Tashkent New Gateway Hub International Airport

The Republic of Uzbekistan

Noise Assessment

February 2026

Tashkent New Gateway Hub International Airport

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Noise Assessment

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1 INTRODUCTION

1.1 Entran Ltd have been commissioned to provide a noise assessment for the project known as the 'Tashkent Gateway Hub International Airport', Uzbekistan. This assessment reports the likely effects of noise due to aircraft operations at the proposed Airport. The assessment reports on the modelling of aircraft noise in the planned year of opening 2029 and 15 years later, 2044. This report provides an assessment of the aircraft noise impacts, and a discussion on mitigation measures that should be considered. Noise impacts from temporary construction works have also been assessed.

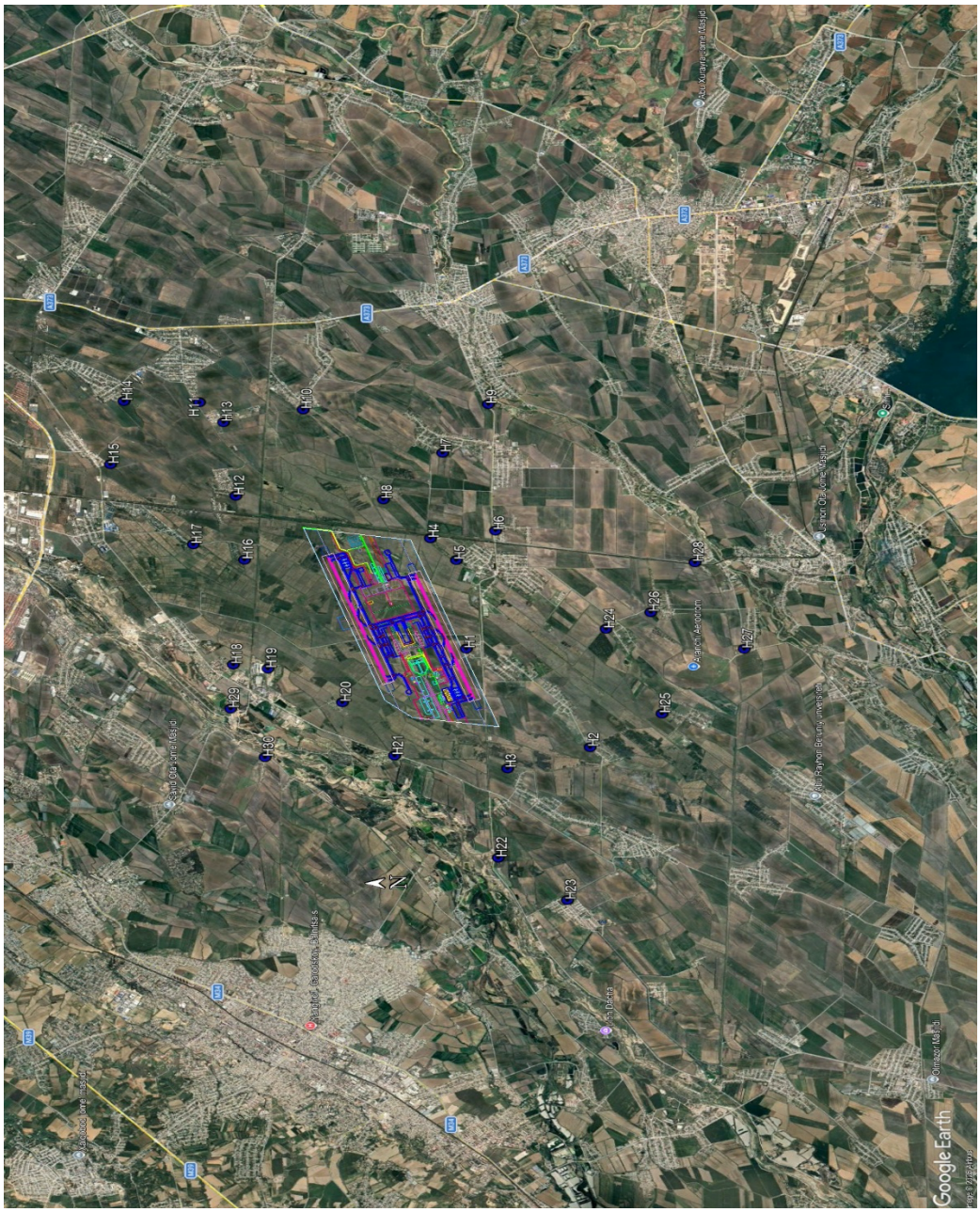
1.2 Islam Karimov Tashkent International Airport will be closed, and the proposed Tashkent Gateway Hub International Airport will take the air traffic in a new airport located some 7km Southwest of the outskirts of the Tashkent built up area (see Figure 1). The existing airport is within the city. It currently served approximately 78,000 Air Traffic Movements (ATMs) each year with flights throughout the day and night. Noise from the existing airport has not been evaluated in this study but is likely to be affecting a great number of homes and other noise sensitive receptors. Therefore, moving the airport to a new rural greenfield site will see a substantial improvement in the noise reduction for the City of Tashkent.

1.3 The proposed airport is in a predominantly rural area with the nearest city, Yangiyo'l (population 62,000) 7km West and numerous villages and small towns closer than this scattered around the airport. These form the Noise Sensitive Receptors for this study.

1.4 Based upon the information provided by Uzbekistan Airports, detailed aircraft noise modelling and assessment data is not available at this preliminary stage of the design. For example, the airspace for the new airport has not yet been designed, so no flight paths are available. Details of the aircraft fleet likely to operate in future are not known. Nonetheless, there is a requirement to model and assess aircraft noise for the ESIA. Therefore, the approach taken is to make a series of reasonable and where necessary worst-case assumptions to produce an initial noise model and assessment that can be used to inform the future design, in particular of the airspace, on the basis that the assessment will be updated at a later stage. The assumptions made are given in this report and so form an important element of the report for future reference.

1.5 This Report is necessarily technical in nature and contains terminology relating to acoustics and noise. Therefore, a glossary together with a brief introduction to the subject of noise has been provided in Appendix A.

Figure 1 New Airport Location & Noise Sensitive Receptors



1.6 The noise sensitive receptors are shown in Table 1.1

Table 1.1 Noise Sensitive Receptors

Receptor	Location	Eastings	Northings	Description
H1	Yangitosh	517043	4547487	Human Settlement
H2	Bessari	514078	4544629	Human Settlement
H3	Kushek	513433	4546526	Human Settlement
H4	Ostanovochniy Punkt	520375	4548326	Human Settlement
H5	Yangi hayoy	519719	4547726	Human Settlement
H6	Eliboytepa	520613	4546830	Human Settlement
H7	Changlitepa	522957	4548054	Human Settlement
H8	**unidentified Receptor**	521545	4549411	Human Settlement
H9	Yahshiovul	524429	4547009	Human Settlement
H10	Dungan	524254	4551266	Human Settlement
H11	Chibintepa	524463	4553656	Human Settlement
H12	Yo'ng'ichqala	521642	4552808	Human Settlement
H13	Identified Receptors	523863	4553098	Human Settlement
H14	Yangiturmush	524493	4555392	Human Settlement
H15	Saidovul	522585	4555697	Human Settlement
H16	Ko'ltepa (South)	519712	4552601	Human Settlement
H17	Ko'ltepa (North)	520172	4553780	Human Settlement
H18	Tashloq	516547	4552848	Human Settlement
H19	**unidentified Receptor**	516428	4552049	Human Settlement
H20	Qizil Sharq	515415	4550334	Human Settlement
H21	Iskandar	513812	4549128	Human Settlement
H22	Oramgoh	510735	4546730	Human Settlement
H23	Madaniyat	509460	4545136	Human Settlement
H24	Bog'chasaroy	517654	4544275	Human Settlement
H25	Isiamobod	515100	4542981	Human Settlement
H26	Yusupov	518158	4543248	Human Settlement
H27	Oronchi	517059	4541095	Human Settlement
H28	Yomgurchi	519670	4542237	Human Settlement
H29	**unidentified Receptor**	515215	4552904	Human Settlement
H30	**unidentified Receptor**	513753	4552108	Human Settlement

2 NOISE ASSESSMENT CRITERIA

Lender Requirements

2.1 The project will be co-funded by the International Finance Corporation/World Bank Group (IFC/WBG) and the European Bank Reconstruction and Development (EBRD).

2.2 The lenders have different approaches for the environmental assessments, but all rely on Good International Industry Practice (GIP) with only the IFC/World Bank Group setting out noise level criteria. The requirements of the EBRD are summarised in Appendix B.

Uzbekistan National Standards

2.3 Given the proximity of the nearby communities, it is expected that the applicable residential standards will be applicable to the Project. SanPiN No. 0339-16 "Sanitary rules and norms of planning and development of settlements of Uzbekistan provides criteria for noise levels at residential areas.

2.4 The guideline criteria for residential areas are set out in Table 2.1 below.

Table 2.1 National Noise Standards

Receptor	Uzbekistan, SanPiN No. 0325-16.	
	Daytime (07:00 to 23:00) $L_{Aeq,T}$ dB	Night-time (23:00 to 07:00) $L_{Aeq,T}$ dB
Residential, institutional, educational	55	45
Industry, commercial	75	70

2.5 There are no national standards specific to aircraft noise in Uzbekistan, only the general noise guidance in SanPiN No. 0339-16 *Sanitary rules and norms of planning and development of settlements*, which relates to planning new settlements.

IFC Guidelines

2.6 The *International Finance Corporation (IFC) Environmental, Health, and Safety Guidelines for Airports (2007)* give guidance on aircraft noise. They do not specify noise limits for airports but instead focus on measures to manage and minimise impacts. The guidance is quoted in full as follows:

The most significant sources of noise and vibrations from airport operations are aircraft during the landing and takeoff (LTO) cycles, followed by a variety of ground operations equipment including aircraft taxiing; operation of ground support vehicles (e.g. passenger buses, mobile lounges, fuel trucks, aircraft tugs, aircraft and baggage tractors, and dolly carts); aircraft auxiliary power units (APUs); and aircraft engine testing activities in airports with aircraft maintenance activities. Other indirect sources of noise include ground vehicle traffic from access roads leading to the airport.

Measures for the prevention, minimization, or control of noise and vibration impacts depend on land-use planning and management activities, which may be the primary responsibility of local authorities, or the type and age of flight equipment used by the airlines.

Recommended noise management practices include:

- *Planning of site for airport location (new developments and expansion of existing facilities), and orientation of routes for arriving and departing aircraft relative to actual and projected residential development and other noise sensitive receptors in the surrounding area. This may include coordination with local authorities with influence over land use planning and overall transportation planning activities;*
- *In areas where significant impacts are anticipated, implementation of preferred procedures and routes for landing and takeoff (LTO) to minimize potential noise from approaching and departing aircraft for noise-sensitive areas. These procedures may include instructions on the use of descent profiles or "noise preferential" routes (NPRs), such as the "continuous descent approach" to avoid noise-sensitive areas, the use of "Low Power / Low Drag" (LPLD) procedure to fly the aircraft in a 'clean' condition (e.g. no flap or wheels deployed) as long as possible to minimize airframe noise, and instructions on minimizing reverse thrust on landing. An alternative approach may include the dispersion of noise through equal use of multiple flight tracks as opposed to a preferential flight track;*
- *Use of night-time or other operating restrictions;*
- *If necessary, working with local authorities to identify and implement noise prevention and control strategies in noise abatement zones (e.g. sound insulation of buildings that are exposed to aircraft noise above levels stipulated by local authorities or limitations on night-time operation of certain landing routes);*
- *Reducing noise of ground operations at the source or through the use of sound barriers and deflectors, as described in the General EHS Guidelines;*
- *Provision of power supply to the aircraft to reduce or eliminate the need for use of APUs*

2.7 The Uzbekistan general guidance (SanPiN No. 0339-16) is similar to international standards for noise in general provided by the World Bank, which is described below, noting IFC do not set numerical standards for aircraft noise, as discussed above.

2.8 The World Bank Group EHS Guidelines include noise level guidelines, based on an interpretation of the relevant section of the WHO 1999 guidance concerning the effect of noise on people and implied potential health effects. These are presented below in Table 2.2.

Table 2.2 IFC/World Bank Group Noise Level Guideline (adopted from WHO guidance)

Receptor	$L_{Aeq,T}$ (dB)	
	Daytime 07:00 – 22:00	Night time 22:00 – 07:00
Residential, Institutional, Educational	55	45
Industrial, Commercial	70	70

2.9 The noise levels in the World Bank Group EHS Guidelines are the same as in Uzbekistan's Sanitary *rules and norms of planning and development of settlements*, with a minor difference of one hour in the definition of the day and night periods. The proposed airport will operate 24 hours a day, and night-time is the more sensitive period, so for this assessment the longer 9 hour night-time period has been adopted so as to not understate noise impacts.

2.10 These World Bank Group EHS noise guidelines are commonly applied to the assessment of fixed noise sources in industrial facilities and are used to design noise control measures such as building elements, noise attenuators, acoustic louvres, noise barriers etc, to meet the stated preferred noise standards. It is because such attenuation measures are not available to reduce noise from aircraft in flight that IFC do not apply the standards in this general guidance to aircraft noise. These noise levels are nonetheless a useful guide as to generally preferred noise levels, in situations where no other specific local guidance is available. They can be considered preferred noise standards that would apply if new housing was being considered in an area already affected by aircraft noise, rather than absolute limits on aircraft noise, and aircraft noise should be mitigated preferably to these levels but if not then as far as practicable. The assessment therefore makes reference to the following noise levels to discuss the results of noise modelling levels at residential noise sensitive receptors (as well as educational and institutional receptors) above which mitigation measures should be considered:

- Day $L_{eq\ 15\ hr}$ (0700-2200 hours) 55dB
- Night $L_{eq\ 9\ hr}$ (2200-0700 hours) 45dB

2.11 Aircraft noise levels just above these levels is not desirable and mitigation measures to reduce noise should be considered, but whilst the level of noise would cause some disturbance to a population overall, it is likely to be acceptable once minimised. As aircraft noise rises above these levels, the level of disturbance increases and there comes a point at which the effects can be judged as significant and noise mitigation becomes essential, and no new noise-sensitive receptors should be permitted.

2.12 For this airport, noise at night will be the key concern because the frequency of flight at night is almost as frequent as during the day and, as can be seen from the guidance described above, night standards are about 10dB lower than day standards, reflecting the greater sensitivity of people to disturbance at night, and in particular sleep disturbance.

2.13 The WHO Night Noise Guidelines 2009 gives guidance on the health effect of night noise including sleep disturbance. A level of $L_{eq,\ 8\ hour}$ night 45 dB is described in those guidelines as the level above which *'Adverse health effects occur frequently, a sizeable proportion of the population is highly annoyed and sleep-disturbed.'* (WHO, 2009). This level is widely adopted as the onset of significant sleep disturbance which should be avoided, for example for aircraft noise by considering noise insulation if no other options are available. In the WHO Night Noise Guidelines night is defined as 8 hours. In this assessment the preferred noise standard from IFC guidance is taken as a 9 hour night. This ensures a worst-case assessment.

Airside Vibration

2.14 Low frequency noise generated by airborne aircraft may result in perceptible secondary vibration such as window rattling within residential properties. Data gathered for a UK study (Research on the Potential Noise Impacts on the Historic Environment by Proposals for Airport Expansion in England (2014)) suggests that aircraft events that exceed 97 dB L_{Cmax} may cause windows to rattle in lightweight building structures with loosely fitted elements. For the purposes of modelling, an indicative 90 dB SEL contour has been adopted noting that for typical transportation noise events (like an aircraft or train pass-by), the SEL is often 5-15 dB higher than the maximum level.

2.15 Another issue associated with the aircraft events is potential vortex damage. However, based upon the distance of receptor locations from the airport, vortex damage is unlikely to ensue.

Ground Noise

2.16 Ground noise, in this context, encompasses noise attributable to aircraft taxiing on taxiways/aprons as well as noise due to auxiliary power units (APUs) as well as potential aircraft maintenance.

2.17 SanPiN No. 0339-16 “Sanitary rules and norms of planning and development of settlements of Uzbekistan applies for the assessment at nearby residential areas.

Road Traffic Noise

2.18 For the assessment of road traffic noise, criteria set out in SanPiN No. 0339-16 is referenced.

Construction Noise & Vibration

2.19 For temporary activities such as construction noise, it is often recognised that long term criteria such as that outlined in SanPin No. 339-16 are impractical. For the purposes of this assessment, a limit of 10 dB over the daytime value of both the national criteria and IFC criterion of 55dB has been applied to permit construction activities whilst offering practical noise protection for nearby noise sensitive properties. This limit maybe revisited once construction phasing/activities are finalised.

2.20 It is worth noting that the purpose of the target construction noise criteria is to control the impact of construction noise insofar as is reasonably practicable, whilst recognising that it is unrealistic for developments of this nature to be constructed without causing some degree of disturbance in the locality. Hence, even if the criteria adopted for this assessment is achieved, noise from construction activities is likely to be readily noticeable.

Construction Vibration

2.21 Vibration may be impulsive, such as that due to hammer-driven piling; transient, such as that due to vehicle movements along a railway; or continuous, such as that due to vibratory driven piling. The primary cause of community concern generally relates to building damage from both construction and operational sources of vibration, although, the human body can perceive vibration at levels which are substantially lower than those required to cause building damage.

2.22 Damage to buildings associated solely with ground-borne vibration is not common and although vibration may be noticeable, there is little evidence to suggest that they produce

cosmetic damage such as a crack in plaster unless the magnitude of the vibration is excessively high. The most likely impact, where elevated levels of vibration do occur during the demolition and construction phases, is associated with perceptibility.

2.23 BS5228 (construction noise) does not present vibration assessment criteria. However, BS6472:2008 'Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting)', provides guidance on the measurement and assessment of vibration within buildings which may cause adverse disturbance to human occupants. Vibration is most simply expressed as Peak Particle Velocity (PPV) values in millimetres per second (mm/s). Environmental vibration is generally in the frequency range of 1 - 80 Hz. Within this range, laboratory studies suggest that levels as low as 0.14mm/s are perceptible.

2.24 British Standard 7385 – Evaluation and Measurement for Vibration in Buildings, Part 2, Guide to Damage Levels from Groundbourne Vibration, 1993, provides frequency-dependent vibration guide levels for lightweight structures and heavier industrial or commercial buildings, below which the probability of cosmetic building damage would be negligible. In more general terms, the standard advises that the probability of cosmetic building damage tends to be zero at around 12.5mm/s.

2.25 Based upon the above, a pragmatic vibration level of 1mm/s has been selected as the target criteria to control the impact of construction vibration, with the criteria for assessing the magnitude of vibration impacts.

3 NOISE METHODOLOGY

AirNoise

3.1 Air noise has been modelled using the United States of America Federal Aviation Authority's Aviation Environment Design Tool (AEDT) version 3g/IMMI. The model uses the latest Base of Aircraft Data (BADA) database of over 5,000 aircraft which gives aircraft performance and noise data. It computes 3-dimensional flight paths, based on the 2-dimensional flight 'track' and the vertical flight profile that it computes from individual aircraft thrust and flap settings, aircraft air speed, and headwind data specific to each aircraft operation that the user defines. The model has been calibrated making use of available metrological and flight data.

3.2 The main data sources and assumptions used to build the aircraft noise model are summarised as follows.

Airport Geometry

3.3 The proposed airport layout was provided in Masterplan Phase 1 (ref BJ7312-NAC-XX-XX-DR-MP-0011). Georeferenced, this shows the two runways ends to be located as shown in Table 3.1.

Table 3.1 Runway End Coordinates

Runways Ends	Lat	Long	Height, m
07 Left (North)	41° 5'40.96"N	69°11'27.85"E	358
25 Right (North)	41° 6'24.91"N	69°14'8.48"E	369
07 Right (South)	41° 4'36.17"N	69°11'5.10"E	353
25 Left (South)	41° 5'20.68"N	69°13'48.66"E	363

3.4 A digital terrain map, sourced from the U.S. Geological Survey, was used to ensure aircraft height about ground was used when computing noise levels at ground level. Terrain in the surrounding area is mostly vegetated and was modelled as acoustically soft. The land on which the airport is being constructed slopes gently from East to West and it is assumed the runways will be at ground level.

