GLADESVILLE BRIDGE MARINA REDEVELOPMENT PROPOSAL

ENVIRONMENTAL IMPACT STATEMENT:

ECOLOGY ASSESSMENT REPORT

Looking towards Gladesville Bridge from Gladesville Bridge Marina 16th May 2019.

Report Prepared for Gladesville Bridge Marina

Marine Pollution Research Pty Ltd

October 2019

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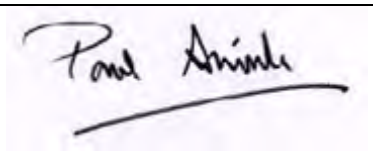
REPORT TITLE:	Gladesville Bridge Marina EIS - Ecology Assessment Report
CLIENT & CONTACT:	Gladesville Bridge Marina Pty Ltd via Mr Matthew Hundleby
MPR REPORT No:	MPR 1162
DRAFT REPORT FOR COMMENT:	Version 1 Sent to PA 4/7/2019.Ver 2 sent to client 12 Aug 19. Revised and Final Ver 3 with additional Water Quality results & revised project description to client on 4 Oct 19.
COMMENTS RECEIVED AND INCORPORATED:	Comments received 15 Oct and Revised Final Ver 4 sent to client on 16 Oct 19.
FINAL REPORT:	Revised Final Report sent 16 Oct 2019
MPR APPROVAL: PAUL ANINK	

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GLOSSARY

BCA	*Biodiversity Conservation Act 2016*
DGV	Default Guideline Value (for Sediment Contamination Criteria)
GVhigh	High Range Guideline Value (for Sediment Contamination Criteria)
CD	0m Chart Datum which is approximately ISLW Fort Denison.
CEMP	Construction Environmental Management Plan
EIS	Environmental Impact Statement
EPA Act	*Environmental Planning and Assessment Act 1979*
EPBC	*Environment Protection and Biodiversity Conservation Act 1999*
FMA	*Fisheries Management Act 1994*
ISLW	Indian Spring Low Water
HAT	Highest Astronomical Tide, roughly 2m above LAT.
LAT	Lowest Astronomical Tide which approximates Chart Datum (CD)
OEMP	Operation Environmental Management Plan
SEARs	Secretary's Environmental Assessment Requirements
TOC	Total Organic Carbon
TSC	*Threatened Species Conservation Act 1995*

1 INTRODUCTION

Marine Pollution Research Pty Ltd has been requested by **Gladesville Bridge Marina (GBM)** to prepare an Ecology Assessment report as part of an Environmental Impact Statement (EIS) for the redevelopment of the marina facilities. The EIS will accompany a Development Application (DA), to be lodged with Canada Bay Council under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Aquatic Ecology Assessment report addresses the following Secretary Environmental Assessment Requirements (SEARs) in the indicated report sections:

Key Issue Biodiversity - *including*

- *accurate predictions of any vegetation clearing on site, including marine vegetation:* There is no loss of terrestrial habitats arising from the proposal, no loss of natural marine vegetated habitats and a doubling of marine hard substratum habitat - see **Section 4.1**, page 35.
- *detailed assessment of the potential impacts on any critical habitats. protected species, threatened species, populations, endangered ecological communities or their habitats* - There are no threatened species or EECs in the locality and there are measures for the protection of transient threatened species during construction activities - See **Section 1.4** pages 8 to 10 and **Section 4.1.2** page 35.
- *a biodiversity assessment in accordance with the Office of Environment and Heritage guidelines* - As above, there are no natural terrestrial habitats at the site and no construction works on or near terrestrial habitats, so a formal terrestrial biodiversity assessment is not required. **Section 1.4** page 8.
- *an aquatic habitat assessment in accordance with the Department of Primary Industries Guidelines* - **Section 2** pages 20 to 33.
- *a detailed description of the measures to avoid, minimise, mitigate and offset biodiversity impacts* - **Section 4** pages 34 to 43.

1.1 Gladesville Bridge Marina Present Operations

Gladesville Bridge Marina includes a water-based marina structure and a land-based building, which is located at 380 Victoria Place, Drummoyne within the Canada Bay Local Government Area (LGA). The site is located to the west of the Gladesville Bridge on the southern foreshore of the Parramatta River, is approximately 19,740m^2 in area, comprising an approximate 1,740m^2 land-based component and an approximate 18,000m^2 of lease area, which accommodates the water-based component (slipway, floating marina and swing moorings). An aerial photo of the site is shown at **Figure 1**.

Figure 1: Aerial view of existing Marina in a small embayment west of Gladesville Bridge (NSW SixMap).

GBM's current services and capabilities are as follows:

- Mooring capacity for 99 boats
    - 50 floating berths; berth sizes range from 25' to 75.5' (7.6m to 23m).
    - 44 swing moorings; swing moorings are available for boats, with the most popular lengths from 17' (5.2m) up to 50' (15m), although there is no limit in length.
- Slipway currently used for antifouling, boat surveys and painting.
    - The slipway can accommodate vessels up to 60' (18m) LOA and 16' (5m) beam.
    - Non-flybridge power vessels of up to 40' (13m) are able to be housed in our undercover slipway area for all weather painting and repairs
- Pump out facilities;
- Work berths available for Boat repairs, Shipwright services, Mechanical services

- Tender service operational 7 days a week, transporting customers to and from the marina pontoons to vessels on swing moorings with dinghies availability for after-hours use
- On-shore facilities and services include:
    - Food and beverage kiosk (currently machine based)
    - New and used boat sales
    - Charter operation (back-of-house).

1.2 GBM Proposed Development

The proposed development constitutes alterations and additions to the existing Marina floating berths, on-shore maintenance facilities, and car parking. **Figure 2** shows the proposed floating marina reconfiguration. Specifically, the proposed development includes the following elements:

- Reconfiguration of the marina berth layout including
    - Removal of 29 swing-moorings and retention of 15 moorings
    - Construction of 65 new floating berths of varying sizes, increasing from a total of 50 to 115 floating berths
- Cessation of slipway activities.
- Demolition of slip rails and demolition of the internal office mezzanine structure within the covered slipway area.
- Provision of eight car parking spaces within the existing slipway structure.

As the proposed development constitutes a 'Marina', with an intended capacity of more than 15 vessels having a length of 20 metres or more, and an intended capacity of more than 80 vessels of any size, it is classified as 'Designated Development' under Schedule 3, Clause 23 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation).

With regard to the existing and proposed Marina facilities:

- Current marina depths range from -3m to -5m below lowest astronomical tide (LAT) for the inner (southern) marina arm and berths, and -5.5m to -8m for the outer (northern) marina arm and berths.
- There are a series of shallow inshore berths offshore from the slipway, depths generally -1m to -2m LAT.
- Depth ranges for proposed new floating pontoons and berths are consistent with the existing structure; -3 to -4.5m depth LAT for the inner arm and -5.5m to -9m depth for the outer arm.

Figure 2: Proposed Floating Berth Marina (black outline) superimposed over existing marina configuration. Hydrographic survey detail has been added (datum 0m Fort Denison which is approximately Indian Spring Low Water ISLW.

1.3 Available Information on Terrestrial and Aquatic Habitats and Condition

The current and proposed marina footprint comprises almost100% impervious surfaces and built structures with a concrete base for the marina driveways, parking, buildings, hardstand and above water plus intertidal slipway. There are two concrete encased planter sections along the road frontage of the marina that support a variety of ornamental plants.

The aquatic ecological communities bounding the shorelines of the Gladesville Bridge Marina are shown on Map 6 for the *Harbour Foreshores and Waterways Area Development Control Plan 2005* (DCP), a portion of which is shown here in **Figure 3**. There are two identified aquatic habitats indicated in the vicinity of the Gladesville Bridge Marina; "mudflat" habitat (light yellow) occurring inshore from the existing and proposed marina, and an area of "mixed rocky intertidal and sand" (light purple) around the eastern perimeter of Five Dock Point.

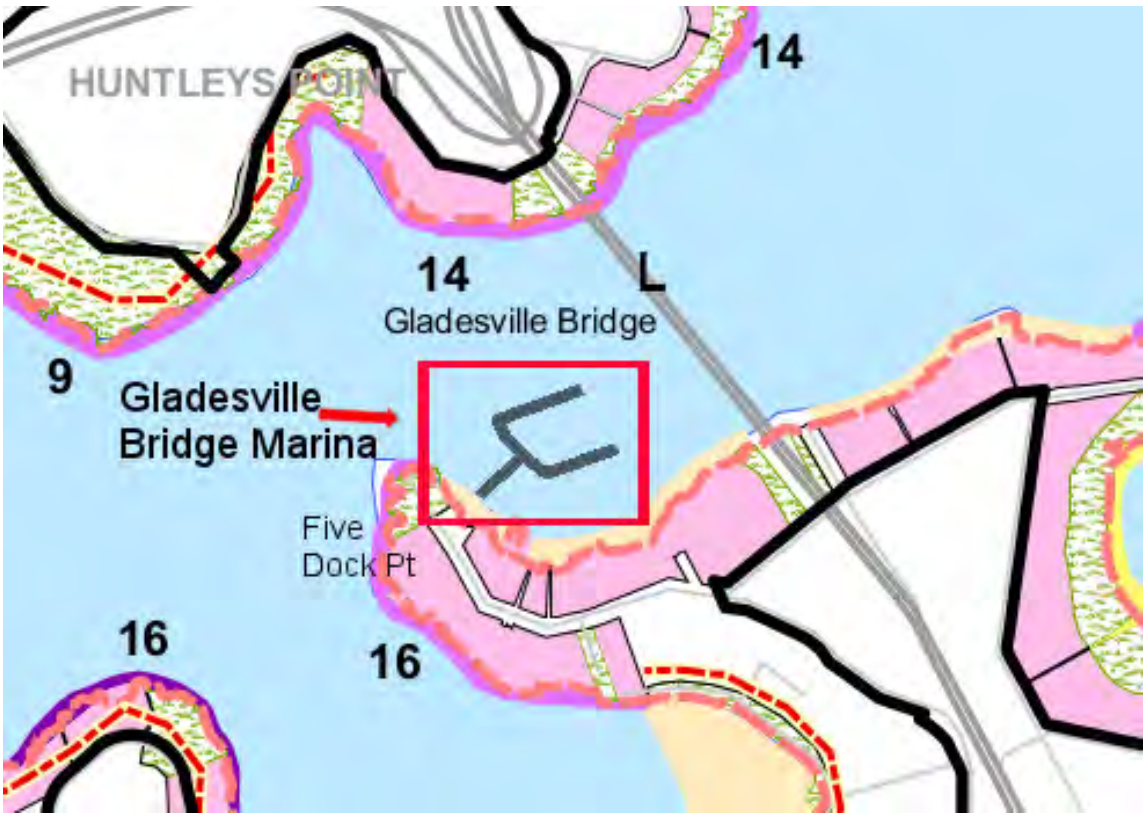

Figure 3: Portion of the DCP Map 6 for the Parramatta River showing "*mudflats*" habitat along the shoreline to the south and east of the marina (light yellow), "*mixed rocky intertidal and sand*" (light purple) to the west of Five Dock Point and along the northern bank, plus "*rock intertidal and rock platform*" habitat (dark purple) to the west of the development site.

Sheet 5 for the *Sydney Regional Environmental Plan Sydney Harbour Catchment 2005* (SREP Sydney Harbour) indicates a continuous band of designated 'wetland' along the southern shoreline of the Parramatta River from Five Dock Point to east of the Gladesville

Bridge (**Figure 4**). Mapping by NSW Department of Primary Industries Fisheries Branch (DPI Fisheries) indicates that there is no estuarine vegetation (seagrasses, mangroves or saltmarsh) in the existing or proposed marina footprint, or in nearby shoreline locations between Five Dock Point and the Gladesville Bridge (**Figure 5)**.

Figure 4: Portion of SREP (Sydney Harbour Catchment) Wetlands Protection Area Sheet 5 showing designated 'wetland' areas (green) in proximity to the Marina.

Figure 5 Portion of NSW DPI (Fisheries) estuarine vegetation map 39a showing proximity of closest mapped estuarine vegetation; Zostera (light blue), mixed Zostera/ Halophila (dark blue) and mangroves (green).

The closest mapped estuarine vegetation includes small patches of *Zostera* and mixed *Zostera*/ *Halophila* plus mangroves along the eastern shoreline of Five Dock Bay (to the west), and a patch of *Zostera* along the shoreline in Drummoyne Bay (to the east). It is therefore concluded that the "wetland" designation shown in **Figure 4** is inferred to be marine algae on inter and sub-tidal rocky substrates.

With regard to intertidal marine vegetation there are no mangroves or saltmarsh indicated on the vegetation surveys prepared by Allen et al (2007) and Kelleway et al (2007).

W.S. Rooney & Associates undertook an aquatic ecological assessment for a proposed extension to the Gladesville Bridge Marina by the former proprietor, and the report findings were included in the Statement of Environmental Effects (SoE) Report prepared by Hyder Consulting (1999). This included and literature review and field investigation of the shoreline and aquatic habitats (by SCUBA) bounding the Gladesville Bridge Marina facilities. The report provided the following summary of the aquatic ecology aspects relevant to the current proposal:

- Piles and pontoons were colonised by mussels (*Mytilus galloprovincialis*), epiphytic algae and bryozoans.
- There were abundant burrows in the soft muddy sediments underneath the marina pontoons, which were associated with polychaete worms, snapping shrimps and Callianassid shrimps, burrowing anemones, crabs and gobies.
- There was a thin (5mm) layer of well aerated sediments overlying anoxic black sediments in both the existing marina location and the proposed extension area.
- There were no seagrasses, kelp (*Ecklonia radiata*) or other macroalgae in the vicinity of the existing marina, nor were there mangroves or other vegetation along the shoreline adjacent to the marina (the only mention of marine or estuarine vegetation was of *Ulva* and *Enteromorpha* on sandstone bedrock).

Marine Pollution Research Pty Ltd (MPR 2006) provided an aquatic ecology constraints and opportunities study for the former owners of the Gladesville Bridge Marina. This included a preliminary aquatic ecology assessment of the inshore habitats bounding the marina. The report noted the presence of macroalgae species inshore of the marina on rock rubble and bedrock platforms, and kelp plus *Sargassum sp* on the slipway rails, plus a small patch of *Halophila* inshore near the base of the slipway.

Marine Pollution Research Pty Ltd (MPR 2015) undertook diver-based surveys of aquatic habitats in the intertidal plus shallow in-shore waters and seabed at Five Dock Point and Huntleys Point, for a proposed optical cable laying project across the Parramatta River. The report provided detailed descriptions of the aquatic habitats along the proposed cable route and associated fauna and flora communities:

- There is intertidal and sub-tidal rock reef (natural reef and on the sides of the sandstone bridge revetments) on both sides of the river, which at the time of inspection supported a variety of epifauna including barnacles, molluscs, tubeworms, ascidians, bryozoans and sponges.

- There was a macroalgae zone between -1.5m and -4m depth LAT that supported *Sargassum sp* and kelp as dominant canopy species and a variety of smaller algae plus encrusting fauna.
- The seabed beyond the rocky reef did not support any marine plants.

Neither of the MPR studies found or reported any seagrass from the areas surveyed and neither study found any *Caulerpa taxifolia,* which is a listed pest algae species known from elsewhere in Sydney Harbour.

1.4 Protected and Threatened Species, and Endangered Ecological Communities

Aquatic habitats, flora and fauna of conservation significance are protected under both State and Federal legislation. In NSW, threatened species, populations and ecological communities of animals and plants are protected under the *Biodiversity Conservation Act 2016* (BCA). Threatened species, populations and ecological communities of fish and marine vegetation are protected under the *Fisheries Management Act 1994* (FMA). The BCA and FMA also list a number of key threatening processes that may threaten the survival of species, populations and ecological communities. The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) protects wetlands of international importance, Commonwealth Marine Areas, nationally threatened species and ecological communities and migratory species, nuclear actions and world and national heritage places.

The FMA, BCA and EPBC Act require that any proposed activity be assessed with respect to its potential impact on species or ecological communities listed as threatened under the Threatened Species Schedules of the Acts or listed as migratory species under the EPBC Act. **Annexure A** provides a table of threatened marine species, endangered marine populations and protected marine fish species known, presumed extinct or that could occur in the location of the proposal. The list is derived from searches of the relevant agency data-bases of listed species; Office of Environment and Heritage (OEH) *Bionet Atlas of NSW Wildlife* and the Commonwealth Department of the Environment *Protected Matters Search Tool*. Note that as per Bionet requirements, the minimum search area is a 10km square.

1.4.1 Listed and Protected Fish and Sharks

The FMA and EPBC Act list a number of marine and estuarine shark and teleost fish species as Vulnerable Species under Schedule 5 of the Act. Syngnathiformes (seahorses, sea-dragons, pipefish, etc) are protected under the EPBC Act and the FMA:

- Given the distance upstream from the estuarine mouth it is considered that listed Grey Nurse and Great White shark species would not be expected to penetrate this far up the river.

- Of the remaining species known from Sydney Harbour, suitable habitat for Black Rock Cod *Epinephelus daemelii* is found in the lower and mid estuary but is unlikely to occur in the Parramatta River at this locality. Notwithstanding, a specific search was made for Black Rock Cod, particularly juveniles and subadults (which are more likely to occur in estuaries), with the main search concentrated within and around the areas of inter to sub-tidal inshore rock rubble, reef and seawalls at the locality.
    - There was no suitable rock habitat, rock crevice, overhang or cave habitat for adult Black Cod in the locality, and no specimens of Black Cod were observed during the field work for this study.
    - It is considered that whilst the rock rubble habitat does not provide shelter and feeding habitat for juvenile Black Cod, the small seagrass beds may do so, and juvenile Black Cod could be expected to occur as rare transients in the area from time to time.
- Of the 31 species Syngnathiformes known from East Coast Australian waters, three of these species, (White's seahorse *Hippocampus whitei*, Coleman's Seahorse *Hippocampus colemani* and the pygmy pipehorse *Idiotropiscis sp.*), are endemic to NSW. White's seahorse is common in the lower estuary and has been found up to at least the Balmain Peninsula. Pipe fish are common in seagrass beds:
    - Specific searches were made for Syngnathids in the rock rubble habitats (attention was given to Kelp holdfasts), with particular reference to White's seahorse, but none were found. Based on the observed overall low density and shallow locations of the kelp habitats, sea-horses are not expected.
    - There were no pipefish observed in the seagrass patches and whilst the habitats are suitable, it is considered unlikely that they would occur in the study area given the small size of the fragmented patches.
- Of the three seagrass species known from Port Jackson estuary, *Zostera capricorni* and *Halophila ovalis* are both protected under the FMA and *Posidonia australis* seagrass is listed under both the FMA and the Commonwealth EPBC Act as an *Endangered Ecological Community* in Port Jackson. No *Posidonia* seagrass was found at the site and it is not expected this far up stream.

1.4.2 Other Listed or Protected Species

Various listed cetaceans (whales and dolphins), marine mammals (seals and sea lions), marine reptiles (turtles and sea-snakes) and sea-birds (migratory ocean birds and waders) are known from the outer Sydney Harbour and are known to penetrate the harbour to and beyond the study area, albeit rarely.

The Bionet search for Sydney Harbour (see **Annexure A** for species maps, figures and tables) indicated eight marine species listed under the *Biodiversity Conservation Act* (BCA); three Endangered species (Loggerhead Turtle, Australasian Bittern and Little Tern), four Vulnerable species (Australian Fur Seals, Black Bittern, White-Bellied Sea-Eagle, Eastern Osprey) and Little Penguins belonging to the Manly Endangered Population. The listed marine species prefer open water or coastal habitats and are generally found on the coastline rocky shores around the harbour entrance or in the outer harbour waters. Little Penguins are observed fishing and feeding throughout the harbour, but are not expected and rarely seen this far up stream.

There were four additional Vulnerable species identified from the Bionet search that are known to frequent hanging structures (roosting sites under bridges and wharves/ jetties); Eastern Freetail Bat, Little and Eastern Bentwing Bats and the Southern Myotis. The only possible structures that could provide suitable habitat form bat within the footprint of the proposal are the Gladesville Bridge arches. Inspections were made for bat droppings and any other indications of roosting birds or bats on the ground under the arches but none were observed. or found.

It is concluded that of the listed or protected marine species that may occur in the vicinity of the site, none would be utilising the resources of the site to any great extent and would generally be in the locality as transients or opportunistic feeders.

None of the species identified in the Bionet searches occur within the Gladesville Bridge Marina proposal study area. The site does not provide any undisturbed intertidal rock reef habitat for seabird roosting or shore bird feeding and is considered unlikely that wading bird species would utilise the shoreline habitats given the level of urbanisation and disturbance of the area.

It is concluded that there are no threatened species or EECs residing or found within the locality of the Gladesville Bridge Marina site and the site does not constitute specific habitat for other threatened aquatic species as listed under the FMA, BCA and EPBC Acts.

2 AQUATIC HABITATS AND ECOLOGY

A diver based aquatic ecology survey of the intertidal plus shallow in-shore waters and seabed extending out to the area under the footprint of the proposed marina was undertaken over two days; 16th and 17th May 2019. Weather conditions were sunny with very little wind, and generally good visibility on both days:

- Five shore-normal transects were established along the shoreline, to investigate depth zonation of habitats,
- Dive inspections were made of the available natural and built structures (seawalls, piles, pontoons and mooring ropes) to describe these habitats and their utilisation by marine biota.

The main aquatic habitats within the marina footprint are shown in **Figure 7.** Descriptions of the main aquatic habitats are provided below in **Sections 2.2 and 2.3,** and additional site photos are provided in **Annexure B)**.

2.1 Main Aquatic Habitats

Intertidal to sub-tidal rocky Shoreline from Five Dock Point east to Gladesville Bridge Marina:

- There is a sandstone seawall around the northern limits of Five Dock Point that extends down to the intertidal. This is built on a natural basement sandstone bedrock outcrop which forms a continuous intertidal to sub-tidal rocky reef shoreline that extends around the base of Five Dock Point to Gladesville Bridge Marina, reaching depths of around 3.0m below 0m LAT to the east of Five Dock Point.
- A sandy pocket beach exists along the foreshore adjacent to the facilities
- There is intertidal to sub-tidal sandstone rock rubble (dominated by large (>200mm) sandstone rocks) situated around the rocky outcrop on the north-eastern side of Five Dock Point swith additional sub-tidal rock rubble extending offshore from the sandy beach.
- The riparian vegetation around Five Dock Point comprises Casuarina trees, a Moreton Bay Fig with the understory dominated by asparagus weed and some exotic grasses.
- There is a mixed concrete and sandstone block seawall around the land-based facilities of the Gladesville Bridge Marina with a narrow intertidal rock rubble toe. The operational slipway is a sloping concrete structure with attached slip rails and some isolated rock rubble around the toe of the slipway.

Figure 7: Main intertidal to shallow sub-tidal aquatic habitats bounding Gladesville Bridge Marina. The offshore habitat is bare sediment.

Intertidal and sub-tidal Rocky Shoreline east of the Gladesville Bridge Marina to Gladesville Bridge:

- The mixed sandstone block and concrete intertidal seawall with short sub-tidal rock rubble toe extends to the east along the foreshore (spanning the waterfront residential properties) with private jetties and associated pontoon structures.
- There are sections of exposed basement sandstone rock platforms along much of the shoreline to the east. The rock platforms are mostly flat with varying degrees of cover by sand and shell deposits offshore.
- Between the Gladesville Bridge Marina and the Gladesville Bridge, the lower intertidal to shallow sub-tidal foreshore toe offshore from seawalls or basement rock outcrops comprises rock rubble overlying sandy sediments.
- The majority of jetties along the foreshore to the east of the Gladesville Bridge Marina are located over rock rubble toe habitat.
- The foreshore bounding the Gladesville Bridge (the eastern and western sides) consists of a steeper profile sandstone bedrock and boulder intertidal and sub-tidal rocky reef. The riparian vegetation consists of Jacaranda (*Jacaranda mimosifolia*), sweet pittosporum (*Pittosporum undulatum*), date palm (*Phoenix canariensis*) and Moreton Bay Fig, with Asparagus weed prevalent throughout the understory.

Sandy sediment habitats:

- There are a series of small intertidal pocket beaches comprising shallow sandy sediments overlying sandstone bedrock platforms. The main extent of sandy beaches includes the area to the west of the Gladesville Bridge Marina and those bordering the properties to the east of the Gladesville Bridge Marina; each of these beaches are contained by constructed seawalls in the mid to upper intertidal zone.
- On the eastern-most sandy beach there is an exposed old concrete boat ramp which is covered with sand in its upper portion.
- The beaches and shallow sub-tidal sand habitats along the shoreline from Five Dock Point to Gladesville Bridge were comprised mostly of silty sand with localised sections of abundant shell material (mostly oysters, mussels and cockle fragments).

2.2 Aquatic Biota of the Hard Substratum Habitats

The aquatic ecology of the rocky shorelines, seawalls and rock rubble reefs described above are summarised as follows:

Mid to upper intertidal portions of rock platforms, seawalls and rock rubble:

- The mid intertidal seawalls and natural rocky substrates (bedrock platforms, boulders and rubble) supported a distinct band of rock oysters (see **Figure 8** below) along most of the foreshore, at heights ranging between 0.7m and 1.5m above 0m LAT.
- Only Sydney Rock Oysters (*Saccostrea glomerata*) were observed and there were no Pacific Oysters (*Crassostrea gigas*), which are known from Sydney Harbour. Oyster density was generally greater in the protected areas on vertical seawall faces. There were several sections of wave-exposed seawall and bedrock platforms that were bare or supported sparse oyster growth, and this was presumably due to the effect of wave action from the Rivercat Ferries which traverse this section of the Parramatta River adjacent to the proposal.
- Barnacles and the periwinkle *Bembicium auratum* were present on rock surfaces in the upper intertidal and extending above the oyster zone, but were generally sparse.
- Coralline algae (*Corallina officinalis*) forming turf mats were prominent on intertidal hard substrata, particularly horizontal bedrock platforms and the concrete boat ramp (see **Figure 9** below) at 0.4 to 1.0m above LAT.

Figure 8: Oyster growth on seawall (left) and on rock rubble around the sandstone rock platform adjacent Five Dock Point (right).

Figure 9: Turf algae growth on rock platforms (left) and underneath oyster band on vertical seawall (right).

- Cunjevoi (*Pyura praeputialis*), mussels and small amounts of green algae (*Ulva sp*) were also found within the lower intertidal, however were more commonly observed growing on vertical seawalls and boulder rubble habitat. Nearly all the cunjevoi and mussels were covered in coralline algal growth plus silty particulate matter along most of the shoreline in the study area.
- Much of the intertidal and shallow sub-tidal habitats were subjected to frequent siltation during the field inspections, with regular re-suspension of silt caused by Rivercat wave energy.

Hard substratum shallow sub-tidal fringe extending to sub-tidal rock reef and rubble:

- Rocky reef and rubble toe habitats in the low intertidal and shallow sub-tidal fringe habitats supported a mixture of encrusting and frondose algae species, including coralline algae, *Sargassum sp, Padina sp,* kelp and *Dictyota dichotoma* (see **Figures 10 and 11** below).

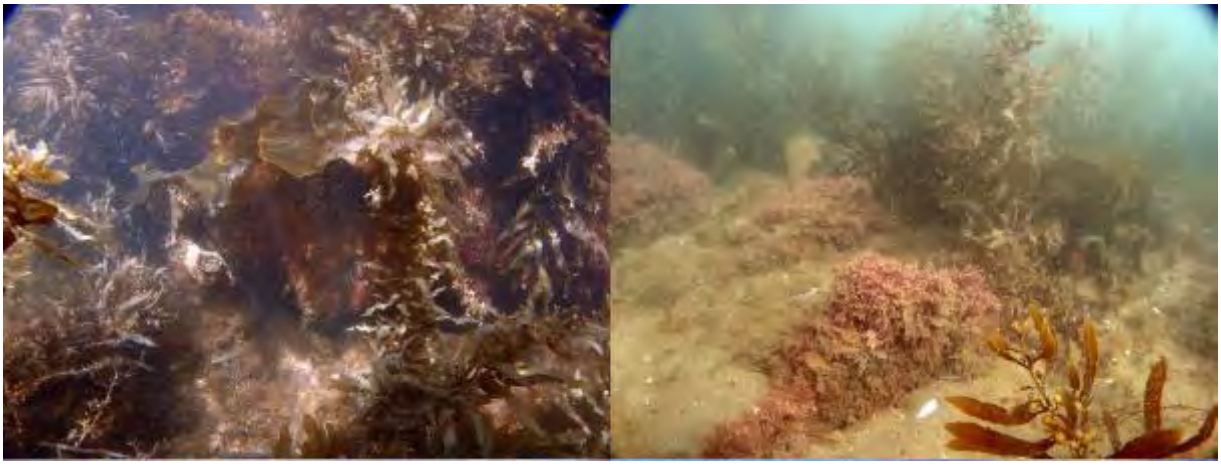

Figure 10: Shallow sub-tidal to sub-tidal sandstone boulders with kelp and sargassum sp (left), and rock rubble with coralline algae, *Sargassum sp*, kelp and *Dictyota* (right).

