Minneapolis St. Paul International Airport (MSP)
2019 Annual Noise Contour Report

Comparison of the 2019 Actual and the 2007 Forecast Noise Contours
February 2020

MAC Community Relations Office and HNTB Corporation

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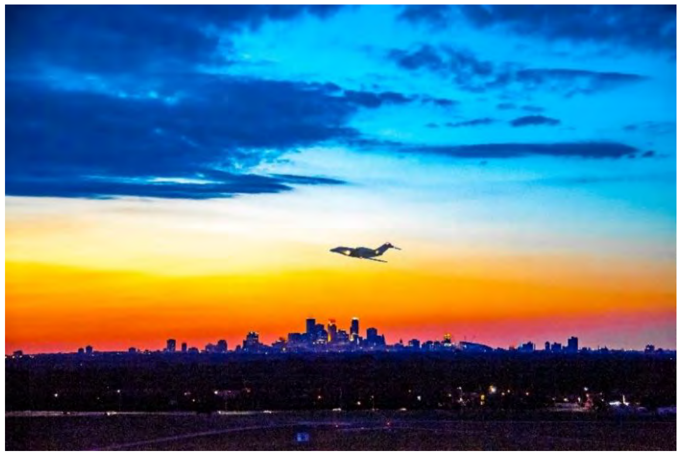
ES EXECUTIVE SUMMARY

ES.1 BACKGROUND

Minneapolis-St. Paul International Airport (MSP) has a long history of quantifying and mitigating noise impacts in a manner responsive to concerns raised by communities around the airport and consistent with federal policy.

In 1992, the Metropolitan Airports Commission (MAC) established the MSP Residential Noise Mitigation Program after initiating a 14 Code of Federal Regulations Part 150 (Part 150) Study. The MSP Residential Noise Mitigation Program was among many noise abatement initiatives in the Part 150 Study. It provided sound insulation to single-family and multi-family residences and schools, and it also acquired residential properties within eligible noise contour areas.



The Federal Aviation Administration (FAA)'s threshold standard for mitigation eligibility is 65-decibel Day-Night Average Sound Level (DNL). The DNL metric is used to represent the total accumulation of all sound energy (decibels or dB) averaged out uniformly over a 24-hour period.

From 1992 to 2006, the Residential Noise Mitigation Program was a large and visible part of the Part 150 program at MSP. Mitigation was conducted within the 65 dB DNL contour and included a combination of home improvements to windows and doors; installation of attic insulation; baffling of attic vents, mail slots and chimneys; and the addition of central air conditioning. By 2006, sound insulation had been provided to 7,846 single-family homes, 1,327 multi-family units and 19 schools. Additionally, 437 residential properties were acquired around MSP. The total cost of the program was approximately $386 million.

In 1999 the MAC began its Part 150 Update, which included significant focus on the mitigation program. Concurrent to the Part 150 Update, the MAC was pursuing the Dual-Track Airport Planning Process, an effort that the State Legislature directed the MAC to undertake in 1989 and that concluded in 1998 with the Legislature's vote that MSP would expand in its current location verses moving to a new location. As part of the Dual-Track process, the MAC was asked to propose an expansion of noise mitigation efforts beyond the federally-recognized threshold of 65 dB DNL if MSP were to stay in its current location. Through the Part 150 Update process, the MAC developed a mitigation package for homes located in the 60-64 dB DNL noise contour area.

ES.2 AIRPORT NOISE LITIGATION AND CONSENT DECREE

The cities located around MSP expressed dissatisfaction with the Part 150 Update associated with the expanded noise mitigation proposal. In early 2005, the Cities of Minneapolis, Eagan, and Richfield and the Minneapolis Public Housing Authority filed a lawsuit in Hennepin County District Court against the MAC.

In September 2005, plaintiffs seeking class action certification filed a separate action against the MAC alleging breach of contract claims associated with mitigation in the 60-64 dB DNL noise contours.

In 2007, the MAC and the Cities of Minneapolis, Eagan, and Richfield and the Minneapolis Public Housing Authority entered into a Consent Decree that settled the litigation.

Upon the completion of the 2007 Consent Decree noise mitigation program in 2014, more than 15,000 single-family homes and 3,303 multi-family units were provided noise mitigation around MSP. The total cost to implement mitigation under the 2007 Consent Decree was $95 million, raising the MAC's expenditures related to its noise mitigation program efforts to over $480 million by the end of 2014.

ES.3 MSP 2020 IMPROVEMENTS EA/EAW

In January 2013, the MAC published the Final MSP 2020 Improvements Environmental Assessment/Environmental Assessment Worksheet (EA/EAW), which reviewed the potential and cumulative environmental impacts of MSP terminal and landside developments needed through the year 2020. In response to new concerns expressed by MSP Noise Oversight Committee membership, a new noise mitigation plan was proposed in the EA/EAW leading to an amendment to the 2007 Consent Decree.

ES.4 THE AMENDED CONSENT DECREE

The first amendment to the 2007 Consent Decree was initiated in 2013 and established mitigation eligibility based on annual assessments of actual MSP aircraft activity rather than projections. To be eligible for noise mitigation, a home would need to be located for three consecutive years in a higher noise mitigation impact area when compared to the home's status under the terms of the 2007 Consent Decree. The first of the three years must occur by 2020. The Full 5-decibel Reduction Package is offered to single-family homes meeting these criteria inside the actual 63 dB DNL noise contour while the Partial Noise Reduction Package is offered to single-family homes in the actual 60-62 dB DNL noise contours. A uniform Multi-Family Noise Reduction Package is offered to multi-family units within the actual 60 dB DNL noise contour. Homes will be mitigated in the year following their eligibility determination. The 2013 actual noise contour marked the first year in assessing this new mitigation program.

A second amendment was made to the 2007 Consent Decree in 2017. This amendment allows the use of the Aviation Environmental Design Tool (AEDT) to develop the actual noise contours each year, beginning with the 2016 actual noise contour. In 2015, AEDT replaced the Integrated Noise Model (INM) as the federally-approved computer model for determining and analyzing noise exposure and land use compatibility issues around airports in the United States. The second amendment also provided clarity on the Opt-Out Eligibility criteria. Specifically, single-family homes that previously opted out of the Partial Noise Reduction Package may participate in the Full 5-decibel Reduction Package, provided the home meets the eligibility requirements.

RESIDENTIAL NOISE MITIGATION PROGRAM	ORIGINAL CONSENT DECREE	AMENDED CONSENT DECREE
• 1992 - 2006 • $385.6 Million	• 2007 - 2014 • $95.1 Million	• 2017 - 2024 • $16.2 Million*

*As of January 13, 2020

ES.5 2019 NOISE CONTOURS

The number of aircraft operations (takeoffs and landings) are one prominent factor in noise contour calculation. Actual aircraft operations have decreased significantly at MSP over the years, despite significant increases in passenger levels at MSP. This has occurred largely because airlines now fly larger planes with more seating and have increased seat occupancy rates (load factors).

Based on the 406,073 total operations at MSP in 2019 (per FAA data) versus the 582,366 total forecasted operations at MSP in 2007, the actual 2019 60 dB DNL contour is approximately 29 percent smaller than the 2007 Forecast Contour and the 2019 65 dB DNL contour is approximately 39 percent smaller than the 2007 Forecast Contour. The predominant contraction in the contours from the 2007 forecast to the 2019 Actual Noise Contour scenario is driven largely by fleet mix changes, including a significant reduction in Hushkit Stage 3 aircraft operations, and a reduction of 483 average daily operations.

Nonetheless, there are homes in areas that qualify for mitigation as outlined by the terms of the Consent Decree. There is a small area in Eagan where the 2019 Actual Contour extends beyond the 2007 Forecast Contour, where some homes are attaining eligibility for mitigation. Areas of the 2019 60 dB DNL contour that extend beyond the 2007 Forecast Contour in Minneapolis have already been included in the amended Consent Decree's mitigation efforts between 2017 and 2020. Areas where the 2019 Actual Contour extends beyond the 2007 Forecast Contour can largely be attributed to nighttime runway use variances between what was forecasted for 2007 and what occurred in 2019, particularly an increase in nighttime arrival operations on Runway 12R.

ES.6 AMENDED CONSENT DECREE PROGRAM ELIGIBILITY

First-Year Candidate Eligibility

Single-family: There are no single-family homes that achieved the first year of eligibility with the 2019 Actual Contour.

Multi-family: There are no multi-family units that achieved the first year of eligibility with the 2019 Actual Contour.

Second-Year Candidate Eligibility

Single-family: The 2019 Actual Contour shrunk under the arrival lobe of Runway 12R, resulting in all homes in Minneapolis that had previously achieved one year of eligibility not reaching a second year of eligibility.

Multi-family: Similarly, the contraction of the contour northwest of Lake Harriet resulted in all multi-family units in Minneapolis that had previously achieved one year of eligibility not reaching a second year of eligibility.

Third-Year Candidate Eligibility

Single-family: All 16 single-family homes that had two years of eligibility as a result of the 2018 annual noise contour were in the 60 dB DNL in the 2019 annual noise contour and are now entered into the 2021 mitigation program. All of these homes are located on one block in Eagan and are eligible for the Partial Noise Reduction Package. The homes on this block were previously eligible for homeowner reimbursements during the original Consent Decree Program. In cases where homes have received previous reimbursement from the MAC, the value of those improvements will be deducted from the efforts required to increase the home mitigation relative to the actual noise level, per the amended Consent Decree. Homeowners of eligible properties will be notified in writing by the MAC.

Multi-family: There are no multi-family units that achieved the third year of eligibility with the 2019 Actual Contour.

The blocks already included in previous mitigation programs and the amended Consent Decree programs are shown in Figures ES-1, ES-2 and ES-3. Additionally, Figure ES-3 shows the block that met the third consecutive year of noise mitigation eligibility by virtue of the 2019 Actual Contour.

ES.7 AMENDED CONSENT DECREE PROGRAM MITIGATION STATUS

2017 Mitigation Program

Single-family: In 2017 the MAC began the project to provide mitigation to 138 single-family homes that became eligible by virtue of the 2015 actual noise contour. As of January 13, 2020, 117 homes have been completed, 14 homes declined to participate while 7 homes were moved to the 2020 program as a result of homeowner actions.

Multi-family: Two multi-family structures also were eligible to participate in the Multi-Family Mitigation Program in 2017. One property is completed, and one property declined to participate.

The total cost for the 2017 Mitigation Program was $2,442,685. The 2017 Mitigation Program is now complete.

2018 Mitigation Program

Single-family: In 2017, the MAC began the project to provide mitigation to 283 single-family homes that became eligible by virtue of the 2016 actual noise contour. As of January 13, 2020, 230 homes have been completed, 27 homes declined to participate while 23 homes were moved to the 2020 program.

Multi-family: The 2018 Mitigation Program does not include any multi-family properties.

The total cost for the 2018 Mitigation Program to date is $7,280,869.

2019 Mitigation Program

Single-family: In 2018, the MAC began the project to provide mitigation to 429 single-family homes that became eligible by virtue of the 2017 actual noise contour. As of January 13, 2020, including the homes transitioned from the 2017 and 2018 programs, 214 homes have been completed, 159 homes are in the construction or pre-construction phase and 68 homes declined to participate.

Multi-family: The 2019 Mitigation Program does not include any multi-family properties.

The total cost for the 2019 Mitigation Program to date is $6,548,594.

2020 Mitigation Program

Single-family: In 2019, the MAC began the project to provide mitigation to 243 single-family homes that became eligible by virtue of the 2018 actual noise contour (164 are eligible for the partial mitigation package and 79 are eligible for the full mitigation package). As of January 13, 2020, including the homes transitioned from the 2018 and 2019 programs, zero homes have been completed, 261 homes are in the construction or pre-construction phase and 4 homes declined to participate.

Multi-family: The 2020 Mitigation Program does not include any multi-family properties.

To date, there have not been any financial expenditures attributed to the 2020 Mitigation Program.

Figure ES-1: 2019 Contours and Mitigation Program Eligibility

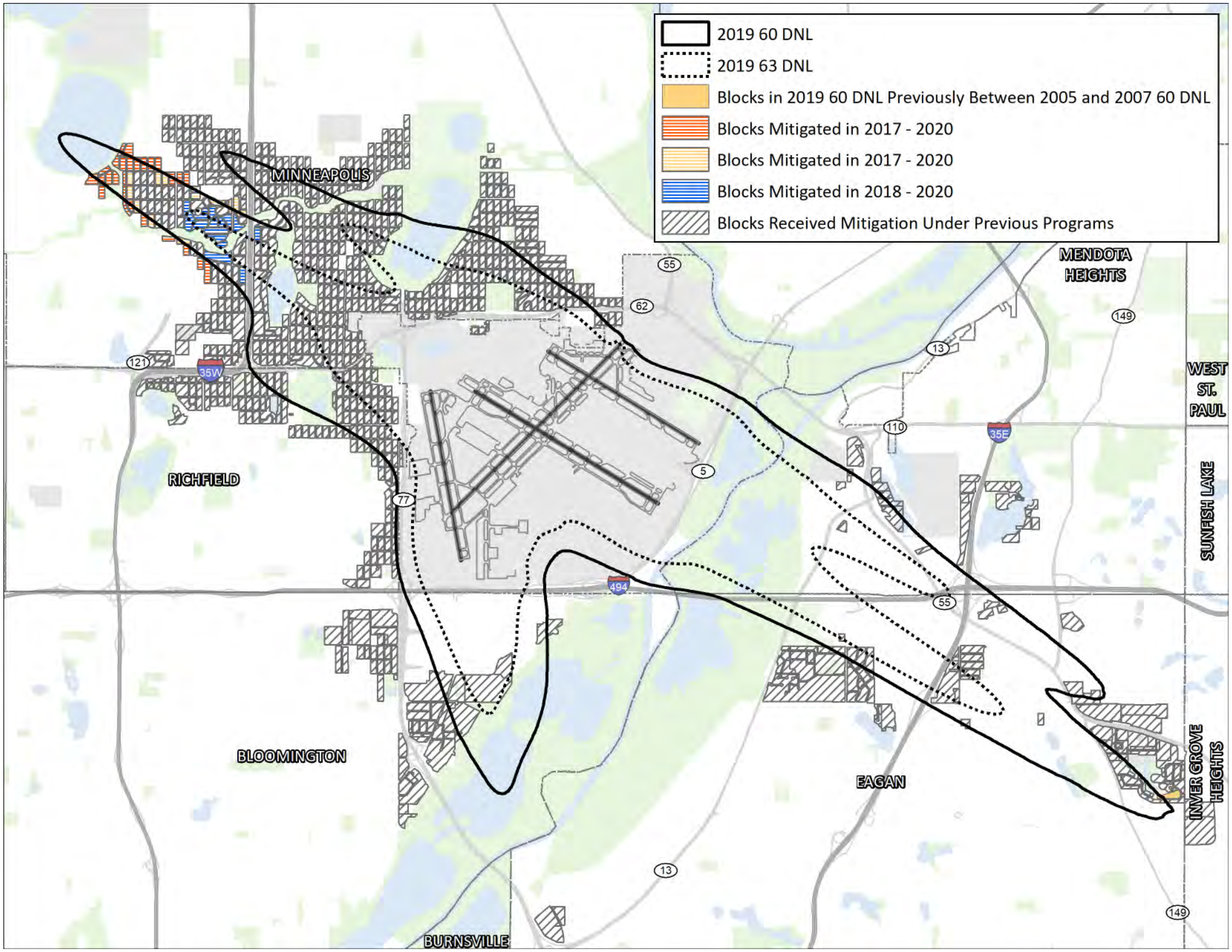


Figure ES-2: 2019 Contours and Mitigation Program Eligibility – City of Minneapolis

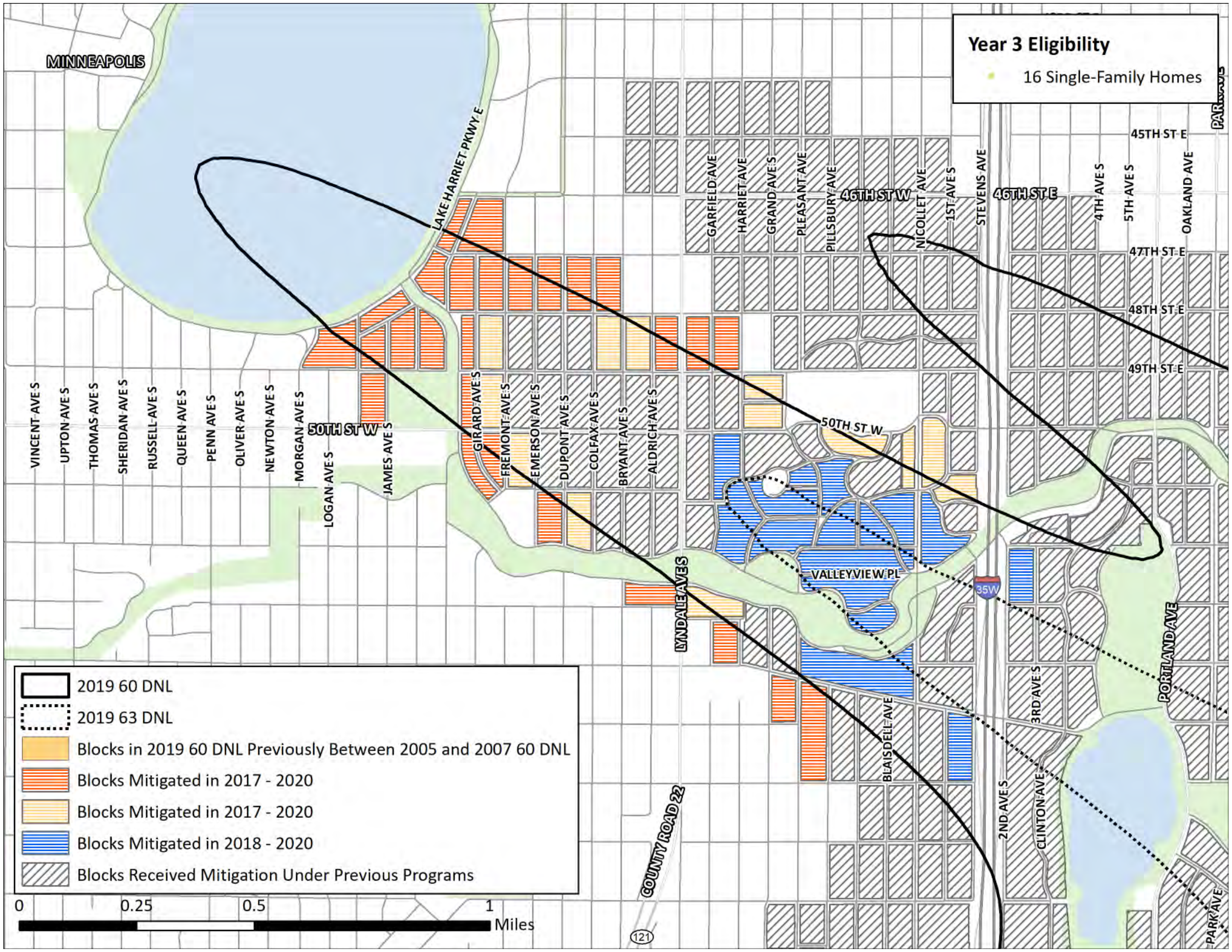
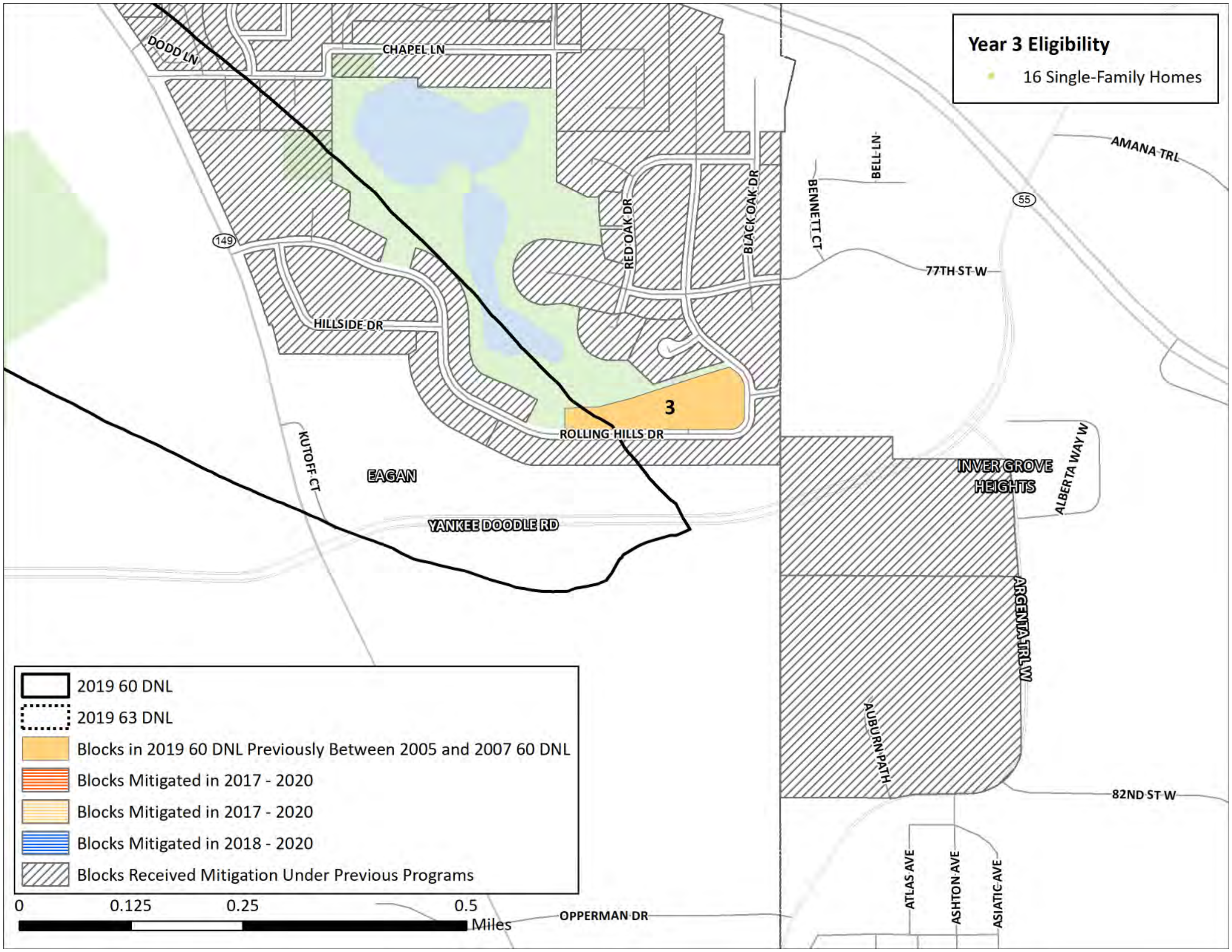


Figure ES-3: 2019 Contours and Mitigation Program Eligibility – City of Eagan



1. INTRODUCTION AND BACKGROUND

The issue of aircraft noise related to the Minneapolis-St. Paul International Airport (MSP) includes a long history of local efforts to quantify and mitigate noise impacts in a manner that is responsive to concerns raised by the communities around the airport and consistent with federal policy. The Metropolitan Airports Commission (MAC) has led the way with these efforts in the conceptualization and implementation of many initiatives to reduce noise impacts to communities around MSP. One of the most notable of these initiatives has been the sound insulation program originally implemented under 14 Code of Federal Regulations Part 150 (Part 150).

Part 150 provides a framework for airport operators to develop a comprehensive noise plan for an airport in the form of a Noise Compatibility Program (NCP). An NCP is a key component of the Part 150 program and is comprised of two fundamental approaches to addressing noise impacts around an airport: (1) Land Use Measures, and (2) Noise Abatement (NA) Measures (operational measures to reduce noise).

Another key component of Part 150 program planning is the development of a Noise Exposure Map (NEM). NEMs are commonly referred to as noise contours. The NEM, or noise contours, characterize noise in terms of Day-Night Average Sound Level (DNL). This metric represents the total accumulation of all sound energy (decibels or dB) averaged out uniformly over a 24-hour period that factors an additional 10-decibel penalty for each noise occurring between 10:00 PM and 7:00 AM. The current federally established threshold for significant noise around an airport attributable to aircraft is 65 dB DNL. Forecast mitigated noise contours depict areas that may be eligible for Land Use Measures around an airport based on forecasted operations levels. Land Use Measures can include compatible land use plans, property acquisition, residential relocation, and sound mitigation (modifications to homes to insulate against sound protrusions).

Development of a NEM includes a Base Case NEM and a five-year forecast NEM with and without noise abatement measures. Including noise abatement measures in NEM development is important because the way an airport is used by aircraft (i.e.: runway use, time of flight) and the way flight procedures (i.e.: power settings, flight paths) are executed have a direct effect on an airport's noise impact.

The MAC was one of the first airport sponsors to submit a Part 150 Study to the Federal Aviation Administration (FAA) and did so for MSP in October 1987. The study's NEM was accepted by the FAA in October 1989, and portions of the study's NCP were approved in April 1990. The NEMs used forecast operations, not actual operations, which came into effect at MSP through the amended consent decree program in 2014. The NCP identified areas eligible for remedial land use measures including the soundproofing of residences, schools and other public buildings.

A 1992 update to the NCP and NEM included a five-year forecast 65 dB DNL noise contour (1996 65dB DNL). This update established the MAC's MSP Residential Noise Mitigation Program and marked the beginning of corrective mitigation measures within the 1996 65 dB DNL noise contour.

1.1 CORRECTIVE LAND USE EFFORTS TO ADDRESS AIRCRAFT NOISE

From 1992 to 2006, the Residential Noise Mitigation Program was a large and visible part of the Part 150 program at MSP. The MAC designed the MSP Residential Noise Mitigation Program using FAA structural Noise Level Reduction (NLR) documentation. This included establishing product-specific Sound Transmission Class (STC) ratings and associated NLR goals, creative bidding practices, and cooperative prioritization and funding efforts. Through innovative approaches to enhancing the program as new information and technologies became available, the MSP Residential Noise Mitigation Program quickly became a national model.

NLR is a number rating that describes the difference between indoor and outdoor noise levels. The FAA uses this number to evaluate the effectiveness of noise mitigation measures. Per FAA guidelines, the objective of a noise mitigation program is to achieve a 5-dB reduction in interior noise with mitigation in place and reduce the average interior noise levels to a level below 45 dB. Testing and evaluation of single-family homes near MSP indicated that the majority of homes provided an average 30 dB of exterior to interior sound reduction or NLR with no mitigation efforts by the MAC, in most cases already achieving an interior noise level of 45 dB or below. This led the MAC to develop a “Full 5-decibel Reduction Package” for single-family homes within the 65 dB DNL and greater noise contours in order to meet FAA objectives.

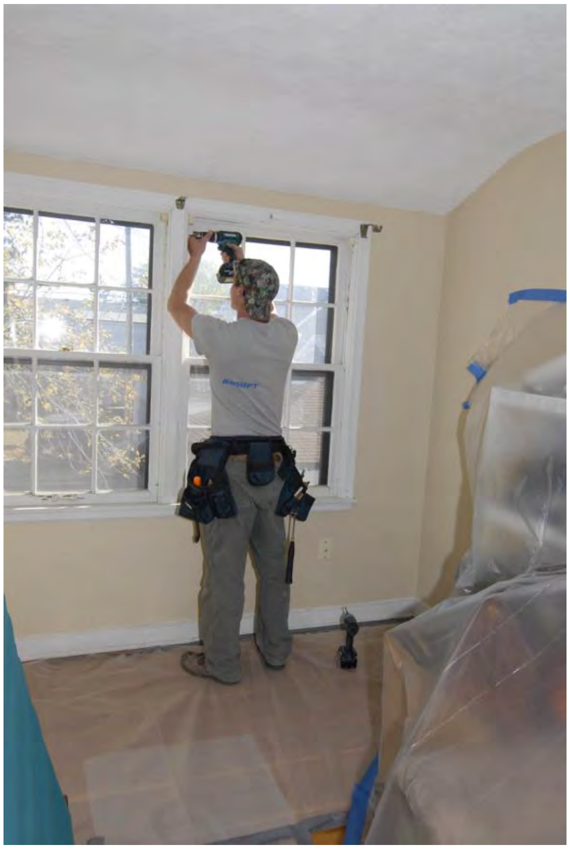
This package provided an average noise reduction level of 5 dB, ensuring a noticeable level of reduction. The Full 5-decibel Reduction Package offered a menu of mitigation measures that the MAC could install to achieve an average 5-dB noise reduction in an individual home. The menu of mitigation measure options included: treating or replacing windows and prime doors; installing or increasing attic insulation; baffling of attic vents, mail slots and chimneys; and the addition of central air-conditioning. The MAC determined which specific mitigation measures were necessary for a home after assessing the home’s existing condition.

As a result of detailed and extensive project management and quality control, the program achieved an excellent record of homeowner satisfaction. Throughout the duration of the program, when homeowners were asked if the improvements were effective at reducing aircraft noise at least 95 percent responded yes.

The MAC reached a significant accomplishment for its industry-leading aircraft noise mitigation program in 2006 when it completed the mitigation of 165 single-family homes in the 2007 forecast mitigated 65 dB DNL noise contour. This marked the completion of the mitigation program for all eligible and participating homes within the 1996 65 dB DNL and the 2007 65 dB DNL contours. In total over 7,800 single-family homes were mitigated around MSP.

Annual average mitigation costs per single-family home ranged from a low of $17,300 in 1994 to a high of $45,000 in 2001. The MAC spent a total of approximately $229.5 million on the single-family home mitigation program during the Residential Noise Mitigation Program's 14-year lifespan (1992-2006).

In addition to the single-family mitigation program, the MAC also mitigated multi-family units and schools, and engaged in property acquisition and relocation. The multi-family component of the Residential Noise Mitigation Program began in 2001 and was significantly smaller in both the number of structures mitigated and the associated costs. With completion of multi-family structures in the 1996 65 dB DNL noise contour, the MAC mitigated approximately 1,327 multi-family units at a total cost of approximately $11.1 million. There were no additional multi-family structures inside the 2007 Forecast Contour. All eligible and participating multi-family structures within the 2007 Forecast Contour were mitigated by 2006.



Also, since 1981, the MAC has mitigated 19 schools located around MSP, which represents all the schools located within the 1996 65 dB DNL noise contour. In response to Minnesota State Legislature's directives, the MAC also provided mitigation to certain schools located outside the 1996 65 dB DNL noise contour. The costs of insulating individual schools varied from $850,000 to $8 million. A total of approximately $52 million was spent on mitigating schools, marking the completion of the school mitigation efforts in 2006.

In addition to the residential and school noise mitigation programs, the MAC implemented a residential property acquisition program in 2002 that removed areas of sensitive land uses, such as residential buildings, from noise impact areas. The intent of the residential acquisition program was to address impacted properties in the 1996 65 dB DNL noise contour, with the property owners and the city in which the respective property resided agreeing that acquisition was the desirable means of mitigating the homes. As a result, the MAC acquired approximately 437 residential properties. In total, the MAC expended approximately $93 million on the residential property acquisition program. The financial investment in the MSP Residential Noise Mitigation Program was among the largest in the nation for such programs. Table 1.1 provides a summary of activity completed and dollars spent between 1992 and 2006.

Table 1.1: Summary of Corrective Efforts (1992-2006)

Corrective Action	Number	Total Cost (in millions)
Single Family Residential	7,846	$229.5
Multi-Family Residential	1,327	$11.1
Schools	19	$52
Residential Property Acquisition	437	$93
Total	--	*$385.6*

1.2 2007 FORECAST CONTOUR

In late 1998, the MAC authorized an update to the Part 150 program at MSP. The update process began in 1999 with the development of noise contours, noise abatement and land use measures. The MAC published a draft Part 150 Update document in October 2000 and submitted the study, including a 2005 forecast NEM and revised NCP, to the FAA for review. In May 2002, after further consideration of the reduction in flight operations and uncertainties in the industry resulting from the events of September 11, 2001, the MAC withdrew the study to update the forecast and associated noise contours.

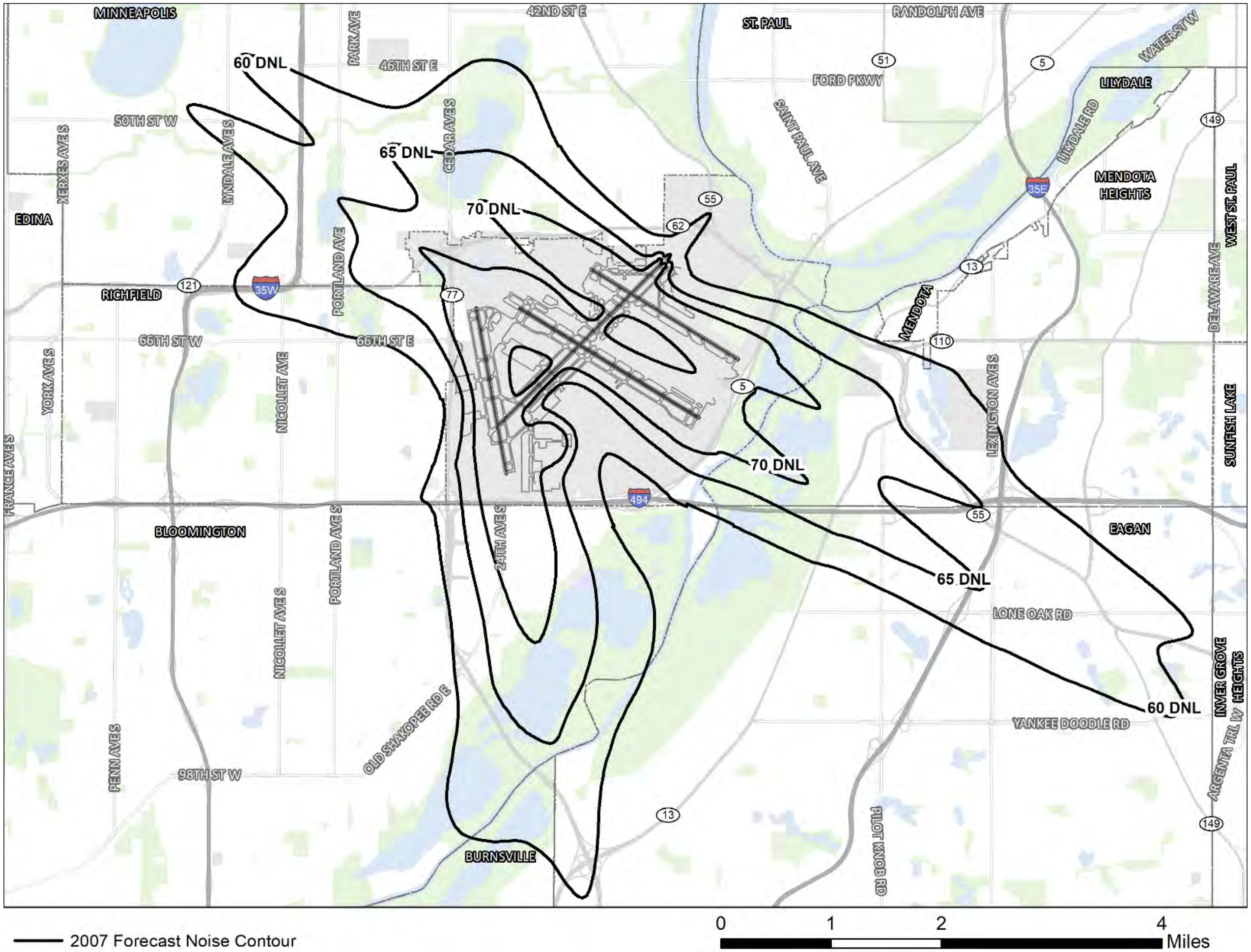
The forecast update process began in February 2003. This effort focused on updating the Base Case year from a 2000 scenario to a 2002 scenario and updating the forecast year from 2005 to 2007. The purpose of the forecast update was to ensure that the noise contours considered the impacts of the events of September 11, 2001 and ongoing changes in the MSP aircraft fleet. In addition to updating the forecast, the MAC and the MSP Noise Oversight Committee (NOC) conducted a review of the Integrated Noise Model (INM) input methodology and data to ensure continued consensus with the contour development process.

