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RDIMS Number Numéro de SGDDI
17720558

July 23, 2021

Winnipeg Airports Authority
249-2000 Wellington Ave
Winnipeg, MB R3H1C2

**Attn:** Andrew Curwain P.Eng, Director, Airport Planning & Infrastructure

**Subject:** Request for a technical review of the noise planning contours contained within the report entitled Winnipeg J.A. Richardson International Airport - Ultimate Airport Noise Exposure Contours for AVDP Update, dated May 31, 2021.

Transport Canada has undertaken its review as per Section 4.2 of Transport Canada's publication TP1247 *Land-use in the vicinity of aerodromes*. Section 4.2 states the preparation and approval of noise contours for aerodromes that are neither owned, nor operated and managed by the Federal Government is not a responsibility of Transport Canada. Transport Canada will conduct a technical review of an NEF, NEP or Planning Contour if requested by the sponsoring aerodrome operator or airport authority provided that:

a. the Aerodrome owner or operator initiates this action;
b. the Aerodrome owner or operator supplies or approves a projection of aircraft traffic, both as to type and numbers; and
c. the Aerodrome owner or operator uses the noise impact prediction methods, procedures and recommended practices relating to aircraft operations as established by Transport Canada.

Transport Canada has concluded that the Noise Exposure Forecast tool has been used appropriately by AVIA NG Airport Consultants to produce the above referenced noise planning contours. The review was based on information provide to Transport Canada by AVIA NG Airport Consultants.

Please note that the scenarios depicted, traffic forecasts, fleet mixes, runway utilization and day/night allocations of traffic used in the production of the contours are the responsibility of the sponsor of these noise contours. Moreover, this technical review does not constitute an endorsement of the recommendations contained within the report. These recommendations are a matter between the authors of the report and the Winnipeg Airports Authority.

Sincerely,

Ted McDonald
Senior Environmental Protection Specialist
Transport Canada, Civil Aviation
Ted.McDonald@tc.gc.ca

AVIA • NG
AIRBIZ

# Winnipeg J.A. Richardson International Airport

# Ultimate Airport Noise Exposure Contours for AVDP Update

# EXECUTIVE SUMMARY

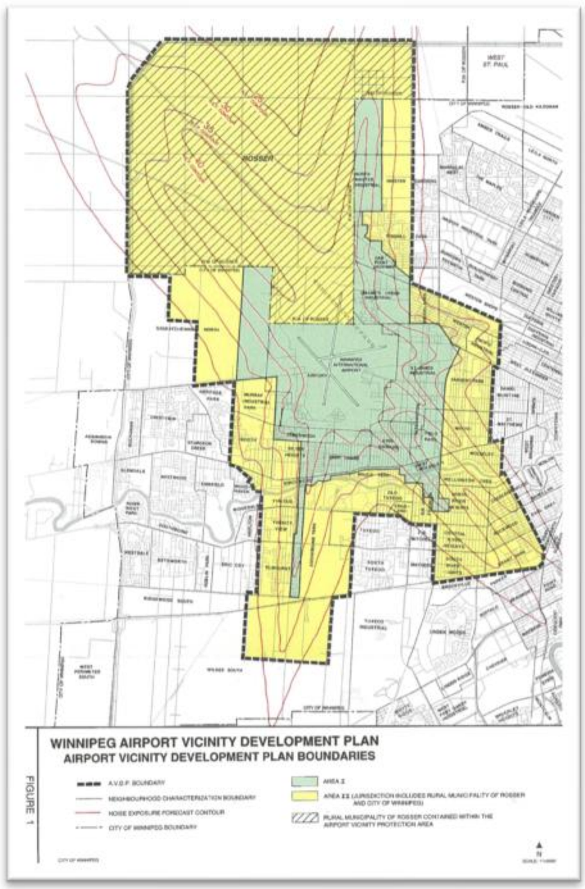
Winnipeg Airports Authority (WAA)

AviaNG.ca

Revision 0
July 7, 2021
21-0024

# 1. INTRODUCTION

- Winnipeg Airports Authority (WAA) recognizes the need for and supports a comprehensive review and update of the City of Winnipeg's *Airport Vicinity Development Plan (AVDP).* The AVDP was established to regulate land uses and development in the vicinity of the airport and was originally adopted by the City of Winnipeg on May 25, 1994.
- The AVDP was designed to protect the ability of the airport to continue to operate 24-hours with no or limited restrictions by promoting compatible development around the airport with particular emphasis on limiting residential development within noisy areas around the airport.
- The boundaries of the AVDP are directly related to noise exposure contours which were established in 1994 by Transport Canada based on the ultimate traffic volume at the Winnipeg J.A. Richardson International Airport in addition to also considering a new parallel runway to the northeast.[1]
- The AVDP boundaries and the associated noise exposure forecast contours are shown in Figure ES-1.
- The existing AVDP contemplated the need to review and update the noise exposure contours at some point in the future due to changes in airport activity, technology and other factors that may influence land use planning policy related to aircraft noise compatibility.
- The purpose of this study entitled ***Ultimate Airport Noise Exposure Contours for AVDP Update*** was to update the noise exposure contours for the Winnipeg J.A. Richardson International Airport (YWG) to reflect a more current vision of the ultimate long-term airport activity and layout and to use the latest Transport Canada noise modelling software and methodologies.
- The resulting updated contours are to be used to inform updates to the AVDP related to aircraft noise compatibility on lands surrounding the airport and is based on the official Canadian Noise Exposure Forecast (NEF) noise metric.




**FigureES-1: Existing Airport Vicinity Development Plan**

[1] Winnipeg Airport Vicinity Development Plan, AVDP Boundary, Adopted by City Council, May 25, 1994.

## 1.1 STUDY STAKEHOLDERS AND ROLES

- **Winnipeg Airports Authority (WAA)**

Winnipeg Airports Authority Inc. (WAA) initiated and has funded this study. WAA acted as the overall project coordinator for this study and provided technical and master planning inputs to the Consultant. WAA also facilitated communications with NAV CANADA and Transport Canada throughout the study period.

- **Transport Canada**

Transport Canada was consulted during the study period to validate the latest noise modelling software and reference standards for noise exposure modelling.

Transport Canada was also advised that in accordance with *Section 4.2 of TP1247-Aviation Land Use in the Vicinity of Aerodromes (Transport Canada Publication)*, WAA would be requesting a technical review of the final study to confirm that that the NEF System was used appropriately and correctly. Under Section 4.2 it states:

> *Transport Canada will conduct a technical review of an NEF, NEP or Planning Contour if requested by the sponsoring aerodrome operator or airport authority provided that:*
>
> *a. the Aerodrome owner or operator initiates this action;*
> *b. the Aerodrome owner or operator supplies or approves a projection of aircraft traffic, both as to type and numbers; and*
> c. *the Aerodrome owner or operator uses the noise impact prediction methods, procedures and recommended practices relating to aircraft operations as established by Transport Canada.*

In this case, WAA meets all the requirements outlined in Section 4.2 and furthermore, WAA believes it to be prudent to conduct this review prior to issuing the final recommended noise exposure contours to the local land use authorities for the purpose of an AVDP update.

- **NAV CANADA**

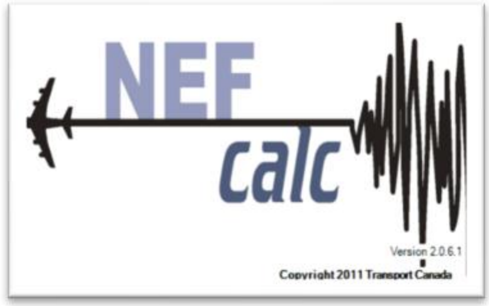
Winnipeg NAV CANADA air traffic control specialists were consulted for this study. Traffic control specialists shared local knowledge and best practices related to air traffic flow patterns, runway and taxiway use and overall general airfield operations. This information was used by the Consultant in developing the airfield capacity and NEF models.

**Consultant (Avia NG/Airbiz)**

Avia NG/Airbiz (the Consultant) was retained by WAA as a recognized expert of the Canadian NEF System and airfield capacity modelling.

### 1.2 SCOPE

The following outlines the approved scope of work completed by the Consultant for this study:




1. The Canadian NEF System was used based on the lasted methodologies approved by Transport Canada. The most current NEF software (NEFCAL 2.0.6.1) was used and confirmed as the most current with Transport Canada prior to initiating the study.
2. Consistent with the existing AVDP, ultimate air traffic volumes for the airport were modelled including the provision to protect the future parallel northeast runway.
3. Three noise exposure scenarios were modelled:
   - Future 2-Runway Ultimate Capacity Noise Exposure Contours.
   - Future 3-Runway (Parallel Runway) Ultimate Capacity Noise Exposure Contours.
   - Ultimate Capacity Composite Planning Noise Exposure Contours Representing the Union the above 2 and 3-Runway Ultimate Capacity Noise Exposure Contours.
4. Submit this report to Transport Canada for their technical review in accordance with Section 4.2 of TP1247- Aviation Land Use in the Vicinity of Aerodromes.

## 2. TRANSPORT CANADA NOISE EXPOSURE FORECAST SYSTEM

- Aviation in Canada is regulated through the authority of the federal government. The Aeronautics Act gives the Minister of Transport the power to enact regulations affecting noise from aircraft and airports. The separation of powers in Constitution of Canada however places the responsibility for control of land at the provincial level. Provinces, in turn, delegate that power down to cities and towns that have the ability to exercise this authority within a set of provincially mandated principles i.e., bylaws, regulations or plans.[2]
- In the interest of ensuring compatible land use surrounding airports is preserved to the extent possible, Transport Canada provides an aircraft noise exposure contouring system, the Noise Exposure Forecast (NEF) System, that has been designed to predict public annoyance related to aircraft noise. The NEF System is recognized by the International Civil Aviation Organization (ICAO[3]) and considers the volume of air traffic, types of aircraft operating at the airport, time of operations, departure configurations (Stage Length) and runway distribution.
- Of special consideration are night operations occurring between the hours of 10 p.m. and 7 a.m. which are weighted higher than day operations by assigning an additional 12 dBA to account for community sensitivity over noise occurring at night. Another way to explain this is that the NEF System considers every night operation factored by 16.7 times that of a daytime operation.

[2] Aircraft Noise Control and Land Use in Canada Presentation Synopsis, Tom Lowrey, 2001
[3] Recommended Method for Computing Noise Contours Around Airports Doc 9911, ICAO

- The NEF System is the official noise metric for land use compatibility planning in Canada.
- The NEF System requires that modelling data be prepared in a structured manner following the general outline below. The study was structured in a similar manner to provide a logical presentation of the study approach, findings, and observations:
  - Airfield Layout and Orientation
  - NEF Calculation Grid
  - Aircraft Local Flight (Circuit) Patterns
  - Aircraft Itinerant Arrival and Departure Paths and Flight Patterns
  - Runway Distribution During the Day and Night
  - Peak Planning Day Aircraft Movements (The Average Busy Day at the Airport)
  - Air Traffic Mix and Destinations (Stage Lengths)
  - Plotting and Presenting the Noise Exposure Contours

# 3. AIRFIELD LAYOUT AND ORIENTATION

- The proposed airfield layouts for the future 2 and 3 Runway Ultimate Capacity NEF models were based on comprehensive consultations with the WAA, NAV CANADA, and consideration of the latest WAA master planning concepts along with respecting existing published aeronautical zoning regulations in place at the airport since 1981.
- The proposed 2 and 3 Runway scenarios remain within their aeronautical zoning regulation protected envelopes with modifications only proposed to limit the new northeast parallel runway in length to be like the existing north-south runway along with a northerly extension to the north-south runway to improve operational flexibility during runway maintenance and rehabilitation through the runway intersection areas.
- Figures ES-2, ES-3 and ES-4 present the existing, 2-Runway and 3-Runway airport layouts, respectively, used to update the NEF ultimate capacity models.

