Milford Sound Piopiotahi Heliport Feasibility Assessment

Final Report
09/05/2024

Contents

Prepared by:	Vairavan Ganesh – Aviation Planner Lakshman Attanayake – Civil 3D Modeller Paul Durham – LiDAR Data Input George Van Hout – Noise Assessment	WSP
Reviewed by:	Gareth Williamson – Director (Aviation)	WSP

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Version 3 – Issued to MOP on 13/05/2025 (Addressing comments in Acoustic Report from MOP on 08/05/2024)

Executive Summary

Executive Summary

Milford Opportunities Project (MOP) commissioned WSP to look at two sites (Deepwater Basin and Little Tahiti) to have a prospective heliport in Milford Sound Piopiotahi. The primary focus of this engagement has been to study the feasibility of conducting helicopter (rotary-wing) operations from the two sites and to understand its impact to the surrounding environment.

The following activities and analysis were carried out as part of the feasibility assessment and are discussed in this report:

- Review of heliport design standards
- Wind analysis to evaluate prevailing wind direction
- Establishing land requirements for a typical helicopter landing area
- Development of Obstacle Limitation Surfaces (OLS) model for helicopter approach/take-off path
- Heliport conceptualization
- Site analysis and discussion of outcomes from the feasibility (aeronautical and environmental) assessment
- Review of the predicted noise emissions and tranquillity assessment
- Heliport capacity assessment
- Compatibility study of proposed heliport concept for a potential Urban Air Mobility (UAM) operations in the future

Executive Summary

Key Findings: Slide 1 of 3

The table below (continued on the next two slides) summarises the analysis undertaken by WSP for each activity in scope and the key outcomes and WSP's recommendation for the proposed heliport at Milford Sound Piopiotahi.

Activity	Summary of the analysis	Outcomes / WSP recommendation
Review of heliport design standards	Comparison between relevant Civil Aviation Authority (CAA) of New Zealand and International Civil Aviation Organization (ICAO) standards in terms of heliport planning requirements and design guidelines.	Primarily the CAA guidelines were adopted for the conceptualization and feasibility exercise. However, for some aspects sufficient guidelines were not available in the CAA and during such instances ICAO standards were adopted.
Wind analysis	Wind analysis of the sites chosen for proposed heliport and the surroundings (Milford Sound Aerodrome) to evaluate prevailing wind direction and speed characteristics.	The prevailing wind direction was confirmed as North Westerly (NNW) and South Easterly (SE). The frequency of stronger winds (that could generate cross wind) were found to be less concerning for helicopter operation.
Helicopter landing area (or) Final approach and take-off area (FATO) requirements	Evaluation of FATO and associated safety area requirements per the design standards and guidelines. Requirement of number of FATO's were not finalized at this stage. However, heliport concepts with both, a single FATO and a double FATO are discussed in this report.	The study considered a circular type helicopter FATO for the critical design helicopter H125, which has a D value (overall length) of 12.94m. FATO + safety area = Circle with diameter of 25.8m Downwash protection area = Circle with diameter of 64.14m
Development of Obstacle Limitation Surfaces (OLS) model	Development of a 3D model of the OLS from both sites using terrain information (LiDAR) obtained from Southland LINZ LiDAR data. The data included terrain, vegetation and building information of the site.	OLS location and geometry are to be considered only as initial and will have to be updated if ground levels change or if the FATO system (dimensions and number of FATOs) changes.
Heliport Conceptualization	Deve opment of heliport concepts per the design guidelines to include FATOs, air taxiways and helicopter parking stands.	Single FATO concept – creates a bottleneck for efficient movement of helicopters and significantly reduces the system capacity. No redundancy within the system if the FATO becomes non- operational due to an incident or breakdown. Dual FATO concept – reduced taxi time and resilient design.

Executive Summary

Key Findings: Slide 2 of 3

Activity	Summary of the analysis	Outcomes / WSP recommendation
Site analysis and outcome	Aeronautical and environmental assessment of Deepwater Basin	• Orientation 12/32 was identified to be suitable for helicopter operation from Deepwater Basin. The terrain does not appear to be of concern in the proposed direction of helicopter operations. 12/32 direction is aligned to the prevailing wind direction at the site. • The environmentally sensitive areas around Deepwater Basin are not significantly impacted due to the heliport proposal and the impacts are likely manageable. • Tranquillity rating in Milford Sound township will be below 8 (threshold set by Department of Conservation) for 4 - 8 hours a day, depending on the proximity to the heliport. Noise levels, particularly on the Milford Sound Foreshore Walk lookout point will require raised voice effort during helicopter take-offs and/or landings.
	Aeronautical and environmental assessment of Little Tahiti	• Orientation 14/29 was identified to be suitable for helicopter operation from Little Tahiti. The terrain does not appear to be of concern, but significant vegetation (trees) management would be required to allow safe helicopter take-offs and landings. • There are areas designated as environmentally sensitive around Little Tahiti and needs further investigation. • Tranquillity rating in Milford Sound township will be below 8 for 2 - 3 hours a day, while average and maximum noise level impacts from aircraft are similar to Deepwater Basin, the Milford Sound Lodge and campervan parking area are likely to require raised voice effort to communicate during helicopter take-offs and/or landings, which is not experienced at Deepwater Basin.

Executive Summary

Key Findings: Slide 3 of 3

Activity	Summary of the analysis	Outcomes / WSP recommendation
Capacity Assessment	Heliport capacity analysis based on sub systems (FATO and helicopter parking stands)	Preliminary assessment shows the stand capacity is a limitation before the FATO capacity. At a minimum, the proposed heliport concept could handle 25-128 flights/day (i.e., 50-256 combined movements or landings/take-offs) depending on the dwell time of each flight/operation.
Compatibility of the proposed heliport for potential UAM operations	Evaluating the compatibility of the heliport concept to handle UAM in the future (in particula the Electric Vertical Take-off and Landing (EVTOL))	Volocity (EVTOL) was chosen for evaluation purpose in this study. And was found to be compatible with the proposed heliport concept.
Noise Review	Noise is likely to be dominating near the helipad during take-offs and landings. In areas this may require people to use a raised voice effort to be heard over the helicopter. It is predicted that no area of Milford Sound township will have a Tranquillity Rating of 8 or greater for a whole day.	The area surrounding the helipad is likely to have a degradation of the tranquillity in the area and high noise levels may impact conversations. However, the existing noise and tranquillity environment is unknown and the existing and proposed should be compared to determine whether there is any impact from the proposed heliport.

Recommended Next Steps:

- Study the applicability of existing flight circuits (of Milford Sound Aerodrome) in the area with proposed helipad approach and take-off orientations/directions.
- The noise modelling and analysis shows that helicopters are likely to cause disturbance and reduce the tranquillity of Milford Sound. To provide a more detailed analysis, it is recommended that the existing environment including existing noise from the airport is assessed and the TRAPT is updated specifically for Milford Sound. This will allow the actual noise impact of this new proposal to be determined against the existing environmental noise.

Glossary

Glossary

Air noise boundary – An area around an airport where the amount of aircraft noise will be at a level to requires appropriate land use control, generally to restrict any noise-sensitive activities occurring within the boundary. This is typically defined as the 65 dB Ldn noise level contour.

Air taxiway – A defined path on the surface established for the air taxiing of helicopters.

Approach – A series of predetermined manoeuvres for the orderly transfer of an aircraft to a point either where a landing may be made or where an aircraft may drop, off-load or pick up persons or load of any description.

D value – The largest overall dimension of the helicopter when rotors are turning measured from the most forward position of the main rotor tip path plane to the most rearward position of the tail rotor tip path plane or helicopter structure.

Decibel – The decibel (dB) is a logarithmic scale that allows a wide range of values to be compressed into a more comprehens ble range, typically 0 dB to 120 dB Noise levels in decibels cannot be added arithmetically since they are logarithmic numbers. The human ear has a vast sound-sensitivity range of over a thousand billion to one, so the logarithmic decibel scale is useful for acoustical assessments.

Final approach and take-off area (FATO)/He ipad – A defined area over which the final phase of the approach manoeuvre to hover or landing is completed and from which the take-off manoeuvre is commenced and, where the FATO is to be used by performance Class 1 helicopters, includes the rejected take-off area available.

Heliport – An aerodrome or a defined area on a structure intended to be used wholly or in part for the arrival, departure and surface movement of helicopters

Helicopter parking stand – A def ned area intended to accommodate a helicopter for purposes of loading or unloading passengers, mail or cargo; fuelling, parking or maintenance; and, where air taxiing operations are contemplated, the TLOF.

Ldn – The day/night average noise level of all aircraft movements time-averaged over 24 hours with the addition of 10 dB to movements which occur from 2200 to 0700 hours the following day to take into account the increased annoyance caused by noise at night

Noise – Noise is typically defined as unwanted, harmful, or intrusive sound.

Obstacle limitation surfaces (OLS) – Surfaces extending outwards and upwards from the FATO or safety area at angles compatible with the flight characteristics of the helicopter, used to evaluate approach and take-off climb surfaces for clearance of obstacles.

Outer control boundary – The outer control boundary defines an area outside the air noise boundary within which any noise-sensitive activity will be designed against aircraft noise. This is typically defined as the 55 dB Ldn noise contour.

Overall helicopter length – The maximum length of a helicopter including rotors, measured through the fore and aft centre line of the aircraft.

Performance Class 3 helicopter – A helicopter with performance such that, in case of engine failure at any time during the flight, a forced landing will be required.

Protection area – A defined area surrounding a stand intended to reduce the risk of damage from helicopters accidentally diverging from the stand.

Glossary

Safety area – A defined area on a heliport surrounding the FATO which is free of obstacles, other than those required for air navigation purposes, and intended to reduce the risk of damage to helicopters accidentally diverging from the FATO. It should be capable of supporting the weight of a helicopter.

Surface level heliport – A heliport located on the ground or on the water.

Touchdown and lift-off area (TLOF) – A load bearing area on which a helicopter may touch down or lift off.

Tranquillity – How readily a person or group of people can engage with the natural environment, which is undisturbed by man-made objects or noise. Tranquillity ranges from 0 (not a tranquil environment) to 10 (highly tranquil environment).

TRAPT – Tranquillity Rating Prediction Tool.

1. Project Background

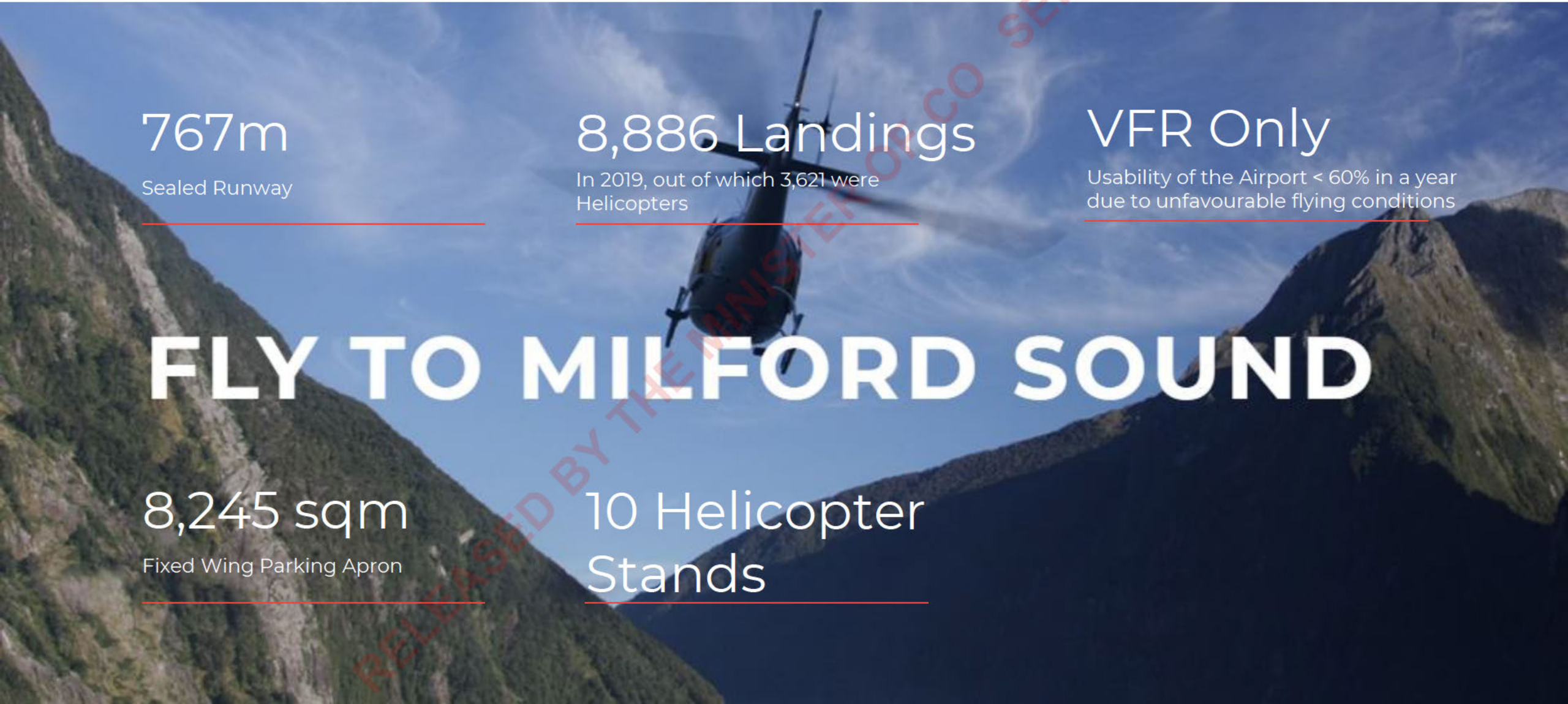
Project Background

The Milford Sound Piopiotahi Masterplan proposes future options for existing and future aviation traffic. One stated option is to decommission the existing aerodrome and replace it with a new facility for rotary aircraft only (heliport). The proposal would:

- Remove the current land access challenges around Milford Sound Piopiotahi due to the location of the current airfield;
- Rehabilitate and return to nature a significant part of the Cleddau Delta;
- Facilitate an improvement in the experience on arrival at Milford Sound Piopiotahi by allowing for the realignment of SH94;
- Continue to provide for flightseeing and resilience/emergency response via a new facility for rotary aircraft, including a small expansion in the number of rotary aircraft provided for; and
- Be associated with the establishment of other commercial operating environments such as a bus layover area, a base for shuttle operations, the proposed heliport, and the marina at Deepwater Basin.

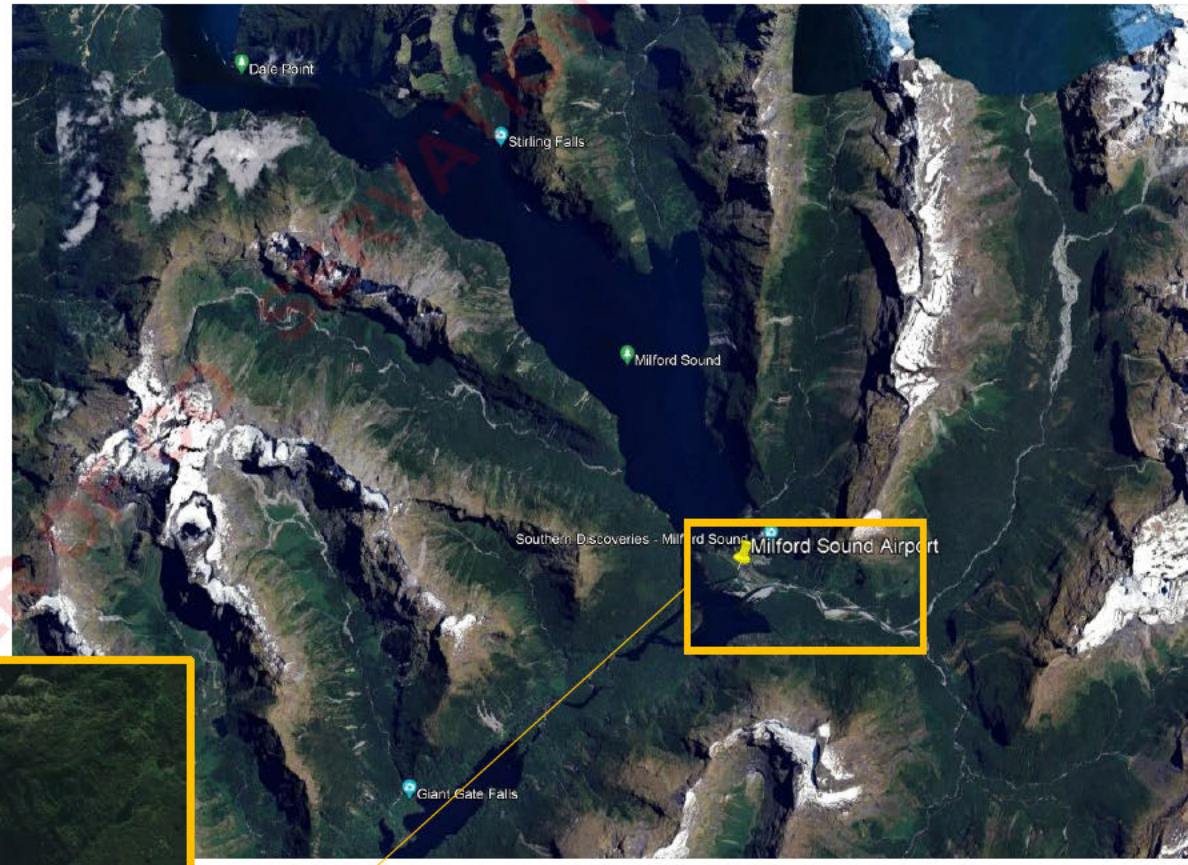
Purpose of this Study: Feasibility assessment to operate helicopters from the proposed Masterplan (2021) site and an alternate location in the area known locally as “Little Tahiti”.

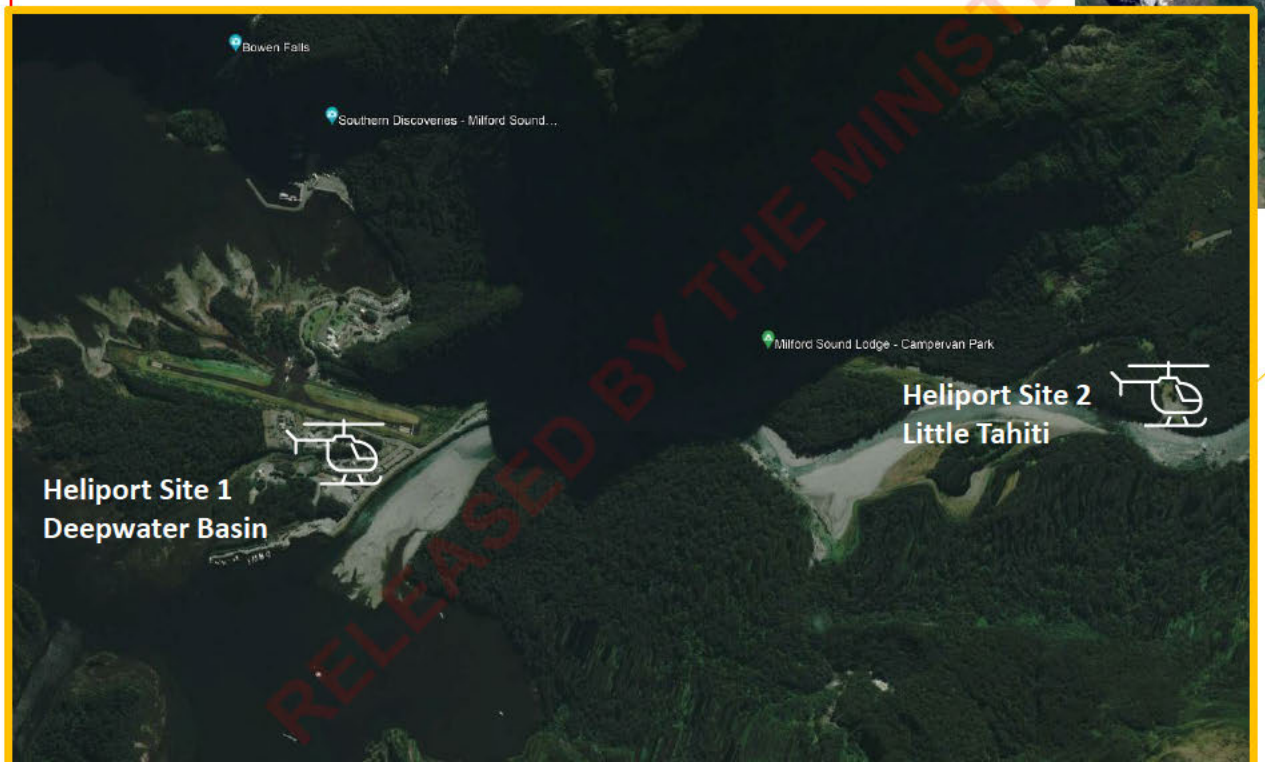
Existing Milford Sound Aerodrome Information



Site Characteristics

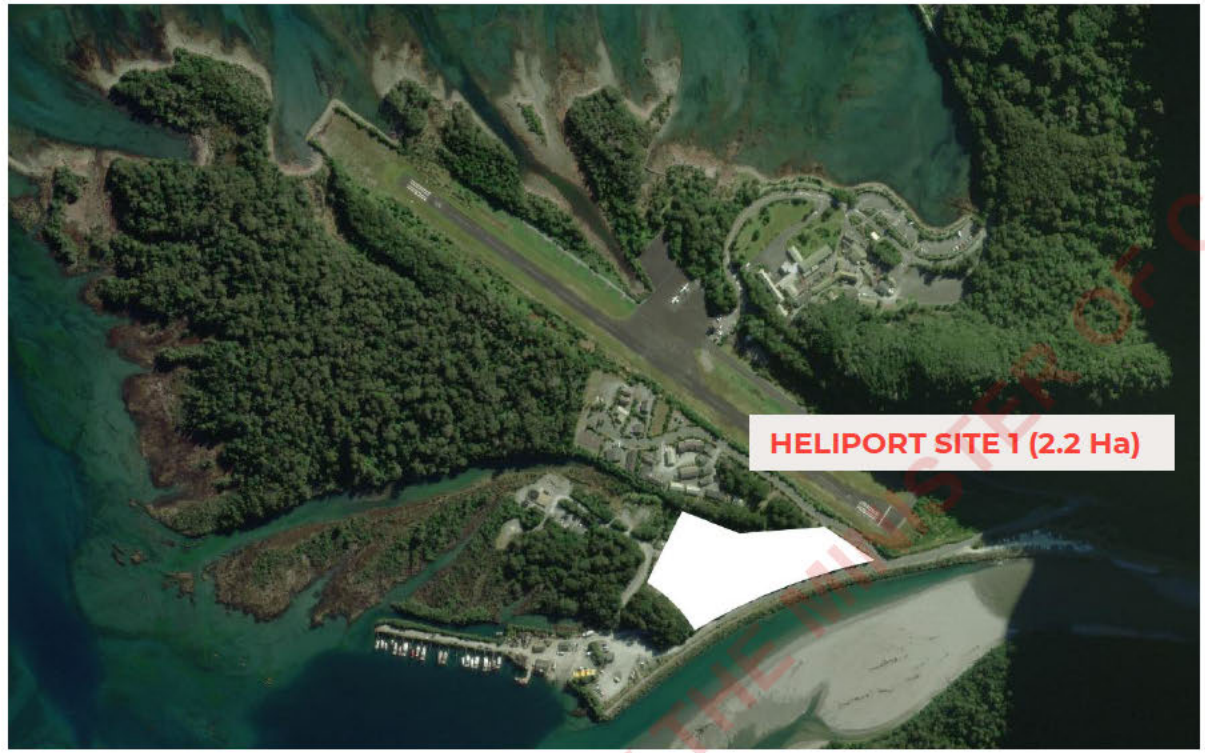
- The existing airfield is surrounded by mountainous terrain.
- The alpine environment can create very challenging flying conditions including wind conditions which can cause excessive turbulence, up and downdrafts, and unpredictable shear areas.





