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ABN 66 153 656 252

**Subject: Trinity Point Marina
Proposed Helipad
Environmental Assessment – Coastal Processes and Hydrodynamics**

Sandra

Royal HaskoningDHV (RHDHV) has undertaken an assessment of coastal processes and hydrodynamics related to the proposed helipad development for the Trinity Point Marina. This assessment is set out below.

1 INTRODUCTION

1.1 Background

In June 2015, Johnson Property Group (JPG) secured development consent for a marina as an initial development of the concept approved Trinity Point Marina and Mixed Use Development on the shores of Lake Macquarie (Bardens Bay), at Morisset Park. **Figure 1** shows the general location of the Trinity Point project site.

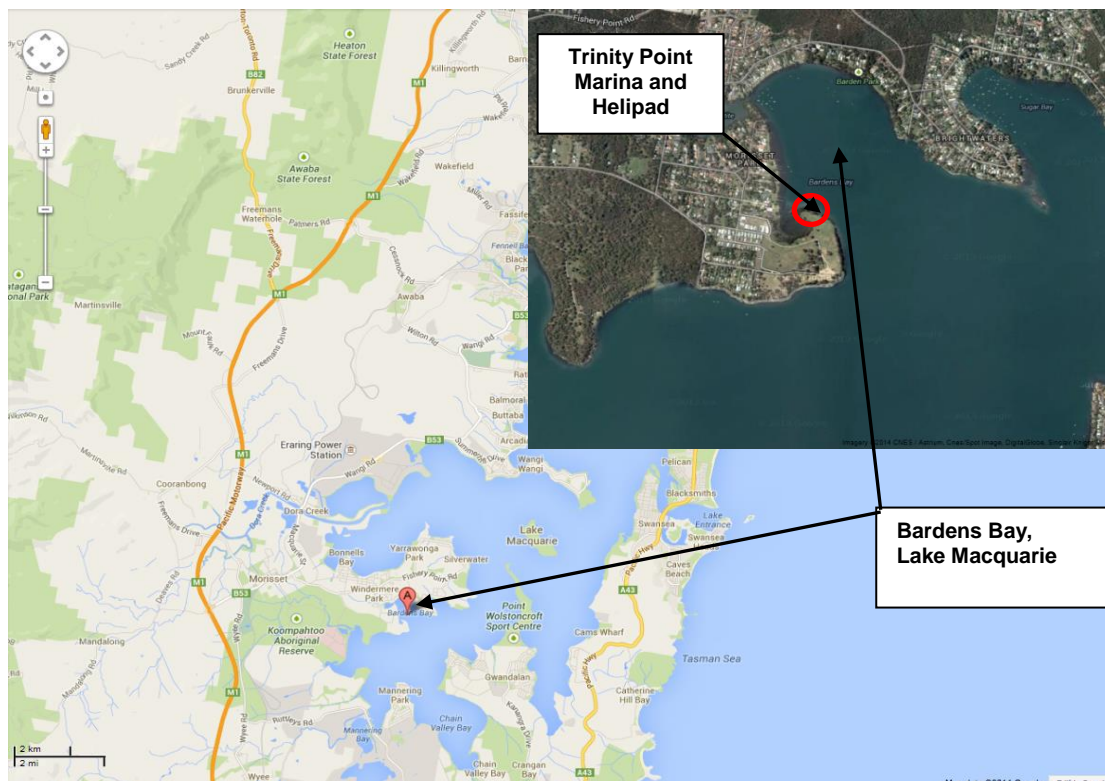


Figure 1 Site Locality

JPG has secured approval for the Development Application (DA) for Stage 1 of the Trinity Point Marina totalling some 94 Berths (i.e. 50% of the ultimate development footprint). As part of the DA (1503/2014), an Environmental Impact Statement (EIS) was prepared to assess environmental aspects of the marina development. As part of this previous EIS, RHDHV undertook a comprehensive assessment of the potential impacts of the marina on coastal processes and hydrodynamics to assess the effects of the proposed development on water circulation within Bardens Bay.

JPG has prepared a Section 75W application under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for a Concept Plan modification for a helipad to be included as part of the approved marina design (Application Number MP 06_0309 MOD 3).

An Environmental Assessment (EA) is to be undertaken for the Concept Plan modification. Requirements for the EA are set out in the Secretary's Environmental Assessment Requirements (SEARs) that were issued by the NSW Department of Planning and Environment (Ref: SEAR 06_0309 MOD 3).

1.2 Scope of this Assessment

An overview of the helipad design is included in **Section 2**.

The SEARs for the application refer to the following key issues:

1. Establishment of Helipad and Helicopter Noise Impacts;
2. Public Access;
3. Natural Hazards;
4. Marina Development and Potential Impacts; and,
5. Design and Visual Impact.

