scope of Assessment

The Director General's Requirements (DGRs) (refer to **Appendix A DGRs**) requested '*an assessment of the potential impacts of all stages of the development, including any cumulative impacts, taking into consideration relevant guidelines, policies, plans and statutes'.*

The DGRs also ask that the proponent *'Estimate the cumulative impacts for the overall site and the surrounding potentially hazardous developments in the area and demonstrate that the proposed development does not increase the cumulative risks of the area to unacceptable levels'.*

In addition, the Environmental Protection Authority (EPA) requested cumulative impacts be considered as part of the noise assessment, taking into account other projects in the area including '*the Maintenance Dredging around Caltex's wharf, the demolition of the Caltex Lube Oil Refinery and the possible future demolition of the Continental Carbon premises'* depending on the timeframe of these projects.

It should be noted that the demolition of the Caltex Lube Oil Refinery has already occurred and as such has not been considered as part of this EIS.

20.3 Legislation and Planning Policy

Environmental Planning and Assessment Act 1979

Under Part 5 of the EP&A Act there is a duty for a determining authority to consider the environmental impacts of proposed works. The supporting *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) states that '*for the purpose of the [EP&A] Act, the factors to be taken in to account when consideration is being given to the likely impact of an activity on the environment include…any cumulative environmental effect with other existing or likely future activities*'.

There is no provision in Part 4 of the EP&A Act explicitly requiring a consideration of the cumulative environmental effect in determining a development application. However, when determining a development application, the consent authority is required, under section 79C(1)(b) of the EP&A Act, to take into account the '*likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality*'.

There is also case law[1] where the consideration of cumulative impact assessment has been successfully contested under the EP&A Act.

[1] Environmental Law News, Spring 2009

20.4 Method of Assessment

20.4.1 Introduction

Cumulative Impact Assessment (CIA) is a receptor based assessment, whereby in order to have a cumulative effect two projects or impacts need to affect the same receptor. Therefore if the Project is not affecting a receptor or group of receptors 'alone' then it cannot have a cumulative effect with another project or action. The only exception to this rule is if one of the potential cumulative projects weakens a management or mitigation measure to the point where a Project residual impact becomes significant again. As such, CIA focusses on the residual impacts (i.e. those impacts that remain post mitigation) from a project.

Cumulative impacts can be formed antagonistically[2], synergistically[3] or additively[4]. They are often caused by an action in combination with other past, present, and reasonably foreseeable future human actions[5].

20.4.2 Approach

The first stage of CIA is to understand the adverse residual impacts of the Project. The second stage is to identify any other development nearby that may affect the same receptors as the Project and/or change the effectiveness of each other's mitigation and management measures. Other relevant projects that may generate a cumulative impact with the proposed works have been identified using the following assessment parameters.

- Spatial parameter - The spatial parameter will depend on the characteristics of the environmental impact and the likely area over which any residual impact would occur. For example, an air quality impact would potentially affect a wider area than a noise impact and would therefore affect different human or environmental receptors in different ways.
- Temporal parameter – The temporal parameter relates to how far into the future or the past the assessment considers cumulative proposals or activities. Projects that are operational have been considered as they form part of the existing environmental baseline for each environmental aspect assessed in this EIS (see **Chapters 8-19**). Projects that are not yet on exhibition have been discounted as their assessments do not contain enough detail on residual effects or final design to allow a robust cumulative impact assessment to take place.

Therefore this CIA has considered the following:

- development applications that are on exhibition;
- development applications that have completed exhibition but are not yet determined; and
- applications that have gained development approval but are not yet fully operational.

[2] Opposing each other potentially resulting in a lower overall environmental effect.
[3] Where two or more impacts produce a total impact greater than the sum of the individual parts. For example oxides of nitrogen and volatile organic compounds each have impacts on human health, but when they combine they form ozone, their combined impact is potentially greater and of more concern to human health.
[4] For example two sources of equally powerful noise can combine to create a greater overall impact.
[5] Defined by the European Commission 1999.

In order to identify relevant development, two databases were reviewed in November 2012:

- Major Project Assessments register on the NSW Department of Planning and Infrastructure (DP&I) website; and
- public notices and the 'invitations to comment' register on the Commonwealth Department of Sustainability, Environment, Water, Population and Communities' (DSEWPaC) website.

A review of these databases was considered the most effective way of identifying future projects that are likely to have significant residual impacts, and therefore may have a cumulative effect with this Project.

20.4.3 Guidance and Standards

There is no guidance on undertaking interactive or cumulative impact/effect assessment in NSW or Australia. Therefore, this assessment has made reference to the European Commission (EC) *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions 1999* and the Canadian Environmental Assessment Agency *Cumulative Effects Assessment Practitioner's Guide 1999*.

20.4.4 Evaluation of Magnitude of Impact

The criteria adopted in each of the technical assessments (refer to **Chapters 8-19**) have been used to assess the significance of any cumulative impact.

20.5 Cumulative Impact Assessment

20.5.1 Cumulative Impact Scoping

Introduction

As discussed, for a cumulative effect to occur, two impacts need to affect the same receptor. The key receptors in the local area include the community of Kurnell and the environmental receptors of Botany Bay, Towra Point Nature Reserve, Towra Point Aquatic Reserve, Kamay Botany Bay National Park, Marton Park Wetlands and Oyster Farming in Quibray Bay and Botany Bay. Equally the heritage value of the refinery is also a consideration.

The Project has the potential to cause a number of environmental impacts. These have been grouped, assessed and discussed under twelve different environmental aspects (refer to **Chapters 8-19**). For the majority of these aspects, there are expected to be no significant residual impacts during construction or operation on any of the identified receptors. As such in many cases a CIA is not required. Provided the proposed management and mitigation measures (refer to **Chapter 21 Management and Mitigation Measures**) are implemented, and remain effective, there would be no likely residual adverse impact for the following aspects given the existing environment:

- Soils, Groundwater and Contamination (refer to Chapter 9);
- Human Health and Ecological Risk (refer to Chapter 10);
- Surface Water, Wastewater and Flooding (refer to Chapter 11);
- Air Quality and Odour (refer to Chapter 13);
- Greenhouse Gas (refer to Chapter 14);
- Waste Management (refer to Chapter 17); and
- Ecology (refer to Chapter 19).

For the remaining aspects, either the Project is likely to generate residual adverse impacts or consideration of cumulative impacts has been specifically requested. Therefore these aspects are discussed further below.

Hazards and Risk

Following the cessation of refining activities there would be a reduction the number of processes and the variety of petroleum products stored on the Site. Therefore the Project would effectively lower the risk profile of the Site.

As part of the Project, Caltex have, and would continue to, upgrade many of the safety mechanisms that currently operate on the Site. These upgrades would help to further reduce the risk profile for Site during and following the conversion works.

The Quantitative Risk Assessment that has been conducted for proposed terminal operation has demonstrated that the risk levels would be significantly reduced following conversion of the refinery to a terminal.

Appropriate risk levels for residential development in NSW have been established by NSW HIPAP No. 4 as one in a million. The one in a million cumulative risk level for operation of the Project would remain on Site with the small exception around one tank which extends a short distance into the adjacent Kamay Botany Bay National Park.

There would be no increase in cumulative risk associated with the Project.

Noise and Vibration

The acoustic environment surrounding the Project, including the nearest residential receptors at Kurnell, are already influenced by the noise from the existing operations. This noise environment is currently governed by noise limits laid out in EPL 837 (refer to **Appendix B EPL**).

During construction, there would be a number of construction plant (equipment) operating (refer to **Table 12-7** of **Chapter 12 Noise and Vibration**). There would also be a small number of additional vehicles to the local road network during construction, prior to the shutdown of the refinery. The combination of these noise sources would have a negligible impact on the surrounding receptors and would be within both the Project Specific Noise Levels and the EPL. Despite this, the potential of an in-combination noise impact with surrounding projects has been considered in **Section 20.5.2**.

Following cessation of refining at the Site, operational noise would reduce substantially and operational noise levels as a result of the Project would remain. These are predicted to be below the INP daytime, evening and night time noise criteria at the closest receivers. It can therefore be concluded that no cumulative noise impact is predicted due to the operation of the Project.

Socio-Economic

This Project is being proposed on the basis of economic efficiency and continuing to supply a reliable source of finished product to NSW and ACT. This has been based on Caltex's internal assessment of economic efficiency (refer to **Chapter 2 Project Need and Alternatives**).

The socioeconomic impact of the Project would be most significant in the Sutherland Shire Local Government Area (SSLGA) where some 70% of employees reside. Direct salary loss from the refinery shut-down has been estimated to be approximately $111 million annually.

To help the staff that would no longer be required at the Site move on in their lives and careers, Caltex has implemented an employee program named “Stay, Focus & Develop”. This program would provide transitional support for any affected staff. The intent of the program is to enable the achievement of safe and reliable operations at the Site, while demonstrating a high level of care for employees as they prepare for the next phase of their lives and careers following the shutdown on the refinery. This program incorporates transitional support through generous redundancy benefits, outplacement support services, careers fairs featuring prospective employers, vocational training allowances, health and wellbeing programs and services, and industry retraining.