On November 17, 2003, the MAC approved the revised forecast and fleet mix numbers and INM input methodology and data for use in developing the 2002 Base Case and 2007 Forecast NEMs. In March 2004, the MAC revised the forecast to incorporate corrections in general aviation numbers and to reflect Northwest Airlines' announcement that it would resume service of five aircraft that had been taken out of service previously.

The 2004 Part 150 Update resulted in a comprehensive NCP recommendation. In addition to several land use measures around MSP, the NCP included operational noise abatement measures. These measures focused on aircraft operational procedures, runway use, departure and arrival flight tracks, voluntary operational agreements with the airlines, and provisions for further evaluation of technology. The MAC implemented these operational noise abatement measures (more information available at www.macnoise.com/our-neighbors/msp-noise-abatement-efforts).

Based on the estimate of 582,366 total operations in the 2007 forecast mitigated scenario, approximately 7,234 acres are in the 65 dB DNL noise contour and approximately 15,708 acres are in the 60 dB DNL noise contour. All eligible and participating homes within the 2007 Forecast Contour have been mitigated. A depiction of the 2007 Forecast Contour is provided in Figure 1.

Figure 1: 2007 Forecast Contour



1.3 AIRCRAFT NOISE LITIGATION

One of the largest discussion items in the 1999 Part 150 Update process focused on the mitigation program that the MAC would offer in the 60-64 dB DNL noise contour area. The FAA recognizes sensitive land uses, such as residential land uses eligible for noise mitigation under Part 150, but only within the 65 dB DNL noise contour or greater. However, as part of the Dual-Track Airport Planning Process (a process that examined moving MSP versus expanding it in its current location, undertaken at the direction of the Minnesota State Legislature), the MAC made a policy decision to provide some level of noise mitigation out to the 60 dB DNL noise contour area surrounding MSP. During the Dual-Track Airport Planning Process, an MSP Noise Mitigation Committee was developed and tasked with proposing a noise mitigation plan to be considered in conjunction with the expansion of MSP at its present location. The MSP Noise Mitigation Committee developed a final recommendation for the MAC to provide mitigation to the 60 dB DNL contour.

In the 2004 Part 150 Update, the MAC's recommendation for mitigation in the 60-64 dB DNL contours called for providing central air-conditioning to single-family homes that did not have it, with a possible homeowner co-pay based on the degree of noise impact. The MAC applied block-intersect methodology to the 2007 Forecast Contour to determine mitigation eligibility. With the block-intersect methodology, if any portion of a city block intersects the 60-64 dB DNL contour, all homes located on that city block would be eligible.

The cities located around MSP expressed dissatisfaction with the MAC proposal, asserting that the MSP Noise Mitigation Committee had recommended that the Full 5-decibel Reduction Package be expanded to all properties in the 60-64 dB DNL noise contours. The MAC countered that the proposal provided mitigation to the 60-64 dB DNL noise contour area and that the MSP Noise Mitigation Committee's recommendations did not specify the mitigation package that must be included. Additionally, the MAC clarified that, because homes in Minnesota have higher than the national average pre-existing noise reduction characteristics, the Full 5-decibel Reduction Package was not necessary outside the 65 dB DNL contour to achieve desired aircraft noise level reduction.

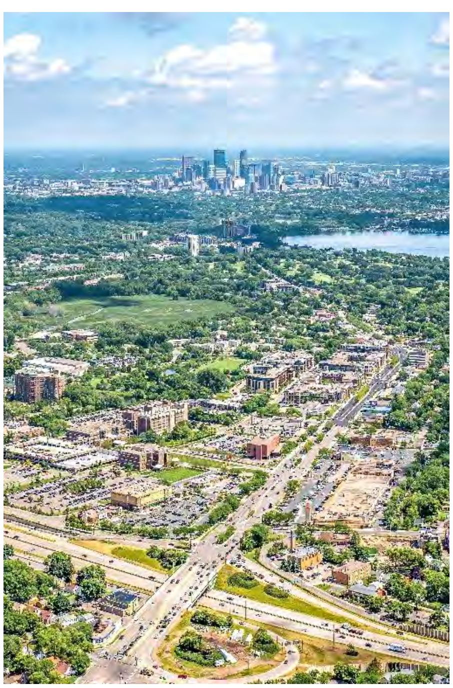
In early 2005, the Cities of Minneapolis, Eagan, and Richfield and the Minneapolis Public Housing Authority filed suit in Hennepin County District Court claiming, among other things, the MAC violated environmental quality standards and the Minnesota Environmental Rights Act (MERA) by failing to provide the Full 5-decibel Reduction Package to single-family homes in the 60-64 dB DNL contours. In September 2005, plaintiffs seeking class action certification filed a separate action against the MAC alleging breach of contract claims associated with mitigation in the 60-64 dB DNL contours. In January 2007, Hennepin County District Judge Stephen Aldrich granted the cities partial summary judgment. The court found, among other things, that the MAC, by virtue of implementing the Full 5-decibel Reduction Package, created an environmental standard that the MAC violated by recommending different mitigation in the 64 to 60 DNL noise contour area. In February 2007, the court held a trial on the cities' MERA and mandamus claims. Before the court entered final judgment post-trial, however, the parties negotiated a global settlement, a Consent Decree, resolving the cities' case and the class action suit.

1.4 NOISE MITIGATION SETTLEMENT AND ANNUAL NOISE CONTOUR

On October 19, 2007, Judge Stephen Aldrich approved a Consent Decree entered into by the MAC and the Cities of Minneapolis, Eagan, and Richfield and the Minneapolis Public Housing Authority that settled the litigation. The Consent Decree provided that it became effective only if: (1) the FAA advised the MAC in writing by November 15, 2007 that the Decree was an appropriate use of airport revenue and was consistent with the MAC's federal grant obligations; and (2) that the court approved a settlement in the class action case by January 17, 2008. Both conditions were ultimately met, and in 2008 the MAC began implementing single-family and multi-family mitigation out to the 2007 60 dB DNL noise contours and mitigation reimbursement funds out to the 2005 60 dB DNL noise contours, as the Consent Decree required. Under the Decree, mitigation activities would vary based on noise exposure. Homes with the highest aircraft noise exposure were eligible for more extensive mitigation than those with less aircraft noise exposure.

The 2007 Consent Decree provided that approximately 457 homes in the 2007 63-64 dB DNL forecast noise contours were eligible to receive the Full 5-decibel Reduction Package, which was the same level of noise mitigation that the MAC provided in the 1996 65 dB DNL and greater contours. The 2007 63-64 dB DNL noise contour mitigation program was designed to achieve 5 dB of noise reduction on average, with mitigation measures that depended upon the home's existing condition. These methods included central air-conditioning; exterior and storm window repair or replacement; prime door and storm door repair or replacement; wall and attic insulation installation; and/or baffling of roof vents and chimney treatment. As required by the Consent Decree, the MAC completed mitigation in the 2007 63-64 dB DNL noise contours by December 31, 2009. A total of 404 homes participated in the program.

In addition, under the Decree, owners of the approximately 5,428 single-family homes in the 2007 60-62 dB DNL noise contours were eligible for one of two mitigation packages: 1) homes that did not have central air-conditioning as of September 1, 2007 would receive it and up to $4,000 (including installation costs) in other noise mitigation products and services they could choose from a menu provided by the MAC; or 2) owners of homes that already had central air-conditioning installed as of September 1, 2007 or who chose not to receive central air-conditioning were eligible for up to $14,000 (including installation costs) in noise mitigation products and services they could choose from a menu provided by the MAC. The mitigation menu included acoustical modifications such as: exterior and storm window repair or replacement; prime door and storm door repair or replacement; wall and attic insulation installation; and/or baffling of roof vents and chimney treatment. These packages collectively became known as the Partial Noise Reduction Program. As required by the Consent Decree, the MAC completed the Partial Noise Reduction Program by December 1, 2012. A total of 5,055 homes participated in the program.



According to the provisions in the Consent Decree, single-family homes in the 2007 63-64 dB DNL contours and in the 2007 60-62 dB DNL contours whose owners opted out of the previously-completed MAC Residential Noise Mitigation Program for the 1996 65 dB DNL noise contours and greater, but that had new owners on September 1, 2007, were eligible to "opt in" and receive noise mitigation. If the total cost to the MAC of the opt-in mitigation is less than $7 million, any remaining funds were used to reimburse owners of single-family homes between the 2005 mitigated 60 dB DNL contour and the 2007 Forecast Contour for purchase and installation of products included on a menu provided by the MAC. The amount each homeowner received was determined by subtracting dollars spent for the opt-in program from the total $7 million budget, and then by dividing the remainder of funds among the total number of single-family homes within the 2005 60 dB DNL and 2007 60 dB DNL contours. This program became known as the Homeowner Reimbursement Program. In September 2014, the MAC completed the Homeowner Reimbursement Program for a total of 1,773 participating single-family homes.

The MAC completed the Multi-Family Noise Reduction Package in 2010 by installing acoustical covers on air-conditioners or installing new air-conditioners in 1,976 dwelling units.

All phases of the MSP Residential Noise Mitigation Program required under the original 2007 Consent Decree were completed by September 2014. The total cost to implement mitigation under the original Consent Decree was approximately $95 million, (which is inclusive of the $7 million for opt-in mitigation and single-family mitigation reimbursement). A summary of actions taken is provided in Table 1.2.

Table 1.2: Summary of Corrective Efforts (2007-2014)

Corrective Action	Number	Total Cost (in millions)
Single Family Residential (full mitigation)	404	$11.2
Single Family Residential (partial mitigation)	5,055	$72.6
Single Family Residential (homeowner reimbursement)	1,773	$5.2
Multi-Family Residential	1,976	$6.1
Total		*$95.1*

In addition to the MAC's mitigation obligations, the Consent Decree releases legal claims that the cities and homeowners have against the MAC in exchange for the actions that the MAC would perform under the Decree. The releases cease to be effective for a certain location if the average annual aircraft noise level in DNL at that location is at or above DNL 60 dB and is at least 2 dB DNL higher than the Base Case DNL Noise Level.

The Base Case DNL Noise Level is established by the actual DNL noise level at a location during the year the home in that location becomes eligible for noise mitigation under the Consent Decree. The Base Case DNL Noise Level for homes that are not eligible for mitigation under the amended Consent Decree is established using the 2007 forecast DNL level for that location.

MAC staff and representatives from the Cities of Minneapolis, Eagan, and Richfield met in February 2008 to discuss and finalize the annual report format. This report is prepared in accordance with the requirements of the Consent Decree and the format agreed upon by the parties. The actual contour that the MAC must develop under Section 8.1(d) of the Consent Decree is relevant to the release provisions in Section 8.1 as well as the determination of mitigation eligibility as defined by an amendment to the Consent Decree, described in Chapter 4 of this report.

1.5 FINAL MSP 2020 IMPROVEMENTS EA/EAW AND AMENDED CONSENT DECREE

In January 2013, the MAC published the Final MSP 2020 Improvements Environmental Assessment/Environmental Assessment Worksheet (EA/EAW), which reviewed the potential and cumulative environmental impacts of MSP terminal and landside developments needed through the year 2020.

As is detailed in the EA/EAW, the FAA's Finding of No Significant Impact/Record of Decision (FONSI/ROD), and summarized in the MAC's related Findings of Fact, Conclusions of Law, and Order, the Preferred Alternative scenario did not have the potential for significant environmental effects. The forecasted noise contours around MSP were driven by natural traffic growth that was anticipated to occur with or without implementation of the 2020 Improvements proposed in the EA/EAW.

Despite this, many of the public comments on the EA/EAW focused on future noise mitigation efforts. The past noise mitigation activities surrounding MSP, the terms of the 2007 Consent Decree and local land use compatibility guidelines defined by the Metropolitan Council were factors in the public dialogue. Additionally, the anticipated completion of the Consent Decree Residential Noise Mitigation Program in 2014 raised community interest regarding the future of noise mitigation at MSP.

In response, MAC staff, in consultation with the MSP NOC, began the process of developing a noise mitigation plan to be included in the EA/EAW. The noise mitigation plan they recommended based eligibility upon actual noise contours that the MAC would prepare for MSP on an annual basis and required that a home would need to be located for three consecutive years in a higher noise mitigation impact area when compared to the home's status under the terms of the 2007 Consent Decree.

The Final MSP 2020 Improvements EA/EAW detailed the following mitigation program elements:

- Mitigation eligibility would be assessed annually based on the actual noise contours for the previous year.
- The annual mitigation assessment would begin with the actual noise contour for the year in which the FAA FONSI/ROD for the EA/EAW was issued.
- For a home to be considered eligible for mitigation it must be located within the actual 60 dB DNL noise contour, within a higher noise impact mitigation area when compared to its status relative to the original Consent Decree noise mitigation program, for a total of three consecutive years, with the first of the three years beginning no later than 2020.
- The noise contour boundary would be based on the block-intersect methodology.
- Homes would be mitigated in the year following their eligibility determination.

On January 7, 2013, the FAA published the Final MSP 2020 Improvements EA/EAW and the Draft FONSI/ROD, which included the following position regarding the proposed noise mitigation program:

> "*The FAA is reviewing MAC's proposal for noise mitigation of homes for consistency with the 1999 FAA Policy and Procedures concerning the use of airport revenue and other applicable policy guidance.*"

During the public comment period on the FAA's Draft FONSI/ROD many communities submitted comments urging the FAA to approve the MAC's revised noise mitigation proposal.

On March 5, 2013, the FAA approved the FONSI/ROD for the Final MSP 2020 Improvements EA/EAW. Specifically, the FAA stated that noise mitigation would not be a condition of FAA approval of the MSP 2020 Improvements project because "[n]o areas of sensitive land uses would experience a 1.5 dB or greater increase in the 65 dB DNL noise contour when comparing the No Action Alternative for 2020 and 2025 with the Proposed Action for the respective years." However, the FAA included a letter dated March 5, 2013, as an attachment to the FONSI/ROD that addresses the conditions under which airport revenue may be used for off-airport noise mitigation. In that letter, the FAA stated:

> *"As a matter of general principle mitigation measures imposed by a state court as part of a consent decree are eligible for use of airport revenue. Conceptually MAC could use airport revenues if it were to amend the 2007 consent decree to include the proposed mitigation."*

Based on the FAA guidance, the MAC initiated discussions with the other parties to the Consent Decree (Cities of Minneapolis, Richfield and Eagan and the Minneapolis Public Housing Authority) to begin the amendment process. Additionally, at the March 20, 2013 NOC meeting, the Committee was updated on the progress of this issue and voted unanimously, supporting the following position:

> *"NOC supports the noise mitigation program as detailed in the final EA/EAW in principal and supports follow-up negotiations between the parties to the Consent Decree to establish mutually agreeable terms for the modification of the Consent Decree consistent with the March 5th FAA letter in Appendix D of the FONSI ROD, for consideration by the Court."*

On July 31, 2013, the Cities of Minneapolis, Richfield and Eagan, and the Minneapolis Public Housing Authority and the MAC jointly filed the first amendment to the Consent Decree to Hennepin County Court. On September 25, 2013, Hennepin County Court Judge Ivy S. Bernardson approved the first amendment to the 2007 Consent Decree. The first amendment contains language that binds the MAC to provide noise mitigation services consistent with the noise mitigation terms described in the EA/EAW.

The 2013 actual noise contours established the first year of candidate eligibility based on the criteria detailed in the EA/EAW. The Full 5-decibel Reduction Package is offered to single-family homes meeting the eligibility criteria inside the actual 63 dB DNL noise contour while the Partial Noise Reduction Package is offered to single-family homes in the actual 60-62 dB DNL noise contours. A uniform Multi-Family Noise Reduction Package is offered to multi-family units within the actual 60 dB DNL noise contour. Homes will be mitigated in the year following their eligibility determination. The 2013 actual contour marked the first year in assessing this amended mitigation program.

In 2017 MAC began mitigating homes meeting the eligibility requirements. The program included 138 single-family homes and 88 multi-family units as part of the 2017 program, 283 single-family homes in the 2018 program, 429 single-family homes in the 2019 program, and 243 single-family homes in the 2020 program. As of January 2020, $16,272,148 has been spent on mitigating homes pursuant to the amended Consent Decree.

In 2016, the Cities of Minneapolis, Richfield and Eagan, and the Minneapolis Public Housing Authority and the MAC drafted a second amendment to the 2007 Consent Decree. This amendment: 1) allows the use of the Aviation Environmental Design Tool (AEDT) to run the actual noise contours each year (beginning with the 2016 actual noise contour; 2) provides clarity on the Opt-Out Eligibility criteria; and 3) provides a safeguard for homes that may fall out of consecutive year mitigation eligibility by virtue of a change in the model used to generate the noise contours. The clarification to the Opt-Out Eligibility criteria states: (1) homeowners who failed to participate in the reimbursement program are not considered "Opt-Outs" and may participate in future programs provided the home meets the eligibility requirements; and (2) single-family homes that previously opted out of the Partial Noise Reduction Package may participate in the Full 5-decibel Reduction Package provided the home meets the eligibility requirements.

In November 2016, the parties to the Consent Decree signed the second amendment. In December 2016, the FAA responded that the second amendment "constitute a proper use of airport revenue" and "is consistent with MAC's grant obligations." On January 31, 2017 Judge Bernardson approved the second amendment to the 2007 Consent Decree.

2. 2019 ACTUAL NOISE CONTOUR

2.1 DEVELOPMENT OF THE 2019 ACTUAL NOISE CONTOUR

2.1.1 Noise Modeling

By March 1 of each year, the MAC is required to prepare actual noise contours reflecting the noise exposure from MSP aircraft operations that took place during the previous calendar year. The availability of federal or airport-generated funds for the purpose of noise mitigation is contingent upon the development of noise contours in a manner consistent with FAA requirements. One of these requirements is the use of the DNL noise assessment metric to determine and analyze aircraft noise exposure. The DNL metric is calculated by averaging cumulative sound levels over a 24-hour period. This average cumulative sound exposure includes a 10-decibel penalty to aircraft noise exposures occurring during the nighttime (10:00 PM to 7:00 AM) to account for relatively low nighttime ambient noise levels and because most people are asleep during these hours.

In May 2015, AEDT version 2b was released by the FAA to replace a series of legacy tools, including INM, which was previously used for modeling noise pursuant to the terms of the Consent Decree. According to the FAA, there was overlap in functionality and underlying methodologies between AEDT and the legacy tools, however updates were made in AEDT that result in differences when comparing outputs from AEDT and the legacy tools. The updates related to noise modeling include: smaller flight segments to more accurately model aircraft noise levels for a larger number of aircraft positions and states along a flight path; a new standard (SAE-ARP-5534) for computing the effects of weather on noise; correcting misidentified aircraft engine mounted locations for three aircraft types; and moving from recursive grids to dynamic grids for noise contour generation. The most recent version of AEDT, version 3b, was released for use on September 24, 2019. This version was used to develop the 2019 Actual Contour. AEDT 3b was a major release that included new and substantial changes to aircraft performance modeling along with other new features, updates, and a series of bug fixes and usability improvements. AEDT 3b introduced the ability to select alternative weight and reduced thrust departure profiles. This new feature is considered non-standard and was not utilized in producing the 2019 Actual Contour. AEDT 3b also included an update to the aircraft fleet database to include data for four new aircraft and two updated aircraft. Those aircraft changes include:

- Airbus A350-941 – New
- Gulfstream G650 – New
- Boeing 737 Max 8 – Update
- Boeing 737-800 – Update
- Two variants of the Airbus A320neo – New
- Dassault Falcon 900EX – New

Noise contours depict an annualized average day of aircraft noise impacts using model inputs, such as runway use, flight track use, aircraft fleet mix, aircraft performance and thrust settings, topography, and atmospheric conditions. Quantifying aircraft-specific noise characteristics in AEDT is accomplished using a comprehensive noise database that has been developed under 14 CFR Part 36. As part of the airworthiness certification process, aircraft manufacturers are required to subject aircraft to a battery of noise tests. Using federally adopted and endorsed algorithms, this aircraft-specific noise information is used in the generation of DNL contours. Justification for such an approach is rooted in national standardization of noise quantification at airports.

2.1.2 2019 Aircraft Operations and Fleet Mix

Most of the aircraft operations at MSP are conducted by airline companies. Thus, changes to operational levels will be impacted by airline decisions. For several years, airlines operating at MSP and nationwide have chosen to upgrade aircraft fleets, often choosing aircraft that can move more passengers with fewer operations. Additionally, airlines are choosing to operate aircraft with higher load factors. A load factor is a measure of how many of the seats of an aircraft are filled. Higher load factors and larger aircraft have resulted in fewer operations necessary to carry record amounts of passengers. For example, the actual 2019 operations level at MSP is below the operational level documented at the airport over 25 years ago, below the operational level forecasted for 2007, and below the 2018 level. Despite this, MSP set an all-time passenger record in 2019 with 38.4 million passengers, an increase of over 4 percent over 2018.

The MAC used its Noise and Operations Monitoring System (MACNOMS) for the 2019 fleet mix data as well as the FAA's Operations Network (OPSNET) total operations counts in the development of the actual 2019 noise contours. The MACNOMS total operations number was 0.5 percent lower than the operations number reported by OPSNET. To reconcile this difference, MACNOMS data was adjusted upward to equal the OPSNET number. In 2019, the total operations at MSP was 406,073 (per FAA data), an average of 1,112.5 daily flights. This represents a decrease of 0.2 percent from the 2018 annual operations level reported by the FAA. MACNOMS found that 89.2% of all operations occurred between 7:00 AM and 10:00 PM (day). The remaining share, 10.8%, occurred between 10:00 PM and 7:00 AM (night). This total translates to 119.8 average daily nighttime operations. That figure is down slightly from the 120.3 average daily nighttime operations in 2018.

Table 2.1: Summary of 2019 Average Daily Flight Operations

Average Daily Flight Operations	Day	Night	Total	% of Total Operations
Manufactured to be Stage 3+	955.3	118.0	1,073.4	96.5%
Hushkit Stage 3 Jets	0.2	0.0	0.2	0.0%
Microjet	0.7	0.0	0.7	0.1%
Propeller	33.6	1.6	35.2	3.2%
Helicopter	0.1	0.0	0.1	0.0%
Military	2.9	0.1	3.0	0.3%
Total	*992.7*	*119.8*	*1,112.5*	*100.0%*
% of Total Operations	*89.2%*	*10.8%*	*100.0%*	

Note: Totals may differ due to rounding.

Source: MAC-provided MACNOMS data, HNTB 2020

The use of newer and quieter aircraft has continued. In 2019, there were 2,400 Airbus A320 NEO (New Engine Option) operations. These operations were split between aircraft with CFM International Leap engines flown by Frontier Airlines and Pratt and Whitney geared turbofan engines flown by Spirit Airlines. Additionally, a small number of Airbus A321 NEO operations were flown by Alaska Airlines and American Airlines in 2019.

The most notable change to the fleet occurred in June as Delta Air Lines began revenue operations using the Airbus A220-100 aircraft at MSP. Delta took delivery of 28 of these aircraft between October 2018 and December 2019. Using those aircraft, Delta conducted nearly 1,200 operations in less than six months. According to Airbus, the noise footprint is up to four times smaller than other in-production aircraft, while fuel burn contributes 20% fewer CO_2 and 50% fewer NO_X emissions. The current version of AEDT does not have a noise profile for the Airbus A220, therefore a conservative approach was taken, consistent with FAA guidance, to substitute a Boeing 737-700 aircraft for the 2019 annual noise contour. All non-standard aircraft substitutions in AEDT were approved by the FAA Office of Energy and Environment.

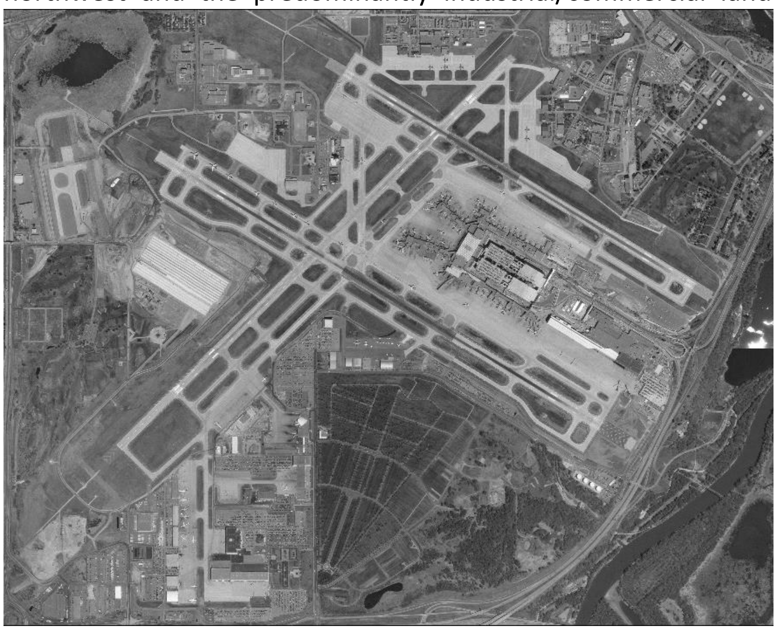
The other notable change to aircraft fleets at MSP that contributed to less noise in 2019 included the introduction of the Airbus A350-941 into revenue service. Delta began using this wide body, twin aisle jet for service to Seoul, South Korea in October. In that short time, Delta conducted more than 100 operations in an aircraft type that Airbus reports was designed to be 25 percent more fuel efficient and 40 percent quieter than previous generations of aircraft.

A summary of the 2019 fleet mix is provided in Table 2.1. A more detailed presentation of the 2019 aircraft fleet mix is provided in Appendix 1.

2.1.3 2019 Runway Use

FAA's control and coordination of runway use throughout the year for arrival and departure operations at MSP has a notable effect on the noise impact around the airport. The number of flights operating on each runway, also called runway use, is one of the factors behind the numbers of people and dwellings impacted by noise.

Historically, prior to the opening of Runway 17/35, arrival and departure operations at MSP occurred on the parallel runways (12L/30R and 12R/30L) in a manner that resulted in approximately 50 percent of the arrival and departure operations occurring to the northwest over South Minneapolis, and 50 percent to the southeast over Mendota Heights and Eagan. Because of the dense residential land uses to the northwest and the predominantly industrial/commercial land uses southeast of MSP, there was a concerted effort to focus departure operations over areas to the southeast as the preferred operational configuration. This tactic proved to affect fewer sensitive land uses and people from an aircraft noise perspective.

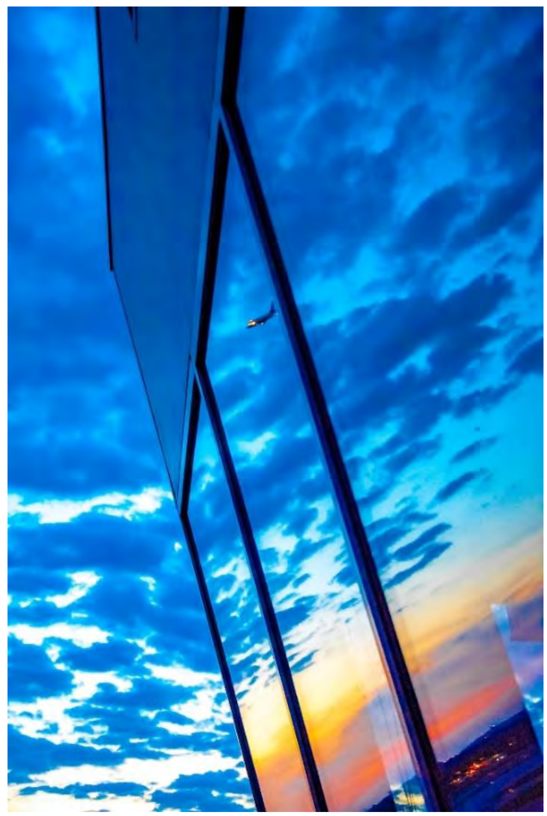


The introduction of Runway 17/35 at MSP in 2005 provided another opportunity to route aircraft over an unpopulated area – the Minnesota River Valley. With use of the Runway 17 Departure Procedure, westbound departing aircraft are routed such that they avoid close-in residential areas southwest of Runway 17. Thus, use of Runway 17 for departing aircraft is the second preferred operational configuration (after Runways 12L and 12R) for noise reduction purposes.

In 2013, the National Transportation Safety Board (NTSB) recommended modifications to arrival and departure procedures for airports with Converging Runway Operations (CRO). CRO exists when the extended centerline of two runways intersect within one nautical mile of the departure ends of those runways. This situation poses a potential risk for aircraft converging at the intersection point. At MSP, this situation exists when aircraft are landing and departing in a northerly direction because the extended centerline of Runway 35 intersects within one mile of the extended centerlines for both Runways 30L and 30R. Since Runway 35 is used only for arrivals from the south, potential convergence of flight paths would occur only if an aircraft executes an aborted landing ("go around") on its approach to Runway 35.

Between 2013 and 2015, the FAA phased-in new safety requirements at United States airports identified by the NTSB. Beginning in July 2015, the FAA worked to introduce the requirements at MSP. At the end of 2015 and throughout 2016, the airport saw notable changes in runway use resulting from the added complexity for controllers when the airport was operating in a CRO condition (landing and departing in a northerly direction). In response, the MSP NOC unanimously passed a resolution requesting the FAA evaluate the current and future environmental and capacity impacts from the new CRO rules and to communicate the findings back to the NOC. The MAC Board of Commissioners took unanimous action supporting the NOC resolution and forwarded it to the FAA.

During 2017, the FAA made progress in designing and employing technological tools within its air traffic control system to revert closer to runway use patterns prior to the new CRO rules, regain some capacity loss, and reduce air traffic controller workload at MSP during CRO. In January 2017, the FAA began using two Arrival Departure Windows (ADWs) for each of the parallel runways. In order to use two ADWs at the same time, a thorough risk assessment and approval process was required. These windows help alternate flights departing from Runways 30L and 30R with flights arriving to Runway 35. Use of the two ADWs increased MSP's northerly arrival rate from 64 to 75 aircraft per hour.



In June 2017, the FAA implemented a Converging Runway Display Aid (CRDA), which aligns aircraft arriving to Runway 30L with aircraft arriving to Runway 35 to help air traffic controllers with sequencing departures to the northwest. The CRDA tool helps arrivals on Runway 35 line up with arrivals on Runway 30L to create a predictable departure gap for Runway 30L. This process has allowed the FAA to develop efficiency gains and increase arrival rates up to 84 aircraft per hour during three peak arrival demand periods throughout the day, which reduces arrival delays. Similarly, in August 2017 the FAA began flexing departure rates upward during peak departure demand periods by routing Runway 35 arrivals to either Runway 30L or Runway 30R, thus eliminating the dependency on ADWs for aircraft departing to the northwest.

During 2018, the FAA continued the implementation of tools and agreements designed to standardize operating expectations within its air traffic control system. The three MSP air traffic control facilities – Tower (ATCT), Terminal Radar Approach Control (TRACON), and Minneapolis Center (ARTCC) – have similar interests in controlling air traffic but different constraints on their activity. To standardize the agreements regarding use of CRO, the facilities began to develop standard operating procedures between the three facilities that identified the variables necessary to commence CRO measures.

In January 2019, the FAA completed a 180-day testing period of a new standardized process to support demand-based CRO. Under the new process, MSP air traffic will only use Runway 35 for arrivals (and implement the CRO mitigations) when demand at the airport justifies the use of that runway. Currently there are three well-defined arrival/departure banks at MSP when traffic demand is at its highest points (Monday through Friday at 7AM, 4PM and 6PM), when such a need has been demonstrated.

The results of the 180-day test were incorporated into Standard Operating Procedure (SOP) by the ATCT, TRACON and ARTCC at MSP. Because the criteria for implementing CRO is demand-based, the times that

CRO may be implemented under the SOP can shift as arrival/departure banks shift. Likewise, new periods of CRO may be implemented as demand requires.

A summary of notable changes in runway use from 2018 to 2019 is provided below:

- Runway 12L arrival usage dropped from 21.3 percent of all arrival activity in 2018 to 20.5 percent in 2019.
- Runway 30L handled 28.7 percent of all arrivals in 2019 compared to only 25.9 percent in 2018.
- Runway 35 arrival usage decreased to 2.5 percent in 2019 compared to 5.5 percent in 2018.
- Runway 12R departure usage increased from 6.2 percent in 2018 to 7.5 percent in 2019.
- Runway 17 departure usage decreased in 2019. This runway was used for 33.8 percent of all MSP departures in 2018 and 32.4 percent in 2019.

A change in runway use between 2018 and 2019 is one of the variables that cause changes in the shape of the noise contours. Table 2.2 provides the average annual runway use distribution for 2019.

