PORT BOTANY EXPANSION

ADDITIONAL HIGH SPOT DREDGING OFF MOLINEUX POINT

SECTION 96 (1A) MODIFICATION

May 2009

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1. INTRODUCTION

Sydney Ports Corporation (Sydney Ports) has obtained planning approval from the Minister for Planning for the construction and operation of a new container terminal, referred to as the Port Botany Expansion (DA-494-11-2003i approved on 13 October 2005 and 22 August 2006).

The approved dredging and reclamation methodology during construction is described in Chapter 8 of the Environmental Impact Statement (EIS) (URS, 2003). The approved development provides for:

- dredging and reclamation within the primary silt curtain between Brotherson Dock and the Parallel Runway; and
- dredging of approximately 220,000m^3 of high spots outside the primary silt curtain.

Chapter 8 of the EIS (page 8-10) states that:

> "*Several high spots currently exist in the ship turning area to the south of the main dredge area as shown in Figure 8.4. It would be necessary to remove these navigation hazards as shipping traffic increases in these areas and ships become larger. Dredging of these minor obstructions would be conducted as part of the contract for the berth and reclamation area to avoid having to remobilise dredging equipment at a later date.*
>
> *It is expected that approximately 220,000 m^3 of material would need to be removed from these areas. The cutter suction dredging method would be used. Where possible, dredged material would be pumped directly to the reclamation area, however, pumping may not prove practical for the most distant locations, in which case, the dredged material would be loaded into barges for transportation to the reclamation site*."

The new terminal and approach channel has been designed to accommodate 8,000 TEU vessels. Recently, ship navigation simulation exercises have been undertaken for the 8,000 TEU vessels. These simulations have identified that during certain wind conditions, the 8,000 TEU vessels can drift onto the high spot at Molineux Point and potentially run aground. The approved extent of dredging of the high spot at Molineux Point is insufficient to prevent the vessels from running aground during these wind conditions.

An additional 20m width is required to be dredged from the high spot off Molineux Point to cater for the 8,000 TEU vessels under adverse wind conditions. This requires an additional 100,000m^3 of dredging.

The additional dredging off Molineux Point would not change the total quantity of material required to be dredged for the Port Botany Expansion Project.

This modification application seeks planning approval for additional dredging of the high spot off Molineux Point, to improve the safety of vessel navigation within Port Botany.

2. MODIFICATION DESCRIPTION

2.1. EIS Approved Dredging Configuration

The approved dredging and reclamation methodology is described in detail in Section 8.2.3 of the EIS. It includes the following principal dredging and reclamation activities:

- dredging of an access channel to the new berths and removal of high spots within the ship turning area to allow ships to manoeuvre and berth at the new terminal;
- reclamation of land for additional container terminal capacity using the dredged material;
- progressive construction of counterfort walls to contain the outer edges of the reclaimed land; and
- reclamation of land for a new boat ramp and car park with direct access to Foreshore Road.

Figure 8.4 of the EIS, reproduced below as Figure 2, identifies the approved dredging configuration.

2.2. Proposed Changes to Dredging Configuration

2.2.1. Additional Dredging – Ship Turning Area

A modification application is currently being assessed by the Department of Planning (DoP) for additional dredging within the ship turning area. The modification is seeking approval to dredge an additional 300,000m^3 of sand from the ship turning area for use in the reclamation. The application would not result in any increase in the total volume of material dredged as part of the Port Botany Expansion project.

The environmental assessment for the additional ship turning area dredging concluded that there would be no increased impact arising from the proposed dredging.

2.2.2. Additional Dredging – High Spot off Molineux Point

The approved EIS identified that dredging of the high spot off Molineux Point would be required as part of the Port Botany Expansion project (refer to Figure 2). To improve vessel navigation safety, it has been identified that the width of the high spot off Molineux Point needs to be increased by 20m, requiring an additional 100,000m^3 of sand to be removed from this location.

This modification application seeks approval to undertake the additional 100,000m^3 of dredging off Molineux Point.

The edge of the dredged areas would have a slope of 1:3 to 1:5 to the adjacent undisturbed areas. All dredged material would be placed within the reclamation area. This dredging would reduce the amount of dredging required within the main dredged area between the Parallel Runway and the new terminal.

As there would be no changes to the total dredged quantity required for the development, or the type, nature, or scale of operations that would take place on the terminal as a result of approval of the modification, the modification is substantially the same development as the approved development.

2.3. Dredging Method for Proposed Changes

It is likely that a Trailing Suction Hopper Dredger would be used for the additional dredging. This method is consistent with the EIS and with the methodology described in the modification application for the additional dredging in the ship turning area.

Trailing Suction Hopper Dredgers are sometimes referred to as ‘vacuum cleaner dredgers’. When arriving on location the dredger is set in position and a suction pipe is lowered overboard until drag heads reach the seabed (**Figure 1**, Number 1). The depth of the drag heads is controlled continuously to ensure correct depths are achieved.

While the vessel moves forward, the loosened seabed material is drawn up the pipe (**Figure 1**, Number 2). The material is pumped into the dredger’s hopper where it settles to the bottom, while the excess water drains through a variable overflow system (**Figure 1**, Number 3).

When the hopper is full, the dredger sails to the reclamation area via the 50 metre gate in the silt curtain, where the material is placed underwater in a controlled manner by splitting the hull over the complete length. All reclamation for the Port Botany Expansion Project is inside the primary silt curtain. The gate in the silt curtain would be kept open while dredging is undertaken off Molineux Point, including when the material is deposited at the reclamation area. The gate will be kept closed while the dredger is working entirely within the area between the Parallel Runway and the new terminal.

The Trailing Suction Hopper Dredger would only be able to loosen unconsolidated sediments. Should the sand be consolidated, a Cutter Suction Dredge would be required to dredge the sediment.

Figure 1 - Working principle of Trailing Suction Hopper Dredge

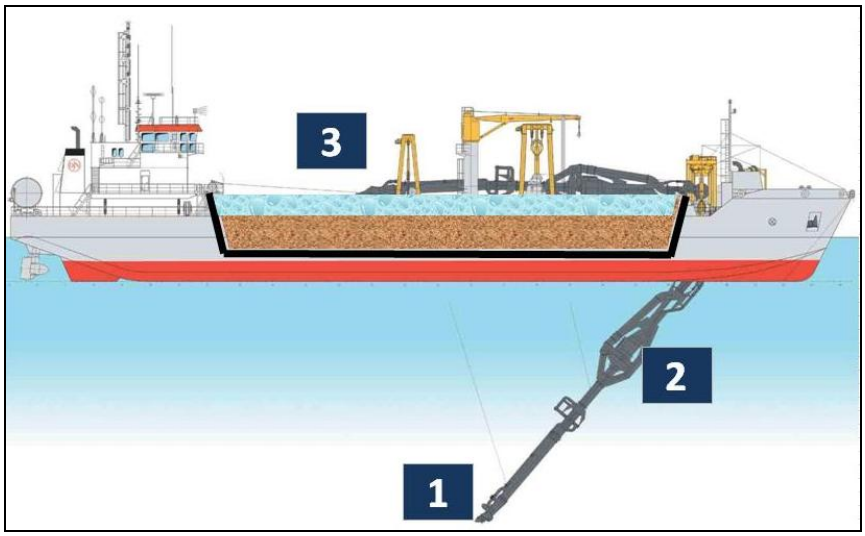
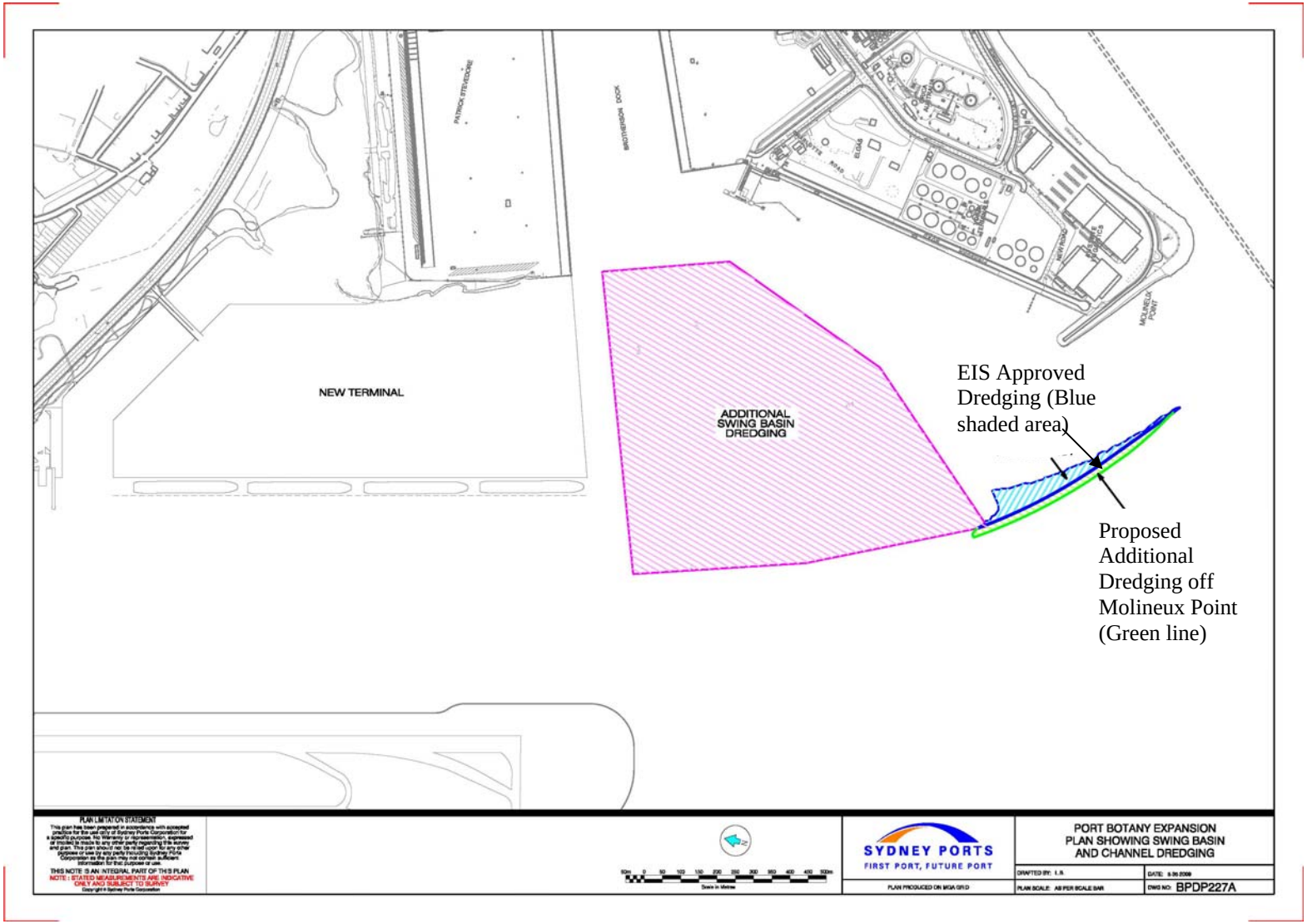


Figure 2: Approved Dredging and Reclamation (From URS, 2003)

Figure 2: Proposed Additional Dredging of High Spot Off Molineux Point



3. RELEVANT STATUTORY REQUIREMENTS AND APPROVAL PROCESSES

3.1. Environment Protection & Biodiversity Conservation Act 1999 [Commonwealth]

The then Commonwealth Minister for the Environment and Heritage accredited the NSW environmental impact assessment process for the proposed Port Botany Expansion. The assessment was undertaken in accordance with Part 4 of the *Environmental Planning & Assessment Act 1979* (EP&A Act), with the single EIS for the project satisfying the assessment requirements of both the Commonwealth and NSW Legislation.

Information on the proposed modification has been sent be sent to the Commonwealth Department of Environment, Heritage, Water and the Arts (DEWHA) by Sydney Ports to seek advice as to whether this modification requires assessment and determination by the Department under this Act. Should a determination be required under the Act then the DoP would refer the application to DEWHA following approval.

There would be no impact on Commonwealth land and no change is required to the Penrhyn Estuary Habitat Enhancement Plan as a result of the modification.

3.2. Airports Act 1996 [Commonwealth]

The modification is not a 'controlled activity' as defined under the *Airports Act*. There would be no intrusion into prescribed airspace and no change to the level of lighting or sunlight reflectivity arising from the modification.

3.3. Environmental Planning & Assessment Act 1979 [NSW]

Section 96 (1A) of the EP&A Act states that a consent authority may modify a development consent if:

"

(a) it is satisfied that the proposed modification is of minimal environmental impact, and

(b) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which the consent was originally granted and before that consent as originally granted was modified (if at all), and

(c) it has notified the application in accordance with:

(i) the regulations, if the regulations so require, or

(ii) a development control plan, if the consent authority is a council that has made a development control plan under section 72 that requires the notification or advertising of applications for modification of a development consent, and

(d) *it has considered any submissions made concerning the proposed modification within any period prescribed by the regulations or provided by the development control plan, as the case may be. "*

Table 1 sets out the sections in this document that relate to each of the above requirements.

Table 1: Section 96(1A) Requirements

Requirement under Section 96(1A)	Location in document where addressed
(a) Proposed modification is of minimal environmental impact	Section 5
(b) Modified consent would be substantially the same development	Section 2.2.2
(c) Notification of the application	Notification is not required under the Regulations or under any Development Control Plan applying to the site. The modification has been discussed with: ▪ the Port Botany Expansion Community Consultative Committee, which includes representatives of the City of Botany Bay Council and Randwick Council; ▪ NSW Department of Primary Industries Fisheries; ▪ the Harbour Master; ▪ NSW Maritime; and ▪ adjacent dredging projects in Botany Bay. Further details are provided in Section 4.
(d) Consideration of submissions	Responses to the comments and issues raised by relevant stakeholders are summarised in Section 4, Table 2.

4. CONSULTATION

4.1. Port Botany Expansion Community Consultative Committee

Sydney Ports has a commitment to the Community Consultative Committee (CCC) to advise them of proposed project modifications in advance of seeking approval from the NSW Department of Planning. Accordingly, this modification was raised with the CCC at the meeting of 6 May 2009. Questions raised by the CCC, and Sydney Ports' response, are provided in **Table 2**.

