



Minneapolis-St. Paul International Airport (MSP) Annual Noise Contour Analysis Comparison of the 2015 Actual Noise Contour and the 2007 Forecast Noise Contour

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Executive Summary

Background

The issue of noise at Minneapolis-St. Paul International Airport (MSP) includes a long history of local efforts to quantify and mitigate noise impacts in a manner responsive to concerns raised by the communities around the airport and consistent with federal policy. In 1992, the Metropolitan Airports Commission (MAC) embarked on a 14 CFR Part 150 Program at MSP, which included a noise mitigation program for single-family and multi-family residences and schools, as well as property acquisition and relocation based on mitigation eligibility defined by the 1996 forecast 65 Day-Night Average Sound Level (DNL) noise contour. When the original Part 150 Program was completed in 2006, noise mitigation had been provided to over 7,800 single-family homes, 1,327 multi-family units, 18 schools and 437 residential properties were acquired around MSP at a cost of approximately \$385.6 million.

In 1999 the MAC began an update to the Part 150 Program at MSP. The resulting program used 2007 forecast operations to produce a 2007 forecast noise contour (a 2005 forecast noise contour was also developed as part of this process but was ultimately not used due to the length of the planning process and associated changes in forecasting variables). One of the largest discussion items in the Part 150 Update process focused on the mitigation program the MAC would offer in the 2007 64 to 60 DNL noise contour area. Expansion of noise mitigation efforts beyond the federally-recognized level of 65 DNL was outlined as part of the Dual-Track Airport Planning Process (a process begun in 1989 and concluded in 1998 that examined moving MSP versus expanding it in its current location, undertaken at the direction of the Minnesota State Legislature). Through the Part 150 Update, the MAC detailed a specific mitigation package to be offered in the 64 to 60 DNL noise contour area, proposing central air-conditioning to single-family homes that did not have it, with a homeowner co-pay based on the degree of noise impact.

Airport Noise Litigation and the Consent Decree

The cities located around MSP expressed dissatisfaction with the Part 150 Update 64 to 60 DNL noise mitigation proposal in the context of the Dual-Track Airport Planning Process discussions. In early 2005, the Cities of Minneapolis, Eagan, and Richfield and the Minneapolis Public Housing Authority filed suit in Hennepin County District Court against the MAC on the grounds that the MAC violated environmental quality standards and the Minnesota Environmental Rights Act by failing to provide a 5-decibel noise reduction package (as was provided in the 1996 65 DNL noise contour) to single-family homes in the 64 to 60 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 64 to 60 DNL 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 cities and class action litigation. The 2007

Consent Decree provided the 5-decibel noise mitigation package to single-family homes in the 2007 forecast 63+ DNL noise contours and lesser noise mitigation package options to single family-homes located in the 2007 forecast 63 to 60 DNL noise contours, with a noise mitigation reimbursement option for single-family homes located between the forecast 2007 and 2005 60 DNL noise contours. Multi-family structures were offered a uniform package in the 2007 forecast 60+ DNL noise contours.

All phases of the 2007 Consent Decree noise mitigation program have been completed at a cost of approximately \$95 million. Completion of the 2007 Consent Decree increased the total number of single-family homes that have received noise mitigation around MSP to over 15,000, and multi-family units to 3,303. The total cost of the MAC's noise mitigation programs to date is over \$480 million.

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. A new noise mitigation plan was proposed in the EA/EAW leading to an amendment to the 2007 Consent Decree.

First Amendment to the 2007 Consent Decree

The First Amendment to the 2007 Consent Decree establishes noise mitigation eligibility based on actual noise contours that the MAC prepares for MSP on an annual basis. For a home to be considered eligible for mitigation it must be located in the actual 60+ DNL noise contour, within a higher noise impact mitigation eligibility area when compared to its status relative to the 2007 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 is based on the block intersect methodology. Homes will be mitigated in the year following their eligibility determination. The First Amendment mitigation program eligibility assessment began with the 2013 actual noise contour. In 2014, an additional chapter was added to the 2013 Annual Noise Contour Analysis to assess the mitigation area and eligibility per the amended 2007 Consent Decree. This report marks the third consecutive year of noise mitigation eligibility analysis under the terms of the First Amendment to the 2007 Consent Decree.

Noise Mitigation Eligibility Status under the First Amendment to the 2007 Consent Decree

Based on the 404,374 total operations at MSP in 2015, the actual 60 DNL contour is approximately 37.8 percent smaller than the 2007 forecast contour and the 65 DNL contour is approximately 46.3 percent smaller than the 2007 forecast contour. The predominant contraction in the contours from the 2007 forecast to the 2015 actual noise contour scenario is driven largely by fleet mix changes, including over a 99.9 percent reduction in Modified – “Hushkit” – Stage 3 aircraft operations and a 30.6 percent reduction in total aircraft operations. However, there is a small area in South Minneapolis where the 2015 actual noise contours extend beyond the 2007 forecast noise contours establishing first, second, and third year impacts in certain residential areas above their noise mitigation eligibility impact levels under the terms

of the 2007 Consent Decree. This expansion of noise impacts can largely be attributed to nighttime runway use variances between what was forecasted for 2007 and what actually occurred in 2015, particularly an increase of the nighttime arrival operations on Runway 12R. This same trend existed in 2013 and 2014.

In the third year of actual noise contour mapping, as established by the terms of the First Amendment to the 2007 Consent Decree, there are a total of 483 single-family homes that meet the first-year eligibility criteria of the three consecutive year higher noise impact mitigation eligibility requirement. Of the 483 single-family homes, 72 were previously eligible for the homeowner reimbursement noise mitigation program (located between the 2007 and 2005 forecast 60 DNL contours) and another 177 homes were outside the program, under the terms of the 2007 Consent Decree. These homes are now within the 2015 actual 60-62 DNL noise contour. If these homes remain within the actual 60-62 DNL noise contour for three consecutive years, they will be eligible for one of two mitigation options, as detailed in Section 9.5(b) of the First Amendment to the 2007 Consent Decree. Additionally, there are 234 single-family homes previously in the 60-62 DNL contour under the terms of the 2007 Consent Decree that meet the first year eligibility criteria of the three consecutive year higher noise impact mitigation eligibility requirement within the 63 DNL contour. If these homes remain within the actual 63+ DNL noise contour for three consecutive years, they will be eligible for mitigation upgrades necessary to achieve the 5-decibel noise reduction package.

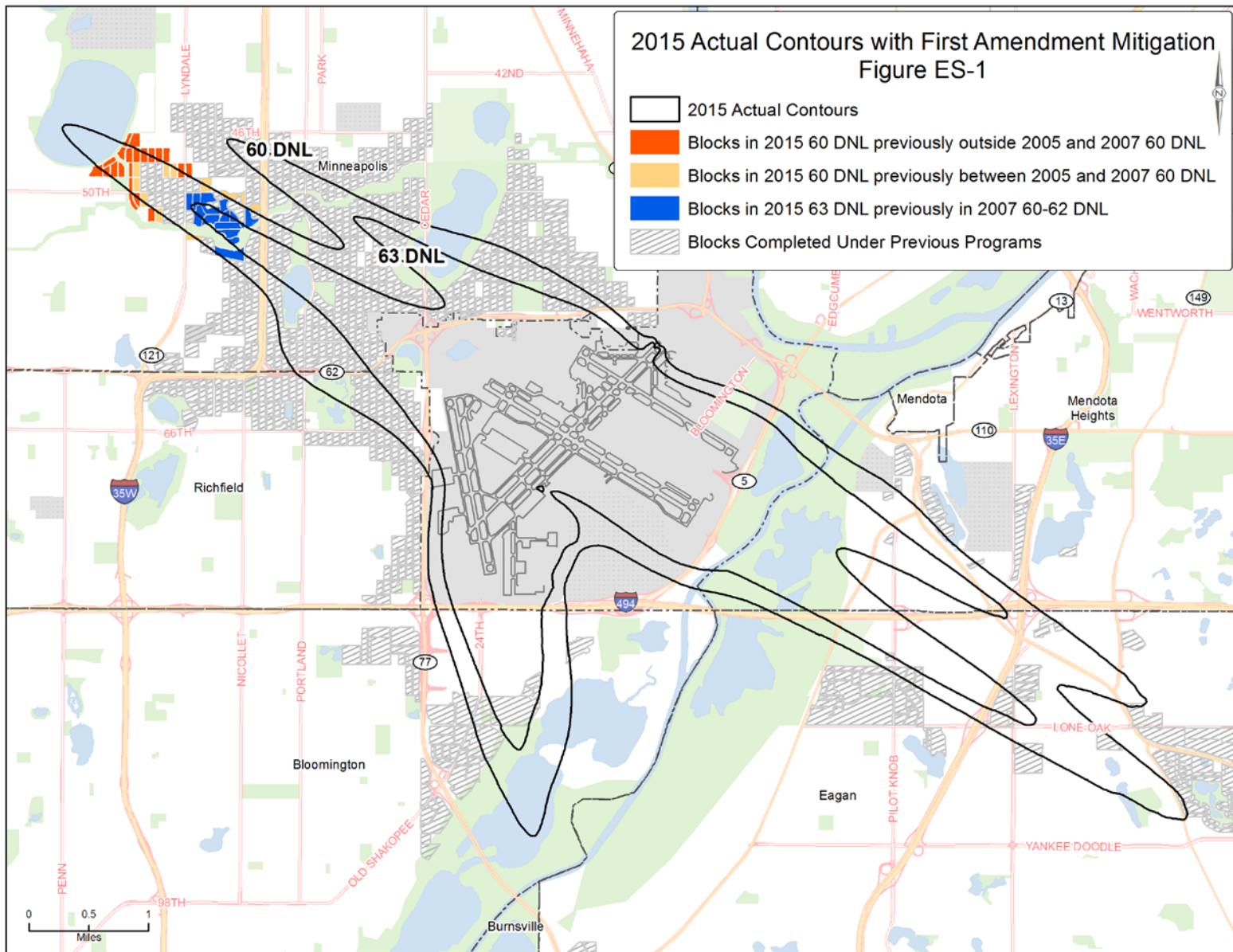
All single-family and multi-family units that met the first year of the higher noise impact mitigation eligibility requirement by virtue of the 2014 actual noise contour achieved a second consecutive year of increased noise impact with the 2015 actual noise contour. There are a total of 285 single-family homes that meet the second consecutive year of higher noise impact. Of the 285 single-family homes, 39 homes were previously eligible for the homeowner reimbursement noise mitigation program (located between the 2007 and 2005 forecast 60 DNL contours) and another 126 homes were previously outside the program and are now within the 2015 60-62 DNL noise contour. If these single-family homes remain within the 60-62 DNL actual noise contour for another year, they will be eligible for one of two mitigation options, as detailed in Section 9.5(b) of the First Amendment to the 2007 Consent Decree. Additionally, there are 120 single-family homes previously in the 60-62 DNL contour under the terms of the 2007 Consent Decree that meet the second year of eligibility within the 63 DNL contour. If these homes remain within the actual 63+ DNL noise contour for three consecutive years, they will be eligible for mitigation upgrades necessary to achieve the 5-decibel noise reduction package.

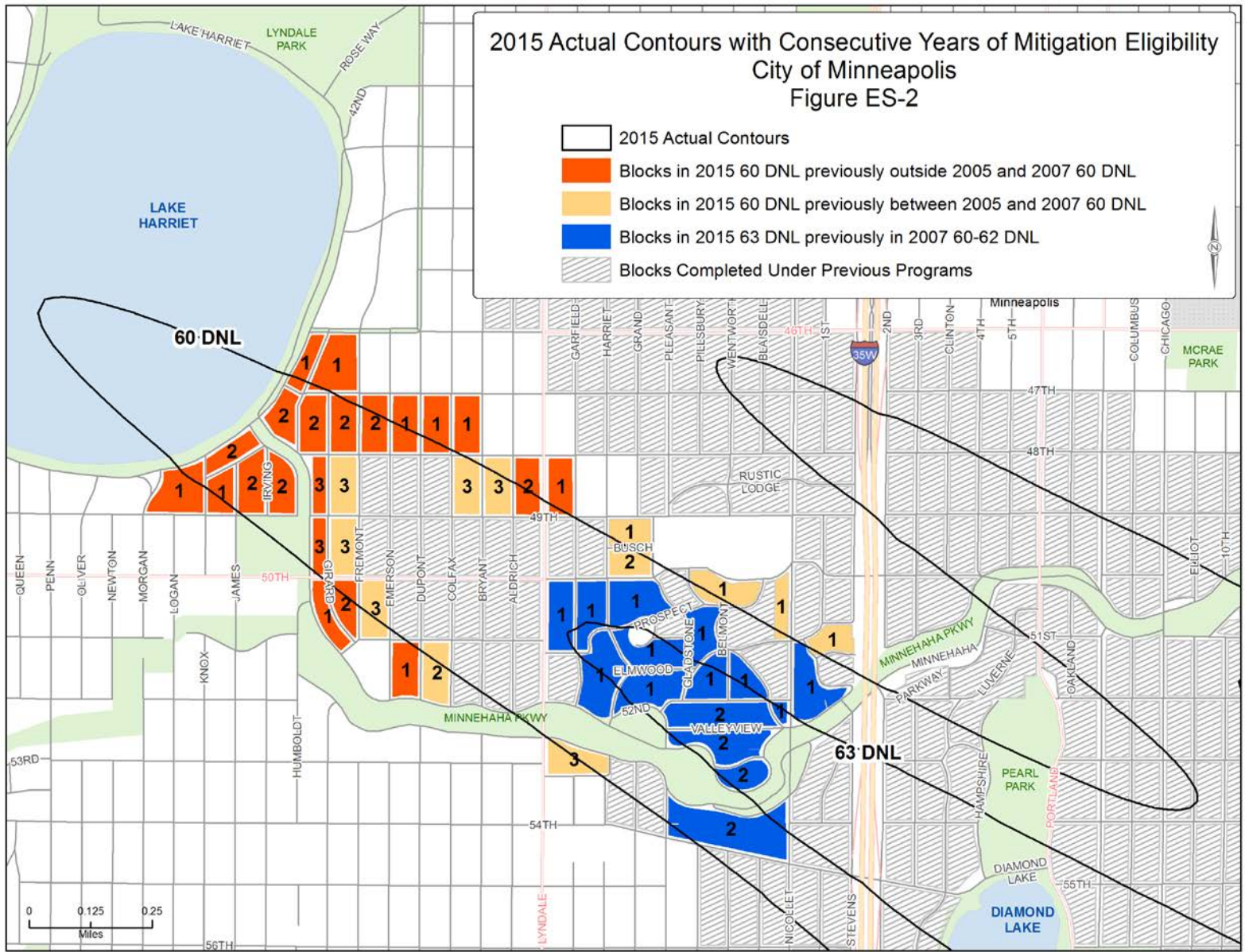
All single-family and multi-family units that met the second year of the higher noise impact mitigation eligibility requirement by virtue of the 2014 actual noise contour achieved a third year of consecutive increased noise impact with the 2015 actual noise contour. There are a total of 137 single-family homes and 88 multi-family units that meet the third consecutive year of higher noise impact. Of the 137 single-family homes, 119 homes were previously eligible for the homeowner reimbursement noise mitigation program (located between the 2007 and 2005 forecast 60 DNL contours) and another 18 homes were previously outside the program and are now within the 2015 60-62 DNL noise contour. These single-family homes are eligible for one of two mitigation options, as detailed in Section 9.5(b) of the First Amendment to the 2007 Consent Decree. Additionally, there are 88 multi-family units which were not included in the 2007 Consent Decree noise mitigation program that are located within the 2015 actual 60-64 DNL contours establishing their third consecutive year at a higher noise impact mitigation eligibility level. These

multi-family units are eligible for the Multi-Family Home Mitigation Package as defined in Section 9.6 of the First Amendment to the Consent Decree.