The assessment provided herein addresses coastal processes and hydrodynamics for the proposed helipad. These aspects relate to Issues 3 and 4 of the SEARs, which are addressed in **Section 3** and **Section 4**, respectively.

2 HELIPAD DESIGN

Design Drawings for the proposed helipad are provided in **Attachment A**. Relevant features of the helipad design to inform the assessment herein include:

- the helipad pontoon surface area is 20 m × 20 m (400 m²) to accommodate the recommended design helicopter;
- the helipad pontoon would be connected to the marina via:
 - three (3) pontoons each with dimensions 3 m × 4 m (36 m²); and
 - a hinged aluminium gangway suspended above the water surface with dimensions 1.5 m width × 17 m long;
- the total pontoon surface area (helipad pontoon and connecting pontoons) is 436 m²;
- the pontoon structures are to be precast concrete similar to the marina breakwater structure;
- the pontoon would sit at a similar height and draught in the water to the floating breakwater structure with a 700 mm freeboard (above water level) and extending 600 mm below the water surface (draught);
- the helipad pontoon would be supported by four (4) telescopic piles (**Figure 2**), while one (1) telescopic pile would support the adjacent connecting pontoons (i.e. five (5) piles in total). Each pile has a nominal diameter of 600 mm. The piles would be designed to adjust their height to accommodate any changes in water level (within a reasonable range), such that the pontoon always sits at the same water level;
- telescopic piles do not extend above the pontoons so as not to present a safety hazard to helicopter take-off and landing;
- two (2) orange flashing lights will be added to the marina pillars for use when a helicopter landing/take off is occurring; and,
- an eastern cardinal marker will be placed adjacent to the eastern corner of pontoon.



Figure 2 Telescopic Pile

3 NATURAL HAZARDS

3.1 SEARs

The SEARs issued for the concept plan modification notes the following in relation to natural hazards:

3. Natural Hazards

Coastal Processes

- a) Address coastal hazards and the provisions of the Coastline Management Manual. In particular consider impacts associated with wave and wind action, coastal erosion, sea level rise and more frequent and intense storms (also refer to discussion below under flooding).
- b) Address consistency with *Rivers and Foreshores Improvements Act 1948*, *NSW Coastal Policy*, *NSW Wetlands Management Policy*, *NSW State Rivers and Estuaries Policy* and *NSW Estuary Management Policy*.

Both of the above aspects are addressed below.

3.2 Coastal Hazards

The *NSW Coastline Management Manual* (NSW Government, 1990) provides an overview of a range of coastal hazards, including the following that are relevant to Bardens Bay:

- coastal erosion;
- coastal inundation; and,
- climate change (including sea level rise and more frequent and intense storms).

Each of these hazards is discussed below in relation to the proposed helipad development.

3.2.1 Coastal Erosion

Foreshore erosion at Bardens Bay may occur as a result of significant wave and wind action. The sources of wave activity contributing to the wave climate at the site comprise local wind generated waves and boat wake. Ocean swell does not penetrate to the main body of Lake Macquarie.

The proposed helipad would not significantly influence the local wind and wave environment in a manner that increases the coastal erosion hazard at Bardens Bay. This is primarily due to the relatively small size of the proposed helipad, and the relatively shallow draught of the pontoon structure (0.6 m).

3.2.2 Coastal Inundation

The pontoon of the proposed helipad is a floating structure supported by telescopic piles. The pontoon level would rise and fall in accordance with local water levels, including extreme water levels during significant lake flooding events.

As such, there would be no risk of inundation of the proposed helipad under normal operating conditions.

3.2.3 Climate Change

Similarly, there would be no risk of inundation of the proposed helipad associated with projected sea level rise.

More frequent and intense storms may occur as a result of climate change, which may lead to more extreme flooding events in Lake Macquarie. However, as noted above, the proposed helipad would not be affected by flooding events.

More frequent and intense storms may also lead to the development of extreme wind wave conditions. As per the marina, the proposed helipad structure has been designed to withstand 50 year average recurrence interval (ARI) wave conditions with appropriate factors of safety incorporated into the design. This is considered to be adequate to deal with extreme wind wave conditions that may develop during the design life of the helipad.

3.3 Consistency with relevant Acts and Policies

3.3.1 Water Management Act 2000

The *Rivers and Foreshores Improvement Act 1948* was repealed in February 2008 and replaced with the controlled activity provisions of the *Water Management Act 2000* (WM Act). Under the WM Act, a controlled activity means:

- (a) the erection of a building or the carrying out of a work (within the meaning of the EP&A Act), or
- (b) the removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise, or
- (c) the deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise, or
- (d) the carrying out of any other activity that affects the quantity or flow of water in a water source.