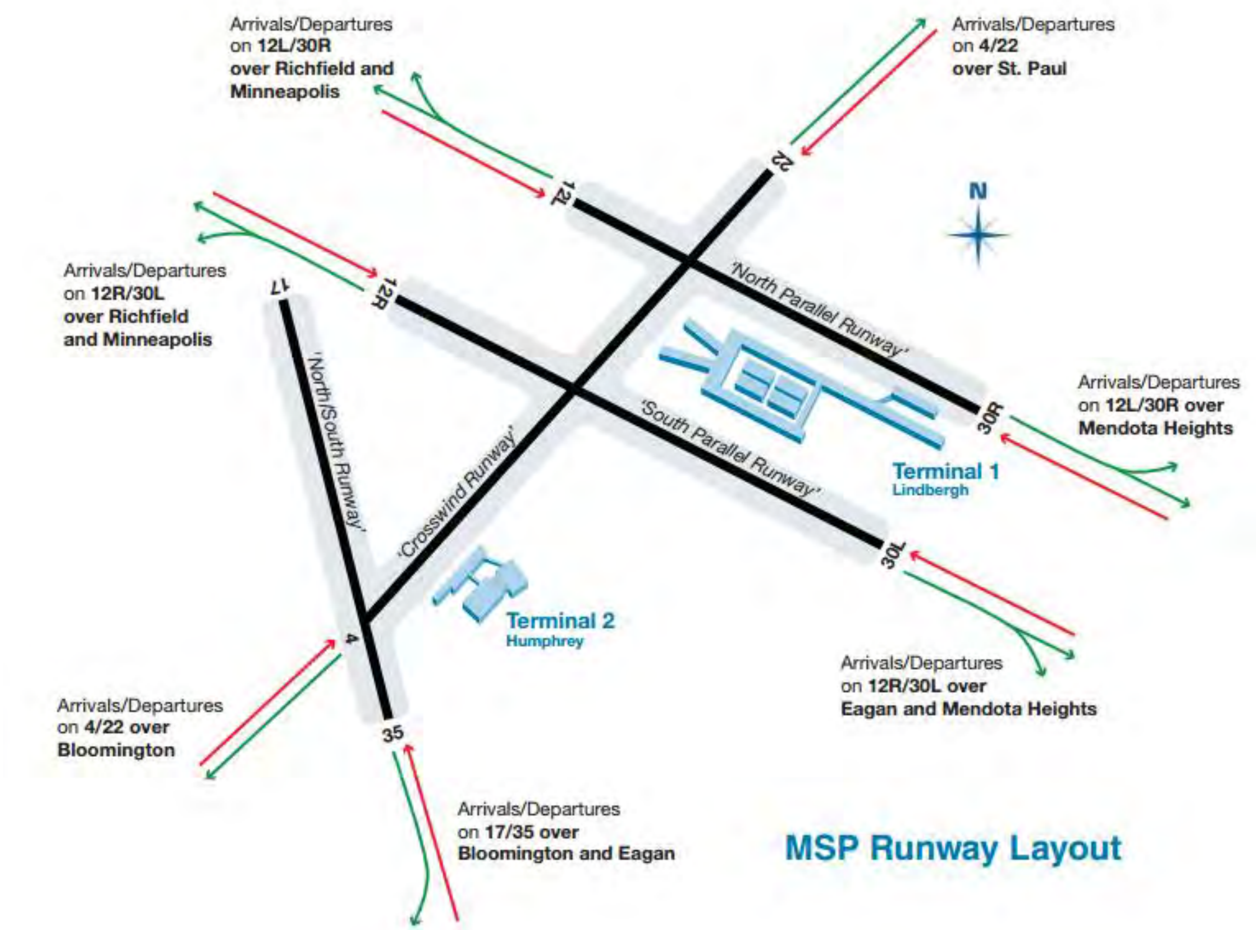


Table 2.2: Summary of 2019 Average Annual Runway Use

Operation	Runway	Day	Night	Total
Arrivals	4	0.1%	0.0%	0.1%
	12L	21.4%	13.7%	20.5%
	12R	25.3%	25.9%	25.4%
	17	0.0%	0.9%	0.1%
	22	0.0%	0.0%	0.0%
	30L	27.7%	36.4%	28.7%
	30R	23.4%	18.0%	22.8%
	35	2.1%	5.2%	2.5%
Departures	4	0.1%	0.0%	0.1%
	12L	14.5%	16.5%	14.7%
	12R	5.5%	25.0%	7.5%
	17	35.1%	8.2%	32.4%
	22	0.0%	0.0%	0.0%
	30L	23.3%	31.0%	24.1%
	30R	21.4%	19.0%	21.2%
	35	0.0%	0.3%	0.1%

Note: Total may not add up due to rounding. Helicopters are excluded.

Source: MAC-provided MACNOMS Data, HNTB 2020

2.1.4 2019 Flight Tracks

Modeled departure and arrival flight tracks were developed using actual flight track data. The model tracks used in the 2019 Actual Contour were identical to those used for the 2018 actual noise contour. Sub-tracks are added to each of the backbone arrival and departure model tracks. The distribution of operations among the backbone and sub-tracks in AEDT use a standard “bell curve” distribution, based on the number of sub-tracks developed.

The same methodology used in previous MSP annual reports also was used to assign actual 2019 flight tracks to the modeled tracks. The correlation process employs a best-fit analysis of the actual flight track data based on linear trends. This approach provides the ability to match each actual flight track directly to the appropriate model track.

Graphics of model flight tracks and the percent that each was used in 2019 are provided in Appendix 2.

2.1.5 Custom Departure Profiles

Aircraft departures at MSP continue to be use the distant noise abatement departure procedure. Historically the noise modeling has utilized custom noise model input in the form of custom profiles for the loudest and most frequent aircraft types. The current set of custom profiles were developed in 2011 and 2014.

With the release of AEDT and continued changes in the fleet mix, the percentage of aircraft that are modeled using a custom distant profile were updated. Based on the data prepared and modeled in the 2017 Annual Noise Contour, approximately 26% of all departures were assigned to a Delta-specific distant procedure, 37% were assigned to a generic distant procedure, and approximately 37% were assigned to standard departure procedures.

In 2018, the MAC contracted HNTB to identify and develop custom departure profiles for aircraft type and airline combinations that occurred at MSP that did not yet have custom profiles available. Custom profiles were developed and reviewed with chief pilots for aircraft operated by Delta Air Lines, UPS, and Spirit Airlines. A total of six aircraft with varying stage lengths were identified, resulting in a total of 21 custom profiles.

Although it is not required for the preparation of the Annual Noise Contour, the MAC in conjunction with HNTB followed the established protocol (Guidance on Using the Aviation Environmental Design Tool to Conduct Environmental Modeling for FAA Actions Subject to NEPA), and submitted the updated profiles to the FAA Airport Planning and Environmental Division and the Office of Environment and Energy Noise Division requesting approval of the development and use of the distant procedures during future modeling projects. The FAA concurred with the updated custom profiles in September 2019. The use of departures with custom profiles decreased from 63 percent in 2017 to 61 percent in 2018. After incorporating these new 21 custom profiles into the portfolio, the use of departures with custom profiles increased to 74.4 percent in 2019.

2.1.6 2019 Atmospheric Conditions

The weather data used in the 2019 Actual Contour were acquired from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center. As per FAA guidance, the following default weather parameters from the MSP weather station were applied:

- Temperature – 45.0 degrees Fahrenheit
- Dew point – 35.9 degrees Fahrenheit
- Wind speed – 8.4 knots
- Pressure – 985.4 Millibars
- Relative humidity – 67.7 percent

2.2 2019 MODELED VERSUS MEASURED DNL VALUES

As part of the 2019 Actual Contour evaluation, a comparison was conducted on the actual 2019 measured aircraft noise levels at the MAC's 39 sound monitoring sites to the modeled DNL noise values from AEDT. The latitude and longitude coordinates for each sound monitoring site was used to calculate modeled DNL values in AEDT.

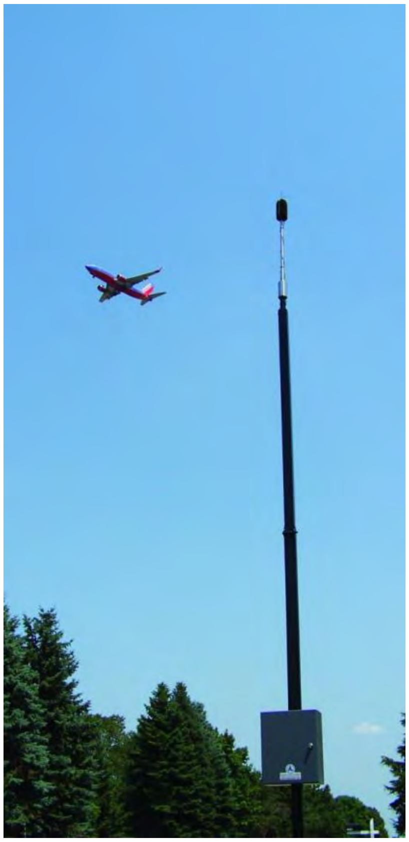


Table 2.3 provides a comparison of the AEDT modeled DNL noise values and the actual measured aircraft DNLs at those locations in 2019.

Table 2.3: 2019 Measured vs. Modeled DNL Values

Sound Monitoring Site	2019 Measured DNL (a)	2019 Modeled DNL	Difference	Absolute Difference
1	56.7	57.2	0.5	0.5
2	58.3	58.0	-0.3	0.3
3	62.6	63.3	0.7	0.7
4	59.2	59.5	0.3	0.3
5	67.4	67.9	0.5	0.5
6	67.3	65.8	-1.5	1.5
7	59.3	58.7	-0.6	0.6
8	55.5	55.6	0.1	0.1
9	34.7	42.7	8.0	8.0
10	36.7	49.2	12.5	12.5
11	33.9	44.4	10.5	10.5
12	33.6	47.4	13.8	13.8
13	53.7	55.1	1.4	1.4
14	60.3	61.1	0.8	0.8
15	55.8	55.9	0.1	0.1
16	64.4	63.7	-0.7	0.7
17	42.8	49.3	6.5	6.5
18	52.5	58.9	6.4	6.4
19	49.0	54.2	5.2	5.2
20	42.1	51.6	9.5	9.5
21	44.9	49.6	4.7	4.7
22	55.6	57.6	2.0	2.0
23	60.4	60.0	-0.4	0.4
24	58.9	59.8	0.9	0.9
25	49.8	52.7	2.9	2.9
26	51.3	54.6	3.3	3.3
27	53.2	55.6	2.4	2.4
28	54.8	61.4	6.6	6.6
29	52.3	53.2	0.9	0.9
30	60.2	59.9	-0.3	0.3
31	46.6	50.5	3.9	3.9
32	41.2	48.2	7.0	7.0
33	46.0	50.1	4.1	4.1
34	43.5	48.0	4.5	4.5
35	50.3	52.1	1.8	1.8
36	49.8	50.1	0.3	0.3
37	45.5	48.3	2.8	2.8
38	48.9	50.5	1.6	1.6
39	50.0	51.4	1.4	1.4
			Average	*3.4*
			Median	*1.8*

Notes:
All units in dB DNL
(a) Computed from daily DNLs

Source: MAC sound monitoring data and HNTB, 2020

There is an inherent difference between modeled noise results and measured noise results. AEDT modeled data only reports on aircraft noise. It cannot replicate the various other sources of community noise that exist and contribute to ambient conditions. AEDT cannot replicate the exact operating characteristics of each aircraft that is input into the model. AEDT uses average weather conditions instead of actual weather conditions at the time of the flight. AEDT also uses conservative aircraft substitutions when new aircraft are not yet available in the model. Conversely, RMT measured data is highly impacted by community sound. The MACNOMS system must set thresholds for events to attempt to eliminate occurrences of community sound events being assigned to aircraft sound. While some of the data is evaluated by staff, most events are assumed to be aircraft if a flight track existed during the time of the event. The factors that may contribute to the difference include site terrain, building reflection, foliage and ground cover, ambient noise level as well as atmospheric conditions. There variables will impact the propagation of sound differently.

The use of absolute values provides a perspective of total difference between the modeled values and the measured values. The average absolute difference between modeled and measured DNL is approximately 3.4 dB, compared with 3.3 dB in 2018, 3.1 dB in 2017 and 2.3 dB in 2016. The absolute median difference is 1.8 dB DNL compared with 2.4 dB DNL in 2018, 1.4 dB DNL in 2017 and 1.1 dB DNL in 2016; this indicates that the 2019 Actual Contour generated through modeling in AEDT are similar in absolute difference to actual measured noise levels. The absolute median difference is considered the most reliable indicator of correlation when considering the data variability across modeled and measured data.

The small variation between actual measured aircraft noise levels and the AEDT modeled noise levels provides additional system verification that AEDT is providing an accurate assessment of the aircraft noise impacts. The larger variations between measured and modeled data occur at sites that have less events overall. When more data is available, that variance decreases. For example, there were 19 sites that had a modeled DNL at or above 55 dB. The average difference between the modeled DNL and measured DNL at those sites was only 1.3 dB. The median of the absolute difference was 0.6 dB at those sites.

2.3 2019 NOISE CONTOUR IMPACTS

Based on the 406,073 total operations in 2019, 4,384.2 acres are in the 65 dB DNL noise contour (a decrease of nearly 60 acres, or 1.3 percent, from the 2018 actual noise contour) and approximately 11,082 acres are in the 60 dB DNL noise contour (a decrease of 241 acres, or 2.1 percent, from the 2018 actual noise contour). The decrease is due to the contribution of various factors, including a decrease in the number of total operations, a minor decrease in nighttime operations and an increase in operations flown by quieter aircraft.

The changes in the noise contours are consistent with changes in day/night split, fleet mix, runway and flight track use. The overall size of the 65 dB and 60 dB DNL contours shrunk in 2019 compared to 2018. Specifically, reductions are visible along the Runway 12L and 12R arrival lobes over Minneapolis and the Runway 35 arrival lobe in Bloomington. Similarly, the Runway 17 departure lobe in Bloomington and Runway 12L departure lobe in Mendota Heights also contracted. The contours grew in Richfield and Minneapolis under the Runway 30L departure lobe and had a minor increase in Eagan along the Runway 30L and 30R arrival lobe. Finally, the contour grew on airport property in the area of the aircraft runup pad.

Table 2.5 contains the count of single-family (one to three units per structure) and multi-family (more than three units per structure) dwelling units in the 2019 Actual Contour. The counts are based on the block-intersect methodology where all structures on a block that located within or touched by the noise contour are counted. The spatial analysis was performed in Universal Transverse Mercator (UTM Zone 15).

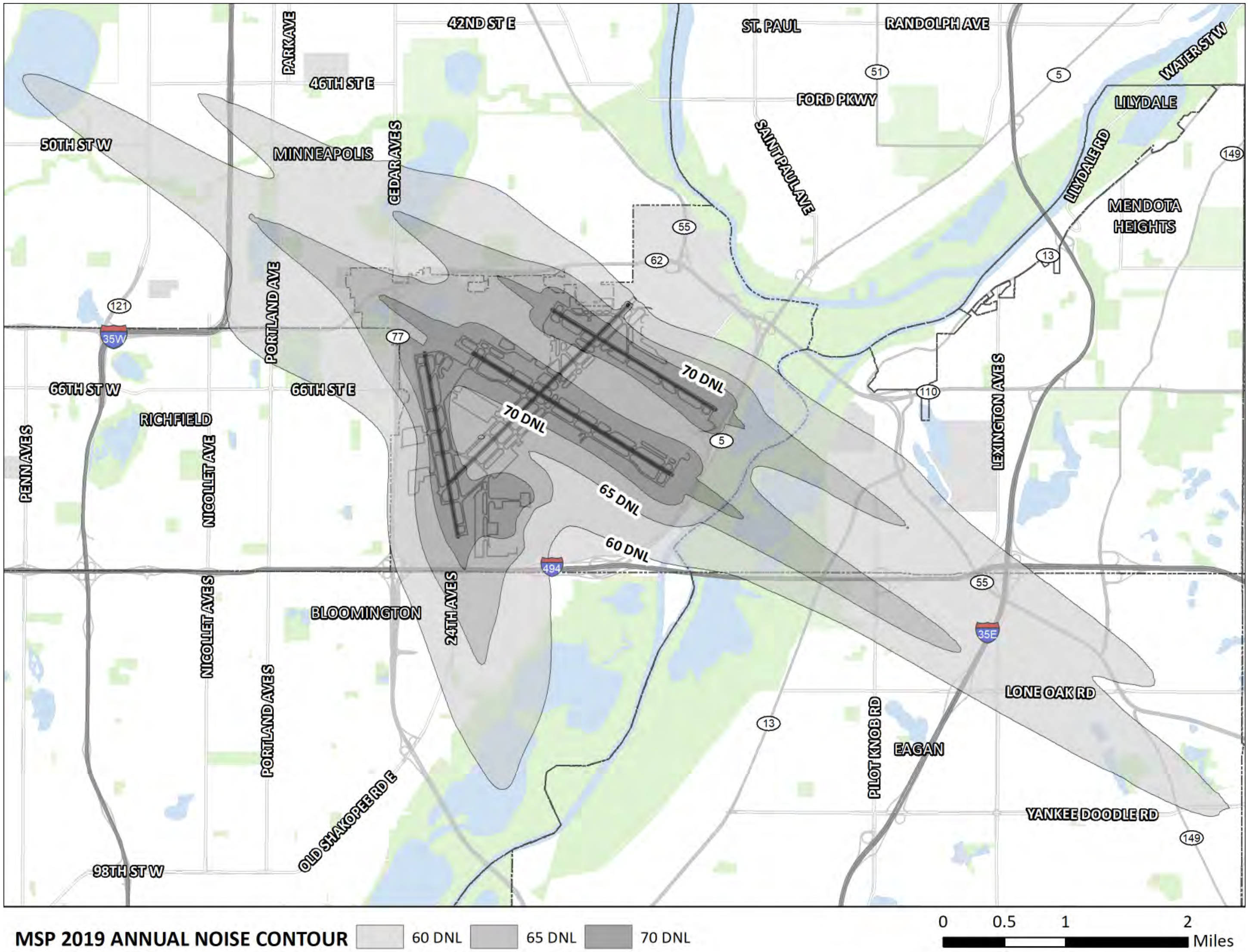
Table 2.4 Summary of 2019 Actual DNL Noise Contour Unit Counts

	Dwelling Units Within dB DNL Interval									
	Single Family					Multi-Family				
City	60-64	65-69	70-74	75+	Total	60-64	65-69	70-74	75+	Total
Bloomington	16	1	-	-	17	516	-	-	-	516
Eagan	338	15	-	-	353	38	-	-	-	38
Mendota Heights	47	1	-	-	48	-	-	-	-	-
Minneapolis	7,671	1,512	-	-	9,183	590	507	-	-	1,097
Richfield	873	60	-	-	933	383	-	-	-	383
All Cities	8,945	1,589	-	-	10,534	1,527	507	-	-	2,034

A total of 1,094 single-family residences and 88 multi-family units within the 60 dB DNL noise contour in the City of Minneapolis were previously entered into the 2017 – 2020 Mitigation Programs. An additional 16 single-family residences within the 60 dB DNL noise contour in the City of Eagan received mitigation eligibility for the 2021 Mitigation Program by virtue of the 2019 Actual Contour. All residential units within the 2019 actual 60 dB DNL noise contour have either received noise mitigation around MSP or are part of the 2017 – 2021 programs.

A thorough evaluation of the 2019 Actual Contour and resulting changes to residential noise mitigation is provided in Chapter 4. A depiction of the 2019 Actual Contour is provided in Figure 2.

Figure 2: 2019 Actual Contour



3. COMPARISON OF THE 2019 ACTUAL AND THE 2007 FORECAST CONTOUR

3.1 COMPARISON OF NOISE CONTOUR INPUTS

3.1.1 Noise Model Considerations

The 2019 Actual Contour was modeled in AEDT version 3b, which incorporates updates to flight segments, atmospheric computing standards, grids used for noise contour generation and other issues that carried over from the INM. The 2007 Forecast Contour was developed using INM Version 6.1.

It is important to note that modeling modifications over time can change the size and shape of a noise contour. For example, a range of case study airports revealed that improvements to lateral attenuation adjustment algorithms and flight path segmentation in INM version 7.0 were found by the FAA to increase the size of a DNL contour for a range of case study airports between 3 and 10 percent over what previous versions of INM would have modeled. Additionally, some updates incorporated into AEDT, had the effect of reducing the 60 dB DNL noise contour by 0.6 percent at MSP compared to the latest version of INM.

3.1.2 Aircraft Operations and Fleet Mix Comparison

The forecasted level of operations in the 2007 noise contour was 582,366 annual flights, an average of 1,595.9 flights per day. In 2019, the actual number of operations at MSP was 406,073, or 1,112.5 flights per day. This represents a reduction of 483.4 daily flights on average, or 30.2 percent from the 2007 forecast number. Nighttime operations decreased by 3.5 average daily flights from the 2007 forecast level to 2019 actual level. Table 3.1 provides a summary comparison of the 2019 actual and the 2007 forecast average daily operations. A more detailed comparison of the 2007 forecast fleet mix and the 2019 actual aircraft fleet mix is provided in Appendix 1.

In general, many of the aircraft groups operating at MSP showed a reduction in the number of average daily operations from the 2007 forecasted level to the 2019 actual level. On average, there was 0.8 Hushkit Stage 3 Jet operations per day in 2019. This is down from the 2007 forecast average of 275 flights per day. Manufactured Stage 3+ average daily operations in 2019 were down by 83.1 flights per day from the 2007 forecast. The number of propeller-driven and military aircraft operations decreased 115.8 per day and 5.4 per day, respectively.

Table 3.1: Summary of 2019 and 2007 Average Daily Flight Operations

Average Daily Flight Operations	Day	Night	Total	% of Total Operations
2019				
Manufactured to be Stage 3+	955.3	118.0	1073.4	96.5%
Hushkit Stage 3 Jet	0.2	0.0	0.2	0.0%
Microjet	0.7	0.0	0.7	0.1%
Propeller	33.6	1.6	35.2	3.2%
Helicopter	0.1	0.0	0.1	0.0%
Military	2.9	0.1	3.0	0.3%
Total	*992.7*	*119.8*	*1112.5*	*100.0%*
% of Total Operations	*89.2%*	*10.8%*	*100.0%*	
2007				
Manufactured to be Stage 3+	1071.5	85.0	1156.5	72.5%
Hushkit Stage 3 Jet	253.3	21.7	275.0	17.2%
Stage 2 Jets under 75,000 lbs	4.2	0.6	4.8	0.3%
Propeller	143.0	16.0	159.0	10.0%
Helicopter	0.0	0.0	0.0	0.0%
Military	0.4	0.0	0.5	0.0%
Total	*1472.4*	*123.3*	*1595.9*	*100.0%*
% of Total Operations	*92.3%*	*7.7%*	*100.0%*	

Notes:
Totals may differ due to rounding
As of January 1, 2016, Stage 2 aircraft below 75,000 lbs are required to be compliant with Stage 3 noise regulations.

Source: MAC-provided MACNOMS data, HNTB 2020

3.1.3 Runway Use Comparison

Table 3.2 provides the runway use percentages for 2019 and a comparison to the 2007 forecast runway use percentages. A general evaluation of the runway use percentages in Table 3.2 shows that the use of Runways 12R and 30L for nighttime arrivals in 2019 is higher than what was forecasted in the 2007 noise contour; use of Runways 12L and 30R for arrivals was lower than the 2007 forecast.

The use of Runway 35 for total arrivals was at 2.5 percent in 2019 compared to 16.5 percent during the 2007 forecast.

In 2007, Runway 17 was forecasted to be used for 34.6 percent of all nighttime departures. In 2019, it was used for only 8.2 percent of nighttime departures.

Lastly, the 2019 Runway 30L departure percentage was 8.3 percent higher at night and 18.2 percent higher during the day than the 2007 forecast.

Table 3.2: Summary of Average Annual Runway Use 2019, 2007

Operation	Runway	Day		Night		Total	
		2019 Actual	2007 Forecast	2019 Actual	2007 Forecast	2019 Actual	2007 Forecast
Arrivals	4	0.1%	0.0%	0.0%	3.8%	0.1%	0.3%
	12L	21.4%	21.8%	13.7%	17.2%	20.5%	21.4%
	12R	25.3%	14.7%	25.9%	12.4%	25.4%	14.5%
	17	0.0%	0.0%	0.9%	0.0%	0.1%	0.0%
	22	0.0%	0.5%	0.0%	2.4%	0.0%	0.6%
	30L	27.7%	21.1%	36.4%	25.1%	28.7%	21.4%
	30R	23.4%	25.1%	18.0%	26.4%	22.8%	25.2%
	35	2.1%	16.9%	5.2%	12.7%	2.5%	16.5%
Departures	4	0.1%	0.2%	0.0%	0.4%	0.1%	0.2%
	12L	14.5%	8.9%	16.5%	14.1%	14.7%	9.3%
	12R	5.5%	15.9%	25.0%	18.3%	7.5%	16.1%
	17	35.1%	37.2%	8.2%	34.6%	32.4%	37.0%
	22	0.0%	0.1%	0.0%	0.8%	0.0%	0.1%
	30L	23.3%	15.0%	31.0%	12.8%	24.1%	14.8%
	30R	21.4%	22.7%	19.0%	19.2%	21.2%	22.4%
	35	0.0%	0.0%	0.3%	0.0%	0.1%	0.0%

Note: Total may not add up due to rounding.
Source: MAC-provided MACNOMS data, HNTB 2020. Annual runway use for 2007 Forecast was obtained from the November 2004 Part 150 document.

3.1.4 Flight Track Considerations

Modeled departure and arrival flight tracks were developed using actual flight track data from 2019. These flight tracks differ from those used to develop the 2007 Forecast Contour due to enhanced modeling methods and improved technologies. Sub-tracks were also added to each of the backbone tracks. Standard distribution in both INM and AEDT were used to distribute the flights to the sub-tracks.

The same methodology as in previous annual reports was used to assign actual 2019 flight tracks to the modeled tracks. The correlation process employs a best-fit analysis of the actual flight track data based on linear trends. This approach provides the ability to match each actual flight track directly to the appropriate model track.

3.1.5 Atmospheric Conditions Comparison

The atmospheric condition inputs vary slightly between INM and AEDT. INM used pressure values in inches of Mercury, where standard atmospheric pressure is 29.92. AEDT takes pressure in millibars, where standard is 1013.25. AEDT takes an additional input value for dew point temperature in degrees Fahrenheit. As stated in Section 2.1.5, the weather data used in the 2019 Actual Contour were acquired from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center. As per FAA guidance, the following default weather parameters from the MSP weather station were applied:

- Temperature – 45.0 degrees Fahrenheit
- Dew point – 35.9 degrees Fahrenheit
- Wind speed – 8.4 knots

- Pressure – 985.4 Millibars
- Relative humidity – 67.7 percent

The following annual average atmospheric conditions were used in the 2007 Forecast Contour:

- Temperature – 47.7 degrees Fahrenheit
- Wind speed – 5.3 knots
- Pressure – 29.90 inches of Mercury
- Relative humidity – 64.0 percent

3.2 COMPARATIVE NOISE MODEL GRID POINT ANALYSIS

AEDT was used to calculate DNL values for the center points of each city block included in the mitigation programs outlined in the amended Consent Decree. Graphics showing the actual 2019 DNL levels calculated for each block, Base Case DNL Noise Levels calculated for each block and the block-by-block difference in DNL levels between the Base Case and the 2019 Actual Contour are contained in Appendix 3.

The Base Case DNL is established using the actual DNL noise level for that location during the year the home becomes eligible for noise mitigation under the amended Consent Decree. The Base Case DNL for homes that are not eligible for mitigation under the amended Consent Decree is established using the 2007 forecast DNL for that location.

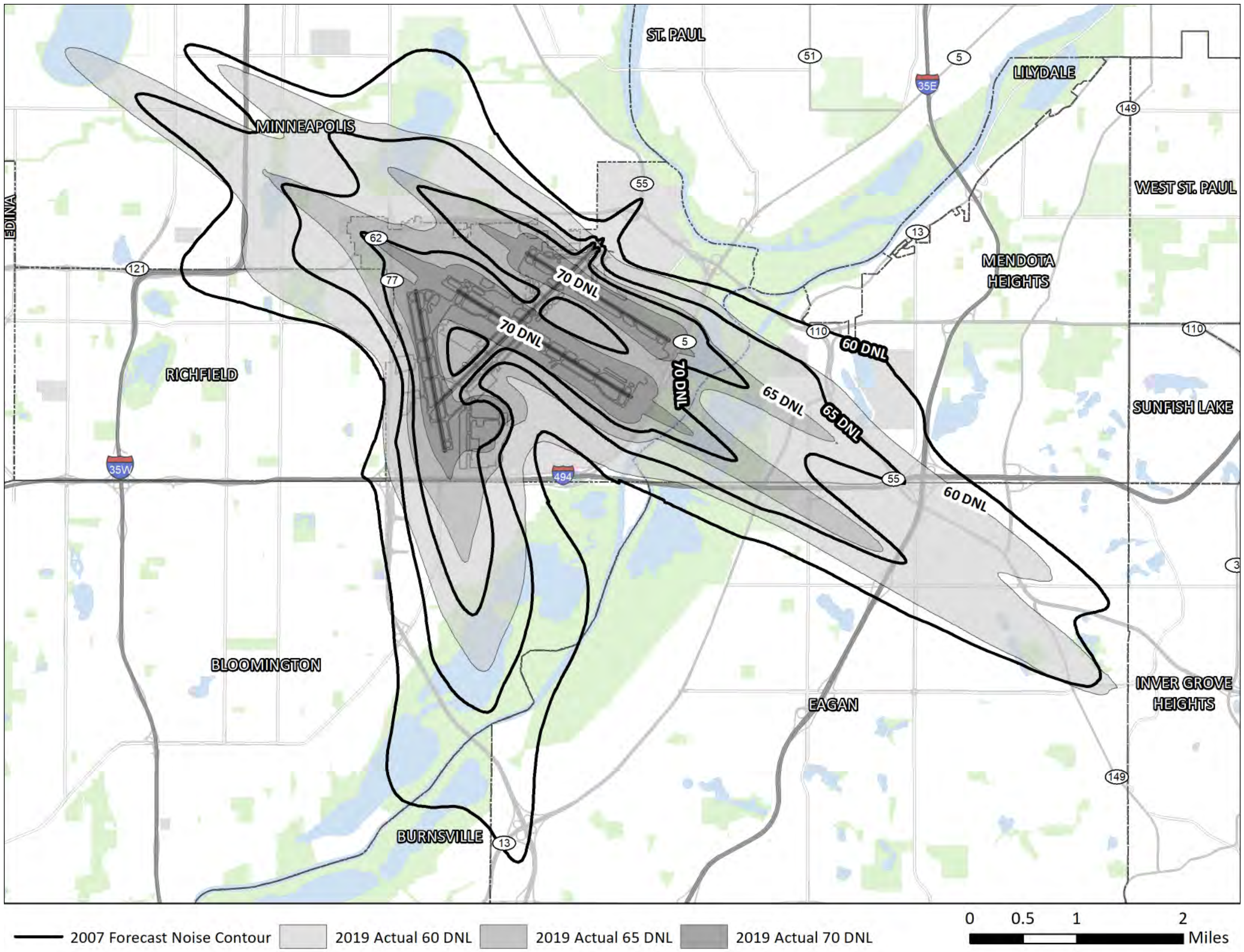
It is important to note that the 2007 forecast DNL was developed in INM Version 6.2a because this was the newest version of INM available to MAC staff to conduct the analysis in early 2008 when the MSP annual noise contour reporting efforts began. When comparing the DNL values generated for the MACNOMS sound monitoring sites with INM 6.1 in the November 2004 Part 150 Update document to the DNL generated for those same locations with INM 6.2a, the differences were insignificant.

3.3 CONTOUR COMPARISON SUMMARY

In addition to modeling updates, other primary factors to consider when comparing the 2007 Forecast Contour to the 2019 Actual Contour are total operation numbers, fleet mix, nighttime operations, and runway use. The 2019 Actual Contour is smaller than the 2007 Forecast Contour by 4,627 acres (29 percent reduction) in the 60 dB DNL contour and by 2,850 acres (39 percent reduction) in the 65 dB DNL contour. As depicted in Figure 3, there is an area in Minneapolis and an area in Eagan where the 2019 Actual Contour extends beyond the 2007 Forecast Contour. The increase in these areas is primarily due to runway use differences between the 2007 forecast and 2019 actual use, particularly arrival operations on Runways 12R and 30L. All homes within the 2019 actual 65 dB DNL contour have received the 5-dB noise reduction mitigation package. Chapter 4 provides an analysis of mitigation eligibility relative to the 2019 Actual Contour consistent with the requirements of the amended Consent Decree.

The predominant contraction in the contours from the 2007 Forecast to the 2019 Actual Contour scenarios is driven largely by fleet mix changes, including a significant reduction in Hushkit Stage 3 aircraft operations, and a reduction of 483.4 average daily operations. The extension of the 2019 Actual Contour beyond the 2007 Forecast Contour can largely be attributed to nighttime runway use variances between what was forecasted for 2007 and what occurred in 2019, particularly an increase in nighttime arrival operations on Runway 12R.

Figure 3: 2019 Actual and 2007 Forecast Contour Comparison



4. 2019 ANNUAL NOISE CONTOUR

As discussed previously, the first amendment to the Consent Decree requires the MAC to determine eligibility for noise mitigation on an annual basis using actual noise contours, developed under Section 8.1(d) of the Consent Decree. This chapter provides detailed information about noise mitigation impacts from the 2019 Actual Contour at MSP.

4.1 2019 ACTUAL CONTOUR NOISE MITIGATION IMPACT

Under the provisions of the first and second amendments to the Consent Decree, properties must meet certain criteria to be considered eligible for participation in the MAC noise mitigation program.

First, as stated in the first amendment:

> *"The community in which the home is located has adopted local land use controls and building performance standards applicable to the home for which mitigation is sought that prohibit new residential construction, unless the construction materials and practices are consistent with the local land use controls and heightened building performance standards for homes within the 60 dB DNL Contour within the community in which the home is located."*

This criterion has been met by all of the incorporated cities contiguous to MSP.

Second, as stated in the first amendment:

> *"The home is located, for a period of three consecutive years, with the first of the three years beginning no later than calendar year 2020 (i) in the actual 60-64 dB DNL noise contour prepared by the MAC under Section 8.l(d) of this Consent Decree and (ii) within a higher noise impact mitigation area when compared to the Single-Family home's status under the noise mitigation programs for Single-Family homes provided in Sections 5.1 through 5.3 of this Consent Decree or when compared to the Multi- Family home's status under the noise mitigation programs for Multi-Family homes provided in Section 5.4 of this Consent Decree. The noise contour boundary will be based on the block intersect methodology. The MAC will offer noise mitigation under Section IX of this Consent Decree to owners of eligible Single-Family homes and Multi-Family homes in the year following the MAC's determination that a Single-Family or Multi-Family home is eligible for noise mitigation under this Section."*

Table 4.1 provides a summary of the number of single-family living units within the 2019 60 dB DNL noise contour, as well as changes in mitigation and the number of years of eligibility achieved by virtue of the 2019 Actual Contour.

Table 4.2 provides the number of multi-family living units within the 2019 60 dB DNL noise contour, as well as changes in mitigation and the number of years of eligibility achieved by virtue of the 2019 Actual Contour. The spatial analysis was performed in Universal Transverse Mercator (UTM Zone 15).

Table 4.1: Summary of 2019 Actual Contour Single-Family Unit Counts

Year of Eligibility	City	Mitigation	DNL Contours 60-62	63-64	65-69	70-74	75+	Total
No Change in Eligibility	Bloomington	In 2019 Actual Contour	16	-	1	-	-	17
Entered the 2021 Mitigation Program	Eagan	In 2019 Actual 60 dB DNL previously between 2005 and 2007 60 dB DNL *(Eligible for additional mitigation, less previous reimbursements)*	16	-	-	-	-	16
No Change in Eligibility	Eagan	In 2019 Actual Contour	262	60	15	-	-	337
No Change in Eligibility	Mendota Heights	In 2019 Actual Contour	47	-	1	-	-	48
No Change in Eligibility	Minneapolis	In 2019 Actual Contour	5,505	2,166	1,512	-	-	9,183
No Change in Eligibility	Richfield	In 2019 Actual Contour	645	228	60			933
		Grand Total	**6,491**	**2,454**	**1,589**	**-**	**-**	**10,534**

Notes: Block-Intersect Methodology; Multi-Family = 4 or more units; As a result of parcel information updated in July 2019, unit counts may differ from previous reports.

Source: HNTB provided AEDT Contours, MAC analysis 2020

Table 4.2 Summary of 2019 Actual Contour Multi-Family Unit Counts

Year of Eligibility	City	Mitigation	DNL Contours				
			60-64	65-69	70-74	75+	Total
No Change in Eligibility	Bloomington	In 2019 Actual Contour previously mitigated	516	-	-	-	516
No Change in Eligibility	Eagan	In 2019 Actual Contour previously mitigated	38	-	-	-	38
No Change in Eligibility	Minneapolis	In 2019 Actual Contour previously mitigated	590	507	-	-	1,097
No Change in Eligibility	Richfield	In 2019 Actual Contour previously mitigated	383	-	-	-	383
		Grand Total	**1,527**	**507**	**-**	**-**	**2,034**

Notes: Block-intersect Methodology; Multi-Family = 4 or more units; As a result of parcel information updated in July 2019, unit counts may differ from previous reports.