4.2. Botany and Randwick Councils

Representatives of Botany Bay and Randwick Councils are members of the CCC. Questions raised by Council representatives at the CCC meeting of 6 May 2009, and Sydney Ports' response, are provided in **Table 2**.

4.3. Harbour Master

The proposed dredging of the high spot off Molineux Point has been discussed with the Harbour Master, and the Harbour Master has subsequently granted permission under Clause 67 of the *Management of Waters and Waterside Lands Regulation*, subject to conditions. A copy of the Harbour Master approval is provided in Appendix A.

4.4. Department of Environment and Climate Change

A licence variation will be sought for dredging of the high spot off Molineux Point. The licence application will be consistent with that prepared for the additional dredging of the ship turning area, for which a draft variation has been received, and will cover information on dredging methods and turbidity monitoring.

4.5. Department of Primary Industries (Fisheries)

Information relating to the proposed dredging, including the hydrodynamic modelling presented in Appendix C, was forwarded to DPI Fisheries for comment. When feedback is received it will be forwarded to the DoP.

4.6. Other Dredging Projects in Botany Bay

Representatives of Sydney Water (Water Delivery Alliance) and Energy Australia were consulted regarding the potential dredging changes at a meeting on 30 April 2009, as the Sydney Ports Port Botany Expansion, Sydney Water Desalination Pipeline and Energy Australia cable works are all occurring within Botany Bay at the same time. There were no comments on the proposed dredging or concerns raised from Sydney Water or Energy Australia.

Note that the hydrodynamic modelling presented in Section 5.2.1 and Appendix C includes impacts from the Sydney Water and Energy Australia projects as a cumulative impact assessment.

4.7. NSW Maritime

Approval from NSW Maritime for the project is given in the Dredging Agreement between NSW Maritime and Sydney Ports dated 27 March 2007. This Agreement includes the area off Molineux Point. Information relating to the proposed dredging was provided to NSW Maritime. NSW Maritime advised by email that they had no navigational objection to the proposed additional dredging. A copy of the email is provided in Appendix A.

4.8. Summary

A summary of the issues raised or comments made by relevant stakeholders, and Sydney Ports' response to these comments are provided in **Table 2**.

Table 2: Stakeholder Comments / Issues & Responses

Stakeholder Issue / Comment	Sydney Ports Response
CCC Community Members Will studies on changes to wave action be done as part of the modification and who will do the study?	Hydrodynamic assessment is being done as part of the modification by Cardno Lawson Treloar – the same organisation that has done all the wave modelling work for the project for Sydney Ports. This assessment is provided in Appendix C to this report.
Botany Council Representative on CCC Representative was not present at CCC meeting.	-
Randwick Council Representative on CCC Would all dredged material associated with the modification be placed in the reclamation?	Yes. All dredged material would be sand that would be placed in the reclamation.
Harbour Master Approved subject to conditions (refer Appendix A).	These conditions are acceptable.
NSW Maritime No navigational objection.	-
NSW Department of Primary Industries Fisheries No response received at this time.	-
Sydney Water (Water Delivery Alliance) No concerns or issues raised.	-
Energy Australia No concerns or issues raised.	-

5. ENVIRONMENTAL ASSESSMENT

5.1. Construction Impacts

Construction impacts are not expected to increase from EIS predictions as a result of the proposed modification.

5.1.1. Turbidity

Turbidity could be generated during dredging from the following sources:

- at the suction / cutter head, though sediment losses are usually small as the economics of dredging is greatly affected by losses near the drag heads;
- discharge of water from the variable overflow system onboard the Trailing Suction Hopper Dredger; and
- when placing dredged material from the hopper on to the reclamation area.

The material to be dredged would be sand which produces less turbidity than clays. Monitoring of dredging and reclamation in sands and clays to date on the Port Botany Expansion project has shown minimal turbidity that is well below the project water quality criteria.

Additional turbidity monitoring would be undertaken during any dredging operations within the ship turning area, in accordance with a DECC licence variation. Turbidity monitoring would consist of:

- monitoring twice during each outgoing tide during daylight hours at at least two locations 50m downstream of the working area. The locations would be dependent on tidal flows.
- comparison of monitoring results to an upstream monitoring location, to allow identification of any differences between turbidity from dredging and local background turbidity levels.
- Monitoring on each outgoing tide during daylight hours at the gate in the silt curtain during the first week of dredging outside the silt curtain, and comparison with turbidity measurements at the continuous monitoring buoys outside the silt curtain. This would confirm that turbidity levels remain below water quality criteria.
- visual surveillance for turbidity plumes at all times during reclamation by a responsible person who can identify turbidity plumes.

Turbidity monitoring would be undertaken with a calibrated handheld probe and recorded with an onboard data logger. All samples would be taken at one metre depth in the water column.

A correlation between Total Suspended Solids (TSS) and turbidity for the specific area to be dredged would be established prior to start of the dredging activities. This correlation would indicate the NTU-equivalent of 50 mg/L that would be used as the field equivalent for TSS.

Dredging would stop if turbidity levels at downstream monitoring locations are greater than the equivalent of 50mg/L above the upstream monitoring locations, and would not recommence until NTU levels return below this threshold. TSS confirmation sampling and laboratory analysis would be undertaken if downstream NTU value exceeds upstream turbidity by the equivalent of 50mg/L.

Operational controls for a Trailing Suction Hopper Dredge, that would be used in response to increasing turbidity levels are described in **Table 3** below. These may be used to control turbidity as needed.

Table 3: Operational Controls for Trailing Suction Hopper Dredge

Mitigation Measure Description	Possible Immediate Measures
Adjust overflow height	✓
Sail dredge away from area	✓
Use turbidity-reducing valve in overflow	✓
Reduce or augment trailing speed	✓
Adjust dredging depth	✓
Limit cycle time	✓

Regular turbidity and water quality monitoring would continue weekly as per the *Soil & Water Management Sub-Plan*.

Turbidity monitoring and exceedance response procedures will be the subject of a licence variation to be submitted to DECC.

5.1.2. Noise

There would be no increased noise impacts, as the dredger would be operating over two kilometres from the nearest residents. This is further than the scenarios modelled in the *Construction Noise & Vibration Management Sub-Plan* which met noise criteria set for the project. There may be reduced impact due to less dredging inside the primary silt curtain, which is closest to the noise-sensitive receivers identified for the project.

Regular noise monitoring would continue monthly as per the *Construction Noise & Vibration Management Sub-Plan*.

5.1.3. Seagrasses

There may be reduced impact on the retained seagrass along Foreshore Beach as there would be less dredging between the Parallel Runway and the new terminal adjacent to the retained seagrass area.

Regular seagrass monitoring would continue weekly as per the *Seagrass Management Sub-Plan*.

5.1.4. Aquatic Ecology

A review of the aquatic ecology issues relating to additional dredging off Molineux Point was undertaken by Cardno Ecology Lab. A copy of the review is provided in Appendix B.

Cardno Ecology Lab's assessment states that the proposed dredging configuration does not change the impacts described in the EIS, on the basis that:

- there are no seagrasses, algal beds or reefs in the high spot off Molineux Point;
- there would be limited opportunity for colonisation of seagrasses or algae in the area;
- temporary losses of benthos would be recolonised following the completion of dredging;
- water exchange is not likely to change as a result of the proposed dredging; and

- any *Caulerpa taxifolia* that may have colonised the area would be deposited and buried within the reclamation.

Therefore the impacts on aquatic ecology are minimal and as per the EIS conclusions.

5.1.5. Other Projects / Services

Consultation with nearby Sydney Water and Energy Australia dredging projects has indicated that there would be no effect on other services, or other current projects in Botany Bay.

5.2. Operational Impacts

Operation impacts are not expected to increase from EIS predictions as a result of the proposed modification.

5.2.1. Hydrodynamics

An investigation of hydrodynamic effects of the proposed additional dredging off Molineux Point was undertaken by Cardno Lawson Treloar. The investigation considers the impacts of the additional dredging off Molineux Point together with the dredging within the ship turning area. A copy of the investigation is provided in Appendix C.

Cardno Lawson Treloar considered that there would be no change to local sea generation and propagation as water depths at the high spot off Molineux Point are sufficiently deep to have no effect on local sea and the proposed additional deepening would have no effect.

Cardno Lawson Treloar undertook additional current and swell wave modelling to assess the impact of the proposed dredging on shipping operations, the Parallel Runway, and shoreline areas of Botany Bay. Wave modelling was undertaken for the following scenarios:

- *existing* as at EIS approval, which is before any dredging commenced;
- *approved development*, which includes all subsequent approvals since EIS approval up to May 2009;
- *additional ship turning area dredging*, the subject of the modification application currently being assessed by the Department of Planning*;* and
- *additional Molineux Point dredging* (referred to in the report and Proposed Knob Dredging May 2009), which includes the *additional ship turning area dredging*. This is the dredging that is the subject of this Section 96 application.

The results of this modelling were:

- Effective wave heights from the *additional Molineux Point dredging* would be similar to those for the *approved development*.
- Wave directions at beaches around Botany Bay following the *additional Molineux Point dredging* would be generally unchanged when compared with the *approved development* (refer to Table 4 below). Changes in wave direction of less than 0.05 degrees would occur in some locations, which amounts to no identifiable change. At one location at Silver Beach a change in wave direction of 0.1 was observed. This location is within the existing Silver Beach groyne field and hence there would be no change on the beach, other than an unidentifiable change within one groyne compartment.
- As the proposed additional dredging shows no change in wave conditions on any beaches around Botany Bay, they would not contribute to any potential impacts in a cumulative way that might arise from other works in Botany Bay.
- Wave heights along the Parallel Runway, with the *additional Molineux Point dredging*, would remain significantly smaller than the wave heights for the *existing* bathymetry.

- Small changes in current direction and magnitude near Port Botany are mainly due to the increase in depth with the *additional ship turning area dredging* and would not affect shipping operations at the port.

The outcome of the modelling by Cardno Lawson Treloar is that the *additional Molineux Point dredging* would not cause any deleterious changes in wave heights and directions within Botany Bay.

Table 4: Results of wave modelling by Cardno Lawson Treloar

He = effective wave height, φm = weighted mean wave direction
Locations: 1 to 29 = Silver Beach, 30- 53 = Towra Beach, 59-86 = Lady Robinsons Beach. Numbers relate to Figure 1 in Appendix B.

Location	Existing as at EIS Approval		Approved Development (Difference from Existing)		Additional Ship Turning Area Dredging (Difference from Existing)		Additional Molineux Point Dredging + Additional Ship Turning Area Dredging (Difference from Existing)	
	He (m)	φm (°TN)	ΔHe (m)	Δφm (°TN)	ΔHe (m)	Δφm (°TN)	ΔHe (m)	Δφm (°TN)
1	0.10	331.8	0.00	0.0	0.00	0.0	0.00	0.0
2	0.12	340.7	0.00	0.0	0.00	0.0	0.00	0.0
3	0.17	344.2	0.00	0.0	0.00	0.0	0.00	0.0
4	0.20	341.6	0.00	0.0	0.00	0.0	0.00	0.0
5	0.20	351.1	0.00	0.0	0.00	0.0	0.00	0.0
6	0.24	4.6	0.00	0.0	0.00	0.0	0.00	0.0
7	0.26	3.5	0.00	0.0	0.00	0.0	0.00	0.0
8	0.23	10.1	0.00	0.0	0.00	0.0	0.00	0.0
9	0.18	18.7	0.00	0.0	0.00	0.0	0.00	0.0
10	0.17	24.1	0.00	0.0	0.00	0.0	0.00	0.0
11	0.16	23.4	0.00	0.0	0.00	0.0	0.00	0.0
12	0.16	30.9	0.00	0.0	0.00	0.0	0.00	0.0
13	0.17	34.3	0.00	0.0	0.00	0.0	0.00	0.0
14	0.18	33.8	0.00	0.0	0.00	0.0	0.00	0.0
15	0.16	34.9	0.00	0.0	0.00	0.0	0.00	0.0
16	0.16	38.6	0.00	0.0	0.00	0.0	0.00	0.0
17	0.16	36.3	0.00	0.0	0.00	0.0	0.00	0.0
18	0.16	31.1	0.00	0.0	0.00	0.0	0.00	0.1
19	0.15	28.8	0.00	0.0	0.00	0.0	0.00	0.0
20	0.15	27.3	0.00	0.0	0.00	0.0	0.00	0.0
21	0.16	34.9	0.00	0.0	0.00	0.0	0.00	0.0
22	0.16	41.0	0.00	0.0	0.00	0.0	0.00	0.0
23	0.17	39.9	0.00	0.1	0.00	0.1	0.00	0.1
24	0.16	38.0	0.00	0.1	0.00	0.1	0.00	0.1
25	0.17	31.9	0.00	0.0	0.00	0.0	0.00	0.0
26	0.16	34.2	0.00	0.0	0.00	0.0	0.00	0.0
27	0.16	35.6	0.00	0.0	0.00	0.0	0.00	0.0
28	0.18	30.5	0.00	0.0	0.00	0.0	0.00	0.0
29	0.17	15.9	0.00	0.0	0.00	0.0	0.00	0.0
30	-	-	0.00	0.0	0.00	0.0	0.00	0.0
31	0.16	62.2	0.00	0.0	0.00	0.0	0.00	0.0
32	0.14	55.4	0.00	0.0	0.00	0.0	0.00	0.0
33	0.16	69.3	0.00	0.0	0.00	0.0	0.00	0.0

