The Acoustic Group

CONSULTING ACOUSTICAL AND VIBRATION ENGINEERS

ACOUSTICAL ASSESSMENT
TWIN-ENGINE HELICOPTER UPGRADE
PORT OF NEWCASTLE HELICOPTER MARINE PILOT TRANSFER
51.3698.R14:MSC

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1.0 INTRODUCTION

Port Authority of NSW ("Port Authority") has several functions in relation to Newcastle Harbour, including as the statutory provider under section 74 of the Marine Safety Act 1998 (NSW) of marine pilotage services for certain declared ports within New South Wales, including for the Port of Newcastle.

In the Port of Newcastle, these services generally involve specialist marine pilots either boarding an incoming commercial vessel approximately 3 to 8 nautical miles off the Newcastle coast and navigating that vessel to its berth in the Port, or conversely navigating a vessel from its berth to a release point approximately 1 to 2 nautical miles offshore. At this point, the Marine Pilot is either returned to the Base, or transferred to another incoming vessel.

Marine Pilot transfers by helicopter from an operational helipad facility at Dyke Point, Carrington are the primary method of transport utilised by Port Authority for the Port of Newcastle. As the commercial operations for the Port of Newcastle operate 24 hours a day for 7 days a week, Helicopter Marine Pilot Transfer (HMPT) operations are conducted during both day and night.

A Development Consent DA 98/1262 was granted by Newcastle City Council on 3rd May 1999 for "helipad facilities at Dyke Point for marine pilot transfer".

The Development Application was supported by an Environmental Impact Statement dated May 1998 ("EIS").

The EIS was based on a single-engine Hughes 500E helicopter and the two nominated flight paths from the helipad (located at Dyke Point) with the main flight path to the north of the helipad identified as Flight Path B and a secondary flight path being south-east of the helipad and then east along the main channel of the Newcastle Harbour being identified as Flight Path A (see Appendix A).

Condition 1.1 of the Development Consent requires the operations to be carried out in accordance with the EIS.

Condition 4.1 of the Development Consent specifies the number of helicopter movements being limited to 40 in any 24 hours period and a maximum of 16 movements between the hours of 10pm and 7am.

Condition 4.5 of the Development Consent required prior to the use of any aircraft type, other than the Hughes 500E, certification by a suitably qualified acoustic consultant being submitted demonstrating that the helicopter(s) concerned is able to meet the noise limits specified in the conditions of consent while operating within the designed flight path.

Aviation regulations for helicopters in Australia (CASA CASR 138) have been amended and will require in the future the Helicopter Marine Pilot Service to be upgraded to use a twin-engine helicopter. Following a selection process the helicopter type proposed for the pilot transfer is to be a twin-engine Eurocopter Type 135.

As a result of replacing the single-engine helicopter with a twin engine helicopter to satisfy Condition 4.5 of development consent requires acoustic testing and evaluation of the noise levels of the twin-engine helicopter.

To provide the necessary acoustic data to assess the introduction of a twin engine helicopter for the marine pilot transfer, a Eurocopter 135 twin-engine helicopter was ferried from interstate to Maitland Airport to undertake testing on Monday 31 May 2021.

As the testing was to determine the impact for the use of the existing flight paths from Dyke Point, the test program identified locations on and to the south of Maitland Airport that represented noise monitoring assessment locations that have historically been used for compliance testing of the existing marine pilot helicopter service in Newcastle (see Appendix B).

The measurement results of the testing at Maitland Airport, assessed in accordance with the acoustic parameters defined in Australian Standard AS 2363, are set out in Appendix C.

2.0 HELICOPTER NOISE CRITERIA

The principal planning document used in Australia for aircraft noise is Australian Standard 2021 “Acoustics - Aircraft noise intrusion – Building siting and construction”. AS2021 was first issued in 1977 with the fifth edition issued in 2015.

AS2021 was the reference document used for the development of helicopter noise criteria in Australia.

AS 2021 uses the ANEF (Australian Noise Exposure Forecast) in determining the average daily noise exposure of aircraft noise.

The ANEF unit incorporates, in a single equation, the noise levels produced by various aircraft operating in airport, plus a logarithmic function of the daily average number of aircraft noise events, with a weighting included if they occur during the evening or night-time hours when the sensitivity of people to noise is increased. The forecast frequency of aircraft movements on various flight paths (either take off, landing, or touch-and-goes), and the proportion of aircraft movements by day and by night, provides input to determine this aircraft number weighting factor.

The actual aircraft noise level measurement used in the ANEF formulation does not rely upon the general dB(A) noise level but utilises the Effective Perceived Noise Level (EPN dB) which takes into account annoying aspects in both the temporal and frequency domains (see Appendix B of AS 2021 for more details).

The ANEF computation is based on forecast of air traffic movements on an average day. Allocations the forecast movements to runways and flight paths are on an averaged basis and take into account the existing and forecast air traffic control procedures at the airport which nominate preferred runways and preferred flight paths for noise abatement purposes.

Under the ANEF system the noise contours are computed as a daily movement average based on 365 days activity per year for civil aerodromes.

The fundamental concept for the use of the ANEF contours is to determine a building site acceptability based on ANEF Zones. Table 2.1 of AS 2021:2015 identified as for houses, home units, flats, caravan parks that the ANEF zone of the site is considered “acceptable” where the site is subject to levels less than 20 ANEF. Table 2.1 identified as a side is “conditionally acceptable” if the ANEF zone of the site is 20 to 25 ANEF. A site in a zone greater than 25 ANEF is identified as “unacceptable”.

The determination of an ANEF contour map for an airport is a complex process and requires modelling of flight tracks with the computation relying upon Noise Power Distance curves (“NPD”). There is limited helicopter NPD data noise available for computer modelling. Data that is available relates to specific helicopter investigations and are normally in dB(A) parameters.

The ANEF system utilises the Effective Perceived Noise Level as the measurement parameter of an aircraft flyover. A general approximation between ANEF and dB(A) Leq is a difference of 35 dB.