As noted in the EIS for the marina development, an approval under Section 91 of the WM Act was not required because the marina is not an 'integrated development' under Section 91 of the EP&A Act. Similarly, approval under the WM Act is not required for the proposed helipad construction.

Nevertheless, the general standards used by the NSW Office and Water in implementing the WM Act will be adhered to for the helipad construction, as per the overall marina development.

3.3.2 NSW Coastal Policy

The *NSW Coastal Policy 1997* has been implemented by the NSW government to better co-ordinate the management of the coast by identifying the State's various management policies, programs and standards as they apply to a defined coastal zone. These policies, programs and standards frequently obtain their legitimacy from other NSW legislation.

Nine goals were adopted for the Coastal Policy including recognising and accommodating the natural processes of the coastal zone. The policy notes that the impacts of natural coastal processes and hazards (including sea level rise) are to be addressed in coastline and estuary management plans.

Coastal hazards are discussed in **Section 3.2**, while hydrodynamics processes are discussed in **Section 4.7**.

It is considered that the proposed helipad is consistent with the Coastal Policy.

3.3.3 *NSW State Rivers and Estuaries Policy*

The intent of the State Rivers and Estuaries Policy is to encourage the sustainable management of the natural resources of the State's rivers, estuaries, wetlands and adjacent riverine plains so as to reduce or halt impacts such as declining water quality and damage to river banks and channels. Means for achieving the policy objectives include adoption of the best available management practices and appropriate safeguards.

The policy lists a number of component policies including the Estuary Management Policy and Wetlands Policy, which are discussed below.

NSW Estuary Management Policy

The general goal of the Estuary Management Policy is to achieve an integrated, balanced, responsible and ecologically sustainable use of the State's estuaries. Specific objectives include the protection of estuarine habitats and ecosystems and maintenance of the necessary hydrologic regime. The sustainable use of estuarine resources includes commercial and recreational uses as appropriate.

The helipad is proposed to be a floating structure, suspended on piles, that does not encroach on the existing seagrass beds that are present along the Bardens Bay shoreline. Minimal disturbance to the movement of seagrass wrack or the disturbance of benthic organisms is expected as a result of the construction of the helipad (these potential impacts are addressed within the Aquatic Ecology report that accompanies the EA). No hydrologic regime change is expected to occur as a result of the helipad construction.

The proposed helipad would therefore not impact estuarine habitats and ecosystems, and would not affect the local hydrology regime within Bardens Bay.

NSW Wetlands Management Policy

The general goal of the Wetlands Policy is the ecologically sustainable use, management and conservation of wetlands in NSW for the benefit of present and future generations. To assist in achieving this, a number of principles were adopted including that water entering natural wetlands will be of sufficient quality so as not to degrade the wetlands. The policy document also notes the importance of wetland vegetation in protecting foreshores from erosion. Land use and management practices that maintain or rehabilitate wetland habitats and processes are encouraged under the policy.

The proposed helipad will not adversely affect coastal processes and is not expected to have any adverse impacts on water quality. Wetland habitats would not be impacted.

4 MARINA DEVELOPMENT AND POTENTIAL IMPACTS

4.1 SEARs

The SEARs issued for the concept plan modification notes the following in relation to the marina development and potential impacts:

4. Marina Development and Potential Impacts

- a) Address the potential marina impacts:
 - due to the marine structure and operations on the seabed, in particular on seagrass and benthic organisms including the shading effects of the structures proposed measures to prevent/mitigate impact (The design should minimise shading on the seagrass beds);
 - due to any structure located on the foreshore to interfere with the free movement of seagrass wrack along the foreshore, and on wave energy and the risk of deflection or refraction to other locations and proposed measures to prevent/mitigate impacts;
 - due to stormwater run-off on water quality and seagrass beds and proposed measures to prevent/mitigate impacts;
 - on navigation and existing swing moorings on or in the immediate area of Bardens Bay;
 - due to dredging activities including method to be used; dimension of area of works; nature of sediment; environmental safeguards;
 - marine vegetation and include mapping and density distribution and measures to minimise harm to marine vegetation and details of compensatory habitat development to replace lost vegetation; and
 - on fish species and their habitat.
- b) Undertake an assessment of potential impacts of the marina development on hydrodynamic processes within Lake Macquarie and Bardens Bay including detailed hydrodynamic modelling undertaken to quantify potential impacts.
- c) Address the principles of Crown lands management under Section 11 Crown Lands Act 1989 and Part 3 – the land assessment provisions.