Location	Existing as at EIS Approval		Approved Development (Difference from Existing)		Additional Ship Turning Area Dredging (Difference from Existing)		Additional Molineux Point Dredging + Additional Ship Turning Area Dredging (Difference from Existing)	
	He (m)	φm (°TN)	ΔHe (m)	Δφm (°TN)	ΔHe (m)	Δφm (°TN)	ΔHe (m)	Δφm (°TN)
34	0.16	52.8	0.00	0.0	0.00	0.0	0.00	0.0
35	0.16	56.8	0.00	0.0	0.00	0.0	0.00	0.0
36	0.17	51.0	0.00	0.0	0.00	0.0	0.00	0.0
37	0.17	56.9	0.00	0.0	0.00	0.0	0.00	0.0
38	0.19	56.2	0.00	0.0	0.00	0.0	0.00	0.0
39	0.15	45.2	0.00	0.0	0.00	0.0	0.00	0.0
40	0.12	38.6	0.00	0.0	0.00	0.0	0.00	0.0
41	0.14	39.9	0.00	0.0	0.00	0.0	0.00	0.0
42	0.18	41.9	0.00	0.0	0.00	0.0	0.00	0.0
43	0.18	46.0	0.00	0.0	0.00	0.0	0.00	0.0
44	0.18	50.7	0.00	0.0	0.00	0.0	0.00	0.0
45	0.16	46.4	0.00	0.0	0.00	0.0	0.00	0.0
46	0.16	41.1	0.00	0.0	0.00	0.0	0.00	0.0
47	0.14	43.9	0.00	0.0	0.00	0.0	0.00	0.0
48	0.13	40.9	0.00	0.0	0.00	0.0	0.00	0.0
49	0.16	36.2	0.00	0.0	0.00	0.0	0.00	0.0
50	0.20	29.5	0.00	0.0	0.00	0.0	0.00	0.0
51	0.20	10.3	0.00	0.0	0.00	0.0	0.00	0.0
52	0.15	1.0	0.00	0.0	0.00	0.0	0.00	0.0
53	0.24	52.5	0.00	0.0	0.00	0.0	0.00	0.0
54	0.24	80.7	0.00	0.0	0.00	0.0	0.00	0.0
55	0.25	79.6	0.00	0.0	0.00	0.0	0.00	0.0
56	0.31	83.6	0.00	0.0	0.00	0.0	0.00	0.0
57	0.29	80.8	0.00	0.0	0.00	0.0	0.00	0.0
58	0.41	84.0	0.00	0.0	0.00	0.0	0.00	0.0
59	0.12	102.5	0.00	0.0	0.00	0.0	0.00	0.0
60	0.15	97.6	0.00	0.0	0.00	0.0	0.00	0.0
61	0.22	82.8	0.00	0.0	0.00	0.0	0.00	0.0
62	0.23	74.2	0.00	0.0	0.00	0.0	0.00	0.0
63	0.20	70.1	0.00	0.0	0.00	0.0	0.00	0.0
64	0.13	83.1	0.00	0.0	0.00	0.0	0.00	0.0
65	0.11	81.8	0.00	0.0	0.00	0.0	0.00	0.0
66	0.13	98.0	0.00	0.0	0.00	0.0	0.00	0.0
67	0.16	100.3	0.00	0.0	0.00	0.0	0.00	0.0
68	0.17	110.9	0.00	0.0	0.00	0.0	0.00	0.0
69	0.22	102.5	0.00	0.0	0.00	0.0	0.00	0.0
70	0.23	97.3	0.00	0.0	0.00	0.0	0.00	0.0
71	0.21	98.3	0.00	0.0	0.00	0.0	0.00	0.0
72	0.21	99.9	0.00	0.0	0.00	0.0	0.00	0.0
73	0.18	110.6	0.00	0.0	0.00	0.0	0.00	0.0
74	0.22	118.6	0.00	0.0	0.00	0.0	0.00	0.0
75	0.18	115.4	0.00	0.0	0.00	0.0	0.00	0.0
76	0.16	113.9	0.00	0.0	0.00	0.0	0.00	0.0
77	0.14	110.5	0.00	0.0	0.00	0.0	0.00	0.0
78	0.14	110.9	0.00	0.0	0.00	0.0	0.00	0.0

Location	Existing as at EIS Approval		Approved Development (Difference from Existing)		Additional Ship Turning Area Dredging (Difference from Existing)		Additional Molineux Point Dredging + Additional Ship Turning Area Dredging (Difference from Existing)	
	He (m)	φm (°TN)	ΔHe (m)	Δφm (°TN)	ΔHe (m)	Δφm (°TN)	ΔHe (m)	Δφm (°TN)
79	0.12	115.3	0.00	0.0	0.00	0.0	0.00	0.0
80	0.10	119.8	0.00	0.0	0.00	0.0	0.00	0.0
81	0.08	123.5	0.00	0.0	0.00	0.0	0.00	0.0
82	0.06	127.9	0.00	0.0	0.00	0.0	0.00	0.0
83	0.04	133.8	0.00	0.0	0.00	0.0	0.00	0.0
84	0.02	139.0	0.00	0.0	0.00	0.0	0.00	0.0
85	0.02	147.5	0.00	0.0	0.00	0.0	0.00	0.0
86	0.01	168.6	0.00	0.0	0.00	0.0	0.00	0.0
87	0.01	191.8	0.00	0.0	0.00	0.0	0.00	0.0
88	0.02	198.3	0.00	0.0	0.00	0.0	0.00	0.0
89	0.14	132.1	0.00	0.0	0.00	0.0	0.00	0.0

6. CONCLUSION & RECOMMENDATION

There would be no increased impact from the additional dredging of the high spot off Molineux Point as assessed in this application. It is considered that the proposed modification is substantially the same development as the approved development and would have minimal environmental impact. Therefore an application under Section 96(1A) is appropriate.

Approval for increasing the volume of sandy material dredged from the high spot off Molineux Point should be granted. The mitigation measures to be implemented as part of the modification are summarised below:

- Turbidity monitoring would be undertaken twice during each outgoing tide during daylight hours, as outlined in Section 5.1.1.
- Visual surveillance for turbidity plumes would be conducted at all times during reclamation.
- Operational controls as outlined in Section 5.1.1 would be implemented in response to increasing turbidity levels.

7. REFERENCES

URS (2003) *Port Botany Expansion Environmental Impact Statement,* prepared for Sydney Ports Corporation

APPENDIX A

SUBMISSIONS FROM STAKEHOLDERS

MAY 2009

SYDNEY PORTS
FIRST PORT, FUTURE PORT

27th May 2009

Jan De Nul
PO Box 641
Botany 1455
New South Wales

Dear Sir

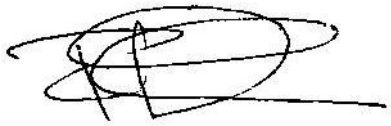
Permission for Disturbance of the Bed of a Special Port Area

I, the Harbour Master for the Ports of Sydney Harbour and Botany Bay, grant permission to Jan De Nul under Clause 67 of the *Management of Waters and Waterside Lands Regulations* for works disturbing the bed of a Special Port Area.

This permission applies to the works described as additional channel widening dredging within the areas shown on plan BPD227A dated 5.05.2009.

The permission is valid for the period of 6 months to 27-11-2009 and is issued subject to the Conditions attached at Schedule 1.

This Permission does not imply that any other permission, approval or consent required under any state or federal legislation has been granted, and works are not to commence until all such permissions, approvals or consents are issued by the relevant authorities.



Richard Lorraine
Harbour Master

27th May 2009

Schedule 1 – Conditions of Permission

1. The Applicant is to implement a marine traffic management plan which is to be approved by Sydney Ports Corporation.

2. The works are not to interfere with the movement of trading vessels unless agreed in advance with Sydney Ports Corporation.

3. Buoys are not to be laid in or adjacent to the shipping channels unless agreed in advance with Sydney Ports Corporation.

4. All buoys are to be fitted with lights.

5. All vessels associated with the works are to have response plans for emergencies and spills.

6. All hours contact numbers are to be provided to Sydney Ports Corporation.

7. All operations to be undertaken in accordance with the current version of port operating protocol.

Message

From: Graeme Alley
Sent: Wednesday, 27 May 2009 12:32 PM
To: Marika Calfas
Subject: FW: Additional Dredging of the High Spot Off Molineux Point

Graeme Alley
Senior Manager, Botany Projects

Sydney Ports Corporation
Penrhyn Road | Banksmeadow NSW 2019 Australia
PO Box 25, Millers Point | NSW 2000 Australia

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www.sydneyports.com.au

From: Graeme Dunlavie [mailto:Graeme.Dunlavie@maritime.nsw.gov.au]
Sent: Wednesday, 27 May 2009 11:05 AM
To: Graeme Alley
Subject: RE: Additional Dredging of the High Spot Off Molineux Point

Good Morning Graeme

Please be advised that NSW Maritime has no navigational objection to the proposed additional dredging woorks to be undertaken off Molineaux Point.
Regards

Graeme Dunlavie
Operations Manager Botany Bay/Port Hacking
Recreational Boating & Regional Services
NSW Maritime

Serving our Boating Community - Safe Waterways and Support for the Maritime Community

T: 02 9545 4422 | F: 02 9545 3648 | M: 0418 417 032
PO Box 456 | SUTHERLAND NSW 1499
www.maritime.nsw.gov.au

> -----Original Message-----
> **From:** Graeme Alley [mailto:galley@sydneyports.com.au]
> **Sent:** Tuesday, 26 May 2009 5:49 PM
> **To:** Graeme Dunlavie
> **Subject:** FW: Additional Dredging of the High Spot Off Molineux Point
>
> Graeme with reference to email below, can you send an email confirming that NSW Maritime have no issues with the proposed additional dredging off Molineux Point. The response is the same that you provided for the Swing Basin dredging. We have to separate the two areas for the DoP submissions.
>
> **Graeme Alley**
> Senior Manager, Botany Projects
>
> **Sydney Ports Corporation**
> Penrhyn Road | Banksmeadow NSW 2019 Australia

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From: Marika Calfas
Sent: Tuesday, 26 May 2009 8:31 AM
To: Graeme Alley
Subject: Additional Dredging of the High Spot Off Molineux Point

Hi Graeme,

NSW Maritime are the owner of the land of the bed of Botany Bay. It would be helpful for inclusion in our documentation to the Department of Planning if we could receive feedback from NSW Maritime regarding the acceptability of the additional 100,000m3 of dredging proposed from the high spot off Molineux Point. This additional dredging will widen the dredged area in this location by 20m. Response from NSW Maritime confirming that they have no issues with the proposed additional dredging is all that is required.

The attached plan shows the location of the additional dredging off Molineux Point (see Green line).

Regards
Marika

Marika Calfas
Senior Manager Planning

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SYDNEY PORTS

APPENDIX B

AQUATIC ECOLOGICAL ASSESSMENT BY CARDNO ECOLOGY LAB

12 MAY 2009

Cardno Ecology Lab Pty Ltd
ABN 73 002 379 473

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Australia
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Marcus.LincolnSmith@cardno.com.au
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12 May 2009

Ms Marika Calfas
Senior Manager – Planning
Sydney Ports Corporation
Level 8, 207 Kent Street Sydney NSW 2000 Australia

Email: Mcalfas@sydneyports.com.au

Dear Marika,

Re: Proposal for change to dredging configuration, Port Botany Expansion – aquatic ecology issues

In response to your enquiry regarding the potential effects on aquatic ecology of changes to the dredging configuration for the Port Botany Expansion, I provide the following advice.

Background and description of proposed changes

Background in the proposed changes was provided by Sydney Ports (email correspondence M. Calfas: 4-5-2009) and is summarised here.

Investigations into potential changes to dredging and reclamation methodology identified an opportunity to use a Trailing Suction Hopper Dredger to undertake some of the dredging. This opportunity presents a number of advantages over the dredging methodology presented in the EIS (URS 2003). The proposed dredging would not change the principal dredging and reclamation activities described in the EIS.

The changes would include the following:

1. Deeper levels in the ship turning basin in some areas by the dredging of an additional 300,000 m^3, compared to that indicated in the EIS. Levels within the ship turning basin would be 1 to 2.5 metres below the current seabed in parts of the ship turning basin, though it is likely that not all sand would be removed to these levels. There would be no widening or re-orientation of the ship turning basin.
2. Additional dredging of the high spot off Molineux Point of 100,000 m^3, compared to that indicated in the EIS.

The edge of these dredged areas would have a slope of between 1:1.5 and 1:3 to the adjacent undisturbed areas.

All dredged material would be placed within the reclamation area. This dredging would reduce the amount of dredging required within the main dredge area between the Parallel Runway and the new

terminal, as the total amount to be dredged as part of the Port Botany Expansion Project would not change.

As there would be no changes to the total dredged quantity for the development, or the type, nature, or scale of operations that would take place on the terminal as a result of approval of the modification, the modification is substantially the same development as the approved development.

Implications for Aquatic Ecology

Staff from The Ecology Lab Pty Ltd inspected the proposed turning basin and high spot by diving in July 2002 as part of the original EIS (Appendix N in URS 2003). No seagrasses, algal beds or reefs were found and observations indicated sandy sediments inhabited by a variety of benthic invertebrates. Given the relatively deep water within the turning basin and hot spots, it is most unlikely that these areas would be colonised by seagrasses and there would be limited opportunity for colonisation by algae.

It was concluded in the original EIS that the dredging would cause a temporary loss of benthic productivity. Additionally, the dredged areas would be connected to the main navigation channel and hence to the bay and adjacent coastal environment. This would avoid the creation of deep, isolated holes potentially subject to poor water quality and ensure water exchange and a potential supply of invertebrate propagules for colonisation of sediments following the dredging operation.

Advice from Cardno Lawson & Treloar indicates that water exchange is not likely to change as result of the dredging now proposed (email correspondence: M. Calfas 11-5-2009). Based on the revised dredging configuration my assessment of impacts in relation to aquatic ecology does not change substantially.

There is a very small risk that the shallower sections of the high spot may have become colonised by the noxious alga *Caulerpa taxifolia* following the inspection in 2002. It is noted, however, that the sediment would be dredged by trailing suction hopper dredge which would transport sediment to the reclamation and hence any *Caulerpa taxifolia* present on the hot spots also would be removed to the reclamation. Therefore, it is considered that the risk of dispersing fragments of *Caulerpa taxifolia* elsewhere in Botany Bay as a result of the dredging is virtually negligible.

Reference

URS (2003). *Port Botany Expansion Environmental Impact Statement.* Prepared for Sydney Ports Corporation.

Dr Marcus Lincoln Smith
Manager
Cardno Ecology Lab Pty Ltd

APPENDIX C

HYDRODYNAMIC ASSESSMENT BY CARDNO LAWSON TRELOAR

19 MAY 2009

Our Ref LJ2548/L1880 :sge

Contact P.D. Treloar/ A. Berthot

19 May 2009

Sydney Ports Corporation
Port Botany Expansion Project
PO Box 25
MILLERS POINT NSW 2000

Attention: Mr Tony Navaratne

Dear Sir,

WAVE CLIMATE INVESTIGATIONS - PORT BOTANY EXPANSION
PROPOSED KNOB-AREA DREDGING VARIATION IN PORT BOTANY

Preamble

Report (LJ2548/L1866) prepared by Cardno Lawson Treloar for Sydney Ports described the outcome of numerical modelling undertaken to investigate the additional dredging proposal for the ship turning basin as part of the Port Botany Expansion project. This report addresses a variation in the dredging of the area known as "the Knob" that is proposed in order to improve navigation near Molineux Point. The details of the proposed additional dredging are presented in Annexure A, where the proposed May 2009 Knob Area additional dredging is indicated in green.