The development of helicopter noise criteria under the NSW SPCC Helicopter Guideline and Australian Standard AS 2363 specified Leq noise targets referenced back to 20 ANEF (adjusted for different time periods rather than 24 hours) and the nominated maximum noise levels corresponding to the Leq levels relative to a number of helicopter movements.

At the time of the preparation of the EIS there were two assessment procedures in existence for the assessment of helicopter noise with both procedures being presented in the EIS and incorporated into the Development Consent.

2.1 NSW SPCC Helicopter Guideline

In 1982 all helicopter operations in NSW were controlled by the SPCC/EPA as helipads were classified as Scheduled Premises under the Noise Control Act. Under the EPA Helicopter Noise Guideline, helipads and heliports were required to satisfy a maximum noise level limit and an energy average noise limit depending upon the time of operation of the helipad.

At the release of the EPA Helicopter Noise Guidelines, the SPCC cited the relationship of ANEF + 35 = Leq dB(A) as previously used (and continued to be used) by the Department of Aviation/Civil Aviation Authority/Air Services Australia.

The SPCC helicopter noise criteria nominated an Leq limit of 55 dB(A) and a maximum level of 82 dB(A) for the period of 7am – 10pm at residential receiver locations – for a helicopter having 50 movements a day. For commercial receiver locations the SPCC noise criteria was increased to an Leq limit of 65 dB(A) and a maximum level of 85 dB(A) for a 24 hour period. If the existing ambient level exceeded 55 dB(A), the introduction of the helicopter operations should not raise the level by more than 2 dB(A).

The SPCC helicopter noise criteria were subsequently set out in a guideline (Chapter 165) contained in the *Environmental Noise Control Manual* (“the EPA Helicopter Noise Guideline”).

To the best of our knowledge all Land & Environment Court matters pertaining to helicopter applications (from 1982 up until 1993) were assessed against the EPA Helicopter Noise Guideline.

The Environmental Noise Control Manual has been superseded and the EPA has not issued any replacement criteria specifically for helicopter noise assessments as the EPA have identified they have no responsibility for the control of helicopters in flight.

2.2 Australian Standard AS 2363

In the late 1980s the Standards Committee responsible for AS2021 was requested by the Environmental Authorities to develop an Australian Standard for helicopter noise. The Standard used both AS 2021 and the NSW Helicopter Guideline as reference documents.

In 1990 Australian Standard AS 2363-1990 *Acoustics – Assessment of noise from helicopter landing sites* was published. The Standard formalised measurement and analysis procedures and excluded ambient noise in the determination of the helicopter noise level to address the technical error in the EPA Helicopter Noise Guideline.

The Standard defined the method of energy averaging the results of the individual flight path movements. The Standard nominated the use of FAST response for helicopter measurements (instead of SLOW response used for the ANEF procedures) to account for the subjective characteristics of helicopter noise.

AS 2363 provided a more rigorous technical process for the assessment of noise from helicopter operations in view of the different flight procedures of helicopters when compared to fixed wing aircraft.

With the benefit of experience with the NSW EPA Guidelines, Section 4 of AS 2363 provides the following definitions for the determination of various acoustic parameters and the cumulative helicopter noise level:

> ***Most affected premises*** *- premises not associated with the helicopter landing site determined by the relevant authority to be the most affected by the noise generated by the helicopter during approach and departure and while on the landing site.*
>
> ***En route*** *- the prescribed flight path followed by the helicopter after take-off and before commencing landing.*
>
> ***Helicopter landing site*** *- the existing or proposed area used for helicopter take-off and landing operations.*

***Final approach** – a reduction of height and airspeed to arrive over a predetermined point, but not including contact with the surface.*

***Flight movement** - one take-off or one landing.*

***Take-off** – acceleration to and commencement of safe client speed including the lift-off manoeuvres.*

***Lift-off** – the raising of a helicopter in the air.*

***Landing**- the lowering of the helicopter to bring it in contact with the surface, including the final approach manoeuvres.*

***Hover** - flight at zero ground speed.*

***$L_{Aeq,T}$ (Amb)** - the totally encompassing sounded a given site over a period T, composed of sound from all sources near and far including local traffic, but excluding of helicopter(s) relevant to the investigation and extraneous or atypical noise sources such as construction, holiday traffic, parties, etc., measured as the time averaged A-weighted sound pressure level.*

***$L_{Aeq,T}$ (Hel)** – the totally encompassing measured or predicted sound contribution at a given site over a period T, composed of sound from the helicopters relevant to the investigation, calculated as the time average A-weighted sound pressure level.*

***L_{Amax} (Event)** – the maximum sound pressure level, occurring during a discrete test of a given operational mode, measured as the maximum A-weighted sound pressure level using 'F' time-weighting.*

***L_{Amax} (Hel)** - the logarithmic average of the L_{Amax} (Event) levels for each mode of operation for each flight path.*

***L_{AE} (Event)** – the sound exposure level as defined in AS 1055.1, with a time period of t_1 to t_2 covering the operational mode being investigated.*

***L_{AE} (Hel)** – the energy average of the L_{AE} (Event) levels for each mode of operation for each flight path.*

Appendix A of AS 2363-1990 provided higher noise limits than the EPA Guideline but identified the L_{Amax} (Hel) at night to be 5 dB lower than the daytime period.

2.3 Development Consent Criteria

As noted above the EIS for the proposed helicopter operation incorporated both the SPCC/EPA Helicopter Noise Guideline and AS2363 (which are based on AS 2021).

Condition 4.10 of the Development Consent stated:

> *The measured Lmax contribution and contribution Leq from the operation of Dyke Point helipad (including takeoffs and landings) but exceeding the following limits when monitored at the location specified.*

Location	*Lmax 24 hours*	*Leq 7am to 10pm*	*Leq 1pm to 7am*
At any residential or commercial premises	*74 dB(A)*	*60.5 dB(A)*	*56 dB(A)*

In relation to the above condition the heading in the last column has a typographical error in that the time period should be 10 pm to 7am to cover the EPA night. In relation to helicopter operations.

