Report

Proposed Change to the Kurnell Port and Berthing Facility Upgrade (SSD:5353)

30 AUGUST 2013

Prepared for

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Executive Summary

Introduction

Caltex Refineries (NSW) Pty Ltd (Caltex) is proposing to upgrade its operational port and berthing facility in Botany Bay (the Project). The Project includes a number of elements of work, one of which is the proposal to dredge Botany Bay and dispose of the sediments at the Sydney Offshore Spoil Ground. Since submitting a development application for the Project to the NSW Department of Planning and Infrastructure (DP&I) in February 2013 (ref: 5353) Caltex has identified an opportunity to reduce its dredging program by four weeks. This would be achieved by increasing the size of each hopper barge required to undertake the dredging works and so reducing the number of hopper barges, and barge movements required to complete the works.

This report explains the drivers for the change proposed, identifies the benefits that this would provide, and assesses the impacts that would result from implementing the proposed change.

Need for Project Change

Caltex originally proposed using four hopper barges to support the dredging works, each with a capacity of 500 m^3. On Caltex appointing its dredging contractor an opportunity arose to achieve greater efficiency in the dredging program through the use of a smaller number of larger barges. Each of the larger barges would have a capacity of 1,200 m^3.

Using hopper barges with this capacity would facilitate the working hopper barge being filled in approximately the same time that it would take for the second hopper barge to transit to and from the spoil ground. This was not possible with the smaller barges, and was the reason for the earlier program inefficiency. This approach would remove the original program inefficiency, and reduce the length of dredging program from 23 weeks to 19 weeks. It would also reduce the capital investment value (CIV) of the Project by approximately $3 million.

Comparing the Barge Sizes

The principal potential concern arising from the change I hopper barge size is the potential change in the dispersion of sediments in Botany Bay arising from overflow dredging operations. The two factors that affect the sediment dispersion resulting from overflow dredging are the overflow spill rate and the length of time overflow dredging takes place.

Both these factors remain unaffected by the proposed change to the Project for the reasons explained in the table below.

Consequently, the impact of the works on the physical environment and ecology of Botany Bay is unchanged from than described in the EIS. However there are a number of benefits that arise through the use of the larger barges. These include a shortening the dredging program timeline, decreasing the number of barge trips required between Botany Bay and the offshore spoil disposal ground, and a reduced project cost.

Changes to the Project

The Project description provided in the EIS would remain largely unaffected. The principal differences in the new proposal are:

- The number of trips between Botany Bay and the offshore spoil disposal ground would reduce from 374 to 206.

- Trips to the offshore disposal ground would be made once every 5h 30 mins, rather than the 2h 45 mins required for operation of the smaller barge scenario described in the in the EIS.
- The dredging time required to fill each hopper barge would increase from ‘up to 1 hour’ to ‘up to 4 h 15 mins’.
- The dredging operation would require the support of two hopper barges instead of the four hopper barges proposed in the EIS.
- The Project to dispose of 6,000 m^3 of dredged sediment within Botany Bay would remain. It would take six hopper barge loads to support this disposal instead of the 13 envisaged in the EIS.

The planning framework under which the Project would be delivered would not be affected by the proposed change.

Environmental Assessment

The potential impacts of the proposed changes in the Project have been assessed in this report.

The proposed changes to the Project would not result in any adverse impacts on the physical environment or ecology of Botany Bay beyond those identified, assessed and described in the EIS.

Nevertheless, beneficial impacts arise from the changes in terms of:

- Reduced likelihood of a potential spillage occurring.
- Reduced duration of noise impacts.
- Reduced risk of hazardous interactions between the ships involved in the planned dredging, current users of the Bay and the ongoing operations at the port and berthing facility.
- Reduced amenity impacts on the other users of the Bay.
- Reduce pressure on the Botany Bay Shipping Channel.

Consequently, Caltex does not propose to modify or amend the mitigation and management measures described in Chapter 19 of the EIS, and revised through the Submissions Report and draft Conditions of Consent.

Introduction

1.1 Introduction

Caltex Refineries (NSW) Pty Ltd (Caltex) is proposing to upgrade its operational port and berthing facility located off Silver Beach in Botany Bay (the Project).

The upgrade comprises four elements of work:

- The replacement and upgrade of the berthing infrastructure.
- Dredging.
- Sediment reuse/disposal within Botany Bay.
- Sediment disposal at the Sydney Offshore Spoil Ground located in Commonwealth waters.

In February 2013 Caltex submitted a development application (DA) to the NSW Department of Planning and Infrastructure (DP&I) seeking consent for the above Project (ref: 5353).

Since submitting the DA Caltex has identified an opportunity to reduce the proposed dredging program by four weeks. This would be achieved by reducing the number of hopper barges required to undertake the dredging works and increasing the size of each hopper barge.

1.2 Purpose of the Report

This report supplements the environmental impact statement (EIS) prepared to support the above DA. It has been prepared by URS Australia Pty Ltd (URS) (ACN 000 691 690) on behalf of Caltex Refineries (NSW) Pty Ltd (Caltex) (ABN: 19 000 108 725).

The purpose of this report is to:

- Describe the need for the change to the Project (see **Chapter 2**).
- Consider how the proposed change impacts on the statutory and planning policy framework that applies to the Project (see **Chapter 3**).
- Identify and assess the additional or modified impacts and benefits that are likely to result from implementing the proposed change (see **Chapter 4**).
- Confirm if there is a requirement to supplement or modify the mitigation and monitoring commitments of the EIS, Submissions Report and draft Conditions of Consent (see **Chapter 5**).

