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MEMORANDUM

To:	Naomi Simmons, Special Counsel (Sparke Helmore Lawyers)
From:	Jason Ryan, Principal Engineer (Aviation)
Date:	23 May 2019
Subject:	Supplementary Trinity Point Downwash Assessment for the Airbus H125
Revision:	1.1

Memorandum Purpose

JJ Ryan Consulting (JJR) have been engaged by Sparke Helmore Lawyers ("Sparke") on behalf of Johnson Property Group Pty Ltd (JPG) to assess helicopter downwash impacts associated with a proposed helipad at Trinity Point.

The purpose of this memorandum is to provide an assessment on the downwash (and obstacle impact) risks for the take-off profile for the H125 aircraft as a supplementary report to JJR's Helicopter Downwash Assessment Report (dated 22 May 2019), (Rotor Downwash Assessment "RDA").

Assessment Background

Trinity Point is a luxury residential, tourist and marina destination project located on the shores of Australia's largest salt water lake, Lake Macquarie, and is approximately a 1 hour drive from Newcastle.

The Minister for Planning approved Concept Plan 06_309 on 5 September 2009. JPG submitted an application for MOD3 to the Concept Plan on 1 October 2013 to include a helipad off the marina and insert appropriate conditions that outline how the helipad is to be assessed for future Part 4 approvals. This modification is currently the subject of ongoing court proceedings.

The modifications to the Concept Approval sought in the Application included the following:

- Add 'helipad' as a permitted use and update the relevant development descriptions and related terms of approval to incorporate the proposed helipad use;
- Incorporate the revised drawings identified in Appendix L of the Environmental Assessment Report (EAR), dated 10 November 2016, into the Concept Approval; and
- Amend the Concept Approval to incorporate a new principle to manage the future construction and use of the proposed helipad in the approved Urban Design Guidelines.

The subject site is located in Bardens Bay with an overview of the proposed helipad location shown in Figure 1 with the currently proposed helipad layout provided in Figure 2. Amendments are proposed to the original application that:

- Extend a managed safety area around the helipad from 30m from the edge of the helipad to 66.5m from the centre of the helipad;
- Increasing the helipad size from 20mx20m to 25mx25m;
- Establishing an exclusion are and a designated take-off and landing area (as shown in Figure 2); and
- Replacing (in the list of helicopters nominated to use the helipad) the Airbus135 with the AS355F. The revised helipad plans are provided in Attachment 1.