3.5 The Masterplan does not show runway approach thresholds, so it is assumed they will be at each runway end and not displaced along the runway.

3.6 It is assumed the Instrument Landing System (ILS) will have a standard 3 degree approach slope.

Meteorological Conditions

3.7 Meteorological data analysed provided the following annual averages:

- Temperature – 14.1 °C
- Relative Humidity – 56%
- Pressure – 995 Pa

3.8 As a conservative assumption zero headwinds were assumed on all runways.

Noise Metrics

3.9 Noise contours have been produced to allow comparison with the Uzbekistan and World Bank Group general noise guidance (as discussed above) as follows:

- Daytime $L_{eq\ (0700\text{-}2200\ hours)}$ 55, 60, 65, 70 dB
- Night-time $L_{eq\ (2200\text{-}0700\ hours)}$ 45, 50, 55, 60, 65dB

3.10 $L_{eq\ (0700\text{-}2200\ hours)}$ and $L_{eq\ (2200\text{-}0700\ hours)}$ are the Equivalent Noise Levels over the 15-hour day (0700-2200) and 9-hour night (2200-0700) periods. Equivalent Noise Levels are logarithmic averages which, unlike common (arithmetic) averages, give a high weighting to peak noise levels such as those from relatively brief aircraft noise events. Equivalent Noise Levels have been found to correlate well with aircraft noise effects such as annoyance and sleep disturbance, because of their logarithmic nature.

Flight Paths

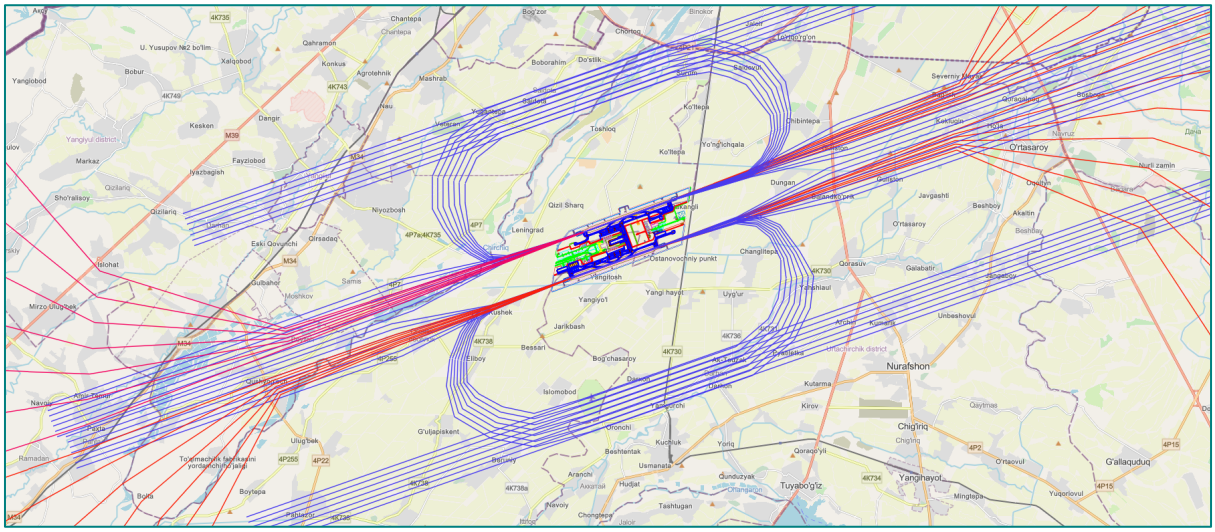
3.11 At this stage, there is no information on flight path routes to and from the proposed airport. Therefore, in order to carry out noise modelling at this stage, it was necessary to make assumptions as to where the aircraft flight paths may go. The flight path routes modelled to and from the proposed airport have been based on common operating procedures as see at the existing National Airport in Tashkent City, as discussed in the following paragraph. The modelling results can be used to inform the future design of the airspace (i.e. to reduce noise

impacts in populated areas) and once the airspace is designed the noise modelling can then be updated with the flight paths that have been designed to provide optimum conditions.

3.12 Flight path information for the current airport shows standard operation procedures where departing aircraft fly straight out to minimum heights (2,800ft (853m) to the West and 3,500ft (1067m) to the East) before turning South or go on flying straight ahead. Aircraft wishing to route North first turn South before looping round (outside the zone likely to be affected by noise) to avoid the other city airport and the city. For the proposed airport we assume these constraints will not apply, and for each runway there will be two departure routes, comprising straight departures to around 3,000ft (914m) then splitting to turn North from the northern runway, or to turn South from the southern runway, or going straight on from both runways. Thus, there will be 8 departure routes. The point at which the routes split will be after all aircraft can reach a safe height to do so, which, based on experience elsewhere, we assume will be 7.5km from the far runway end where the aircraft start their departure roll (about 3.5km from the near runway end). Arrivals are modelled straight in along the extended runway centre line. For both arrivals and departures, aircraft are spread (or dispersed) across 5 sub-tracks around the central track using typical RNAV (Area Navigation) dispersion functions. Beyond the 7.5km points departing dispersion was increased by a factor of three to reflect some aircraft dispersing away from the modelled route to their destinations. For aircraft approaching the airport the dispersion is increased beyond 13.5km before touchdown to broadly simulate how approaching aircraft will turn from the north and south onto the extended runway centre lines to join the Instrument Landing System.

3.13 Figure 2 shows the assumed aircraft track centre line tracks and sub-tracks to and from the two runways covering the area over which the noise contours lie. Arrivals routes are shown red and departure routes are shown blue. In practice further from the airport aircraft will divert to/from these routes to/from their destinations. For example, aircraft departing from runway 25R straight ahead will turn north of south at some point, but this is expected to be beyond the extent of the noise contours, so is not necessary for the noise model. It must be noted this is a speculative set of indicative arrival and departure flight paths, created in the absence of any airspace design at this stage, and the noise modelling must be repeated when the designed routes are available.

Figure 2 Assumed Flight Routes



3.14 Air Transport Movements (ATMs) for the existing airport in 2025 were split 69% on runway 08 and 31% on runway 26. We assume this was typical. For the proposed airport the same East/West proportions has been used, and it is assumed both parallel runway pairs will be equally utilised (i.e. 07L and 07R equally used and 25L and 25R equally used) by the same aircraft fleets. In the absence of any routeing information for the new airport, departures in a given direction, e.g. west, are split equally across the four westerly departure routes. These assumptions apply for the day and night noise models in both years 2029 and 2044.

Air Traffic

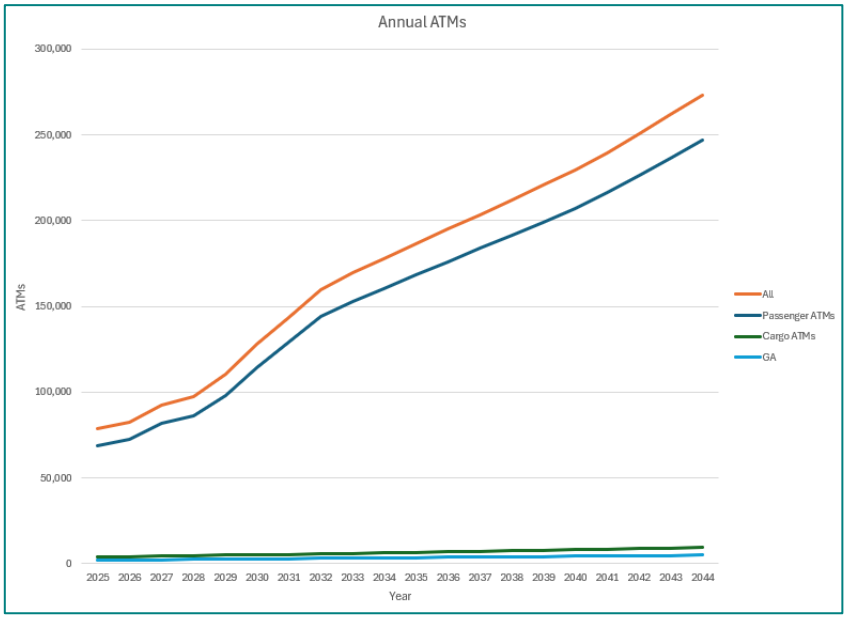
3.15 With the closure of Islam Karimov Tashkent International Airport, it is assumed that all air transport movements (ATMs) will operate at the proposed airport in the base year, expected to be 2029.

3.16 A full breakdown of ATMs by aircraft type and time of day for 2025 at Islam Karimov Tashkent International Airport shows 78,593 ATMs that is assumed to be all the air traffic for the full 12 month period. This comprised 109 different aircraft types. Each aircraft type was assigned an appropriate type from the AEDT model database. For the most common and noisy aircraft, reference was made to the main airline fleets operating at Tashkent Internation Airport (Uzbekistan Airways and Turkish Airlines) so as to select the most relevant aircraft variant including engine option. 88 of the 109 aircraft types operated less than once per day, and for most of these types a substitution was chosen using a common AEDT type for multiple types, so as to limit the total number of types to be modelled. In this way 26 AEDT aircraft types were chosen to represent all flights logged in 2025.

3.17 Appendix C gives a full set of data describing each of these 26 aircraft types and the numbers of each during the day (0700-2200 hours) and night (2200-0700 hours) periods.

3.18 Forecasts from 2022 of passenger, cargo and General Aviation air traffic have been provided (in *TAF Traffic Forecast*). The 2022 forecast for all aircraft in 2025 was 75,180, so this has been increased to 78,593 to match the exact total in the data provided for the actual aircraft flown described above. The forecast is summarised in Figure 3.

Figure 3 TAF Traffic Forecasts for ESIA



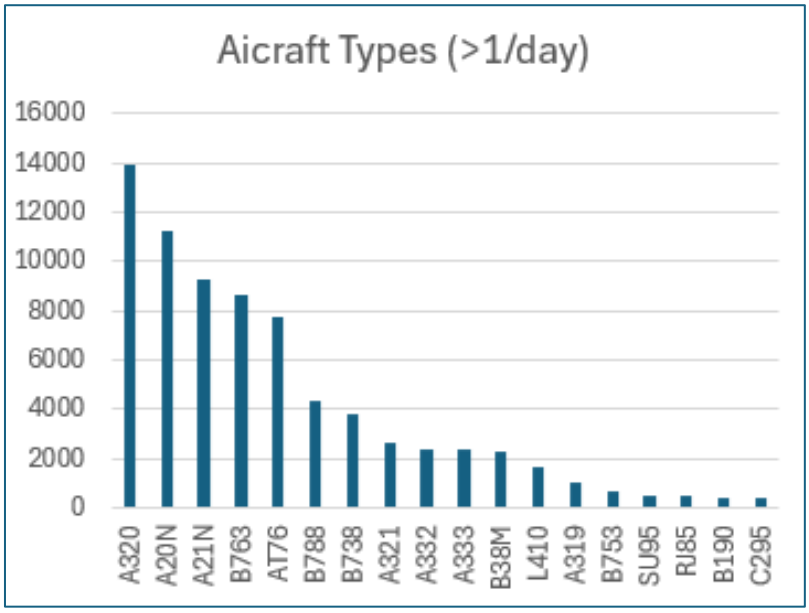
3.19 The total of all ATMs for the required years are:

Table 3.2 Total ATMs

Base Year, 2025	Year of Opening, 2029	Future Assessment Year, 2044
ATMs		
78,593	110,367	274,045

3.20 The mix of aircraft that make up the airport fleet is important in determining the total noise output. For the 2025 base year this has been provided, as discussed above, and it can be summarised in Figure 4 by showing the annual total movements for the 18 most common aircraft operating.

Figure 4 2025 Air Traffic Fleet (annual)



3.21 In future, as airlines replace their older aircraft with newer models this fleet will gradually transition, and over time because newer aircraft are generally quieter, the fleet will become gradually quieter. At this time, because there are no forecasts of future air traffic by aircraft type, it is not possible to take fleet transition into account. Such forecasts require an understanding of local airline fleet procurement plans and markets, so no generic assumption is possible. Instead, it has been assumed that the mix of aircraft making up the fleet remains as in 2025, leading to a worst case (i.e. noisier) noise model for all future years, especially in the future assessment year 2044. Appendix C provides the full modelled fleet forecasts for 2029 and 2044.

3.22 As can be seen from Appendix C that over a 24 hour period, 64% of flights are in the day and 36% are in the night. The numbers of flights per hour forecast in 2029 are 12.8 in the day and 12.2 at night. The numbers of flight forecast per hour in 2044 are 31.7 in the day and 30.2 at night. So, the airport is expected to be a truly 24 hours airport, that is very nearly as 'busy' at night as during the day. Its noise impacts will therefore be more significant at night because people are more sensitive to noise at night.

3.23 Appendix C also lists the aircraft Stage Lengths used in AEDT. Stage lengths of aircraft in AEDT range from 1 to 9 and equate to flight distances of 0 to 11,000 nm and are used in AEDT as a proxy for aircraft take-off weight because aircraft travelling further take off with more fuel so are proportionately heavier. Heavier aircraft climb more slowly and produce higher noise levels on the ground. So, considering stage length is useful in calibrating the model for the

specific fleet operating. An analysis of flight destinations from the 2025 ATM data was used to estimate Stage Lengths and for each aircraft type the most common was used.

Ground Noise

3.24 Ground noise sources would normally include taxiing aircraft on taxiways and aprons as well as engine maintenance facilities. However, at this stage there is no information available on stand use, detailed taxi routes information such as speed, direction or engine testing etc. However, an attempt is made to give an indicative aircraft taxiing noise assessment at neighbouring areas.

3.25 Noise levels at the neighbouring areas have been calculated using the noise-modelling suite IMMI2025 in accordance with the ISO 9613 prediction methodology. Further refinements include aircraft directivity following the methodology researched by Ansensio & others for Madrid Airport.

3.26 Using the aircraft noise data from AEDT database, taxiing aircraft are assumed to be travelling at 10m/s. The following aircraft groups have been modelled on assumed taxiway usage:

Table 3.3 Taxiway Aircraft Assumptions

Aircraft Types	Sound Power Level, dB(A)
Large Jets	142
Medium Jets	136
Turbo-prop	133

Construction Noise & Vibration

3.27 BS 5228 sets out a methodology for predicting, assessing and controlling noise levels arising from a wide variety of construction and related activities. As such, it can be used to predict noise levels arising from the operations at proposed construction sites. BS5228 also sets out tables of sound power levels generated by a wide variety of construction plant to facilitate such predictions.

3.28 Noise levels generated by the proposed site operations and experienced at local receptors will depend upon a number of variables, the most significant of which are:

- the amount of noise generated by plant and equipment being used at the development site, generally expressed as a sound power level;
- the periods of operation of the plant at the development site, known as the “on-time”;
- the distance between the noise source and the receptor, known as the “stand-off”;
- the attenuation due to ground absorption or barrier screening effects; and
- the reflection of noise due to the presence of hard vertical faces such as walls.

3.29 At this stage, construction plant/numbers/locations/traffic etc are not known. Therefore, an indicative assessment is based on the following key stages using assumed construction plant presented in Appendix D:

- Site Clearance
- Earthworks & Ground Improvement (Runway/Taxiway Formation)
- Piling & Foundation Works (Terminals/Buildings)
- General Structural & Finishing Stage

Construction Vibration

3.30 Damage to buildings associated solely with ground-borne vibration is not common and although vibration may be noticeable, there is little evidence to suggest that they produce cosmetic damage such as cracks in plaster unless the magnitude of the vibration is excessively high. The most likely impact, where elevated levels of vibration do occur during the construction works, will be associated with perceptibility.

3.31 Table 3.4 below details the distances at which certain construction activities could give rise to a just perceptible level of vibration. These figures are based on historical field measurements.

Table 3.4 Distances at which construction vibration may be just perceptible

Construction Activity	Distance from activity when vibration may just be perceptible
Excavation	10 - 15 metres
Heavy Vehicles (e.g. dump trucks)	5 - 10 metres
Hydraulic Breakers	15 - 20 metres
Large Rotary Bored Piling Rig	20 - 30 metres
Piling Rigs (dependent on ground conditions)	50 – 100 metres

Road Traffic Noise

3.32 The UK utilises a technical memorandum 'Calculation of Road Traffic Noise', (CRTN) which sets out a series of technical methods to ascertain the noise level at receptors arising from road traffic flows.

3.33 The corrections which may influence road traffic noise levels at source can be divided into two groups:

- Road-related factors - topographical
- Traffic related factors - flow, speed and the proportion of heavy goods vehicles, type of road surface etc.

3.34 The propagation of noise is also covered in CRTN and can influence the noise levels at receptor locations.

3.35 The airport will be accessed via two access roads. The main access road, which will be used by all passenger road traffic, accesses the airport on the western side and links to the proposed new highway. The service road access which will be used by service vehicles and cargo traffic accesses the airport via the north-east corner and travels north to join the proposed new highway approximately 2.1km to the north of the Site. It is noted that the new highway does not form part of this application and the traffic data associated with the new highway is not known. Similarly, data on other surface transport links is not known.

3.36 For an indicative assessment, noise levels associated with the airport link road are estimated. Based on 14 million annual passenger movements and assumed occupancy of vehicles (including private cars, taxis, e-hailing, minivans, buses), the following traffic is assumed on the link road:

Table 3.5 Assumed Traffic Data, Link Road

Road	Traffic Flow (AAWT)	Percentage HGVs	Traffic Speed
Airport Link Road	32526	5.7%	60 km/h
Service Road	1022	100	60 km/h

3.37 It is noted that Uzbekistan has a high number of electric vehicles (EV) (7400 registered vehicles) with the majority (approx. 5600 cars) within the Tashkent region. In terms of the noise characteristics of EVs, it is noted that at speeds below 20 km/h, are near-silent. This quietness

is primarily due to the absence of engine noise, making EVs significantly less audible in low-speed environments compared to their internal combustion engine (ICE) counterparts. However, as the speed increases to medium and high ranges (above 30–50 km/h), the dominant sources of noise shift. At these higher speeds, the interaction between tyres and the road surface, as well as wind resistance, become the main contributors to the overall noise produced by the vehicle. Consequently, the noise profile of EVs at these speeds becomes comparable to that of vehicles fitted with internal combustion engines, as the reduction in engine noise is offset by these other factors.

4 BASELINE NOISE SURVEYS

4.1 A baseline noise survey of the existing background and ambient sound levels was undertaken at the locations adjacent to the proposed airport site as well as potential flight paths, from November 2025 to January 2026.

4.2 The surveys were conducted by contractors employed by SLR Limited at eleven locations. The survey locations are presented in Figure 5, and the coordinates/survey dates are shown in Table 4.1.