Cardno Lawson Treloar have been engaged by Sydney Ports Corporation to investigate the cumulative hydrodynamic effects of the Additional Ship Turning Basin Dredging (ASTBD) together with the proposed new Knob dredging (May 2009), on: shipping operations; the Sydney Airport parallel runway structure; and shoreline areas of Botany Bay. This letter describes wave and current modelling outcomes. Two main aspects of potential wave climate change were addressed using the SWAN and MIKE-21 BW wave models - the same systems as those used for EIS investigations.

It is important to note that, as wave models of Botany Bay have evolved, the grid size of the bay-wide SWAN model has reduced to provide better resolution; and model output locations along the shorelines and at structures such as the parallel runway of Sydney Kingsford Smith airport have changed slightly. Hence, in order to maintain a consistent basis for case-by-case comparison, the scenarios modelled in the EIS have been re-run using the new models. Note that the Approved Development case includes the approved modification to the EIS for construction of vertical quay walls on the new terminal, and the new rock protection works along the perimeter of the parallel runway. The Existing case refers to the bay bathymetry as it was in 2003 before port expansion works (currently in progress), Sydney Desalination project (Water Delivery Alliance (WDA)) (currently in progress), and Energy Australia Cable Laying (EA) projects commenced.

Cardno Lawson Treloar Pty Ltd
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Mackay
Rockhampton
Hervey Bay
Sunshine Coast
Toowoomba
Gold Coast
Gosford
Baulkham Hills
Wollongong
Busselton

Papua New Guinea
Indonesia
Vietnam
China
Kenya
United Arab Emirates
United Kingdom
United States

Wave Modelling Investigations

Wave modelling has been undertaken for the following bathymetries:-

- *Existing as at EIS Approval:* that is, bathymetry as it was at the time of the EIS approval and before any dredging work started, (referred to as Existing in this letter).

- *Approved Development (AD-EIS)*: that is, port development works approved to date May 2009, (referred as AD-EIS in this letter).

- *Additional Ship Turning Basin Dredging (ASTBD)*: that is, the Approved Development model bathymetry + the proposed additional ship turning basin dredging, (referred as ASTBD in this letter).

- *Proposed Knob Dredging May 2009 (KNOB May 2009)*: that is, the Approved Development model bathymetry + the proposed additional ship turning basin dredging + the proposed Knob Area dredging May 2009, (referred to as KNOB May 2009 in this letter).

Because several major projects are occurring simultaneously within Botany Bay, it was understood that the potential cumulative impacts on coastal processes due to the EA, WDA and Port Botany Expansion projects were to be considered. Figure 2 describes the location of the EA cable and WDA project works.

The majority of the EA cable will be jetted directly into the seabed and will have no effect on wave propagation. One section of the cable route, on the southern side of the Port Botany shipping channel, requires pre-dredging before cable-laying. If this location is not backfilled then changes to wave propagation are predicted (Cardno Lawson Treloar 2009, Rep2527v2).

Because the Desalination Project dredged trench will be backfilled and the Silver Beach and Kyeemagh Beach work-sites will be demobilized and returned to their previous states, it is anticipated that there will be no long-term cumulative impacts arising from those works in conjunction with the Port Botany Expansion and EA cable works. In addition, we understand that the spoil from the EA dredged trench and WDA pipeline trench may be removed from the existing dredged basin west of the main north-south runway of Sydney airport at the completion of those projects. In this context only the EA dredged trench and Port Botany Expansion dredging will remain with potential cumulative impacts and is addressed below. The placement of dredged spoil by EA and WDA in the existing dredged hole would only cause minor effects within the region of Lady Robinsons Beach protected by groynes; should it not be removed as we understand it will - pers. comm. WDA and EA - Cardno Lawson Treloar.

Shoreline Wave Climate - SWAN Wave Modelling

It was not expected that dredging the Knob as shown in Annexure A would affect local sea generation and propagation and so only swell wave modelling was undertaken. Water depths near the Knob are already sufficiently deep to have no significant effect on local sea and this additional deepening would have no effect. The longest local sea wave periods may be about 3 seconds and those waves are not affected by depths greater than about 7-10m. Additionally, the proposed dredging does not affect local sea fetches. Hence Foreshore Beach and the seagrass areas nearby, which are affected mainly by local sea, would not be affected by the proposed dredging.

The general procedure of modelling a range of offshore wave directions and wave periods, see Lawson and Treloar, 2003, was followed, in order to prepare matrices of inshore wave coefficients, wave periods and wave directions at the model output locations shown on Figure 1. Those offshore to inshore wave transfer coefficients were used to transfer about 15 years of offshore directional wave data recorded by the Long Reef directional Waverider Buoy (1992-2007) operated by the Manly Hydraulics Laboratory. This procedure provided time series of transferred wave parameters at each of the locations shown on Figure 1. Those time series were analysed to provide estimates of the effective significant wave height H_e and weighted mean wave direction Φ_m parameters at those locations - procedures described in Lawson and Treloar, 2003.

The outcomes are presented in tabular form in Annexure B.

Figure 3 illustrates wave propagation into Botany Bay for both the AD-EIS and KNOB May2009 bathymetric cases, for a south-south-easterly offshore wave height of H_s=1.5 with a peak period of T_p=12.6s. Figure 4 presents the differences between the significant wave heights and weighted mean wave directions for the KNOB May2009 bathymetric and AD-EIS bathymetric cases.

Figures 5 and 6 present the changes in terms of the effective wave height (H_e) and the weighted mean wave (Φ_m) direction at shoreline locations for the Existing, AD-EIS, and KNOB May2009 bathymetric cases. Each figure presents the effective wave height and the weighted mean wave direction (top two graphs) and the difference in effective wave height and weighted mean wave direction for the AD-EIS and KNOB May2009 bathymetry cases compared to the existing bathymetry (bottom two graphs). The KNOB May2009 bathymetric case results are similar to those from the AD-EIS bathymetric case previously investigated (Lawson and Treloar 2003).

The very small changes in the wave direction that occurred with the AD-EIS bathymetric case, when compared to the Existing bathymetric case, would be generally unchanged for the proposed KNOB May2009 case at locations on Silver Beach (Locations 1 to 29, Figure 5) and slightly reduced near Towra Beach (Locations 30 to 53, Figure 5). These changes are too small to be evident in the Annexure B table and amount to no identifiable change, other than at Location 18. This location is within the existing Silver Beach groyne field and hence there would be no change on the beach, other than an unidentifiable change within one groyne compartment..

Near Lady Robinsons Beach (Figure 6) changes in wave direction were generally very small for the AD-EIS proposed dredging and this is still the case with the inclusion of the proposed KNOB May2009 work (change in direction is less than 0.05 degrees). Near Locations 70 to 77, i.e north of the northern-most groyne near Solander Street - about Location 69, the wave directions, when the proposed KNOB May2009 dredging is considered, are globally similar to the results from theAD-EIS bathymetric case.

Based on recent SPC surveys (2008) of the beach area immediately north of the northern-most groyne, the beach there is known to be receding - as expected from the groyne design investigations SPA et al (1996). The change in wave direction arising from the proposed ASTBD works would slightly reduce the northward transport locally - from the northernmost groyne to a little north of President Avenue.

The presence of groynes south of President Avenue (Location 70) tends to prevent longshore transport and potential shoreline changes in that region. The change in wave parameters there, and therefore sediment transport, are expected to have no identifiable effect.

Cumulative Impacts

Because these investigations of the proposed KNOB May2009 dredging works show negligible change in wave conditions on any shorelines of Botany Bay, they would not contribute to any potential impacts in a cumulative way that might arise from other works in Botany Bay.

Wave Propagation Changes – Port Botany and Airport Third Runway

Near Port Botany and the Airport parallel runway seawall there are minimal changes in effective wave height between the AD-EIS and the proposed KNOB May2009 works cases. These changes are too small to be evident in the Annexure B table and amount to no identifiable change. However, although these areas are represented in the SWAN model, SWAN cannot resolve phase dependant diffraction which occurs around Molineux Point and the partial and full wave reflections that occur from the port works and runways. A calibrated MIKE-21 Boussinesq wave model was used to investigate these processes in the four bathymetric cases; that is, the Existing, Approved Development EIS, proposed ASTBD and proposed KNOB May2009 dredging. Figure 7 presents the MIKE-21 output locations for the Third Runway and new container berths. This is the same model system and these are the same output locations as those used in the EIS investigations, Lawson and Treloar (2003).

Tables 1 and 2 present wave climate results for model output locations along the parallel Runway and at the new container berths for each bathymetric case. The EIS case investigated in this study is consistent with the Approved Development (AD-EIS). There is only a very small increase in wave heights along the Third Runway with the proposed KNOB May2009 dredging works compared to those for the AD-EIS case. However, the overall variations between the AD-EIS and the KNOB May2009 option investigated in this study are smaller than could be detected with present instrumentation. It should be noted that the wave heights with the proposed KNOB May2009 dredging works would remain significantly smaller than the wave heights for the Existing bathymetry. Note that there is a small increase in wave heights at the new container berths. However, these wave heights remain small in an absolute sense and would not affect berth operations.

Table 1: Wave Heights Along the Parallel Runway

Probability of Exceedance	Location	Existing as at EIS Approval	Approved Development	Additional Ship Turning Basin Dredging	Knob Dredging May 2009
1day/year	RW1	0.50	0.34	0.35	0.27
	RW2	0.45	0.18	0.20	0.23
	RW3	0.35	0.08	0.08	0.11
0.01%	RW1	0.79	0.52	0.55	0.41
	RW2	0.73	0.28	0.31	0.35
	RW3	0.55	0.13	0.12	0.17
10%	RW1	0.22	0.15	0.16	0.12
	RW2	0.21	0.08	0.09	0.10
	RW3	0.16	0.04	0.03	0.05

Table 2: Wave Heights Along the New Container Berth

Probability of Exceedance	Location	Existing as at EIS Approval	Approved Development	Additional Ship Turning Basin Dredging	Knob Dredging May 2009
1day/year	CT1	-	0.18	0.16	0.19
	CT2	-	0.15	0.14	0.13
	CT3	-	0.15	0.13	0.14
	CT4	-	0.16	0.14	0.15
0.01%	CT1	-	0.27	0.25	0.30
	CT2	-	0.23	0.22	0.20
	CT3	-	0.24	0.21	0.21
	CT4	-	0.24	0.23	0.24
10%	CT1	-	0.08	0.07	0.09
	CT2	-	0.07	0.06	0.06
	CT3	-	0.07	0.06	0.06
	CT4	-	0.07	0.06	0.07

Current Modelling Investigations

Current modelling was undertaken for the following bathymetries:-

- *Approved Development (AD-EIS)*: that is port development works approved to date May 2009, (referred to as AD-EIS in this letter).

- *Proposed Knob Dredging May 2009 (KNOB May2009)*: that is, the Approved Development model bathymetry + the proposed additional ship turning basin dredging + the proposed Knob dredging May 2009, (referred as KNOB May2009 in this letter).

The Delft3D FLOW model set-up used in Lawson and Treloar 2003 was applied here. The model was run for a spring tide for each bathymetric case. Current maps for times of peak flood and peak ebb, spring tide, are presented on Figures 8 and 9. Blue vector arrows represent the depth averaged current for the AD-EIS bathymetry and the red vector arrows represent the depth-averaged currents for the KNOB May2009 dredging bathymetry. Note that where a red vector only is visible, this is because the blue vectors are plotted first and when the red and blue vectors are the same then only the red vector will be visible.

Time series of the water level, current magnitude and direction at location C1, (located within the turning basin) are presented in Figure 10. Note that these time series were extracted from the current map files and therefore are only on an hourly time step, a shorter time step would provide a smoother signal.

Results show that generally the changes in currents near Port Botany are minimal.

Small changes in direction and magnitude presented in Figure 10 are mainly due to the increase in depth at location C1 with the proposed additional ship turning basin dredging. A small reduction in current magnitude in the order of few centimetres per second is expected there due to the increase in the water depth.

The outcome of these analyses is that the proposed KNOB May2009 work would not cause any deleterious changes in wave heights and directions within Botany Bay. Changes in the current patterns within Port Botany will be minimal and generally a small reduction in the current magnitude is expected.

Should you have any questions please contact me on 02 9499 3000.

Yours faithfully,

P.D. Treloar/A.A. Berthot
Manager - Coastal, Ocean & Estuarine Studies and Senior Oceanographer
for **Cardno Lawson Treloar**

References

Lawson and Treloar (2003): Proposed Expansion of Container Port Facilities in Botany Bay, NSW. Coastal Process and Water Resources Issues. Volume 3: Waves, Currents and Coastal Process Investigations. Report (J2076/R1999/Vol. 3) Prepared for Sydney Ports Corporation.

Sydney Ports Authority, Lawson and Treloar and Sinclair Knight Merz (1996): Lady Robinsons Beach, Botany Bay. Beach Management Options, Florence Street to the Cooks River.

Cardno Lawson Treloar (2009) Energy Australia's Botany Bay Cable Project, Dredging Adjacent to the Port Botany Shipping Channel – Coastal Processes and Sediment Plume Investigations. Rep2527v2.

