

## REPORT

# Kendall Bay Remediation Project

### Navigation Study

Client: JBS&G Australia Pty Ltd

Reference: M&APA1848R004F1.0

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## Appendices

Appendix A: NSW Boating Information

## 1 Introduction

Royal HaskoningDHV (RHDHV) has been engaged by JBS&G to prepare a Navigation Study for the Kendall Bay Remediation Project that addresses the potential impacts of the remediation works on existing waterway navigation. The project proposal comprises the remediation of contaminated sediments within specific areas of Kendall Bay. A general description of the project is provided in **Section 2** and a detailed remediation methodology is provided in **Section 3**.

A navigation study including existing and proposed waterway activities (as a result of the project) is provided within the following sections of this report:

- Existing Site (refer **Section 4**);
- Existing Waterway Navigation (refer **Section 5**);
- Proposed Water Based Activities (refer **Section 6**); and,
- Assessment of Impacts and Mitigation Measures (refer **Section 7**).

This specialist report forms an input into the overarching Environmental Assessment prepared by JBS&G, and addresses the Secretary's Environmental Assessment Requirements (SEARS) (application number SSD 6701) relating to the key issue of 'traffic' including:

- details of the water based traffic that would be generated by the project (land based traffic is covered by a separate report);
- transport routes; and,
- navigation and safety impacts on other water based traffic and ferry commuter services from any barging of contaminated material, including any proposed measures to manage navigational conflicts.

## 2 Project Description

### 2.1 Project Background

Kendall Bay, located approximately 10 km west of the Sydney Central Business District (CBD) on the Parramatta River, was historically used for loading and unloading coal and other materials at the adjacent former Australian Gas Light Company (AGL) Mortlake gasworks.

Investigations carried out by AGL established that areas of sediments within the Bay had been contaminated and they entered into a voluntary remediation agreement (VRA) with the NSW Environment Protection Authority (EPA) in September 2005. The VRA committed AGL to further investigations and to remediate the sediment areas that required remediation.

Jemena inherited AGL's VRA obligations in late 2006 when the AGL Group was split up.

Two areas of contaminated sediments that require remediation have been identified by a number of phases of investigation followed by the application of human health and environmental risk assessments that were commissioned by Jemena. NSW Environmental Protection Authority, NSW Department of Health, NSW Department of Primary Industries (Fisheries), and NSW Roads and Maritime Services have been consulted throughout the investigation and risk assessment programs.

Approval for the Project is being sought under the State Significant Development (SSD) provisions (Division 4.1) of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

### 2.2 Site Description

#### 2.2.1 Site Locality

Kendall Bay is located on the southern side of the Parramatta River, approximately 10 km west of the Sydney central business district (CBD) and is located within the Canada Bay local government area (LGA) to the north of the suburb of Cabarita. The Breakfast Point residential development is located along the western and southern shoreline and Cabarita Park is along the eastern shoreline of the Kendall Bay.

The proposed staging site located at 140 Tennyson Road, Mortlake (herein referred to as the 'Staging Site') was formerly a marina, however is currently vacant and has been acquired by Jemena to facilitate the treatment and transport of the excavated sediment. The Staging Site is located on the southern shoreline of Fairmile Cove within the Parramatta River and situated approximately 1 km north west of the remediation area in Kendall Bay.

#### 2.2.2 Surrounding Context and Land Uses

The land surrounding Kendall Bay comprises a constructed western shoreline consisting of a walkway, with a medium density residential backdrop situated on the former gasworks site (the development forming Breakfast Point). The southern shoreline area consists of an intertidal beach and mangroves and is more natural in comparison to the western shoreline. The eastern shoreline largely consists of rock outcrops and smaller pockets of mangroves.

Cabarita Park is located to the immediate east of Kendall Bay with internal access roads and picnic areas extending throughout the parkland.

The Parramatta River is located to the north of Kendall Bay. A mixture of both powered private and commercial vessels is used on the waterway along with unpowered craft such as canoes, row boats and small yachts. Large passenger ferries also operate along the river between the Sydney CBD and Parramatta.

Breakfast Point is situated to the immediate west of Kendall Bay and consists of residential dwellings which are predominately attached medium density dwellings and residential apartment buildings.

Kendall Bay is predominately used for recreational purposes by small private motorised boats, canoes and row boats. Kendall Bay can be accessed by pedestrians utilising the shared pathway that leads from Cabarita Point to Kendall Bay, and there is a public boat ramp adjoining the public wharf towards the north western corner of Cabarita Park.

The Staging Site is adjoined by the Parramatta River to the north and north east, light industrial buildings to south and west, and residential dwellings generally located slightly beyond the marina site to the north-west and south-east.

## 2.3 Project Area

Collectively, the Project Area includes the:

- Remediation Areas;
- Staging Site; and,
- Declared Area;

The application of the three key areas outlined above is described below.

### 2.3.1 Remediation Areas

The project will involve the remediation of contaminated sediments within two defined areas within Kendall Bay. The extent of the defined remediation areas at the head of the Bay, referred to herein as the 'Southern Remediation Area', are shown on **Figure 1**. The remediation areas located on the western side of the Bay in the vicinity of the former loading wharf, referred to herein as the 'Northern Remediation Area', are shown on **Figure 2**.

### 2.3.2 Staging Site

Treatment of contaminated sediment, if required, will occur at the Staging Site located at 140 Tennyson Road, Mortlake (refer **Figure 3**). The Staging Site provides direct access to Parramatta River, which is strategically important as it enables ready access to Kendall Bay, without the reliance on adjoining public or other land. All plant and equipment to be utilised as part of the project will be transported to and from the proposed Staging Site and subsequently from the Staging Site to and from the Remediation Areas.

Existing facilities at the Staging Site include several large warehouses (previously used for ship repair), a foreshore hardstand area, a concrete piled wharf structure, a number of mooring piles and several gangways provided access to floating pontoons.

### 2.3.3 Declared Area

The EPA Declared Area (refer **Figure 3**) will encompass the route vessels will take to facilitate the transport of sediments and other materials removed from the Remediation Areas to the Staging Site and solidification materials and clean sand and rocks to the site. Excavated materials will be transported via barges to the Staging Site for onshore transfer, treatment, storage and disposal, where required.





Figure 1: Southern Remediation Area (S&W, 2018)



Figure 2: Northern Remediation Area (S&W, 2018)





Figure 3: Staging Site and Declared Area (URS, 2007a)

## 2.4 Remediation Approach

The remediation objectives and approach for each remediation area is summarised below from the more detailed description provided in the Remediation Action Plan (S&W, 2018).

### 2.4.1 Southern Remediation Area 1 – SA1

The objective in remediation area SA1 is to remediate to the extent practicable the surface sediments that pose an unacceptable risk to human health and pose an acute risk to the marine ecosystem and in which no viable marine community has been identified.

The proposed remediation strategy in this area is to solidify the sediments into columns to support a cemented raft over the top. The installation of columns may not be required in areas of shallow sediment depth where the stabilised material extends to a geotechnically suitable unit (Unit 2B). The top of the raft

will then be excavated down to 0.5m below Lowest Astronomical Tide (LAT). The excavated cemented material will be classified in accordance with the NSW EPA (2014) Waste Classification Guidelines. Part 1: Classifying Waste and taken to landfill. Secondary treatment of the in situ solidification (ISS) materials at an EPA licensed offsite waste facility may be considered before the waste materials are transported to landfill. A 0.3m thick capping layer suitable for re-establishment of viable benthic communities would be placed on top of the raft. This strategy would prevent human access to the contaminated sediments and improve the marine ecosystem within the bay.

To minimise excavation and generation of waste, it is proposed to use cement-based mass solidification techniques to create a 'raft' structure over the Remediation Area to support the overlying capping material that is to be placed to a finished level at LAT. The cement-solidified layer would be supported on deep sediment mixed columns extending down to the level of competent material to minimise settlement.

A 0.3 m thickness of cobble-sized rock capping material would be placed directly on to the excavated surface cut into the solidified material. An activated carbon impregnated geotextile would be placed as an initial layer incorporated into the base of the 0.3 m capping material thickness. Sand would be placed over the rock layer to form a suitable substrate within interstitial spaces of the rocks for benthic community colonisation. The rock would be placed first, followed by the sand layer to ensure that the sand is able to be distributed throughout the entire interstitial space.

It is proposed to enclose remediation area SA1 in a continuous sheet pile wall to provide environmental control during remediation. Contamination containment within the Remediation Area post remediation will be determined following remediation trial works.

#### **2.4.2 Southern Remediation Area 2 – SA2**

The objective in remediation area SA2 is to remove contaminated sediments that present a human health risk and/or an acute ecological risk, and remediate stained surfaces, sediments giving rise to emission of odours when exposed at low tides, and rubbish in accessible areas of the mangroves and along the foreshore, adjacent to the seawall.

The remediation strategy in this area is to remove stained rock/rubble and sediments to a depth of 0.3m between the seawall and to a nominal distance of 5m seaward or to the surveyed LAT contour in the northern part of the area and between the seawall and the edge of SA1 in the southern section of the area.

It is proposed to lower the seabed such that the final seabed level is below LAT and incorporates a 0.3m thick capping layer suitable for re-establishment of viable benthic communities. Geotechnical considerations, such as avoiding undermining founding material associated with the seawall, will also be considered when determining the depth of excavation adjacent to the seawall. This would prevent human access to the contaminated rubble material along the base of the seawall at low tide and improve the marine ecosystem within the bay.

It is proposed that careful excavation of surface stained materials and rubble be completed at the toe of the seawall down to a level of -0.3 m LAT or the level of the seawall toe apron slabs, whichever is reached first. Beyond the extent of seawall toe apron slabs, careful excavation can be completed to -0.3 m LAT.

The westernmost mangroves in the southern area of SA2 will be removed to allow for accurate removal of contaminated sediment and replacement of clean material to achieve the human health risk objectives.

Excavation will be followed by placement of a layer of geotextile fabric and 0.3 m thick layer of cobble sized rock to a finished level of 0 m LAT. Geotechnical considerations for the existing seawall may impact the finished level that can be obtained adjacent to the seawall. Sand would be subsequently placed over the rock layer to provide substrate within the interstitial spaces of the rocks for benthic recolonisation.

### 2.4.3 Southern Remediation Area 3 – SA3

The objectives in remediation area SA3 are:

- managing sediments that pose an unacceptable risk to human health to users of the beach and mangrove areas; and,
- installing control measures to ensure stormwater discharge to Kendall Bay will not impact the remediated and managed parts of the Southern Remediation Area.

The remediation strategy in the northern part of SA3 is to remove any coke and coal from the intertidal sand surface to a nominal depth of 0.2m. A layer of clean imported sand (VENM, compatible with the existing natural material) will be placed over the area as required to restore the existing sand surface where removal of material was required.

The remediation strategy in the southern part of SA3 is to retain the existing established mangrove vegetation and clean up the area due to it being accessible to humans. This would involve removal of coke and coal from the sand surface in amongst the mangroves to a nominal depth of 0.2m using small excavators. A layer of clean imported sand (VENM, compatible with the existing natural material) will be placed over the area as required to restore the existing sand surface where removal of material was required.

Management of stormwater flow from the large 1650mm diameter outlet discharging behind the mangroves at the head of the bay will be carried out. Migration of the existing scour channel to the east would impact on the amenity of the adjacent beach area in SA4 and SA5. The impact on the beach area will be limited by the proposed landward extension of the existing sandstone wall (discussed below). However, eastward-migrating stormwater flows running alongside the wall may cause localised scour and undermining of the structure. To address these issues, stormwater flows will be redirected away from the wall by the installation of a series of spur walls along an alignment through the mangrove area. These low-level rock mound structures would train stormwater discharge away from the wall extension whilst allowing the flow to spread over the sand shoals without scouring a deep channel.

### 2.4.4 Southern Remediation Area 4 – SA4

The objective in remediation of area SA4 is to improve the public amenity of the beach.

The remediation strategy in this area is to clean up the existing beach area by removing coke and coal from the sand surface and to a nominal depth of 0.2 m (screened sand would be returned to the beach profile). The natural rocks over the beach could also be collected as part of beach clean-up activities and beneficially reused in the construction of the spur walls proposed within area SA3.

The public amenity of the beach is to be improved by the placement of a 0.5m layer of clean sand (VENM) over the area. The grading of the imported sand material would be compatible with the existing beach sand and placed at the same slope and planform alignment. This would minimise readjustment of the beach profile and/or loss of sand offshore under wave action. The nearshore beach slope is around 1V:8H before it flattens significantly to a slope of 1V:100H beyond a bed level of +0.4 m LAT, which is around the Mean Low Water mark. It is estimated that the volume of sand placement would be in the order of 500 m<sup>3</sup>.



The quantity of sand on the existing beach fluctuates in response to prevailing wind wave action and the regular action of boat wake waves from Rivercats and Harbourcats, which may cause beach sand to move alongshore and be captured within the sand shoal that has been established in the mangrove area. For this reason, it is necessary to retain any beach nourishment sand within the SA4 area to maintain beach amenity. This will be achieved by a seaward extension of the existing sandstone wall (which is approximately 0.5 m wide by 0.5 m high) located on the western side of the beach. This will act as a groyne to retain sand within the embayment created on its eastern side and will also act to prevent scouring of the beach area by meandering stormwater discharge from the head of the bay (although the proposed spur walls would be the primary means to mitigate this process). The sandstone wall will extend offshore beyond the limit of sand placement, which would result in a wall extension length of around 30 m.

It is expected that in high rainfall events, the existing stormwater outlet located towards the eastern end of the beach would discharge across the beach creating a scour channel and deposition of debris and rubbish from the catchment. The associated impacts on beach amenity would be resolved by diversion of the outlet to a location further to the east, where stormwater could discharge out on to the existing rock platform. Should this not prove technically feasible or not be approved by Council and RMS, other measures could include installation of a gross pollutant trap(s) (GPT) upstream in the system and construction of an energy dissipation structure at the outlet.

#### **2.4.5 Southern Remediation Area 5 – SA5**

The objective in remediation area SA5 is to provide a clean, firmer underfoot, offshore wading area to be accessed from the beach.

The remediation strategy in this area involves shallow excavation of existing seabed material to 0.3m depth followed by placement of a 0.3m layer of clean sand to match the existing bed level. The sand placement would provide a clean, firmer underfoot, offshore wading area to be accessed from the beach and mangrove area and would extend to the limit of SA5. The offshore boundary of SA5 is located around the 0.2m to 0.3m LAT contour, which is around the position of the waterline at Mean Low Water Spring tide (MLWS, 0.27m LAT). The grading of the imported sand material (VENM) would be compatible with the existing beach sand further inshore. Beneficial reuse of the excavated fine grained material would be achieved by blending it with sand used for capping of other remediation areas (e.g. SA1).

#### **2.4.6 Northern Remediation Area 1 – NA1**

The primary objective of remediation in NA1 is to protect human health by preventing people using the area being exposed to contaminated sediments. Remediation works in NA1 will also remove stained surfaces, sediments giving rise to emission of odours when exposed at low tides and the presence of rubbish in accessible areas and in the foreshore, adjacent to the seawall.

The remediation strategy in this area is to remove stained rock/rubble and any contaminated sediment to 0.3 m depth within the designated area adjacent to the vertical seawall and replace with clean sandstone to restore site aesthetics. The process used will be similar to that employed for SA2. That is, to lower the seabed to below the level of Lowest Astronomical Tide (LAT) and to provide a 0.3m thick capping layer for establishment of viable benthic communities. Geotechnical considerations for the existing seawall may impact the finished level that can be obtained adjacent to the seawall. This treatment will prevent air exposure of contaminated rubble material and sediments along the base of the seawall at low tide and improve the marine ecosystem within the bay.



It is proposed that careful excavation of surface stained materials and rubble should be completed at the toe of the seawall down to a target level of -0.3 m LAT whilst preserving the existing toe support along the seawall structure. Excavation would be followed by placement of a layer of geotextile fabric and a 0.3 m thick layer of cobble sized rock to a finished level of 0 m LAT where possible. Sand would be subsequently placed over the rock layer to provide substrate within the interstitial spaces of the rocks for benthic recolonisation.

#### **2.4.7 Northern Remediation Area 2 – NA2+NA3**

The objective in remediation area NA2+NA3 is to remediate to the extent practicable the surface sediments that pose an unacceptable risk to human health, and that pose an acute risk to the marine ecosystem.

The remediation strategy in this area is to establish a surficial layer of material on the seabed for re-establishment of viable benthic communities. This would initially involve removal of surficial loose contaminated materials over hard surfaces associated with operation and demolition of the former wharf. Cement-based solidification techniques would then be used to create a 'raft' structure over the Remediation Area to support the overlying capping material that is to be placed to a finished level equivalent to the existing natural surface. The raft in NA2 +NA3 is to be constructed through the full depth of sediments to the competent Unit 2B – Stiff Clay material as the sediment depth appears to be much shallower than in remediation area SA1 and as such columns are not required. A geotechnical investigation will be completed to confirm the depth of the Unit 2B - Stiff Clay material.

The depth of mass solidification is to be completed up to a depth of approximately 3.0 m. Following the in situ stabilisation of contaminated sediments the surface of the stabilised raft is to be excavated to a depth of 0.5 m below LAT and to a minimum depth of 0.5 m from the surface of the in situ stabilised sediments.

A 0.3 m thickness of cobble-sized rock capping material would be placed directly on to the excavated surface cut into the solidified material. As proposed for Remediation Area SA1, an activated carbon impregnated geotextile would be placed as an initial layer incorporated into the base of the 0.3 m capping material thickness. Sand would be placed over the rock layer to form a suitable substrate within interstitial spaces of the rocks for benthic community colonisation. The rock would be placed first, followed by the sand layer to ensure that the sand is able to be distributed throughout the entire interstitial space.

It is proposed to enclose remediation area NA2+NA3 in a continuous sheet pile wall to provide environmental control during remediation. Contamination containment within the Remediation Area post remediation will be determined following remediation trial works.

### 3 Proposed Remediation Methodology

#### 3.1 General

The proposed remediation construction method has been derived from the information contained within the Remediation Action Plan (S&W, 2018). It should be noted that the details of the remediation method are subject to the future design phase and refinement by the preferred remediation contractor.

The construction steps and methods proposed within the various remediation areas are briefly described in the following sections.

#### 3.2 Remediation Area SA1 and NA2+NA3

- Installation of sheet pile walls around the perimeter of the remediation areas with barge-mounted equipment.
- Construction of supportive deep sediment mixed columns, nominally 0.6 m diameter and at 1.8 m centres (exact details to be determined in the detailed design phase of the project), using barge-mounted equipment comprising a drilling rig, binder silo and mixing plant and grout pump and positioned using GPS control.
- In-situ cement solidification of the upper sediment layer in SA1 using an amphibious excavator with a mixing attachment linked via a supply hose to a cement supply silo/tank mounted on a floating barge and positioned using GPS control.
- In-situ cement solidification of the upper sediment layer in area NA2+NA3 would be achieved by using barge-mounted equipment (as described above for column construction) to create a series of overlapping columns over the area down to the Unit 2B interface.
- Excavation of cement solidified material with barge-mounted excavator and placement into an adjacent hopper barge or a barge carrying smaller hoppers or skip bins.
- Transfer of excavated material overwater by barge to the Staging Site for treatment (if necessary) and disposal by truck to a licensed waste facility.
- Placement of an activated carbon impregnated geotextile mat and then cobble-sized rock using small earthmoving equipment (e.g. Bobcat or small excavator) gradually tipping rock over the edge of a floating barge containing stockpiled material.
- Placement of sand over the cobble layer in a similar manner to rock.

#### 3.3 Remediation Area SA2 and NA1

- Careful excavation of surface materials with a barge-mounted excavator with GPS control at high tide and placement of materials into an adjacent hopper barge or flat barge carrying smaller sealed hoppers or skip bins.
- Transfer of excavated material overwater by barge to the Staging Site for treatment (if required) and disposal by truck to a licensed waste facility.
- Placement of panels of geotextile fabric and geogrid from floating barges to achieve a minimum 0.9m overlap between adjacent panels, use of polyester non-woven geotextile fabric would facilitate underwater deployment (polypropylene geotextile fabric is buoyant).
- Placement of capping materials using small earthmoving equipment (e.g. Bobcat or small excavator) gradually tipping material over the edge of a floating barge containing stockpiled material, or capping materials placed and groomed by barge-mounted excavator with GPS control.

