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LEND LEASE (MILLERS POINT) PTY LIMITED

BARANGAROO STAGE 1 – PA1

Barangaroo Concept Plan Amendment (MP06_0162 MOD 4)

NAVIGATION STUDY

July, 2010

Disclaimer

301015-01896-24 BARANGAROO STAGE 1 – PA1

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for Internal Review	MDG	GB	PMC	27/05/10		
B	Issued for Client Review	MDG	MD	PMC	01/06/10		
C	Issued for Client Approval	MDG	MD	PMC	04/06/10		
D	Issued for Client Approval	MDG	MD	PMC	07/06/10		
E	Issued for Formal Response to DGRs	MDG	MD	PMC	09/06/10		
F	Issued for Client Approval after Formal Response to DGRs	MGD	DG	PMC	26/07/10		

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1. INTRODUCTION

WorleyParsons has been engaged by Lend Lease (Millers Point) Pty Limited (Lend Lease) to respond to navigation related Director General's Requirements (DGRs) provided by the NSW Department of Planning in its letter dated 23 March 2010. These Director General Requirements relate to a proposed Amendment (Modification No. 4) to the Approved Concept Plan for Barangaroo, at Millers Point, NSW.

1.1 Background

The Barangaroo redevelopment will transform a harbourside industrial site in the Sydney CBD into a new mixed use precinct for Sydney at the site of the former Patricks Stevedore and P & O Passenger Ship Terminals.

On 9 February 2007 the Minister approved a Concept Plan for the Barangaroo site and on 12 October 2007 the land was rezoned to facilitate its redevelopment.

The Approved Concept Plan allowed for:

- a mixed use development involving a maximum of 388,300m2 of gross floor area (GFA) contained within 8 blocks on a total site area of 22 hectares;
- approximately 11 hectares of new public open space/public domain, with a range of formal and informal open spaces serving separate recreational functions and including a 1.4km public foreshore promenade;
- maximum building heights and maximum GFA for each development block within the mixed use zone; and
- public domain landscape concept, including parks, streets and pedestrian connections.

A condition of consent also required two enlarged water intrusions into the Barangaroo site, one at the northern end and one at the southern end (Southern Cove) and the creation of a natural northern headland.

A Modification Application (Modification 1) was approved in September 2007 which corrected a number of minor typographical errors.

Approved Concept Plan February 2009 (Modification 2). On 25 February 2009 the Minister approved the Modification to the Concept Plan. The Approved Concept Plan as modified allowed for a mixed use development involving a maximum of 508,300m^2 of gross floor area (GFA) contained within 8 blocks on a total site area of 22 hectares.

On the 20th December 2009, Lend Lease (Millers Point) Pty Limited was appointed as the preferred proponent to develop Stage 1 of Barangaroo, comprising Block 1 to 4 and associated public recreation area.

Approved Concept Plan November 2009 (Modification 3). On 11 November 2009 the Minister approved the Modification to the Concept Plan to allow for a modified design for the Headland Park and Northern Cove. The Approved Concept Plan as modified allowed for a mixed use development involving a maximum of 489,500m^2 of gross floor area (GFA) contained within 7 blocks on a total site area of 22 hectares.

Concept Plan Amendment (Modification 4) *(MP06_0162)*

The current modification application seeks the Minister's consent for:

- additional GFA within Barangaroo South predominantly related to an increase in residential GFA;
- a redistribution of the land use mix;
- an increase in height within Barangaroo South;
- the establishment of the new pier and landmark building extending into the Harbour; and
- reconfiguration and activation of the public waterferont area through the introduction of users including retail and residential to the west of Globe Street

The NSW Department of Planning requires Lend Lease to address Director General's Requirements (DGRs) relating to the Barangaroo Concept Plan Amendment (Modification 4) (MP06_0162).

1.2 Scope of this Report

Section 2 provides information on the background to current navigational arrangements, navigation rules, and existing site conditions and establishes the context for the proposed redevelopment. Section 3 of this report provides the response to the navigation question in the Director General's Requirements for Barangaroo Concept Plan Amendment (MP 06_0162), as follows:

"6. Landmark Building

- *address the cumulative impact on boating activities, including ferries, in the locality and the proposed Landmark Building's impact on navigation and the movement of vessels in consultation with the Harbour Master of the Port of Sydney and NSW Maritime."*

It addresses the cumulative impact on boating activities, including ferries, in the locality and the proposed Landmark Building's impact on navigation and the movement of vessels in consultation with the Harbour Master of the Port of Sydney and NSW Maritime. It also considers the navigational issues during the various construction stages associated with the Landmark building public pier, future ferry terminals and southern cove and discusses the cumulative impact on boating activities both during development related construction activities and upon the completion of the development.

1.3 Prior Consultation

In the preparation of this report, consultation meetings were held with representatives of WorleyParsons, Lend Lease (Millers Point) Pty Limited, Sydney Ports Corporation and NSW Maritime on 18 May 2010. Subsequent email and telephone correspondence has been undertaken with Sydney Ports in relation to navigation channels and turning basin details. Subsequent telephone correspondence has been undertaken with both NSW Maritime and Sydney Ports regarding the final proposed length of projection of the Landmark Building Public Pier into Darling Harbour contemplated as part of Concept Plan Amendment (MP06_0162 MOD 4).

2. BACKGROUND TO NAVIGATION RULES, EXISTING SITE AND PROPOSED REDEVELOPMENT

2.1 Navigation Rules

The NSW Maritime Recreational Boating and Regional Services Division Boating Handbook provides boating information for operating on NSW waters including water traffic rules and "Part Three: Safe Operation" from that Handbook includes the following sub-sections:

- Boat Handling;
- Water Traffic Rules;
- Navigation at Night;
- Personal Watercraft;
- Towing People;
- Kite Surfing; and
- Navigational Markers.

