

Kurnell Wharf Infrastructure Upgrade Sediment and Water Quality Monitoring Program

CALTEX REFINERIES (NSW) PTY LTD

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1 INTRODUCTION

Caltex Refineries (NSW) Pty Ltd (Caltex) proposes to undertake port and berthing facility works off Silver Beach in Botany Bay, NSW (the Project). There are two main elements to the Project:

- Dredging; and
- Upgrading existing elements of the berthing infrastructure.

This Sediment and Water Quality Monitoring Program (Monitoring Program) relates only to the dredging component of the works and the monitoring requirements of Draft Condition of Approval including condition C36.

This Monitoring Program has been developed to support the Sediment and Water Quality Management Plan (SWQMP) which has been prepared in accordance with Conditions of Approval C1, C2 and C3. This Monitoring Program must be implemented in conjunction with the SWQMP.

2 OBJECTIVE

The objective of this Monitoring Program is to specify the sediment and water monitoring to be undertaken before, during and after dredging activities. The Monitoring Program addresses the sampling requirements needed for compliance with the Environmental Protection License issued by the EPA.

3 PROJECT OVERVIEW

Dredging of approximately 153,000 m³ is required from spot locations within the berths, approaches and turning circle over a total area of approximately 178,000 m². Dredging locations are shown on Figure 1.

The dredging is required to achieve a number of access improvements, including:

- Improve overall navigability across the dredge footprint through removal of sediment that has accumulated over the past 40 years;
- Extend the depth, length and width of the two fixed berths to allow larger capacity ships to access the berths and load/unload at the Kurnell Wharf; and
- Provide improved access in and out of the sub berth.

The dredging works will leave a broadly flat, uniform area across the base of the dredge footprint to the following depths:

- Turning circle and approaches returned to the design depth of 12.8 m below CD;
- Sub berth returned to the design depth of 14m below CD; and
- Fixed berths increased to overall effective depth of 12.8 m below CD.

Up to 6,000 m³ of dredged sediments will be reused locally to cover an exposed section of the Kurnell Refinery subsea fuel pipelines located behind the sub berth and a former anchor point at the entry to the sub berth.

The majority of dredged sediments (up to a maximum of 153,000 m³) will be disposed of at the Sydney Offshore Spoil Ground (as per the conditions of the Sea Dumping Permit, issued for the Project under the Commonwealth *Environmental Protection (Sea Dumping) Act 1981*).