Each of the potential marina impacts listed in Item 4 (a) above is addressed below, with the exception of the first, sixth and seventh items, i.e. excluding potential impacts related to:

- the marine structure and operations on the seabed on seagrass and benthic organisms;
- marine vegetation; and,
- fish species and their habitat.

These items are addressed within the Aquatic Ecology report that accompanies the EA.

Items 4 (b) and (c) are also addressed below.

4.2 Seagrass Wrack

Seagrass wrack modelling (represented using hydrodynamic particle tracking modelling) was previously undertaken for the marina EIS to determine the impact of the proposed marina on the transport and fate of seagrass wrack in Bardens Bay. The findings of this investigation were reported in Appendix I of the EIS (RHDHV, 2014b) and can be summarised as follows:

- wind driven currents are able to transport seagrass wrack (represented in the modelling by particles) throughout the south-western arm of Lake Macquarie;
- the marina has an insignificant influence in the overall distribution of seagrass wrack;
- seagrass wrack will travel freely either side of the marina and, due to the random nature of the wind driven currents, there is no significant shadow (i.e. reduction in wrack density) along the western shore of Bardens Bay.

The proposed helipad and connecting pontoons would cover a water surface area of approximately 436 m² which is very minor in comparison to the approved Stage 1 of the marina which will cover a water surface area of approximately 20,000 m² (i.e. an approximately 2% increase to the marina footprint). The final proposed marina footprint would be of the order of 40,000 m². Therefore, it would not be expected that the minor increase to the marina footprint would alter the above findings.

Furthermore, the helipad pontoon would sit at a similar level in the water to the floating breakwater structure for the approved marina, and would not represent a different type of barrier to wrack movement at the site which might otherwise necessitate a review of the above findings.

4.3 Wave Energy

The sources of wave activity contributing to the wave climate at the site comprise local wind generated waves and boat wake. Ocean swell does not penetrate to the main body of Lake Macquarie. Wave data collected at the proposed marina site has been used to inform modelling undertaken by Bellingham Marine for the design wave conditions for the marina structures.

The proposed helipad would not significantly influence the local wave environment, including deflection and refraction to other locations. This is primarily due to the relatively small size of the proposed helipad, and the relatively shallow draught of the pontoon structure (0.6 m).

4.4 Water Quality

The proposed helipad introduces a very minor risk of water quality impacts associated with spills or leaks of hydrocarbons from helicopters. However, the likelihood of this occurring is considered to be almost negligible because:

- refuelling of helicopters would not be undertaken at the marina;
- helicopters are subject to regular and stringent safety checks, including fuel containment systems;
- if fuel leakage occurred in a helicopter travelling to the marina, this would likely be identified prior to take-off or during the early stages of the flight, and the helicopter would return to the airport rather than continuing to the marina.

Nevertheless, the risk of any hydrocarbons spills associated with the proposed helipad can be managed with the following measures:

- bunding of the deck structure to prevent runoff from directly entering the lake;
- provision of readily accessible oil / fuel spill kits and containment boom; and,
- first flush treatment for the deck of the pontoon structure.

The preferred details of the hydrocarbon spill prevention will be provided at the detailed design stage.

4.5 Navigation

A recreational boating study was undertaken as part of the EIS for the marina development to demonstrate existing usage patterns and to consider adequate lake resource to support the development. The study was documented in Appendix AC of the EIS (JF Resources, 2014). The study was undertaken to provide a snapshot analysis of existing patterns of usage of the southern end of Lake Macquarie. The analysis included consideration of regular patterns of usage (i.e. sailing clubs) and also considered the irregular usage patterns (i.e. unorganised boating activities such as recreational fishing).

The study concluded that the southern end of Lake Macquarie is not significantly utilised and there have been no significant environmental or vessel incidents. The EIS also noted that the marina would not have a significant impact on existing water navigation or prejudice other lake users.

The addition of the proposed helipad would not alter the above findings due to the relatively small size of the helipad in relation to the approved marina.

Furthermore, navigation safety would be managed with the following measures:

- a 30 m exclusion zone would be enforced during helicopter take-off and landing; and,
- an eastern cardinal marker would be placed adjacent to the eastern corner of the helicopter landing pontoon.

4.6 Dredging Activities

No dredging or removal of marine sediment is required to develop the helipad. Minor disturbance to bed sediments may occur during pile driving of the five (5) telescopic piles that will support the helipad and connecting pontoons. However, it should be noted that the lake bed sediments at the site are generally not contaminated, as described in the baseline monitoring report for the project (RHDHV, 2014b) which is included in Appendix H of the marina EIS.

The construction sequence for pile driving is as follows:

- Piles would be delivered to the site and stockpiled ready for launching onto barges prior to driving.
- Piles and pontoons will be lifted into the water (i.e. over the top of the nearshore seagrass beds) rather than slid into the water from the shore. Piles will be lifted onto a barge which will then transport the piles into position ready for driving. Alternatively, the piles will arrive by water.
- As required, geofabric and silt curtains will be deployed to prevent sediment dispersion resulting from the piling process.