The water traffic rules include guidelines on preventing collision and the interaction of vessels and reference is made to the requirement to comply with the International Regulations for Preventing Collisions at Sea.

The Boating Handbook states the following relating to Sydney Harbour:

> *'Sydney Harbour is a unique waterway that is used extensively by a diverse range of recreational and commercial vessels including large ships, ferries and charter boats, private cruisers and yachts, runabouts, sailing skiffs, dinghies, sailboards, rowing shells, kayaks and dragon boats. The Harbour is an extremely busy waterway that requires operators of vessels to be aware of their responsibilities and to take care when boating in busy navigational channels and to make allowances for commercial activity. There is a need to consider paddlers, rowers and sailors as well as accommodating the needs of commercial operators, and those wishing to cruise, ski and fish on the Harbour.'* http://www.maritime.nsw.gov.au/docs/transit_map.pdf (NSW Maritime, 2008).

NSW Maritime operates a safety awareness initiative, aimed at the boating community, called "You're the Skipper. You're Responsible". The campaign is designed to encourage all recreational operators to take responsibility for their actions on the water, highlighting that boat operators, or skippers, are responsible for the safety of their vessel and the people on board. The information booklet produced for this campaign is available on the NSW Maritime web site at www.maritime.nsw.gov.au.

The clear message from NSW Maritime is that the responsibility for safety rests with the boat users themselves.

In addition to recreational boating activities, the Darling Harbour region of Sydney Harbour receives a high volume of commercial vessel operations. A commercial vessel is any vessel used for a commercial purpose and includes vessels carrying passengers or goods; vessels that are hired; or vessels used in connection with a business, trade or commerce (NSW Maritime). Examples of commercial vessels include fishing vessels, tourist or charter boats, workboats, tugs, barges, ferries, water taxis, sailing schools, rescue boats, government vessels, dive boats, thrill rides and "hire and drive" boats.

Commercial vessels operating in Australian Waters are governed under the 'International Regulations for Preventing Collisions at Sea 1972'. In Sydney Harbour these rules and regulations are enforced by NSW Maritime. As with recreational vessels, it is the duty and responsibility of anyone in charge of a ship, big or small, to correctly apply these rules and regulations in all circumstances, in a seamanlike manner, and in the interests of safety to themselves, their passengers and crew and the safety of others using the Harbour (Small Ships Handbook).

2.2 Existing Site Conditions

A layout of the existing site is provided in **Figure 1**. Barangaroo sits along the western side of the City of Sydney between Walsh Bay to the north and King Street Wharf to the south.

2.2.1 Water Depths

Water depths in the vicinity of the proposed site, in metres below Chart Datum (CD), are shown in **Figure 2**. Chart Datum is zero on the Fort Denison Tide Gauge (ZFDTG) and is approximately 0.92m below Australian Height Datum (AHD).

Water depths within the area vary between approximately -10m and -12m CD. These depths are fairly consistent along the face of the existing Darling Harbour wharves as they have been previously dredged and maintained at these depths to suit the former port operations at the site.

2.2.2 Water Levels

General

Still water levels at the subject site are dependent on a number of factors, including astronomical tide, storm surge and wave setup. The combination of all these factors in storm events causes elevated still water levels. The still water levels in the Bay are unaffected by flood flows as these effects are very small at this location.

Water levels are further increased above the still water level at the shoreline by the process of wave run-up. The magnitude of wave run-up is affected by a range of factors including shoreline type.

Tidal Planes

Tidal planes in Sydney Harbour are presented in **Table 2.1**, based on analysis undertaken by AWACS (1996). Long term tidal records for Sydney Harbour suggest that Indian Spring Low Water (ISLW) is closer to 0.11 m CD and this relationship has been adopted for the purposes of this report.

Design Still Water Levels

The design still water levels for Sydney Harbour are presented in **Table 2.2**, based on an analysis of the Fort Denison water level database by AWACS (1991). Note that these levels do not include the effects of local wind setup, wave setup and wave run-up, i.e. they incorporate the effects of astronomical tide and regional storm surge only.

Table 2.1 Tidal Planes & Tidal Ranges in Sydney Harbour

Tidal Planes		m CD
High Water Solstices Spring	HHWSS	1.94
Mean High Water Springs	MHWS	1.59
Mean High Water	MHW	1.47
Mean High Water Neaps	MHWN	1.35
Mean Sea Level	MSL	0.98
Mean Low Water Neaps	MLWN	0.60
Mean Low Water	MLW	0.48
Mean Low Water Springs	MLWS	0.36
Indian Spring Low Water	ISLW	0.11

Source: Lawson and Treloar (2002)

Table 2.2 Design Still Water Levels for Sydney Harbour

Return Period (yrs)	Still Water Level (m CD)
20	2.35
50	2.39
100	2.42

Source: Lawson and Treloar (2002)

2.2.3 King Street Wharf

The foreshore to the south of the Barangaroo South site is currently occupied by the King Street Wharf charter vessel facility. The King Street Wharf includes four leased wharves, four "common user" wharves and a ferry wharf. The leased wharves are used by charter vessels such as the

Captain Cook Explorer, the Blue Line Vessels and Sydney 2000 which, at 63m in length, is the largest vessel to access the King Street Wharf. The "common user" berths are used by water taxis; access by other vessels, typically up to 40m in length (44m in length for Wharf 9), can be arranged through NSW Maritime's wharf booking system. The ferry wharf is used by Sydney Ferries for its Rydalmere/Parramatta service that operates 37m long RiverCat vessels.