This report has been prepared in accordance with the provisions of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). In doing so the report:

- Identifies whether the proposed change to the Project would alter the impact assessment reported in the EIS.
- Confirms the significance of any such impact on the threatened species defined by the *Threatened Species Conservation Act 1995* (TSC Act) and the *Fisheries Management Act 1994* (FM Act).
- Identifies the potential for the proposed change to led to a significant impact on a Matter of National Environmental Significance (MNES) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Need for Project Change

This section describes the need for the change to the Project. The chapter also discusses the how the proposed change affects certain dredging parameters compared to the proposal included in the EIS. It also describes the principal impact-considerations that would result from the change.

2.1 Need for the Proposed Change in Project

The EIS described the Project as including the use of four hopper barges to support the proposed dredging operation with each barge containing up to 500 m^3 of dredged sediment. It was proposed that two of these hopper barges would remain in the Bay at any one time and two would be in transit to and from the Sydney Offshore Spoil Ground.

Whilst the proposal in the EIS was for a continuous dredging operation, the use of four hopper barges would have resulted in some redundancy (i.e., loss of time efficiency) in the program. This would have arisen due to the disparity in the time it would take to load the sediments onto the hopper barges in the Bay and the time it would take for the hopper barges to transit to and from the spoil disposal ground once they were loaded.

Estimates provided to support the EIS suggested it would take approximately 1 hour for a backhoe dredger to load 500 m^3 of sediment on to the barges proposed in the EIS . It would then take 5h 30 mins for the hopper barge to transit to and from the spoil ground. To ensure that there would be a constant rotation of barges, the filled hopper could only be replaced once an empty hopper had returned to the Bay. As a hopper barge would only return to the Bay once every 2h 45 mins, then there would be a period of up to 1h 45 mins where a full hopper barge would sit idle in the Bay[1]. This approach is not optimal in terms of both cost and program.

The use of larger capacity hopper barges would provide greater loading capacity in the dredging program. This would allow sediment to be loaded for a longer period of time between trips to and from the spoil disposal ground.

The optimal balance would be achieved by increasing the hopper barge size and reducing the number of hopper barges used to undertake the works. This approach has been proposed by Caltex's dredging contactor.

Reducing the number of hopper barges also means that fewer ships would be operating around the operational port and berthing facility. This makes it easier and safer for Caltex to manage its planned dredging works in parallel with needing to continue to load and unload fuel from tanker ships throughout the dredging program.

The proposed change also remains consistent with the wider Project outcomes that are described in Chapter 2 of the EIS, which are to:

- Ensure that shipping can continue to safely access the Kurnell port and berthing facility in the future; something that is at risk of being compromised due to a build-up of seabed sediment across parts of the dredge footprint.
- Improve the economics of the facility by reconfiguring the berthing arrangement. This would allow unloading during heavy seas; something that is currently restricted due to the capacity of the fixed berths and the greater restrictions placed on operating the sub berth during such conditions.

[1] Whilst there would be a spare hopper in the Bay, the dredging program requires the barges to rotate at regular intervals. The rotation would be determined by the time it takes for a hopper barge to return from the spoil ground, which is approximately 2 h 45 mins, i.e., half the time it takes (5 h 30 mins) for the hopper barge to transit to and from the spoil disposal ground.

- Upgrading the facility to current safety compliance standards set by the Oil Companies International Marine Forum (OCIMF) by:
  - Maintaining current shipping capability and access.
  - Extending shipping capability and access in line with expected future demands.
  - Reducing supply costs.

2.2 Proposal Overview

It is now proposed that the dredging works would be supported using two hopper barges. Caltex has considered using two different capacity hopper barges each larger than the carrying capacity of the hopper barges proposed in the EIS.

The use of a larger hopper barge would reduce the equipment needed to undertake the works compared the proposed dredging method outlined in the EIS.

Caltex's preference is to use the largest available hopper barge, which has a carrying capacity of 1,200 m^3.

Using a hopper barge with this capacity would result in the working hopper being filled in approximately the same time that it would take for the second hopper to transit to and from the spoil ground. This would reduce redundancy in the dredging program and restrict the length of dredging operations. The key benefits of the proposal to change to using the largest available capacity hopper barge are:

- Reducing the number of trips required to transport sediment to the spoil disposal ground from 374 to 206.
- Reducing the capital investment value (CIV) of the Project by approximately $3 million.
- Reducing the dredging program from 23 weeks to 19 weeks.

2.2.1 Comparison of potential approaches

Table 2-1 provides a summary of key dredging parameters associated with three alternative barges that Caltex has considered using.

Table 2-1 Key Dredging Parameters

Aspect	EIS	Use of 750 m^3 hopper barges	Use of 1,200 m^3 hopper barges
General information			
Average volume of dredge sediments contained within the barge (with overflow dredging).	500 m^3	550 m^3	1000 m^3
Average volume of dredged sediments contained within the barge (without overflow dredging)	350 m^3	400 m^3	600 m^3
Percentage of the dredging sediments (by volume) where overflow dredging would not occur.	Approximately 52%		
Total length of dredging program (allowing for contingency)	23 weeks	23 weeks	19 weeks
Number of barge movements to and from the spoil ground	374	332	206
Optimum loading and transportation time	every 2h 45 mins	every 5h 30 mins	every 5h 30 mins
Maximum number of barge trips offshore each day	up to 8	up to 4	up to 4

Dredging			
Spill rate	Modelled spill rate: 20 m^3/minute[2]		
Average dredging/barge loading time	~45 mins – 1 h	~1h 40 mins – 2h 30 mins	~3h – 4h 15 mins
Duration of overflow dredging per barge load	~20 - 30 mins	~22 - 33 mins	~40 - 60 mins
Maximum length of time overflow dredging takes place each day	Modelled length of overflow dredging each day: 22 hours [3]		
Dredging intensity [1]	22 hours per day	22 hours per day	22 hours per day
Dredging rate adopted in the modelling	1 dredging cycle per minute	1 dredging cycle per minute	1 dredging cycle per minute

[1] The original modelling assumed that the small hopper barges would be used to support dredging in Botany Bay for 22 hours per day. Caltex's appointed dredging contractor has confirmed that each hopper barge would be filled in a shorter period of time than it would have taken for the second barge to transit to and from the north west corner of the spoil ground. Consequently, the working hopper barge in the Bay would sit idle until the returning barge replaced it. Using a larger hopper barge would mean that more material could be loaded over a longer period whist the second hopper barge was in transit. This would introduce program efficiency.