The image to the left shows a close-up representation of the sites that have been assessed as part of this study.

Helicopter Sites Considered for Assessment



Deepwater Basin

Little Tahiti

Design Helicopter

The Airbus H125 is the most common helicopter type used by commercial operators to service Milford Sound Piopiotahi.

H125 technical information

Design Helicopter	
Design Helicopter	H125
D Value	12.94 m
Rotor Diameter (RD)	10.69m
MTOW	2,370kg
PAX Capacity	6 Pax + 1 Pilot
Performance Class	PC3

2. Standards & Assumptions

Regulations and Standards

Advisory Circular AC139-8 (Rev 3, 2018) of the Civil Aviation Authority of New Zealand is the primary design standard that has been applied to the concepts in this study. However, for some aspects, since sufficient guidance was not available from NZ CAA, the ICAO Annex 14 Vol 2 (Fifth edition, 2020) and Document 9261 (Fifth edition, 2021) have been used.

Description	NZ CAA AC 139-8	ICAO Annex 14 Vol 2/ Doc 9261	Adopted
FATO	1.5* Design D D Value for H125 – 12.94m	1.5* Design D D Value for H125 – 12.94m	19.41m
Safety Area	0.25* Design D	0.25* Design D	3.23m
TLOF	Within FATO 1.5*UCW (Under Carriage Width)	Within FATO 0.83*D	0.83*D 10.74m Reason to adopt ICAO is due to unavailability of UCW in the H125 manual
Rotor Downwash Protection Area	No guidance available	2 to 3 Rotor Diameters (RD)	3 times Rotor Diameter 32.07m
Side Slope	No guidance available	Rising at 45 degree from the edge of the Safety area and extending to 10 m.	Adopted ICAO Annex 14 Vol 2 guidance on protected side slope.
Obstacle Limitation	**Take-off / Approach surface** Divergence = 1:10 until the surface is 7 rotor diameters wide, after which they become parallel (Day Operation) Length = 1,220m (@1:8 slope) Inner Width = same as width of the Safety Area Outer Width = 7*RD = 74.83m.	**Take-off / Approach surface (PC3)** Divergence = 1:10 until the surface is 7 rotor diameters wide, after which they become parallel (Day Operation) Length = 1,220m (@1:8 slope) Inner Width = same as width of the Safety Area Outer Width = 7*RD = 74.83m.	NZ CAA guidance is adopted, not much different to ICAO recommendation.

Regulations and Standards

Description	NZ CAA AC 139-8	ICAO Annex 14 Vol 2/ Doc 9261	Adopted
Parking Stands	Should be clear of approach and take off surfaces. 1/3*RD distance separation from any adjacent fixed object.	A circle of diameter 1.2 * Design D of the Design Helicopter	ICAO guidance of 1.2 * Design D is adopted for helicopter parking stands. 1.2*12.94=15.52m
Stand Protection Area	Nil	0.4*Design D	0.4*12.94= 5.17m, as no guidance found in NZ CAA
Air Taxiway	2 times overall width of the helicopter	2 times largest overall width	21.38m
In addition to stand protection there is an additional 5m separation provided to allow service vehicle movement between stands.			

Planning Parameters & Assumptions

- The site boundaries currently shown are tentative and driven by the heliport concepts proposed in this study.
- Design Helicopter H125 (previously designated AS350) is used for this study purposes. The H125 is the most common helicopter used by commercial operators to service Milford Sound Piopiotahi.
- This Helicopter (H125) is expected to operate under performance class 3, per international guidance single engine rotorcraft are required to be operated in PC3. Hence the guidance on PC 3 (Category C) was used in the concept/study to develop FATO and approach/take-off surfaces.
- Physical dimension guidance for type “Surface Level Heliports” was used for study purpose. It assumes the FATO will be sited on ground.
- The heliport is expected to cater to daytime operations only or under VMC conditions. This eliminates the requirement for a transitional surface for FATO
- Helicopters at this heliport are expected to hover or air taxi to the parking stands after landing in the FATO. Same for take-off (air taxi from the parking stand to FATO and take-off).
- The elevation model for OLS assessment was created using a combination of the Southland LINZ Lidar data, captured between December 2020 and April 2023, supplemented with the NZ 8m Elevation Model, 2012 to fill the wider area not covered by the Lidar.
- The elevation model includes existing ground, buildings and tree information.
- The landing pad leve considered for the OLS assessment – 5m for Site 1 Helipad and 20m for Site 2 Helipad (matches the underneath ground level)

Noise Parameters & Assumptions

Parameter	Description
Noise Modelling Software	AEDT 3f, developed by the United States Federal Aviation Administration. - Maximum noise and time-above modelling undertaken by DoC - Day-night-average noise modelling undertaken by WSP
Noise Modelling Methodology	Day-night-average: NZS 6807: Noise Management and Land-use Planning for Helicopter Landing Areas Tranquillity: Tranquillity mapping in New Zealand national parks – a pilot study, November 2000
Movements	Day-night-average: 256 daytime movements occurring between 0800 – 1800 hours Maximum noise level and tranquillity: 1 fl ght (1 arrival, 1 departure)
Flight profiles	A single helipad assumed at each locat on. 80% of aircraft movements would occur to the west/northwest, with 20% occurring to the east/southeast. Approach/departure profiles based on GPS logged data of a test arrival/departure at each of the locations. Day-night-average noise levels have been assessed until helicopters reach 500 ft (152 metres) above the ground, in line with the High Court Dome Valley decision. This takes approximately 1220 horizontal metres to occur along the flight paths.
Tranquillity parameters	Assumption that natural and contextual features are 100% and 0 moderating Factor

This analysis does not account for the effects of existing noise within Milford Sound (from aircraft, road traffic, birdlife, etc.)

A tranquillity Rating of 8 or higher (on a 10-point scale) are considered to be "excellent tranquillity" environments. As such the time at which tranquillity falls below 8 has been assessed.

3. Wind Analysis

Wind Rose – Milford Sound

Wind Rose Plot for MFN
Direction – Blowing From
Source: NIWA
Duration : 2016 – 2019
Hourly wind observations
Data Record - 33511

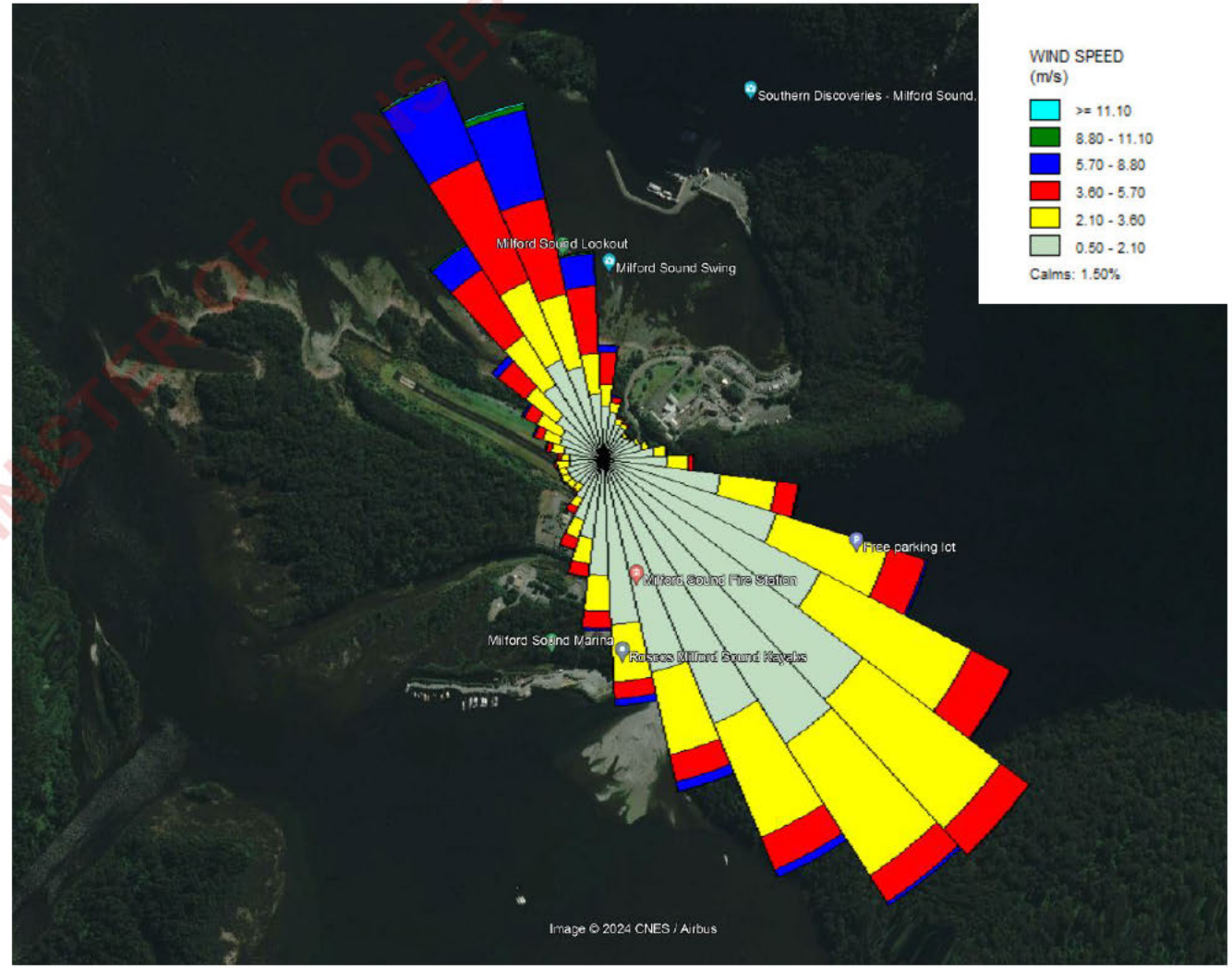
Station ID: 40987

The following tools were used to analyse the wind data obtained from NIWA:

- WRPLOT
- Windrose Pro 3
- FAA Wind Rose Tool

The prevailing wind direction is North Westerly (NNW) and South Easterly (SE)

The image to the right represents wind direction and speed over 3 years at the existing runway at Milford Sound Aerodrome.

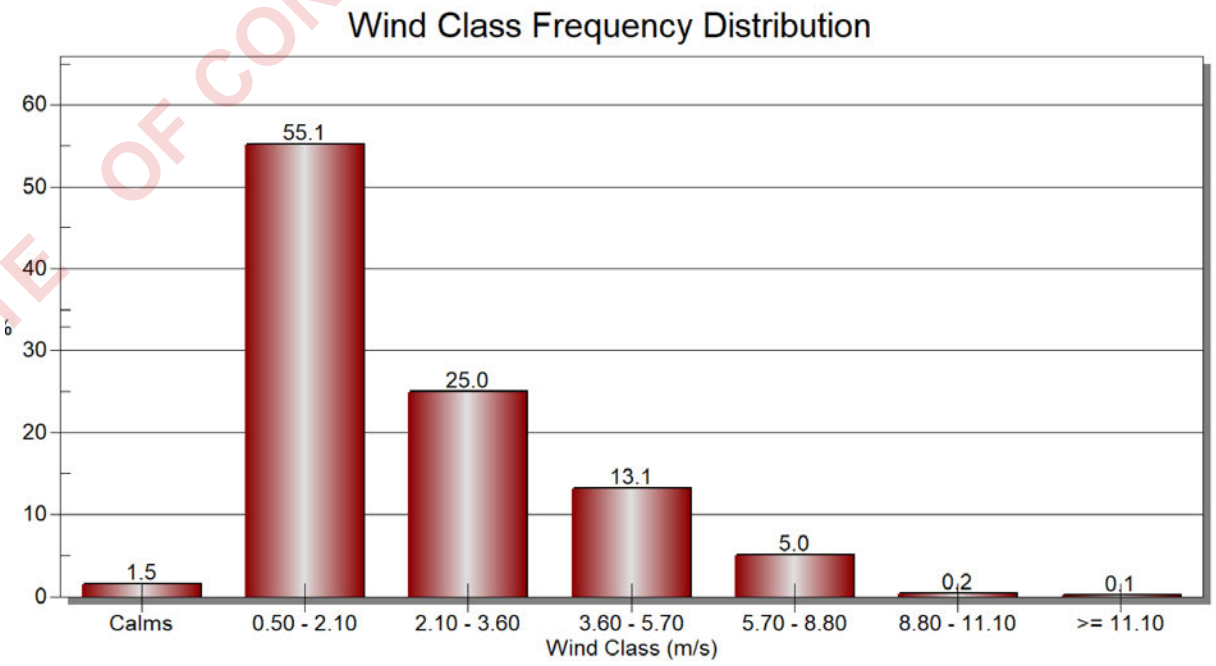


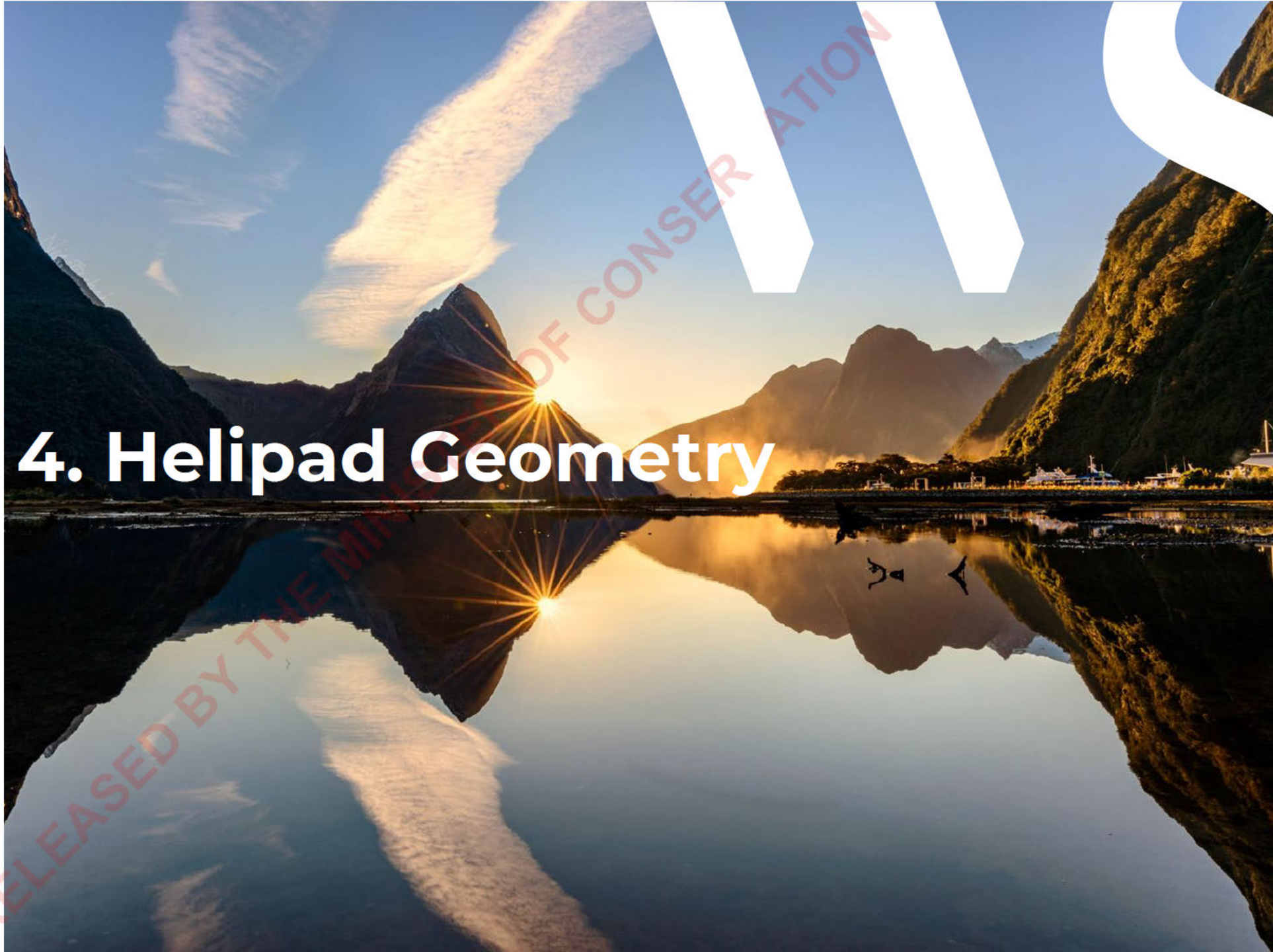
Wind Data Distribution

The percentage occurrence of wind speed from the hourly wind data is represented as a bar graph.

Milford Sound is surrounded by mountainous terrain, which typically shelters the area from strong winds.

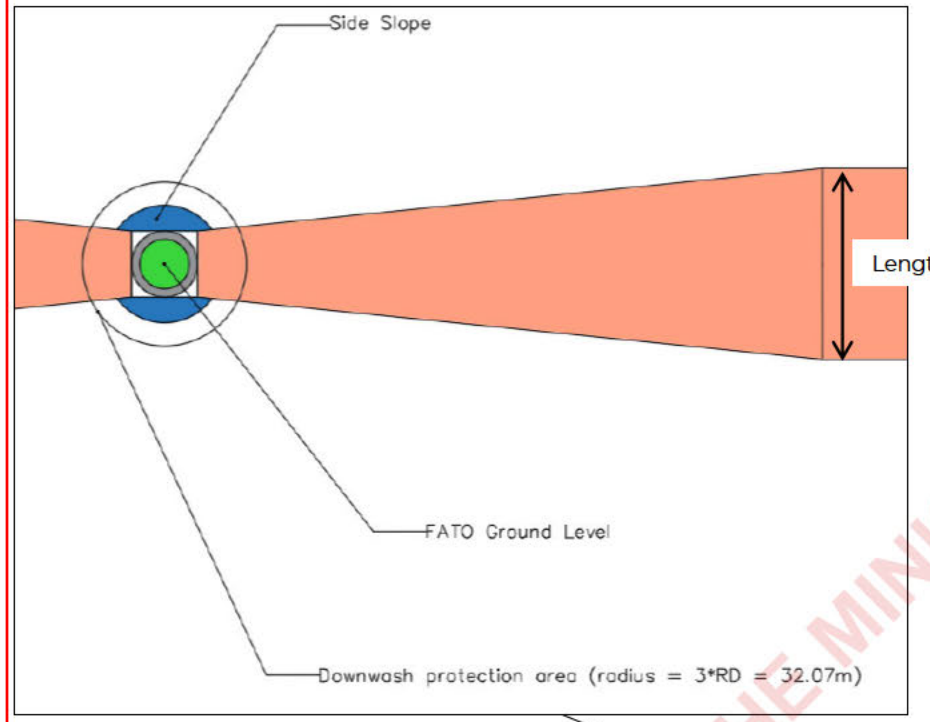
The occurrence of winds stronger than 5 m/s (10 kts, which could affect helicopter operations) from the overall data is <5% of the time overall.