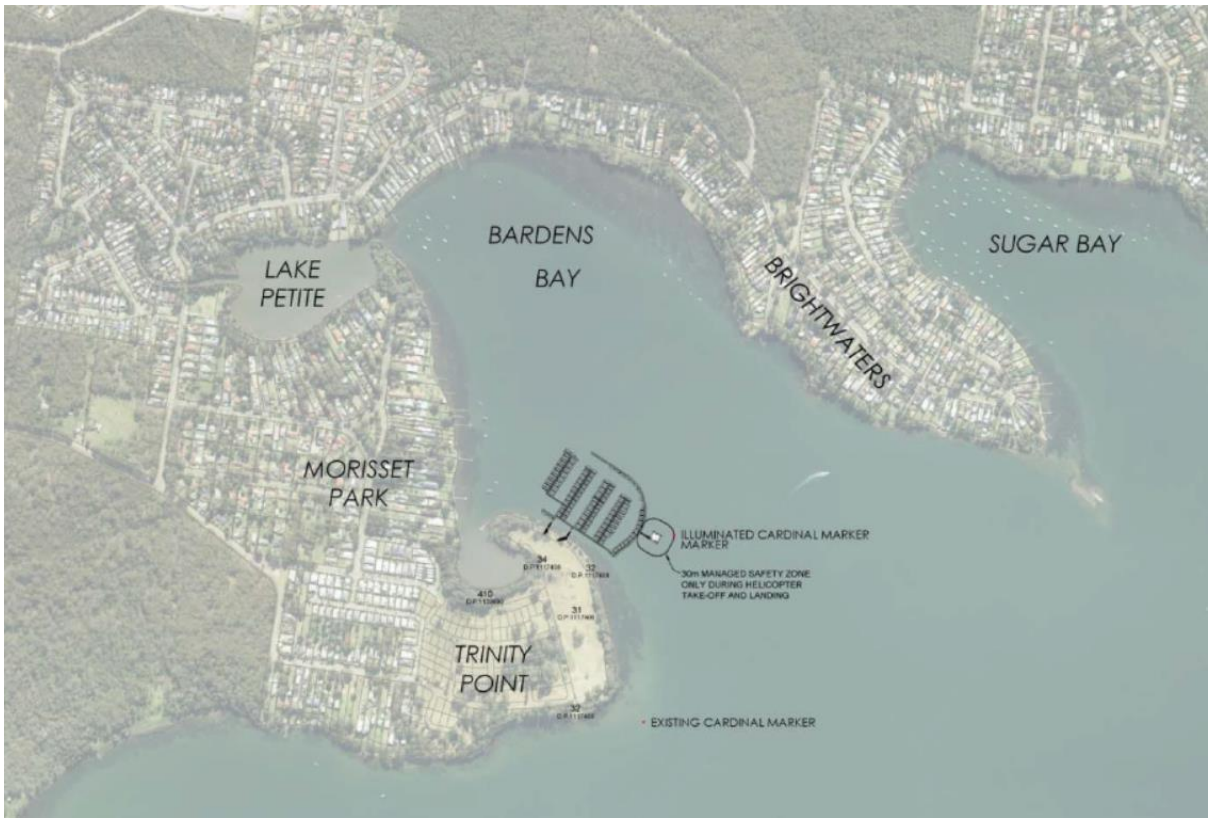


Figure 1 Locality plan showing the proposed helipad

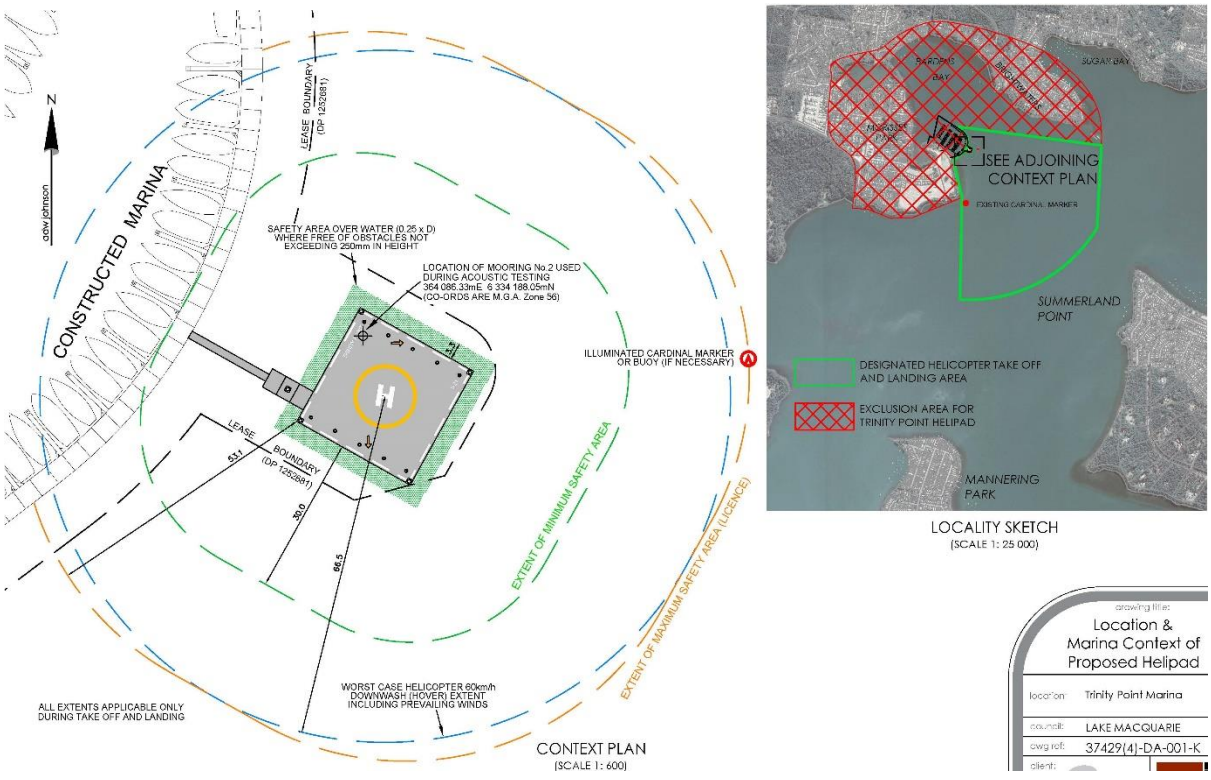


Figure 2 Proposed helipad layout

Regulatory Context

The scope of this report does not comment on the regulatory requirements that helicopter pilots must abide by in the context of selected flight profiles (e.g. normal performance take-off in accordance with the RFM versus steeper angles of departure).

Rotor Flight Manual Take-off Profile for the H125

The Rotor Flight Manual (RFM) for the AS350B3 (now known as the Airbus H125) has been utilised as the basis for typical helicopter take-off and landing scenarios.

The Airbus H125 operating procedures have been provided as a reference example only for helicopter operating procedures, noting that each helicopter has its own flight manual developed by the aircraft manufacturer, stipulating different requirements and/or recommendations for operating procedures.