Beginning in 2017, the MAC will offer additional mitigation, based on previous mitigation performed, to single-family homes and multi-family units achieving their third and final year of eligibility by virtue of the 2015 actual noise contour. In cases where homes have received previous reimbursements or mitigation from the MAC, 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.

The blocks meeting the first, second and third consecutive year(s) of higher noise impact mitigation eligibility requirement for increased noise mitigation from the MAC are shown in Figures ES-1 and ES-2.





The issue of noise at Minneapolis-St. Paul International Airport (MSP) includes a long history of local efforts to quantify and mitigate noise impacts in a manner responsive to concerns raised by the communities around the airport and consistent with federal policy. These efforts have resulted in the conceptualization and implementation of many initiatives to reduce noise impacts around MSP. One of the most notable of these initiatives has been the sound insulation program originally implemented under 14 Code of Federal Regulations (C.F.R.) 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). A Part 150 NCP is comprised of two fundamental approaches to addressing noise impacts around an airport: (1) Land Use Measures, and (2) Noise Abatement Measures (operational measures to reduce noise). A key component of Part 150 program planning is the development of a base case Noise Exposure Map (NEM) and a five-year forecast NEM without (unmitigated forecast scenario) and with (forecast mitigated scenario) the recommended operational noise abatement measures. Including operational noise abatement measures is important because how an airport is operated and how aircraft procedures are executed have a direct effect on an airport's noise impact. NEMs are commonly referred to as noise contours. Forecast mitigated noise contours depict the areas that may be eligible for Land Use Measures (compatible land use plans, property acquisition, residential relocation, and sound mitigation) around an airport.

Recognizing the need for increased infrastructure and the emerging importance of noise issues as operations at MSP increased, the Metropolitan Airports Commission (MAC) submitted its first MSP Part 150 Study to the Federal Aviation Administration (FAA) in October 1987. NEMs were accepted by the FAA in October 1989, and portions of the NCP were approved in April 1990. The NCP included Corrective Land Use Measures which called for the soundproofing of residences, schools and other public buildings. A 1992 update to the NCP and NEM marked the beginning of corrective mitigation measures in the forecast 1996 NEM 65 and greater Day-Night Average Sound Level (DNL) noise contours.

1.1 Corrective Land Use Efforts at MSP to Address Airport 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 to establish 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.

Because testing and evaluation of single-family homes near MSP indicated that the majority of such homes provided an average 30 decibels (dB) of exterior to interior sound attenuation, the MAC developed a “5 dB package” for single-family homes within the 65 DNL and greater noise contours. This package provided an average exterior-to-interior noise reduction level of 5 dB, ensuring a noticeable level of reduction designed to meet the FAA’s target of a 45 DNL interior noise level in each home.¹ The 5 dB package offered a menu of mitigation measures that the MAC might install to achieve an average 5 dB noise reduction and meet the 45 DNL interior noise level in an individual home. The menu of mitigation measures included: windows; prime doors; 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 particular 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. When asked if the modifications improved interior home comfort, at least 95 percent responded yes.

In 2004, the MAC awarded the final bids for the remaining unmitigated homes in the 1996 65 DNL noise contour. In early 2006, the MAC completed the mitigation of an additional 165 single-family homes in the 2007 forecast mitigated 65 DNL noise contour. With the completion of the 165 single-family homes, all eligible and participating homes within the 2007 forecast mitigated 65 DNL contour have been mitigated. This represented a significant accomplishment for an industry-leading airport noise mitigation program. The program resulted in the mitigation of over 7,800 single-family homes in communities around MSP.

The financial investment in the MSP Residential Sound Insulation Program was among the largest in the nation for such programs. Throughout the 14-year project (1992-2006) several variables had an impact on the project’s annual financial profile. Year-to-year variations in housing stock and material costs caused fluctuations in the unit, or per-house, costs. This, combined with variations in annual budgets as a result of challenges such as the terrorist attacks of September 11, 2001, resulted in a fluctuating rate of annual home completions.

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 its 14-year lifespan.

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 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 mitigated 65 DNL noise

¹ FAA, “Guidelines for the Sound Insulation of Residences Exposed to Aircraft Operations,” July 1993.

contour. All eligible and participating multi-family structures within the 2007 forecast mitigated 65 DNL noise contour have been mitigated.

Also, since 1981, the MAC has mitigated 18 schools located around MSP. This total represents all of the schools located within the 1996 65 DNL noise contour. In response to Minnesota State Legislature's directives, the MAC also provided mitigation to certain schools located outside the 1996 65 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 the school sound insulation program.

In addition to the residential and school noise mitigation programs, the MAC implemented a residential property acquisition program that facilitated the relocation of sensitive land uses, such as residential buildings, in noise impact areas. The intent of the residential acquisition program was to address impacted properties in the 1996 65 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 \$93.0 million on the residential property acquisition program.

1.2 2007 Forecast Mitigated Noise 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 and 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 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 base case, 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 previous contour (i.e., November 2001) development process.

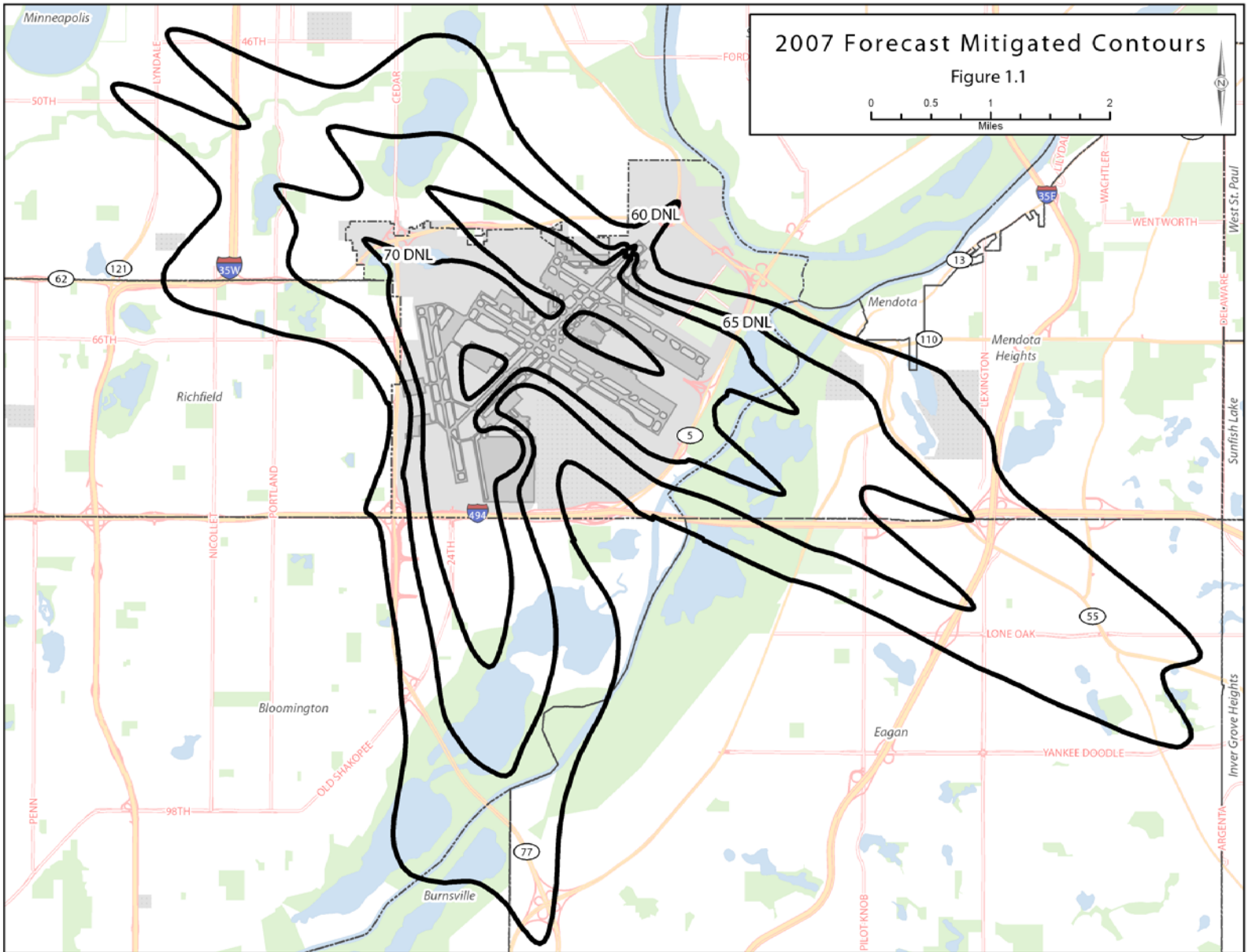
On November 17, 2003, the MAC approved the revised forecast and fleet mix numbers and INM input methodology and data for use in developing the 2002 and 2007 NEMs. In March 2004, the MAC revised the forecast to incorporate certain corrections in general aviation numbers and to reflect Northwest Airlines' announcement that it would resume service of five RJ85 aircraft that had been taken out of service previously.

The 2004 Part 150 Update resulted in a comprehensive Noise Compatibility Program (NCP) recommendation. In addition to several land use measures around MSP, the NCP included provisions for a number of operational Noise Abatement (NA) Measures. The aircraft and airport operational noise abatement initiatives in the 2004 Part 150 Update focused on aircraft operation procedures, runway use,

departure and arrival flight tracks, voluntary operational agreements with the airlines, and provisions for further evaluation of technology.

The MAC has implemented the operational NA Measures outlined in the November 2004 Part 150 Update NCP that are reflected in the 2007 forecast mitigated noise contour included in the 2004 MSP Part 150 Update.

Based on the estimate of 582,366 total operations in the 2007 forecast mitigated scenario, approximately 7,234.4 acres are in the 65 DNL noise contour and approximately 15,708.3 acres are in the 60 DNL noise contour. Since 2014 all eligible and participating homes within the 2007 forecast mitigated 60 DNL noise contour have been mitigated. A depiction of the 2007 forecast mitigated noise contours are provided in Figure 1.1.



1.3 Airport Noise Litigation

One of the largest discussion items in the Part 150 Update process that began in 1999 focused on the mitigation program that the MAC would offer in the 64 to 60 DNL noise contour area. The FAA recognizes sensitive land uses, such as residential land uses eligible for noise mitigation under Part 150, only within the 65 and greater DNL noise contours. 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 DNL noise contour at 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.

Throughout the Part 150 Update process, the intent of the MSP Noise Mitigation Committee's recommendation regarding mitigation outside the 65 DNL contour was a topic of detailed discussion and debate. During the course of the Part 150 Update process the MAC formulated a number of mitigation proposals, culminating in a final MAC position on mitigation outside the 65 DNL contour. In the November 2004 Part 150 Update, the MAC's recommendation for mitigation in the 64 to 60 DNL contours called for providing central air-conditioning to single-family homes that did not have it, with a homeowner co-pay based on the degree of noise impact.

The MAC based eligibility for the mitigation proposal on the 2007 forecast mitigated noise contour using the block intersect methodology. The cities located around MSP expressed dissatisfaction with the MAC proposal, asserting that the MSP Noise Mitigation Committee recommended that the 5 dB package was to be expanded to all properties in the 64 to 60 DNL noise contours. The MAC countered that the MSP Noise Mitigation Committee's recommendations did not specify the mitigation package elements to be offered in the 64 to 60 DNL noise contour area and that, because homes in Minnesota have higher than the national average pre-existing noise attenuation characteristics, the full 5 dB package was not necessary outside the 65 DNL contour.

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 a 5 dB package to single-family homes in the 64 to 60 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 64 to 60 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 5 dB 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 resolving the cities' case and the class action suit.