Figure 5 Noise Survey Locations

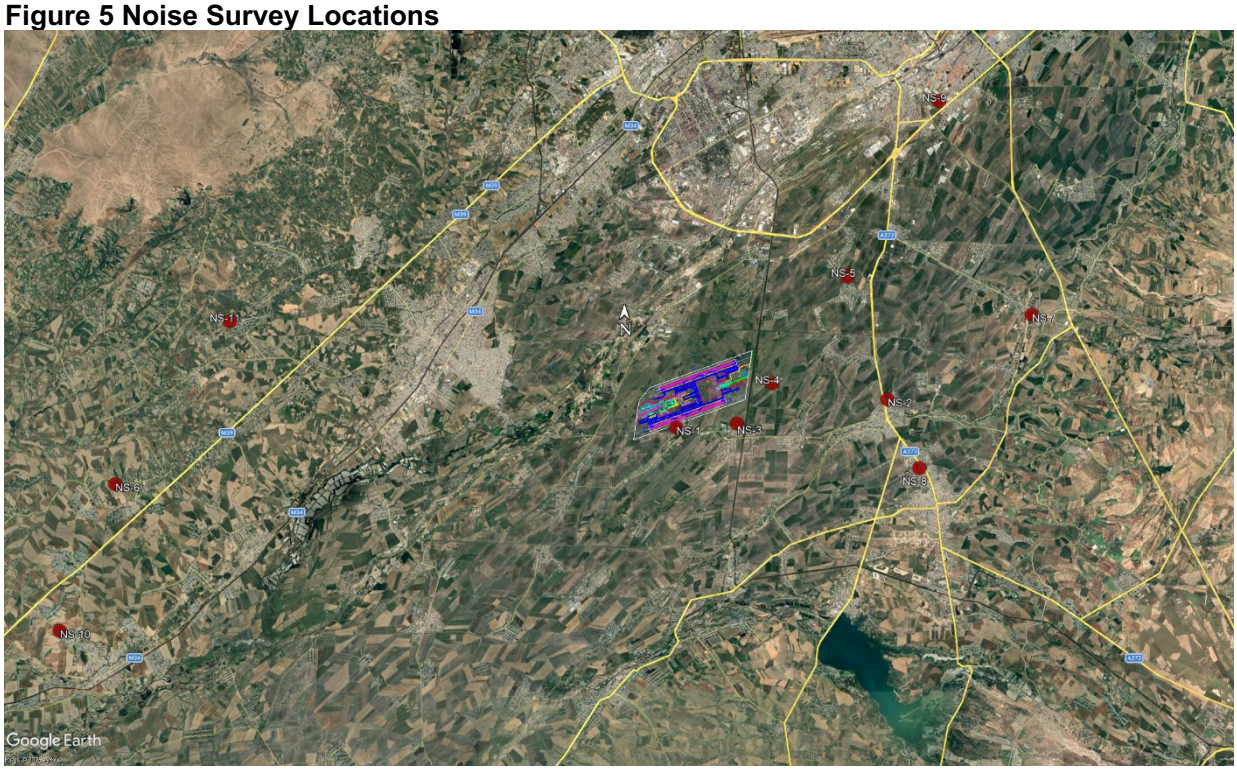


Table 4.1 Noise Survey Locations and Survey Dates

Survey Location	Easting	Northing	Survey Dates
NS-1	516824	4547319	16-18 December 2025, 11-13 January 2026
NS-2	527529	4548777	20-24 December 2025, 18-20 January 2026
NS-3	519905	4547530	16-19 December 2025, 14-16 January 2026
NS-4	521672	4549572	19-23 December 2025, 14-16 January 2026
NS-5	525505	4554981	24-27 December 2025, 17-19 January 2026
NS-6	488385	4544356	8-10 January 2026, 27-29 January 2026
NS-7	534828	4553085	5-7 January 2026, 24-26 January 2026
NS-8	529161	4545321	24-27 December 2025
NS-9	530087	4563859	05-8 January 2026, 20-24 January 2026
NS-10	485595	4536927	11-14 January 2026, 27-29 January 2026
NS-11	494173	4552597	08-11 January 2026, 24-26 January 2026

4.3 Time histories of the measured noise levels are presented in Appendix E. The summary data is presented in Table 4.2.

Table 4.2 Summary of Measured Noise Levels (rounded)

Location	Period	$L_{Aeq,T}$ dB	$L_{Amax,f}$ dB	$L_{A90,T}$ dB
NS-1	Day	51	59	35
	Night	44	53	32
NS-2	Day	48	56	37
	Night	43	51	37
NS-3	Day	55	65	33
	Night	50	59	29
NS-4	Day	50	62	35
	Night	48	56	30
NS-5	Day	55	70	41
	Night	51	65	39
NS-6	Day	48	61	37
	Night	43	55	33
NS-7	Day	48	58	40
	Night	52	51	35
NS-8	Day	50	59	43
	Night	45	53	38
NS-9	Day	54	70	44
	Night	50	61	42
NS-10	Day	53	68	39
	Night	46	61	37
NS-11	Day	45	61	35
	Night	38	51	31

4.4 The measured survey data indicates that the ambient noise levels present at the new site are consistent with those typically found in rural areas. This suggests that the location is sufficiently removed from significant sources of noise, such as major roads or industrial activity. As a result, the existing environmental soundscape is characterised by low background noise, which is typical for countryside settings. However, it is also noted that at some locations, the night-time baseline noise levels are higher than that outlined in the adopted criteria.

5 ASSESSMENT OF NOISE IMPACTS

AirNoise

Noise Impacts 2029

5.1 The day and night noise modelling results for the 2029 air traffic forecasts are shown in Figures F.1 and F.2 Appendix F:

- Figure F.1 - 2029 $L_{eq\ 15\ hour}$ day 55dB, 60dB, 65dB, 70dB
- Figure F.2 - 2029 $L_{eq\ 9\ hour}$ night 45dB, 50dB, 55dB, 60dB, 65dB

Daytime Impacts, 2029

5.2 In Figure F.1, the outer most noise contour is the daytime $L_{eq\ 15\ hr}$ 55dB in 2029, the preferred noise level for new housing and educational land used. This contour includes:

- To the East – Bakangli, a small group of houses immediately outside the airport boundary.
- To the South – Yangitosh and part of Yangiyo'l, a small residential village immediately outside the airport boundary.
- To the Southwest, 1.5km – part of Kushek village that is mainly residential.
- To the East, 1km- Qorasuv, a small mixed residential village with some light industry.

5.3 The small group of houses at Bakangli are next to the proposed fuel farm and within 600m of the northern runway, and it is assumed they will be relocated as part of the Project.

5.4 Noise levels at Yangitosh immediately to the south are predicted to be up to $L_{eq\ 15\ hr}$ 60dB and mitigation should be considered, as discussed below.

5.5 Kushek and Qorasuv would be overflown by aircraft using the southern runway 07R/25L, with noise levels in the range $L_{eq\ 15\ hr}$ 55- 60dB and noise mitigation should be considered, as discussed below.

5.6 The assessment provided above has been conducted using a worst-case scenario approach. This methodology ensures that the evaluation considers the highest potential impact, taking into account the most challenging conditions that may arise. As the composition of the aircraft fleet evolves over time, with the introduction of newer and quieter aircraft, it is anticipated that the extent of the noise contours will diminish. The adoption of quieter technologies within the

fleet is likely to result in a noticeable improvement in the size and reach of noise footprints surrounding the airport.

Night-time Impacts, 2029

5.7 In Figure F.2, the outer most noise contour is the night-time $L_{eq\ 9\ hr}$ 45dB contour in 2029, the preferred noise level for new housing and educational land used. This contour includes:

- To the East – Bakangli, a small group of houses immediately outside the airport boundary.
- To the South – Yangitosh, Yangiyo'l and Jaricjbash, three residential villages, from zero to 1.8km from the airport boundary.
- To the Southwest – part of Kushek, Eliboy, Ogonek, Boytsh and part of Qushyog'och villages, from 1.5 to 13km from the airport, that are mainly residential.
- To the East - Qorasuv, Balandko'prik, Dungan, Gullston, part of Chibintepa and Ko'kbo'yin from 1km to 13km from the airport, that are mixed residential villages with some light industry.

5.8 The small group of houses at Bakangli are next to the proposed fuel farm and within 600m of the northern runway, and we assume they will be relocated as part of the Project.

5.9 Noise levels at the nearest part of Yangitosh immediately to the south are predicted to be up to $L_{eq\ 9\ hr}$ night 62dB, which is above the WHO Night Noise Guidance level of 55dB and here mitigation is essential, as discussed below.

5.10 Kushek and Qorasuv would be overflown by aircraft using the southern runway (07R/25L), with noise levels above in the WHO Night Noise Guidance level of $L_{eq\ 9\ hr}$ night 55dB and here mitigation is essential, as discussed below. Several other villages would be overflown by aircraft using the southern runway, with lower noise levels also requiring consideration of mitigation.

5.11 The assessment provided above has been conducted using a worst-case scenario approach. This methodology ensures that the evaluation considers the highest potential impact, taking into account the most challenging conditions that may arise. As the composition of the aircraft fleet evolves over time, with the introduction of newer and quieter aircraft, it is anticipated that the extent of the noise contours will diminish. The adoption of quieter technologies within the fleet is likely to result in a noticeable improvement in the size and reach of noise footprints surrounding the airport.

Noise Impacts, 2044

5.12 The day and night noise modelling results for the 2044 air traffic forecasts are shown in Figure F.3 and Figure F.4 as the following noise contours:

- Figure F.3 - 2044 $L_{eq\ 15\ hour}$ day 55dB, 60dB, 65dB, 70dB
- Figure F.4 - 2044 $L_{eq\ 9\ hour}$ night 45dB, 50dB, 55dB, 60dB, 65dB

Daytime Impacts, 2044

5.13 The air traffic forecast for 2044 is about 2.5 times that for 2029, with the same fleet assume, resulting in noise levels about 4dB higher.

5.14 In Figure F.3, the outer most noise contour is the daytime $L_{eq\ 15\ hr}$ 55dB in 2029, the preferred noise level for new housing and educational land used. This contour includes:

- To the East – Bakangli, a small group of houses immediately outside the airport boundary.
- To the South – Yangitosh and the majority of Yangiyo'l, a small residential village immediately outside the airport boundary.
- To the Southwest – Kushek village, that is mainly residential, 1.5 to 3km from the airport.
- To the East - Qorasuv, Balandko'prik and part of Gulliston, mixed residential village with some light industry 1.5 to 7km from the airport.

5.15 The small group of houses at Bakangli are next to the proposed fuel farm and within 600m of the northern runway, and it is assumed they will be relocated as part of the Project.

5.16 Noise levels at Yangitosh immediately to the south are predicted to be up to $L_{eq\ 15\ hr}$ 65dB and mitigation should be considered, as discussed below.

5.17 Kushek, Qorasuv, Balandko'prik would be overflown by aircraft using the southern runway 07R/25L, with noise levels in the range $L_{eq\ 15\ hr}$ 55- 63dB and noise mitigation should be considered, as discussed below. Part of Gulliston further east would be similarly affected by noise from the northern runway (07L/25R).

5.18 The assessment provided above has been conducted using a worst-case scenario approach. This methodology ensures that the evaluation considers the highest potential impact, taking

into account the most challenging conditions that may arise. As the composition of the aircraft fleet evolves over time, with the introduction of newer and quieter aircraft, it is anticipated that the extent of the noise contours will diminish. The adoption of quieter technologies within the fleet is likely to result in a noticeable improvement in the size and reach of noise footprints surrounding the airport.

Night-time Impacts, 2044

5.19 In Figure F.4, the outer most noise contour is the night-time $L_{eq\ 9\ hr}$ 45dB contour in 2044, the preferred noise level for new housing and educational land used. This contour includes:

- To the East – Bakangli, a small group of houses immediately outside the airport boundary.
- To the South – Yangitosh, Yangiyo'l and Jarikbash residential villages, from zero to 1.8km airport boundary, and several other villages and part of small towns up to 7km from the airport including Yangi Hayot, Bog'chasaraoy, Islomobod, Darxon, Oronchi, Yamgurchi, Darhan, Pyatilekta, ulg'ur and Yahshiaul.
- To the Southwest – part of Kushek, Eliboy, Ogonek, Boytsh, Qushyog'och villages from 1.5 to 13km from the airport and the small town of Paxa 20km from the airport, that are mainly residential.
- To the East - Qorasuv, Balandko'prik, Dungan, Guliston, Chibintepa and Ko'kbo'yin from 1km to 13km from the airport, and the town of O'rtasaroy 15km from the airport.
- To the North – Toshiloq, Ko'ltepa, Yo'ng'ichqala, Chibintepa, Yangiturmush, Saidovul, Sorum, Saldota, Yugantepa villages up to 7km from the airport

5.20 The small group of houses at Bakangli are next to the proposed fuel farm and within 600m of the northern runway, and we assume they will be relocated as part of the Project.

5.21 Noise levels at the nearest part of Yangitosh immediately to the south are predicted to be up to $L_{eq\ 9\ hr}$ night 66dB, which is substantially above the WHO Night Noise Guidance level of 55dB and here mitigation is essential, as discussed below.

5.22 Kushek and Qorasuv would be overflown by aircraft using the southern runway (07R/25L), with noise levels up to $L_{eq\ 9\ hr}$ night 62dB, 7dB above in the WHO Night Noise Guidance level of $L_{eq\ 9\ hr}$ night 55dB and here mitigation is essential, as discussed below. Noise levels at Balandko'prik to the East are also just above the guidance level.

5.23 Further from the airport to the South and North there are approximately 40 other villages and small towns that would have noise levels above the preferred level also requiring consideration of mitigation.

5.24 The assessment provided above has been conducted using a worst-case scenario approach. This methodology ensures that the evaluation considers the highest potential impact, taking into account the most challenging conditions that may arise. As the composition of the aircraft fleet evolves over time, with the introduction of newer and quieter aircraft, it is anticipated that the extent of the noise contours will diminish. The adoption of quieter technologies within the fleet is likely to result in a noticeable improvement in the size and reach of noise footprints surrounding the airport.

AirNoise Mitigation

5.25 As explained above, it is proposed that the airport will operate nearly the same frequency of flights at night as during the day, so day and night noise levels will be similar, but because the night noise standards are 10dB lower than those for the day, the impacts at night are forecast to be much greater (about 10dB) with many more properties potentially affected than during the day. The mitigation proposed therefore focuses on the night noise impacts.

5.26 From opening in 2029 to 2044 the forecast is that fights will increase by a factor of about 2.5, increasing noise levels by about 4dB, thus increasing noise impacts significantly. The worst-case noise impacts are therefore at night, in 2044, and the mitigation is proposed to address this. Table 5.1 gives the areas of the key day and night noise contours in 2029 and 2044.

Table 5.1 Noise Contour Areas

Noise Contour	2029 Coverage, km^2	2044 Coverage, km^2
$L_{eq,15hr}$ 55 dB Day	27	52
$L_{eq,9hr}$ 45 dB Night	166	420

5.27 The mitigation proposals therefore focus on mitigation for the worst case, in the night in 2044. Whilst in theory some mitigation could be developed in the years after opening, in most cases it is best designed into the scheme before it opens, for example flight path design etc.

5.28 Initial noise modelling for night noise in 2044 shows there is potential for substantial noise impacts from the proposed airport, as discussed in Section 5.2.3. Approximately 45 villages or small towns have predicted noise levels above the preferred standard for new houses and schools and mitigation is recommended. There are 4 areas where night noise levels are predicted to be at least 10dB higher than this, and above the WHO Night Noise Guidelines level of $L_{eq\ 9\ hr}$ night 55dB (Kushek and Qorasuv, Yangitosh and Bakangli) where mitigation is considered to be essential to avoid significant sleep disturbance.

5.29 Both IFC and International Civil Aviation Organisation (ICAO) guidelines require mitigation measures to be taken to reduce minimise aircraft noise impacts.

5.30 The ICAO guidance is in their Balanced Approach to Aircraft Noise Management that consists of four main elements:

- noise at source;
- operating procedures;
- operating restrictions; and
- land use planning

5.31 The IFC guidance, shown in Section 2 above, is similar in a similar structure. The recommended application of this guidance to the development of Tashkent International Airport is discussed under these headings below.

Noise at Source

5.32 ICAO establishes International Standards, recommended practices and procedures regarding the technical areas of aviation, including aircraft noise. The standards, once adopted, are put into effect by each ICAO member state in its own country.

5.33 An important pillar of the Balanced Approach to Aircraft Noise Management is the reduction of noise at source. Aircraft noise ("noise at source") has been controlled since the 1970s by the setting of noise limits for aircraft in the form of Standards and Recommended Practices (SARPs) contained in Annex 16 to the Convention on International Civil Aviation (the "Chicago Convention"). This continues to be the case today. Noise provisions appear in Volume I of Annex 16. The primary purpose of noise certification of new aircraft is to ensure that the latest available noise reduction technology is incorporated into aircraft design and that this is demonstrated by procedures that are relevant to day-to-day operations.

5.34 The first noise standard was developed by the ICAO Committee on Aircraft Noise in 1971 and became applicable in 1973, setting noise limits as a direct function of Maximum Take-off Mass (MTOM) in order to recognize that heavier aeroplanes, which were of greater transport capability, produce more noise than lighter aeroplane types. This is the so called ‘Chapter 2’ Noise Standard contained in Annex 16, Volume I. Since then, Chapter 3, Chapter 4 and Chapter 14 standards for new aircraft have been introduced and noise levels from new aircraft have reduced substantially.

5.35 The effect of this at Tashkent Airport will be that in future years individual aircraft will become quieter as they are gradually replaced by newer versions that meet the stricter international noise limits. The effect overall will be slow because aircraft typically have a service life of at least 20 years. The noise modelling reported in this study has taken a cautious view of this effect by assuming that in 2029 and in 2044 the aircraft operating will be the same types as operated in 2025. It is therefore conservative. When future fleet forecasts are available the modelling should be refined to better predict future noise contours to use in managing noise at the airport, as discussed below.

5.36 Some regions, countries legislate permittable aircraft on the basis of noise level. Some airports ban the noisiest aircraft and/or incentivise their airlines to fly quieter aircraft by making higher charges for noisier aircraft, to increase the rate of transition of the fleet to become quieter. There are international regulations in some regions controlling how this can be done. The benefit of international regulation on aircraft noise emissions should be felt at Tashkent Airport because the aircraft fleet will transition without any intervention on behalf of the airport and will help to offset the increase of noise as aircraft numbers increase.

Operating Procedures

Flight Paths

5.37 The IFC Airports guidance refers to the value of operating procedures to reduce aircraft noise impacts and, as noted in Section 2 above, requires… '*implementation of preferred procedures and routes for landing and takeoff (LTO) to minimize potential noise from approaching and departing aircraft for noise-sensitive areas'*. In this case, the landing and take-off routes have not been designed, so it is important that when they are being designed, they are routed to minimise noise impacts in noise-sensitive areas. A study should be undertaken to assist the development of future flight paths with the air of minimising the population affected by aircraft noise. The noise modelling reported above, has been based on an assumed set of aircraft routes and has indicated potential for significant noise impacts in several areas which should be minimised by adjusting the flight paths including as follows, as far as is practicable consistent with safety and other airspace design requirements:

1. Departures to the West from runway 25R that turn North should make a sharp turn North to avoid overflying Niyozbosh (as modelled in this study).
2. Departures to the West from runway 25L that turn South should turn to the South on a route designed to minimise overflying, which could involve a later turn than modelled in this study.
3. Departures to the West from both runways that route West should be designed to minimise overflying built up areas including Paxta, which could require a slight turn South.

4. Departures to the East from Runway 07R that turn South should turn sharply to minimise overflying the Qorasuv residential area.
5. Departures to the East from Runway 07L that turn North should turn sharply to minimise overflying the Chibintepo and other residential areas.
6. Departures to the East from both runways that route East should be designed to minimise overflying built up areas including O'rtasaroy and Ko'kbo'yin.

5.38 For departures it is recommended that Noise Preferential Routes are defined. These are typically used to set corridors 1.5km either side of the preferred route centre-line within which departing aircraft should fly up to a given height. The airport should then monitor the compliance of airlines flying within these Noise Preferential Routes and, if necessary, arrange a financial process to incentive compliance. This will help reduce aircraft unnecessarily flying in locations that disturb local communities.

5.39 For arrivals, it is generally harder to control where aircraft are routed as they approach an airport because of pilot workload in timing and configuring the aircraft safely for landing. In this study we have assumed aircraft will not join the Instrument Landing System (ILS) on the extended runway centre line before 13.5km from the runway thresholds. 69% of arrivals are assumed to come from the East. The effect of this is to concentrate arrivals in the built up areas of O'rtasaroy and Ko'kbo'yin. Preferably arrivals from the east would avoid overflying these areas, for example if they could join the ILS later or route more from the North. Arrivals from the West straight to the runways could route over the built up area of Paxta. This study has spread those arrivals North, South and over Paxta. Preferably arrivals from the West would minimise noise impacts in Paxta by avoiding overflying the built up area, by turning in to join the ILS nearer the airport.

Quieter Aircraft Operating Procedures

5.40 There are quieter ways to operate aircraft, both on arrival and departure, by varying the aircraft configuration (flaps, thrust etc) and these should be explored with airlines who wish to operate at the airport. For example, Continuous Descent Approach procedures are used at many airports to reduce aircraft noise on arrival by smoothing the aircraft's decent profile and minimising engine thrust over built-up areas.