A summary of the relevant operating procedures for the Airbus H125 are as follows:

- **Take-off:** Gradually increase the collective pitch and maintain hover and head into wind at a height of approximately 1.5m (5ft);
- **Transition to hover:** Increase speed without increasing the power demand (power required for hover in ground effect) and without climbing until the Indicated Airspeed (IAS) is 74km/h (40kt);
- **Climb:** Maintain power and climb while avoiding entering the height / airspeed diagram;
- **Climb:** Above 30m (100ft) select maximum continuous power and optimum climbing speed of (v_y) IAS = 65kt (120km/hr – 1 kt/1000ft);
- **Approach:** Final approach should be made into the wind at a low sink rate and recommended airspeed of 120km/h (65kt); and
- **Landing:** From hover, reduce collective pitch gradually until initial touch-down is made, then cancel collective pitch completely.

An expert helicopter pilot (the “pilot”) has been consulted to provide JJR with information on typical helicopter operations including information on acceleration during take-off.

The pilot has indicated that a typical H125 would achieve an IAS of 50kts over a maximum distance of 100m at a nose down angle of 20°.The pilot reiterated that he is confident that a 20° angle of attack is acceptable, and that the estimation of this distance is based on significant flying experience.

To verify the distance to achieve a 40kt IAS, JJR have undertaken first-principles engineering calculations to verify the empirical distances estimated by the pilot versus theoretical distances calculated to reach 40kt, based on the following variables:

- Maximum Take-off Weight;
- Operating Weight (90% of MTOW);
- Rate of Climb;
- Theoretical Thrust; and
- Angle of Attack.

The theoretical distance to achieve 40kt IAS with a 20° angle of attack is 127m from the centre of the helipad (assuming that the angle of attack is constant, not accounting for the time to nose down from 0° to 20°, however for the purposes of verifying distances this has been considered negligible).

On this basis, JJR have assumed a conservative distance of 127m is required to achieve an IAS of 40kts (speed required to commence climb) in accordance with the pilot’s recommendations. The back-calculated uniform acceleration on this basis is 1.667m/s^2.

An overview of the helicopter downwash velocities with a mass between 2,000kg and 3,000kg and a rotor span between 10m and 11m is provided in Figure 3.

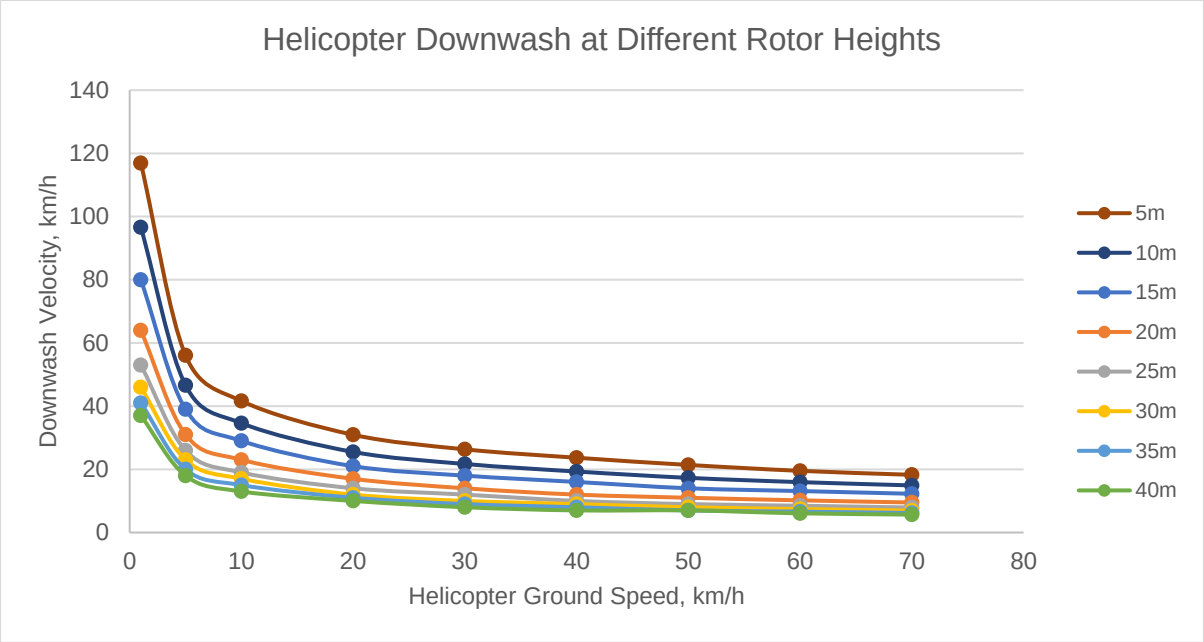


Figure 3 Helicopter downwash velocity at different rotor heights

In accordance with the Rotor Flight Manual (RFM), the H125 will be in a hover at a height from the ground to the rotor of approximately 5.0m (noting that the rotor would be higher due to the height of the pontoon above water level, plus height of hover, plus height of the rotor above the skids).