### 3.4 Remediation Area SA3

- Removal of surficial material where practicable over the nearshore sand shoal by small earthmoving equipment (e.g. Bobcat or small excavator) deployed on to the beach at low tide by a landing barge.
- Removal of surficial material within the mangroves by hand with labourers wearing appropriate personal protective equipment (PPE).
- Waste material would be placed into skip bins positioned on the nearshore sand shoal and within reach of floating barges at high tide.
- Transfer of waste material overwater by barge to the Staging Site for treatment (if required) and disposal by truck to a licensed waste facility.
- Sand placement will be achieved hydraulically via a small pipeline (e.g. 100mm diameter, able to be shifted by hand) extending from a floating barge fitted with a slurry pump box and displacement pump for delivery of sand slurry into the pipeline. Alternatively, sand will be stockpiled on the beach by small earthmoving equipment deployed on to the beach at low tide by a landing barge, profiled/graded by small earthmoving equipment over the unvegetated shoal area, and distributed throughout the mangroves by hand using wheelbarrow, spades and rakes.
- Spur walls could be constructed with rock placed with small earthmoving equipment (e.g. Bobcat or small excavator) deployed on to the beach at low tide by a landing barge.
- If small equipment access into mangroves is problematic, the spur walls could be constructed with smaller rock that is able to be transported and lifted into place by hand.

### 3.5 Remediation Area SA4

- Construction of the sandstone wall extension over beach and intertidal area will be undertaken by small earthmoving equipment (e.g. Bobcat or small excavator) deployed on to the beach at low tide by a landing barge.
- Construction materials will be delivered to the site by barge and an amphibious excavator may be required in areas where weak ground conditions exist.
- Removal of surficial material from the beach area by small earthmoving equipment (e.g. Bobcat or small excavator) deployed on to the beach at low tide by a landing barge, utilising a screening bucket or similar).
- Waste material would be placed into skip bins positioned on the nearshore sand shoal and within reach of floating barges at high tide.
- Transfer of waste material overwater by barge to the Staging Site for treatment and disposal by truck to a licensed waste facility.
- Placement of sand layer over beach by small earthmoving equipment deployed on to the beach at low tide by a landing barge.
- Alternatively, hydraulic sand placement could be achieved as per the method described for SA3 and profiling/grading of placed sand undertaken by small earthmoving equipment.

### 3.6 Remediation Area SA5

- An amphibious excavator will track over intertidal/subtidal areas to excavate material.
- An amphibious excavator will place sand from stockpiles located on the beach (SA4) or floating barges.
- Excavated material will be placed into skip bins positioned on the nearshore sand shoal and within reach of floating barges at high tide.
- Blending of excavated material with sand using earthmoving equipment for beneficial re-use in capping of other remediation areas.

## 4 Existing Site

### 4.1 General

The following describes the existing site conditions that relate to navigation, including:

- bathymetry and shoreline;
- wave climate;
- water level; and,
- currents.

### 4.2 Bathymetry and Shoreline

Kendall Bay and Fairmile Cove are shallow embayments on the southern foreshore of the Parramatta River (refer **Figure 4**). The head of Kendall Bay faces north and the bay itself is formed by Breakfast Point on its western foreshore and Cabarita Park and Cabarita Point on its eastern foreshore. The head of Fairmile Cove faces north and the bay itself is formed by Mortlake Point on its western foreshore and Breakfast Point on its eastern foreshore.



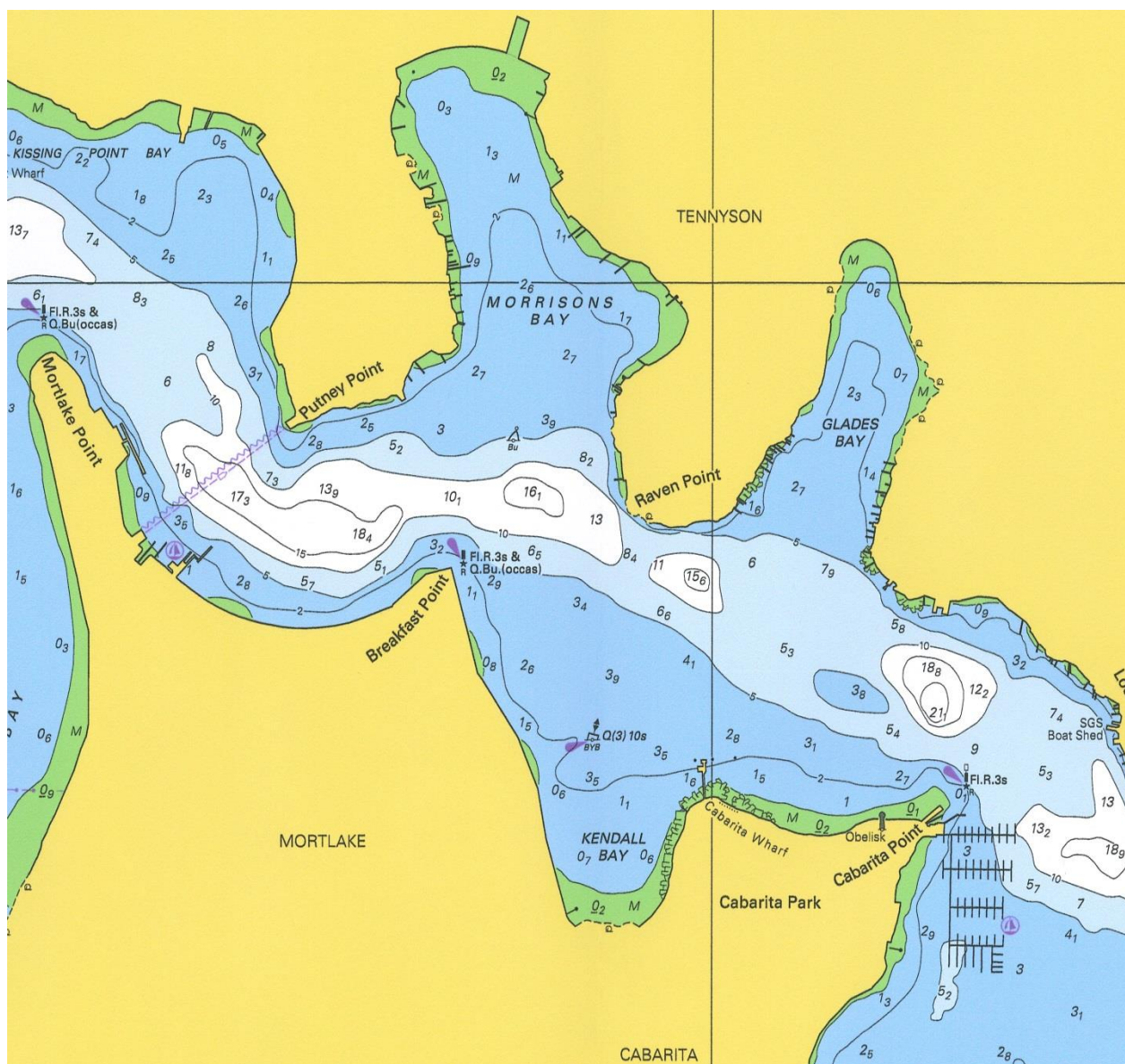


Figure 4: Admiralty Chart for Project Area (Aus 203)

Within Kendall Bay the bathymetric levels are typically less than 2m below chart datum<sup>1</sup> (CD) except in the vicinity of the former coal wharf on the western foreshore, where a channel and berthing areas were dredged to provide shipping access from the wharf (shown on the historical aerial photograph on **Figure 5**) to the main channel of the Parramatta River. Kendall Bay is also generally bound by various concrete and stone seawalls with a small beach and intertidal area to the south of the bay, and a boat ramp (refer **Figure 6**) and ferry wharf (Cabarita Ferry Wharf) at the point on the eastern side of the bay.

<sup>1</sup> Chart Datum (CD) is approximately the level of Lowest Astronomical Tide (LAT) and is approximately 0.9m below Australian Height Datum (AHD).





Figure 5: Historical aerial photograph and coarse bathymetry (URS, 2006)





*Figure 6: View across Kendall Bay from the boat ramp*

The detailed bathymetry within Kendall Bay is provided on a plan prepared from a hydrographic survey undertaken by Hydrographic & Cadastral Survey Pty Ltd on 5 June 2014 (refer **Figure 7**), which shows surveyed depths relative to Chart Datum. The survey indicates that bed levels within the Southern Remediation Area at the head of the bay range between -0.2m CD and +2m CD. Bed levels within the Northern Remediation Area on the western side of the bay range between -1m CD and 0m CD.



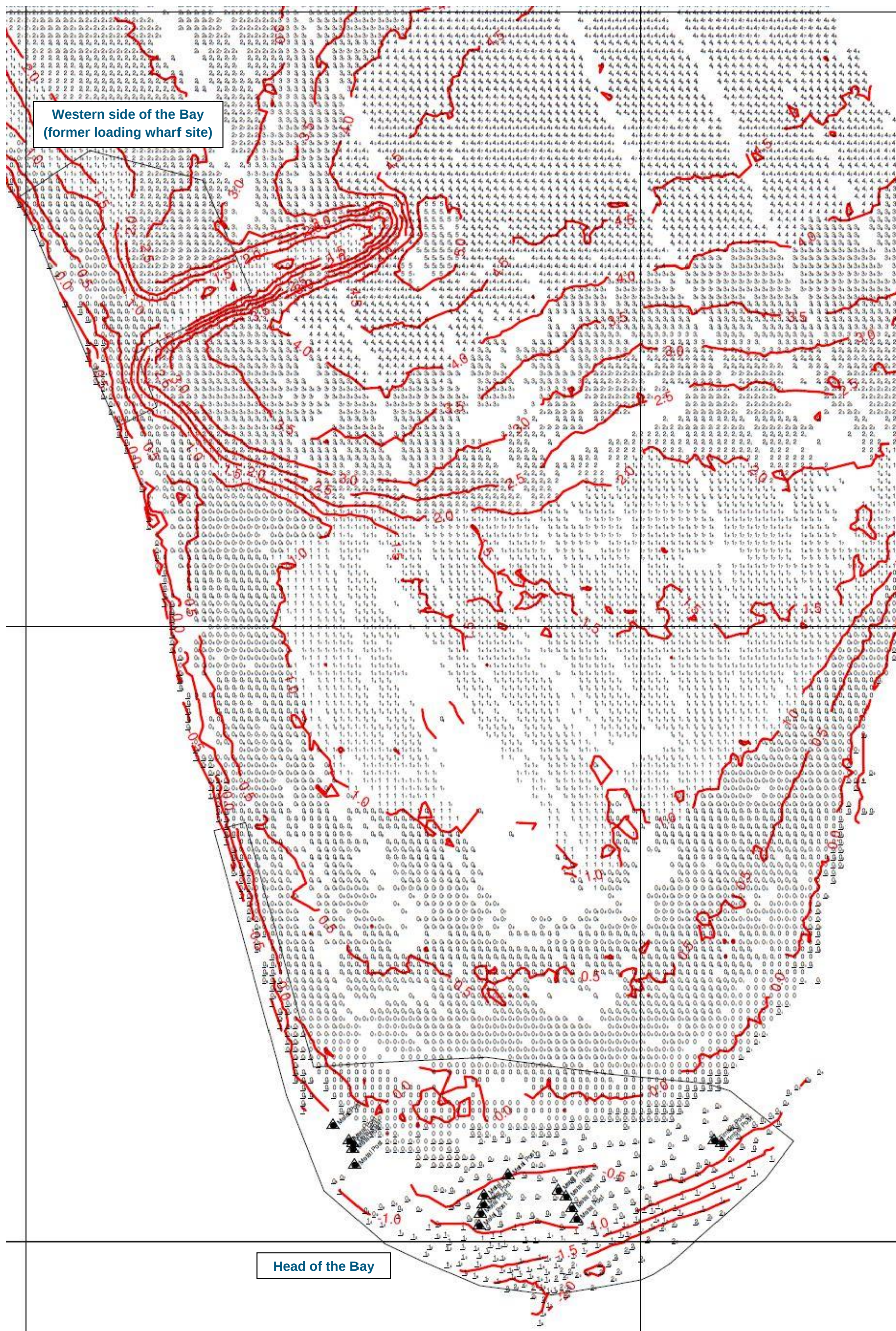


Figure 7: Detailed bathymetry within Kendall Bay (Hydrographic & Cadastral Survey Pty Ltd, 2014)



Within Fairmile Cove the bathymetric levels are typically less than -2m CD close to shore and grade away from the shore towards the main channel to around -10m CD to -20m CD (refer **Figure 4**). Fairmile Cove (refer **Figure 8**) is also bound by sections of sloping concrete and stone seawall (refer **Figure 9**) that do not promote water access. The Mortlake Ferry stop and slipway is located on the northern foreshore. The old River Quays Marina site and a cluster of swing moorings are located immediately downstream of the ferry stop.



*Figure 8: View of Fairmile Cove from Breakfast Point*



*Figure 9: Sloped revetment within Fairmile Cove (looking towards the Staging Site)*

Hydrographic survey data at the Staging Site (refer **Figure 10**) indicates that the bed levels in the vicinity of the existing wharf structures at the site range between -3m CD to -3.5m CD.



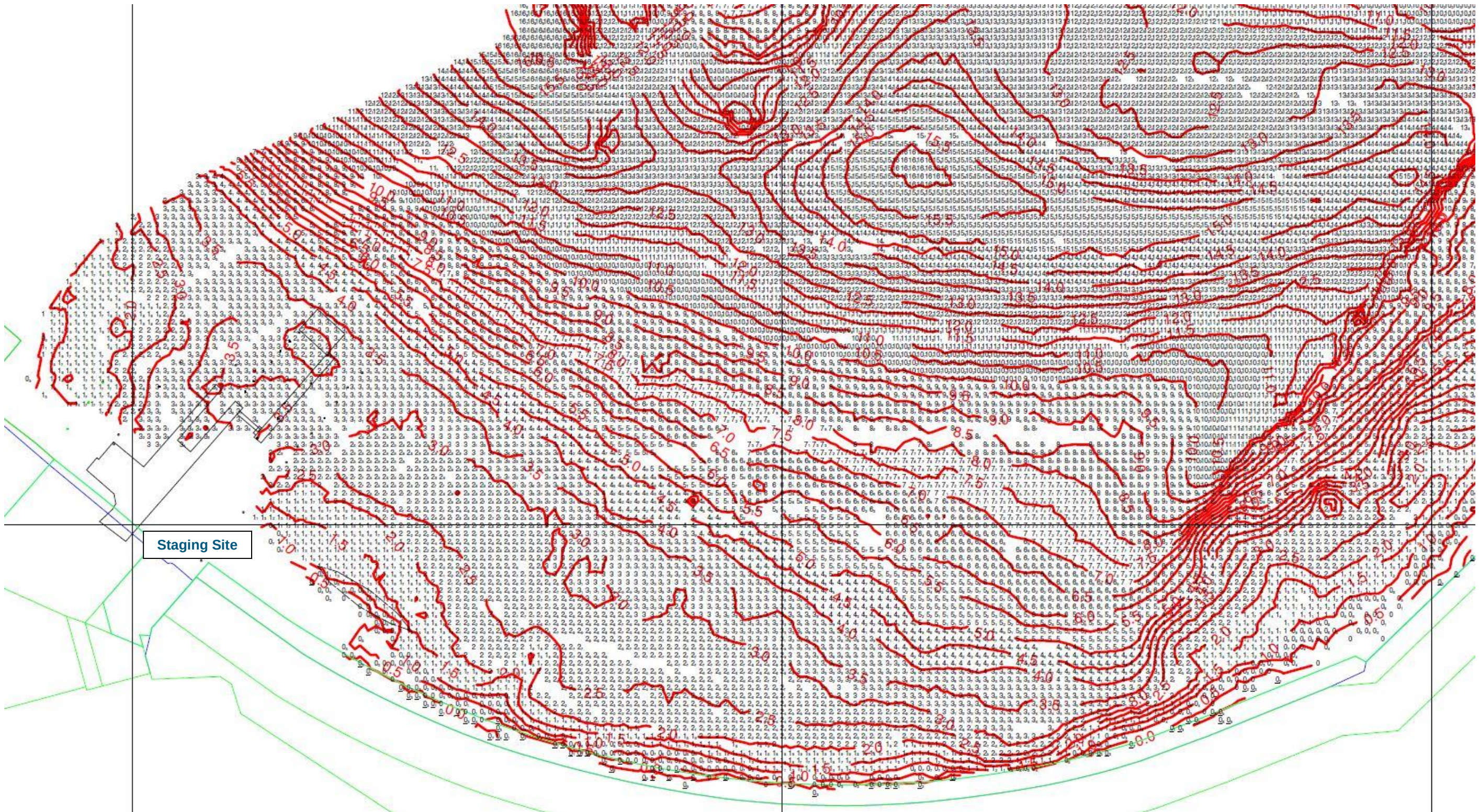


Figure 10: Bathymetric survey at the Staging Site (Hydrographic & Cadastral Survey Pty Ltd, 2014)



As shown on **Figure 4**, the main channel within the Parramatta River runs across the entrance to Kendall Bay and Fairmile Cove (refer **Figure 11**). Based on the current AusChart (Aus 203) it has depths adjacent to Kendall Bay ranging between -6.0m CD and -8.4m CD. The Parramatta River channel has several deeper areas with depths between -16.1m CD and -15.6m CD between Breakfast Point and Raven Point, and down to -21.1m CD opposite Cabarita Point. The main channel has depths greater than -15m CD adjacent to Fairmile Cove and deeper areas of between -17.3m CD and -18.4m CD.



*Figure 11: View of the main channel from Breakfast Point*

## 4.3 Wave Climate

The wave climate within Kendall Bay is influenced by wind waves and boat generated waves. A discussion of the nature of these contributions is provided below.

### 4.3.1 Wind Waves

Kendall Bay is exposed to overwater wind directions (i.e. wind fetches) in the sector between the NNW and E directions. A selection of worst case wind fetches within this sector have been defined to develop design wind wave conditions for 1 year Average Recurrence Interval (ARI) and 20 year ARI wind speeds. The 1 year ARI wave provides an indication of conditions that may occur at least once during the construction period. The 20 year ARI wave represents the design condition for 'temporary works' in accordance with Australian Standard AS 4997 – 2005 Guidelines for the Design of Maritime Structures.

The wind wave climates for the 1 year ARI and 20 year ARI design events are summarised in **Table 1** for the critical wind fetches into Kendall Bay. The wave climates have been calculated using the procedures for shallow water wind wave prediction within the Shore Protection Manual (SPM, 1984) with input wind data from AS 1170.2 – 2011 Structural Design Actions – Part 2: Wind Action.

Table 1: Wind Wave Climate

| Wind Direction | Fetch Description                                       | Fetch (m) | Average Depth (m) | 1 year ARI     |             | 20 year ARI  |           |
|----------------|---------------------------------------------------------|-----------|-------------------|----------------|-------------|--------------|-----------|
|                |                                                         |           |                   | $H_{m0}^2$ (m) | $T_m^3$ (s) | $H_{m0}$ (m) | $T_m$ (s) |
| NNW            | From head of Kendall Bay into Morrisons Bay             | 1600      | 5                 | 0.56           | 2.15        | 0.72         | 2.34      |
| N              | From northern remediation area into Morrisons Bay       | 1250      | 5                 | 0.51           | 1.99        | 0.65         | 2.18      |
| NNE            | From head of Kendall Bay into Glades Bay                | 1300      | 5                 | 0.51           | 2.02        | 0.67         | 2.20      |
| NE             | From northern remediation area to Gladesville foreshore | 800       | 5                 | 0.42           | 1.75        | 0.54         | 1.91      |
| E              | From northern remediation area to Looking Glass Point   | 1050      | 5                 | 0.47           | 1.89        | 0.61         | 2.07      |

Note: Refer to **Figure 4** for geographic locations referred to above.

The above results indicate that the worst case wind wave would be generated from a NNW wind, giving a significant wave height ( $H_{m0}$ ) of around 0.56m and peak wave period ( $T_m$ ) of around 2.15 seconds in the case of a 1 year ARI design event.