Runway Preference

5.41 The choice of westerly or easterly operating directions will mostly be dictated by wind conditions, but it may be possible to operate one or other runways more intensely when throughput allows. Some of the greatest noise impacts are from aircraft using the southern

runway (07R/25L). The benefit of operating a northern runway preference should be studied, within the package of noise mitigation measures that is developed.

Operating Restrictions

5.42 A key feature of the proposed airport is its 24 hour operations, that make the noise impacts at night far greater than during the day. Clearly if a proportion of the flights forecast at night could instead be during the day the overall noise impact would be smaller. It is recognised that demand for some flights is at certain times of the day or night. Nonetheless, given the extent of night noise impacts predicted, the possibility of shifting some night flights to the less noise-sensitive day periods should be studied as part of the future scheduling plans for the new airport.

5.43 Many airports around the world where there are large noise impacts at night use operating restrictions to limit noisier aircraft in the more sensitive night period and to incentivise airlines to use their quieter aircraft at night. This can take the form of banning the noisiest aircraft at night, or having landing charges that increase with higher noise level, usually measured using certificated noise levels. Some airports also measure noise levels directly and apply fines to the noisiest flights. At Tashkent there are some types of aircraft currently operating at night that do not meet the latest ICAO noise Chapter standards by some margin and are significantly noisier than their modern quieter equivalents, eg Boeing 767 300, Airbus C295, Boeing 757 200 and Ilyushin IL76. Whilst these aircraft are relatively few in number, making up about 14% of the flights at night, because of the nature of sleep-disturbance at night, they may contribute disproportionately to the night-time noise impact. It is therefore recommended that operational restrictions are developed to limit the operation of the noisiest aircraft at night. These restrictions may take the form of a full ban on the noisiest aircraft types, and/or increased charges for noisier aircraft, so as to incentivise airlines to operate their quietest fleets in the sensitive night-time period.

Land Use Planning

5.44 The IFC guidelines refer to land use planning, as follows:

> *"…working with local authorities to identify and implement noise prevention and control strategies in noise abatement zones (e.g. sound insulation of buildings that are exposed to aircraft noise above levels stipulated by local authorities…)* and
>
> *Reducing noise of ground operations at the source or through the use of sound barriers and deflectors, as described in the General EHS Guidelines."*

5.45 The design of the airfield should consider a noise barrier or bund on the southern side to reduce aircraft noise affecting Yangitish and Yangiyo'l. Clearly such a bund would not reduce noise from aircraft once airborne, but it would reduce noise from aircraft on the runway (as well as taxiing etc).

5.46 There are 4 areas where night noise levels are predicted to be above the WHO Night Noise Guidelines level of $L_{eq\ 9\ hr}$ night 45dB (Kushek, Qorasuv, Yangitosh and Bakangli) where mitigation is essential to avoid significant sleep disturbance. It is assumed that the small group of properties at Bakangli will be relocated because of their proximity to the runway and fuel farm. The predicted noise levels at night support this.

5.47 At Kushek and Qorasuv and Yangitosh significant sleep disturbance is predicted. Noise impacts of this type should be avoided, and one solution is therefore to relocate the dwellings. Alternatively, a noise insulation scheme could be developed to reduce noise levels inside homes to help residents to sleep at night. Noise insulation schemes are used around some major airports as a last resort when other noise mitigation measures are not adequate. They clearly do not benefit outside space. They are effective at reducing noise disturbance indoors, including sleep disturbance. They rely on windows remaining closed and so, particularly in hot weather locations, can require additional ventilation for cooling. It is recommended that once other noise mitigation measures have been developed the feasibility of a noise insulation scheme is studied for residential properties where noise levels are predicted to be above $L_{eq,9hr}$ night 45 dB.

5.48 The construction of the airport may increase the development of new housing and noise-sensitive receptors in the area. Land use planning processes should be put in place to ensure that such future development is not built in areas that will be exposed to high levels of aircraft noise in future. SanPiN No. 0339-16 *Sanitary rules and norms of planning and development of settlements* of Uzbekistan provides for this process. The refined aircraft noise contours produced following design of the airspace, including further mitigation outlined this this report, should then be used to ensure new noise sensitive development is not allowed within the noise contours showing the preferred noise levels of daytime $L_{eq\ day\ (0700\text{-}2200\ hours)}$ 55dB and night-time $L_{eq\ 9\ hr\ (2200\text{-}0700\ hours)}$ 45dB.

AirNoise Affects, Baseline

5.49 Table 5.2 shows the receptors with representative noise survey results as well as noise contour band of each receptor.

Table 5.2 Baseline and Calculated Receptor Noise Contour Bands

Receptor	Location	Nearest Survey Station	Baseline Day	Baseline Night	2029 Day	2029 Night	2044 Day	2044 Night	Noise Affects, dB(A)			
			L_{Aeq}, dB	L_{Aeq}, dB	L_{Aeq}, dB	L_{Aeq}, dB	L_{Aeq}, dB	L_{Aeq}, dB	2029 Day	2029 Night	2044 Day	2044 Night
H1	Yangitosh (relocated?)	NS-1	51	44	60-65	60-65	65-70	65-70	9-14	16-21	14-19	21-26
H2	Bessari	NS-1	51	44	<55	<45	<55	50-55	4	1	4	6-11
H3	Kushek	NS-1	51	44	55-60	55-60	60-65	60-65	4-9	11-16	9-14	16-21
H4	Ostanovochniy Punkt	NS-3	55	50	<55	50-55	55-60	55-60	0	5	5	5-10
H5	Yangi hayoy	NS-3	55	50	<55	50-55	55-60	55-60	0	5	5	5-10
H6	Eliboytepa	NS-3	55	50	<55	<45	<55	45-50	0	0	0	0
H7	Changlitepa	NS-4	50	48	<55	<45	<55	45-50	5	0	5	2
H8	unidentified Receptor	NS-4	50	48	55-60	55-60	60-65	60-65	5-10	7-12	10-15	12-17
H9	Yahshiovul	NS-2	48	43	<55	<45	<55	45-50	7	2	7	2-7
H10	Dungan	NS-4	50	48	<55	45-50	<55	50-55	5	2	5	2-7
H11	Chibintepa	NS-5	55	51	<55	45-50	<55	50-55	0	0	0	4
H12	Yo'ng'ichqala	NS-4	50	48	<55	45	<55	45-50	5	0	5	2
H13	unidentified Receptor	NS-5	55	51	<55	45-50	<55	50-55	0	0	0	4
H14	Yangiturmush	NS-5	55	51	<55	<45	<55	45-50	0	0	0	0
H15	Saidovul	NS-5	55	51	<55	<45	<55	45-50	0	0	0	0
H16	Ko'ltepa (South)	NS-4	50	48	<55	45-50	<55	45-50	5	2	5	2
H17	Ko'ltepa (North)	NS-4	50	48	<55	<45	<55	45-50	5	0	5	2
H18	Tashloq	NS-1	51	44	<55	<45	<55	45-50	4	1	4	1-6
H19	unidentified Receptor	NS-1	51	44	<55	<45	<55	45-50	4	1	4	1-6
H20	Qizil Sharq	NS-1	51	44	<55	50-55	55	55-60	4	6-11	4	11-16
H21	Iskandar	NS-1	51	44	<55	55	55-60	55-60	4	11	4-9	11-16
H22	Oramgoh	NS-1	51	44	<55	50-55	<55	50-55	4	6-11	4	6-11
H23	Madaniyat	NS-1	51	44	<55	50-55	55	55-60	4	6-11	4	11-16
H24	Bog'chasaroy	NS-1	51	44	<55	<45	<55	45-50	4	1	4	1-6
H25	Isiamobod	NS-1	51	44	<55	<45	<55	45-50	4	1	4	1-6
H26	Yusupov	NS-1	51	44	<55	<45	<55	45-50	4	1	4	1-6
H27	Oronchi	NS-1	51	44	<55	<45	<55	45-50	4	1	4	1-6
H28	Yomgurchi	NS-3	55	50	<55	<45	<55	45-50	0	0	0	0
H29	unidentified Receptor	NS-1	51	44	<55	<45	<55	45-50	4	1	4	1-6
H30	unidentified Receptor	NS-1	51	44	<55	<45	<55	45-50	4	1	4	1-6

5.50 The mitigation measures outlined above will be required to minimise the noise affects at the receptors. It is noted that a 10km radius from the existing Islam Karimov Tashkent International Airport covers a significant portion of the dense urban core to the north and east, as well as

the rapidly developing but slightly less dense residential areas to the south and west. The estimated population density within a 10km radius of Tashkent International Airport (TAS) is approximately 5,000 to 6,000 people per km^2. A far higher number of people are likely to have noise benefits than disbenefits with the proposed airport.

5.51 The airnoise assessment provided above has been conducted using a worst-case scenario approach. This methodology ensures that the evaluation considers the highest potential impact, taking into account the most challenging conditions that may arise. As the composition of the aircraft fleet evolves over time, with the introduction of newer and quieter aircraft, it is anticipated that the extent of the noise contours will diminish. The adoption of quieter technologies within the fleet is likely to result in a noticeable improvement in the size and reach of noise footprints surrounding the airport.

AirSide Vibration

5.52 This section examines the likelihood of perceptible secondary vibration, such as window rattling, within residential properties located near the airport. The assessment focuses specifically on the impact of aircraft noise associated with operations on each runway.

5.53 To evaluate the potential for secondary vibration effects, an indicative 90 dB Sound Exposure Level (SEL) contour was modelled for a B767-300 aircraft for each runway. Figure F.5 presents the results of this modelling, illustrating the areas where noise levels reach or exceed 90 dB SEL.

5.54 The modelling identified five receptor areas (H1, H3, H4, H5 and H8) within the 90 dB SEL contour. Properties in these areas may therefore be susceptible to secondary vibration phenomena, such as window rattling, due to elevated noise levels from aircraft operations.

Mitigation, Airside Vibration

5.55 Opportunities for mitigation are limited in this scenario. The most feasible interventions may consist of remedial structural works to reduce the transmission of vibration within affected properties.

Ground Noise

Taxiing Aircraft

5.56 Noise predictions for ground noise activities have been carried out using the 'IMMI2025' noise modelling software. This software is designed to apply established noise prediction methodologies, ensuring consistency and reliability in the assessment process.

5.57 The modelling approach utilises the prediction methodology set out in ISO 9613-2. This internationally recognised standard provides guidance for calculating the propagation of sound outdoors, enabling precise estimation of noise levels generated by ground activities.

5.58 For the assessment of ground-based aircraft noise sources, aircraft have been grouped into specific categories. This categorisation allows for a systematic approach to analysing noise contributions from various types of aircraft operating on the ground.

5.59 Sound power data corresponding to each category of aircraft has been estimated using information from the AEDT database. Details of these estimations and the categorisation of aircraft are presented in Section 3 of this report. It should be noted that there is no available information on taxi routes, time frames or apron activity and therefore this assessment based on assumed routes etc is indicative.

5.60 It has also assumed that the airport will have embedded mitigation such a 3m solid wall running parallel to each runway which may also be used a security wall. The resulting noise levels at the receptors are presented in Table 5.3.

Table 5.3 Taxiing Ground Noise Levels

Receptor	2029 $L_{Aeq,T}$ dB		2044 $L_{Aeq,T}$ dB		Noise affect, dB(A)	
	Day (7-22 h)	Night (22-7 h)	Day (7-22 h)	Night (22-7 h)	Day	Night
H1	60.2	60.2	61.6	61.5	1.4	1.3
H2	37.2	37.2	39.3	39.1	2.0	2.0
H3	40.2	40.1	42.2	42.1	2.0	2.0
H4	48.3	48.2	50.4	50.2	2.1	2.0
H5	50.3	50.2	52.3	52.2	2.0	2.0
H6	43.1	43.0	45.3	45.2	2.2	2.2
H7	36.8	36.8	39.0	38.9	2.2	2.2
H8	43.8	43.7	45.9	45.8	2.1	2.0
H9	31.6	31.5	33.5	33.4	1.9	1.9
H10	32.3	32.2	34.3	34.2	2.0	1.9
H11	29.1	29.1	30.9	30.8	1.8	1.7
H12	38.6	38.5	40.4	40.3	1.8	1.8
H13	31.1	31.1	33.1	33.0	1.9	1.9
H14	26.6	26.6	28.1	28.0	1.5	1.5
H15	29.1	29.1	30.8	30.7	1.7	1.6
H16	43.8	43.7	45.8	45.6	2.0	1.9
H17	37.8	37.8	40.0	39.8	2.1	2.1
H18	41.7	41.6	43.8	43.7	2.1	2.0
H19	44.7	44.6	46.8	46.7	2.1	2.0

H20	49.3	49.3	51.1	51.0	1.7	1.7
H21	42.9	42.8	45.0	44.9	2.1	2.0
H22	31.3	31.2	33.1	33.0	1.9	1.8
H23	27.6	27.6	29.0	28.9	1.3	1.3
H24	39.8	39.7	41.7	41.6	1.9	1.9
H25	33.7	33.6	35.7	35.6	2.0	2.0
H26	35.6	35.5	37.6	37.5	2.0	2.0
H27	29.6	29.5	31.3	31.2	1.7	1.7
H28	31.6	31.5	33.4	33.3	1.9	1.8
H29	38.8	38.7	41.0	40.9	2.2	2.1
H30	37.4	37.4	39.6	39.5	2.1	2.1

5.61 For taxing noise, receptors H1 (day & night), H4, H5, and H20 (night) remain above the adopted criteria, however, the noise level increases between 2029 and 2044 remain less than 3 dB(A). We assume that H1 will be relocated.

Mitigation, Taxiing Aircraft

5.62 The design of the embedded noise barrier is predicated on its alignment parallel to the existing runways. This configuration is intended to maximise the effectiveness of noise attenuation for sensitive receptors situated nearby.

5.63 In order to ensure adequate noise protection for receptors H4, H5, and H20, it is necessary to consider extending the length of the noise barrier. Such an extension, subject to site safety constraints, should be implemented so that these receptors are encompassed within the shadow zone created by the barrier. This approach will help to mitigate the impact of runway noise on these locations.

Ground Support Vehicles and Auxiliary Power Units

5.64 The proposed ground support vehicles at the airport are anticipated to be electric, reflecting the applicant's commitment to green-energy principles. By prioritising the use of electric vehicles, the project aims to minimise environmental impact and support sustainability objectives.

5.65 As the ground support vehicles and equipment are expected to be electric, noise emissions from these sources have been excluded from this assessment. The adoption of electric technology is intended to significantly reduce noise levels typically associated with conventional ground support operations.

5.66 It is also envisaged that aircraft will be powered directly from the airport's infrastructure, rather than relying on auxiliary power units (APUs). As a result, noise emissions from APUs have

been scoped out of this assessment, further supporting the project's green-energy objectives and reducing the overall environmental footprint.

Road Traffic Noise

5.67 The airport will be served by two distinct access roads, each designated for specific types of traffic. The primary access route, intended for all passenger vehicles, approaches the airport from the western side. This main road will connect directly to the proposed new highway, facilitating efficient movement of passenger traffic to and from the airport. In addition to this, a separate service road will accommodate service vehicles and cargo traffic. This service access enters the airport via the north-east corner and continues northwards, joining the proposed new highway approximately 2.1 kilometres to the north of the airport site.

5.68 It should be noted that the new highway referenced here does not form part of the current application. At present, there is no available data regarding the traffic volumes associated with this new highway. Similarly, information concerning other surface transport links is not currently known.

5.69 The potential noise impact resulting from road traffic on the airport's access roads has been assessed using the IMMI2025 suite of noise modelling software. IMMI2025 applies established acoustic principles in combination with approved prediction methodologies and is widely recognised as a reliable tool for forecasting noise generated by a range of sources. For this assessment, the model was configured to perform predictions in line with the Calculation of Road Traffic Noise (CRTN) methodology.

5.70 The noise model was developed using 18-hour Annual Average Weekday Traffic (AAWT) flows and vehicle composition data, as outlined in Section 3 of this report.

5.71 The calculated noise levels at the nearest receptors to the roads is presented in Table 5.4.

Table 5.4 Calculate Noise Levels, Access/service Roads

Nearest Receptors	Free-field Noise Level, $L_{Aeq,T}$ dB (Day and Night)(Rounded)
H3	42
H21	44
H12	38
H16	35

5.72 Due to the low traffic flows on the access/service roads and the intervening distances to the receptors, all calculated noise levels remain below the adopted criteria.

Construction Noise & Vibration

5.73 Noise predictions have been undertaken to provide an estimate of the noise emissions from the site during the construction works at the nearest receptors. From these predictions it has been possible to determine whether the adopted target noise criterion of 65 dB $L_{Aeq,T}$ is likely to be met during the noisiest stages of the works. The magnitude of any impact has then been determined and the requirement for further mitigation measures considered.

5.74 Construction noise predictions have been based on the construction noise assumptions on the plant to be used and the source noise data provided in BS5228. Assumed construction plant and numbers are set out in Appendix D.

5.75 Calculated daytime noise levels have been based on a worst-case scenario where the noisiest item of construction plant is located at the closest typical point of the proposed construction works, to the sensitive off-site receptors. The calculations assume a 3m screen at the boundary of the site.

5.76 The results of the indicative noise calculations are presented in Table 5.5

Table 5.5 Calculated Construction Noise Levels

Receptor	Site Clearance	Earthworks & Ground Improvement	Piling & Foundation Works	General Structural & Finishing Stage
	$L_{Aeq, T}$ dB			
H1	60	62	63	57
H2	48	50	51	45
H3	50	52	53	47
H4	56	58	59	53
H5	55	57	58	52
H6	51	53	54	48
H7	48	50	51	45
H8	53	55	56	50
H9	45	47	48	42
H10	46	48	49	43
H11	44	46	47	41
H12	48	50	51	45
H13	45	47	48	42
H14	43	45	46	40
H15	44	46	47	41
H16	51	53	54	48
H17	48	50	51	45
H18	49	51	52	46
H19	51	53	54	48
H20	54	56	57	51
H21	52	54	55	49
H22	45	47	48	42
H23	43	45	46	40
H24	48	50	51	45
H25	46	48	49	43
H26	47	49	50	44
H27	44	46	47	41

H28	45	47	48	42
H29	48	50	51	45
H30	48	50	51	45

5.77 Due to the embedded mitigation (noise screen), none of the considered receptors exceed the adopted criteria. Once further construction phasing and other details are available, a more precise assessment can be undertaken.

Construction Vibration

5.78 With reference to the activities listed in Table 3.4; it is anticipated that such activities are not typically anticipated to be at distances of less than 100 metres to sensitive off-site receptors, with only excavation, grading and paving works proposed in close proximity off-site receptors.

5.79 Accordingly, given the above, it is considered that there is a generally low potential for vibration at any off-site receptor location to reach perceptible or significant levels.

6 SUMMARY

6.1 This study has provided initial modelling of aircraft noise from the proposed Tashkent International Airport. The assessment reports on the modelling of aircraft noise in the year of opening in 2029 and 15 years later in 2044. It provides an assessment of the aircraft noise impacts, and a discussion on mitigation measures that should be considered.

6.2 The study has been informed by the available sources of information at this time, and much of the information that is required to carry out detailed aircraft noise modelling and assessment is not available. For example, the airspace has not yet been designed, so no flight paths are available. Details of the aircraft fleet likely to operate in future are not known. Nonetheless, there is a requirement to model and assess aircraft noise at this stage. Therefore, the approach taken is to make a series of reasonable and where possible worst-case assumptions to produce an initial noise model and assessment that can be used to inform the future design, in particular of the airspace, on the basis that the assessment can be updated at a later stage. The assumptions are detailed in this report and form an important element of the report for future reference.

6.3 There are no noise standards specific to aircraft noise in Uzbekistan. So, reference is made to the general national land use planning guidance and IFC and World Bank guidance on aircraft noise.

6.4 The airport is proposed to operate nearly the same frequency of flights at night as during the day. Therefore, the noise impacts at night are forecast to be much greater than during the day. The mitigation proposed therefore focuses on the night noise impacts.