[2] It should also be noted that the modelling undertaken in the Environmental Impact Assessment (EIA) adopted a notional spill rate of 20 m^3 per minute. However, the dredging contractor has advised that its predicted overflow rate is 4 m^3 per minute. Should this be the case, it would suggest that the modelling provided in the EIA over estimates the potential dispersion impacts from the dredging work in Botany Bay.

[3] The modelling prepared for the EIS allowed for overflow dredging to continuously occur for 22 hours each day. In reality the overflow dredging would take place for a shorter period of time each day:

- Approximately up to 4 hours for the smaller barges included in the proposed dredging method reported in the EIS.
- Approximately up to 2 hours for the 750 m^3 barges.
- Approximately up to 4 hours for the 1,200 m^3 barges.

2.3 Large Barge vs. Small Barge

In giving consideration to the use of a large barge, the principal impact-concern relates to changes in potential sediment dispersion arising from overflow dredging.

Two factors affect the dispersion of sediment into the environment from overflow dredging. These are:

- the overflow spill rate; and
- the length of time overflow dredging takes place.

The sediment introduced into the environment is proportional to the spill rate and period of time across which overflow dredging occurs.

2.3.1 Overflow spill rate

The spill rate generated from the use of the 1,200 m^3 hopper barge would be the same as that from the use of the barges as proposed under the dredging method included in the EIS. This is for the reasons explained in **Section 4.3.2**.

2.3.2 Length of Overflow Dredging

The period of time across which overflow dredging occurs is proportional to the barge size. Using a larger barge would mean overflow dredging from that barge would last for a longer period of time. However, over the course of the dredging program as the same volume of sediment would be removed from the Bay at the same rate using the same size of the bucket, the overall duration of overflow dredging would remain constant. Also the same volume of sediment would be dispersed into the environment over the same depositional footprint. Therefore any impacts would be consistent with those presented in the EIS.

As a consequence of the improved efficiency of barge use, the 1,200 m^3 barges would result in the dredger being active for longer periods over the continuous 19 week program.

Reducing the dredging program would also:

- Reduce general construction risk such as the likelihood of a spillage.
- Reduce the risk of marine mammals be struck by ships.
- Reduce the risk of mammals becoming entrained in the dredging equipment.
- Reduce the duration over which the assessed noise impact would occur.

2.4 Changes to the Proposed Project

The following section describes the how the proposed use of two 1,200 m^3 hopper barges alters the Project description provided in Chapter 3 of the EIS

2.4.1 Dredging Method

Overall approach

The dredging method described in Section 4.4 of the EIS would not be affected by the proposed change.

The method allows continuous dredging over a 19 week period. During this time there would be approximately 200 trips made to the spoil ground.

As described in the Submissions Report, the dredger would operate with a silt boom around the backhoe head. The boom would extend from the surface down to four metres.

Reuse and Disposal

The proposal to dispose of up to 6,000 m^3 of dredged sediments in Botany Bay as described under Section 4.4.9 of the EIS remains unchanged.

Dredging Rate

The backhoe dredger would work the seabed approximately once every minute consistent with the rate adopted in the modelling prepared to support the EIS and subsequent assessments.

It would take between 3h and 4h 15 mins to fill a 1,200 m^3 hopper barge. The difference in loading times allows for the variation in the physical characteristics of the sediment across the dredge footprint.

Dewatering

The method of dewatering (overflow dredging) would be consistent with the description provided in Section 4.4.6 of the EIS. Whilst the EIS reports an anticipated spill rate of approximately 20 m^3 every minute it is possible that this rate may be as low as 4 m^3 per minute for the reasons described in comment 2 in **Table 2-1**.

Overflow dredging would take place in all areas of the dredge footprint except in the fixed berths and a contaminated area in part of the approach to the sub berth. This is consistent with the description provided in the EIS.

The use of 1,200 m^3 would not affect the overall duration of overflow dredging. The only change would be that overflow dredging would occur for a longer a period of each time a hopper barge was filled.

Anchoring and Mooring

The method of anchoring and mooring is consistent with the methods described in Section 4.4.7 of the EIS.

Materials and Waste

The anticipated resource requirement needed to carry out the works, and volumes of waste generated as a result of the works, would be broadly consistent with the quantities reported in the EIS. No additional resource or waste streams would be introduced under the proposed change.

Disposal

The sediments would be disposed in accordance with the method provided in Section 4.4.9 of the EIS. The only change would be the ability to dispose of the sediment from a total of six hopper barges instead of the 13 hopper barges reported in the EIS.

2.4.2 Environmental Management

The works would continue to operate under the environmental management control measures specified under Section 4.7 of the EIS, notwithstanding the additional mitigation and management measures included in the Submissions Report and draft Conditions of Consent.

The dredging works would also continue to be managed under a Dredging and Spoil Disposal Management Plan (DSDMP).