Caltex has indicated that $80 million dollars is budgeted to be spent on redundancies, retraining and supporting works.

Although the residual socio economic impact of the Project in the area would be significant, conversion to terminal operation would allow some of the existing staff to be retrained and redeployed once the Project is operational and the Site is once again economically viable.

Transport and Access

While not a significant impact, the Project (during construction) would add a small number of vehicles to the local road network. However, as described in **Chapter 16 Transport and Access**, the Level of Service for the peak construction year would remain unchanged.

It should be noted, however, that the road network around the Site already experiences congestion issues during peak periods without inclusion of the vehicles generated by the Project. This is illustrated, in particular, by the fact that the LOS for Captain Cook Drive is currently in the D range. Consequently, construction vehicles utilising these roads during the AM or PM Peak Hour would experience traffic congestion and potential delays.

It should also be noted that, following the shutdown of the refinery in the second half of 2014, road transportation of products from the Site would cease (except in exceptional circumstances) and worker numbers on Site would gradually decrease from approximately 885 to 100 full time employees, resulting in a significant improvement to the local traffic environment.

Heritage

The Site is listed as ‘Australian Oil Refinery’, an ‘archaeological heritage’ item on the SEPP (Kurnell Peninsula). The decommissioning and conversion of the existing refinery to a finished product terminal would result in a residual adverse impact. Although decommissioning would impact the heritage value of the refinery, the conversion works would conserve some historical value through continued use of the Site as a finished product terminal. A Heritage Management Strategy would be developed to mitigate the residual impacts from the Project as described in **Chapter 18 Heritage**.

Conclusion

The majority of the impacts related to the Project would be avoided or mitigated through the implementation of the measures outlined in **Chapter 21 Management and Mitigation Measures**. Residual impacts relating to Heritage would be managed through the production and implementation of a Heritage Management Strategy. Any impacts related to wastewater and noise would be managed by adhering to the wastewater and noise limits respectively within EPL 837.

During peak construction, traffic may increase from the Site. Whilst this increase would not change the LOS along Captain Cook Road, there would nonetheless be a small increase in traffic which could result in a cumulative impact with other projects.

Whilst no adverse noise impacts are expected, a consideration of cumulative noise impacts has been requested. Therefore the noise from the Project alongside other relevant developments has been assessed in more detail below.

In conclusion, noise and traffic impacts have been considered below.

20.5.2 Cumulative Impact Assessment

Approved and Committed Development

The following section considers approved and committed developments that are not yet fully operational, which could give rise to potential cumulative impacts in combination with the Project.

Table 20-1 identifies projects that meet the requirements of **Section 20.4.2**.

Table 20-1 Potential Cumulative Projects

Project Name	Reference No.	Location	Proposed Works	Approximate Commissioning Date	Status
Botany Bay Cable Crossing and modifications	MP 06_0284 Mod 3	Bunnerong Rd, Matraville to, Captain Cook Drive, Kurnell	Ausgrid propose to construct five rock mounds over a 50 metre section of the cable that cannot be buried to the required depth below the sea floor.	Modification 3: Committed Development (DGRs Issued) Cables have been laid. Remaining work at Kurnell substation to be completed in 2015.	Modification 3: 12/08/2011
*Concept Plan - Mixed Use Development, Cronulla Sharks	10_0229	461 Captain Cook Drive , Woolooware	Concept Plan application seeking approval for a mixed use development .	Approved Development.	27/08/2012
*Stage 1 - Retail Development, Cronulla Sharks	10_0230	461 Captain Cook Drive , Woolooware	Construction of a Neighbourhood Retail Centre and redevelopment of the existing Sharks Leagues Club facilities.	Committed Development (DGRs Issued).	25/03/2011
Caltex Kurnell Port and Berthing Project	SSD-5353	Botany Bay	Dredging of Botany Bay.	Q3 2013	On Exhibition
Continental Carbon Facility	DA 12/0760	145 Sir Joseph Banks Drive Kurnell	Demolition and remediation of the Continental Carbon Facility.	March 2013	Approved
Boral Kurnell	DA 12/0808	69-83 Sir Joseph Banks Drive Kurnell	Rehabilitation of the brick stockpile on site.	As soon as approved.	Not yet approved.

The Botany Bay Cable Crossing project is now largely complete with minor substation work required in 2015. These minor works are unlikely to result in cumulative impacts with the Project in terms of traffic and noise.

The Cronulla Sharks developments (10_0229 and 10_0230) do not share the same spatial or temporal parameters as the Project given the likely residual impacts of the Project.

The mixed use development next to the Cronulla Sharks ground is a development 6 km to the west of the Project. Consultation with RMS and SSC identified that it was not a development needing consideration in terms of potential cumulative impacts (refer to **Chapter 6 Consultation**) and does not share any of the same spatial parameters as the Project.

The Continental Carbon Facility demolition and remediation would be complete by the time construction of the Project commences. The Continental Carbon Facility is located approximately 1 km south of the Project Area. As per the Statement of Environmental Effects (SEE) undertaken for the development (GreenPlus, 2012), the majority of the demolition works would be completed prior to August 2013. There would be no significant overlap in construction works between the projects. The works at the Continental Carbon Facility in isolation do not have residual environmental impacts in terms of noise, traffic or any other environmental aspects. Therefore given the Continental Carbon Facility timescales and the conclusions of the assessments in the approved SEE, these works are unlikely to result in any significant cumulative impacts with the Project.

The Boral Kurnell project involves the rehabilitation of an existing brick stockpile at the former Boral brickworks site located along Sir Joseph Banks Drive immediately south west of the CLOR, and approximately 600 m south west of the Project Area. The works are minor in nature and the majority of any noise of traffic generating works would be completed in 2013. There would be no significant overlap in construction activities between these works and the Project. The works at the Boral Kurnell project are not expected to have residual environmental impacts. As such, these works are unlikely to result in any significant cumulative impacts with the Project.

Therefore, the Port and Berthing Project (SSD-5353) is the only proposed development that could affect the same noise and traffic sensitive receptors as the Project.

Cumulative noise and traffic assessments for the Project and the Port and Berthing Project are provided below.

Noise and Vibration

Current noise levels for the Site inclusive of all operating refinery plant are presented in **Table 12-12** of **Chapter 12 Noise and Vibration.** Current noise levels are shown to be within the limits of the Site EPL (**Appendix B EPL**).

The construction impacts from the Kurnell Port and Berthing Project have identified potential residual impacts at residences on Prince Charles Parade and the Rangers' House as these are the closest residential receivers. Maximum construction noise levels including piling and impulsive noise sources where predicted to be between 56 and 49 dBA for day time construction works (URS, 2013).

Construction noise levels for the proposed Project are identified in **Section 12.7.1** of **Chapter 12 Noise and Vibration** and show predicted construction noise levels of 34 dBA at Prince Charles Parade and 28 dBA at the Rangers' House. It can therefore be concluded that the predicted noise contribution from the Project would have an acoustically insignificant contribution to the construction noise levels from the Kurnell Port and Berthing Project.

Due to the anticipated small volume of vehicle movements from both the Kurnell Port and Berthing Project and the Project along Captain Cook Drive, cumulative road traffic noise impacts during construction will be less than 2 dB and as such considered negligible impact.

Transport and Access

The construction stage of the Kurnell Port and Berthing Facility Upgrade Works are expected to commence in Q3 2013 and continue to Q2 2015. The EIS produced for the Kurnell Port and Berthing Facility Upgrade Works (SSD-5353) noted one period of time when there would be a number of trucks accessing the Kurnell Wharf. There would be nine days between Q3 2014 and Q2 2015 when there would be 100 concrete pouring trucks accessing the wharf. There could be up to 25 trucks on one day with the remaining days seeing up to nine trucks in one day (URS, 2012).

By the time there is a potential for a cumulative impact of construction traffic between the two projects, the refinery operations at the Site would have ceased (second half 2014) and the number of workers accessing the Site would be gradually reducing from approximately 885 to 100. Therefore, traffic generation from the Project would be significantly lower than at present and the potential for a cumulative impact associated with the construction stage of the Kurnell Port and Berthing Facility Upgrade Works and the Project would be negligible.

Conclusions

A number of environmental aspects were required to be assessed in order to complete the cumulative assessments. These assessments have concluded that the Project is unlikely to result in a significant adverse cumulative impact on any of the surrounding community or environmental receptors.

21 Management and Mitigation Measures

The preceding chapters of this EIS describe the potential impacts of the Project and identify a range of measures to manage risk and avoid, mitigate or offset impacts. This chapter provides a summary of the proposed management and mitigation measures. These measures would provide a basis for the conditions of consent that would be issued to Caltex should the Project be approved.

This chapter details how mitigation and management measures would be implemented and monitored through a Construction Environmental Management Plan (CEMP) for the Project. Any operational measures presented below would be incorporated into existing management plans and operating procedures currently in place at the existing Site.