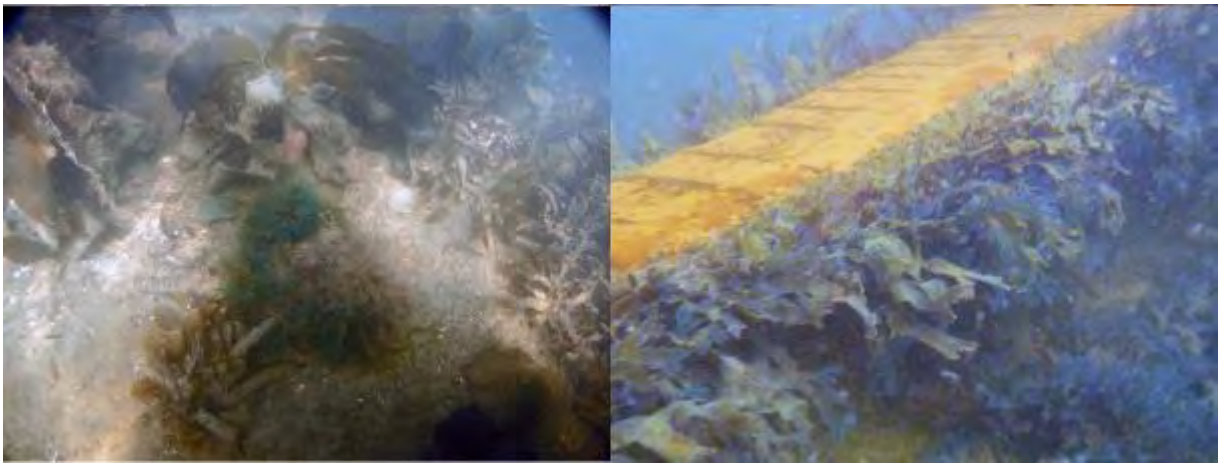

Figure 11: Shallow sub-tidal to sub-tidal hard substratum habitats; rock rubble with *Sargassum sp,* kelp and *Dictyota* (left) and *Dictyota* growth on slipway rails (bottom right).

- *Dictyota* was the dominant algae growing on slipway rails.
- The sub-tidal rock reef and rubble aquatic biota assemblages are dominated by brown macro-algae taxa; kelp and *Sargassum* species. The other taxa recorded from sub-tidal rocky substrates included *Padina*, coralline algae and *Dictyota* but were less commonly encountered.

Marina and private jetty hard substrata (piles and floating pontoons):

- The private jetty and marina piles supported a range of encrusting fauna and flora. As for the shoreline rocky substrates, the wetted surfaces of the support piles supported a distinct band of oysters in the mid intertidal range with sparse barnacle growth higher up in the tidal range.
- There were less distinct zonation patterns observed with encrusting fauna below the oyster band. The lower intertidal to subtidal (pile base) pile surfaces supported a variety of encrusting biota including mussels, ascidians (*Herdmania momus* and *Botrylloides sp*), bryozoans (*Watersipora arcuata*), sea urchins (*Holopneustes sp*) and sponges, most of which was covered in coralline and fine algae.
- Whilst Kelp and *Dictyota* growth occurs throughout the depth range of the existing Gladesville Bridge Marina piles, densities were generally sparse compared to rocky substrates along the shoreline. The deeper piles on the outer side of the marina either had no or very small amounts of kelp compared to the inshore shallower piles adjacent to rocky substrates that supported kelp.
- The wetted sides of floating pontoons supported dense growth of taxa also found on piles; kelp, coralline algae, *Dictyota* and *Ulva* were common for most of the pontoons inspected. Pontoon sides also supported a variety of encrusting fauna such as mussels, ascidians and sponges.
- There were higher densities of kelp found on the pontoons inshore, bordering rocky substrate habitats that are colonised by kelp.
- Pontoons further towards the southern shore in shallower waters supported little kelp with only small amounts of *Padina* and *Sargassum*.
- For the most part, mooring ropes were generally devoid of encrusting fauna and flora. For those that supported growth, *Hermania*, *Dictyota*, mussels and decorator crabs (family Majidae) were noted, and most of the mooring ropes were covered in short filamentous algae and silt.

2.3 Aquatic Biota of the Sandy Substratum Habitats

The deeper sub-tidal soft sediment habitats around the marina structure and towards the Gladesville Bridge comprised soft silty sand with coarse shell fragments at varying depths (from the surface to around 30cm depth). There were localised areas with numerous yabby holes observed (see **Figure 12**):

- A single yabby (family Callianassidae) and polychaete worm (*Chaetopterus sp*) were recovered from the sediment sample cores, and blue swimmer crabs (*Portunus pelagicus*) were observed during field surveys in sub-tidal open sandy sediment habitats.
- There were four small patches (maximum bed size of around 9m^2) of *Zostera capricorni* seagrass growing in silty sand near the sandy beaches and although the beds were isolated, plant growths were moderately dense with some long leaf forms (15-30cm leaf length; see **Figure 12**).
- Paddleweed *Halophila ovalis* was observed in several locations. Most of the observations were of very sparse, stunted growths smothered in silt however there was one bed observed near the slipway that supported dense growth (see **Figure 13)**.
- No *Zostera* seagrass beds were located under or near the proposed marina footprint.
- A specific search was made for the listed pest algae species *Caulerpa taxifolia* which is reported from Sydney Harbour, but none was found in the Gladesville Bridge Marina study area.

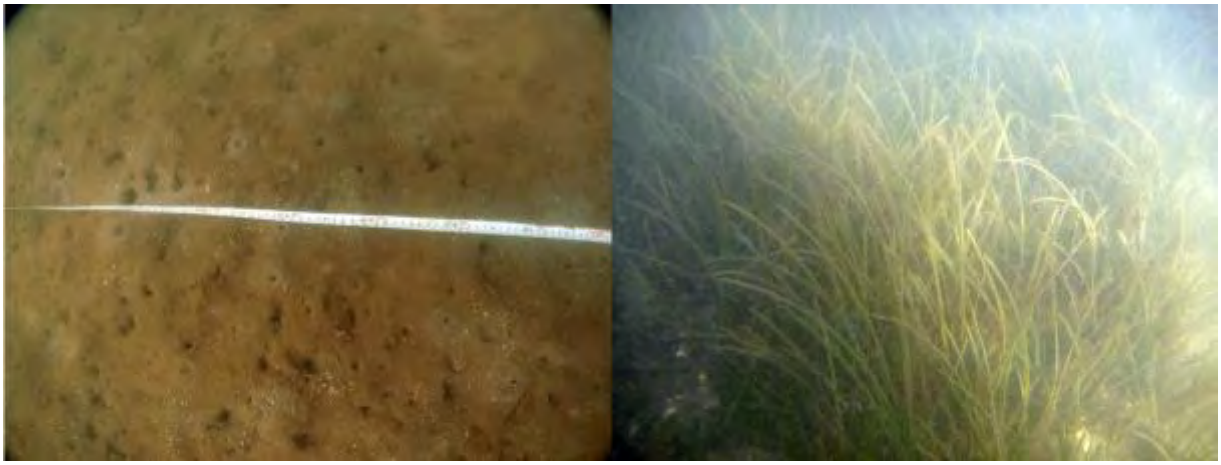

Figure 12: Sub-tidal sandy sediments showing infauna burrows (left) and *Zostera* seagrass beds (right).

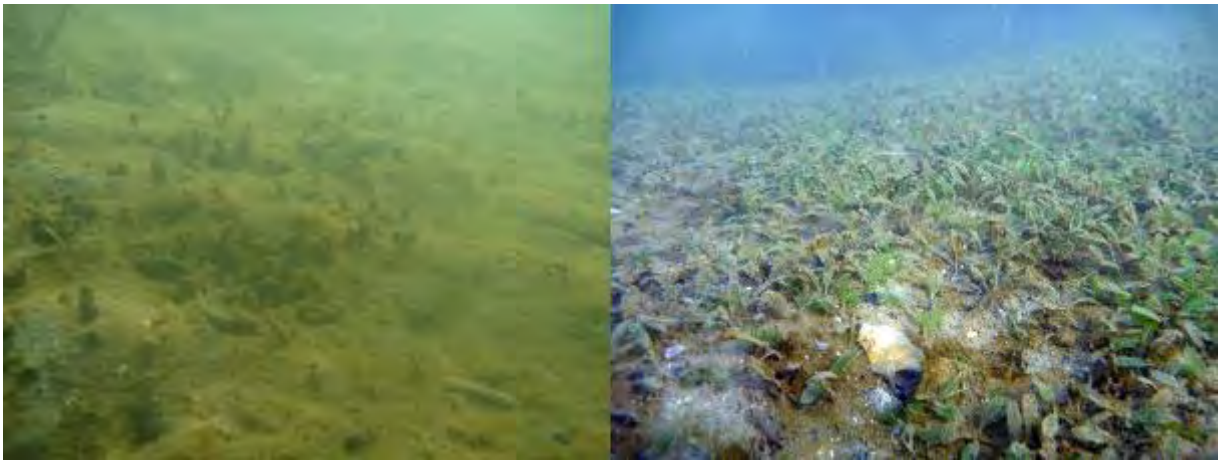

Figure 13: Sparse *Halophila* covered in silt (left) and dense patch near the slipway (right).

With respect to the other specific requirements of NSW Fisheries and of Roads and Maritime Services:

- There were no mangroves or saltmarsh along the foreshore or in the vicinity of the proposed marina.
- With regards to commercial fishing; there has been a ban on commercial fishing operations in Sydney Harbour estuary since 2006 and consequently, the proposal does not have any impact on commercial fishing operations or aquaculture.

2.4 Key Fish Habitat Assessment

With regard to the Fisheries NSW waterway classification scheme as shown in Table 2 of the revised Policy and Guidelines document (NSW Fisheries 2013), the Parramatta River is a Class 1 "Major key fish habitat" (KFH) by virtue of it being an estuarine waterway. In terms of the sensitivity classification of the specific habitats within the Gladesville Bridge Marina Study area (as defined in Table 1 of Fisheries NSW 2013), the following key points are made:

- The small patches of *Zostera* and *Halophila* (**Figures 12 and 13**) are classified as Type 1 "highly sensitive KFH" as patch sizes are greater than $5m^2$. The *Zostera* patches are located inshore and more than 65m from the existing (and proposed) marina berths. The *Halophila* patches are close to the existing and proposed marina infrastructure.
- The inshore rocky reef and rubble habitat inshore of the marina is Type 2 "moderately sensitive KFH" by virtue of the presence of the macroalgae species *Ecklonia* (kelp) and *Sargassum sp*. *Dictyota*, observed on the slipway and throughout the rocky substrate habitats, whilst not specifically named in the guidelines, is considered part of the "marine algae" Type 2 habitat description.
- The un-vegetated silty-sand and shell habitat offshore from the inshore rocky rubble reef habitat (is Type 3 "minimally sensitive") KFH.

2.4.1 Fisheries Management Act Permit Requirements

Part 7 of the Fisheries Management Act 1994 (FMA) sets out the conditions under which permits are required for various construction activities, and the conditions under which a permit may be granted are specified in the Fisheries NSW Policy and Guidelines (NSW Fisheries 2013). With respect to estuarine activities, permits are required *inter alia* for the "*taking or harming of marine vegetation*" or for "*reclamation or dredging works*".

There are no dredging or reclamation works required for the proposal and the only direct loss of marine algae will be due to removal of marina structures; piles and pontoons plus

slipway rail infrastructure, however this is considered negligible due to the amount of similar habitat that will be created in the proposed marina expansion. Accordingly, it is concluded that it is unlikely that the proposal would require a permit from DPI (Fisheries) under the FMA.

3 WATER QUALITY AND SEDIMENT SAMPLING

Water quality and sediment sampling programs were initiated to meet the obligations of aquatic habitat impact assessment outlined in the SEARs. The aim of the sediment sampling for the aquatic ecology program was to compliment contamination sampling being undertaken by others in regard to slipway removal in order to understand the potential impact of vessel disturbance of inshore sediments. Sample methodology for both monitoring programs are detailed in **Section 3.1**. **Annexure C** contains the full results from metered water quality profiling and water quality laboratory results. Sediment sampling lab results and core photos are provided in **Annexure D**. Water quality and sediment results are summarised in **Sections 3.2** and **3.3** below.

The locations of water quality and sediment sample sites are shown below in **Figure 14**. In total, there were twelve water quality monitoring sites (four each of river (R), middle (M) and inshore (B) locations), and eight sediment sample sites along the inshore waters from Five Dock point south and east towards the Gladesville Bridge.

3.1 Water quality and Sediment Sampling

A water quality monitoring program was initiated to establish existing conditions using copper as a surrogate for antifouling contaminants, and is designed to be used as a baseline for comparison with construction and operational monitoring periods. The water quality monitoring program involved the following elements;

- Sampling of surface and bottom waters from up to 12 locations bounding the study area over three events; neap dry, spring dry and wet weather conditions (see **Figure 14** for site locations).
- Water samples were analysed for total suspended solids (TSS), Copper and dissolved organic carbon (DOC).
- Depth profiling of water quality was undertaken using a submersible Yeo-Kal 915 water quality data logger which records water depth, temperature, dissolved oxygen concentration and saturation, pH, conductivity and turbidity.

At the time of report production (October 2019) the Dry Neap Tide and Wet Weather Sampling had been completed with the Spring Dry sampling still to be undertaken

Figure 14: Site figure showing locations for water quality and sediment sample sites. Note the footprint of the proposed marina (black outline).

Sediment sampling was designed to supplement the contamination survey work being done around the slipway (EIS Contamination Report Appendix G), in order to determine the potential impacts of propeller wash or grounding of vessels inshore. Sediments were collected from eight inshore locations (**see Figure 14**) by divers, using a 100mm diameter by 500mm length corer. Sample analytes are shown below in **Table 1**. Samples were analysed for a range of metals and for Total Organic Carbon, following a recommendation by Birch and Olmos (2008) who found that the correlation between three metals (Copper, Lead, and Zinc) with other contaminants, including Organochloride pesticides (OCPs), Polychlorinated Biphenyls (PCBs) and Polynuclear Aromatic Hydrocarbons (PAH), from 103 sites in Port Jackson and nearby estuaries was significant ($r^2 = 0.63$, $p < 0.05$), and concluded that sediment-bound heavy metals data can provide the spatial extent and magnitude of chemical change, as well as the risk of biological stress attributable to contamination in estuarine ecosystems. Total Organic Carbon was included as an analyte, as organic carbon strongly binds organic contaminants (ANZECC 2000).

Table 1 GBM Sediment Sample Schedule

Site	PSA Sieve	Tot Metals	TOC
Samples	90	50	24
S1-S	1	1	1
S1-B	1	1	1
S2-S	1	1	1
S2-B	1	1	1
S3-S		1	
S3-B		1	
S4-S	1	1	1
S4-B	1	1	1
S5-S		1	
S5-B		1	
S6-S	1	1	1
S6-B	1	1	1
S7-S		1	
S7-B		1	
S8-S	1	1	1
S8-B	1	1	1

For each site, the corer was inserted to a minimum depth of 400mm into the sediments, before capping and processing in the survey vessel. If the substrate was impenetrable (i.e. due to bedrock or coarse shell fragments), the site was relocated at distances of 50cm until minimum core depths were able to be retrieved. For each core sample, the core was carefully eased out into a tub, measured and photographed, then divided into two equal sub-samples (surface and bottom) which were homogenised to form composite samples. Site details were recorded; depth and time of sampling, site co-ordinates and core integrity.

3.2 Water Quality Results

Annexure C provides details of water quality sampling, all metered water quality results and laboratory analysis reports. and the results are summarised in the sub0sections below.

3.2.1 Dry Neap Tide Sampling

Initial dry weather neap tide sampling was undertaken on 1st May 2019 and there had not been any rain in the locality for 26 days (see **Table C1** in **Annexure C**). Sampling was done from 11:18 to 12:22 around a Neap low Tide of 0.53m at 12:14. The corresponding high tides were 1.54m at 05:51 and 1.52m at 18:30; a tidal range of ± 1m.

Full profile metered water quality data are provided in **Annexure C** and summary physical and chemical water quality results are presented below in **Tables 2 and 3** respectively. Note that SCUBA diver sampling of bottom waters for chemical analysis was curtailed for the dry weather neap tide event due to excessive surface fish activity and the consequent potential for interaction with sharks, and as such only five of the eight sites were able to be sampled for bottom waters.

Table 2 Gladesville Bridge Marina Summary Metered Water Quality 1st May 2019

Site group		Temp °C	Cond (ms/cm)	Sal ppt	DO % sat	DO mg/L	pH units	Turb NTU
R1-R4	Min	21.0	53.2	35.1	78.9	5.7	7.7	3.9
	Max	21.1	53.5	35.3	80.6	5.9	7.8	8.7
	Mean	21.1	53.3	35.1	79.5	5.8	7.7	5.6
	SD	0.0	0.1	0.1	0.4	0.0	0.0	1.1
M1-M4	Min	21.1	53.2	35.1	80.1	5.8	7.8	3.1
	Max	21.1	53.5	35.3	83.1	6.0	7.8	6.7
	Mean	21.1	53.3	35.2	81.1	5.9	7.8	4.3
	SD	0.0	0.1	0.0	0.7	0.1	0.0	0.9
B1-B4	Min	21.1	38.8	24.7	79.8	5.8	7.8	2.5
	Max	21.1	53.5	35.3	88.2	6.5	7.8	23.1
	Mean	21.1	52.9	34.9	81.2	5.9	7.8	4.4
	SD	0.0	2.6	1.9	1.4	0.1	0.0	3.5

Table 3 Gladesville Bridge Marina Neap Dry Water Quality Results 1st May 2019

Analyte	Units	LOR	R1	R2		R3	R4	M1	M2		M3	M4		B1	B2		B3	B4	
			S	S	B	S	S	S	S	B	S	S	B	S	S	B	S	S	B
TSS	mg/L	1	3	3	2	3	<1	2	1	2	<1	3	3	3	3	<1	<1	4	3
Copper	µg/L	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
DOC	mg/L	1	<1	2	1	1	1	1	1	1	1	1	<1	1	1	1	1	1	1

Notes: DOC = Dissolved organic carbon, S = surface sample, B = bottom sample.

For the most part there were no major differences between surface and bottom readings within sites or between sites for physical water quality parameters, indicating adequate mixing within the water column. The only anomaly was the surface reading at B4 which recorded a much lower salinity (24.7 ppt), highest turbidity (23.1 NTU) and highest TSS value (4mg/L) value. There were no obvious irregularities (e.g. water plumes), stormwater discharges or observations noted at the time of sampling and this result was presumably due to a localised freshwater discharge of vessel water or runoff from a waterfront point source discharge. For the remainder of water quality profiles undertaken on 1st May 2019, the water quality results are summarised as follows:

- Water temperatures were similar with a range of 21.0 to 21.1°C.
- Salinity and the dissolved oxygen values were similar throughout the depth profiles ranging between 35.1 and 35.2 ppt and 79.8% and 82.5% saturation respectively.
- Water pH was uniform throughout the survey (7.7 to 7.8 pH units).
- Water turbidity was low with an overall mean (± standard deviation of SD) of 3.8 ± 0.8 NTU, indicating generally clear waters at all sites. This was reflected in TSS results with most results at or below 3mg/L.
- Both Dissolved copper and DOC were low and uniform across sites and with depth.

3.2.2 Wet Weather Sampling

Whilst there were several periods of rainfall throughout June, the rain was either recorded over-night or over weekends when sampling for laboratory analysis could not be done, or was generally confined to the coastal fringe with little or no rain in the Parramatta River catchment. July was very dry and the first rainfall event that included more widespread rainfall in the catchment and that could be sampled occurred at the end of August (see **Annexure C** for rainfall and flood water details details).

In the event, as the wet weather prediction was for steady and low intensity but widespread rainfall rather than heavy rain, wet weather sampling was undertaken over two days; initial sampling during the start of river flooding (rising limb, around 15:00 on 29th August) and during the tail of the rain storm the next day (falling limb around 12:00 on 30th August). Accordingly, a set of half the sample sites (see **Figure 14** in main text) was sampled on each day.

Full results of the August 2019 wet weather metered and sampled water quality are provided in **Annexure C**. Summary metered water quality results are shown in **Tables 4 and 5** below, and **Table 6** provides the results of the laboratory analysis of collected water samples.

Table 4 Site Metered Water Quality Statistics - 29th Aug							
Site	Total	R1	R2	M1	M2	B2	B3
Start Time	15:07	15:07	15:20	15:32	15:42	15:50	15:55
Finish Time	15:57	15:12	15:27	15:37	15:46	15:52	15:57
Bottom (m)		9.98	10.76	3.45	5.72	3.28	3.62
Temperature (°C)							
Min	14.78	14.81	14.78	14.80	14.79	14.80	14.79
Median	14.81	14.82	14.81	14.81	14.80	14.81	14.80
Mean	14.81	14.82	14.80	14.81	14.80	14.81	14.80
Max	14.85	14.85	14.82	14.82	14.81	14.82	14.82
Max-Min	0.07	0.04	0.04	0.02	0.02	0.02	0.03
Salinity (‰)							
Min	36.08	36.08	36.10	36.09	36.14	36.12	36.13
Median	36.18	36.17	36.23	36.20	36.24	36.15	36.17
Mean	36.19	36.17	36.23	36.17	36.22	36.15	36.17
Max	36.33	36.25	36.33	36.21	36.27	36.18	36.22
Max-Min	0.25	0.17	0.23	0.12	0.13	0.06	0.09
Dissolved Oxygen (% saturation)							
Min	89.2	90.3	89.2	90.1	89.8	89.9	89.8
Median	90.4	91.3	90.2	90.4	90.3	90.2	90.4
Mean	90.6	91.3	90.5	90.4	90.3	90.1	90.3
Max	92.5	92.4	92.5	90.6	90.8	90.3	90.6
Max-Min	3.3	2.1	3.3	0.5	1.0	0.4	0.8
Oxidation Reduction Potential ORP (mV)							
Min	445	501	479	464	457	451	445
Median	465	506	480	465	458	452	446
Mean	473	507	480	465	458	452	446
Max	516	516	480	466	459	453	447
Max-Min	71	15	1	2	2	2	2
Turbidity (NTU)							
Min	0.00	0.00	0.00	0.10	0.00	0.10	0.10
Median	0.20	0.20	0.15	0.15	0.10	0.20	0.20
Mean	0.28	0.27	0.51	0.22	0.19	0.17	0.21
Max	5.00	0.90	5.00	0.60	0.80	0.30	0.40
Max-Min	5.00	0.90	5.00	0.50	0.80	0.20	0.30
Water Acidity (pH units)							
Min	7.56	7.56	7.94	7.98	7.99	7.96	8.01
Median	7.98	7.80	7.96	7.98	8.00	7.97	8.01
Mean	7.93	7.76	7.96	7.98	8.00	7.97	8.01
Max	8.02	7.89	8.01	8.01	8.01	7.99	8.02
Max-Min	0.46	0.33	0.07	0.03	0.02	0.03	0.01

Table 5 Site Metered Water Quality Statistics - 30 Aug							
Site	Total	R1	R2	M1	M2	B2	B3
Start Time	12:18	12:18	12:26	12:33	12:40	12:45	12:54
Finish Time	12:58	12:23	12:30	12:36	12:44	12:51	12:58
Bottom (m)		9.47	8.44	2.31	6.49	2.76	3.15
Temperature (°C)							
Min	14.46	14.57	14.58	14.66	14.55	14.46	14.58
Median	14.61	14.61	14.59	14.67	14.58	14.63	14.61
Mean	14.61	14.62	14.60	14.67	14.58	14.61	14.61
Max	14.67	14.67	14.63	14.67	14.62	14.66	14.62
Max-Min	0.21	0.10	0.05	0.01	0.07	0.20	0.04
Salinity (‰)							
Min	34.95	35.88	35.74	35.87	35.77	34.95	35.77
Median	35.88	35.99	35.86	35.91	35.84	35.85	35.85
Mean	35.87	35.97	35.83	35.92	35.84	35.76	35.84
Max	36.05	36.05	35.88	35.96	35.91	35.95	35.88
Max-Min	1.10	0.17	0.14	0.09	0.14	1.00	0.11
Dissolved Oxygen (% saturation)							
Min	88.7	90.2	89.8	90.3	89.0	89.2	88.7
Median	90.2	90.6	90.3	90.5	89.3	89.7	89.0
Mean	90.1	90.8	90.4	90.6	89.4	90.1	89.0
Max	92.3	92.0	91.2	92.3	90.1	92.1	89.3
Max-Min	3.6	1.8	1.4	2.0	1.1	2.9	0.6
Oxidation Reduction Potential ORP (mV)							
Min	420	446	445	431	425	420	424
Median	431	446	445	432	426	421	425
Mean	433	446	445	432	426	421	425
Max	447	447	446	432	427	421	426
Max-Min	27	1	1	1	2	1	2
Turbidity (NTU)							
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.10
Median	0.10	0.10	0.15	0.10	0.20	0.10	0.10
Mean	0.17	0.15	0.19	0.09	0.31	0.10	0.17
Max	2.00	0.50	0.50	0.20	2.00	0.30	0.30
Max-Min	2.00	0.50	0.50	0.20	2.00	0.30	0.20
Water Acidity (pH units)							
Min	8.00	8.00	8.06	8.07	8.06	8.07	8.06
Median	8.07	8.02	8.08	8.07	8.07	8.08	8.06
Mean	8.06	8.02	8.08	8.07	8.07	8.09	8.06
Max	8.13	8.06	8.09	8.08	8.08	8.13	8.06
Max-Min	0.13	0.06	0.03	0.01	0.02	0.06	0.00

The 29th August rising limb sampling was undertaken on a 1.96m flood tide at about half tide (±1m), with a very thin lower salinity and lower temperature initial floodwater layer overlaying more saline tidal waters. The 30th August falling limb sampling was undertaken towards the bottom of an ebb tide (0.26m) at about 3/4 tide ((± 0.5m). There was a discernible floodwater layer overlaying more saline tidal water.

Metered water quality results are summarised as follows:

- Water temperatures were generally similar between sites with minimum temperatures generally in the upper readings - consistent with cold rainwater overlaying and mixing with warmer estuarine tidal waters. Overall water temperatures were lower on the 30th as more colder flood water mixed with estuarine tidal water and there was a more distinct thin cold layer for most sites.
- Salinity results were more variable with distinct but very thin lower salinity layers less than 0.2m depth noticeable at some sites during both the rasing and falling limbs. Notwithstanding, the differences were only around 0.1 part per thousand and the remaining water quality profiles showed greater variations indicating layers of mixed fresh and saline waters in the upper sampled waters with generally more estuarine waters towards the bottom. Overall salinity was lower on the 30th compared to the 29th.
- Dissolved oxygen results (as % saturation) varied between 88.7 and 92.5 %sat over both days with no obvious pattern to variation with location, depth or sampling day.
- Whilst there were consistent sharp distinctions in Oxidation Reduction Potential (ORP) result for the thin surface water layer, for the most part the remaining profiles were similar for both days with overall between site variation linked to time of sampling and consistent ORP decreases with depth.
- Turbidity (as NTU units) was relatively low for both days with values ranging between unmeasurable to 5 NTUs. Overall the waters on 29th were slightly more turbid than the waters on 30th.

The water sampling results (see **Table 6** summary below) provide further discrimination of surface to bottom water conditions for the two sampling days and highlight the following differences between sample days and sites:

- For the most part the Total Suspended Solids (TSS) concentrations were higher for both surface and bottom waters on the 29th (on a rising tide) compared to results for the ebb tide sample on the 30th.
- Surface copper concentrations were all below detection on the 29th (with the exception, of site M1 surface 3µg/L) and most were around 2µg/L on the 30th (with 4µg/L at site M1 surface and 3µg/L at site R1 surface.
- Dissolved Organic Carbon (DOC) concentrations were higher on the 29th (2mg/L all sites and depths), and generally at or less than detection (1mg/L) for all sites and depths for the 30th.

The combined metered and sampled water quality results indicate that the waters at Gladesville Bridge Marina during the August wet weather event were fairly well mixed with

differences between sampling days more aligned to state of tide than actual stormwater characteristics. The water sample results support the contention that stormwater mixing is well advanced for waters flowing down the Parramatta River past Gladesville Bridge Marina for an event with moderate but low intensity rainfall.

Table 6 Gladesville Bridge Marina Wet Weather Water Quality Results 29 & 30 Aug 19*

Sample Event	Location	R1	R2	R1	R2	M1	M2	M1	M2	B2	B3	B2	B3
	Depth	S	S	B	B	S	S	B	B	S	S	B	B
Wet Up 29th	TSS	8	7	13	11	7	8	8	6	7	3	8	8
Wet Down 30th	TSS	3	7	6	3	3	5	4	6	3	6	6	6
Wet Up 29th	Copper	<1	<1	<1	<1	3	<1	<1	<1	<1	<1	<1	<1
Wet Down 30th	Copper	3	2	2	2	4	2	2	2	2	2	2	2
Wet Up 29th	DOC	2	2	2	2	2	2	2	2	2	2	2	2
Wet Down 30th	DOC	<1	1	<1	1	<1	1	1	<1	<1	<1	<1	<1
Notes:	Detection Limits are 1mg/L (TSS and DOC) and 1µg/L for Cu. S = surface sample, B = bottom sample. **DOC = Dissolved organic carbon. Up = 29th & Down = 30th Aug.												

3.2.3 Comparison of Dry and Wet Weather Water Quality Sampling Results

Annex **Table C-4** provides statistical analysis of the water sampling results with combined Means for Site by Depth combinations and Means plus Standard Deviations of the means (SDs) for total Event Surface and Bottom Waters with results summarised in **Table 7** below.

Table 7 Water Sample Event Statistics

Sample Event	Analyte	Event Means ± SD* Mean	± SD
NEAP	TSS	2.1	0.41
Wet Up	TSS	7.8	2.29
Wet Down	TSS	4.8	0.68
Spring Ebb	TSS		
Sp Flood	TSS		
NEAP	Copper	2.0	0.00
Wet Up	Copper	0.7	0.51
Wet Down	Copper	2.3	0.42
Spring Ebb	Copper		
Sp Flood	Copper		
NEAP	DOC**	1.0	0.12
Wet Up	DOC	2.0	0.00
Wet Down	DOC	0.7	0.13
Spring Ebb	DOC		
Sp Flood	DOC		
Notes:	Detection Limits are 1mg/L (TSS and DOC) and 1µg/L for Cu. SD = Standard Deviation of the Mean.		