Vessels heading into Darling Harbour enter an 8 knot speed limit and travel along the western side of the waterway, away from the Barangaroo South site. Refer to **Figure 3**. This 8 knot speed limit is currently under review by NSW Maritime with NSW Maritime expecting to reduce the speed limit to 4 knots. Vessels heading out of Darling Harbour travel on the eastern side of the water and pass the King Street Wharf berths as they approach the Barangaroo South site. The King Street Wharf berths extend approximately 68m beyond the face of the wharf and vessels exiting these berths sound their horn three times before moving astern into the channel, as per NSW Maritime regulations. Vessels passing the King Street Wharf berths typically travel some distance to the west of the berths to provide open water between themselves and any vessels which might depart the wharves. Vessels travelling north past the King Street Wharf and the existing cruise ship terminal at Darling Harbour Berth 5 typically travel within a tapering navigation channel which widens considerably as vessels travel further north, refer **Figure 3**.

2.2.4 Temporary Cruise Ship Terminal

The cruise ship terminal at Darling Harbour Berth 8 has been temporarily relocated to Darling Harbour Berth 5, refer **Figure 3**.

From July 2010 the temporary cruise ship terminal will be operational for a period of two years and cater for vessels capable of passing under the Sydney Harbour Bridge and up to 300m in length. The berth box for the temporary cruise ship terminal at Berth 5 is approximately 335m long and 40m wide. Maritime Security Zones have been in place at certain berths within port areas since 1 July 2004. These zones are termed "water-side restricted zones". The Water-side restricted zone at the current maritime security level 1 is 30m clearance from any berthed cruise vessels at 5 Darling Harbour. . Therefore vessels exiting Darling Harbour northwards would be required to transit a minimum of 70m west of the wharf face of Berth 5.

The temporary cruise ship terminal is currently scheduled to receive approximately 90 cruise liner visits per year.

Cruise liners typically berth and depart using bow thrusters under their own steam and do not require tugs. Cruise liners would make way into Darling Harbour from the north into the marked navigation channel running from Goat Island towards Pyrmont Bay. Refer to **Figure 5**.

Cruise liners preferring to moor port side to would make way into Darling Harbour as far south as Darling Island and then traverse sideways to the temporary cruise ship terminal. Cruise liners preferring to moor starboard side to would make way into Darling Harbour as far south as the turning

basin at the intersection with Johnston's Bay, turn through 180°, come astern as far south as Darling Island and then traverse sideways to the temporary cruise ship terminal. Refer **Figure 5**.

Departures would be the reverse of the other arrival procedure, with vessels not using the turning basin on arrival using the turning basin on departure and vice versa.

2.2.5 Other Maritime and Recreational Activities

Other maritime and recreational activities in the area include vessel movements to and from Darling Harbour to the south and to and from Johnston's Bay, White Bay, Blackwattle Bay and Rozelle Bay to the north and west of the Barangaroo South site (see **Figure 3**).

Vessels accessing facilities further to the south include the Matilda Cruises fleet of charter vessels berthed near the Aquarium, small private motor cruises berthed at the Darling Harbour Marina, Sydney Ferries First Fleet ferries using the Darling Harbour (Aquarium) and Pyrmont Bay (Casino/Maritime Museum) ferry wharves and other smaller craft such as water taxis and jet boats accessing Darling Harbour south of the Pyrmont Bridge.

Vessels accessing facilities further to the north and west include large passenger cruise liners and cargo vessels using White Bay, fishing vessels using the Fish Markets, cement carriers using White Bay and Blackwattle Bay, superyachts using the Sydney Superyacht Marina in Rozelle Bay, construction barges and smaller craft using the working maritime precincts in Blackwattle Bay and Rozelle Bay and other smaller private craft visiting the bays or using the Rozelle Bay dry stack facility. From mid 2012, the temporary cruise ship terminal at Darling Harbour Berth 5 is expected to be relocated to White Bay.

The entrance to Johnston's Bay from Darling Harbour is to the north of the Barangaroo South site, and all but the largest vessels would navigate this stretch of the harbour without regard to the Barangaroo South foreshore. Refer to **Figure 3**. For the largest cruise liners, cargo ships and bulk carriers, navigation into Johnston's Bay requires some level of manoeuvre in the turning basin at the intersection with Darling Harbour. Refer to **Figure 5**. Depending on the vessel's size and operating procedures, large vessels would make way into Darling Harbour as far south as the turning basin, rotate under their own power or be rotated with tugs and either make way or come astern into White Bay. Alternatively, they could make way into Darling Harbour with the bow slightly further south of the turning basin, swing the stern around into Johnston's Bay (either under their own power or with tug boats) and come astern in towards White Bay.

2.3 Proposed Redevelopment

The Barangaroo South urban mixed use precinct is proposed to feature a public waterfront, shops, supermarket, waterfront restaurants, a library, an international hotel, apartmentsand a financial and commercial headquarters for Australian and international corporations.

Landmark Building and Public Pier

The proposed amendment to the Barangaroo Concept Plan includes the Landmark Building and Public Pier. The Landmark Building is proposed to include hotel and public uses on a public pier over the water. The building basement would provide for car parking, loading and servicing of the Landmark Building from below. The basement is proposed to project into and be submerged beneath the harbour directly under the Public Pier; however it is not proposed to rest on the harbour bed. Remaining water below the base of the submerged basement structure would be able to pass below the basement above the harbour bed. The Public Pier structure is proposed to project in the order of 85m into Darling Harbour past the existing Berth 8 wharf face.

The Public Pier face on the southern side of the Landmark Building is also proposed to be used for the berthing of superyachts which might visit Sydney Harbour.

Southern Cove

The enlarged Southern Cove is proposed to be delivered in accordance with an existing condition of consent which is imposed under the Approved Concept Plan. The enlargement will return an area of the reclaimed land to water, as it is located (in part) within the site of a former re-entrant body of water, the Darling Harbour Wharves 6 and 7 which were at the site between the 1960's and the 1990's.

The Southern Cove is designed to bring people onto the waterfront. The Southern Cove does not include any facilities to encourage the set-down/drop-off, mooring or general use of the water within the cove by any vessels.