2.4.3 Dredging Works Schedule

The anticipated dredging program would be revised. On the basis of continuous working, the dredging would take approximately 19 weeks to complete. In addition there would be one week to mobilise and one week to demobilise.

As noted in the EIS, the dredging schedule would be dictated by the shipping schedule at the port and berthing facility, with only a few weeks dredging required in each of the main locations (see Section 4.4.4 of the EIS).

2.4.4 Overall Program

A revised works schedule accounting for the proposed change (and the delay to approvals process) is provided below.

Table 2-2 Anticipated Construction Program

Works	Duration of Works	Total Works Period	2013			2014				2015	
			Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Dredging											
Dredging Works (including 1 weeks Mobilisation/ Demobilisation)	21 Weeks*	5 Months									
Reuse Works	1 Week										
*This allows for one week's mobilisation and one week's demobilisation as per the EIS.											

2.4.5 Peak Construction and Equipment Schedule

The peak construction periods would be consistent with the description provided in Section 4.9.5 of the EIS.

A revised equipment list is provided in the following table.

Table 2-3 Construction Equipment List

Activity	Equipment List	Original Equipment Schedule	Revised Equipment Schedule	Notes
Dredging				
Dredging Works	BHD (with associated lifting arms compressors and generators)	1	1	-
Dredging Works	Split Hopper	2 (4)	1 (2)	There would be a reduction in the number of hopper barges required to undertake the Project. One hopper barge would be in the Bay and one would be in transit. The hopper barges would swap over once every 5h 30 mins.
Safety and manoeuvring	Tugboat	3 (5)	2 (4)	The proposal in the EIS required one tugboat to remain with each of the four hopper barges at all times. The fifth tugboat was required for the backhoe dredger. Under the proposed change two tugboats would be required to transit a hopper barge offshore. Another two tugboats would be required to remain in the Bay, one to support the backhoe dredger and one to support the other hopper barge.
Supply	Launch/Supply Ship	2	1	As the number of hopper barges and tugboats would decrease so would the requirement to operate with two launch/supply ships.

2 Need for Project Change

Activity	Equipment List	Original Equipment Schedule	Revised Equipment Schedule	Notes
Two numbers are provided above for the hopper barges and tugboats. The first number, not in brackets, is the number of hoppers and tugboats operating in the Bay. The number in brackets is the total number of hopper barges and tugboats required for the Project. This shows that there would always be one hopper barge and two tugboats in transit to and from the spoil ground.				

2.4.6 Proposed Working Hours

The works would operate continuously over the 19 week program consistent with the information provided in Section 4.9.2 of the EIS.

2.4.7 Employment

The change would not affect the required construction workforce of 53[2].

[2] As confirmed by Caltex in an email to NSW DP&I 12 August 2013.

Legislation and Planning Policy

3.1 Introduction

The planning framework under which the Project would be delivered would not be affected by the proposed change. This framework is described in Chapter 5 of the EIS and summarised in **Table 4-1**. The following table also describes the impact the proposed change would have on the legislation and planning policy considered in the EIS.

3.2 Approvals and Licences

No additional approvals and licences are required under the proposed change.

Environmental Assessment

4.1 Introduction

This chapter identifies and assesses the additional or modified impacts and benefits that are likely to arise from proposed use of the 1,200 m^3 barges.

All existing mitigation and management measures specified in EIS, Submissions Report and draft Conditions of Consent would still be implemented under the proposed change.

Any additional mitigation and management measures specifically relating to the proposed use of the large capacity barges are identified below.

This chapter adopts the assessment criteria described in the EIS.

4.2 Issues Identification

The proposed use of 1,200 m^3 barges has been reviewed in the context of the receiving environment to identify any new issues for assessment. This review is documented below in **Table 4-1**.

Table 4-1 Environmental Issues Review and Gap Analysis

Environmental Aspect considered in the EIS	Further assessed in this report	Reasoning
Hydrodynamics and Coastal Process (Chapter 8)	Yes (Section 5.3)	• Dredging rate and spill rate not affected by the larger hopper barge (see **Section 2.4.1**). • Increased duration of overflow dredging from loading each hopper barge however the overall duration of overflow dredging would not be affected. • All other aspects of the works that influence the Projects' hydrodynamic impact are consistent with the EIS.
Spoil and Contamination (Chapter 9)	Yes (Section 5.4)	• No change to the volume of sediment disposed in Botany Bay. • Reduced number of disposal loads in Botany Bay (see **Section 2.4.1**).
Water and Sediment Quality (Chapter 10)	Yes (Section 5.5)	• Increased duration of overflow dredging from loading each hopper barge however the overall duration of overflow dredging would not be affected. • Extent and depth of sediment deposition consistent with the assessment made in the EIS. • Reduced program therefore reduction in impact duration. • Dispersion and availability of TBT consistent with the assessment made in the EIS.
Ecology (Chapter 11)	Yes (Section 5.6)	• Increased duration of overflow dredging from loading each hopper barge however the overall duration of overflow dredging would not be affected. • Reduced program therefore reduction in impact duration. • Reduced spillage risk due to shorter dredging program, less equipment and fewer trips offshore. • Reduced risk of marine pest introduction due to shorter dredging program, less equipment and fewer trips offshore. • Reduce strike/entrainment risk due to shorter dredging program, less equipment and fewer trips offshore.
Heritage	No	• Consistent with impacts documented in the EIS. The management