- Piles to be drilled and hammer driven to minimise bed sediment disturbance. Piles will be driven from barges floated to the site. The pile driving barge will likely be anchored and cabled or involve a jack-up type barge that will hold its position without ongoing disturbance of the lake bed during pile driving.

Management and mitigation measures for impacts of pile driving are described in the Construction Environment Management Plan (CEMP) for the marina project (Appendix W of the EIS), and include:

- Piles will be drilled and driven into bare sediment habitat offshore from the seagrass beds resulting in no loss of seagrass habitat.
- Each pile will only displace a very small area of benthic habitat. However, as the pile driving activity pushes most sediment aside rather than entraining it downwards, the actual loss of benthic biota is minimal as most organisms are pushed aside with the displaced sediments, and are able to successfully re-establish after pile driving is completed. Further, as there is abundant bare sediment habitat in Bardens Bay, colonisation of displaced sediments would occur rapidly from the adjacent sediments. Accordingly it is concluded that the overall impact of pile driving on bare sediment benthic habitats would be negligible.
- All contractors undertaking construction activities in the lake are to ensure that their activities do not scour, disturb, scalp or smother seagrass beds, do not scour bare sediment seabed habitat or cause excessive turbidity and do not cause water pollution from fuel and oil spills.
- When drilling piles, a silt curtain should be used if a sediment plume is identified.
- Visual water quality monitoring will be undertaken during piling and pile launching activities. Any additional water quality monitoring will be undertaken as required by an Environment Protection Licence.

With the implementation of the above measures, and in consideration of the small scale of piling activities associated with the proposed helipad construction (five piles only), there would be negligible impacts on lake bed sediments or the water column.

4.7 Hydrodynamic Processes

A comprehensive assessment of hydrodynamic impacts associated with the approved marina development was reported in RHDHV (2014b), which is contained in Appendix I of the EIS. The hydrodynamics investigation provided a quantitative description of the important physical process under both existing and design conditions, including a detailed analysis of the following:

- lake circulation using a 3D numerical model;
- effect of the marina on flushing times of Bardens Bay;
- particle tracking analysis to assess fate of pollutants from potential contaminate spills within the marina;
- particle tracking analysis to model and track seagrass wrack movement and fate (refer **Section 4.2**).

As noted in **Section 4.2**, the proposed helipad represents an approximately 2% increase to the Stage 1 marina footprint, and only 1% of the final marina footprint (note that the final footprint was modelled, so likely less than a 1% change in the modelled footprint). Furthermore, the helipad pontoon would sit at a similar level in the water to the floating breakwater structure of the approved marina. As such, the proposed helipad would not significantly alter hydrodynamics processes at

the marina. Therefore, additional hydrodynamics modelling that incorporates the proposed helipad is not considered to be necessary, and the findings of RHDHV (2014b) would not be altered, i.e.:

- There would be no significant impacts on localised circulation currents and on the flushing times of Bardens Bay. Better than acceptable water exchange between Lake Macquarie and Bardens Bay would be maintained under the marina and helipad development.
- It is unlikely that pollutants from any potential spill within the marina or from the helipad would be spread to the greater Lake environment, provided industry standard spill prevention practices are implemented and managed.
- Due to the general shape and bathymetry of Bardens Bay and south-western Lake Macquarie, circulation between the Lake and the Bay is greatest under east to south wind directions, although the persistent winds that commonly occur at the site from the west through north-west directions are the most significant in the net flushing regime of the Bay.
- Due to its location, the marina has a limited effect on westerly to north-westerly wind-driven currents and the overall circulation of the Bay during these conditions.
- The marina development is considered unlikely to affect water quality or the physical well-being of natural estuarine habitats in Bardens Bay.

4.8 Crown Lands Management

The principles of Crown land management, as set out in Section 11 of *Crown Lands Act 1989*, are as follows:

- (a) Environmental protection principles be observed in relation to the management and administration of Crown land;
- (b) The natural resources of Crown land (including water, soil, flora, fauna and scenic quality) be conserved wherever possible;
- (c) Public use and enjoyment of appropriate Crown land be encouraged;
- (d) Where appropriate, multiple use of Crown land be encouraged;
- (e) Where appropriate, Crown land should be used and managed in such a way that both the land and its resources are sustained in perpetuity; and
- (f) Crown land be occupied, used, sold, leased, licensed or otherwise dealt with in the best interests of the State consistent with the above principles.