### 4.3.2 Boat Generated Waves

Waves generated by boat traffic provide a significant contribution to the daily wave climate experienced within Kendall Bay. This statement is particularly relevant to 'Rivercat' and 'Harbourcat' vessels that run services through the main channel of the Parramatta River and pass Kendall Bay a number of times each day. The typical magnitude of waves generated by passing boat traffic was reported in an assessment by gbaCOASTAL Pty Ltd (GBAC, 2009) as part of an environmental assessment submitted for a marina proposal at Breakfast Point. A compilation of wave conditions was presented in this report and are reproduced in **Table 2**. Review of the 2016 ferry timetable determined Cabarita Ferry Wharf receives 25,608 ferries annually, which is similar to the annual number of passings reported in **Table 2**.

Recreational boat ownership in Sydney Harbour has been reported to have increased by 1.3% annually between 1999 and 2009 (NSW Maritime, 2010) which would increase the number of passings from this type of craft. However, this is not considered to be material for the current assessment as ferries pass closer to Kendall Bay on a regular basis to service the Cabarita Ferry Wharf and are considered to be the main source of boat generated waves within Kendall Bay.

<sup>2</sup>  $H_{m0}$  is the spectrally based significant wave height and is four times the square root of the variance of the sea surface variation.  $H_{m0}$  is approximately equal to the significant wave height ( $H_s$ ) in deep water.

<sup>3</sup>  $T_m$  is the period of the peak of the wave energy spectrum.



Table 2: Design Near-Field Boat Wave Climate (GBAC, 2009)

| Boat Type                           | No. Passings per Year <sup>4</sup> | Typical Maximum Wave Conditions <sup>5</sup> |           | Root-Mean-Square Typical Maximum Wave Conditions <sup>6</sup> |       |
|-------------------------------------|------------------------------------|----------------------------------------------|-----------|---------------------------------------------------------------|-------|
|                                     |                                    | H max (m)                                    | T (s)     | H max <sub>(RMS)</sub>                                        | T (s) |
| Recreational Power Craft            | 71,000                             | 0.2 – 0.4                                    | 1.5 – 2.5 | 0.27                                                          | 2.0   |
| Ferries (Rivercats and Harbourcats) | 25,000                             | 0.25 – 0.35                                  | 6 - 8     | 0.3                                                           | 7     |
| Charter Vessels                     | 3,500                              | 0.3 – 0.4                                    | 2.0 – 2.5 | 0.35                                                          | 2.2   |
| Work Boats                          | 3,600                              | 0.2 – 0.4                                    | 1.5 – 2.5 | 0.30                                                          | 2.0   |

**Table 2** indicates that the height of waves generated by passing vessels is similar to those from more regular wind wave events. However, the wave period generated by Rivercat and Harbourcat vessels is much longer and would therefore impart more wave energy into Kendall Bay. Although the near-field boat wave conditions reported in **Table 2** would reduce with distance from the sailing line (or path) of vessels, the near-field wave energy generated from ferries would effectively be delivered unattenuated into Kendall Bay when these vessels access Cabarita Ferry Wharf.

## 4.4 Water Levels

Water levels within Kendall Bay vary primarily in response to astronomical tides, although storm surge (barometric and wind set-up) and freshwater flooding may also influence water levels from time to time. Sea level rise will have a long-term effect on water levels.

### 4.4.1 Astronomical Tide

Kendall Bay is subject to semi-diurnal tides (i.e. two high tides and two low tides per day) that propagate along the Parramatta River from the estuary mouth at Sydney Harbour. The predicted tides for Cabarita (near Kendall Bay) derived by the MSB Sydney Ports Authority in 1995 are provided in **Table 3** below.

High and low tides at Cabarita were reported to lag the corresponding high and low tides at Fort Denison by approximately 9 and 7 minutes respectively.

<sup>4</sup> Based on Parramatta River boating surveys reported in 2001, scaled up to 2009 according to trends in NSW boating registrations 1991-2006. Ferry movements from April 2009 Sydney Ferries timetable for Parramatta River service.

<sup>5</sup> Typical maximum wave conditions interpreted from GBAC database including WA (2001) and Blumberg et al (2003). Typical operating speeds are assumed.

<sup>6</sup> Root Mean Square (RMS) wave conditions assessed by GBAC. These related to average wave energy conditions. H max<sub>(RMS)</sub> for recreational power craft based on an assessment of waves generated by the expected range of actual vessel sizes and their distribution within the traffic profile, simulated using registration statistics.

Table 3: Predicted Tidal Planes for Cabarita (MSB, 1995)

| Tidal Plane                     | Water Level (m CD)    |
|---------------------------------|-----------------------|
| Highest Astronomical Tide (HAT) | 2.1 (Fort Denison)    |
| Mean High Water Springs (MHWS)  | 1.64                  |
| Mean High Water (MHW)           | 1.51                  |
| Mean High Water Neaps (MHWN)    | 1.38                  |
| Mean Tide Level (MTL)           | 0.98                  |
| Mean Low Water (MLW)            | 0.39                  |
| Mean Low Water Springs (MLWS)   | 0.27                  |
| Lowest Astronomical Tide (LAT)  | -0.003 (Fort Denison) |

#### 4.4.2 Storm Surge and Sea Level Rise

The combined effect of barometric pressure setup and wind stress setup is referred to as storm surge. Barometric pressure setup refers to the increase in mean sea level caused by a drop in atmospheric pressure, such as when a low pressure system is centred over an area. Wind stress setup is the increase in mean sea level caused by the 'piling up' of water on a shoreline by wind action acting on the water surface.

DECCW (2010) has provided design ocean still water levels for the NSW coast at 2010, 2050 and 2100 (for various ARI events, refer **Table 4**). These water levels include allowances for astronomical tide, design barometric setup and wind setup, and future sea level rise<sup>7</sup>. Given the similarity of the tidal levels between Cabarita and Fort Denison, these values are considered to be reasonable for application at the Kendall Bay remediation site.

Table 4: Design still water levels at Fort Denison (DECCW, 2010)

| Average Recurrence Interval | 2010  |      | 2050  |      | 2100  |      |
|-----------------------------|-------|------|-------|------|-------|------|
| Years                       | m AHD | m CD | m AHD | m CD | m AHD | m CD |
| 0.02                        | 0.97  | 1.90 | 1.31  | 2.24 | 1.81  | 2.74 |
| 0.05                        | 1.05  | 1.98 | 1.39  | 2.32 | 1.89  | 2.82 |
| 0.1                         | 1.00  | 1.93 | 1.44  | 2.37 | 1.94  | 2.87 |
| 1                           | 1.24  | 2.17 | 1.58  | 2.51 | 2.08  | 3.01 |
| 10                          | 1.35  | 2.28 | 1.69  | 2.62 | 2.19  | 3.12 |
| 50                          | 1.41  | 2.34 | 1.75  | 2.68 | 2.25  | 3.18 |
| 100                         | 1.44  | 2.37 | 1.78  | 2.71 | 2.28  | 3.21 |

The above water levels exclude the effects of wave setup, which have to be assessed separately from a consideration of the wave climate at the particular site of interest.

<sup>7</sup> The values adopted for sea level rise between 2010 and 2050, and 2010 and 2100, were 0.34m and 0.84m respectively and remain suitable for adoption for current planning purposes.



#### 4.4.3 Wave Setup

Wave setup at the shoreline is approximately 10-15% of the breaking significant wave height. For the worst case 20 year ARI wind wave conditions (refer **Table 1**) the wave setup is estimated to be between 0.09m and 0.13m. For the worst case 1 year ARI wind wave conditions (refer **Table 1**) the wave setup is estimated to be between 0.07m and 0.10m.

#### 4.4.4 Freshwater Flooding

The Lower Parramatta River Flood Study (PWD, 1986) reported that flood levels between the Silverwater Bridge and Ryde Bridge (downstream limit of the study area) were determined by the adopted storm tide level and were not influenced by river discharge. A similar approach was adopted in the subsequent update to the flood study completed in 2005 (SKM, 2005).

### 4.5 Currents

Currents within navigable areas of Kendall Bay and surrounds can be generated by several processes that include:

- Tides;
- Freshwater flows;
- Wind; and,
- Boat wash.

#### 4.5.1 Tidal Currents

An investigation into tidal currents was undertaken as part of the Environmental Risk Assessment (URS, 2006), which included an Acoustic Doppler Current Profiler (ADCP) survey of several transects across the Parramatta River including areas of Kendall Bay and Fairmile Cove. It was reported that water velocities are generally low and complex at high (slack) tide with velocities less than 0.2 metres per second (m/s). During the peak ebb tide, currents of up to 0.7m/s were measured in an ESE direction off the end of Breakfast Point and were expected to be of a similar magnitude during flood tides. Tidal currents were observed to be confined to the main channel through the Parramatta River and the higher velocity ebb tide currents recorded off Breakfast Point did not extend into the shallow waters of Kendall Bay. Tidal currents within Kendall Bay were generally recorded between 0.2-0.3m/s on the ebb tide. Ebb tide currents within Fairmile Cove were around 0.15m/s.

#### 4.5.2 Freshwater Flows

Currents resulting from freshwater flows are expected to be confined to the main channel of the Parramatta River and would not exceed peak tidal flows.

#### 4.5.3 Wind Induced Currents

Wind-induced currents can be generated by the action of surface shear (unidirectional currents) or wave action (oscillatory currents).

Measurements (Limnology and Oceanography, 1951) have shown that unidirectional surface currents can be induced by surface shear of winds up to 7m/s before the surface response becomes oscillatory and wind waves are generated. These unidirectional surface currents can reach 1 to 2% of the wind speed, giving a maximum potential velocity of around 0.15m/s.

Oscillatory currents from wind wave action vary according to the water depths within the bay. **Table 5** summarises the calculated near bed (50mm above the bed) horizontal velocities generated by the worst case NNW wind wave conditions for water depths of 3m, 2m and 1m.

*Table 5: Maximum Horizontal Wind Wave Induced Currents at the Bed*

| Design Event      | Wave Height (m) | Wave Period (s) | Maximum Near-bed Current Speed (m/s) |      |      |
|-------------------|-----------------|-----------------|--------------------------------------|------|------|
|                   |                 |                 | 3m                                   | 2m   | 1m   |
| 1 year ARI (NNW)  | 0.56            | 2.15            | 0.11                                 | 0.25 | 0.57 |
| 20 year ARI (NNW) | 0.72            | 2.34            | 0.20                                 | 0.38 | 0.78 |

#### 4.5.4 Boat Wash

Oscillatory currents generated by boat waves have been determined using the wake typically produced by Rivercat vessels passing the site on a daily basis. If a wave height of 0.3m and wave period of 7 seconds is adopted (refer **Table 2**), then at water depths within the bay of 3m, 2m and 1m the corresponding near bed (50mm above the bed) currents would be 0.27m/s, 0.37m/s and 0.63m/s respectively.



## 5 Existing Waterway Navigation

### 5.1 Navigation Rules

The Roads and Maritime Services (RMS) Boating Handbook (RMS, 2016b) provides boating information for operating on NSW waters including water traffic rules. The “Safety on the Water” section from the RMS Boating Handbook is provided within **Appendix A** to this report and includes the following sub-sections:

- Know the Rules;
- Navigation Marks and Signs;
- Night Safety;
- Special Areas;
- Big Ships and Small Boats; and,
- Go Easy on the Drink.

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 in relation to Sydney Harbour:

*Sydney Harbour is a unique waterway that is used extensively by a diverse range of recreational and commercial boats including large ships, ferries, charter boats, cruisers, yachts, runabouts, sailing skiffs, dinghies, sailboards, rowing shells, kayaks and dragon boats.*

*The Harbour is an extremely busy waterway that requires you to be aware of your responsibilities and to take care when boating, especially in busy navigational channels, and 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.*

*The number of vessels on the Harbour is increasing each year, providing a greater challenge in managing the potential for additional conflict and incidents to ensure safety on the waterway.*

*There is a continuing need for an understanding and commitment to water safety by all people using the Harbour. The different types of boating may not always be compatible and can lead to potential conflicts: for example, people sailing in organised events and commercial vessels operating to timetables.*

RMS has launched 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 onboard. The information booklet produced for this campaign is included within **Appendix A**.

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

## 5.2 Navigation around Kendall Bay and Fairmile Cove

The RMS boating map (RMS, 2016a) that covers Kendall Bay and Fairmile Cove is shown on **Figure 12**, and imposes a speed limit of 4 knots when within 100m of the Mortlake Ferry (working with chains and wires) and this is also signposted at Breakfast Point (refer **Figure 13**). Otherwise, no other boating restrictions are imposed around Kendall Bay and Fairmile Cove. Where not specifically stated, rules regarding speed, wash etc. would be governed by the “Safety on the Water” section from the RMS Boating Handbook (refer **Appendix A**).



Figure 12: Excerpt from RMS Boating Map (Map No. 9G Upper Parramatta River)



Figure 13: Mortlake Ferry warning sign at Breakfast Point

The primary navigation route in the area is the main channel located to the north of Kendall Bay and Fairmile Cove with depths of around 5m to 20m. A port hand mark is located approximately 20m to the

north east of Breakfast Point, which delineates nearshore bathymetry typically shallower than -2m CD. An east cardinal mark exists within Kendall Bay to mark the navigation hazard posed by a raised mound extending along the seabed from the shoreline where the former coal wharf was demolished. Seabed levels over the raised mound are around -1.2m CD.

Located at the point on the eastern side of Kendall Bay is a single lane public boat ramp, and a floating pontoon ferry wharf (Cabarita Ferry Wharf). Located within the western portion of Fairmile Cove is the Mortlake Ferry landing (vehicular ferry), an RMS Slipway to service vehicular ferries, and the old River Quays Marina (purchased by Jemena for the Kendall Bay Remediation Project and now referred to as the Staging Site). There are also 20 commercial swing moorings within Fairmile Cove that are still leased to the company River Quays Marina Pty Limited. About 50m downstream of the old River Quays Marina, and 20m from shore is a wreck (the Lady Edeline) that is partly visible at lower tides, and is marked with white marker buoys (refer **Figure 14**).



Figure 14: Old River Quays Marina (while still in operation) and the Lady Edeline wreck in the foreground

### 5.3 Vessel Use

The following sections outline the existing vessel and small craft use within Fairmile Cove and Kendall Bay areas. This includes:

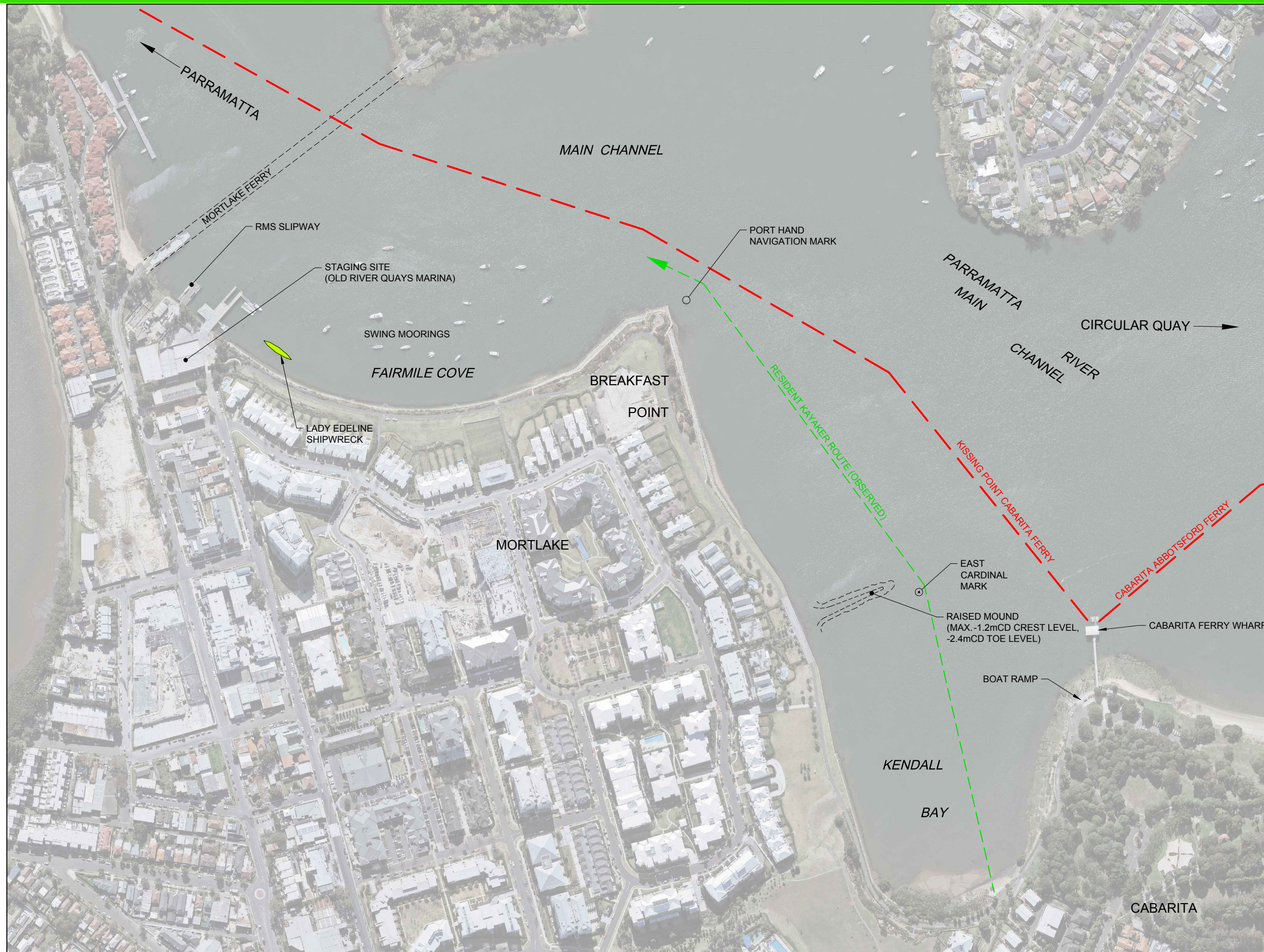
- Public Passenger Ferries;
- Mortlake Ferry;
- Rowing Boats;
- Dragon Boats;
- Sail Boats;
- Kayakers;
- Recreational Power Boats; and,
- Swing moorings.

Waterway observations of Kendall Bay and Fairmile Cove by a local resident and the former River Quays Marina operator respectively have also been documented.

An overview of vessel use is provided on **Figure 15** including known vessel routes and launching areas.



FIGURE 15  
EXISTING WATERWAY NAVIGATION AROUND  
KENDALL BAY AND FAIRMILE COVE



NOT FOR CONSTRUCTION



### 5.3.1 Public Passenger Ferries

Sydney Ferries run a service between Circular Quay and Parramatta that stops at the wharf at Cabarita on the eastern point of Kendall Bay (refer **Figure 16**). The Rivercat class ferries that service the Parramatta River are specially designed, low-wash catamaran vessels. The Rivercat Class ferry is around 35m in length, has a service speed of 22 knots and a displacement of 58 tonnes. The downstream ferry route starting at Parramatta follows the main channel until it passes Breakfast Point, and then cuts across just out from the mouth of Kendall Bay into the Cabarita Wharf. From the wharf, the ferry continues downstream towards Circular Quay via the main channel. Ferries travelling upstream, (Circular Quay to Parramatta) follow a similar route to the downstream service.

The schedule of the Sydney Ferries service stopping at Cabarita is summarised in **Table 6**.

In addition to public commuter ferries, other harbour based passenger cruise vessels also move along this stretch of river but generally do not deviate from the main channel.

Table 6: Summary of Sydney Ferries Service at Cabarita

| Day      | Route                       | First Ferry | Last Ferry | Number of stops at Cabarita Wharf |
|----------|-----------------------------|-------------|------------|-----------------------------------|
| Weekday  | Parramatta to Circular Quay | 6:12am      | 10:50pm    | 38                                |
| Weekday  | Circular Quay to Parramatta | 6:23am      | 12:23am    | 38                                |
| Saturday | Parramatta to Circular Quay | 11:19am     | 10:50pm    | 29                                |
| Saturday | Circular Quay to Parramatta | 7:48am      | 12:33am    | 29                                |
| Sunday   | Parramatta to Circular Quay | 11:15am     | 7:50pm     | 30                                |
| Sunday   | Circular Quay to Parramatta | 7:48am      | 7:48pm     | 29                                |



Figure 16: Cabarita Ferry Wharf with Circular Quay Service approaching, looking upstream

### 5.3.2 Mortlake Ferry

The Mortlake Ferry (commonly known to locals as the Putney Punt) is a vehicular ferry operated by RMS (refer **Figure 17** and **Figure 18**). It began operating in the 1920's and is the only remaining punt in the Sydney metropolitan area. It crosses the Parramatta River from Hilly Street, Mortlake to Pellisier Road, Putney and takes about 5 minutes to make the 300m crossing. The ferry has a capacity of 15 cars, accepts passengers and does not charge for its service. The ferry is approximately 35m in length, has a displacement of 71 tonnes and is operated on twin cables from its respective landings. As previously noted, a speed limit of 4 knots applies all vessels with 100m of the ferry and its cables while in operation.