Ferry Wharves

The ferry wharves located at Barangaroo Stage 1 are proposed to be delivered by the NSW government in the future. The ferry wharves will service a number of routes within Sydney Harbour, details of which will be decided at a later date.

The indicative design of the ferry wharves includes a floating pontoon with gangway access to the shore, in a similar arrangement to the adjacent King Street Ferry Wharf. The Barangaroo Ferry Wharves are proposed to extend approximately 70m past the existing Berth 8 wharf face into Darling Harbour.

3. CONCEPT PLAN AMENDMENT (MP 06_0162)

3.1 Assessment of Impacts and Mitigation Measures

Figure 4 shows the proposed Barangaroo South Concept Plan amendment overlaid on the navigation layouts for Darling Harbour.

The proposed Concept Plan Amendment has the following elements which would have the potential to impact on navigation within Darling Harbour:

- the Landmark Building;
- the Public Pier and associated submerged basement; and
- the methods employed in the construction/creation of each of the above.

The potential impact on navigation and any mitigation measures recommended for each of these is discussed in the following sections.

3.1.1 Landmark Building Public Pier and Submerged Basement

The Landmark Structure, which consists of the Landmark Building, submerged basement and Public Peir is proposed to project out into the waters of Darling Harbour (**Figure 4**). Given that the building envelope extends to the edge of the Public Peir, the Landmark Structure will present some restriction to lines of sight between vessels travelling up and down Darling Harbour and vessels exiting the existing King Street Wharf or the proposed Barangaroo Ferry Wharves.

The Landmark Structure is proposed to project out approximately 85m from the existing foreshore alignment into the waters of Darling Harbour. Its length from the existing foreshore would be approximately 17m further into the harbour than the length of the berth boxes for the adjacent King Street Wharves (e.g. Sydney 2000, etc.) being 68m.

Looking at the existing width of Darling Harbour between the King Street Wharf and Pyrmont Wharf, there is currently approximately 130m of open water. Giving due allowance for a nominal 15m buffer zone on each side leaves a channel width of approximately 100m for active vessel navigation or approximately 50m in each direction. With the introduction of the proposed 85m long Landmark Structure, the remaining channel width of Darling Harbour would be approximately 220m. Giving due allowance for a 15m buffer zone on each side, this would leave a channel width of approximately 190m for active vessel navigation or approximately 95m in each direction. Therefore, the introduction of the 85m long Landmark Structure would not represent a net reduction in the already generous width of the navigation channel, when compared to the existing channel width at the existing King Street Wharf. The proposed introduction by NSW Maritime of a 4 knot speed limit (while not essential to the Concept Plan Amendment scheme proposal) will further mitigate potential navigational impacts

arising from the Landmark Structure. Please note that no standard channel widths exist in Sydney Harbour; rather these dimensions are given to illustrate the buffers available to all vessels.

Matilda charter vessels and Sydney Ferries departing from adjacent to the Aquarium currently have to change course to navigate around the Australian National Maritime Museum pontoons and change course again to avoid the King Street Wharf, refer to **Figure 6**. Therefore vessels operating in Darling Harbour that would have to navigate past the proposed Landmark Structure would already be used to altering course to avoid navigation hazards. Furthermore, the amount by which a vessel would have to alter its course would be less than for other existing navigation hazards within Darling Harbour.

Vessels travelling north past the King Street Wharf and the existing cruise ship terminal at Darling Harbour Berth 8 typically travel within a tapering navigation channel which widens as vessels travel north. The introduction of the proposed 85m long Landmark Structure extending 17m beyond the King Street Wharf berth boxes would necessitate vessels navigating a line further west than is currently possible.

As vessels currently navigate out of a relatively narrow and winding channel at the southern end of Darling Harbour into a significantly wider channel to the north of the King Street Wharf, it is considered that the proposed Landmark Structure would not have an adverse impact on navigation at the site. Should the NSW Maritime proposed 4 knot speed restriction be applied to Darling Harbour as far north as the proposed Landmark Structure, (refer to **Figure 4**), this would be further improved.

Any proposed vessel berths on the southern side of the Landmark Structure are proposed to extend no further west than the end of the proposed structure and therefore would not encroach any further into the navigation channel for vessels heading north where they currently transit clear of the King Street Wharf. A vessel entering or exiting this area would do so in an identical manner to the existing larger charter vessels operating out of the King Street Wharf. Large private vessels and superyachts already navigate in this locality, when accessing the Darling Harbour Marina and the Sydney Bay Superyacht Marina in Rozelle Bay. Other vessel users in this area would be accustomed to the passage of these types of vessels in the locality.

Superyachts, or other similar vessels, berthing alongside the southern side of the Landmark Structure would not pose any threats to navigations in the area. Vessels intending to berth at this point would approach from the western side of the channel which would allow for an unobstructed view of all vessel movement in and out of Darling Harbour. Vessels leaving the berth would sound their horns three times when moving astern, as per regulations, and have an unobstructed view of vessels leaving Darling Harbour along the eastern channel. Similarly, vessels leaving Darling Harbour along this channel would have an unimpeded view of vessels arriving or departing from the Landmark Structure once past King Street Wharf. As is practice at King Street Wharf, vessels making way give way and vessels coming astern from berths.

The proposed Landmark Structure would not encroach within the maximum turning basin required by Sydney Ports Corporation (300m plus 40m tug/line each end) at the junction of Darling Harbour and Johnston's Bay, refer **Figure 5**. A vessel manoeuvring under tug attendance and encroaching

outside the current adopted maximum Sydney Ports Corporation turning basin would currently already be restricted by the three surrounding existing land masses of Peacock Point, Jones Bay Wharf/Darling Point and Darling Harbour Berth 5 (with a further buffer zone of some 80m) prior to any physical interaction with the proposed Landmark Structure.