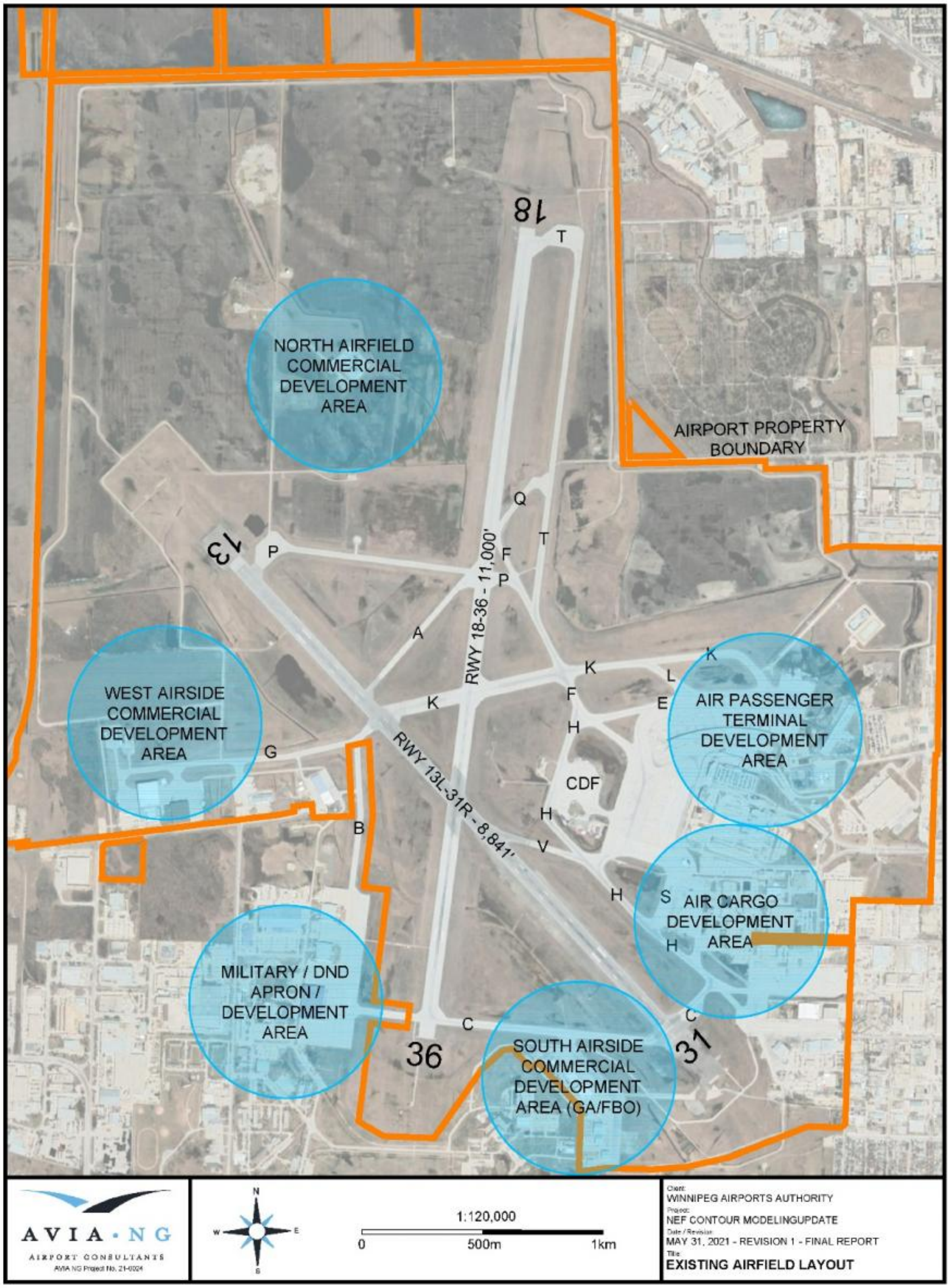



**Figure ES-2: Existing Airfield Layout**

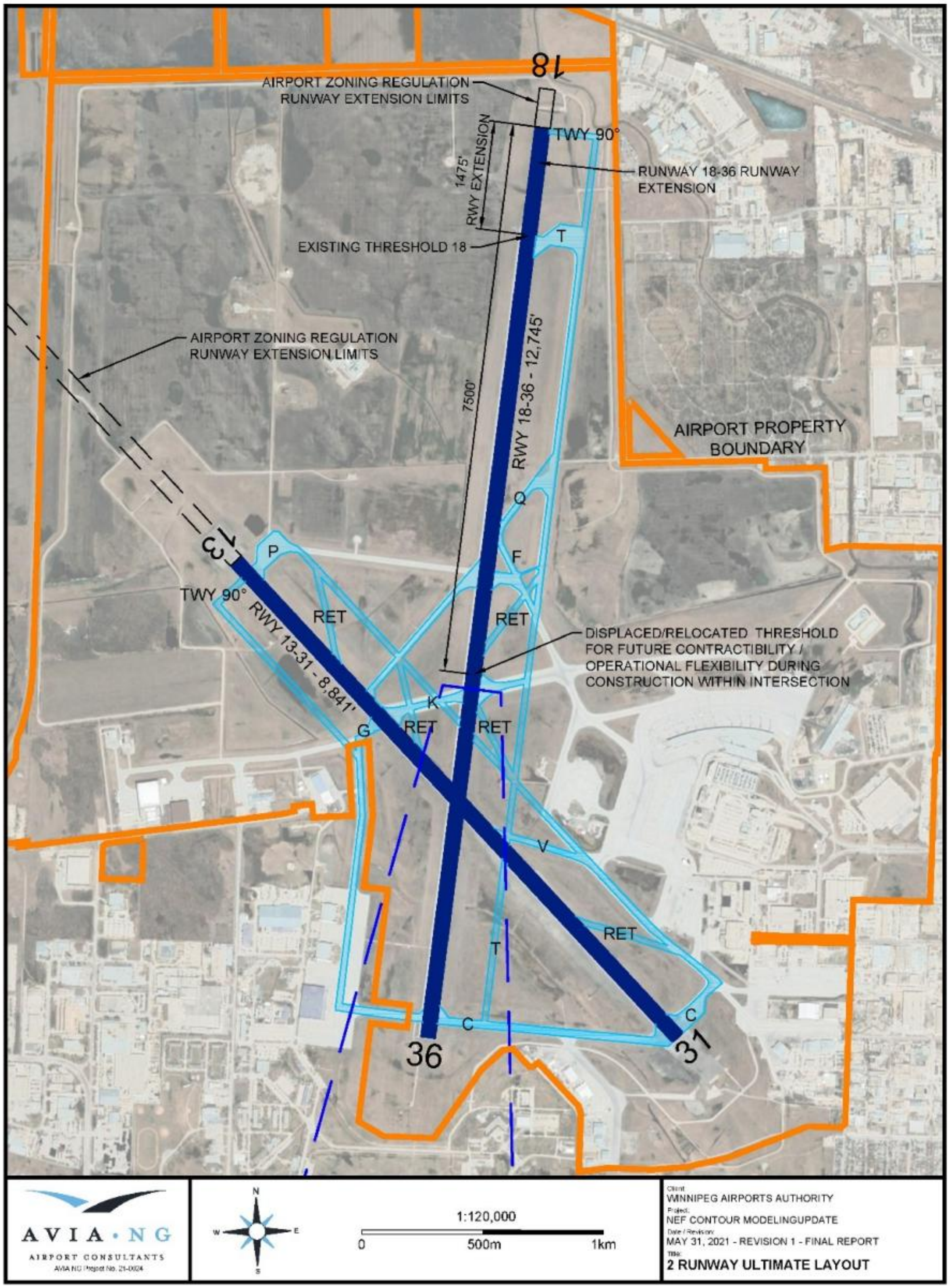



**Figure ES-3: Ultimate Long-Term 2-Runway Airfield Layout**

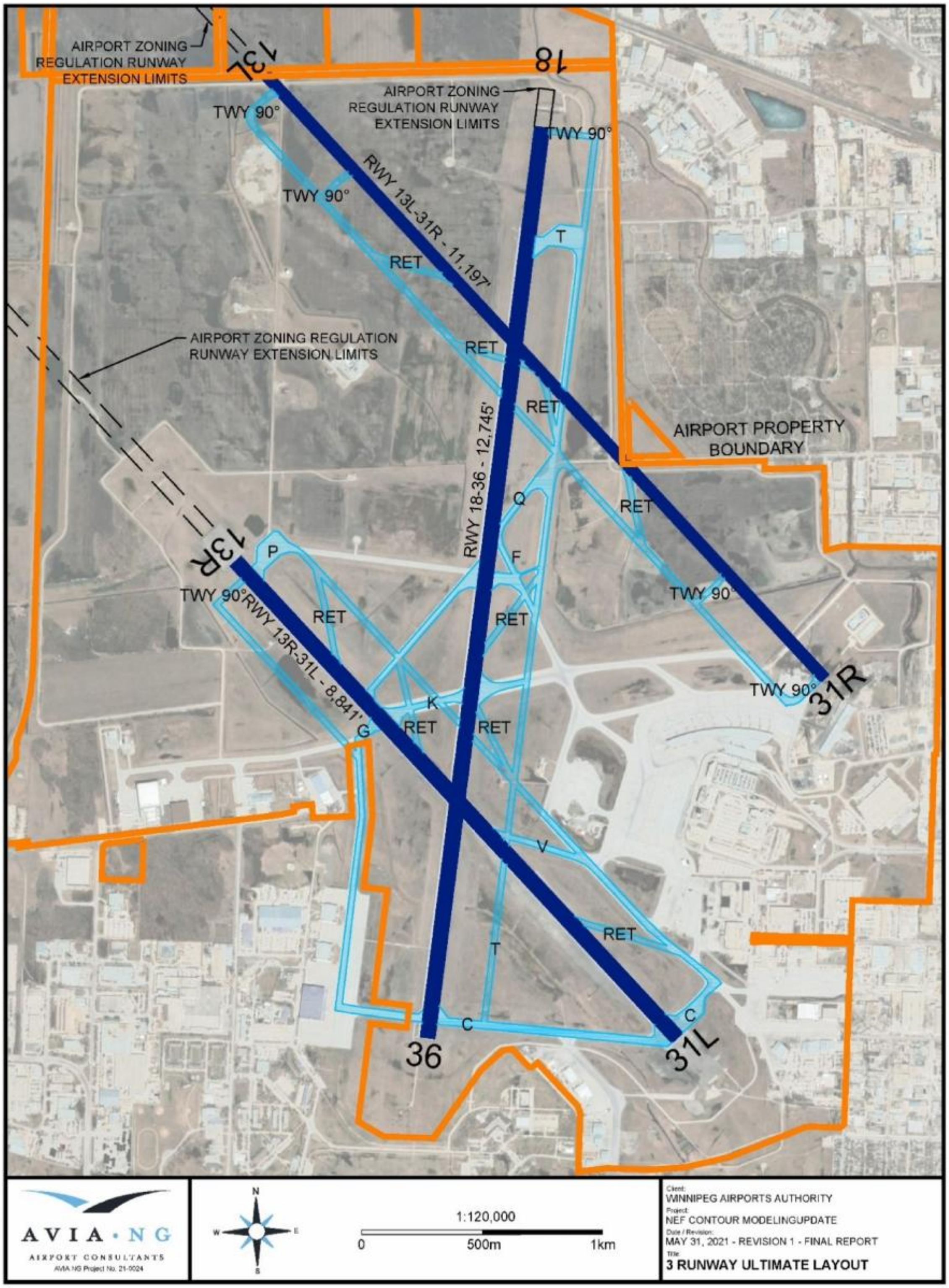



**Figure ES-4: Ultimate Long-Term 3-Runway Airfield Layout**

# 4. NEF Calculation Grid Density

- The NEF-Calc software calculates NEF values on grid points. The more closely spaced the grid points, the more accurately the contours are plotted by the software.
- The NEF contours produced for this study used the highest density grid spacing possible to maximize the accuracy of the plotted contours. The selected grid spacing was 100 ft. x 100 ft.
- Figure ES-5 shows a range of grid spacing alternatives explored and the resulting changes in NEF contour resolution to demonstrate the importance of selecting the proper grid density.