The RDA outlined that a conservative acceptable velocity is 20km/hr of downwash velocity impacting vessels. It is calculated that the helicopter downwash velocity would be a maximum of 20km/h at a helicopter IAS of approximately 55km/h. Based on the assumption of uniform acceleration and uniform angle of attack, it is calculated that the H125 will reach an IAS of 30kts (55km/hr) at 70.0m from the centre of the helipad.

There is a proposed 66.5m maximum safety area (licence) which is based on the worst-case stationary helicopter 60km/h downwash extents (accounting for prevailing winds). It has been calculated downwash impacts of the H125 accelerating away from the helipad will reach an acceptable level 70.0m from the centre of the helipad, noting that there are various factors of safety contained within the calculations. The calculations are provided in Attachment 2 for reference.

The proposed maximum safety area (licence) is therefore suitable from a downwash perspective for operations of the H125 in accordance with the RFM. It should be noted that the downwash impacts will continuously reduce as the aircraft continues to generate ground speed and begin to climb.

Based on this supplementary rotor downwash assessment, it is noted that the obstacle clearance will govern aviation safety rather than the helicopter downwash impacts. As per the RDA, the Mannering Park Amateur Sailing Club (MPASC) raised concerns with impacts on the regatta sailing area which commences approximately 366m south of the centre of the helipad pontoon and will therefore not be significantly impacted by H125 movements.

JJR recommend the Helipad Operations Manual includes a requirement for helicopter pilots to complete a visual check for nearby watercraft and liaise with the helipad landing officer prior to take-off (and landing) to minimise downwash impacts as well as ensuring no watercraft create an obstacle for pilots during take-off and landing.

Review of Rotor Flight Manuals

JJR have reviewed the RFM for the following six (6) aircraft originally proposed for the helipad development:

- Bell 407;
- Bell 206B3;
- Bell 206L3;
- Airbus 135 (previously the EC135) (now excluded);
- AW109SP; and
- MD500D/E.

The six (6) RFMs that were reviewed outlined normal take-off procedures that are less prescriptive than the H125, typically recommending that pilots fly in accordance with the height-velocity diagram requirements for the specific helicopter model.

Downwash Assessment of other Helicopters

The purpose of this memorandum was to assess the downwash impacts of the H125 take-off procedure which is more prescriptive than other helicopters (based on its RFM) proposed as part of the Trinity Point helipad development. The downwash impacts of this aircraft's take-off procedures are acceptable given the proposed managed safety zone and safety impacts can be further mitigated as outlined above.

Other aircraft have been assessed and determined to create a downwash impact that is less than the H125 based on their take-off procedures, as well as size and performance as outlined in JJR's RDA.

The requirements for the maximum safety area and visual checking of the anticipated flight path out to 130m could be conservatively applied to all other aircraft that propose to take-off by hovering at a low altitude and then accelerating without climbing until reaching required speed. This will ensure consistent helicopter operations and further minimise any potential downwash impacts on watercraft.

Summary & Conclusion

A summary of JJR's findings based on the preliminary assessment of helicopter downwash associated with the proposed helipad pontoon development are provided below:

- The maximum safety area has been identified as 66.5m from the centre of the helipad;
- The downwash impacts of the H125 will be less than 20km/h approximately 70.0m from the centre of the helipad (when the helicopter reaches 30kt IAS);
- There are various factors of safety in the calculation of the 70.0m distance to reach this distance and the pilot has indicated that it would take 100m to reach 50kt;
- The Helipad Operations Manual should include a requirement for helicopter pilots to complete a visual check for nearby watercraft and liaise with the helipad landing officer prior to take-off.

Please do not hesitate to contact the undersigned via mobile phone (+61 424 783 638) or email (jason.ryan@jjryan.com.au) if you require any further information or clarification of any elements of this memorandum.