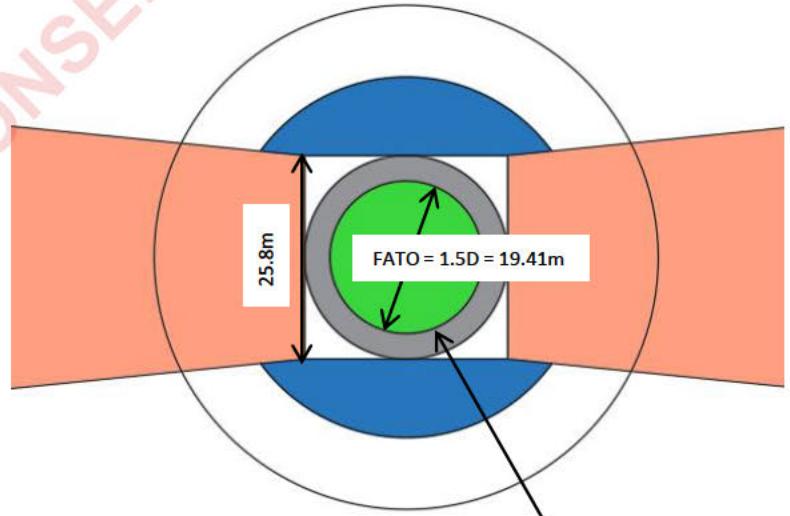




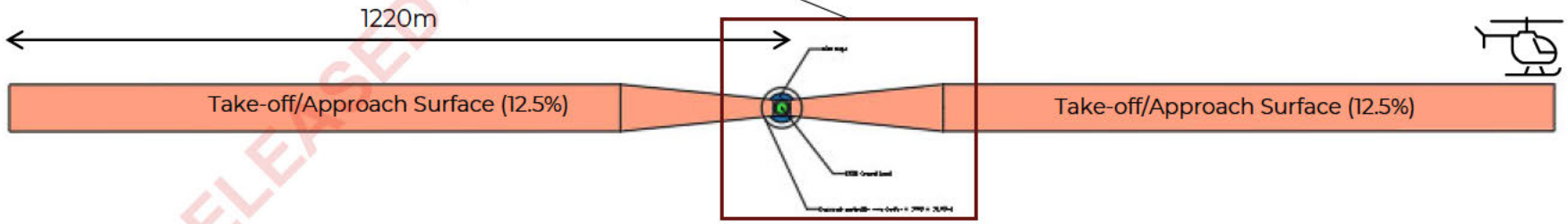
4. Helipad Geometry

Typical Helipad Geometry – H125





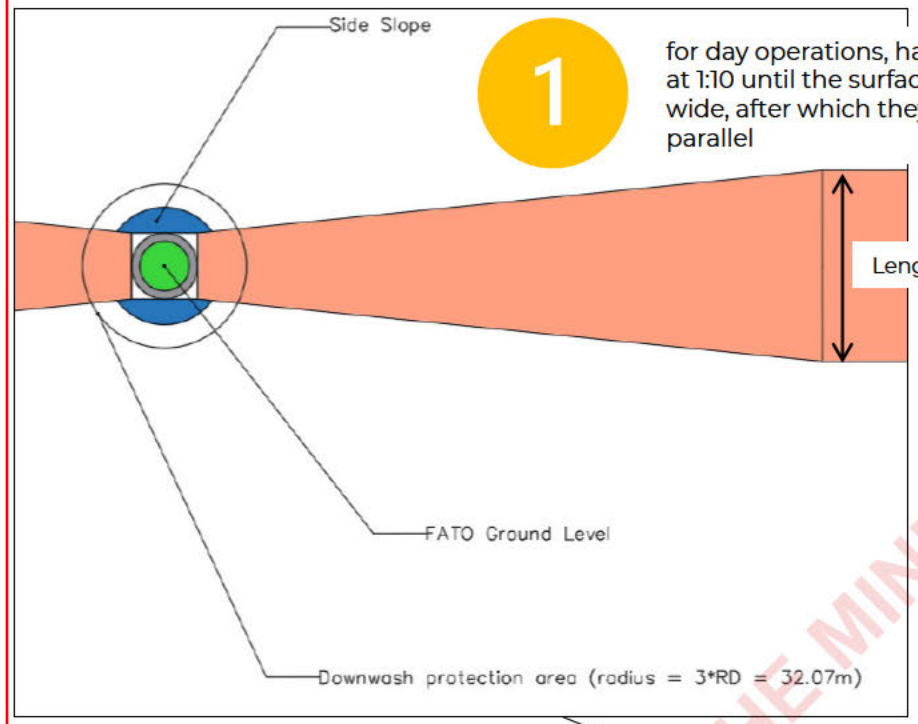
Safety Area = 0.25D = 3.235m



Take-off/Approach Surface length of 1220m associated with the respective slope (12.5%) brings the helicopter to 152m above FATO elevation

Helipad OLS Surface Design

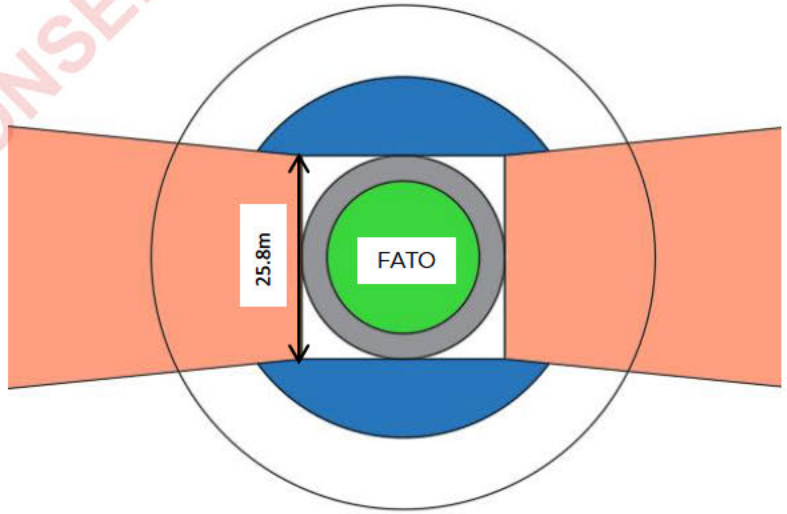
Please note – no transitional surface requirements for helipads operating in VFR (Day Time).



1

for day operations, have sides splaying out at 1:10 until the surface is 7 rotor diameters wide, after which they may become parallel

Length = 7*RD = 74.8m



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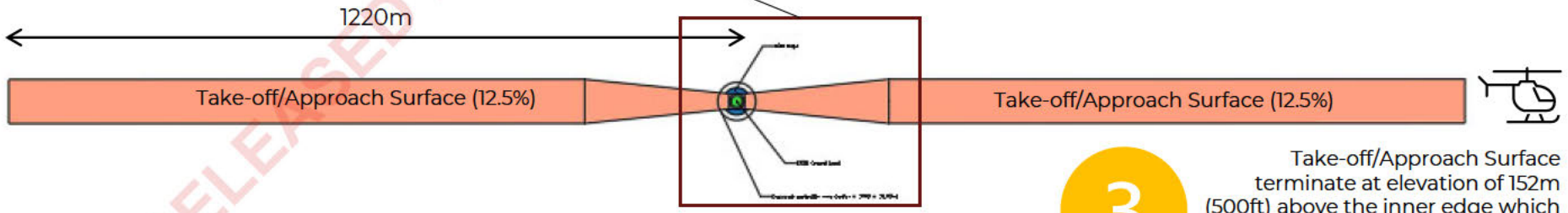
Inner edge of the approach/take-off surface equal to the width of the FATO



3

Take-off/Approach Surface terminate at elevation of 152m (500ft) above the inner edge which equates to 1220m horizontally from the inner edge.

5. Helipad Concepts

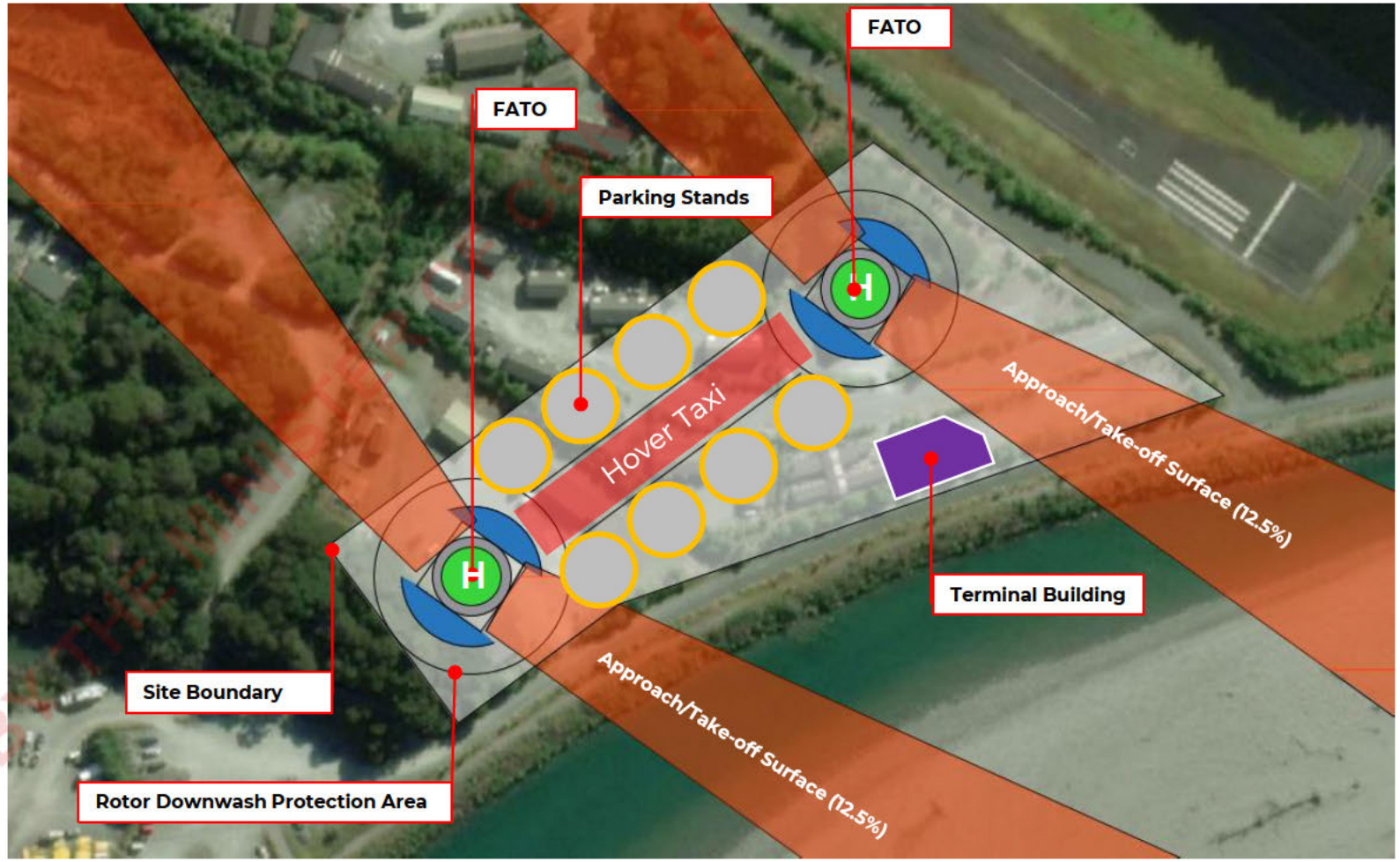
Heliport Concept – 1 (2.2 Ha)

- The area shown for maintenance and the terminal facility is tentative and not measured to scale.

- The location of the FATO requires further optimisation based on the planned boundary fence height. It is possible that the location may be moved slightly to the south from the current location to allow sufficient separation from the FATO to the boundary fence, so that the fence does not infringe the approach/take-off surface.

Heliport Concept – 2 (2.2 Ha)

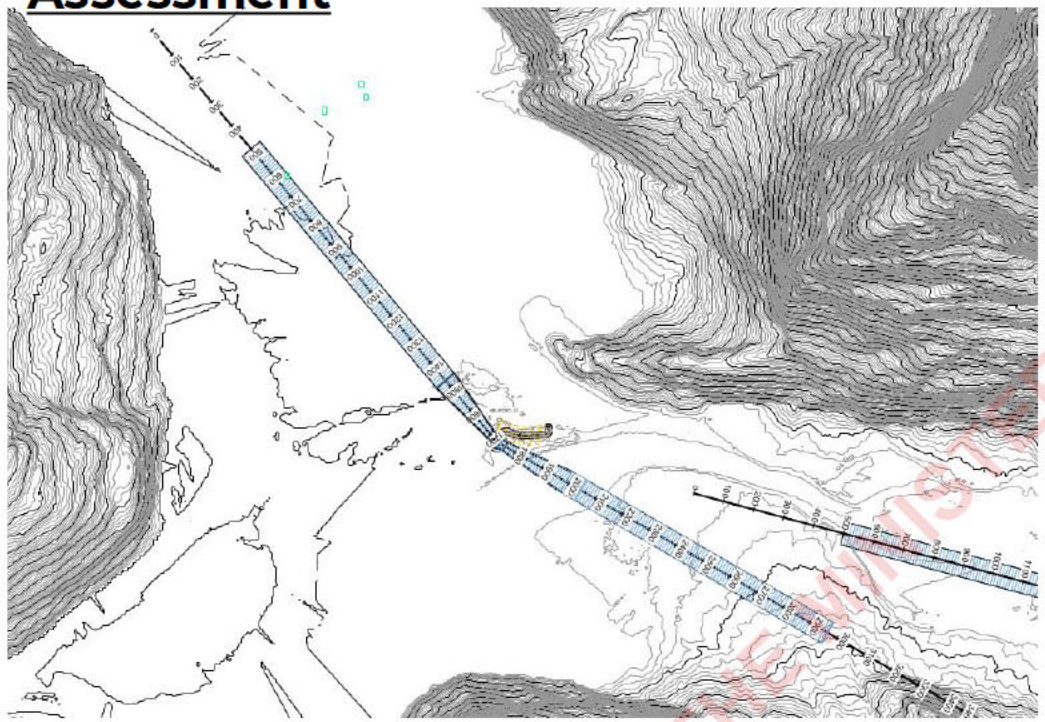
- This concept/configuration can accommodate 8 parking stands and 2 FATOs.
- This concept follows a pier topology, and a resilient design with two FATO's. Even if one of the FATO become unusable due to an incident the system can still operate safely using the other.
- The taxi time is substantially reduced compared to the previous concept, as the helicopters are not restricted to land or take off from a single FATO.



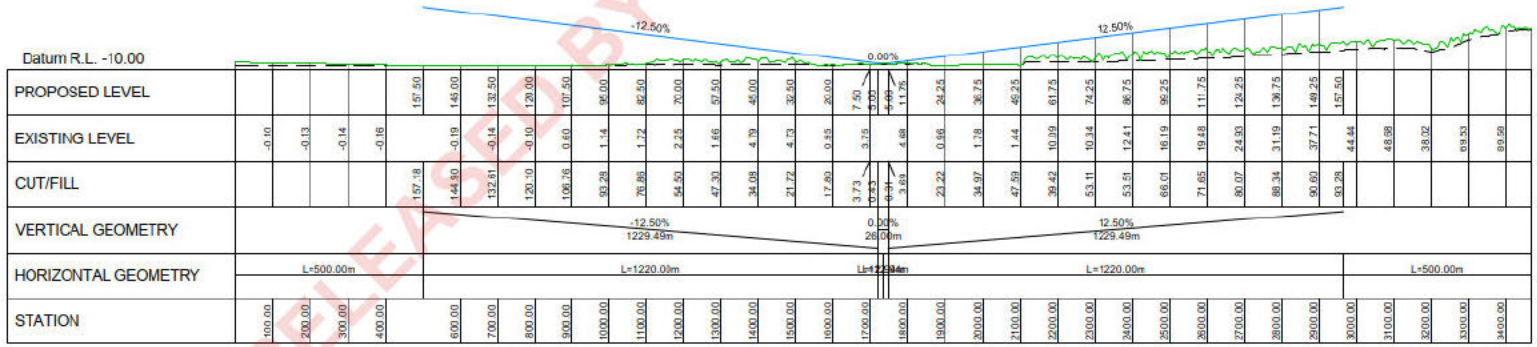
6. Site 1 (Deepwater Basin) Findings

Site 1 (Deepwater Basin) Findings

Obstacle Limitation Surfaces (OLS) Assessment



- 12/32 was identified to be a suitable orientation for the approach/take-off path for Site 1.
- The OLS assessment was limited to concept 1 (one FATO) only.
- The modelled OLS surface is placed over the contours containing existing ground level and trees/building information.
- The corresponding profile view (NW – SE) is shown below. The blue line is the modelled surface, and the dashed line is the existing ground.
- No infringements were identified in the flight path due to the terrain, and the terrain for the modelled section (1.2+0.5 km) in each direction seems to be flat.



Approach/Take-off Surface

Trees/Buildings

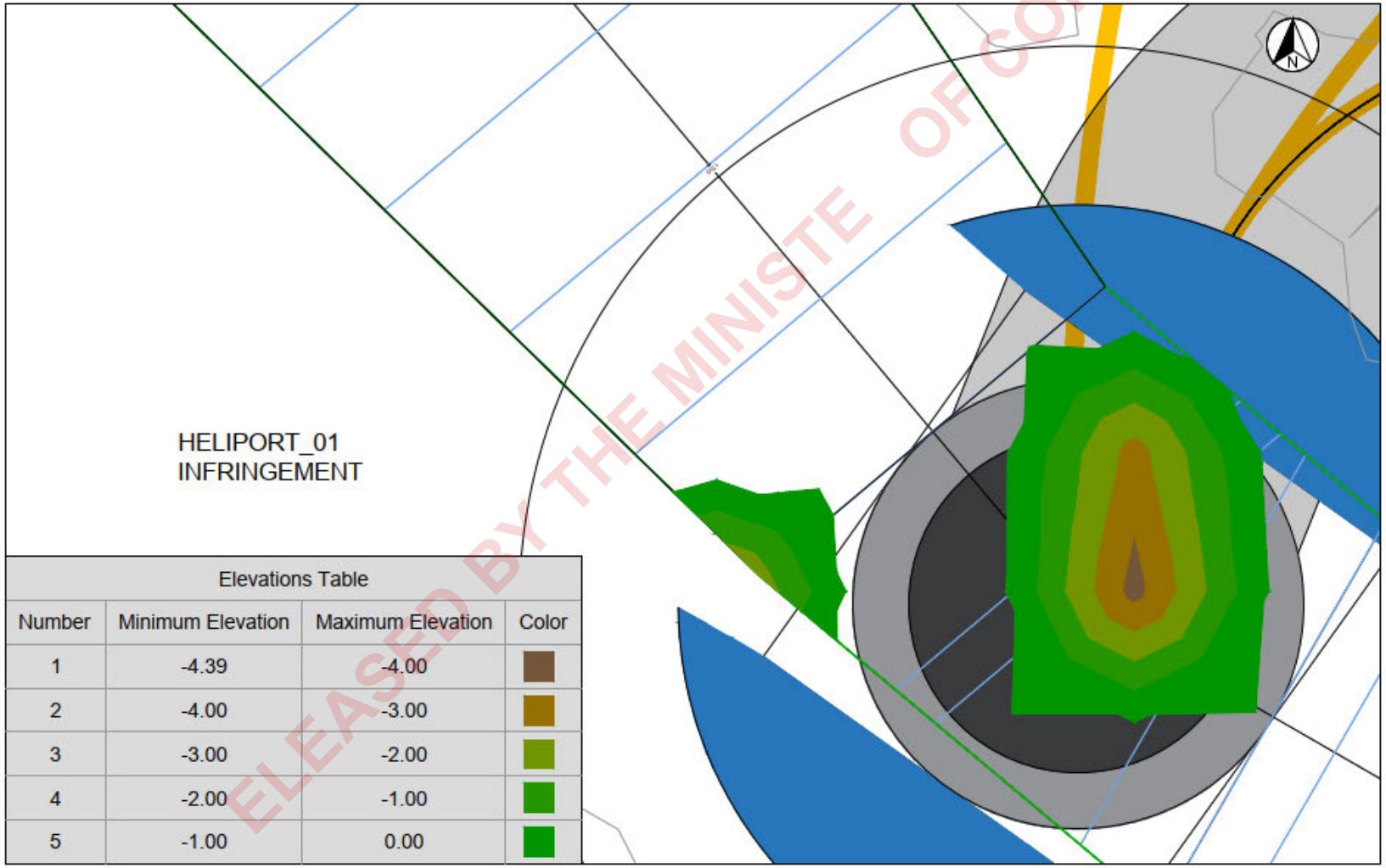
Ground Profile

Heliport_01
SECTION BETWEEN CH: 0.00 AND 3465.88

Site 1 (Deepwater Basin) Findings

OLS Assessment continued

Infringements to the OLS by buildings are observed for Site 1 heliport. However, it is noted in the masterplan that all staff accommodation and buildings in the Deepwater Basin node (site 1) will be cleared to enable the heliport proposal.



Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	-4.39	-4.00	
2	-4.00	-3.00	
3	-3.00	-2.00	
4	-2.00	-1.00	
5	-1.00	0.00	

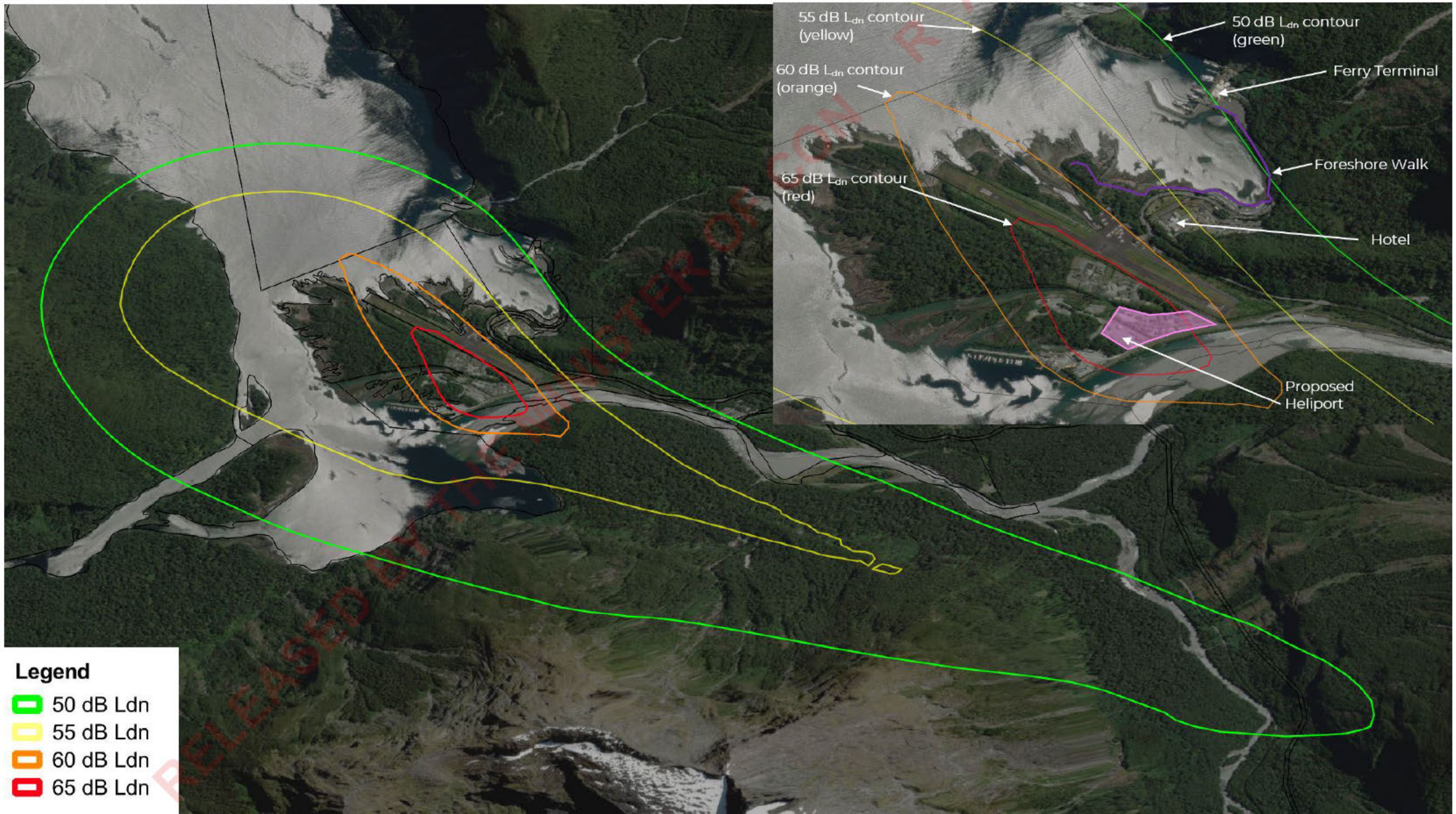
Site 1 (Deepwater Basin) Findings

Environmental Assessment

- Site 1 (in Deepwater Basin Node) is a brownfield, and the proposed heliport concept would be constructed by clearing the existing development at the site including carpark and accommodation.
- Images below represent the site boundary in relation to the environmentally sensitive areas at Site 1.
- Based on preliminary review, the environmental impacts are likely to be manageable for the proposed concepts. Environmentally sensitive areas are not found to be significantly impacted by this proposal.
- If the topology/concept of the heliport changes or a new location identified, further environmental assessment will be required.

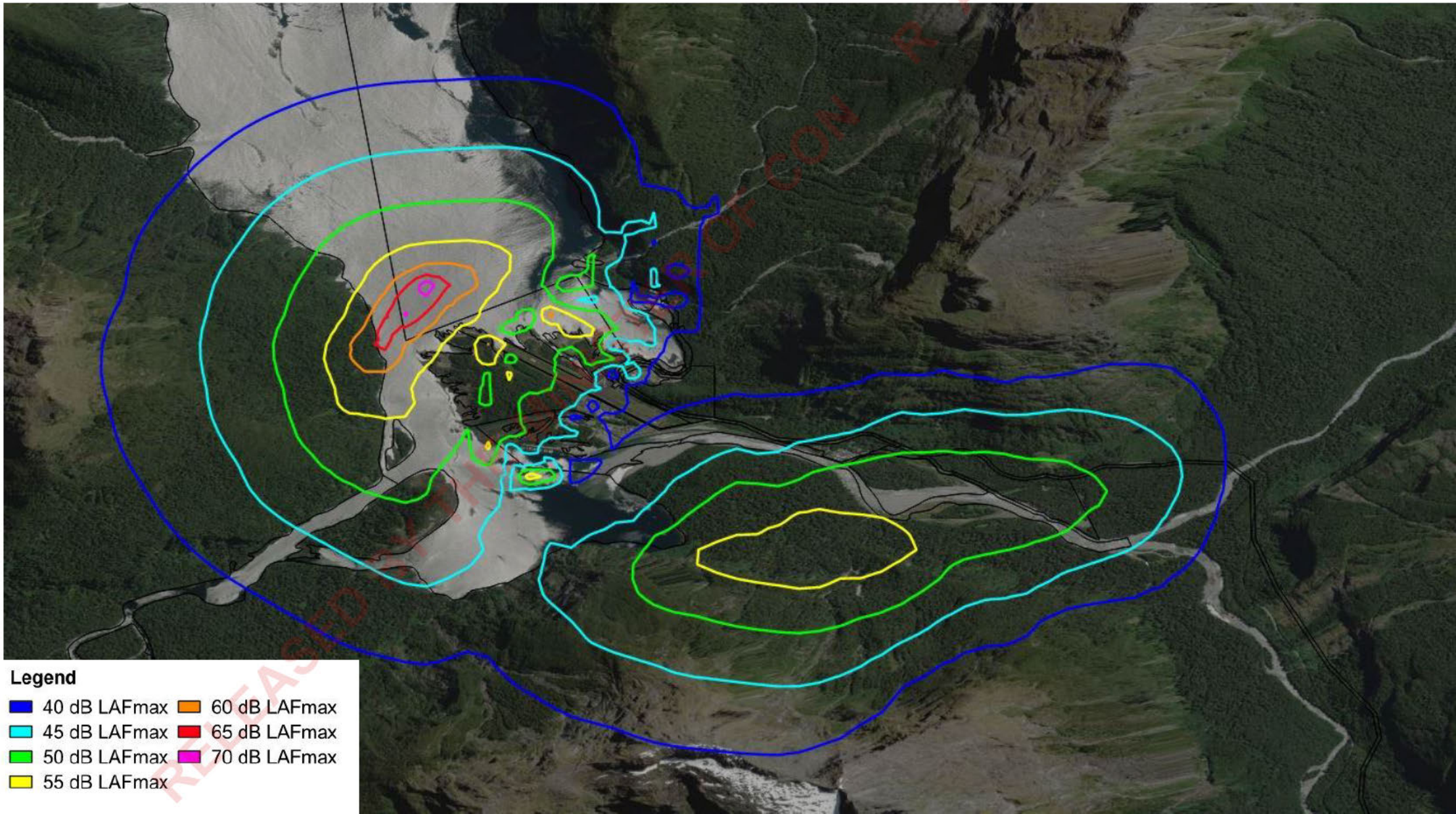
Site 1 (Deepwater Basin) Findings

Noise Assessment – day-night-average



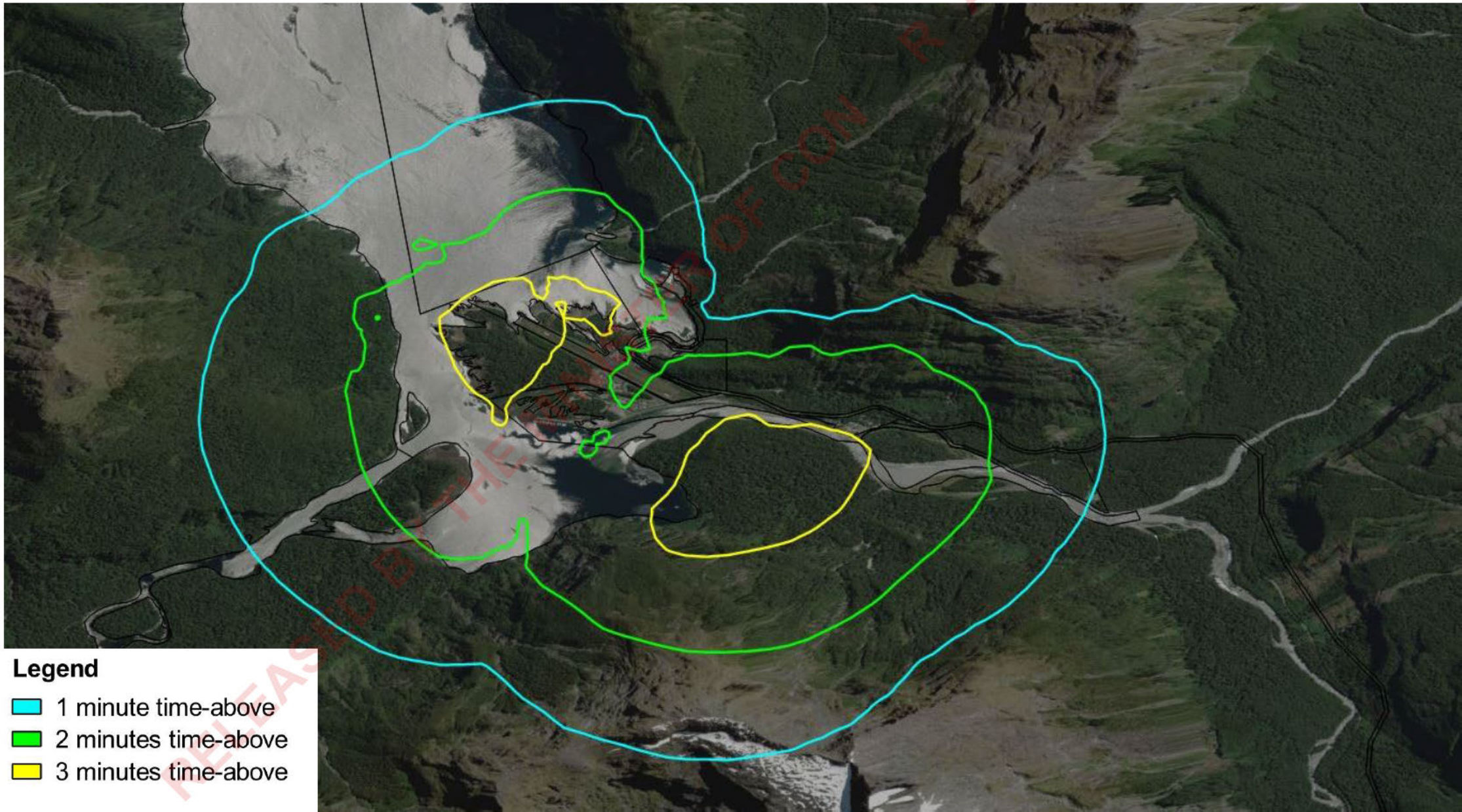
Site 1 (Deepwater Basin) Findings

Noise Contours – maximum noise levels



Site 1 (Deepwater Basin) Findings

Noise Contours – Time-above, tranquillity



Site 1 (Deepwater Basin) Findings

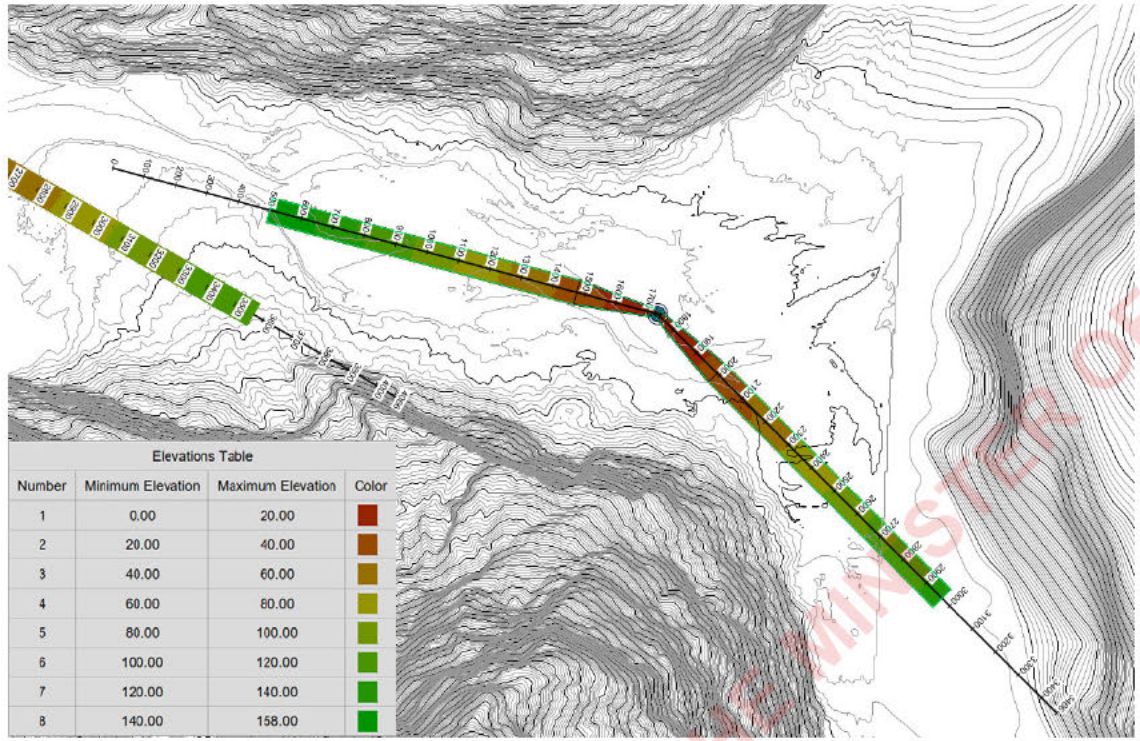
Noise Assessment

Parameter	Description
Day-night-average	The hotel and associated buildings are predicted to receive noise levels between 53 – 58 dB L_{dn}. When helicopters arrive and depart, raised voice effort will be required to be audible over helicopter noise when outdoors. Noise may also be distracting for some indoor activity. WHO research outlines that 22 to 32% of people would be highly annoyed when exposed to aircraft noise between 53 – 58 dB L_{dn}. Levels of 50 dB L_{dn} or less are predicted at the ferry terminal. Normal speech effort is unlikely to be disrupted by helicopter flights at this location. The Milford Sound Foreshore Walk is predicted to receive noise levels between 58 dB L_{dn} and 50 dB L_{dn}. Raised voices may be required at times at the lookout area at times, especially when helicopters fly overhead.
Maximum noise level	Noise levels at the hotel and the ferry terminal are predicted to be at or below 45 dB L_{AFmax} from helicopter arrivals or departures. At this level, there is no risk of conversation being disturbed or sleep disturbance. Noise levels on the point of the Milford Sound Foreshore Walk (near the lookout point) are predicted to be up to 55 dB L_{AFmax}. During helicopter departures/arrivals from the west, raised voice effort will be required to converse. Based on international surveys, visitors to national parks are likely to view aircraft noise as intolerable when levels are greater than 54 dBA. This only impacts the lookout point area of the Milford Sound Foreshore Walk.
Tranquillity	The time-above noise level has been set to 32 dBA. Based on NZ research, this is when the tranquillity level is likely to fall below 8. No area within Milford Sound will have a Tranquillity Rating of 8 or higher for a full day. All areas of Milford Sound township are predicted experience tranquillity levels below 8 for at minimum 1 minute of each helicopter flight (arrival and departure). Specifically, Bowen Falls is predicted to have a tranquillity rating below 8 for approximately 4 hours a day, or 40% of a 10-hour day. Milford Track Trailhead/Sandfly Point is predicted to experience a tranquillity rating of less than 8 for 2 hours (or 20%) of the day with Milford Foreshore Walk and ferry terminal are predicted to have a tranquillity rating of less than 8 for 4 – 8 hours of each day.

7. Site 2 (Little Tahiti) Findings

Site 2 (Little Tahiti) Findings

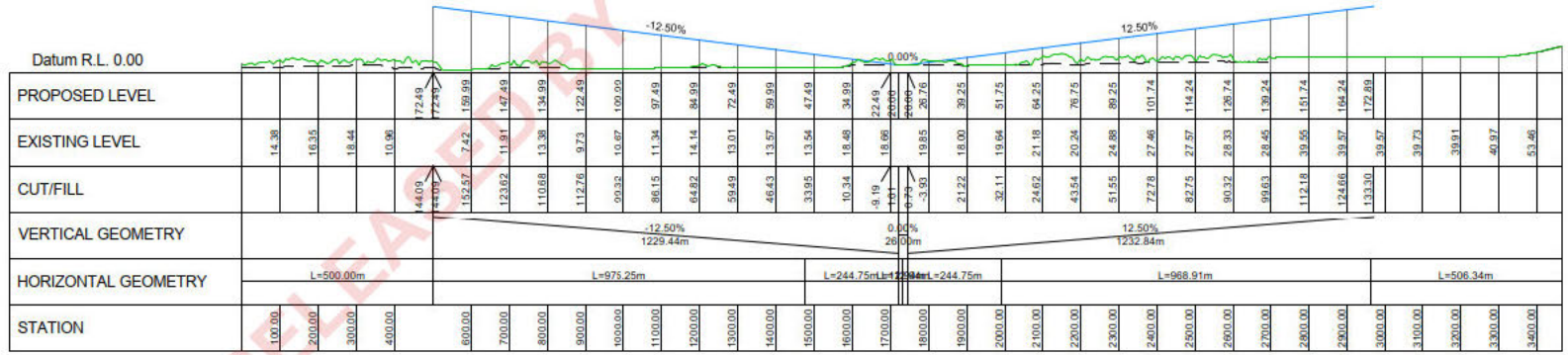
OLS Assessment



Elevations Table

Number	Minimum Elevation	Maximum Elevation	Color
1	0.00	20.00	
2	20.00	40.00	
3	40.00	60.00	
4	60.00	80.00	
5	80.00	100.00	
6	100.00	120.00	
7	120.00	140.00	
8	140.00	158.00	

- 14/29 was identified as a suitable orientation for the approach/take-off path for Site 2.
- The OLS assessment was limited to concept 1 (one FATO) only.
- The modelled OLS surface is placed over the contours containing existing ground-level information
- The corresponding profile view (NW – SE) is shown below. The blue line is the modelled surface, and the dashed line is the existing ground.
- No infringements were identified in the flight path due to the terrain, and the terrain for the modelled section (1.2+0.5 km) in each direction is flat.