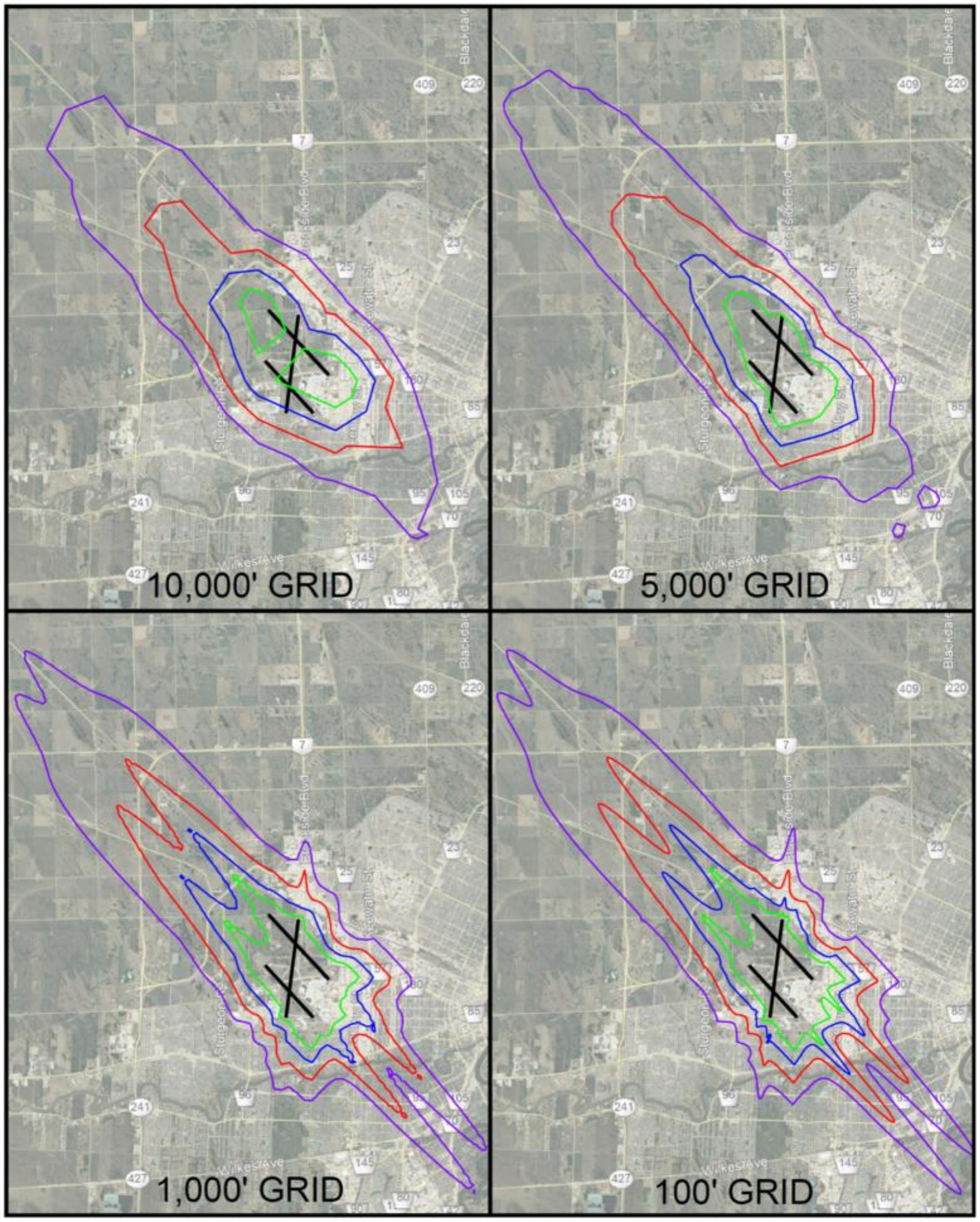



**Figure ES-5: Sensitivity Analysis of Grid Density on NEF Contour Resolution**

# 5. AIR TRAFFIC PATTERNS

- The NEF System considers the patterns aircraft fly on arrival, departure and when conducting local circuit patterns around the airfield. These patterns influence the position of aircraft both horizontally and vertically around the airport which directly impacts the NEF calculations.
- Flight patterns around an airport are also influenced by aeronautical restrictions and noise abatement procedures as published in the Canada Air Pilot (CAP) and the Canada Flight Supplement (CFS). These publications are issued under the authority of Transport Canada and are enforceable under the federal Aeronautics Act. In other words, pilots are required to follow these procedures and conduct flight operations accordingly.
- Winnipeg J.A. Richardson International Airport operates on a 24-hour basis but has adopted a balanced approach to aircraft noise management and operates with regulated noise abatement procedures. The NEF models developed for this study have incorporated these procedures within the capabilities of the software.
- In general, the enacted noise abatement procedures favour landings and departures away from the built-up areas of the City of Winnipeg.
- Actual flight track data and aircraft movements from NAV CANADA were analyzed along with WAA consultations in order to develop a reasonable representation of the flight tracks for the airport.
- Figures ES-6 and ES-7 show the resulting flight tracks used for the NEF models.

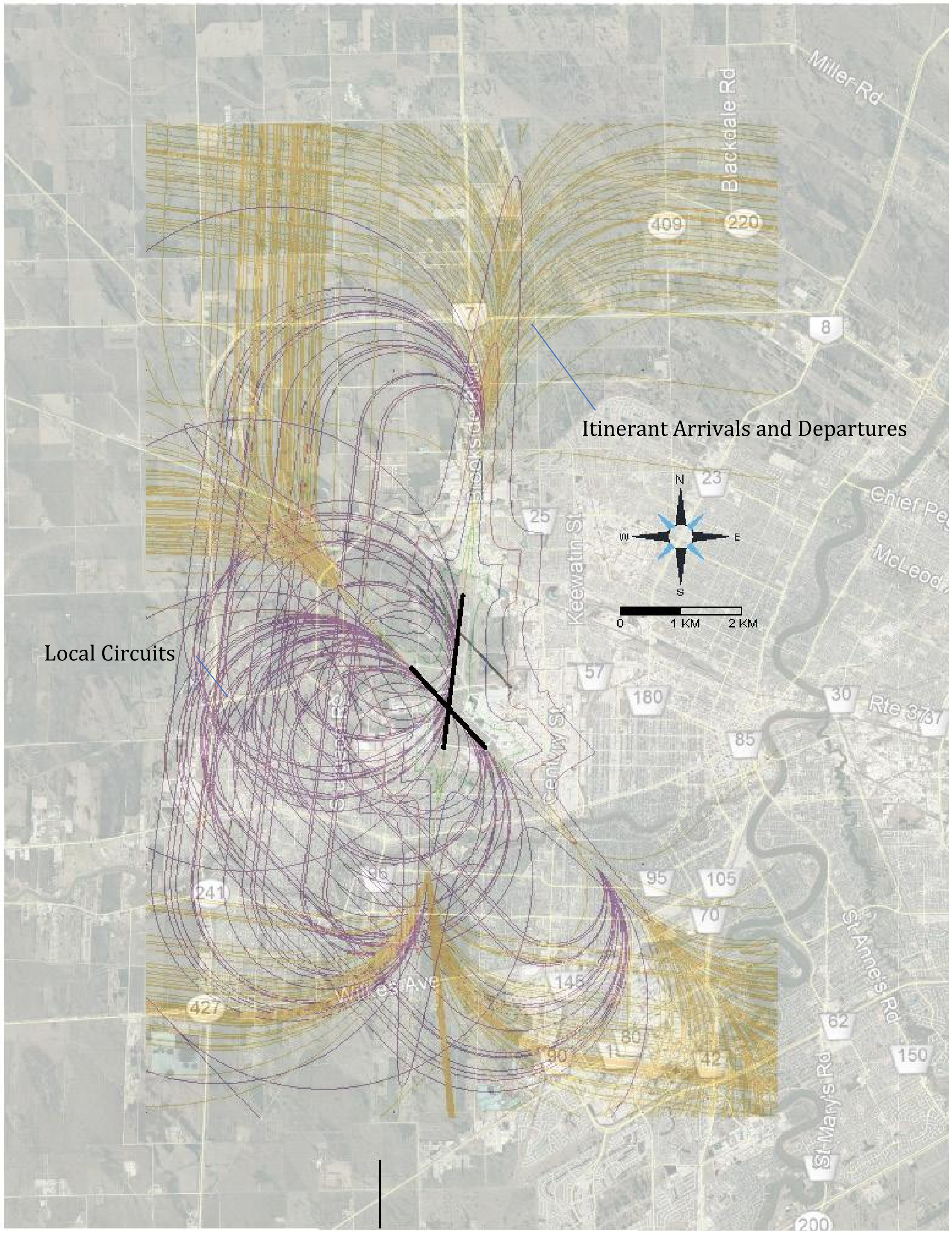



**Figure ES-6: NEF-Calc Flight Path Plot for the 2-Runway Layout**

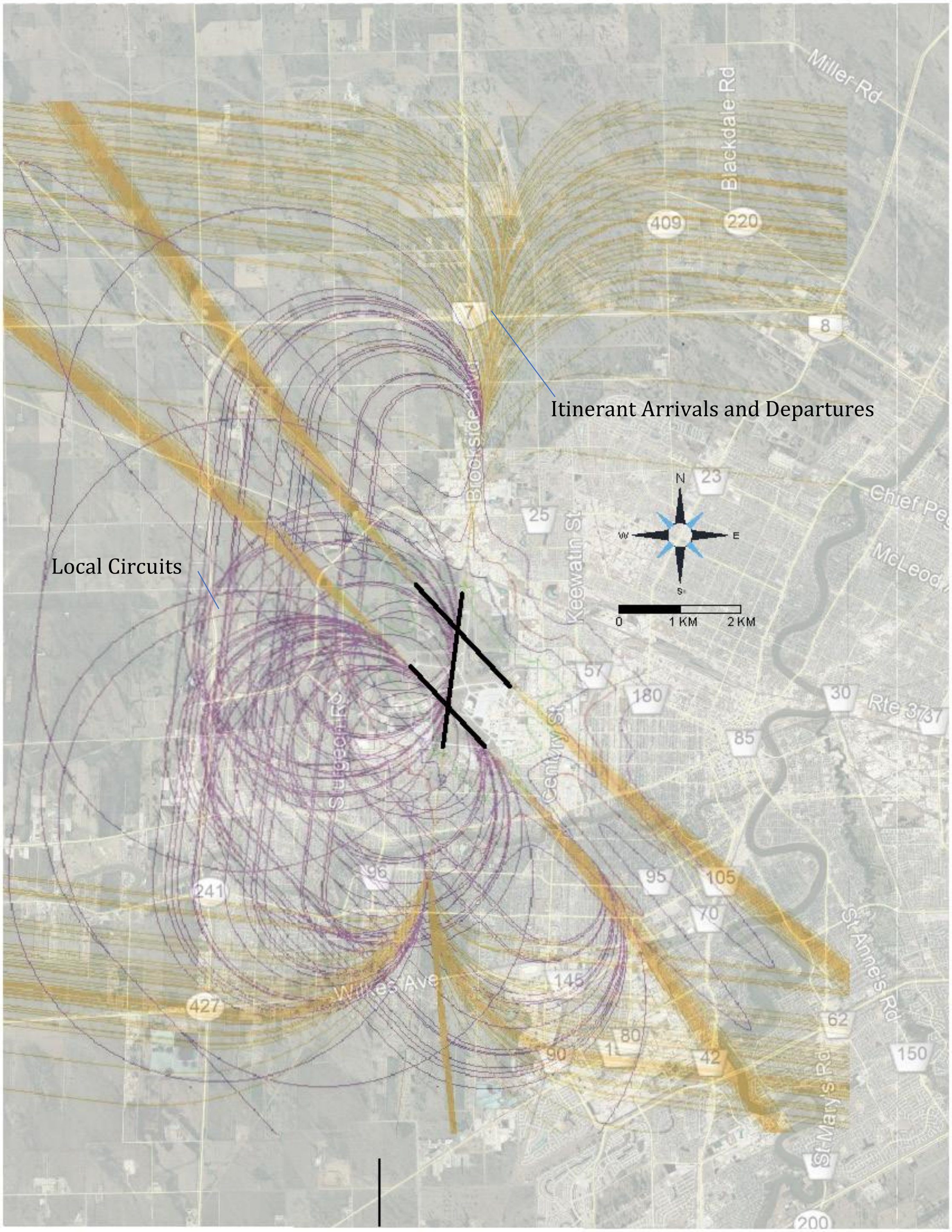
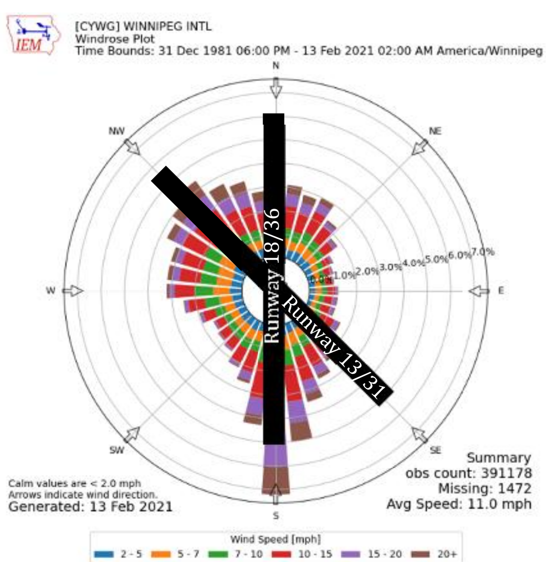