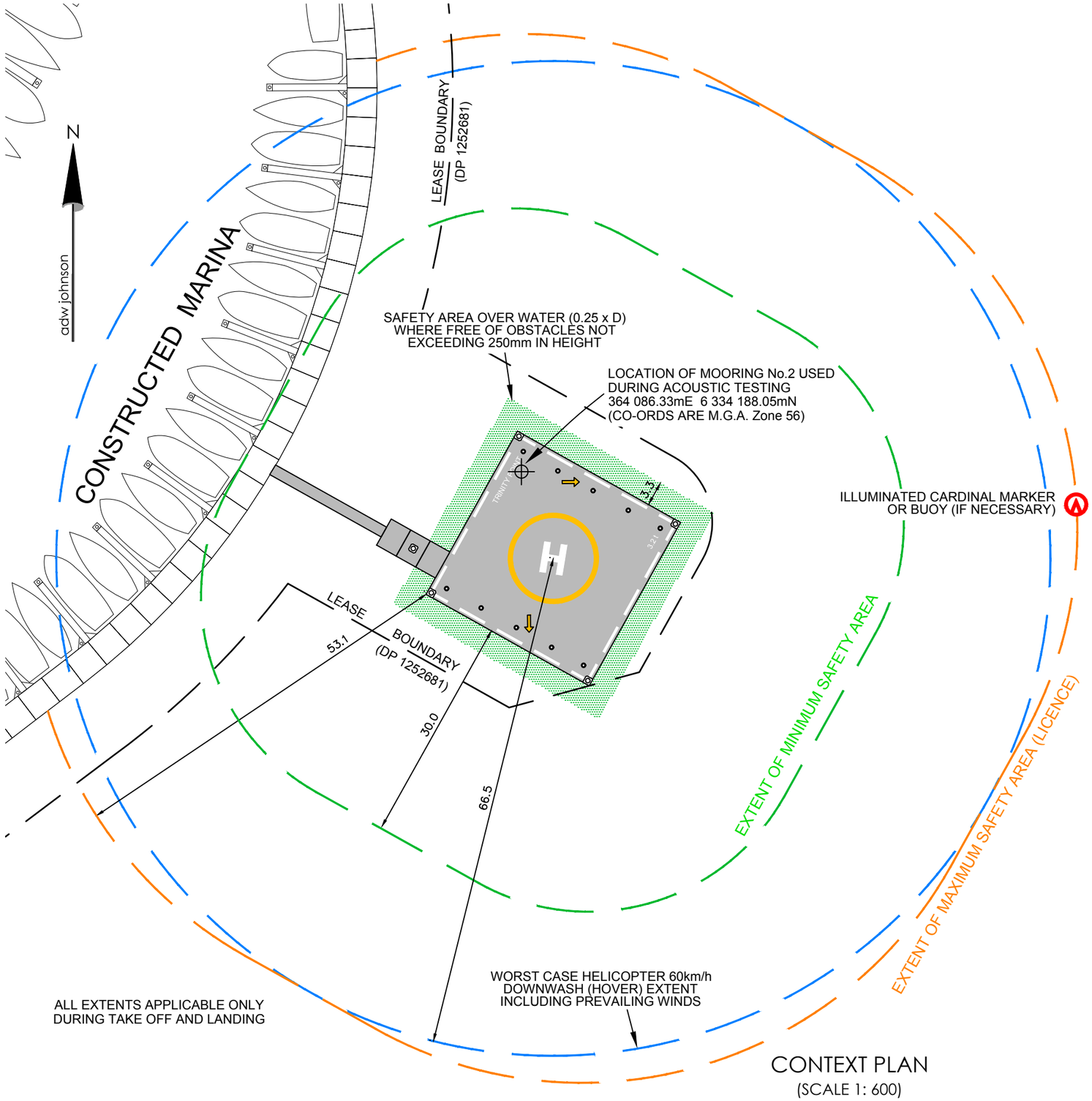
Jason Ryan
For and on behalf of **JJ Ryan Consulting Pty Ltd**
Principal Engineer (Aviation)

BEng(Hons) GCEng(Man) GCEng(Ports) MEng
MIEAust CPEng NER IntPE(Aus) APEC Engineer
RPEQ RBP(EC) MAICD

Attachments
Attachment 1 – Revised Helipad Plans
Attachment 2 – Airbus H125 Acceleration and Velocity Calculations