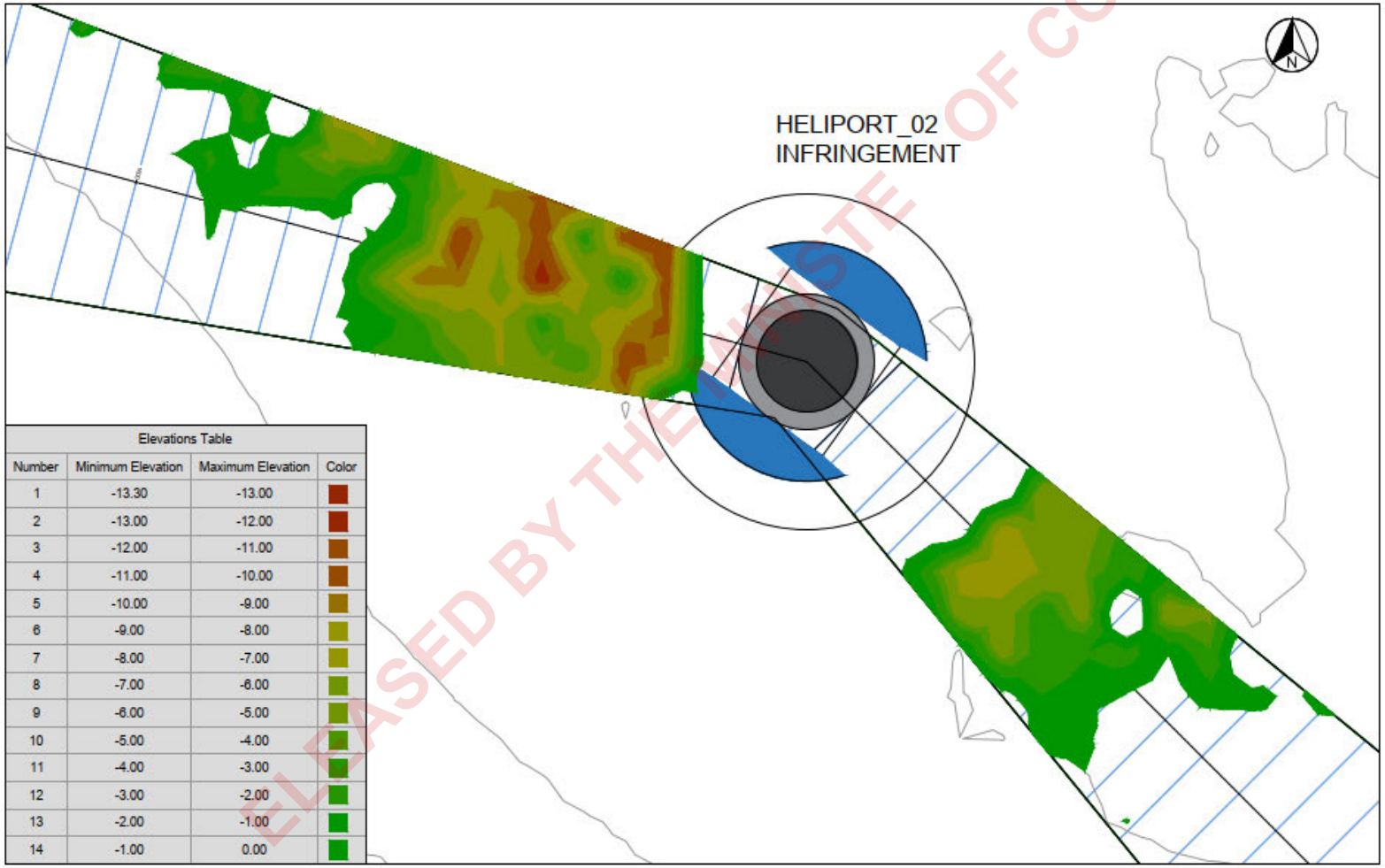


Heliport_02
SECTION BETWEEN CH: 0.00 AND 3465.88

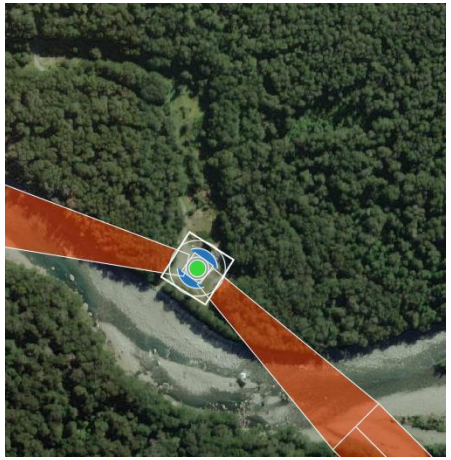
Site 2 (Little Tahiti) Findings

OLS Assessment

The infringements due to trees are quite significant (as seen in the illustration below), which is due to dense forest surrounding the Little Tahiti site. The level of infringement by the trees into the OLS surface is up to 13m.



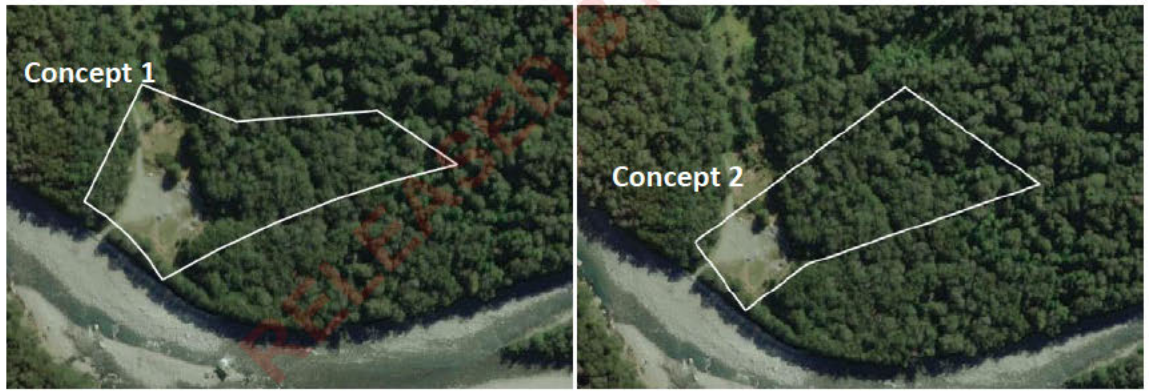
Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	-13.30	-13.00	
2	-13.00	-12.00	
3	-12.00	-11.00	
4	-11.00	-10.00	
5	-10.00	-9.00	
6	-9.00	-8.00	
7	-8.00	-7.00	
8	-7.00	-6.00	
9	-6.00	-5.00	
10	-5.00	-4.00	
11	-4.00	-3.00	
12	-3.00	-2.00	
13	-2.00	-1.00	
14	-1.00	0.00	

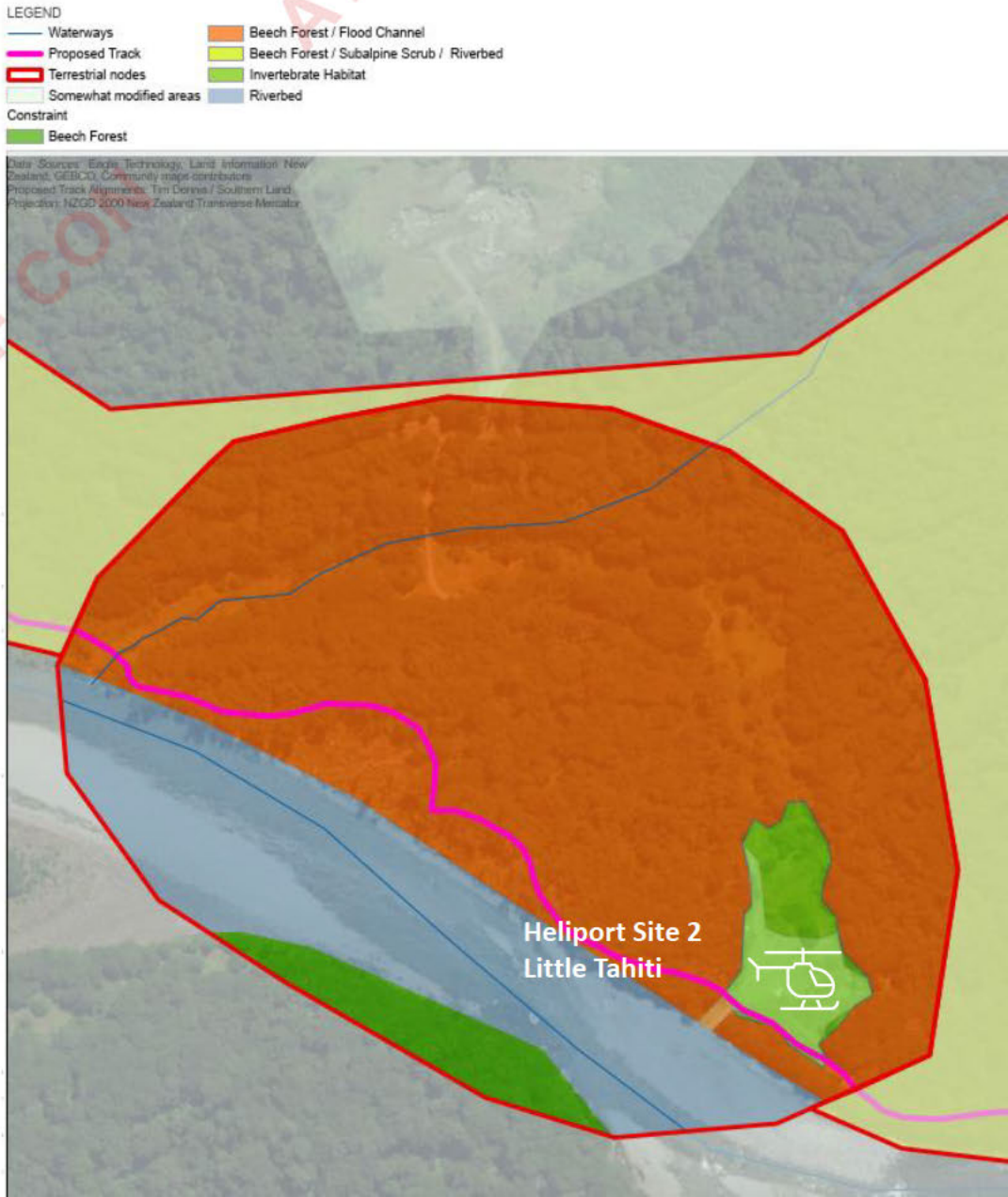


Site 2 (Little Tahiti) Findings

Environmental Assessment

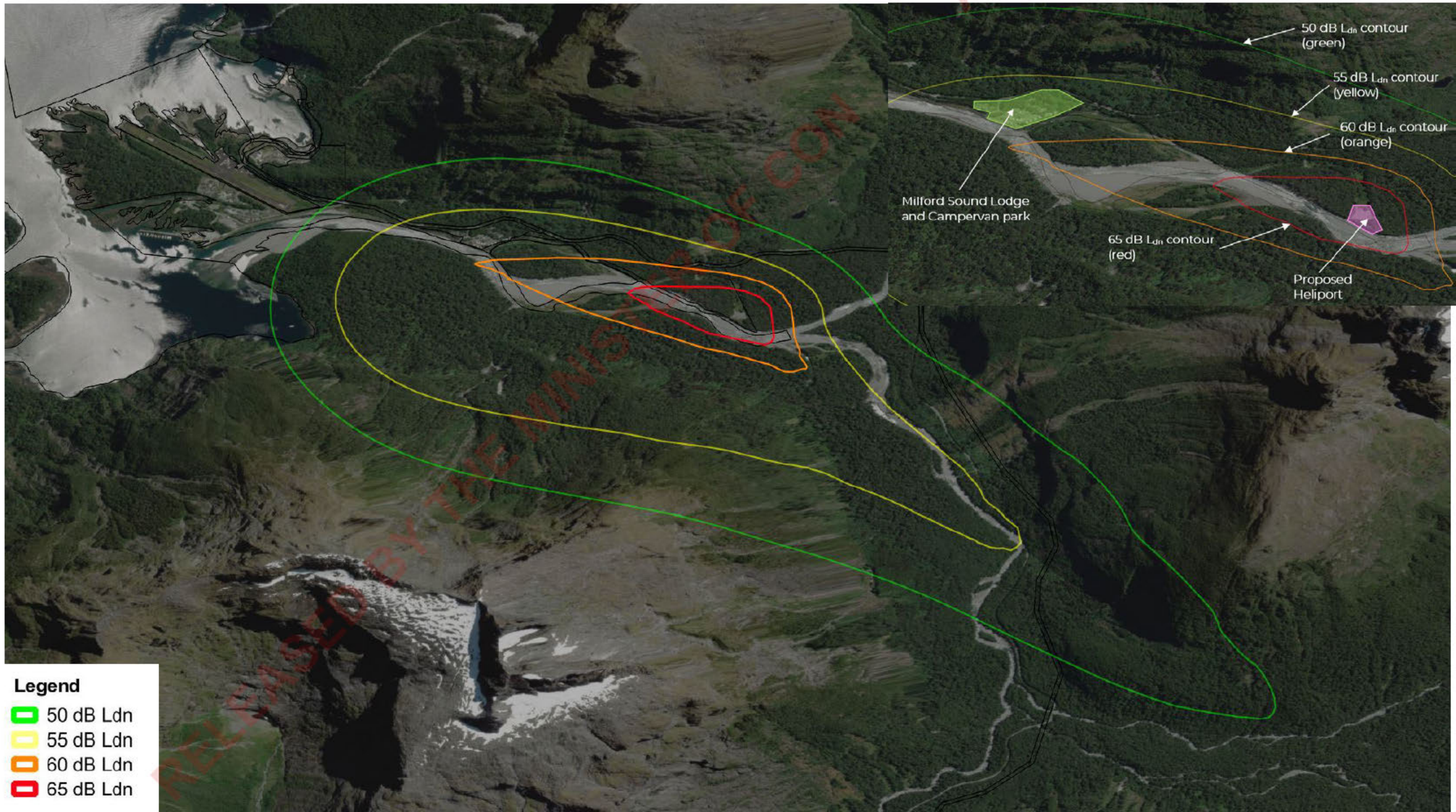
- Site 2 is largely undeveloped, is located close to a riverbed and sits over the areas designated as environmentally sensitive (i.e. invertebrate habitat, beech forest).
- Below are the images showing the heliport concepts overlayed on Site 2 (Little Tahiti).
- Approximately 1.5 – 1.7 Ha of vegetation is required to be cleared at Little Tahiti to have an operational heliport as proposed in this study. **Please note -** this does not include the cut/trim quantity of trees outside the site.
- Approximately 22,396 cubic metres volume of cut is required to the tree surface (outside the site) to enable obstruction free approach/take-off in direction 14/29 for one FATO (measured from the model shown in previous slide). **Please note -** the cut volume captured is estimated, the actual cut volume may vary.





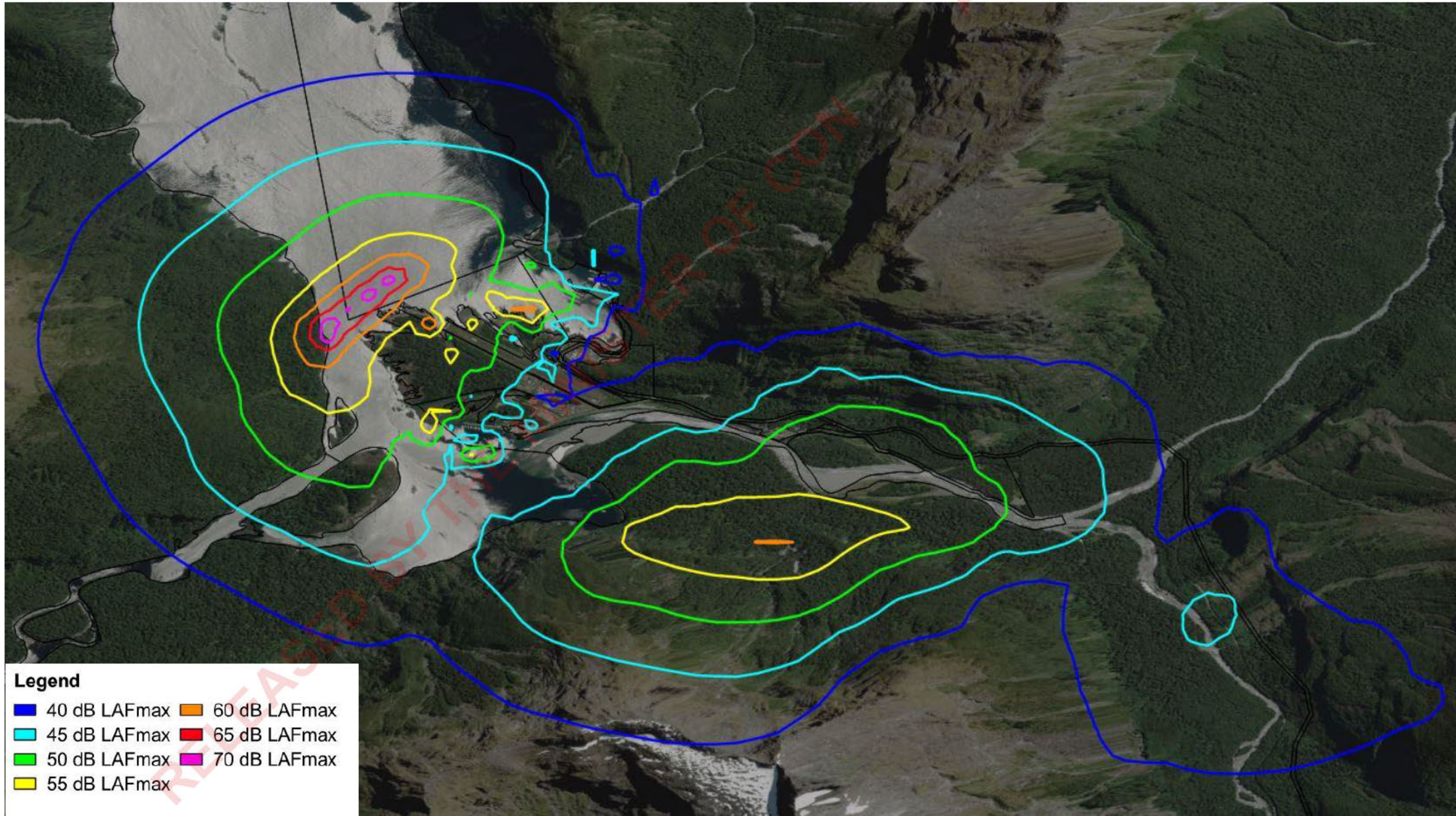
Site 2 (Little Tahiti) Findings

Noise Contours – day-night average



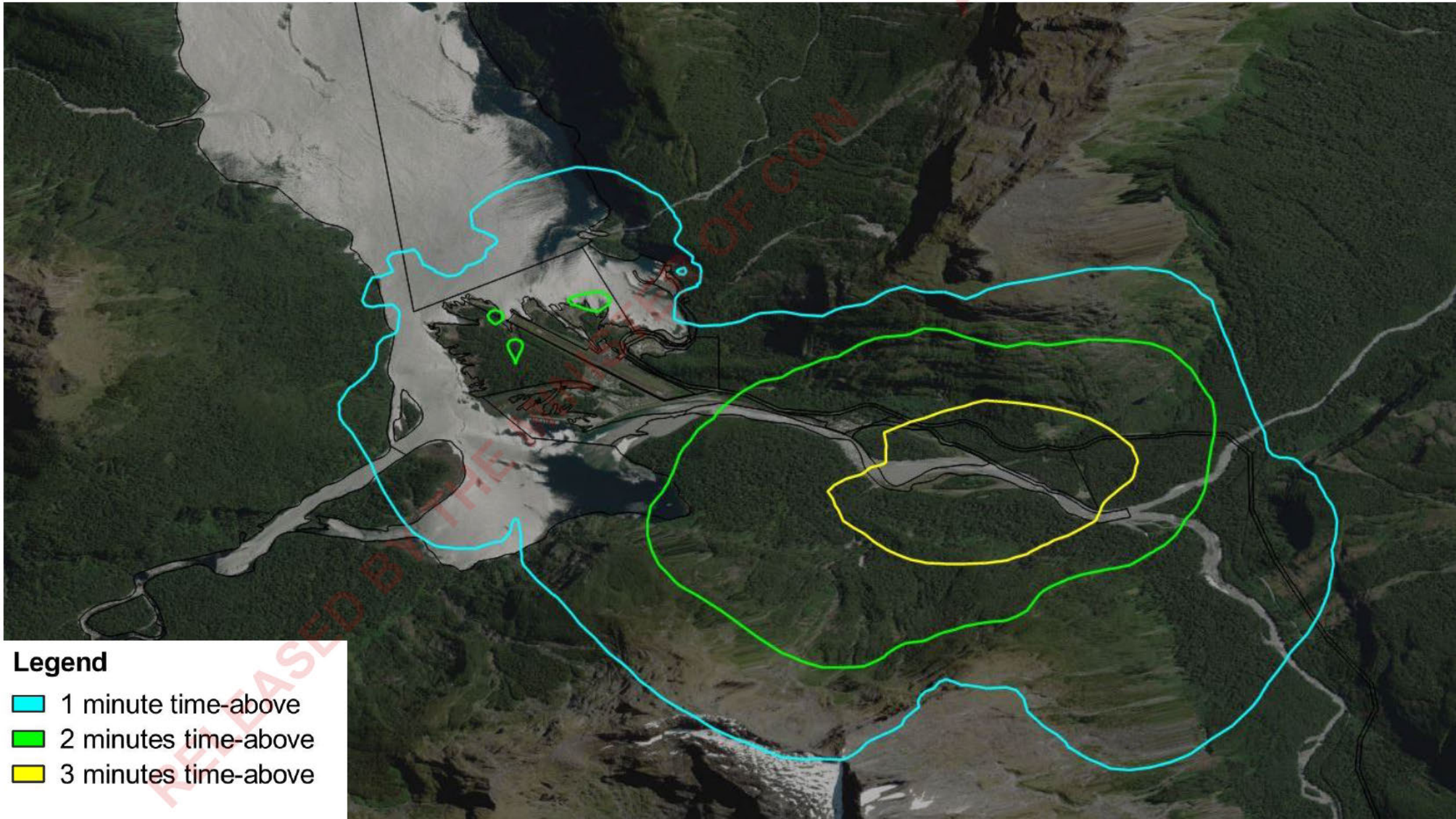
Site 2 (Little Tahiti) Findings

Noise Contours – maximum noise levels



Site 2 (Little Tahiti) Findings

Noise Contours – time-above, tranquillity



Site 2 (Little Tahiti) Findings

Noise Assessment

Parameter	Description
Day-night-average	Milford Sound Lodge and campervan park to the west of the proposed Little Tahiti heliport are the only developed locations which are predicted to receive noise levels greater than 50 dB L_{dn}. Noise at other locations are either roads or are undeveloped areas. Milford Sound Lodge is predicted to receive noise levels up to 58 dB L_{dn}. Based on WHO research, noise from aircraft at this level would result in 32% of people being highly annoyed. This location is likely to receive lower noise from existing aviation activities and as such the change in aviation noise at this site is likely to be high. As there are no night flights, there is no risk of leep disturbance from the operation of the heliport
Maximum noise level	Due to the flight paths, the noise levels for helicopter movements from the Little Tahiti site are predicted to be similar to those at the Deepwater Site, and as such the same comments apply. Milford Sound Lodge and Campervan Park are predicted to receive noise levels of 50 dB L_{AFmax}. Maximum noise levels o 50 dB L_{AFmax} are unlikely to impact normal voice effort conversations outdoors.
Tranquillity	The time-above noise level has been set to 32 dBA, which is when the tranquillity level is likely to fall below 8 based on national research. No area within Milford Sound will have a Tranquillity Rating of 8 or higher for a full day. All areas of Milford Sound township are predicted experience tranquillity levels below 8 for at minimum 1 minute of each helicopter flight (arrival and departure). This equates to 2 – 3 hours a day that any area of Milford Sound township would experience tranquillity rating of lower than 8. Bowen Falls is predicted to have a tranquillity rating of less than 8 for 2 hours a day. Milford Track Trailhead/Sandfly Point are predicted to experience less than 1 minute of tranquillity degradation for each helicopter movement.