**Figure ES-7: NEF-Calc Flight Path Plot for the 3-Runway Layout**

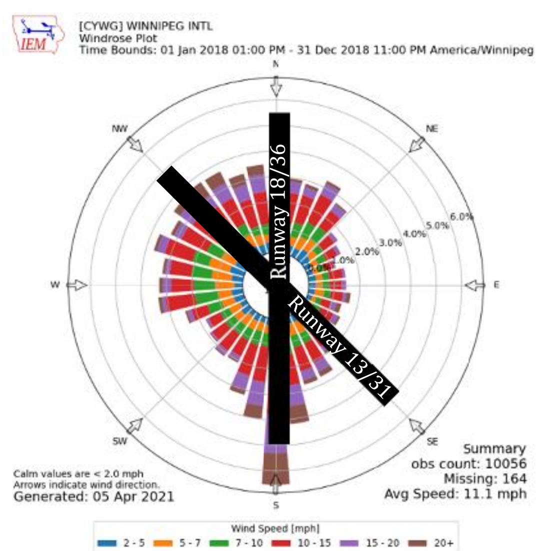
# 6. RUNWAY END DISTRIBUTION

- Runway end distribution has a significant impact on the shape of the noise exposure contours, particularly those runways used for takeoffs, and those that handle the loudest aircraft operations. If for example, one runway is used more often than another for takeoff, the NEF contours will generally be larger off those runway ends. Issues that influence which runways are used can range from weather, winds, operational preferences by carriers, air traffic control, and preferential runway selection to mitigate noise impacts on certain areas of the community.
- For NEF modelling, an annualized average runway distribution is used based on historical runway usage. Using actual historical aircraft movement data provides a composite of all factors influencing runway use and thereby provides a reasonable average distribution for the purpose of predicting NEF values.
- The year 2018 was used to analyze existing runway use at Winnipeg. 2018 was considered the most recent representation of normal airport operations given the significant reductions on air traffic due to COVID-19 in 2020 and into 2021.
- An interesting pattern emerges from these statistics which align with the noise abatement procedures discussed in Section 5. At night, the percentage of arrivals from the southeast and departures towards the southeast declines while departures and arrivals increase away from the city northwest of the airport.
- Historical wind data shown below analyzed over a forty-year (40) period that demonstrates the consistency in wind directions which supported the assumption that using the existing actual runway distributions was considered reasonable for projecting the 2 and 3-Runway ultimate capacity NEF models.

**40 Year Windrose**




**2018 Windrose**



- Figure ES-8 shows the general traffic arrival/departure distribution for the 2 Runway scenario by day and night. The general runway use is summarized below:

| Runway Distribution – 2018 and Future 2-Runway Ultimate Capacity | | | |
|---|---|---|---|
| **Runway** | **Day** | **Night** | **Total** |
| 13-31 | 42.6% | 35.6% | 41.3% |
| 18-36 | 57.4% | 64.4% | 58.7% |
| **Total** | **100%** | **100%** | **100%** |

- For the long-term 3-Runway ultimate capacity scenario, 97% of all traffic was allocated to the two parallel runways based on weather and wind analysis. Operating in a parallel runway environment creates the most efficient mode of operation. Under this scenario, the existing north-south Runway 18-36 becomes a limited-use runway primarily for poor weather, during construction and for potential noise mitigation strategies by enabling alternating runway use. It is expected that Runway 18-36 would be used less than 3% of the time once a parallel runway system is in place.
- Figure ES-9 shows the general traffic arrival/departure for the 3-Runway scenario by day and night. The general runway use is summarized below:

| Ultimate Capacity 3 Runway - Runway Distribution | | | |
|---|---|---|---|
| **Runway** | **Day** | **Night** | **Total** |
| 13R-31L (Existing) | 49.1% | 49.3% | 49.1% |
| 13L-31R (Future) | 47.9% | 47.7% | 47.9% |
| 18-36 (Existing) | 3.0% | 3.0% | 3.0% |
| **Total** | **100%** | **100%** | **100%** |