Furthermore, if following either the SPCC/EPA helicopter noise guideline or AS 2363 commercial premises have higher noise limits than for residential premises.

With respect to the maximum noise level limit the EPA helicopter guideline provided a day time noise limit of 82 dB(A) at residential receivers but did not provide a night-time limit.

Utilising the 5 dB(A) difference between day and night set out in Appendix A of AS 2363 – 1990 the EIS identified on using the SPCC/EPA Guideline the maximum limit for day time operations would be 82 dB(A) and 77 dB(A) for night time operations.

Newcastle City Council utilised the results of the testing for the Hughes 500E helicopter and for that helicopter set a maximum limit of 74 dB(A) – being the maximum level that was measured for that helicopter.

With the provision of a different helicopter type (to that tested at the EIS stage), to be consistent with the EIS and by use of the SPCC/EPA Guideline the following noise limits would have applied.

TABLE 1: Corrected Noise Limits

Location	Lmax 7am to 10pm	Lmax 10pm to 7am	Leq 7am to 10pm	Leq 10pm to 7am
At any residential premises	82 dB(A)	77 dB(A)	60.5 dB(A)	56 dB(A)
At any commercial premises	85 dB(A)	85 dB(A)	65 dB(A)	65 dB(A)

3.0 HELICOPTER NOISE ASSESSMENT

The existing helicopter helipad at Dyke Point is shown in Appendix A1 and indicates the two flight paths utilised by the Marine Pilot Transfer Service. The main flight path used by the service is shown as Flight Path B and on take-off utilises a track to the north of the helipad and then a turn to the east, to head out to sea.

Appendix A1 identifies the secondary flight path as generally taking off to the east of the helipad and then proceeding along the main channel out to sea. The secondary flight path (identified as Flight Path A) is used infrequently with the primary reason for using the secondary flight path being weather conditions or restrictions on air traffic as a result of operations at Newcastle Airport/RAAF Base Williamtown.

Appendix A2 provides real-time tracking data from the operation of the existing helicopter operations off Dyke Point to confirm the general use of flight paths to the north and identifies locations used by the helicopter out to sea.

Appendix A3 identifies by one track the occasional use of the eastern flight track.

It is necessary to note that at the time of the EIS the Flight Path identification was reversed. With operation of the helipad and the issue by the EPA of an Environment Protection Licence (no longer applicable) the identification of flight paths was altered.

Because helicopters do not operate in a manner similar to fixed wing aircraft, the use of computer modelling for helicopter operations (by certification data) has not been accepted by environmental authorities in Australia with the EPAs in NSW and Victoria, and Australian Standard AS2363 requiring the measurement of helicopter operations to assess the noise impact. With respect to the acoustic impact of the proposed helicopter type it was necessary to undertake testing of actual flight operations for the purpose of identifying the extent and magnitude of noise generated by the twin-engine helicopter.

For the purpose of undertaking the acoustic testing a number of sites were evaluated in Queensland and New South Wales that could permit multiple test flights in one day and incorporate test flights that would be representative of the operations conducted at Newcastle and at which the resident reference locations that have been used for noise monitoring of the existing facility could be located.

With the use of Maitland Airport being identified as suitable for the conduct of the acoustic testing, the existing helipad flight paths (used in The Port of Newcastle) were oriented around the nominated landing site to position the monitoring locations in open areas that would represent the reference compliance check sites that have been previously used in Newcastle.

3.1 Helicopter Noise Data

The acoustic testing (following the basis of the original assessment) required multiple flights of the twin-engine helicopter to evaluate the different flight paths. That level of testing would exceed the permitted number of flights per day on the current consent if one was following the previous helicopter noise protocol adopted for the assessment as outlined in Australian Standard AS 2363. The results of the testing are set out in a separate report (TAG reference 51.3698.R13, dated 30 September 2021) from which the relevant extracts are appended to this report.
Appendix B identifies the equivalent Port of Newcastle locations relative to the flight tracks that were used at Maitland Airport and the measurement locations.

The testing involved two measurement locations on the Maitland Airport site and four measurement locations on the southern side of the New England Highway which are representative of the noise monitoring assessment locations that have historically been used for compliance testing of the existing marine pilot helicopter in Newcastle.
The two measurement locations on the airport (to the north-east of the helicopter landing/take-off position) represent the residential premises in Stockton, on Queen Street and at the intersection of Hunter Street and Punt Road.

The four measurement locations on the southern side of the New England Highway represent the Lee Wharf Apartments, Crown Plaza Apartments and Nautilos Apartments which are in close proximity to the southern bank of the Hunter River, and “The Boltons” terraced houses on Menkens Lane, The Hill which are further inland.

With respect to the measurement location to the south-west of the Maitland Airport, the location representative of the Lee Wharf apartment building is in a paddock at 643 New England Highway. This paddock was occupied by horses during the helicopter testing and therefore, the noise monitoring was conducted at the boundary of the paddock (approximately 100 metres to the north of the location identified as being representative of the Lee Wharf Apartments).

As the distance between the Lee Wharf apartment building and the Dyke Point helipad is greater than the distance between measurement location and the landing site at Maitland Airport, it is expected that the noise emission of the helicopter pilot transfer operations at the Lee Wharf apartment building will be slightly less than the measured results as a result of further distance attenuation.

The operational procedures for a twin-engine helicopter utilising the existing helipad at Dyke Point are different to the flight profiles and procedures utilised by the existing single engine helicopter.

The current helicopter landing and take off procedures by the single engine aircraft at Dyke Point requires the helicopter to hover above the helipad and then climb out on the normal flight track to cruise altitude. On the landing phase for the current operations the helicopter leaves cruise altitude and adopts a straight in track to the helipad where the helicopter comes into a hover above the helipad and then lands onto the helipad.