The **Table 7** comparisons of overall Gladesville Bridge Marina water quality sampling results to date indicate the following:

- TSS was lowest for the Neap Tide Dry weather sample, as expected for a prolonged dry period, highest for the rising wet weather sample - consistent with higher TSS loads in initial catchment runoff waters, and lower for the falling wet weather samples, also consistent with additional dilution of cleaner post first-flush rainfall mixing. There were no overlaps of the Standard Deviations indicating that the differences between sampling events were probably statistically significant.
- Mean copper concentrations for the dry sample and falling limb samples were similar, with a slight but non-significant higher mean on the wet falling limb. The values are close to the overall low flow mean for Port Jackson of 1.68±0.37 µg/L (Hatje et al 2003). The wet weather rising mean was much lower with all values except on less than detection (1µg/L) and a single value of 3µg/L at site $M1_{surf}$.
- Dissolved Organic Carbon (DOC) results showed a similar pattern to Copper with similar results for Neap and Falling Limb but instead of a lower result for Rising Limb, TOC was highest.

These results indicate that the elevated TSS derived from initial stormwater runoff (Wet Weather Rising) had elevated organic matter (high TOC) but did not contain much copper (low Cu).

The pattern of water sample results is also consistent with the river flow mechanisms described in the MetOcean Report (EIS Appendix L), where it was noted that as a consequence of the marina being located in a small embayment off the mean channel, "*current velocities within the embayment are expected to be about 5-15cm/s, with velocities decreasing between the main channel and the shoreline (Cardno 2014). A small eddy (clockwise circulation within the embayment) may be present during the ebb with the flow separating off the Five Dock Point. Under strong wind conditions, this small clockwise eddy may strengthen under Westerly winds, stronger currents may also be present and flowing westward along the shoreline during winds from a South Easterly to North Easterly sector.*"

3.3 Sediment Sampling Results

Sediment sampling was undertaken on 15th May 2019. Sediment core photos and sample notes are shown in **Annexure D** which provides descriptions of the core samples (colour, sediment grain size and shell content throughout depths). Whilst sites S1 to S3 contained generally darker sediments with higher variation in sediment colour from dark browns in surficial sediments to dark grey and black sediments in the deeper core sediments, S4 to S8

sediments were more uniform in colour with a less distinct transition, consisting of lighter brown sediments. Sediment sample results are shown below in **Table 8** and are compared to the web-based *Australian & New Zealand Guidelines for Fresh & Marine Water Quality* Default Guideline Values (DVGs) for sediment toxicants. These Guidelines are the revised version of the previous published ANZECC/ARMCANZ (2000) guidelines, and are referred as *ANZECC (2018)* guidelines for the remainder of this report:

- Sediment composition was variable with % fines ranging from 13 to 54%, and sediments from the sites closer to the slipway generally had higher fines proportions in bottom samples compared to surface samples. Site 1 samples plus bottom sediments at all other sites had relatively high proportions of coarse material "*gravel*" which, from observation, was generally broken shell material.
- Metal concentrations were generally higher at sites closer to the slipway (Sites 1 and 2), with concentrations at those sites generally higher in bottom sediments.
- The cluster of elevated results around Sites 3 and 4 are likely to be associated with historic slipway activities, as these sites are just offshore from the old Halvorsen Slipway (see Heritage Impact Assessment; EIS Appendix Y).
- Whilst lead concentrations were uniformly above the Default Guideline Value (DGV), the concentrations were generally below the mean Port Jackson concentration of 364mg/kg (Birch and Olmos 2008).
- Similarly, the cluster of elevated copper and zinc results from sites closest to the slipway were well below the Port Jackson means of 188 and 651mg/kg respectively.
- Whilst mercury concentrations were generally below detection, three surface sediment samples from sites remote to the Marina slipway had concentrations just above the DGV. These may be associated with older historic slipway activities around Site 4 as described above.

3.3.1 Comparison to Slipway Sediment Contamination Survey Results

Table 9 provides a summary table of the additional surface sediment sampling from immediately around the Marina slipway undertaken in July 2019 for the Zoic Contamination Investigation (EIS Appendix G). Two inshore sediment samples were obtained, one from each side of the slipway SD-1 and SD-2) with one sample (SD-3) obtained from sediments west of the Marina hardstand area (see **Figure 15**):

- As indicated in **Table 5,** the slipway sediments contained highly elevated concentrations of Copper, Lead, Zinc TPHs and TBT and elevated levels of Nickel and Mercury. Total PAHs were for the most part below the ANZECC Low ISQG but mean PAH for the slipway was slightly higher.

Table 8 Gladesville Bridge Marina Sediment Sampling Results 15th May 2019

Analyte	LOR	Units	ANZECC 18		1S	1B	2S	2B	3S	3B	4S	4B	5S	5B	6S	6B	7S	7B	8S	8B
			DGV	GV High																
Fines (<75µm)	1	%			44	52	19	26	----	----	34	24	----	----	19	14	----	----	15	13
Sand (>75µm)	1	%			19	17	77	64	----	----	53	45	----	----	79	67	----	----	81	67
Gravel (>2mm)	1	%			37	31	4	11	----	----	13	31	----	----	2	19	----	----	4	20
Cobbles (>6cm)	1	%			<1	<1	<1	<1	----	----	<1	<1	----	----	<1	<1	----	----	<1	<1
Antimony	1	mg/kg	2	25	<1.0	11	3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	1	mg/kg	20	70	5.4	3.2	2.0	2.2	3.8	2.6	4.7	3.2	3.0	3.1	3.1	2.2	2.9	3.0	3.2	3.6
Cadmium	0.1	mg/kg	1.5	10	0.3	0.3	0.2	0.3	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	1	mg/kg	80	370	39	29	20	22	20	21	30	19	18	14	18	18	13	12	11	10
Copper	1	mg/kg	65	270	66	40	84	67	57	41	81	61	47	34	46	36	29	29	28	27
Lead	1	mg/kg	50	220	191	240	117	162	141	133	163	128	92	74	93	96	69	70	64	60
Nickel	1	mg/kg	21	52	3.0	3.4	2.4	2.8	2.5	2.2	3.6	2.9	1.9	1.7	2.0	2.0	1.6	1.4	1.3	1.2
Silver	1	mg/kg	1	3.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Zinc	1	mg/kg	200	410	331	378	346	436	353	262	282	183	167	124	166	168	124	115	110	90
Mercury	0.1	mg/kg	0.15	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.16	<0.1	<0.1	<0.1	0.11	<0.1	0.16	<0.1	0.17	<0.1
TOC	0.02	%			1.4	3.4	1.4	1.8	----	----	5.0	6.7	----	----	0.8	0.7	----	----	0.5	0.3

Key to Colouring

Red Numbers — Likely to be above Default Guideline Value (DGV)

Below DGV

Between DGV and High Guideline Value (GVhigh)

Above GVhigh

Note: TOC = Total organic carbon, S = Surface sediments, B = bottom sediments.

Figure 15 Portion of Zoic (EIS Appendix G) Figure 3 showing the location of Surface Sediment Samples (SD-1 to SD3).

Table 9 Zoic Sediment Sample Results compared to MPR Mean ± Standard Deviation (SD) Results

Analyte	LOR	Units	ANZECC DVGs		Zoic Sample Sites			MPR	Sample Means		StDev	%age
			DVG	GVHigh	SD-1	SD-2	SD-3	Max	Zoic	MPR	MPR	MPR/Zoic
Arsenic	1	mg/kg	20	70	12	17	10	5.4	14.5	3.2	0.9	22.1
Cadmium	0.1	mg/kg	1.5	10	<0.4	1	<0.4	0.3	0.6	0.3	0.1	41.7
Chromium	1	mg/kg	80	370	61	150	17	38.6	105.5	19.7	7.7	18.6
Copper	1	mg/kg	65	270	10000	19000	570	84	14500	48.2	18.8	0.3
Lead	1	mg/kg	50	220	920	280	130	240	600.0	118.3	51.5	19.7
Nickel	1	mg/kg	21	52	27	75	5	3.6	51.0	2.2	0.7	4.4
Zinc	1	mg/kg	200	410	7500	6300	260	436	6900	227.2	112.7	3.3
Mercury	0.1	mg/kg	0.15	1	0.8	1.8	1.6	0.17	1.3	0.2	0.0	11.5
TPHs	75	mg/kg	280	550	975	2825	<75		1900			
PAHs	0.5	mg/kg	10	50	5.8	15.0	5.9		10.4			
TBT	0.5	mg//kg	0.009	0.070	36	52	4.9		44			
Key to Colouring:		Below DGV			Between DGV and GVhigh				Above GVhigh			

Note that Project means in red are comparisons that contain results less than detection and are thus less reliable.

The DGVs for sediment contaminants are shown as a range with a DGV indicating *potential toxicity above this value* and a higher (GVhigh) that *should be taken as an indicator of potential high-level toxicity problems*. The ANZECC (2018) guidelines also note that the bio-availability and toxicity of contaminants depends primarily on sediment grain size and effects databases are largely associated with the silty (<63µm) fraction of the sediment sample. The ANZECC (2018) guidelines also note that increasing Organic Carbon content

favours partitioning of both metals and organics to sediment particles and particularly so for hydrophobic organic contaminants, including Organotin compounds:

- It is not known whether the PAH results were normalised for 1% TOC and if not, given the MPR mean TOC of 2.2%, the normalised PAH results are more likely to be below the DGV.
- If the TBT concentrations are normalised for 2.2% TOC (the MPR mean), the concentrations will remain well over the GV_{high} value. However, the values are similar to values from other working slipways in Sydney Harbour.
- The comparison of Slipway Mean results (Samples SD-1 and SD-2) to MPR Mean results provides an indication of the localisation of the elevated contaminants around the immediate slipway area, with MPR Copper results only 0.3% of slipway results, Nickel 4.4%, and Arsenic, Chromium and Lead all around 20%. On this basis the organic and organotin contaminants are also likely to be reduced to at least 20% or more of the slipway concentrations, also in line with background sediment concentrations for Port Jackson (MPR 2011).

Overall, the combined Zoic and MPR sediment contamination results indicate that there is localised very high contamination of sediments in the immediate vicinity of the working slipway with some elevated residual contamination of sediments at the base of the old Halverson Slipway to the north, and slightly elevated contamination for remaining sediments around the sub-tidal shallows of the Gladesville Bridge Marina Cove. The Cove sediment contamination away from the two slipway locations is generally in line with background sediment contamination levels for Port Jackson Estuary.

4 IMPACT ASSESSMENT

The redevelopment proposal includes alterations and additions to the existing Marina floating berths (see **Figure 16** below), shore-based maintenance facilities, and car parking. With regard to the assessment of possible impacts on aquatic ecological aspects, the following elements are considered:

- Removal of 29 swing-moorings and retention of 15.
- Reconfiguration of the marina berth layout.
- Construction of 65 new floating berths of varying sizes, increasing from a total of 50 to 115 floating berths.
- Cessation of slipway activities and demolition of slipway rails.

Figure 16: Gladesville Bridge Marina showing the proposed Marina layout (black outline) and proximity of identified aquatic habitats.

The management of the constructional and operational activities are considered in **Sections 4.1 and 4.2** respectively. **Section 4.3** addresses the Fisheries Management Act Permit & Habitat Protection Requirements and an Aquatic Construction Environmental Management Plan (Aquatic CEMP) is provided in **Section 4.4**.

4.1 Management of Marina Construction Activities

As described in **Sections 2.2 and 2.3** above, there are both hard substratum and soft sediment marine vegetation assemblages around the existing marina with none under the existing marina. The reconfigured marina will not include any elements built over the identified marine vegetation habitats so there is no net loss of natural marine vegetated assemblages arising from the proposed reconfiguration. Whilst marine vegetation assemblages on piles and pontoons to be permanently removed will be lost, the expanded marina will provide more than double additional hard substratum wetted surface area for colonisation by similar marine vegetation-based assemblages, which is considered a beneficial impact.

4.1.1 Disturbance of inshore habitats from construction vessels

Much of the construction work associated with the removal of moorings, the construction of the marina berths and slipway demolition will involve the use of barges and service vessels, and these in turn will require the use of anchors, mooring blocks and other apparatus for holding floating plant in place whilst undertaking demolition and construction works.

This has the potential to disturb or destroy inshore rock rubble and kelp habitat along the shallower inshore areas adjacent Five Dock Point and near the slipway. Excessive vessel wash and propeller thrust from vessels close in-shore can also damage inshore rock rubble and marine algae habitat by directly smothering the plants from displaced sediments or by excessive turbidity from disturbed seabed sediments. Persistent or constant propeller thrust and vessel wash could result in mobilisation of contaminated sediments into the water column. Whilst wake-mediated turbidity was regularly observed during field inspections throughout the length of intertidal and shallow sub-tidal shoreline (due to re-suspension of finer sediments by long-period Rivercat ferry waves), there was sufficient time in between successive ferry transits for sediments to settle.

These risks can be mitigated to insignificance by the implementation of suitable mooring, anchoring and work practices that require contractors to not place anchors, chains, wires or other mooring apparatus into the inshore rock rubble reef habitats inshore of the **-3m LAT** contour and to ensure that there is no excessive directional propeller wash onto these habitats (see also suggested aquatic construction environment management measures in **Section 4.4**).

4.1.2 Impacts and Management of Demolition and Marina Construction

The termination of active slipway activities including termination of vessel washdown,

scraping and anti-fouling activities will remove the present source of contamination runoff from the marina to the inshore aquatic habitats, and retention of the concrete slipway base ramp will ensure that the highly contaminated sediments in the immediate surrounds of the slipway will not be disturbed. This is considered the most beneficial impact arising from the proposal in regard to the protection of the aquatic ecology of the locality.

Removal of Swing Moorings:
The removal of swing moorings will involve taking the swing mooring blocks and associated chain off the soft sediment seafloor for disposal or re-use elsewhere. These blocks are regularly lifted and inspected as part of the lease requirements for regular maintenance, and as such the removal of the mooring apparatus will not disturb sediments to any degree greater than existing inspection disturbance. Additionally, sediments are often much coarser around mooring blocks due to the action of the mooring chains which will influence the rate of settlement for disturbed sediments back onto the seabed during the removal process. It is therefore considered that there is no risk to the aquatic ecology of the locality arising from mobilisation of contaminants from the disturbed sediments.

Removal of slipway rails:
Removal of the slipway rails will likely result in habitat loss and has the potential for creating localised turbidity:

- Removal of the slipway rails will result in a loss of attached brown macroalgae habitat (primarily *Dictyota dichotoma*). This loss will be adequately offset by the gain of additional suitable algae habitat created by the addition of marina locator piles plus additional marina floating pontoons for the marina redevelopment.
- Potential mobilisation of sediment contaminants from the intertidal slipway rails can be mitigated by ensuring that the rails are removed at low tides with sediment containment facilities on the lower side of the slipway rail to ensure that disturbed sediments are retained above the water line for collection and appropriate off-site disposal.
- Potential impact of mobilisation of sediment contaminants from sliprail removal from the shallow sub-tidal portions of the slipway can be minimised by use of silt curtains.

Reconfiguring the marina will involve removal of the existing marina locator piles and associated floating pontoons and replacement or reuse of piles and pontoons plus introduction of additional new piles and pontoon structures:

- While the removal of the piles and pontoons will result in a loss of attached epifaunal communities and brown macro-algae species, the increase in surface area provided by the new marina construction will result in a net increase of hard substratum habitats available for epifaunal communities, and in turn would provide

increased shelter and feeding habitat for small reef fish and for the larger pelagic fish that prey on these reef fish.

- Removal of piles will result in some mobilisation of bottom sediments and from sloughing off of sediment material from the piles as they are drawn through the water column. Most sediments will fall rapidly to the seabed and sediment contaminants that are disturbed are more likely to stay firmly bonded to the fine particulate and organic materials making up the sediments and rapidly re-settle (Knott and Johnson 2010). Dispersal of finer particulate material can be limited by the use of silt curtains around the demolition works.
- The risk that pile placement will result in the mobilisation of contaminated sediments is low, as inserted piles force sediment downward via the pile friction effect and laterally away via displacement. This means that there is little or no upward mobilisation of the sub-surface sediments that could contain contaminants, as the pile driving action further buries displaced sub-surface sediments.
- For installation of shallower inshore piles, it is recommended that silt curtains be deployed between the works and the identified inshore fish habitats to minimise the potential for fine sediment dispersal. Particular attention should be given to areas bounding the slipway as sediments in this area contain the highest concentration of contaminants.
- In regard to removal and replacement of floating walkway and pontoon elements, the main risk for aquatic biota is associated with the use of vessels and barges for manoeuvring the pontoons into place (see also **Section 4.1.1** above). These risks can be mitigated to insignificance by the implementation of suitable mooring, anchoring and vessel work practices that require contractors to not place anchors, wires or other mooring apparatus into the inshore rock rubble reef habitats inshore of the -3m LAT contour and to ensure that there is no excessive propeller wash onto these shallow inshore habitats.

Addition of extra floating walkways, pontoons and moored vessels will shade the seabed with a risk of loss of marine vegetation:

- As the seabed under the proposed reconfigured floating marina and marina pens does not support any patches or beds of seagrass or macro-algae, there are no direct shading effects on aquatic flora arising from the reconfigured marina infrastructure. or from moored construction vessels, provided that construction vessels are not moored over the inshore vegetated habitats as identified in **Figure 16** above.

Potential impacts of construction noise:

Pile installation has the potential to create impact noise that can adversely affect the behaviour of cetaceans and other marine mammals that are known to penetrate the harbour

beyond the Harbour Bridge and could conceivably be in the vicinity of the construction pile driving works:

- Marine mammals, if in the locality, would generally be conspicuous and, given the location, they would be expected to be well monitored in regard to location, species and numbers, and their presence would be well publicised (including via regular marine VHF radio notices from NSW Ports Corporation).
- In the unlikely event that there are marine mammals in the vicinity of the construction works, it is recommended that if piling works at the time are associated with impact noise, that these activities be suspended until the marine mammals have left the area (i.e. have moved east beyond Gladesville Bridge).

Potential impacts from Marina fit-out:
Risks to aquatic biota of spillages of liquids and solids from the construction work associated with the installation of services to the floating marina can be managed by a combination of normal best-practice to be specified in the project Construction Environmental Management Plan (CEMP) that would include information about the threat posed to marine biota (fishing birds, marine mammals and fish) of ingestion and throttling from discarded garbage and in particular from plastic wrapping materials and plastic off-cuts (such as hosing, plastic clips, cable ties, electrical wiring offcuts).

4.2 Management of Marina Operations

After construction is completed, the following potential impacts are associated with the day to day operation of the marina:

1. Marina structures and moored vessels will shade the seabed.
2. Vessels entering and exiting the marina may create wash and increased wave activity along the shoreline, resulting in more frequent mobilisation of shallow inshore sediments and a risk of smothering inshore vegetated habitats.
3. Vessel propeller wash could disturb and mobilise seabed sediments with a potential for contaminants to be transferred to the water column.
4. There are increased risks of spillages of liquids and solids from over-water pump-out and maintenance works on vessels in the marina.
5. The increased concentration of vessels that use copper-based antifouling paint in the marina could increase the concentrations of dissolved copper and other biocides within and around the Gladesville Bridge Marina.

Shading Impacts:
As noted in **Section 4.1** above there is no loss of seagrass or rocky reef and rubble algae habitat to shading from the expanded marina structures. With regard to shading impacts of

vessels moored within the expanded marine, all vessels will be moored in berths located in areas offshore where there is no seagrass or marine vegetation:

- There is rock rubble and associated *Sargassum* algae habitat close to the existing inner berths and pontoon on the western side of Arm A, and there are currently no shading impacts from those berths or from the pontoon. As the proposed innermost berths for the reconfigured Arm A are located further out from the identified rock rubble habitats than the existing innermost floating pontoon there remains no risk of shading from the reconfigured berths.
- Vessels moored in the innermost berth on the eastern side of A arm (next to the slipway) will be close to a small *Halophila* patch. However, the new berth location places a vessel at the same distance from the seagrass patch as presently exists. Given that this patch was first identified in 2006 (see **Section 1.3**), it is considered that the risk of damage to this patch from use of the new berth is low. Risk is further mitigated by the cessation of use of the slipway for vessel haul-out.

Vessel wash impacts:
Vessel wash impacts has been considered in the Marine Safety and Navigation Report (EIS Appendix F) which details the procedures to be in place for minimising wash impacts. The report also highlights the fact that there is a no-wash zone on Parramatta River between Gladesville Bridge and Five Dock Point and that this provides an additional safeguard on vessel wash for vessels approaching or leaving the marina. Further, as detailed in the Wave Climate Report (EIS Appendix L), the extension of the marine to the east towards Gladesville Bridge will protect inshore habitats from wind waves to some extent, and the marina infrastructure plus moored vessels will attenuate some of the force in the long-period wash waves generated by passing River Cats, which should diminish the current periodic mobilisation of inshore sediments and associated siltation of marine flora habitats.

With regard to wash directed towards the inshore rock reefs, the propulsion gear of vessels entering or leaving the inshore berths of Arms A and E would be directed almost parallel to the reefs and there would be a low risk of dislodging attached biota from the habitats or dislodging cryptic fauna. As vessels are moored stern to, propeller wash from vessels backing into the pens would be directed against and moderated by impact with the stern and undersides of the vessel.

Risk of Propeller Strike and Mobilisation of Sediment Contaminants:
The overall depths at the reconfigured marina berths (from > -3m to > -9m LAT) means that there is only low risk of bottom sediment disturbance from vessels manoeuvring in and out of the berths or transiting the marina fairways and, as detailed in the Marine Safety and Navigation Report (EIS Appendix F), the risk of vessels going aground whilst entering or

exiting the marine is low. Given that rock rubble aquatic habitats are located inshore of the -2m LAT contour, vessels that may stray inshore (via loss of propulsion or loss of control via windage) are more likely to ground before propulsion gear can strike the reef habitats.

Risks of spillages from marina workshop operations:
For the reconfigured marina, all out of water repairs including slipping will cease. The marina workshops will continue to function as at present, and the workshop areas will remain bunded, with no on-shore works undertaken outside of the workshop area. There will not be any dedicated work berths in the marina.

There will be no change to the way vessel maintenance activities are undertaken, and general maintenance will continue to be carried out on vessels on the marina. This includes mechanical, shipwright, rigging, trimming and detailing services. All of these activities will comply to EPA and industry best practice e.g. dust producing activities are not permitted unless they can be fully contained (interior work), painting will be touch-ups only and masked up or covered appropriately. Any work that cannot be contained and/or causes fumes, dust or excessive noise will be referred to a suitable hardstand provider.

The risks of spillages of liquids and solids will be managed by a combination of normal best-practice and will be detailed in the Marina Operational Environmental Management Plan (OEMP). The OEMP would also include information about the threat posed to marine biota (fishing birds, marine mammals and fish) for ingestion and throttling from discarded garbage and in particular from plastic wrapping materials and plastic off-cuts (such as hosing, jetty fenders, electrical wiring).

Increased copper concentrations:
The present combined marina and mooring field moors 94 vessels over an area of about 4581 Ha and the proposed marina and associated mooring field would moor 130 vessels over an estimated water surface area of around 1562Ha. The increased anti-fouled (essentially copper-coated) wetted surfaces areas of the vessels in the enlarged marina has the potential to result in elevated copper concentrations within and around the marina.

Table 10 provides a comparison of the gross wetted surface areas of vessels currently using the combined Gladesville Bridge Marina floating pontoon marina and swing mooring complex and of the proposed reconfigured floating pontoon with the reduced moorings. Note that for calculation purposes the present and proposed swing mooring capacity has been calculated on the present and proposed maximum vessel length for the commercial moorings which is 20m. This provides an overestimate of the actual wetted surface area for vessels on moorings but does provide an upper limit for comparisons. The calculations for wetted surface area are based on a review of wetted surface area calculation factors

undertaken for marina operations in Rozelle Bay (MPR 2016). Note that there are also likely to be other biocides used for antifouling but, for the purposes of impact assessment, the changes in copper are considered as this is the most widely used anti-fouling ingredient.

The following conclusions arise from the **Table 10** calculations:

- The total wetted surface area of vessels in the existing marina is 9215 m^2 and the total wetted surface area of vessels for the proposed marina is 12575 m^2. This is a proportional increase of 1.36 times the existing wetted surface area.
- The wetted surface areas of vessels on swing moorings from the present to proposed marina would decrease by a factor of 0.35 but, as the remaining 15 vessels on swing moorings would probably take up the same area as 15 vessels from the present mooring field, the actual concentrations of copper in these waters resulting from the 15 moored vessels would remain the same.
- Whilst there would be a proportional increase of 2.34 in the wetted surface areas of vessels actually contained in the enlarged marina, the overall area of the proposed marina also increases, so the overall concentration of copper in the waters of the proposed marina would be expected to be about 15% greater than in the present marina.

Note that the changes in copper concentrations in the waters of the marina provided above are predicated on the waters being quiescent and, in practice, as the marina is located in a tidal river, the waters will seldom be truly still - due to tidal currents, wind mediated currents and turbulence arising from passing vessel wash. In this regard the conclusion from the Wave Report (EIS Appendix L) on marina flushing is pertinent; *with the marina layout maintaining its general alignment to the main tidal flow and promoting the maintenance of the small eddy during easterly currents (i.e. ebb flow), circulation along the shore (between the marina and the coastline), and opening towards the East (flood flow and wind generated currents) the proposed extension is expected to present similar flushing characteristics than the existing marina.*

Table 10 Wetted Surface Area (WSA) Calculations

Vessel Lengths Range (m)		Lit WSAs (sq m)*		Marina Vessels				Calculated WSAs (sq m)			
				On Moorings		In Marina berths		On Moorings		In Marina berths	
From	To	Vessel Length	Adopted WSA	Present	Proposed	Present	Proposed	Present	Proposed	Present	Proposed
0	9.9	9	25			5	1	0	0	125	25
10	12.9	12	51			0	18	0	0	0	918
13	15.9	15	77			8	30	0	0	612	2295
16	17.9	17	94			8	16	0	0	752	1504
18	20.9	20	102	44	15	23	39	4488	1530	2346	3978
21	25.9	25	149			6	2	0	0	892.5	297.5
26	30.9	30	179			0	5	0	0	0	892.5
31	35.9	35	238			0	3	0	0	0	714
36	40.9	40	340			0	0	0	0	0	0
41	45.9	45	421			0	1	0	0	0	420.75
Marina & Mooring Field Areas**				Totals		50	115	4488	1530	4727.5	11044.75

Moorings		Marina				
Present	Proposed	Present	Proposed		Combined Totals	9215.5	12575
4.58	1.56	1.117	2.194		Change Proportions	-0.34	2.34
					Overall Change	1.36	

Notes * From MPR 2016 review. ** Areas are in Hectares and the area for the proposed reduced swing mooring area is proportioned from the present swing mooring area. The marina areas are estimated via a line connecting the bows of all vessels.

Note that the calculations shown in **Table 10** do not include the wetted surface areas of vessels being scraped and anti-fouled at the present slipway which is an additional and significant source of particulate and dissolved copper to the local waters. A broad estimate of 70 vessels slipped per annum at a mean vessel length of 10m provides an additional estimated 3570 m^2 of wetted surface area being cleaned per year, a practice that will be discontinued for the reconfigured marina.

4.3 Suggested Aquatic CEMP

The following measures provide specific detail for the protection of the aquatic environment that are to be incorporated into the Construction Environmental Management Plan (CEMP):

All contractors undertaking construction work associated for the Gladesville Bridge Marina Project shall ensure that their activities do not cause any harm to the inshore rocky reef or rubble habitats, or areas of marine vegetation near the slipway as indicated on **Figure 15** for this report. In order to achieve these aims, contractors shall implement the following precautions:

- Due to the shallow depths over the inshore rock rubble habitats (as identified in **Figure 15**), all vessel movements and vessel placements (e.g., barges) should be confined to the bare sediment habitat offshore from the rock rubble reef and seagrass patch areas wherever possible, or tied to existing marina piles in the absence of anchor use.
- There will be no stockpiling of demolition or construction materials on the seabed.
- No vessel is to be moored with anchor or other bottom tackle located in or over the rock rubble or inshore and slipway seagrass and marine vegetation habitats shown in **Figure 15**.
- Mooring lines, cables must not be laid across the marine vegetation habitats if there is any risk of these cables reaching the bottom or the slipway due to wave action or low tides. If deployed, they must be suitably buoyed prior to laying, and kept buoyed once laid, to prevent cable drag and cable swing damage (scalping) to marine vegetation areas. Where this is impractical, contractors should use floating rope.
- In order to minimise wash and prevent bottom scouring of the marine vegetation habitats, towing or pushing vessels must not use excessive power to manoeuvre barges into place near the designated marine vegetation habitats. Scouring damage can also be minimised by ‘working the wind and tides’, i.e., only moving floating plant into place on high tides and under favourable or no winds.
- The risks of spillages of liquids and solids from the marina construction and fitout work can be managed by a combination of normal best-practice to be specified in the project Construction Environment Management Plan (CEMP) and will include information about the threat posed to marine biota (fishing birds, marine mammals and fish) of ingestion and throttling from discarded garbage and in particular from plastic wrapping materials and plastic off-cuts (such as hosing, jetty fenders, electrical wiring).