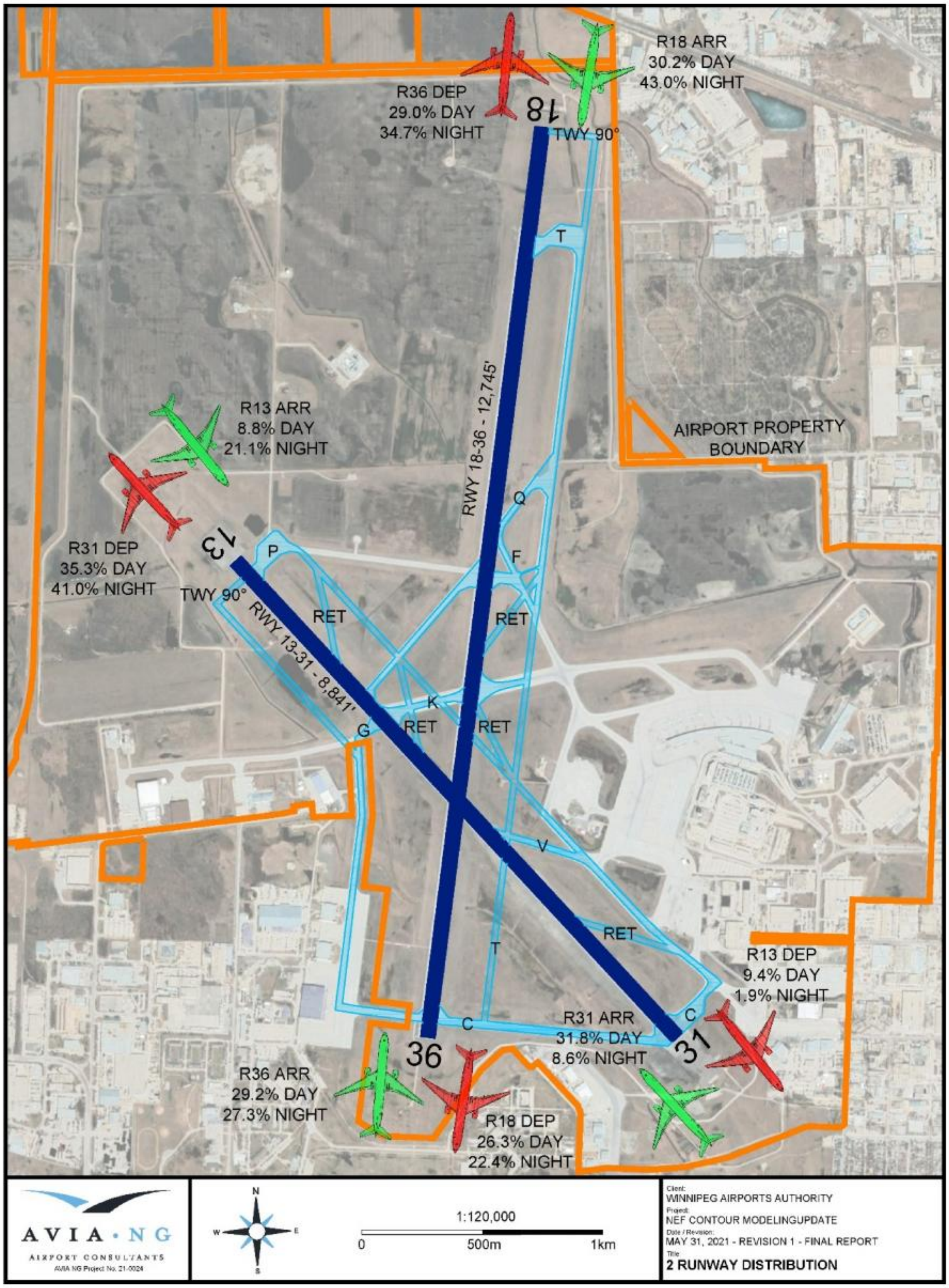



**Figure ES-8: 2018 Average and Future 2-Runway End Distribution – Itinerant**

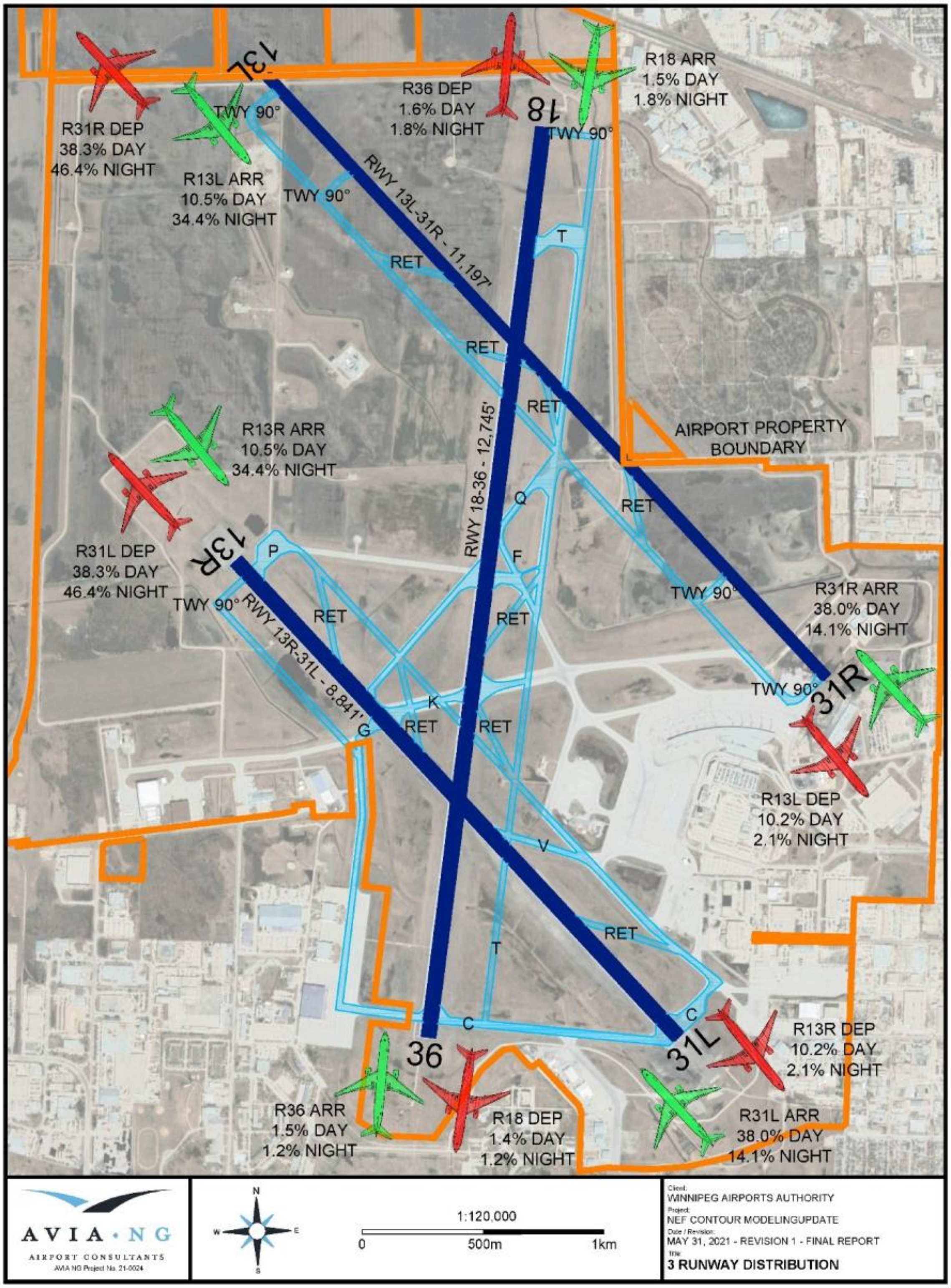



**Figure ES-9: Future 3-Runway End Distribution - Itinerant**

# 7. Peak Planning Day and Airfield Capacity

- The NEF System requires that the NEF contours be representative of a near to peak 24-hour period, which is referred to as a Peak Planning Day (PPD).
- The PPD represents an average busy 24-hour day at the airport, where only 5% of the days in the year are busier. This is also often referred to as the 95th percentile day.
- In a National Research Council (NRC) study[4], it was observed that for most large commercial airports in Canada the number of operations for a PPD is typically factored 1.4 times larger than the mean day. Based on the Consultants experience, this factor can also trend lower as airports become more highly scheduled. The Consultant has observed factors at large international Canadian airports in the range of 1.2 to 1.3.
- For NEF contours generated for this study, a representative PPD was required. To calculate a PPD for the 2 and 3-Runway Ultimate Capacity scenarios a detailed practical airfield capacity analysis was completed to determine maximum hourly movements and the associated maximum daily and annual operations which the airfield would be capable of supporting.
- For the most part, the annual capacities calculated under this study compared relatively favourably to those developed by WAA in their Airport Master Plans and those projected in the 2021 Provincial Study completed by HM Aero.
- For the 2-Runway Ultimate Capacity Scenario, the resulting PPD is shown below:

| Scenario | Day | Night | Total |
|---|---|---|---|
| 2019 Busy Day (PPD) | 323 | 79 | 402 |
| **Ultimate 2 Runway Capacity PPD** | **663** | **217** | **880** |
| **Annual Movements (YYZ Method)** | | | **239,355 - 281,594**<br>**Average: 260,475** |
| PPD Factor (Compared to Average Day) | | | 1.24 |

[4] National Research Council Canada. "NEF Validation Study: (1) Issues Related to the Calculation of Aircraft noise Contours", Bradley, J.S., Contract Report A-1505.3 (Final). December 1996.

- For the 3-Runway Ultimate Capacity Scenario, the resulting PPD is shown below:

| Scenario | Day | Night | Total |
|---|---|---|---|
| 2019 Busy Day (PPD) | 323 | 79 | 402 |
| **Ultimate 3 Runway Capacity PPD** | **1250** | **379** | **1629** |
| **Annual Movements (YYZ Method)** | | | **443,350 – 521,589**<br>**Average: 482,470** |
| PPD Factor (Compared to Average Day) | | | 1.24 |

- The PPD factors for the ultimate 2 and 3-Runway ultimate practical capacity scenarios are generally lower than the NRC target of 1.4 being closer to 1.24. These lower factors are consistent with a highly scheduled commercial operating environment and was considered appropriate for this NEF study. These lower factors also align with the Consultants experience with other larger commercial airports in Canada.
- It should be noted that while the annual capacity compared favourably, the PPD used in the 2021 Provincial Study for the ultimate capacity of a 3-runway system does not appear to be within a normal expected range of 1.3-1.4 times the mean day. At a factor of 0.95, the proposed PPD is below the average day which is not considered a representative PPD for NEF modelling.

# 8. PLANNING DAY AIRCRAFT MIX

- Given that the time frames associated with ultimate capacity scenarios are well into the future, rather than attempting to predict growth rates of the various air traffic sectors i.e., scheduled service, general aviation, military, cargo etc., the concept of a composite aircraft mix was developed.
- Aircraft types for the NEF models were assigned based on actual aircraft types operating at Winnipeg today and modified by assigning reasonable future equivalents based on industry trends and technological improvements.
- The NEF System has a limited selection of these transition aircraft but where possible, the most modern equivalent aircraft models were assigned. For example, the older technology Fairchild Metroliner III twin turboprops used extensively by Perimeter Airlines were transitioned to newer technology Dash 8 series turboprops. All Boeing 737 series aircraft were mapped to the most up to date NEF model available being the B737-800. Cargo aircraft were transitioned to primarily a B767 fleet. While we expect to see operations by larger wide body types like that Boeing 777, using the B767 accounts for future technology improvements in the B777 or other future aircraft which will use quieter engine technology and better performance characteristics.

- Helicopters will continue to operate at the airport but their overall contribution to noise was considered part of the overall fixed wing noise generating fleet. The NEF System does not include helicopters in its database. An NRC study found that "….the bulk of the results in the literature suggest that the disturbance from helicopter noise can be treated similarly to that from conventional fixed wing aircraft….", and "…Where some helicopter operations are mixed with regular air traffic operations, they may not influence calculated NEF values, although they will have significant localized effects. It would seem more appropriate to consider helicopters in terms of single event type noise measures." [5] The NEF models produced for this study indirectly account for helicopter movements as part of the overall allocation of peak planning day movements of the fixed wing fleet mix.
- Military aircraft were separated in the composite mix to enable the model to adjust these movements at a declining % of overall movements by modelling their existing total movements for all scenarios. This assumption was considered reasonable based on a review of other military movement trends across Canadian airports.
- Cargo traffic was expected to grow aggressively as a result of major investments by WAA in establishing a cargo hub at the airport. Cargo traffic growth was also subject to higher traffic volumes assigned to night-time traffic, a more noise sensitive period under the NEF system.
- Local (Circuit) movements were included in the future ultimate capacity models. Based on the relatively low number of local movements today and in the future models, the influence of local traffic on the overall contours was not significant. Local traffic was projected to decline as a percentage of the total movements. Local movements were modelled to trend to about 1-2% of total movements when airport traffic levels exceed 250,000 movements or more. The local aircraft mix at Winnipeg is comprised of general aviation aircraft movements but also includes a significant amount of military, search and rescue and aircraft maintenance flight operations. This is reflected in the high percentage of medium turbine aircraft in the mix.
- Summary of Itinerant 2-Runway Ultimate Capacity Composite Mix by Engine Type:

| **Engine Type - Itinerant** | | | |
|---|---|---|---|
| **Engine Type** | **Day** | **Night** | **Total** |
| Jet | 50% | 70% | 55% |
| Turbine | 47% | 29% | 43% |
| Piston | 3% | 1% | 2% |
| **Total** | **100%** | **100%** | **100%** |

[5] National Research Council Canada. "NEF Validation Study: (2) Review of Aircraft Noise and its Effects", Bradley, J.S., Contract Report A-1505.5 (Final). December 1996.

- Summary of Local 2-Runway Ultimate Practical Capacity Composite Mix by Engine Type:

| Engine Type - local | | | |
|---|---|---|---|
| | **Day** | **Night** | **Total** |
| Jet | 7% | 1% | 6% |
| Turbine | 81% | 86% | 82% |
| Piston | 12% | 13% | 12% |
| **Total** | **100%** | **100%** | **100%** |

- Summary of Itinerant 3-Runway Ultimate Capacity Composite Mix by Engine Type:

| Engine Type - Itinerant | | | |
|---|---|---|---|
| **Engine Type** | **Day** | **Night** | **Total** |
| Jet | 51% | 74% | 56% |
| Turbine | 46% | 25% | 42% |
| Piston | 3% | 1% | 2% |
| **Total** | **100%** | **100%** | **100%** |

- Summary of Local 3-Runway Ultimate Practical Capacity Composite Mix by Engine Type:

| Engine Type - local | | | |
|---|---|---|---|
| | **Day** | **Night** | **Total** |
| Jet | 7% | 1% | 6% |
| Turbine | 83% | 88% | 84% |
| Piston | 10% | 11% | 10% |
| **Total** | **100%** | **100%** | **100%** |

- The composite aircraft mix also required that reasonable flight distances (destinations) be assigned for departing aircraft. This is also commonly referred to as Stage Length. Aircraft takeoff characteristics will vary depending how heavily they are loaded. Greater flight distances will result in heavier aircraft takeoff weights due primarily to increased fuel loads. A heavily loaded aircraft will generally take off with a slower climb rate which increases the exposure to noise on the ground over larger areas and for longer periods of time. It is for this reason that the NEF System takes into consideration aircraft stage lengths for noise modelling purposes.

- Figure ES-10 shows great circle distances centred on Winnipeg to provide a geographical perspective on the destinations covered up to a Stage Length of 5 which covers up to 3500 nm. This distribution will remain relatively consistent for Winnipeg and was modelled accordingly.

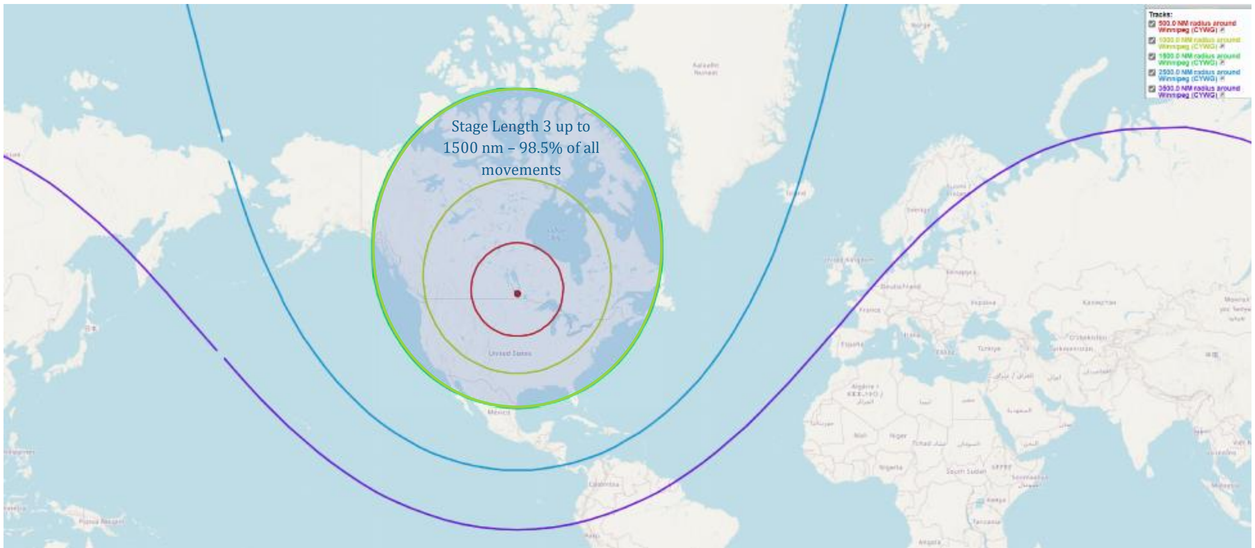



**Figure ES-10: Great Circle Distances (Stage Lengths) from YWG**

- Recognizing that there are a wide variety of factors that could influence the size and shape of the NEF contours given the long-term nature of these models, it was considered prudent to complete a sensitivity analysis by introducing variations in the Peak planning Day (PPD) and the sensitive night-time period.
- The sensitivity analysis for PPD variations only considered a reduction in the PPD given that the ultimate practical capacity values of the PPD already consider a highly efficient airfield with optimized infrastructure and ATC procedures. It could be conceivable that the PPD values may be somewhat tempered based on actual operational conditions that may not achieve the levels of service and performance assumed in the models.
- To that end, a sensitivity analysis was completed by reducing the total PPD values by 20%. 20% was used as it represents a significant deviation in the PPD values that we would expect to result in appreciable changes in the NEF size and shape. Furthermore, 20% was selected as it was also used in an NRC study [6] which also tested the sensitivity to changes PPDs on the size and shape of contours. The NRC concluded that a 20% error in the PPD will lead to errors in NEF values of approximately 1, and this magnitude of error is likely to occur quite frequently. Based on this, a lower limit of probable NEF values was established using a 20% deviation below our Base Case PPD values to understand the impacts on the NEF contours.
- The PPDs developed for the ultimate aircraft configurations considered a range of night-time capacities. These ranged from retaining the existing split of day and night movements based on