The twin-engine operations involve a different procedure where on take off the helicopter ascends above the pad, incorporating a slight rearward movement so as to be hovering at a position in the order of 100 to 120 feet above the helipad ground level whilst maintaining the take off area insight and then commences the take off procedure on the nominated flight track up to cruise altitude.

For landing the twin-engine helicopter procedure involves the aircraft upon leaving cruise altitude to ascend to a hover at a point before the helipad and at an altitude of 100 to 120 ft above the helipad ground level, and then descend onto the helipad.

This operation results in a different noise emission signature at the reference residential receiver locations for the twin-engine helicopter versus the current single-engine operations.

The following figures identify the above procedures for the twin-engine helicopter landing and take off procedures tested at Maitland Airport.

Fig. C12 Heliport Sight Picture at 120 ft AHE (Surface Level Heliport) – Helicopter equipped with **extended instrument panel**

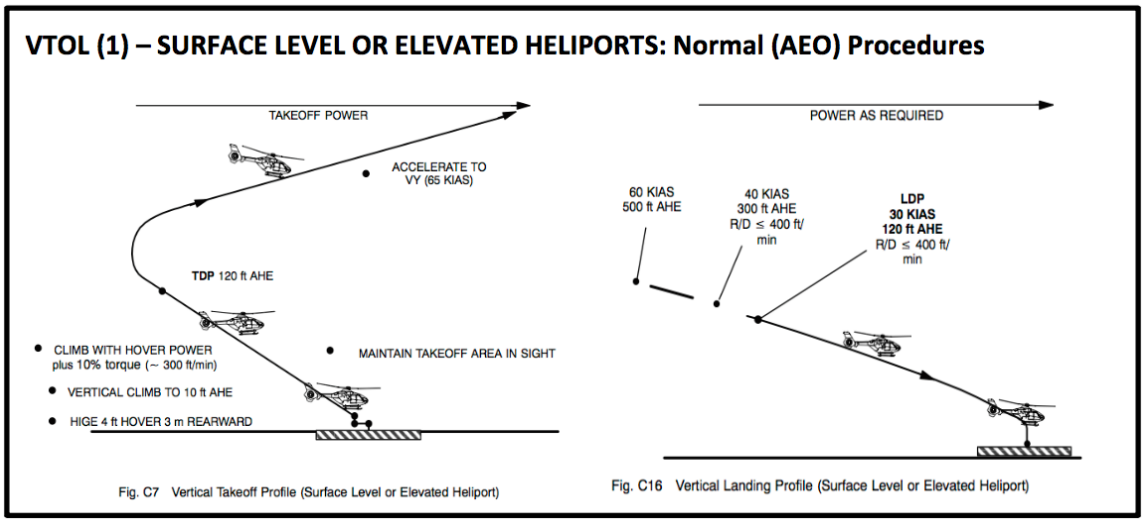


Fig. C7 Vertical Takeoff Profile (Surface Level or Elevated Heliport)

Fig. C16 Vertical Landing Profile (Surface Level or Elevated Heliport)

The helicopter used for the testing is an EC 135P2+ helicopter (serial number 197) having a registration identification of VH-ZGZ. The subject helicopter shown in the following photos taken at Maitland Airport on the day of the test is used for pilot transfers in Queensland.

The existing helicopter operations for the Port of Newcastle utilised either only the helicopter pilot on board the aircraft, or the helicopter pilot and the marine pilot on board the aircraft.

For the purpose of the acoustic testing at Maitland all operations of the helicopter had the helicopter pilot and an observer on board the aircraft with the aircraft at or near full fuel capacity that is such could represent the upper limit of the proposed operations but with respect to general operations via load that would normally occur.

Advice from the helicopter pilot was that at the start of the flight testing the helicopter had an all up take off weight of approximately 2777kg (maximum take off weight being 2910 kg).

At the completion of the first testing (movement 33) the fuel burn was approximately 400kg resulting in an estimate of weight of approximately 2377kg when the helicopter departed the area for refuelling.

When the aircraft returned (after refuelling) to begin the second round of test flights the weight was estimated to be at 2777kg.

Due to the two designated flight paths and the different cruise altitudes of the daytime and night-time operations, the test program involved a total of 40 different take-off/landing movements which were followed by 12 overflight movements.

The results of the individual movements analysis using the multiple systems included for comparison purposes the SLOW response measurements (being maximum levels identified on certification documentation).

For the purpose of calculating the L_{Aeq} helicopter noise contribution AS 2363 and maximum noise levels requires the results of the individual helicopter movements to be logarithmically averaged for the relevant flight path landing or take off operations and overflights.

Appendix C summarises the logarithmic averaging of the measurement data related to twin-engine operations from Dyke Point. Table 2 below presents the logarithmic average of the maximum (L_{Amax} (Hel)) from Appendix C for each reference location for the various operation modes.

TABLE 2: L_{Amax} (Hel) Summary

Circuit Height	Flight Path	Movement Type	Lee Wharf Apts	Crown Plazas Apts	Nautilos Apts	The Boltons	Hunter Street	Queen Street
			L_{AF} max	L_{AF} max	L_{AF} max	L_{AF} max	L_{AF} max	L_{AF} max
Day	B	Take off	67	74	73	68	69	61
	B	Landing	62	72	63	58	68	63
	A	Take off	74	75	70	64	65	65
	A	Landing	66	73	70	63	67	72
Night	B	Take off	69	75	72	65	70	62
	B	Landing	66	70	64	59	68	66
	A	Take off	74	76	71	66	67	66
	A	Landing	70	72	70	64	68	68
Day		Overflight					69	65
Night		Overflight					66	64

Table 2 reveals the maximum levels are less than the 77 dB(A) night time criteria.

From Appendix C the Leq helicopter contributions can be derived from L_{AE} (Hel) results, having identified the distribution of helicopter operations per flight path.