4.4 Fisheries Management Act Permit and Habitat Protection Requirements

Part 7 of the Fisheries Management Act 1994 (FMA) sets out the conditions under which permits are required for various construction activities, and the conditions under which a permit may be granted are specified in the NSW DPI (Fisheries) Policy and Guidelines (NSW Fisheries 1999). With respect to estuarine activities, permits are required for reclamation or dredging works and for the taking or harming of marine vegetation:

- The present proposal does not include activities that fall under the definition of dredging or reclamation, nor would the proposal result in loss of natural rock macroalgae habitat by means of direct removal, destruction or shading.
- Provided suitable construction precautions are in place (as detailed above and summarised in Section 5.1 above), there is negligible risk of damage to marine algae habitats. It is concluded that the proposal would not require a permit under the FMA to take or kill marine vegetation.

5 SUMMARY AND CONCLUSIONS

The key findings of this study are as follows:

- The present key fish habitats at the Gladesville Bridge Marina site include the inshore rock and rock rubble reef habitats plus some small patches of *Zostera* and *Halophila* seagrass. The reef habitats are more or less continuous around the shoreline from Five Dock Point to Gladseville Bridge and all habitats are confined to shallow waters above the -2m LAT hydrographic contour. There are no direct losses of these habitats resulting from the proposed marina reconfiguration.
- There are no terrestrial habitats at the marina site and no bat roosting areas were found at the marina or under the Gladesville Bridge southern ramparts.
- There are no threatened species as listed under the EPBC Act, FMA or BCA known from the site and immediate locality, none were found during the field work for the study and it is concluded that of the listed or protected marine species that may occur in the vicinity of the site, none would be utilising the resources of the site to any great extent and would generally be in the locality as transients or opportunistic feeders.
- Water quality surveys to date indicate that the waters of the marina are generally well mixed and that water quality is a function of diurnal tidal water mixing and river flood waters following rainfall. This is in line with the conclusions of the Wave Climate report (EIA Appendix L).
- Analysis of dissolved copper concentrations in the waters of the marina also support the contention that the marina and inshore of marina waters are generally well mixed and copper concentrations are in line with background concentrations for Port Jackson estuary.
- Combined sediment contamination results indicate that there is localised very high contamination of sediments in the immediate vicinity of the working slipway with some elevated residual contamination of sediments at the base of the old Halverson Slipway to the north, and slightly elevated contamination for remaining sediments around the sub-tidal shallows of the Gladesville Bridge Marina Cove. Sediment contamination away from the two slipway locations is generally in line with background sediment contamination levels for Port Jackson Estuary.

It is concluded that the reconfiguration of the Gladesville Bridge Marina would result in overall water quality improvement, negligible losses of sediment benthic aquatic habitat and organisms to additional piling and a long-term gain in available hard-substratum marine vegetation (algae) habitat post-construction:

- Cessation of slipway activities is the biggest benefit for overall water quality and aquatic ecology of the locality, and the decision to only remove the sliprails and leave the concrete ramp *in situ* will ensure that there are no impacts from disturbance

of the highly contaminated sediments immediately surrounding the slipway. This is in line with the conclusions of the Contamination Report (EIS Appendix H).

- Whilst the concentration of vessels into an overall smaller footprint increases the potential for elevated dissolved copper concentrations, the combination of the doubling of the size of the floating marina and the retention of the same alignment with the river flow means that the overall increase in copper concentration remains small and is likely to be immeasurable, by virtue of the mixing and flushing characteristics of the marina (in line with the conclusions of the Wave Climate Report (EIS Appendix L). Overall copper concentrations in terms of mass balance are likely to be similar to the present marina by virtue of the discontinuing of slipway vessel cleaning and anti-fouling activities for the proposed marina.
- Whilst sediment benthic organisms would be disturbed or lost to piling operations, new encrusting assemblages would colonise wetted surfaces of piles and pontoons for the new facility with a net increase in hard substratum habitat for the locality.
- Provided suitable construction environmental management procedures are adopted disruption to fish assemblages of the inshore rocky reef and rubble habitats would be negligible and overall fish assemblages would benefit from the additional hard substratum habitat arising from the expanded wetted surface areas from the marina structures.
- Shading impact risk associated with the project is low and there would be a substantial increase in pile plus floating pontoon habitat available to support additional marine algae growth.
- Possible impacts arising from the proposed construction work can be satisfactorily mitigated by appropriate best-practice construction and operational safeguards as outlined in the report and these would be specified in the project Construction Environmental Management Plan (CEMP).
- Additional possible impacts arising for operation of the marina operations including the risk of vessel wash or propeller strike on adjacent marine vegetation habitats and mobilisation of contaminated sediments are both predicted to be negligible, and the project includes the production of a Marina Operational Environment Management Plan (MOEP) that includes:
    - Navigation safety practices and procedures,
    - Directions for Marina users regarding avoidance/prevention of vessel discharges or spills plus prevention of solid waste discharge,
    - Directions for Marina staff or contractors setting the limits on what works may be undertaken on vessels and providing procedures for avoiding and preventing spills and preventing solid waste discharges.
    - Information on the need to protect inshore marine vegetation fish habitat, and the need to protect marine fauna from waste material ingestion and vessel discharges.

On balance, there could be a net beneficial impact from the Gladesville Bridge Marina proposal in regard to available fish habitat, as there would be no net loss of natural aquatic habitat to construction or operation and, in the medium to long term, there would be a beneficial impact for reef fish assemblages utilising the additional marine assemblages colonising the wetted surfaces of the additional new piles and pontoons, and there would be improved water quality arising from the cessation of slipway anti-fouling activities.

Residual risk of loss of key fish habitat to marina construction and operation can be lowered by adopting the Aquatic environmental management measures outlined in this report, and overall loss can be offset by adopting the mitigation measures recommended in this report.

In line with the conclusions of the Marine Safety and Navigation Report (EIS Appendix F), the risk of vessel impacts on adjacent and underlying aquatic habitats associated with vessel movements in and out of the marina is considered low, and risk would be managed by the provision of suitable vessel speed limits and docking procedures that are to be specified in the Operational Environment Management Plan (OEMP).

Impacts associated with rubbish disposal, spillages, hydrocarbon (oils, bilges and fuel) spills and grey plus black water spillages would be minimised by appropriate waste prevention and minimisation plus control measures that would be specified in the OEMP, in marina usage documents provided to marina users and via appropriate public signage prepared and displayed prominently around the marina by the marina management.

Provided the mitigation, offset and additional recommendations of this report are incorporated into the marina design, construction and operation of the refurbished Gladesville Bridge Marina, residual impact risk can be managed to satisfy the aquatic ecology and fish habitat conservation requirements of the SEPP (Sydney Harbour). The project would also meet the fish habitat conservation requirements of the Fisheries Management Act 1994 - as set out in the Fisheries NSW Policy and Guidelines (NSW Fisheries 2013) - to ensure that there would be *no net loss of fish habitat.*

On the basis of this assessment, it is concluded that a permit under Part 7 of the Fisheries Management Act 1994 (FMA) is not required for the "*taking or harming of marine vegetation"* or for "*reclamation or dredging works"*.

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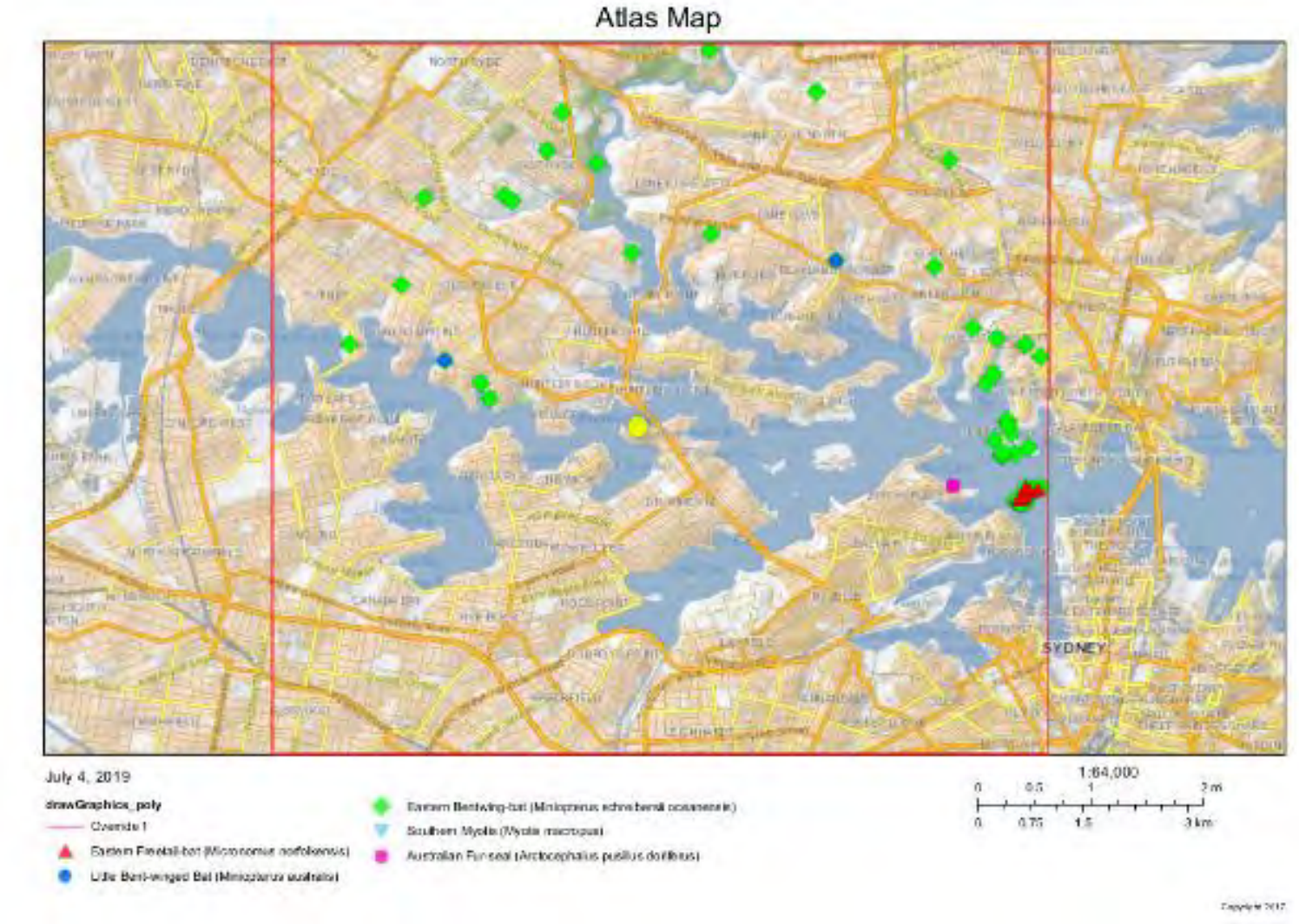
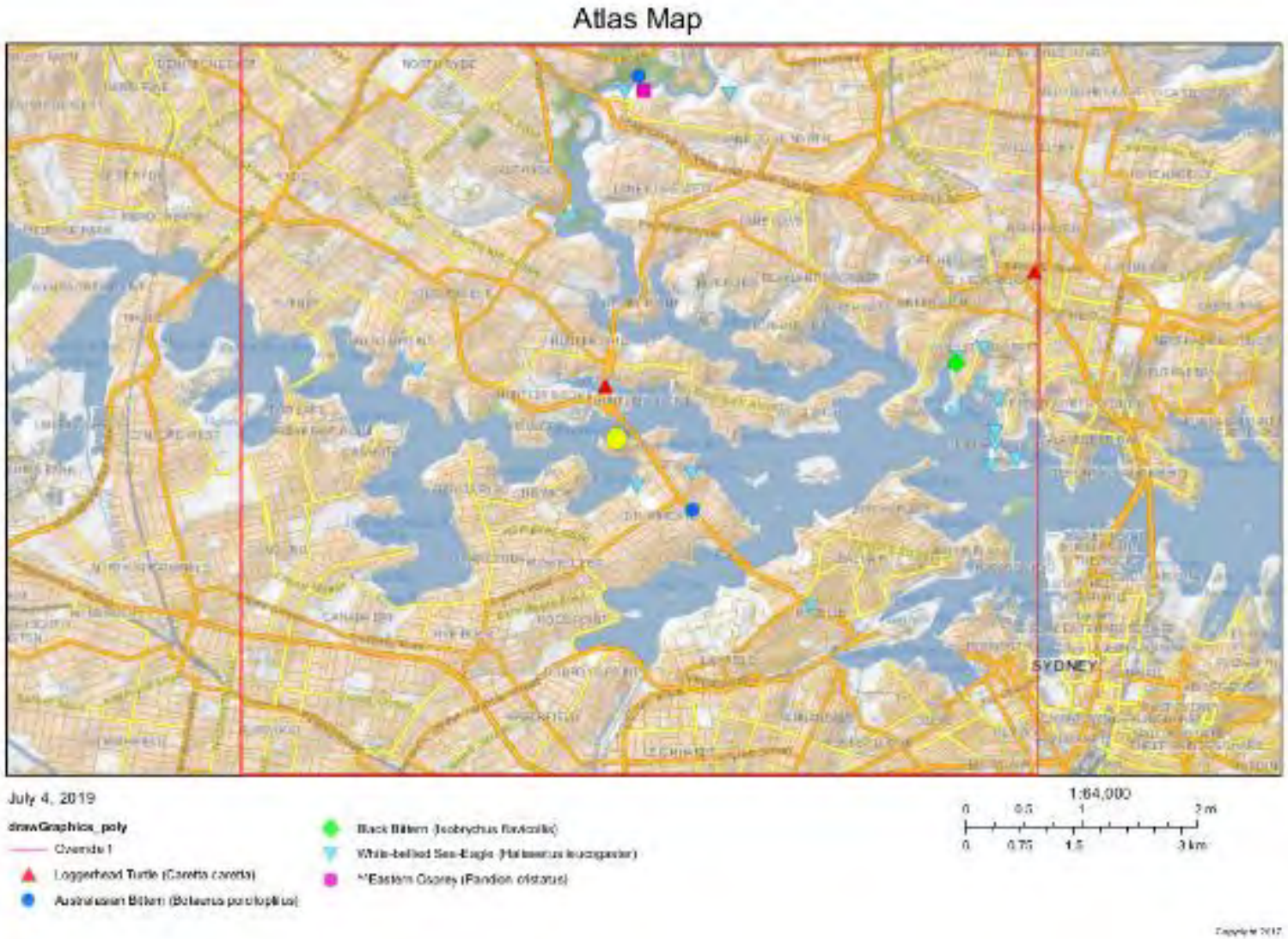
ANNEXURE A THREATENED AND PROTECTED SPECIES AND POPULATIONS IN SYDNEY HARBOUR. NSW



Annexure Figure A1: Bionet and EPBC Search Species Occurrences (note the study area indicated by a yellow circle).



Annexure Figure A2: Bionet and EPBC Search Species Occurrences (note the study area indicated by a yellow circle).

Table A1 Listed marine and other species that have been recorded in the 10km square Bionet Search Area*

Kingdom	Class	Family	Scientific Name	Common Name	NSW status	Comm. status	Records
Animalia	Reptilia	Cheloniidae	*Caretta caretta*	Loggerhead Turtle	E1,P	E	2
Animalia	Aves	Ardeidae	*Botaurus poiciloptilus*	Australasian Bittern	E1,P	E	2
Animalia	Aves	Ardeidae	*Ixobrychus flavicollis*	Black Bittern	V,P		4
Animalia	Aves	Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V,P	C	25
Animalia	Aves	Accipitridae	*Pandion cristatus*	Eastern Osprey	V,P,3		6
Animalia	Aves	Laridae	*Sternula albifrons*	Little Tern	E1,P	C,J,K	1
Animalia	Mammalia	Molossidae	*Micronomus norfolkensis*	Eastern Freetail-bat	V,P		10
Animalia	Mammalia	Vespertilionidae	*Miniopterus australis*	Little Bent-winged Bat	V,P		2
Animalia	Mammalia	Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V,P		62
Animalia	Mammalia	Vespertilionidae	*Myotis macropus*	Southern Myotis	V,P		10
Animalia	Mammalia	Otariidae	*Arctocephalus pusillus doriferus*	Australian Fur-seal	V,P		1

Note: *Bat species were included as roosting sites may occur under wharves, jetties and bridges.

ANNEXURE B

ADDITIONAL AQUATIC ECOLOGY SITE PHOTOGRAPHS

FROM FIELD ASSESSMENT

MAY 2019

Photos progress from Five Dock Point

east around to Gladesville Bridge

Plate 1: Looking west at Five Dock Point across intertidal rock platform with rock rubble.

Plate 2: Intertidal rock platform and sandy beach on western side of Gladesville Bridge Marina.

Plate 3: Concrete seawall bounding Gladesville Bridge Marina. Note the dense band of oysters above the waterline.

Plate 4: Looking across the front of the Gladesville Bridge Marina land-based facilities showing entrance to the marina on right.

Plate 5: Gladesville Bridge Marina slipway (to be removed under proposal), with beginning of seawall (left hand side) bounding the waterfront residential properties.

Plate 6: Looking east along sandstone block seawall and waterfront properties from the slipway.

Plate 7: Looking west towards the eastern limits of the seawall in Plate 6.

Plate 8: Looking south towards waterfront residential properties, and rock platform plus sandy beach shoreline.

Plate 9: Looking east along shoreline from Plate 8, showing sandstone block breakwall.

Plate 10: Shoreline including sandy beach with abundant shell material and seawall structures.

Plate 11: Looking east at old boat ramp on sandy beach.

Plate 12: Looking west across intertidal rock platform and rock rubble, towards beach bounded by waterfront seawall.

Plate 13: Intertidal bedrock platform and rubble shoreline bounded by seawall, with private jetty and pontoon.

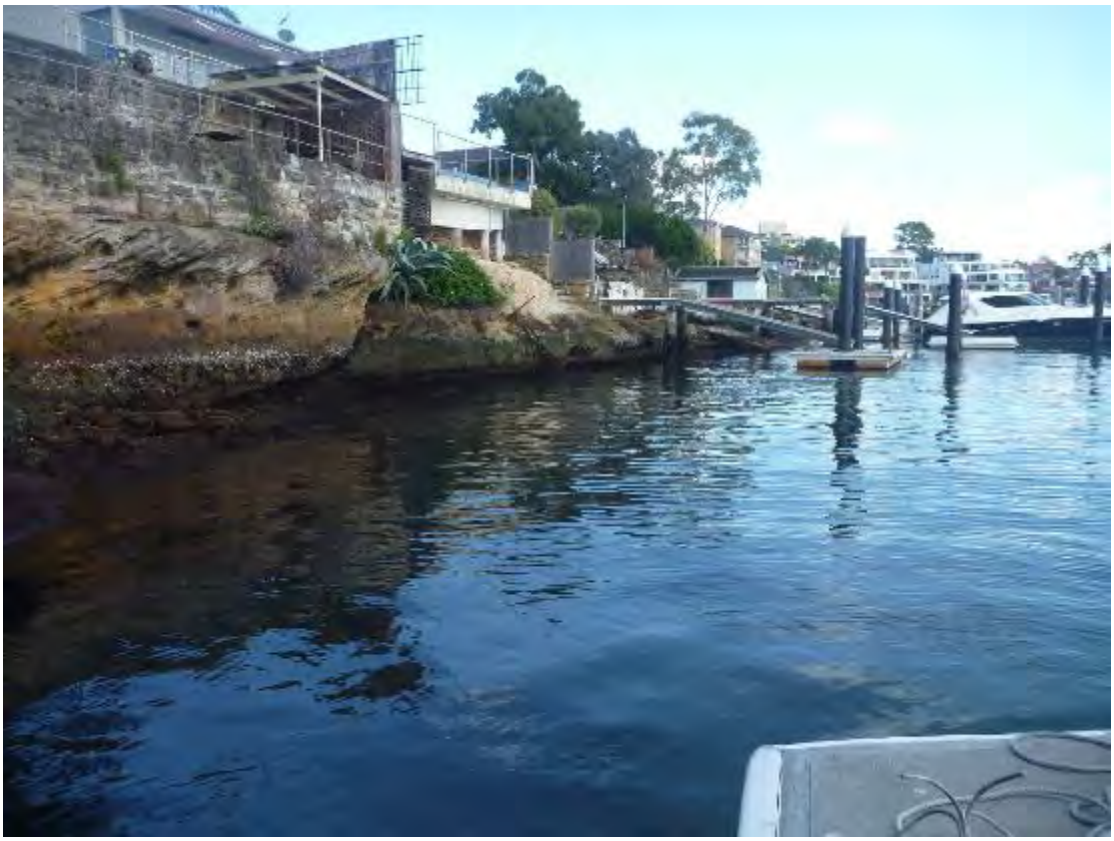


Plate 14: Looking west along rock shoreline from Gladesville Bridge.

Plate 15: Looking east at the concrete footing for Gladesville Bridge.

ANNEXURE C

GLADESVILLE BRIDGE MARINA

WATER QUALITY SURVEYS

AND

RESULTS

C-1 Dry Neap Tide Sampling

Initial dry weather neap tide sampling was undertaken on 1st May 2019 and there had not been any rain in the locality for 26 days (see **Table C1).** Metered water quality data are provided in **Table C-2** below and Laboratory Analysis reports for Neap Tide Dry weather sampling are appended to the end of this Annexure.

Table C-1 Daily Rainfall (Concord (Brays Rd) BoM Station Number 66048*

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1st	3.2	1.8	0	0	0	0	0	1
2nd	0	15.4	0	0	0	0	0	0
3rd	0	1	0.6	2.4	0.2	0	0	0
4th	0	0	0	0	9.8	21.6	10	0
5th	0	0	0	12.2	0	4.6	16.8	0
6th	31.4	0.8	0	2.2	0	4	5	0
7th	0	0	2	0	0	0	1.4	0
8th	0.6	0	0	0	0	2.6	0.2	0
9th	7	37.2	0	0	0	0	0	0
10th	0	0	0.6	0	0	0	0	0
11th	0.8	0	0	0	0	0	0	0
12th	4.6	0	0	0	0	0	0	0.2
13th	0	0	2	0	0	0	0	0
14th	0	0	2	0	0	0	0	0
15th	0	0	9.6	0	0	0	0	0
16th	0	0	29	0	0	14.2	0	0
17th	0	0	31.2	0	0	11.8	0	0
18th	0	0	44.4	0	0	17	0	0
19th	0	0	1.8	0	0	0	0	0
20th	0	6.8	2.2	0	0	0	0	0
21st	1.6	0.4	0	0	0	0	0	0
22nd	0.2	7	3.2	0	0	0	0	0
23rd	0	1.2	1.4	0	0	0	0	0
24th	0	2.6	0.6	0	0	33.4	0	0
25th	0	0.2	3.8	0	0	15.6	0	0
26th	0	0	0.6	0	0	5.8	0	0
27th	0	0	0	0	0	1	0	2.2
28th	4.4	0	0	0	0	0.2	0	0
29th	0		0	0	0	0	0	0
30th	0		31.6	0	0	0	2.8	36.6
31st	0				0		1.4	
Total	53.8	74.4	166.6	16.8	10	131.8	37.6	40

* Note that daily rainfall is the rain over the previous 24 hours up to 9:00 AM on the day. Dates highlighted in yellow are water quality sampling dates. Note also that sediment sampling was undertaken on 1st May as well.

Table C-2 Gladesville Bridge Marina Neap Tide Dry Weather Water Quality Profiling Results 1st May 2019

Site	Time	Depth m	Temp °C	Cond (ms/cm)	Sal ppt	DO % sat	DO mg/L	pH units	Turb NTU
R1	11:18	0.2	21.0	53.2	35.1	79.1	5.7	7.67	8.4
R1	11:18	1.1	21.0	53.2	35.1	79.0	5.7	7.67	5.5
R1	11:19	1.5	21.0	53.2	35.1	79.2	5.7	7.67	5.8
R1	11:19	2.1	21.0	53.2	35.1	79.2	5.7	7.67	5.7
R1	11:20	3.0	21.1	53.2	35.1	79.4	5.8	7.67	5.3
R1	11:20	4.1	21.1	53.2	35.1	79.3	5.8	7.67	5.3
R1	11:21	5.0	21.1	53.2	35.1	79.3	5.8	7.67	5.1
R1	11:21	6.1	21.1	53.2	35.1	78.9	5.7	7.68	5.5
R1	11:22	7.0	21.1	53.2	35.1	79.2	5.7	7.68	4.6
R1	11:22	8.0	21.1	53.3	35.2	79.2	5.7	7.68	5.4
R1	11:22	8.4	21.1	53.2	35.1	79.1	5.7	7.68	6.7
R1	11:23	9.1	21.1	53.3	35.1	79.0	5.7	7.68	5.8
R1	11:25	10.3	21.1	53.3	35.2	79.2	5.7	7.69	5.8
R2	11:39	0.1	21.0	53.2	35.1	80.2	5.8	7.71	5.5
R2	11:39	0.2	21.0	53.2	35.1	79.9	5.8	7.71	4.5
R2	11:40	1.1	21.0	53.2	35.1	79.8	5.8	7.71	4.4
R2	11:40	2.0	21.0	53.2	35.1	80.1	5.8	7.71	4.5
R2	11:40	3.0	21.0	53.2	35.1	80.1	5.8	7.72	4.6
R2	11:41	4.0	21.0	53.3	35.2	79.7	5.8	7.72	4.5
R2	11:41	5.0	21.1	53.3	35.2	79.6	5.8	7.72	5.5
R2	11:42	6.0	21.1	53.3	35.2	79.4	5.8	7.72	4.5
R2	11:42	7.0	21.1	53.3	35.2	79.3	5.7	7.73	7.6
R2	11:43	8.1	21.1	53.4	35.2	79.2	5.7	7.73	5.8
R2	11:43	8.6	21.1	53.4	35.2	79.2	5.7	7.73	6.3
R2	11:43	8.9	21.1	53.5	35.3	79.4	5.8	7.73	6.1
R2	11:44	9.1	21.1	53.5	35.3	79.5	5.8	7.73	7.6
R2	11:44	9.3	21.1	53.5	35.3	79.4	5.8	7.74	6.5
R2	11:44	9.8	21.1	53.5	35.3	79.3	5.7	7.74	5.8
R2	11:44	10.2	21.1	53.5	35.3	79.1	5.7	7.74	7.0
R3	11:51	0.2	21.0	53.2	35.1	80.6	5.9	7.73	3.9
R3	11:51	1.1	21.0	53.2	35.1	80.3	5.8	7.73	4.3
R3	11:52	2.1	21.0	53.2	35.1	80.0	5.8	7.73	5.1
R3	11:52	3.0	21.1	53.3	35.1	79.9	5.8	7.73	4.8
R3	11:52	4.1	21.1	53.3	35.1	79.8	5.8	7.73	4.3
R3	11:52	5.1	21.1	53.3	35.1	79.5	5.8	7.73	5.6
R3	11:53	6.0	21.1	53.3	35.1	79.4	5.8	7.73	6.5
R3	11:53	7.1	21.1	53.3	35.1	79.4	5.8	7.74	4.6
R3	11:53	8.1	21.1	53.3	35.1	79.4	5.8	7.74	5.1
R3	11:54	8.2	21.1	53.3	35.1	79.5	5.8	7.74	6.8
R3	11:54	9.1	21.1	53.3	35.2	79.5	5.8	7.74	6.1
R3	11:54	10.1	21.1	53.3	35.2	79.3	5.8	7.74	6.6
R3	11:54	11.0	21.1	53.4	35.2	79.3	5.8	7.74	6.1
R4	12:02	0.2	21.1	53.2	35.1	80.6	5.8	7.74	3.9
R4	12:02	1.1	21.1	53.2	35.1	80.0	5.8	7.74	4.3
R4	12:03	2.1	21.1	53.2	35.1	80.0	5.8	7.74	4.4
R4	12:03	3.0	21.1	53.3	35.1	79.6	5.8	7.74	8.7
R4	12:04	4.0	21.1	53.3	35.2	79.3	5.8	7.75	8.3

R4	12:04	4.0	21.1	53.3	35.1	79.4	5.8	7.75	5.1
R4	12:04	5.1	21.1	53.3	35.1	79.4	5.8	7.75	5.1
R4	12:05	6.1	21.1	53.3	35.1	79.4	5.8	7.75	5.3
R4	12:05	7.1	21.1	53.3	35.2	79.3	5.8	7.75	4.9
R4	12:05	8.1	21.1	53.4	35.2	79.4	5.8	7.75	5.8
R4	12:06	9.1	21.1	53.3	35.2	79.8	5.8	7.76	5.0
R4	12:06	10.0	21.1	53.5	35.3	79.7	5.8	7.76	5.6
R4	12:06	10.2	21.1	53.5	35.3	79.6	5.8	7.76	6.7
Minimum			21.0	53.2	35.1	78.9	5.7	7.7	3.9
Maximum			21.1	53.5	35.3	80.6	5.9	7.8	8.7
Mean			21.1	53.3	35.1	79.5	5.8	7.7	5.6
Standard Deviation of the Mean			0.0	0.1	0.1	0.4	0.0	0.0	1.1