A slipway located immediately downstream of the Mortlake approach ramp is used for the maintenance of all the RMS-owned vehicular ferries operating in the greater Sydney area and surrounds. Other than the Mortlake Ferry, these include the Berowra Waters Ferry, Sackville Ferry, Webbs Creek Ferry and Wisemans Ferry, all of which operate on the Hawkesbury River and its tributaries.



Figure 17: Mortlake Ferry crossing the main channel



Figure 18: View from Mortlake Ferry landing (Mortlake side)



### 5.3.3 Rowing Boats

The Sydney Rowing Club, and several school rowing sheds, are located downstream of Kendall Bay in the Abbotsford and Gladesville areas. In discussions with the Sydney Rowing Club, it was confirmed that their rowing routes do not enter Kendall Bay and Fairmile Cove, but stay within the main channel. Sydney Rowing Club also commented that they did not expect, and have not seen, other rowing clubs and schools enter Kendall Bay and Fairmile Cove.

### 5.3.4 Dragon Boats

The Sydney Dragon Boat Club Association (based at Rhodes) confirmed that they rarely venture as far downstream along the Parramatta River as Kendall Bay.

### 5.3.5 Sailing Boats

Abbotsford 12ft Sailing Club is situated on the Parramatta River at the end of Great North Road, Abbotsford and generally operates every Saturday. The Vice President of the sailing club advised that the sailing club does not use Kendall Bay or Fairmile Cove.

### 5.3.6 Kayaks

Unlike other rowed craft, kayakers are not as likely to be part of a club. Kayakers are known to enter Kendall Bay and Fairmile Cove from time to time but these waterways are not considered to be popular kayaking areas as no known kayak rental locations are close by. Jolly Roger Kayaks, who run kayak tours across Sydney (including the Parramatta River) has listed on their website that the general area around Kendall Bay and Fairmile Cove is a restricted zone for their tours due to the potential danger presented by the Mortlake Ferry.

In discussions with a local resident (refer **Section 5.3.9**), it is understood that one particular individual often uses the beach in the south east corner of Kendall Bay to launch his kayak. This resident kayaker was also observed during a site inspection at around 8am (refer **Figure 19** and **Figure 20**). The route taken by the kayaker on this occasion was generally through the middle of Kendall Bay until well past the port hand mark and then upstream. The resident kayaker is also known to travel downstream.



Figure 19: Resident kayaker in Kendall Bay



Figure 20: Resident kayaker moving around Breakfast Point

### 5.3.7 Recreational Power Boats

Recreational power boats are not as likely to be part of a club. Recreational power boats are known to enter the Kendall Bay and Fairmile Cove from time to time but these locations are not considered to be popular boating areas. In discussions with a local resident (refer **Section 5.3.9**), it is understood that power boats launched at the public boat ramp at Cabarita Park tend to head directly to the deeper water within the main channel.

### 5.3.8 Swing Moorings

There are 20 commercial swing moorings within Fairmile Cove that are leased to the company River Quays Marina Pty Limited. The vessels on these swing moorings are a mixture of small sailing and powered vessels (refer **Figure 21**). The moorings are located immediately downstream of the old River Quays Marina, cover an area of around 200m by 100m, and are approximately 50m from shore in water depths of around 3m to 10m.





Figure 21: Swing Moorings in Fairmile Cove

### 5.3.9 Resident Observations of Kendall Bay

On 14 April 2014, RHDHV staff met with a local resident of around 15 years in Cabarita. The resident has a panoramic view of Kendall Bay (refer **Figure 22**) from their house located in an elevated position at the head of the bay. The resident is also a member and spokesman for Friends of Cabarita Park and Wharf, a community group very much interested in the development of the Kendall Bay area and the Kendall Bay Remediation Project.

The resident provided some casual observation records of watercraft viewed from his balcony as follows: watercraft rarely enter Kendall Bay and generally stay within the main channel; and there is a resident kayaker that uses Kendall Bay regularly, as described in **Section 5.3.6**.



*Figure 22: View over Kendall Bay from local residents' balcony*

### **5.3.10 Previous River Quays Marine Owner Observations of Fairmile Cove**

On 15 April 2014, RHDHV staff contacted the former owner of the River Quays Marina prior to its sale to Jemena. The former owner of the proposed staging site has a good understanding of waterway usage around Fairmile Cove and stated that the majority of vessels stay well within the main channel and beyond the swing moorings. It was stated that kayakers rarely enter Fairmile Cove, and on occasional weekends fisherman drift around the marina structures (refer **Figure 23**) for short periods of time before moving on to another hard structures around the river. It was also stated that the vessels moored on the swing moorings (refer **Section 5.3.8**) are rarely used (if at all), and if required could be easily relocated during the construction period.





*Figure 23: View of wharf structures at the old River Quays Marina (Staging Site)*

## 6 Proposed Water Based Activities

### 6.1 General

As described in **Section 2** and **Section 3**, several water based activities are proposed to be undertaken as part of the remediation project, all of which are temporary for the duration of the works. From a navigation perspective, these water based activities can be grouped into the following construction stages:

- site establishment / disestablishment;
- in situ solidification, material excavation and overwater transport; and,
- cap construction.

Equipment expected to be used to undertake water based activities associated with these construction stages is listed in **Section 6.2**, **Section 6.3** and **Section 6.4**. As shown on **Figure 24**, the waterway area occupied by the project would generally comprise:

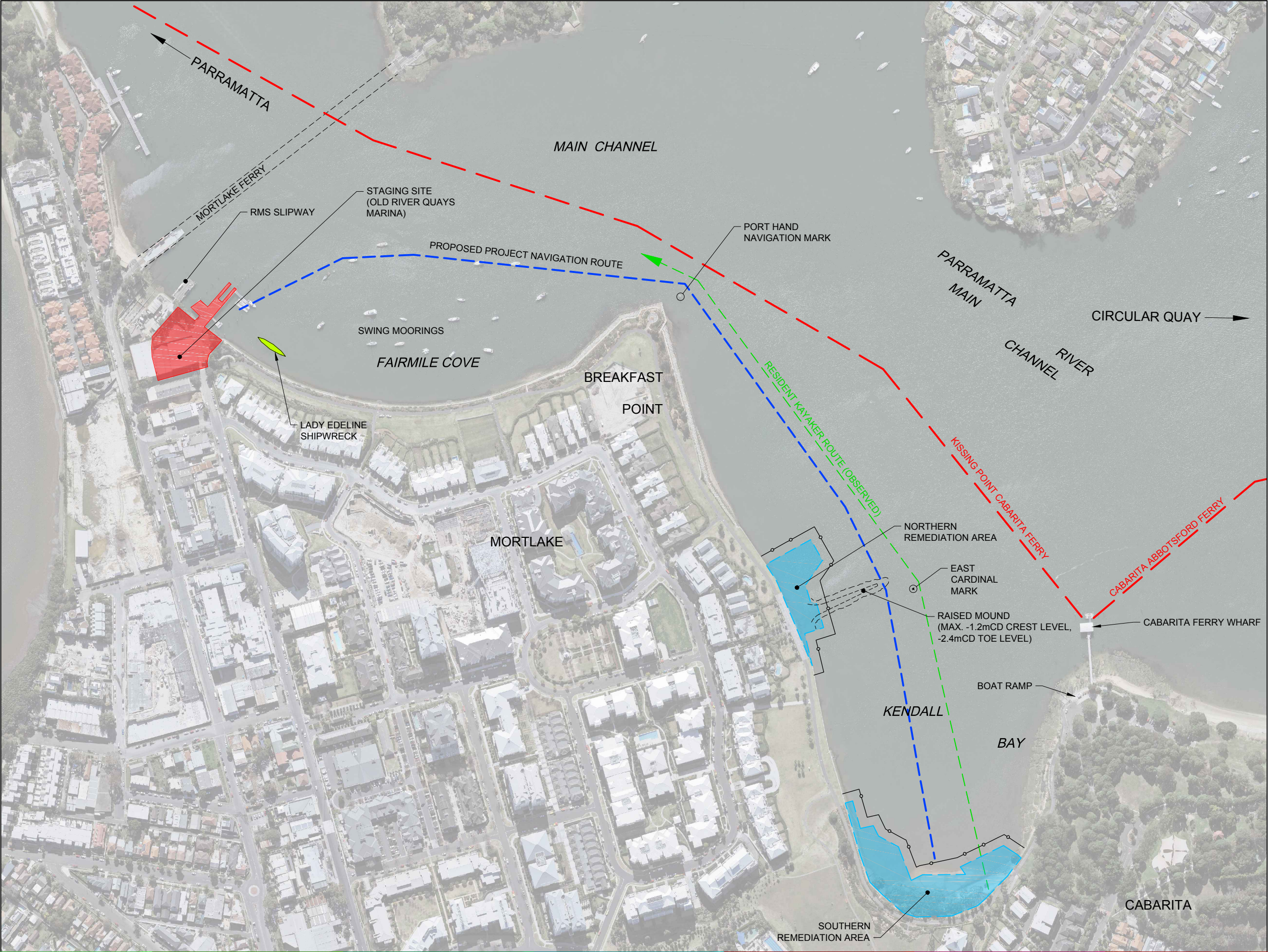
- areas immediately around the Staging Site and wharf structures;
- Northern and Southern Remediation Areas, and approximately 10 to 20m surrounding for the associated silt curtains and construction area marker buoys; and,
- the project navigation route between the Staging Site and Kendall Bay.

At the Staging Site, the seabed levels in the area alongside the wharf structures expected to be utilised for construction activity and mooring of vessels range between -3m CD to -3.5m CD (refer **Figure 10**).

The waterway area occupied by the project is intended to be as close to shore as practicable to avoid/limit impacts on existing navigation, and would be delineated with appropriate buoys and signage. All vessels would adhere to RMS waterway rules and regulations and would typically not travel at speeds greater than 4 knots. Waterway activities would be restricted to the expected project operation times of 7am to 6pm weekdays and 8am to 5pm on Saturdays. A proposed indicative navigation route for the project is shown on **Figure 24**.



FIGURE 24  
PROPOSED WATER BASED ACTIVITIES FOR  
THE KENDALL BAY REMEDIATION PROJECT





## 6.2 Site Establishment / Disestablishment

Water based equipment utilised during site establishment/disestablishment would typically comprise:

- barge-mounted pile rig for installation/removal of silt curtain piles;
- barge-mounted crane or excavator for installation/removal of silt curtain (may include divers), silt curtain anchor blocks and construction area marker buoys; and,
- work boats for transfer of personnel.

## 6.3 In situ Solidification, Material Excavation and Overwater Transport

Water based equipment utilised during in situ solidification, material excavation and overwater transport activities would typically comprise:

- barge-mounted pile rig for installation of sheet pile walls around remediation areas SA1 and NA2+NA3;
- barge-mounted excavator;
- flat top barges with hoppers/skip bins for transport of excavated materials;
- barge-mounted drilling rig for deep sediment mixed columns;
- cement supply silo/tank, mixing plant and pump mounted on a floating barge;
- amphibious excavator for in situ solidification by mass mixing;
- landing barges for onshore deployment of small earthmoving equipment;
- work boats(s) for manoeuvring barges, general maintenance for items such as the silt curtains, and transfer of personnel;
- survey boat; and,
- water quality monitoring boat.

## 6.4 Cap Construction, Rock Structures and Beach Filling

Water based equipment utilised during cap construction would typically comprise:

- barges (including work boat/s if not self-propelled) for delivering capping materials and rock for structures including the extension of the existing sandstone wall, spur walls and energy dissipation structures at stormwater outlets;
- barge-mounted crane or excavator for placement of geotextile fabric and geogrid;
- barge-mounted excavator for placing/grooming capping material;
- amphibious excavator for use in areas where weak ground conditions exist;
- barge fitted with a slurry pump box and displacement pump for delivery of sand slurry into shallow nearshore areas (if hydraulic placement is proposed for SA3/SA4 beach filling);
- workboat/s to manoeuvring barges, general maintenance for items such as the silt curtain, and for transfer of personnel;
- survey boat; and,
- water quality monitoring boat.

## **7 Assessment of Impacts and Mitigation Measures**

### **7.1 General**

Waterway navigation impacts due to the Kendall Bay Remediation Project would be limited to the duration of the project.

At the conclusion of the project all structures constructed for the purposes of carrying out the project would be removed, and the temporarily modified bathymetry within remediation areas would generally be restored to a target finished level at or below existing levels.

An exception to this exists at remediation area NA2+NA3 where penetration of hard surfaces over the footprint of the former coal wharf may not be possible. In this case, a capping layer of cobbles/sand would be placed over the top of the existing mounded area to provide substrate for re-establishment of viable benthic communities. This could locally raise bed levels by 200-300mm. However, the existing hazard to navigation posed by the mounded seabed in the former wharf area is already identified by a cardinal mark. This navigation aid would continue to alert boaters of the shallow inshore depths in the area following completion of the remediation works.

The position of a number of the existing swing moorings within Fairmile Cove may need to be temporarily relocated to facilitate the project navigation route but could remain within their designated lease area.

### **7.2 Kendall Bay**

As previously described, waterway traffic within Kendall Bay is minimal with the public passenger ferries passing across the mouth of the bay well away from the proposed construction activities. The boat ramp and associated route to the main channel is also isolated from the proposed construction activities. The resident kayaker that uses the bay would not be able to launch at the beach area due to the remediation works (which include excavation and beach filling in remediation areas SA4 and SA5). However, less than 200m away the public boat ramp and a beach adjacent to Cabarita Ferry Wharf would be available for launching of passive craft. It is understood the resident kayaker's typical navigation route would not be greatly affected, and launching from the boat ramp and/or beach would further distance the kayaker away from the proposed construction activities.

The proposed project navigation route through Kendall Bay is at a safe distance from the existing ferry route to Cabarita Ferry Wharf such that interaction of construction traffic with ferries is unlikely to occur within Kendall Bay.

It is noted that the proposed project navigation route passes on the western side of the east cardinal mark, which marks the position of the raised mound extending along the seabed from the shoreline where the former coal wharf was demolished. The crest level of the raised mound is at around -1.2m CD and should be considered in the selection of the draught of construction vessels navigating in the vicinity of the area and within the shallow waters of Kendall Bay. An alternative for deeper draughted vessels would be to pass on the eastern side of the cardinal mark where there is sufficient waterway area to maintain a safe distance from the ferry route to Cabarita Ferry Wharf.

### **7.3 Fairmile Cove**

As previously described, waterway traffic within Fairmile Cove is minimal. Any modifications to the former River Quays Marina to establish the project Staging Site would be within the existing lease boundary and would therefore not encroach further into the Parramatta River. The Mortlake Ferry and associated



slipway is upstream of the former River Quays Marina and would not be impacted upon by the proposed construction activities.

The proposed project navigation route may partially impact some of the existing swing moorings. However, based on discussions with the lessee (River Quays Marina Pty Limited), temporary relocation of these moorings is feasible. Based on an examination of local bathymetry and the existing mooring configuration, it would be possible to relocate swing moorings if required, subject to RMS approval.

## 7.4 Breakfast Point

The majority of waterway traffic in the area is contained within the main channel of the Parramatta River. The proposed project navigation route would pass by Breakfast Point on the outside of the port hand marker and along the edge of the main channel. Passing vessels are typically located well away from Breakfast Point and towards the centre of the main channel. Based on site observations, the passenger ferry did not appear to deviate from the main channel to and from the Cabarita Ferry Wharf until it was positioned downstream of Breakfast Point. Therefore, there would appear to be sufficient waterway area to allow for safe passage of construction traffic without impeding the existing ferry route (refer **Figure 24**). In addition, the ferry timetable would be known and overwater transport of construction vessels could be scheduled to accommodate ferry movements.

However, the proposed navigation route is likely to require vessel speeds to be limited to 4 knots to allow for a careful approach to Breakfast Point from both directions. This speed limit is already imposed upstream of Breakfast Point due to the operation of the Mortlake Ferry. Two-way passing of construction vessels approaching from either side of Breakfast Point should generally be avoided at Breakfast Point with right of way being given to vessels approaching from within Kendall Bay. Construction vessels should be in frequent radio contact with each other and with ferries on approach to Breakfast Point.

## 7.5 Summary of Potential Impacts and Mitigation Measures

The following table summarises the recommended mitigation measures to address the potential impacts of the proposed remediation works on existing navigation within the waterway area surrounding the project area.

| Potential Impact                                                                                                                                                                                                                       | Recommended Mitigation Measures/Controls                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Waterway users navigating near the proposed remediation works and project navigation route.                                                                                                                                            | <ul style="list-style-type: none"> <li>in coordination with RMS, a 'Notice to Mariners' should be issued to advise the boating community of the extent, nature and duration of the construction activities</li> <li>provision of special marker buoys (including lighting for night-time navigation) and appropriate signage to delineate construction areas in accordance with RMS requirements and in consultation with the Harbour Master</li> <li>Contractor to provide an 'All Hours' contact number to the Harbour Master for use during the remediation works</li> <li>should the Contractor anticipate that over-water activities could interfere with seagoing ships / commercial vessels then a Marine Traffic Management Plan should be prepared for submission to Jemena and the Harbour Master for approval prior to commencement of works</li> </ul> |
| Navigation of construction vessels through the shallow water depths within Kendall Bay and in the vicinity of the Northern Remediation area where a raised mound exists on the seabed at the demolition site of the former coal wharf. | <ul style="list-style-type: none"> <li>selection of construction vessels with an appropriate draught to navigate safely within the shallow waters of Kendall Bay</li> <li>use of an alternate navigation route on the eastern side of the cardinal mark by deeper draughted vessels to avoid the potential navigation hazard posed by the raised mound</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Interaction of the proposed project navigation route with the existing swing moorings within Fairmile Cove.                                                                                                                            | <ul style="list-style-type: none"> <li>temporary relocation of swing moorings as required to facilitate construction traffic to and from the Staging Site</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |



| Potential Impact                                                                                                                              | Recommended Mitigation Measures/Controls                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Limited sight distance for construction vessels approaching along the proposed navigation route from either side of Breakfast Point.</p>   | <ul style="list-style-type: none"> <li>• limiting vessel speeds to 4 knots to promote safe navigation, and reduce wash for passing watercraft</li> <li>• vessels should maintain an approximately easterly heading when approaching Breakfast Point from within Fairmile Cove to improve site distance to and for vessels approaching from within Kendall Bay</li> <li>• two-way passing of construction vessels approaching from either side of Breakfast Point should generally be avoided at Breakfast Point with right of way being given to vessels approaching from within Kendall Bay</li> <li>• construction vessels should be in frequent radio contact with each other and with ferries on approach to Breakfast Point</li> </ul> |
| <p>Launching of kayaks from the beach at the head of Kendall Bay will not be possible for the duration of the proposed remediation works.</p> | <ul style="list-style-type: none"> <li>• consultation with the resident kayaker(s) to inform them of the Kendall Bay Remediation Project and to agree temporary modifications to landing and retrieval locations, such as the boat ramp and beach areas adjacent to Cabarita Ferry Wharf</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                         |

## 8 References

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## Appendix A: NSW Boating Information



Safety on  
the water



## **46 Know the rules**

- Safe speed
- Proper lookout
- Bow riding
- Giving way
- Safe distance and speed
- Mooring areas
- Diving activities
- Dredges
- Vehicular ferries
- Commercial fishing vessels

## **57 Navigation marks and signs**

## **64 Night safety**

- Navigation lights checklist

## **70 Special areas**

- Open waters
- Bar crossings
- Inland waterways
- Alpine waters
- Sydney Harbour

## **78 Big ships and small boats**

## **79 Go easy on the drink**



## KNOW THE RULES

All masters must be aware of the International Regulations for Preventing Collisions at Sea which are adopted in NSW and modified through the *Marine Safety Regulation 2016* and available on the Roads and Maritime website at [rms.nsw.gov.au/maritime](http://rms.nsw.gov.au/maritime). A summary of these rules is given in this section.