1.4 Noise Mitigation Settlement and Annual Noise Contour Analysis

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 cities' 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 of these conditions were satisfied, and in 2008 the MAC began implementing single-family and multi-family mitigation out to the 2007 60 DNL noise contours and mitigation reimbursement funds out to the 2005 60 DNL noise contours, as the Consent Decree required. Under the Decree, mitigation activities would vary based on noise contour. Homes in the most noise-impacted contours were eligible for more extensive mitigation than those in less-impacted areas.

The 2007 Consent Decree provided that approximately 457 homes in the 2007 64 to 63 DNL forecast noise contours were eligible to receive the same level of noise mitigation that the MAC provided in the 1996 65 DNL and greater contours. The 2007 64 to 63 DNL noise contour mitigation program was designed to achieve 5 dB of noise reduction on average, with mitigation measures that might include the following, depending upon the home's existing condition: central air-conditioning; exterior and storm window repair or replacement; prime door and storm door repair or replacement; wall and attic insulation; baffling of roof vents and chimney treatment. As required by the Consent Decree, the MAC completed construction of mitigation in the 2007 64 and 63 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 62 to 60 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; and baffling of roof vents and chimney treatment. As required by the Consent Decree, the MAC completed construction of mitigation in the 2007 62 to 60 DNL contours 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 64 and 63 DNL contours and in the 2007 62 to 60 DNL contours whose earlier owners opted out of the previously-completed MAC noise mitigation program for the 1996 65 and greater DNL contours, 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 DNL contour and the 2007 forecast mitigated 60 DNL 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 DNL and 2007 60 DNL contours.

In September 2014, the MAC completed reimbursement claim payments for approved noise mitigation enhancements for a total of 1,773 single-family homes between the 2005 mitigated 60 DNL contour and the 2007 forecast mitigated 60 DNL contour. The total cost of the “opt-in” mitigation and the 2005 mitigated 60 DNL contour reimbursement mitigation program was capped at \$7 million.

With regard to the multi-family noise mitigation program, the MAC installed acoustical covers on the air-conditioners or completed the installation of new air-conditioning units in 1,976 living units marking completion of that program in 2010.

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). With the final MAC payments in September 2014 for noise mitigation reimbursements, all of the phases of the noise mitigation program required under the original Consent Decree have been completed.

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. (Consent Decree Section 8.1, p. 38). 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 and is at least 2 dB in DNL higher than the DNL level for that location in the 2007 mitigated noise contours. The MAC determines future DNL values by using the FAA’s noise modeling software and actual MSP operations data to generate a noise contour reflecting noise conditions at MSP for the prior calendar year. (Consent Decree Section 8.1(d), pp. 38-39.) The MAC must develop a noise contour reflecting noise conditions for the prior calendar year by March 1 of each year. The MAC has prepared this report to satisfy Section 8.1(d) of the Consent Decree. MAC staff and representatives from the Cities of Minneapolis, Eagan, and Richfield met on February 11 and 20, 2008 to discuss and finalize the annual report format. 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 Environmental Assessment/Environmental Assessment Worksheet (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. Of the several development alternatives examined, Alternative 2-Airlines Relocate was determined to be the Preferred Alternative. This alternative outlined improvements needed to 2020, presuming that the non-SkyTeam airlines currently located in Terminal 1-Lindbergh are relocated to Terminal 2-Humphrey. SkyTeam is an alliance of 20 member airlines, including Delta Air Lines.

As is detailed in the EA/EAW, the Federal Aviation Administration’s (FAA) 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 does not have the potential for significant environmental effects. The forecasted noise contours around MSP are driven by natural traffic growth that is anticipated to occur with or without implementation of the 2020 Improvements.

However, given past noise mitigation activities surrounding MSP, the terms of the 2007 Consent Decree in *City of Minneapolis, et. al. v. Metropolitan Airports Commission*, and local land use compatibility guidelines defined by the Metropolitan Council, many of the public comments on the EA/EAW focused on future noise mitigation efforts. Additionally, the anticipated completion of the Consent Decree 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 Noise Oversight Committee (NOC), began the process of developing a noise mitigation plan to be included in the EA/EAW. The resulting recommended noise mitigation program established that noise mitigation program eligibility be based upon actual noise contours that the MAC would prepare for MSP on an annual basis. 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 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 in the actual 60+ 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 Finding of No Significant Impact/Record of Decision (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, on page 15 of the approved FONSI/ROD, 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 DNL noise contour when comparing the No Action Alternative for 2020 and 2025 with the Proposed Action [Preferred Alternative – Airlines Relocate scenario] for the respective years." However, the FAA included a letter dated March 5, 2013, as Attachment D 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.”

This report was updated to provide maps analyzing changes that occur in noise mitigation eligibility as compared to the 2007 Consent Decree, and associated trends relative to consecutive yearly impacts. This information is detailed in Chapter 4.

As discussed previously, Section 8.1(d) of the Consent Decree requires the MAC to prepare, by March 1 of each year, an actual noise contour reflecting the noise conditions around MSP for the prior calendar year. This chapter provides detailed information on the 2015 actual noise contour at MSP.

2.1 2015 Actual Noise Contour Development

2.1.1 Noise Modeling

The availability of federal or airport-generated funds for the purpose of noise mitigation efforts is contingent upon the development of a Noise Exposure Map (noise contours) in a manner consistent with federal criteria. The FAA currently requires use of the Day-Night Average Sound Level (DNL) metric to determine and analyze noise exposure and aid in the determination of aircraft noise and land use compatibility issues around United States airports. The DNL metric is calculated by cumulatively averaging sound levels over a 24-hour period. This average cumulative sound exposure includes the application of a 10-decibel penalty to sound exposures occurring during the nighttime (10:00 PM to 7:00 AM). The night sound exposures are increased by 10 decibels to account for relatively low nighttime ambient noise levels and because most people are asleep during these hours.

The most recent version of the FAA's Integrated Noise Model (INM), version 7.0d, was used to develop the 2015 Actual Noise Contours. The INM uses input files consisting of information regarding runway use, flight track use, aircraft fleet mix, aircraft performance and thrust settings, topography information, and atmospheric conditions to generate noise contours depicting an annualized average day of aircraft noise impacts. Quantifying aircraft-specific noise characteristics in INM is accomplished through the use of a comprehensive noise database that has been developed under the auspices of Federal Aviation Regulation (FAR) Part 36. As part of the airworthiness certification process, aircraft manufacturers are required to subject aircraft to a battery of noise tests. Through the use of 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. The modeled DNL contours are the focal point of any noise mitigation measures and residential parcel eligibility described in the terms of the Consent Decree.

In May 2015, the FAA released the Aviation Environmental Design Tool (AEDT), version 2b, for use in preparing all environmental review documents and Part 150 studies in place of INM going forward. AEDT is a software system that models aircraft performance in time and space to estimate not only noise, using the same algorithms as INM, but also fuel consumption, emissions, and air quality. Upon the release of AEDT, the MAC contracted with HNTB Corporation, an aviation consulting group. The MAC has requested HNTB Corporation, which has national noise modeling expertise and past noise modeling experience at MSP, to compare, quantify, and explain any noise contour variations noted between those generated by INM versus AEDT.

As a result of this comparison, the MAC and HNTB raised concerns regarding the accuracy of the AEDT version 2b model. These concerns were formally communicated to the FAA for consideration. The FAA has not yet responded to these concerns. As a result, to ensure completion of the Annual Noise report by the court-ordered deadline of March 1, 2016, the MAC was left with no choice other than using INM, version 7.0d, to calculate the 2015 actual noise contours. This decision has been supported by all parties to the Consent Decree.

It is anticipated that at such time as the FAA addresses the concerns expressed by the MAC and other users concerning the integrity of the AEDT modeling, the MAC will commence using AEDT for all future noise contour and environmental analysis as the FAA now requires. This will become increasingly more important in subsequent years, as INM, version 7.0d will become increasingly out of date and unable to incorporate state of the art modeling techniques. We believe that FAA will require AEDT modeling before the MAC is able to use airport revenue for any noise mitigation determined eligible under the Consent Decree.

2.1.2 2015 Aircraft Operations and Fleet Mix

The past 15 years have presented many challenges to the aviation industry. From a local perspective, operational levels and the aircraft fleet mix at MSP have been subject to effects from the events of September 11, 2001, high fuel prices, a flurry of bankruptcy filings by several legacy airlines including the former Northwest Airlines, and an economic recession. Additionally, overall market forces appear to be favoring consolidation, as indicated by major airline acquisitions and mergers, beginning with Delta Air Lines' acquisition of Northwest Airlines in 2008, followed by United Airlines' acquisition of Continental Airlines in 2012, the merger of American Airlines and US Airways in 2013 and the merger of Southwest Airlines and AirTran in 2014. These developments have had profound effects on airline and airport operations. For example, the actual 2015 operational level at MSP is below the operational level documented at the airport over 23 years ago.

The MAC derived MSP operations numbers for this study from the MAC's Noise and Operations Monitoring System (MACNOMS) data. The MACNOMS total operations number was 0.5 percent lower than the FAA Operations Network (OPSNET) number. To rectify the numbers, the MAC adjusted the MACNOMS data upward to equal the total 2015 FAA OPSNET number. Table 2.1 provides the total number of 2015 aircraft operations at MSP by operational category. The 2015 total operations number of 404,374 is down from the 2014 number of 411,760 (1.8 percent decrease).

**Table 2.1
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
2015 Total Operations**

Operations Category	Number of Operations*
Scheduled Passenger Air Carrier (a)	367,778
Cargo	12,789
Charter	80
GA (b)	20,898
Military	2,829
TOTAL	404,374

Notes:

(a) Includes both air carrier and regional carrier operations

(b) Includes both GA and non-scheduled air taxi operations

* Based on actual 2015 MACNOMS data adjusted to match FAA ATADS data (to account for unavailable MACNOMS operations data).

Considering the multi-faceted nature of the variables that are presently impacting the operational level at MSP, forecasting long-term operational implications is complex. All signs, however, in the near-term seem to point to a fundamental change in the nature of airline operations at MSP, especially in the type

of aircraft flown by all airlines and in particular by Delta Air Lines. The use of larger aircraft and the elimination of DC-9 operations by Delta Air Lines in January 2014 are examples.

The use of newer and quieter aircraft is on the rise. Some examples at MSP of these newer aircraft are the Airbus A320/319, CRJ-900 Regional Jets, McDonnell Douglas MD-90 and Boeing B737-700/800/900.

When comparing the DC9 hushkitted aircraft to the Airbus A319, 15 A319 operations would be required to generate the same noise energy as one DC9 operation. The Airbus A319 aircraft represents newer technology engine noise emission levels compared to the DC9 aircraft.

Table 2.2 provides a breakdown of the 2015 aircraft fleet mix at MSP. The average daily number of Modified (“hushkitted”) Stage 3 aircraft operations was down in 2015 to 0.07 from 0.10 in 2014. In 2015, the average daily number of total nighttime operations was 106.7, up from the 95.3 average daily nighttime operations in 2014. Overall, the 2015 total average daily operations number of 1,107.8 is down by 1.8 percent from the 1,128.1 average daily operations in 2014.

**Table 2.2
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
2015 Aircraft Fleet Mix Average Daily Operations**

Group	Aircraft Type	Day	Night	Total
Manufactured/Re-engined Stage 3 Jet	7478	0.0	0.0	0.0
	717200	14.6	0.6	15.3
	737300	7.2	1.6	8.8
	737400	0.2	0.1	0.3
	737700	39.9	9.8	49.7
	737800	52.8	16.9	69.7
	737900	24.7	4.2	28.9
	747400	0.2	0.1	0.3
	74720B	0.0	0.0	0.0
	757300	14.4	0.9	15.3
	757PW	39.2	7.0	46.2
	757RR	2.4	1.9	4.3
	767300	6.2	1.4	7.7
	767400	1.7	0.5	2.3
	767CF6	0.6	0.0	0.7
	767JT9	0.8	0.0	0.8
	777200	1.7	0.0	1.7
	7773ER	0.0	0.0	0.0
	A300-622R	0.6	0.2	0.8
	A310-304	0.1	0.1	0.2
	A319-131	75.1	6.1	81.1
	A320-232	82.3	10.6	92.9
	A321-232	5.6	3.0	8.6
	A330-301	0.0	0.0	0.0
	A330-343	7.2	0.3	7.5
	A340-211	0.7	0.0	0.7
	AN124	0.0	0.0	0.0
	BD100	4.2	0.4	4.6

Table 2.2
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
2015 Aircraft Fleet Mix Average Daily Operations

Group	Aircraft Type	Day	Night	Total
Manufactured/Re-engined Stage 3 Jet (Cont'd)	BD700	0.3	0.0	0.3
	BEC400	0.9	0.0	0.9
	CL601	1.7	0.1	1.8
	CLREGJ	169.1	8.2	177.3
	CNA500	0.3	0.0	0.3
	CNA501	0.1	0.0	0.1
	CNA525C	0.6	0.0	0.7
	CNA550	0.1	0.0	0.1
	CNA55B	0.4	0.1	0.5
	CNA560E	1.3	0.1	1.4
	CNA560U	0.3	0.0	0.3
	CNA560XL	3.1	0.2	3.4
	CNA650	0.5	0.0	0.6
	CNA680	1.7	0.1	1.8
	CNA750	3.5	0.3	3.7
	CRJ701	32.2	2.7	34.9
	CRJ900	143.6	7.8	151.4
	D328J	0.2	0.0	0.2
	DC1010	1.9	0.6	2.5
	EMB135	0.2	0.0	0.2
	EMB145	7.3	0.1	7.4
	EMB14L	5.2	0.2	5.4
	EMB170	71.1	4.8	75.9
	EMB190	2.6	0.0	2.6
	F10062	0.1	0.0	0.1
	FAL10	0.0	0.0	0.0
	FAL20A	1.2	0.0	1.3
	FAL50	0.9	0.1	1.0
	FAL900	1.0	0.1	1.2
	G150	0.2	0.0	0.2
	G200	1.5	0.2	1.7
	GIV	1.5	0.1	1.7
	GV	1.6	0.2	1.9
	HK4000	0.1	0.0	0.1
	HS125	0.0	0.0	0.0
	HS1258	2.5	0.1	2.6
	IA1124	0.0	0.0	0.1
	IA1125	0.1	0.0	0.1
	LEAR31	0.1	0.0	0.1
	LEAR35	0.7	0.1	0.8
LEAR45	2.8	0.2	3.0	
LEAR55	0.1	0.0	0.1	
LEAR60	0.4	0.0	0.5	
MD11GE	1.5	1.3	2.8	