The Landmark Structure is proposed to be sited at the location of the former Sydney Ports Corporation cruise ship terminal (Berth 8) which ceased operations in June 2010. This comprised of a 40m berth box plus a 30m water-side restricted zone when a liner was berthed. This area of water was not commonly used for navigation or the movement of vessels (other than the cruise liners which have since been relocated north to Berth 5). Accordingly, there would be no cumulative adverse impact on navigation at the site.

As the Landmark Structure would form a new structure in the harbour, it is proposed to adopt a recommendation arising from consultation with NSW Maritime for the provision of a port hand lateral mark that is lit at night at the western most end of the Public Pier. The exact positioning and detailing of the port hand lateral mark would be the subject of a future Project Application and further approval of NSW Maritime if required.

The Landmark Structure would not impact on the southern cove and the operation of the future ferry wharves as:

- vessels are not proposed to navigate the Southern Cove (with the exception of vessels undertaking infrequent maintenance);
- any vessels inadvertently navigating the Southern Cove could head north without being impacted by the Public Pier;
- any vessels inadvertently navigating the Southern Cove could head south by moving slowly into the nominal 15m buffer zone of water beyond the west end of the Public Pier that would be created with the proposed relocation of the navigation channel to the west. From the buffer zone these vessels would have clear lines of sight north and south and would be clearly visible to other vessels heading north from Darling Harbour in the proposed relocated navigation channel some 20m further west; and
- the Barangaroo Ferry Wharves would operate as an extension of the King Street Wharf facility and would depart the ferry wharves and easily navigate past the proposed Public Pier in the proposed relocated navigation channel.

3.1.2 Construction of Landmark Building Public Pier and Submerged Basement

The construction phase of the Landmark Building Public Pier and submerged basement is likely to give rise to “one off” particular navigational challenges which have also been considered.

Prior to the undertaking of any works, Lend Lease would develop a detailed work method plan for all water based construction related activities that would form the basis of detailed consultation between

Lend Lease, Sydney Ports, NSW Maritime and other appropriate Authorities. No works would commence without the approval of Sydney Ports and NSW Maritime, where required. The water based construction work plan would form part of the documentation informing and supporting the future landmark Building/Public Pier Project Application.

For the purpose of the Concept Plan Amendment, the following indicative water based construction work planning was developed to allow assessment of navigation impacts during construction.

Prior to the construction of the Landmark Building Public Pier, the area of water required to undertake the works (the works zone) would be established with a floating boom and silt curtain. The boom would typically be continuously floated along its entire length, brightly coloured and would be tethered to temporary buoys anchored to the seabed to retain the silt curtain in position. The position of the boom would only protrude as far beyond the perimeter of the Public Pier as was required for construction purposes, which is likely to be of the order of 30m and would not likely need to be in excess of 50m.

The exact details of the plant, equipment and methods to be utilised in the construction of the Public Pier and the proposed Landmark Building submerged basement are not yet finalised. They are expected to include the use of large barge mounted pin jib cranes servicing specialist piling rigs capable of the driving or screwing steel casings/liners associated with augured, cast in situ piles through the seabed and into underlying rock strata. For the purpose of installing the piles, piling rigs could either be supported from the existing wharf using a long reach piling rig with an incrementally constructed deck placed progressively out over the water or from a barge or jack-up platform. The craneage and piling works would be supported by other smaller work boats.

Upon the completion of piling, the submerged basement structure would likely be cast in situ on raised formwork temporarily supported by the driven piles and progressively sunk into the harbour utilising similar techniques to those adopted in the recent development of Walsh Bay Pier 6/7. In the event a precast solution was chosen for the purpose of constructing the Landmark Building basement, precast elements could be barged or towed to the work zone utilising the established navigation paths during hours agreed with the Authorities and then sunk and connected entirely within the work zone.

As an alternate, the installation of a cofferdam around the perimeter of the proposed structure that is dewatered with construction of foundations and structure taking place from a temporary platform constructed on the existing sea bed might also be considered. The cofferdam could either be designed as a double skin self supporting structure or it could be strutted internally.

For the majority of the Public Pier construction period, the works zone required by water based plant under the various construction options discussed above could be typically managed within a 50m distance of the northern and southern sides of the Public Pier. This would have no adverse impact on vessels travelling north from Darling Harbour in the proposed relocated navigation channel.

There might be limited instances of works extending out further to the west than the west end of the Public Pier. On those occasions, a 30m work zone is expected to be sufficient. If this was required,

additional navigation marker buoys could be positioned to clearly show the temporary repositioned navigation channel around the temporary works zone. Prior to the establishment of any temporary change to the navigation channel for the purposes of construction, a detailed program of consultation and communication with stakeholders would be undertaken by Lend Lease. It is considered that the width of the channel at the proposed Landmark Building Public Pier would be sufficient to accommodate a temporary work zone, for a short period, should it be required.

There is a possibility that construction would have commenced on the proposed public pier before mid 2012. If so, on the 90 or so days of the year when cruise liners are berthed at the new temporary cruise ship terminal at Darling Harbour Berth 5 (to be used from July 2010), vessels steaming north past the King Street Wharf and the proposed Landmark Building Public Pier would hold their distance from the eastern shore until they were at least past Berth 5.

Once the Public Pier is created and the Landmark Building basement structure sunk into position (but remaining suspended above the harbour bed), the Landmark Building itself could be largely constructed from the Public Pier utilising climbing tower cranes and other conventional materials handling techniques associated with typical high rise building construction all serviced via access from Barangaroo South landside.

On the basis that the indicative construction work zones discussed above are complied with, and that the Landmark Building above the Public Pier is largely constructed from landside at Barangaroo, the construction of the proposed Landmark Building Public Pier, Landmark Building and its proposed submerged basement structure would not impact adversely on navigation in Darling Harbour. Where there were minor impacts, it is perceived that these impacts would be only for short durations (months), which could be readily managed via an appropriate program of consultation and information with Authorities, stakeholders and the general public.