Environmental Aspect considered in the EIS	Further assessed in this report	Reasoning
(Chapter 12)		and mitigation measures of Table 12-5 of the EIS (as modified by the Submissions Report and draft Conditions of Consent) are applicable to the proposed change.
Noise (Chapter 13)	Yes (Section 5.7)	• Reduced program therefore reduction in impact duration.
Air Quality (Chapter 14)	No	• Consistent with impacts documented in the EIS. The management and mitigation measures of Table 14-5 of the EIS (as modified by the Submissions Report and draft Conditions of Consent) are applicable to the proposed change.
Hazards and Risks Assessment (Chapter 15)	Yes (Section 5.8)	• Reduced program, less equipment and fewer ships therefore less operational risk.
Wastes and Resource Management (Chapter 16)	No	• Negligible change in the Project's waste and resource profile (see **Section 2.4.1**). No change in waste or resource management. • Consistent with impacts documented in the EIS. The management and mitigation measures of Table 16-4 of the EIS (as modified by the Submissions Report and draft Conditions of Consent) are applicable to the proposed change.
Amenity, Land Use, Recreation and Navigation (Chapter 17)	Yes (Section 5.9)	• Reduction in pressure on the Botany Bay Shipping Channel. • Reduced program therefore reduction in impact duration. • Reduced duration of temporary accesses restrictions around the dredger.
Cumulative Effects (Chapter 18)	No	• The reduced program of works would not alter the Project's cumulative impact as described in the EIS. • Since preparing the EIS no additional development is proposed that shares any spatial or temporal parameters with the Project.

4.3 Hydrodynamics and Coastal Process

This Section compares the hydrodynamic changes that would result from the proposal to reduce the dredging program and increase the size of the hopper barges. The assessment is based on information provided by Cardno in a memo dated 5 August 2013. This memo is presented in **Appendix A** and a summary of the main findings is provided below.

4.3.1 Existing Environment

The existing environment is consistent with the description provided in Section 8.5 of the EIS.

4.3.2 Impact Assessment

The attached Cardno memo (see **Appendix A**) reviews the inputs to the hydrodynamic modelling prepared to support the EIS.

Spill Rate

The memo confirms that the spill rate adopted in the modelling was 20 m^3 per minute. The memo notes that the spill rate is dictated by how quickly the sediment is dredged from the seabed (the production rate). Overflow dredging only starts once the dredger is full and the water level has reached the top of the barge. At this point a constant volume of water is displaced from the hopper barge every time the backhoe places (a fixed volume of) sediment into the barge. Therefore the spill rate is dictated by the size of the bucket on the dredger and not the size of the barge. As the bucket size would not vary under the proposed change the spill rate would remain constant.

The memo also notes that, based on advice provided by the Caltex-appointed dredging contactor, the spill rate used in the modelling may be an overestimate. The contractor advises that in its view approximately four cubic metres of sediment would be released every minute during overflow dredging. Should this be the case, it would also suggest the modelling prepared for the EIS overestimated the potential dispersion and deposition impacts. Importantly, this information also suggests that the modelling results presented in the EIS are conservative.

Overflow Dredging

As noted under **Table 2-1,** when each 1,200 m^3 hopper barge is filled there would be approximately 40 to 60 minutes of overflow dredging. This is compared to the 20-30 minutes of overflow dredging that would occur on filling each barge as estimated in the EIS. Importantly, the total length of time overflow dredging would take place across the Project would not vary under the proposed change. In this case the total length of time overflow dredging occurs is dictated by the volume of sediment that would be removed from the Bay. As the volume of dredged sediment would not vary under the proposed change the total length of overflow dredging would remain constant.

The EIS modelled the impact of overflow dredging continuously for 22 hours each day. Therefore the proposed change would still result in a period of overflow dredging that would be less than the 22 hours modelled in the EIS.

Validity of the Modelling

The modelled impacts reported in the EIS remain valid under the proposed change. This is due to there being no change in the spill rate and the fact that the modelling allowed for continuous overflow dredging.

It can therefore be concluded that the predicted impacts resulting from the proposed use of 1,200 m^3 barges would be no worse than modelled and assessed in the EIS.

4.3.3 Mitigation and Management Measures

No new or revised mitigation or management measures are required to support the proposed change.

4.4 Spoil and Contamination

This Section assesses the impacts on sediment quality and the disposal of sediment resulting from the proposed change.

4.4.1 Existing Environment

The existing environment is consistent with the description provided in Section 9.5 of the EIS.

4.4.2 Impact Assessment

The same volume of sediment would be dredged from the same areas of the seabed under the proposed change. Therefore the physical and chemical characteristics of the dredged sediments are consistent with the description provided in the EIS.

Sediment Disposal in Botany Bay

The proposal to dispose of up to 6,000 m^3 of dredged sediments in the Bay remains. These sediments would still be dredged from the same two locations confirmed in Section 9.6.2 of the EIS. However, the proposed change to use 1,200 m^3 barges would require fewer loads to dispose of the sediment in the Bay:

- Under the dredging method reported in the EIS 13 hopper barges would have been required to dispose of the sediments in the Bay.
- Under the proposed change six hopper barges would be required to dispose of the sediment in the Bay.

A greater volume of sediment would be released from each hopper barge under the proposed change. Therefore the peak suspended sediment concentration generated on disposing the sediments would be marginally higher than predicted by the modelling.

The EIS modelling included the proposed disposal of up to 6,000 m^3 in the Bay. The modelling concluded that this disposal would have negligible overall impact on the results due to the fact that the majority (97-99 percent) of the suspended sediment would be generated as a result of the overflow dredging (see Appendix C of the EIS).

Despite the slight increase in peak suspended sediment concentrations from disposing of the sediments in the Bay this would have a negligible effect on the modelling results. The change does not affect the validity of the assessment or conclusions of the EIS.

4.4.3 Mitigation and Management Measures

No new or revised mitigation or management measures are required to support the proposed change.

4.5 Water and Sediment Quality

This Section describes the water and sediment quality impacts that would result from the proposed change.