Table 2.2
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
2015 Aircraft Fleet Mix Average Daily Operations

Group	Aircraft Type	Day	Night	Total
Manufactured/Re-engined Stage 3 Jet (Cont'd)	MD11PW	1.4	1.0	2.5
	MD80	0.0	0.0	0.0
	MD81	0.0	0.0	0.0
	MD82	6.7	1.4	8.1
	MD83	7.0	1.6	8.5
	MD88	18.6	0.9	19.5
	MD9025	36.4	1.8	38.2
	MD9028	45.0	1.8	46.8
	MU300	0.0	0.0	0.0
	R390	0.2	0.0	0.2
	<i>Total</i>	<i>962.6</i>	<i>102.2</i>	<i>1,064.8</i>
Modified ("hushkitted") Stage 3 Jet	727EM2	0.0	0.0	0.0
	737N17	0.0	0.0	0.0
	DC93LW	0.0	0.0	0.0
	DC9Q7	0.0	0.0	0.0
	<i>Total</i>	<i>0.0</i>	<i>0.0</i>	<i>0.1</i>
Microjet	CNA510	0.5	0.1	0.7
	ECLIPSE500	0.1	0.0	0.1
	<i>Total</i>	<i>0.6</i>	<i>0.1</i>	<i>0.7</i>
Stage 2 Less than 75,000 lb. MTOW ²	FAL20	0.7	1.5	2.3
	GII	0.0	0.0	0.0
	GULF3	0.0	0.0	0.0
	LEAR24	0.0	0.0	0.0
	SABR80	0.0	0.0	0.0
	<i>Total</i>	<i>0.8</i>	<i>1.5</i>	<i>2.3</i>
Propeller	1900D	13.0	0.7	13.7
	AC50	0.0	0.0	0.0
	AC95	0.0	0.0	0.0
	ATR42	1.3	0.2	1.4
	BAEJ41	0.0	0.0	0.0
	BEC100	0.0	0.0	0.0
	BEC200	0.8	0.1	0.9
	BEC300	0.5	0.0	0.5
	BEC30B	0.2	0.0	0.2
	BEC33	0.0	0.0	0.0
	BEC58	0.1	0.0	0.1
	BEC65	5.9	0.8	6.7
	BEC80	1.7	0.1	1.9
	BEC90	0.4	0.0	0.5
	BEC99	3.7	0.3	4.1
BEC9F	0.0	0.0	0.0	

² As of January 1, 2016, all Stage 2 aircraft types are required to meet Stage 3 noise standards.

Table 2.2
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
2015 Aircraft Fleet Mix Average Daily Operations

Group	Aircraft Type	Day	Night	Total
Propeller (Cont'd)	BECM35	0.1	0.0	0.1
	CNA172	0.1	0.0	0.1
	CNA180	0.0	0.0	0.0
	CNA182	0.0	0.0	0.0
	CNA206	0.0	0.0	0.0
	CNA208	1.0	0.0	1.0
	CNA210	0.0	0.0	0.0
	CNA303	0.0	0.0	0.0
	CNA310	0.1	0.0	0.1
	CNA340	0.0	0.0	0.0
	CNA402	0.0	0.0	0.0
	CNA404	0.0	0.0	0.0
	CNA414	0.1	0.0	0.1
	CNA421	0.1	0.0	0.2
	CNA425	0.0	0.0	0.0
	CNA441	0.1	0.0	0.1
	DA42	0.0	0.0	0.0
	DHC6	0.0	0.0	0.0
	DHC8	0.0	0.0	0.0
	DHC830	0.0	0.0	0.0
	DO328	0.0	0.0	0.0
	EMB110	0.0	0.0	0.0
	EMB120	0.0	0.0	0.0
	GASEPV	0.0	0.0	0.0
	M20J	0.2	0.0	0.2
	MU2	0.0	0.0	0.0
	P180	0.0	0.0	0.0
	PA23AZ	0.0	0.0	0.0
	PA24	0.0	0.0	0.0
	PA28	0.0	0.0	0.0
	PA28AR	0.0	0.0	0.0
	PA28DK	0.0	0.0	0.0
	PA31	0.1	0.0	0.1
	PA31T	0.1	0.0	0.1
	PA32LA	0.0	0.0	0.0
	PA32SG	0.0	0.0	0.0
	PA34	0.1	0.0	0.1
	PA42	0.0	0.0	0.0
	PA46	0.1	0.0	0.1
	PA60	0.0	0.0	0.0
PC12	0.3	0.0	0.3	
RWCM69	0.0	0.0	0.0	
SAAB20	0.0	0.0	0.0	
SAMER3	0.0	0.0	0.0	

Table 2.2
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
2015 Aircraft Fleet Mix Average Daily Operations

Group	Aircraft Type	Day	Night	Total
Propeller (Cont'd)	SAMER4	4.0	0.3	4.3
	SR22	0.4	0.0	0.4
	STBM7	0.0	0.0	0.0
	TED600	0.1	0.0	0.1
	<i>Total</i>	<i>35.5</i>	<i>2.8</i>	<i>38.3</i>
Helicopter	B429	0.0	0.0	0.0
	R22	0.0	0.0	0.0
	S76	0.0	0.0	0.0
	SA355F	0.0	0.0	0.0
	<i>Total</i>	<i>0.1</i>	<i>0.0</i>	<i>0.1</i>
Military	C-130E	1.4	0.0	1.5
	C17	0.0	0.0	0.0
	F-18	0.0	0.0	0.0
	KC-135	0.0	0.0	0.0
	T33A	0.0	0.0	0.0
	T-38A	0.0	0.0	0.0
	T6	0.0	0.0	0.0
<i>Total</i>	<i>1.5</i>	<i>0.1</i>	<i>1.6</i>	
<i>Grand Total</i>		<i>1,001.1</i>	<i>106.7</i>	<i>1,107.8</i>

Notes: Total may differ due to rounding

Source: MAC-provided INM Input Data, HNTB 2016

2.1.3 2015 Runway Use

FAA control 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 people and dwellings impacted by noise is a direct result of the number of operations on a given runway and the land uses off the end of the runway.

Historically, prior to the opening of Runway 17/35, arrival and departure operations occurred on the parallel runways at MSP (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. As a result of the dense residential land uses to the northwest and the predominantly industrial/commercial land uses to the southeast of MSP, focusing departure operations to the southeast has long been the preferred operational configuration from a noise reduction perspective.

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

Table 2.3 provides the runway use percentages for 2015. From 2014 to 2015 arrival operation percentages decreased on Runways 30L, 30R and 35 and increased on Runways 12L and 12R. There were little to no changes in the arrival operation percentages on Runways 4, 17 and 22. Notable changes in total arrival runway use from 2014 to 2015 include a 5.0 percent increase (from 20.4 percent to 25.4 percent) in Runway 12R arrival operations and a 5.8 percent decrease (from 17.2 percent to 11.4 percent) in Runway 35 arrival operations. Notable changes in arrival runway use during the nighttime hours include a decrease in Runway 30L from 35.5 percent in 2014 to 31.3 percent in 2015 and an increase in Runway 12L from 19.0 percent in 2014 to 22.5 percent in 2015. Departure operations increased on Runways 12L, 12R and 17 and decreased on Runways 30L and 30R from 2014 to 2015. There were little to no changes in

Table 2.3
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
2015 Runway Use

Operation	Runway	Day	Night	Total
Arrival	4	0.0%	0.1%	0.0%
	12L	23.0%	18.3%	22.5%
	12R	25.0%	28.4%	25.4%
	17	0.1%	0.0%	0.0%
	22	0.1%	0.4%	0.1%
	30L	18.9%	31.3%	20.2%
	30R	20.3%	20.2%	20.3%
	35	12.6%	1.3%	11.4%
Total		100.0%	100.0%	100.0%
Departure	4	0.1%	0.3%	0.1%
	12L	15.6%	20.0%	15.9%
	12R	5.4%	29.0%	7.4%
	17	31.4%	11.9%	29.8%
	22	0.0%	0.2%	0.1%
	30L	25.9%	22.1%	25.6%
	30R	21.5%	16.4%	21.1%
	35	0.0%	0.1%	0.0%
Total		100.0%	100.0%	100.0%
Overall	4	0.1%	0.2%	0.1%
	12L	19.3%	19.1%	19.2%
	12R	15.1%	28.7%	16.4%
	17	15.9%	5.3%	14.9%
	22	0.1%	0.3%	0.1%
	30L	22.4%	27.2%	22.9%
	30R	20.9%	18.5%	20.7%
	35	6.2%	0.8%	5.7%
Total		100.0%	100.0%	100.0%

Note: Total may not add up due to rounding.

Source: MAC-provided INM Input Data, HNTB 2016.

departure operation percentages on Runways 4, 22 and 35. Notable changes in total departure runway use from 2014 to 2015 include a 6.3 percent increase (from 23.4 percent to 29.8 percent) in Runway 17 departure operations and a 7.2 percent decrease (from 32.8 percent to 25.6 percent) in Runway 30L departure operations. Notable changes in departure runway use during the nighttime hours include a decrease in Runway 30L from 27.8 percent in 2014 to 22.1 percent in 2015 and an increase in Runway 12L from 14.4 percent in 2014 to 20.0 percent in 2015.

2.1.4 2015 Flight Tracks

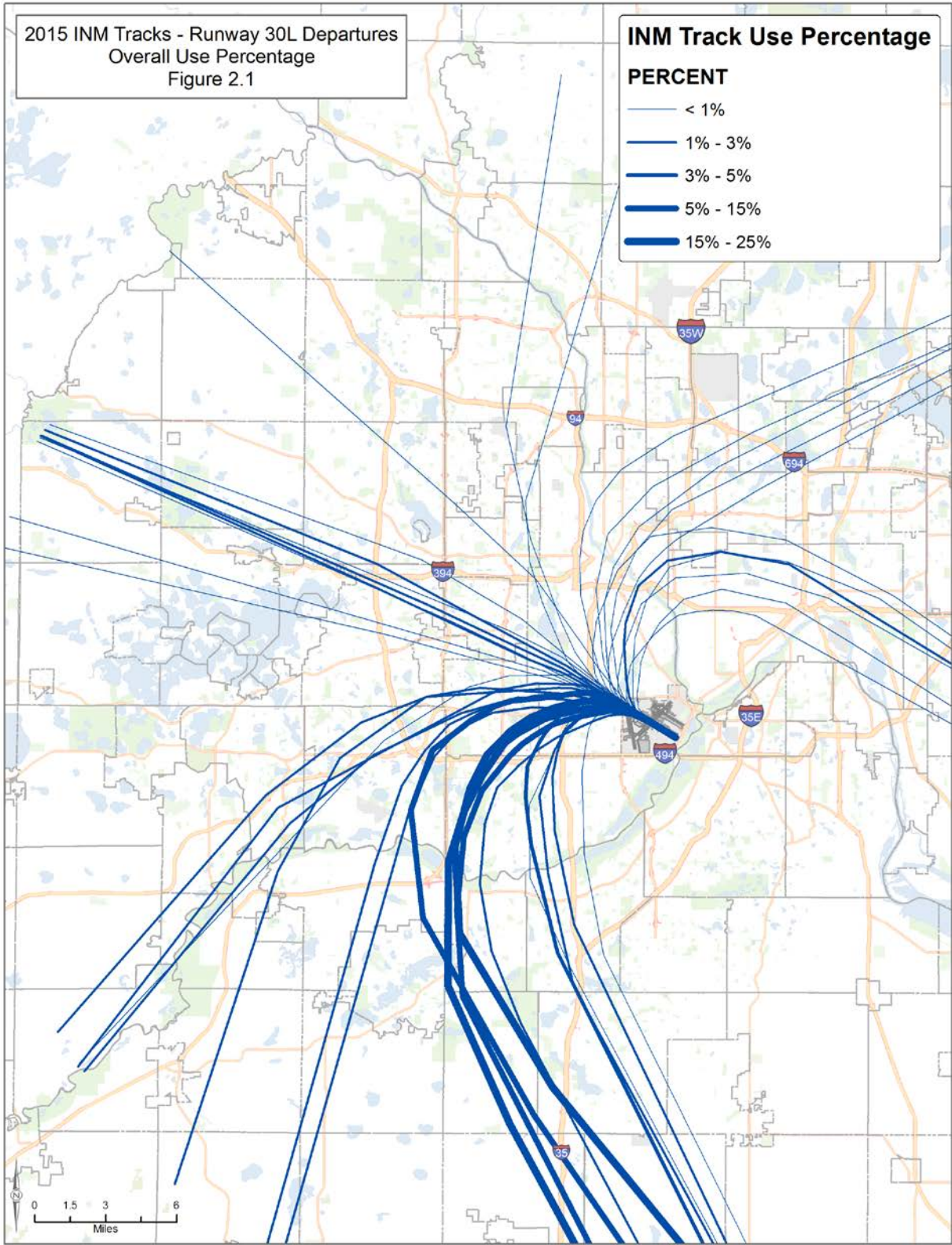
The INM departure and arrival flight track locations used to develop the 2015 actual noise contour were identical to those used for the 2014 actual noise contour. These flight tracks differ from those used to develop the 2007 forecast mitigated noise contour due to enhanced modeling methods and improved technologies. Sub-tracks were also added to each of the backbone tracks. The INM's standard distribution was used in distributing the flights to the sub-tracks.