6.5 At opening in 2029 the forecast is for 110 flights at night (2200-0700 hours). This is forecast to rise to 272 by 2044, i.e. by a factor of about 2.5, increasing noise levels by about 4dB, thus increasing noise impacts similarly. The mitigation proposals therefore focus on mitigation for the worst case in 2044. Whilst in theory some mitigation could be developed in the years after opening, in most cases it is best designed into the scheme before it opens, for example flight path design etc.

6.6 The worst-case noise impacts are therefore at night, in 2044. The noise contours presented in Appendix F shows the noise contours predicted for the night period in 2044. It should be noted that these are based on a series of worst-case assumptions, in particular around the fleet of aircraft operating in 2044, and when these assumptions are revisited in future noise

studies, the noise levels may be lower. The night noise impacts predicted in 2044 can be summarised as follows:

- The small group of houses at Bakangli are next to the proposed fuel farm and within 600m of the northern runway, and we assume they will be relocated as part of the Project.

- Noise levels at the nearest part of Yangitosh immediately to the south are predicted to be up to $L_{eq\ 9\ hr}$ night 66dB, which is substantially above the WHO Night Noise Guidance level of 55dB and here mitigation is essential, as discussed below.

- Kushek and Qorasuv would be overflown by aircraft using the southern runway (07R/25L), with noise levels above in the WHO Night Noise Guidance level of $L_{eq\ 9\ hr}$ night 55dB and here mitigation is essential, as discussed below.

- Further from the airport to the South and North there are approximately 40 other villages and small towns that would have noise levels above the preferred level, also requiring consideration of mitigation.

6.7 Section 6 gives details of a series of noise mitigation measures that should be developed, that are summarised as follows:

1. A study should be undertaken to assist the development of future flight paths with the aim of minimising the population affected by aircraft noise. For departures it is recommended that Noise Preferential Routes are defined, and the airport should then monitor the compliance of airlines flying within them. For arrivals routes should aim to minimise noise to the main built-up areas.
2. The benefit of operating a northern runway preference should be studied (see Section 6.3.3)
3. The possibility of shifting some night flights to the less noise-sensitive day periods should be studied as part of the future scheduling plans for the new airport (Section 6.4)
4. Operational restrictions should be developed to limit the operation of the noisiest aircraft at night, either by a full ban on the noisiest aircraft types, and/or increased charges for noisier aircraft, so as to incentivise airlines to operate their quietest fleets in the sensitive night-time period.
5. The design of the airfield should consider a noise barrier or bund on the southern side to reduce aircraft noise affecting Yangitish and Yangiyo'l.
6. It is assumed that the small group of properties at Bakangli will be relocated because of their proximity to the runway and fuel farm.
7. At Kushek and Qorasuv and Yangitosh significant sleep disturbance is predicted. Noise impacts of this type should be avoided, and one solution is therefore to relocate the dwellings. Alternatively, a noise insulation scheme could be developed to reduce noise levels inside homes to help residents to sleep at night.
8. Once other noise mitigation measures have been developed the feasibility of a noise insulation scheme should be studied for residential properties where noise levels are predicted to be above $L_{eq\ 9\ hr}$ night 45dB.
9. Land use planning processes should be put in place to ensure that future noise-sensitive development (eg residential and education) is not built in areas that will be exposed to high

levels of aircraft noise in future. SanPiN No. 0339-16 *Sanitary rules and norms of planning and development of settlements of Uzbekistan* provides for this process.

6.8 This study has provided an initial assessment of air-noise impacts from the airport, based on a series of worst-case assumptions. It indicates widespread significant noise impacts especially at night. It is recommended that the noise mitigation measures described are progressed through a series of further noise modelling studies working with the airport designers and Air Traffic Control providers.

6.9 The assessment of ground noise activities at the airport was conducted using IMMI2025 noise modelling software, employing the ISO 9613-2 methodology for accurate prediction of outdoor sound propagation. Aircraft were categorised for systematic analysis, with sound power data estimated from the AEDT database. Due to limited information on taxi routes and apron activities, the assessment is indicative and based on assumptions. Embedded mitigation measures, such as a 3-metre solid wall parallel to each runway, are included in the modelling, with noise levels reported for various receptors. While some receptors exceed noise criteria during taxiing, increases between 2029 and 2044 are less than 3 dB(A), and relocation of receptor H1 is assumed. Extending the noise barrier may be necessary to further protect sensitive locations. The proposal prioritises electric ground support vehicles and infrastructure-powered aircraft, thereby excluding associated noise emissions from the assessment and supporting sustainability objectives.

6.10 This report provides an assessment of the potential noise impact from road traffic on airport access roads, using the IMMI2025 noise modelling software in accordance with the Calculation of Road Traffic Noise (CRTN) methodology. While the new highway referenced is not part of the current application and lacks available traffic data, the report presents calculated noise levels at the nearest receptors are below the adopted criteria.

6.11 Noise predictions have been undertaken to provide an estimate of the noise emissions from the site during the construction works at the nearest receptors.

6.12 The report outlines that noise predictions have been carried out to estimate the levels of noise generated from construction activities at the closest sensitive receptors. These estimates are based on assumptions about the construction equipment to be used and source noise data from BS5228. Calculations have considered a worst-case scenario, placing the loudest machinery nearest to the receptors, and factoring in a 3-metre boundary screen. The results of these assessments indicate that construction noise at the considered receptors do not exceed the adopted criteria.

References

1. **World Bank Group**. *Environmental, Health, and Safety (EHS) Guidelines*. World Bank Group. 2007 (IFC)
2. **World Health Organization (WHO)**. *Guidelines for Community Noise*. WHO, 1999.
3. **World Health Organization (WHO)**. *Night Noise Guidelines for Europe*. WHO Regional Office for Europe, 2009.
4. **Research on Potential Noise Impacts on the Historic Environment**. *Proposals for Airport Expansion in England*. United Kingdom, 2014.
5. **Low Frequency Noise Study** prepared by Kathleen K. Hodgdon, Anthony A. Atchley, Robert J. Bernhard, April 2007 Report no.partner-coe-2007-001.
6. **Federal Aviation Administration (FAA)**. *Aviation Environmental Design Tool (AEDT)*. US Federal Aviation Authority.
7. **British Standards Institution (BSI)**. *BS 5228: 2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites*. BSI.
8. **British Standards Institution (BSI)**. *BS 6472:2008 – Guide to Evaluation of Human Exposure to Vibration in Buildings*. BSI, 2008.
9. **British Standards Institution (BSI)**. *BS 7385:1993 – Evaluation and Measurement for Vibration in Buildings*. BSI, 1993.
10. ***Calculation of Road Traffic Noise (CRTN).*** United Kingdom, 1988. Department of Transport (UK)**.**
11. **ISO 9613-2:2024 Acoustics** — Attenuation of sound during propagation outdoors Part 2: Engineering method for the prediction of sound pressure levels outdoors.

APPENDIX A – INTRODUCTION TO NOISE

Noise

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB.

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs. For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest.

In the UK, traffic noise is measured as the L_{A10}, the noise level exceeded for 10% of the measurement period. The L_{A90} is the level exceeded for 90% of the time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, L_{Aeq}. This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound.

To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

Note that the time constant and the period of the noise measurement should be specified. For example, BS 4142 specifies background noise measurement periods of 1 hour during the day and 5 minutes during the night. The noise levels are commonly symbolised as $_{A90(1hour)}$ and $L_{A90(5mins)}$. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125 ms.

Table A1: Glossary of Terms

Term	Definition
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1/s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{Aeq,15h}$ (DAY)	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded. For contours this is based on the daily average aircraft movements that take place within the 17-hour period (0700-2200 local time) over the year.
$L_{Aeq,9h}$ (NIGHT)	For contours this is based on the daily average aircraft movements that take place within the 17-hour period (2200-0700 local time) over the year.
$L_{A90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the 'average minimum' noise level and is often used to describe the background noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Lden	Equivalent sound level of aircraft noise in dBA for the 24-hour annual average period with 5 dB weightings for $L_{evening}$ and 10 dB weightings for L_{night}.
ECAC	European Civil Aviation Conference
ILS	Instrument Landing System
Rating Noise Level	The specific noise level plus any adjustment for the characteristic features of the noise ($L_{Ar,Tr}$).
SEL	The total noise energy produced from a single noise event, normalised to a 1-second duration. This is equal to L_{Aeq} + 10log(T).
EHS Guidelines	Environmental, Health, and Safety Guidelines issued by the World Bank Group, providing performance levels and measures for environmental and occupational risk management.
WHO	World Health Organization, a United Nations agency responsible for public health guidance, including environmental noise impacts on human health.
Night Noise Guidelines	WHO guidance defining recommended night-time noise limits to protect sleep and prevent adverse health effects.
FAA	Federal Aviation Administration of the United States, responsible for civil aviation regulation and environmental assessment tools
AEDT	Aviation Environmental Design Tool, a software system developed by the FAA to model aircraft noise, emissions, and fuel consumption.

Term	Definition
ESIA	Environmental and Social Impact Assessment, a formal process to identify, predict, and evaluate environmental and social effects of proposed developments.
CRTN	Calculation of Road Traffic Noise, the UK's long-established methodology for predicting noise from road traffic.
AirNoise	A noise modelling software package commonly used for aircraft noise assessment at airports.
ISO 9613	An international standard describing methods for calculating outdoor sound propagation and attenuation.

APPENDIX B – SUMMARY OF LENDER REQUIREMENT

Summary of Lender Requirements

EBRD Guidelines

The European Bank for Reconstruction and Development (EBRD) sets out its Environmental and Social Requirements (ESR) in ten documents, with the following being central to noise assessment:

- ESR1: Assessment and management of environmental and social risks and impacts
- ESR3: Resource efficiency and pollution prevention and control
- ESR4: Health, safety and security
- ESR8: Cultural Heritage
- ESR10: Stakeholder Engagement

The guidelines further specify project categorisation as follows:

- A project is categorised “A” if it may result in significant environmental and/or social impacts, including direct and cumulative impacts that are new, additional and not easily identified or mitigated. Category A projects require a formal, participatory environmental and social impact assessment (ESIA), including **screening, scoping,** and assessment of alternatives. Airports with a basic runway length of 2,100 metres or more are an example of Category A projects.
- A project is categorised “B” when its potential adverse impacts are typically site-specific and can be identified and addressed through mitigation. The EBRD determines the scope of assessment on a case-by-case basis.
- A project is categorised “C” if it is likely to have limited impacts that can be readily identified and mitigated.

ESR3 requires clients to assess noise and vibration impacts based on the results of the environmental and social risk assessment. This may involve gathering baseline data, identifying key receptors, and assessing both negative and positive impacts, ensuring compliance with national legislation and Good International Industry Practice (GIIP) such as IFC Guideleines**.**

APPENDIX C – AIRCRAFT FOR NOISE MODELLING & FORECASTS

Table C1 Aircraft Types

ICAO Type	Type	AEDT Type	AEDT Description	AEDT Engine Model	Stage Length
A320	A320	A320-211	A320-211\CFM56-5A1	CFM56-5B4/P	4
A20N	A320 NEO	A320-270N	A320-271N\PW1127G-JM with mod160734 engines	LEAP-1A26/26E1	1
A21N	A321 NEO	A321-232	A321-232\V2530-A5	LEAP-1A35A/33/33B2/32/30	3
B763	B767 300	767300	BOEING 767-300/CF6-80A	PW4062	4
AT76	ATR 72 600	DHC830	DASH 8-300/PW123	PW127F	1
B788	B787 800	7879	Boeing 787-9/GEnx-1B76A/P2	02P23RR126	4
B738	B737 800	737800	BOEING 737-800/CFM56-7B26	CFM56-7B26E	1
A332	A330 200	A330-343	A330-343\RR TRENT 772B	Trent 772	4
B38M	B737 MAX8	7378MAX	737MAX8\CFMLeap1B27	LEAP-1B25	3
L410	Turbolet	DHC6	DASH 6/PT6A-27	TP10GT	1
A319	A319	A319-131	A319-131\IAE V2522-A5	CFM56-5B3/2P	4
B753	B757 300	757RR	BOEING 757-200/RB211-535E4	RB211-535E4B	4
SU95	Sukhoi SJ 100-95	737300	BOEING 737-300/CFM56-3B-1	CFM56-3-B1	3
RJ85	BAe 146	BAE146	BAE146-200/ALF502R-5	ALF 502R-3	1
B190	Beechcraft 1900	1900D	BEECH 1900D / PT6A67	PT6A-67D	1
C295	Airbus C295	DHC8	DASH 8-100/PW121	PW127G	1
B77L	B777 200	777200	BOEING 777-200ER/GE90-90B	9GE127	5
H130	H130	EC130	Eurocopter EC-130 w/Arriel 2B1	TPE3	1
HDJT	HA-420	CNA510	510 CITATION MUSTANG	1PW036	1
CRJ2	CRJ-200	CL601	CL601/CF34-3A	1GE035	1
B752	B757 200	757300	BOEING 757-300/RB211-535E4B	PW2043	1
IL76	IL76	C17	F117-PW-100 NM	13AA006	1
GLEX	GLEX	BD-700-1A10	BD-700-1A10\BR700-710A2-20	4BR002	1
E190	E190	EMB190	ERJ190-100	8GE119	4
C172	C172	CNA172	CESSNA 172R / LYCOMING IO-360-L2A	IO360	1
B748	B747 800	747400	BOEING 747-400/PW4056	RB211-524G-T	2

Table C2 Daily Forecast Aircraft Numbers 2029, 2044

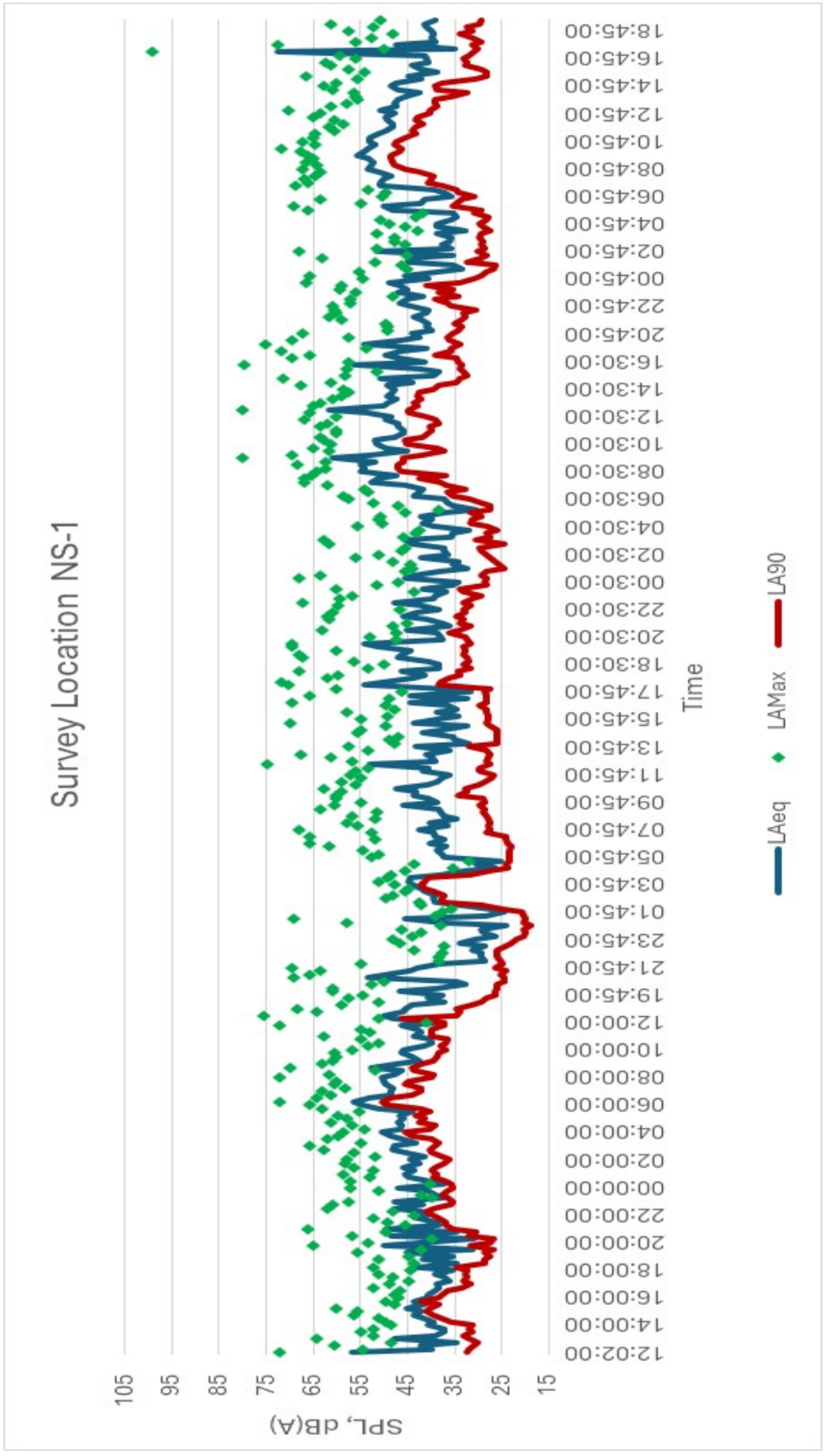
ICAO Type	Type	2029 Day	2029 Night	2044 Day	2044 Night
A320	A320	33.7	19.8	83.4	49.1
A20N	A320 NEO	28.2	14.9	69.9	36.8
A21N	A321 NEO	30.2	15.5	74.8	38.3
B763	B767 300	20.1	13.8	49.6	34.0
AT76	ATR 72 600	19.8	10.2	48.9	25.1
B788	B787 800	10.0	6.8	24.8	16.7
B738	B737 800	8.7	6.4	21.5	15.7
A332	A330 200	12.2	6.0	30.1	14.9
B38M	B737 MAX8	7.0	2.1	17.3	5.2
L410	Turbolet	3.2	3.2	8.0	8.0
A319	A319	3.0	1.1	7.5	2.6
B753	B757 300	1.7	1.1	4.2	2.6
SU95	Sukhoi SJ 100-95	1.0	1.9	2.5	4.7
RJ85	BAe 146	1.3	0.5	3.2	1.2
B190	Beechcraft 1900	0.8	0.8	1.9	1.9
C295	Airbus C295	0.9	0.6	2.1	1.6
B77L	B777 200	0.6	0.6	1.6	1.4
H130	H130	1.8	1.2	4.3	3.0
HDJT	HA-420	0.7	0.3	1.8	0.7
CRJ2	CRJ-200	0.8	0.2	1.9	0.4
B752	B757 200	0.5	0.3	1.4	0.8
IL76	IL76	0.5	0.4	1.3	1.0
GLEX	GLEX	4.1	1.7	10.0	4.2
E190	E190	0.5	0.2	1.3	0.4
C172	C172	0.8	0.5	1.9	1.1
B748	B747 800	0.3	0.2	0.7	0.5
Total		**192.4**	**110.0**	**475.9**	**272.2**