4.5.1 Existing Environment

The existing environment is consistent with the description provided in Section 10.5 of the EIS.

4.5.2 Impact Assessment

Sediment Dispersion and Deposition

As noted in Section 10.6 of the EIS overflow dredging is the only process that would contribute anything of significance to the background suspended sediment concentrations found in the Bay.

Figure 10-2 in the EIS shows the sediment dispersion that would occur in Botany Bay as a result of overflow dredging close to the base of the turning circle and along the eastern arm of the approaches. The EIS concludes that "*the amount of generated suspended sediment falls to levels below 5 mg/L [the minimum ambient concentration found in Botany Bay] within a very short distance of the boundary of the project site*".

For the reasons explained under **Section 4.3.2** of this report there would be no increase in the modelled overflow impact reported in the EIS. As such, the predicted sediment dispersion and deposition impacts would be no worse than reported in the EIS.

Water Quality and TBT

The release of TBT is affected by the agitation of the water column, resulting in the release of dissolved TBT, and the dispersion and deposition of sediment-bound TBT.

The proposed change would not increase the potential for dissolved TBT to be dispersed into the environment as there would be no greater agitation of the water column. The rate and volume of sediment released during the works would be consistent with that reported in the EIS. Therefore there would be no increase or decrease in the amount of sediment-bound TBT released into the environment.

Spill Management

The likelihood of a potential spillage occurring during the works would decrease as a result of: reducing the dredging program; reducing the equipment required to undertake the works; and reducing the number of trips to the spoil ground.

4.5.3 Mitigation and Management Measures

No new or revised mitigation or management measures are required to support the proposed change.

4.6 Ecology

The following section considers the ecological impacts resulting from the proposed change.

4.6.1 Existing Environment

The existing environment is consistent with the description provided in Section 11.5 of the EIS.

4.6.2 Impact Assessment

The following table considers the nine potential direct and indirect ecological impacts assessed in the EIS.

Table 4-2 Ecological Impact Assessment

Impact	Comment
Direct removal of habitat.	The proposed change would not affect the dredge footprint. Therefore the amount and type of removed habitat would be consistent with that reported in the EIS.
Creation of sediment plumes and associated impacts on	For the reasons explained in **Section 4.3** and **Section 4.5** of this report the sediment dispersion impacts would be no worse than those described in the

Impact	Comment
water quality, including mobilisation of contaminated sediments.	EIS. Also there would be no change in water quality impacts as a result of the proposed change. There would therefore be no change in associated ecological impacts assessed and reported in the EIS.
Deposition of sediments disturbed during dredging.	The predicted sediment deposition impacts would be no worse than those described in the EIS. Therefore the ecological impacts would be consistent with those assessed and reported in the EIS.
Ship strike and entrainment in dredging equipment.	The reduced dredging program, reduced number of trips offshore and the reduced equipment required to undertake the works would decrease the potential for marine mammal strikes and entrainment in the dredging equipment.
Altered light regimes.	The maximum peak suspended sediment concentrations generated during overflow dredging would be no worse under the proposed change than assessed in the EIS. Therefore the ecological impacts would be consistent with those reported in the EIS.
Acoustic impacts.	See **Section 4.7**.
Introduction of pest species.	The risk of transferring or introducing marine pest species would decrease due to the fewer trips offshore and the shortened dredging program.
Marine oil spills.	As noted under **Section 4.5.2** of this report the likelihood of a potential spillage occurring during the works would decrease as a result of reducing the dredging program, reducing the equipment required to undertake the works and reducing the number of trips offshore. Therefore the ecological impacts would be now worse that those assessed and reported in the EIS.
Changes to hydrodynamic processes.	As noted in **Section 4.3** the impacts resulting from the proposed change would be no worse than modelled in the EIS. Therefore the ecological impacts would be consistent with those assessed and reported in the EIS.

4.6.3 Mitigation and Management Measures

No new or revised mitigation or management measures are required to support the proposed change.

4.7 Noise

This section describes the acoustic impacts resulting from the proposed modification.

4.7.1 Existing Environment

The proposed use of two 1,200 m^3 barges would not alter the construction noise sources included in Table 7-2 of Appendix G to the EIS. The construction noise scenarios would however change.

Table 13-1 of the EIS reports the eight scenarios that would occur whilst the works are taking place. The first three scenarios include the proposed dredging works.

For each dredging scenario the identified noise sources included one dredger and two tugboats. The modelling did not account for the third tugboat that would remain in the Bay because it would only be operating very occasionally.

Under the proposed change there would still be three noise sources: one dredger and two hopper barges as per **Table 2-3**.

4.7.2 Impact Assessment

Surface Noise

As noted above the proposed change would require the same (noise generating) equipment to operate in Botany Bay. The overall noise level would therefore be consistent with that modelled in the EIS.

The noise generated by the tugboats moving the hopper barges offshore was not modelled in the EIS. This is because it represented an occasional noise source with a low sound power level compared to the other higher sound power level (nosier) equipment that would be working constantly in the Bay. Therefore the proposed change to using two tugboats to transit the 1,200 m^3 hopper barges offshore would have no likely material noise impact.

Shortening the dredging program would however reduce the length each receptor is exposed to the associated noise generated during dredging.

Underwater Noise

As reported in Section 13.6.3 of the EIS the underwater noise generated during dredging would potentially affect any marine mammals and fish within 150 metres. The proposed change would not alter the underwater noise generated during dredging; therefore the impact is consistent with the assessment made in the EIS.

Shortening the dredging program would however reduce the length each receptor is exposed to the associated noise generated during dredging.