ATTACHMENT 1 – REVISED HELIPAD PLANS

37429(4)-DA-001-K



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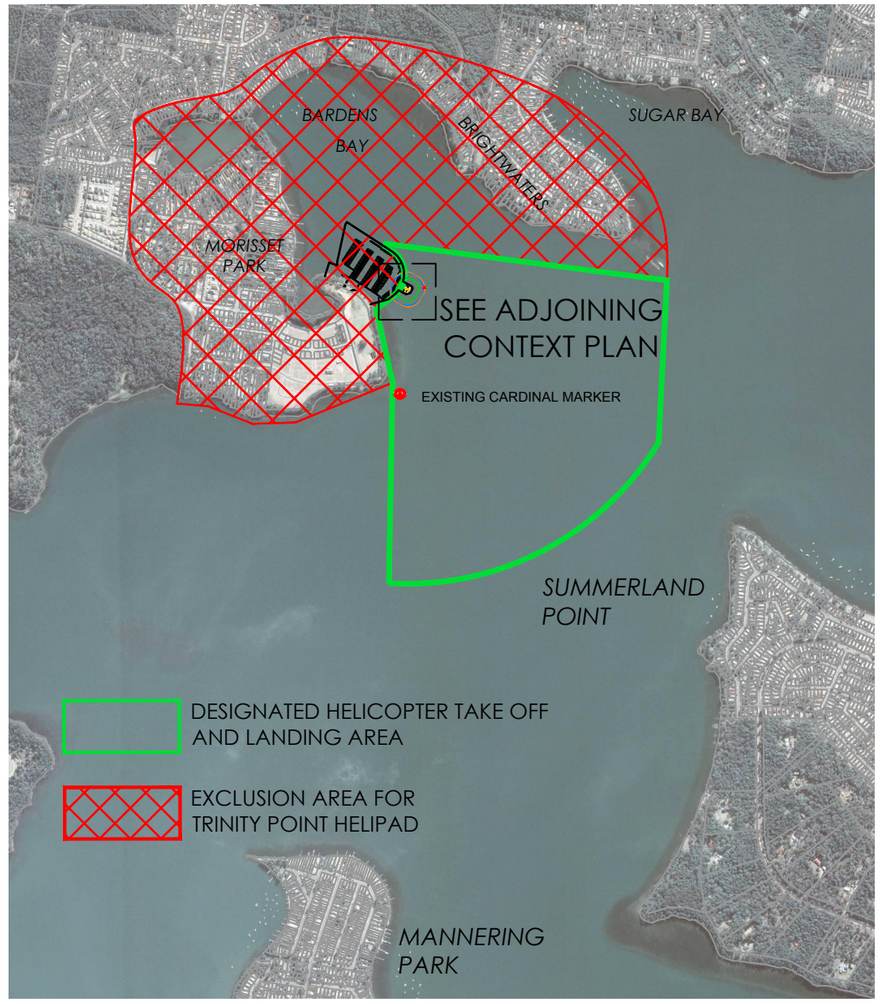

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(SCALE 1: 25 000)

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H	14.03.18	MINOR AMENDMENTS	-	Z.J.	M.R.	S.H.
I	04.03.19	EXTENT OF SAFETY AREA	-	Z.J.	M.R.	S.H.
J	24.04.19	REVISED HELICOPTER TAKE OFF & LANDING AREA	-	M.C.	M.R.	S.H.
K	20.05.19	LARGER HELIPAD PONTOON	-	M.S.	M.R.	S.H.

co-ordinate & level information:
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ORIGIN OF CO-ORDINATES: P.M.58712
DATUM: N/A
ORIGIN OF LEVELS: N/A
CONTOUR INTERVAL: N/A

scale (A3 original size): 0 15.0 30.0m
SCALE: 1:600 (FULL)

page: 1 OF 3
Date of Surv

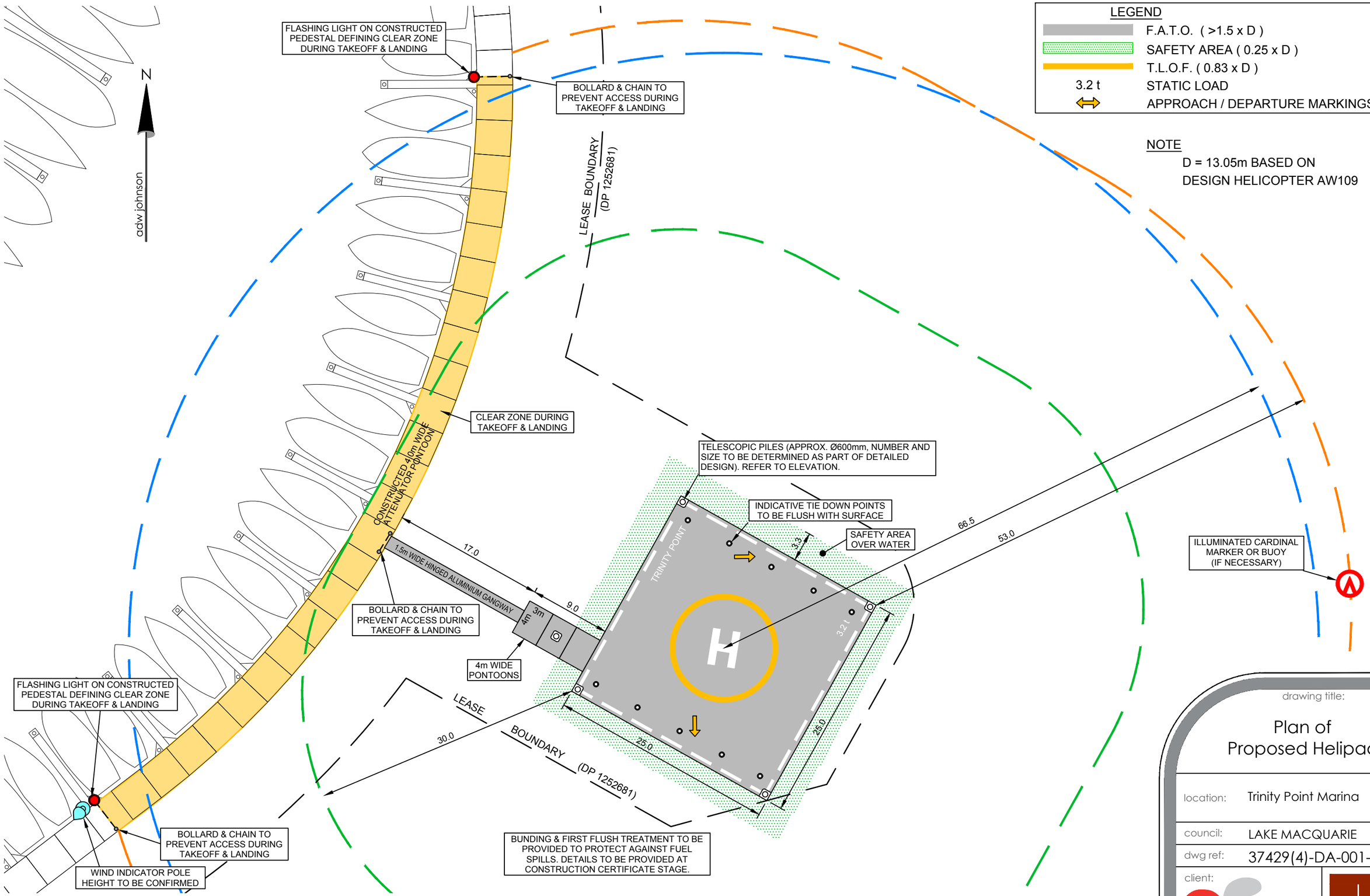
drawing title:
Location &
Marina Context of
Proposed Helipad