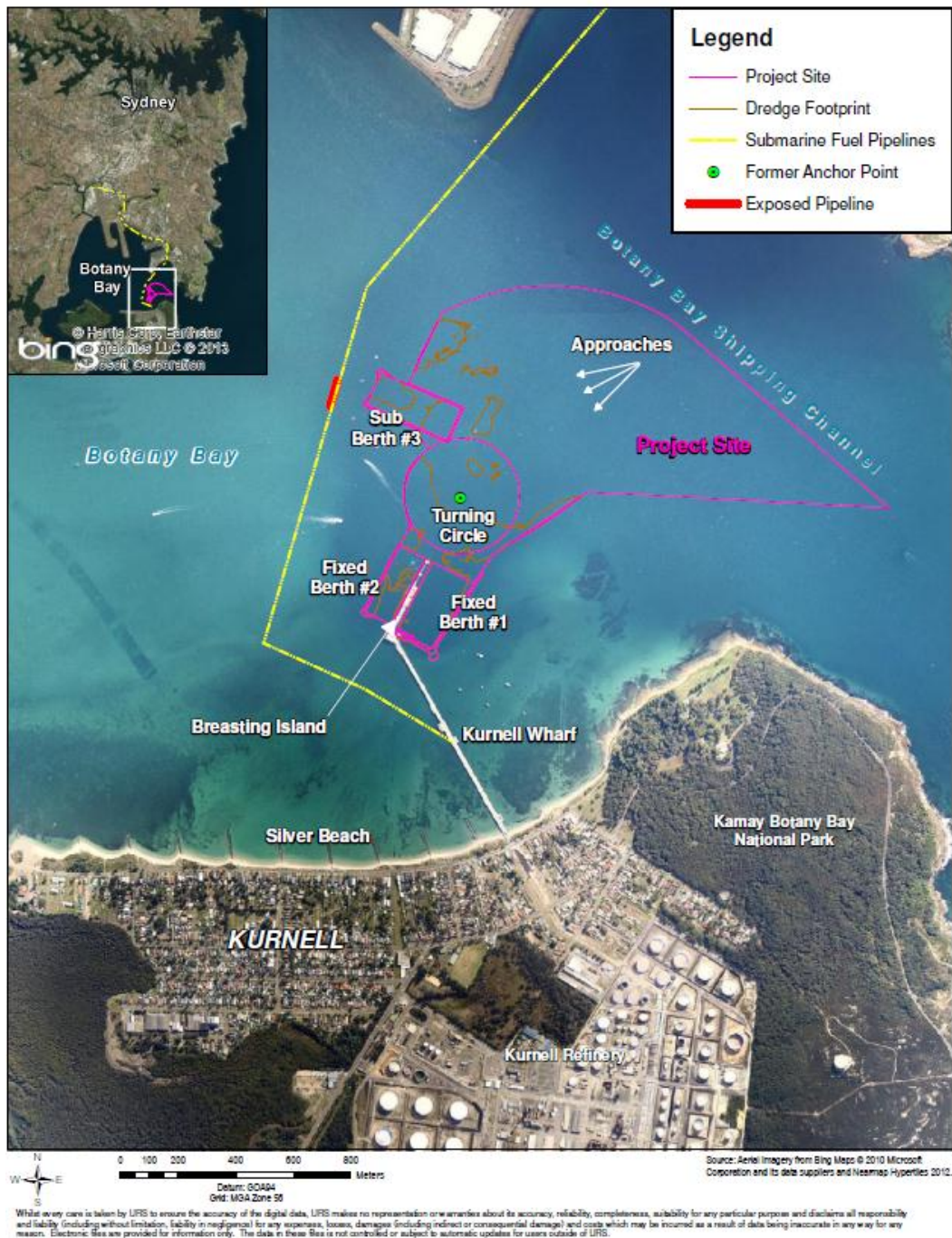


Figure 1 - Project Site and dredge footprint (URS 2013a)

4 MONITORING

Water quality within Botany Bay during dredging will be evaluated against baseline levels. Dry weather baseline water quality monitoring will be carried out for a period of at least four weeks prior to the commencement of dredging activities to establish concentrations against which levels during dredging can be compared [DCoA C3].

4.1 Monitoring Parameters

The range of parameters that will be monitored during the dredging activities will include testing for:

- Dissolved TBT;
- Sediment bound TBT;
- Total suspended solids;
- Dissolved oxygen (DO); and
- pH.

The measurement of turbidity (NTU) will be used to monitor concentrations of total suspended solids once the statistical relationship between turbidity and total suspended solids has been established and approved by the EPA prior to commencement of dredging [EPL Condition L2.5]. Monitoring of turbidity allows for direct measurement which is not possible for total suspended solids.

4.2 Monitoring Locations

It is proposed to establish six fixed water quality monitoring points (Monitoring Points 1 to 6) and two mobile monitoring point, in accordance with EPL Condition P1.2 and DCoA C3.

The location of the fixed monitoring points is shown in Figure 8-1 and described in EPL Condition P1.2. These monitoring points are:

- Monitoring Point 1 Reference Site – Background water quality monitoring
- Monitoring Point 2 Aquaculture Site – Discharge to waters monitoring
- Monitoring Point 3 Seagrass Site (Posidonia) – Discharge to waters monitoring
- Monitoring Point 4 Seagrass Site (Posidonia / Halophila) – Discharge to waters monitoring
- Monitoring Point 5 Project Site – Discharge to waters monitoring
- Monitoring Point 6 Project Site – Discharge to waters monitoring

The mobile water quality monitoring points 7 and 8 (Monitoring Point 7 – Discharge to waters – near field water quality monitoring and Monitoring Point 8 – Discharge to waters – water quality monitoring) are proposed to be down current and within the flow path of the sediment plume under all tidal

conditions and approximately 10m and 50m respectively from the outside edge of the dredge silt boom, dredge barge or overflow barge (whichever is relevant to the sediment plume flow path). The locations for Monitoring Point 7 and Monitoring Point 8 will consider tidal current directions, vessel location, dredging activities and plume direction [EPL Condition L.2].