4.7.3 Mitigation and Management Measures

No new or revised mitigation or management measures are required to support the proposed change.

4.8 Hazards and Risks

This Section assesses the hazards and risks resulting from the proposed change.

4.8.1 Existing Environment

The existing environment is consistent with the description provided in Section 15.5 of the EIS.

4.8.2 Impact Assessment

The EIS developed a number of incident scenarios and assessed the risk of associated with each scenario.

Three scenarios would benefit for the shorter program, reduced equipment needed to undertake the works and the reduced number of trips offshore, as summarised in the table below.

Table 4-3 Summary List of Incident Scenarios

Dredging and Facility Upgrade	
Scenario 2	Hazardous interactions between ships involved in the proposed dredging and upgrade works and the current commercial and recreational ships that use the area, with the potential for personnel injury or the loss of personnel overboard.
Scenario 5	Loss of containment event (diesels, oils, lubricants and hydraulic fluids) from ships as a result of the proposed works.
Scenario 9	Hazardous interaction between ongoing port and berthing activities leading to impacts on submerged submarine fuel pipelines, hoses, risers etc., resulting in the loss of containment of crude oil and petroleum products.

4.8.3 Mitigation and Management Measures

No new or revised mitigation or management measures are required to support the proposed change.

4.9 Amenity, Land Use, Recreation and Navigation

This Section assesses the navigational and recreational impacts resulting from the proposed change.

4.9.1 Existing Environment

The existing environment is consistent with the description provided in Section 17.4.2 and Section 17.5.2 of the EIS.

4.9.2 Impact Assessment

Recreational Use

The shorter dredging program would reduce the length of time the temporary exclusion zone would need to be implemented around the works. Also, reducing the respite periods during dredging would mean the dredger would not sit idle in a given location for a long period of time. This would reduce the amount of time recreational users would be excluded from a given area of the Bay.

Integration with Current Shipping Operation

The proposed use of 1,200 m^3 barges would reduce the number of ships operating in the dredge footprint whilst dredging takes place. The EIS reported the need for up to 10 ships to operate in this area whilst dredging. The proposed change would reduce this number to seven.

- The 10 ships reported in the EIS included the ships listed in **Table 2-3** and one jack-up barge required for piling and one barge to support the mobile crane (required for the piling and sub berth upgrades).
- Under the proposed change there would be a requirement for seven ships to operate in the Bay. This accounts for reduction in equipment shown in **Table 2-3**.

This reduces the risks of needing to manage the works in an area where ongoing loading and unloading operations would be taking place.

Shipping Channel

The proposed changes reduce the number of trips offshore form 374 to 206. This would put less pressure on the shipping channel. Further benefit would be provided by reducing the program of works by four weeks.

4.9.3 Mitigation and Management Measures

No new or revised mitigation or management measures are required to support the proposed change.

Mitigation and Management Measures

As assessed under **Chapter 5** there would be no increase in impact resulting from the proposed change. At worst the predicted impacts would be consistent with the assessment made in the EIS.

As such, there is no proposed change to the mitigation and management measures described in Chapter 19 of the EIS, which are revised through the Submissions Report and draft Conditions of Consent.

Limitations

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Appendix A : Cardno Report

Our Ref LJ3008/L2625 :sge

Contact P. D. Treloar

12 August 2013

South Australia and Permits Section, EACD
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Attention: Daryl Venables
CC: Ms Christina Halim, Caltex; Mr Craig Patterson, NSW EPA

Dear Sir,

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Purpose of this Letter

Caltex has been advised by Heron Construction (the appointed dredging contractor for the above works) that economies of scale and a reduced number of dredged-spoil barge loads can be achieved by using barges that are larger than those described in the Sea Dumping Permit (SDP) Application and used in previous spoil ground plume modelling. The revised proposal is to use a hopper barge that has a capacity of 1200m^3. This larger hopper barge would increase dredging efficiency through loading more material into each barge whilst the second barge is in transit to and from the Spoil Ground.

The purpose of this letter is to confirm, based on further modelling undertaken, potential changes to impacts on Botany Bay and the Sydney Offshore Spoil Ground. This letter has been prepared with reference to the Environmental Impact Assessment (EIA) prepared to support the approved SDP Application.

The following section describes the changes in loading, spill and discharge rates in Botany Bay and at the Spoil Ground that would result from both the increased size of hopper barge and shorter discharge times offshore.

Sediment Loading

The spill rate from the proposed larger barges will not vary from that for the smaller barges because the spill rate is dictated by the production rate of the Machiavelli (back-hoe). If the Machiavelli loads one bucket of material into the barge every minute and the bucket is 5.5m^3 (as advised by the approved contractor), then once the water level in the barge reaches the top, a maximum of 5.5m^3 of water will be displaced every time the Machiavelli places a bucket of sediment into the barge. Hence, the spill rate will be 5.5m^3/minute and therefore there is no increase in dredge and overflow plume conditions within Botany Bay. Note: that the previous modelling adopted a spill rate of 20m^3/minute, based on advice at that time; hence that overflow modelling was conservative.

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The predicted dredging rates in Botany Bay are based on the use of a 5.5m^3 bucket (80% full) and a cycle time of 65 seconds. This leads to a spill rate of 4.0m^3/minute.

However, for the purpose of this exercise, the assessment has used 100% full buckets and a 60 second cycle time, which equates to a spill rate of 5.5m^3/minute. This rate is much lower than adopted for the previous modelling.

As the spill rates do not vary between barge sizes there has been no requirement to remodel hydrodynamic impacts in Botany Bay. The existing modelling is valid under the proposal to use a larger barge.