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

client: JOHNSON PROPERTY GROUP

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

Plotted By: Mark Spitzkowsky Plot Date: 20/05/19 2:20:59PM Cad File: N:\37429\37429(4)\DWG\PLANNING\DA\37429(4)-DA-001-K.DWG



LEGEND

- F.A.T.O. (>1.5 x D)
- SAFETY AREA (0.25 x D)
- T.L.O.F. (0.83 x D)
- 3.2 t — STATIC LOAD
- APPROACH / DEPARTURE MARKINGS

NOTE

D = 13.05m BASED ON DESIGN HELICOPTER AW109

ver.	date	comment	surveyed	drawn	checked	pm
H	14.03.18	MINOR AMENDMENTS	-	Z.J.	M.R.	S.H.
I	04.03.19	EXTENT OF SAFETY AREA	-	Z.J.	M.R.	S.H.
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co-ordinate & level information

CO-ORDINATE SYSTEM: M.G.A. 56
ORIGIN OF CO-ORDINATES: P.M.58712
DATUM: N/A
ORIGIN OF LEVELS: N/A
CONTOUR INTERVAL: N/A

scale (A3 original size)

0 10.0 20.0m
SCALE: 1:400 (FULL)

page: 2 OF 3
Date of Surv

drawing title:

Plan of Proposed Helipad

location: Trinity Point Marina

council: LAKE MACQUARIE

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

client: JOHNSON PROPERTY GROUP

adw johnson
central coast office ph: (02) 4305 4300
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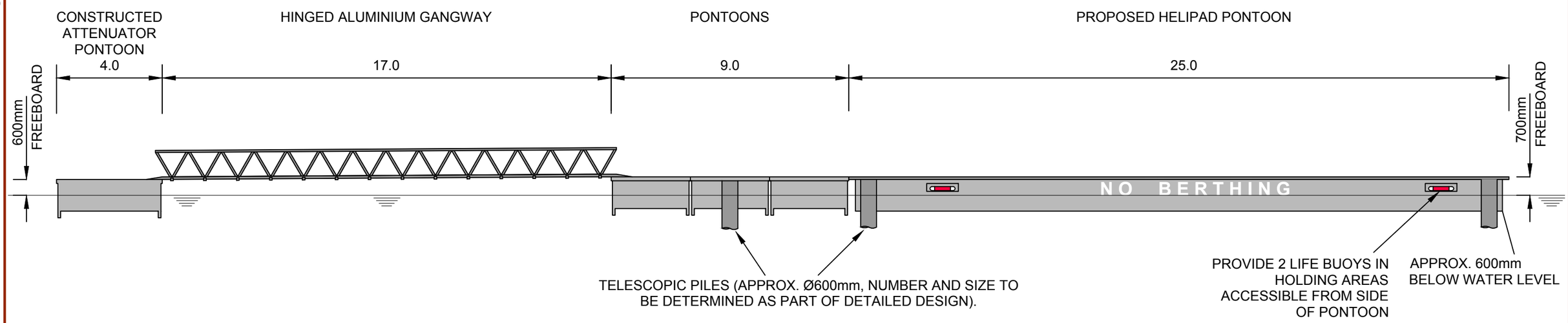