21.1 Draft Mitigation and Management Measures

The adoption of the mitigation and management measures discussed in **Chapters 8 - 19** is an important component of the Project and reinforces Caltex's commitment to controlling its impact on the environment. These measures would be complemented by an ongoing process of community and regulatory engagement, before and during the construction and operation of the Project. The details of the proposed engagement process are set out in **Chapter 6 Consultation**.

Table 21-1 presents the proposed management and mitigation measures, and confirms the proposed timeframe for their implementation. If required, these measures may be modified following review of any formal submissions received during the EIS exhibition, and as a result of subsequent discussions with NSW Department of Planning and Infrastructure (DP&I) and other stakeholders.

Table 21-1 Mitigation and Management Measures

Item	Mitigation and Management Measures	Implementation of Mitigation Measures		
		Design	Implementation	Operation
General				
A1	Caltex would carry out the proposed works in accordance with the EIS and the approval conditions.	✓	✓	✓
A2	Caltex would implement reasonable and practicable measures to avoid, or minimise impacts to the environment that may arise as a result of the Project.	✓	✓	✓
A3	Caltex would ensure that the Project contractor prepares and implements a Construction Environmental Management Plan (CEMP) to manage any Project impacts. This would be reviewed and approved by a Caltex Environmental Management Representative (EMR).		✓	
A4	Caltex would appoint an EMR to monitor the implementation of all required environmental mitigation and management measures. The EMR would ensure that all measures were being effectively applied during the proposed works and that the work would be carried out in accordance with the CEMP and all environmental approvals and legislative conditions.		✓	
A5	Caltex and the various works' contractor personnel would undergo training in accordance with the CEMP and currently implemented environmental and safety measures agreed as part of the Project approval.		✓	

Item	Mitigation and Management Measures	Implementation of Mitigation Measures		
		Design	Implementation	Operation
Hazard and Risk				
B1	A program of routine testing, inspection and maintenance would be developed for each new piece of equipment or function of instrumentation to be added to the preventative maintenance program already established for existing plant and equipment.		✓	✓
B2	The recommendations of the Fire Safety Study would be implemented for the design and operation of the terminal.	✓	✓	
B3	The Process Hazard Analysis Recommendations would be implemented for the design and operation of the terminal.	✓	✓	
B4	The spill response plan for the Site would be updated for the proposed terminal.		✓	
B5	Caltex would review hardware protection in place and proposed to ensure the risk of filling low flash point material into tanks designed for high flash point usage is minimised. Particular attention to human factors issues at manifolds.	✓	✓	
B6	Caltex would determine need for additional means of communication, e.g. for lone worker on the proposed terminal.		✓	
B7	Caltex would review the procedures used for potentially hazardous manual operation to ensure they are appropriate and sufficient for any increased frequency of use.		✓	
Soils Groundwater and Contamination				
C1	A Soils and Erosion Management Plan would be developed as part of the CEMP to manage the excavation, testing, stockpiling, reuse and rehabilitation of soils. This plan would outline: • the areas where soil disturbance is likely; • soil testing procedures; • soil handling procedures; • locations where soil would be stockpiled on-site for either removal, treatment or reuse; • procedures to reduce erosion and the spread of dust; • restricting traffic to defined roads or tracks where necessary; and • the rehabilitation of bare soil following completion of the construction works.		✓	

Item	Mitigation and Management Measures	Implementation of Mitigation Measures		
		Design	Implementation	Operation
C2	All materials would be stockpiled in accordance with 'The Blue Book' Managing Urban Stormwater - Soils and Construction Volume 1 and 2 (Landcom, 2004). Principal controls would include the following: • silt fences would be installed around stockpiles to reduce erosion and protect vegetation or Site infrastructure as necessary; • silt and sediment traps would be installed across stormwater drains in proximity to excavation areas; • stockpiles would be restricted to cleared areas and not impact any vegetation; • stockpiles would be placed on impermeable sheeting; • stockpiles would be covered and wetted down in order to reduce dust creation; and • stockpiles would not be located in close proximity to any stormwater drainage systems.		✓	
C3	The Soils and Erosion Management Plan would also outline the inspection program for any erosion control structures and bunded areas.		✓	
C4	Excavated soils would be tested for both contaminants and odour using standard practices (e.g. soil vapour and soil sampling etc.).		✓	
C5	Clean materials would be separated from contaminated materials for reuse as backfill where required.		✓	
C6	A Contamination Management Plan would form part of the CEMP for the Project. This plan would outline measures for testing, classifying, handling, storing and managing contaminated soils and contaminated groundwater that may be encountered.		✓	
C7	Suspected contaminated materials would be assessed and classified in accordance with EPL requirements and NSW (2009) *Waste Classification Guidelines: Part 1: Classifying Waste*, batched, further tested (where required) and disposed by a licenced contractor.		✓	
C8	Disposal of any contaminated soils or groundwater would be in accordance with EPL requirements and NSW DECCW's *Waste Classification Guidelines* and the Contamination Management Plan (CMP) for the Project. Contaminated materials would be sent to appropriately licensed facilities in accordance with the *Contaminated Land Management Act 1997*.		✓	
C9	If Acid Sulfate Soils (ASS) are encountered during construction, an ASS Management Plan would be prepared in accordance with the ASS Manual (ASS Management Advisory Committee 1998).		✓	

Item	Mitigation and Management Measures	Implementation of Mitigation Measures		
		Design	Implementation	Operation
C10	A Groundwater Management Plan (GWMP) would be developed and included within the CEMP. This plan would outline the measures that would be used to manage the testing, dewatering, storage, movement and treatment of any groundwater intercepted during the construction phase. Measures would include: • the use of appropriate drip trays and interception techniques for any construction specific liquids stored on the Site; • bunding of any fuel or chemical storage area at the construction Site; • regular inspection of construction equipment to ensure any leaks are minimised and rectified; • management of vehicles leaving the Site to reduce soil on roads, production of dust and the introduction of contamination to the groundwater and/or stormwater system; • appropriate and timely disposal of any contaminated soil, water or waste generated during construction; • regular inspection of erosion control structures and bunded areas; and • regular inspection and testing of containment areas, drainage lines and process pipe work.		✓	
C11	Any runoff that may accumulate in excavations would be periodically tested for elevated levels of contamination. Water that is found to have elevated levels of contaminants would be collected and sent to the on-site Wastewater Treatment Plant in accordance with the established refinery wastewater management procedures.		✓	
C12	Runoff entering any excavations would be limited by using bunds or similar structures as required.		✓	
C13	Construction workers would be instructed in appropriate health and safety and handling protocols for minimising human contact with contaminated soils and groundwater.		✓	
C14	During the cleaning of the crude and finished fuel tanks, measures would be implemented in line with Caltex's existing Turnaround and Inspection process to contain and collect any potentially contaminating material for appropriate disposal to the on-site wastewater treatment plant, landfarm or appropriate off-site disposal facilities. This process would be detailed within the CEMP.		✓	
C15	Permits would be required to work in the areas where potential soil and groundwater contamination exists. The work permit includes requirements such as monitoring and PPE. No unauthorised entry into these areas is permitted, without a permit.		✓	

Item	Mitigation and Management Measures	Implementation of Mitigation Measures		
		Design	Implementation	Operation
C16	Appropriate inspection, assessment, maintenance and repair programmes that would be implemented as part of the operation of the Project. These safeguards would be incorporated into the updated management plans for the proposed terminal. The Project would be appropriately licenced under the *Protection of the Environment Operations Act 1997* and would be managed in accordance with EPL requirements.			✓
Human Health and Ecological Risk				
D1	Construction personnel would be made aware of the potential presence of Non Aqueous Phase Liquids (NAPL) and would be shown how to identify its presence. The CEMP would include management measures to appropriately deal with any NAPL found on Site.		✓	
D2	Construction staff would be inducted and provided with training prior to working with potentially contaminated soil as part of the Project, to prevent unnecessary disturbance (e.g. dust generation, asbestos fibre liberation, contaminant mobility and volatilisation).		✓	
D3	The location of potentially contaminated areas would be noted in the CEMP and provided to construction personnel involved in soil excavation and handling. The CEMP would also identify the type of contamination found in each area. Where necessary, safety training and appropriate PPE would be provided.		✓	✓
D4	Caltex would continue to monitor groundwater quality in areas that are known to contain impacts to ensure that significant mobilisation of COPC from groundwater to surface water is not occurring.		✓	✓
Surface Water, Wastewater and Flooding				
E1	The Construction Environmental Management Plan (CEMP) for the Project would include a Soil and Erosion Management Plan. This plan would include the following measures: • All materials would be stockpiled in accordance with 'The Blue Book' Managing Urban Stormwater – Soils and Construction Volume 1 and 2 (Landcom, 2004); • Silt fences would be installed around stockpiles to reduce erosion and the movement of suspended solids as necessary; • Soil stockpiles and any polluted materials would be stored in designated areas which are not in close proximity to any stormwater drainage systems; • Erosion control structures, bunded areas, containment areas, drainage lines and interception measures would be subject to regular inspection; • Clean materials would be separated from contaminated materials; and Soil erosion and sedimentation devices would remain in place until the disturbed ground surface is restored. These devices would also capture any gross pollutants.		✓	