Sediment Disposal

In the original modelling, a discharge period of between 1 and 10 minutes was adopted (see EIA report Section 4.6.1). The shortest possible discharge period has been revised down to 40 seconds following advice sought from the commissioned dredging contractor. This has been adopted to assess the impact of discharging with a larger hopper barge at the offshore spoil ground.

The result of having a shorter disposal time and a larger disposal load is that sediment plumes would be generated with higher peak suspended sediment concentrations than had previously been predicted. This is demonstrated in the attached figures.

Table 1-1 Discharge Volume Comparisons

	Time to Discharge	Volume of Sediment per Load
750m^3 Split Hopper Barges	40 seconds	550 – 600m^3
1200m^3 Split Hopper Barges	40 seconds	950 – 1000m^3

Using the above data, the worst case modelling scenario was rerun to calculate potential changes in sediment deposition impact. Note that the Table 1-1 data assumes overflow and barge filling to 80% of capacity.

Model Setup

As noted above, the dredging contractor has advised that barge unloading times may be as short as 40 seconds. During this period, up to 1,000m^3 of sediment would be discharge at the Spoil Ground. This is compared to the discharge of 550m^3 over a of one minute period reported in the EIA (see Paragraph 4.2.1.2, Appendix D2 of the EIA report).

A sensitivity analysis based on this modified disposal procedure has been undertaken to describe the changes in suspended sediment concentrations. In such a case the barge would travel at 4 knots and cover a distance of approximately 80m during 40 seconds. The sensitivity simulation was undertaken for Track C (see Appendix D2 of the EIA) assuming a current speed of 0.1m/s with flow going south. Taking into account the model grid size at the Spoil Ground, which is approximately 50m, the modelled discharge takes place over a length of three grid points or 100m. The modelling predictions also used the highest percentage of fines that would be dispersed (dredged from Area 3, see Appendix D2 of the EIA). No discount for fines lost already during the dredging near the fixed berth has been included. Consequently, the concentrations of suspended sediments will be conservatively high.

Model Results

Results are presented in the accompanying **Figures 1.1** and **1.2**. Cardno has also provided **Figures 4.7a** and **4.7b** from Appendix D2 to facilitate a direct comparison between the outcome of the previous model and this latest modelling work. For ease, a matching suspended sediment scale has been used. Peak suspended sediment concentrations 10 minutes after commencing disposal, and for a barge unloading time of one minute (Cardno, 2013) and 40 seconds, are shown in **Table 1-2**.

Table 1-2 Peak Suspended Sediment Concentrations

Peak Suspended Sediment Concentration 10 Minutes after End of Disposal - Track C (mg/L)	Barge Unloading Time		
	1 Minute ($750m^3$ Barge)		40 Seconds ($1,200m^3$ Barge)
Current Magnitude (m/s)	**0.1**	**0.3**	**0.1**
Top 20m of the Water Column	5	3	11
Bottom 20m of the Water Column	5	4	16

The peak concentration 10 minutes after the end of disposal in the bottom 20m of the water column would be about 16mg/L for a 40 second disposal time using the larger hopper barge. Note that these are peak concentrations from the far field Delft3D numerical modelling reported in Appendix D2 and not the steady state model that reported a peak concentration of 30mg/L.

The steady-state analytical results presented in Appendix D2 were higher because no grid size averaging occurs, but being steady-state there is also some over-estimation of a very short-term process. Although not re-calculated herein, based on the results in **Table 1-2**, the maximum concentration derived from the analytical model would be about 90mg/L.

For a barge unloading time of one minute (**Figures 4.7a** and **4.7b**) it can be seen that peak concentrations decrease as the current magnitude increases.

In a similar way, peak sediment concentrations would be lower for a barge unloading time of 40 seconds and a current magnitude of 0.3m/s, in comparison to the case of the current being 0.1m/s (note: this scenario has not been remodelled).

This remodelled simulation provides a worst case scenario (lowest ocean current speed) in terms of suspended sediment concentrations.

Conclusions

Based on a threshold concentration of 5mg/L of fines being the concentration lower limit of visible surface silt plumes in clean seawater, these results suggest that the plumes would be visible for a barge unloading time of 40 seconds. This threshold is based on Cardno's observational experience of suspended sediments in Moreton Bay, Newcastle and Botany Bay.

Twenty (20) minutes after the end of disposal, peak concentrations in the top 20m of the water column will have diminished to approximately 5mg/L and hence the plumes would only be slightly visible.

Generally, dispersion of the suspended fine sediments will be over the same spatial extent, or less, than predicted previously. The potential for less dispersion arises from the fact that there would be less surface area/unit mass of dredged sediment exposed to the sea as the larger parcels of dredged sediments descended to the seabed.

Table 1-3 Peak Suspended Sediment Concentrations

Peak Suspended Sediment Concentration 20 Minutes after End of Disposal Track C (mg/L)	Barge Unloading Time		
	1 Minute		40 Seconds
Current Magnitude (m/s)	**0.1**	**0.3**	**0.1**
Top 20m of the Water Column	2	2	5
Bottom 20m of the Water Column	3	3	9

There would be no difference in the average depth of discharged spoil on the seabed, but the bigger barge loads would likely cause some higher ridges greater than the reported 0.5 m in the EIA report.

Yours faithfully,

P. D. Treloar

P. D. Treloar
Senior Principal - Coastal and Ocean
for **Cardno (NSW/ACT) Pty Ltd**

References

Cardno (2013) Appendix D2 - Kurnell Port and Berthing Facility Upgrade Offshore Spoil Ground Disposal - Suspended Sediment Plumes, Deposition and Spoil Ground Stability Studies. *LJ3008/R2789 Prepared for URS Corporation on Behalf of Caltex Refineries (NSW) Pty Ltd*

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