Source: HNTB provided AEDT Contours, MAC analysis 2020

4.2 AMENDED CONSENT DECREE PROGRAM ELIGIBILITY

First-Year Candidate Eligibility

Single-family: There are no single-family homes that achieved the first year of eligibility with the 2019 Actual Contour.

Multi-family: There are no multi-family units that achieved the first year of eligibility with the 2019 Actual Contour.

Second-Year Candidate Eligibility

Single-family: The 2019 Actual Contour shrunk under the arrival lobe of Runway 12R, resulting in all homes in Minneapolis that had previously achieved one year of eligibility not reaching a second year of eligibility.

Multi-family: Similarly, the contraction of the contour northwest of Lake Harriet resulted in all multi-family units in Minneapolis that had previously achieved one year of eligibility not reaching a second year of eligibility.

Third-Year Candidate Eligibility

Single-family: All 16 single-family homes that had two years of eligibility as a result of the 2018 annual noise contour were in the 60 dB DNL in the 2019 annual noise contour and are now entered into the 2021 mitigation program. All eligible homes are located on one block in Eagan within the Partial Noise Reduction Package. The homes on this block were previously eligible for homeowner reimbursements during the original Consent Decree Program. In cases where homes have received previous reimbursement from the MAC, the value of those improvements will be deducted from the efforts required to increase the home mitigation relative to the actual noise level, per the amended Consent Decree. These homes are now entered into the 2021 mitigation program. Homeowners of eligible properties will be notified by the MAC in writing.

The blocks already included in previous mitigation programs and the amended Consent Decree programs are shown in Figures 4.1, 4.2 and 4.3. Additionally, Figure 4.3 shows the block that met the third consecutive year of noise mitigation eligibility by virtue of the 2019 Actual Contour.

Multi-family: There are no multi-family units that achieved the third year of eligibility with the 2019 Actual Contour.

4.3 AMENDED CONSENT DECREE PROGRAM MITIGATION STATUS

2017 Mitigation Program

Single-family: In 2017 the MAC began the project to provide mitigation to 138 single-family homes that became eligible by virtue of the 2015 actual noise contour. As of January 13, 2020, 117 homes have been completed, 14 homes declined to participate while 7 homes were moved to the 2020 program as a result of homeowner actions.

Multi-family: Two multi-family structures were also eligible to participate in the Multi-Family Mitigation Program in 2017; one property is completed, and one property declined to participate.

The total cost for the completed 2017 Mitigation Program was $2,442,685.

2018 Mitigation Program

Single-family: In 2017, the MAC began the project to provide mitigation to 283 single-family homes that became eligible by virtue of the 2016 actual noise contour. As of January 13, 2020, 230 homes have been completed, 27 homes declined to participate while 23 homes were moved to the 2020 program.

Multi-family: The 2018 Mitigation Program does not include any multi-family properties.

The total cost for the 2018 Mitigation Program to date is $7,280,869.

2019 Mitigation Program

Single-family: In 2018, the MAC began the project to provide mitigation to 429 single-family homes that became eligible by virtue of the 2017 actual noise contour. As of January 13, 2020, including the homes transitioned from the 2017 and 2018 programs, 214 homes have been completed, 159 homes are in the construction or pre-construction phase and 68 homes declined to participate.

Multi-family: The 2019 Mitigation Program does not include any multi-family properties.

The total cost for the 2019 Mitigation Program to date is $6,548,594.

2020 Mitigation Program

Single-family: In 2019, the MAC began the project to provide mitigation to 243 single-family homes that became eligible by virtue of the 2018 actual noise contour (164 are eligible for the partial mitigation package and 79 are eligible for the full mitigation package). As of January 13, 2020, including the homes transitioned from the 2018 and 2019 programs, zero homes have been completed, 261 homes are in the construction or pre-construction phase and 4 homes declined to participate.

Multi-family: The 2020 Mitigation Program does not include any multi-family properties.

To date, there has not been any financial expenditures attributed to the 2020 Mitigation Program.

Figure 4.1: 2019 Contours and Mitigation Program Eligibility

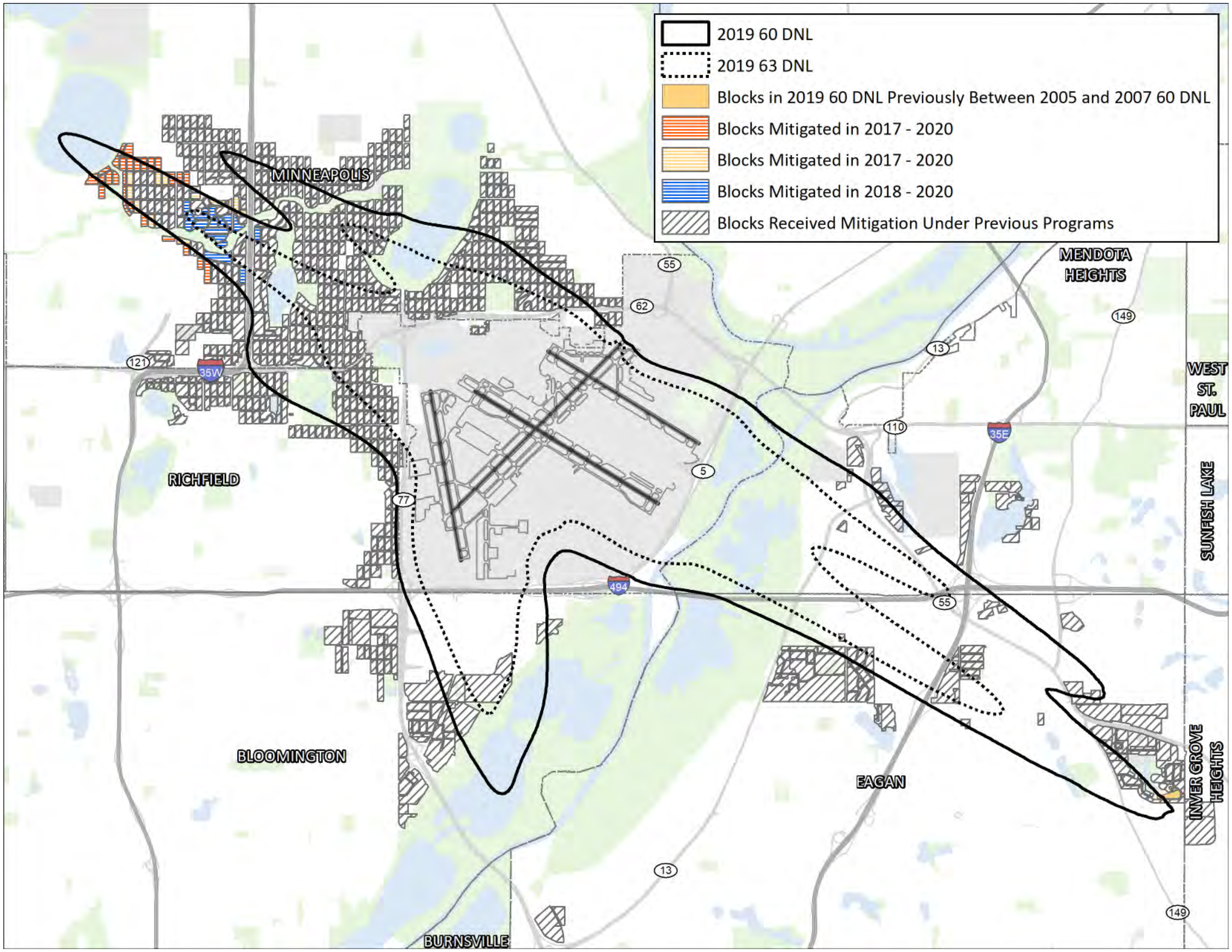


Figure 4.2: 2019 Contours and Mitigation Program Eligibility – City of Minneapolis

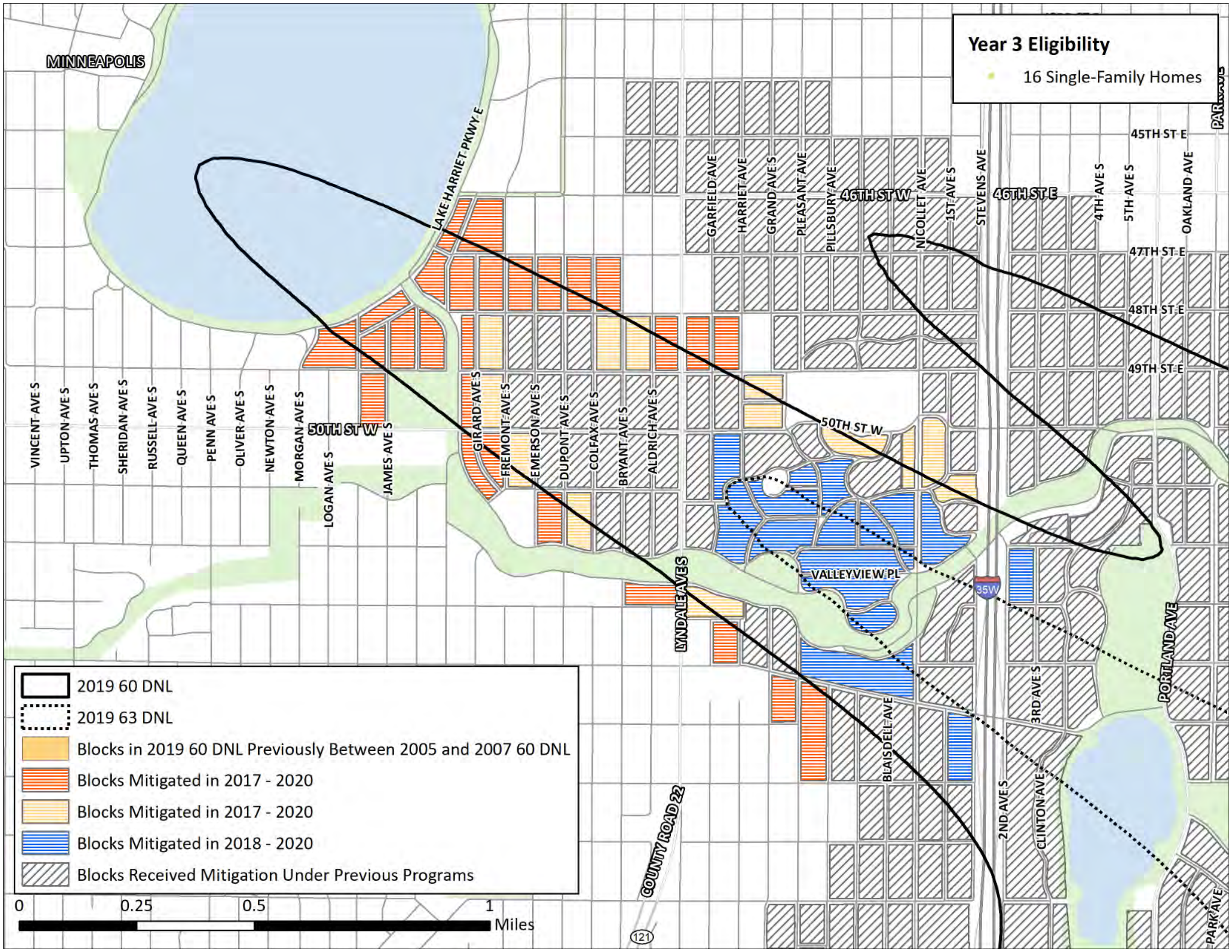
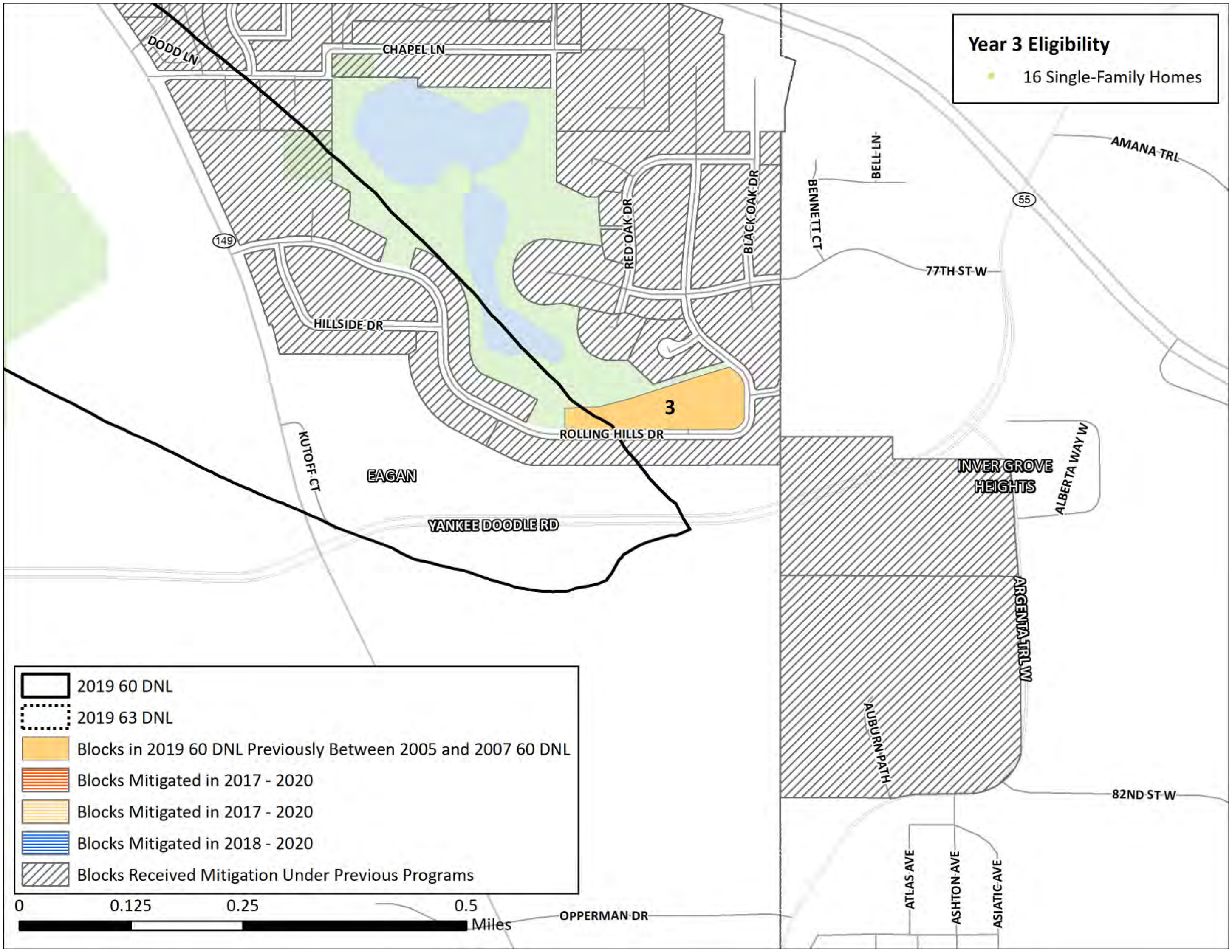


Figure 4.3: 2019 Contours and Mitigation Program Eligibility – City of Eagan



Metropolitan Airports Commission

MAC Community Relations Office and HNTB Corporation

6040 28th Avenue South • Minneapolis, MN 55450

macnoise.com

List of Appendices

Appendix 1: Detailed Aircraft Fleet Mix Average Daily Operations

Table A1-1: 2019 Aircraft Fleet Mix Average Daily Operations

Group	Aircraft Code	AEDT Aircraft (ANP)	AEDT Aircraft Description	2019 Day	2019 Night	2019 Total
Manufactured to be Stage 3+	A124	74720B	Antonov An-124 Ruslan	0.0	0.0	0.0
	A20N	A320-271N	Airbus A320NEO Series	0.0	0.0	0.1
	A21N	A321-232	Airbus A321 series	0.0	0.0	0.1
	A306	A300-622R	Airbus A300-600/622R	0.9	1.3	2.2
	A319	A319-131	Airbus A319 series	64.5	5.0	69.5
	A320	A320-211	Airbus A320 series	48.0	3.6	51.6
	A320	A320-232	Airbus A320 series	19.8	6.1	25.8
	A320	A320-271N	Airbus A320 series	5.2	1.4	6.6
	A321	A321-232	Airbus A321 series	59.3	9.4	68.7
	A32N	A321-232	Airbus A321NEO Series	0.0	0.0	0.0
	A332	A330-343	Airbus A330-200	0.4	0.0	0.4
	A333	A330-301	Airbus A330-300	4.1	0.3	4.4
	A333	A330-343	Airbus A330-300	1.4	0.2	1.5
	A346	A340-642	Airbus A340-600	0.0	0.0	0.0
	A359	A350-941	Airbus A350-900	0.3	0.0	0.3
	ASTR	IA1125	IAI 1125 Astra	0.0	0.0	0.0
	B38M	737MAX8	Boeing 737 MAX 8	0.2	0.1	0.2
	B712	717200	Boeing 717-200 / Extended Range	77.3	4.2	81.4
	B721	727QF	Boeing 727-100 with Rolls-Royce TAY 650 Engine	0.0	0.0	0.0
	B733	737300	Boeing 737-300	0.1	0.0	0.1
	B733	7373B2	Boeing 737-300	0.1	0.0	0.1
	B734	737400	Boeing 737-400	0.3	0.1	0.4
	B735	737500	Boeing 737-500	0.0	0.0	0.0
	B737	737700	Boeing 737-700	31.4	8.3	39.7
	B738	737800	Boeing 737-800	93.8	24.2	118.0
	B739	737800	Boeing 737-900	75.5	9.1	84.7
	B744	747400	Boeing 747-400	0.2	0.1	0.4
	B748	7478	Boeing 747-800	0.2	0.1	0.3
	B74S	747SP	Boeing 747SP	0.0	0.0	0.0
	B752	757PW	Boeing 757-200	28.5	7.0	35.6
	B752	757RR	Boeing 757-200	2.0	2.1	4.1
	B753	757300	Boeing 757-300	13.2	0.8	14.0
	B762	767CF6	Boeing 767-200	0.0	0.0	0.1
	B762	767JT9	Boeing 767-200	0.0	0.0	0.0
	B763	767300	Boeing 767-300	8.2	3.6	11.8
	B764	767400	Boeing 767-400ER	0.5	0.3	0.8
	B767	767CF6	Boeing 767	0.0	0.0	0.0
	B772	777200	Boeing 777-200	5.3	0.1	5.4
	B77L	777300	Boeing 777-200LR	0.1	0.0	0.1
	B77W	7773ER	Boeing 777-300ER	0.1	0.0	0.1
	B788	7878R	Boeing 787 Dreamliner (800 Model)	0.0	0.0	0.0
	B789	7878R	Boeing 787-9 Dreamliner	0.7	0.1	0.8
	BCS1	737700	Airbus A220 Series	3.2	0.2	3.3
	BE40	MU3001	Beechcraft Beechjet 400	0.5	0.0	0.5
	C25A	CNA500	Cessna CitationJet CJ2, 525A	0.1	0.0	0.1
	C25B	CNA500	Cessna CitationJet CJ3, 525B	0.4	0.0	0.4
	C25C	CNA525C	Cessna CitationJet CJ4, 525C	0.2	0.0	0.2
	C25M	CNA500	Cessna CitationJet CJ1, 525	0.0	0.0	0.0
	C32	757PW	Boeing C-32	0.0	0.0	0.0
	C500	CNA500	Cessna Citation I Twin Jet	0.0	0.0	0.0
	C501	CNA500	Cessna Citation I Single Pilot Twin Jet	0.0	0.0	0.1

Group	Aircraft Code	AEDT Aircraft (ANP)	AEDT Aircraft Description	2019 Day	2019 Night	2019 Total
Manufactured to be Stage 3+	C525	CNA500	Cessna CitationJet CJ1, 525	0.3	0.0	0.3
	C550	CNA55B	Cessna Citation 550 Citation II	0.2	0.0	0.2
	C55B	CNA55B	Cessna Citation 550 Citation II	0.0	0.0	0.0
	C560	CNA560E	Cessna 560 Citation V, Ultra & Ultra Encore	0.4	0.0	0.5
	C560	CNA560U	Cessna 560 Citation V, Ultra & Ultra Encore	0.2	0.0	0.3
	C56X	CNA560XL	Cessna 560XL Citation Excel	2.6	0.1	2.7
	C650	CIT3	Cessna Citation III	0.2	0.0	0.3
	C680	CNA680	Cessna 680 Citation Sovereign	2.7	0.1	2.8
	C68A	CNA680	Cessna Citation Latitude	1.4	0.0	1.4
	C700	CNA680	Cessna Citation Longitude	0.0	0.0	0.0
	C750	CNA750	Cessna 750 series/Citation X	1.5	0.1	1.6
	CL30	CL600	Bombardier Challenger 300	2.6	0.3	2.9
	CL35	CL600	Bombardier Challenger 350	2.1	0.1	2.2
	CL60	CL601	Canadair Bombardier CL600/610 Challenger Twin Jet	1.2	0.1	1.2
	CRJ2	CL600	Bombardier CRJ 200 Regional Jet	125.9	8.3	134.2
	CRJ7	CRJ9-ER	Bombardier CRJ 700 Regional Jet	37.4	2.7	40.1
	CRJ9	CRJ9-ER	Bombardier CRJ 900 Regional Jet	136.5	6.8	143.3
	DC10	DC1010	McDonnell Douglas DC-10	0.0	0.0	0.0
	DC10	DC1030	McDonnell Douglas DC-10	0.0	0.0	0.0
	E135	EMB145	Embraer ERJ-135	0.3	0.0	0.4
	E145	EMB145	Embraer ERJ-145	0.2	0.0	0.2
	E170	EMB170	Embraer ERJ-170	11.0	1.2	12.2
	E190	EMB190	Embraer ERJ-190-100 /-200	2.6	1.1	3.7
	E35L	EMB145	Embraer EMB-135 LR	0.1	0.0	0.1
	E45X	EMB145	Embraer EMB-145 EX (Extra Long Range)	0.2	0.0	0.2
	E550	CNA55B	Embraer EMB550 Phenom 300	0.3	0.0	0.3
	E55P	CNA55B	Embraer EMB550 Phenom 300	1.2	0.1	1.2
	E75L	EMB175	Embraer ERJ-175	46.4	4.8	51.2
	E75S	EMB175	Embraer ERJ-175	11.0	2.0	13.0
	F2TH	CNA750	Dassault Falcon 2000	1.2	0.1	1.3
	F900	FAL900EX	Dassault Falcon 900	1.1	0.0	1.2
	FA10	LEAR35	Dassault Falcon 10	0.0	0.0	0.0
	FA50	FAL900EX	Dassault Falcon 50	0.8	0.1	0.8
	FA7X	GIV	Dassault Falcon 7X	0.2	0.0	0.2
	FA8X	GIV	Dassault Falcon 8X	0.0	0.0	0.0
	G150	IA1125	Gulfstream G150	0.2	0.0	0.2
	G280	IA1125	Gulfstream G280	1.5	0.1	1.6
	GA5C	GV	Gulfstream G500/600	0.0	0.0	0.0
	GALX	IA1125	IAI 1126 Astra Galaxy/Gulfstream 200	0.9	0.1	1.0
	GL5T	BD-700-1A11	Bombardier Global 5000	0.2	0.0	0.2
	GLEX	BD-700-1A10	Bombardier BD-700 Global Express	0.4	0.0	0.5
	GLF4	GIV	Gulfstream IV	1.2	0.1	1.4
	GLF5	GV	Gulfstream V	1.7	0.2	1.8
	GLF6	G650ER	Gulfstream VI / G650	0.2	0.0	0.2
	H25B	LEAR35	Hawker 800/800 XP/850 XP Twin Turbojet/Bae (Hawker-Siddeley) 125-800	1.0	0.1	1.1
	H25C	LEAR35	Hawker 1000 / Bae 125-1000	0.0	0.0	0.0
	HA4T	CNA750	Hawker Beechcraft 4000 Horizon (Horizon 1000)	0.1	0.0	0.1
	HDJT	CNA680	Honda Jet	0.0	0.0	0.0
	HDJT	MU3001	Honda Jet	0.0	0.0	0.0
	J328	CNA750	Fairchild Dornier 328 Jet	0.0	0.0	0.0
	LJ31	LEAR35	Learjet 31 Twin Jet	0.0	0.0	0.0

Group	Aircraft Code	AEDT Aircraft (ANP)	AEDT Aircraft Description	2019 Day	2019 Night	2019 Total
Manufactured to be Stage 3+	LJ31	LEAR35	Learjet 31 Twin Jet	0.0	0.0	0.0
	LJ35	LEAR35	Learjet 35 Twin Jet	0.4	0.0	0.4
	LJ40	LEAR35	Learjet 40 Twin Jet	0.1	0.0	0.1
	LJ45	LEAR35	Learjet 45 Twin Jet	0.7	0.0	0.8
	LJ55	LEAR35	Learjet 55 Twin Jet	0.1	0.0	0.1
	LJ60	CNA750	Learjet 60 Twin Jet	0.4	0.0	0.4
	LJ70	LEAR35	Learjet 70 Twin Jet	0.0	0.0	0.0
	LJ75	LEAR35	Learjet 75 Twin Jet	0.0	0.0	0.0
	MD11	MD11GE	McDonnell Douglas MD-11 (Mixed)	0.8	0.3	1.1
	MD11	MD11PW	McDonnell Douglas MD-11 (Mixed)	1.0	0.5	1.5
	MD81	MD81	McDonnell Douglas MD-81	0.0	0.0	0.0
	MD82	MD82	McDonnell Douglas MD-82	0.0	0.0	0.0
	MD83	MD83	McDonnell Douglas MD-83	0.2	0.0	0.2
	MD87	MD81	McDonnell Douglas MD-87	0.0	0.0	0.0
	MD87	MD83	McDonnell Douglas MD-87	0.0	0.0	0.0
	MD88	MD83	McDonnell Douglas MD-88	0.0	0.0	0.0
	MD90	MD9028	McDonnell Douglas MD-90	6.4	0.3	6.7
	PC24	CNA55B	Pilatus PC-24	0.0	0.0	0.0
	PRM1	CNA55B	Raytheon 390 Premier	0.0	0.0	0.0
	PRM1	MU3001	Raytheon 390 Premier	0.0	0.0	0.0
	VC25	74720B	Boeing VC-25	0.0	0.0	0.0
	WW24	IA1125	IAI 1124 Westwind	0.0	0.0	0.0
			Manufactured to be Stage 3+ Total	*955.3*	*118.0*	*1073.4*

Group	Aircraft Code	AEDT Aircraft (ANP)	AEDT Aircraft Description	2019 Day	2019 Night	2019 Total
Hushkit	B722	727EM2	Boeing 727-200	0.0	0.0	0.0
	B732	737N17	Boeing 737-200 Modified Stage 3	0.0	0.0	0.0
	DC91	DC93LW	McDonnell Douglas DC-9-10 with ABS3 Hushkit	0.0	0.0	0.0
	FA20	FAL20	Dassault Falcon 20 Mystere 20 /200	0.1	0.0	0.1
	GLF2	GII	Gulfstream II	0.0	0.0	0.0
	GLF3	GIIB	Gulfstream III	0.0	0.0	0.0
			Hushkit Total	***0.2***	***0.0***	***0.2***

Group	Aircraft Code	AEDT Aircraft (ANP)	AEDT Aircraft Description	2019 Day	2019 Night	2019 Total
Military	A400	C130	Airbus A400M Altas	0.0	0.0	0.0
	AN12	C130E	Antonov An-12 Cub	0.0	0.0	0.0
	C130	C130E	Lockheed Martin C-130	2.8	0.1	2.9
	C17	C17	Boeing C-17 Globemaster III	0.0	0.0	0.0
	C17A	C17	Boeing C-17 Globemaster III	0.0	0.0	0.0
	C30J	C130HP	Lockheed Martin C-130J Super Hercules	0.0	0.0	0.0
	F18S	F-18	McDonnell Douglas (Boeing) F/A-18 Hornet	0.0	0.0	0.0
	HAWK	T-38A	Raytheon Hawker 400	0.0	0.0	0.0
	K35R	KC135R	Boeing C-135R Stratotanker	0.0	0.0	0.0
	T38	T-38A	Northrop T-38 Talon	0.0	0.0	0.0
			Military Total	*2.9*	*0.1*	*3.0*

Group	Aircraft Code	AEDT Aircraft (ANP)	AEDT Aircraft Description	2019 Day	2019 Night	2019 Total
Microjet	C510	CNA510	Cessna Citation Mustang	0.0	0.0	0.0
	E50P	CNA510	Embraer EMB500 Phenom 100	0.1	0.0	0.1
	E545	CNA510	Embraer Legacy 545	0.4	0.0	0.4
	EA50	ECLIPSE500	Eclipse 500 VLJ	0.1	0.0	0.1
	SF50	CNA510	Cirrus Vision SF50	0.0	0.0	0.0
			Microjet Total	***0.7***	***0.0***	***0.7***

Group	Aircraft Code	AEDT Aircraft (ANP)	AEDT Aircraft Description	2019 Day	2019 Night	2019 Total
Piston	AC95	DHC6	Rockwell / Gulfstream 695 Jetprop Commander 1000	0.0	0.0	0.0
	AEST	BEC58P	Ted Smith Aerostar 600 /Aerostar Aircraft /Piper Aerostar	0.0	0.0	0.0
	AT43	DHC8	Avions de Transport Régional ATR-43	1.1	0.2	1.4
	AT72	HS748A	Avions de Transport Régional ATR-72	0.0	0.0	0.0
	B190	1900D	Beechcraft 1900D	2.8	0.2	3.1
	B350	DHC6	Beechcraft Super King Air 350/300B	0.4	0.0	0.4
	BE10	DHC6	Beechcraft King Air 100	0.0	0.0	0.0
	BE20	DHC6	Beechcraft Model 200 (Super) King Air 200	0.4	0.1	0.5
	BE23	GASEPF	Beechcraft Model 23 Musketeer	0.0	0.0	0.0
	BE30	DHC6	Beechcraft Super King Air 300	0.3	0.0	0.4
	BE35	GASEPV	Beechcraft Model 35 Bonanza	0.0	0.0	0.0
	BE36	GASEPV	Beechcraft Model 36 Bonanza	0.0	0.0	0.0
	BE58	BEC58P	Beechcraft Model 58 Baron	0.0	0.0	0.0
	BE65	BEC58P	Beechcraft Model 65 Queen Air	5.9	0.3	6.2
	BE80	BEC58P	Beechcraft Model 80 Queen Air	0.7	0.1	0.7
	BE99	DHC6	Beechcraft Airliner Model 99	3.3	0.1	3.5
	BE9L	DHC6	Beechcraft Model 90 King Air	0.2	0.0	0.2
	BE9T	CNA441	Beechcraft Super King Air F90	0.0	0.0	0.0
	C172	CNA172	Cessna 172 Single Engine SEPF	0.0	0.0	0.0
	C180	GASEPV	Cessna 180 Skywagon	0.0	0.0	0.0
	C182	CNA182	Cessna 182 Skylane	0.0	0.0	0.0
	C185	CNA206	Cessna 185 Skywagon	0.0	0.0	0.0
	C206	CNA206	Cessna 206 Stationair	0.0	0.0	0.0
	C208	CNA208	Cessna 208 Caravan I	6.4	0.0	6.4
	C240	GASEPV	Cessna 240 TTx Model	0.0	0.0	0.0
	C310	BEC58P	Cessna 310 Twin Engine Piston aircraft	0.0	0.0	0.0
	C340	BEC58P	Cessna 340 Twin Piston MEVP	0.0	0.0	0.0
	C402	BEC58P	Cessna 402 Businessliner	0.0	0.0	0.0
	C414	BEC58P	Cessna 414 Chancellor MEVP	0.1	0.0	0.1
	C421	BEC58P	Cessna 421 Golden Eagle	0.0	0.0	0.0
	C425	CNA441	Cessna 425 (Corsair/Conquest)	0.0	0.0	0.0
	C441	CNA441	Cessna 441 (Conquest/Conquest2)	0.1	0.0	0.1
	COL3	GASEPV	Cessna 350 Corvallis/Lancair LC42	0.0	0.0	0.0
	DH8A	DHC8	de Havilland Canada Dash-8/DHC8-100/200/400	0.0	0.0	0.0
	DH8A	DHC830	de Havilland Canada Dash-8/DHC8-100/200/400	0.0	0.0	0.0
	DHC6	DHC6	de Havilland Canada DHC-6 Twin Otter	0.0	0.0	0.0
	DHC6	DHC6QP	de Havilland Canada DHC-6 Twin Otter	0.0	0.0	0.0
	E120	EMB120	Embraer EMB-120 Brasilia	0.0	0.0	0.0
	M20P	GASEPV	Mooney Mark 20 Series	0.1	0.0	0.1
	M600	CNA441	Piper M600	0.0	0.0	0.0
	MU2	DHC6	Mitsubishi MU-2 Marquise / Solitaire	0.0	0.0	0.0

Group	Aircraft Code	AEDT Aircraft (ANP)	AEDT Aircraft Description	2019 Day	2019 Night	2019 Total
Piston	P180	DHC6	Piaggio P180 Avanti	0.0	0.0	0.0
	P28A	GASEPF	Piper PA-28-140/150/160/180 Cherokee	0.0	0.0	0.0
	P28A	PA28	Piper PA-28-140/150/160/180 Cherokee	0.0	0.0	0.0
	P28R	GASEPF	Piper PA-28R-180/200/201 Cherokee Arrow I/II/III	0.0	0.0	0.0
	P32R	GASEPV	Piper PA-32R Lance/Saratoga	0.0	0.0	0.0
	P46T	CNA441	Piper PA-46-500TP Malibu Meridian	0.0	0.0	0.0
	PA31	BEC58P	Piper PA-31 Navajo	0.0	0.0	0.0
	PA32	GASEPV	Piper PA-32 Cherokee Six	0.0	0.0	0.0
	PA46	GASEPV	Piper PA-46 Malibu	0.0	0.0	0.0
	PAY1	CNA441	Piper PA-31T-2 Cheyenne I/II	0.0	0.0	0.0
	PAY2	CNA441	Piper PA-31T-2 Cheyenne I/II	0.0	0.0	0.0
	PAY3	PA42	Piper PA-42 Cheyenne III/IV	0.0	0.0	0.0
	PC12	CNA208	Pilatus PC-12	5.5	0.0	5.6
	S22T	COMSEP	Cirrus SR22 Turbo	0.0	0.0	0.0
	SB20	HS748A	Saab 2000	0.0	0.0	0.0
	SR20	COMSEP	Cirrus SR20	0.0	0.0	0.0
	SR22	COMSEP	Cirrus SR22	0.2	0.0	0.2
	SW4	DHC6	Swearingen Merlin IV /Fairchild Merlin IV	5.4	0.3	5.7
	TBM7	CNA208	Socata TBM 700	0.0	0.0	0.0
	TBM7	GASEPV	Socata TBM 700	0.0	0.0	0.0
	TBM8	CNA441	Socata TBM 850 Single Engine Turboprop	0.0	0.0	0.0
	TBM9	CNA208	Daher TMB900	0.0	0.0	0.0
	TEX2	CNA208	Beechcraft T-6 Texan II	0.0	0.0	0.0
			Piston Total	*33.6*	*1.6*	*35.2*