3.2 Flight Distributions

Under the Development Consent the total number of helicopter movements is limited to 40 movements in any 24 hour period, and a maximum of 16 helicopter movements between the hours of 10 pm and 7 am daily.

Appendix D sets out the number of marine pilot transfers for the years of 2018, 2019 and 2020 and also includes movements for the first six months of 2021. The transfers include operations by use of the helicopter and also by boat (pilot cutter) for the two operational time periods set out in the consent of 7 am to 10 pm, and 10 pm to 7 am.

The second table in Appendix D identifies that the average number of helicopter flights is less than the maximum number of helicopter movements set out in Conditions 4.1 and 4.2 of the consent.

The majority of the helicopter flights utilise Flight Path B being the track to the north of the helipad with a relatively small number of flights utilising Flight Path A.

Appendix E sets out an analysis of the helicopter pilot logs to identify the basis of using alternative Flight Path A to reveal the majority of the occasions when Flight Path A is used arises from a request by Air Traffic Control (RAAF Base Williamtown), i.e., to not conflict with operations at RAAF Base Williamtown.

Not all the helicopter records provide the basis of utilising flight parfait to which Appendix E identifies the next highest ranking relates to an unknown reason, then followed by a requirement to use flight path a as a result of weather conditions.
The review of the helicopter flight records then identified the number of movements (arrival or departure, or a single round trip) to be slightly higher than the record classification of Flight Path A.

The second table in Appendix E identifies the total number of night-time flight movements for 2019, 2020 and 2021 (pro rata from 6 month of data to a year) are less than 30 movements in a year, that in turn results in less than 3 night movements in a month, and less than 0.1 movements averaged into a single night.

From the above there are a number of permutations in relation to flight movements that could occur by reason of the Development Consent. As the majority of operations utilise Flight Path B, Table 3 sets out the permutations of the maximum number of 40 movements occurring in the day, 24 movements occurring in the day and the maximum of 16 movements occurring in night, all utilising Flight Path B.

TABLE 3: All Operations by Flight Path B – L_{Aeq}

No of Movements	Lee Wharf Apts	Crown Plaza Apts	Nautilos Apts	The Boltons	Hunter Street	Queen Street	Leq Criteria
40 7am – 10pm	41.8	48.8	43.1	39.8	46.8	41.7	60.5
24 7am – 10pm	39.6	46.6	40.9	37.6	44.6	39.5	60.5
16 10pm – 7am	46.4	50.1	45.1	43.1	44.4	45.1	56.0

With respect to the L_{Aeq} noise limits apply to residential receivers the critical application for this assessment relates to night-time operations where the L_{Aeq} level is lower but also because the time period is for nine hours instead of 15 hours the computation of the L_{Aeq} parameter gives a higher L_{Aeq} level is shown in Table 2 above.

Whilst the occurrence of the use of Flight Path A during the night time period is on average less than 1 movement per night, and L_{Aeq} calculation has been undertaken for the application of one landing at night and one take-off at night utilising Flight Path A with the results set out in Table 4 below.

TABLE 4: All Operations by Flight Path B except for 1 take off at night and 1 landing at night on Flight Path A

No of Movements	Lee Wharf Apts	Crown Plaza Apts	Nautilos Apts	The Boltons	Hunter Street	Queen Street	Leq Criteria
40 7am – 10pm	41.8	48.8	43.1	39.8	46.8	41.7	60.5
24 7am – 10pm	39.6	46.6	40.9	37.6	44.6	39.5	60.5
16 10pm – 7am	46.0	49.8	44.7	42.8	44.6	44.8	56.0

The results set out in Tables 3 & 4 reveal the L_{Aeq} levels for the reference residential receivers as a result of the proposed twin-engine helicopter are well below the relevant Leq criteria set out on the current development consent.

4.0 CONCLUSION

The Development Consent for the approved Marine Helicopter Pilot Transfer operation based at Dyke Point was based upon the Hughes 500E helicopter. The consent required consideration of any other helicopter type required an assessment of the noise emitted from the proposed helicopter(s).

For the purpose of assessing the acoustic impact of transitioning from a single-engine helicopter to a twin-engine helicopter used for the marine pilot transfer operation from Dyke Point, Newcastle, it is necessary to have measurement data that reflects the normal operation of the helicopter service and to provide data to identify the maximum noise level and LAeq level from the helicopter operations.

The use of helicopter certification noise data represent helicopter operations that do not occur in practice does not reflect the normal operation of the existing helicopter service or the operating procedure required for twin-engine helicopters operating in Australia.

To be consistent with the original acoustic assessment and compliance testing for the existing service, AS2363 and EPA procedures, and all helicopter applications before the Land & Environment Court of NSW, the assessment required the conduct of noise testing of the proposed twin-engine helicopter.

To provide the necessary data to be used for assessment of the Dyke Point helipad testing was undertaken for take -off and landing operations at Maitland Airport and incorporated noise monitoring locations representative of the reference residential locations previously used for compliance testing of the existing operations.

The test flights were conducted using a Eurocopter EC 135 helicopter fitted out for the conduct of marine pilot transfers and utilised flight tracks that replicate the Dyke Point helipad operations.

The operation of twin engine helicopters are required to undertake a different take off and landing procedure to that utilised by the existing single engine helicopter operating from Dyke Point.

The different landing and take off requirements for the twin-engine helicopter result in the helicopter having a higher altitude on both the landing and take off profiles to that for the existing single-engine profile results in a lower noise level than that that would occur if the twin-engine helicopter followed the existing profiles used at Dyke Point.

The testing undertaken at Maitland Airport utilised operations for both landing and take off on the existing Dyke Point flight paths for both daytime cruise altitude of 1000 feet above ground level and a night time cruise altitude of 1500 feet above ground level.

The analysis of the helicopter testing to determine the applicable L_{AE} and Maximum level for each flight profile/flight track was determined in accordance with Australian Standard 2363, that whilst having been removed from use, was the Standard used for testing for the original Dyke Point Environmental Impact Statement. Therefore, for comparison and consistency with the EIS the same analysis procedure has been used for the subject testing.