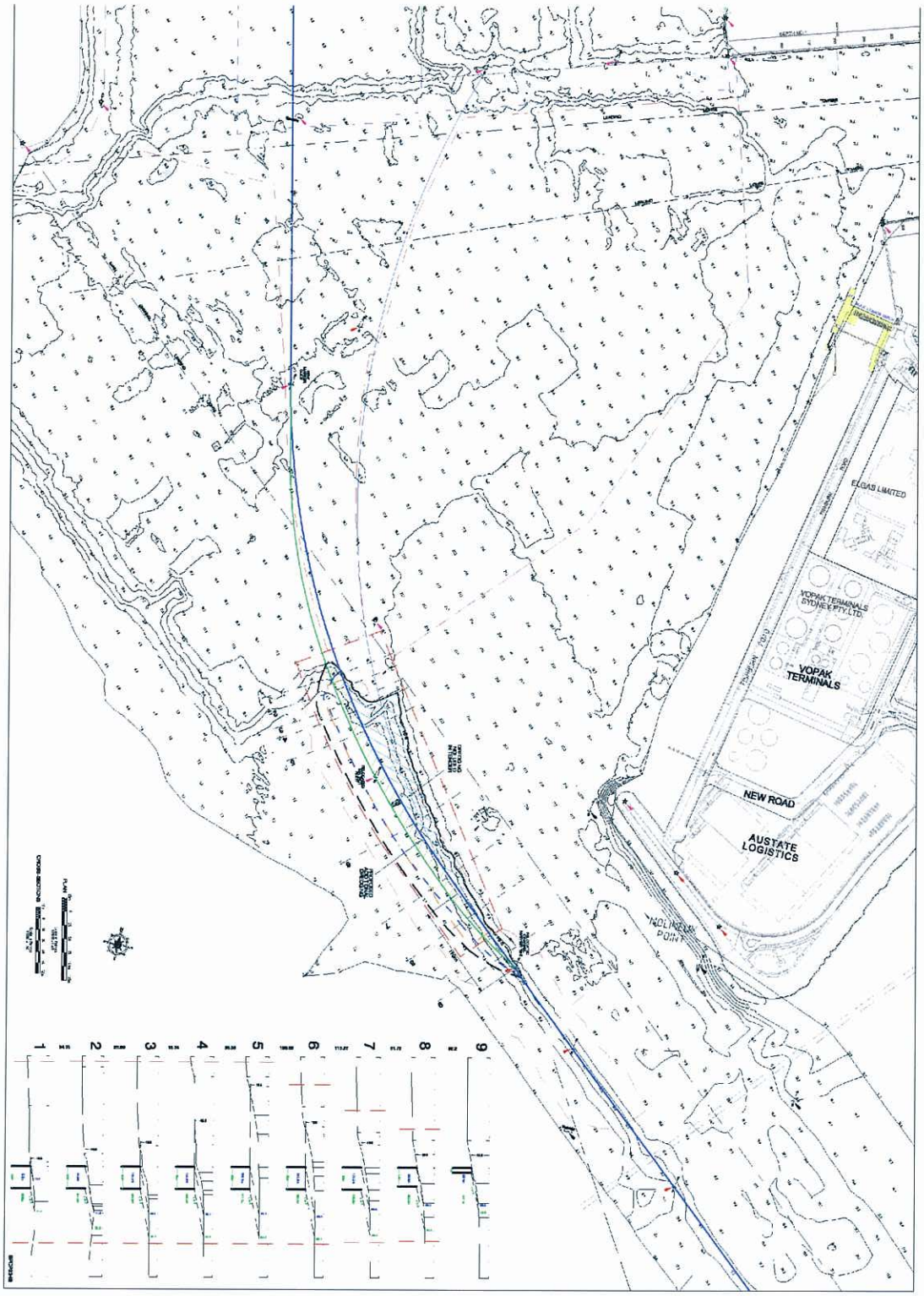
Enc.

Annexure A – JDN Dredging Proposal and Knob Dredging May 2009
Annexure B – Swell Wave Parameters at Botany Bay Output Locations

Cardno Lawson Treloar

Annexure A

Knob Dredging May 2009

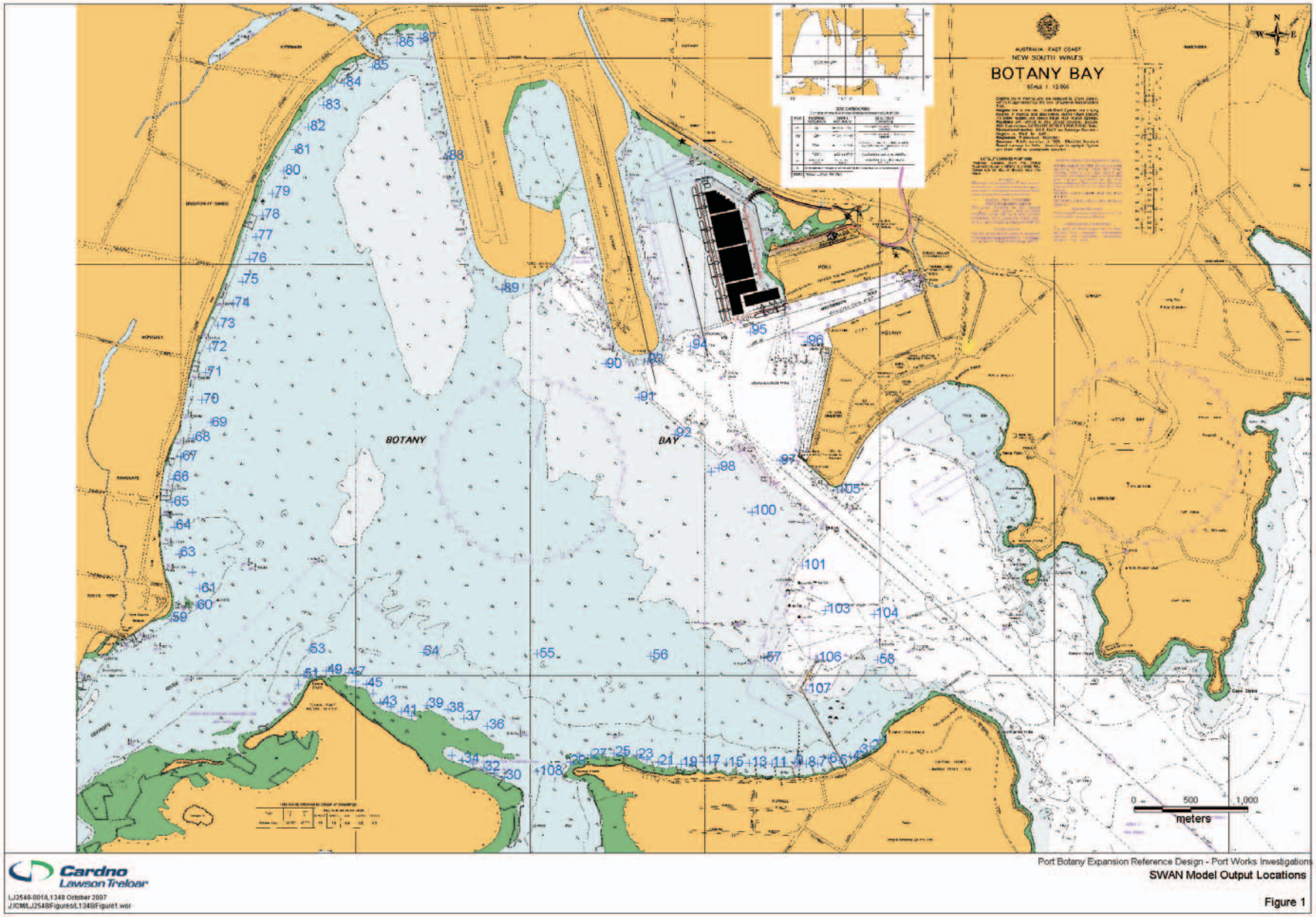

ELGAS LIMITED
VOPAK TERMINALS SYDNEY PTY LTD
VOPAK TERMINALS
NEW ROAD
AUSTATE LOGISTICS
HOLMAN POINT

Annexure B

SWELL WAVE PARAMETERS AT BOTANY BAY OUTPUT LOCATIONS

Location	Existing as at EIS Approval		Approved Development (Difference from Existing)		Additional Ship Turning Basin Dredging (Difference from Existing)		Knob May 09 - Dredging	
	He (m)	φm (°TN)	ΔHe (m)	Δφm (°TN)	ΔHe (m)	Δφm (°TN)	ΔHe (m)	Δφm (°TN)
1	0.10	331.8	0.00	0.0	0.00	0.0	0.00	0.0
2	0.12	340.7	0.00	0.0	0.00	0.0	0.00	0.0
3	0.17	344.2	0.00	0.0	0.00	0.0	0.00	0.0
4	0.20	341.6	0.00	0.0	0.00	0.0	0.00	0.0
5	0.20	351.1	0.00	0.0	0.00	0.0	0.00	0.0
6	0.24	4.6	0.00	0.0	0.00	0.0	0.00	0.0
7	0.26	3.5	0.00	0.0	0.00	0.0	0.00	0.0
8	0.23	10.1	0.00	0.0	0.00	0.0	0.00	0.0
9	0.18	18.7	0.00	0.0	0.00	0.0	0.00	0.0
10	0.17	24.1	0.00	0.0	0.00	0.0	0.00	0.0
11	0.16	23.4	0.00	0.0	0.00	0.0	0.00	0.0
12	0.16	30.9	0.00	0.0	0.00	0.0	0.00	0.0
13	0.17	34.3	0.00	0.0	0.00	0.0	0.00	0.0
14	0.18	33.8	0.00	0.0	0.00	0.0	0.00	0.0
15	0.16	34.9	0.00	0.0	0.00	0.0	0.00	0.0
16	0.16	38.6	0.00	0.0	0.00	0.0	0.00	0.0
17	0.16	36.3	0.00	0.0	0.00	0.0	0.00	0.0
18	0.16	31.1	0.00	0.0	0.00	0.0	0.00	0.1
19	0.15	28.8	0.00	0.0	0.00	0.0	0.00	0.0
20	0.15	27.3	0.00	0.0	0.00	0.0	0.00	0.0
21	0.16	34.9	0.00	0.0	0.00	0.0	0.00	0.0
22	0.16	41.0	0.00	0.0	0.00	0.0	0.00	0.0
23	0.17	39.9	0.00	0.1	0.00	0.1	0.00	0.1
24	0.16	38.0	0.00	0.1	0.00	0.1	0.00	0.1
25	0.17	31.9	0.00	0.0	0.00	0.0	0.00	0.0
26	0.16	34.2	0.00	0.0	0.00	0.0	0.00	0.0
27	0.16	35.6	0.00	0.0	0.00	0.0	0.00	0.0
28	0.18	30.5	0.00	0.0	0.00	0.0	0.00	0.0
29	0.17	15.9	0.00	0.0	0.00	0.0	0.00	0.0
30	-	-	0.00	0.0	0.00	0.0	0.00	0.0
31	0.16	62.2	0.00	0.0	0.00	0.0	0.00	0.0
32	0.14	55.4	0.00	0.0	0.00	0.0	0.00	0.0
33	0.16	69.3	0.00	0.0	0.00	0.0	0.00	0.0
34	0.16	52.8	0.00	0.0	0.00	0.0	0.00	0.0
35	0.16	56.8	0.00	0.0	0.00	0.0	0.00	0.0
36	0.17	51.0	0.00	0.0	0.00	0.0	0.00	0.0
37	0.17	56.9	0.00	0.0	0.00	0.0	0.00	0.0
38	0.19	56.2	0.00	0.0	0.00	0.0	0.00	0.0
39	0.15	45.2	0.00	0.0	0.00	0.0	0.00	0.0
40	0.12	38.6	0.00	0.0	0.00	0.0	0.00	0.0
41	0.14	39.9	0.00	0.0	0.00	0.0	0.00	0.0
42	0.18	41.9	0.00	0.0	0.00	0.0	0.00	0.0
43	0.18	46.0	0.00	0.0	0.00	0.0	0.00	0.0
44	0.18	50.7	0.00	0.0	0.00	0.0	0.00	0.0
45	0.16	46.4	0.00	0.0	0.00	0.0	0.00	0.0

46	0.16	41.1	0.00	0.0	0.00	0.0	0.00	0.0
47	0.14	43.9	0.00	0.0	0.00	0.0	0.00	0.0
48	0.13	40.9	0.00	0.0	0.00	0.0	0.00	0.0
49	0.16	36.2	0.00	0.0	0.00	0.0	0.00	0.0
50	0.20	29.5	0.00	0.0	0.00	0.0	0.00	0.0
51	0.20	10.3	0.00	0.0	0.00	0.0	0.00	0.0
52	0.15	1.0	0.00	0.0	0.00	0.0	0.00	0.0
53	0.24	52.5	0.00	0.0	0.00	0.0	0.00	0.0
54	0.24	80.7	0.00	0.0	0.00	0.0	0.00	0.0
55	0.25	79.6	0.00	0.0	0.00	0.0	0.00	0.0
56	0.31	83.6	0.00	0.0	0.00	0.0	0.00	0.0
57	0.29	80.8	0.00	0.0	0.00	0.0	0.00	0.0
58	0.41	84.0	0.00	0.0	0.00	0.0	0.00	0.0
59	0.12	102.5	0.00	0.0	0.00	0.0	0.00	0.0
60	0.15	97.6	0.00	0.0	0.00	0.0	0.00	0.0
61	0.22	82.8	0.00	0.0	0.00	0.0	0.00	0.0
62	0.23	74.2	0.00	0.0	0.00	0.0	0.00	0.0
63	0.20	70.1	0.00	0.0	0.00	0.0	0.00	0.0
64	0.13	83.1	0.00	0.0	0.00	0.0	0.00	0.0
65	0.11	81.8	0.00	0.0	0.00	0.0	0.00	0.0
66	0.13	98.0	0.00	0.0	0.00	0.0	0.00	0.0
67	0.16	100.3	0.00	0.0	0.00	0.0	0.00	0.0
68	0.17	110.9	0.00	0.0	0.00	0.0	0.00	0.0
69	0.22	102.5	0.00	0.0	0.00	0.0	0.00	0.0
70	0.23	97.3	0.00	0.0	0.00	0.0	0.00	0.0
71	0.21	98.3	0.00	0.0	0.00	0.0	0.00	0.0
72	0.21	99.9	0.00	0.0	0.00	0.0	0.00	0.0
73	0.18	110.6	0.00	0.0	0.00	0.0	0.00	0.0
74	0.22	118.6	0.00	0.0	0.00	0.0	0.00	0.0
75	0.18	115.4	0.00	0.0	0.00	0.0	0.00	0.0
76	0.16	113.9	0.00	0.0	0.00	0.0	0.00	0.0
77	0.14	110.5	0.00	0.0	0.00	0.0	0.00	0.0
78	0.14	110.9	0.00	0.0	0.00	0.0	0.00	0.0
79	0.12	115.3	0.00	0.0	0.00	0.0	0.00	0.0
80	0.10	119.8	0.00	0.0	0.00	0.0	0.00	0.0
81	0.08	123.5	0.00	0.0	0.00	0.0	0.00	0.0
82	0.06	127.9	0.00	0.0	0.00	0.0	0.00	0.0
83	0.04	133.8	0.00	0.0	0.00	0.0	0.00	0.0
84	0.02	139.0	0.00	0.0	0.00	0.0	0.00	0.0
85	0.02	147.5	0.00	0.0	0.00	0.0	0.00	0.0
86	0.01	168.6	0.00	0.0	0.00	0.0	0.00	0.0
87	0.01	191.8	0.00	0.0	0.00	0.0	0.00	0.0
88	0.02	198.3	0.00	0.0	0.00	0.0	0.00	0.0
89	0.14	132.1	0.00	0.0	0.00	0.0	0.00	0.0