Group	Aircraft Code	AEDT Aircraft (ANP)	AEDT Aircraft Description	2019 Day	2019 Night	2019 Total
Helicopter	AS50	SA350D	Eurocopter AS-350	0.0	0.0	0.0
	B407	B407	Bell Helicopter 407	0.0	0.0	0.0
	B412	S76	Bell Helicopter 412 Sentinel	0.0	0.0	0.0
	B47G	R44	Bell 47	0.0	0.0	0.0
	EC12	SA341G	Eurocopter EC-120	0.0	0.0	0.0
	EC30	EC130	Eurocopter EC-130	0.0	0.0	0.0
	R44	R44	Robinson R44 Clipper/Raven Helicopter	0.0	0.0	0.0
	UH60	S70	Sikorsky UH-60 Black Hawk Helicopter	0.0	0.0	0.0
	S76	S76	Sikorsky S-76	0.0	0.0	0.0
	SA341G	SA341G	Aérospatiale Gazelle	0.0	0.0	0.0
			Helicopter Total	*0.1*	*0.0*	*0.1*

Group	2019 Day	2019 Night	2019 Total
Manufactured to be Stage 3+	955.3	118.0	1073.4
Hushkit	0.2	0.0	0.2
Military	2.9	0.1	3.0
Microjet	0.7	0.0	0.7
Piston	33.6	1.6	35.2
Helicopter	0.1	0.0	0.1
Total	***992.7***	***119.8***	***1,112.5***

Table A1-2: Comparison of 2007 Forecast Fleet Mix and 2019 Actual Fleet Mix Average Daily Operations

Group	Aircraft Type	Day		Night		Total		Difference
		2007 Forecast	2019 Actual	2007 Forecast	2019 Actual	2007 Forecast	2019 Actual	
Helicopter	B407	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	EC130	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	R44	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	S70	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	S76	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	SA341G	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	SA350D	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Helicopter Total		***0.0***	***0.1***	***0.0***	***0.0***	***0.0***	***0.1***	***0.1***

Group	Aircraft Type	Day		Night		Total		Difference
		2007 Forecast	2019 Actual	2007 Forecast	2019 Actual	2007 Forecast	2019 Actual	
Hushkit Stage 3 Jet	727EM2	8.0	0.0	6.4	0.0	14.4	0.0	(14.4)
	737N17	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DC93LW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DC9Q	245.3	0.0	15.3	0.0	260.6	0.0	(260.6)
	FAL20	0.0	0.1	0.0	0.0	0.0	0.1	0.1
	GII	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hushkit Stage 3 Jet Total		***253.3***	***0.1***	***21.7***	***0.0***	***275.0***	***0.2***	***(274.8)***

Group	Aircraft Type	Day		Night		Total		Difference
		2007 Forecast	2019 Actual	2007 Forecast	2019 Actual	2007 Forecast	2019 Actual	
Microjet	CNA510	0.0	0.6	0.0	0.0	0.0	0.6	0.6
	ECLIPSE500	0.0	0.1	0.0	0.0	0.0	0.1	0.1
Microjet Total		***0.0***	***0.7***	***0.0***	***0.0***	***0.0***	***0.7***	***0.7***

Group	Aircraft Type	Day		Night		Total		Difference
		2007 Forecast	2019 Actual	2007 Forecast	2019 Actual	2007 Forecast	2019 Actual	
Military	C130	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	C130E	0.0	2.8	0.0	0.1	0.0	2.9	2.9
	C-130E	7.8	0.0	0.2	0.0	8.0	0.0	(8.0)
	C130HP	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	C17	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	C5	0.1	0.0	0.0	0.0	0.1	0.0	(0.1)
	F16GE	0.1	0.0	0.0	0.0	0.1	0.0	(0.1)
	F-18	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	KC135R	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	T37	0.1	0.0	0.0	0.0	0.1	0.0	(0.1)
	T38	0.1	0.0	0.0	0.0	0.1	0.0	(0.1)
	T-38A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Military Total		***8.2***	***2.9***	***0.2***	***0.1***	***8.4***	***3.0***	***(5.4)***

Group	Aircraft Type	Day		Night		Total		Difference
		2007 Forecast	2019 Actual	2007 Forecast	2019 Actual	2007 Forecast	2019 Actual	
Manufactured to be Stage 3+	7478	0.0	0.2	0.0	0.1	0.0	0.3	0.3
	717200	7.3	77.3	1.0	4.2	8.3	81.4	73.1
	737300	48.2	0.1	3.5	0.0	51.7	0.1	(51.6)
	737400	0.1	0.3	0.0	0.1	0.1	0.4	0.3
	737500	5.7	0.0	0.5	0.0	6.2	0.0	(6.2)
	737700	7.8	34.6	0.5	8.4	8.3	43.0	34.7
	737800	65.5	169.3	12.6	33.3	78.1	202.6	124.5
	737900	5.7	0.0	0.5	0.0	6.2	0.0	(6.2)
	747400	1.9	0.2	0.2	0.1	2.1	0.4	(1.7)
	757300	34.1	13.2	1.1	0.8	35.2	14.0	(21.2)
	767200	1.2	0.0	0.5	0.0	1.7	0.0	(1.7)
	767300	0.0	8.2	0.0	3.6	0.0	11.8	11.8
	767400	0.0	0.5	0.0	0.3	0.0	0.8	0.8
	777200	0.0	5.3	0.0	0.1	0.0	5.4	5.4
	777300	0.0	0.1	0.0	0.0	0.0	0.1	0.1
	727QF	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	7373B2	0.0	0.1	0.0	0.0	0.0	0.1	0.1
	737MAX8	0.0	0.2	0.0	0.1	0.0	0.2	0.2
	74720B	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	747SP	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	757PW	88.4	28.5	8.6	7.0	97.0	35.6	(61.4)
	757RR	0.0	2.0	0.0	2.1	0.0	4.1	4.1
	767CF6	0.0	0.1	0.0	0.0	0.0	0.1	0.1
	767JT9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	7773ER	0.0	0.1	0.0	0.0	0.0	0.1	0.1
	7878R	0.0	0.7	0.0	0.1	0.0	0.8	0.8
	A300-622R	4.8	0.9	4.2	1.3	9.0	2.2	(6.8)
	A310-304	1.4	0.0	1.3	0.0	2.7	0.0	(2.7)
	A318	5.7	0.0	0.5	0.0	6.2	0.0	(6.2)
	A319-131	149.1	64.5	3.9	5.0	153.0	69.5	(83.5)
	A320-211	173.4	48.0	16.5	3.6	189.9	51.6	(138.3)
	A320-232	0.0	19.8	0.0	6.1	0.0	25.8	25.8
	A320-271N	0.0	5.3	0.0	1.4	0.0	6.7	6.7
	A321-232	0.0	59.3	0.0	9.4	0.0	68.7	68.7
	A330-301	6.2	4.1	0.0	0.3	6.2	4.4	(1.8)
	A330-343	0.0	1.7	0.0	0.2	0.0	2.0	2.0
	A340-642	2.1	0.0	0.0	0.0	2.1	0.0	(2.1)
	A350-941	0.0	0.3	0.0	0.0	0.0	0.3	0.3
	ASTR	2.3	0.0	0.2	0.0	2.5	0.0	(2.5)
	BAE146	74.3	0.0	2.2	0.0	76.5	0.0	(76.5)
	BD-700-1A10	0.0	0.4	0.0	0.0	0.0	0.5	0.5
	BD-700-1A11	0.0	0.2	0.0	0.0	0.0	0.2	0.2
	CIT3	0.0	0.2	0.0	0.0	0.0	0.3	0.3
	CL600	0.0	130.6	0.0	8.7	0.0	139.3	139.3
	CL601	264.1	1.2	14.7	0.1	278.8	1.2	(277.6)
	CNA500	1.4	0.9	0.1	0.1	1.5	0.9	(0.6)
	CNA525C	0.0	0.2	0.0	0.0	0.0	0.2	0.2
	CNA55B	0.0	1.7	0.0	0.1	0.0	1.8	1.8
	CNA560E	0.0	0.4	0.0	0.0	0.0	0.5	0.5
	CNA560U	0.0	0.2	0.0	0.0	0.0	0.3	0.3
	CNA560XL	0.0	2.6	0.0	0.1	0.0	2.7	2.7
	CNA650	4.9	0.0	0.6	0.0	5.5	0.0	(5.5)

Group	Aircraft Type	Day 2007 Forecast	Day 2019 Actual	Night 2007 Forecast	Night 2019 Actual	Total 2007 Forecast	Total 2019 Actual	Difference
Manufactured to be Stage 3+	CNA750	4.6	3.2	0.3	0.2	4.9	3.4	(1.5)
	CRJ9-ER	0.0	173.8	0.0	9.5	0.0	183.4	183.4
	DC1010	9.6	0.0	3.8	0.0	13.4	0.0	(13.4)
	DC1030	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DC870	0.0	0.0	1.4	0.0	1.4	0.0	(1.4)
	EMB145	45.3	0.7	0.2	0.1	45.5	0.8	(44.7)
	EMB170	0.0	11.0	0.0	1.2	0.0	12.2	12.2
	EMB175	0.0	57.4	0.0	6.9	0.0	64.3	64.3
	EMB190	0.0	2.6	0.0	1.1	0.0	3.7	3.7
	FAL20A	1.0	0.0	0.7	0.0	1.7	0.0	(1.7)
	FAL900EX	0.0	1.9	0.0	0.1	0.0	2.0	2.0
	G650ER	0.0	0.2	0.0	0.0	0.0	0.2	0.2
	GIV	2.6	1.4	0.2	0.1	2.8	1.5	(1.3)
	GV	0.8	1.7	0.1	0.2	0.9	1.9	1.0
	IA1125	0.0	2.6	0.0	0.2	0.0	2.8	2.8
	L101	0.6	0.0	0.2	0.0	0.8	0.0	(0.8)
	LEAR35	26.0	2.5	2.3	0.2	28.3	2.7	(25.6)
	MD11GE	0.3	0.8	0.4	0.3	0.7	1.1	0.4
	MD11PW	0.0	1.0	0.0	0.5	0.0	1.5	1.5
	MD81	0.5	0.0	0.0	0.0	0.5	0.0	(0.5)
	MD82	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MD83	17.0	0.2	1.6	0.0	18.6	0.2	(18.4)
	MD9028	0.0	6.4	0.0	0.3	0.0	6.7	6.7
	MU300	7.2	0.0	0.6	0.0	7.8	0.0	(7.8)
	MU3001	0.0	0.5	0.0	0.0	0.0	0.6	0.6
	SBR2	0.4	0.0	0.0	0.0	0.4	0.0	(0.4)
Manufactured to be Stage 3+ Total		***1071.5***	***955.3***	***85.0***	***118.0***	***1156.5***	***1073.4***	***(83.1)***

Group	Aircraft Type	Day 2007 Forecast	Day 2019 Actual	Night 2007 Forecast	Night 2019 Actual	Total 2007 Forecast	Total 2019 Actual	Difference
Stage 2 Jets under 75,000 lbs	GIIB	2.1	0.0	0.2	0.0	2.3	0.0	(2.3)
	LEAR25	2.1	0.0	0.4	0.0	2.5	0.0	(2.5)
Stage 2 Jets under 75,000 lbs Total		***4.2***	***0.0***	***0.6***	***0.0***	***4.8***	***0.0***	***(4.8)***

Group	Aircraft Type	Day		Night		Total		Difference
		2007 Forecast	2019 Actual	2007 Forecast	2019 Actual	2007 Forecast	2019 Actual	
Propeller	1900D	0.0	2.8	0.0	0.2	0.0	3.1	3.1
	BEC58	14.3	0.0	4.7	0.0	19.0	0.0	(19.0)
	BEC58P	0.0	6.8	0.0	0.4	0.0	7.2	7.2
	CNA172	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CNA182	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CNA206	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CNA208	0.0	11.9	0.0	0.0	0.0	12.0	12.0
	CNA441	0.0	0.2	0.0	0.0	0.0	0.2	0.2
	COMSEP	0.0	0.2	0.0	0.0	0.0	0.2	0.2
	DHC6	22.5	10.1	4.4	0.6	26.9	10.7	(16.2)
	DHC6QP	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DHC8	0.0	1.1	0.0	0.2	0.0	1.4	1.4
	DHC830	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	EMB120	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	FK27	0.1	0.0	0.0	0.0	0.1	0.0	(0.1)
	GASEPF	1.3	0.0	0.3	0.0	1.6	0.0	(1.6)
	GASEPV	3.7	0.2	0.5	0.0	4.2	0.3	(3.9)
	HS748A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	PA28	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	PA42	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	SF340	93.3	0.0	5.9	0.0	99.2	0.0	(99.2)
Propeller Total		***135.2***	***33.6***	***15.8***	***1.6***	***151.0***	***35.2***	***(115.8)***

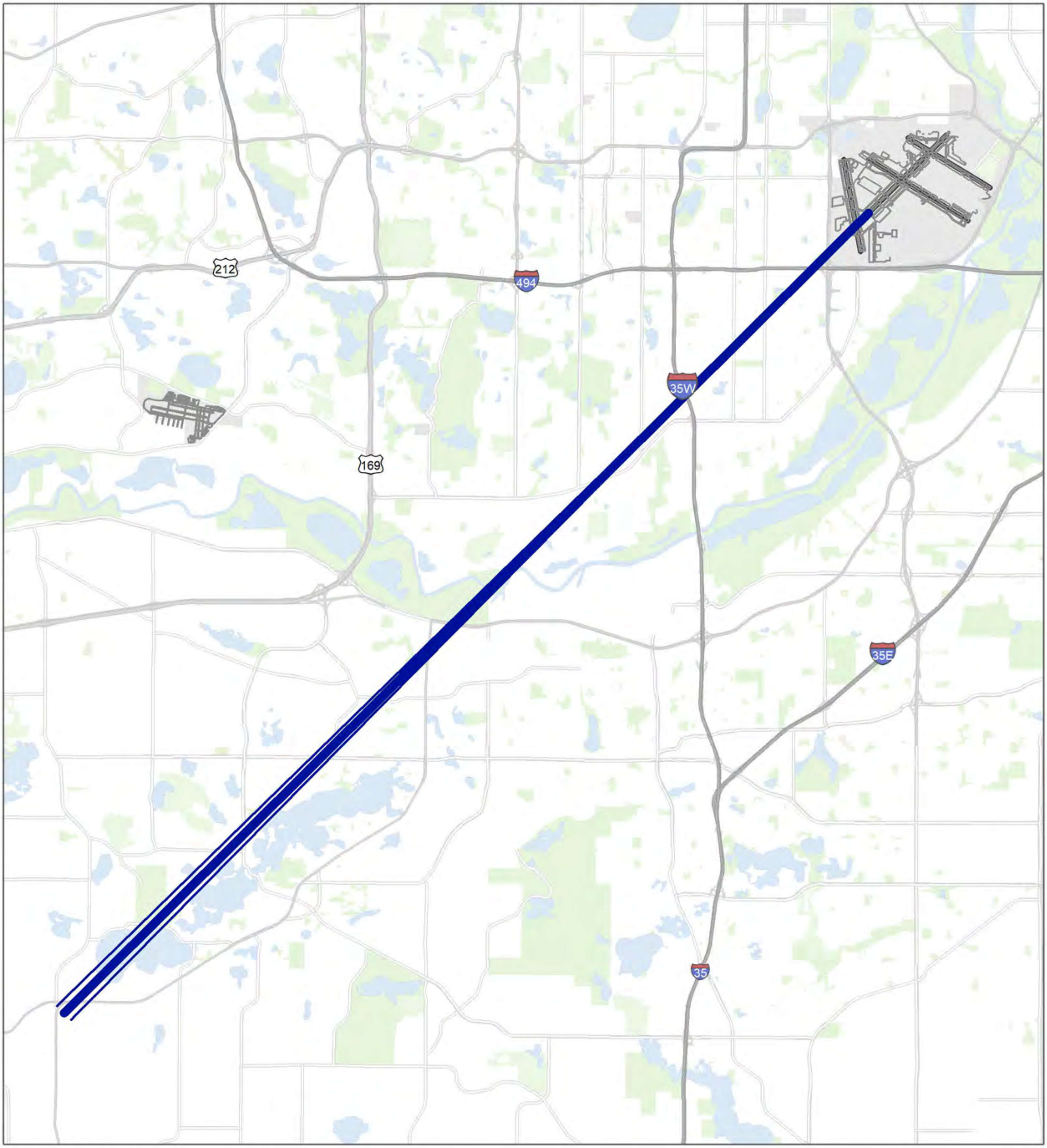
Grand Total	***1472.4***	***992.7***	***123.3***	***119.8***	***1595.7***	***1112.5***	***(483.2)***

Appendix 2: 2019 Model Flight Tracks and Use

2019 AEDT TRACKS - ARRIVAL RUNWAY 4

Overall Use Percentage

Figure 2.1



AEDT Track Use Percentage

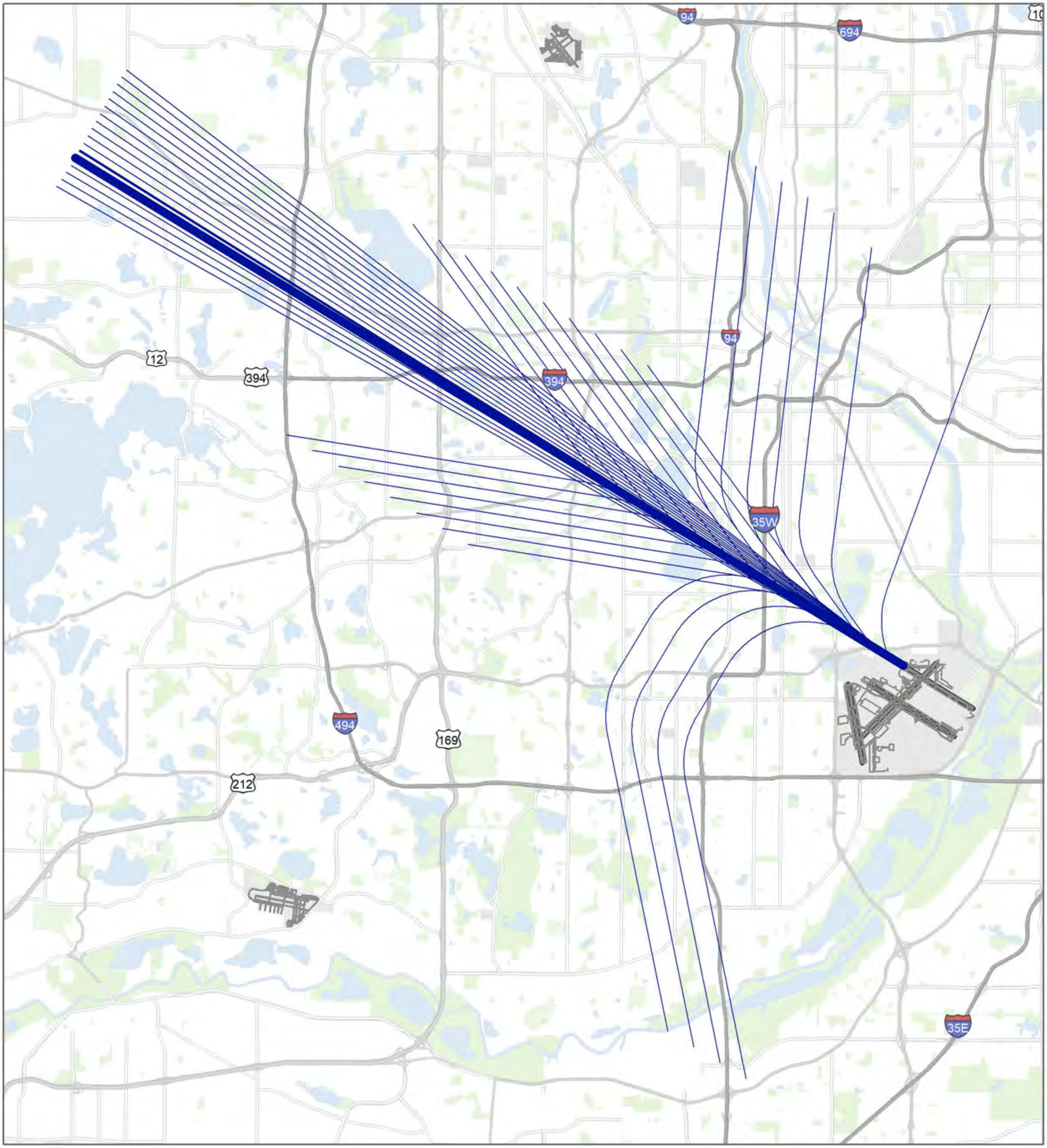
< 5% | 10 - 20% | 30 - 50%
5 - 10% | 20 - 30% | > 50%

0 1.25 2.5 5 Miles

2019 AEDT TRACKS - ARRIVAL RUNWAY 12L

Overall Use Percentage

Figure 2.2

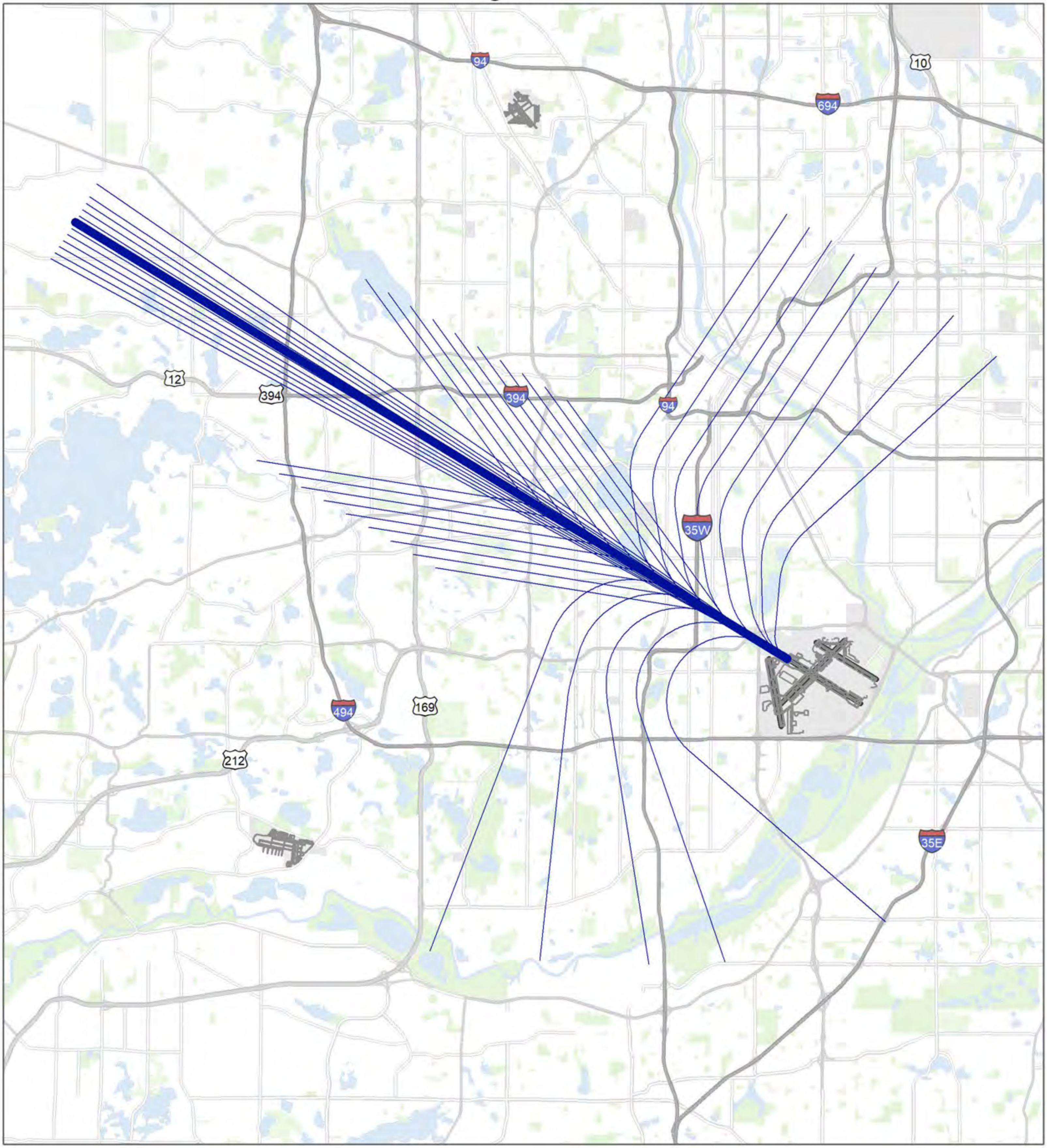


AEDT Track Use Percentage

2019 AEDT TRACKS - ARRIVAL RUNWAY 12R

Overall Use Percentage

Figure 2.3



AEDT Track Use Percentage

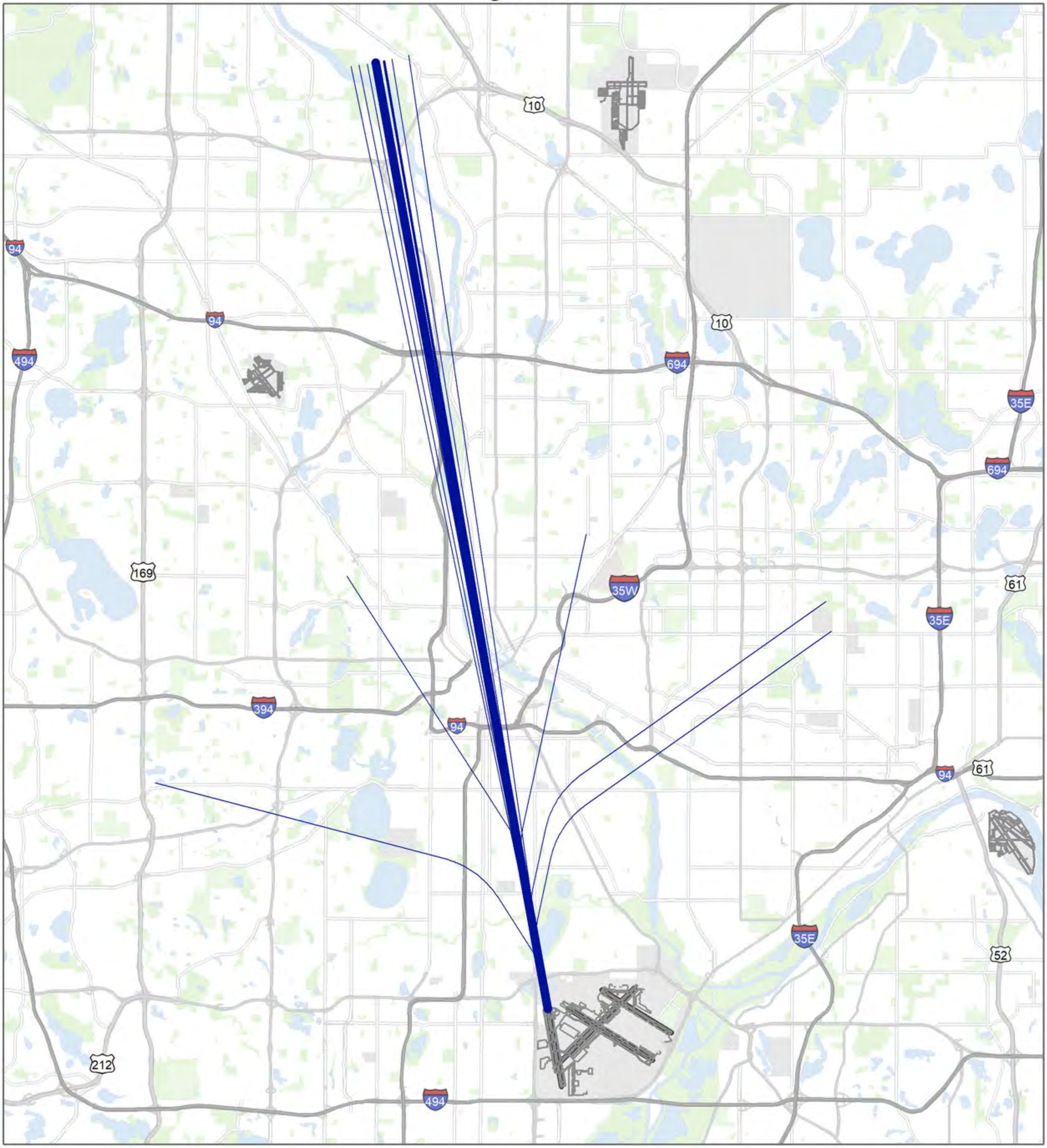
< 5%	10 - 20%	30 - 50%
5 - 10%	20 - 30%	> 50%

0 1.5 3 6 Miles

2019 AEDT TRACKS - ARRIVAL RUNWAY 17

Overall Use Percentage

Figure 2.4



AEDT Track Use Percentage

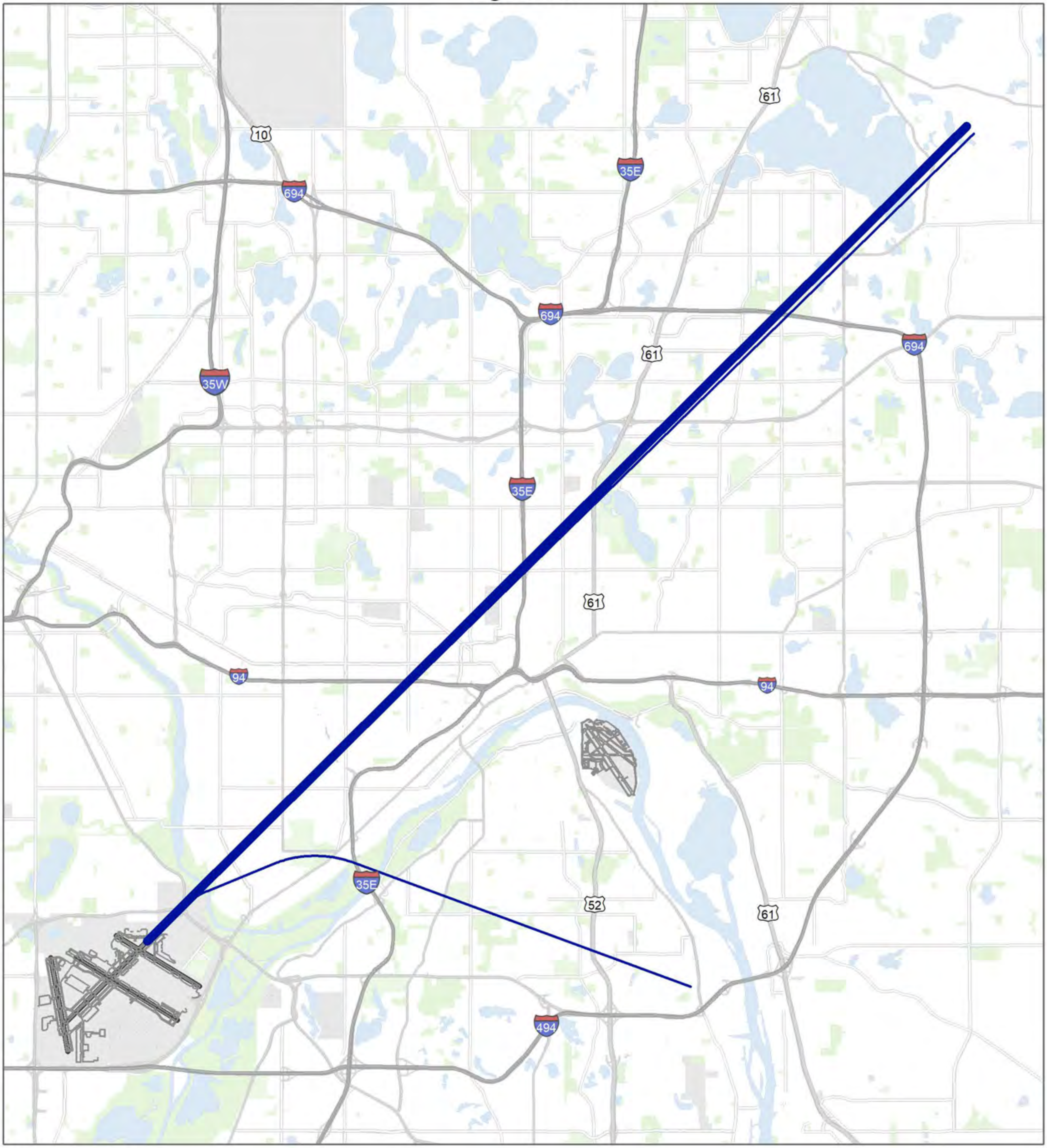
< 5%
5 - 10%
10 - 20%
20 - 30%
30 - 50%
> 50%

0 1.5 3 6 Miles

2019 AEDT TRACKS - ARRIVAL RUNWAY 22

Overall Use Percentage

Figure 2.5



AEDT Track Use Percentage

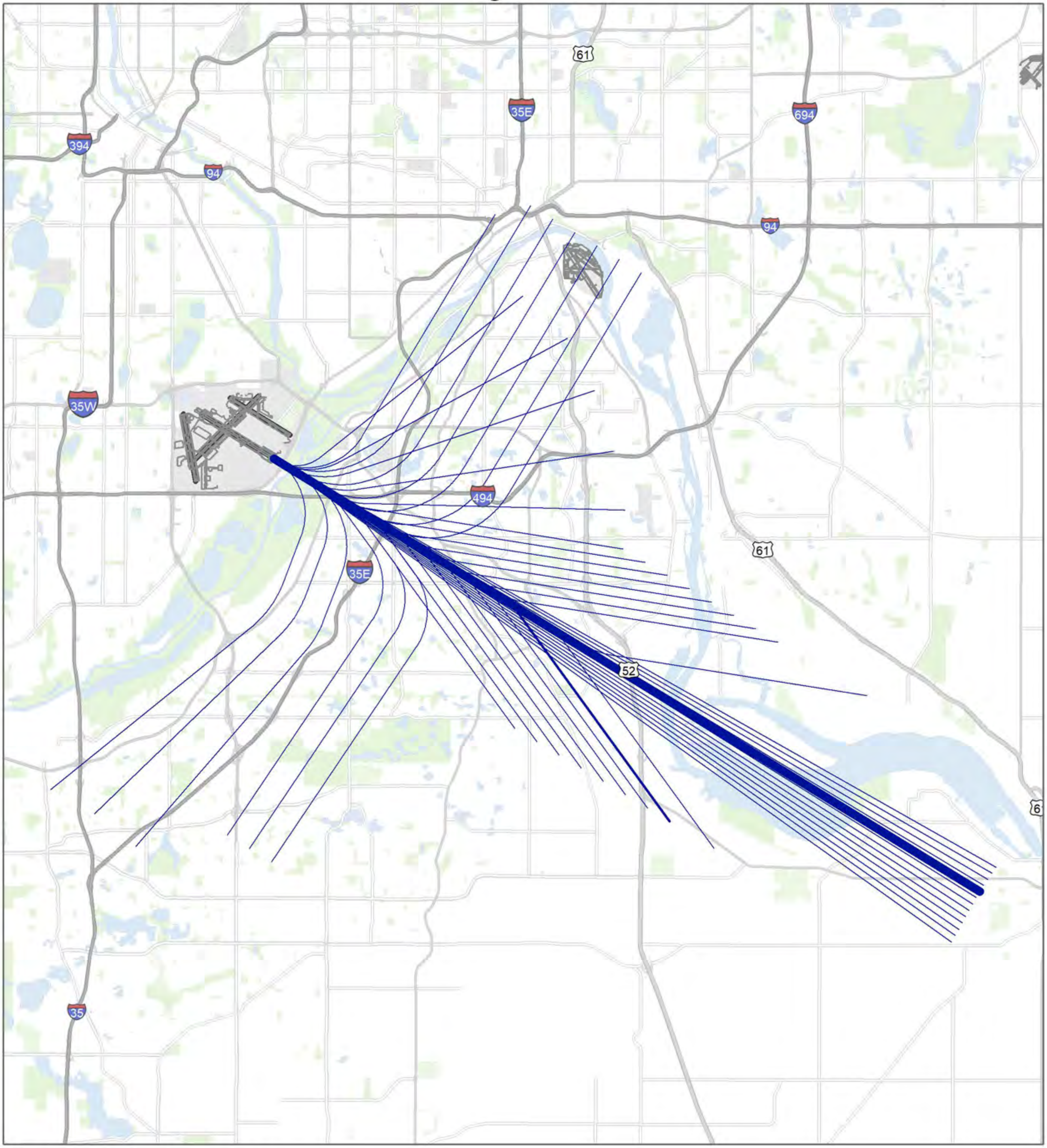
< 5%
5 - 10%
10 - 20%
20 - 30%
30 - 50%
> 50%