Item	Mitigation and Management Measures	Implementation of Mitigation Measures		
		Design	Implementation	Operation
E2	Caltex would continue to implement the measures within the Stormwater Management Plan for the Site. This plan has been produced in response to Environment Protection Licence No. 837, PRP U24.1: Stormwater Catchment and Management Plan. The SMP has committed Caltex to implementing a Stormwater Management Strategy and completing a number of stormwater management measures in a staged manner. Measures include: • Ongoing maintenance of the existing stormwater system; • Implementation of a number of projects to improve the infrastructure, reduce the potential for the refinery to flood, and prevent contaminated stormwater leaving the refinery premises; • Working with the NSW Office of Environment and Heritage (OEH), NSW EPA and Sutherland Shire Council to divert to flow of stormwater from the National Park away from the Site's stormwater system to the Sutherland Shire Council's stormwater infrastructure; • Carrying out stormwater flow monitoring; and • Updating the Site's stormwater system performance model to account for the changes to the stormwater system infrastructure that can then be used as a tool to assess future modifications, as necessary. This work would be completed in consultation with NSW EPA.	✓	✓	✓
E3	Discharges from the Wastewater Treatment Plant would be within existing EPL limits during construction and operation. Any required change to this Oily Water Management System would be discussed and agreed with NSW EPA.	✓	✓	
E4	The measures and processes currently in place at the Site to prevent any loss of contaminant would be maintained throughout the construction and operation phases of the Project. All bunds on tanks which are retained in service would meet the capacity requirements of Australian Standard *AS1940* during the operation of the Project.		✓	✓
E5	Improvements to monitoring would be initiated to ensure that if a loss of containment into a bund occurs it is detected early and contingency actions can be taken promptly. The measures for tanks containing low flash materials include: • explosive vapour detectors within the bunds; • triple infrared scanners on tank roofs; and • CCTV in conjunction with infrared cameras as a confirmation for alarms. All tanks on-site would be subject to: • an automated high level shut off system; and • continuance of a comprehensive inspection/repair program.		✓	
E6	Caltex will reassess the Site's flood risk during the future remediation works that would be completed once the converstion works are complete to ensure that any future flood risks to the Site following conversion, demolition and remediation are understood and appropriately managed.			✓

Item	Mitigation and Management Measures	Implementation of Mitigation Measures		
		Design	Implementation	Operation
Noise and Vibration				
F1	The CEMP for the Project would include a Noise Management Plan (NMP). The NMP would outline: • the locations of noise sensitive receptors; • construction noise monitoring procedures; and • construction equipment maintenance to ensure good working order.		✓	
F2	Low-noise plant and equipment would be selected, where practicable, in order to minimise potential for noise and vibration. All equipment would be regularly checked to ensure that the mufflers and other noise reduction equipment are working correctly.		✓	
F3	Community consultation with local residents would be undertaken to assist in the alleviation of community concerns. A complaints register is maintained and managed in line with the existing feedback process at the Site.		✓	✓
F4	Any noise complaint(s) would be investigated immediately. Reasonable and feasible measures would to be implemented to reduce noise impacts.		✓	✓
F5	Construction equipment would be located to reduce noise emission to sensitive receptors, where practicable.		✓	
F6	The majority of the conversion works for the Project would typically be completed between 7.00am to 10.00pm seven days a week. Some works consistent with Caltex's existing day-to-day operational and maintenance procedures would occur over a 24 hour period as regulated by the Environmental Protection Licence (No. 837) (EPL) for the Site.		✓	
F7	Construction staff and contractors would undergo training in environmental noise issues including: • minimising the use of horn signals and maintaining a low volume. Alternative methods of communication should be considered; • avoiding any unnecessary noise when carrying out manual operations and when operating plant; and • switching off any equipment not in use for extended periods during construction work.		✓	
F8	Should any unexpected construction activities occur which could potentially generate significant noise not described in this report, monitoring would be undertaken to ensure construction noise emission levels do not exceed EPL limits.		✓	
Air Quality and Odour				
G1	Dust emissions from the construction phase of the Project would be monitored by construction staff. A designated worker would continuously monitor downwind emissions to the community or local residents and call a halt to activities if sensitive receptors are likely to be affected by airborne particulate matter. Should significant impacts be likely, appropriate measures would be taken to mitigate any adverse air quality effects.		✓	

Item	Mitigation and Management Measures	Implementation of Mitigation Measures		
		Design	Implementation	Operation
G2	Within the refinery, construction vehicles would only travel on designated roads and would be limited to a maximum speed of 10 km/hr in construction areas, and 25 km/hr elsewhere.		✓	
G3	Where there is the potential for dust or odour generation, trucks carrying spoil loads would be covered and all tailgates would be securely fastened. Vehicles would not be loaded higher than the sides and tailboard.		✓	
G4	Construction activities would be limited during high wind events if sensitive receptors are likely to be significantly impacted.		✓	
G5	Construction plant would be maintained and operated in line with the manufacturer's specifications in order to minimise the emission of air pollutants and offensive odours. Plant and construction vehicles would be turned off when not in use.		✓	
G6	Stockpiled material would be assessed for the potential for causing odorous or particulate emissions. If air pollutants and offensive odours are likely, controls would be put into place to manage any adverse affects.		✓	
G7	All concrete cutting and coring would to be undertaken using "wet tools".		✓	
G8	An odour reduction program would be implemented in accordance with the existing EPL.			✓
G9	The guidepoles on the EFRTs in gasolise service would be fitted with sleeves.		✓	✓
G10	Caltex's Leak Detection and Repair (LDAR) Program would continue during Project construction and operation.		✓	✓
Greenhouse Gas				
H1	Equipment would be inspected and maintained to ensure efficient running, minimising Green House Gas (GHG)production, and so it is appropriately sized for the task in hand.	✓	✓	
H2	Local supplies and/or facilities would be utilised to minimise vehicle kilometres travelled (where reasonable and feasible).	✓	✓	
H3	Energy efficiency opportunities would be identified and implemented (where reasonable and feasible) during construction and operation of the Project.	✓	✓	✓
Traffic and Transport				
I1	Local Authorities and Kurnell residents would be informed of any Project related work which would affect the road network.		✓	

Item	Mitigation and Management Measures	Implementation of Mitigation Measures		
		Design	Implementation	Operation
I2	A Traffic Management Plan would be developed for the construction phase. The Traffic Management Plan would comply with all relevant Regulations and By-Laws and in particular address safe access and egress to the public road network. The Transport Management Plan would include: • hours of permitted vehicle activity; • designated routes for construction traffic and defined access points to the Site; • designated areas within the Site for truck turning movements, parking, loading and unloading to allow heavy vehicles to enter and leave the Site in a forward direction; • sequence for implementing traffic management measures should these be required; and • procedures and/or principles for construction vehicle speed limits and the safe operation of construction vehicles.		✓	
Waste Management				
J1	The Project would be integrated into existing resource efficiency, waste management and handling, emergency response and preparedness plans for the existing Kurnell Refinery.	✓	✓	✓
J2	Construction and Operation Waste and Resource Management Plans (WRMP) would be compiled prior to the each phase commencing.	✓		
J3	The WRMPs would: • identify requirements consistent with the waste and resource hierarchy; • ensure resourcing efficiency is delivered through the design and responsible construction and operational practices; • provide consistent clear direction on waste and resource handling, storage, stockpiling, use and reuse management measures (consistent with current management practices relating to Caltex's Kurnell Waste Management System); • identify disposal and management routes consistent with current management practices as adapted for the Project; • set out clear requirements for meeting legislative and regulatory requirements; • define requirements to support Caltex's sustainable procurement objectives through effective, design, construction, operation and procurement; and • set out processes for disposal, including on-site transfer, management and the necessary associated approvals.	✓	✓	✓
J4	The WRMPs would incorporate the requirements of the waste and resource hierarchy and cleaner production initiatives.	✓	✓	✓

Item	Mitigation and Management Measures	Implementation of Mitigation Measures		
		Design	Implementation	Operation
J5	The WRMPs would include a process for auditing, monitoring and reporting, which would include regular inspections off-site activities and the waste management area(s). The WRMPs would be subject to regular auditing and a system would be used to record and report the types, volumes and management measures for all waste and resource arising from/used for the works.	✓	✓	✓
J6	Works-generated waste would be segregated at source and stored in accordance with current Site practices. Site management practices would potentially need adapting to consider additional storage requirements. Regardless, all waste would be stored in suitable containers and designated waste management areas.		✓	✓
J7	Caltex's existing procedures for the disposal of sewage, grey water, hazardous materials, general waste and recyclable materials would be adopted for the Project (and modified if required). This would include using licensed contractors to remove and transport waste from the Site.		✓	✓
Heritage				
K1	An archival photographic record of the existing fabric and operations of the Kurnell Refinery would be prepared while the plant is still operational, and during the decommissioning process. The recording would be undertaken in accordance with the Heritage Council guidelines on *Photographic Recording of Heritage Items Using Film or Digital Capture* (2006). The archival recording would be maintained for the appreciation of present and future generations. To this end, the recording would be lodged with Sutherland Shire Library and the NSW State Library.	✓		
K2	A Heritage Management Strategy would be prepared for the Australian Oil Refinery prior to shut-down of the refinery plant, to provide Caltex with a basic framework for the ongoing management of the Site's heritage during present and future works. The Strategy would include a review of the heritage significance of the overall Site. The review would clarify the extent and relative heritage value of the place by identifying key elements of industrial and built heritage as well as social values of the refinery, and the relative contribution of these elements to the overall significance of the Site. Recommendations would also address the future assessment and management of memorabilia and other significant items of moveable heritage maintained on-site.	✓		
K3	If any further heritage items were discovered throughout the Project, work would cease until an assessment is carried out by a qualified heritage professional.	✓	✓	