Site	Time	Depth m	Temp °C	Cond (ms/cm)	Sal ppt	DO % sat	DO mg/L	pH units	Turb NTU
M1	13:03	0.1	21.1	53.3	35.2	82.8	6.0	7.83	3.1
M1	13:03	1.0	21.1	53.3	35.2	81.9	5.9	7.83	3.8
M1	13:03	1.6	21.1	53.3	35.2	81.4	5.9	7.83	3.7
M1	13:04	2.0	21.1	53.3	35.2	81.2	5.9	7.83	3.1
M1	13:04	2.4	21.1	53.3	35.2	80.9	5.9	7.83	4.0
M1	13:04	3.0	21.1	53.3	35.2	80.8	5.9	7.83	3.8
M2	12:55	0.1	21.1	53.2	35.1	83.1	6.0	7.83	3.4
M2	12:56	1.0	21.1	53.2	35.1	82.2	6.0	7.83	3.9
M2	12:56	2.0	21.1	53.2	35.1	81.5	5.9	7.82	3.8
M2	12:56	3.0	21.1	53.2	35.1	80.9	5.9	7.82	4.0
M2	12:56	4.0	21.1	53.3	35.1	80.9	5.9	7.83	5.7
M2	12:57	5.1	21.1	53.3	35.2	80.8	5.9	7.83	3.9
M2	12:57	6.0	21.1	53.4	35.2	80.5	5.8	7.83	3.8
M2	12:57	6.4	21.1	53.4	35.2	80.7	5.8	7.83	3.6
M2	12:57	6.6	21.1	53.4	35.2	80.7	5.8	7.83	5.7
M2	12:58	6.8	21.1	53.4	35.2	80.4	5.8	7.83	6.7
M3	12:50	0.2	21.1	53.2	35.1	80.9	5.9	7.81	3.9
M3	12:50	1.2	21.1	53.2	35.1	80.7	5.9	7.81	4.0
M3	12:50	2.1	21.1	53.3	35.1	80.6	5.9	7.82	4.9
M3	12:51	3.0	21.1	53.3	35.1	80.5	5.8	7.82	3.6
M3	12:51	4.0	21.1	53.3	35.2	80.4	5.8	7.82	4.7
M3	12:51	5.2	21.1	53.3	35.2	80.2	5.8	7.82	3.9
M3	12:52	6.0	21.1	53.4	35.2	80.1	5.8	7.82	4.5
M4	12:13	0.3	21.1	53.3	35.1	80.9	5.9	7.76	4.3
M4	12:13	1.1	21.1	53.3	35.1	80.8	5.9	7.76	4.4
M4	12:14	2.0	21.1	53.3	35.1	81.2	5.9	7.76	5.2
M4	12:15	4.0	21.1	53.4	35.2	81.7	5.9	7.77	4.8
M4	12:15	5.0	21.1	53.5	35.3	81.4	5.9	7.77	5.6
M4	12:15	4.2	21.1	53.4	35.2	81.0	5.9	7.77	5.1
Minimum			21.1	53.2	35.1	80.1	5.8	7.8	3.1
Maximum			21.1	53.5	35.3	83.1	6.0	7.8	6.7
Mean			21.1	53.3	35.2	81.1	5.9	7.8	4.3
Standard Deviation of the Mean			0.0	0.1	0.0	0.7	0.1	0.0	0.9

Site	Time	Depth	Temp	Cond	Sal	DO	DO	pH	Turb

		m	°C	(ms/cm)	ppt	% sat	mg/L	units	NTU
B1	12:42	0.1	21.1	53.3	35.1	82.5	6.0	7.81	3.4
B1	12:42	1.0	21.1	53.3	35.2	81.4	5.9	7.81	4.4
B1	12:43	2.1	21.1	53.3	35.2	80.8	5.9	7.81	3.5
B1	12:43	2.8	21.1	53.4	35.2	80.7	5.8	7.81	3.6
B1	12:43	3.1	21.1	53.4	35.2	80.8	5.9	7.82	4.0
B1	12:43	3.4	21.1	53.4	35.2	80.8	5.9	7.82	3.0
B1	12:44	3.7	21.1	53.4	35.2	81.0	5.9	7.82	3.7
B1	12:44	3.9	21.1	53.4	35.2	80.9	5.9	7.82	4.2
B1	12:44	4.0	21.1	53.4	35.2	80.8	5.9	7.82	5.0
B2	12:36	0.1	21.1	53.3	35.2	82.4	6.0	7.80	2.9
B2	12:36	1.0	21.1	53.3	35.2	80.7	5.9	7.80	3.2
B2	12:36	2.1	21.1	53.3	35.2	80.5	5.8	7.80	3.6
B2	12:37	3.1	21.1	53.4	35.2	80.7	5.9	7.81	3.2
B2	12:37	3.3	21.1	53.4	35.2	80.9	5.9	7.81	3.0
B2	12:37	3.7	21.1	53.4	35.2	81.0	5.9	7.81	4.2
B3	12:28	0.1	21.1	53.3	35.2	79.8	5.8	7.78	2.5
B3	12:28	0.1	21.1	53.3	35.1	80.2	5.8	7.78	3.7
B3	12:29	1.0	21.1	53.3	35.2	80.1	5.8	7.79	3.4
B3	12:29	2.0	21.1	53.4	35.2	80.3	5.8	7.79	3.4
B3	12:29	3.0	21.1	53.4	35.2	81.1	5.9	7.80	4.0
B3	12:30	3.3	21.1	53.4	35.2	81.2	5.9	7.80	4.7
B3	12:30	3.6	21.1	53.4	35.2	81.2	5.9	7.80	3.6
B3	12:30	3.9	21.1	53.4	35.2	81.1	5.9	7.80	3.9
B3	12:30	3.8	21.1	53.4	35.2	80.8	5.8	7.80	6.2
B4	12:22	0.1	21.1	38.8	24.7	88.2	6.5	7.78	23.1
B4	12:22	0.8	21.1	53.3	35.2	81.9	5.9	7.78	3.2
B4	12:22	1.0	21.1	53.3	35.2	81.3	5.9	7.78	3.3
B4	12:22	2.1	21.1	53.4	35.2	80.8	5.9	7.78	4.1
B4	12:22	3.0	21.1	53.5	35.3	80.9	5.9	7.79	4.0
B4	12:22	3.5	21.1	53.5	35.3	81.2	5.9	7.79	4.1
B4	12:22	3.7	21.1	53.5	35.3	81.2	5.9	7.79	4.5
B4	12:22	4.0	21.1	53.5	35.3	81.0	5.9	7.79	5.3
Minimum		Min	21.1	38.8	24.7	79.8	5.8	7.8	2.5
Maximum		Max	21.1	53.5	35.3	88.2	6.5	7.8	23.1
Mean		Mean	21.1	52.9	34.9	81.2	5.9	7.8	4.4
Standard Deviation of the Mean		SD	0.0	2.6	1.9	1.4	0.1	0.0	3.5

C-2 Wet Weather Sampling

As the wet weather even predicted for late August was scheduled to be steady and low intensity but widespread rainfall rather than heavy rain, the decision was made to split the wet weather sampling over two days, initial sampling during the start of river flooding (rising limb, around 15:00 on 29th August) and during the tail of the rain storm the next day (falling limb around 12:00 on 30th August). Accordingly, a set of half the sample sites (see **Figure 14** in main text) was sampled on each day.

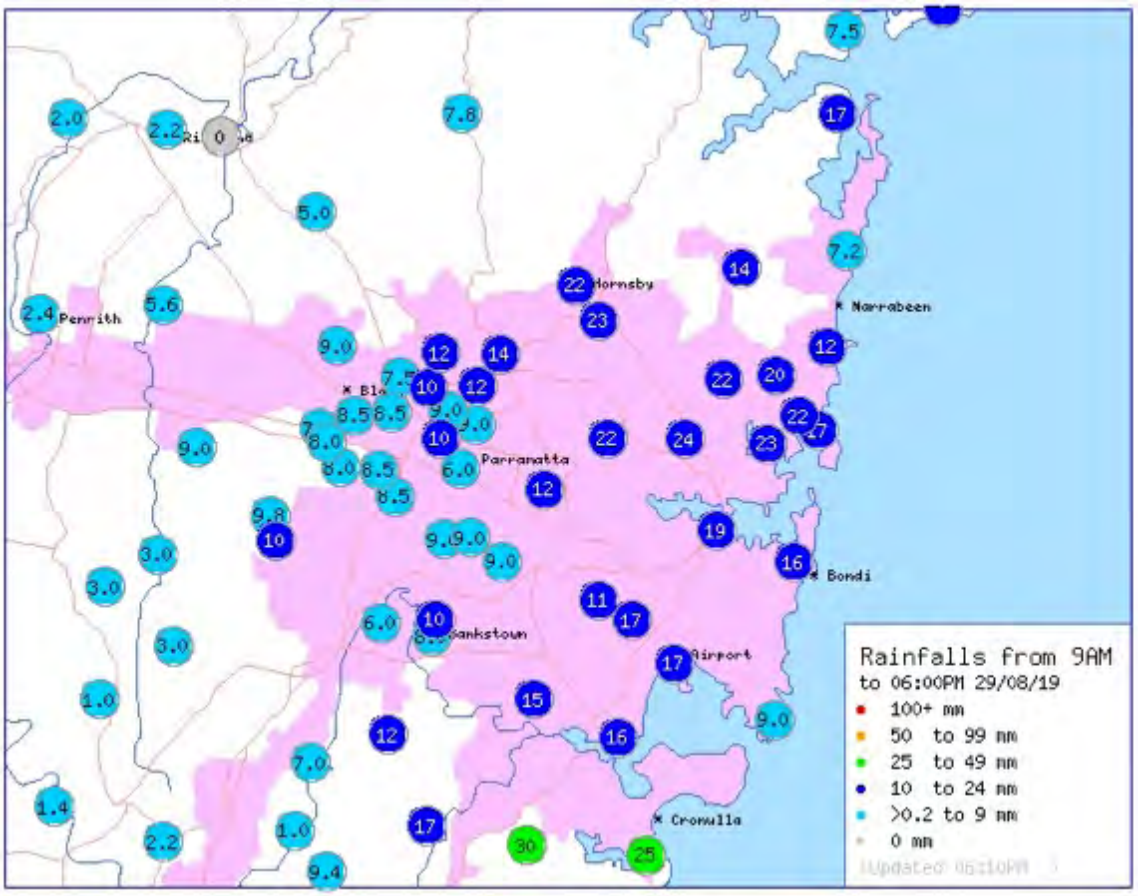


Figure C-1 Total Rainfall (mm) recorded for Parramatta River and Sydney Basin BoM sites between 9:00 and 18:00 on 29 August 2019 (GBM Rising Limb sampling between 15:00 and 16:00).

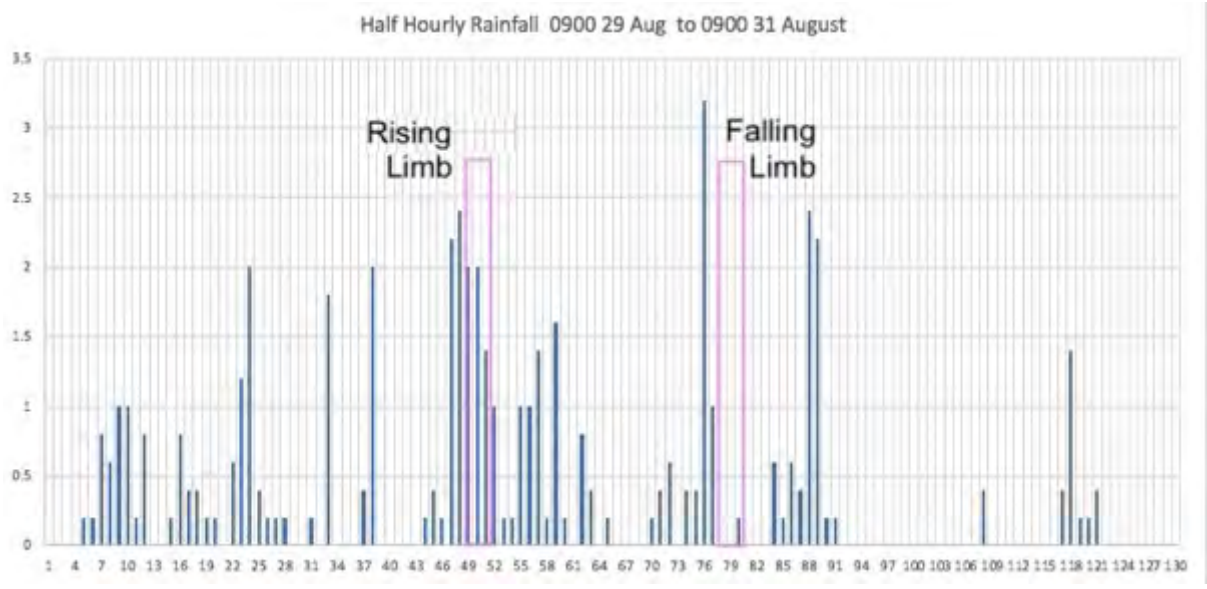


Figure C-2 Half-hourly rainfall recorded at Sydney Olympic Park BoM Gauge. The pink boxes indicate the sampling times for the Wet Weather sampling. Note that the 130 observations are between 09:00 on 29th to 09:00 on 31st 2019. Whilst 96 of the readings are at half hourly intervals, the automatic sampling will record additional values during storm bursts - in this case 36 records (see also **Figure C-3** below for rainfall accumulation graph).

Figure C-3 Accumulated rainfall recorded at Sydney Olympic Park BoM Gauge. from 09:00 on 29th to 09:00 on 31st 2019. The pink boxes indicate the sampling times for the Wet Weather sampling (15:00 to 16:00 on 29th for Raising Limb and 12:00 to 13:00 on 30th August for Falling Limb).

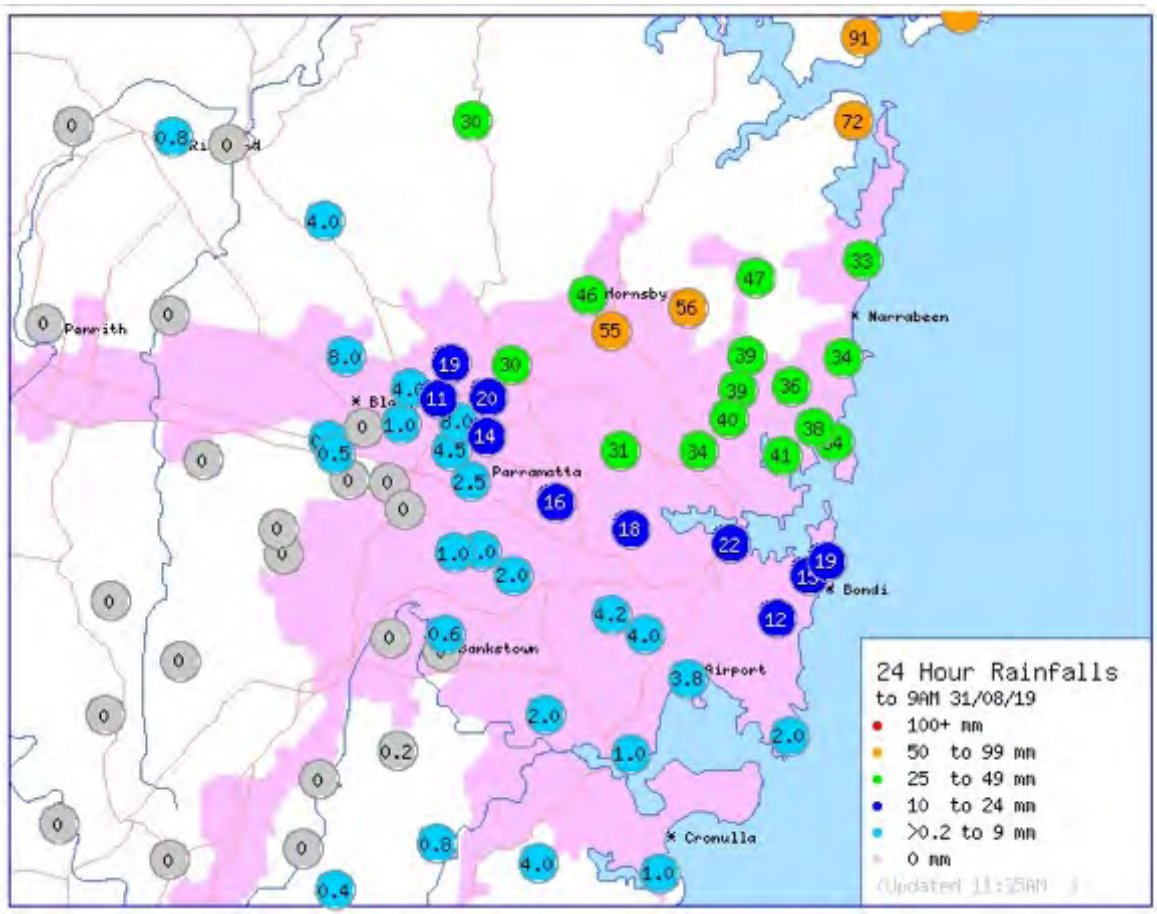


Figure C-4 Total Rainfall (mm) recorded for Parramatta River and Sydney Basin BoM sites between 09:00 on 30th August and 09:00 on 31st August 2019 (GBM Falling Limb sampling between 1200 and 13:00).

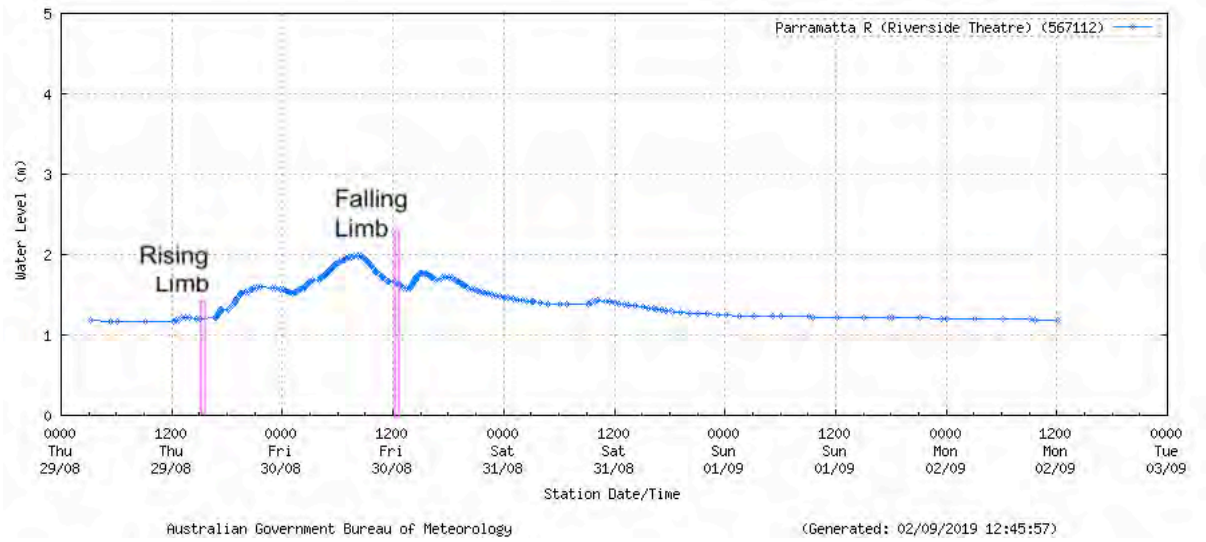


Figure C-5 Parramatta River Height (m) at BoM Riverside Theater site in the last weir pool before the head of the estuary at Parramatta. The pink boxes indicate the wet weather water quality sampling times (15:00 to 16:00 on 29th for Raising Limb and 12:00 to 13:00 on 30th August for Falling Limb).

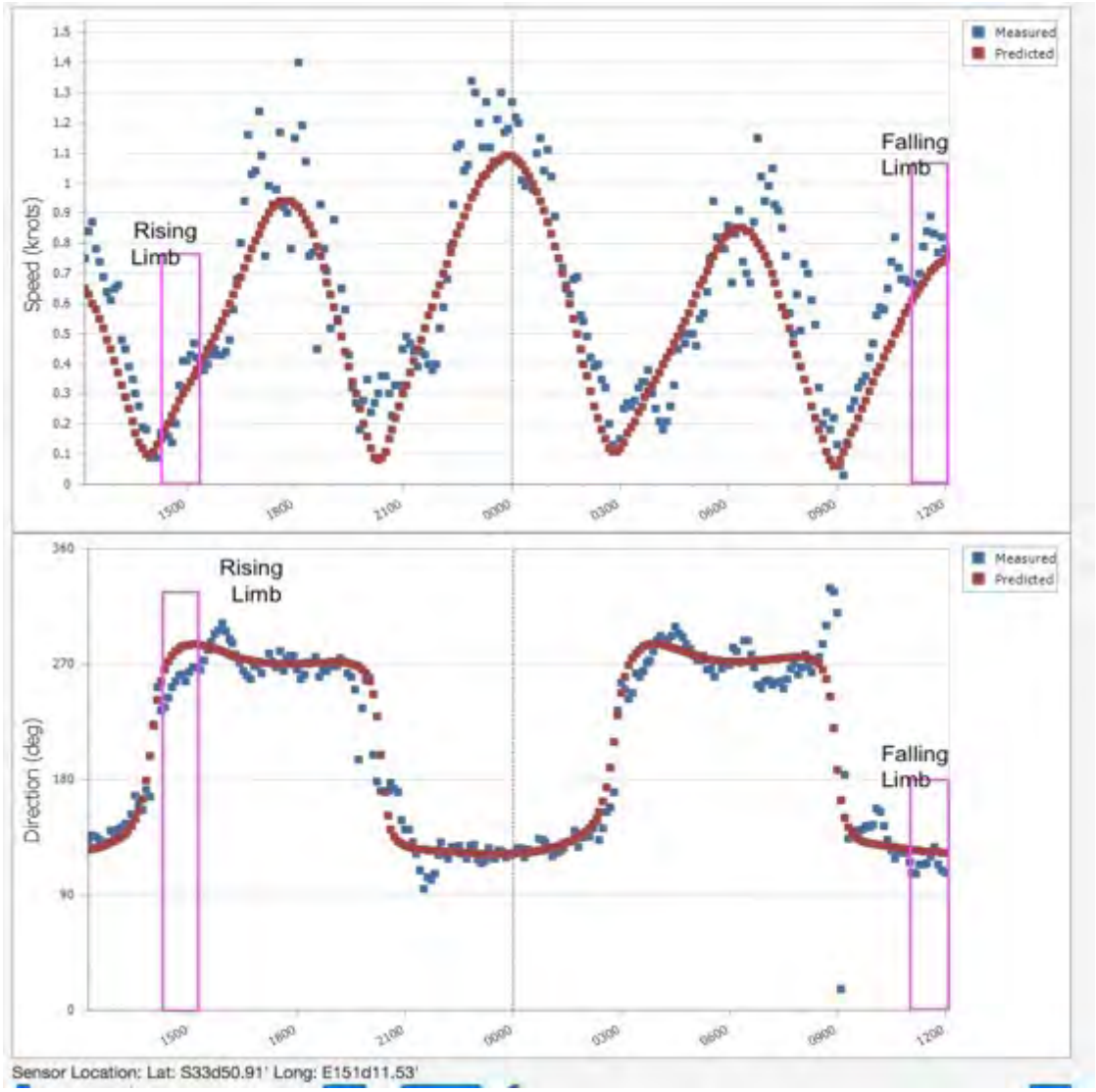


Figure C-6 Estuary Current & Direction at Balls Head. Note sampling times have been offset for the ± 45min lag at Gladesville Bridge.

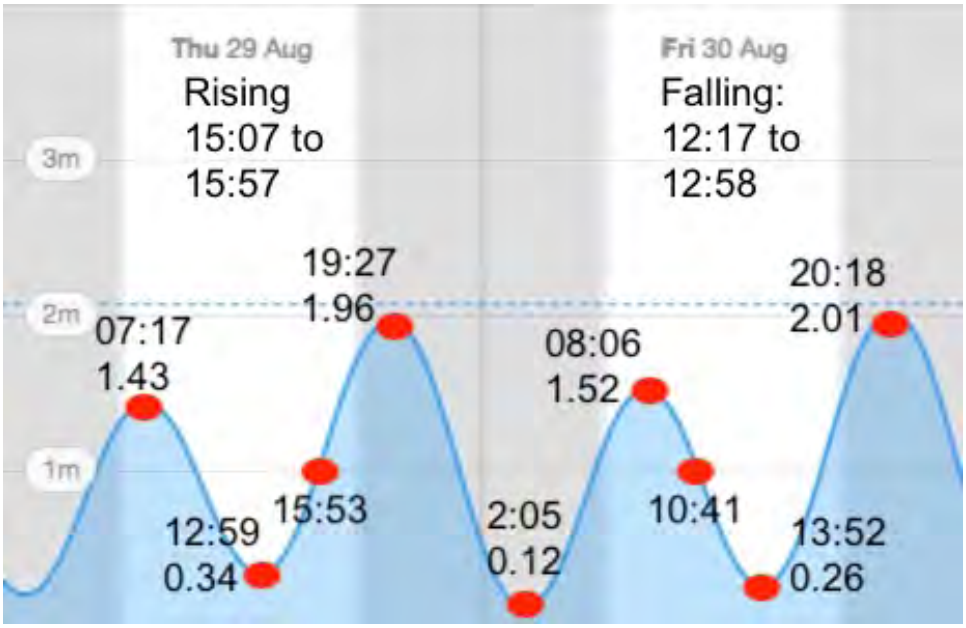


Figure C7 Predicted Tides at Gladesville Bridge 29 to 30 August 2019. As the tidal anomaly for this period was close to zero, the predicted tides are the actual tides.

Table C-3 Gladesville Bridge Marina Wet Weather Water Quality Profiling Results 29 to 30 August 2019

Site	Date	Depth	Temp	Sal	pH	ORP	Turb	DO	DO
Rising Limb		m	°C	ppt	units	mV	NTU	%sat	mg/L
R1	29/8/19	0.1	14.81	36.12	7.56	516	0.5	91.7	7.45
R1	29/8/19	0.1	14.82	36.09	7.58	515	0.8	91.6	7.44
R1	29/8/19	0.2	14.82	36.17	7.60	514	0.2	91.6	7.43
R1	29/8/19	0.3	14.84	36.19	7.62	514	0.2	91.8	7.45
R1	29/8/19	0.5	14.85	36.20	7.64	513	0.1	91.8	7.45
R1	29/8/19	0.7	14.84	36.22	7.66	511	0.1	91.5	7.42
R1	29/8/19	0.8	14.83	36.24	7.69	510	0.1	91.2	7.40
R1	29/8/19	1.0	14.84	36.17	7.71	509	0.0	91.1	7.39
R1	29/8/19	1.6	14.82	36.08	7.74	508	0.1	90.7	7.37
R1	29/8/19	2.5	14.83	36.19	7.77	507	0.2	90.3	7.33
R1	29/8/19	3.2	14.82	36.15	7.80	506	0.2	90.4	7.34
R1	29/8/19	3.6	14.82	36.13	7.81	505	0.1	90.4	7.34
R1	29/8/19	4.2	14.82	36.14	7.83	504	0.1	90.7	7.36
R1	29/8/19	4.6	14.82	36.14	7.85	503	0.3	90.9	7.38
R1	29/8/19	5.4	14.82	36.13	7.85	503	0.1	91.0	7.39
R1	29/8/19	5.6	14.82	36.15	7.86	503	0.4	91.0	7.39
R1	29/8/19	6.5	14.82	36.18	7.87	503	0.1	91.3	7.41
R1	29/8/19	7.6	14.82	36.25	7.88	502	0.5	91.7	7.44
R1	29/8/19	8.6	14.82	36.24	7.88	502	0.4	91.9	7.45
R1	29/8/19	9.4	14.81	36.20	7.89	502	0.3	92.3	7.49
R1	29/8/19	10.0	14.82	36.16	7.89	501	0.9	92.4	7.50
R2	29/8/19	0.1	14.79	36.30	7.94	480	0.1	89.2	7.24
R2	29/8/19	0.1	14.78	36.32	7.98	480	0.3	89.3	7.25
R2	29/8/19	0.2	14.79	36.33	7.94	480	0.2	89.3	7.25
R2	29/8/19	0.2	14.79	36.32	7.94	480	0.1	89.4	7.26
R2	29/8/19	0.3	14.79	36.33	7.94	480	0.1	89.7	7.28
R2	29/8/19	0.5	14.81	36.31	7.94	480	0.1	89.4	7.26
R2	29/8/19	0.6	14.81	36.31	7.94	480	0.1	89.5	7.26