[6] National Research Council Canada. "NEF Validation Study: (1) Issues Related to the Calculation of Aircraft noise Contours", Contract Report A-1505.3 (Final). December 1996.

current conditions of about 18% to 19%, in addition to options to expand night-time capacity to accommodate increased movements associated primarily with cargo and some passenger air traffic up to about 23% of total itinerant movements. This range covered night-time capacities from 10 movements per hour up to 30 movements per hour. This represents a range of noise sensitive nighttime operations that could be considered reasonable given the 24-hour operations available at Winnipeg with aggressive plans to expand the air cargo market and facilities at the airport.

# 9. PROPOSED NOISE EXPOSURE CONTOURS

- Figure ES-11 shows the 2-Runway Ultimate Capacity Noise Exposure Contours with a comparison to the existing AVDP 1994 NEF Contours.
- Figure ES-12 shows the 3-Runway Ultimate Capacity Noise Exposure Contours with a comparison to the existing AVDP 1994 NEF Contours.
- Each contour includes the high/base case/low sensitivity ranges discussed under Section 8 above. The Base Case contour is shown as the single solid line, whereas the low and high ranges are represented by the inner and outer band of the shading around each contour.
- To ensure that there is a set of noise exposure contours that offers effective guidance for land use compatibility throughout the transition from the 2 to 3-Runway scenarios, the concept of a composite contour was proposed. The composite contour was created through the union of the contour sets for both the 2 and 3-Runway scenarios. This composite noise exposure contour would protect for both scenarios.
- The concept and application of composite noise exposure contours has been used at other airports in Canada including Edmonton, Ottawa, and Toronto.
- Figure ES-13 shows the resulting Recommended Ultimate Capacity Composite Noise Exposure Contour for Winnipeg including the high/Base Case/low sensitivity ranges discussed under Section 8. The Base Case contour is shown as the single solid line, whereas the low and high ranges are represented by the inner and outer band of the shading around each contour.

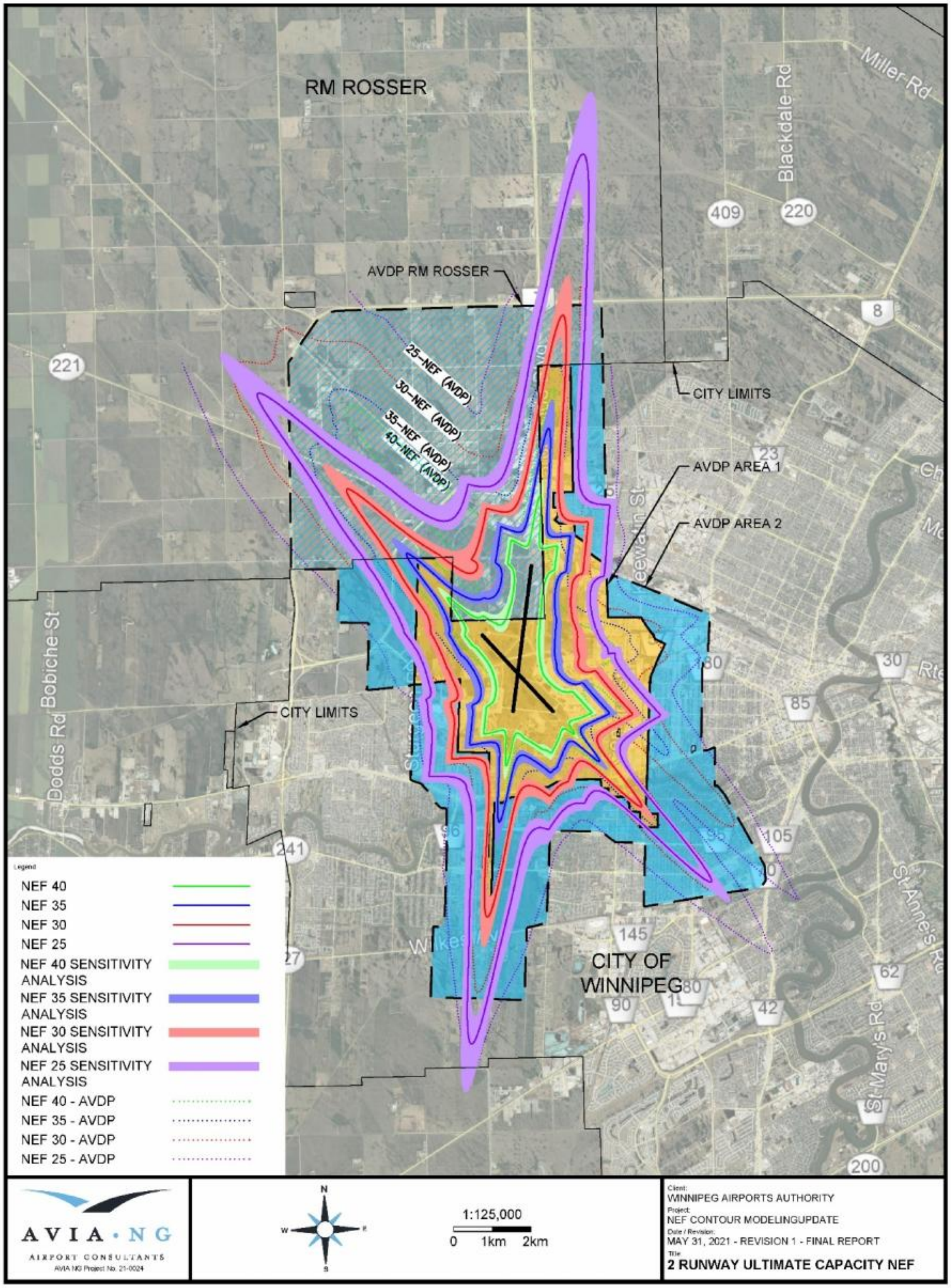
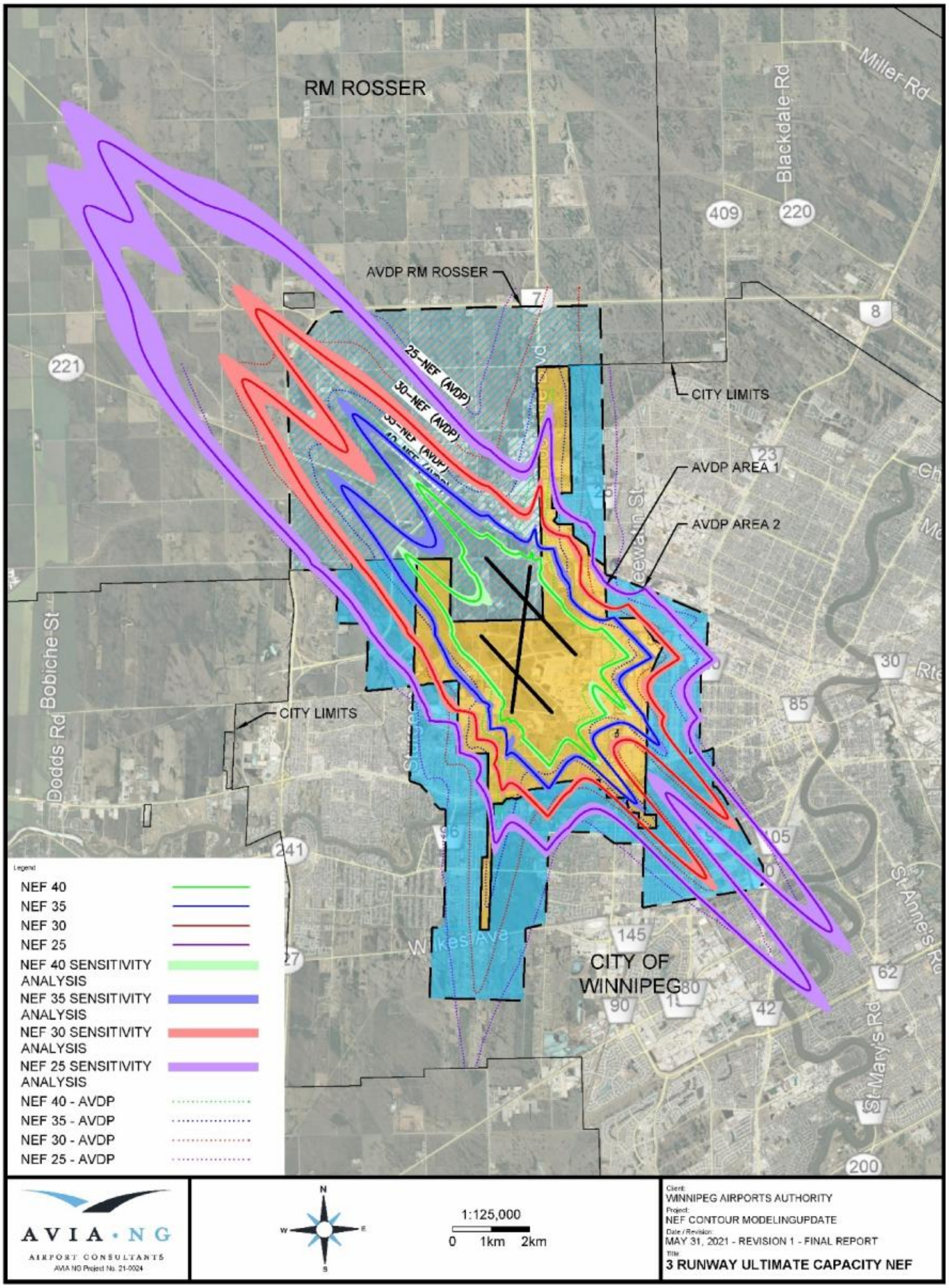