3.1.3 Construction of Southern Cove in Relation to the Landmark Building Public Pier

The cumulative impact on boating activities and navigation impacts arising from the proposed Landmark Building during the construction phase in the event of the parallel creation of the Southern Cove (which in that event, may give rise to “one off” particular navigational challenges) have been considered.

Once again, prior to the undertaking of any works, Lend Lease would develop a detailed work method plan for all water based construction related activities that would form the basis of detailed consultation between Lend Lease, Sydney Ports, NSW Maritime and other appropriate Authorities. No works would commence on the Southern Cove foreshore without the approval of Sydney Ports and NSW Maritime, where required. The water based construction work plan would form part of the documentation informing and supporting the future Southern Cove Project Application.

Prior to the creation of the Southern Cove, the area of water required to undertake the works (the works zone) would be established with a floating boom and silt curtain. The boom would be continuously floated along its entire length, brightly coloured and would typically be tethered to temporary buoys anchored to the seabed to retain the silt curtain in position. The position of the boom would only protrude as far beyond the proposed mouth of the Southern Cove (the current Barangaroo foreshore alignment) as was required for demolition, excavation and construction purposes, which is likely to be of the order of 20 to 30m past the Southern Cove mouth to the north, west and south which would be entirely within the current passenger terminal berth boxes. Additional navigation marker buoys could be temporarily positioned to define the eastern limit of the navigation channel, to guide vessels clear of the temporary works zone and floating boom if required.

Generally, the Southern Cove would be excavated largely from land using conventional earthmoving equipment, dewatering and civil engineering practices, with the spoil transferred to and stockpiled on Barangaroo. Some static dredging from fixed barge positions adjacent the existing foreshore may be required during the final stages of the cove excavation, however materials dredged from the barge position during this phase would be immediately (daily) transferred to landside for disposal. These barges, if used, would only transport material between the existing foreshore and the face of the Darling Harbour Berth 7 or 5 and would typically remain adjacent the site boundary and within the works zone established by the floating boom and silt curtain. At this stage it is not proposed that barges would transport any material off Barangaroo via Sydney Harbour.

If the proposed Southern Cove were created prior to commencement of works on the proposed Public Pier, vessels travelling north from Darling Harbour would be some 80 to 100m to the west of the face of the existing Barangaroo foreshore. These vessels would pass the Southern Cove site with approximately 50 to 70m of open water between themselves and the floating boom.

If the proposed Southern Cove were created during construction works or after completion of the proposed Public Pier, vessels travelling north from Darling Harbour would be some 100 to 130m to the west of the face of the existing Barangaroo foreshore. These vessels would pass the Southern Cove site with approximately 70 to 100m of open water between themselves and the floating boom.

Cruise liners at the southern limit of the temporary cruise liner terminal berth box would still be approximately 90m north of the northern end of the mouth of the Southern Cove and would have approximately 60m of open water to the floating boom. Any tug servicing the cruise ships in this location would still retain adequate clearance form the Southern Cove works zone which is delineated by the proposed floating boom.

On the basis that the work zones and construction techniques associated with the Southern Cove discussed above are complied with, the creation of the proposed Southern Cove would not impact adversely on navigation in Darling Harbour be it created before, during or subsequent to the construction of the Landmark Building and Public Pier..

3.1.4 Construction of Ferry Wharves in Relation to the Landmark Building Public Pier

The proposed Ferry Wharves would be developed by others, however the cumulative impact on boating activities and navigation impacts arising from their potential construction and or operation during or prior to proposed Landmark Building works, (which may give rise to "one off" particular navigational challenges), have been considered.

Prior to the construction of the ferry wharves, it is expected that others would establish the area of water required to undertake the works (the works zone) by establishing a floating boom and silt curtain. It is not expected that the floating boom and silt curtain would extend beyond 20m past the perimeter of the proposed ferry wharf pontoon locations, to the north and south and would not need to be more than a few metres to the west of the western end of the proposed pontoon. Additional navigation marker buoys might be temporarily positioned to define the eastern limit of the navigation channel, to guide vessels clear of the temporary worksite and floating boom.

The construction of the new ferry wharves would likely utilise smaller water based piling rigs and a land or water based crane. Floating plant would be able to undertake the majority of these operations from the north or south side of the wharves and would not be expected to need to sit further west than the western end of the proposed pontoon.

Vessels travelling north from Darling Harbour would be some 80 to 100m to the west of the face of the existing Darling Harbour wharf face, so would pass the ferry wharves site with approximately 35 to 55m of open water between themselves and the floating boom.

In the event that the Landmark Building and Public pier and the new ferry terminal wharves were constructed simultaneously, or the ferry wharves were in service prior to and during the construction of the Landmark Building, there is sufficient clearance between the two activities such that navigation in Darling Harbour would not be adversely affected.

3.2 Conclusion

It is considered that the proposed Landmark Building and the Public Pier contemplated under the Concept Plan Amendment would not give rise to adverse cumulative impacts on boating activities, including ferries, (both existing and proposed future services), within the locality of Darling Harbour. Furthermore, it is considered that the water-based construction activities necessary for the construction of the Landmark Building and Public Pier and the adjacent simultaneous construction of the proposed Southern Cove and ferry wharves (in those events) would not give rise to adverse cumulative impacts on boating activities, including ferries, within the locality of Darling Harbour.

Following consultation with NSW Maritime and the Harbour Master of the Port of Sydney, it is considered that the addition of the proposed Landmark Building and Public Pier at the Barangaroo South site would not adversely impact on navigation and the movement of vessels in Darling Harbour.