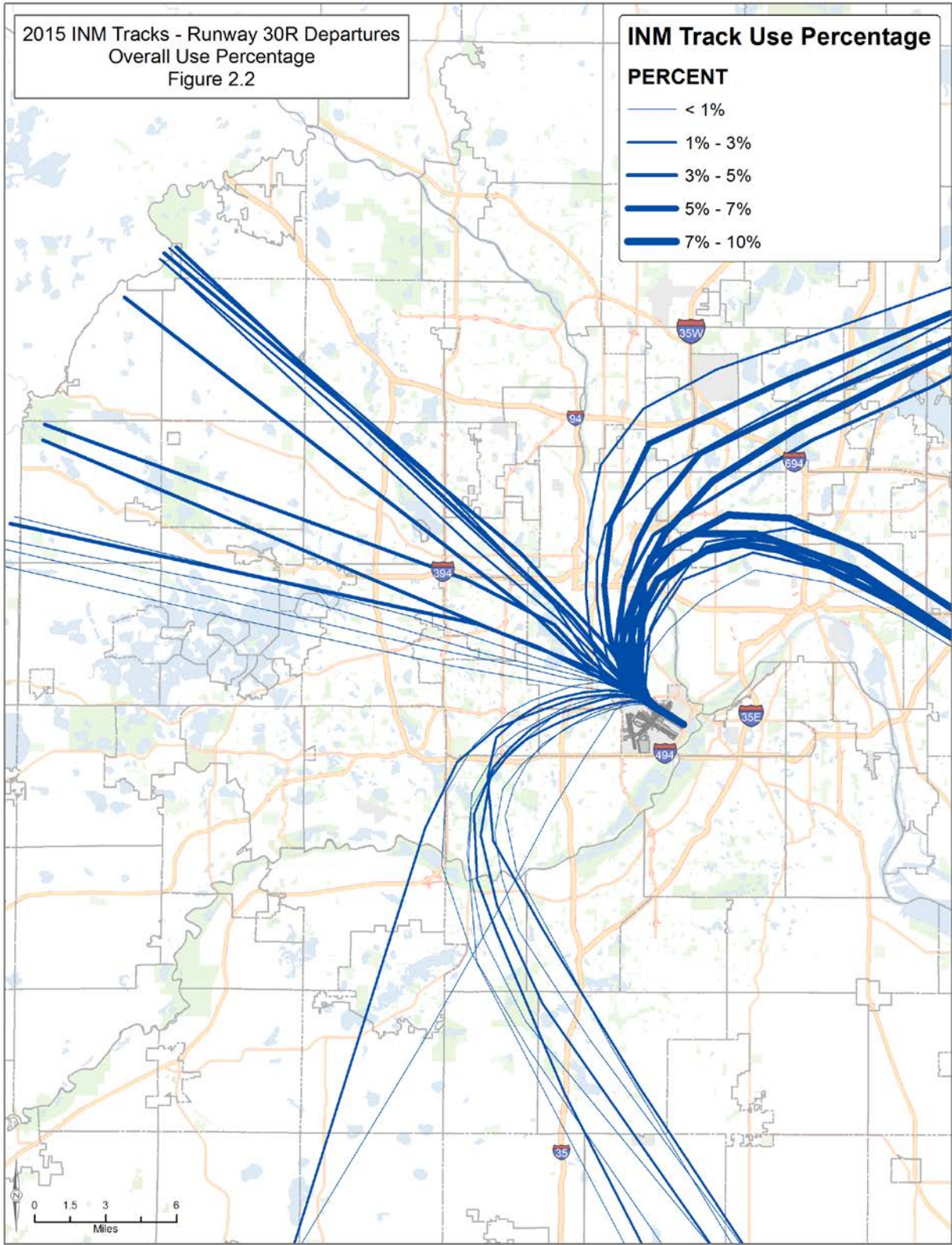
The same methodology as in previous annual reports was used to assign 2015 radar data to the INM flight tracks. The radar-to-INM flight track correlation process employs a best-fit analysis of the radar flight track data based on linear trends. This approach provides the ability to match each radar flight track directly to the appropriate INM track.

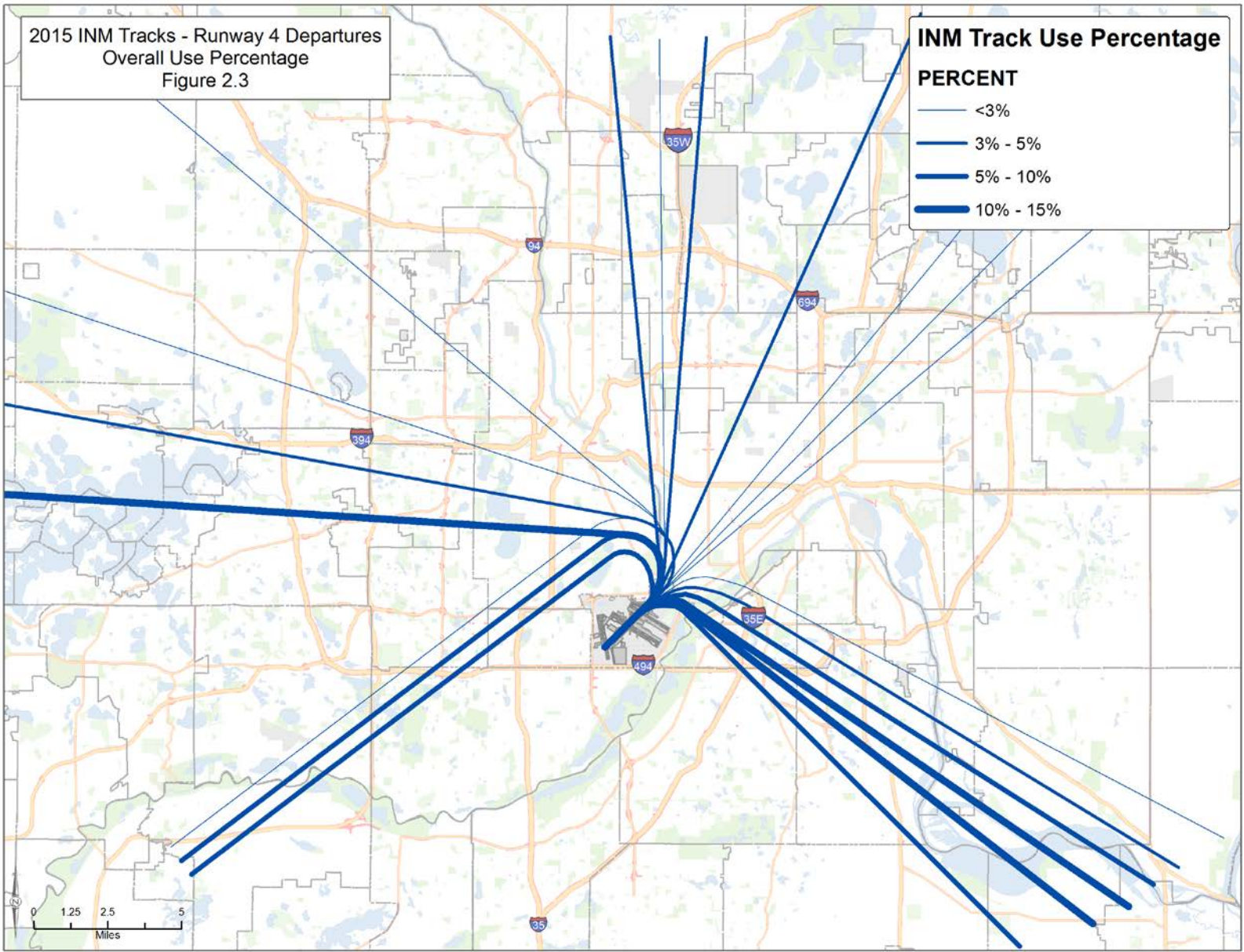
Figures 2.1 to 2.16 provide the updated backbone INM departure and arrival flight track and the use information used to develop the 2015 actual noise contour.

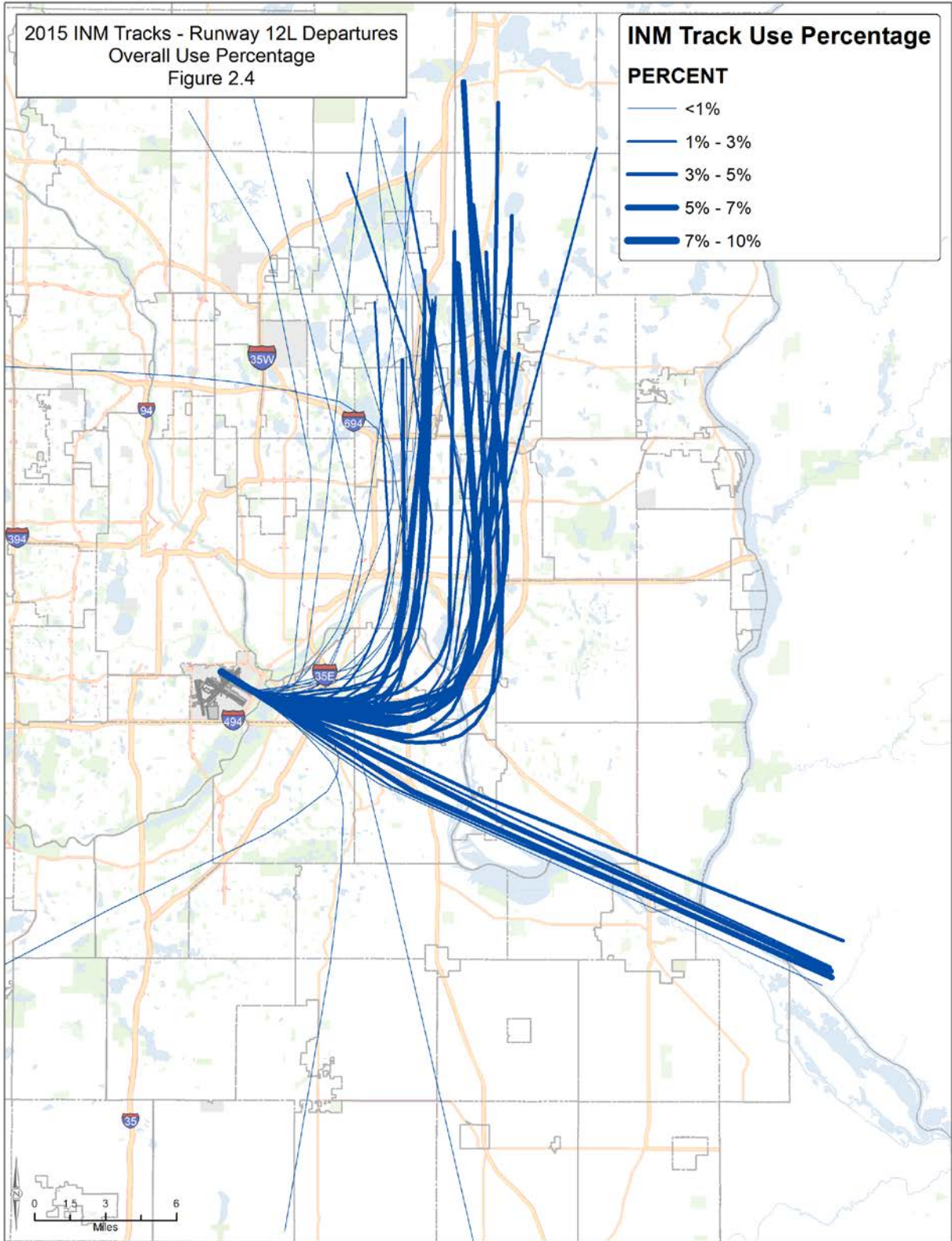
2.1.5 2015 Atmospheric Conditions

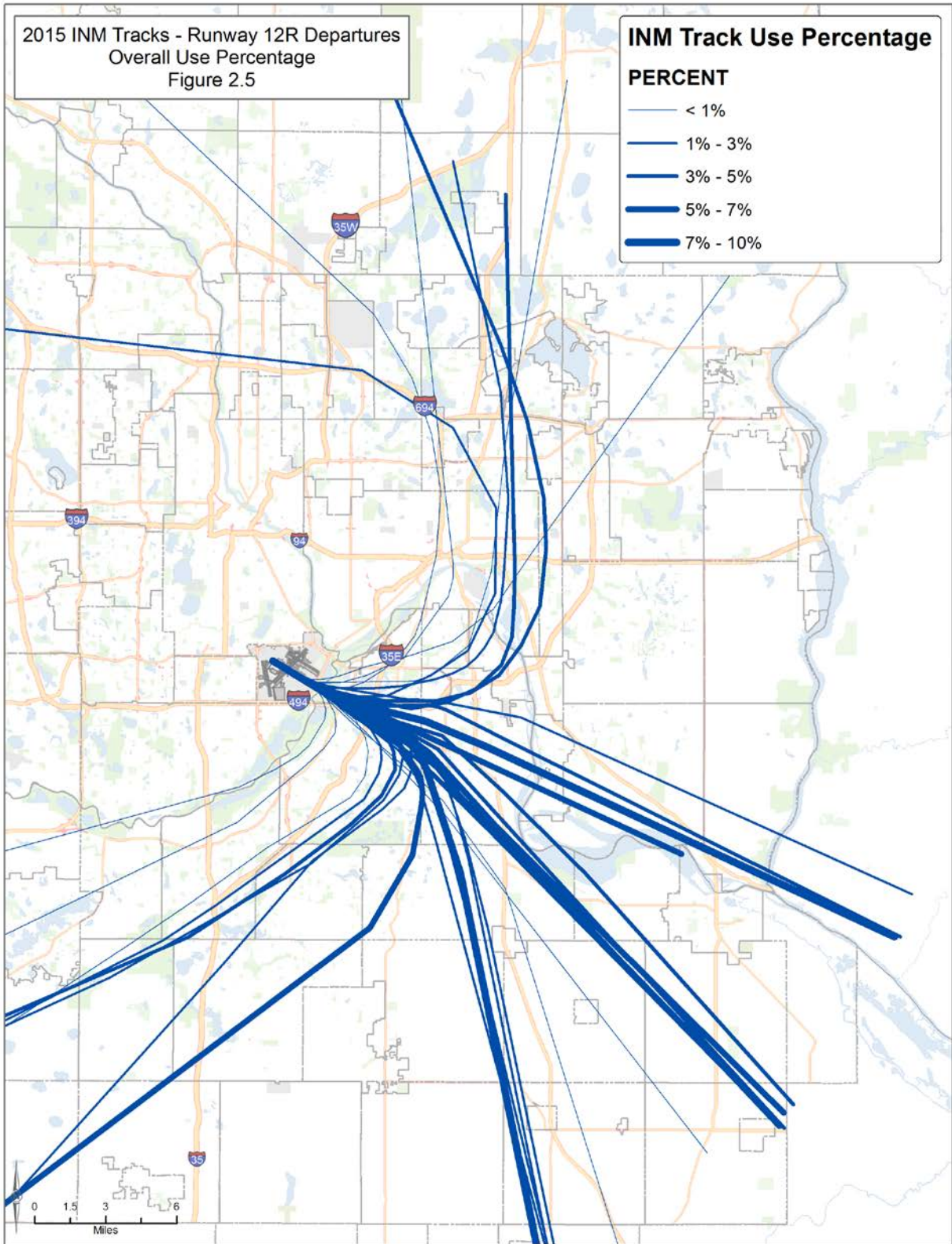
The MAC gathered atmospheric data for the 2015 actual noise contour from the Minnesota State Climatology Office. The 2015 annual average temperature of 48.6 degrees Fahrenheit and 2015 average annual wind speed of 8.3 knots were used in the INM modeling process. The 2015 average annual pressure of 30.01 inches of Mercury and a 2015 annual average relative humidity of 63.3 percent were also used.