8. Capacity Assessment

Capacity Assessment

Analytical models are developed for estimating the theoretical capacity of the airside subsystems.

- FATO
- Helicopter Parking Stands

The heliport capacity is determined by the minimum capacity among the capacities of the subsystems.

FATO Capacity

The ground capacity of the FATO can be estimated based on the FATO occupancy time of each helicopters and the separation (headway) minima required between two landings.

Occupancy Time - Ideally at airports, a fixed wing aircraft takes about 50-60 seconds to touch down and clear the runway for next movement. So, it is reasonable to assume 40 seconds for helicopters to clear the FATO and move to the respective stands.

Landing/Approach Separation Minima - for study purposes minimum separation between two landings is considered as 3 nautical miles. And this can be translated into time using an approach speed of 100 knots.

3X(3600 seconds/90 knots) = 120 seconds

Number of landings that can be accommodated in a **single FATO per hour** will be = 3600/(40+120)= **22 landings/hr**

However, the FATO capacity can be increased by inserting a take-off between any two landings without affecting landing intervals. Hence, the number of operations per FATO might be doubled (i.e., 44 combined movements with consecutive landing and take-off) during periods with similar numbers of take-offs and landings by alternating such operations on one FATO.

For this study, it is reasonable to assume 22 landings/hr (or 44 combined movements) per FATO to be conservative. And for a day (10-hr window period 8 AM – 6 PM) is approximately 220 landings (or 440 combined movements).

Capacity Assessment

Stand Capacity

The stand capacity is mainly determined by stand occupancy time. s9(2)(a) [redacted] operating flights to tourist traveling from ZQN to MFN , provided helicopter shut down time at MFN for different tourist packages as below.

Milford Sound, Flight 201 (**scenic flight) – approx. 30 minutes**
Milford Sound, Flight 203 (**one of their most popular flight) – approx. 30 minutes**

For the (Heli- Cruise – Heli) package from ZQN to MFN, s9(2)(a) confirmed that helicopters shutdown and stay in Milford when they have clients completing the cruise. And confirmed the shutdown time is approx. **2 hours 20 minutes when on Milford Sound + Cruise trips**

In addition to the above, a stand utilisation factor is considered in the calculation. This utilisation factor accounts for demand variability and for the time required to manoeuvre helicopter in and out of stands. Typically, the gate utilisation factor at conventional airports varies between 0.5 and 0.8 (source: FAA)

For Concept 1, a utilisation factor of 0.6 is considered due to constrains such as single FATO for all the 11 stands and dependent hover taxi movement. Whereas for Concept 2, a utilisation factor of 0.8 is considered because of the efficient pier type configuration of parking stands and helicopters being able to land/take-off from two FATO's.

Stand Capacity (Flights/day)			
	Concept 1 11 stands	**Concept 2 8 Stands**	**for Every Additional Stand**
Utilisation Factor	0.6	0.8	
Turnaround Time/Shutdown Time - 0.5 hr	132	128	12-16
Turnaround Time/Shutdown Time - 2.5 hr	26	25	3

See **Appendix A** for responses from s9(2)(a) [redacted]

Capacity Assessment

- We have proposed deterministic models to estimate the theoretical capacity of each of the subsystem: FATO and stands. The lowest capacity value among these subsystems is assumed to be the total system capacity.

- The FATO capacity per day (10 hr period) is 220 landings per FATO. This number can be increased (to 440 combined movements) by inserting a take-off between any two landings without affecting the landing intervals.

- The stand capacity results based on concept 2 (assuming worst case – A total of 8 number of stands)

    - With a shutdown time of 0.5 hr the heliport can accommodate 128 flights/day (256 combined movements), for every additional stand the system can accommodate 12-16 more flights.
    - With a shutdown time of 2.5 hr the heliport can accommodate 25 flights/day (50 combined movements), for every additional stand the system can accommodate 2 more flights.

- Preliminary results show the stand capacity is more likely to be critical than FATO capacity. Based on concept 2 with 8 parking stands the heliport can accommodate anywhere between 25-128 flights/day (50 to 256 combined movements) depending on the shut down time of each flight.

9. Considerations of future Urban Air Mobility hub requirements

EVTOL – Volocity

- Currently, the NZ CAA does not have a guidance on the vertiports. However, CASA (Australian) does ***AC 139.V-01v1.0***.

- Please see next slide comparing the physical characteristics of vertiports with heliports. The similarities in design standards can be observed.

- The concept in this study is planned to be able to accommodate the H125 helicopter. The H125 is a larger than the Volocity (D value of H125 is 12.94 and D value of Volocity is 11.3m). So, this provides flexibility to convert the space into an Urban Air Mobility hub in the future.

Volocity Charachteristics

1 General	
Capacity	2 pax incl. hand luggage
Aspired Certification	EASA SC-VTOL, category enhanced
Power type	Electric / batteries
2 Performance	
Max. take-off mass (MTOM)	900 kg
Max. payload	200 kg
Operating weight empty (OWE)	700 kg
Range	35 km
Max. airspeed	110 km/h
3 Structures	
Materials used	Composite
Overall height	2,5 m
Diameter of the rotor rim incl. rotor	11,3 m
Diameter of the rotor rim excl. rotor	9,3 m
Diameter of a single rotor	2,3 m
Number of rotors	18
4 Powertrain	
a) Power supply & battery	
Power supply	9 battery packs
Battery type	Lithium-ion
Battery system	Exchangable rechargable battery packs
Battery swapping time	5 mins
b) Motors	
Engine type	Brushless DC electric motor (BLDC)
Number of motors	18

Limiting Dimension – D Value

Comparing the Physical Characteristics– Heliport/Vertiport

	Heliport – ICAO Annex 14 Vol II	Vertiport - CASA AC 139.V-01
Final Approach and Take-Off area (FATO)		
Length (side length of square) if proposed in shape of a circle (then min diameter)	1.5D	1.5D
Touchdown and lift-off areas (TLOF)		
Dimensions (can be external diameter of circle)	Within FATO 0.83*D	0.83D
FATO Safety Area		
Dimensions	.25D	3m or .25D
Air Taxiway and Air Taxi-routes		
Width	2 times overall width of the helicopter	EVTOL air taxi-route should have a minimum width of twice the overall width of the design aircraft it is intended to serve
Stands		
Dimensions	A circle of diameter 1.2 * Design D of the Design Helicopter	A circle of diameter of 1.2 Design D, when there is a limitation on manoeuvring and positioning, of sufficient width to meet the requirement above, but not less than 1.2 times overall width of design aircraft.

10. Summary and Next Steps

Summary of findings

Category	Site 1 (Deepwater Basin)	Site 2 (Little Tahiti)
OLS Obstacles	The proposed FATO orientation is free of obstacles. The terrain does not infringe the approach or take-off surface.	The OLS in the proposed direction for the FATO in site 2 is not infringed by the terrain. However, there are dense trees/vegetation around this site which infringes the OLS and must be trimmed or removed to enable heliport operations at Little Tahiti.
Environmental	The environmentally sensitive areas are not found to be significantly impacted due to this proposal and likely to be manageable.	The Little Tahiti site is situated in a location surrounded by dense vegetation and requiring much work to have an operational heliport. Also, there are some portions in the site designated as environmentally sensitive. This requires further investigation to confirm impacts as part of the heliport proposal.
Noise	The tranquillity rating in Milford Sound township will be below 8 for 4 - 8 hours a day, depending on the proximity to the heliport. Noise levels, particularly on the Milford Sound Foreshore Walk point lookout and swing will require raised voice effort during helicopter take-offs and/or landings.	The tranquillity rating in Milford Sound township will be below 8 for 2 - 3 hours a day. While average and maximum noise level impacts from aircraft are similar to Site 1, the Milford Sound Lodge and campervan parking area are likely to require raised voice effort to communicate during helicopter take-offs and/or landings, which is not experienced for Site 1.

Next Steps

Key assumptions have been developed for this feasibility assessment. During the next stage of the project, it is recommended that the following works are undertaken:

- Study the applicability of existing flight circuit with the proposed approach/take-off orientation of the helipads (FATO).
- Undertaking specific research for using/modifying the TRAPT for Milford Sound based on the research undertaken at Aoraki Mt Cook.
- Noise monitoring to quantify the existing noise environment with and without aircraft.
- Undertake further computational noise modelling to include detailed flight paths of both scenic flights and transfers (such as between Queenstown and Milford Sound), different makes/models of aircraft used, taxiing of aircraft, non-helicopter operational noise.
- Noise modelling/monitoring of the existing helicopter/fixed wing noise generated by the existing airport to compare to the proposed future heliport(s).

Appendix

Appendix A – Responses from Helicopter, Queenstown

s9(2)(a) [redacted]

Responses from s9(2)(a) [redacted]

Particularly for the Milford Sound+Cruise

Please note, we have two other scenic flights that also land in Milford, both of these flights shutdown for approx. 30 minutes at the Milford Sound Airport.

Milford Sound, Flight 201

Milford Extended, Flight 203 (one of our most popular flights)

• Will the same helicopter that is taking the pax to cruise will stay at MFN and pick up the pax back after the cruise to ZQN or will it be a different helicopter based on availability?
I can confirm that our helicopters shutdown and stay in Milford when we have clients completing the cruise.

• Ideally or on an average what is the dwell time (the time helicopter stays on ground at MFN airport)?

They typically spend approx. 2 hours 20 minutes on the ground when on the Milford Sound + Cruise trips, but it can sometimes be slightly longer.

Thanks in Advance!

Appendix B – Helicopter Noise Review

Consultant Design Note

To	s9(2)(a) Milford Opportunities Project
From	George van Hout
Date	9 May 2024
File/Ref	240509-6VO060-GvH-M1-Rev3-Milford Sound Helipad Feasibility
Subject	**Milford Sound Piopiotahi Heliport Feasibility Assessment – Helicopter Noise Review**

WSP has been appointed by the Milford Opportunities Project (MOP) to predict the noise from two heliport location options Milford Sound. The development of either option would include the removal of the existing Milford Sound Aerodrome (not included as part of this review).

The purpose of this memorandum is to determine:

- Whether any receptors receive an unreasonable level of noise under Section 16 of the Resource Management Act 1991, and
- To determine the likely impact on the environment under Section 4 of the National Parks Act 1980.

This report is necessarily technical in nature, and as such a glossary is provided in Appendix A.

1 Acoustic Criteria

Section 16 of the Resource Management Act 1991 (RMA) requires occupiers of land to adopt the best practicable option to ensure that the emission of noise from that land does not exceed a reasonable level.

Section 4 of the National Parks Act 1980 requires National Parks to be preserved as far as possible in their natural state and preserving, in perpetuity, National Parks for the benefit, use and enjoyment of these public areas. Undue noise is likely to reduce the natural state of the environment and the enjoyment of users in these spaces.

Suitable acoustic criteria are discussed in the following sub-sections.

1.1 New Zealand Standard NZS 6807

NZS 6807[1] is used throughout New Zealand to assess the impacts of noise from helicopters on existing or proposed land uses around helipads. This standard is also referenced in the National Planning Standards. The criteria in NZS 6807 have been adopted as a *reasonable level of noise* under the RMA 1991 to assess the noise impact from any of the two helipad options.

Noise limits for helicopter landing areas are outlined in Table 1 of NZS 6807 and are reproduced in Table 1. These apply at or within the boundary (or notional boundary) of adjacent land uses.

[1] New Zealand Standard NZS 6807:1994 *Noise Management and Land Use Planning for Helicopter Landing Area*

Table 1: NZS 6807 Table 1 limits of acceptability

AFFECTED LAND USE	L_{dn} DAY-NIGHT AVERAGE SOUND LEVEL (dBA)	L_{max} NIGHT-TIME MAXIMUM SOUND LEVEL (dBA)*
Commercial	65	n/a
Residential	50	70
Rural (at the notional boundary)	50	70
Residential (internal)	40	55

* Night is defined as between 2200-0700 hours

Any buildings that receive outdoor noise levels greater than those specified in Table 1 above shall be acoustically insulated so that the internal noise levels are achieved at the new heliports' expense. Any new buildings within the external noise limits shall be designed to achieve the internal noise limits.

Noise assessments in line with NZS 6807 predict noise from helicopters landing/departing only. Noise from refuelling, people on site, vehicles, etc. will also need to be considered separately (outside of the scope of this assessment).

The assessment of helicopter noise under NZS 6807 considers the daily average number of helicopter movements over a worst-case 7-day period. Any ai craft movements which occur during the night-time period (2200 – 0700 hours) have a +10 dB penalty.

1.2 Tranquillity

Based on discussions with the Department of Conservation (DoC), the metric to assess noise impacts within National Parks in New Zealand (to determine whether the outcomes of the National Parks Act and Conservation Act are being met) is the tranquillity rating. The tranquillity rating is a single number on a scale of 1 – 10 where 0 is a non-tranquil environment (no natural features, loud anthropogenic noise, and high levels of litter/graffiti), and 10 is a highly tranquil space (low anthropogenic noise and all-natural features, such as a bush walk).

The Tranquillity Rating and Prediction Tool (TRAPT) developed in the UK[2] provides an objective tool to assess tranquillity by determining the level of natural features in a landscape, the anthropogenic noise level, and any moderating factors (such as litter, graffiti, etc.) based on subjective responses of people. While other tools (particularly in soundscape) have been developed, this tool is preferred by DoC as it allows quantification of the tranquillity of the environment.

A pilot study to determine a New Zealand National Park-specific TRAPT was developed in 2020[3]. This study concluded that a Tranquillity Rating of 8 or higher meant that "tranquillity levels a e considered excellent" which meant anthropogenic noise was required to be at or lower than 32 dB $L_{Aeq,T}$.

A Tranquillity Level of 8 has been adopted for this assessment.

[2] Article *Tranquillity rating prediction tool (TRAPT).* Robert J. Pheasant, Kirill V. Horoshenkov, and Greg R. Watts
[3] Article titled *Tranquillity mapping in New Zealand National Parks – A Pilot Study.* Greg Watts, John Pearse, Loannis Delikostidis, Johan Kissick, Brian Donohue, Jeff Dalley. Noise Mapp. 2020; 7, 303-315.

2 Proposed Sites

The proposed sites are outlined in this section.

2.1 Deepwater Basin

The proposed Deepwater Basin heliport is located to the south of the existing Milford Sound Aerodrome, as shown in Figure 1.

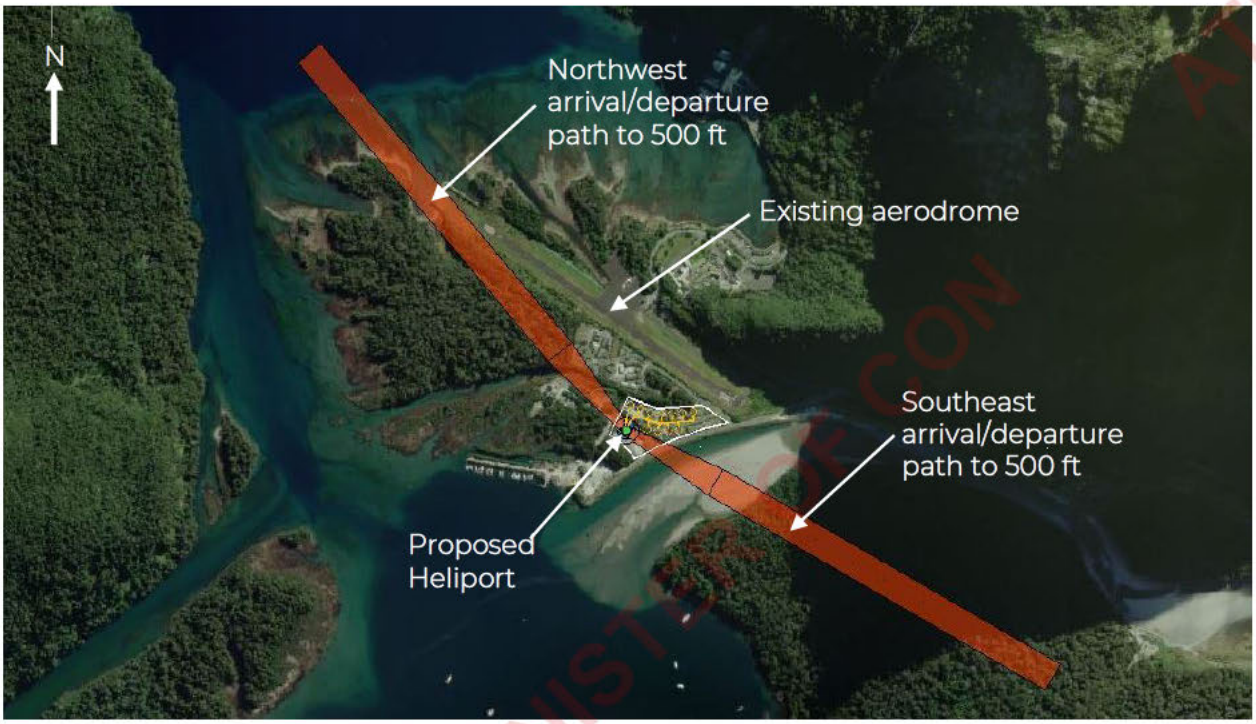


Figure 1 Deepwater Basin heliport and flightpaths

2.2 Little Tahiti

The proposed Little Tahiti heliport is located to the east of the existing Milford Sound Aerodrome, as shown Figure 2.

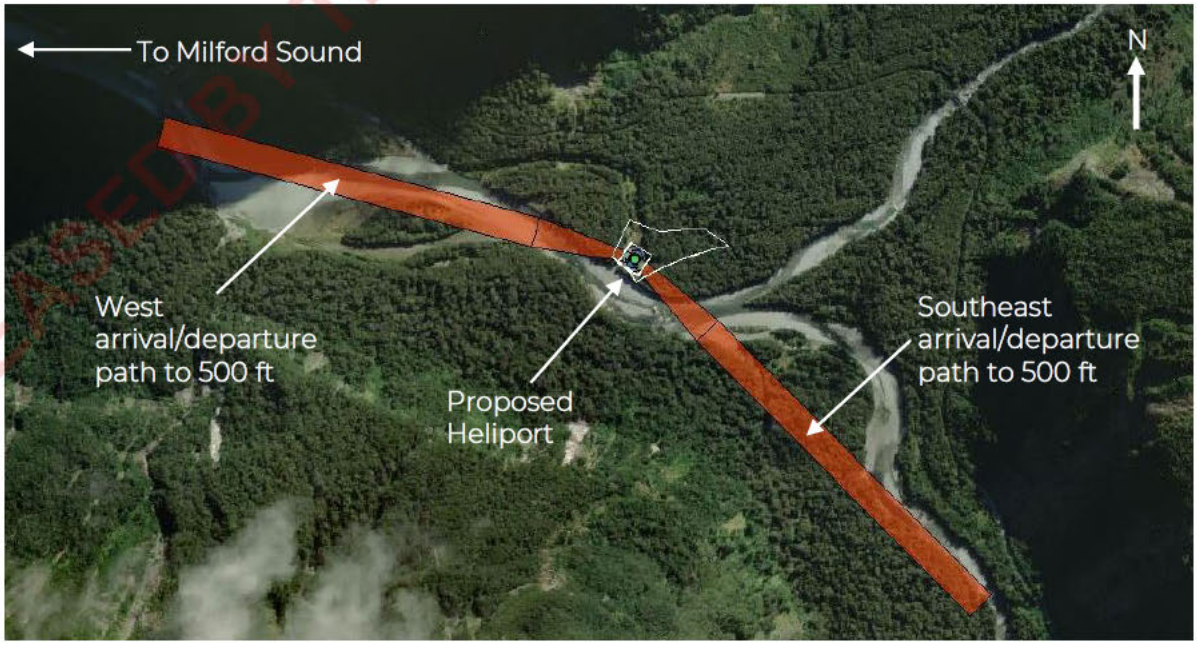


Figure 2 Little Tahiti heliport and flightpaths

3 Noise Prediction Methodology

Noise propagation from aircraft at the three sites has been assessed using the United States (US) Federal Aviation Administration's (FAA) Aviation Environmental Design Tool (AEDT) Version 3f (released December 2023) computational noise modelling software. The assessment considers attenuation due to distance, atmospheric absorption, and considers prevailing wind conditions at the site.

WSP undertook noise modelling for the day-night-average noise levels. These noise contours are based on the information provided Table 2, assuming 50% arrivals and 50% departures.