In regard to coastal processes and hydrodynamics, the proposed helipad development is consistent with the principles of *Crown Lands Act 1989*. The assessment provided herein confirms that coastal processes and hydrodynamics considerations can be managed by the proposed development. Furthermore, the proposed helipad will improve the quality of the marina facility which will encourage public access and visitation.

5 REFERENCES

JF Resources (2014), *Trinity Point Marina Recreational Boating Study, South Lake Macquarie, April 2014*

Royal HaskoningDHV [RHDHV] (2014a), *Trinity Point Marina Verification of Baseline Data*, prepared for Johnson Property Group, July 2014

Royal HaskoningDHV [RHDHV] (2014b), *Trinity Point Marina Hydrodynamic Model Investigations Report*, prepared for Johnson Property Group, September 2014

NSW Government (1990), *Coastline Management Manual*, September 1990, ISBN 0730575063

6 SALUTATION

We trust that the above information adequately assesses the coastal processes and hydrodynamics matters related to the proposed helipad development.

Should you have any queries regarding this assessment, please do not hesitate to contact the undersigned on 02 4926 9503 or 0408 005 660.

Yours faithfully
HASKONING AUSTRALIA

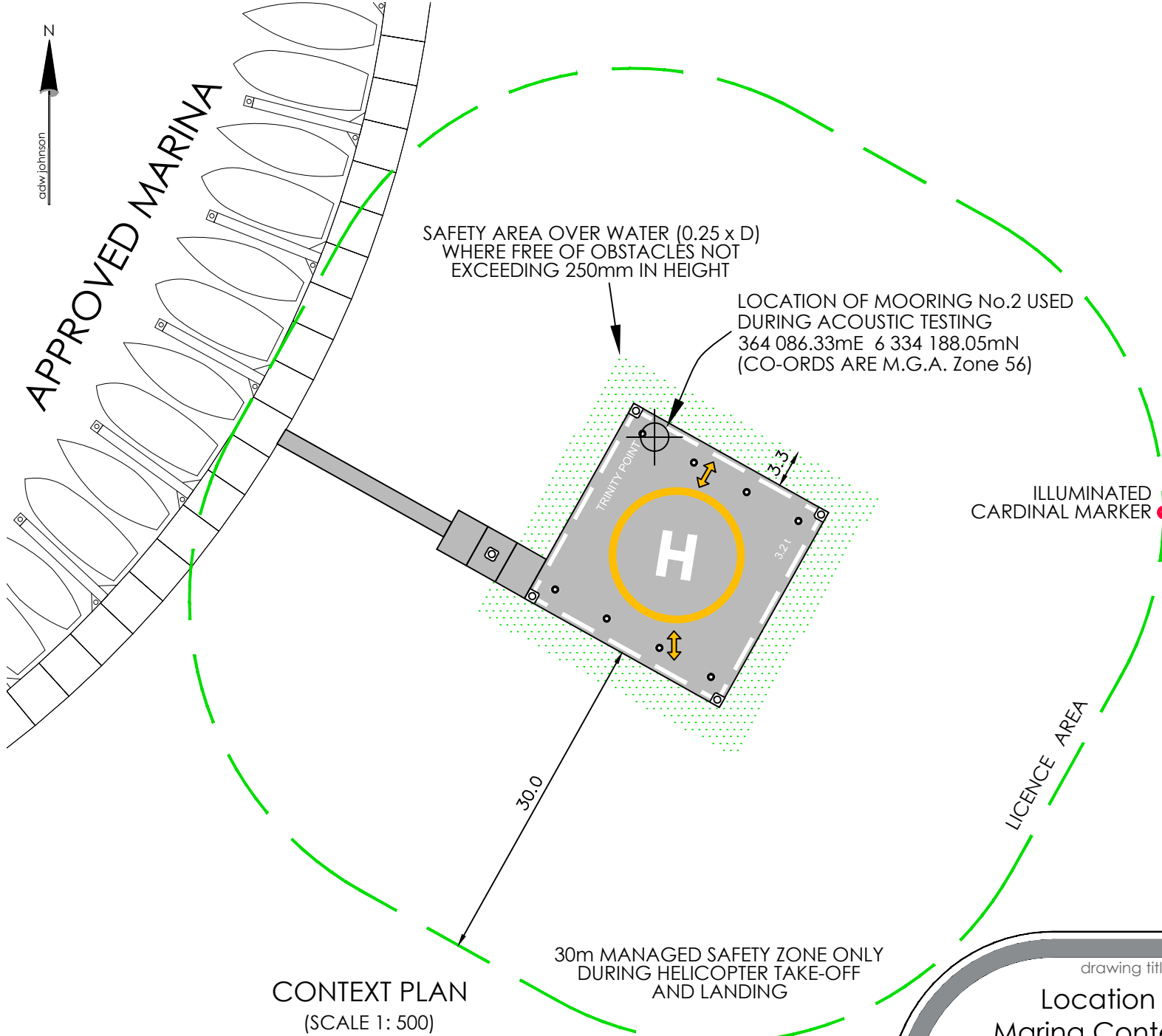


Ben Patterson
Associate Director – Rivers, and Water Management - Australia

ATTACHMENT A – HELIPAD DESIGN DRAWINGS



LOCALITY SKETCH
(SCALE 1: 10 000)