### SAFE SPEED

**All vessels must travel at a safe speed at all times.**

A safe speed cannot be expressed as a maximum or minimum number of knots because it varies with circumstances and conditions. The master (skipper) must continually assess the safety of the vessel's speed.

A safe speed is one at which the vessel can be stopped in time to avoid any danger which arises suddenly. In judging a safe speed the master must consider a number of issues including:

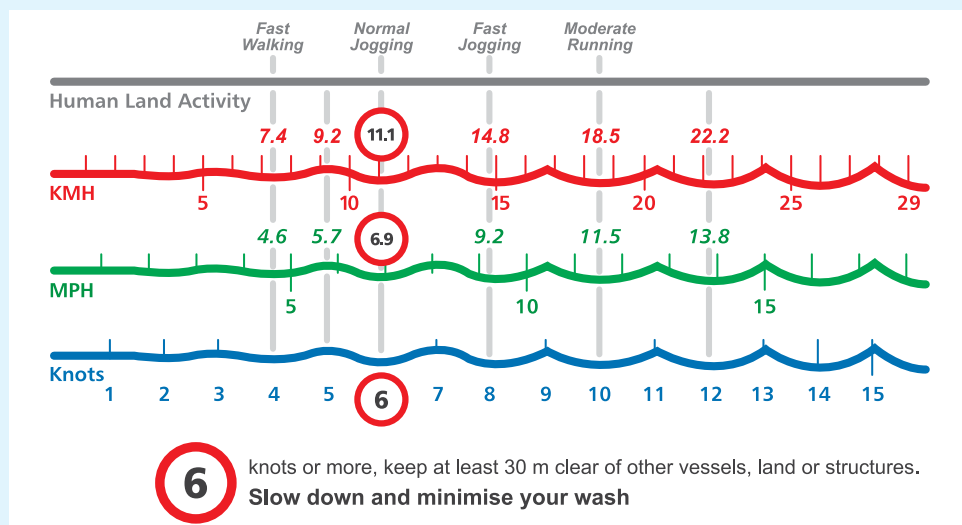
- **Visibility** – Drive slowly in rain, fog, mist, smoke or glare
- **Night** – Special caution is required between sunset and sunrise because many potential hazards may not be lit or may not be easily seen. Background shore lighting may confuse you

- **Other vessels** – Slow down on busy waterways and when near moored or anchored vessels, working vessels showing special signals and large vessels which have difficulties in manoeuvring
- **Navigation hazards** – Slow down in shallow areas or in unfamiliar waterways. Water depth can vary and change frequently. Not all hazards may be marked or lit and signs, buoys, marks or lights may have shifted or been vandalised
- **Wind, waves and currents** – May adversely affect the manoeuvrability of a vessel
- **Manoeuvrability of the vessel** – Stopping and turning ability depends on the speed travelled, wind and current and the boat's design, such as hull shape, engine and propeller type and number.

If your vessel does not have a speedometer, you must be able to determine if you are exceeding a local speed limit. For example, if your boat is planing in a restricted speed zone it is likely that you are exceeding the speed limit, so slow down.

### WASH

Wash refers to the waves and turbulence created by a boat as it moves through the water. The size of a boat's wash and the effects it might have depend on how the boat is driven, its hull shape and how much load it is carrying.



## PROPER LOOKOUT

The master is responsible at all times for keeping a lookout for dangers. A good lookout must be kept by sight and hearing.

The master must be fully aware of the boating environment, especially in bad weather, restricted visibility or darkness. Don't forget to look all around, even behind you.

Special care should be taken when operating your boat in areas where high speed vessels operate, such as Sydney Harbour. The situation can become dangerous very quickly due to rapid closing speeds, even if your vessel is travelling slowly.

For example a vessel going at 20 knots will cover more than 100 metres in less than 10 seconds and the speed of your boat may further decrease your time to react to avoid a collision.

Don't confuse the lookout duties of the master with those of the observer when the boat is towing a person on skis, tubes etc.

See page 82 for information on towing responsibilities.



## BOW RIDING IS ILLEGAL

Bow riding means:

- Extending any part of your body outside the perimeter of a power-driven vessel that is making way, or
- Being on the bow in a position that increases the risk of falling overboard.



### IMPORTANT NOTE

The offence relating to bow riding applies to both the operator of the vessel and the offending person. Fines apply.



Safety on the water



*'Bow riding' on a moving powerboat includes being on the bow in a position increasing the risk of falling overboard, or sitting or leaning out over any edge of the vessel.*

## GIVING WAY

The master must continuously assess the risk of collision with other vessels. Power vessels must give way to:

- Sailing vessels
- Vessels approaching head on, by altering course to starboard
- Vessels approaching from the right (starboard) hand side, ie crossing
- Vessels displaying the special lights and signals shown in this chapter
- Large vessels restricted in their manoeuvrability
- Any vessel being overtaken
- Vessels engaged in fishing activities and showing appropriate signals.

**A vessel drifting is deemed to be underway and has no special right of way. It is required to comply with the International Regulations for Preventing Collisions at Sea.**

Do not create a dangerous situation by forcing your right of way. Always keep a safe distance from other vessels so the vessel can be stopped or manoeuvred to avoid any sudden danger.

The faster the speed, the greater the safe distance must be.

When altering course make your intentions clear to others as early as possible.



### IMPORTANT NOTE

In a collision, all masters involved can be held responsible even if the give-way vessel does not give way, because all masters are required to exercise caution and take avoiding action if the other vessel does not.

## SOUND SIGNALS

Special sound signals exist for powered vessels to indicate their manoeuvring intentions when they are in sight of one another.

### 1 short blast

I am altering course to starboard (the right).

### 2 short blasts

I am altering course to port (the left).

### 3 short blasts

I am operating engines astern (stopping/slowing or reversing).

### 5 short blasts

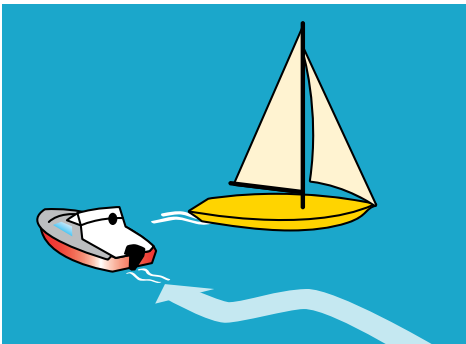
I am unsure of your intentions and I doubt whether you are taking sufficient action to avoid collision.





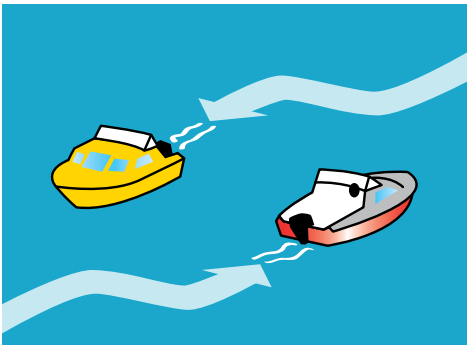
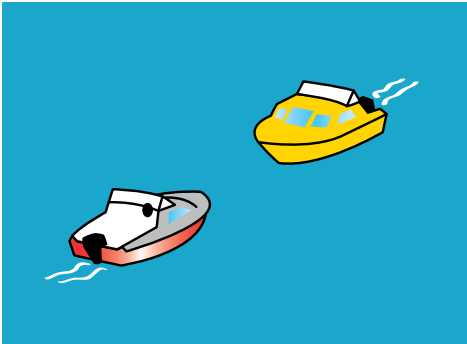
### POWER GIVES WAY TO SAIL

A power driven vessel must give way to a sailing vessel unless the sailing vessel is in the process of overtaking it.



### POWER DRIVEN VESSELS MEETING HEAD ON

When two power driven vessels meet head on, each must alter course to starboard (to the right) and pass at a safe distance.



### ACTION TO AVOID COLLISION

The give-way vessel must avoid a collision by changing course substantially, by slowing down, or stopping and allowing the vessel which has right of way to pass clear ahead. This must be done as early as possible.

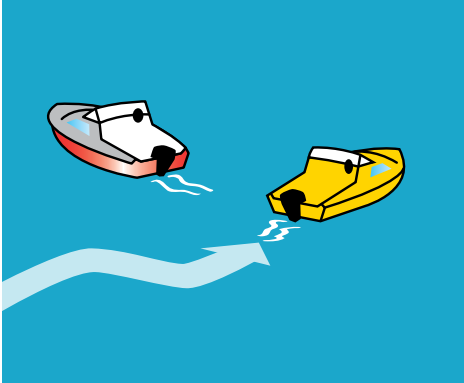
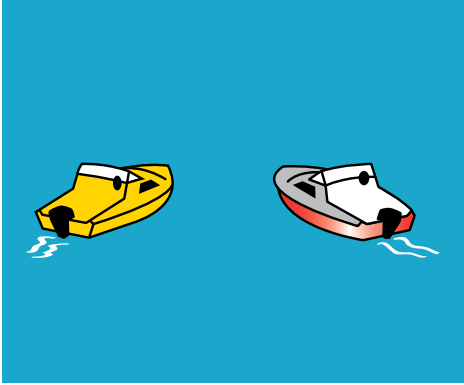


#### IMPORTANT NOTE

The master of the vessel which has right of way must maintain a lookout, maintain course and speed and be prepared to take action to avoid a collision if necessary.

## POWER DRIVEN VESSELS CROSSING

In crossing situations, give way to the right.



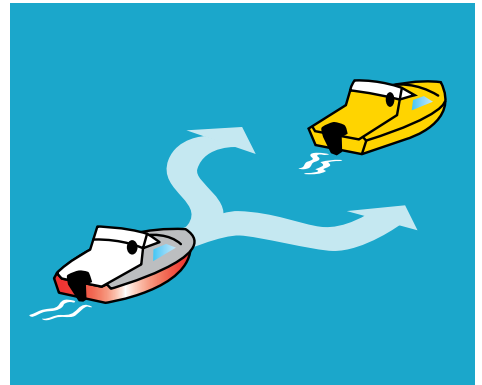
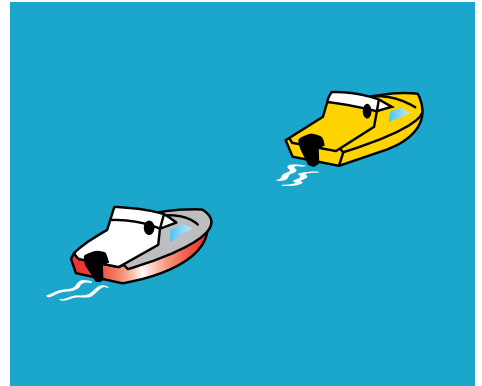
## VESSELS OVERTAKING

Any vessel (including a sailing boat) which is overtaking another vessel must keep well clear of the vessel being overtaken.

You can overtake another vessel on either side but only when it is safe and you must stay well clear.

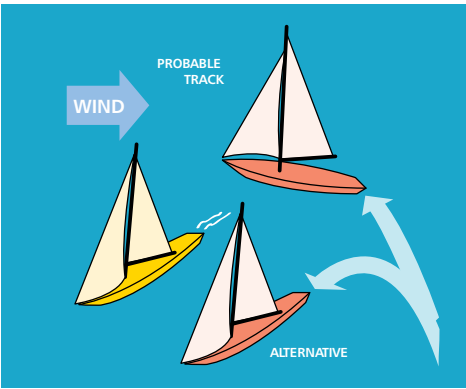
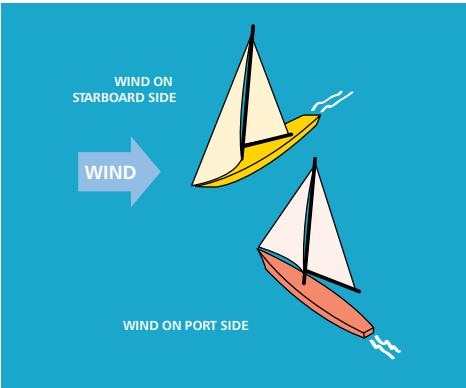
In narrow channels you must be particularly careful when overtaking.

In all instances, make sure you do not cut in front of the vessel you have overtaken.



# SAILING VESSELS AND SAILBOARDS

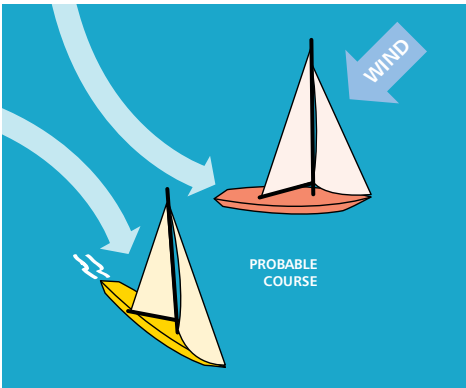
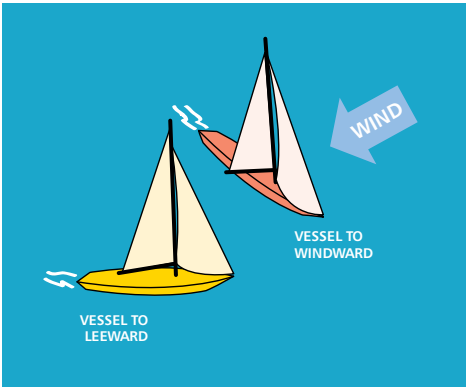
When two sailing vessels have wind on different sides, the vessel with wind on the port side gives way. In the following scenarios, the red vessel gives way.



## IMPORTANT NOTE

If a collision appears inevitable, the skipper of each vessel must take proper action to avoid the collision.

When both craft have wind on the same side, the vessel which is to windward shall keep out of the way of the vessel which is to leeward.



Safety on the water



## SAFE DISTANCE AND SPEED

A **safe distance and speed** between a vessel and a person or thing (including another vessel) is a distance and speed that will ensure that the vessel will not cause danger or injury to the person or damage to the thing, having regard to all relevant safety factors including weather conditions at the time, visibility, speed of the vessel and obstructions to navigation that are present.

Changes have been made to the safe distance requirements (also known as 'distance off') from July 2016 by the introduction of the *Marine Safety Regulation 2016*. The revised rules are explained below.

When driving any vessel (including when towing a person or people) you must keep the vessel, any towing equipment and anyone being towed, a minimum distance of:

- **60 metres** from people in the water or if that is not possible, a safe distance and speed
- **60 metres** from a dive flag on the surface of the water or if that is not possible, a safe distance and speed.

Exceptions are when you are supporting swimmers or divers in the water; or your vessel is human-powered, eg a canoe, kayak, surf ski or rowboat; or it is a sailing vessel under 5.5 metres long without an auxiliary engine; or you are launching or removing it from the water taking care to avoid injuring people or damaging property.



When driving a power-driven vessel at a speed of six knots or more (including when towing a person or people) you must keep the vessel, any towing equipment and anyone being towed, a minimum distance of:

- **30 metres** from any other vessel, land, structures (including jetties, bridges and navigation markers), moored or anchored vessels, or if that it is not possible, a safe distance and safe speed.



Parasailing vessels, any towing equipment and anyone being towed, must maintain a distance of at least **200 metres** from any other vessel, bridge, cable, wire, pipeline or structure.

## DESIGNATED SWIMMING AREAS

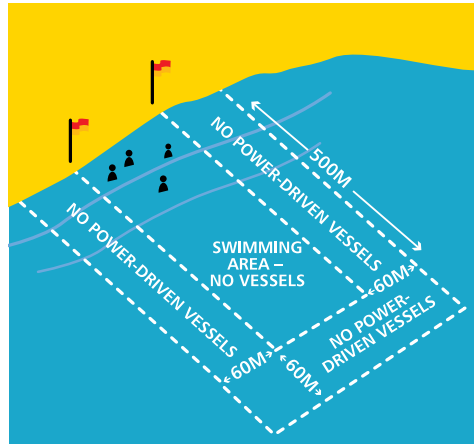
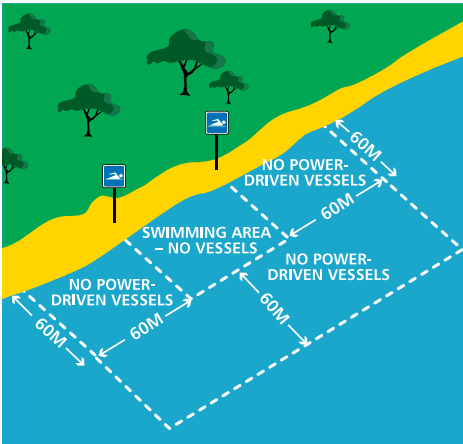
Vessels must not be operated in a swimming area, unless permitted to do so by signage.

A designated swimming area in a surf zone is defined as the area extending 500 metres out from shore between surf patrol flags or signs.

In all other areas a swimming area is defined as the area extending 60 metres out from shore between signs for swimmers.

Power-driven vessels must not be operated within 60 metres of a swimming area and the flags or signs marking such zones, unless they are a vessel operated by Surf Life Saving NSW or Council lifeguards or unless permitted to do so by a sign.

Remember the same rules apply for PWC as other vessels operating near surf zones/ swimming areas.



*All vessels must stay outside swimming areas and power-driven vessels must not come within 60 metres, unless permitted by signage.*

## MOORING AREAS

On many waterways in NSW, areas are set aside for the mooring of vessels. These vessels are not required to be lit at night and the masters of other vessels must be aware of the location of such moorings.

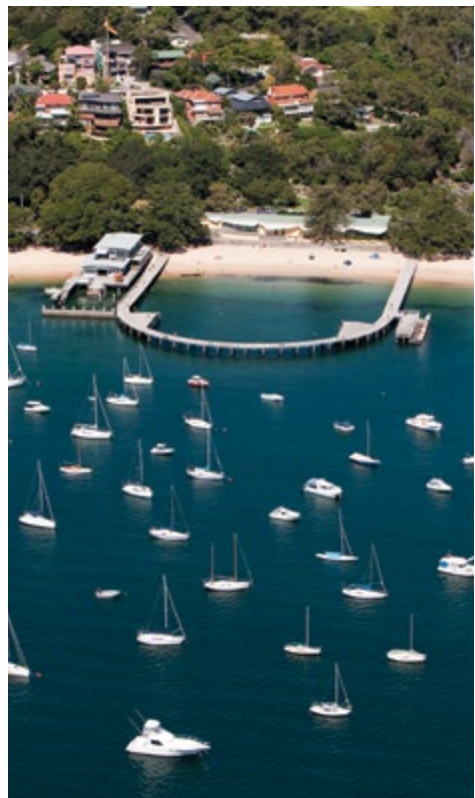
Check local maps or charts, or contact your local Roads and Maritime centre for details of mooring areas.



### REMEMBER

When navigating near, in or through a mooring area:

- Drive slowly and keep wash to a minimum
- Keep a lookout for people in the water, small dinghies, and trailing ropes
- When travelling at 6 knots or more in a power-driven vessel, you must stay at least 30 metres from any moored vessel.



*Special rules apply when navigating through and near mooring areas.*



## DIVING ACTIVITIES

Always keep a good lookout for people in the water, including divers, snorkellers, spearfishers and swimmers. Keep an eye out for the 'Alpha' flag, which means divers, snorkellers or spearfishers are in the water nearby.

Divers may be present in a variety of areas: Headlands, rocky reefs, bomboras and sheltered coves. Check your local boating map for likely areas before going out on the water.

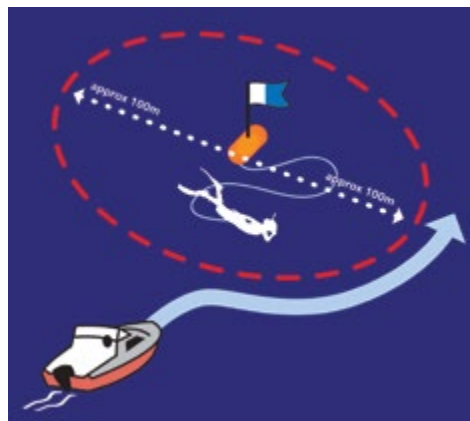
Navigate with caution whenever within 200 metres of the shore where divers may be present. Be particularly careful when visibility is poor, such as in fog, glare, low light and surface chop.