0 1.25 2.5 5 Miles

2019 AEDT TRACKS - ARRIVAL RUNWAY 30L

Overall Use Percentage

Figure 2.6



AEDT Track Use Percentage

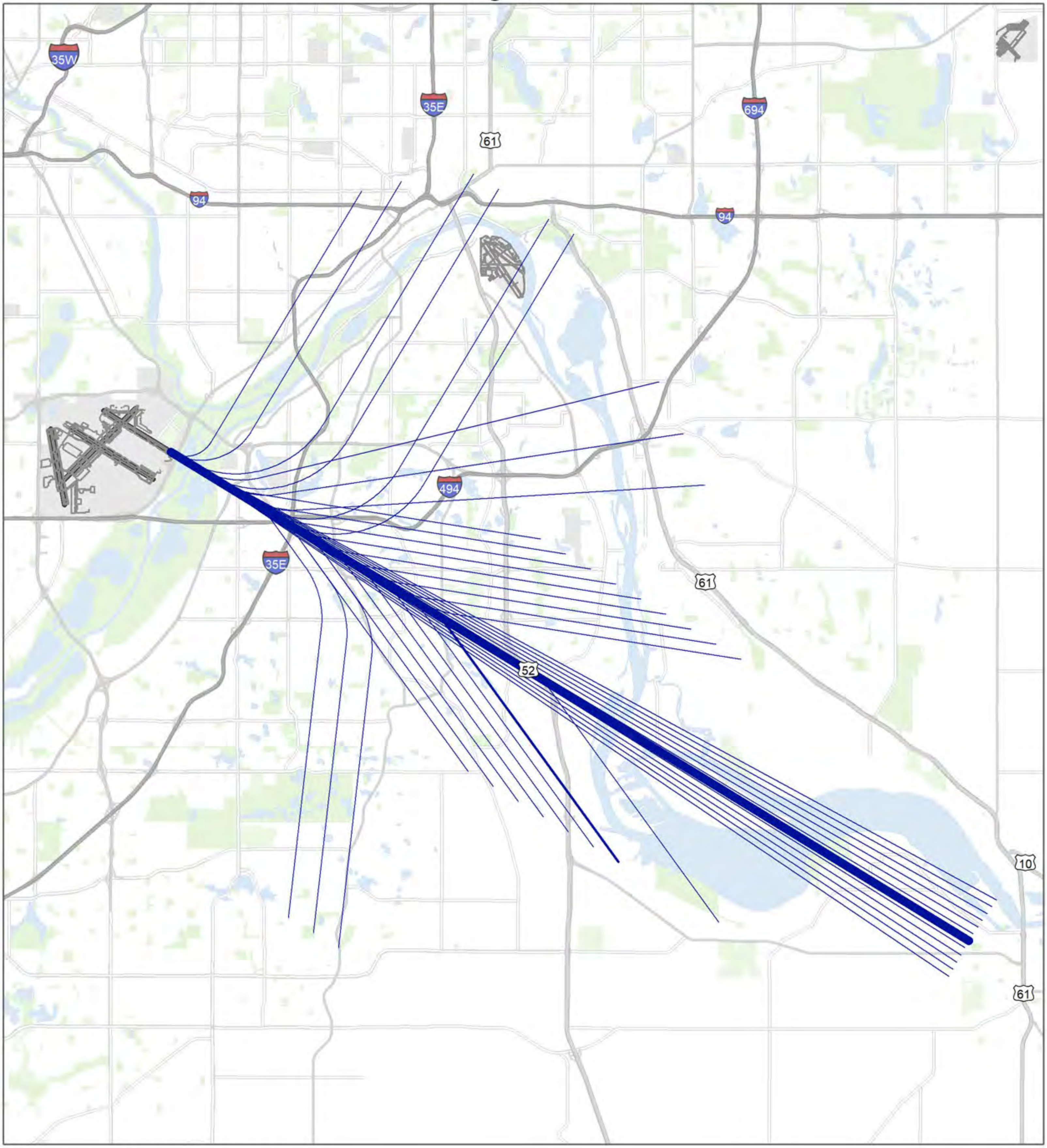
< 5%
5 - 10%
10 - 20%
20 - 30%
30 - 50%
> 50%

0 1.75 3.5 7 Miles

2019 AEDT TRACKS - ARRIVAL RUNWAY 30R

Overall Use Percentage

Figure 2.7



AEDT Track Use Percentage

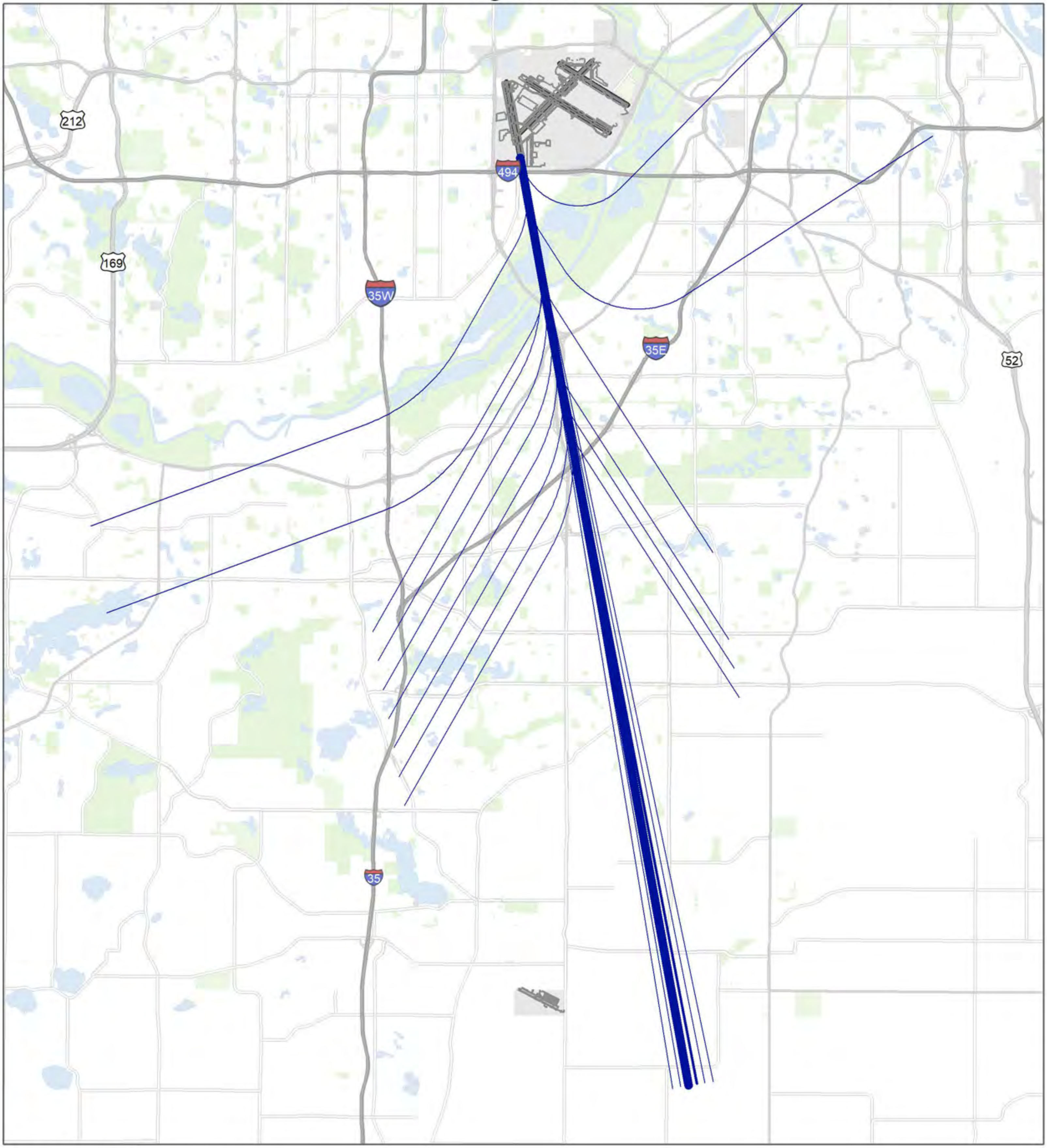
< 5%
10 - 20%
30 - 50%
5 - 10%
20 - 30%
> 50%

0 1.5 3 6 Miles

2019 AEDT TRACKS - ARRIVAL RUNWAY 35

Overall Use Percentage

Figure 2.8



AEDT Track Use Percentage

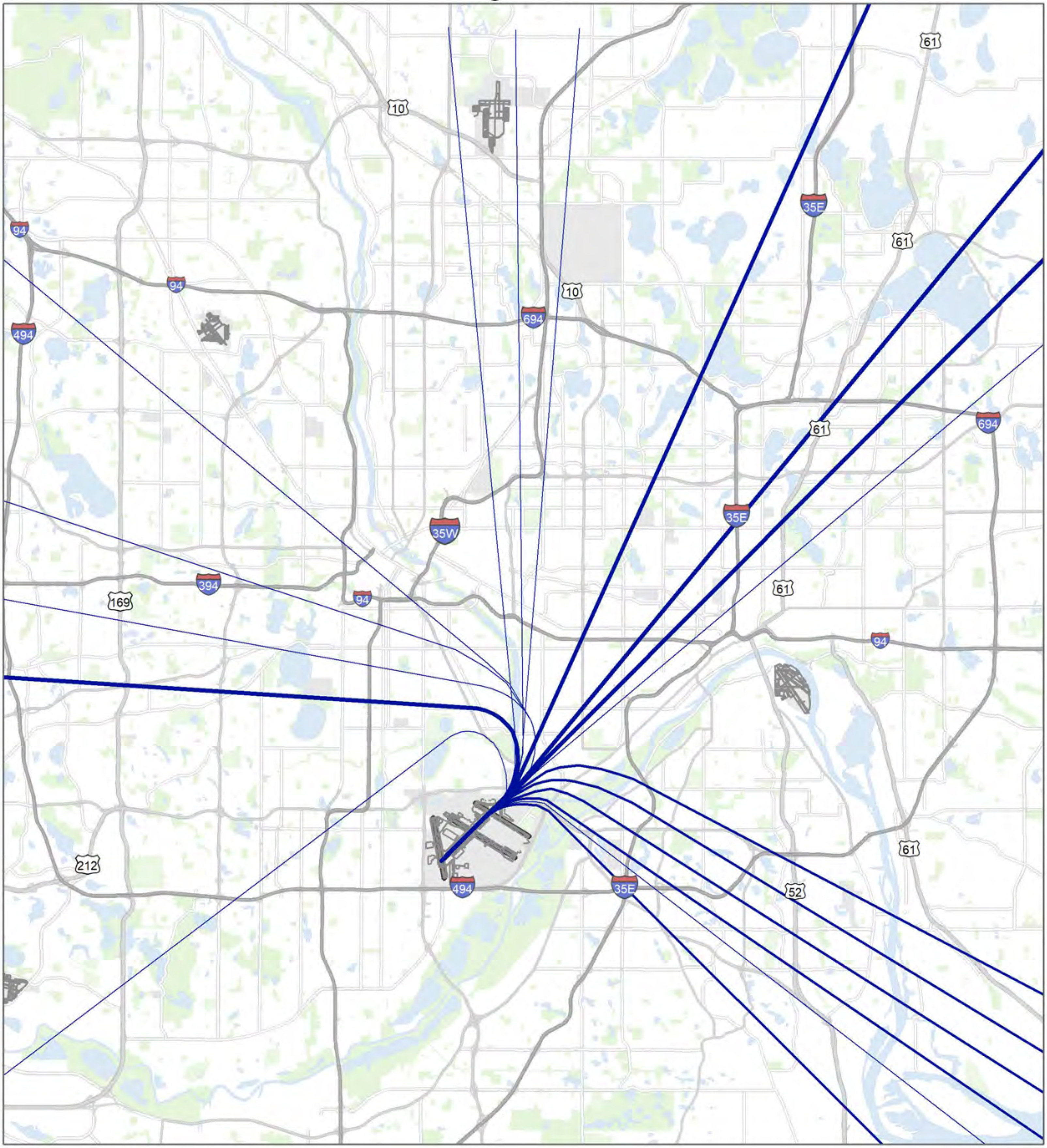
< 5%
10 - 20%
30 - 50%
5 - 10%
20 - 30%
> 50%

0 1.5 3 6 Miles

2019 AEDT TRACKS - DEPARTURE RUNWAY 4

Overall Use Percentage

Figure 2.9



AEDT Track Use Percentage

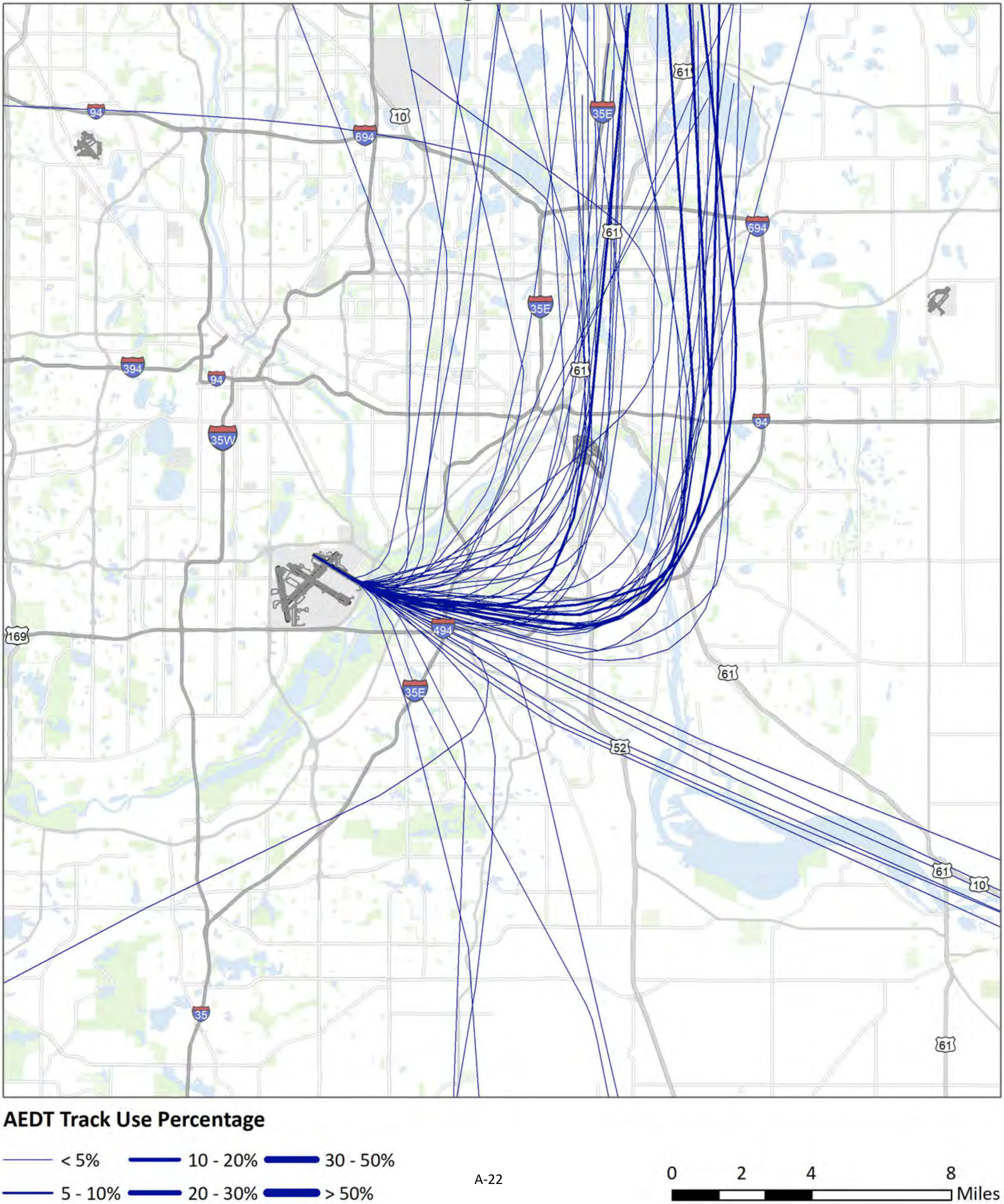
< 5%
10 - 20%
30 - 50%
5 - 10%
20 - 30%
> 50%

0 1.75 3.5 7 Miles

2019 AEDT TRACKS - DEPARTURE RUNWAY 12L

Overall Use Percentage

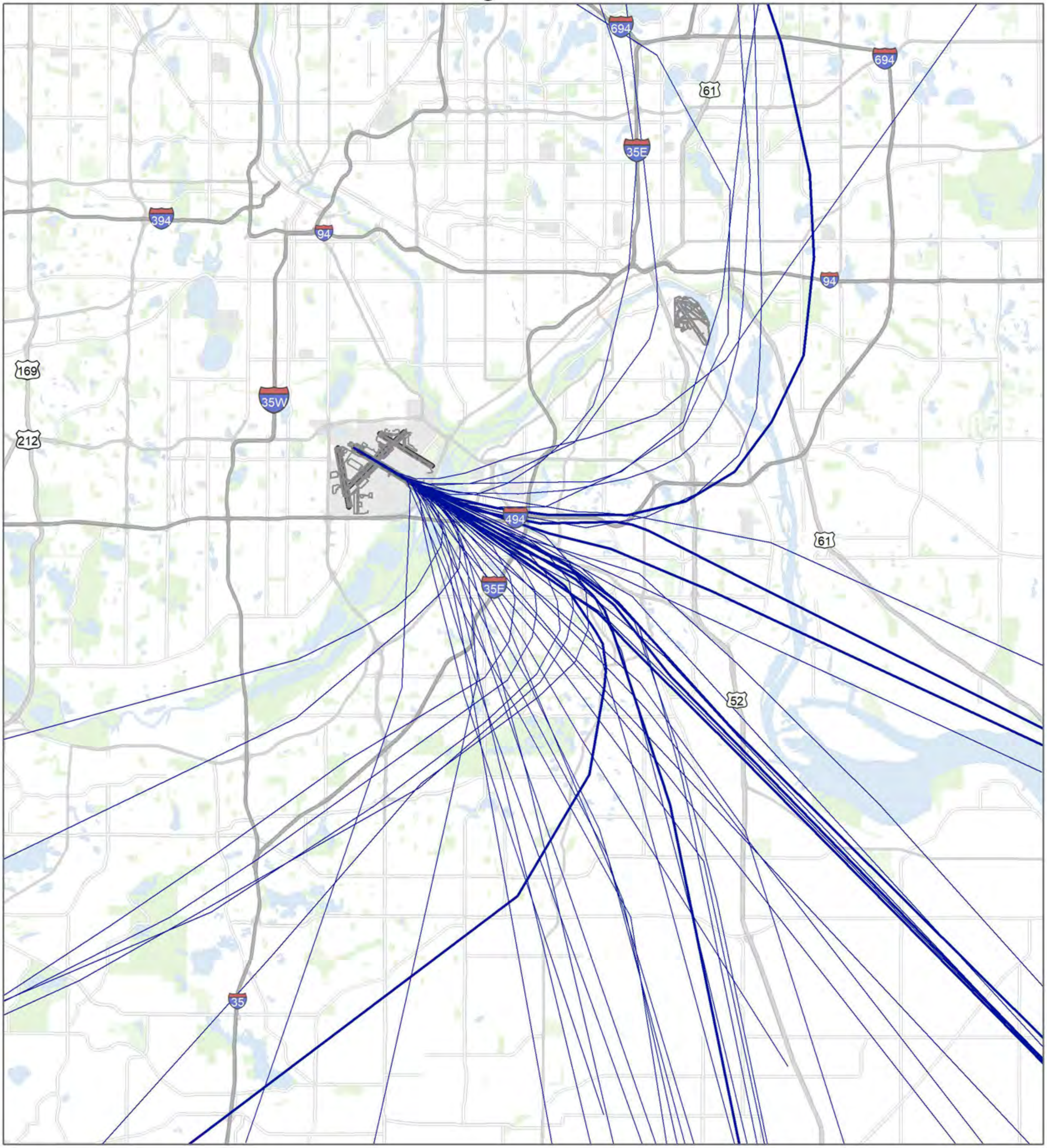
Figure 2.10

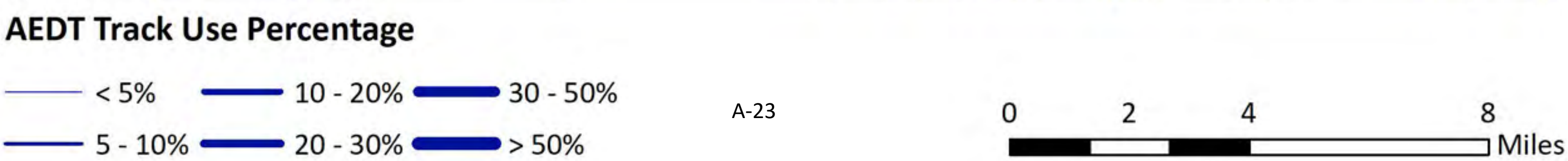


2019 AEDT TRACKS - DEPARTURE RUNWAY 12R

Overall Use Percentage

Figure 2.11

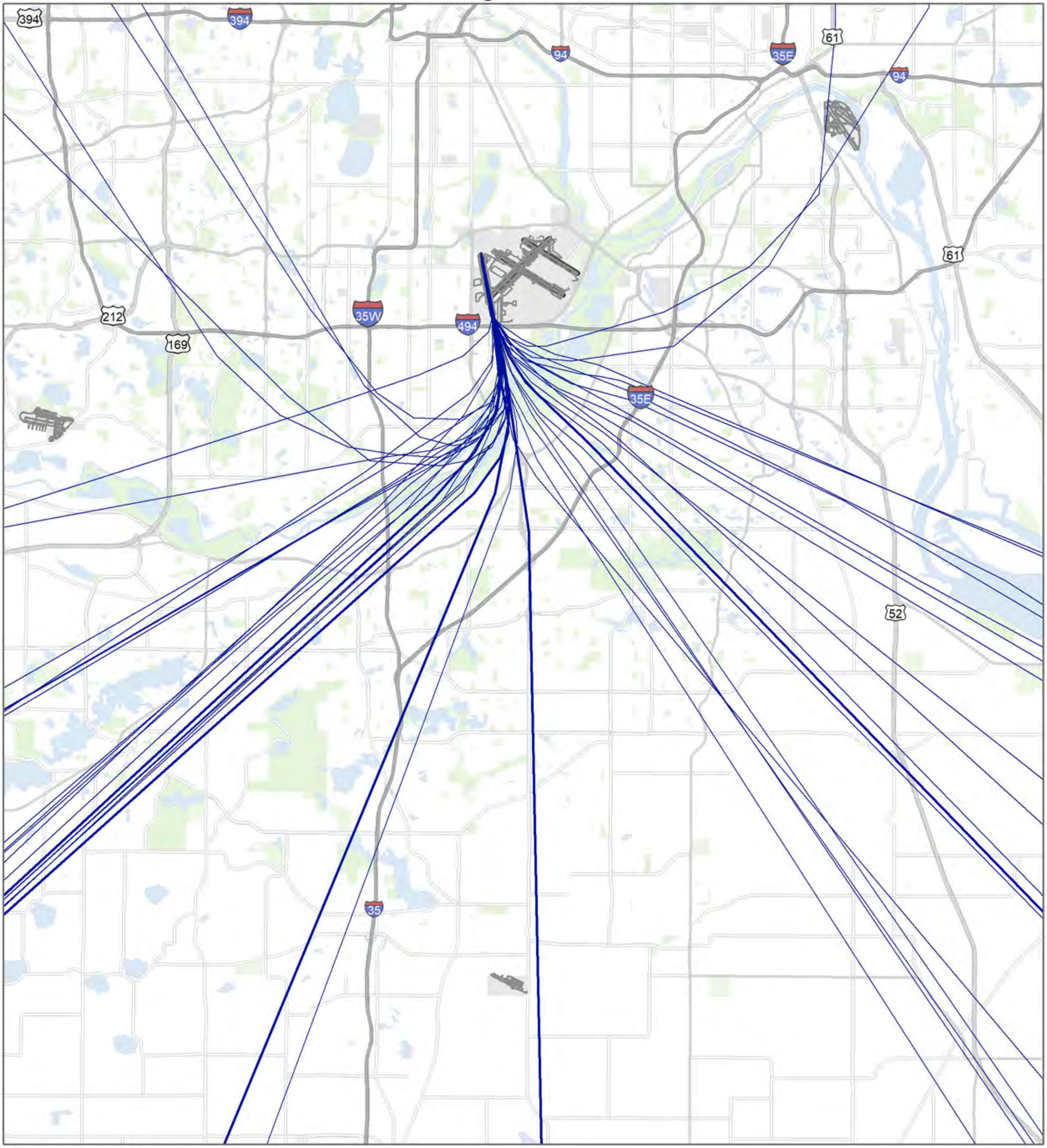




2019 AEDT TRACKS - DEPARTURE RUNWAY 17

Overall Use Percentage

Figure 2.12



AEDT Track Use Percentage

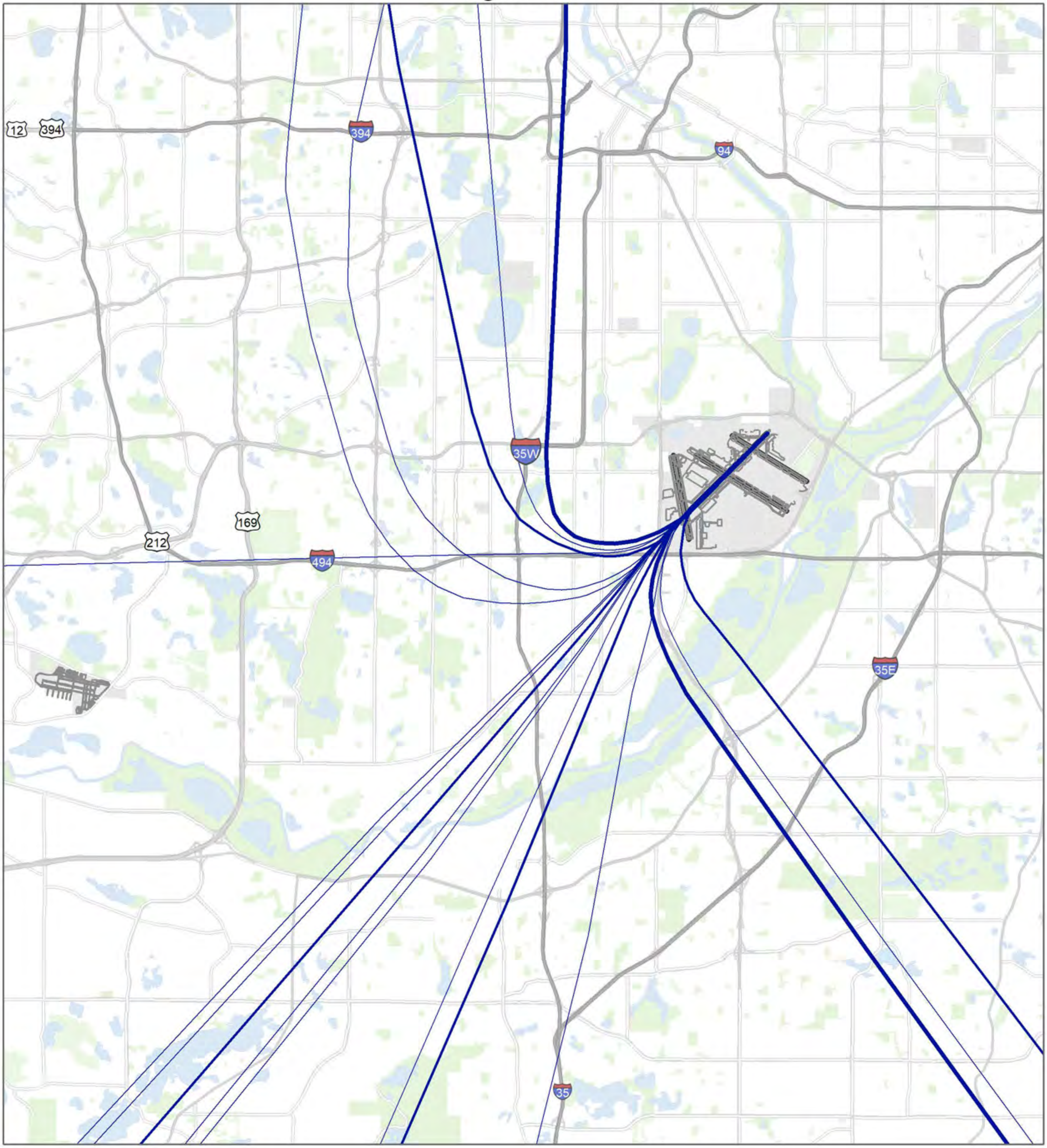
< 5%
10 - 20%
30 - 50%
5 - 10%
20 - 30%
> 50%