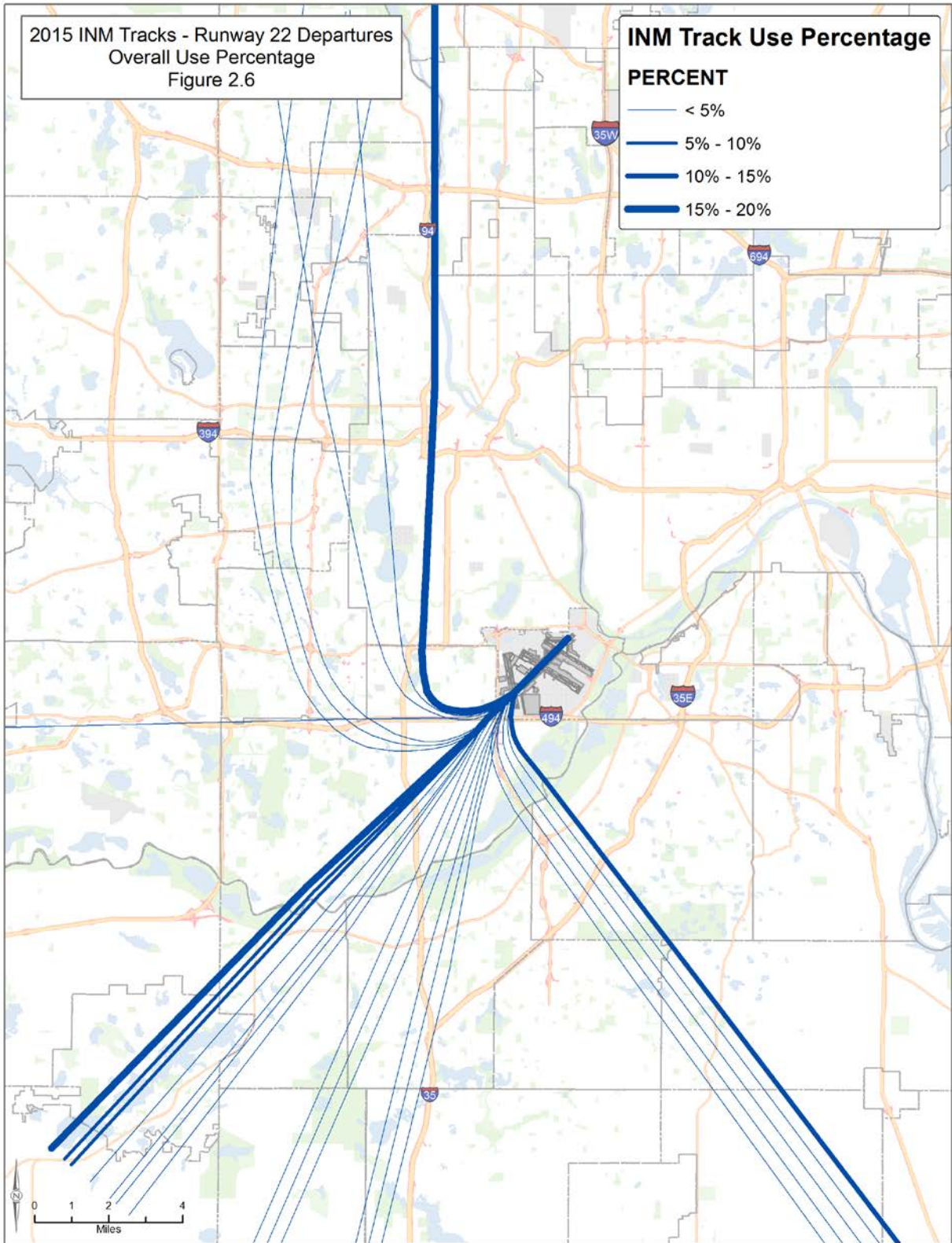


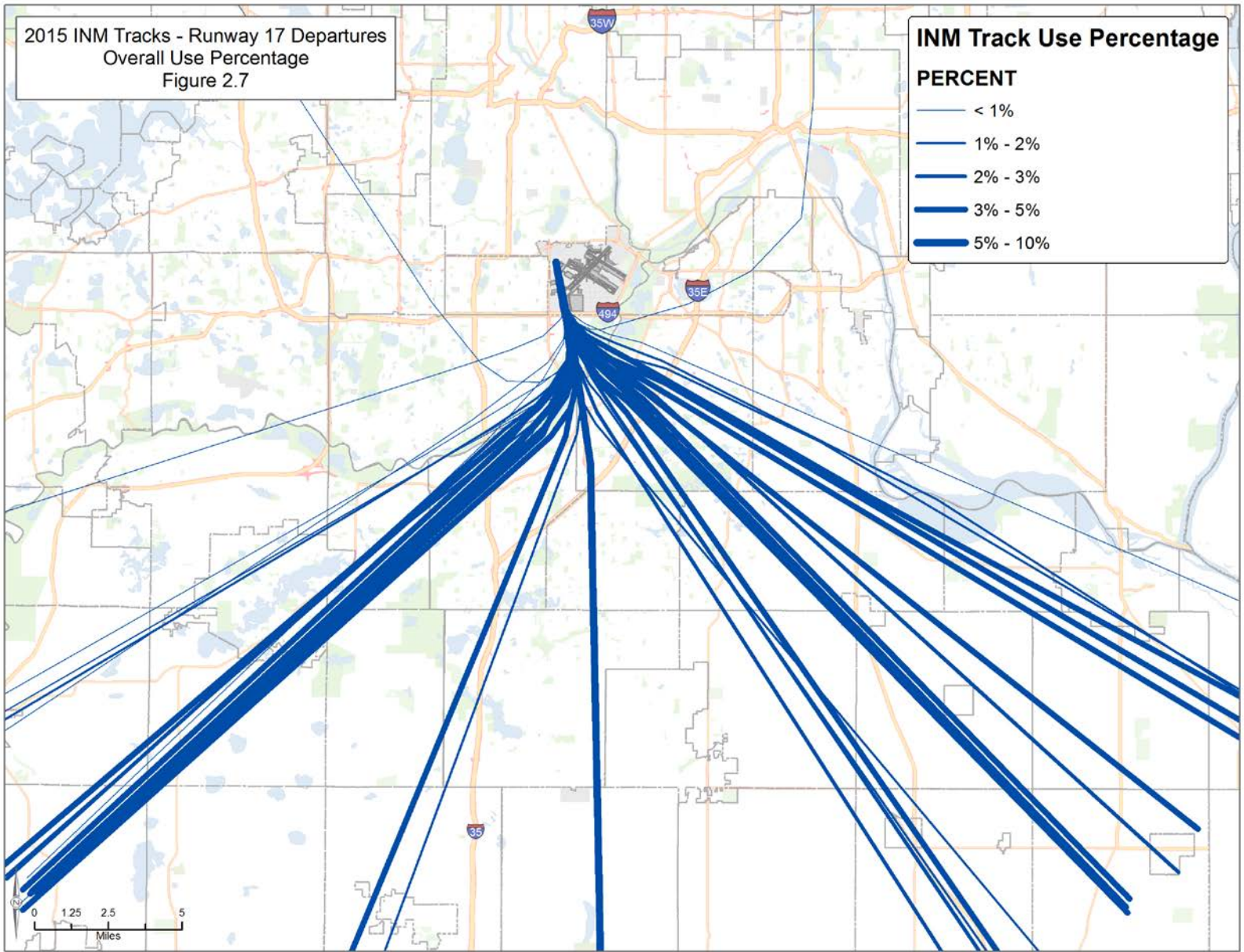


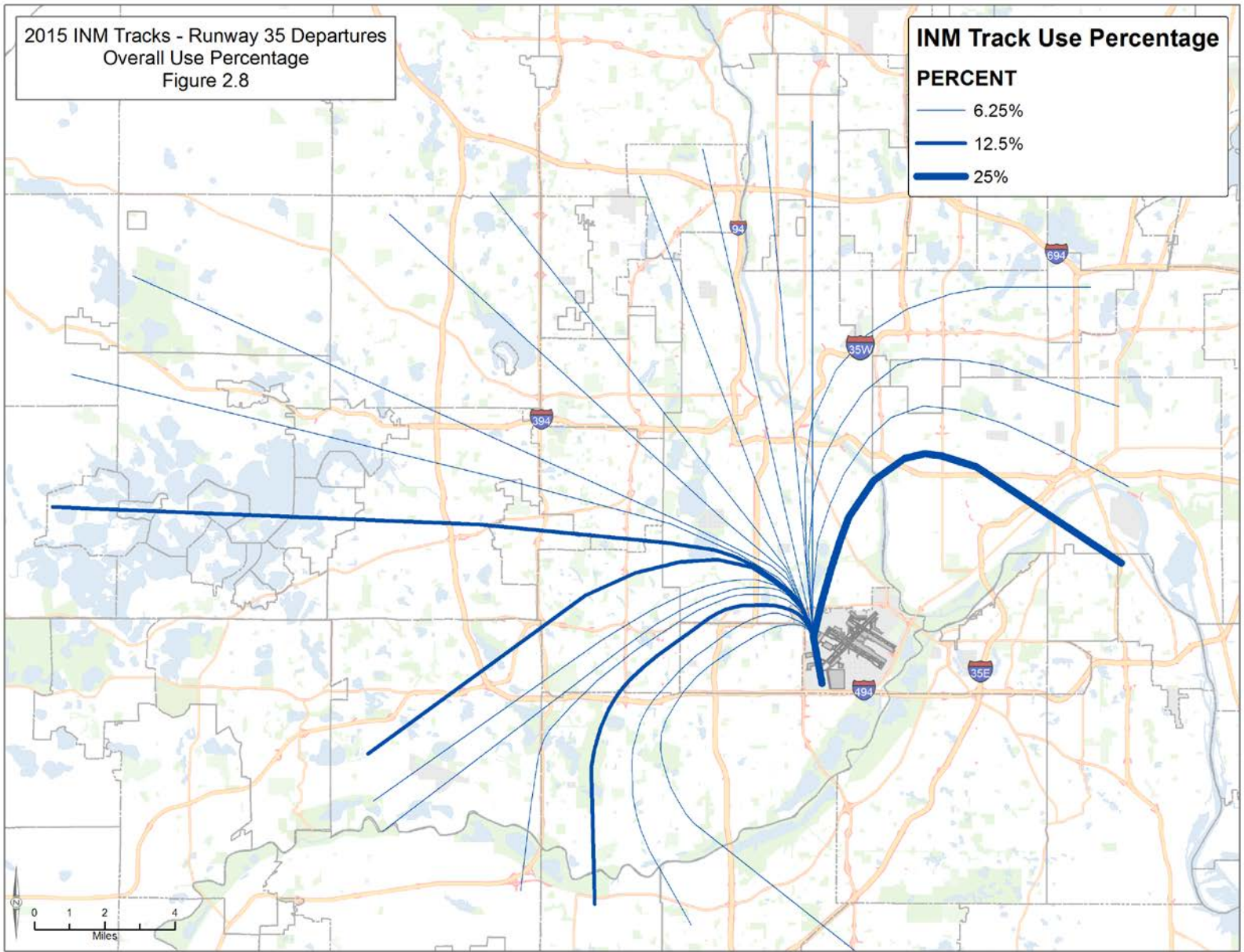


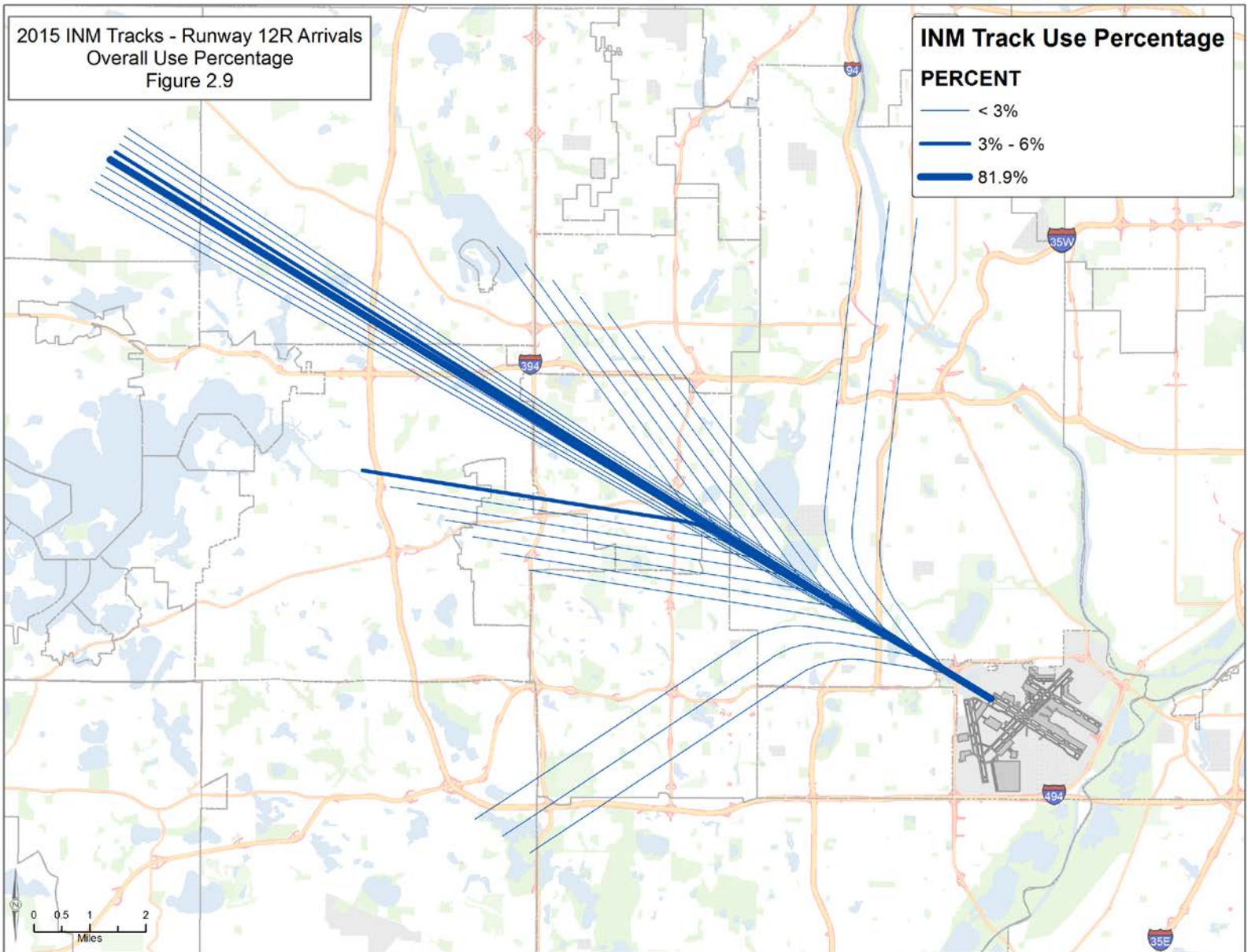


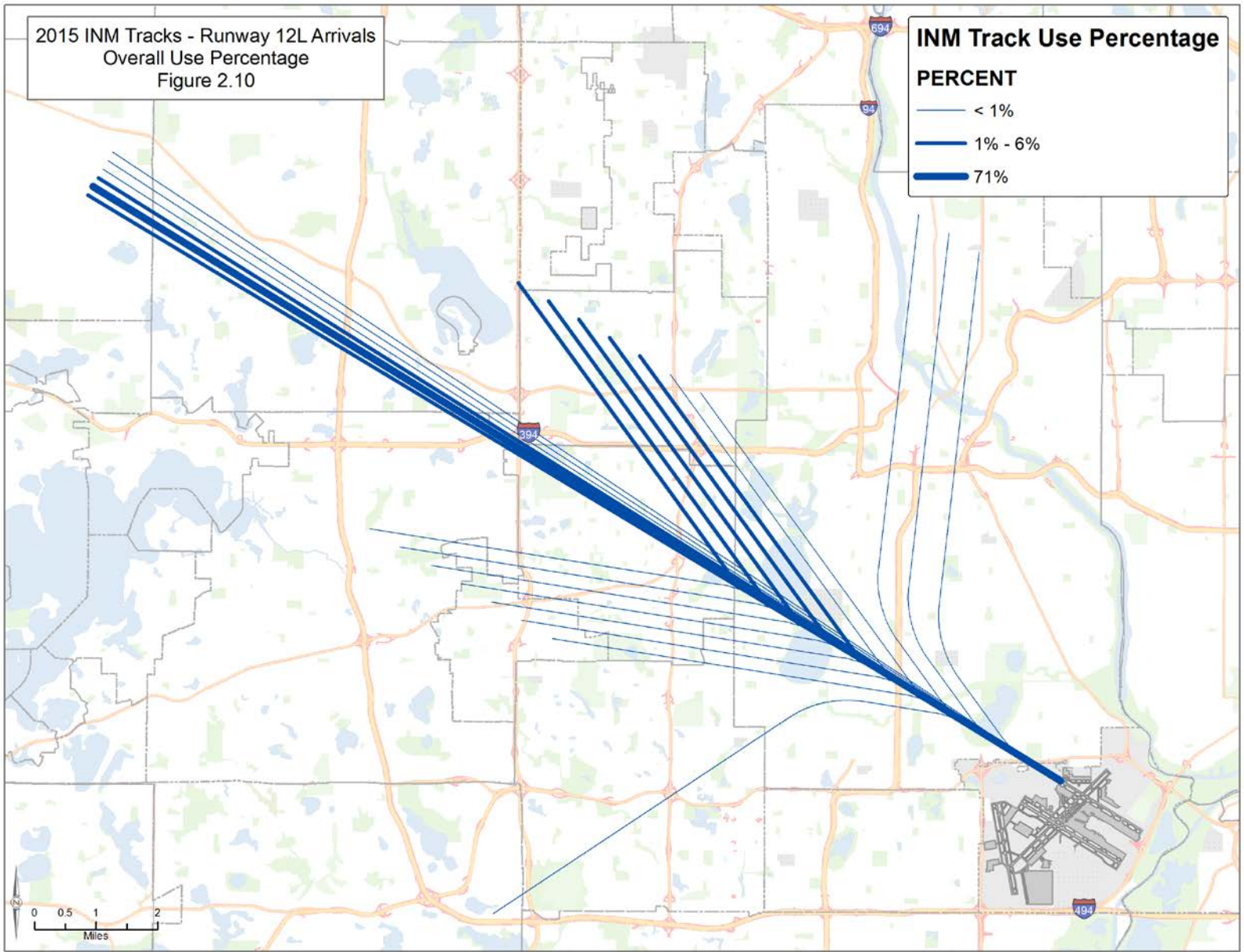


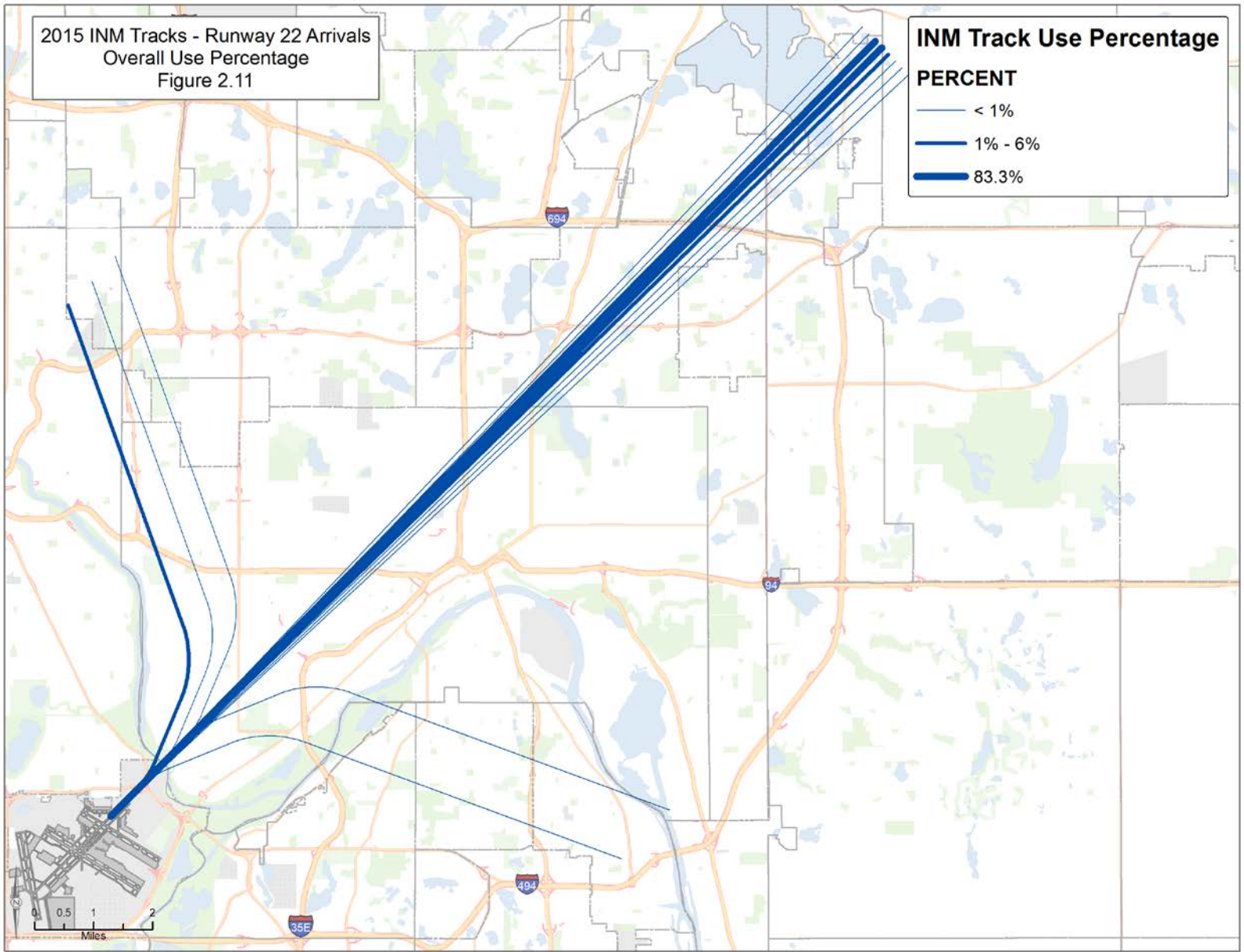


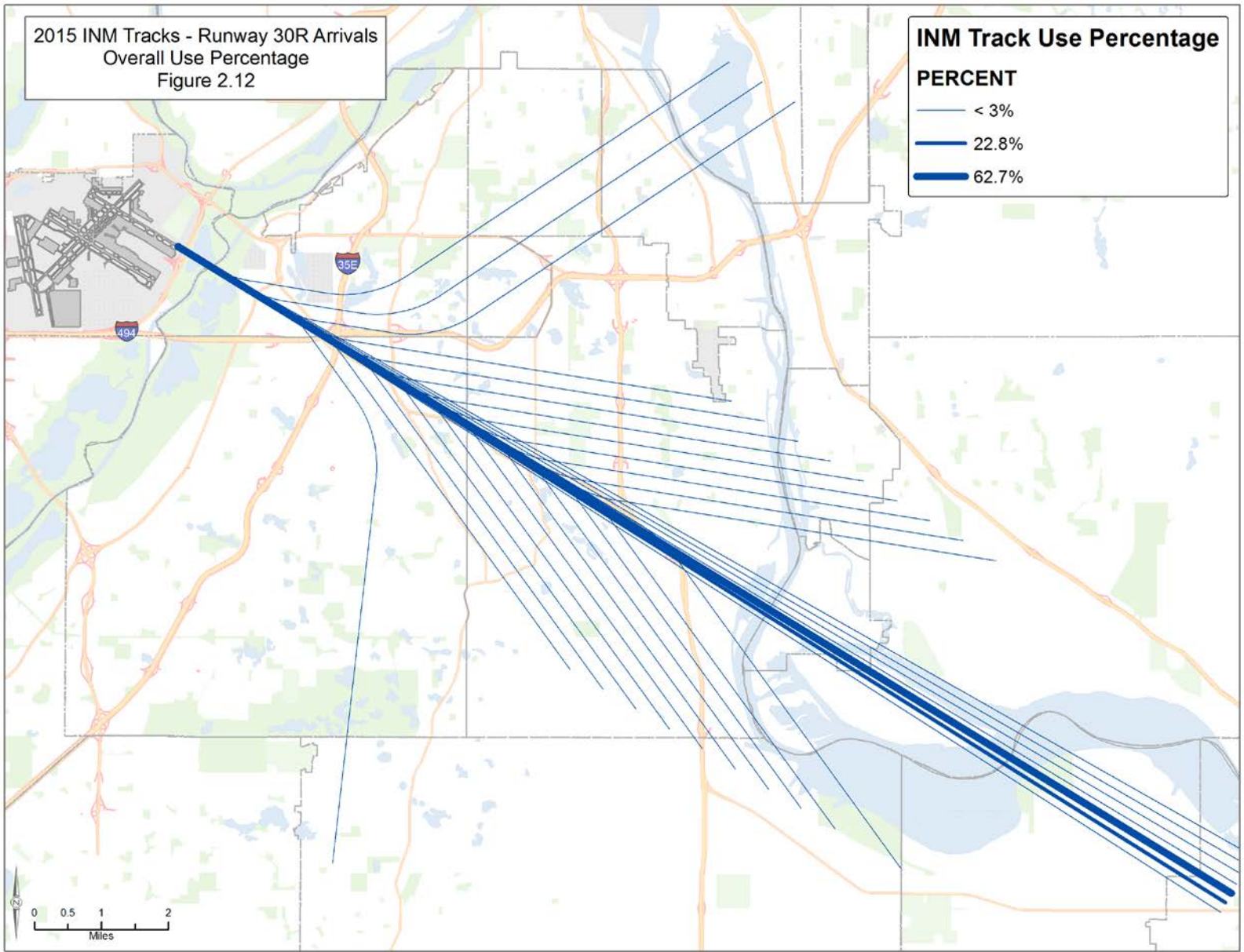


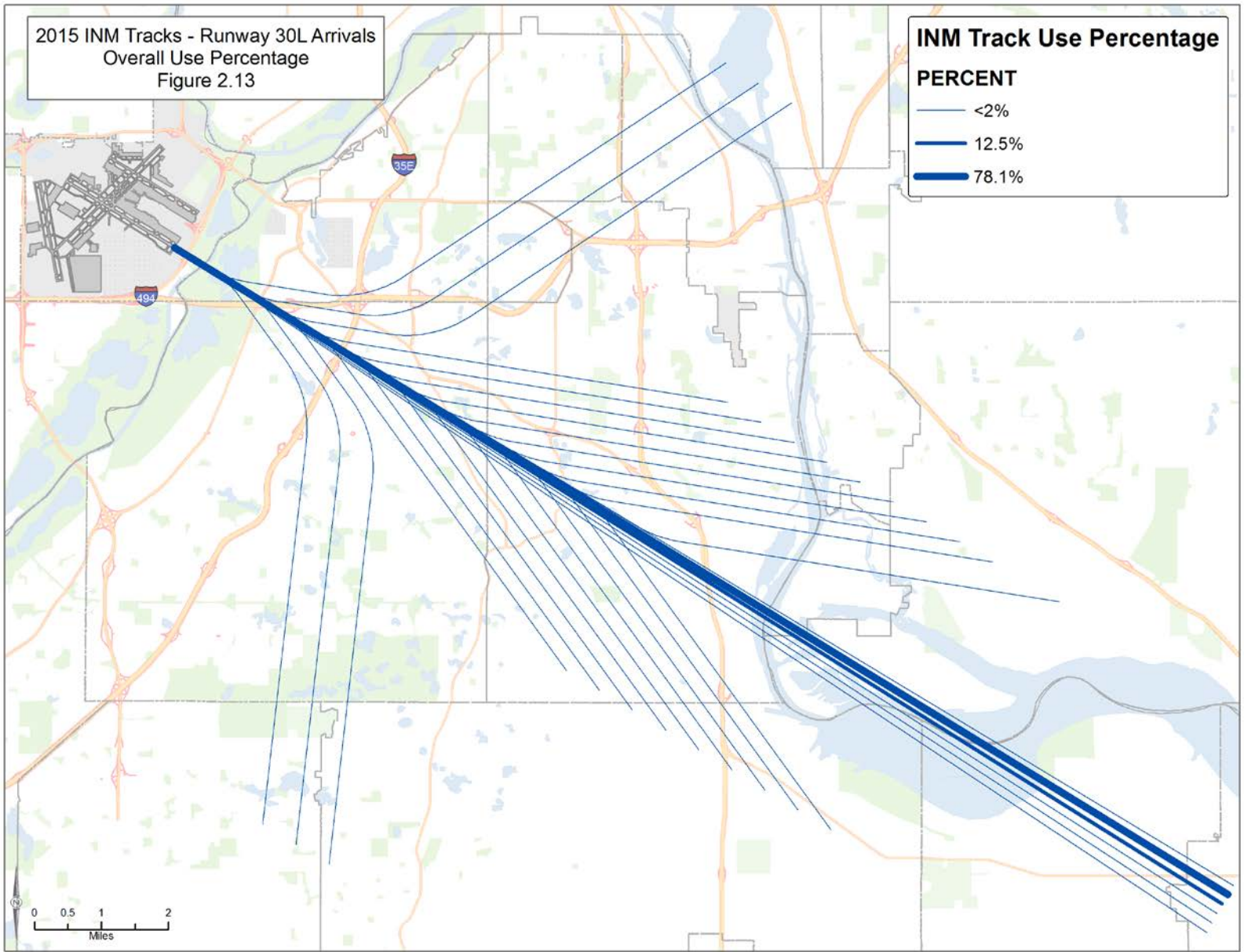


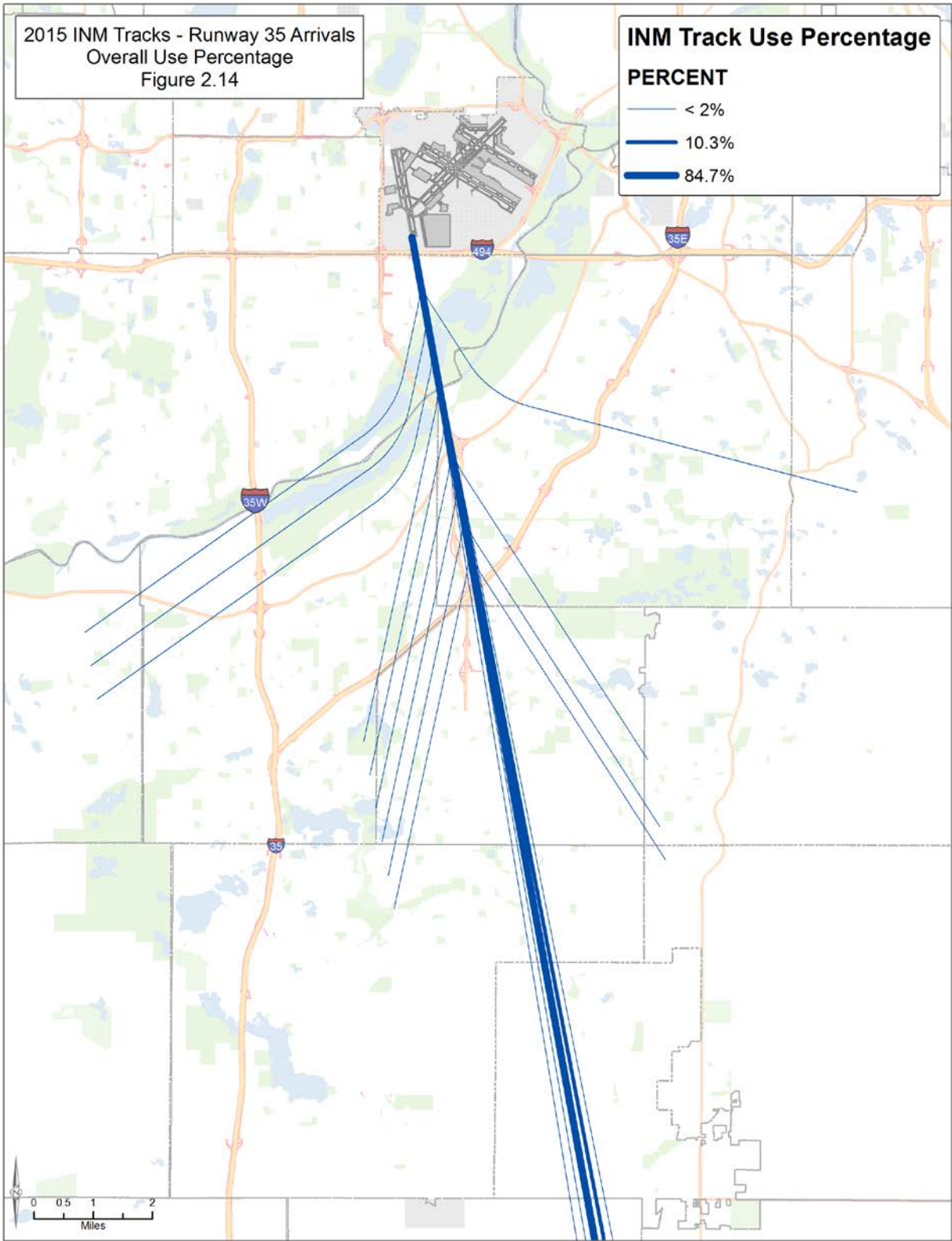


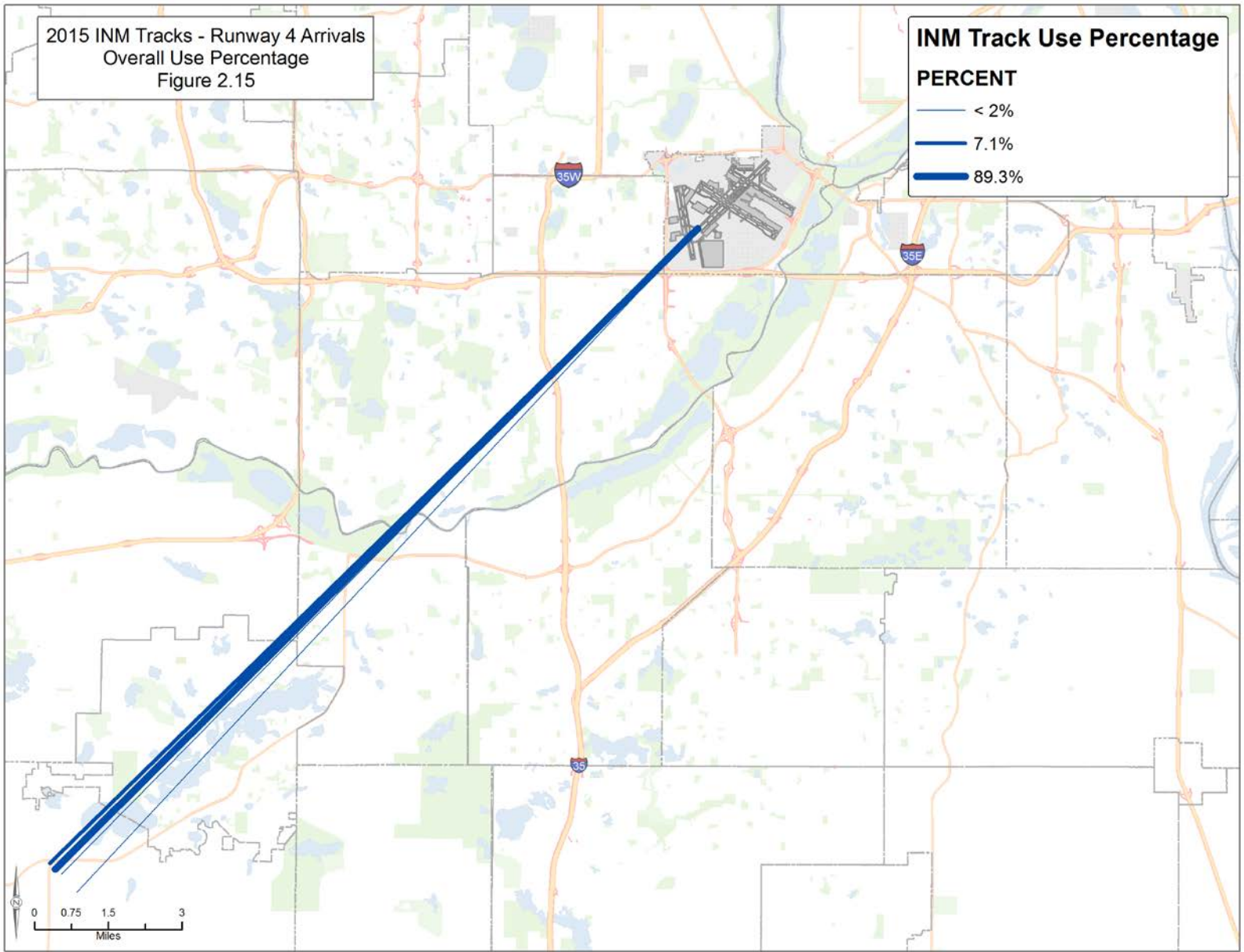














2.2 2015 Modeled Versus Measured DNL Levels

As part of the 2015 actual noise contour development process, an analysis was conducted by the MAC to compare the INM-developed 2015 DNL noise contours to actual measured aircraft noise levels at the 39 MAC Noise and Operations Monitoring System (MACNOMS) Remote Monitoring Towers (RMTs) around MSP. An INM grid point analysis determined the model's predicted 2015 DNL noise levels at each of the RMT locations (determined in the INM by the latitude and longitude coordinates of each RMT).