The blue and white Alpha flag must be displayed whenever divers, spearfishers or snorkellers are operating from the vessel. It should measure at least 40 centimetres x 40 centimetres in size, be rigid, and be flown in a vertical position at least one metre above the vessel's superstructure and visible through 360 degrees. In addition, it is a good idea to attach a high visibility fluorescent yellow/green flag to draw attention to the Alpha flag, whether it is displayed from a vessel, buoy or personal float.



Alternatively the Alpha flag can be flown off a nearby float/buoy, in which case it must be at least two metres above the water level. It is also strongly recommended that a personal float and an Alpha flag be towed by snorkellers or spearfishers who venture more than 60 metres away from their vessel or who are operating from shore. For even greater visibility, it is a good idea to use a float that displays the high visibility colours.

If you see any Alpha flags, brightly coloured flags or brightly coloured floats, slow down and keep well clear. Remember, you must stay at least 60 metres away from anyone in the water, or a safe distance and speed if that is not practicable.



*Divers can be up to 100 metres from their float/flag. You must stay at least 60 metres away from anyone in the water.*



*Fluorescent floats and/or flags are recommended to draw attention to the Alpha flag.*



If you suddenly find yourself close to divers' flags and/or floats, cut the engine immediately, look around and match people to floats before slowly motoring clear. Remember that spearfishers may be up to 100 metres from their float and flag.

Avoid passing between a diving vessel and the shore, pass well clear to the seaward side. Be aware that spearfishing and snorkelling vessels

are not always at anchor, and often move about picking up and dropping off divers.

If picking up or dropping off snorkellers or divers, always be prop aware. For more information on propeller strikes, see page 92. Preferably switch off the engine first and always choose a safe position well clear of rocks or breaking waves so you don't have to rush.

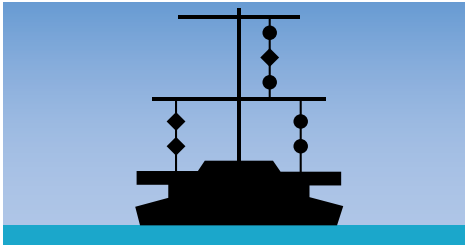


*The blue and white 'Alpha' flag means divers, snorkellers or spearfishers are in the water nearby.*



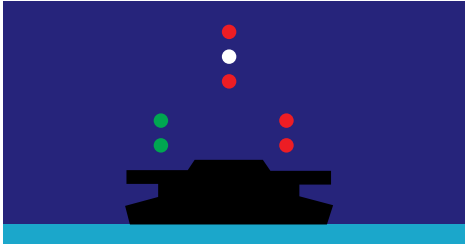
## DREDGES

When driving your vessel you must not create wash that may damage or unreasonably impact on a dredge or work barge.



**Safe side to pass  
(Diamonds)**

**Obstruction this side  
(Balls)**



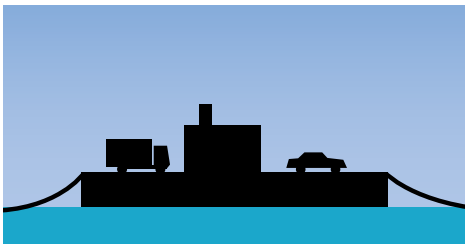
**Safe side to pass  
(Green – Go)**

**Obstruction this side  
(Red – Danger)**

## VEHICULAR FERRIES

In some areas vehicular ferries drag themselves across channels using wires or chains. Because these wires/chains are often below the water you may not see the danger.

You must slow down to four knots or less when within 100 metres of the wires or chains of a vehicular ferry when it is underway and disengage power when crossing the wires or chains.



Always pass astern of the ferry. Preferably wait until it has reached the shore to avoid becoming entangled in the wires.

A vehicular ferry underway will display an all-round flashing light. You should give way, as it is significantly restricted in its ability to manoeuvre.

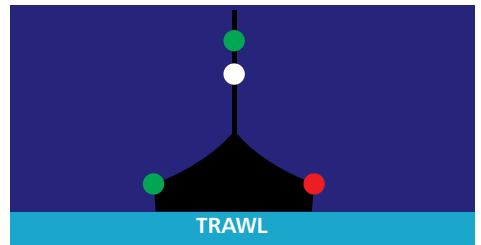


## COMMERCIAL FISHING VESSELS

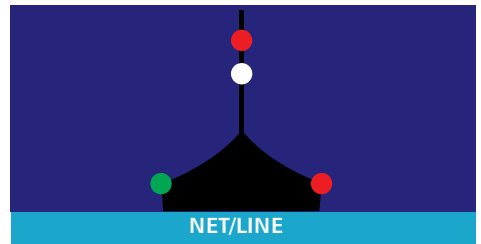
Licensed fishing vessels (LFB) display special shapes and lights when their manoeuvrability is restricted by their fishing apparatus.

You should keep clear of these vessels when you see such shapes or lights or notice they are working with nets and lines.

Contact your local NSW Department of Primary Industries (NSW DPI) Fisheries office for more details about the rights of commercial fishing vessels.



**TRAWL**



**NET/LINE**

# NAVIGATION MARKS AND SIGNS

A system of buoys, poles and lights is used to assist safe navigation. Each type of mark has a unique combination of colour, shape, topmark and light. You must be able to identify these marks and pass them safely on the correct side.

An interactive guide to safe navigation, including marks and signs as well as vessel lights, is available online at [rms.nsw.gov.au/maritime](https://rms.nsw.gov.au/maritime).

## LATERAL MARKS

Port and starboard marks are referred to as lateral marks.

### Port hand markers

Port markers are red and have a can shaped topmark or buoy.

If lit, a port hand mark shows a flashing red light.

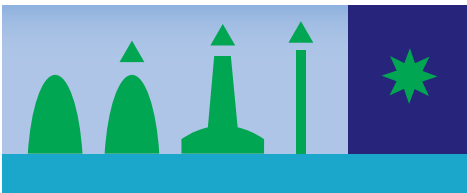
Port markers may be any of the shapes shown below.



### Starboard hand markers

Starboard markers are green and have a cone shaped topmark or buoy. If lit, a starboard hand mark shows a flashing green light.

Starboard markers may be any of the shapes shown below.



Safety on the water



### IMPORTANT NOTE

When port and starboard marks are placed near each other, you travel between the two.



## Single lateral marks

Often lateral marks are not placed in pairs, so you will need to decide on the safe side to pass.

The safe side to pass a lateral navigation marker is determined by your direction of travel to or from the sea.

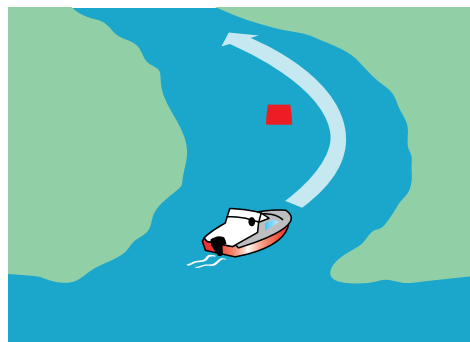


### IMPORTANT NOTE

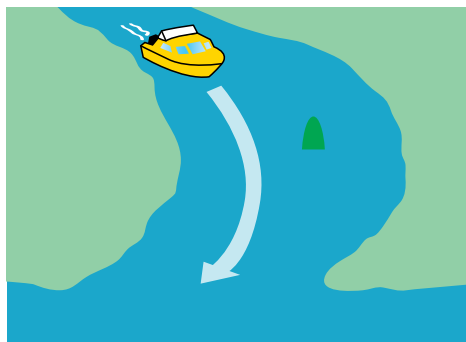
Heading upstream means in a direction away from the sea. Heading downstream means in a direction towards the sea.



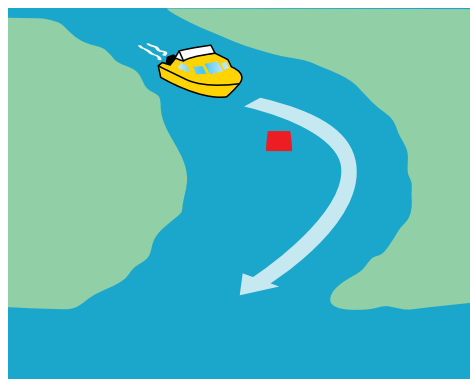
Keep **green** (starboard hand marks) on your **right hand side** (to starboard) when going upstream.



Keep **red** (port hand marks) on your **left hand side** (to port) when going upstream.



Keep **green** (starboard hand marks) on your **left hand side** (to port) when going downstream.



Keep **red** (port hand marks) on your **right hand side** (to starboard) when going downstream.



**GREEN to GREEN**  
when going upstream



**GREEN to RED**  
when seas are ahead

## CHANNELS AND RIVERS

In NSW, the term 'channel' means an area of navigable waters that, whether or not indicated by navigation marks, provides a passage for vessels. This means that the term channel extends to bays and sounds as well as the more traditional marked channels, fairways, passages and rivers. Generally speaking, best practice is to keep to starboard (right hand side) in all waterways. However, in narrow channels a vessel **must** keep to starboard.

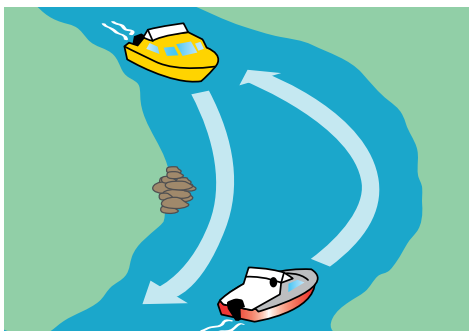
When driving a boat on rivers and estuaries, extreme caution should be exercised because not all shallow areas and navigation hazards may be marked and shallow areas may shift.

**Be careful at bends. Keep a good lookout for boats coming the opposite way.**

**Do not cut corners.**

In channels or narrow stretches of water all regulations for avoiding collision apply. Remember:

- Keep to the starboard side (right-hand side) of the channel
- Do not get in the way of larger vessels operating in the channel and watch for unexpected alterations of course as they try to follow the deepest water route
- Do not anchor or fish in channels where you may obstruct other vessels.

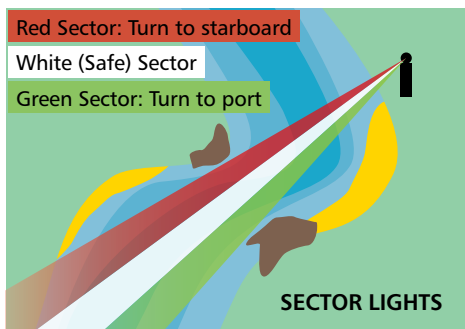
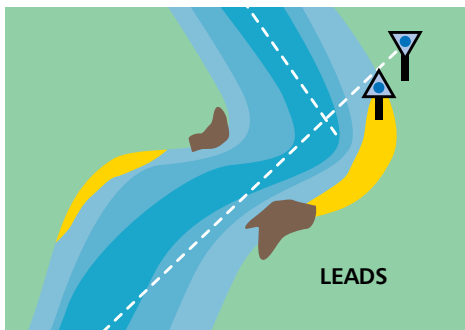


## LEADS AND SECTOR LIGHTS

Leads are often used to guide vessels into a port or through sections of a waterway. By moving your vessel to a position so that both leads are lined up, the course should be a safe one.

At night, major leads are lit. Move your vessel to ensure that the lights are vertically above each other. All leads are shown on maps and charts, so it is essential to consult your chart for relevant leads and other navigation aids before entering unfamiliar waters.

The leads at major ports are usually highly visible blue triangular or vertical lights mounted on bright orange or red triangular boards.



Sector lights vary from port to port and a chart should be referred to before using them. Where sector lights mark the entrance to a port, be aware that the white sector is the shipping channel. Do not impede the passage of seagoing ships. See page 78 for more information on large vessels.



## CARDINAL MARKS

Cardinal marks are used to indicate that deeper water lies in a compass direction away from a danger such as a reef, shallow areas, etc. They are painted in combinations of yellow and black as shown.



### REMEMBER

Think of a clock face when remembering the lights on cardinal marks.

Three flashes = East.

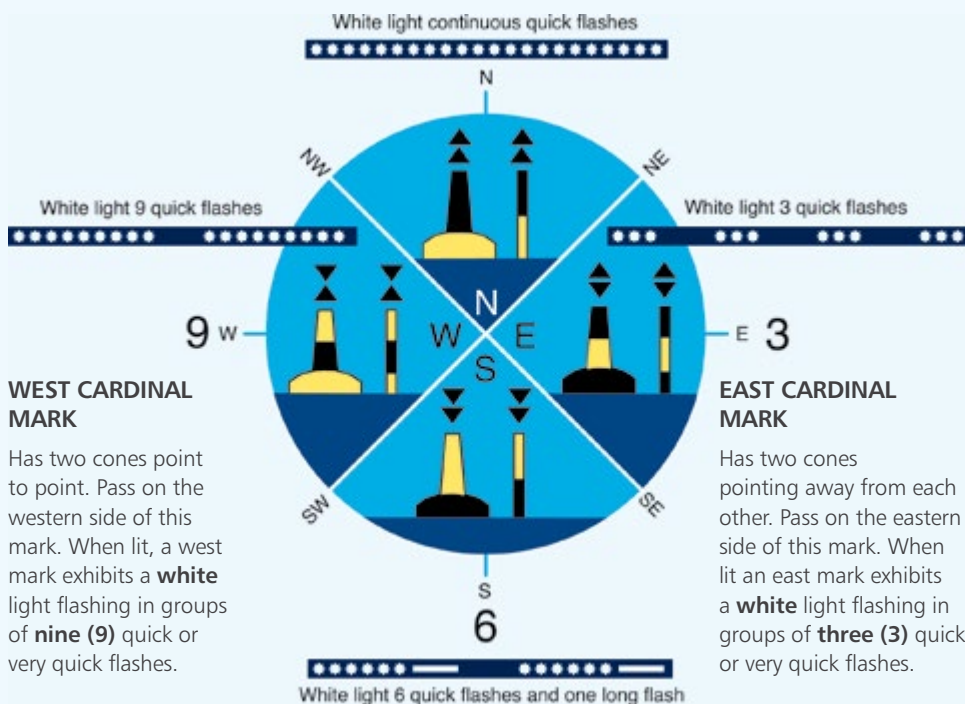
Six flashes and one long flash = South.

Nine flashes = West.

Continuous flashes = North.

### NORTH CARDINAL MARK

Has two cones pointing up. Pass on the northern side of this mark. When lit, a north marker exhibits a **continuous** (very) quick **flashing white** light.



### WEST CARDINAL MARK

Has two cones point to point. Pass on the western side of this mark. When lit, a west mark exhibits a **white** light flashing in groups of **nine (9)** quick or very quick flashes.

### EAST CARDINAL MARK

Has two cones pointing away from each other. Pass on the eastern side of this mark. When lit an east mark exhibits a **white** light flashing in groups of **three (3)** quick or very quick flashes.

### SOUTH CARDINAL MARK

Has two cones both pointing down. Pass on the southern side of this mark. When lit a south mark exhibits a **white** light flashing in groups of **six (6)** quick or very quick flashes followed by a long flash



## SPEED SIGNS

In some areas, speed restriction signs are used for safety reasons in NSW. These usually show four or eight knots, but can also show six, 10 and 15 knots. Penalties apply for travelling in excess of the speed restriction.



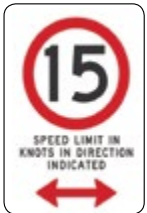
### 4 knots

About 7 km/h or  
a fast walking speed



### 6 knots

About 11 km/h  
or a jogging speed



### 15 knots

About 28 km/h or a fast  
running speed. Used in  
the Sydney Harbour Transit  
Zone. See page 76 for  
additional details.

## WASH

The operator of a vessel must not cause wash that damages or impacts unreasonably on:

- Any dredge or floating plant
- Any construction or other works in progress
- Any bank, shore or waterside structure
- Any other vessel, including a vessel that is moored.

'Wash' is the wave effect created by a vessel moving through the water. 'No Wash' and 'Reduce Wash' signs are placed in some areas where the wash from a vessel is likely to cause damage to the foreshore or vessels, or injury or annoyance to people.



Be aware that vessel wash can travel for hundreds of metres, and you can be held legally responsible for damage caused by wash from your vessel.

Travel at a speed which creates minimal wash when you see this sign and when near moored or anchored vessels. Look behind occasionally to see if your boat is creating wash that affects other boats or the shore. Adjust your speed if necessary.

Regardless of signs, you should not navigate your vessel in such a way as to produce wash that damages other vessels or impacts unreasonably. This is an offence.



### IMPORTANT NOTE

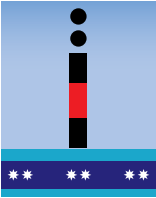
On the spot fines are issued for creating excessive wash.

Travelling at the speed shown on a speed restriction sign does not guarantee you are not creating excessive wash.



# OTHER BUOYS AND SIGNS

## Isolated danger



Indicates specific dangers with generally safe waters all around (eg a wreck). You can pass them on any side but do not pass too close. If lit, it shows a white light flashing in groups of two.

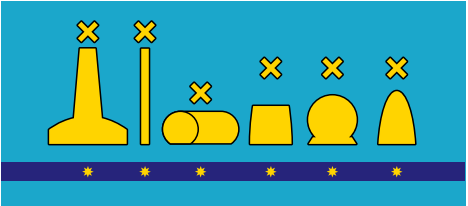
## Special marks

Indicates special features or areas such as:

- Tide poles
- Spoil grounds
- Underwater pipes.

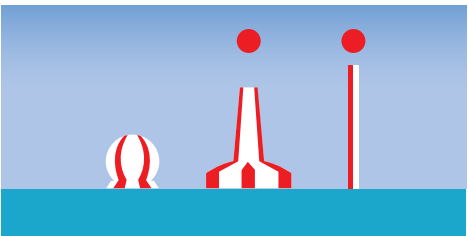
They can be utilised as lateral marks by using can or conical shaped buoys. If so they must be passed as lateral marks: can (port hand) or conical (starboard hand). See page 57 for more information.

These marks, if lit, show a yellow light at night which may flash in any rhythm.



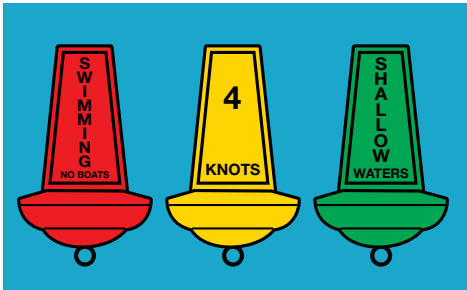
## Safe water marks

These are not common in NSW. They may be used to mark the division of large shipping channels. They may show a white flashing light at night. Where the mark is used to identify a turning point or centre line it should be kept on your left hand (port) side.



## Aquamark minibuoy

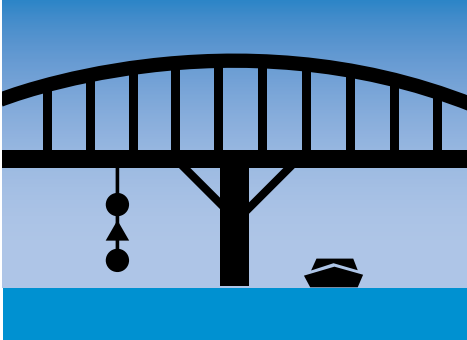
Used in some areas as alternatives to conventional buoyage. They often have advisory messages on them and penalties may apply for breaching the requirement displayed.



## Channel blocked/closed

These signals mean vessels should not navigate in that part of the channel.

- Bridge span blocked
- Channel is blocked
- Port closed.



## Submarine cables

Submarine cables carry electrical power or telecommunication signals under the water. Anchoring is prohibited within 200 metres of a submarine cable. If your anchor becomes snagged in this area, it should not be retrieved. Cut the anchor line as close as you can to the anchor.

## Overhead power lines

As clearance height can vary according to water levels, it is most important that masters know the heights of their masts and understand the height level given on any sign.

Most of the existing signs on the water give the clearance of the power lines as the clearance above Mean High Water Springs or the average of very high tides. It is important to know that this clearance height may be reduced during king tides or floods.