0 1.75 3.5 7 Miles

2019 AEDT TRACKS - DEPARTURE RUNWAY 22

Overall Use Percentage

Figure 2.13



AEDT Track Use Percentage

< 5% 10 - 20% 30 - 50%

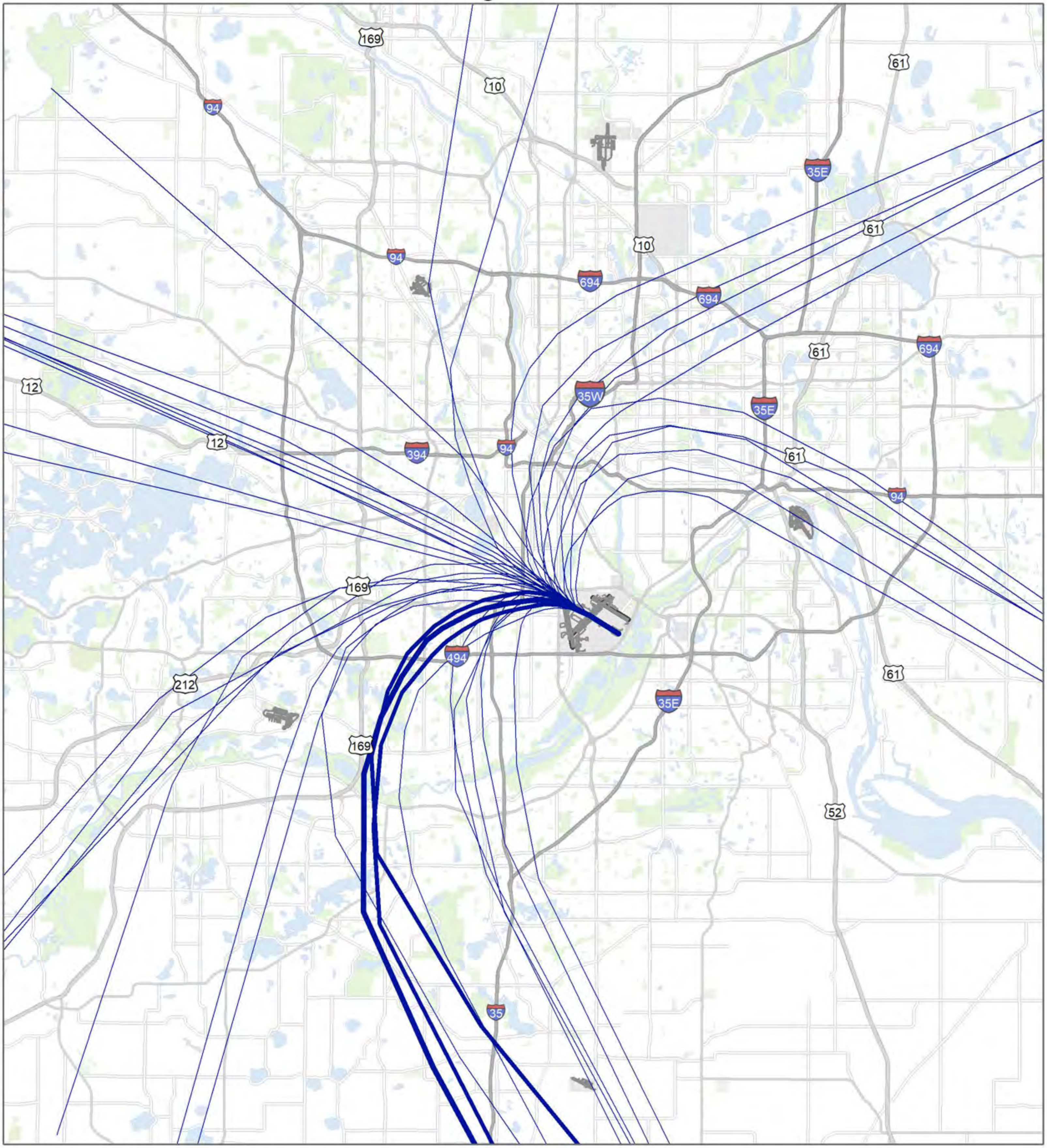
5 - 10% 20 - 30% > 50%

0 1.25 2.5 5 Miles

2019 AEDT TRACKS - DEPARTURE RUNWAY 30L

Overall Use Percentage

Figure 2.14



AEDT Track Use Percentage

< 5%

5 - 10%

10 - 20%

20 - 30%

30 - 50%

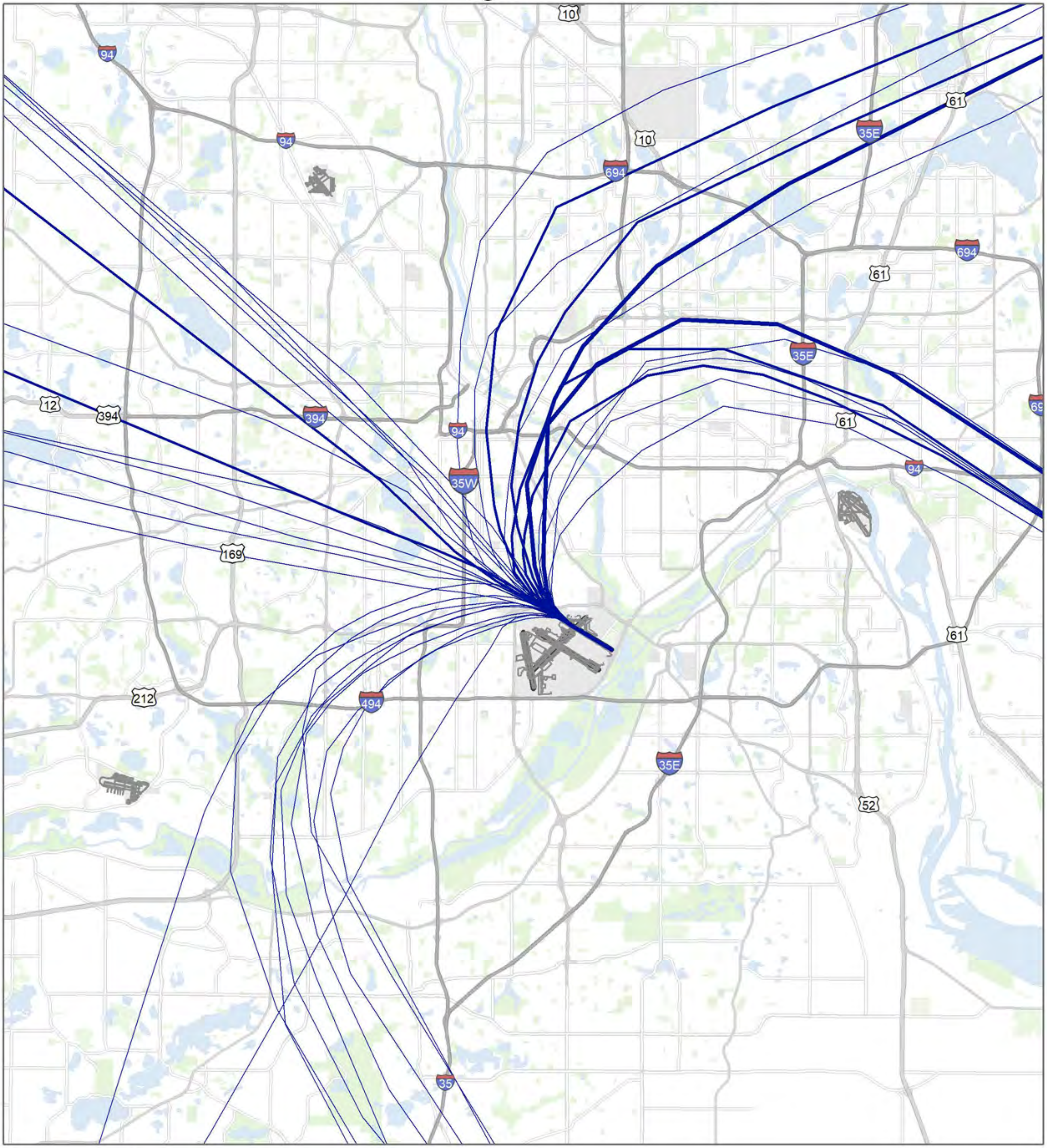
> 50%

0 3 6 12 Miles

2019 AEDT TRACKS - DEPARTURE RUNWAY 30R

Overall Use Percentage

Figure 2.15



AEDT Track Use Percentage

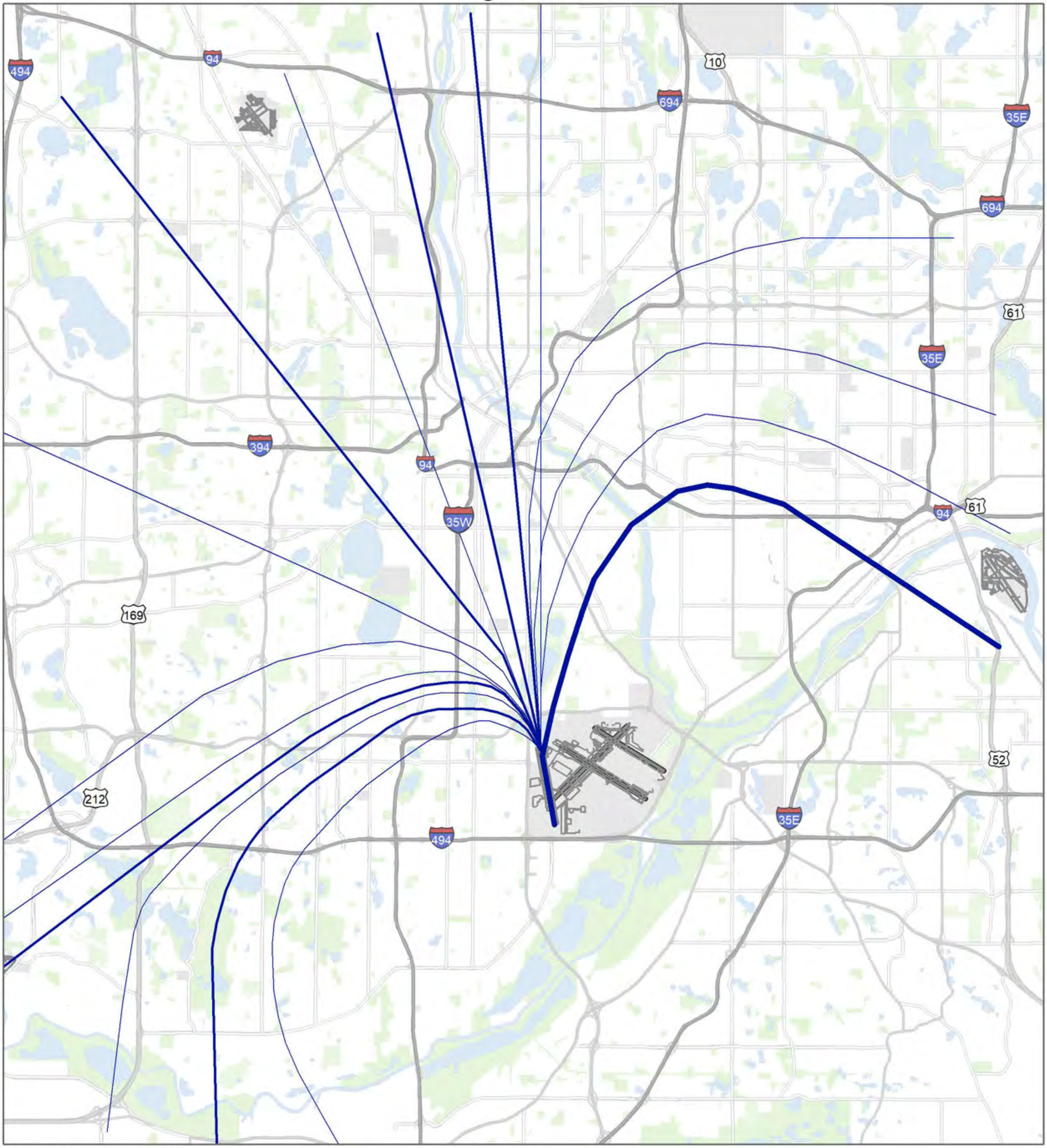
< 5%
5 - 10%
10 - 20%
20 - 30%
30 - 50%
> 50%

0 2 4 8 Miles

2019 AEDT TRACKS - DEPARTURE RUNWAY 35

Overall Use Percentage

Figure 2.16



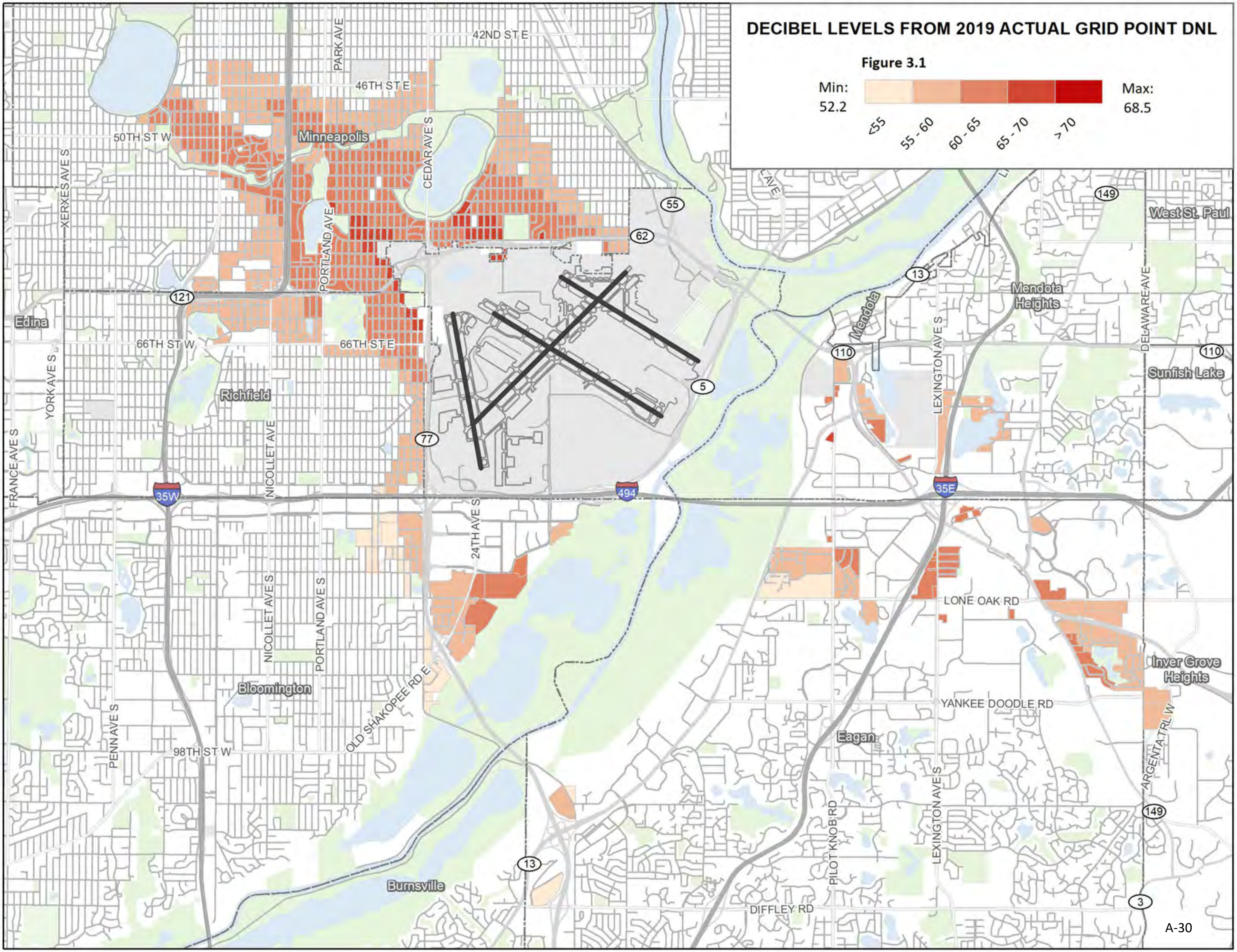
AEDT Track Use Percentage

< 5% | 10 - 20% | 30 - 50%

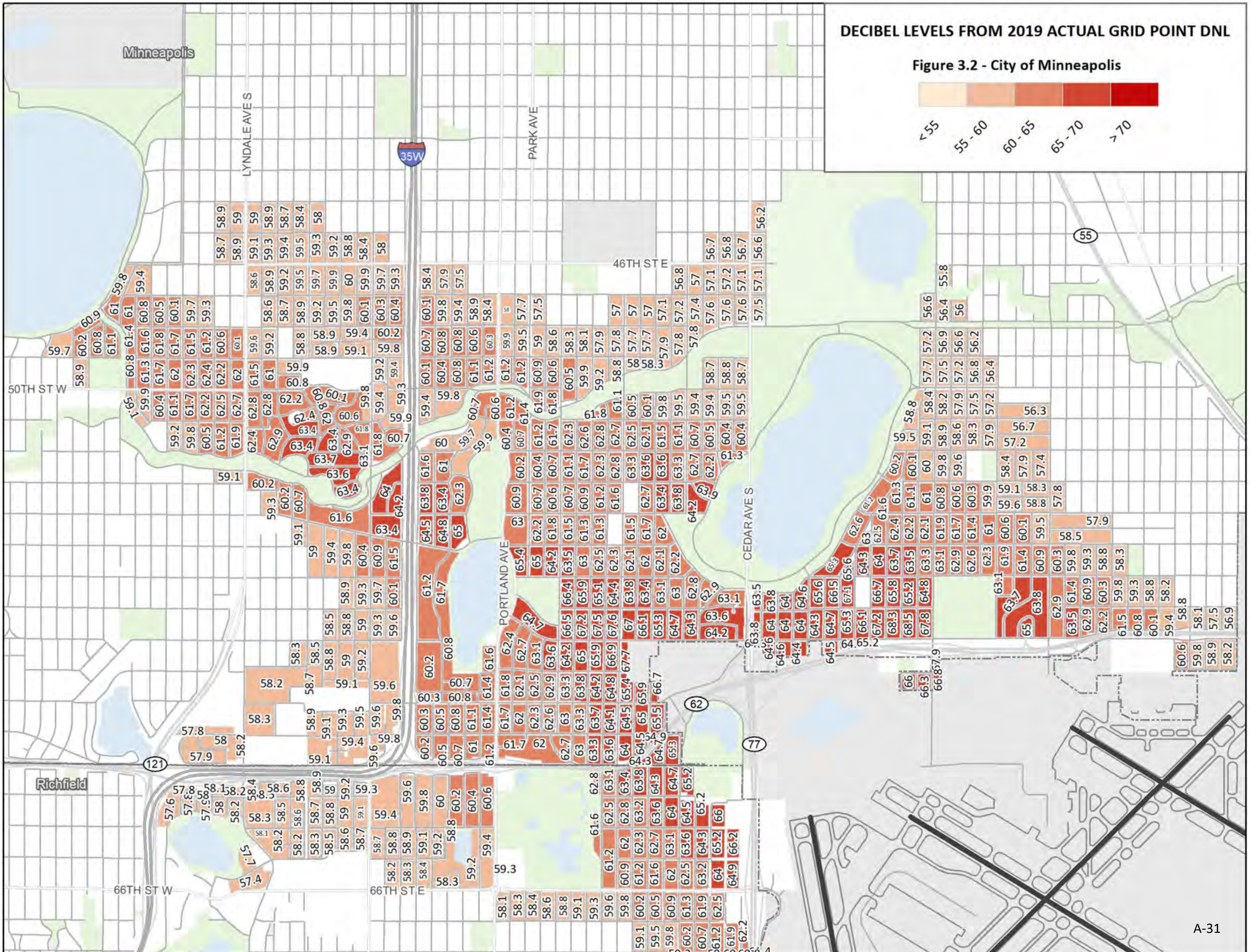
5 - 10% | 20 - 30% | > 50%

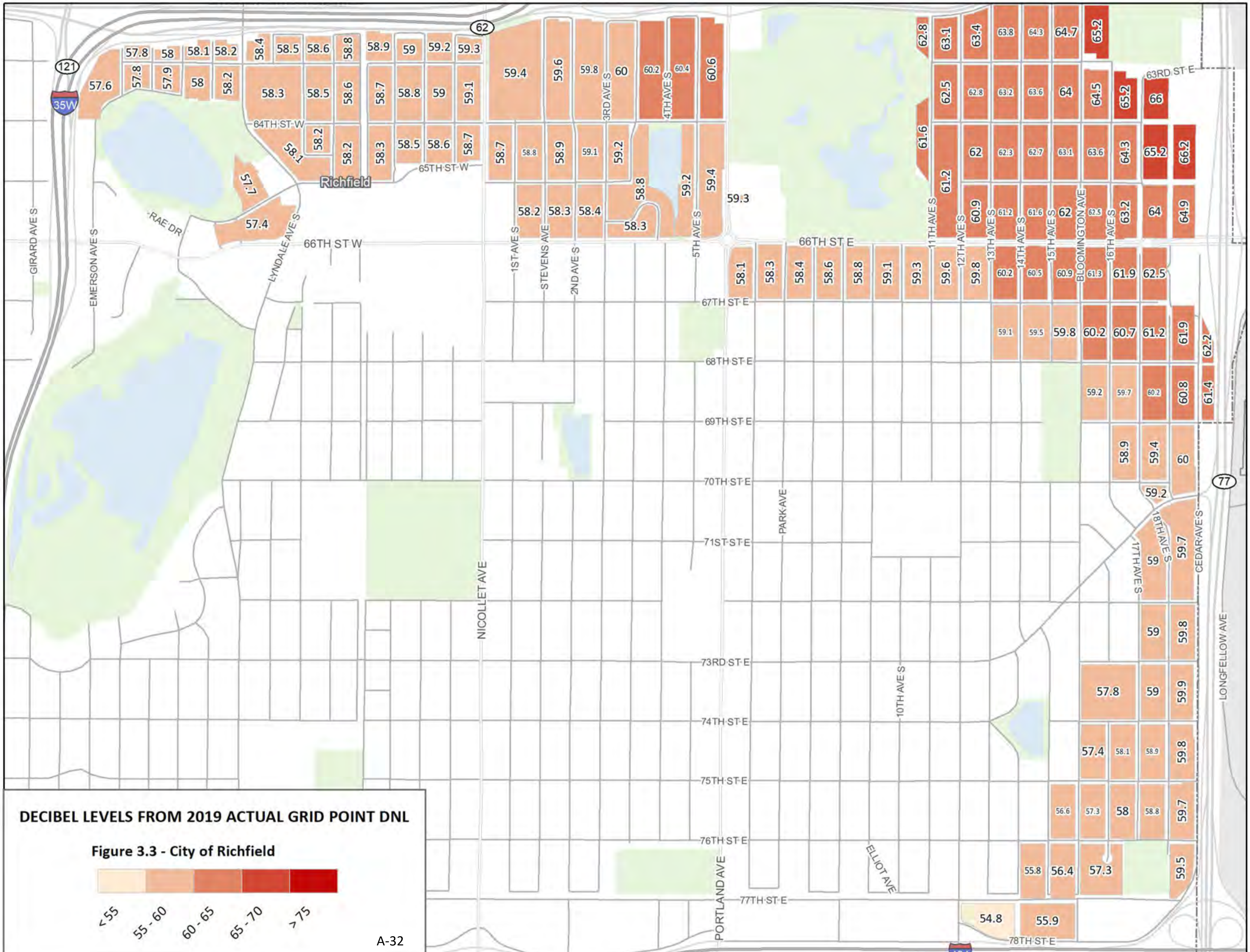
0 1.5 3 6 Miles

Appendix 3: Noise Model Grid Point Maps



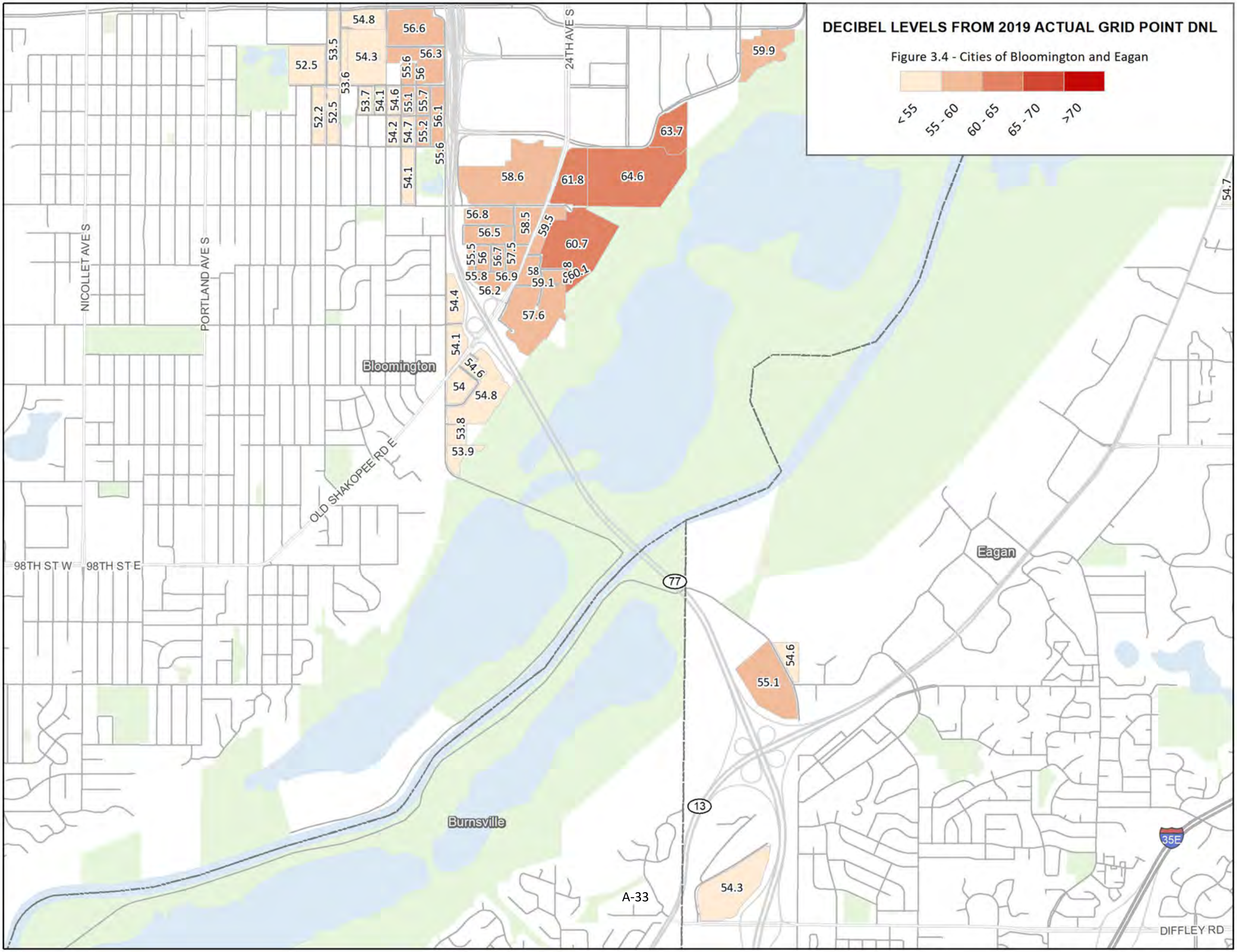
DECIBEL LEVELS FROM 2019 ACTUAL GRID POINT DNL
Figure 3.1
Min:
52.2
<55
55 - 60
60 - 65
65 - 70
> 70
Max:
68.5
42ND ST E
PARK AVE
46TH ST E
50TH ST W
Minneapolis
CEDAR AVE S
XERXES AVE S
PORTLAND AVE
55
62
149
West St. Paul
13
Mendota Heights
Mendota
121
Edina
66TH ST W
66TH ST E
110
Sunfish Lake
LEXINGTON AVE S
DELAWARE AVE
5
Richfield
YORK AVE S
77
NICOLLET AVE
FRANCE AVE S
35W
494
35E
24TH AVE S
LONE OAK RD
NICOLLET AVE S
PORTLAND AVE S
Inver Grove Heights
Bloomington
OLD SHAKOPEE RD E
YANKEE DOODLE RD
PENN AVE S
98TH ST W
Eagan
ARGENTA TRL W
PILOT KNOB RD
Burnsville
DIFFLEY RD
3


DECIBEL LEVELS FROM 2019 ACTUAL GRID POINT DNL
Figure 3.2 - City of Minneapolis
<55
55 - 60
60 - 65
65 - 70
>70
Minneapolis
Richfield
LYNDALE AVE S
PARK AVE
PORTLAND AVE
CEDAR AVE S
46TH ST E
50TH ST W
66TH ST W
66TH ST E
35W
55
62
77
121



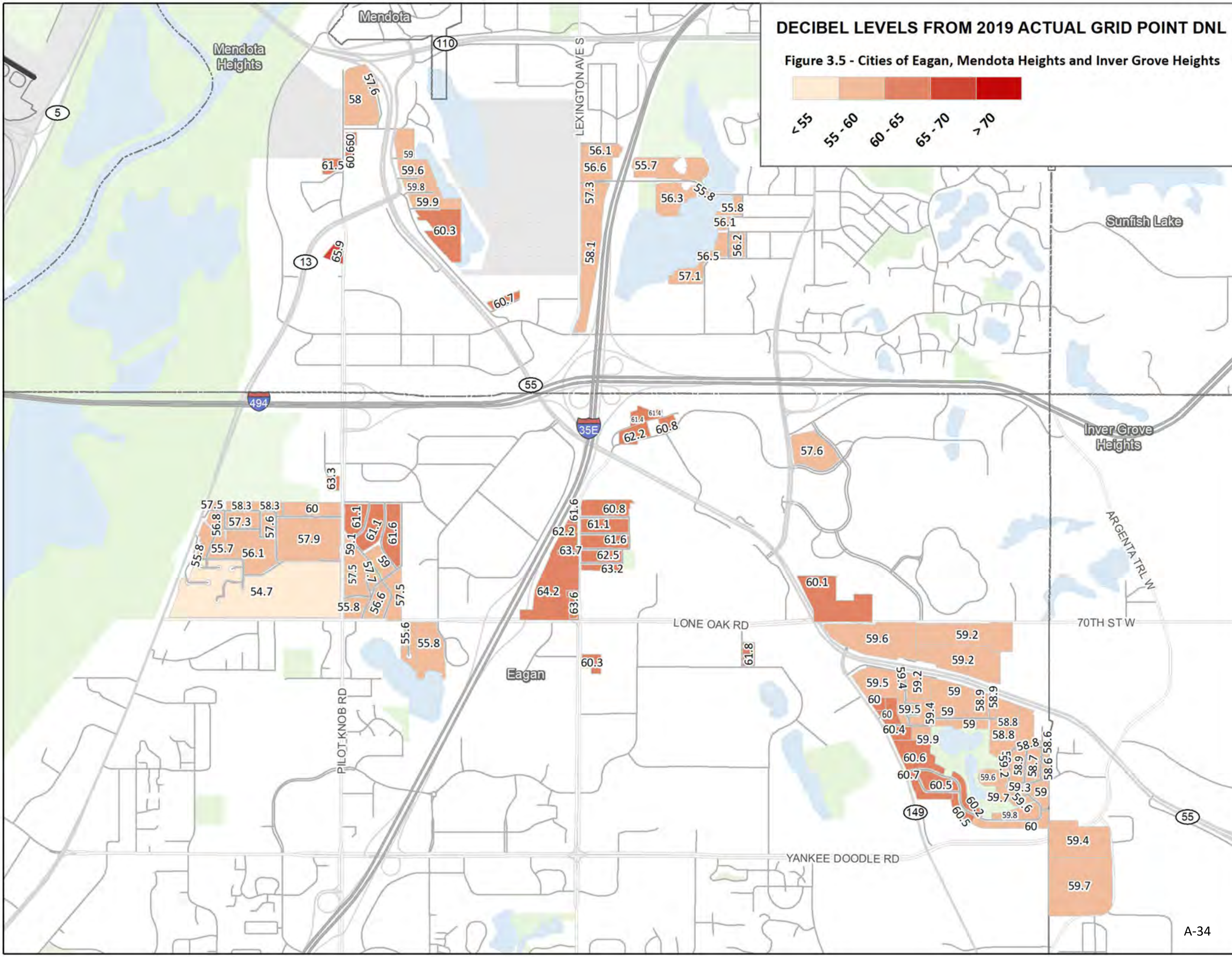
DECIBEL LEVELS FROM 2019 ACTUAL GRID POINT DNL

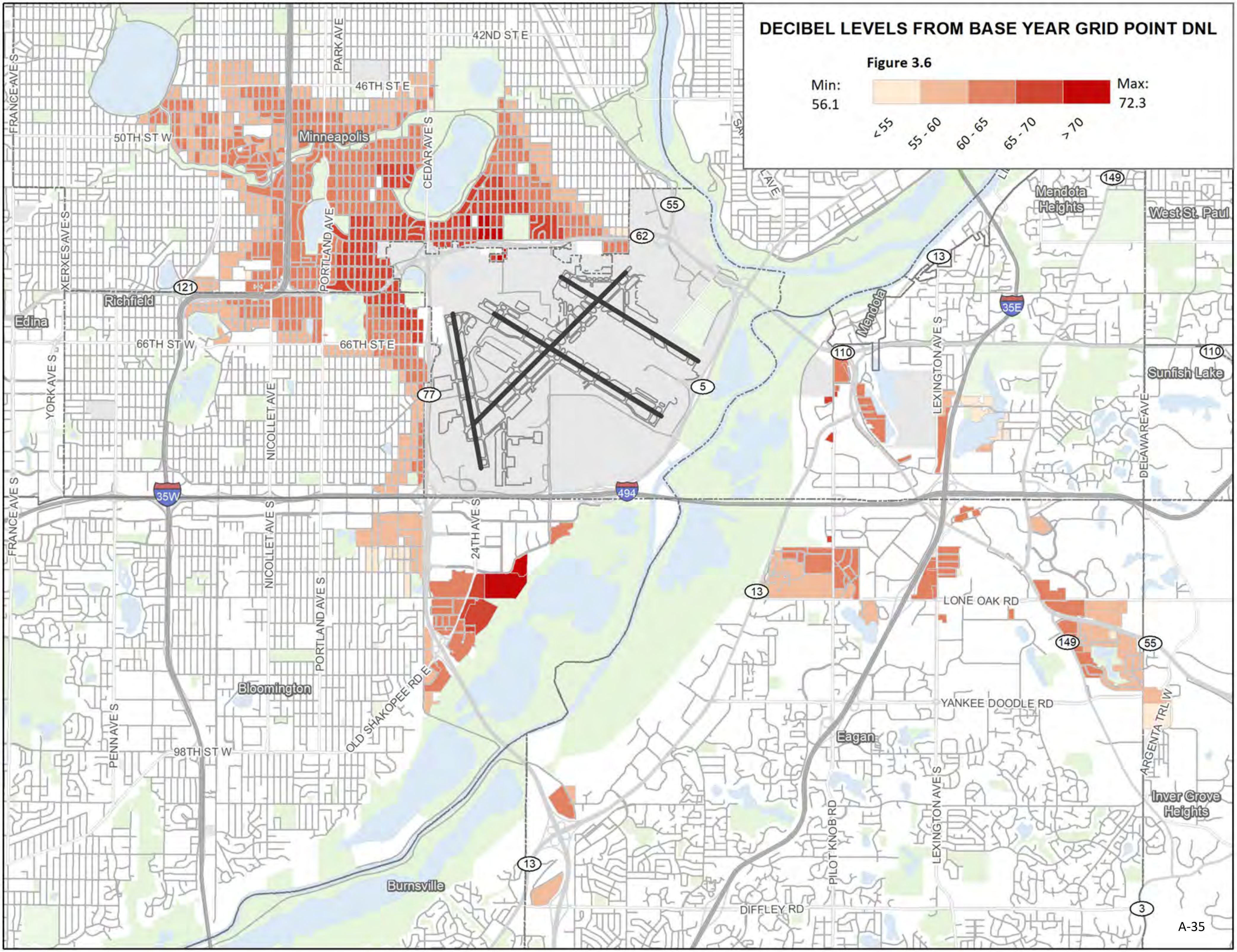
Figure 3.3 - City of Richfield

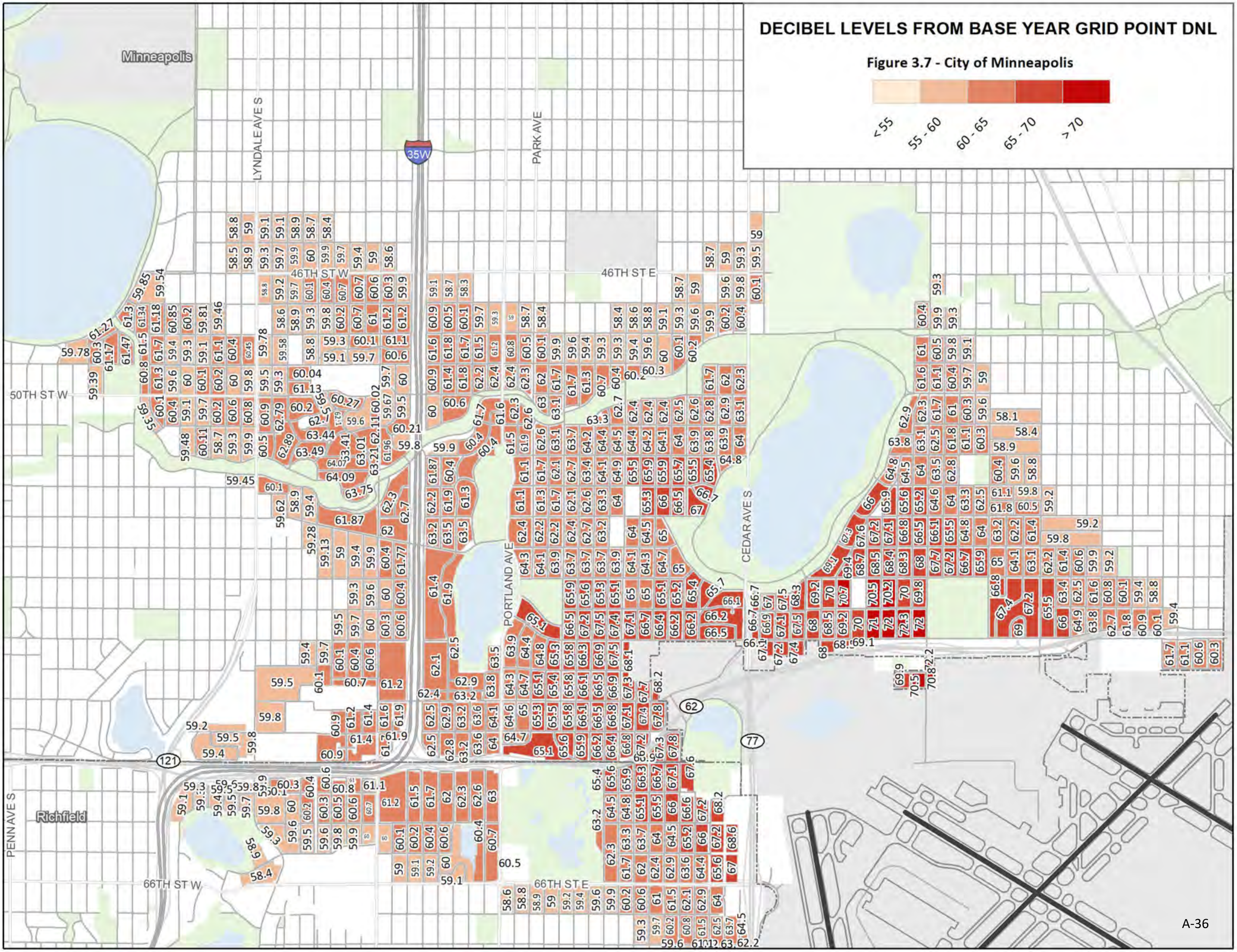

DECIBEL LEVELS FROM 2019 ACTUAL GRID POINT DNL
Figure 3.4 - Cities of Bloomington and Eagan
<55
55 - 60
60 - 65
65 - 70
>70
24TH AVE S
NICOLLET AVE S
PORTLAND AVE S
OLD SHAKOPEE RD E
98TH ST W
98TH ST E
DIFFLEY RD
Bloomington
Eagan
Burnsville
77
13
35E
54.8
56.6
52.5
53.5
54.3
56.3
53.6
55.6
56
59.9
52.2
52.5
53.7
54.1
54.6
55.1
55.7
56.1
54.2
54.7
55.2
55.6
63.7
54.1
58.6
61.8
64.6
54.7
56.8
58.5
59.5
56.5
60.7
55.5
56
56.7
57.5
55.8
56.9
58
60.1
59.1
56.2
54.4
57.6
54.1
54.6
54
54.8
53.8
53.9
54.6
55.1
54.3