Item	Mitigation and Management Measures	Implementation of Mitigation Measures		
		Design	Implementation	Operation
Ecology				
Management of Weeds				
L1	A Biodiversity and Weed Management Plan (BWMP) would be prepared in order to limit and control the spread of noxious weeds within the Site. It would include the following: • wash down procedures to reduce the spread of weeds via vehicles and machinery; • measures to target potential new weed outbreaks including soil stockpiles and any other disturbed areas; • outline monitoring programs for noxious and problematic weeds on sites and in the surrounding areas; • measures for strict stockpiling control to help eradicate all noxious weeds as per NSW DPI specifications for SSLGA; • include a list of 'frog-friendly' and 'wetland friendly' herbicides such as Roundup Biactive or Weedmaster DUO for the control of noxious weeds; and ensure that only amphibian friendly herbicides are used; • wash down protocols for construction vehicles and machinery to prevent the spread of root-rot fungus (*Phytophthora cinnamomi*); and • all personnel undertaking routine management activities of any noxious weeds should be appropriated trained and all contractors should hold the necessary permits and licenses.	✓	✓	✓
Restriction of Access to Existing Vegetated Areas				
L2	A BWMP would be prepared in order to limit potential impacts to existing vegetation outside of the area of proposed works, but within the Site It would include the following: • existing vegetation on Site would be clearly marked on all Site plans and construction diagrams, with clear indications of no-go zones within all vegetated areas; • existing vegetation would be clearly signposted and fenced off prior to the commencement of construction activities, and should remain fenced off until the completion of works; and • absolutely all works would be limited to the defined construction footprint.	✓	✓	

Item	Mitigation and Management Measures	Implementation of Mitigation Measures		
		Design	Implementation	Operation
Ecology- Fauna Management				
L3	To minimise the potential for impacts to native fauna species, the BWMP would be developed and include following measures: • if any frogs are found within the Project Area, works would cease until frogs have been relocated to areas outside the area of impact; • if any threatened frogs e.g. Green and Golden Bell Frog or Wallum Froglet are identified within the Site, works would cease and active searching should be undertaken by a qualified zoologist experienced in the identification and management of the Green and Golden Bell Frog and Wallum Froglet; • all trenches would be inspected prior to works each morning. Any frogs that become trapped within trenches would be assessed by a suitably qualified ecologist or veterinarian and then released into the nearest suitable habitat if uninjured; • identification sheets would be provided to all construction workers on Site for the two threatened frog species predicted to occur within the Site; • wash down protocols to prevent the spread of Amphibian Chytrid Disease (chytridiomycosis) would be implemented at relevant work areas. Protocols would be consistent with OEH guidelines (DECC, 2008b). • 'frog-friendly' and 'wetland friendly' herbicides such as Roundup Biactive or Weedmaster DUO would be used for the control of noxious weeds; and • if fauna are found to be utilising the Site, or a nest, den or roost is found, work in the immediate area is to stop and the animals are to be allowed to move off freely, or relocated by an authorised person to an area outside the construction footprint.	✓	✓	✓

21.2 Environmental Management

21.2.1 Overview

Current operations at the Site comply with EPL no. 837. In order to maintain compliance, Caltex implements an Environmental Management Plan (EMP). The EMP consists of a suite of internal policy documents and plans. The EMP is overseen by a dedicated member of the Caltex Environment Team.

The EIS has outlined a number of measures that would help to avoid, mitigate or manage the anticipated impacts associated with the construction and operation of the Project. These measures would be incorporated into the conditions of consent for the Project and during construction would be implemented through a Construction Environment Management Plan (CEMP).

The CEMP would cover all environmental aspects associated with the construction of the Project and would include the controls and mitigation measures identified within **Chapters 8 -19** of thisEIS.

This system ensures that:

- all work complies with all relevant environmental statutes, regulations and standards;
- environmental factors are taken into account for each activity; and
- regular audits are performed to confirm compliance with environmental policies and standards.

Any operational measures included in the EIS and CEMP would be incorporated into existing management plans and operating procedures currently in place at the Site and in accordance with the EPL (refer to **Appendix B EPL**).

21.2.2 CEMP Outline

The CEMP outlines the procedures that would be implemented to address and manage environmental impacts associated with construction of the Project. The CEMP shall be prepared by Caltex prior to commencement of construction works.

The primary purpose of the CEMP is to provide a reference document that ensures that the safeguards and mitigation measures specified as part of the Project approval are being implemented and monitored. The CEMP shall outline the key steps to be taken by all personnel to manage the environmental hazards and risks associated with the Project and to effectively minimise the potential for environmental harm. The CEMP would be subject to the regulator review prior to commencement of construction works and ongoing review throughout the construction period.

The CEMP shall include the following:

- a description of the proposed construction works;
- an outline of the proposed construction program;
- statutory requirements – licences and approvals required;
- standards and/or performance measures for the relevant environmental issues associated with the construction work;
- a description of what actions and measures would be implemented to mitigate the potential impacts associated with the construction works and ensure that these works would comply with the relevant standards and/or performance measures;

- a description of the procedures to ensure all employees are trained in regards to their responsibilities under the CEMP;
- a description of the procedures that would be implemented to register, report and respond to any complaints during the construction work;
- a description of the procedures that would be implemented to manage any environmental incidents and associated reporting requirements;
- identification of key personnel who would be involved in the construction works, and provide their contact numbers;
- monitoring procedures and a description of the process to be followed if any non-compliance is detected; and
- detailed:
  - Biodiversity and Weed Management Plan (BWMP);
  - Soils and Erosion Management Plan;
  - Contamination Management Plan;
  - Groundwater Management Plan;
  - Stormwater Management Plan (SMP);
  - Noise Management Plan (NMP);
  - Air Quality Management Plan;
  - Waste and Resource Management Plans (WRMP);
  - Traffic Management Plan;
  - Heritage Management Plan; and
  - Acid Sulfate Management Plan (if required).

These items are consistent with the management measures presented in **Table 21-1**.

21.2.3 Existing and Future EMS

The existing Environment Management System (EMS) for the Site, which is ISO 14001 accredited, consists of a suite of guidance documents, policies and procedures that cover every aspect of the existing operation. Relevant provisions from within **Table 21-1** would be incorporated into the existing EMS as it is updated to apply to the proposed terminal operation and any future changes to the Site EPL. The Caltex Kurnell EMS would continue to be implemented and monitored by a dedicated member of staff.

22 Project Evaluation and Justification

This chapter provides an evaluation of the Project and the outcomes of this Environmental Impact Statement, including a discussion of the justification for proceeding with the Project. The chapter also provides:

- an environmental risk assessment;
- an assessment of the Project against the principles of Ecologically Sustainable Development;
- a description of the Project's benefits;
- consideration of the consistency of the Project with the objects of the EP&A Act; and
- the justification for the Project.

22.1 Environmental Risk Assessment

The following Environmental Risk Assessment (ERA) provides an analysis of the environmental risks that have been identified and outlined as part of this EIS.

An initial qualitative environmental scoping exercise was completed in **Chapter 7 Environmental Scoping Assessment**. This exercise identified the key environmental issues for the Project, described them and categorised them according to their risk of impact.

The EIS process has confirmed the potential environmental impacts associated with the Project (construction and operation), proposed mitigation measures for those impacts and any potentially significant residual environmental impacts which still exist after the application of the proposed mitigation measures.

This ERA was undertaken using the methodology described below to determine the risk associated with each environmental issue. The ERA has been based upon the methodology outlined in Standards Australia's document *HB 203:2006 Environmental Risk Management – Principles and Process, Australian Standard AS/NZ 4360:2004 Risk Management*, and *AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines.*

The analysis categorised levels of risk for a given event based on the significance of effects (consequences) and the manageability of those effects (likelihood). The measures of likelihood categories and the measures of consequences categories as well as the risk ranking matrix are detailed in **Tables 22-1**, **22-2** and **22-3** below.