R2	29/8/19	0.7	14.80	36.29	7.94	480	0.1	89.6	7.27
R2	29/8/19	1.2	14.79	36.30	7.95	480	0.1	89.8	7.29
R2	29/8/19	1.7	14.79	36.25	7.95	480	0.1	90.0	7.30
R2	29/8/19	2.7	14.80	36.20	7.95	480	0.2	90.3	7.33
R2	29/8/19	3.7	14.80	36.19	7.96	480	0.2	90.5	7.35
R2	29/8/19	4.7	14.81	36.20	7.97	480	0.0	90.9	7.38
R2	29/8/19	5.6	14.81	36.16	7.97	480	0.1	91.3	7.41
R2	29/8/19	6.6	14.81	36.11	7.98	480	0.4	91.5	7.43
R2	29/8/19	7.6	14.81	36.10	7.98	480	0.2	91.8	7.46
R2	29/8/19	8.5	14.81	36.14	7.98	480	0.7	91.8	7.45
R2	29/8/19	9.5	14.82	36.16	8.00	479	0.4	92.0	7.47
R2	29/8/19	9.8	14.81	36.15	8.00	479	5.0	92.2	7.49
R2	29/8/19	10.8	14.82	36.14	8.01	479	1.6	92.5	7.51
M1	29/8/19	0.1	14.80	36.09	8.01	465	0.3	90.5	7.35
M1	29/8/19	0.2	14.80	36.11	7.98	465	0.2	90.4	7.35
M1	29/8/19	0.2	14.80	36.15	7.98	466	0.1	90.4	7.34
M1	29/8/19	0.3	14.80	36.20	7.98	466	0.1	90.4	7.34
M1	29/8/19	0.4	14.81	36.16	7.98	464	0.3	90.1	7.32
M1	29/8/19	0.5	14.81	36.13	7.98	464	0.4	90.3	7.33
M1	29/8/19	0.8	14.82	36.19	7.98	464	0.1	90.4	7.34
M1	29/8/19	1.3	14.82	36.21	7.98	464	0.1	90.1	7.31
M1	29/8/19	1.6	14.82	36.21	7.98	464	0.1	90.4	7.34
M1	29/8/19	2.6	14.82	36.20	7.98	464	0.1	90.3	7.33
M1	29/8/19	2.9	14.81	36.21	7.99	465	0.2	90.6	7.35
M1	29/8/19	3.5	14.81	36.21	7.99	465	0.6	90.6	7.35
M2	29/8/19	0.1	14.79	36.26	7.99	457	0.3	89.9	7.30
M2	29/8/19	0.2	14.79	36.27	8.00	457	0.2	90.0	7.30
M2	29/8/19	0.3	14.80	36.26	8.00	457	0.2	89.9	7.30
M2	29/8/19	0.5	14.79	36.26	8.00	457	0.1	89.8	7.29
M2	29/8/19	0.7	14.80	36.27	8.00	458	0.0	89.8	7.28
M2	29/8/19	0.9	14.80	36.24	8.00	458	0.1	89.9	7.30
M2	29/8/19	1.3	14.80	36.24	8.00	458	0.1	90.2	7.32
M2	29/8/19	1.6	14.80	36.23	8.00	458	0.0	90.3	7.33
M2	29/8/19	2.1	14.80	36.24	8.00	458	0.1	90.4	7.34
M2	29/8/19	2.7	14.80	36.21	8.01	458	0.3	90.5	7.35
M2	29/8/19	3.0	14.80	36.20	8.01	458	0.1	90.7	7.36
M2	29/8/19	3.1	14.80	36.19	8.01	459	0.1	90.6	7.35
M2	29/8/19	3.7	14.81	36.16	8.01	459	0.1	90.7	7.37
M2	29/8/19	4.7	14.81	36.14	8.01	459	0.3	90.7	7.36
M2	29/8/19	5.7	14.81	36.14	8.01	459	0.8	90.8	7.37
B2	29/8/19	0.1	14.81	36.15	7.96	451	0.1	89.9	7.31
B2	29/8/19	0.2	14.80	36.18	7.99	451	0.2	90.0	7.31
B2	29/8/19	0.3	14.81	36.18	7.96	451	0.1	90.0	7.31
B2	29/8/19	0.4	14.82	36.18	7.96	452	0.3	90.0	7.31
B2	29/8/19	0.6	14.82	36.17	7.97	452	0.2	90.2	7.32
B2	29/8/19	0.7	14.82	36.18	7.96	452	0.1	90.2	7.32
B2	29/8/19	1.1	14.82	36.12	7.97	452	0.2	90.3	7.34
B2	29/8/19	1.7	14.82	36.12	7.97	452	0.1	90.3	7.33
B2	29/8/19	2.5	14.80	36.13	7.97	453	0.1	90.3	7.33
B2	29/8/19	2.7	14.81	36.13	7.97	453	0.3	90.2	7.33
B2	29/8/19	3.3	14.81	36.13	7.97	453	0.2	90.1	7.32
B3	29/8/19	0.1	14.79	36.19	8.01	445	0.2	90.4	7.34
B3	29/8/19	0.2	14.80	36.21	8.01	445	0.1	90.1	7.32

B3	29/8/19	0.3	14.80	36.22	8.01	445	0.1	90.0	7.31
B3	29/8/19	0.5	14.80	36.18	8.01	445	0.3	90.0	7.31
B3	29/8/19	0.7	14.80	36.18	8.01	446	0.1	89.8	7.30
B3	29/8/19	1.0	14.80	36.15	8.01	446	0.1	90.0	7.31
B3	29/8/19	1.2	14.80	36.16	8.01	446	0.1	90.4	7.34
B3	29/8/19	1.7	14.80	36.17	8.01	446	0.2	90.5	7.35
B3	29/8/19	2.1	14.81	36.16	8.02	446	0.4	90.6	7.36
B3	29/8/19	2.7	14.81	36.15	8.01	447	0.3	90.4	7.34
B3	29/8/19	3.1	14.82	36.13	8.02	447	0.2	90.6	7.36
B3	29/8/19	3.6	14.82	36.13	8.02	447	0.4	90.5	7.35

Table C-3 (cont) Gladesville Bridge Marina Wet Weather Water Quality Profiling Results 30 August 2019

Site	Date	Depth	Temp	Sal	pH	ORP	Turb	DO	DO
Falling Limb		m	°C	ppt	units	mV	NTU	%sat	mg/L
R1	30/8/19	0.1	14.57	35.93	8.00	447	0.3	90.6	7.40
R1	30/8/19	0.1	14.58	35.98	8.00	447	0.1	90.5	7.39
R1	30/8/19	0.2	14.58	35.96	8.01	447	0.1	90.4	7.39
R1	30/8/19	0.2	14.59	36.00	8.00	447	0.1	90.2	7.37
R1	30/8/19	0.3	14.60	35.99	8.01	446	0.2	90.4	7.38
R1	30/8/19	0.4	14.60	36.02	8.01	446	0.1	90.3	7.37
R1	30/8/19	0.5	14.61	36.01	8.01	446	0.4	90.3	7.37
R1	30/8/19	0.6	14.62	36.01	8.02	446	0.5	90.2	7.36
R1	30/8/19	0.7	14.61	36.03	8.02	446	0.1	90.3	7.37
R1	30/8/19	0.8	14.61	35.99	8.02	446	0.1	90.3	7.37
R1	30/8/19	1.6	14.61	36.00	8.03	446	0.1	90.4	7.38
R1	30/8/19	2.6	14.63	35.97	8.03	446	0.3	90.6	7.40
R1	30/8/19	3.6	14.61	35.93	8.03	446	0.0	91.1	7.44
R1	30/8/19	4.6	14.65	36.00	8.04	446	0.0	91.0	7.42
R1	30/8/19	5.6	14.64	35.94	8.04	446	0.0	91.1	7.44
R1	30/8/19	6.6	14.63	35.88	8.05	446	0.4	91.3	7.46
R1	30/8/19	7.6	14.64	35.88	8.05	446	0.0	91.9	7.50
R1	30/8/19	8.7	14.67	35.92	8.06	446	0.1	92.0	7.51
R1	30/8/19	9.5	14.67	35.90	8.02	446	0.0	91.9	7.50
R2	30/8/19	0.1	14.59	35.87	8.09	446	0.5	90.6	7.40
R2	30/8/19	0.2	14.59	35.88	8.09	445	0.3	90.2	7.37
R2	30/8/19	0.3	14.59	35.88	8.08	445	0.2	89.9	7.34
R2	30/8/19	0.5	14.59	35.86	8.07	445	0.2	89.8	7.34
R2	30/8/19	0.6	14.59	35.86	8.06	445	0.0	89.8	7.34
R2	30/8/19	1.0	14.58	35.85	8.06	445	0.2	89.8	7.34
R2	30/8/19	1.7	14.59	35.88	8.06	445	0.1	90.0	7.36
R2	30/8/19	2.6	14.60	35.88	8.07	445	0.4	90.1	7.36
R2	30/8/19	3.7	14.61	35.81	8.07	445	0.1	90.3	7.38
R2	30/8/19	4.7	14.59	35.76	8.07	445	0.0	90.5	7.40
R2	30/8/19	5.6	14.61	35.84	8.08	445	0.1	90.7	7.41
R2	30/8/19	6.7	14.61	35.74	8.08	445	0.4	90.9	7.43
R2	30/8/19	7.7	14.63	35.76	8.09	445	0.1	91.2	7.45
R2	30/8/19	8.4	14.63	35.77	8.09	445	0.1	91.2	7.45
M1	30/8/19	0.1	14.66	35.87	8.08	432	0.1	92.3	7.53
M1	30/8/19	0.1	14.66	35.88	8.08	431	0.1	90.4	7.38
M1	30/8/19	0.3	14.66	35.93	8.08	431	0.1	90.5	7.38

M1	30/8/19	0.3	14.67	35.91	8.08	431	0.1	90.4	7.38
M1	30/8/19	0.3	14.66	35.90	8.08	432	0.2	90.5	7.38
M1	30/8/19	0.4	14.67	35.96	8.07	432	0.1	90.5	7.38
M1	30/8/19	0.4	14.67	35.95	8.07	432	0.1	90.5	7.38
M1	30/8/19	0.6	14.66	35.88	8.07	432	0.1	90.3	7.37
M1	30/8/19	0.7	14.67	35.90	8.07	432	0.1	90.3	7.36
M1	30/8/19	1.2	14.66	35.91	8.07	432	0.0	90.3	7.37
M1	30/8/19	1.6	14.67	35.93	8.07	432	0.1	90.5	7.38
M1	30/8/19	1.8	14.67	35.95	8.07	432	0.0	90.5	7.38
M1	30/8/19	2.3	14.67	35.96	8.07	432	0.1	90.8	7.41
M2	30/8/19	0.1	14.55	35.86	8.07	426	0.2	89.6	7.33
M2	30/8/19	0.1	14.56	35.87	8.07	425	0.1	89.3	7.30
M2	30/8/19	0.2	14.57	35.89	8.06	425	0.2	89.2	7.29
M2	30/8/19	0.2	14.57	35.90	8.06	425	0.1	89.2	7.29
M2	30/8/19	0.3	14.57	35.89	8.07	426	0.3	89.3	7.30
M2	30/8/19	0.4	14.57	35.91	8.07	426	0.1	89.4	7.30
M2	30/8/19	0.5	14.57	35.89	8.06	426	0.1	89.2	7.29
M2	30/8/19	0.6	14.58	35.88	8.06	426	0.1	89.2	7.29
M2	30/8/19	0.7	14.58	35.84	8.06	426	0.1	89.0	7.28
M2	30/8/19	1.2	14.59	35.79	8.06	426	0.3	89.1	7.28
M2	30/8/19	1.7	14.59	35.78	8.06	426	0.0	89.0	7.28
M2	30/8/19	2.4	14.59	35.77	8.07	427	0.2	89.3	7.30
M2	30/8/19	2.9	14.59	35.78	8.07	427	0.3	89.3	7.30
M2	30/8/19	3.7	14.60	35.79	8.07	427	0.3	89.5	7.32
M2	30/8/19	4.7	14.61	35.82	8.07	427	0.1	89.8	7.33
M2	30/8/19	5.8	14.62	35.80	8.08	427	0.7	90.1	7.36
M2	30/8/19	6.5	14.62	35.77	8.08	427	2.0	90.1	7.36
B2	30/8/19	0.1	14.46	34.95	8.13	420	0.1	92.1	7.59
B2	30/8/19	0.1	14.61	35.61	8.11	420	0.1	91.2	7.46
B2	30/8/19	0.2	14.64	35.75	8.10	420	0.2	90.7	7.41
B2	30/8/19	0.4	14.61	35.77	8.08	421	0.3	90.5	7.40
B2	30/8/19	0.5	14.60	35.85	8.08	421	0.0	90.0	7.36
B2	30/8/19	0.7	14.61	35.85	8.07	421	0.0	89.6	7.32
B2	30/8/19	1.1	14.63	35.91	8.08	421	0.0	89.2	7.28
B2	30/8/19	1.7	14.63	35.95	8.08	421	0.1	89.2	7.28
B2	30/8/19	2.0	14.64	35.94	8.08	421	0.1	89.4	7.29
B2	30/8/19	2.6	14.65	35.92	8.09	421	0.1	89.6	7.31
B2	30/8/19	2.8	14.66	35.90	8.09	421	0.1	89.7	7.32
B3	30/8/19	0.1	14.58	35.83	8.06	424	0.2	89.1	7.28
B3	30/8/19	0.1	14.60	35.86	8.06	424	0.3	88.8	7.25
B3	30/8/19	0.2	14.60	35.85	8.06	424	0.3	88.7	7.25
B3	30/8/19	0.3	14.60	35.86	8.06	424	0.1	88.7	7.24
B3	30/8/19	0.3	14.60	35.87	8.06	424	0.3	88.8	7.26
B3	30/8/19	0.4	14.61	35.87	8.06	424	0.2	88.9	7.26
B3	30/8/19	0.5	14.61	35.87	8.06	424	0.1	89.0	7.27
B3	30/8/19	0.6	14.61	35.88	8.06	425	0.1	89.0	7.27
B3	30/8/19	0.7	14.61	35.88	8.06	425	0.1	89.1	7.27
B3	30/8/19	0.8	14.61	35.83	8.06	425	0.1	89.1	7.28
B3	30/8/19	1.0	14.61	35.79	8.06	425	0.1	89.0	7.27
B3	30/8/19	1.7	14.61	35.79	8.06	425	0.1	89.1	7.28
B3	30/8/19	2.2	14.61	35.80	8.06	425	0.1	89.3	7.30
B3	30/8/19	2.6	14.61	35.80	8.06	426	0.2	89.3	7.29
B3	30/8/19	3.2	14.62	35.77	8.06	426	0.2	89.3	7.30

Table C-3 Gladesville Bridge Marina Base-Line Water Quality Results 2019 *																								
Sample	Analyte	R1 S	R2 S	R3 S	R4 S	R1 B	R2 B	R3 B	R4 B	M1 S	M2 S	M3 S	M4 S	M1 B	M2 B	M3 B	M4 B	B1 S	B2 S	B3 S	B4 S	B1 B	B2 B	B3 B	B4 B
NEAP	TSS	3	3	3	0.5		2			2	1	0.5	3		2		3	3	3	0.5	4		0.5		3
Wet Up	TSS	8	7			13	11			7	8			8	6				7	3			8	8	
Wet Down	TSS	3	7			6	3			3	5			4	6				3	6			6	6	
Spring Ebb	TSS																								
Sp Flood	TSS																								
NEAP	Copper	2	2	2	2		2			2	2	2	2		2		2	2	2	2	2		2		2
Wet Up	Copper	0.5	0.5			0.5	0.5			3	0.5			0.5	0.5				0.5	0.5			0.5	0.5	
Wet Down	Copper	3	2			2	2			4	2			2	2				2	2			2	2	
Spring Ebb	Copper																								
Sp Flood	Copper																								
NEAP	DOC**	0.5	2	1	1		1			1	1	1	1		1		0.5	1	1	1	1		1		1
Wet Up	DOC	2	2			2	2			2	2			2	2				2	2			2	2	
Wet Down	DOC	0.5	1			0.5	1			0.5	1			1	0.5				0.5	0.5			0.5	0.5	
Spring Ebb	DOC																								
Sp Flood	DOC																								
Notes:	* Detection Limits are 1mg/L (TSS and DOC) and 1µg/L for Cu. Values < detection are set at half detection for statistical evaluations. S = surface sample, B = bottom sample. **DOC = Dissolved organic carbon,																								

Table C-4 Summary Statistics of Baseline Water Sample Analysis Results to September 2019											
Sample		Survey Means (Site X Depth)						Total Means & SDs (Surface & Bottom)			
	Location	R		M		B		Total	SD	Total	SD
	Depth	S	B	S	B	S	B	Surface		Bottom	
NEAP	TSS	2.4	2.0	1.6	2.5	2.6	1.8	2.21	1.25	2.10	1.02
Wet Up	TSS	7.5	12.0	7.5	7.0	5.0	8.0	6.67	1.86	9.00	2.53
Wet Down	TSS	5.0	4.5	4.0	5.0	4.5	6.0	4.50	1.76	5.17	1.33
Spring Ebb	TSS										
Sp Flood	TSS										
NEAP	Copper	2.0	2.0	2.0	2.0	2.0	2.0	2.00	0.00	2.00	0.00
Wet Up	Copper	0.5	0.5	1.8	0.5	0.5	0.5	0.92	1.02	0.50	0.00
Wet Down	Copper	2.5	2.0	3.0	2.0	2.0	2.0	2.50	0.84	2.00	0.00
Spring Ebb	Copper										
Sp Flood	Copper										
NEAP	DOC**	1.1	1.0	1.0	0.8	1.0	1.0	1.04	0.33	0.90	0.22
Wet Up	DOC	2.0	2.0	2.0	2.0	2.0	2.0	2.00	0.00	2.00	0.00
Wet Down	DOC	0.8	0.8	0.8	0.8	0.5	0.5	0.67	0.26	0.67	0.26
Spring Ebb	DOC										
Sp Flood	DOC										
Notes:	* Detection Limits are 1mg/L (TSS and DOC) and 1µg/L for Cu. Values < detection are set at half detection for statistical evaluations. S = surface sample, B = bottom sample. **DOC = Dissolved organic carbon, SD = Standard Deviation of the mean.										

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1913103**	Page	: 1 of 6
Client	: **MARINE POLLUTION RESEARCH PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR JACOB BROOM (gmail)	Contact	: Customer Services ES
Address	: PO BOX 279 CHURCH POINT SYDNEY NSW 2105	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: 02 9997 6541	Telephone	: +61-2-8784 8555
Project	: ----	Date Samples Received	: 01-May-2019 14:15
Order number	:	Date Analysis Commenced	: 03-May-2019
C-O-C number	: ----	Issue Date	: 08-May-2019 12:51
Sampler	: Jacob Broom		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 17		
No. of samples analysed	: 17		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EG093: Samples containing high levels of sulfate may precipitate barium under the acidic conditions of this method and may therefore bias results low.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	R1-Surf	R2-Surf	R3-Surf	R4-Surf	B1-Surf
				Client sampling date / time	01-May-2019 00:00	01-May-2019 00:00	01-May-2019 00:00	01-May-2019 00:00	01-May-2019 00:00
Compound	CAS Number	LOR	Unit		ES1913103-001	ES1913103-002	ES1913103-003	ES1913103-004	ES1913103-005
					Result	Result	Result	Result	Result
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	1	mg/L		**3**	**3**	**3**	<1	**3**
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS									
Copper	7440-50-8	1	µg/L		**2**	**2**	**2**	**2**	**2**
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L		<1	**2**	**1**	**1**	**1**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	B2-Surf	B3-Surf	B4-Surf	M1-Surf	M2-Surf
				Client sampling date / time	01-May-2019 00:00	01-May-2019 00:00	01-May-2019 00:00	01-May-2019 00:00	01-May-2019 00:00
Compound	CAS Number	LOR	Unit		ES1913103-006	ES1913103-007	ES1913103-008	ES1913103-009	ES1913103-010
					Result	Result	Result	Result	Result
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	1	mg/L		**3**	<1	**4**	**2**	**1**
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS									
Copper	7440-50-8	1	µg/L		**2**	**2**	**2**	**2**	**2**
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L		**1**	**1**	**1**	**1**	**1**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	M3-Surf	M4-Surf	R2-Bott	M4-Bott	M2-Bott
				Client sampling date / time	01-May-2019 00:00	01-May-2019 00:00	01-May-2019 00:00	01-May-2019 00:00	01-May-2019 00:00
Compound	CAS Number	LOR	Unit		ES1913103-011	ES1913103-012	ES1913103-013	ES1913103-014	ES1913103-015
					Result	Result	Result	Result	Result
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	1	mg/L		<1	**3**	**2**	**3**	**2**
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS									
Copper	7440-50-8	1	µg/L		**2**	**2**	**2**	**2**	**2**
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L		**1**	**1**	**1**	<1	**1**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Client sample ID	**B2-Bott**	**B4-Bott**	**----**	**----**	**----**
				Client sampling date / time	01-May-2019 00:00	01-May-2019 00:00	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**ES1913103-016**	**ES1913103-017**	**--------**	**--------**	**--------**
					Result	Result	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	1	mg/L		<1	**3**	**----**	**----**	**----**
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS									
Copper	7440-50-8	1	µg/L		**2**	**2**	**----**	**----**	**----**
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L		**1**	**1**	**----**	**----**	**----**

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1913103**	Page	: 1 of 3
Client	: **MARINE POLLUTION RESEARCH PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR JACOB BROOM (gmail)	Contact	: Customer Services ES
Address	: PO BOX 279 CHURCH POINT SYDNEY NSW 2105	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: 02 9997 6541	Telephone	: +61-2-8784 8555
Project	: ----	Date Samples Received	: 01-May-2019
Order number	:	Date Analysis Commenced	: 03-May-2019
C-O-C number	: ----	Issue Date	: 08-May-2019
Sampler	: Jacob Broom		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 17		
No. of samples analysed	: 17		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 2330996)									
ES1913103-001	R1-Surf	EA025: Suspended Solids (SS)	----	1	mg/L	3	4	28.6	No Limit
ES1913103-010	M2-Surf	EA025: Suspended Solids (SS)	----	1	mg/L	1	5	117	No Limit
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 2329270)									
ES1913103-001	R1-Surf	EG093A-F: Copper	7440-50-8	1	µg/L	2	2	0.00	No Limit
ES1913103-006	B2-Surf	EG093A-F: Copper	7440-50-8	1	µg/L	2	2	0.00	No Limit
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 2329271)									
ES1913103-016	B2-Bott	EG093A-F: Copper	7440-50-8	1	µg/L	2	2	0.00	No Limit
EP002: Dissolved Organic Carbon (DOC) (QC Lot: 2326182)									
ES1913037-001	Anonymous	EP002: Dissolved Organic Carbon	----	1	mg/L	1	1	0.00	No Limit
ES1913103-003	R3-Surf	EP002: Dissolved Organic Carbon	----	1	mg/L	1	1	0.00	No Limit
EP002: Dissolved Organic Carbon (DOC) (QC Lot: 2326184)									
ES1913103-013	R2-Bott	EP002: Dissolved Organic Carbon	----	1	mg/L	1	1	0.00	No Limit
ES1913217-005	Anonymous	EP002: Dissolved Organic Carbon	----	1	mg/L	8	8	0.00	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 2330996)								
EA025: Suspended Solids (SS)	----	1	mg/L	<1	150 mg/L	99.3	83	129
				<1	1000 mg/L	98.2	81	111
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 2329270)								
EG093A-F: Copper	7440-50-8	1	µg/L	<1	10 µg/L	92.5	71	129
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 2329271)								
EG093A-F: Copper	7440-50-8	1	µg/L	<1	10 µg/L	96.4	71	129
EP002: Dissolved Organic Carbon (DOC) (QCLot: 2326182)								
EP002: Dissolved Organic Carbon	----	1	mg/L	<1	10 mg/L	80.4	71	121
EP002: Dissolved Organic Carbon (DOC) (QCLot: 2326184)								
EP002: Dissolved Organic Carbon	----	1	mg/L	<1	10 mg/L	76.8	71	121

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 2329270)							
ES1913103-002	R2-Surf	EG093A-F: Copper	7440-50-8	50 µg/L	93.4	70	130
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 2329271)							
ES1913103-017	B4-Bott	EG093A-F: Copper	7440-50-8	50 µg/L	90.7	70	130
EP002: Dissolved Organic Carbon (DOC) (QCLot: 2326182)							
ES1913049-001	Anonymous	EP002: Dissolved Organic Carbon	----	100 mg/L	85.9	70	130
EP002: Dissolved Organic Carbon (DOC) (QCLot: 2326184)							
ES1913103-014	M4-Bott	EP002: Dissolved Organic Carbon	----	100 mg/L	79.8	70	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1913103**	Page	: 1 of 5
Client	: **MARINE POLLUTION RESEARCH PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR JACOB BROOM (gmail)	Telephone	: +61-2-8784 8555
Project	: ----	Date Samples Received	: 01-May-2019
Site	: ----	Issue Date	: 08-May-2019
Sampler	: Jacob Broom	No. of samples received	: 17
Order number	:	No. of samples analysed	: 17

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA025: Total Suspended Solids dried at 104 ± 2°C							
Clear Plastic Bottle - Natural (EA025)							
R1-Surf, R2-Surf, R3-Surf, R4-Surf, B1-Surf, B2-Surf, B3-Surf, B4-Surf, M1-Surf, M2-Surf, M3-Surf, M4-Surf, R2-Bott, M4-Bott, M2-Bott, B2-Bott, B4-Bott	**01-May-2019**	**----**	----	----	**07-May-2019**	08-May-2019	✓
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS							
Clear Plastic Bottle - Natural (EG093A-F)							
R1-Surf, R2-Surf, R3-Surf, R4-Surf, B1-Surf, B2-Surf, B3-Surf, B4-Surf, M1-Surf, M2-Surf, M3-Surf, M4-Surf, R2-Bott, M4-Bott, M2-Bott, B2-Bott, B4-Bott	**01-May-2019**	**----**	----	----	**06-May-2019**	28-Oct-2019	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP002: Dissolved Organic Carbon (DOC)							
Amber DOC Filtered- Sulfuric Preserved (EP002)							
R1-Surf, R2-Surf, R3-Surf, R4-Surf, B1-Surf, B2-Surf, B3-Surf, B4-Surf, M1-Surf, M2-Surf, M3-Surf, M4-Surf, R2-Bott, M4-Bott, M2-Bott, B2-Bott, B4-Bott	**01-May-2019**	**----**	----	----	**03-May-2019**	29-May-2019	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	3	17	**17.65**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Organic Carbon	EP002	4	32	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids	EA025	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	2	17	**11.76**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Organic Carbon	EP002	2	32	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids	EA025	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	2	17	**11.76**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Organic Carbon	EP002	2	32	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids	EA025	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	2	17	**11.76**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Organic Carbon	EP002	2	32	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Suspended Solids	EA025	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Organic Carbon	EP002	WATER	In house: Referenced to APHA 5310 B. This method is compliant with NEPM (2013) Schedule B(3) . Samples are combusted at high termperature in the presence of an oxidative catalyst. The evolved carbon dioxide is quantified using an IR detector.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1927633**	Page	: 1 of 5
Client	: **MARINE POLLUTION RESEARCH PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Paul Anink	Contact	: Customer Services ES
Address	: PO BOX 279 CHURCH POINT SYDNEY NSW 2105	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Gladesville Bridge Marina	Date Samples Received	: 29-Aug-2019 16:20
Order number	:	Date Analysis Commenced	: 30-Aug-2019
C-O-C number	: ----	Issue Date	: 04-Sep-2019 11:21
Sampler	: Jacob Broom		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 12		
No. of samples analysed	: 12		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EG093: Samples containing high levels of sulfate may precipitate barium under the acidic conditions of this method and may therefore bias results low.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	R1-Surf	R1-Bott	R2-Surf	R2-Bott	M1-Surf
			Client sampling date / time	[29-Aug-2019]	[29-Aug-2019]	[29-Aug-2019]	[29-Aug-2019]	[29-Aug-2019]
Compound	CAS Number	LOR	Unit	ES1927633-001	ES1927633-002	ES1927633-003	ES1927633-004	ES1927633-005
				Result	Result	Result	Result	Result
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	1	mg/L	**8**	**13**	**7**	**11**	**7**
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS								
Copper	7440-50-8	1	µg/L	<1	<1	<1	<1	**3**
EP002: Dissolved Organic Carbon (DOC)								
Dissolved Organic Carbon	----	1	mg/L	**2**	**2**	**2**	**2**	**2**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	M1-Bott	M2-Surf	M2-Bott	B2-Surf	B2-Bott
				Client sampling date / time	[29-Aug-2019]	[29-Aug-2019]	[29-Aug-2019]	[29-Aug-2019]	[29-Aug-2019]
Compound	CAS Number	LOR	Unit		ES1927633-006	ES1927633-007	ES1927633-008	ES1927633-009	ES1927633-010
					Result	Result	Result	Result	Result
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	1	mg/L		**8**	**8**	**6**	**7**	**8**
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS									
Copper	7440-50-8	1	µg/L		<1	<1	<1	<1	<1
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L		**2**	**2**	**2**	**2**	**2**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			Client sample ID	**B3-Surf**	**B3-Bott**	**----**	**----**	**----**
			Client sampling date / time	[29-Aug-2019]	[29-Aug-2019]	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES1927633-011**	**ES1927633-012**	**--------**	**--------**	**--------**
				Result	Result	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	1	mg/L	**3**	**8**	**----**	**----**	**----**
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS								
Copper	7440-50-8	1	µg/L	<1	<1	**----**	**----**	**----**
EP002: Dissolved Organic Carbon (DOC)								
Dissolved Organic Carbon	----	1	mg/L	**2**	**2**	**----**	**----**	**----**

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1927633**	Page	: 1 of 3
Client	: **MARINE POLLUTION RESEARCH PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Paul Anink	Contact	: Customer Services ES
Address	: PO BOX 279 CHURCH POINT SYDNEY NSW 2105	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Gladesville Bridge Marina	Date Samples Received	: 29-Aug-2019
Order number	:	Date Analysis Commenced	: 30-Aug-2019
C-O-C number	: ----	Issue Date	: 04-Sep-2019
Sampler	: Jacob Broom		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 12		
No. of samples analysed	: 12		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 2560549)									
ES1927633-001	R1-Surf	EA025LL: Suspended Solids (SS)	----	1	mg/L	8	7	0.00	No Limit
ES1927633-011	B3-Surf	EA025LL: Suspended Solids (SS)	----	1	mg/L	3	8	95.5	No Limit
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 2557380)									
ES1927633-002	R1-Bott	EG093A-F: Copper	7440-50-8	1	µg/L	<1	<1	0.00	No Limit
ES1927633-010	B2-Bott	EG093A-F: Copper	7440-50-8	1	µg/L	<1	<1	0.00	No Limit
EP002: Dissolved Organic Carbon (DOC) (QC Lot: 2555197)									
EP1908630-001	Anonymous	EP002: Dissolved Organic Carbon	----	1	mg/L	194	210	8.22	0% - 20%
ES1927368-005	Anonymous	EP002: Dissolved Organic Carbon	----	1	mg/L	<1	2	0.00	No Limit
EP002: Dissolved Organic Carbon (DOC) (QC Lot: 2555199)									
ES1927633-006	M1-Bott	EP002: Dissolved Organic Carbon	----	1	mg/L	2	2	0.00	No Limit
EW1903711-004	Anonymous	EP002: Dissolved Organic Carbon	----	1	mg/L	4	5	35.6	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 2560549)								
EA025LL: Suspended Solids (SS)	----	1	mg/L	<1	150 mg/L	103	80	120
				<1	1000 mg/L	96.5	80	120
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 2557380)								
EG093A-F: Copper	7440-50-8	1	µg/L	<1	10 µg/L	90.1	71	129
EP002: Dissolved Organic Carbon (DOC) (QCLot: 2555197)								
EP002: Dissolved Organic Carbon	----	1	mg/L	<1	10 mg/L	110	71	121
EP002: Dissolved Organic Carbon (DOC) (QCLot: 2555199)								
EP002: Dissolved Organic Carbon	----	1	mg/L	<1	10 mg/L	104	71	121