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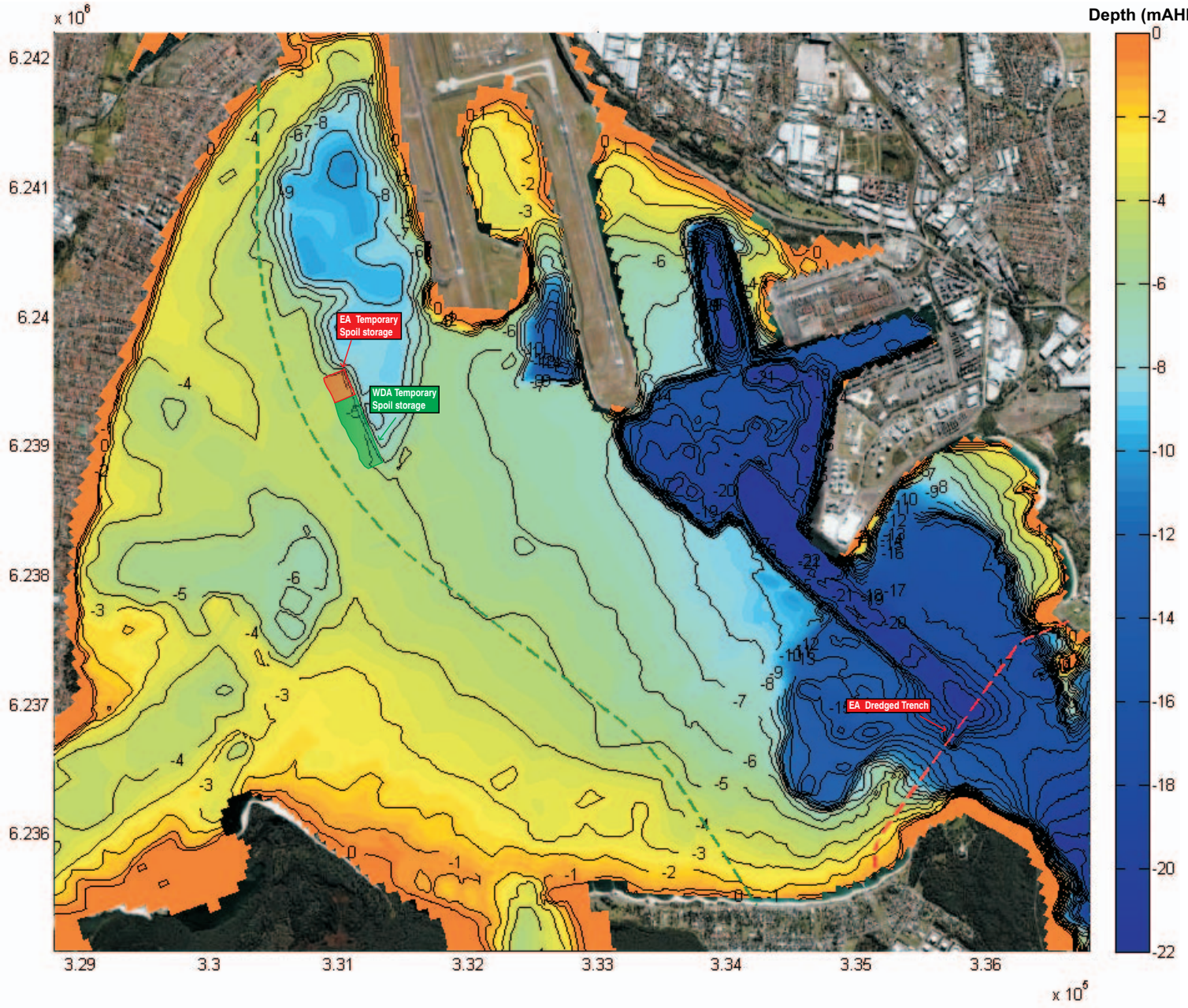
Port Botany Expansion - Dredging Matters
SWAN MODEL OUTPUT LOCATIONS

Figure 1



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Port Botany Expansion - Dredging Matters

WATER DELIVERY ALLIANCE (WDA) AND ENERGY AUSTRALIA (EA) PROJECTS IN BOTANY BAY

Figure 2

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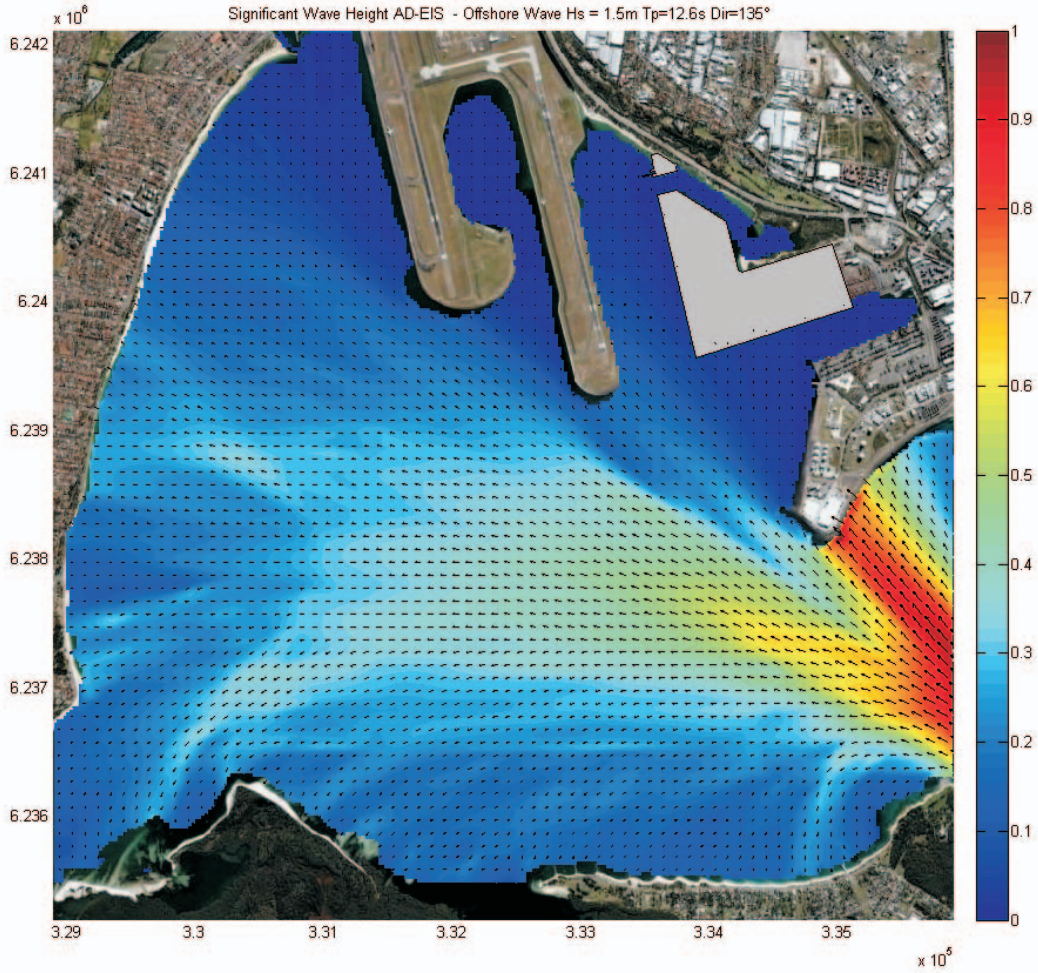

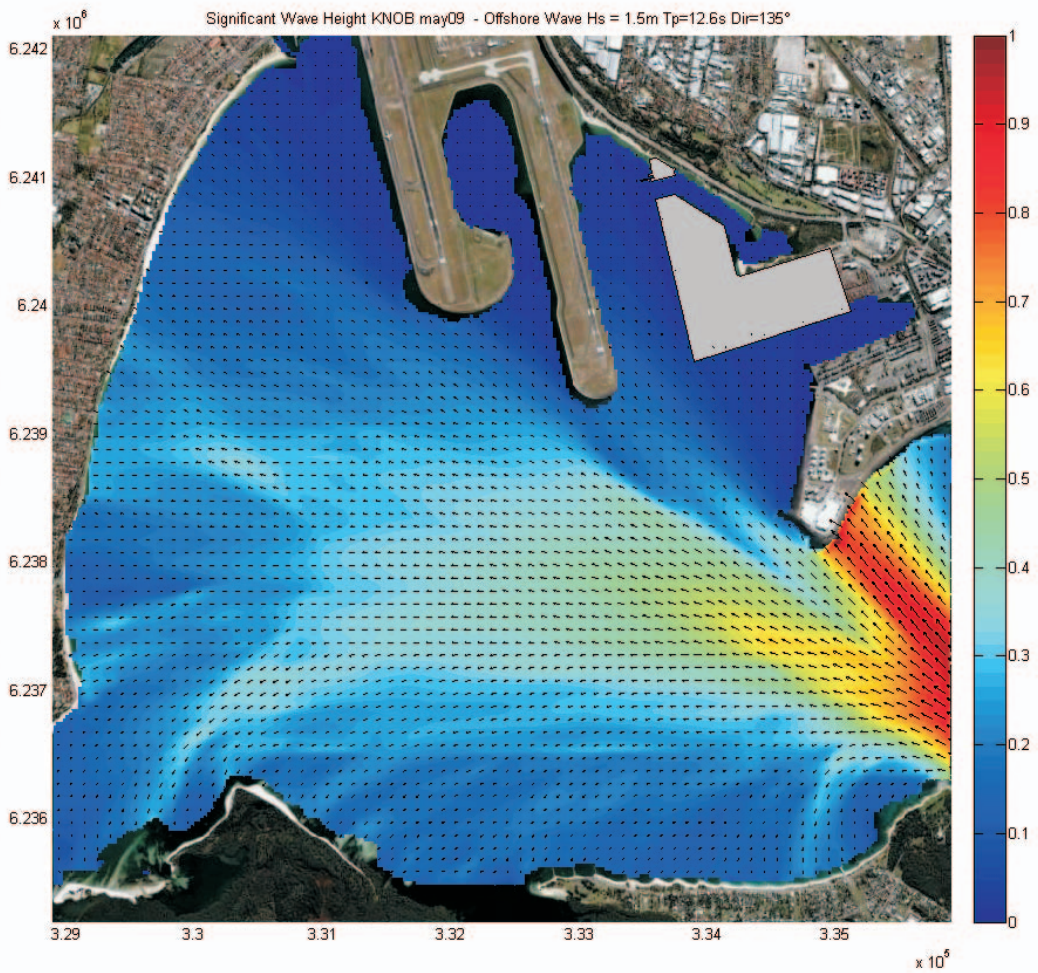

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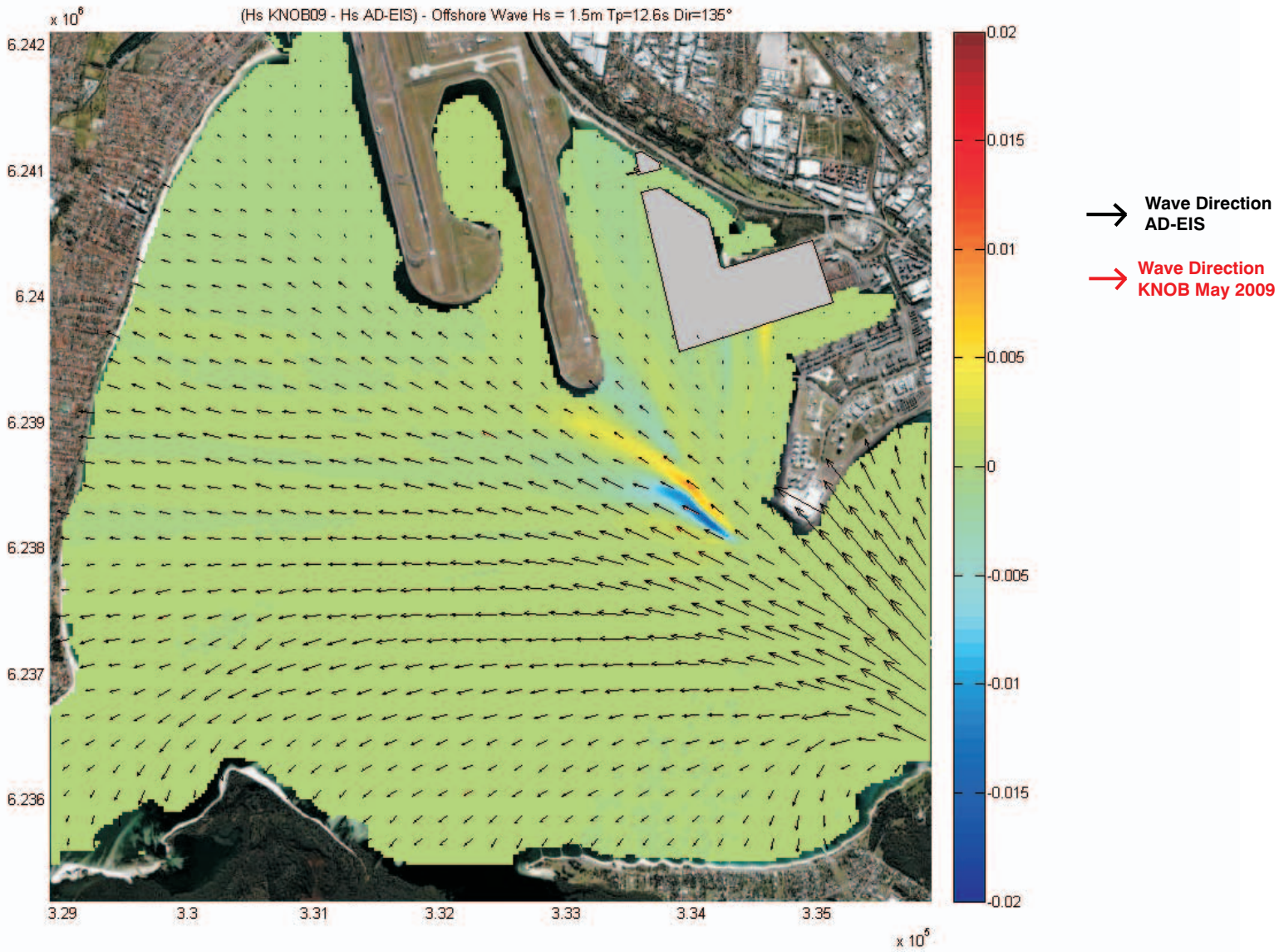
LJ2548/L1880 19/05/2009
File: J/CM/LJ2548/Docs/LJ2548_L1880Figures.cdr