A new crossings signage system is progressively being introduced on NSW waterways. The new

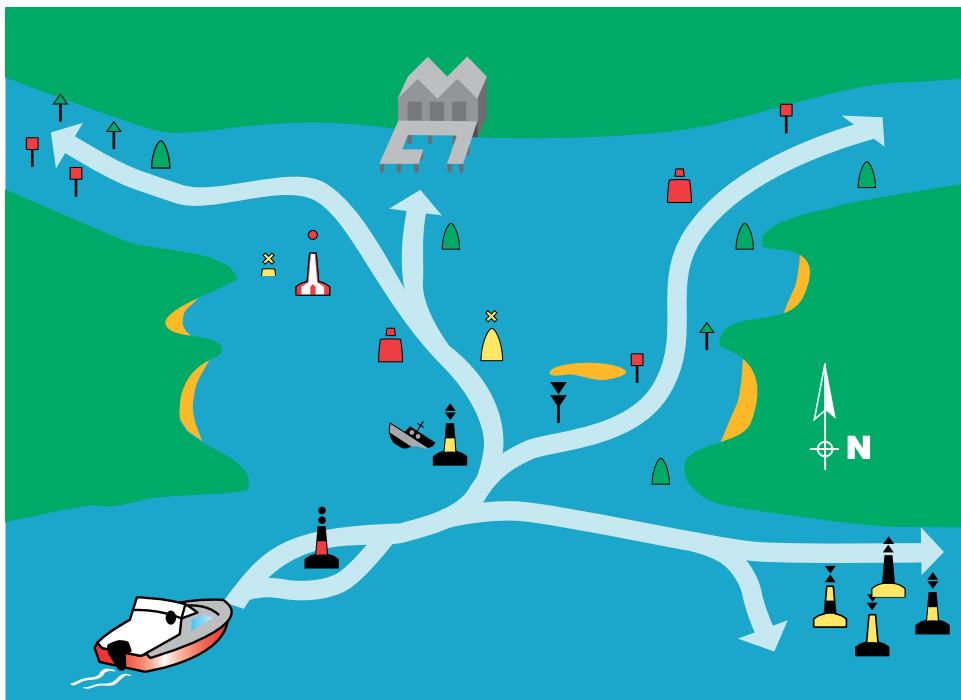
signage advises the maximum vessel height which can be navigated under an overhead crossing. It is important to note that clearances may be reduced during floods.

Roads and Maritime offers a free sticker which you can use to help remember the height of your vessel above the water line. You are encouraged to place the sticker close to the steering position of your vessel.

Extra caution is required during the changeover period from the old to the new system and when launching/retrieving vessels with a mast on shore. Always keep a lookout for overhead power lines.

## Bridges

Bridge heights on maps are measured at the Mean High Water mark, so you should allow for higher than average tides at certain times of the year. Also consider your vessel may require more room when unloaded.



*Understanding the system of navigation buoys, poles and lights is an essential element of safe boating.*





## NIGHT SAFETY

### BE BRIGHT – BE SAFE AT NIGHT

When night falls it is a completely different world on the water and so vessels that operate from sunset to sunrise, whether at anchor or underway, must carry and exhibit the correct lights.



#### IMPORTANT NOTE

##### Boating at Night

Go slow, be seen, keep a lookout and be bright.

### GO SLOW

When fog, glare, smoke or darkness restricts your visibility, you must slow down to a safe speed. A safe speed is one at which you can stop and avoid a collision, considering the circumstances and conditions at the time.

You wouldn't drive fast on a dark road without headlights, the same applies on dark waterways. Be bright!

Remember, the faster you go, the faster you approach hazards and the less time you have to react. Hitting a hazard at speed can have a greater impact on you, your passengers and your boat.



*Check all your navigation lights are working before heading out on the water, switch them on and slow down to a safe speed when night falls.*

## BE SEEN

You may be able to see others but can they see you? At night, every type of craft on the water needs lights in order to be seen. Whether you are paddling, rowing, sailing or motoring, everyone needs to be able to recognise where you are and what you are doing.

Make sure you have the correct lights for your craft and that they work properly. Use them as soon as the sun goes down or when visibility is poor. Your lights should be mounted in a position that gives you optimum night vision and allow others to see you from every direction.

You must carry a working waterproof floating torch. It may help others see you if you shine your torch on your sails or superstructure.

Make sure you don't adversely affect your night vision or the vision of other boat skippers.



*Vessels at anchor displaying all round white lights. Photo courtesy of City of Sydney.*



## NAVIGATION LIGHTS CHECKLIST

Check your lights before heading out. When boating at night or in times of restricted visibility:

- Check switches are on
- Check navigation lights are on and working
- Physically check each light is on
- Turn off cabin lights as they may reduce your ability to see
- If the vessel has a flybridge and weather permits, it is generally preferable to drive from there as you will have a better all round view
- If you anchor at night, show an all round white light clearly visible through an arc of 360 degrees, where it can best be seen.

## KEEP A LOOKOUT

Navigating at night requires special care, it can be like looking into a black hole. Look and listen at all times, as a number of hazards such as logs, moored boats or sandbanks are unlit.

Navigation lights may not be as bright as other lights and background lights may hide something that is closer. If it is a large ship, the lights might be high and you may not realise that you are looking at the sides of a black hull.

If you have the slightest doubt, stop, ensure you are lit and have a good look around you.

## KNOW YOUR WATERWAY

Navigation markers can aid you in safe passage of a waterway. These aids to navigation can indicate where prominent hazards are, but should be coupled with reference to a map or chart and use of local knowledge of the area, particularly in the dark.

## DIFFERENT LIGHTS

**All round white light:** A white light showing an unbroken light over an arc of the horizon of 360 degrees.

**Masthead light:** A white light placed over the fore and aft centreline of a vessel, showing an unbroken light over an arc of the horizon of 225 degrees and fixed to show from anywhere ahead, to just behind the beams of the vessel.

**Sidelights:** A green light on the starboard (right) side, and a red light on the port (left) side of a vessel. Each shows an unbroken light over an arc of the horizon of 112.5 degrees, and is fixed to show from ahead to just behind the beam of the vessel on its respective side.

On a vessel of less than 20 metres in length, the sidelights may be combined in one light unit, carried on the fore and aft centreline of the vessel.

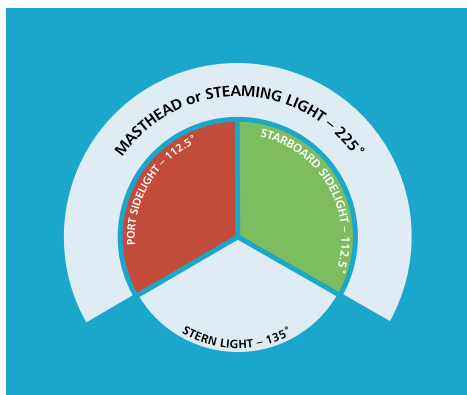
**Sternlight:** A white light placed near the stern, showing an unbroken light over an arc of the horizon of 135 degrees, fixed to show from behind the vessel.



### REMEMBER

#### Look out at night

- Is that a vessel(s)?
- How big is it?
- What direction is it travelling in?
- How fast is it moving?
- How far away is it?
- Does it have priority?
- What is our relative position?





# RANGE OF VISIBILITY

## Vessels under 12 metres

- Masthead light – 2 nautical miles (nm)
- Sidelight – 1nm
- Stern light – 2nm
- All round lights – 2nm.

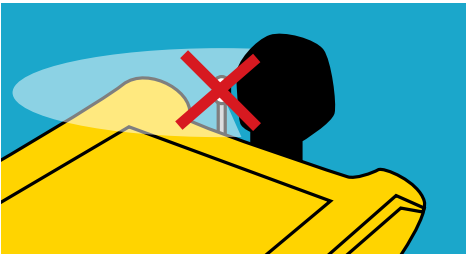
## Vessels 12 metres to 20 metres

- Masthead light – 3nm
- Sidelight and stern light – 2nm
- All round lights – 2nm.

# PLACEMENT OF LIGHTS

## Incorrectly installed navigation lights

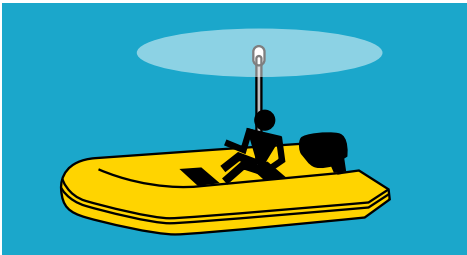
Navigation lights should be installed correctly so they show the appropriate arc of light and are not obscured by the vessel's superstructure as shown in the diagram below, or interfered with by deck lights. This reduces the vessel's visibility and is dangerous.



The diagram above shows incorrectly installed sidelights. Don't install them so they point only forward or straight up. They need to point out across the water as described and illustrated on the opposite page.

## Masthead

The masthead and/or all round white light must be fitted (if practical) on the centreline (bow to stern) of the vessel.



## POWER VESSELS UNDERWAY

### Power vessels under seven metres and less than seven knots

Powered vessels of less than seven metres in length, capable of a maximum speed of seven knots or less, shall exhibit a white light visible all round and if possible, separate and/or combined sidelights.

### All other power vessels under 12 metres

Shall exhibit one of the following:

- Separate or combined sidelights; a masthead light and a stern light
- Separate or combined sidelights and an all round white light.

The masthead or white all round light shall be carried at least one metre above the sidelights.



## Power vessels 12 metres to 20 metres

Shall exhibit one of the following:

- A masthead light, separate sidelights and stern light
- A masthead light, combined sidelights and stern light.

The masthead light shall be carried at least 2.5 metres above the gunwale. Combined sidelights shall be carried at least one metre below the masthead light.



## SAILING VESSELS UNDERWAY

Sailing vessels while underway (being motor driven) under power shall exhibit navigation lights applicable to power driven vessels.

### Sailing vessels under seven metres

Sailing vessels of less than seven metres in length, or vessels being rowed, should if practicable exhibit the lights required for sailing vessels over seven metres.

If not they should have ready use of a torch or lantern showing a white light which shall be exhibited in sufficient time to prevent collision.



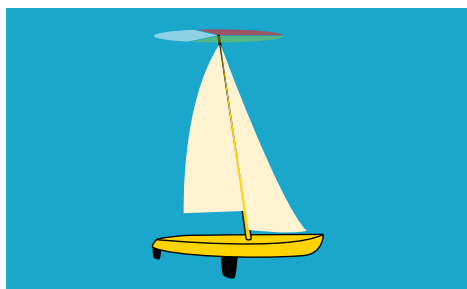
## IMPORTANT NOTE

The use of tricoloured lights alone in areas affected by backlighting is not recommended eg Sydney Harbour. In these cases it is recommended to use deck level navigation lights to make your vessel as visible as possible.

## Sailing vessels seven metres to 20 metres

Shall exhibit one of the following:

- A combined lantern, that is at or near the top of the mast and incorporates sidelights and stern light
- Separate sidelights and stern light.



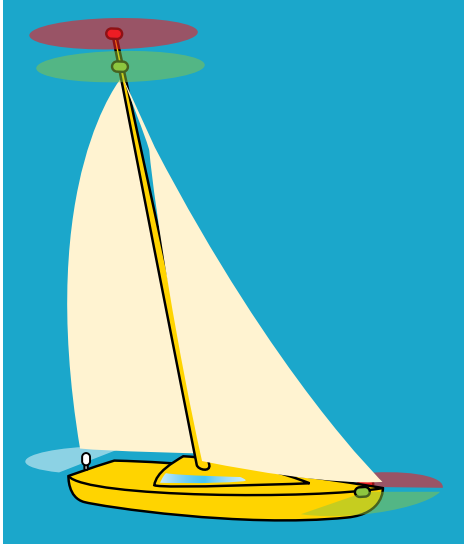
## Sailing vessels over 20 metres

Must exhibit sidelights and stern light and may carry the optional red and green all round lights. However, these vessels may not carry a combined lantern.



## Optional lights for sailing vessels

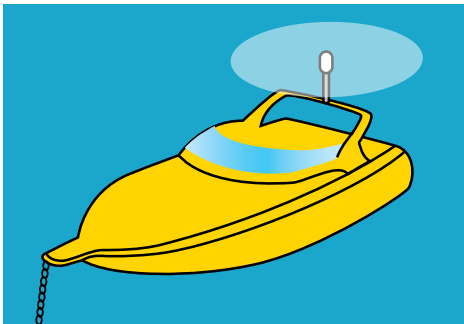
A sailing vessel of any length which is fitted with sidelights and a stern light (but not a combined lantern) may, in addition, carry two all round lights in a vertical line at or near the top of the mast. The upper light shall be red and the lower green.



## Power and sailing vessels at anchor

Vessels less than 50 metres in length at anchor shall exhibit an all round white light, placed where it may be well seen.

Anchor lights must always be shown from sunset to sunrise. If you are at anchor in a busy area, then show additional lights such as deck lights or cabin lights to ensure you are seen and keep a good watch.



## ROWING/PADDLE VESSELS

Such craft must have a torch or lantern ready to display in time to prevent a collision. Craft that are more than four metres long should exhibit two all-round lights, either continuous or a combination of continuous and flashing white lights, positioned at either end, in accordance with the Code of Conduct for Rowing.



### IMPORTANT NOTE

There are many other combinations of lights used on vessels. The lights shown relate to the activity the vessel is engaged in, ie fishing, dredging, not under command.

A simple rule of thumb for a small power boat is to stay clear of any vessels exhibiting additional lights.





# SPECIAL AREAS

## OPEN WATERS

### Handling a vessel at sea

The way a boat handles at sea will depend on:

- Its hull design and strength
- The amount of power used to propel it
- Wave direction
- The way the boat is steered
- The distribution of weight on board.

### Bomboras

When boating along the coastline, particularly when close to a shoreline, be aware of bomboras. Bomboras are shallow areas such as those created by rocks or reefs that cause waves to break.

It is advisable to check maps and charts, talk to experienced locals and be aware of the existence of bomboras. The danger posed by these formations can be higher in good weather, as a bombora may not be identifiable because it may not always have breaking waves.

Boaters need to be cautious anywhere bomboras may exist.

### Head seas

Generally, the best way to tackle bigger waves is to take them bow on or up to about 30 degrees off each bow.

Too much power will result in the boat leaping over the crests and crashing down into troughs. This slamming action is not good for either the boat or the people on board.



Too little power may mean that the waves break onto or over the vessel.

Control the speed and direction steered to achieve the most comfortable and safest ride.

### Beam seas

The danger from travelling beam on to waves is that rolling is increased. The amount of rolling can be reduced by varying the angle to the seas.

The bow is the strongest part for taking on waves and is typically designed to take the initial impact of chop and waves. Vessel design however is extremely varied and it is essential you know the limits of your boat's capability.

Watch out for waves that are larger than others and consider changing course or speed to ride over or with it.



## Following seas

Travelling with a following sea has the greatest potential for disaster, with broaching sideways and swamping/capsize a real possibility. Steering power is reduced by following seas and judicious use of the throttle controls is critical.

As in crossing a bar (see page 72), you should attempt to maintain a position on the back of waves, using throttle to keep ahead of waves breaking behind the boat.

## Remember when conditions worsen

- Ensure all persons are wearing lifejackets
- Ensure the boat is as watertight as possible
- Use throttle control and steering to reduce the impact of waves
- The bow of a boat is the strongest part for taking on waves
- If caught in rough weather, report your situation to rescue authorities
- Secure all moveable items in the boat so that they do not become missiles
- Ensure all people are holding on firmly
- Have an EPIRB ready for use in case of capsize
- Stay with the capsized boat unless you are very close to shore.

## Handling a vessel in rough weather/hazards

Like other hazards on the water, rough weather can generally be avoided by obtaining a weather forecast prior to setting out.

A sudden unpredicted squall, however, can catch even the most careful boater, so you should always prepare and plan for the worst and keep a good lookout for tell-tale clouds and white cap waves.

### **IMPORTANT NOTE**

If you doubt your chances of safely running back to harbour you may prefer to ride out the initial onslaught by keeping your bow into the wind and waves.

If you are close enough, run for the shore, a safe harbour or the lee of an island, where the wind cannot generate large waves.

Sudden squalls usually only last for a short period and sometimes precede a change in wind direction, usually blowing at much stronger speeds than the wind that will follow.

The main thing is to keep a speed sufficient to allow you to steer the vessel, but no faster. Without power to maintain steerage, a vessel will drift side on or beam on to the sea and be vulnerable to capsize.

A sea anchor or a strong bucket tied to the bows will help to keep you pointing into the waves should your engine fail.



### **IMPORTANT NOTE**

Always wear your lifejacket at times of heightened risk.

## SEAPLANES

When on the water, seaplanes are just like any other vessel. They are subject to all the restrictions and privileges of other boats and must conduct their operations accordingly.

Don't be alarmed if a small seaplane alights or takes off in the waterways near you. Seaplane pilots are specially trained and qualified to operate upon the water. Like other boat operators, they hold marine boating licences to operate a vessel at speeds in excess of 10 knots.

Avoid making sudden changes of direction which might confuse the pilot or obstruct the seaplane's path.





*Check the conditions before you cross ... this skipper made it, just!*

## BAR CROSSINGS

Shallow sand bars which can form at the point where rivers, creeks, lakes or harbours meet the sea are locations for experienced vessel drivers only. Any channel through such bars can change frequently. Even in apparently calm conditions vessels can be swamped, damaged or wrecked on bars and lives have been lost.

Avoid crossing a bar on a run-out tide as this is when dangerous waves are most likely to occur.

### Knowledge and experience

#### If in doubt, don't go out.

Do not attempt to cross any bar without experience and local knowledge. You should:

- Spend considerable time watching the bar conditions in all combinations of weather and tide
- Cross the bar with other experienced skippers before trying it yourself
- Obtain and read a copy of the bar crossing brochure from Roads and Maritime.

### Preparation and planning

Prior to crossing any bar it is recommended that the following checks should be made.

- Know the times of the tide and obtain an up to-date weather forecast, especially expected wind and sea conditions

- Observe the bar conditions, either in person or via the online network of web cameras, and be prepared to cancel or delay the crossing
- If unfamiliar with the bar, obtain advice from experienced locals, eg from the local Marine Rescue NSW unit
- Check the vessel, especially steering and throttle controls, watertight hatches and drains. The vessel must be seaworthy, suitable for the conditions and able to take some impact from waves
- Ensure that all loose items can be stowed away in lockers or tied down to prevent movement
- Check that all watertight hatches can be closed and sealed properly, drain holes are free and bilge pumps work.

### On the water prior to crossing

- Secure all loose gear and equipment
- Brief your passengers/crew about the dangers
- Make sure all people onboard have their Level 100+ lifejacket on
- Check all watertight hatches are closed and secured but not locked
- Assess the bar conditions, have they changed since your last inspection?
- When crossing coastal bars, you should not lose your nerve in the white water. Once committed, keep going
- Trying to turn around in the middle of a bar entrance can be disastrous. Try to take waves as close to head on as possible.



## Going out

The outgoing vessel must meet the incoming wave energy. Do not hit waves at high speed as an airborne vessel is out of control and can cause damage and injury. Do not allow waves to break onto your vessel.

As a guide:

- Idle towards the breaking waves watching for any lulls
- If a flat spot occurs speed up and run through it
- If the waves keep rolling in, motor to the break zone
- Gently accelerate over the first part of broken water
- Apply more power and run to the next wave, heading for the lowest part (the saddle) if possible because this is the last part to break
- Back off the power just before meeting the next swell
- Pass slowly through the wave and accelerate again to the next wave
- Repeat the process until through the break zone.

## Coming in

Be aware the conditions may have changed.

If dangerous, consider alternatives:

- Wait for conditions to abate
- Wait for change of tide
- Seek alternate safe harbour.

The vessel should travel at the same speed as the waves. The aim is to travel in on the back of a swell, staying ahead of waves breaking behind the vessel.

You should:

- Approach the break zone and try to pick the spot with the least activity
- Keep any leads in transit as breakers may obscure your vision of the entrance
- Choose a set of waves suitable for your entry
- Position the vessel on the back of a swell and maintain speed, ensuring that:
  - You do not overtake the wave and run down its face
  - You stay ahead of any wave behind you



- When the wave ahead of you has broken, accelerate through the white water
- Beware of steep pressure waves bouncing back off the entrance or shore
- Adjust speed to counter any pressure waves or any outgoing current.

Roads and Maritime has a number of initiatives on bar crossings including the brochure *Bars 'n' Boats – A Safety Guide*, a list of coastal bars and a bar crossing safety checklist sticker.