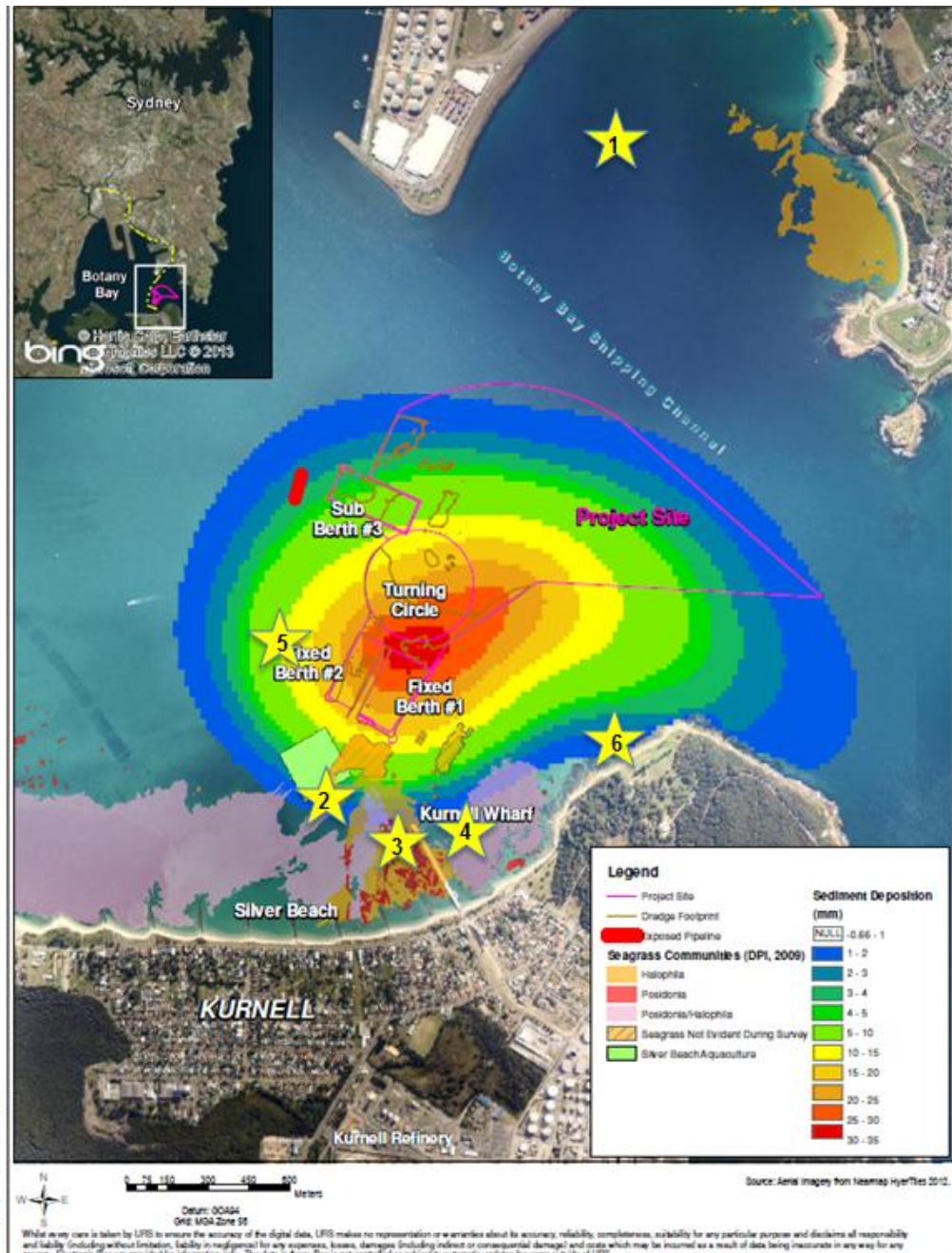


Figure 2 - Location of water quality monitoring points (URS 2013)