The results of all the individual test flights for the 6 residential reference locations are set out in a separate noise monitoring report. The results in Appendix C form the basis of the acoustical assessment of the twin-engine helicopter for the marine pilot transfer service operating from Dyke Point, Newcastle.

Condition 4.10 of the Development Consent has a number of errors that have been corrected as set out in Table 1.

From Appendix C the L_{Amax} (Hel) level are less than the day and night time limits set out in Table 1 and reflect a 2 dB (A) increase in the 74 dB(A) L_{Amax} (Hel) set out in the Consent as a result of testing of the single-engine Hughes 500E helicopter. In subjective loudness terms (as identified by the EPA) a 2dB increase is generally not perceived by the human ear.

In relation to the L_{Aeq} levels set out in the existing consent have been assessed in Table 2 for the three permutations of the maximum number of operations when all flights utilise the main flight path – identified by Flight Path B.

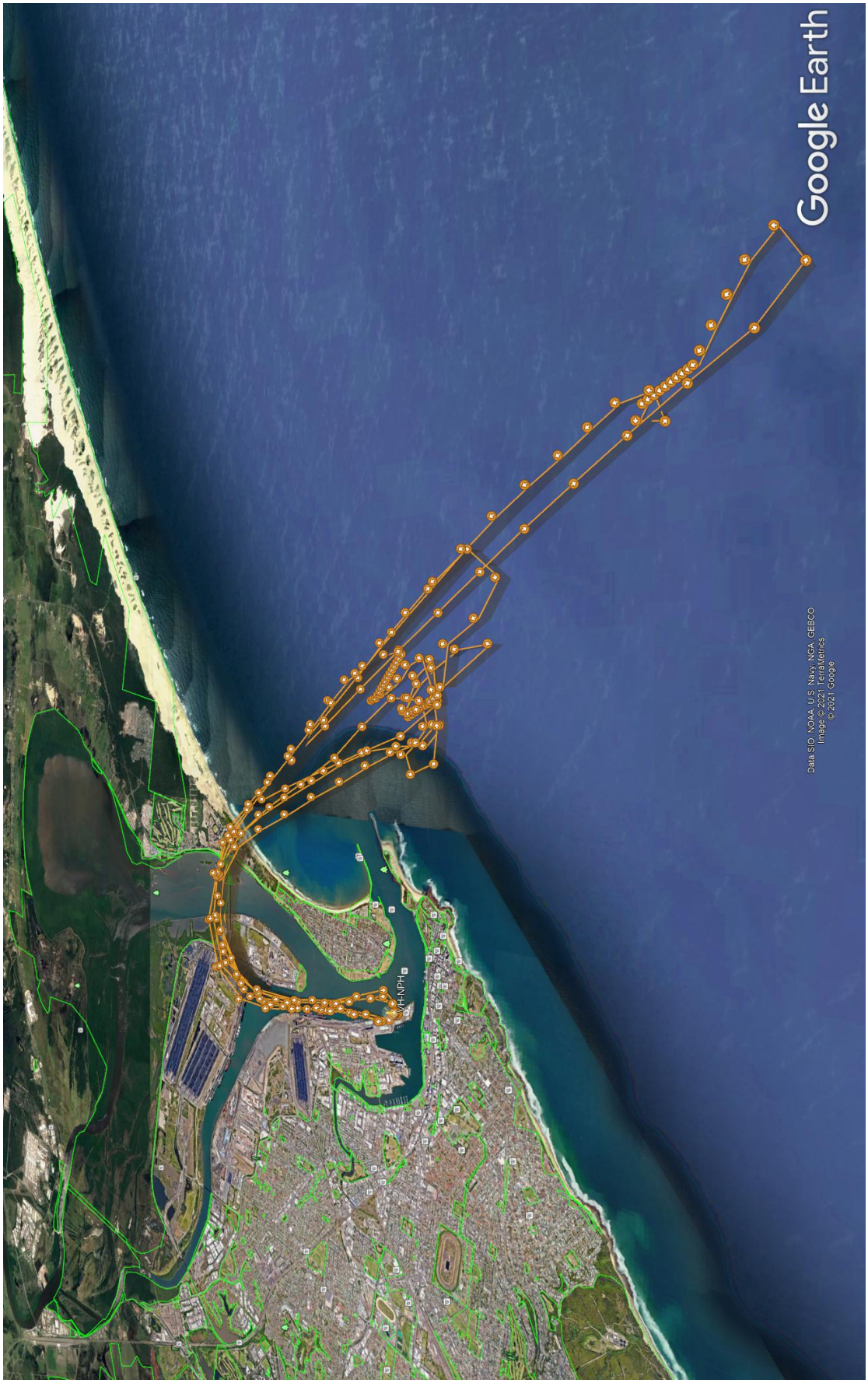
An analysis of the helicopter flight data for the existing operation s from Dyke Point reveal the use of Flight Path A is as an average a small percentage. Table 3 presents the consideration of 1 take off and 1 landing for the night period on Flight Path A and 14 movements on Flight Path B. The resultant L_{Aeq} contribution from the above night time scenario for helicopter operations using the proposed twin-engine helicopter are significantly below the 56 dB(A) limit set out on the Development Consent.