Table 22-1 Measures of Probability Categories for ERA

Rank	Probability	Description
A	Almost Certain	Happens often and is expected to occur
B	Likely	Could easily happen and would probably occur
C	Possible	Could happen and has occurred elsewhere
D	Unlikely	Unlikely to happen but may occur
E	Rare	Could happen, but only in extreme circumstances

Table 22-2 Measures of Consequence Categories for ERA

Rank	Consequence	Description
1	Extreme	Permanent and catastrophic impacts on the environment; large impact area; reportable incident to external agency; large fines and prosecution; operational constraints; substantial community concern.
2	Major	Permanent and detrimental impacts on the environment; large impact area; reportable incident to external agency; may result in large fines and prosecution; operational constraints; high level of community concern.
3	Moderate	Substantial temporary or minor long term detrimental impacts on the environment; moderate impact area; reportable incident to external agency; action required by reportable agency; community interested.
4	Minor	Minor detrimental impacts on the environment; small impact area; reportable incident internally; no operational constraints; some local community interest.
5	Low	Nil or temporary impacts on the environment; small or isolated impact area; not reportable incident; no operational constraints; uncontroversial project no community interest.
1*	Extreme	Permanent and extremely beneficial impacts on the environment or population; large impact area.
2*	Major	Permanent and beneficial impacts on the environment or population; large impact area.
3*	Moderate	Substantial temporary or minor long term beneficial impacts on the environment or population; moderate impact area.
4*	Minor	Minor beneficial impacts on the environment or population; small impact area.
5*	Low	Nil or temporary beneficial impacts on the environment or population; small or isolated impact area.

* Indicates the ranking and criteria for positive consequences.

Table 22-3 Risk Matrix for ERA

		CONSEQUENCES				
		1 Extreme	2 Major	3 Moderate	4 Minor	5 Low
Likelihood	A (Almost Certain)	VH	VH	H	H	M
	B (Likely)	VH	H	H	M	M
	C (Possible)	H	H	M	M	L
	D (Unlikely)	H	M	M	L	L
	E (Rare)	H	M	L	L	L

Risk Matrix is defined as follows: VH = Very High, H = High, M = Medium and L = Low.

Taking into account the Project's design, mitigation measures described in **Chapters 8-19**, the Cumulative Impact Assessment in **Chapter 20** and the commitments provided in the **Chapter 21 Management and Mitigation Measures**, **Table 22-4** provides an assessment of the mitigated risks associated with the Project, or the residual risk analysis. This has been completed for each potential environmental impact identified in **Table 22-4** based on the likelihood of occurrence and potential environmental consequence.

Note that where a positive impact has been identified, a shading of blue has been used in **Table 22-4**.

Table 22-4 Environmental Risk Analysis

Environmental Issue	Potential Impacts Based On Unmitigated/ Inherent Risk	Probability	Consequence	Potential Risk Before Mitigation	Actions/Proposed Mitigation Measures	Residual Probability	Residual Consequence	Residual Risk Post Mitigation
Hazard and Risk Chapter 8	Fires from large refined petroleum product storage tanks and associated transfer pipelines and pumps within the terminal.	D	1	H	Tank and infrastructure upgrades alongside modifications to existing Site hazard management measures and processes would ensure that any risks to on Site or off Site receptors would continue to be acceptable under HIPAP 4.	E	3	L
	Significant reduction in the variety of Dangerous Goods stored on Site and the cessation of refining process would remove some of the existing risks associated with the Site.	A	3*		As part of the Project Caltex would implement improvements and upgrades to the existing safety system to improve the safety of the facility.	A	3*	
	Significant reduction of loading and unloading activities associated dangerous goods. The majority of truck movements would cease. Most material would arrive on Site via ship or pipeline.	A	3*		None Proposed. The Project would result in a significant lowering of the risk associated with road transport in and out of the Site.	A	3*	
Soils, Groundwater and Contamination Chapter 9	Erosion of soils resulting in sedimentation of stormwater during construction.	C	5	L	A Soils and Erosion Management Plan would form part of the CEMP for the Project. This plan would outline management measures for any soils that are excavated or stored on-site during the construction works.	D	5	L

Environmental Issue	Potential Impacts Based On Unmitigated/ Inherent Risk	Probability	Consequence	Potential Risk Before Mitigation	Actions/Proposed Mitigation Measures	Residual Probability	Residual Consequence	Residual Risk Post Mitigation
	Mobilisation of contamination from soils during excavation works.	C	3	M	A Contamination Management Plan would form part of the CEMP for the Project. This plan would outline measures for testing, handling, storing and managing contaminated soils and contaminated groundwater.	E	3	L
	Disruption of Acid Sulfate Soils during excavation works.	E	4	L	ASS Management Plan would be prepared in accordance with the *ASS Manual (ASS Management Advisory Committee 1998)* if ASSs were encountered during the construction phase of the Project.	E	4	L
	Contamination of runoff collected in excavations from soils or groundwater.	C	4	M	Runoff in excavations would be periodically tested for contamination. Water that is found to have elevated levels of contaminants would be collected and sent to the WWTP.	E	4	L
	Groundwater has the potential to be contaminated by spills, leaks or the mismanagement of certain substances e.g. contamination, cleaning product etc.	C	3	M	A Groundwater Management Plan would be included in the CEMP. This plan would recommend measures to prevent the infiltration of contaminated run off to groundwater due to construction activities. Other measures to manage related impacts would also be included in the CEMP (refer to **Chapter 9 Soils, Groundwater and Contamination**).	D	4	L

Environmental Issue	Potential Impacts Based On Unmitigated/ Inherent Risk	Probability	Consequence	Potential Risk Before Mitigation	Actions/Proposed Mitigation Measures	Residual Probability	Residual Consequence	Residual Risk Post Mitigation
Human Health and Ecological Risk Chapter 10	Asbestos in the form of small fragments and fibres has been recorded on-site in various places including in surface soil layers. This has the potential to cause a health risk to workers working with excavated soil.	C	2	H	Construction staff would be inducted and provided with training prior to working on the Site, to prevent unnecessary disturbance (e.g. dust generation, asbestos fibre liberation, contaminant mobility and volatilisation). These measures would be outlined in the CEMP. **Chapter 10 Human Health and Ecological Risk** provides further detail.	E	2	M
	Potential soil contamination may pose a vapour risk for workers spending extended time in enclosed or semi-enclosed areas above the source (e.g. in a building or a deep trench).	C	3	M	The location of potentially contaminated areas should be noted and provided to construction personnel (especially with regard to certain specific contaminants such as asbestos). Safety training should be provided, including assessment of PPE requirements. The depth of excavations mean impacts would be negligible.	D	4	L
	The completed Project would likely result in a reduction of risk of exposure of receptors to COPC.	B	3*		Risks to human health and the environment would be expected to be lower than or, in the worst case, equal to the risks currently posed by current operations on the Site.	C	3*	
Surface Water Wastewater and Flooding Chapter 11	Contamination of sensitive receptors especially during a high rainfall event.	C	3	M	Storm water captured on-site during operation would be managed through the existing systems and separated into clean or contaminated streams as required. A full list of management and mitigation measures is available in **Chapter 11 Surface Water, Wastewater and Flooding**.	E	3	L

Environmental Issue	Potential Impacts Based On Unmitigated/ Inherent Risk	Probability	Consequence	Potential Risk Before Mitigation	Actions/Proposed Mitigation Measures	Residual Probability	Residual Consequence	Residual Risk Post Mitigation
	Spillages during terminal operation could have the potential to contaminate surface water.	C	4	M	Appropriate bunding would be maintained around storage tanks and in areas with potential for spillage to occur. Spill detection measures would continue to be utilised in bunds as part of the Project. The Site would meet the capacity requirements of AS1940. Stormwater captured on-site during operation would be managed through the existing systems and separated into clean or contaminated streams as required. A full list of management and mitigation measures is available in **Chapter 11 Surface Water, Wastewater and Flooding**.	D	4	L
	Potential impacts on stormwater associated with construction include erosion, sedimentation impacts.	C	5	L		C	5	L
	Potential construction impacts include interaction of stormwater with hydrocarbon impacted soils.	C	3	M	Potentially contaminated soils would be stored in a manner that would discourage contamination of storm water. Contaminated storm water would be treated before disposal.	E	3	L
	Potential adverse impacts to stormwater flows and discharge.	C	3	M	Caltex has prepared a Stormwater Management Plan (EPA) for the Site with the EPA in response to EPL 837 Pollution	E	4	L

Environmental Issue	Potential Impacts Based On Unmitigated/ Inherent Risk	Probability	Consequence	Potential Risk Before Mitigation	Actions/Proposed Mitigation Measures	Residual Probability	Residual Consequence	Residual Risk Post Mitigation
	Reduction in the overall contaminant load from Catchments A and B, which would reduce the cumulative impact, if any, of the discharges to the respective receiving environments.	B	3*		Reduction Plan U24.1: *Stormwater Catchment and Management Plan*. This plan involves implementing a stormwater management strategy at the Site and completing a number of stormwater management measures in a staged manner over the coming years. The SMP has committed Caltex to implementing a stormwater management strategy and completing a number of stormwater management measures in a staged manner. Implementation of the stormwater management strategy over the coming years would ensure any impacts are minimised.	B	3*	
	The overall volume and contaminant load to the oily water sewer would reduce substantially.	B	3*		Improvement - No Mitigation Measures Necessary.	B	3*	
Noise and Vibration Chapter 12	The construction phase of the Project could cause acoustic impacts at identified sensitive receptors. The construction noise levels from the Project would comply with the existing EPL for the Site.	D	4	L	Working hours and noise limits would be limited to within those specified within the EPL. A full list of Management and Mitigation Measures is available in **Chapter 12 Noise and Vibration**.	E	4	L
	Operational noise would be likely to be less than the current operations and within the acoustic limits of the EPL.	B	3*		Improvement - No Mitigation Measures Necessary.	B	3*	