4.3 Sampling Frequency

Water quality monitoring during dredging will include both real time (live) continuous monitoring of selected parameters and some discrete sample collection events (grab samples) with subsequent laboratory analysis.

Real time monitoring of turbidity, pH and DO will be undertaken for the duration of the dredging activities. This will be achieved through the deployment of the continuous water quality monitoring buoys. Water quality monitoring buoys will monitor, record and transmit turbidity, pH and DO levels at 0.2 m below the water line at approximately 15 minute intervals [EPL Condition M2.1].

The measurement of dissolved TBT and sediment bound TBT also cannot be undertaken as real time monitoring so discrete water samples (grab samples) will be collected and submitted to a laboratory for analysis.

The frequency of sampling for all sampling before, during and after dredging activities are summarized on Table 1-1, Table 1-2 and Table 1-3.

Table 1-1 Monitoring Program – Prior to commencement of dredging activities

Parameter	Location	Frequency	Comment
Total suspended solids measured as turbidity (NTU)	Reference Site (Monitoring Point 1)	Real time monitoring for 4 weeks prior to dredging	Correlate with all fix monitoring points
	Aquaculture Site (Monitoring Point 2)	Real time monitoring for 4 weeks prior to dredging	Correlate with all fix monitoring points
	Seagrass Beds (Monitoring Points 3 and 4)	Real time monitoring for 4 weeks prior to dredging	Correlate with all fix monitoring points
	Project Site (Monitoring Point 5 and 6)	Real time monitoring for 4 weeks prior to dredging	Correlate with all fix monitoring points
	Mobile Monitoring Site (Monitoring Point 7 & 8)	NIL	
Tributyltin (TBT) (dissolved TBT)	Reference Site (Monitoring Point 1)	NIL	
	Aquaculture Site (Monitoring Point 2)	NIL	
	Seagrass Beds (Monitoring Points 3 and 4)	NIL	
	Project Site (Monitoring Point 5 and 6 which)	Every two weeks prior to commencement over four weeks (twice in total)	Correlate results between Points 5 and 6. Retest if concentrations are not consistent
	Mobile Monitoring Site (Monitoring Point 7 & 8)	NIL	
Tributyltin (TBT) (sediment bound TBT)	Reference Site (Monitoring Point 1)	NIL	
	Aquaculture Site (Monitoring Point 2)	NIL	
	Seagrass Beds (Monitoring Points 3	NIL	

	and 4)		
	Project Site (Monitoring Point 5 and 6)	Every two weeks prior to commencement over four weeks (twice in total)	Correlate results between Points 5 and 6. Retest if concentrations are not consistent
	Mobile Monitoring Site (Monitoring Point 7 & 8)	NIL	
Dissolved Oxygen (DO) and pH	Reference Site (Monitoring Point 1)	Real time monitoring for 4 weeks prior to dredging	Correlate with all fix monitoring points
	Aquaculture Site (Monitoring Point 2)	Real time monitoring for 4 weeks prior to dredging	Correlate with all fix monitoring points
	Seagrass Beds (Monitoring Points 3 and 4)	Real time monitoring for 4 weeks prior to dredging	Correlate with all fix monitoring points
	Project Site (Monitoring Point 5 and 6)	Real time monitoring for 4 weeks prior to dredging	Correlate with all fix monitoring points
	Mobile Monitoring Site (Monitoring Point 7 & 8)	NIL	

Note: In the event that the correlation of TBT results (both dissolved and sediment bound) shows inconsistent results then retesting may result in a third or fourth sampling event.