FIGURES

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Barangaroo Navigation Impact Assessment

FIGURE 1

Existing Site Layout

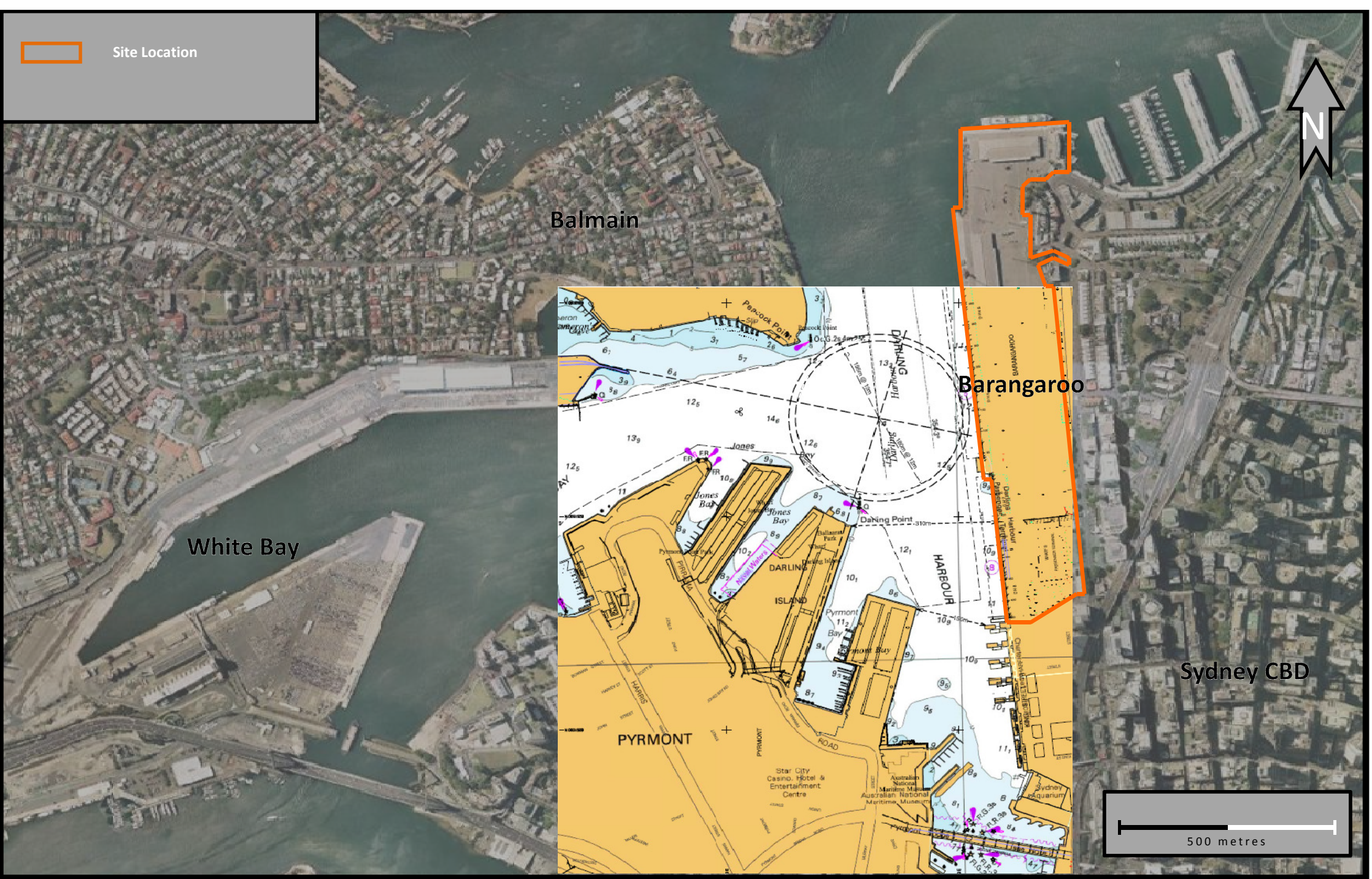

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FIGURE 2
Water Depths