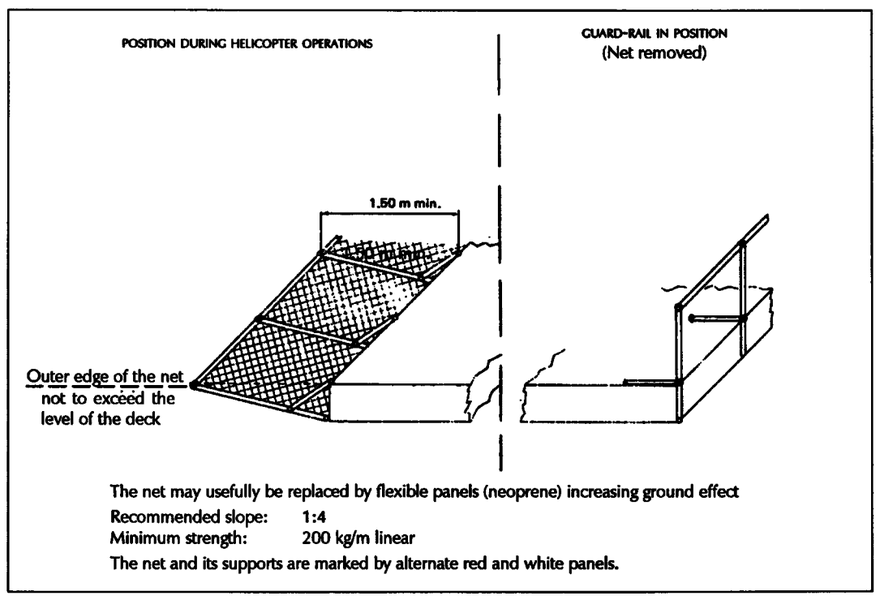

Figure 3-1. Collapsible guard-rail with movable safety net

Detailed design to include a safety net on the perimeter of the floating pontoon, consistent with Section 3.2.8 & 3.2.9 of CAANZ Advisory Circular 139-8, if required.

ver.	date	comment	surveyed	drawn	checked	pm
H	14.03.18	MINOR AMENDMENTS	-	Z.J.	M.R.	S.H.
I	04.03.19	EXTENT OF SAFETY AREA	-	Z.J.	M.R.	S.H.
J	24.04.19	REVISED HELICOPTER TAKE OFF & LANDING AREA	-	M.C.	M.R.	S.H.
K	20.05.19	LARGER HELIPAD PONTOON	-	M.S.	M.R.	S.H.

co-ordinate & level information:
CO-ORDINATE SYSTEM: M.G.A. 56
ORIGIN OF CO-ORDINATES: P.M.58712
DATUM: N/A
ORIGIN OF LEVELS: N/A
CONTOUR INTERVAL: N/A

scale (A3 original size): 0 5.0 10.0m
SCALE: 1:200 (FULL)

page: 3 OF 3
Date of Surv

drawing title:
Typical Elevation of Proposed Helipad

location: Trinity Point Marina
council: LAKE MACQUARIE
dwg ref: 37429(4)-DA-001-K
client: JOHNSON PROPERTY GROUP

adw johnson
central coast office ph: (02) 4305 4300
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ATTACHMENT 2 – AIRBUS H125 ACCELERATION AND VELOCITY CALCULATIONS

JJ RYAN CONSULTING PTY LTD

Trinity Point Helicopter Downwash

Airbus H125 Acceleration Calculations

Aircraft performance data

Parameter	Value	Unit
Empty Weight	1241	kg
Maximum Take-off Weight	2250	kg
Maximum Payload	1009	kg
Rate of Climb	10	m/s
Rate of Climb	1959	ft/min
Gravity	9.81	m/s^2

Calculations

Theoretical Thrust	9898	N
Operating Weight	2025	kg

Acceleration

Angle of Attack (θ°)	5	10	15	20	25	30	35
Angle of Attack (θ^r)	0.09	0.17	0.26	0.35	0.44	0.52	0.61
Acceleration (m/s^2)	0.43	0.85	1.27	1.67	2.07	2.44	2.80
Distance to reach 40kt (m)	496.98	249.44	167.35	126.64	102.49	86.63	75.52

Trinity Point Helicopter Downwash

Airbus H125 Acceleration Calculations

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Rate of Climb	10	m/s
Rate of Climb	1959	ft/min
Gravity	9.81	m/s^2

Calculations

Theoretical Thrust	9898	N		
Operating Weight	2025	kg		
Initial velocity	0	m/s	0	kts
Final velocity	21	m/s	40	kts
Distance	127	m		
Acceleration	1.667	m/s2	*assuming constant acceleration	
Initial velocity	0	m/s	0	kts
Final velocity	15	m/s	55	km/h
Acceleration	1.667	m/s2	*assuming constant acceleration	
Distance	70.00	m		