The Department of Conservation (DoC) undertook noise modelling of a single helicopter movement. Maximum noise level contours and the time-above noise contours were provided for arrival, departures and loops. The assumptions for this noise modelling are provided in Table 3. The time above contours were assessed to determine the time on an average day that areas within Milford Sound would experience less than a tranquillity rating of 8.

3.1 Day-night-average noise levels

The noise modelling parameters for both the Deepwater Basin and Little Tahiti heliports are presented in Table 2. This data has been sourced from the design team based on current and proposed use of the heliport, historical weather data, and flight procedures.

Table 2: Day-night average aircraft noise modelling parameters

PARAMETER	DESCRIPTION
Daily aircraft movements	256 movements a day (based on 128 flights a day)
Daytime Movements (7 am to 10 pm)	256 (occurring between 0800 – 1800 hours)
Night-time movements (10 pm to 7 am)	0 (helipad proposed to operate 0800 – 1800 hours only)
Flight path	80% movements northwest 20% movements southeast
Breakdown of aircraft	Airbus H125 (formally AS350 Squirrel)
Helipad location	Deepwater Basin: -44.6814387, 167.9527749 Little Tahiti: -44.6761586, 167.9240095

3.2 Tranquillity assessment

The noise modelling parameters for undertaking the tranquillity assessed at both the Deepwater Basin and Little Tahiti heliports are presented in Table 3. This data was sourced from DoC.

Table 3: Tranquillity rating aircraft noise modelling parameters

PARAMETER	DESCRIPTION
Aircraft Movement	1 movement
Flight path	As given in Figure 3
Breakdown of aircraft	Airbus H125 (formally AS350 Squirrel)
Helipad location	Deepwater Basin: -44.6763467, 167.92567 Little Tahiti: -44.6814415, 167.95277
Natural and Contextual Features	100%
Moderating Factor	0

The typical route of tourism helicopters was used in the noise modelling. 3D GPS coordinates were provided by the helicopter operators using a GNSS receiver which had a 10-second sampling rate with an accuracy of 2-5 metres. These arrival and departure tracks for each heliport location are provided in Figure 3.

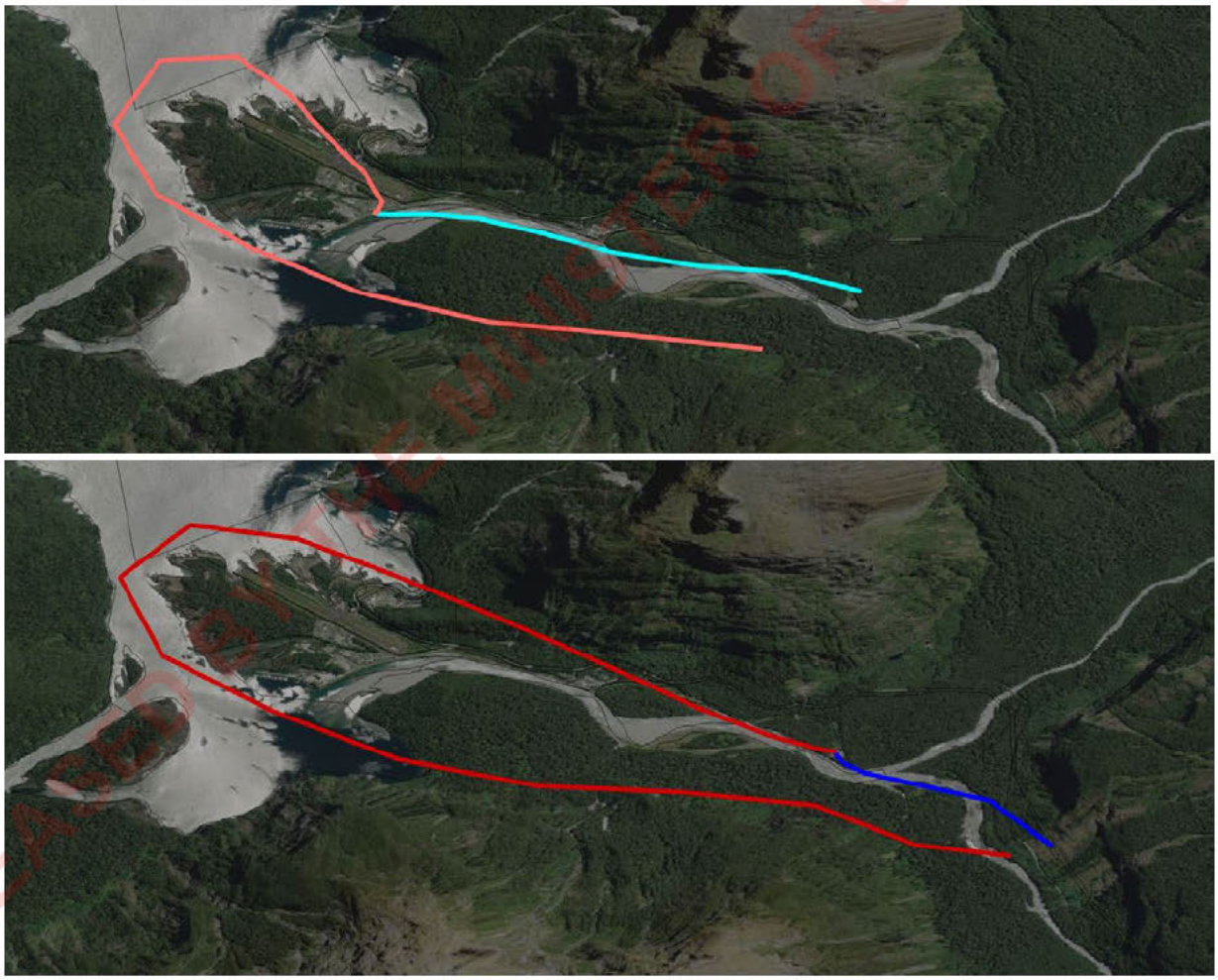


Figure 3 *Deepwater Basin (top) and Little Tahiti (bottom) flight paths for Tranquillity Rating assessment*

4 Predicted Noise Levels

This section outlines the predicted noise levels and tranquillity rating.

4.1 Day-night-average noise levels

Noise generated on a typical worst-case day was predicted. The following noise contours associated with helicopter movements on this worst-case day were produced:

- 50 dB L_{dn}: The "helinoise boundary" to determine the noise-sensitive buildings that would likely require construction upgrades to provide suitable internal noise levels.
- 60 dB L_{dn}: The point at which conversations outside may get disrupted/disturbed.
- 65 dB L_{dn}: Commercial buildings within this contour will likely require construction upgrades to provide a suitable internal noise level.

In addition, the World Health Organisation[4] recommends that the existing ambient noise levels in outdoor areas of parklands and conservation areas be preserved and the ratio of anthropogenic noise to background noise is kept low.

4.1.1 Deepwater Basin

While there is currently an area of worker accommodation to the north of the proposed helipad, the master plan suggests that this is replaced by a bus layover. As such there would be no impacts from the proposed helipad.

Based on research by the World Health Organisation[5] (WHO), over 45% of people will be highly annoyed by noise levels of this magnitude from aircra t. Assuming all of these buildings are residential and there are 3 people on average in each building, approximately 30 people would be highly annoyed by the proposed heliport.

The Deepwater Marina buildings are predicted to receive noise levels in the order of 60 dB L_{dn}. When aircraft arrive or depart, speech will likely be disrupted in these outdoor areas. However, it is unlikely to disrupt typical non-noise-sensitive activities inside buildings.

The hotel and buildings in the township are predicted to receive noise levels between 53 dB L_{dn} and 58 dB L_{dn}. During helicopter overflights, noise levels will require raised voice effort, and may disrupt quiet indoor activities such as reading. Noise is not predicted to be at a level which impacts commercial activities. Based on the research by the WHO, noise levels of 55 dB L_{dn} are likely to result in 28% of people being highly annoyed in this area.

The ferry terminal is predicted to receive noise levels of 50 dB L_{dn} or less. Noise at this location is likely acceptable and reasonable. Likely, conversations using normal voice effort will be able to occur during aircraft operations in this location.

The Milford Sound Foreshore Walk between the lookout/swing and ferry terminal ranges in noise level from 58 dB L_{dn} (lookout end) to 50 dB L_{dn} (ferry terminal end). Closer to the proposed helipad, a raised or loud voice effort will be required when helicopters are arriving or departing to be audible.

The locations and predicted noise levels are presented in Figure 4.

[4] *Guidelines for Community Noise,* published by the World Health Organisation dated April 1999
[5] *Environmental Noise Guidelines for the European Region*, published by the World Health Organisation, dated 2018.

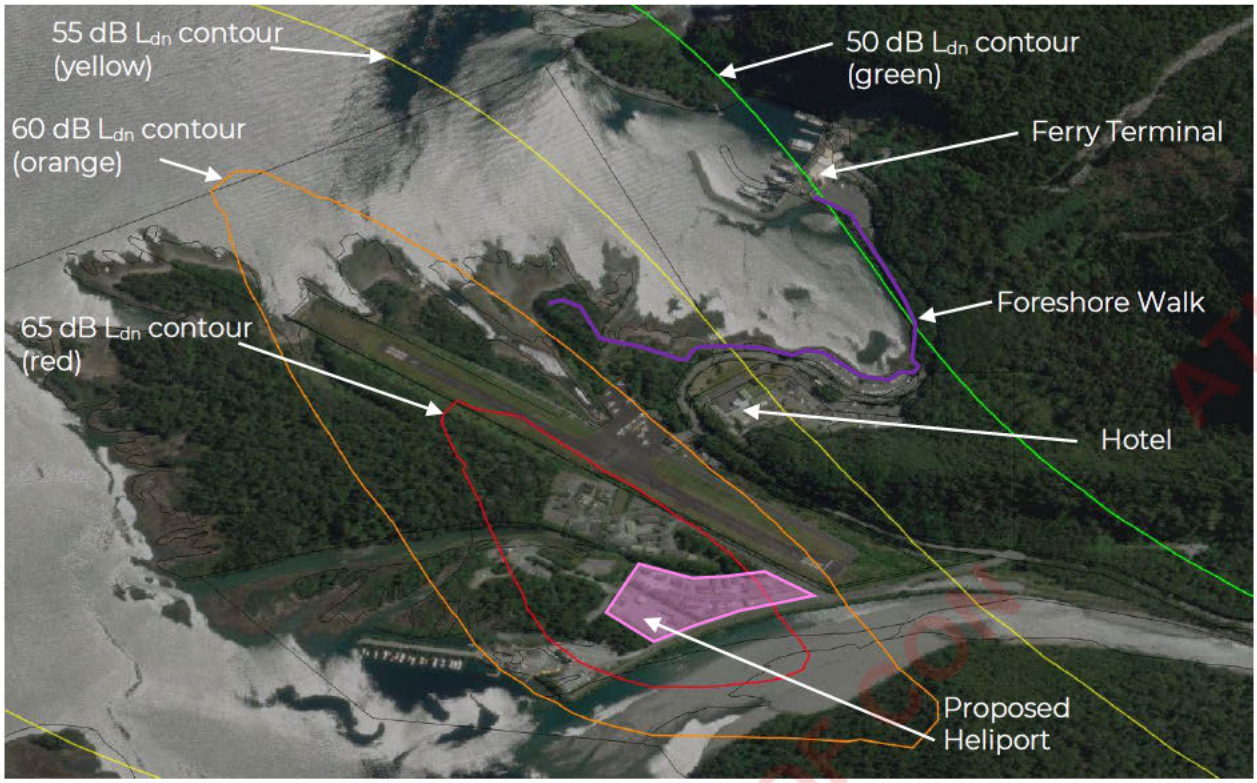


Figure 4 Location and noise contours for Deepwater Basin site

As there are no night flights, there is no risk of sleep disturbance from the operation of the heliport. This remains a key risk if the heliport is upgraded to be able to receive night flights on a regularly scheduled basis.

4.1.2 Little Tahiti

Milford Sound Lodge and a campervan park to the west of the proposed Little Tahiti heliport are the only locations which are predicted to receive noise levels greater than 50 dB L_{dn}. This area is predicted to receive noise levels of up to 58 dB L_{dn}. This area is shown in Figure 5.

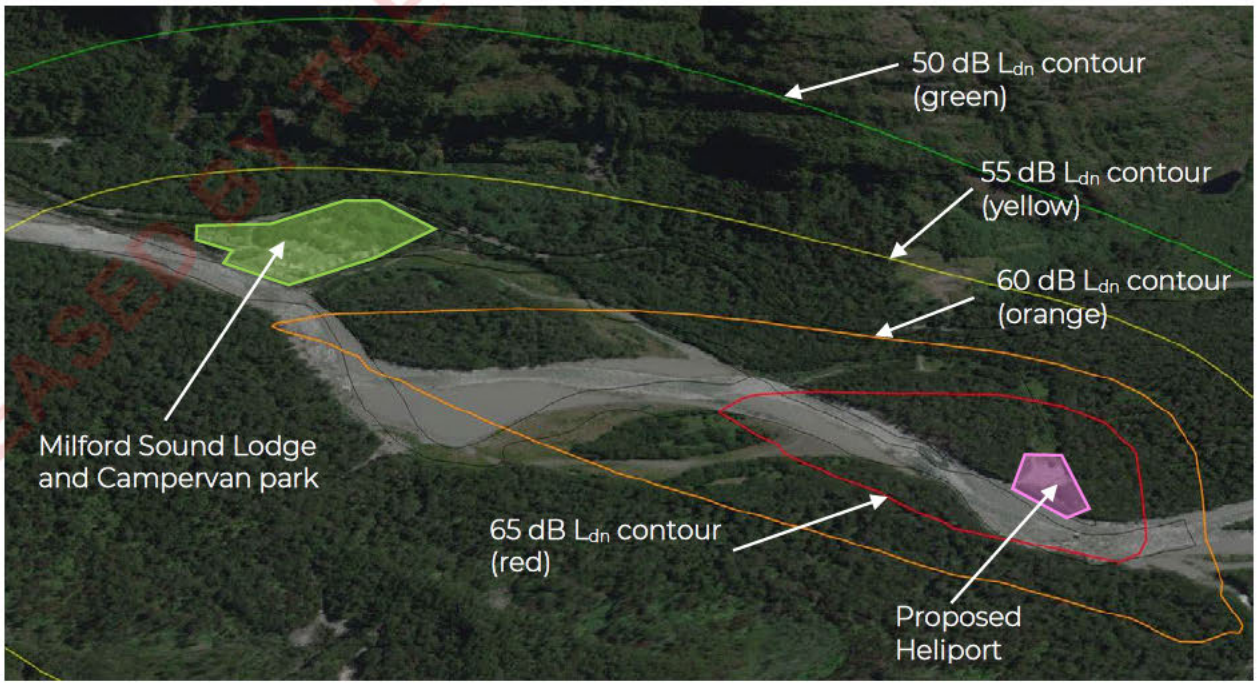


Figure 5 Location and noise contours for Little Tahiti site

The level of noise predicted over the campervan park site will likely require raised or shouted voice effort when helicopters fly over to be audible. This level of helicopter flyovers may also disrupt quiet indoor activities such as reading.

Based on the research by the WHO, noise levels of 58 dB L_{dn} are likely to result in 32% of people being highly annoyed in this area. Note that this research is based on people living and/or working in an area, not transient accommodation. As such annoyance factors may change.

While this location would experience noise from aviation currently (due to the existing airport) and road traffic noise, it is likely at a lower level than what is predicted during the operation of the Little Tahiti heliport site.

As there are no night flights, there is no risk of sleep disturbance from the operation of the heliport. This remains a key risk if the heliport is developed to be able to receive night flights on a regularly scheduled basis.

4.2 Maximum Noise Levels

The maximum noise level contours presented in Appendix C provide the highest noise level generated at any point along the flight path. Typically, the highest noise level is around the helipad as the most thrust/acceleration is required to take off or slow for landing.

Maximum noise levels indicate the level of disturbance, primarily for sleep disturbance (i.e. will noise from aircraft wake a person sleeping).

Based on the provided maximum noise level contours, we have the following comments regarding the predicted maximum noise levels:

Deepwater Basin

- Noise levels at the marina to the south of the proposed heliport are predicted to be approximately 50 dB L_{AFmax}. The normal voice effort of one person talking 2 metres away is approximately 55 – 57 dB $L_{A\ q,T}$. Therefore, it is unlikely that helicopter noise will impact conversations in this area.
- Noise levels at the hotel and ferry terminal are predicted to be at or below 45 dB L_{AFmax} from helicopter arrivals or departures. At this level, there is no risk of conversation being disturbed or sleep disturbance.
- Noise levels on the point of the Milford Sound Foreshore Walk (near the swing and point lookout) are predicted to be up to 55 dB L_{AFmax}. During helicopter departures/arrivals from the west, raised voice effort will be required to converse between people.

Little Tahiti

- Due to the flight paths, the noise levels for helicopter movements from the Little Tahiti site are predicted to be similar to those at the Deepwater Basin Site, and as such the same comments apply.
- Noise levels at the Campervan Park along State Highway 1 are predicted to receive noise levels of 50 dB L_{AFmax}. At this level of noise, it is unlikely that helicopter noise will impact conversations, as people will be able to converse in normal voice effort.

In all cases, while ambient background noise measurements have not been undertaken anthropogenic noise from helicopters will likely be audible at all points within the Milford Sound township area during take-off and landings of aircraft.

Based on on-site surveys within Denali National Park in the US[6], all visitors who were not interested in air tours rated aircraft noise as being unacceptable over 54 dB(A). Based on the maximum noise level contours provided by DoC, a small area at the point of the Milford Sound

[6] *How much is too much? Methods for identifying threshold for soundscape quality and ecosystem services.* L.A. Ferguson, P. Newman, M.F. McKenna, D.H. Betchkal, Z.D. Miller, R. Keller, K.M. Fristrup, B.D. Taff, Applied Acoustics, April 2023.

Foreshore Walk (near the swing and point lookout) is likely to receive unacceptable noise levels.

4.3 Tranquillity Assessment

The time above contours provided by DoC are presented in Appendix D for Deepwater Basin and Little Tahiti. The time-above contours show the time (in minutes) the area of land is exposed to noise levels above 32 dB L_{AFmax} (determined to be the highest level of noise before the Tranquillity Rating is reduced below 8) for a helicopter flight (arrival and departure). Therefore, any land within the contours presented in Appendix D will experience parts of the day where tranquillity is less than 8.

Based on the noise contours provided by DoC:

- No area within Milford Sound will have a Tranquillity Rating of 8 or higher for a full day.
- At the marina to the south and the hotel to the north of the proposed Deepwater Basin heliport, a tranquillity rating of less than 8 is predicted for 2 minutes of each helicopter flight. Based on a total of 128 flights per day, this location will experience over 4 hours where the tranquillity will be less than 8 (40% of a 10-hour day).
- The point of the Milford Sound Waterfront Walk (near the swing and lookout) is expected to have a tranquillity rating of less than 8 for 3 minutes of each helicopter flight. This equates to over 6 hours where the tranquillity will be less than 8.
- The two lookout areas adjacent to the main waterfront carpark are predicted to experience noise levels above 32 dB L_{AFmax} for less than 2 minutes of each helicopter flight. For the 128 helicopter movements, this equates to approximately 3 hours and 50 minutes where the tranquillity rating will be less than 8.
- The tranquillity rating at Bowen Falls is predicted to be degraded below 8 for 2 minutes for each helicopter flight. Assuming 128 flights a day, Bowen Falls will have a tranquillity rating of less than 8 for 4 hours a day.
- Milford Track Trailhead/Sandfly Point including the building in this location is predicted to receive noise levels greater than 32 dB L_{AFmax} for 1 minute for each helicopter flight. Therefore, for over 2 hours a day, this area will have a Tranquillity rating of less than 8.
- This analysis assumes that there are 100% natural features in the landscape. The landscape element of the TRAPT equation may already result in lower Tranquillity Rating levels over parts of Milford Sound due to the current buildings, carparks, structures, boats, and aircraft in the environment. The quantification of this reduction is outside the current scope of this assessment.

4.4 Limitations of Study

Where flight numbers, distribution of day/night flights, different approach/departure tracks and profiles, and/or types of helicopters change from that used, the noise contours will change.

Noise has been assessed from aircraft arriving and departing the site only. No analysis has been undertaken on noise from the wider side (idling aircraft at gates, noise from vehicles on internal roads, etc.), or the construction of the site.

The impacts on the environment also depend on the change in noise level from the existing noise environment. No noise modelling has been undertaken of the existing airport at this stage. To provide a better indication of the effects, noise from the selected heliport option should be compared against the existing noise of the airport.

The day-night average noise level is an average 24-hour noise level, and the tranquillity assessment is averaged over a 10-hour operating window. Consideration will need to be given to any likely future operating rhythm to test the effect of 'pulsing' due to aircraft arrivals and departures synching with boat movements.

The maximum noise levels and tranquillity analysis are based on the noise contours produced by DoC. No verification of these contours and/or noise levels has been undertaken.

The assessment of tranquillity is based on research undertaken in Aoraki Mt Cook National Park[7]. This study is a pilot study with a limited dataset. It was also undertaken in a different National Park which may not produce the same dose-response as Milford Sound or Fiordland National Park. It is recommended that the Aoraki Mt Cook work is reproduced in Milford Sound.

The tranquillity rating assessment assumes 100% natural and contextual features and no moderating factors. Milford Sound includes tourism development, and therefore in some areas, the tranquillity rating may be lower.