Environmental Issue	Potential Impacts Based On Unmitigated/ Inherent Risk	Probability	Consequence	Potential Risk Before Mitigation	Actions/Proposed Mitigation Measures	Residual Probability	Residual Consequence	Residual Risk Post Mitigation
	Given existing traffic volumes, the noise contribution from traffic generated by the Project construction would be negligible at residences on Captain Cook Drive (that is, less than a 2dB increase).	C	5*		No Mitigation Measures Necessary.	C	5*	
Air Quality and Odour Chapter 13	Construction activities have potential to cause odour and air quality impacts as existing infrastructure is decommissioned.	C	3	M	Excavated soils would be assessed for odour as/if they are stockpiled, and would be controlled in order to manage potential odour or dust emissions. Mitigation measures outlined within this EIS would be incorporated into the CEMP to reduce the impact during construction.	E	4	L
	Given the change in emissions profile, the odour sensitivity of nearby receptors may also be modified. Whilst a significant reduction in odour emissions is expected, odour would still need to be managed through the existing odour reduction programs present on the Site.	B	3*		An odour reduction program is in place for the Site and would continue to be implemented throughout the operation of the Project. A full list of Management and Mitigation Measures is available in **Chapter 13 Air Quality and Odour**.	B	3*	
	Relative to existing operations, total VOC emissions are anticipated to halve in quantity during the operational phase of the Project.	A	3*		Improvement - No Mitigation Measure Necessary.	A	3*	

Environmental Issue	Potential Impacts Based On Unmitigated/ Inherent Risk	Probability	Consequence	Potential Risk Before Mitigation	Actions/Proposed Mitigation Measures	Residual Probability	Residual Consequence	Residual Risk Post Mitigation
Greenhouse Gas Chapter 14	GHG emissions during the construction phase would add to local inventories.	B	5	M	Efficiency opportunities would be identified to allow construction phase GHG emissions to be reduced. A full list of Management and Mitigation Measures is available in **Chapter 14 Greenhouse Gas**.	B	5	M
	The Project would result in a significant reduction of GHG included as part of the NSW inventory of emissions.	A	3*		Improvement - No Mitigation Measure Necessary.	A	3*	
Socio-Economic Chapter 15	The Project would generate a positive economic impact within the local community through the creation of local employment opportunities during the construction phase.	A	4*		It is anticipated that the workforce could be sourced from the local area. The direct spending within the local economy would also have a positive impact on local services and businesses during construction.	A	4*	
	Cessation of refinery operations would occur in the second half of 2014 and would lead to a gradual loss of approximatelty 949 full time equivalent jobs.	A	2	VH	Caltex has developed an employee program incorporating transitional support through generous redundancy benefits, outplacement support services, careers fairs featuring prospective employers, vocational training allowances, health and wellbeing programs and services, and industry retraining. A full list of Management and Mitigation Measures is available in **Chapter 15 Socio-Economic**.	A	3	H

Environmental Issue	Potential Impacts Based On Unmitigated/ Inherent Risk	Probability	Consequence	Potential Risk Before Mitigation	Actions/Proposed Mitigation Measures	Residual Probability	Residual Consequence	Residual Risk Post Mitigation
Transport and Access Chapter 16	Construction traffic could impact the local road network.	B	5	M	A Traffic Management Plan would be incorporated into the CEMP to manage the traffic impacts during the construction phase of the Project. A full list of Management and Mitigation Measures is available in **Chapter 16 Transport and Access**.	E	5	L
	Routine distribution of petroleum products from the Site by road would typically cease once the Project is operational.	B	2*		Improvement - No Mitigation Measures necessary. During operation the Project would result in an improvement to the local traffic environment and a beneficial transport impact.	B	2*	
	A staffing reduction would result in a net reduction in traffic volumes along Captain Cook Drive gradually following cessation of refining at the Site.	B	2*			B	2*	
Waste Management Chapter 17	The Project could create additional waste streams from the Site.	B	5	M	A Waste and Resource Management Plan would be incorporated into the CEMP and into the Site EMPs to manage waste streams and ensure that the maximum resource efficiency is maintained. A full list of Management and Mitigation Measures is available in **Chapter 17 Waste Management**.	C	5	L

Environmental Issue	Potential Impacts Based On Unmitigated/ Inherent Risk	Probability	Consequence	Potential Risk Before Mitigation	Actions/Proposed Mitigation Measures	Residual Probability	Residual Consequence	Residual Risk Post Mitigation
Heritage Chapter 18	The Project would have an impact on the locally significant Oil Refinery Site.	A	3	H	A Heritage Management Strategy would be prepared for the Australian Oil Refinery site prior to shut-down of the refinery plant, to provide Caltex with a framework for the ongoing management of the Site's heritage during present and future works on Site. A full list of Management and Mitigation Measures is available in **Chapter 18 Heritage**.	A	4	H
Ecology Chapter 19	Potential impacts to significant ecological values in close proximity to the Site.	C	3	H	The management and mitigation measures for the Project would ensure that any off-site impacts to nearby ecological values would be negligible.	E	5	L
	Temporary and localised alterations to potential habitat on-site and to noxious weeds could occur as a result of the Project.	C	4	L	The following ecological aspects would be managed through measures within the CEMP: • spread of weeds; • impacts on existing vegetation; and • Fauna impacts. Implementation of these measures would ensure that any potential impacts would be avoided.	E	4	L

22.1.1 Summary of Risk Analysis

The Environmental Risk Assessment in **Table 22-4** illustrates how the assessments and mitigation measures contained within **Chapters 8 – 19** have helped understand the Project and reduce the potential environmental risks. Certain risks regarding the presence of contamination, the loss of jobs at the Site and impacts of the conversion works on the heritage value of the Site, remain. However, careful management would help avoid and mitigate these potential impacts as far as possible.

In addition to these risks the Project also creates a number of beneficial effects. The air quality around the Site is likely to improve as a result of the Project. Equally greenhouse gases generated from the Site, traffic movements and water usage on-site would also significantly reduce. Other environmental aspects, e.g. noise from the Site, would also experience improvements.

It can therefore be concluded that, provided the management and mitigation measures presented in **Chapter 21** are implemented, any remaining residual impacts would be negligible.

22.2 Ecologically Sustainable Development

22.2.1 The Principles

This section provides a review of the Project, its impacts and associated safeguards against the principles of Ecologically Sustainable Development (ESD) in accordance with the *Environmental Planning and Assessment Regulation 2000*. The principles, as listed in the Regulation, are as follows:

a) *"The precautionary principle - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;*

b) *Inter-generational equity - namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations;*

c) *conservation of biological diversity and ecological integrity - namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration; and*

d) *improved valuation, pricing and incentive mechanisms - namely, that environmental factors should be included in the valuation of assets and services."*

These principles are discussed below.

22.2.2 Precautionary Principle

The precautionary principle deals with certainty in environmental and technical decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

An EIS is a public process which examines the potential effects of the Project. Therefore the EIS process is precautionary in nature. The requirement to assess the impacts of the Project is a form of regulation designed to identify and address uncertainty about the effects of the Project.

Caltex has commissioned specialists to conduct detailed assessments on a range of environmental aspects identified during the Environmental Risk Assessment process as outlined in **Chapter 7 Environmental Scoping Assessment**. These assessments provide sufficient scientific understanding of the Project and surrounding environment to enable a decision to be made that is consistent with this principle.

Project Objectives

The Project has been designed to include a number of design elements to reduce the severity of potential impacts and reduce the risk of potential impacts occurring. The Project has also been designed to ensure compliance with environmental criteria, community expectations, as well as all relevant statutory requirements. This is achieved through appropriate design, management and mitigation measures.

Design Safeguards

A number of design safeguards have been incorporated during the initial design stage in response to the Precautionary Principle. These design modifications include the following:

- The area affected by the Project would not extend beyond the boundary of the Site currently operated by Caltex.
- Improvements would be made to the existing infrastructure as part of the Project to increase the efficiency of the facility and reduce the likelihood of an environmental incident occurring.
- The finished product terminal would be designed to maintain integrity during all foreseeable operating conditions (e.g. start-up, shut down, and normal operation) to prevent an uncontrolled loss of containment. To minimise impacts associated with a loss of containment during an incident, the design would provide adequate sectioning and local containment as well as emergency response capability for mitigation.