Table 1-2 Monitoring Program – During dredging activities

Parameter	Location	Frequency	Comment
Total suspended solids measured as turbidity (NTU)	Reference Site (Monitoring Point 1)	Real time monitoring	Background level
	Aquaculture Site (Monitoring Point 2)	Real time monitoring	Result should be less than 10mg/l above background Level
	Seagrass Beds (Monitoring Points 3 and 4)	Real time monitoring	Result should be less than 10mg/l above background Level
	Project Site (Monitoring Point 5 and 6)	Real time monitoring	Result should be less than 50mg/l above background Level
	Mobile Monitoring Site (Monitoring Point 7 & 8)	Grab sample collected 3 times in the first week of overflow dredging in the Sub Berth and 3 times in the first week of dredging in Berth 1 and weekly thereafter. Weekly sampling for all other dredging	Correlate results with real time monitoring at Point 1 through to Point 6. Results should not be less than Points 1 through 6
Tributyltin (TBT) (dissolved TBT)	Reference Site (Monitoring Point 1)	NIL	No scheduled monitoring although adhoc testing may be conducted for result verification
	Aquaculture Site (Monitoring Point 2)	NIL	No scheduled monitoring although adhoc testing may be conducted for result verification
	Seagrass Beds (Monitoring Points 3 and 4)	NIL	No scheduled monitoring although adhoc testing may be conducted for result verification
	Project Site (Monitoring Point 5 or 6 whichever is up current of dredging)	Grab sample collected 3 times in the first week of overflow dredging in the Sub Berth and 3 times in the	Schedule may be revised after consultation with the EPA

	activities)	first week of dredging in Berth 1 and weekly thereafter. Weekly sampling for all other dredging	
	Mobile Monitoring Site (Monitoring Point 7 & 8)	Grab sample collected 3 times in the first week of overflow dredging in the Sub Berth and 3 times in the first week of dredging in Berth 1 and weekly thereafter. Weekly sampling for all other dredging	Concentration at Monitoring Point 8 should be below 0.006ug/l. Schedule may be revised after consultation with the EPA
Tributyltin (TBT) (sediment bound TBT)	Reference Site (Monitoring Point 1)	NIL	No scheduled monitoring although adhoc testing may be conducted for result verification
	Aquaculture Site (Monitoring Point 2)	NIL	No scheduled monitoring although adhoc testing may be conducted for result verification
	Seagrass Beds (Monitoring Points 3 and 4)	NIL	No scheduled monitoring although adhoc testing may be conducted for result verification
	Project Site (Monitoring Point 5 and 6)	Grab sample collected 3 times in the first week of overflow dredging in the Sub Berth and 3 times in the first week of dredging in Berth 1	Correlate with results of Monitoring Point 5 or 6 and Points 7 and 8
	Mobile Monitoring Site (Monitoring Point 7 & 8)	Grab sample collected 3 times in the first week of overflow dredging in the Sub Berth and 3 times in the first week of dredging in Berth 1	Correlate with results of Monitoring Point 5 or 6 and Points 7 and 8
Dissolved Oxygen (DO) and pH	Reference Site (Monitoring Point 1)	Real time monitoring	Background level
	Aquaculture Site (Monitoring Point 2)	Real time monitoring	Results should be within +/- 1.5 pH units and <6mg/l DO
	Seagrass Beds (Monitoring Points 3 and 4)	Real time monitoring	Results should be within +/- 1.5 pH units and <6mg/l DO
	Project Site (Monitoring Point 5 and 6)	Real time monitoring	Results should be within +/- 1.5 pH units and <6mg/l