CONTEXT PLAN
(SCALE 1: 500)

drawing title:
**Location &
Marina Context of
Proposed Helipad**

location: Trinity Point Marina

council: LAKE MACQUARIE

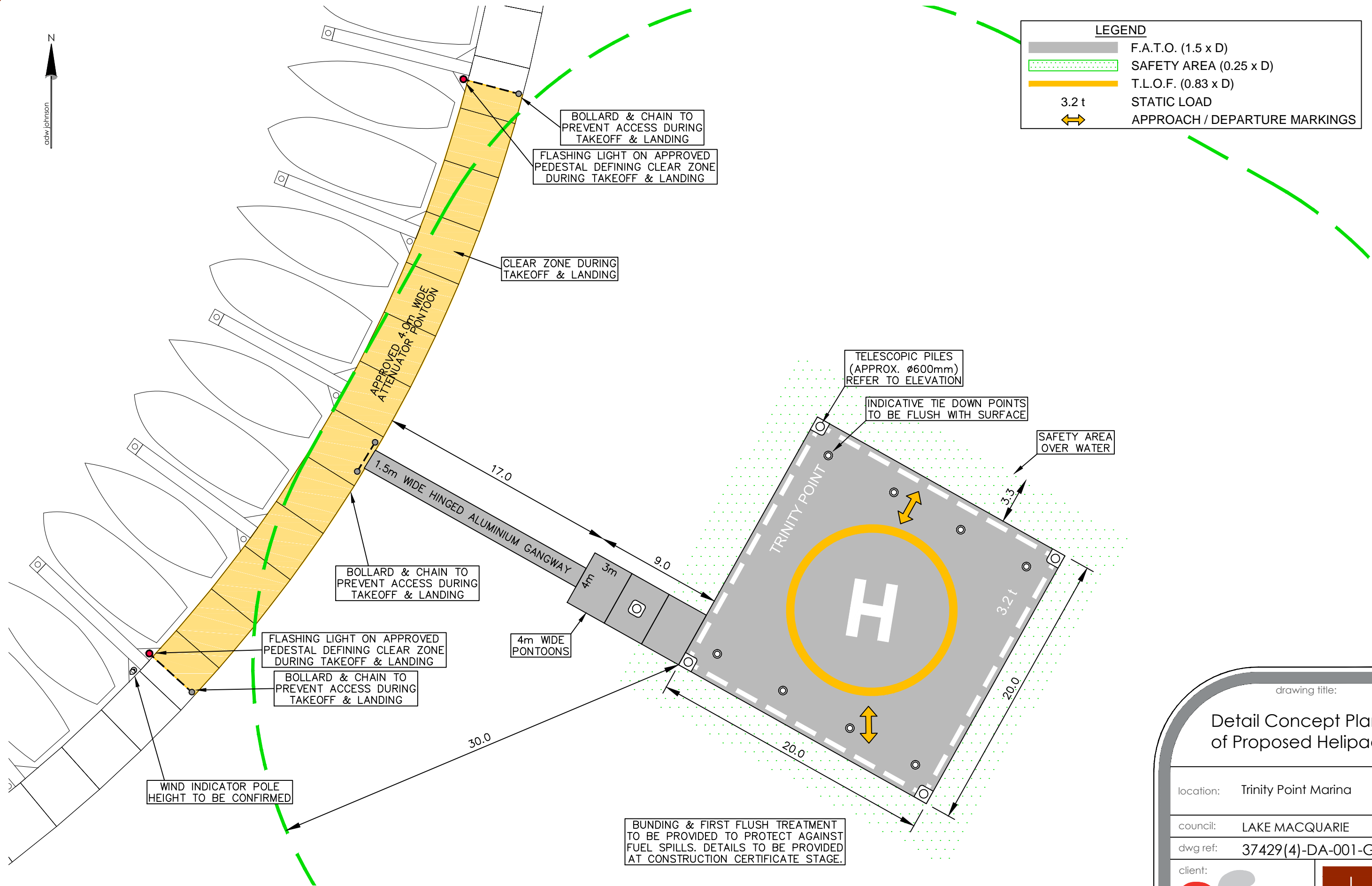
dwg ref: 37429(4)-DA-001-G

client:



central coast office ph: (02) 4305 4300
hunter office ph: (02) 4978 5100

ver.	date	comment	surveyed	drawn	checked	pm	co-ordinate & level information	scale (A3 original size)	page
D	24.08.16	UPDATE HELIPAD DESIGN	-	Z.J.	M.D.	S.H.	CO-ORDINATE SYSTEM: M.G.A. 56	<div><div>012.525.0m</div><div>SCALE: 1:500 (FULL)</div></div>	1 OF 3
E	25.08.16	UPDATE HELIPAD DESIGN	-	Z.J.	M.R.	S.H.	ORIGIN OF CO-ORDINATES: P.M.58712		
F	29.08.16	REVISE LAYOUT	-	Z.J.	M.R.	S.H.	DATUM: N/A		Date of Surv
G	12.09.16	UPDATE CARDINAL MARKER LOCATION	-	Z.J.	M.R.	S.H.	ORIGIN OF LEVELS: N/A CONTOUR INTERVAL: N/A		



drawing title:


Detail Concept Plan of Proposed Helipad

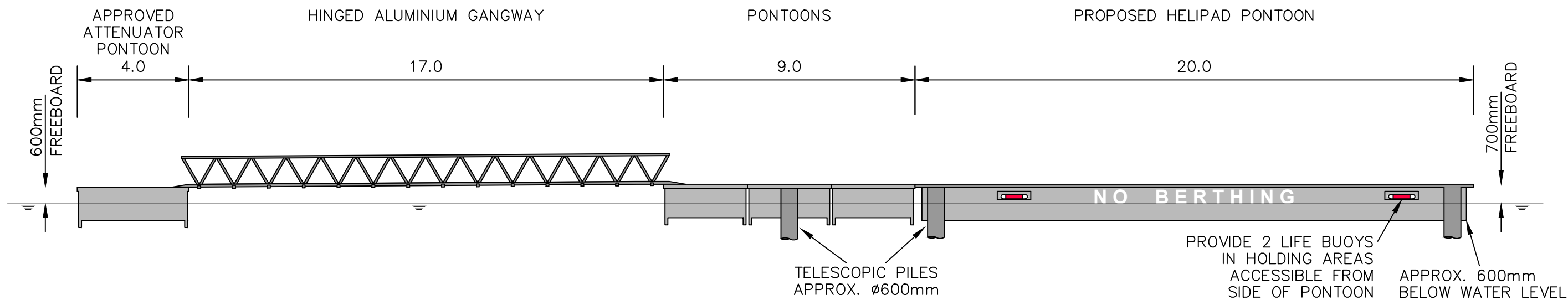
location: Trinity Point Marina
council: LAKE MACQUARIE
dwg ref: 37429(4)-DA-001-G

client:



central coast office ph: (02) 4305 4300
hunter office ph: (02) 4978 5100

ver.	date	comment	surveyed	drawn	checked	pm	co-ordinate & level information	scale (A3 original size)	page
D	24.08.16	UPDATE HELIPAD DESIGN	-	Z.J.	M.D.	S.H.	CO-ORDINATE SYSTEM: M.G.A. 56	 SCALE: 1:250 (FULL)	2 OF 3
E	25.08.16	UPDATE HELIPAD DESIGN	-	Z.J.	M.R.	S.H.	ORIGIN OF CO-ORDINATES: P.M.58712		
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G	12.09.16	UPDATE CARDINAL MARKER LOCATION	-	Z.J.	M.R.	S.H.	ORIGIN OF LEVELS: N/A CONTOUR INTERVAL: N/A		



drawing title:
Typical Concept
Elevation of
Proposed Helipad

location: Trinity Point Marina

council: LAKE MACQUARIE

dwg ref: 37429(4)-DA-001-G

client:



central coast office ph: (02) 4305 4300
hunter office ph: (02) 4978 5100

ver.	date	comment	surveyed	drawn	checked	pm	co-ordinate & level information	scale (A3 original size)	page
D	24.08.16	UPDATE HELIPAD DESIGN	-	Z.J.	M.D.	S.H.	CO-ORDINATE SYSTEM: M.G.A. 56		3 OF 3
E	25.08.16	UPDATE HELIPAD DESIGN	-	Z.J.	M.R.	S.H.	ORIGIN OF CO-ORDINATES: P.M.58712		
F	29.08.16	REVISE LAYOUT	-	Z.J.	M.R.	S.H.	DATUM: N/A		
G	12.09.16	UPDATE CARDINAL MARKER LOCATION	-	Z.J.	M.R.	S.H.	ORIGIN OF LEVELS: N/A		
							CONTOUR INTERVAL: N/A		Date of Surv