Port Botany Expansion - Dredging Matters
SIGNIFICANT WAVE HEIGHT IN BOTANY BAY - AD-EIS and KNOB May2009 Bathymetries
Offshore Wave Hs=1.5m Tz=12.6s Dir=135°
Figure 3



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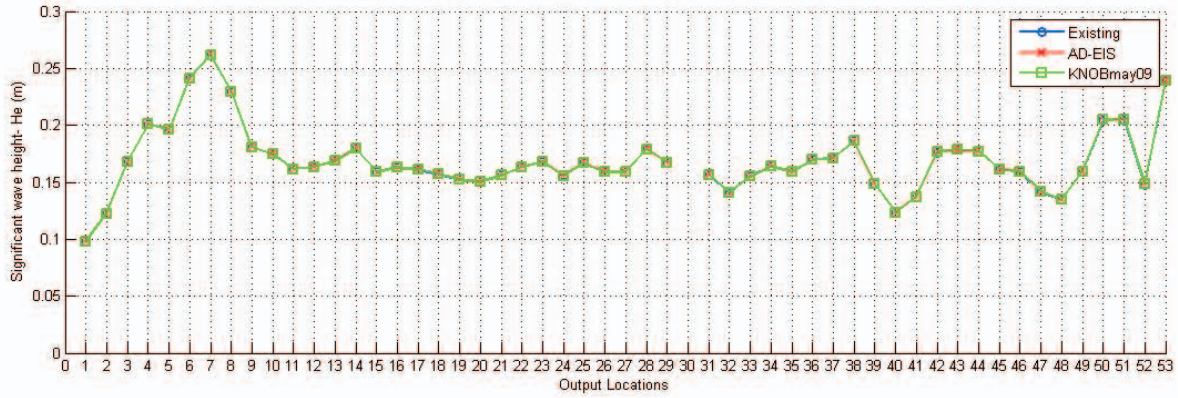
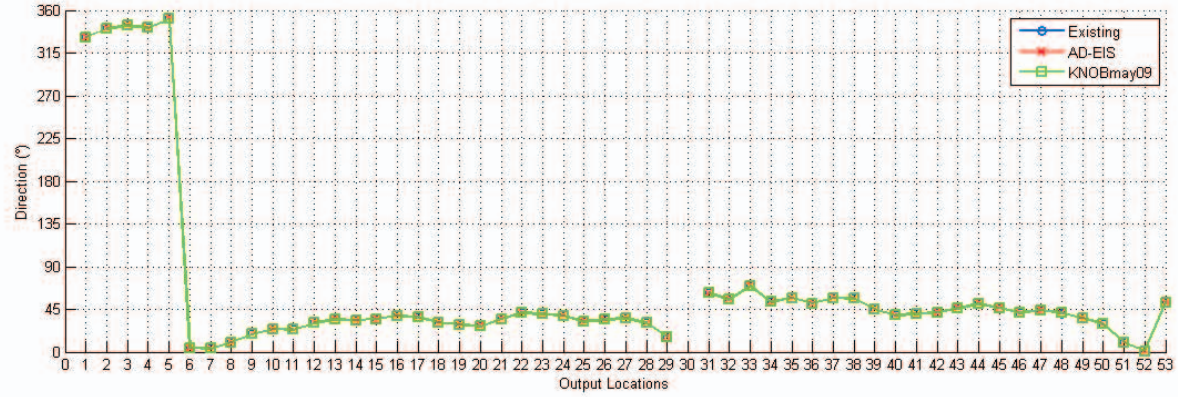
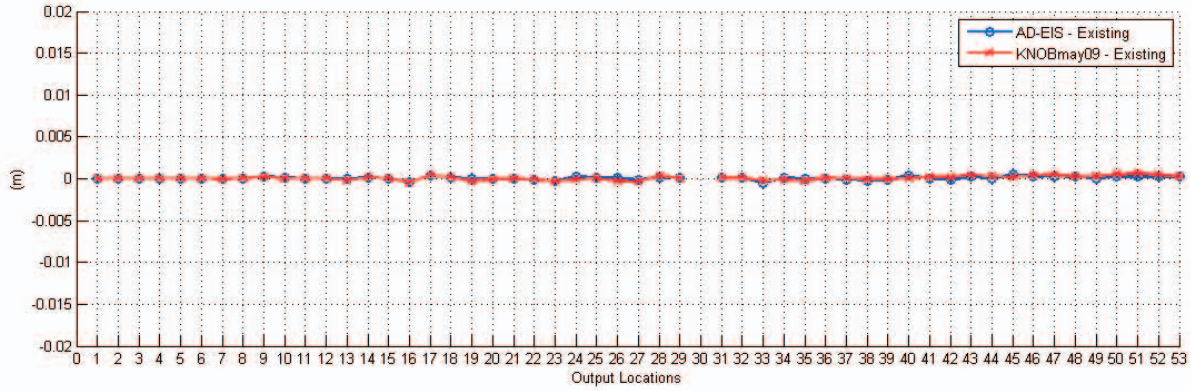
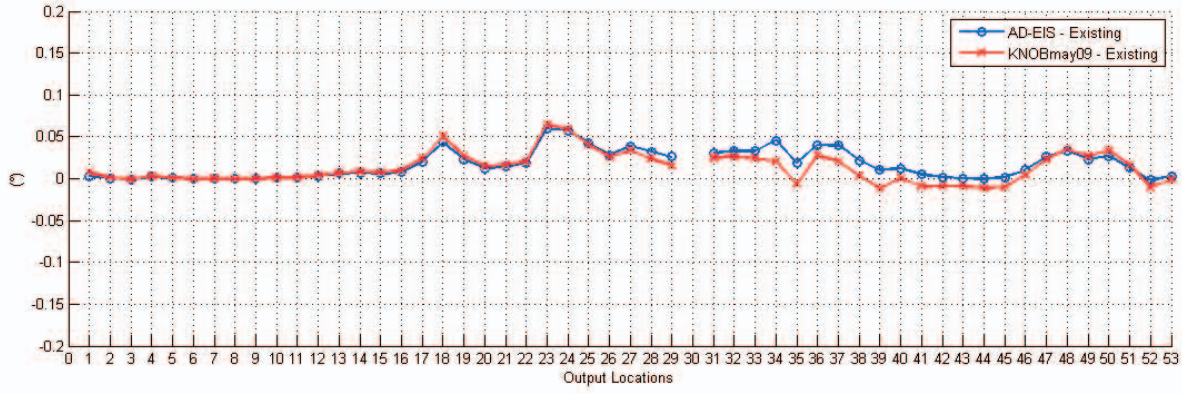
LJ2548/L1880 19/05/2009
File: J/CM/LJ2548/Docs/LJ2548_L1880Figures.cdr

Port Botany Expansion - Dredging Matters
DIFFERENCE IN SIGNIFICANT WAVE HEIGHT AND DIRECTION IN BOTANY BAY - (KNOB May2009 - AD-EIS)
Offshore Wave Hs=1.5m Tz=12.6s Dir=135°
Figure 4









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Port Botany Expansion - Dredging Matters
EFFECTIVE WAVE HEIGHT AND MEAN DIRECTION - SILVER AND TOWRA BEACH
Existing, AD-EIS, KNOB May09 Bathymetries
Figure 5

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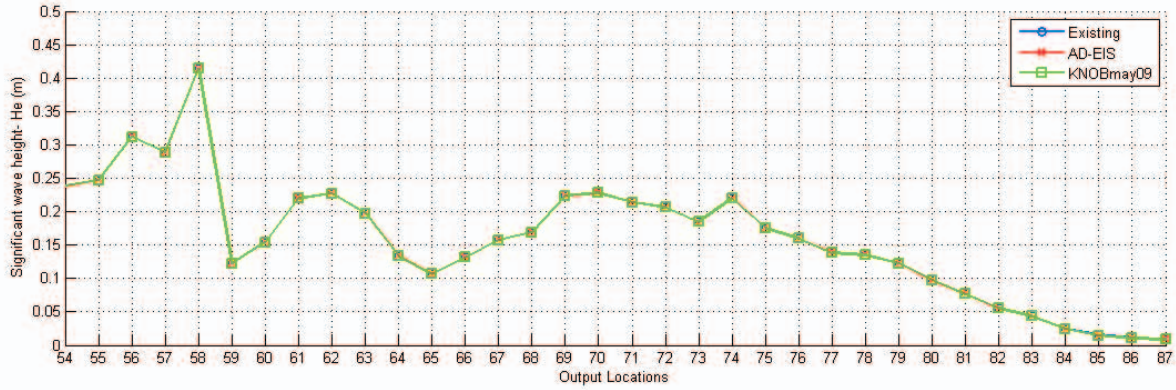

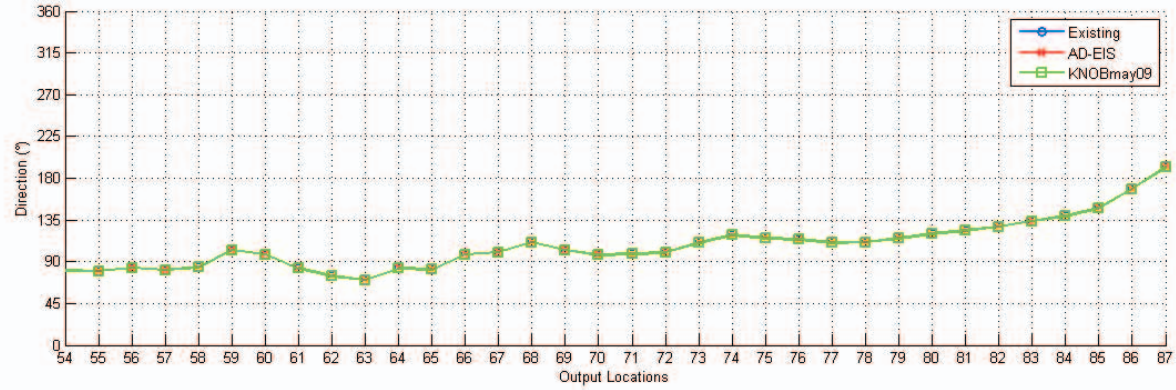

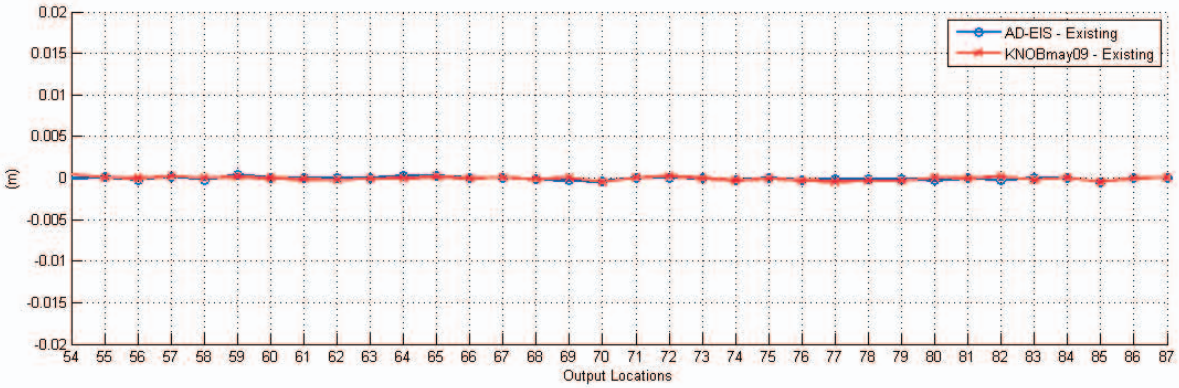

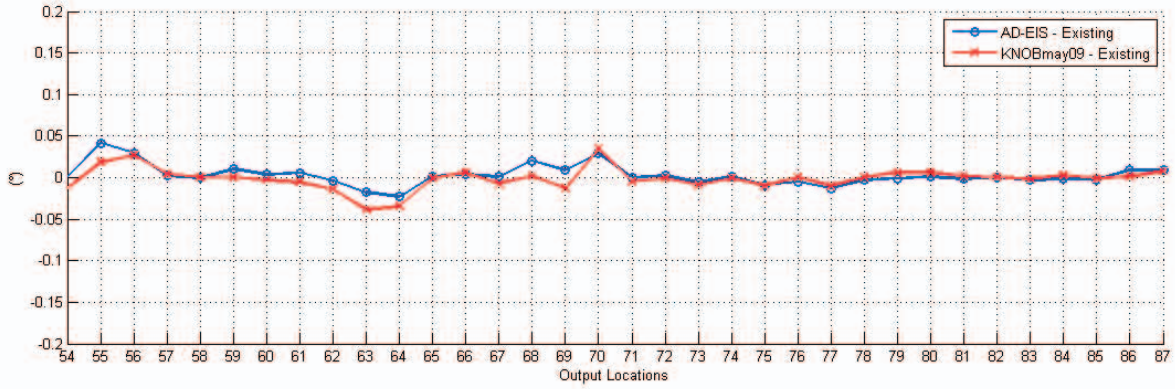

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Port Botany Expansion - Dredging Matters
EFFECTIVE WAVE HEIGHT AND MEAN DIRECTION - LADY ROBINSON BEACH
Existing, AD-EIS, KNOB May09 Bathymetries
Figure 6