This study assesses the potential noise impacts from two separate heliport options proposed when the existing Aerodrome is removed. A single option will be developed further in later design stages, and therefore each heliport has been assessed individually.

4.5 Further Work

This analysis has been undertaken to inform the feasibility of a heliport in Milford Sound and site selection if a heliport is considered. When a site is selected, the following works will need to be undertaken during developed design and consenting:

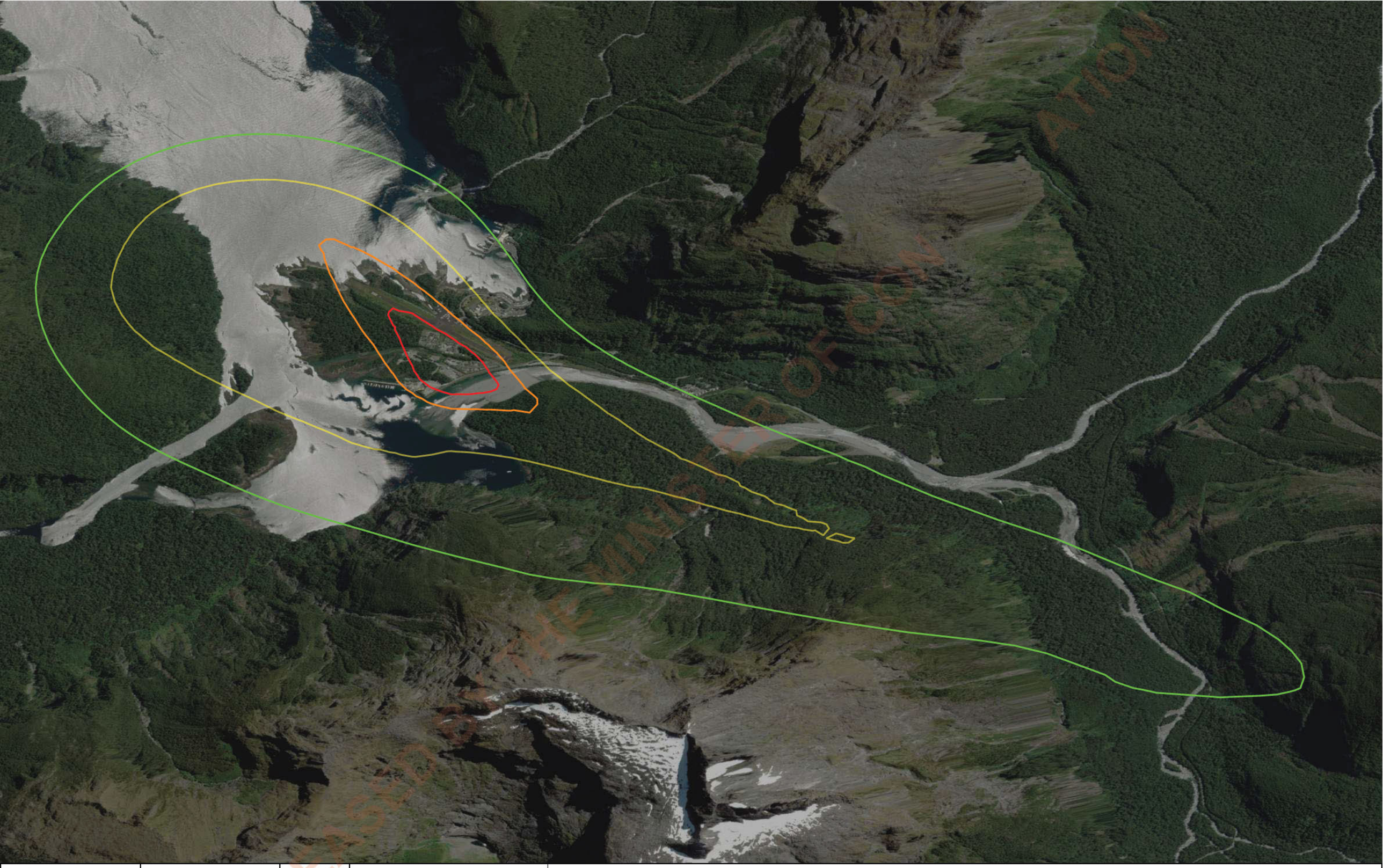
- Updating the New Zealand TRAPT for Milford Sound. This will build on the research within [2] and determine the appropriate noise level which would result in a tranquillity rating of less than 8. This will require a site visit to undertake noise measurements and recordings, and public survey and laboratory listening room surveys.
- Noise monitoring to quantify the existing environmental noise with and without aircraft operating.
- Undertaking detailed computational noise calculations of the proposed activity including:
    - Detailed flight paths of tourism operators for scenic flights and transfers (such as between Queenstown and Milford Sound).
    - Different helicopter make/models used.
    - Taxiing of helicopters
- Comparison of the proposed helicopter noise to the existing helicopter and/or fixed-wing noise generated by the existing airport.

[7] Article titled Tranquillity mapping in New Zealand National Parks – A Pilot Study. Greg Watts, John Pearse, Loannis Delikostidis, Johan Kissick, Brian Donohue, Jeff Dalley. Noise Mapp. 2020; 7, 303-315.

Attachment A: Glossary

Term	Definition
A-weighting	A frequency weighting devised to attempt to take into account the fact that human response to sound is not equally sensitive to all frequencies; it consists of an electronic filter in a sound level meter, which attempts to build this variability into the indicated noise level reading so that it will correlate, approximately, with human response
Audible	Audible refers to a sound that can be heard. There is a range o audibility grades, varying from "barely audible", and "just audible" to "clearly audible" and "prominent".
Air Noise Boundary	An area around an airport where the amount of aircraft noise will be at a level to requires appropriate land use control, generally to restrict any noise-sensitive activities occurring within the boundary. This is typically defined as the 65 dB L noise level contour.
Decibel	The decibel (dB) is a logarithmic scale that allows a wide range of values to be compressed into a more comprehensible range, typically 0 dB to 120 dB. Noise levels in decibels cannot be added arithmetically since they are logar thmic numbers. The human ear has a vast sound-sensitivity range of over a thousand billion to one, so the logarithmic decibe scale is useful for acoustical assessments.
L_{dn}	The day/night average noise level of all aircraft movements time-averaged over 24 hours with the addition of 10 dB to movements which occur from 2200 to 0700 hours the following day to take into accoun th increased annoyance caused by noise at night
L_{AFmax}	The max mum A-weighted, fast response, noise level recorded during the measurement period.
$L_{Aeq,T}$	The A-weighted sound pressure level in decibels of a continuous steady sound that has, within a specified time interval, T, the same energy as the sound being measured.
Noise	Noise is typically defined as unwanted, harmful, or intrusive sound.
Outer Control Boundary	The outer control boundary defines an area outside the air noise boundary within which any noise-sensitive activity will be designed against aircraft noise. This is typically defined as the 55 dB L_{dn} noise contour.
Octave	An octave is the interval between two points where the frequency at the second point is twice the frequency of the first.
Sound Exposure Level (SEL or L_{AE})	The A-weighted sound level which conveys the sound energy of an event over time in a period of 1 second.

Attachment B: Day-Night Average Noise Contours



Map: Deepwater Basin_V1	Author: GvH	N
Date: 12/04/2024		

To be read in conjunction with WSP Report.

Map Source: NSW SIX Maps

0 200 400 600 m

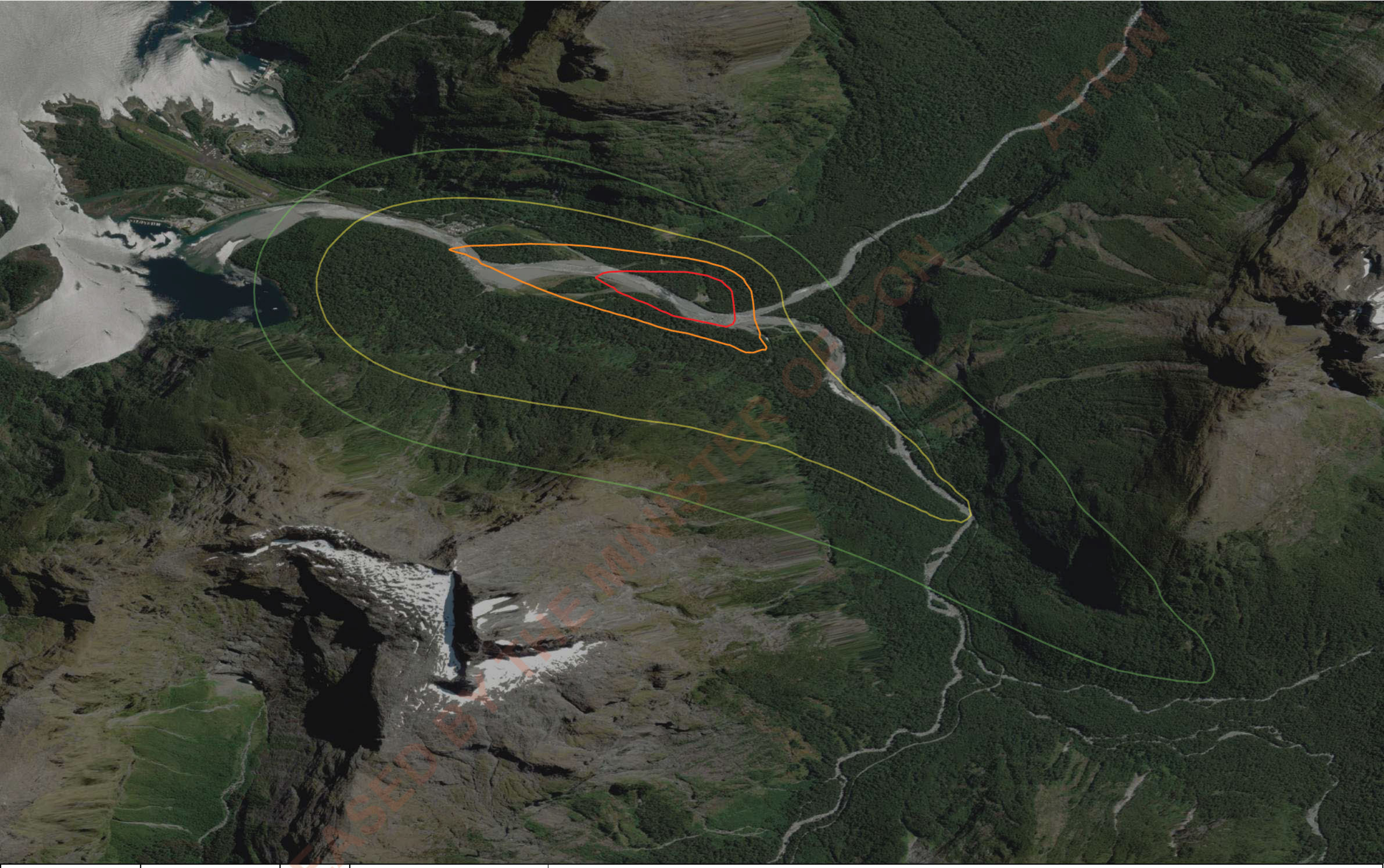
1:11,000.at A3

Legend

- 50 dB Ldn
- 55 dB Ldn
- 60 dB Ldn
- 65 dB Ldn

Milford Opportunities Project - New Helipad

New Deepwater Helipad day-night-avergae (Ldn) Noise Contours



Map: Little Tahiti_V1	Author: GvH	N
Date: 12/04/2024		

To be read in conjunction with WSP Report.

Map Source: NSW SIX Maps

0 200 400 600 m

1:10,998.620317 at A3

Legend

- 50 dB Ldn
- 55 dB Ldn
- 60 dB Ldn
- 65 dB Ldn

Milford Opportunities Project - New Helipad

Little Tahiti Helipad day-night-avergae (Ldn) Noise Contours

wsp

Attachment C: Maximum Noise Level Contours

Map: Deepwater_Lmax	Author: GvH	N
Date: 12/04/2024		

To be read in conjunction with WSP Report.

Map Source: NSW SIX Maps

0 200 400 600 m

1:12,000 at A3

Legend

- 40 dB LAFmax
- 45 dB LAFmax
- 50 dB LAFmax
- 55 dB LAFmax
- 60 dB LAFmax
- 65 dB LAFmax
- 70 dB LAFmax

Milford Opportunities Project - New Helipad

New Deepwater Helipad Noise Maximum Noise Contours (Lmax) from an arrival and depature (combined)

Map:Little Tahiti_Lmax	Author: GvH	N
Date: 12/04/2024		

To be read in conjunction with WSP Report.

Map Source: NSW SIX Maps

0 200 400 600 m

1:12,000 at A3

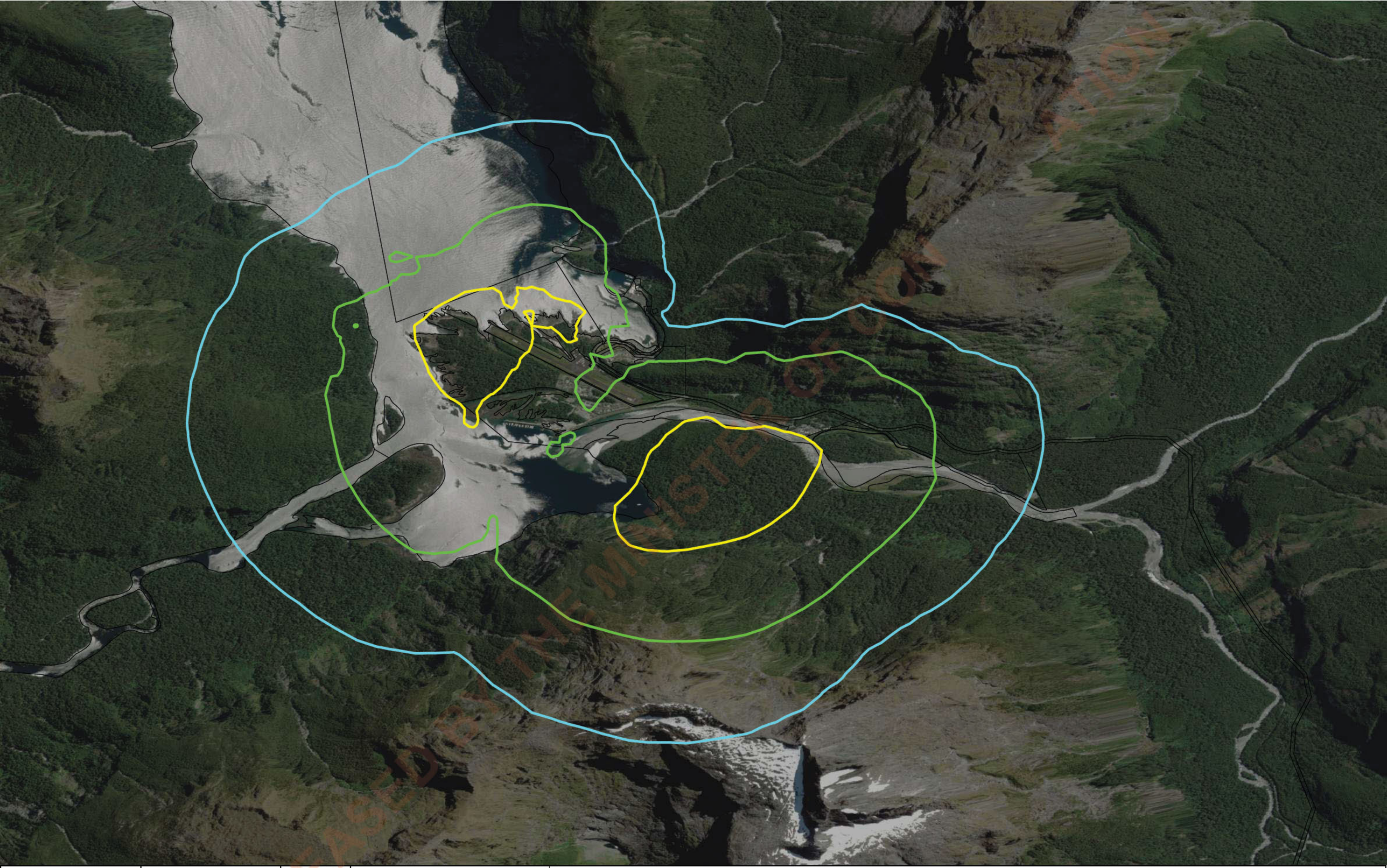
Legend

- 40 dB LAFmax
- 45 dB LAFmax
- 50 dB LAFmax
- 55 dB LAFmax
- 60 dB LAFmax
- 65 dB LAFmax
- 70 dB LAFmax

Milford Opportunities Project - New Helipad

New Little Tahiti Helipad Noise Maximum Noise Contours (Lmax) from an arrival and depature (combined)

Attachment D: Tranquillity Rating Contours



Map: Deepwater_TimeAbove	Author: GvH	N	0 200 400 600 m
Date: 12/04/2024			1:12,000 at A3

To be read in conjunction with WSP Report.

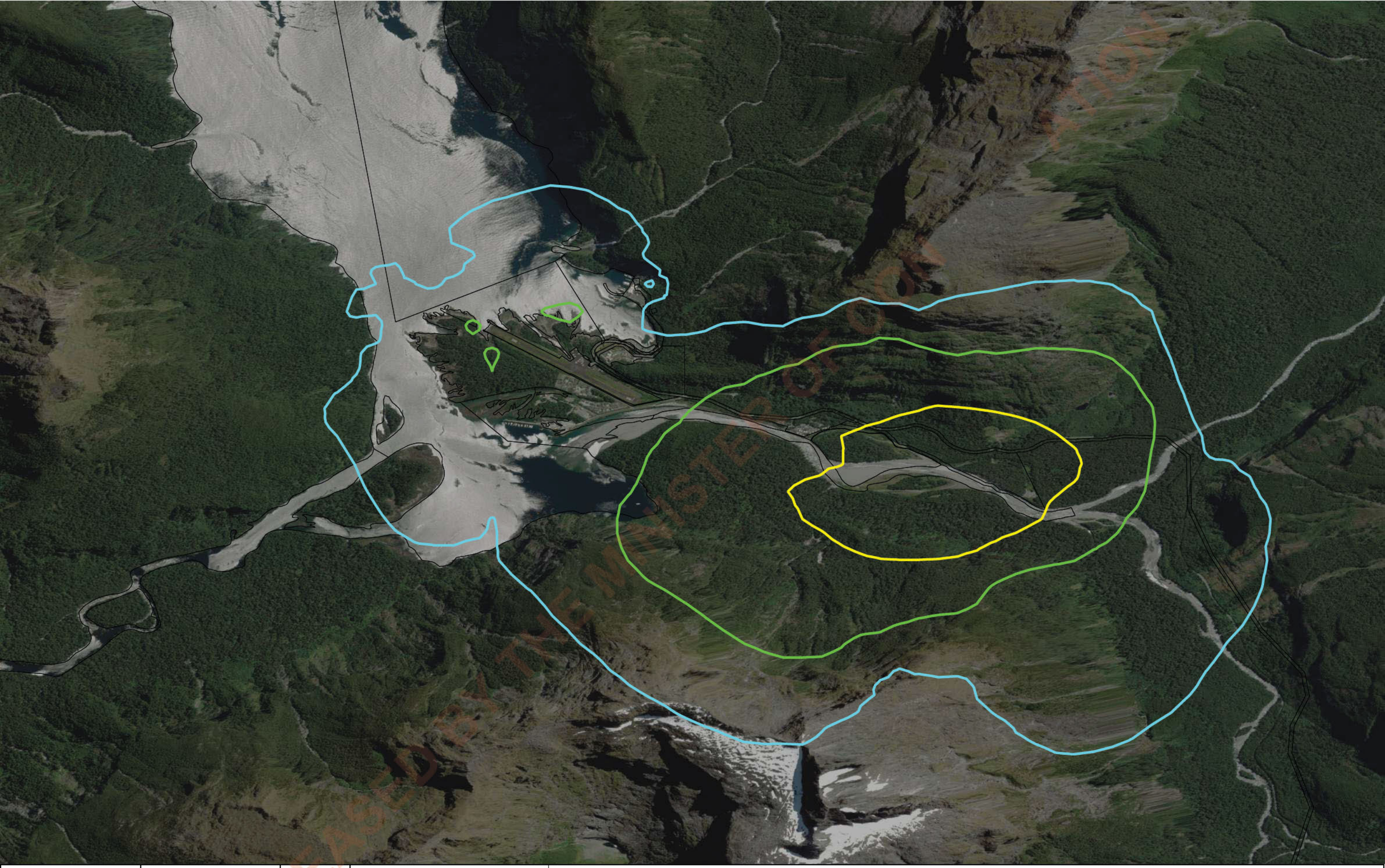
Map Source: NSW SIX Maps

Legend

- 1 minute time-above
- 2 minutes time-above
- 3 minutes time-above

Milford Opportunities Project - New Helipad

New Deepwater Helipad Noise time-above noise contours from an arrival and depature (combined)



Map: Tahiti_TimeAbove	Author: GvH	N
Date: 12/04/2024		

To be read in conjunction with WSP Report.

Map Source: NSW SIX Maps

0 200 400 600 m

1:12,000 at A3

Legend

- 1 minute time-above
- 2 minutes time-above
- 3 minutes time-above

Milford Opportunities Project - New Helipad

New Little Tahiti Helipad Noise time-above noise contours from an arrival and depature (combined)