Yours faithfully,

THE ACOUSTIC GROUP PTY LTD

STEVEN E COOPER

APPENDIX A: Flight Tracks - Newcastle Ports Helipad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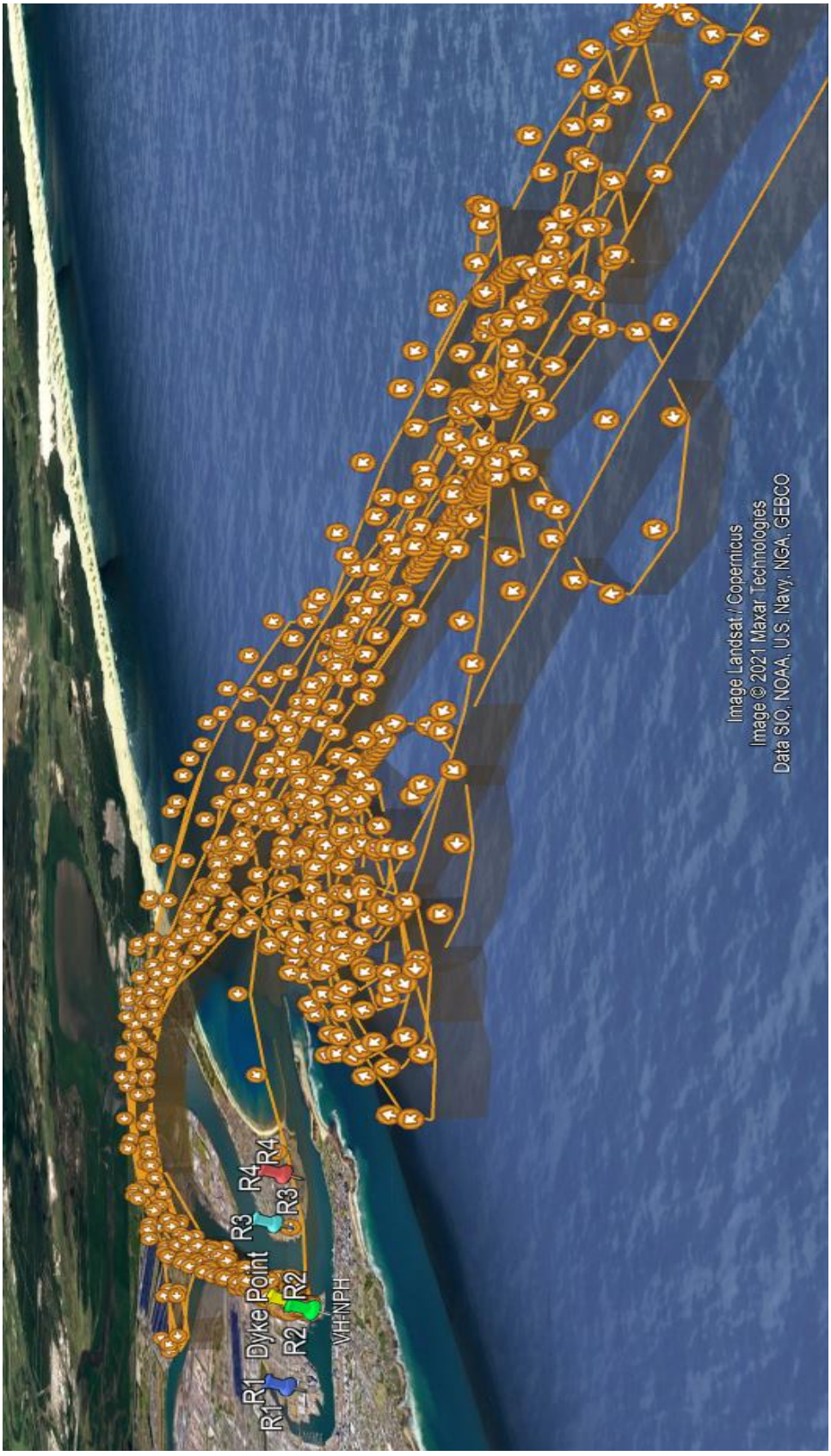
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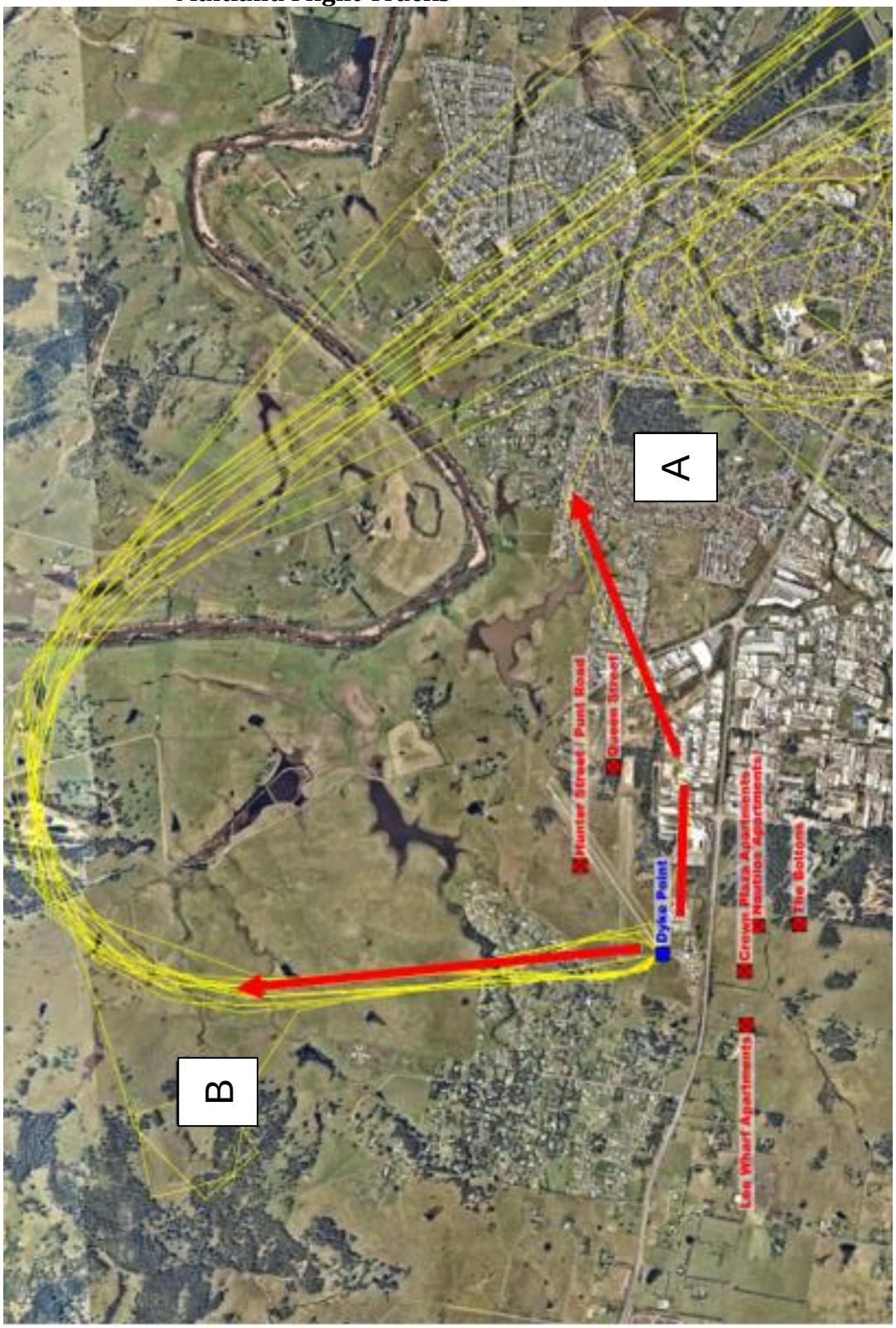
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