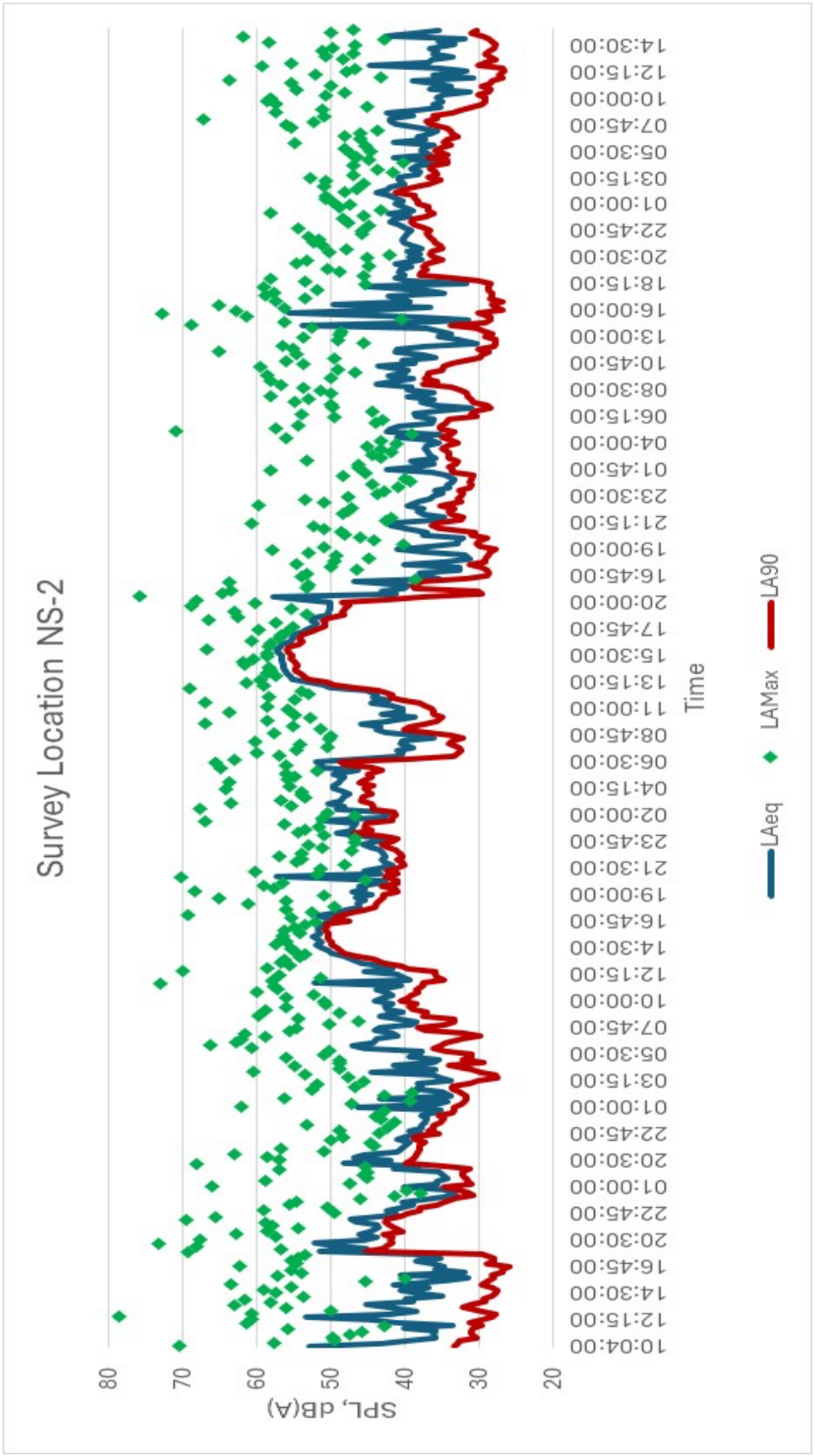
APPENDIX D – CONSTRUCTION PLANT

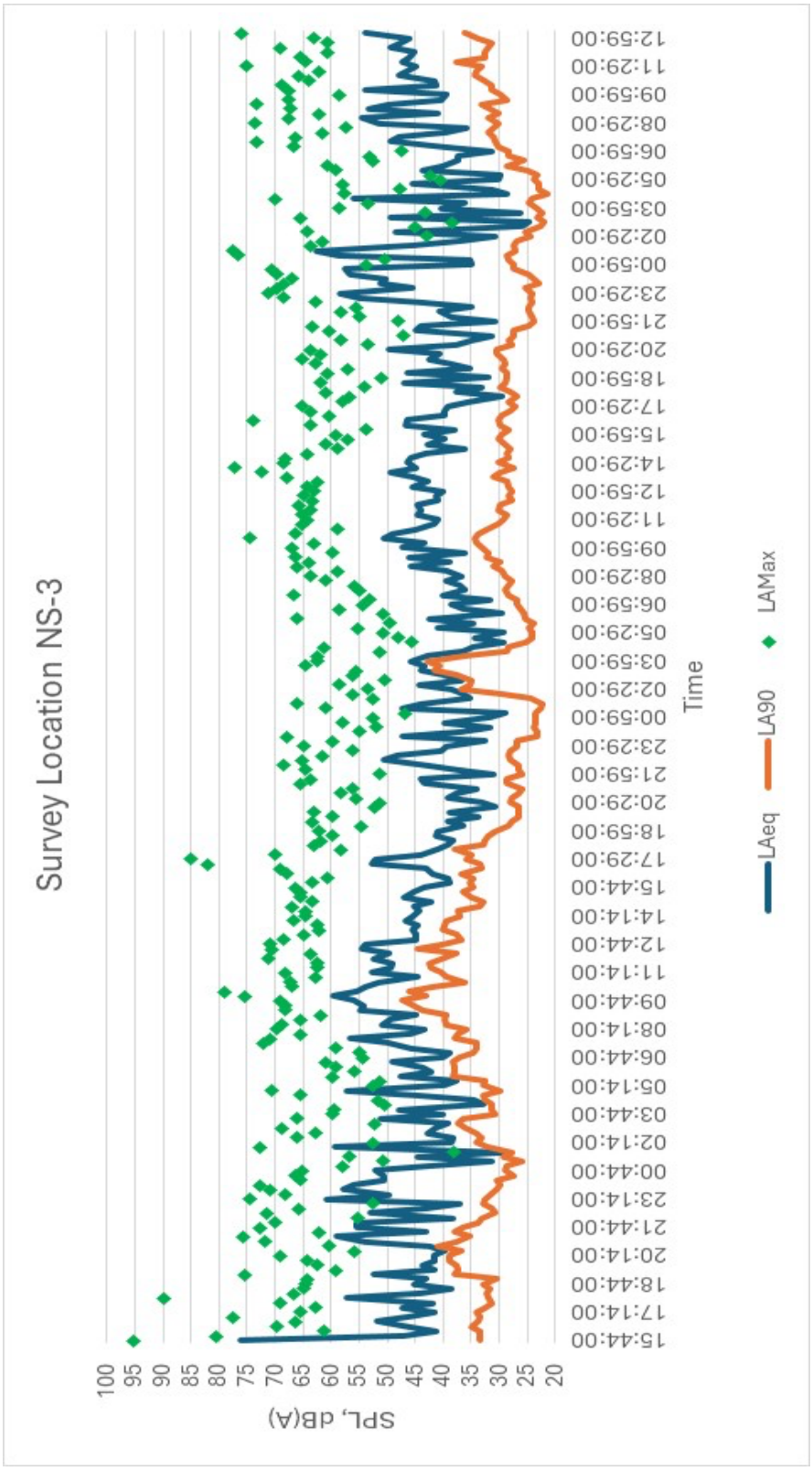
Table D1 Assumed Construction Plant

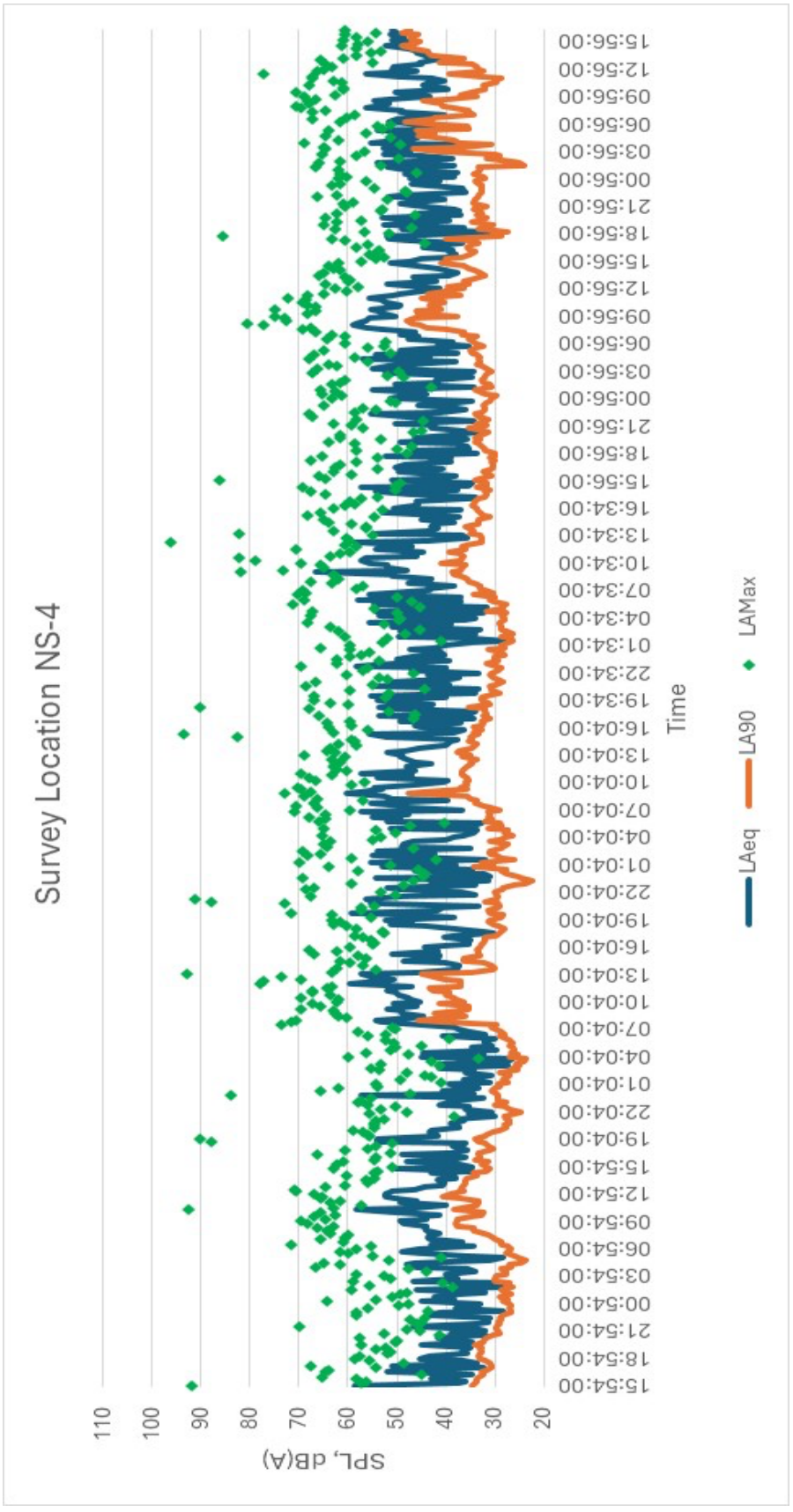
Construction Activity	BS5288 Reference	Sound Power Level, dB(A)	Number of Plant
Site Clearance			
Tracked Excavator (22t)	BS8233: Table C.2(3)	106	1
Bulldozer	BS8233: Table C.2(12)	109	1
Dump Truck (29t)	BS8233: Table C.2(30)	107	10
Vibratory Roller	BS8233: Table C.2(39)	102	1
Earthworks & Ground Improvement (Runway/Taxiway Formation)			
Dump Truck (29t)	BS8233: Table C.2(30)	107	2
Wheeled Loader	BS8233: Table C.2(27)	108	1
Scraper	BS8233: Table D.9(13)	95	1
Compactor/Bomag	BS8233: Table C.2(42)	106	1
Excavator breaker(360, 15t)	BS8233: Table C.1(9)	118	1
Air Compressors	BS8233: Table C.5(5)	93	2
Piling & Foundation Works (Terminals/Buildings)			
Hydraulic Hammer Rig	BS8233: Table C.3(1)	117	1
Tracked Crane	BS8233: Table C.3(29)	98	1
Excavator	BS8233: Table C.2(3)	106	1
General Structural & Finishing Stage			
Tracked Mobile crane	BS8233: Table C.4(45)	110	1
Lorry	BS8233: Table C.2(34)	108	5
Dump truck	BS8233: Table C.2(30)	107	2
Tracked Excavator	BS8233: Table C.2(19)	105	1

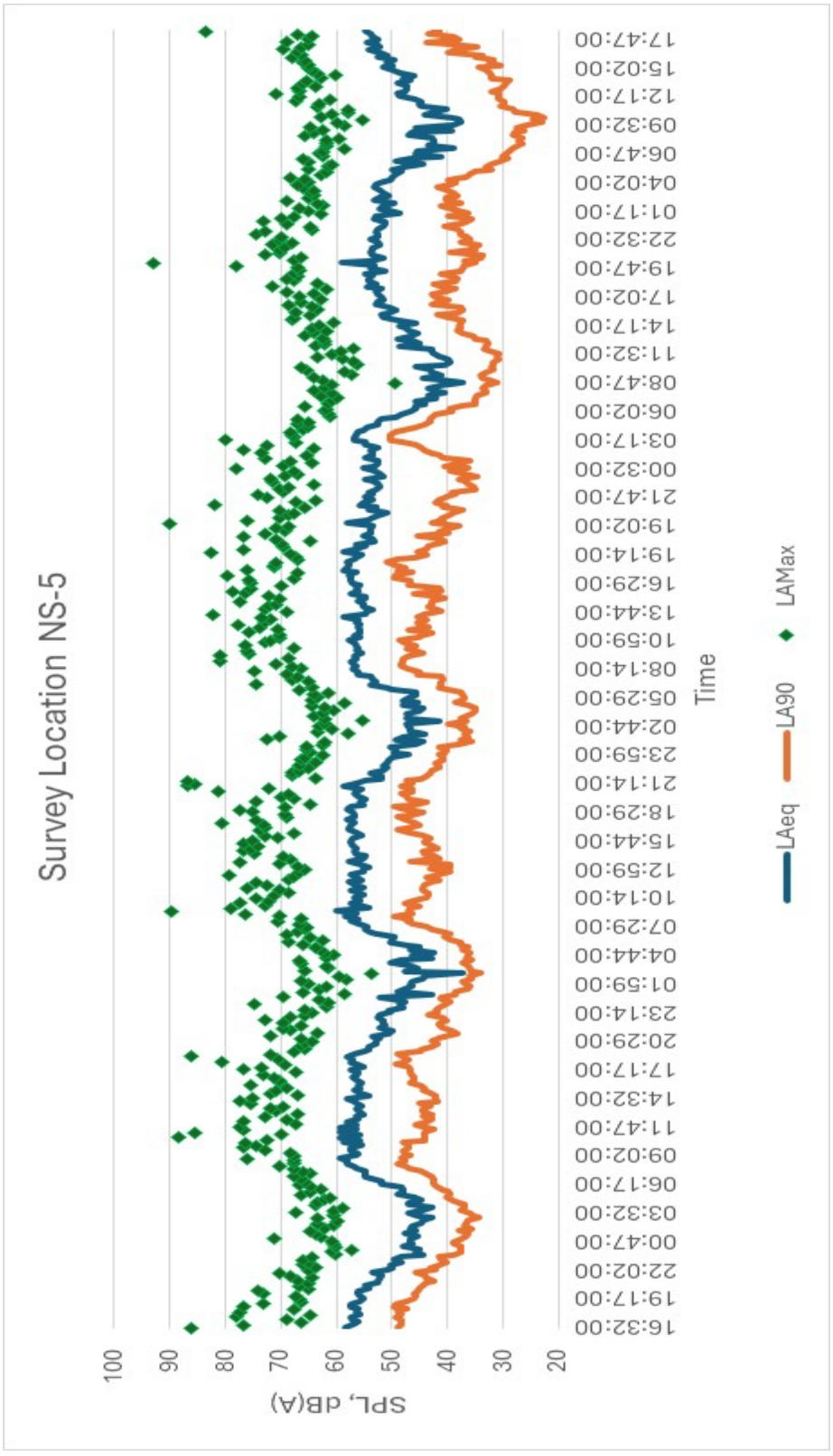
APPENDIX E – TIME HISTORIES OF MEASURED NOISE LEVEL

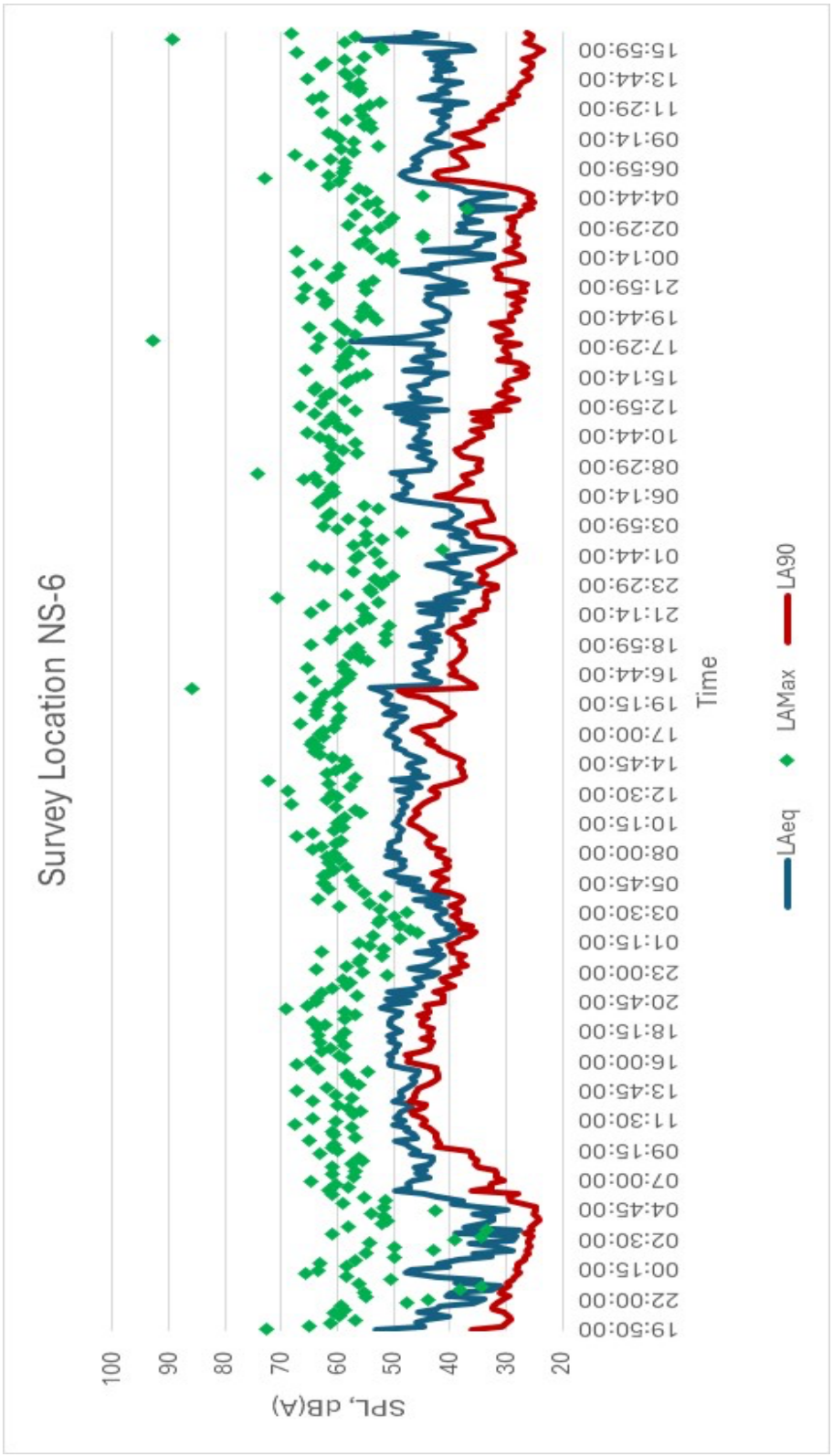

Survey Location NS-1
SPL, dB(A)
105
95
85
75
65
55
45
35
25
15
Time
12:02:00
14:00:00
16:00:00
18:00:00
20:00:00
22:00:00
00:00:00
02:00:00
04:00:00
06:00:00
08:00:00
10:00:00
12:00:00
19:45:00
21:45:00
23:45:00
01:45:00
03:45:00
05:45:00
07:45:00
09:45:00
11:45:00
13:45:00
15:45:00
17:45:00
18:30:00
20:30:00
22:30:00
00:30:00
02:30:00
04:30:00
06:30:00
08:30:00
10:30:00
12:30:00
14:30:00
16:30:00
20:45:00
22:45:00
00:45:00
02:45:00
04:45:00
06:45:00
08:45:00
10:45:00
12:45:00
14:45:00
16:45:00
18:45:00
LAeq
LAMax
LA90