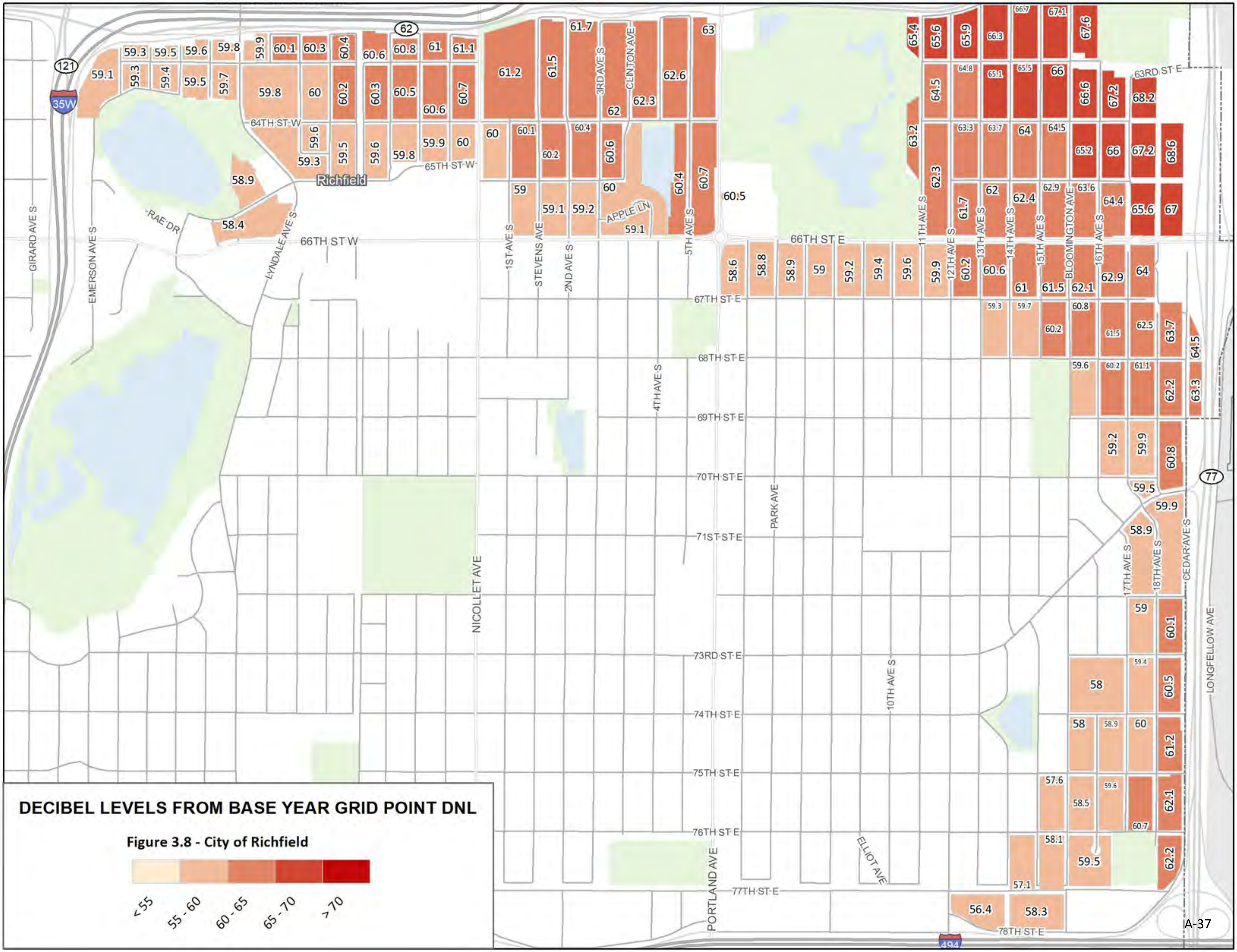
DECIBEL LEVELS FROM 2019 ACTUAL GRID POINT DNL

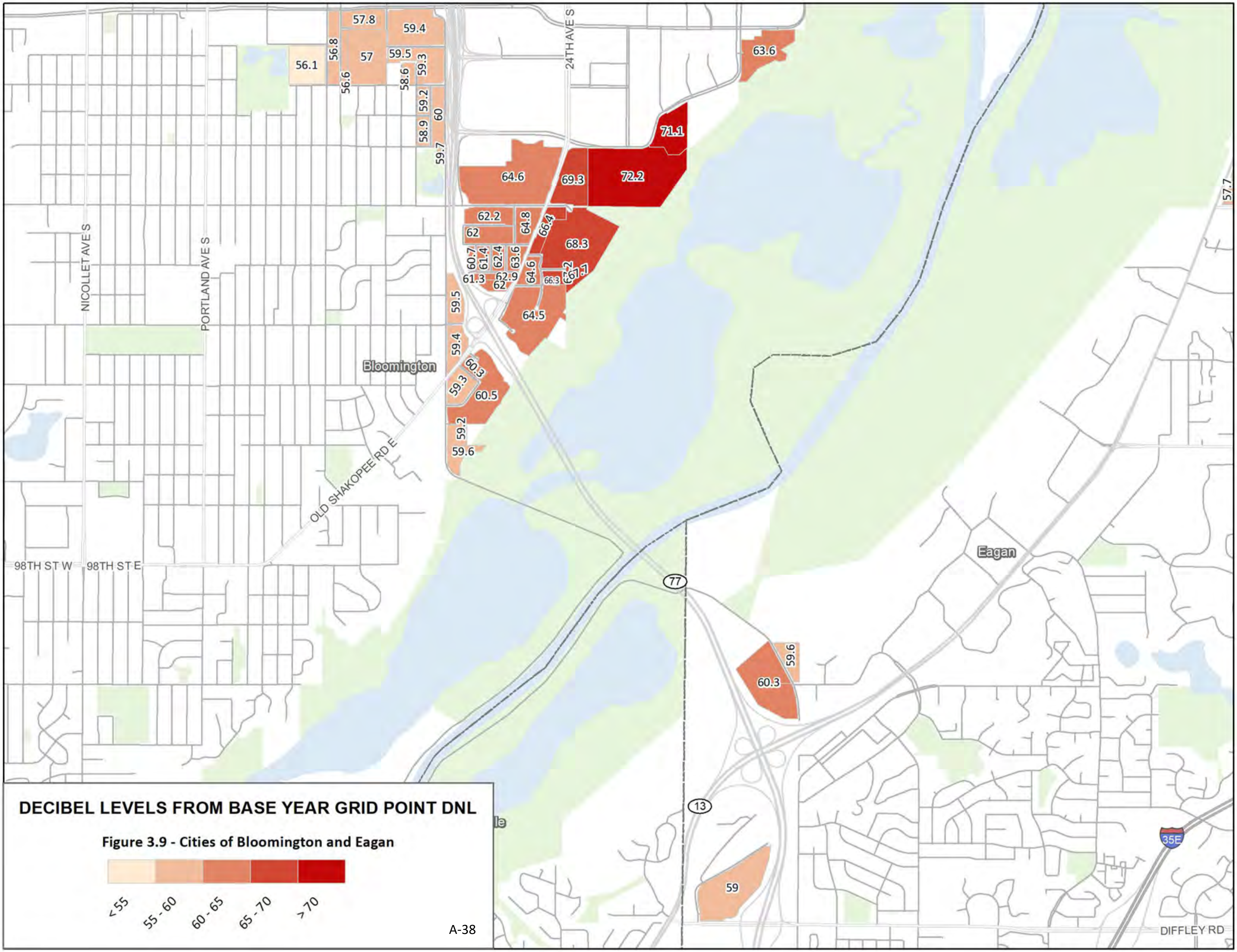
Figure 3.5 - Cities of Eagan, Mendota Heights and Inver Grove Heights




DECIBEL LEVELS FROM BASE YEAR GRID POINT DNL
Figure 3.6
Min:
56.1
Max:
72.3
<55
55 - 60
60 - 65
65 - 70
>70
Minneapolis
Richfield
Edina
Bloomington
Burnsville
Eagan
Mendota Heights
Mendota
West St. Paul
Sunfish Lake
Inver Grove Heights
42ND ST E
46TH ST E
50TH ST W
66TH ST W
66TH ST E
98TH ST W
FRANCE AVE S
XERXES AVE S
YORK AVE S
PENN AVE S
NICOLLET AVE
NICOLLET AVE S
PORTLAND AVE
PORTLAND AVE S
PARK AVE
CEDAR AVE S
24TH AVE S
OLD SHAKOPEE RD E
LEXINGTON AVE S
PILOT KNOB RD
DELAWARE AVE
ARGENTA TRL W
LONE OAK RD
YANKEE DOODLE RD
DIFFLEY RD
35W
35E
494
55
62
121
77
5
13
110
149
3


DECIBEL LEVELS FROM BASE YEAR GRID POINT DNL
Figure 3.7 - City of Minneapolis
<55
55 - 60
60 - 65
65 - 70
>70
Minneapolis
Richfield
LYNDALE AVE S
PARK AVE
PORTLAND AVE
CEDAR AVE S
PENN AVE S
46TH ST W
46TH ST E
50TH ST W
66TH ST W
66TH ST E
35W
62
77
121

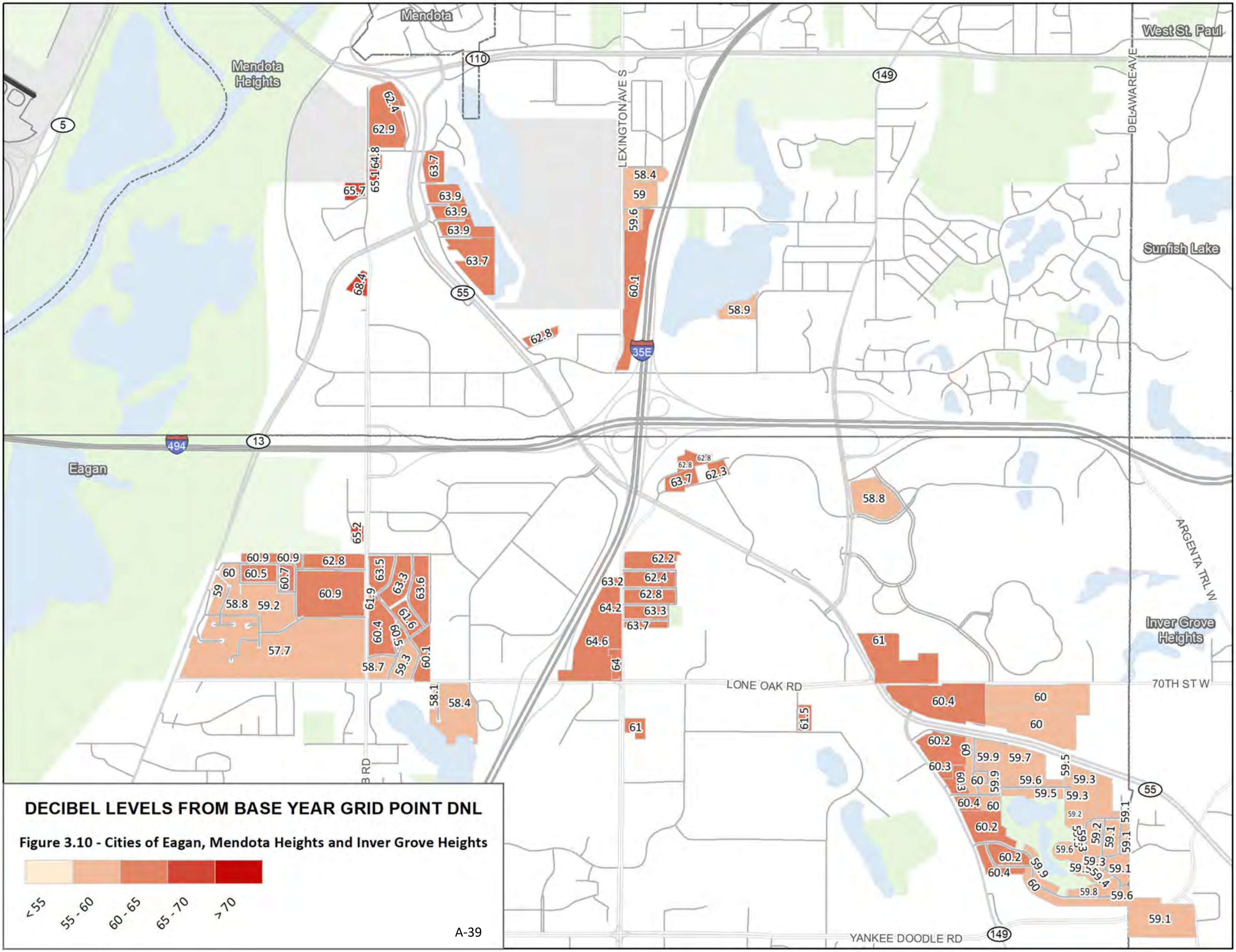

DECIBEL LEVELS FROM BASE YEAR GRID POINT DNL
Figure 3.8 - City of Richfield
< 55
55 - 60
60 - 65
65 - 70
> 70
Richfield
62
121
35W
77
494
63RD ST E
64TH ST W
65TH ST W
RAE DR
66TH ST W
66TH ST E
67TH ST E
68TH ST E
69TH ST E
70TH ST E
71ST ST E
73RD ST E
74TH ST E
75TH ST E
76TH ST E
77TH ST E
78TH ST E
GIRARD AVE S
EMERSON AVE S
LYNDALE AVE S
NICOLLET AVE
1ST AVE S
STEVENS AVE
2ND AVE S
3RD AVE S
CLINTON AVE
APPLE LN
4TH AVE S
5TH AVE S
PORTLAND AVE
PARK AVE
ELLIOT AVE
10TH AVE S
11TH AVE S
12TH AVE S
13TH AVE S
14TH AVE S
15TH AVE S
BLOOMINGTON AVE
16TH AVE S
17TH AVE S
18TH AVE S
CEDAR AVE S
LONGFELLOW AVE



DECIBEL LEVELS FROM BASE YEAR GRID POINT DNL

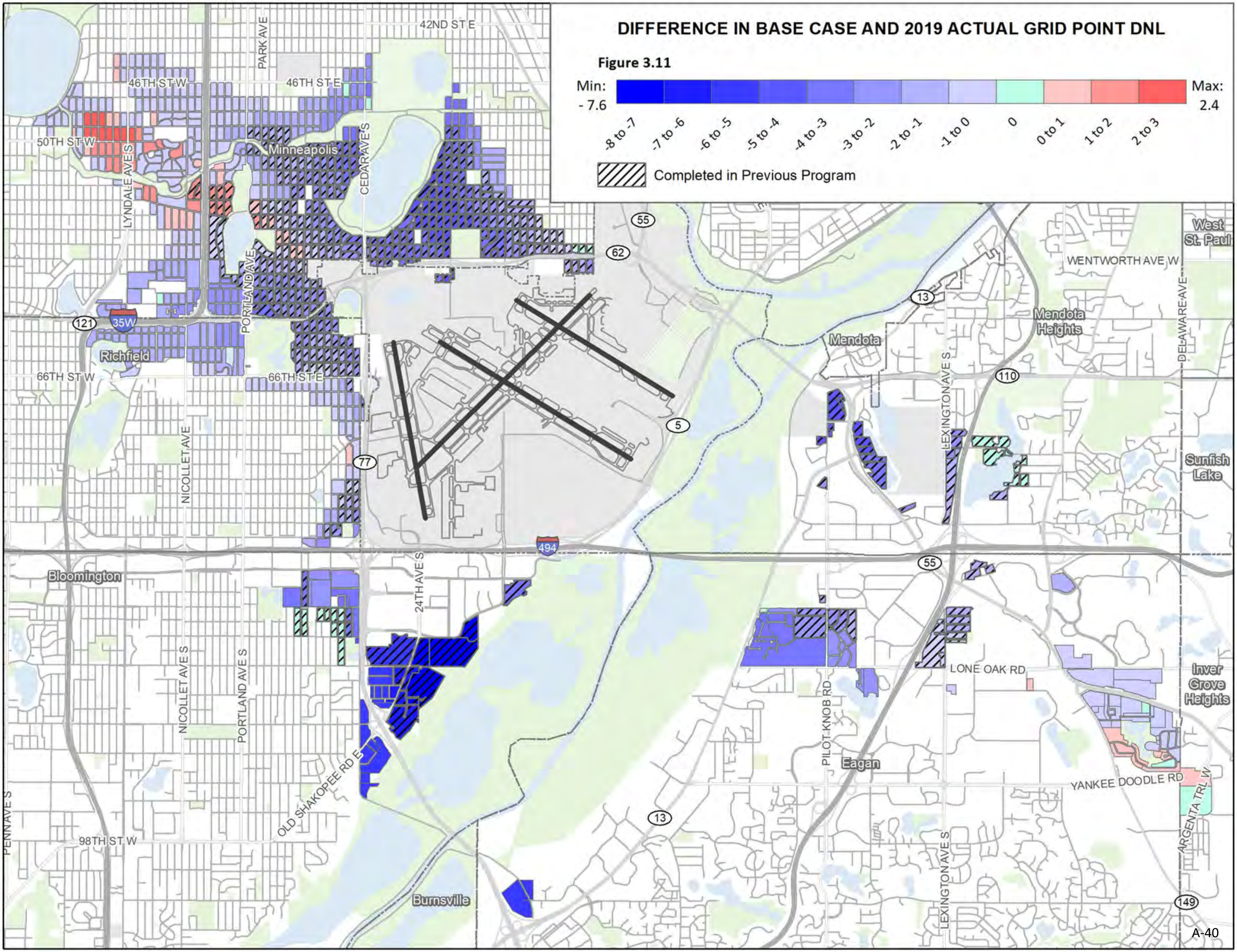
Figure 3.9 - Cities of Bloomington and Eagan

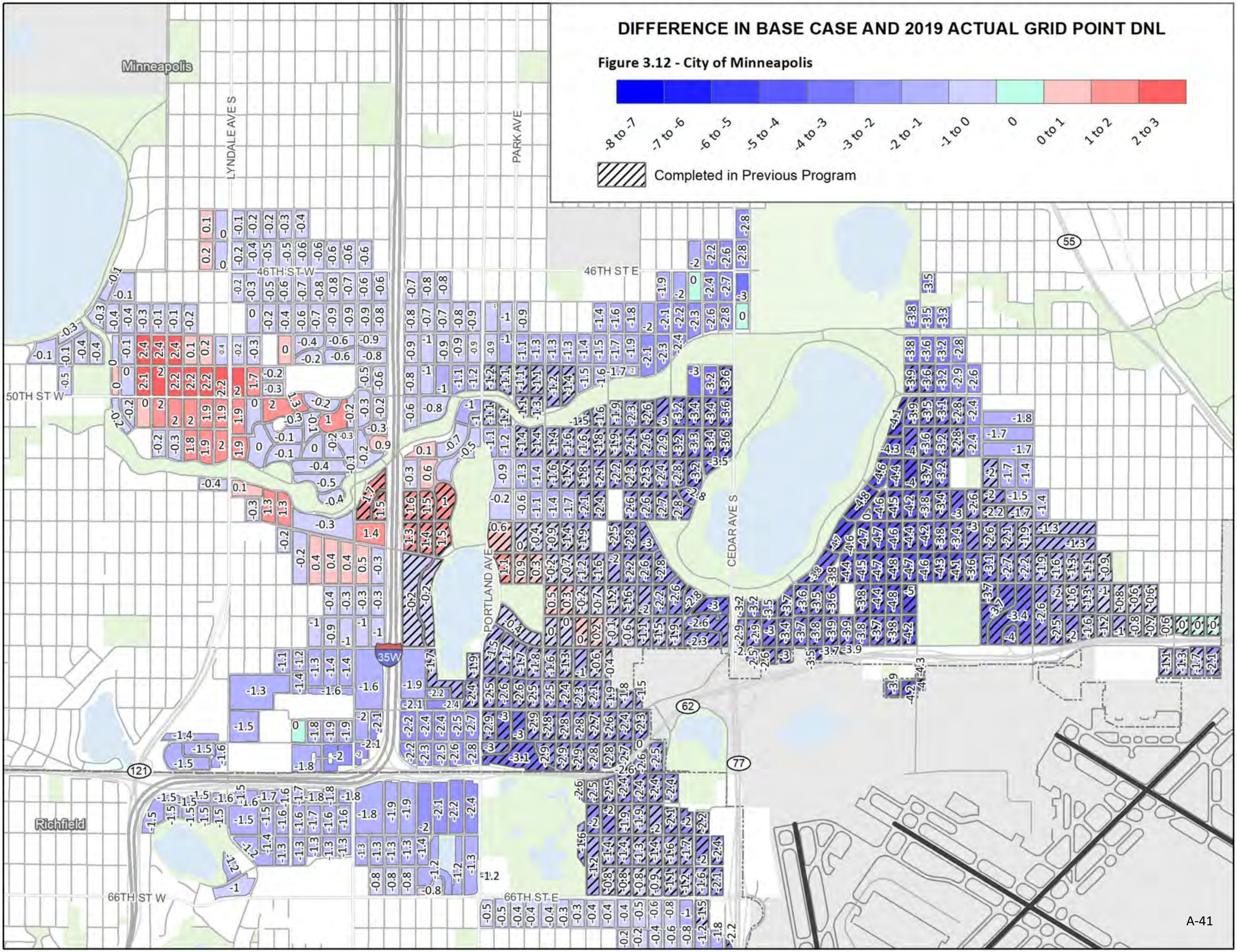
<55 | 55 - 60 | 60 - 65 | 65 - 70 | >70

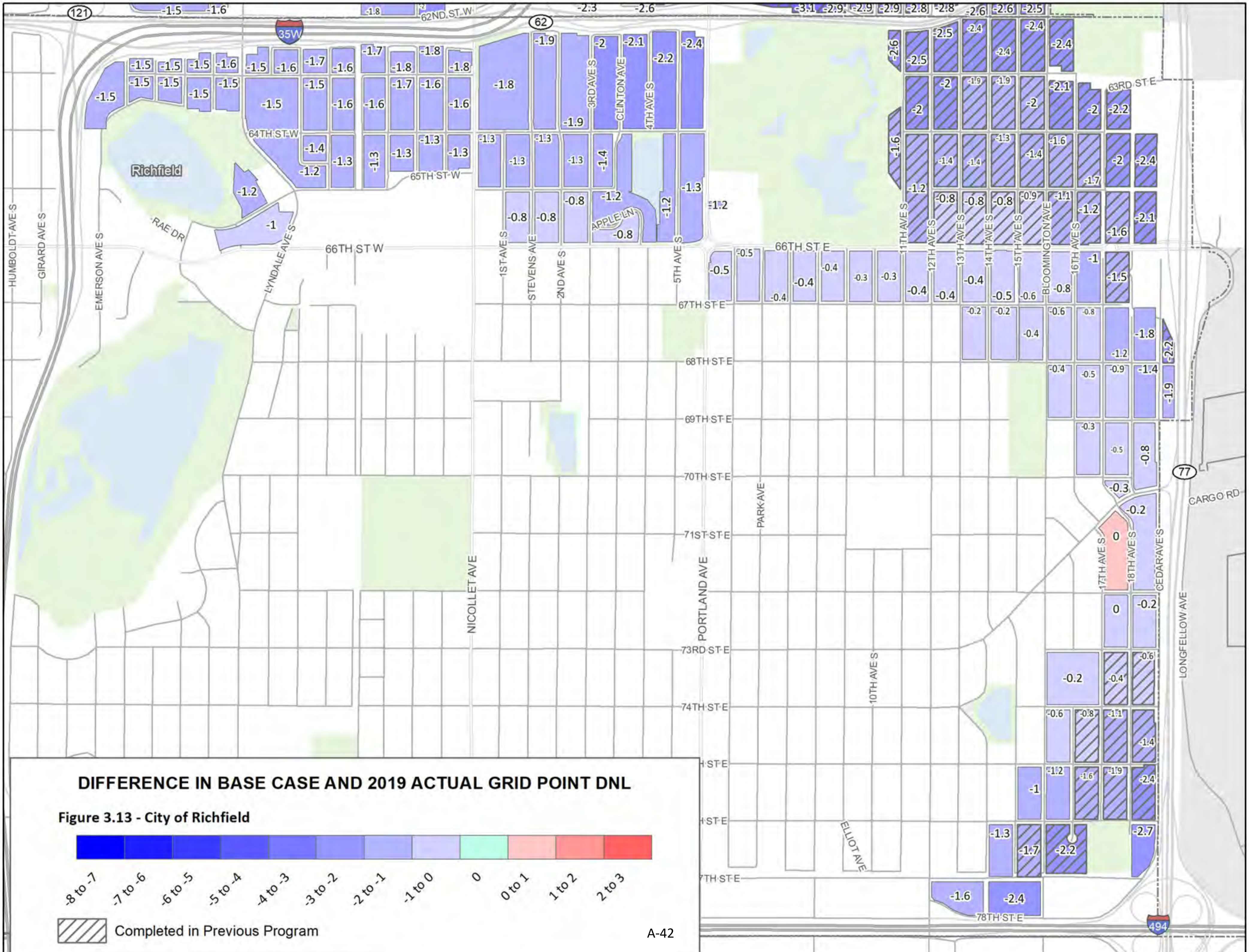


DECIBEL LEVELS FROM BASE YEAR GRID POINT DNL

Figure 3.10 - Cities of Eagan, Mendota Heights and Inver Grove Heights

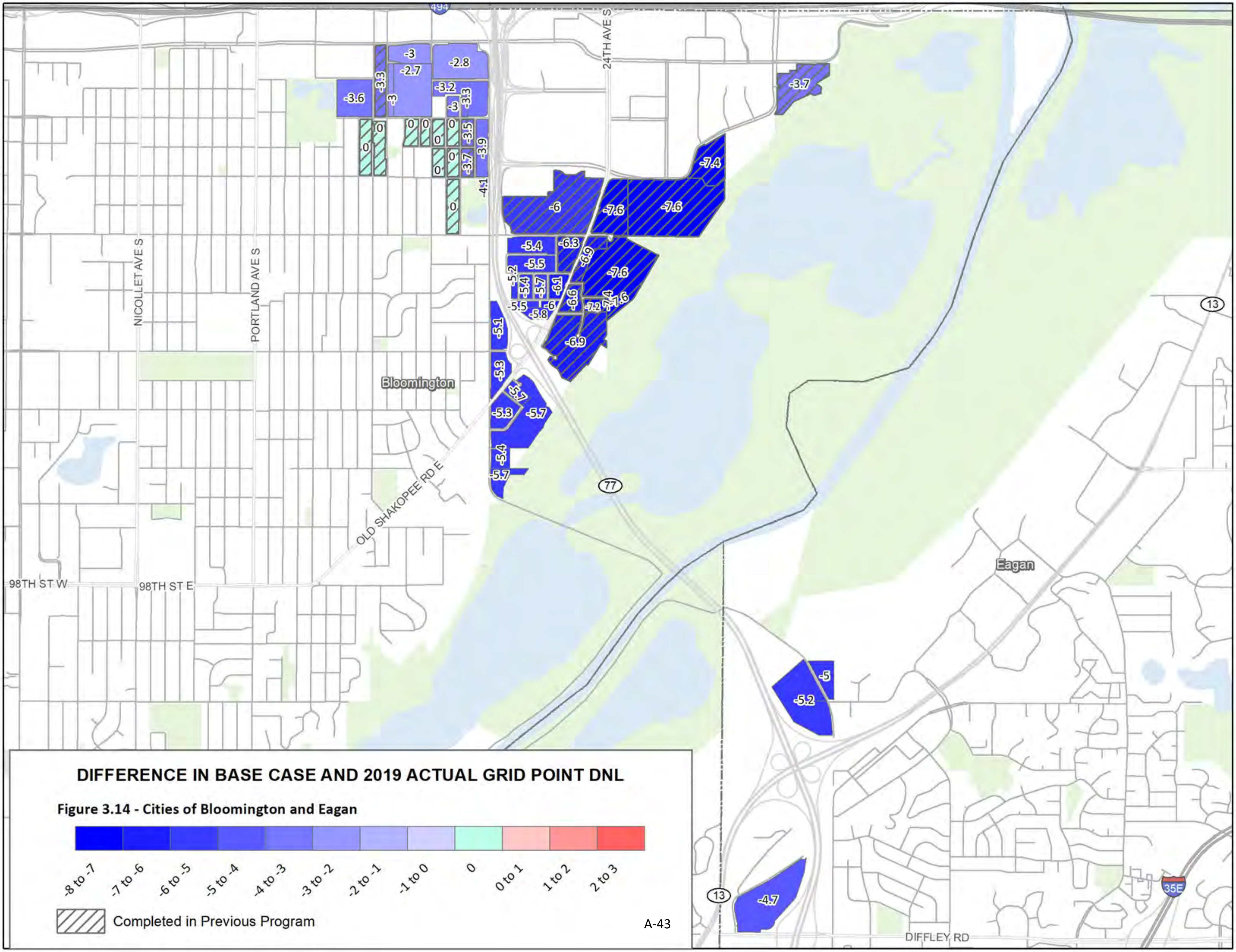

DIFFERENCE IN BASE CASE AND 2019 ACTUAL GRID POINT DNL
Figure 3.11
Min: - 7.6
Max: 2.4
-8 to -7
-7 to -6
-6 to -5
-5 to -4
-4 to -3
-3 to -2
-2 to -1
-1 to 0
0
0 to 1
1 to 2
2 to 3
Completed in Previous Program
42ND ST E
PARK AVE
46TH ST W
46TH ST E
50TH ST W
Minneapolis
CEDAR AVE S
LYNDALE AVE S
PORTLAND AVE
35W
121
Richfield
66TH ST W
66TH ST E
NICOLLET AVE
77
55
62
13
5
110
West St. Paul
WENTWORTH AVE W
Mendota Heights
Mendota
DELAWARE AVE
LEXINGTON AVE S
Sunfish Lake
494
Bloomington
24TH AVE S
NICOLLET AVE S
PORTLAND AVE S
OLD SHAKOPEE RD E
LONE OAK RD
PILOT KNOB RD
Eagan
Inver Grove Heights
YANKEE DOODLE RD
ARGENTA TRL W
PENN AVE S
98TH ST W
Burnsville
149


DIFFERENCE IN BASE CASE AND 2019 ACTUAL GRID POINT DNL
Figure 3.12 - City of Minneapolis
-8 to -7
-7 to -6
-6 to -5
-5 to -4
-4 to -3
-3 to -2
-2 to -1
-1 to 0
0
0 to 1
1 to 2
2 to 3
Completed in Previous Program
Minneapolis
Richfield
LYNDALE AVE S
PARK AVE
PORTLAND AVE
CEDAR AVE S
46TH ST W
46TH ST E
50TH ST W
66TH ST W
66TH ST E
35W
55
62
77
121



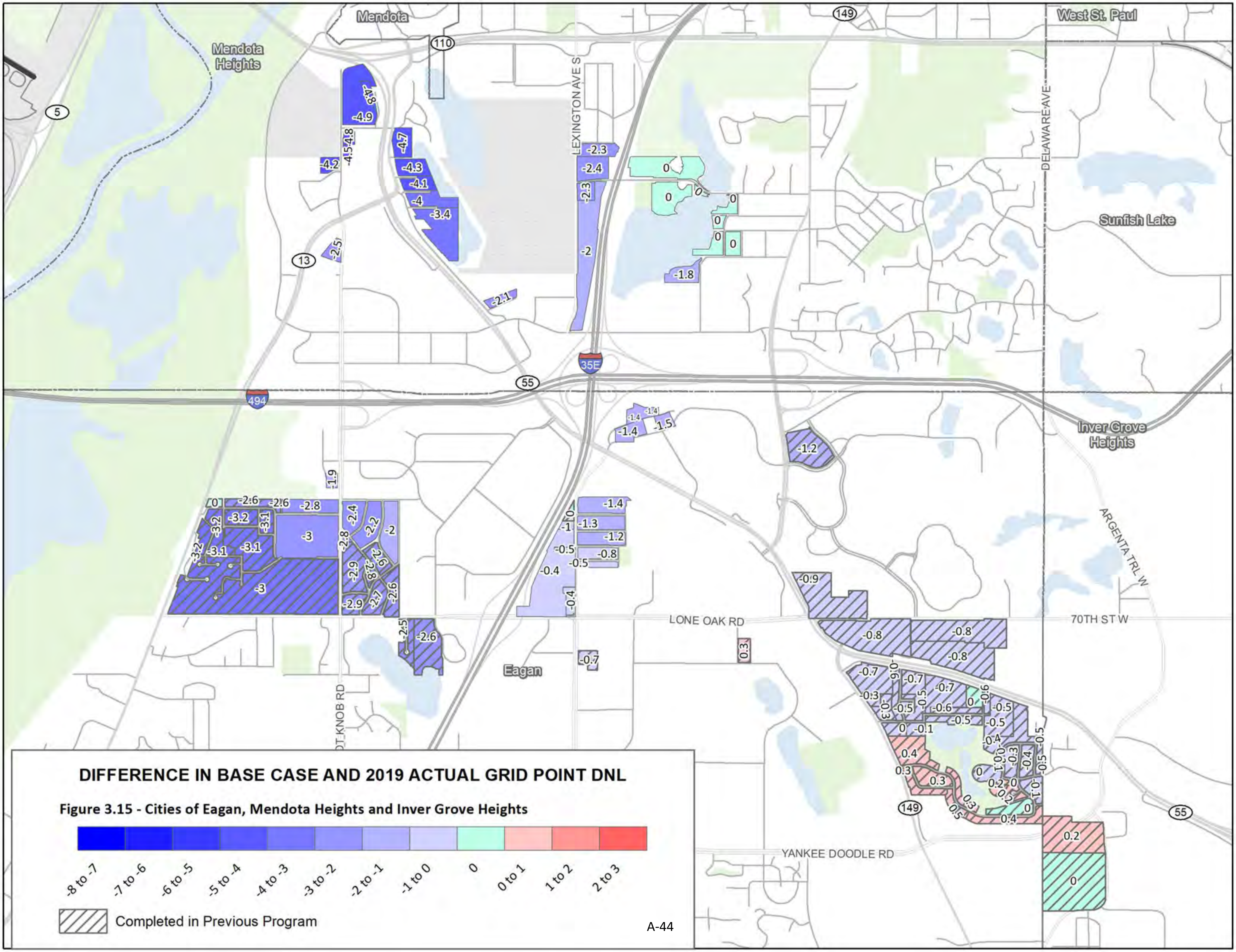
DIFFERENCE IN BASE CASE AND 2019 ACTUAL GRID POINT DNL

Figure 3.13 - City of Richfield



DIFFERENCE IN BASE CASE AND 2019 ACTUAL GRID POINT DNL

Figure 3.14 - Cities of Bloomington and Eagan



DIFFERENCE IN BASE CASE AND 2019 ACTUAL GRID POINT DNL

Figure 3.15 - Cities of Eagan, Mendota Heights and Inver Grove Heights