APPENDIX B: Newcastle Flight Path and Measurement Locations overlayed on Maitland Flight Tracks



APPENDIX C: Summary of Measurement Results - dB(A)

Circuit Height	Flight Path	Movement Type	Lee Wharf Apartments			Crown Plaza Apartments			Nautilos Apartments		
			L_{AE} (Hel)	L_{AF} max	L_{AS} max	L_{AE} (Hel)	L_{AF} max	L_{AS} max	L_{AE} (Hel)	L_{AF} max	L_{AS} max
Day	B	Take off	74	67	64	81	74	71	76	73	68
	B	Landing	72	62	59	79	72	68	72	63	61
	A	Take off	78	74	71	83	75	73	76	70	66
	A	Landing	75	66	63	81	73	69	79	70	66
Night	B	Take off	75	69	65	81	75	73	73	72	70
	B	Landing	75	66	64	80	70	67	73	64	58
	A	Take off	81	74	72	84	76	76	75	71	66
	A	Landing	77	70	66	82	72	70	80	70	67
Day		Overflight	-	-	-	-	-	-	-	-	-
Night		Overflight	-	-	-	-	-	-	-	-	-

Circuit Height	Flight Path	Movement Type	The Boltons			Hunter Street			Queen Street		
			L_{AE} (Hel)	L_{AF} max	L_{AS} max	L_{AE} (Hel)	L_{AF} max	L_{AS} max	L_{AE} (Hel)	L_{AF} max	L_{AS} max
Day	B	Take off	72	68	63	77	69	66	73	61	58
	B	Landing	70	58	55	79	68	65	73	63	60
	A	Take off	73	64	60	75	65	62	74	65	62
	A	Landing	74	63	59	78	67	65	81	72	68
Night	B	Take off	72	65	62	78	70	67	72	62	59
	B	Landing	74	59	57	80	68	65	75	66	60
	A	Take off	75	66	62	75	67	63	75	66	62
	A	Landing	77	64	60	79	68	65	80	68	68
Day		Overflight	-	-	-	77	69	65	73	65	61
Night		Overflight	-	-	-	75	66	62	72	64	61

APPENDIX D: Existing Annual Number of Marine Pilot Transfers

Calendar Years	Daytime			Night time		
	Helicopter	Pilot Cutter	Day total	Helicopter	Pilot Cutter	Night total
2018	2435	604	3039	1159	499	1658
2019	2390	670	3060	987	596	1583
2020	2456	574	3030	885	576	1461
2021*	1210	323	1533	409	285	692

* to June 21

Calendar Years	Total by year	Day (07:00 hrs – 21:59 hrs)			
		Helicopter %	Cutter %	Avg no of vessels per day using Helicopter	Avg no of flights req (2 movements per visit)
2018	3039	80.13	19.87	6.67	13.34
2019	3060	78.10	21.9	6.55	13.10
2020	3030	71.06	18.94	6.73	13.46
2021*	1533	78.93	21.07	3.32	6.63

* to June 21

Calendar Years	Total by year	Night time (22:00 hrs – 06:59 hrs)			
		Helicopter %	Cutter %	Avg no of vessels per day using Helicopter	Avg no of flights req (2 movements per visit)
2018	1658	69.09	30.10	3.18	6.35
2019	1583	62.35	37.65	2.7	5.41
2020	1461	60.57	39.43	2.42	4.85
2021*	692	58.76	41.24	1.11	2.22

* to June 21

APPENDIX E: Number of Helicopter Movements using Flight Path A

Data analysis of alternative flight path usage for 31 months (Jan 19 – June 21).

Reason for Alternative Flight Path A	2019			2020			2021*		
	Day	Night	Total	Day	Night	Total	Day	Night	Total
Aircraft Technical	2		2	1	1	2			
ATC request	164	9	173	78		78	67	2	69
Other				1		1			
Ship changeover				4		4			
Timing	11	1	12	9		9			
Traffic Issue				2		2			
Unknown	57	5	62	37	1	38	43		43
Weather	23	7	30	27	10	37	10	6	16
Grand Total	**257**	**22**	**279**	**159**	**12**	**171**	**120**	**8**	**128**

* 6 month data for 2021

Review of helicopter flight records identify single flight movements (Arrival or Departure) or as a single round trip 'Arrival and Departure'. Where records were identified as Arrival and Departure to obtain movements the A & D data was multiplied by 2 to obtain the following number of movements.

	2019	2020	2021
Total Night flight movements by year	29.0	20.0	20.6 **
Average night flight movements per month	2.42	1.67	2.94
Average night flight (per day)	0.080	0.055	0.056

* 2021 6 month data pro rata to 12 months