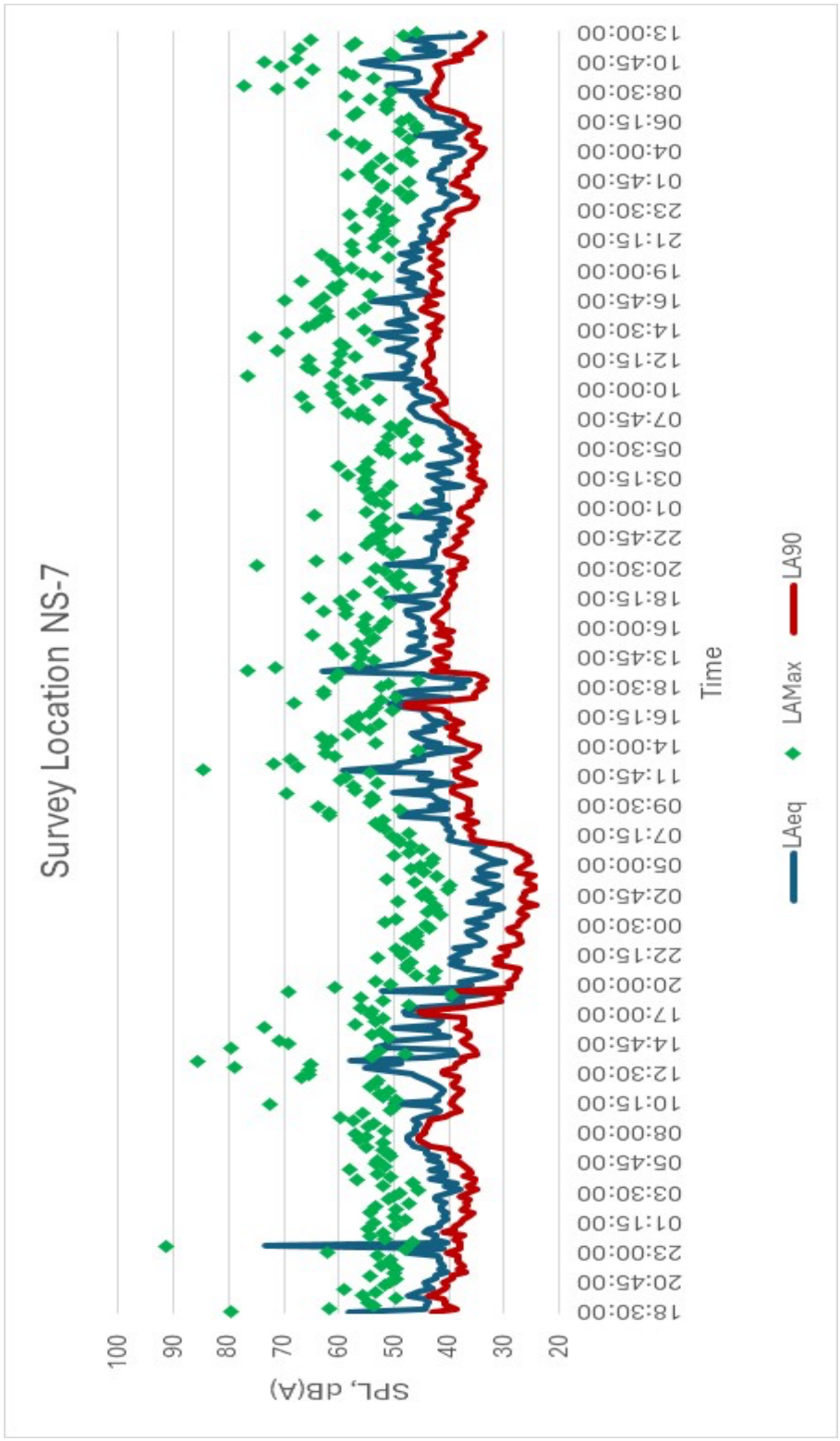

Survey Location NS-2
SPL, dB(A)
80
70
60
50
40
30
20
Time
10:04:00
12:15:00
14:30:00
16:45:00
20:30:00
22:45:00
01:00:00
03:15:00
05:30:00
07:45:00
10:00:00
12:15:00
14:30:00
16:45:00
19:00:00
21:30:00
23:45:00
02:00:00
04:15:00
06:30:00
08:45:00
11:00:00
13:15:00
15:30:00
17:45:00
20:00:00
16:45:00
19:00:00
21:15:00
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13:00:00
16:00:00
18:15:00
20:30:00
22:45:00
01:00:00
03:15:00
05:30:00
07:45:00
10:00:00
12:15:00
14:30:00
LAeq
LAMax
LA90

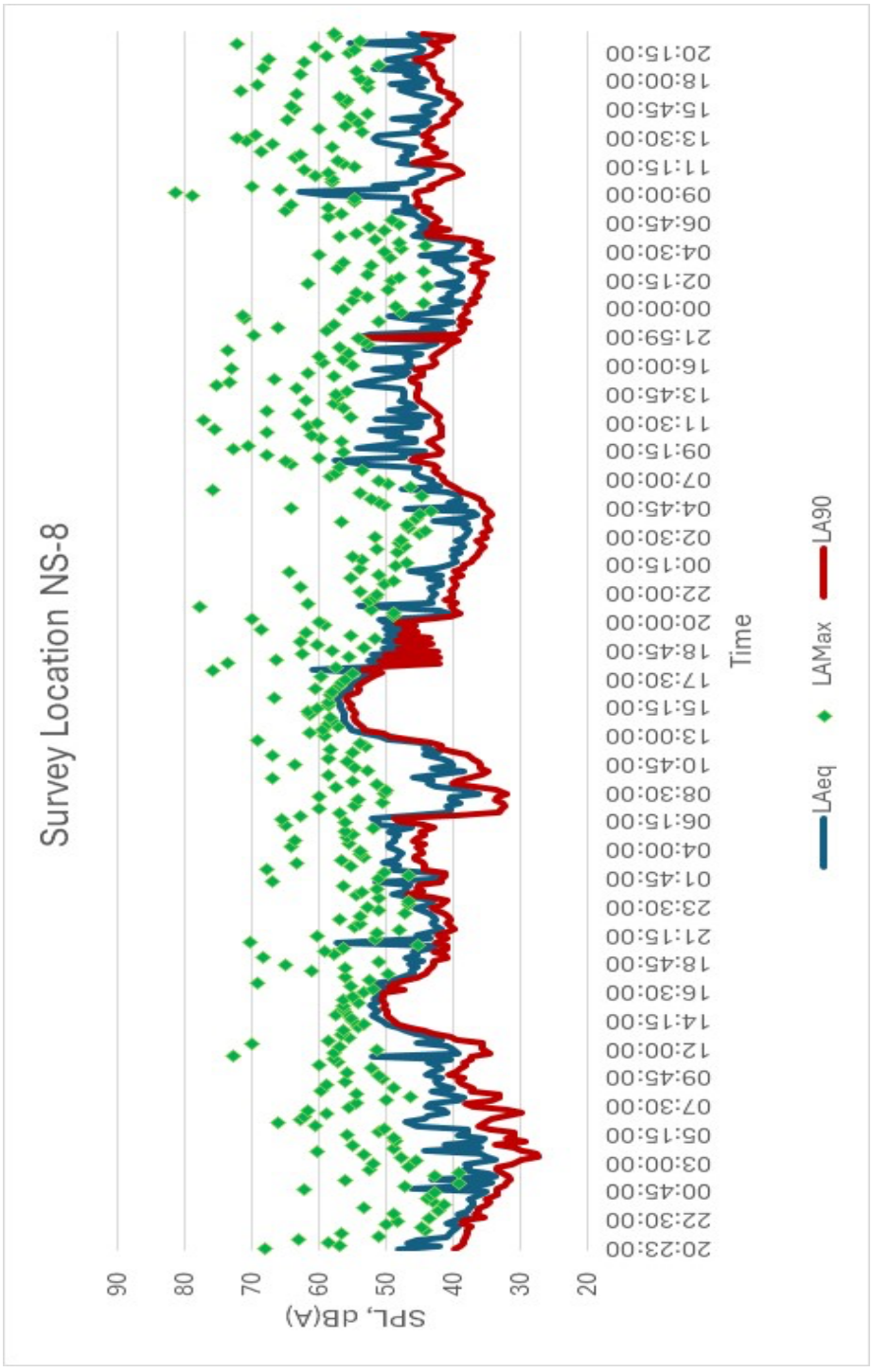

Survey Location NS-3
SPL, dB(A)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
Time
15:44:00
17:14:00
18:44:00
20:14:00
21:44:00
23:14:00
00:44:00
02:14:00
03:44:00
05:14:00
06:44:00
08:14:00
09:44:00
11:14:00
12:44:00
14:14:00
15:44:00
17:29:00
18:59:00
20:29:00
21:59:00
23:29:00
00:59:00
02:29:00
03:59:00
05:29:00
06:59:00
08:29:00
09:59:00
11:29:00
12:59:00
14:29:00
15:59:00
17:29:00
18:59:00
20:29:00
21:59:00
23:29:00
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02:29:00
03:59:00
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06:59:00
08:29:00
09:59:00
11:29:00
12:59:00
LAeq
LA90
LAMax

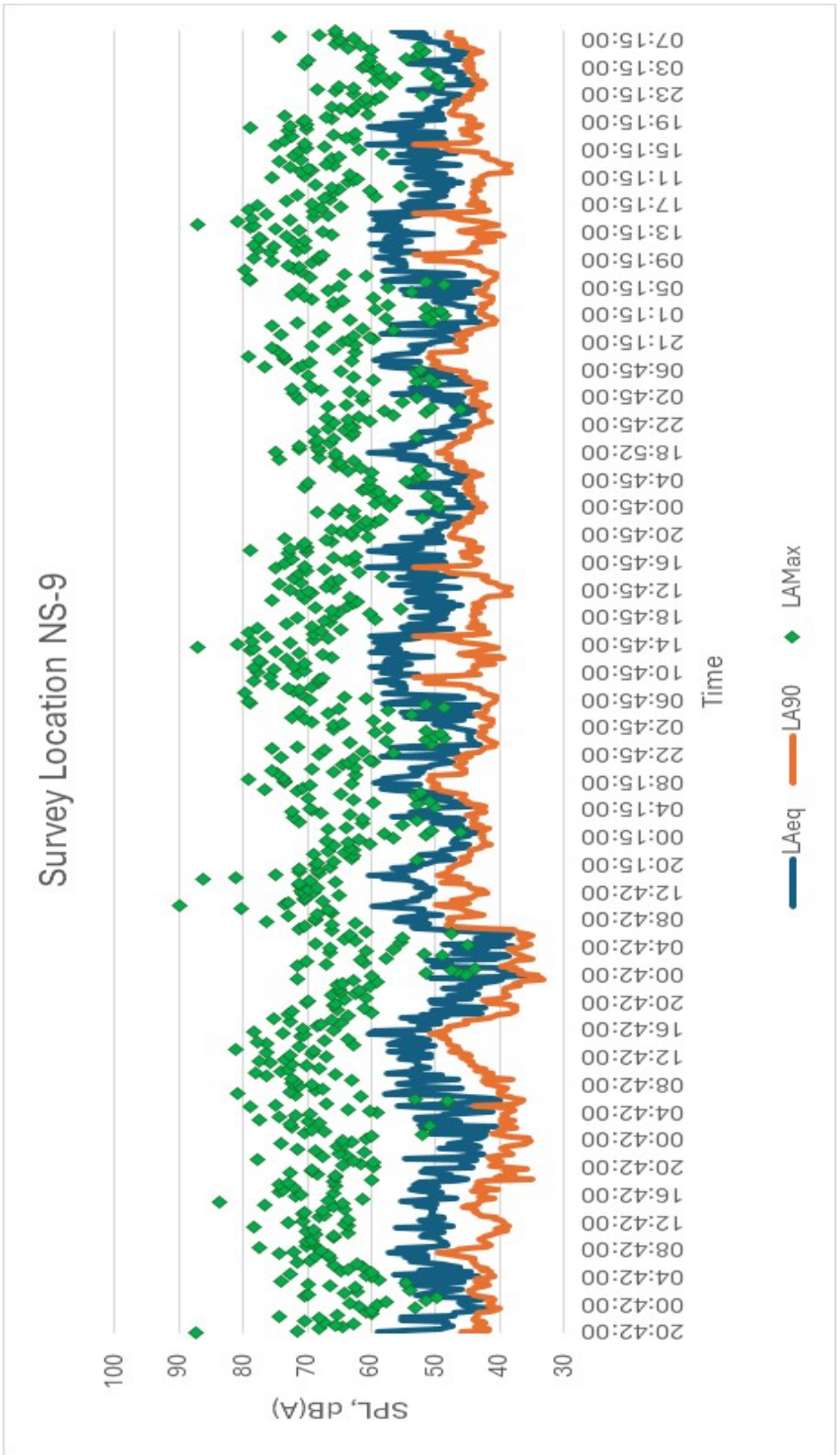

Survey Location NS-4
SPL, dB(A)
110
100
90
80
70
60
50
40
30
20
Time
15:54:00
18:54:00
21:54:00
00:54:00
03:54:00
06:54:00
09:54:00
12:54:00
15:54:00
19:04:00
22:04:00
01:04:00
04:04:00
07:04:00
10:04:00
13:04:00
16:04:00
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22:04:00
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07:04:00
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18:56:00
21:56:00
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03:56:00
06:56:00
09:56:00
12:56:00
15:56:00
LAeq
LA90
LAMax

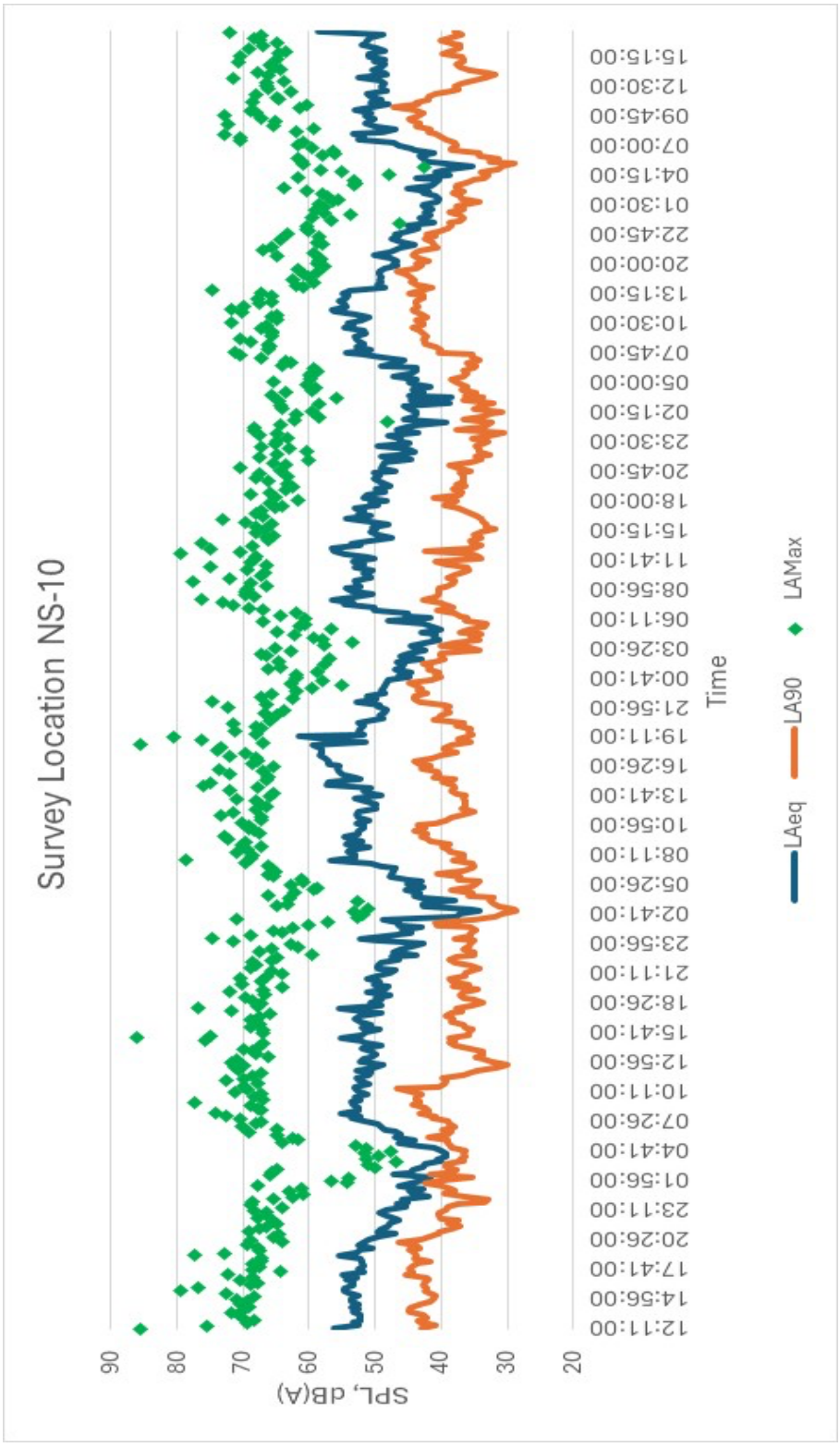

Survey Location NS-5
SPL, dB(A)
100
90
80
70
60
50
40
30
20
Time
16:32:00
19:17:00
22:02:00
00:47:00
03:32:00
06:17:00
09:02:00
11:47:00
14:32:00
17:17:00
20:29:00
23:14:00
01:59:00
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07:29:00
10:14:00
12:59:00
15:44:00
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10:59:00
13:44:00
16:29:00
19:14:00
19:02:00
21:47:00
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03:17:00
06:02:00
08:47:00
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14:17:00
17:02:00
19:47:00
22:32:00
01:17:00
04:02:00
06:47:00
09:32:00
12:17:00
15:02:00
17:47:00
LAeq
LA90
LAMax