**Figure ES-11: 2-Runway Ultimate Practical Capacity Noise Exposure Contours**




**FigureES-12: 3-Runway Ultimate Practical Capacity Noise Exposure Contours**

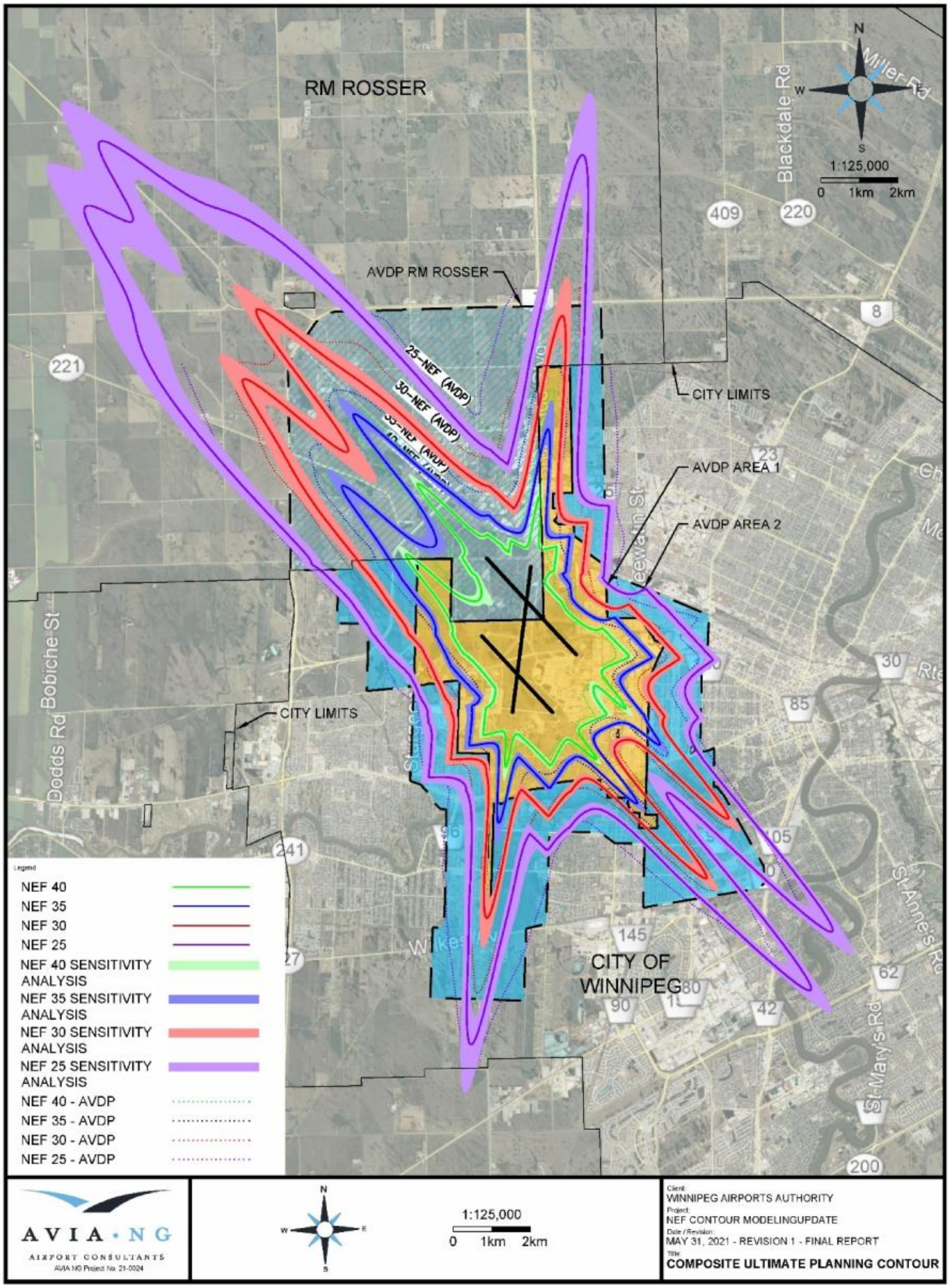
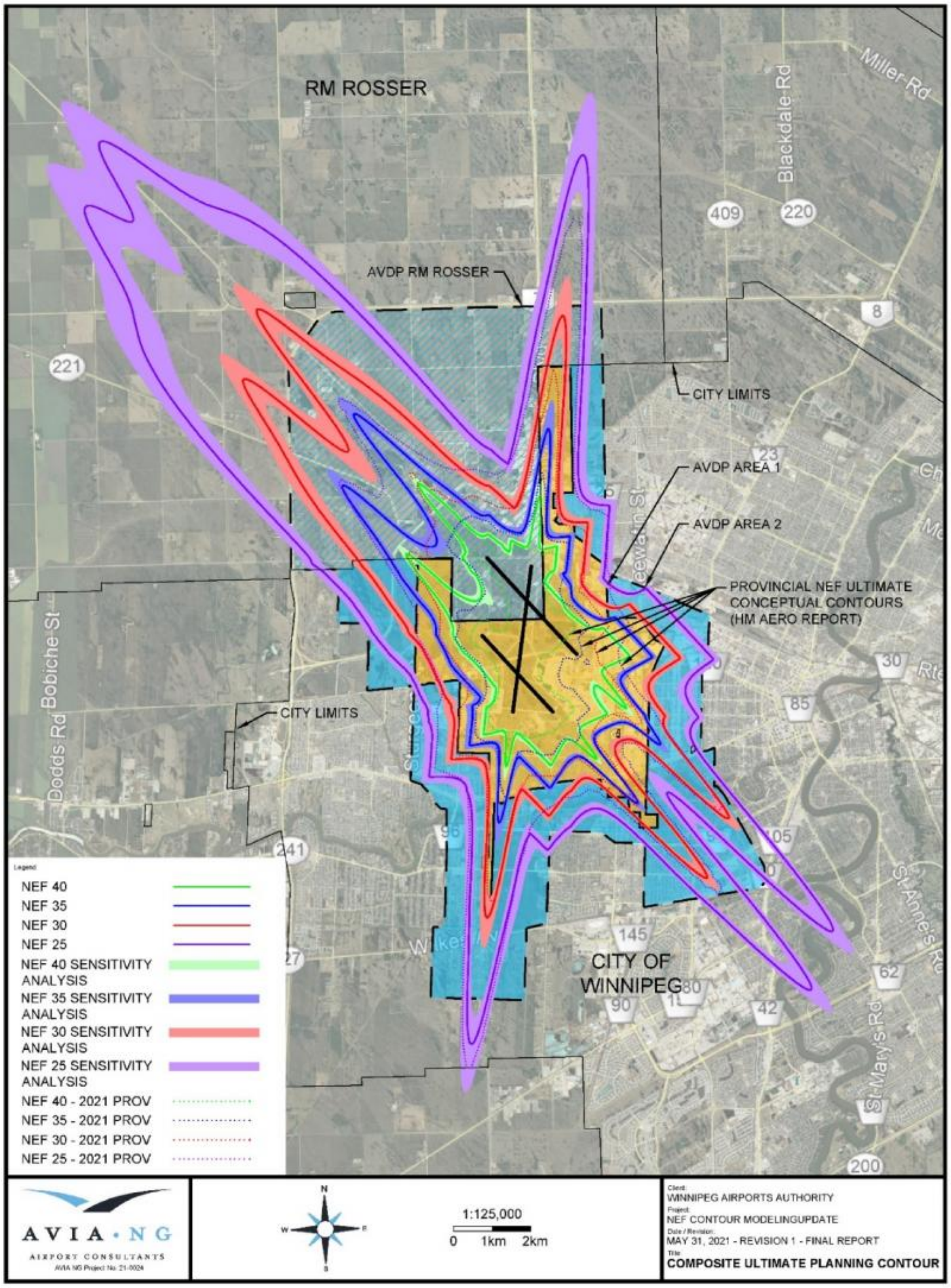



**Figure ES-13: Ultimate Practical Capacity Composite Noise Exposure Contours**

- Figure ES-14 shows the Ultimate Practical Capacity Composite Contour compared to the contours proposed in the 2021 Provincial NEF Report for an equivalent 3-Runway scenario. The provincial report refers to their scenario as Ultimate-Term Conceptual Conditions.




**FigureES-14: Ultimate Practical Capacity Composite Noise Exposure Contours Compared to 2021 Provincial 3-Runway Ultimate Term Conceptual Conditions NEF Contours**

# 10. RECOMMENDATIONS

- Based on the foregoing, the following recommendations are made:
  - WAA adopt the upper limits of the Recommended Ultimate Practical Capacity Composite Runway Noise Exposure Contours as shown in Figure ES-15. The WAA should recommend these contours to the City of Winnipeg as part of any planned update of the AVDP.
  - Table ES-1 presents the noise exposure contour areas for the Recommended Ultimate Practical Capacity Composite Noise Exposure Contours compared to the existing 1994 AVDP contours. Overall, there is reduction in the NEF areas except for the 25 NEF area which is higher than the estimated 1994 AVDP 25 NEF area by 7 km2.

**Table ES-1: Comparison of NEF Areas for the Recommend Ultimate Practical Capacity Composite Contour versus the existing 1994 AVDP Contours**

| NEF Contour Interval | Recommended Ultimate Practical Capacity Noise Exposure Contour Area ($km^2$) | Existing 1994 Contour AVDP Area ($km^2$)[7] | Difference Between the Recommended Ultimate Practical Capacity Noise Contours Versus the Existing 1994 AVDP Contours ($km^2$) |
|---|---|---|---|
| **25** | 157 | 150 | +7 |
| **30** | 71 | 83 | -12 |
| **35** | 35 | 44 | -9 |
| **40** | 19 | 24 | -5 |

[7] Areas have been estimated from available mapping and the 25 NEF contour are required extrapolation where parts of the contours are omitted on the AVDP.

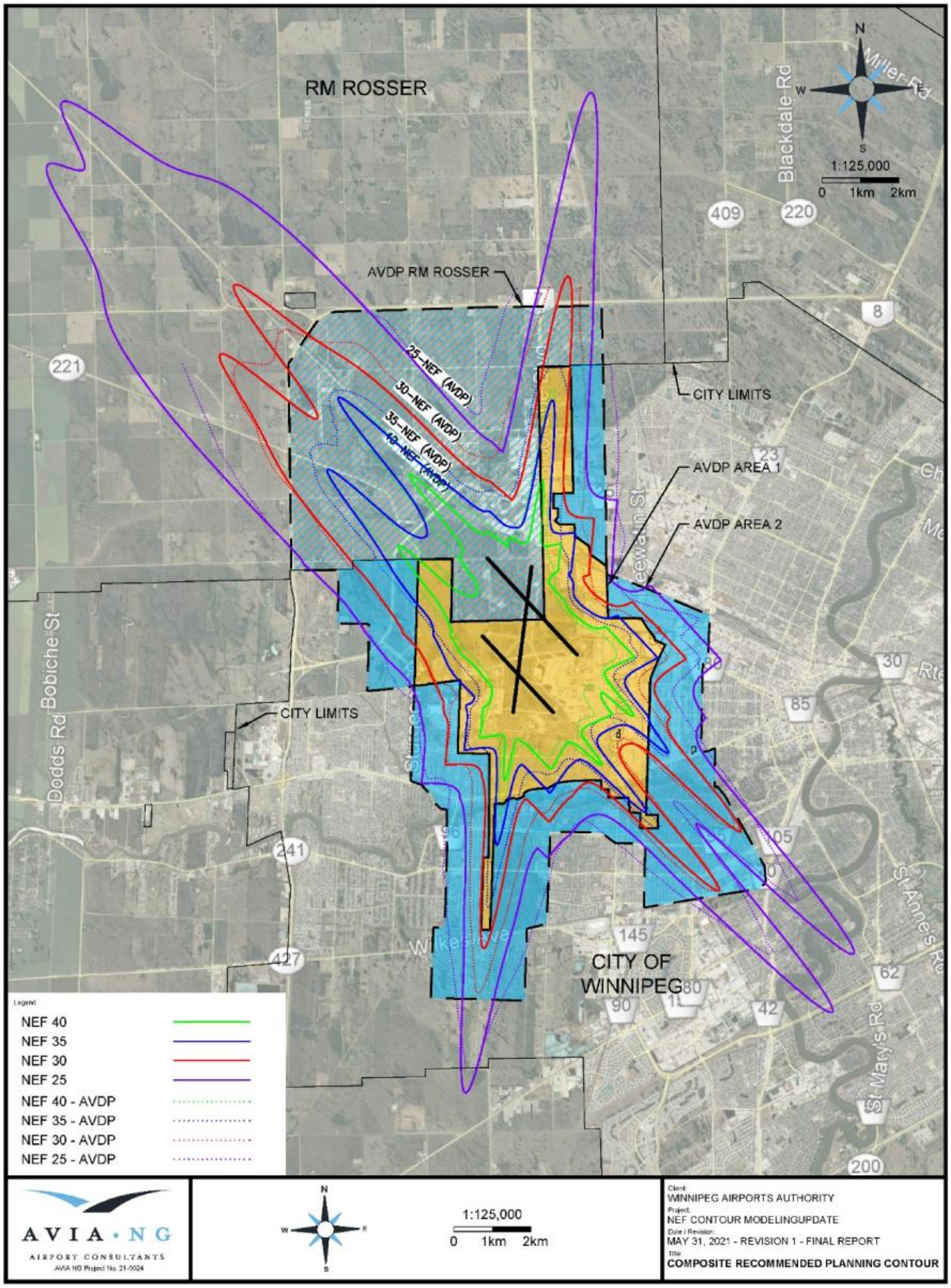
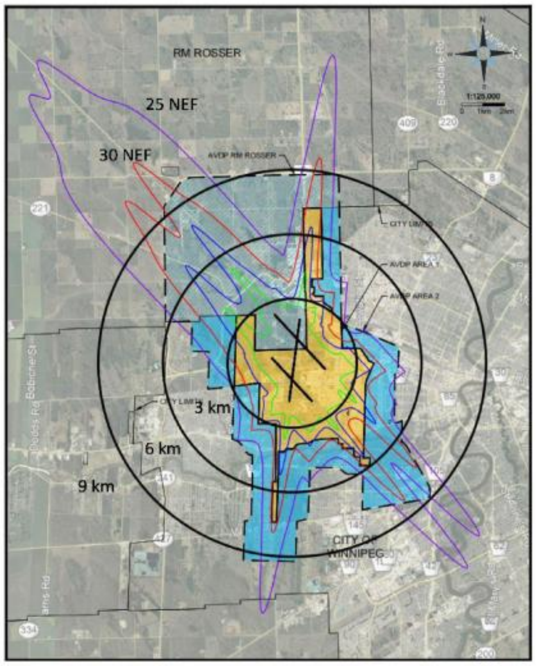