			DO
	Mobile Monitoring Site (Monitoring Point 7 & 8)	NIL	

Table 1-3 Monitoring Program – Following completion of dredging activities

Parameter	Location	Frequency	Comment
Total suspended solids measured as turbidity (NTU)	Reference Site (Monitoring Point 1)	Real time monitoring for one week following completion of dredging	Correlate with all fix monitoring points
	Aquaculture Site (Monitoring Point 2)	Real time monitoring for one week following completion of dredging	Correlate with all fix monitoring points
	Seagrass Beds (Monitoring Points 3 and 4)	Real time monitoring for one week following completion of dredging	Correlate with all fix monitoring points
	Project Site (Monitoring Point 5 and 6)	Real time monitoring for one week following completion of dredging	Correlate with all fix monitoring points
	Mobile Monitoring Site (Monitoring Point 7 & 8)	NIL	
Tributyltin (TBT) (dissolved TBT)	Reference Site (Monitoring Point 1)	NIL	
	Aquaculture Site (Monitoring Point 2)	NIL	
	Seagrass Beds (Monitoring Points 3 and 4)	NIL	
	Project Site (Monitoring Point 5 and 6 which)	At the completion of dredging and one week after completion of dredging	
	Mobile Monitoring Site (Monitoring Point 7 & 8)	NIL	

Tributyltin (TBT) (sediment bound TBT)	Reference Site (Monitoring Point 1)	NIL	
	Aquaculture Site (Monitoring Point 2)	NIL	
	Seagrass Beds (Monitoring Points 3 and 4)	NIL	
	Project Site (Monitoring Point 5 and 6)	One week after completion of dredging	Correlate with Total Suspended Solids results
	Mobile Monitoring Site (Monitoring Point 7 & 8)	NIL	
Dissolved Oxygen (DO) and pH	Reference Site (Monitoring Point 1)	Real time monitoring for one week following completion of dredging	Correlate with all fix monitoring points
	Aquaculture Site (Monitoring Point 2)	Real time monitoring for one week following completion of dredging	Correlate with all fix monitoring points
	Seagrass Beds (Monitoring Points 3 and 4)	Real time monitoring for one week following completion of dredging	Correlate with all fix monitoring points
	Project Site (Monitoring Point 5 and 6)	Real time monitoring for one week following completion of dredging	Correlate with all fix monitoring points
	Mobile Monitoring Site (Monitoring Point 7 & 8)	NIL	

4.4 Sampling

The collection of samples for TBT analysis needs to consider tidal current direction, vessel location, dredging activities and plume direction. Samples at Monitoring Points 7 and 8 must be collected down current and within the flow path of a sediment plume under all tidal conditions.

The water samples collected for TBT analysis (grab samples) will be collected at mid depth in the water column or approximately 4 m from the water's surface (if depth is greater than 4 m). Duplicate grab samples will be collected at every sampling event. The duplicate samples will be stored and used for data verification as needed.

During the collection of grab samples the following information must be recorded:

- Date of sampling;
- Time of sampling;
- Sampling location and depth;
- Name of sampler;
- Dredger location and current direction;
- Dredging activities (overflow/non overflow); and
- Any observations including sediment plume locations (if visible).

5 DATA MANAGEMENT

Water quality monitoring data will be assessed against baseline water quality levels (measured prior to commencement of dredging), reference water quality levels (measured at Monitoring Point 1, 5 and/or 6) and rainfall data to confirm the validity of results. Validated results will then be assessed against the trigger levels set out in the EPL and the SWQMP. Tables 1-1, 1-2 and 1-3 include comments that need to be considered during the assessment of data.

Rainfall will be measured and recorded in millimetres per 24 hour period, at the same time each day throughout the dredging activities [EPL Condition L2.4]. Where turbidity levels exceed the trigger levels the rainfall data will be examined to determine the potential influence of rainfall run-off on turbidity levels.

If anomalous results detected in grab samples (including elevated concentrations of TBT) then analysis of the corresponding duplicate sample should be undertaken. The testing of the duplicate sample will validate the primary sample result reflected the concentration of TBT in the water sample.

All monitoring will be carried out in accordance with the relevant Approved Methods Publication, unless otherwise set out in EPL or approved in writing by the EPA [EPL Condition M3.2]. All Project personnel will have the experience and necessary training to carry out their required tasks, including in the use of equipment and the implementation of this Monitoring Program.