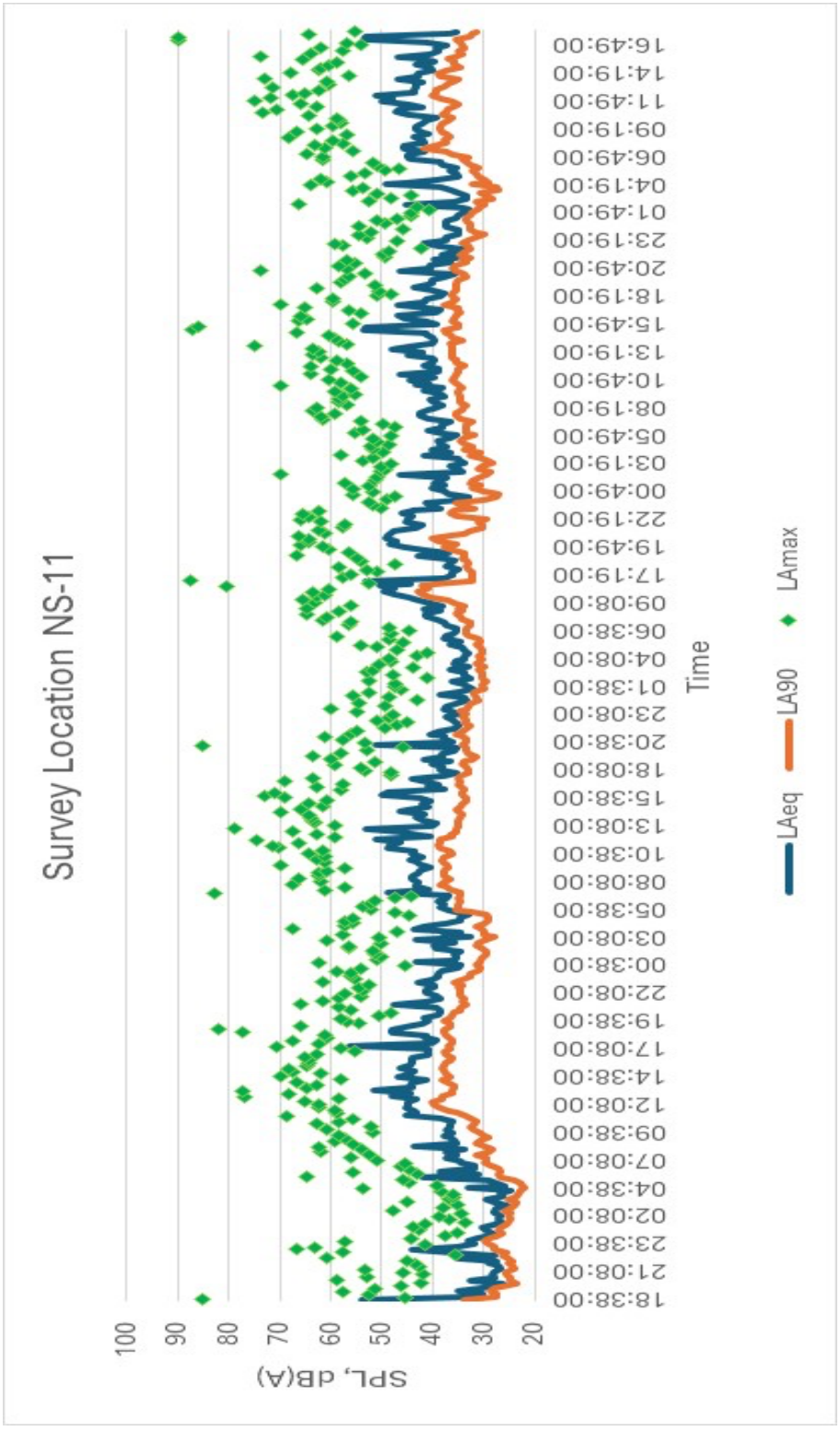

Survey Location NS-6
SPL, dB(A)
100
90
80
70
60
50
40
30
20
Time
19:50:00
22:00:00
00:15:00
02:30:00
04:45:00
07:00:00
09:15:00
11:30:00
13:45:00
16:00:00
18:15:00
20:45:00
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19:44:00
21:59:00
00:14:00
02:29:00
04:44:00
06:59:00
09:14:00
11:29:00
13:44:00
15:59:00
LAeq
LAMax
LA90


Survey Location NS-7
SPL, dB(A)
100
90
80
70
60
50
40
30
20
Time
18:30:00
20:45:00
23:00:00
01:15:00
03:30:00
05:45:00
08:00:00
10:15:00
12:30:00
14:45:00
17:00:00
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03:15:00
05:30:00
07:45:00
10:00:00
12:15:00
14:30:00
16:45:00
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21:15:00
23:30:00
01:45:00
04:00:00
06:15:00
08:30:00
10:45:00
13:00:00
LAeq
LAMax
LA90


Survey Location NS-8
SPL, dB(A)
90
80
70
60
50
40
30
20
Time
20:23:00
22:30:00
00:45:00
03:00:00
05:15:00
07:30:00
09:45:00
12:00:00
14:15:00
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04:30:00
06:45:00
09:00:00
11:15:00
13:30:00
15:45:00
18:00:00
20:15:00
LAeq
LAMax
LA90


Survey Location NS-9
SPL, dB(A)
100
90
80
70
60
50
40
30
Time
LAeq
LA90
LAMax
20:42:00
00:42:00
04:42:00
08:42:00
12:42:00
16:42:00
20:42:00
00:42:00
04:42:00
08:42:00
12:42:00
16:42:00
20:42:00
00:42:00
04:42:00
08:42:00
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06:45:00
21:15:00
01:15:00
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09:15:00
13:15:00
17:15:00
11:15:00
15:15:00
19:15:00
23:15:00
03:15:00
07:15:00


Survey Location NS-10
SPL, dB(A)
90
80
70
60
50
40
30
20
Time
12:11:00
14:56:00
17:41:00
20:26:00
23:11:00
01:56:00
04:41:00
07:26:00
10:11:00
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21:56:00
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18:00:00
20:45:00
23:30:00
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05:00:00
07:45:00
10:30:00
13:15:00
20:00:00
22:45:00
01:30:00
04:15:00
07:00:00
09:45:00
12:30:00
15:15:00
LAeq
LA90
LAMax


Survey Location NS-11
SPL, dB(A)
100
90
80
70
60
50
40
30
20
Time
18:38:00
21:08:00
23:38:00
02:08:00
04:38:00
07:08:00
09:38:00
12:08:00
14:38:00
17:08:00
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20:49:00
23:19:00
01:49:00
04:19:00
06:49:00
09:19:00
11:49:00
14:19:00
16:49:00
LAeq
LA90
LAmax

APPENDIX F – AIRNOISE CONTOURS

Figure F.1 2029 Daytime $L_{eq\ 15\ hr}$ Noise Contours

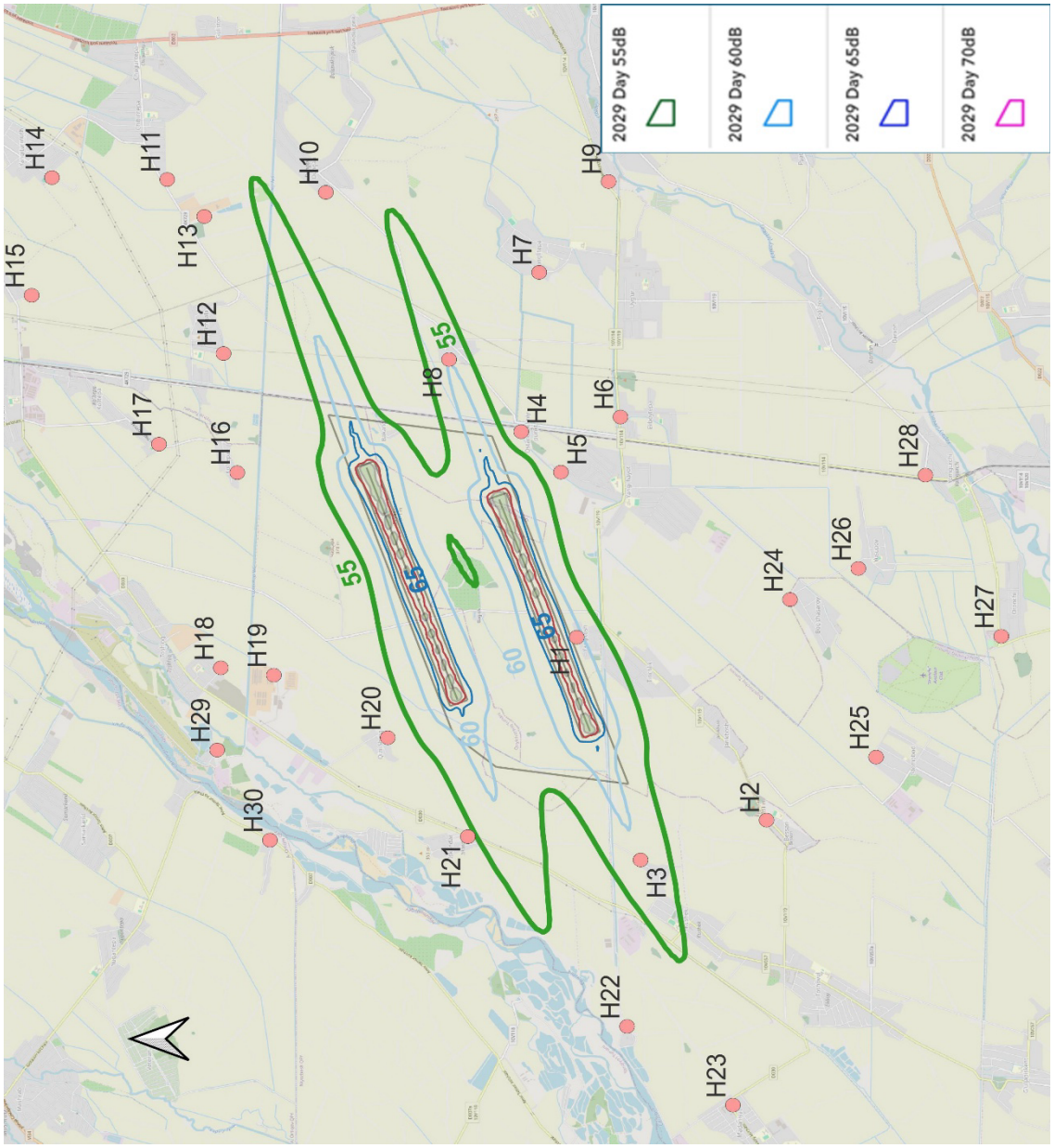


Figure F.2 2029 Night-time $L_{eq\ 9\ hr}$ Noise Contours

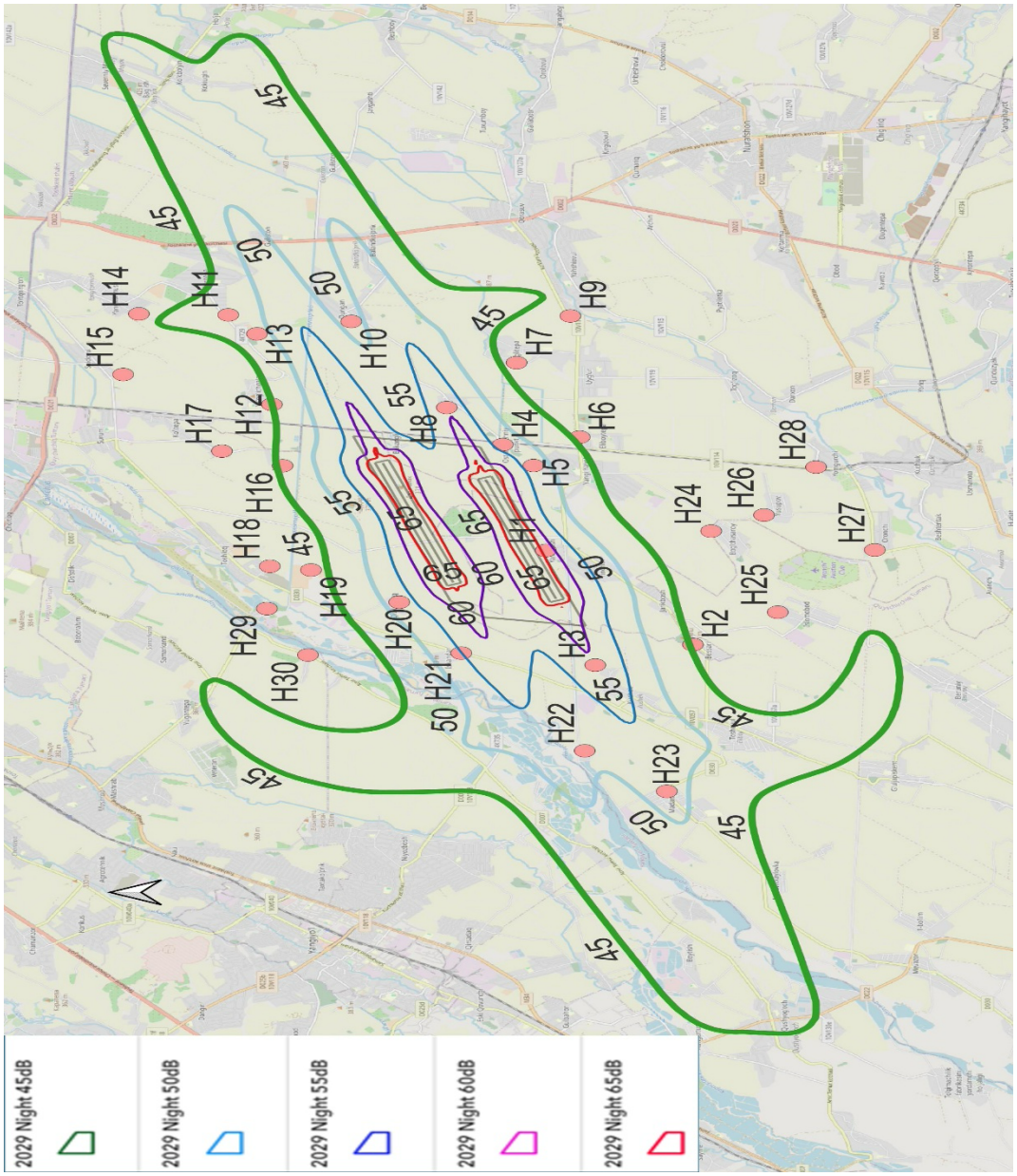


Figure F.3 2044 Daytime $L_{eq\ 15\ hr}$ Noise Contours

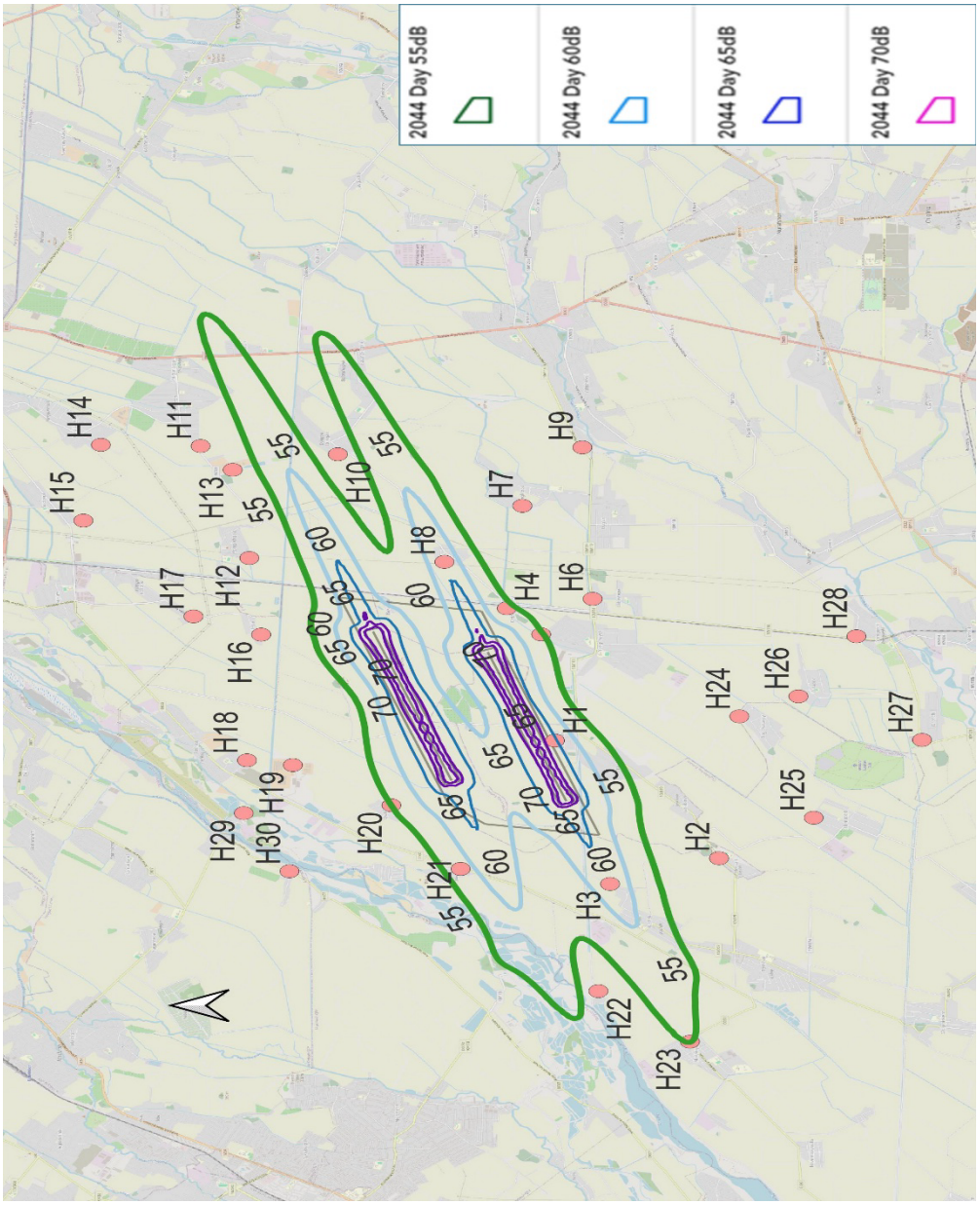


Figure F.4 2044 Night-time $L_{eq\ 9\ hr}$ Noise Contours

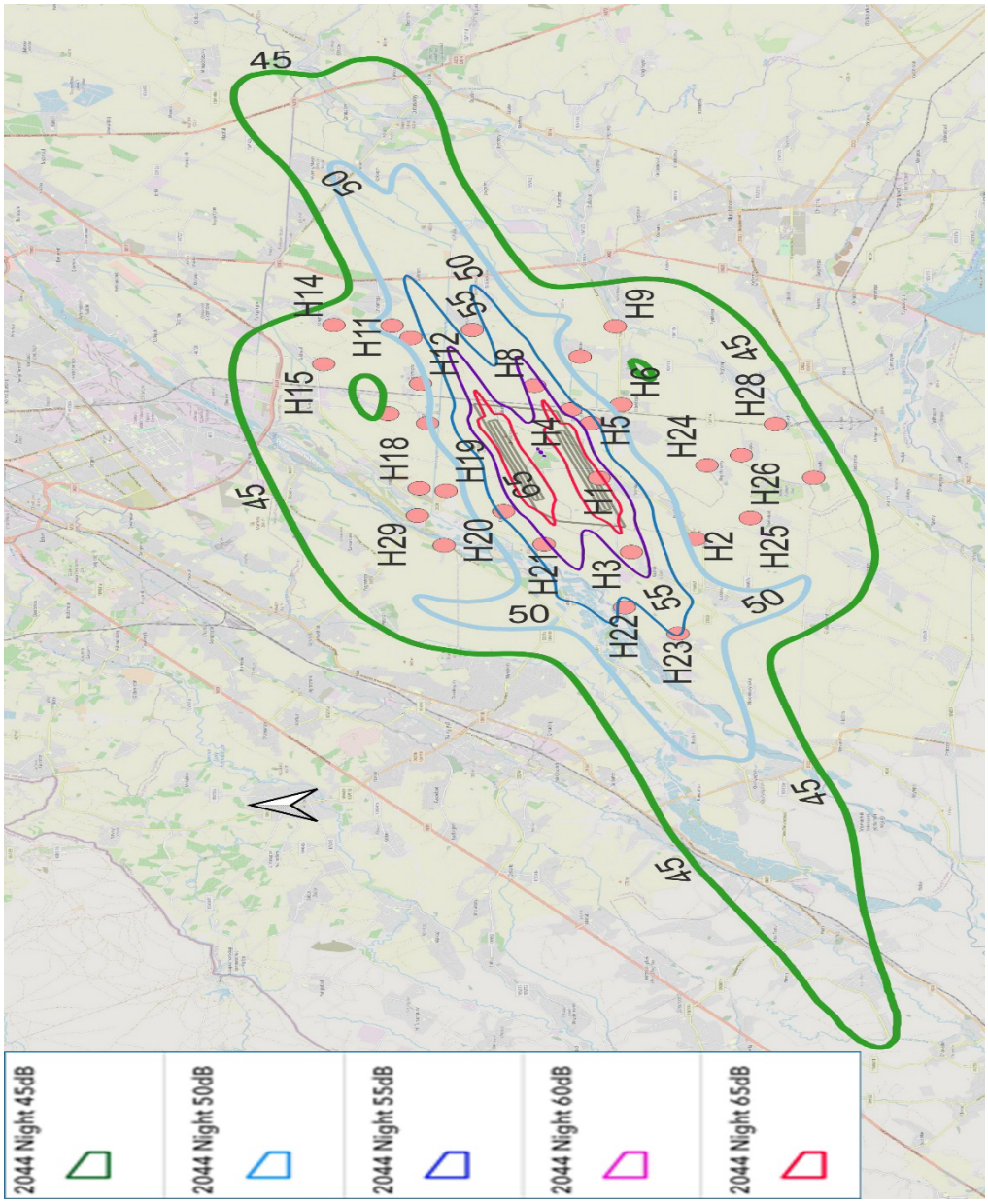


Figure F.5 90 dB SEL Contour (B767-300)