Roads and Maritime also has a network of web cameras to assist in trip preparation. Check the Roads and Maritime website for up-to-date information and live vision of 19 locations along the NSW coast and in the alpine area.



## INLAND WATERWAYS

Boating on inland waterways such as rivers, creeks and dams demands special care. Many of these areas present issues not encountered in coastal waters, including submerged trees and other snags.

Inland waterways are often murky and constantly changing; if you don't have a depth finder play it safe and reduce speed.

Familiarise yourself with the area using maps and wherever you can, talk to local operators. They can often provide valuable knowledge such as how the current runs after rain and water depth following drought.

Keep a good lookout for objects ahead or above you, such as overhead powerlines and low level bridges.

Strong currents in major rivers and creeks can flow at fast rates and affect the manoeuvrability of vessels. Never underestimate the power of even a moderate current, which can exert a strong force that may trap vessels such as canoes

against rocks. Extra caution is required following heavy rain or flooding.

Be careful in dams subject to water releases and stay well clear of spillways. These can be extremely dangerous due to turbulence as the water flows through spillway gates. Boats can easily become caught in the turbulence and trapped.

Also remember that during release periods the foreshore can become soft, trapping vehicles during launch and retrieval.

Rivers and dams may look peaceful, but low water temperature and remote locations could prove risky should trouble occur.

Remember not to overload your vessel.

### Wind and waves

The surface of the water in shallow dams and storage areas can become extremely rough in windy conditions. Waves are generally short and steep, and can be as high as those encountered in coastal areas.



*Submerged trees and other snags can pose danger on inland waterways.*

Always get a wind/weather report before boating and once out on the water, keep a constant lookout for signs of:

- Changing weather
- White caps/disturbance on the water
- Cloud development.

If the conditions deteriorate, put on your lifejacket and head for shore. Remember it is better to be on the shore a long way from home, than a long way from shore in such conditions.

## Communication

If you are going to go boating in remote locations, have a good reporting plan in place. Always tell someone where you will be launching from and going, how many people are with you and when you intend to return.

Phone or radio coverage is not always possible, making assistance difficult if problems occur.

## ALPINE WATERS

Alpine waters refers to:

- Lake Burrinjuck
- Lake Eucumbene
- Lake Jindabyne
- Khancoban Pondage
- Swampy Plains River
- Mannus Lake
- Googong Reservoir
- Blowering Reservoir
- Pejar Dam
- Yass River
- Lake Oberon
- All navigable waters within the boundaries of Kosciuszko National Park.

Alpine waters present their own unique boating challenges. As with other inland waters, many hazards are not marked and as water levels fluctuate, more hazards may develop just under the surface.

The most common vessel operated in these areas is the small open runabout which is reasonably inexpensive to buy, easy to tow

and used as a fishing platform. The majority of these vessels, however, are designed for calm water conditions only.

Wearing a lifejacket is compulsory in most situations on alpine waters. For full details refer to pages 22-23.

## Alpine weather

Alpine lakes are often subject to very cold and windy weather. Many of these lakes commonly experience snow in winter. The higher altitude means weather often changes quickly, so proper trip preparation and continuous monitoring of the weather when you are out are essential. Watch for any warnings and be prepared to change your plans if necessary.

When boating in alpine waters check the weather with the Bureau of Meteorology's graphical forecasts **[bom.gov.au/australia/meteye/](http://bom.gov.au/australia/meteye/)** and zoom into your location. You can also use **[m.bom.gov.au](http://m.bom.gov.au)** on your mobile device and type in the nearest location.

## Cold water

Winter brings a greater risk of hypothermia to boaters exposed to the elements. Capsizing in cold water can also be life-threatening. 'Cold shock' can incapacitate almost instantly. So plan and prepare to avoid cold shock and hypothermia.

- Minimise your capsize risk
- Check the weather. If in doubt, don't go out
- Wear warm and wet weather gear
- Wear a lifejacket
- In the water, don't swim unless extremely close to the shore. Remain with your craft in the 'HELP' or 'Huddle' position
- Remember, alcohol increases the body's heat loss.

See page 94 for more information.



## SYDNEY HARBOUR

Sydney Harbour is a unique waterway that is used extensively by a diverse range of recreational and commercial boats including large ships, ferries, charter boats, cruisers, yachts, runabouts, sailing skiffs, dinghies, sailboards, rowing shells, kayaks and dragon boats.

The harbour is an extremely busy waterway that requires you to be aware of your responsibilities and to take care when boating, especially in busy navigational channels, and 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.

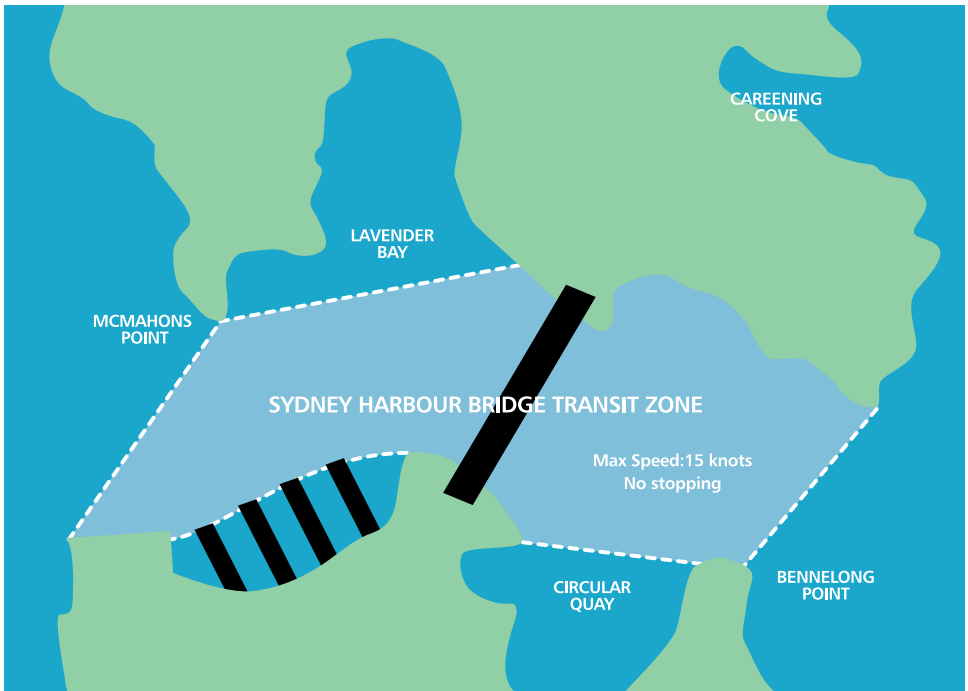
The number of vessels on the Harbour is increasing each year, providing a greater challenge in managing the potential for additional conflict and incidents to ensure safety on the waterway.

There is a continuing need for an understanding and commitment to water safety by all people using the harbour. The different types of boating may not always be compatible and can lead to potential conflicts eg people sailing in organised events and commercial vessels operating to timetables.

### Sydney Harbour Bridge Transit Zone

Roads and Maritime has established the Sydney Harbour Bridge Transit Zone. The transit zone has a 15 knot maximum speed limit in the vicinity of the Harbour Bridge, between a line drawn between Bennelong Point and Kirribilli Point to Millers Point and Blues Point, but does not include Walsh Bay, Sydney Cove or Lavender Bay north of a line between Blues Point and the southern extremity of Milsons Point ferry wharf.

Within this zone, anchoring or drifting are prohibited other than in an emergency. This means that vessels may only travel through this area to reach an area alongside or outside of the transit zone.

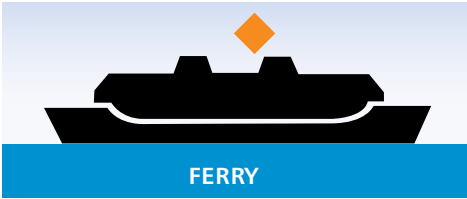




# Priority over sail

Some ferries on Sydney Harbour display an orange diamond shape. The shape is called the priority over sail signal. This shape removes the usual 'power gives way to sail' rule - meaning a sailing vessel is required to keep out of the way of any ferry displaying an orange diamond. The only exception is if the ferry is overtaking the sailing vessel.

For general safety and courtesy, skippers of sailing vessels should stay at least 200 metres from the bow, and at least 30 metres from the sides or stern of a ferry displaying the priority over sail signal.

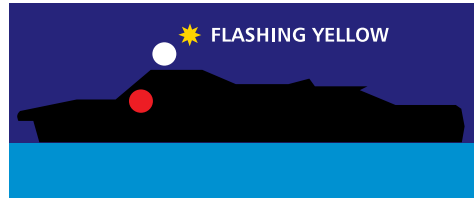


## IMPORTANT NOTE

The use of a PWC is prohibited in Sydney Harbour, including all tributaries such as Parramatta River.

## High speed ferries (on Sydney Harbour)

These craft carry the normal lights for a power driven vessel underway and, in addition, they exhibit an all-round flashing yellow light when they are travelling at speed.



Safety on the water



## Look for the BIA member symbol

Businesses throughout all segments of recreational boating can be found as members of the Boating Industry Association.

These businesses have pledged to abide by the association's Code of Practice.

## Consider dealing with a BIA member first

Look for the BIA member logo or visit our website

[www.bia.org.au](http://www.bia.org.au)



# MyBoatingLife

[.com.au](http://MyBoatingLife.com.au)

MyBoatingLife.com.au covers just about everything there is to know about recreational boating in Australia.



Make it your homeport  
Create your own dashboard.

[MyBoatingLife.com.au](http://MyBoatingLife.com.au)



## Sydney Harbour Control

Channel 16/13 (24 hours). Details of large vessel movements, navigation warnings and meteorological forecasts are broadcast on VHF Channel 13 from approximately 1.05am, every second hour. Unless otherwise directed, sailing vessels and motor vessels are not to impede the passage of commercial shipping/naval vessels inside the shipping channels. See pages 78-79 for more information.

## BIG SHIPS AND SMALL BOATS

Large vessels are restricted to particular channels and cannot deviate from their set course. These vessels are restricted in their ability to alter their course due to their size and need a large area to turn and stop. Their stern swings out wide when negotiating a turn and they lose steerage if they travel too slowly.

The main safety tips for small boats around shipping and ferry channels are:

- Recreational boats, both power and sail, should keep well clear of large vessels and ferries
- Do not cross ahead of large vessels or ferries unless well clear. Even when hundreds of metres away, your boat may disappear from the ship master's view from the bridge

- Remember, large vessels tend to travel much faster than they appear to be. Give yourself plenty of room
- Do not cross close astern of a large vessel or ferry
- Always keep to the starboard side of a channel
- Do not cross a channel if you are going to impede a vessel which has to use the channel
- Roads and Maritime provides more information regarding big ships and small boats on its website, including map sections within the local boating map showing the shipping channels. Visit [rms.nsw.gov.au/maritime](http://rms.nsw.gov.au/maritime).

### Active radar reflectors (ARR)

Active radio reflectors emit a signal to nearby radar receivers. The signal is amplified and returned to the transmitting vessel.

This makes vessels more visible on radar receivers from greater distances and may reduce the chance of being involved in an incident. It may also assist rescue operations in the event of an incident.

ARR need to be mounted high enough on a vessel to be effective (eg up the mast) and they require a power source. Consequently they may not be suitable for some smaller vessels.

While ARR are not mandatory on NSW navigable waters, they may be a good inclusion to improve your visibility to other vessel operators.



*Large vessels are restricted in their ability to alter course and cannot stop quickly. Always keep well clear of them.*

## Recreational boat users beware

- Always keep a proper lookout for big ships and steer clear of them
- Make your intentions clear to an approaching vessel well in advance. For the master of a large ship who is unclear of your intentions, you should indicate that you are getting out of the way of a large vessel at least one kilometre in advance of that vessel
- Do not anchor in a navigation channel
- Ensure you can be seen clearly at all times. Dull aluminium tinnies can be difficult to see, especially in overcast and poor conditions. Wear bright clothing and be seen
- After sunset and in restricted visibility, ensure you have the correct navigation lights fitted and they are in proper working order. Your lights must be bright and must be visible for a distance of kilometres. Lights not only tell the other vessel what sort of vessel you have, but also what you are doing and where you are going. Make sure that if someone 'interprets' your lights, they are getting the right message.



*Do not risk crossing ahead of large vessels unless well clear.*

## GO EASY ON THE DRINK

When afloat, your coordination, judgement, vision, balance and reaction time can decline up to three times faster after consuming alcohol. The boating environment with the waves, motion, vibration, engine noise, weather, wind and spray multiply the effects of alcohol. Driving under the influence of alcohol or drugs is an offence.

Everyone aboard needs to take care. Studies have shown that boat passengers are just as likely as operators to be involved in incidents such as capsizing the vessel or falling overboard as a result of drinking alcohol.

Operators of vessels that are underway may be subject to random breath testing and subject to heavy penalties if found to be over the limit. The 'operator' of a vessel includes anyone steering or exercising control over its course or direction and includes the observer in a vessel which is towing people, as well as anyone being towed.

See page 107 for further information about drug and alcohol offences and random breath/drug testing.



WEATHER

Always check the weather before and during boating. If it looks dicey, don't go out. If it starts to turn bad, head straight for shelter. A marine radio helps you keep in touch with weather updates. Learn to understand and read weather patterns, the wind, waves and the limits of your craft.

GOING OFFSHORE

A good skipper will always treat the ocean with respect, so it's essential to plan and prepare when going offshore. Check the weather forecast and your safety gear.

Plan for any change of conditions by anticipating wind, waves, tides and safe havens.

You must have a marine radio and a 406 MHz EPIRB distress beacon when more than two (2) miles offshore. And, always let someone know where you're going and when you plan to return.



BE PROP AWARE

Boat propellers pose a risk that is easily ignored because they are under the water, 'out of sight and out of mind.' But a strike from a spinning propeller can cause serious injury or even death.

- Ensure the prop area is all clear before starting the engine
- Keep all arms and legs inside the boat
- Keep a proper lookout, especially when near swimmers, observe 'distance off' rules and stay out of designated swimming areas
- Wear a kill-switch lanyard when boating alone.

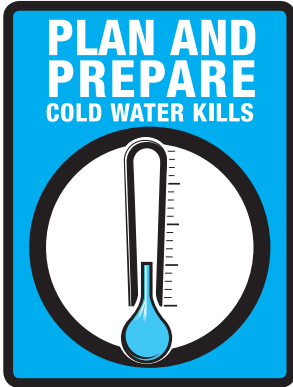


HYPOTHERMIA

Boating in cooler weather increases the risk of developing hypothermia from wind-chill, capsize, and damp and wet clothes.

Hypothermia is the effect of heat loss from the body. Immersion in cold water causes the body to lose heat up to 25 times faster than normal and the shock of sudden immersion in cold water can be a serious threat to survivors of accidents.

- Plan and prepare to avoid hypothermia. Minimise the risk of capsize or swamping, keep an eye on the weather and if in doubt, don't go out
- Wear warm thermal clothing, including a beanie and add wet weather gear over your warm clothes to provide wind proofing. Foul weather gear or waders may help keep you warm but are extremely difficult to swim in. So, if you wear this sort of gear in a boat – put on a lifejacket
- Wear a lifejacket at all times of heightened risk
- In the water, don't swim. Remain with your craft in the "huddle" position
- If hypothermia is suspected, try to reduce any further heat loss and commence rewarming slowly.



NAVIGATION LIGHTS

When night falls, it is a completely different world on the water. Vessels that operate from sunset to sunrise, whether at anchor or underway, must carry and exhibit the correct lights. When boating at night – go slow, be seen, keep a lookout and be bright. Make sure you have the right lights for your craft, they are working properly and mounted in a position that gives you optimum night vision and allows others to see you from every direction.

Carry a working waterproof torch. It may help others see you if you shine your torch on your sails or superstructure. Make sure you don't affect your night vision, or the vision of other boat skippers.

If you anchor at night, show an all-round white light where it can best be seen.

Navigating at night requires special care – look and listen at all times, as a number of hazards are unlit such as logs, moored boats or sandbanks.

If you have the slightest doubt, stop, ensure you are lit and have a good look around you.



For more information, visit [www.maritime.nsw.gov.au](http://www.maritime.nsw.gov.au) or call the info line 13 12 56.

Maritime is a division of Roads and Maritime Services.

**YOU'RE THE SKIPPER  
YOU'RE RESPONSIBLE!**

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YOU'RE RESPONSIBLE**



MAR0303/UC02/12







## SAFE AND RESPONSIBLE BOATING

The skipper of every boat is responsible for the safety of their vessel and the people on board.

While that responsibility presents some challenges, a seaworthy and well-prepared vessel in good hands can provide an immense amount of enjoyment for you, your friends and your family.

Preparation and awareness are two of the most important elements of safe and responsible boating.

As skipper, take time to ensure the boat is ready and also spend time to consider the safety issues highlighted in this brochure.

More information on these and other boating safety issues is available at [www.maritime.nsw.gov.au](http://www.maritime.nsw.gov.au)

## LIFEJACKET – WEAR IT

Lif jackets save lives. But a lifejacket will not save your life if you are not wearing it.

You must carry a lifejacket for every person on board. But don't just have lifejackets on board, make sure you and your passengers wear them.

New rules apply in NSW and you must wear a lifejacket in situations including if you are:

- Under 12 years of age
- In a small vessel up to 4.8m long when boating alone, at night, on open (ocean) waters and on alpine waters
- On a PWC
- Being towed
- When wearing waders on alpine waters
- Instructed to by the skipper.

For more information, visit [www.lifejacketwearit.com.au](http://www.lifejacketwearit.com.au) or call the info line **13 12 56**.



## GO EASY ON THE DRINK

The blood alcohol limit on the water is the same as on land, 0.05, but that's where the similarities end. Drinking on the water isn't the same as drinking on land. Wind, waves and the sun can increase the effects of alcohol on your body. You are more likely to get drunk quicker and get disorientated, increasing the chance of a boating accident or drowning.

Be aware that random breath testing applies to the skipper of any vessel while underway.



## KEEP A PROPER LOOKOUT

It may seem obvious, but you must keep an eye on what's going on around you. The skipper must be in a good lookout position at all times to watch and listen carefully, especially in bad weather, restricted visibility or darkness.

- Don't forget to look all around – even behind you
- Take special care in areas where higher speed vessels operate
- Keep watch for smaller vessels that can be difficult to see, especially kayaks and dinghies
- Watch for swimmers, floating debris and whitewater that may indicate submerged reefs and rocks
- Even when you have an observer while towing a person on skis or tubes, the skipper is always responsible for keeping a proper lookout
- Keep safe, keep to the right, especially when entering a narrow passage or on a sharp bend.



## CARBON MONOXIDE

Carbon monoxide is a colourless and odourless gas produced when carbon-based fuel burns. Exposure to this gas can cause death or serious injury.

Carbon monoxide is normally at the back of the boat when engines and generators are running. If you have a headache, feel nauseous, dizzy or drowsy, move to fresh air.

To keep these gas levels under control and prevent poisoning, regular boat and engine maintenance and proper operation are important.

## SPEEDING

Speeding on the water is the same as speeding on the road. It can kill. A skipper is responsible for taking a number of things into account.

### CONDITIONS

Conditions on the water can change in the blink of an eye. The wind might pick up, wave size might increase and the current may change. The skipper is responsible for making sure a boat travels at a safe speed. If in doubt, slow down to suit the conditions.

### VISIBILITY

You must slow down in heavy rain, thick fog, dense mist and intense glare when you're on the water. If you are travelling at night you are responsible for displaying navigation lights. Not all hazards are lit, so special caution is needed at night.

### OTHER VESSELS

You must not speed close to other vessels. Slow down and take care in busy waterways and when you're near moored or anchored vessels and smaller craft. Extra caution is needed around working vessels or large boats that find it hard to manoeuvre.

### NAVIGATION HAZARDS

Waterways are filled with hazards. Keep an eye on your speed in shallow or unfamiliar waters. Not all hazards are marked or lit, signs and buoys can be damaged, and lights can be out of action. You can report damage to nav markers to the info line **13 12 56**.

### YOUR VESSEL

All boats are different. The size of your hull, engine and propeller type can affect your manoeuvrability. You are responsible for knowing your vessel's limitations. How quickly can you stop and turn?

### CHILDREN

Children need to be carefully watched. Be especially careful not to allow children to be on the bow or to sit with legs dangling over the side while under power.