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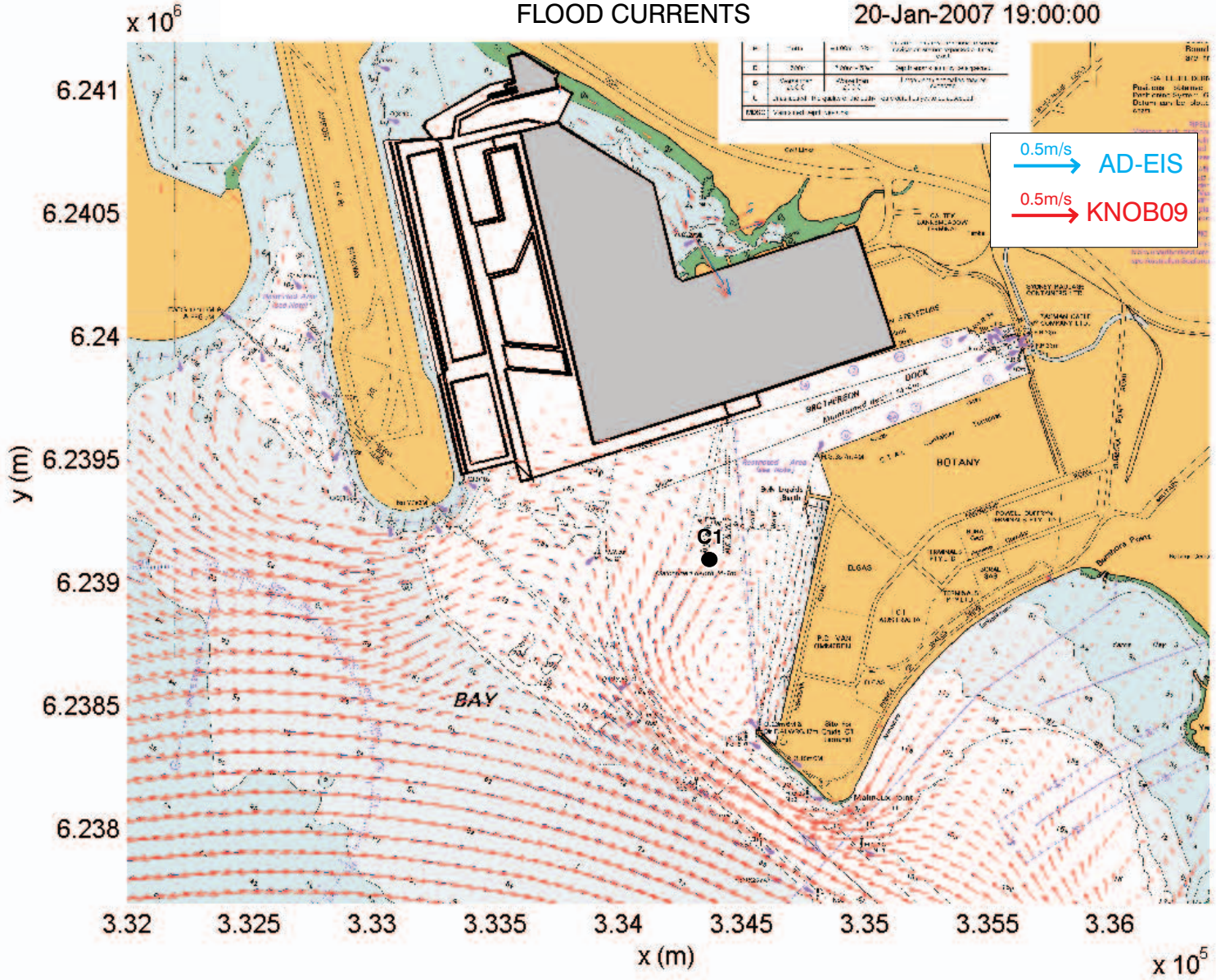
Port Botany Expansion - Dredging Matters
PORT BOTANY AND AIRPORT THIRD RUNWAY OUTPUT LOCATIONS
MIKE 21
Figure 7



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LJ2548/L1880 19/05/2009
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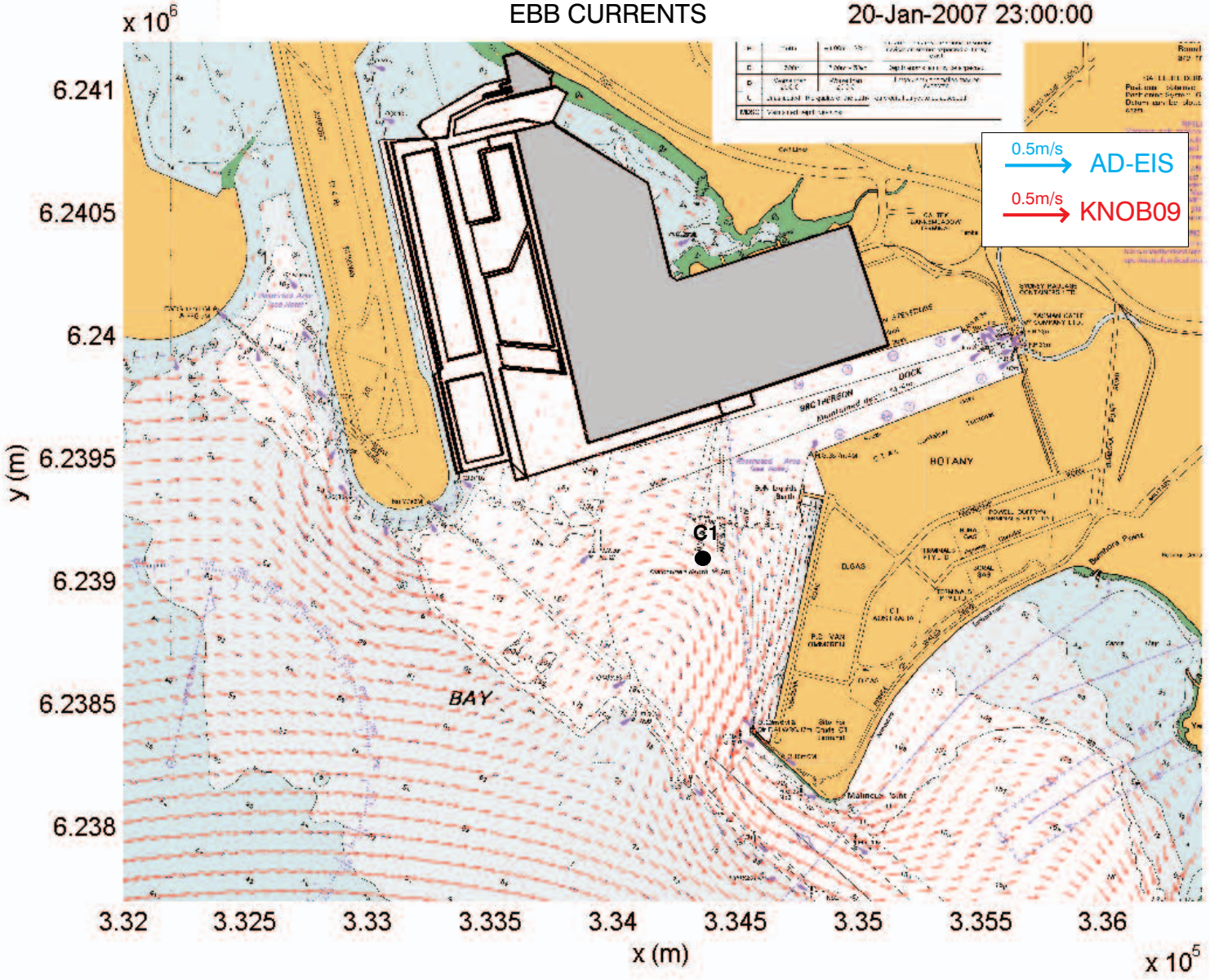
Port Botany Expansion - Dredging Matters
DEPTH AVERAGED CURRENT DURING FLOOD - PORT BOTANY
AD-EIS, KNOB May09 Bathymetries
Figure 8



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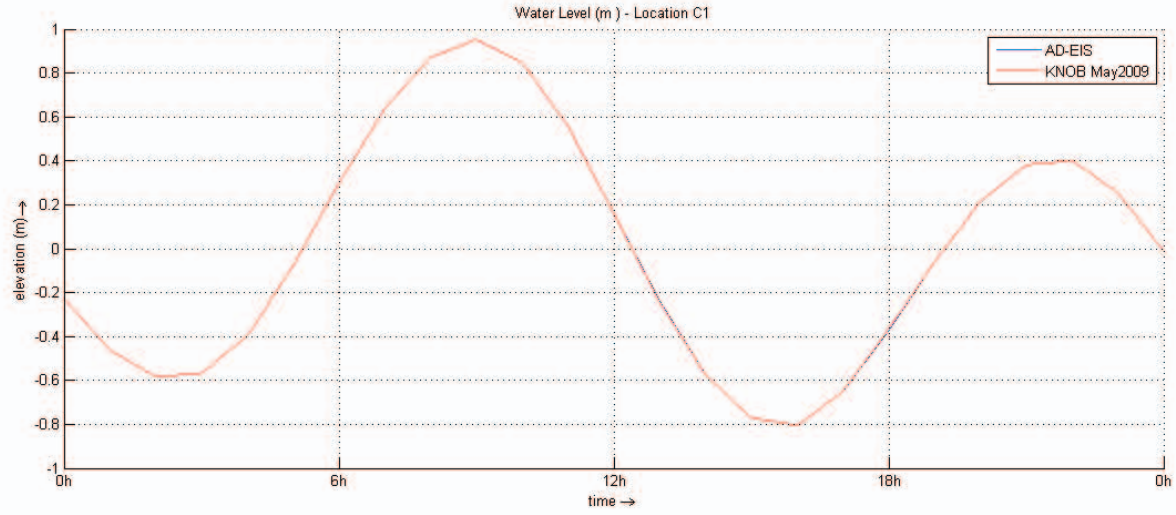
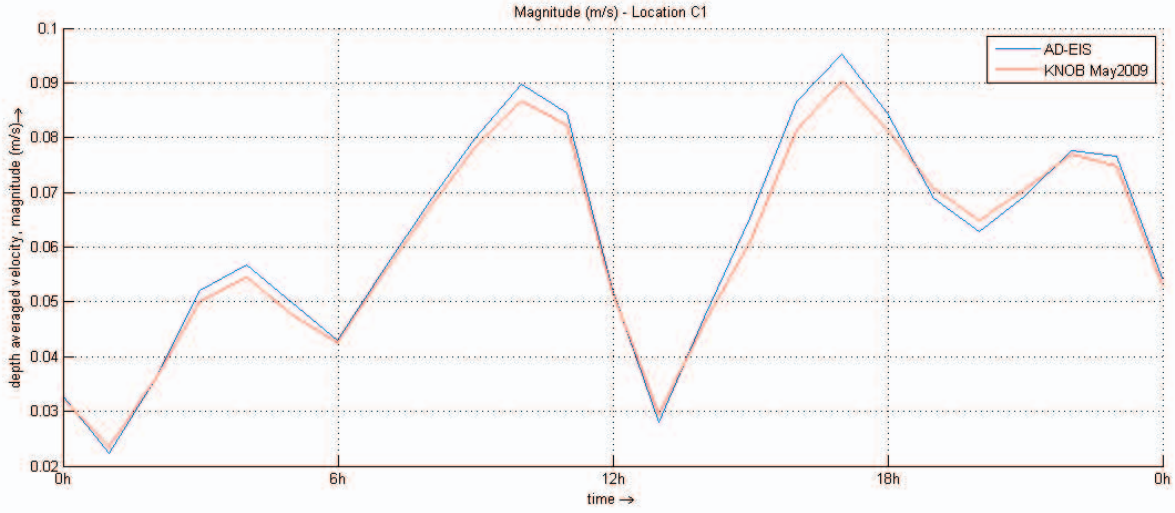
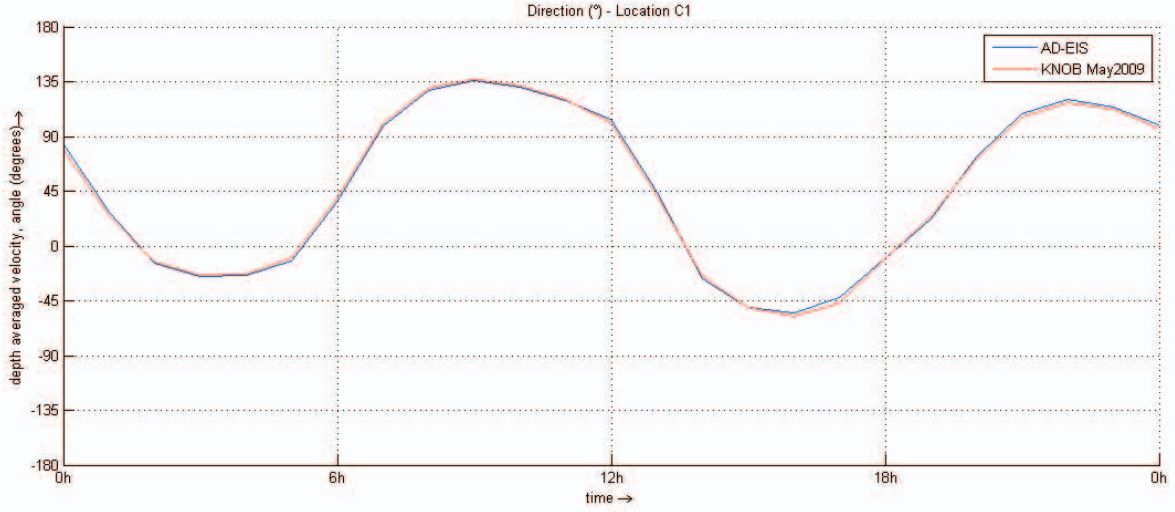
LJ2548/L1880 19/05/2009
File: J/CM/LJ2548/Docs/LJ2548_L1880Figures.cdr

Port Botany Expansion - Dredging Matters
DEPTH AVERAGED CURRENT DURING EBB - PORT BOTANY
AD-EIS, KNOB May09 Bathymetries
Figure 9







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LJ2548/L1880 19/05/2009
File: J/CM/LJ2548/Docs/LJ2548_L1880Figures.cdr

Port Botany Expansion - Dredging Matters
WATER LEVEL, DEPTH AVERAGED CURRENTMAGNITUDE AND DIRECTION
LOCATION C1 - AD-EIS, KNOB May09 Bathymetries
Figure 10