Construction and Operational Principles

Should the Project be approved, a number of the safeguards and management and mitigation measures included in this EIS would form the basis of a Construction Environment Management Plan (CEMP). Operational safeguards nominated in this EIS would be integrated into existing management plans and operating procedures currently in place at the existing Site. Monitoring programs would be developed to address the specific content requirements within the Project Approval.

22.2.3 Inter-Generational Equity

Inter-generational equity requires that the present generation pass onto the next generation an environment that does not limit the ability of those future generations to attain a quality of life at least equal to that of the current generation.

Through the design of the Project, the implementation of operational safeguards mitigating any short-term or long-term environmental impacts, and the proposed rehabilitation of any disturbed areas, inter-generational social equality impacts have been addressed. Examples of matters that are relevant to the various stages of the Project are described below.

Project Objectives

The Project would ensure the continued use of the Site for distribution of petroleum products despite changes to the international petroleum market making the continued refining of crude within Australia less financially feasible. The cessation of refining at the Site would result in some beneficial environmental outcomes for future generations as outlined in **Table 22-4**.

Design Safeguards

The Project would maintain inter-generational equity by ensuring components of the existing bio-physical, social and economic environment available now would also be maintained for future generations. Relevant design considerations include the following:

- ensuring that no ecological features are impacted as a result the Project;
- reducing potential contamination by managing pollution risks during construction and managing any contamination that is found as part of the Project;
- maintaining agreed noise and air quality limits during construction and operation;
- the cessation of refining on the Site would reduce emissions of VOCs, combustion pollutants to air and would also result in a decrease in GHG emissions; and
- a 'whole of life' approach to the Project to benefit future generations (e.g. continuing use of the Site rather than the option of shutting down the refinery, allowing for some continuation of economic benefits in the area.

Construction and Operational Principles

Caltex would continue to maintain inter-generational equity through the safeguards identified in this EIS, including but not limited to the following:

- ongoing consultation and engagement with the local community to provide an opportunity to ask questions and identify and manage areas of concern; and
- development of an appropriate environmental protocols in consultation with relevant State agencies.

The Project would result in a loss of jobs at the Site now and for the future. The loss of these jobs has been recognised by Caltex and they have implemented a program named "Stay, Focus & Develop". This program incorporates transitional support through generous redundancy benefits, outplacement support services, careers fairs featuring prospective employers, vocational training allowances, health and wellbeing programs and services, and industry retraining.

The loss of the heritage value of the Site would also affect inter-generational equity. Mitigation measures have however been identified to ensure that whilst the nature of the Site may change, a record of the Site's history would be retained for the appreciation of future generations.

22.2.4 Conservation of Biological Diversity and Ecological Integrity

This EIS includes an assessment of the ecological impacts of the Project against the requirements of NSW Legislation. The ecological impact assessment concluded that the Project is unlikely to cause any ecological impacts provided that certain mitigation measures were followed.

Design Principles

As part of the planning for the Project, the following design features were incorporated to minimise the impact of the proposed activities on the biodiversity and ecological integrity of the locality:

- the location of the Project does not directly impact any important ecological areas or threatened ecological species or communities; and
- mitigation measures would be put into place that reduce the likelihood of any indirect ecological impacts affecting any threatened ecological species or communities.

In addition to these design features, flora and fauna management plans would be incorporated into the final CEMP.

Management and Operational Safeguards

The Project would not have an adverse impact on ecology during operation. The Site currently operates in line with existing legislation and guidance to ensure that the risk of any potential impact on the local environment is minimised.

22.2.5 Improved Valuation and Pricing of Environmental Resources

This ESD principle is premised on an assumption that all resources should be appropriately valued and that the value of environmental resources should be considered alongside any economic or cost benefit analysis for the life of the project.

Project Objectives

The Project would provide value to the local and State economy whist at the same time not compromising the natural value of the local environment and the services it provides.

Conclusion

The value placed by Caltex on environmental resources is evident from the extent of site-specific investigations, planning and environmental safeguards and measures that have been undertaken and which would be implemented to prevent irreversible damage to the local environment. The cessation of refining at the Site would result in some beneficial environmental outcomes as outlined in **Table 22-4**.

22.2.6 Compatibility with the Principles of ESD

The approach taken in planning the Project has been multi-disciplinary, involving consultation with various stakeholders including government agencies and the community (refer to **Chapter 6 Consultation**). Emphasis has been placed on the avoidance of impacts through careful design as well as management and mitigation measures to minimise potential negative environmental, social and economic impacts, during construction and operation. The principles of ESD have been incorporated into every stage of the Project.

22.3 Objects of the Environmental Planning & Assessment Act 1979

As required by the DGRs issued for this Project, consideration has been given to the consistency of the Project with the objects of the EP&A Act as outlined below.

a) To encourage:

i. The proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.

The Project would facilitate the proper management of resources by allowing the Site, which could otherwise become redundant, to continue to be operated by Caltex. By providing viable repurposing for the existing infrastructure, the Project provides for the continued use for an existing site and removes the need to develop a second location for the import and distribution of refined product to the NSW and ACT markets.

ii the promotion and co-ordination of the orderly and economic use and development of land.

The SEPP (Kurnell Peninsula) provides for the land use and zoning in the area. Pursuant to the SEPP, the Site falls within zone 4(c1) (Special Industrial (Oil Refining) Zone. The objectives of zone 4 (c1) are to recognise land used for oil refinery, liquid fuel depot and liquefied petroleum gas extraction purposes, and to ensure that development has regard to environmental safety planning principles. As the Project would continue the use of the land as a liquid fuel depot, the Project is deemed permissible under the land use zones in this SEPP and therefore is in line with orderly and economic use and development of land.

The Project would not significantly affect the future orderly use or development of land as it does not compromise any existing planning policy.

iii the protection, provision and co-ordination of communication and utility services.

The Project would not directly impact on the provision and co-ordination of communication and utility services.

iv the provision of land for public purposes.

The Project would not directly impact on the provision of land for public purposes.

v the provision and co-ordination of community services and facilities.

The Project would not impact on the provision of existing or future community services and facilities.

vi the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.

The Project would not directly or indirectly impact any threatened species, populations and ecological communities, and their habitats. Equally the mitigation measures outlined within this EIS, would ensure that any impact on native plants and animals would be unlikely.

vii ecologically sustainable development.

An assessment of the Project against the principles of ecologically sustainable development has been undertaken in **Section 22.2** above.

viii the provision and maintenance of affordable housing.

The Project would not impact on the provision or maintenance of affordable housing.

b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State.

The Project is to be assessed as State Significant Development under Part 4 of the EP&A Act by the Department of Planning and Infrastructure (DP&I). In preparing to assess the Project, the DP&I request input from local councils to the Director General's Requirements. Sutherland Shire Council provided input into the DGRs for the Project and remains an important stakeholder during the ongoing consultation effort.

c) to provide increased opportunity for public involvement and participation in environmental planning and assessment.

Caltex has undertaken consultation activities to inform and receive feedback from the public and Government agencies as the Project has progressed. This consultation is summarised in **Chapter 6 Consultation**.

In addition, the EIS would be placed on public exhibition by the NSW DP&I for a minimum of 30 days. In accordance with the requirements of the EP&A Act, stakeholders and the public are invited to make submissions. This process provides further opportunity for public involvement and participation in the environmental planning and assessment process for this Project.

22.4 Project Justification

Caltex initiated a review of their refining operations in May 2011, as refineries throughout Australia were competitively disadvantaged and were consequently losing money. The Kurnell and Lytton refineries in their current configuration are relatively small and are disadvantaged compared to the modern, larger scale and more efficient refineries in the Asian region. This disadvantage has been exacerbated by the impact of the on-going strength of the Australian dollar, lower Caltex refining margins, inability to meet market place fuel requirements, and increasing costs on the 'as is' refining business.

As a result of the refining review, Caltex is proposing to close the Kurnell Refinery and convert the Site to an finished product import terminal. Conversion to a terminal is required to support the safe, reliable supply of fuel to Caltex's marketing operations, and more broadly to ensure supply reliability of petroleum fuels to the NSW and ACT economies.

The EIS provides a comprehensive assessment of this Project and includes investigations regarding all relevant environmental issues.

Potential impacts have been assessed and strategies to avoid, minimise and mitigate those impacts form a key part of the EIS. The Project includes a number of commitments to manage environmental impacts during its construction and operation.

The Project has, to the extent feasible, been designed to address the issues of concern to the community and Government. Caltex has also considered impacts on the surrounding environment and community of Kurnell. Caltex firmly believes it can undertake the conversion and operate in a manner which would maintain and in certain areas improve the local environment and public amenity in the area.

This EIS has concluded that the Project should proceed because it would:

1. result in no long term adverse impacts to the environment or local community (and result in some beneficial outcomes as outlined in **Table 22-4**);
2. allow for the continued use of the Site following the closure of the refining facility;
3. facilitate the continued employment of local people (albeit at a reduced level); and
4. satisfy the principles of Ecologically Sustainable Development as described in the EP&A Regulation.

This EIS has highlighted a range of issues which would be addressed through the careful design and operation of the Project.

On the basis of the findings detailed within this Environmental Impact Statement, the Project is considered to be justified.

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