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 2557380)							
ES1927633-002	R1-Bott	EG093A-F: Copper	7440-50-8	50 µg/L	94.9	70	130
EP002: Dissolved Organic Carbon (DOC) (QCLot: 2555197)							
EP1908630-002	Anonymous	EP002: Dissolved Organic Carbon	----	100 mg/L	# Not Determined	70	130
EP002: Dissolved Organic Carbon (DOC) (QCLot: 2555199)							
ES1927633-007	M2-Surf	EP002: Dissolved Organic Carbon	----	100 mg/L	99.8	70	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1927633**	Page	: 1 of 4
Client	: **MARINE POLLUTION RESEARCH PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Paul Anink	Telephone	: +61-2-8784 8555
Project	: Gladesville Bridge Marina	Date Samples Received	: 29-Aug-2019
Site	: ----	Issue Date	: 04-Sep-2019
Sampler	: Jacob Broom	No. of samples received	: 12
Order number	:	No. of samples analysed	: 12

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP002: Dissolved Organic Carbon (DOC)	EP1908630--002	Anonymous	**Dissolved Organic Carbon**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA025: Total Suspended Solids dried at 104 ± 2°C								
Clear Plastic Bottle - Natural (EA025LL)								
R1-Surf,	R1-Bott,	**29-Aug-2019**	**----**	----	----	**03-Sep-2019**	05-Sep-2019	✓
R2-Surf,	R2-Bott,							
M1-Surf,	M1-Bott,							
M2-Surf,	M2-Bott,							
B2-Surf,	B2-Bott,							
B3-Surf,	B3-Bott							
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS								
Clear Plastic Bottle - Natural (EG093A-F)								
R1-Surf,	R1-Bott,	**29-Aug-2019**	**----**	----	----	**31-Aug-2019**	25-Feb-2020	✓
R2-Surf,	R2-Bott,							
M1-Surf,	M1-Bott,							
M2-Surf,	M2-Bott,							
B2-Surf,	B2-Bott,							
B3-Surf,	B3-Bott							
EP002: Dissolved Organic Carbon (DOC)								
Amber DOC Filtered- Sulfuric Preserved (EP002)								
R1-Surf,	R1-Bott,	**29-Aug-2019**	**----**	----	----	**30-Aug-2019**	26-Sep-2019	✓
R2-Surf,	R2-Bott,							
M1-Surf,	M1-Bott,							
M2-Surf,	M2-Bott,							
B2-Surf,	B2-Bott,							
B3-Surf,	B3-Bott							

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Organic Carbon	EP002	4	32	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (Low Level)	EA025LL	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Organic Carbon	EP002	2	32	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (Low Level)	EA025LL	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Organic Carbon	EP002	2	32	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (Low Level)	EA025LL	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Organic Carbon	EP002	2	32	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Suspended Solids (Low Level)	EA025LL	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . Extra volume is used to counter the effect from saline water. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Organic Carbon	EP002	WATER	In house: Referenced to APHA 5310 B. This method is compliant with NEPM (2013) Schedule B(3) . Samples are combusted at high termperature in the presence of an oxidative catalyst. The evolved carbon dioxide is quantified using an IR detector.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1927755**	Page	: 1 of 5
Client	: **MARINE POLLUTION RESEARCH PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Paul Anink	Contact	: Customer Services ES
Address	: PO BOX 279 CHURCH POINT SYDNEY NSW 2105	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Gladesville Bridge Marina	Date Samples Received	: 30-Aug-2019 13:25
Order number	:	Date Analysis Commenced	: 02-Sep-2019
C-O-C number	: ----	Issue Date	: 06-Sep-2019 15:08
Sampler	: Jacob Broom		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 12		
No. of samples analysed	: 12		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EG093: Samples containing high levels of sulfate may precipitate barium under the acidic conditions of this method and may therefore bias results low.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	R1-Surf	R1-Bott	R2-Surf	R2-Bott	M1-Surf
				Client sampling date / time	30-Aug-2019 00:00	30-Aug-2019 00:00	30-Aug-2019 00:00	30-Aug-2019 00:00	30-Aug-2019 00:00
Compound	CAS Number	LOR	Unit		ES1927755-001	ES1927755-002	ES1927755-003	ES1927755-004	ES1927755-005
					Result	Result	Result	Result	Result
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	1	mg/L		**3**	**6**	**7**	**3**	**3**
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS									
Copper	7440-50-8	1	µg/L		**3**	**2**	**2**	**2**	**4**
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L		<1	<1	**1**	**1**	<1

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	M1-Bott	M2-Surf	M2-Bott	B2-Surf	B2-Bott
				Client sampling date / time	30-Aug-2019 00:00	30-Aug-2019 00:00	30-Aug-2019 00:00	30-Aug-2019 00:00	30-Aug-2019 00:00
Compound	CAS Number	LOR	Unit		ES1927755-006	ES1927755-007	ES1927755-008	ES1927755-009	ES1927755-010
					Result	Result	Result	Result	Result
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	1	mg/L		**4**	**5**	**6**	**3**	**6**
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS									
Copper	7440-50-8	1	µg/L		**2**	**2**	**2**	**2**	**2**
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	----	1	mg/L		**1**	**1**	<1	<1	<1

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			Client sample ID	**B3-Surf**	**B3-Bott**	**----**	**----**	**----**
			Client sampling date / time	30-Aug-2019 00:00	30-Aug-2019 00:00	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES1927755-011**	**ES1927755-012**	**--------**	**--------**	**--------**
				Result	Result	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	1	mg/L	**6**	**6**	**----**	**----**	**----**
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS								
Copper	7440-50-8	1	µg/L	**2**	**2**	**----**	**----**	**----**
EP002: Dissolved Organic Carbon (DOC)								
Dissolved Organic Carbon	----	1	mg/L	<1	<1	**----**	**----**	**----**

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1927755**	Page	: 1 of 3
Client	: **MARINE POLLUTION RESEARCH PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Paul Anink	Contact	: Customer Services ES
Address	: PO BOX 279 CHURCH POINT SYDNEY NSW 2105	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Gladesville Bridge Marina	Date Samples Received	: 30-Aug-2019
Order number	:	Date Analysis Commenced	: 02-Sep-2019
C-O-C number	: ----	Issue Date	: 06-Sep-2019
Sampler	: Jacob Broom		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 12		
No. of samples analysed	: 12		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 2562843)									
ES1927755-001	R1-Surf	EA025LL: Suspended Solids (SS)	----	1	mg/L	3	9	98.7	No Limit
ES1927755-011	B3-Surf	EA025LL: Suspended Solids (SS)	----	1	mg/L	6	4	59.4	No Limit
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 2565701)									
EP1908773-001	Anonymous	EG093A-F: Copper	7440-50-8	1	µg/L	20	21	0.00	0% - 20%
EP1908773-016	Anonymous	EG093A-F: Copper	7440-50-8	1	µg/L	9	9	0.00	No Limit
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 2565702)									
ES1927755-008	M2-Bott	EG093A-F: Copper	7440-50-8	1	µg/L	2	2	0.00	No Limit
EP002: Dissolved Organic Carbon (DOC) (QC Lot: 2558157)									
ES1927700-001	Anonymous	EP002: Dissolved Organic Carbon	----	1	mg/L	10	10	0.00	0% - 50%
ES1927755-006	M1-Bott	EP002: Dissolved Organic Carbon	----	1	mg/L	1	2	0.00	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 2562843)								
EA025LL: Suspended Solids (SS)	----	1	mg/L	<1	150 mg/L	106	80	120
				<1	1000 mg/L	94.4	80	120
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 2565701)								
EG093A-F: Copper	7440-50-8	1	µg/L	<1	10 µg/L	99.3	71	129
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 2565702)								
EG093A-F: Copper	7440-50-8	1	µg/L	<1	10 µg/L	102	71	129
EP002: Dissolved Organic Carbon (DOC) (QCLot: 2558157)								
EP002: Dissolved Organic Carbon	----	1	mg/L	<1	10 mg/L	115	71	121

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 2565701)							
EP1908773-002	Anonymous	EG093A-F: Copper	7440-50-8	50 µg/L	81.8	70	130
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 2565702)							
ES1927755-009	B2-Surf	EG093A-F: Copper	7440-50-8	50 µg/L	95.2	70	130
EP002: Dissolved Organic Carbon (DOC) (QCLot: 2558157)							
ES1927700-002	Anonymous	EP002: Dissolved Organic Carbon	----	100 mg/L	115	70	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1927755**	Page	: 1 of 4
Client	: **MARINE POLLUTION RESEARCH PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Paul Anink	Telephone	: +61-2-8784 8555
Project	: Gladesville Bridge Marina	Date Samples Received	: 30-Aug-2019
Site	: ----	Issue Date	: 06-Sep-2019
Sampler	: Jacob Broom	No. of samples received	: 12
Order number	:	No. of samples analysed	: 12

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA025: Total Suspended Solids dried at 104 ± 2°C								
Clear Plastic Bottle - Natural (EA025LL)								
R1-Surf,	R1-Bott,	**30-Aug-2019**	**----**	----	----	**04-Sep-2019**	06-Sep-2019	✓
R2-Surf,	R2-Bott,							
M1-Surf,	M1-Bott,							
M2-Surf,	M2-Bott,							
B2-Surf,	B2-Bott,							
B3-Surf,	B3-Bott							
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS								
Clear Plastic Bottle - Natural (EG093A-F)								
R1-Surf,	R1-Bott,	**30-Aug-2019**	**----**	----	----	**05-Sep-2019**	26-Feb-2020	✓
R2-Surf,	R2-Bott,							
M1-Surf,	M1-Bott,							
M2-Surf,	M2-Bott,							
B2-Surf,	B2-Bott,							
B3-Surf,	B3-Bott							
EP002: Dissolved Organic Carbon (DOC)								
Amber DOC Filtered- Sulfuric Preserved (EP002)								
R1-Surf,	R1-Bott,	**30-Aug-2019**	**----**	----	----	**02-Sep-2019**	27-Sep-2019	✓
R2-Surf,	R2-Bott,							
M1-Surf,	M1-Bott,							
M2-Surf,	M2-Bott,							
B2-Surf,	B2-Bott,							
B3-Surf,	B3-Bott							

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	3	12	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Organic Carbon	EP002	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (Low Level)	EA025LL	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Organic Carbon	EP002	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (Low Level)	EA025LL	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Organic Carbon	EP002	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (Low Level)	EA025LL	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Organic Carbon	EP002	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Suspended Solids (Low Level)	EA025LL	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . Extra volume is used to counter the effect from saline water. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Organic Carbon	EP002	WATER	In house: Referenced to APHA 5310 B. This method is compliant with NEPM (2013) Schedule B(3) . Samples are combusted at high termperature in the presence of an oxidative catalyst. The evolved carbon dioxide is quantified using an IR detector.

ANNEXURE D

GLADESVILLE BRIDGE MARINA

MPR

SEDIMENT SURVEY

FIELD NOTES

CORE PHOTOGRAPHS

&

LABORATORY REPORTS

Table D-1 Gladesville Bridge Marina Sediment Sampling 15th May 2019					
Site	Core Depth	Depth ISLW	Easting	Northing	Sampling notes
	cm	m			
S1	45	2.07	328402	6253662	Moved sample site towards jetty from marker buoy due to hitting bedrock. A lot of shell material throughout core sample, particularly the upper 20 to 30cm. Colour black on the bottom of core sample.
S2	45	2.26	328420	6253628	Kept hitting bedrock at original site location. Core collapsed in tub, a lot of shell material at around 30cm depth. Above that mostly sand, changing from lightish sandy colour to darker with depth. Some boulders and rock rubble with attached kelp around site. Colour dark grey to black with increasing depth.
S3	50	2.32	328550	6253588	Stiff upper layer (shell grit upper 10-20cm). Upper core lighter then darker grey with depth (coarse sandy sediment with some shell grit in lower half of core).
S4	50	2.30	328566	6253598	Finer sandy sediment in upper half or core with higher proportion of shell grit in lower half. Yabby in sample. Generally brown in colour and relatively uniform throughout.
S5	48	2.52	328601	6253613	Site relocated out a few times due to limited depth of core being retrieved. Upper core sandy, lighter in colour becoming darker grey with depth and more shell grit in bottom 10-20cm. First 40cm of core easily penetrated through sediments.
S6	50	2.63	328617	6253627	Site moved once. Bottom 20cm in core shell grit (similar to previous core), uniform brown in colour. Top 20-25cm splays out in tub (finer sediments).
S7	50	2.71	328640	6253651	Core location moved several times due to limited depth of retrievable cores. Similar in appearance to previous cores (S4 to S7); browner in upper core half becoming darker grey with depth. Higher amounts of shell grit lower 20cm, smoother finer sediments in top 20-30cm).
S8	47	2.84	328658	6253663	Top layer (20cm) with finer sediments than underlying layer which contains higher proportions of shell fragments, generally uniform brown colour throughout.

Plate 1: Sediment core samples from S1 (left) and S2 (right). Note the 5cm lines for scale.

Plate 2: Sediment core samples from S3 (left) and S4 (right).

Plate 3: Sediment core samples from S5 (left) and S6 (right).

Plate 4: Sediment core samples from S7 (left) and S8 (right).

Certificate of Analysis

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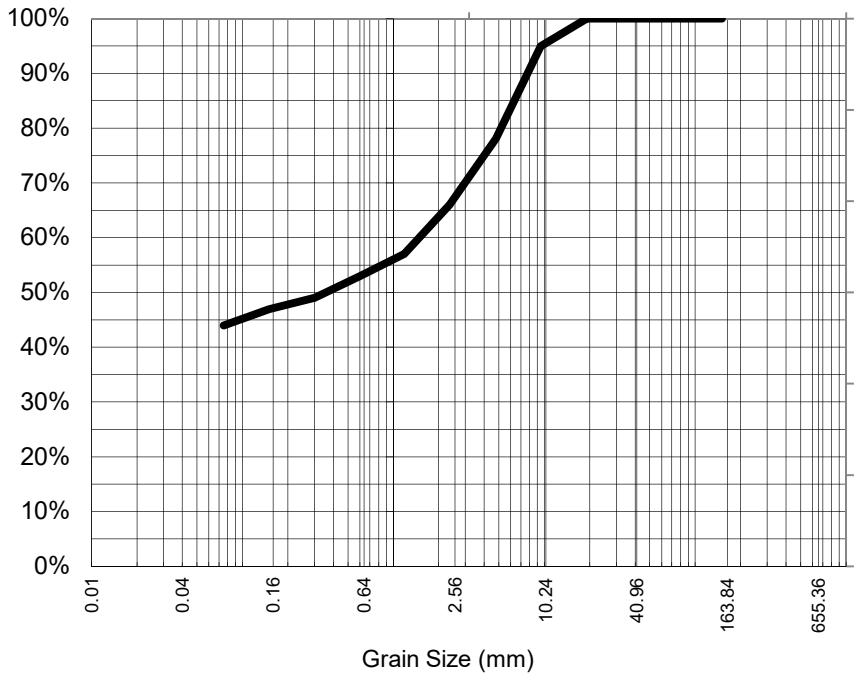
pH 02 4014 2500
fax 02 4968 0349
samples.newcastle@alsenviro.com

ALS Environmental

Newcastle, NSW

CLIENT:	MR JACOB BROOM (gmail)	**DATE REPORTED:**	27-May-2019
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	15-May-2019
ADDRESS:	PO Box 279 Church Point Sydney NSW	**REPORT NO:**	ES1914712-001 / PSD
PROJECT:	Gladesville Bridge Marina	**SAMPLE ID:**	1S

Particle Size Distribution



Particle Size (mm)	% Passing
19.0	100%
9.50	95%
4.75	78%
2.36	66%
1.18	57%
0.600	53%
0.425	51%
0.300	49%
0.150	47%
0.075	44%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.363

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 23-May-19

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, GRAVEL, SAND, SHELL

Test Method: AS1289.3.6.2/AS1289.3.6.3

#N/A

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Authorised Signatory

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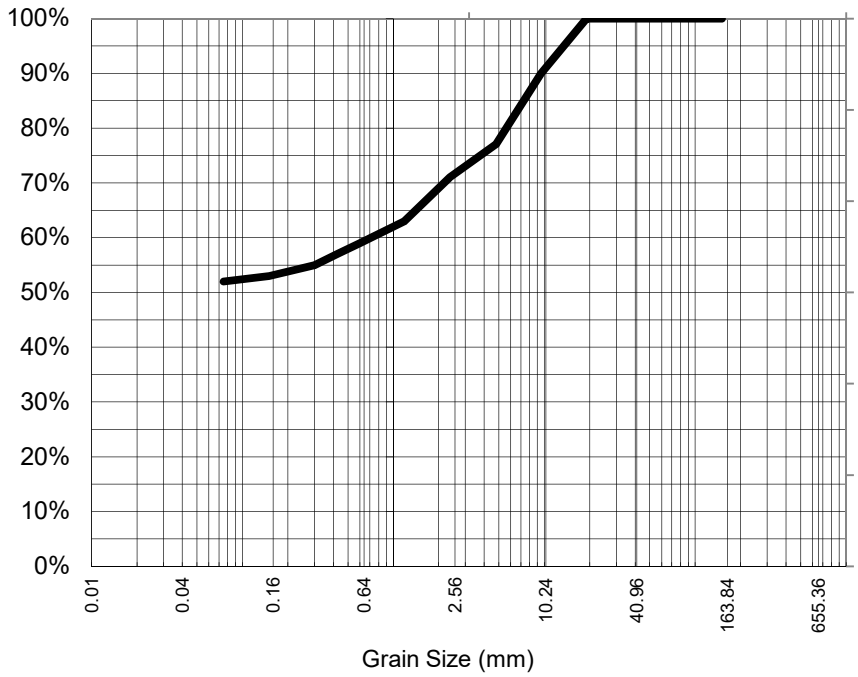
CLIENT:	MR JACOB BROOM (gmail)	**DATE REPORTED:**	27-May-2019
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	15-May-2019
ADDRESS:	PO Box 279 Church Point Sydney NSW	**REPORT NO:**	ES1914712-002 / PSD
PROJECT:	Gladesville Bridge Marina	**SAMPLE ID:**	1B

Particle Size Distribution



Particle Size (mm)	% Passing
19.0	100%
9.50	90%
4.75	77%
2.36	71%
1.18	63%
0.600	59%
0.425	57%
0.300	55%
0.150	53%
0.075	52%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	<0.075

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 23-May-19

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, GRAVEL, SAND, SHELL

Test Method: AS1289.3.6.2/AS1289.3.6.3

#N/A

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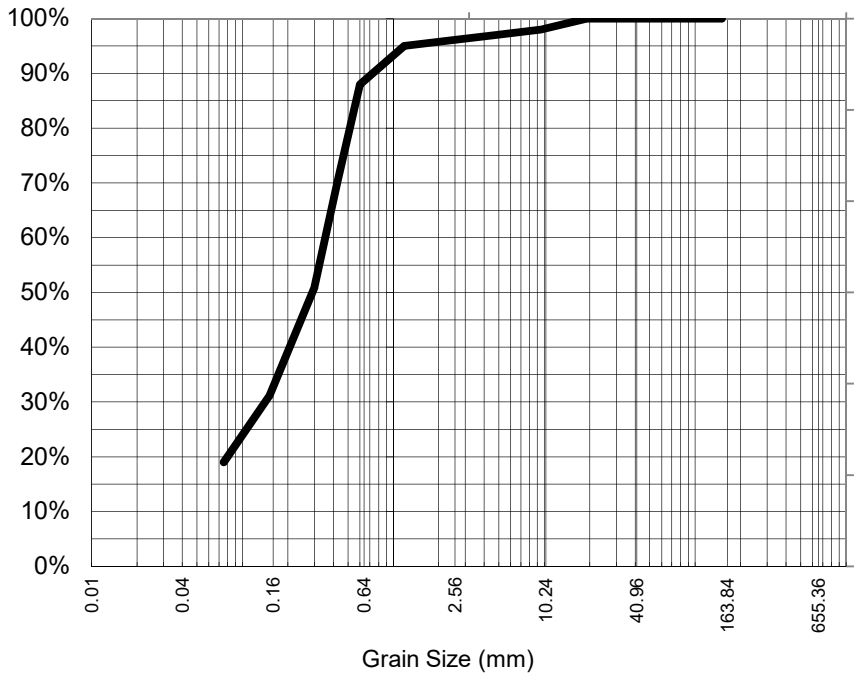
CLIENT:	MR JACOB BROOM (gmail)	**DATE REPORTED:**	27-May-2019
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	15-May-2019
ADDRESS:	PO Box 279 Church Point Sydney NSW	**REPORT NO:**	ES1914712-003 / PSD
PROJECT:	Gladesville Bridge Marina	**SAMPLE ID:**	2S

Particle Size Distribution



Particle Size (mm)	% Passing
19.0	100%
9.50	98%
4.75	97%
2.36	96%
1.18	95%
0.600	88%
0.425	70%
0.300	51%
0.150	31%
0.075	19%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.293

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 23-May-19

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, FINES, GRAVEL, SHELL

Test Method: AS1289.3.6.2/AS1289.3.6.3

#N/A

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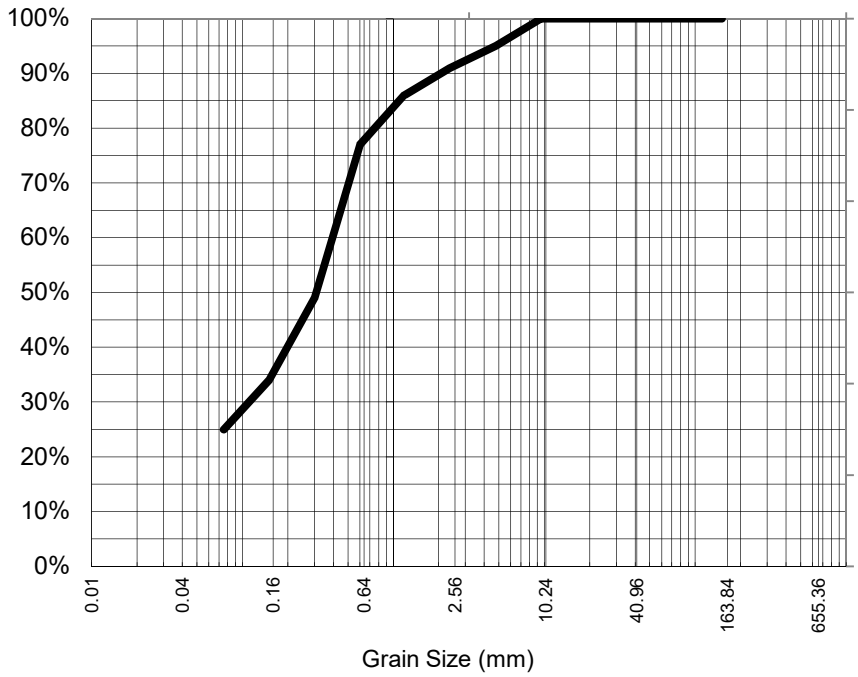
CLIENT:	MR JACOB BROOM (gmail)	**DATE REPORTED:**	27-May-2019
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	15-May-2019
ADDRESS:	PO Box 279 Church Point Sydney NSW	**REPORT NO:**	ES1914712-004 / PSD
PROJECT:	Gladesville Bridge Marina	**SAMPLE ID:**	2B

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	95%
2.36	91%
1.18	86%
0.600	77%
0.425	63%
0.300	49%
0.150	34%
0.075	25%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.309

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 23-May-19

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, FINES, GRAVEL, SHELL

Test Method: AS1289.3.6.2/AS1289.3.6.3

#N/A

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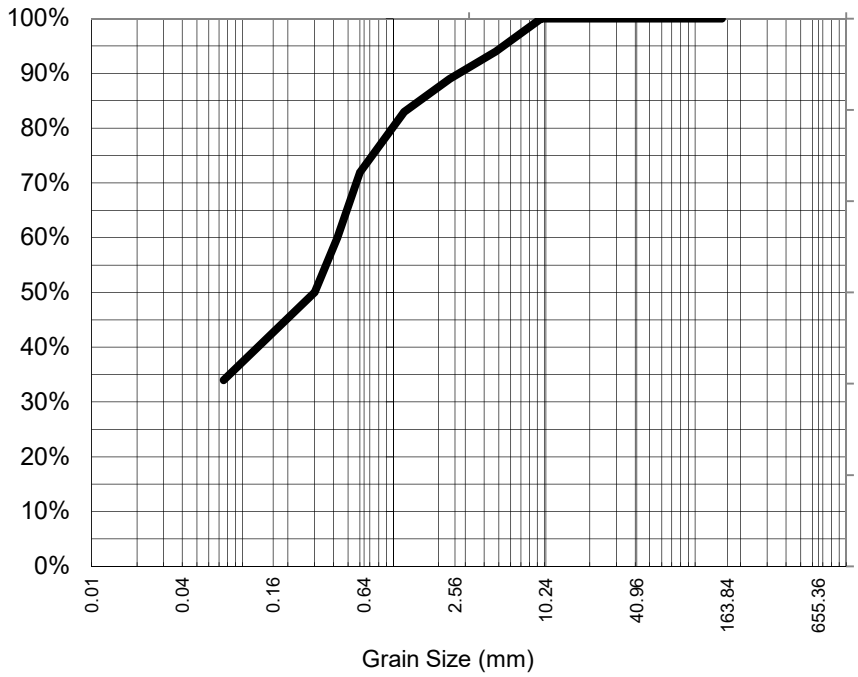
CLIENT:	MR JACOB BROOM (gmail)	**DATE REPORTED:**	27-May-2019
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	15-May-2019
ADDRESS:	PO Box 279 Church Point Sydney NSW	**REPORT NO:**	ES1914712-007 / PSD
PROJECT:	Gladesville Bridge Marina	**SAMPLE ID:**	4S

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	94%
2.36	89%
1.18	83%
0.600	72%
0.425	60%
0.300	50%
0.150	42%
0.075	34%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.300

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 23-May-19

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, FINES, GRAVEL, SHELL

Test Method: AS1289.3.6.2/AS1289.3.6.3

#N/A

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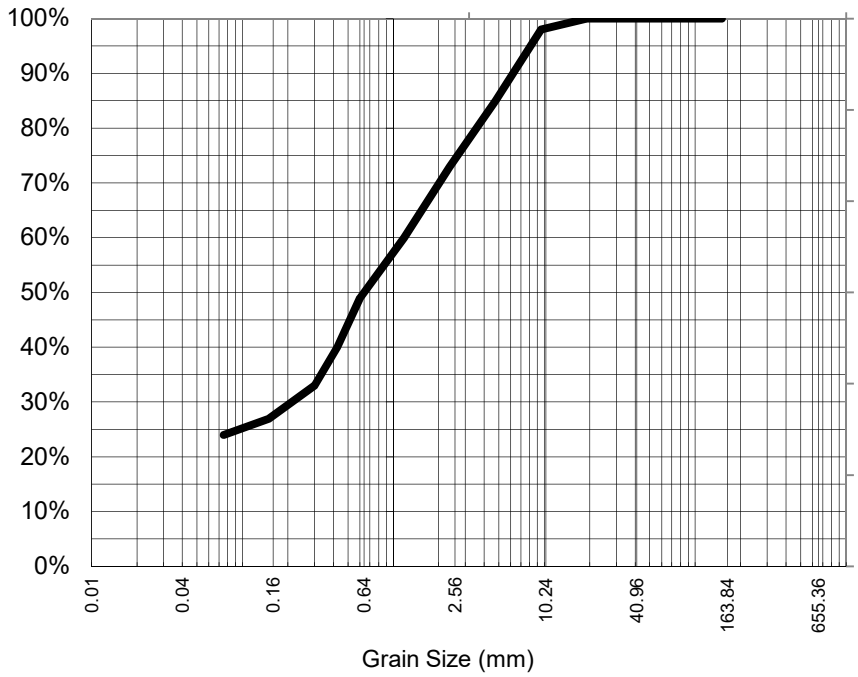
CLIENT:	MR JACOB BROOM (gmail)	**DATE REPORTED:**	27-May-2019
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	15-May-2019
ADDRESS:	PO Box 279 Church Point Sydney NSW	**REPORT NO:**	ES1914712-008 / PSD
PROJECT:	Gladesville Bridge Marina	**SAMPLE ID:**	4B

Particle Size Distribution



Particle Size (mm)	% Passing
19.0	100%
9.50	98%
4.75	85%
2.36	73%
1.18	60%
0.600	49%
0.425	40%
0.300	33%
0.150	27%
0.075	24%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.653