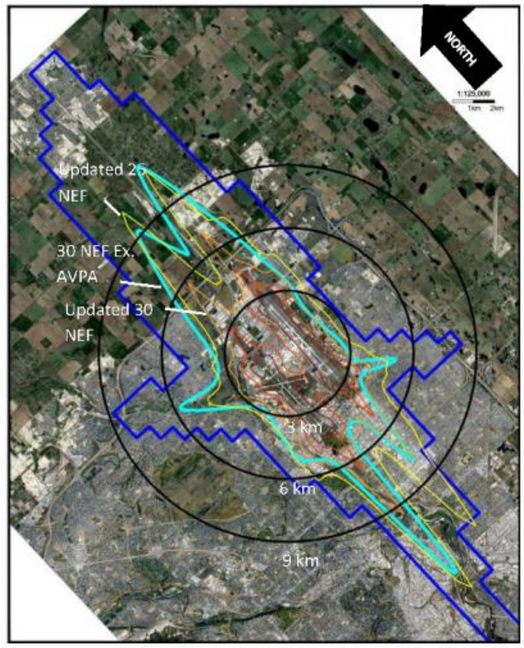

**Figure ES-15: Recommended Ultimate Practical Capacity Composite Noise Exposure Contours**

- Figure ES-16 presents a comparison of the recommended YWG contours to other published noise exposure contour maps for three major Canadian airports with parallel runway systems. The purpose of this comparison was to show the general consistency in the size and area of the contours.
  - From Figure ES-16, general patterns can be identified which highlight predominant use runways with wider contours off departure runway ends and narrower contours related to higher use arrival runways. The contour shapes capture the unique operating conditions at each airport.
  - To further quantify how the NEF contours compare between these airports, Figure ES-17 quantifies the NEF areas which considers the total area for each contour interval.
  - From Figure ES-17, the Toronto Pearson (YYZ) NEF areas are the largest which can be attributed to the higher capacity of the airfield given its five runways, an annual airfield capacity of over 632,000 movement as published in the Airport Master Plan, and the fact that these are also composite contours. With a lower annual ultimate practical capacity for Winnipeg in the range of about 485,000 movements, the NEF areas for YWG are expected to be lower than those of YYZ
  - The Winnipeg Recommended Ultimate Practical Capacity Composite Noise Exposure Contours trend higher than those of Vancouver (YVR) and Calgary (YYC) which can be attributed in large part to the fact that the YWG composite contour captures NEF areas for both the 2 and 3-Runway scenarios combined whereas those for YVR and YYC reflect primarily only the parallel runways.
  - Figure ES-17 also shows the NEF areas plotted for just the 3-Runway Ultimate Practical Capacity Noise Exposure Contour Base Case at Winnipeg. This is a more representative comparison to the YVR and YYC examples as the influence of the north-south runway is not as significant as it is under the composite contour. This contour compares much more favourably with the YVR and YYC examples as the total annual capacity for these airports are in the same range of the YWG ultimate 3 runway capacity of 400,000-500,000 8 movements.
  - Considering the foregoing, the recommended Winnipeg NEF contours compare reasonably to other major airports in Canada where NEFs are used for compatible land use planning.
- Finally, it is recommended that this report and associated NEF models be submitted to Transport Canada for technical review in accordance with Section 4.2 of Transport Canada document TP1247- Aviation Land Use in the Vicinity of Aerodromes.

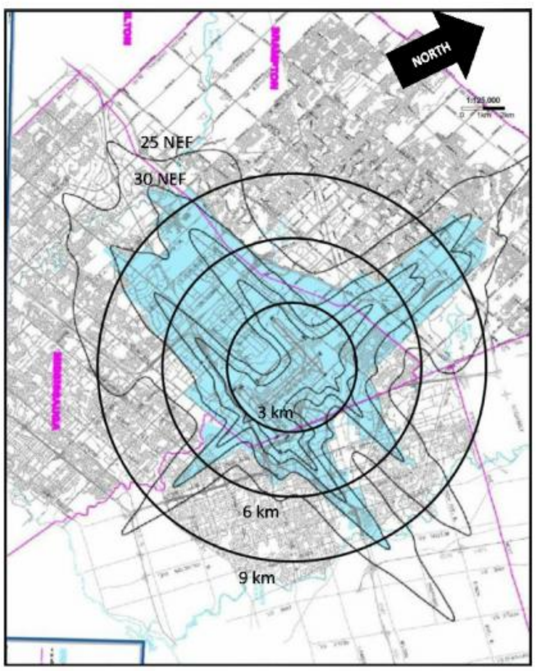
[8] YVR 2027 Airport Master Plan and YYC Noise Exposure Contours Discussion Paper, Airbiz, August 2020



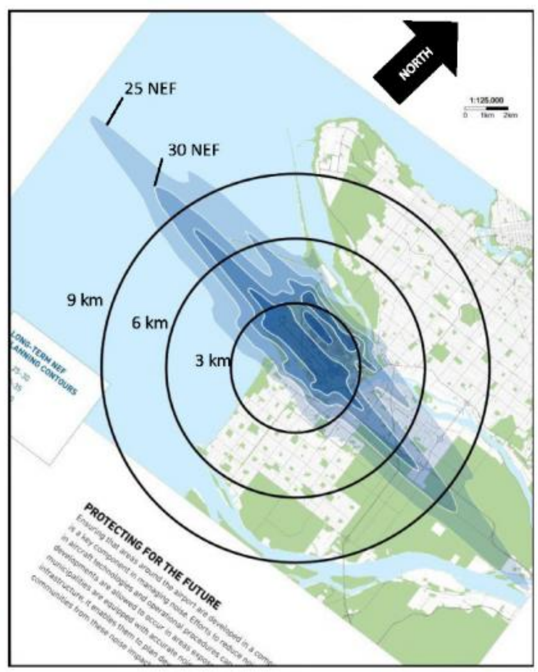

**Winnipeg (YWG) Recommended Ultimate Practical Capacity Composite NEF Contour**




**Calgary (YYC) AVPA NEF Contours (Updated 2020)**




**Toronto Pearson (YYZ) Composite NEF Contour**




**Vancouver (YVR) NEF Contour (YVR 2037 Airport Master Plan)**

**Figure ES-16: Noise Exposure Contour Comparisons to other Major Canadian Airports with Parallel Runway Systems**

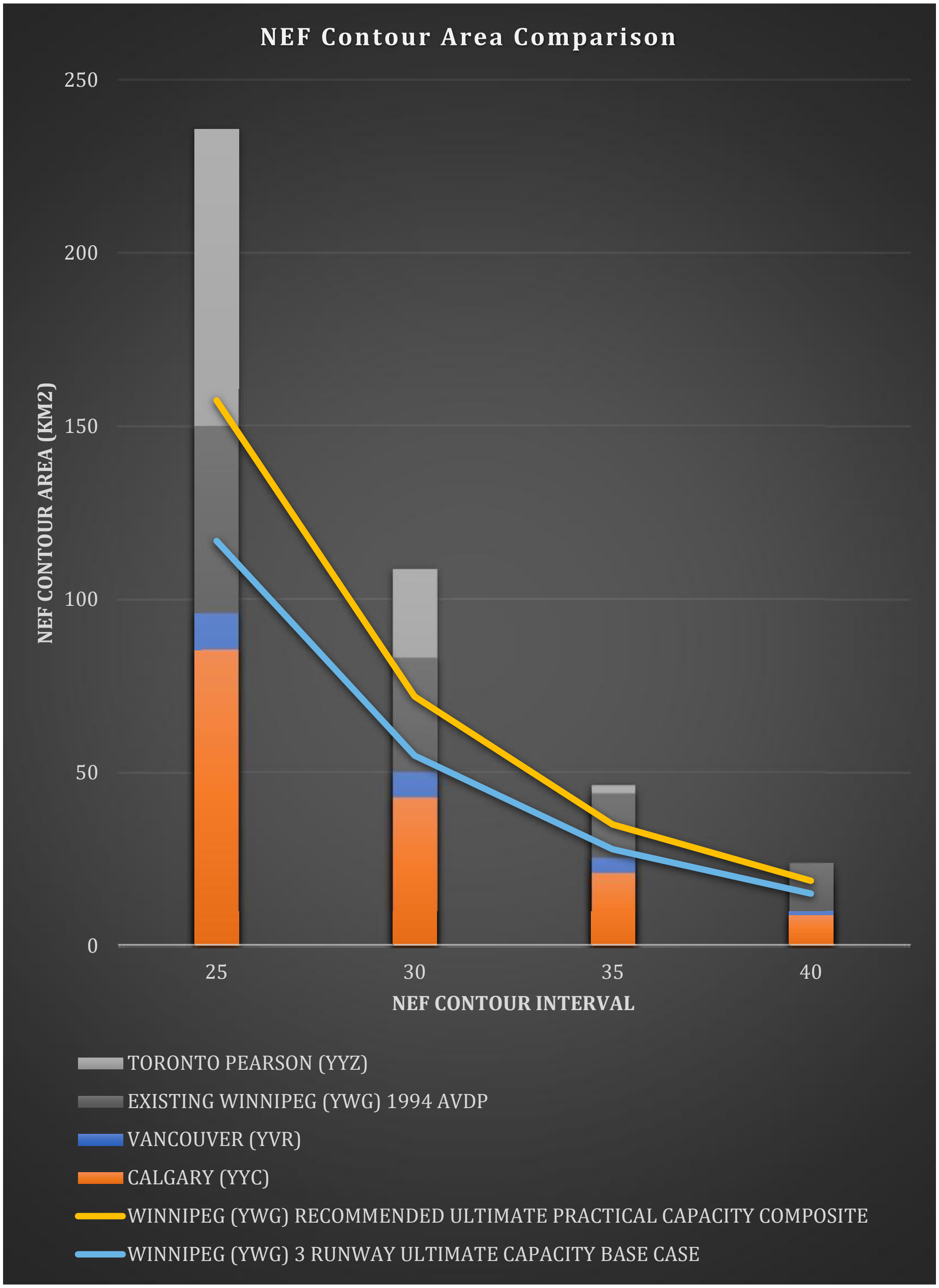



**Figure ES-17: Noise Exposure Contour Area Comparisons to other Major Canadian Airports with Parallel Runway Systems**

***>>> END OF EXECUTIVE SUMMARY***