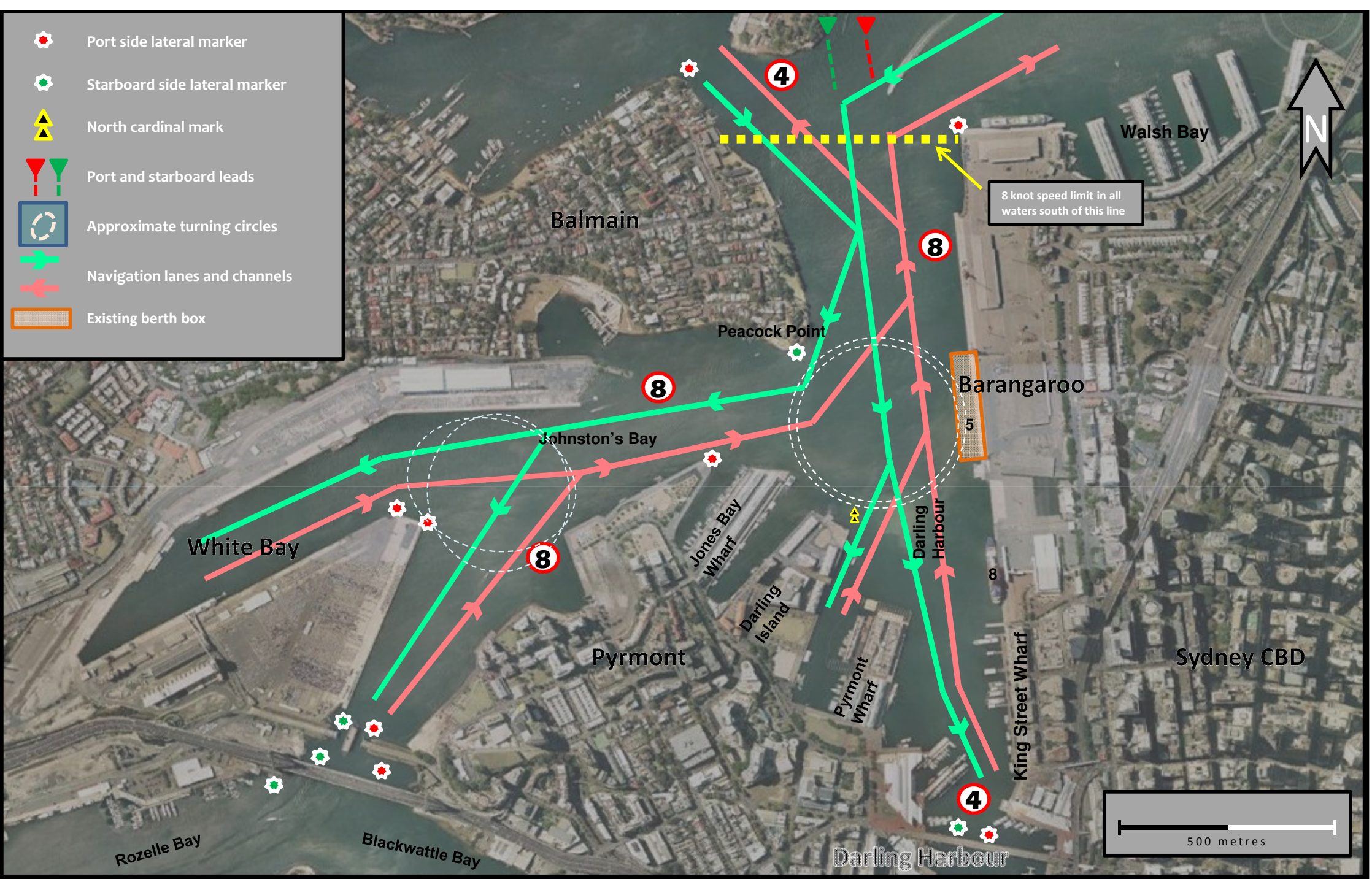

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FIGURE 3
Existing Navigation Information

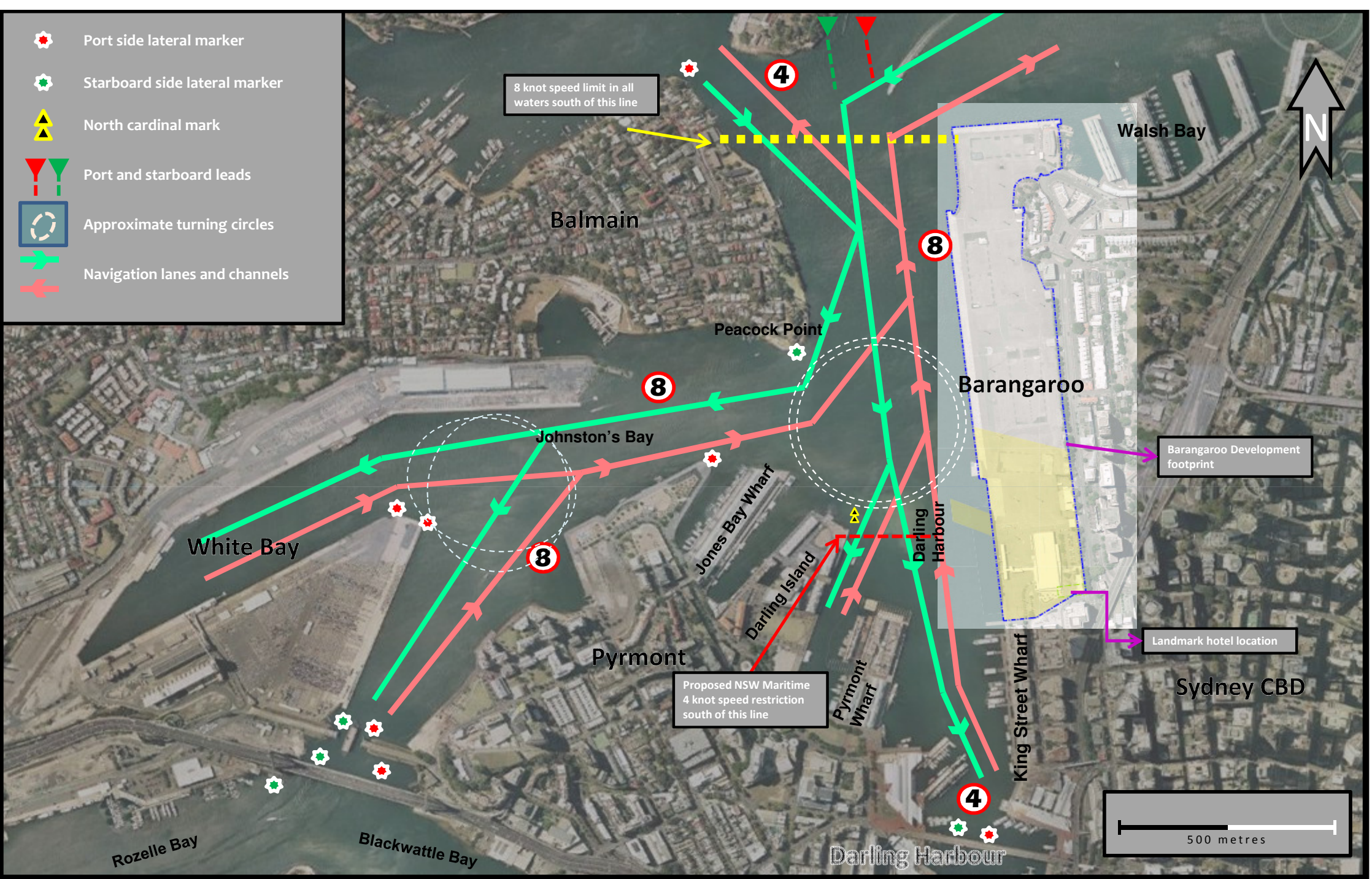

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FIGURE 4

Impact of Landmark Building on Navigation