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 23-May-19

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, FINES, GRAVEL, SHELL

Test Method: AS1289.3.6.2/AS1289.3.6.3

#N/A

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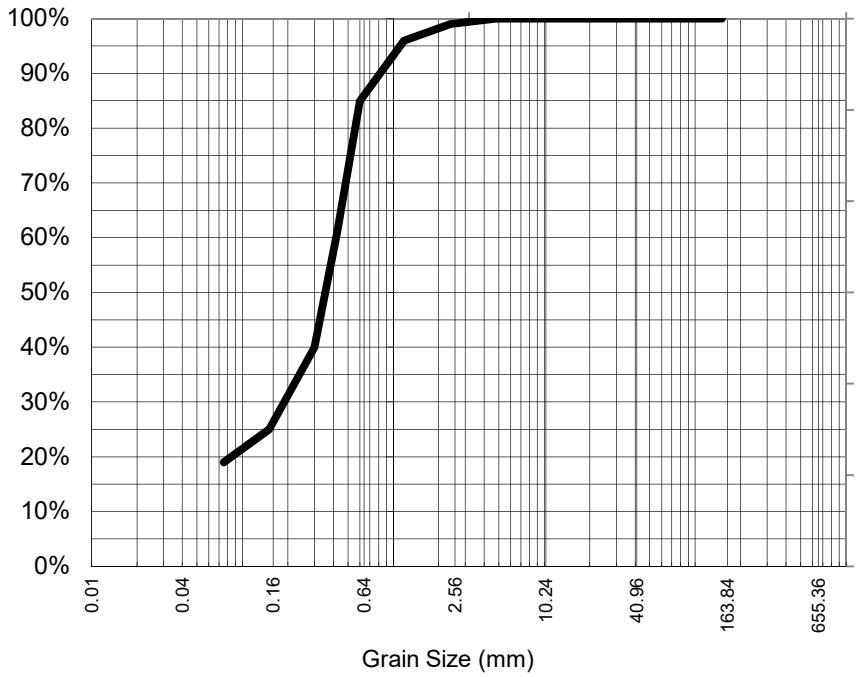
CLIENT:	MR JACOB BROOM (gmail)	**DATE REPORTED:**	27-May-2019
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	15-May-2019
ADDRESS:	PO Box 279 Church Point Sydney NSW	**REPORT NO:**	ES1914712-011 / PSD
PROJECT:	Gladesville Bridge Marina	**SAMPLE ID:**	6S

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	96%
0.600	85%
0.425	61%
0.300	40%
0.150	25%
0.075	19%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.360

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 23-May-19

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, FINES, GRAVEL, SHELL

Test Method: AS1289.3.6.2/AS1289.3.6.3

#N/A

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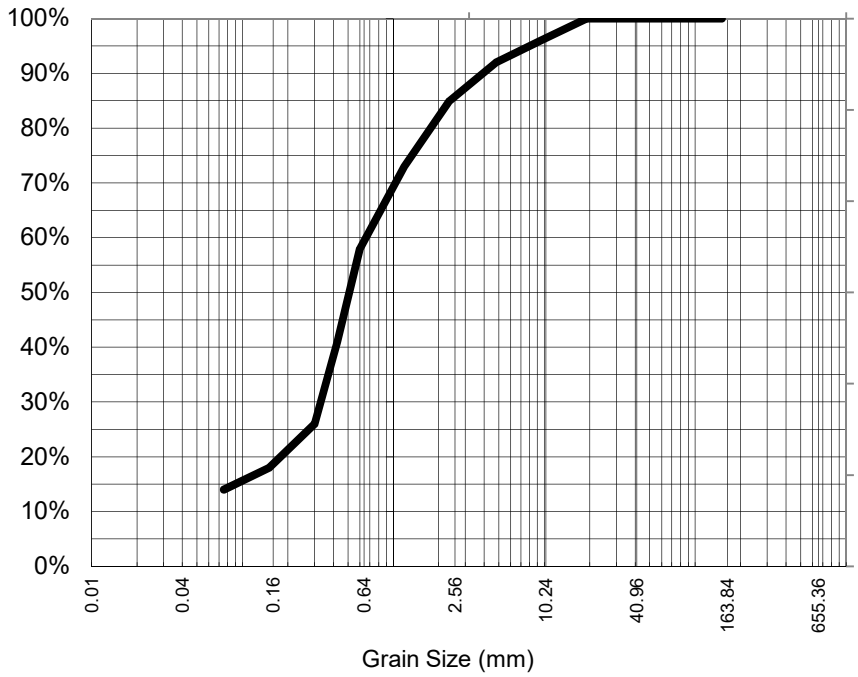
CLIENT:	MR JACOB BROOM (gmail)	**DATE REPORTED:**	27-May-2019
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	15-May-2019
ADDRESS:	PO Box 279 Church Point Sydney NSW	**REPORT NO:**	ES1914712-012 / PSD
PROJECT:	Gladesville Bridge Marina	**SAMPLE ID:**	6B

Particle Size Distribution



Particle Size (mm)	% Passing
19.0	100%
9.50	96%
4.75	92%
2.36	85%
1.18	73%
0.600	58%
0.425	41%
0.300	26%
0.150	18%
0.075	14%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.518

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 23-May-19

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, FINES, GRAVEL, SHELL

Test Method: AS1289.3.6.2/AS1289.3.6.3

#N/A

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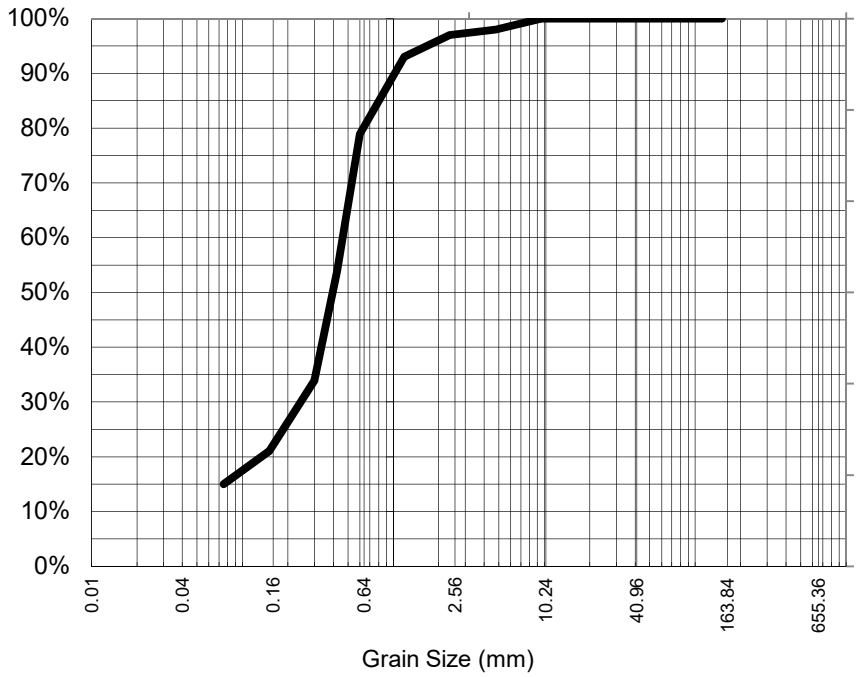
CLIENT:	MR JACOB BROOM (gmail)	**DATE REPORTED:**	27-May-2019
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	15-May-2019
ADDRESS:	PO Box 279 Church Point Sydney NSW	**REPORT NO:**	ES1914712-015 / PSD
PROJECT:	Gladesville Bridge Marina	**SAMPLE ID:**	8S

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	98%
2.36	97%
1.18	93%
0.600	79%
0.425	54%
0.300	34%
0.150	21%
0.075	15%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.400

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 23-May-19

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, FINES, GRAVEL, SHELL

Test Method: AS1289.3.6.2/AS1289.3.6.3

#N/A

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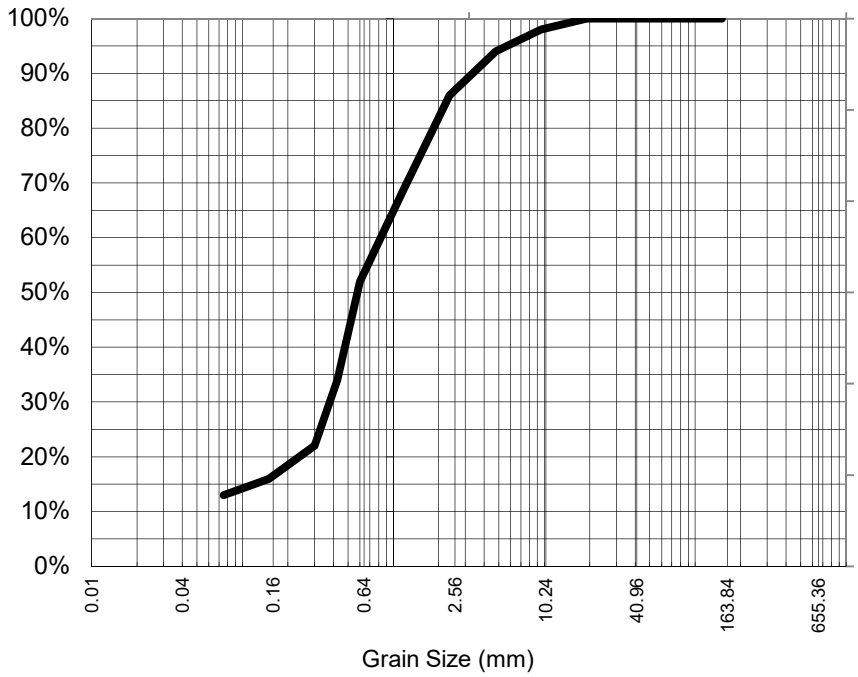
Newcastle, NSW

CLIENT:	MR JACOB BROOM (gmail)	**DATE REPORTED:**	27-May-2019
COMPANY:	MARINE POLLUTION RESEARCH PTY LTD	**DATE RECEIVED:**	15-May-2019
ADDRESS:	PO Box 279 Church Point Sydney NSW	**REPORT NO:**	ES1914712-016 / PSD
PROJECT:	Gladesville Bridge Marina	**SAMPLE ID:**	8B

Particle Size Distribution



Particle Size (mm)	% Passing
19.0	100%
9.50	98%
4.75	94%
2.36	86%
1.18	69%
0.600	52%
0.425	34%
0.300	22%
0.150	16%
0.075	13%

Analysis Notes

Samples analysed as received.

Median Particle Size (mm)*	0.581

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 23-May-19

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: SAND, FINES, GRAVEL, SHELL

Test Method: AS1289.3.6.2/AS1289.3.6.3

#N/A

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Dianne Blane
Laboratory Coordinator
Authorised Signatory

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1914712**	Page	: 1 of 6
Client	: **MARINE POLLUTION RESEARCH PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR JACOB BROOM (gmail)	Contact	: Customer Services ES
Address	: PO BOX 279 CHURCH POINT SYDNEY NSW 2105	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: 02 9997 6541	Telephone	: +61-2-8784 8555
Project	: Gladesville Bridge Marina	Date Samples Received	: 15-May-2019 17:10
Order number	:	Date Analysis Commenced	: 21-May-2019
C-O-C number	: ----	Issue Date	: 27-May-2019 19:55
Sampler	: ----		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 16		
No. of samples analysed	: 16		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EG005T: Poor matrix spike recovery was obtained for Arsenic, Cadmium, Chromium, Copper , Lead and Nickel on sample ES1914710-2. Results have been confirmed by re-extraction and reanalysis.

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Client sample ID	1S	1B	2S	2B	3S
			Client sampling date / time	15-May-2019 00:00	15-May-2019 00:00	15-May-2019 00:00	15-May-2019 00:00	15-May-2019 00:00
Compound	CAS Number	LOR	Unit	ES1914712-001	ES1914712-002	ES1914712-003	ES1914712-004	ES1914712-005
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	44.7	47.9	42.8	39.4	51.1
EA150: Particle Sizing								
+75µm	----	1	%	56	48	81	74	----
+150µm	----	1	%	53	47	69	66	----
+300µm	----	1	%	51	45	48	51	----
+425µm	----	1	%	49	43	30	37	----
+600µm	----	1	%	47	41	12	23	----
+1180µm	----	1	%	43	37	5	14	----
+2.36mm	----	1	%	34	29	4	9	----
+4.75mm	----	1	%	22	23	3	5	----
+9.5mm	----	1	%	5	10	2	<1	----
+19.0mm	----	1	%	<1	<1	<1	<1	----
+37.5mm	----	1	%	<1	<1	<1	<1	----
+75.0mm	----	1	%	<1	<1	<1	<1	----
EA150: Soil Classification based on Particle Size								
Fines (<75 µm)	----	1	%	44	52	19	26	----
Sand (>75 µm)	----	1	%	19	17	77	64	----
Gravel (>2mm)	----	1	%	37	31	4	11	----
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	----
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES								
Antimony	7440-36-0	1.0	mg/kg	<1.0	11.1	3.0	<1.0	<1.0
Arsenic	7440-38-2	1.0	mg/kg	5.4	3.2	2.0	2.2	3.8
Cadmium	7440-43-9	0.1	mg/kg	0.3	0.3	0.2	0.3	0.2
Chromium	7440-47-3	1.0	mg/kg	38.6	28.9	20.4	22.0	20.0
Copper	7440-50-8	1.0	mg/kg	65.9	39.7	84.0	66.6	56.5
Lead	7439-92-1	1.0	mg/kg	191	240	117	162	141
Nickel	7440-02-0	1.0	mg/kg	3.0	3.4	2.4	2.8	2.5
Silver	7440-22-4	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Zinc	7440-66-6	1.0	mg/kg	331	378	346	436	353
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Mercury	7439-97-6	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	1.37	3.39	1.43	1.77	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	3B	4S	4B	5S	5B
				Client sampling date / time	15-May-2019 00:00	15-May-2019 00:00	15-May-2019 00:00	15-May-2019 00:00	15-May-2019 00:00
Compound	CAS Number	LOR	Unit		ES1914712-006	ES1914712-007	ES1914712-008	ES1914712-009	ES1914712-010
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		39.6	51.7	43.3	40.4	36.2
EA150: Particle Sizing									
+75µm	----	1	%		----	66	76	----	----
+150µm	----	1	%		----	58	73	----	----
+300µm	----	1	%		----	50	67	----	----
+425µm	----	1	%		----	40	60	----	----
+600µm	----	1	%		----	28	51	----	----
+1180µm	----	1	%		----	18	40	----	----
+2.36mm	----	1	%		----	11	27	----	----
+4.75mm	----	1	%		----	6	15	----	----
+9.5mm	----	1	%		----	<1	2	----	----
+19.0mm	----	1	%		----	<1	<1	----	----
+37.5mm	----	1	%		----	<1	<1	----	----
+75.0mm	----	1	%		----	<1	<1	----	----
EA150: Soil Classification based on Particle Size									
Fines (<75 µm)	----	1	%		----	34	24	----	----
Sand (>75 µm)	----	1	%		----	53	45	----	----
Gravel (>2mm)	----	1	%		----	13	31	----	----
Cobbles (>6cm)	----	1	%		----	<1	<1	----	----
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES									
Antimony	7440-36-0	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	7440-38-2	1.0	mg/kg		2.6	4.7	3.2	3.0	3.1
Cadmium	7440-43-9	0.1	mg/kg		0.2	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg		21.1	30.2	19.4	17.9	13.7
Copper	7440-50-8	1.0	mg/kg		41.0	81.1	61.0	46.5	33.8
Lead	7439-92-1	1.0	mg/kg		133	163	128	91.6	74.0
Nickel	7440-02-0	1.0	mg/kg		2.2	3.6	2.9	1.9	1.7
Silver	7440-22-4	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Zinc	7440-66-6	1.0	mg/kg		262	282	183	167	124
EG035-SDH: 1M HCl extractable Mercury by FIMS									
Mercury	7439-97-6	0.10	mg/kg		<0.10	0.16	<0.10	<0.10	<0.10
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		----	4.98	6.65	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	6S	6B	7S	7B	8S
				Client sampling date / time	15-May-2019 00:00	15-May-2019 00:00	15-May-2019 00:00	15-May-2019 00:00	15-May-2019 00:00
Compound	CAS Number	LOR	Unit		ES1914712-011	ES1914712-012	ES1914712-013	ES1914712-014	ES1914712-015
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		42.5	45.4	37.2	41.0	37.4
EA150: Particle Sizing									
+75µm	----	1	%		81	86	----	----	85
+150µm	----	1	%		75	82	----	----	79
+300µm	----	1	%		60	74	----	----	66
+425µm	----	1	%		39	59	----	----	46
+600µm	----	1	%		15	42	----	----	21
+1180µm	----	1	%		4	27	----	----	6
+2.36mm	----	1	%		1	15	----	----	3
+4.75mm	----	1	%		<1	8	----	----	2
+9.5mm	----	1	%		<1	4	----	----	<1
+19.0mm	----	1	%		<1	<1	----	----	<1
+37.5mm	----	1	%		<1	<1	----	----	<1
+75.0mm	----	1	%		<1	<1	----	----	<1
EA150: Soil Classification based on Particle Size									
Fines (<75 µm)	----	1	%		19	14	----	----	15
Sand (>75 µm)	----	1	%		79	67	----	----	81
Gravel (>2mm)	----	1	%		2	19	----	----	4
Cobbles (>6cm)	----	1	%		<1	<1	----	----	<1
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES									
Antimony	7440-36-0	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	7440-38-2	1.0	mg/kg		3.1	2.2	2.9	3.0	3.2
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg		18.0	18.4	13.3	12.0	10.9
Copper	7440-50-8	1.0	mg/kg		45.6	36.4	29.3	28.8	27.9
Lead	7439-92-1	1.0	mg/kg		93.3	95.6	68.6	70.3	64.4
Nickel	7440-02-0	1.0	mg/kg		2.0	2.0	1.6	1.4	1.3
Silver	7440-22-4	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Zinc	7440-66-6	1.0	mg/kg		166	168	124	115	110
EG035-SDH: 1M HCl extractable Mercury by FIMS									
Mercury	7439-97-6	0.10	mg/kg		0.11	<0.10	0.16	<0.10	0.17
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.78	0.70	----	----	0.46

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Client sample ID	8B	----	----	----	----
			Client sampling date / time	15-May-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1914712-016	--------	--------	--------	--------
				Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**33.5**	----	----	----	----
EA150: Particle Sizing								
+75µm	----	1	%	**87**	----	----	----	----
+150µm	----	1	%	**84**	----	----	----	----
+300µm	----	1	%	**78**	----	----	----	----
+425µm	----	1	%	**66**	----	----	----	----
+600µm	----	1	%	**48**	----	----	----	----
+1180µm	----	1	%	**31**	----	----	----	----
+2.36mm	----	1	%	**14**	----	----	----	----
+4.75mm	----	1	%	**6**	----	----	----	----
+9.5mm	----	1	%	**2**	----	----	----	----
+19.0mm	----	1	%	<1	----	----	----	----
+37.5mm	----	1	%	<1	----	----	----	----
+75.0mm	----	1	%	<1	----	----	----	----
EA150: Soil Classification based on Particle Size								
Fines (<75 µm)	----	1	%	**13**	----	----	----	----
Sand (>75 µm)	----	1	%	**67**	----	----	----	----
Gravel (>2mm)	----	1	%	**20**	----	----	----	----
Cobbles (>6cm)	----	1	%	<1	----	----	----	----
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES								
Antimony	7440-36-0	1.0	mg/kg	<1.0	----	----	----	----
Arsenic	7440-38-2	1.0	mg/kg	**3.6**	----	----	----	----
Cadmium	7440-43-9	0.1	mg/kg	<0.1	----	----	----	----
Chromium	7440-47-3	1.0	mg/kg	**9.8**	----	----	----	----
Copper	7440-50-8	1.0	mg/kg	**27.0**	----	----	----	----
Lead	7439-92-1	1.0	mg/kg	**59.8**	----	----	----	----
Nickel	7440-02-0	1.0	mg/kg	**1.2**	----	----	----	----
Silver	7440-22-4	1.0	mg/kg	<1.0	----	----	----	----
Zinc	7440-66-6	1.0	mg/kg	**89.7**	----	----	----	----
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Mercury	7439-97-6	0.10	mg/kg	<0.10	----	----	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**0.33**	----	----	----	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1914712**	Page	: 1 of 4
Client	: **MARINE POLLUTION RESEARCH PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR JACOB BROOM (gmail)	Contact	: Customer Services ES
Address	: PO BOX 279 CHURCH POINT SYDNEY NSW 2105	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: 02 9997 6541	Telephone	: +61-2-8784 8555
Project	: Gladesville Bridge Marina	Date Samples Received	: 15-May-2019
Order number	:	Date Analysis Commenced	: 21-May-2019
C-O-C number	: ----	Issue Date	: 27-May-2019
Sampler	: ----		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 16		
No. of samples analysed	: 16		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES (QC Lot: 2361129)									
ES1914710-002	Anonymous	EG005-SDH: Cadmium	7440-43-9	0.1	mg/kg	0.4	0.4	0.00	No Limit
		EG005-SDH: Arsenic	7440-38-2	1	mg/kg	1.9	2.4	22.6	No Limit
		EG005-SDH: Chromium	7440-47-3	1	mg/kg	18.9	17.2	9.77	0% - 50%
		EG005-SDH: Copper	7440-50-8	1	mg/kg	6.0	9.6	45.3	No Limit
		EG005-SDH: Lead	7439-92-1	1	mg/kg	269	265	1.51	0% - 20%
		EG005-SDH: Nickel	7440-02-0	1	mg/kg	3.2	3.2	0.00	No Limit
		EG005-SDH: Zinc	7440-66-6	1	mg/kg	773	669	14.5	0% - 20%
ES1914710-002	Anonymous	EG005-SDH: Antimony	7440-36-0	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG005-SDH: Silver	7440-22-4	1	mg/kg	<1.0	<1.0	0.00	No Limit
ES1914712-008	4B	EG005-SDH: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005-SDH: Antimony	7440-36-0	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG005-SDH: Arsenic	7440-38-2	1	mg/kg	3.2	3.0	5.88	No Limit
		EG005-SDH: Chromium	7440-47-3	1	mg/kg	19.4	15.8	21.0	0% - 50%
		EG005-SDH: Copper	7440-50-8	1	mg/kg	61.0	54.7	10.8	0% - 20%
		EG005-SDH: Lead	7439-92-1	1	mg/kg	128	109	15.7	0% - 20%
		EG005-SDH: Nickel	7440-02-0	1	mg/kg	2.9	2.3	20.2	No Limit
		EG005-SDH: Silver	7440-22-4	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG005-SDH: Zinc	7440-66-6	1	mg/kg	183	157	15.2	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2359817)									
ES1914708-003	Anonymous	EA055: Moisture Content	----	0.1	%	61.7	63.1	2.23	0% - 20%
ES1914712-004	2B	EA055: Moisture Content	----	0.1	%	39.4	39.2	0.529	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2359818)									
ES1914712-013	7S	EA055: Moisture Content	----	0.1	%	37.2	41.4	10.6	0% - 20%
ES1915198-001	Anonymous	EA055: Moisture Content	----	0.1	%	38.8	36.0	7.46	0% - 20%

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG035-SDH: 1M HCl extractable Mercury by FIMS (QC Lot: 2361130)									
ES1914712-008	4B	EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	0.00	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 2366554)									
EM1906803-019	Anonymous	EP003: Total Organic Carbon	----	0.02	%	1.37	1.29	6.12	0% - 20%
ES1914710-002	Anonymous	EP003: Total Organic Carbon	----	0.02	%	9.38	9.44	0.700	0% - 20%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 2366555)									
ES1914712-012	6B	EP003: Total Organic Carbon	----	0.02	%	0.70	0.66	6.10	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES (QCLot: 2361129)								
EG005-SDH: Antimony	7440-36-0	1	mg/kg	<1.0	5.35 mg/kg	102	70	130
EG005-SDH: Arsenic	7440-38-2	1	mg/kg	<1.0	17.9 mg/kg	86.2	77	119
EG005-SDH: Cadmium	7440-43-9	0.1	mg/kg	<0.1	4.27 mg/kg	91.6	85	115
EG005-SDH: Chromium	7440-47-3	1	mg/kg	<1.0	17.7 mg/kg	83.7	70	122
EG005-SDH: Copper	7440-50-8	1	mg/kg	<1.0	15.2 mg/kg	88.6	74	120
EG005-SDH: Lead	7439-92-1	1	mg/kg	<1.0	35.2 mg/kg	87.6	76	118
EG005-SDH: Nickel	7440-02-0	1	mg/kg	<1.0	17.2 mg/kg	79.1	70	116
EG005-SDH: Silver	7440-22-4	1	mg/kg	<1.0	1.91 mg/kg	86.0	71	127
EG005-SDH: Zinc	7440-66-6	1	mg/kg	<1.0	21.1 mg/kg	75.6	70	130
EG035-SDH: 1M HCl extractable Mercury by FIMS (QCLot: 2361130)								
EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	2.57 mg/kg	86.0	70	130
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 2366554)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	4.16 %	109	70	130
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 2366555)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	0.44 %	98.1	70	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES (QCLot: 2361129)							
ES1914710-002	Anonymous	EG005-SDH: Arsenic	7440-38-2	50 mg/kg	# 39.7	70	130
		EG005-SDH: Cadmium	7440-43-9	12.5 mg/kg	# 47.7	70	130
		EG005-SDH: Chromium	7440-47-3	50 mg/kg	# 48.0	70	130
		EG005-SDH: Copper	7440-50-8	50 mg/kg	# 6.32	70	130
		EG005-SDH: Lead	7439-92-1	50 mg/kg	# 0.0571	70	130
		EG005-SDH: Nickel	7440-02-0	50 mg/kg	# 48.0	70	130
		EG005-SDH: Zinc	7440-66-6	50 mg/kg	# Not Determined	70	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1914712**	Page	: 1 of 6
Client	: **MARINE POLLUTION RESEARCH PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR JACOB BROOM (gmail)	Telephone	: +61-2-8784 8555
Project	: Gladesville Bridge Marina	Date Samples Received	: 15-May-2019
Site	: ----	Issue Date	: 27-May-2019
Sampler	: ----	No. of samples received	: 16
Order number	:	No. of samples analysed	: 16

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICP	ES1914710--002	Anonymous	**Arsenic**	7440-38-2	39.7 %	70-130%	**Recovery less than lower data quality objective**
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICP	ES1914710--002	Anonymous	**Cadmium**	7440-43-9	47.7 %	70-130%	**Recovery less than lower data quality objective**
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICP	ES1914710--002	Anonymous	**Chromium**	7440-47-3	48.0 %	70-130%	**Recovery less than lower data quality objective**
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICP	ES1914710--002	Anonymous	**Copper**	7440-50-8	6.32 %	70-130%	**Recovery less than lower data quality objective**
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICP	ES1914710--002	Anonymous	**Lead**	7439-92-1	0.0571 %	70-130%	**Recovery less than lower data quality objective**
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICP	ES1914710--002	Anonymous	**Nickel**	7440-02-0	48.0 %	70-130%	**Recovery less than lower data quality objective**
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICP	ES1914710--002	Anonymous	**Zinc**	7440-66-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
1M HCl Extractable Mercury by FIMS	1	19	5.26	10.53	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
1M HCl Extractable Mercury by FIMS	0	19	0.00	5.26	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / ***Container*** / *Client Sample ID(s)*	***Sample Date***	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055)								
1S,	1B,	**15-May-2019**	**----**	----	----	**21-May-2019**	29-May-2019	✓
2S,	2B,							
3S,	3B,							
4S,	4B,							
5S,	5B,							
6S,	6B,							
7S,	7B,							
8S,	8B							
EA150: Particle Sizing								
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150)								
1S,	1B,	**15-May-2019**	**----**	----	----	**27-May-2019**	11-Nov-2019	✓
2S,	2B,							
4S,	4B,							
6S,	6B,							
8S,	8B							
EA150: Soil Classification based on Particle Size								
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150)								
1S,	1B,	**15-May-2019**	**----**	----	----	**27-May-2019**	11-Nov-2019	✓
2S,	2B,							
4S,	4B,							
6S,	6B,							
8S,	8B							
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES								
Soil Glass Jar - Unpreserved (EG005-SDH)								
1S,	1B,	**15-May-2019**	**22-May-2019**	11-Nov-2019	✓	**22-May-2019**	11-Nov-2019	✓
2S,	2B,							
3S,	3B,							
4S,	4B,							
5S,	5B,							
6S,	6B,							
7S,	7B,							
8S,	8B							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Soil Glass Jar - Unpreserved (EG035-SDH)								
1S,	1B,	**15-May-2019**	**22-May-2019**	12-Jun-2019	✓	**24-May-2019**	12-Jun-2019	✓
2S,	2B,							
3S,	3B,							
4S,	4B,							
5S,	5B,							
6S,	6B,							
7S,	7B,							
8S,	8B							
EP003: Total Organic Carbon (TOC) in Soil								
Pulp Bag (EP003)								
1S,	1B,	**15-May-2019**	**24-May-2019**	12-Jun-2019	✓	**24-May-2019**	12-Jun-2019	✓
2S,	2B,							
4S,	4B,							
6S,	6B,							
8S,	8B							

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	19	**5.26**	**10.53**	×	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SDH	3	20	**15.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	3	25	**12.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	19	**5.26**	**5.26**	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SDH	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	25	**8.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	19	**5.26**	**5.26**	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SDH	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	25	**8.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	0	19	**0.00**	**5.26**	×	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SDH	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Particle Size Analysis (Sieving)	EA150	SOIL	In house: Referenced to AS1289.3.6.1 - 2009. Particle Size Analysis by Sieving
1M HCl Extractable Metals	EG005-SDH	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined via ICPAES following weak acid extraction. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3). LORs per NAGD. ALS is not NATA accredited for the analysis of Barium, Boron, Molybdenum and Strontium by this method.
1M HCl Extractable Mercury by FIMS	EG035-SDH	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B. Mercury is determined via FIMS following weak acid extraction. FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automaticaly measured by infra-red detector.

Preparation Methods	Method	Matrix	Method Descriptions
1M HCl Extraction for Metals in Sediments (1 hour)	EN71	SOIL	In house: Referenced to In house, Allen (1993). 1g of sample is leached at room temperature for 1 hour in 10% hydrochloric acid. The resultant extract is filtered and bulked for analysis of extracted metals.
Dry and Pulverise (up to 100g)	GEO30	SOIL	#