Table 2.4 provides a comparison of the INM grid point analysis at each MACNOMS RMT site, based on the 2015 actual noise contour as produced with the INM, and the actual MACNOMS monitored aircraft DNLs at those locations in 2015.

The average absolute difference between the modeled and measured DNLs was 2.1 dB (the 2014 average absolute difference was 2.2 dB). The median difference was 1.4 dB (the 2014 median difference was 1.5 dB). There were 16 MACNOMS RMTs that reported slightly higher DNL levels than the INM model generated. The MAC believes that this is due in part to the inclusive approach MAC staff has taken in tuning MACNOMS noise-to-track matching parameters. This conservative approach, along with the increasing number of quieter jets operating at the airport, results in increased instances of community-driven noise events being attributed to quieter aircraft operating at further distances from the monitoring location. The use of absolute values provides a perspective of total difference between the INM modeled values and the measured DNL values provided by MACNOMS in 2015. The median is considered the most reliable indicator of correlation when considering the data variability across modeled and monitored data.

Overall, the small variation between the actual MACNOMS monitored aircraft noise levels and the INM modeled noise levels provides additional external system verification that the INM is providing an accurate assessment of the actual aircraft noise impacts around MSP.

Table 2.4
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
2015 Measured vs. Modeled INM DNL Values at RMT
Locations

RMT Site	2015 Annual Measured DNL (a)	2015 Modeled DNL	Difference (Modeled minus Measured)	
			Sign	Absolute
1	56.2	57.0	0.8	0.8
2	58.8	58.0	-0.8	0.8
3	63.1	63.4	0.3	0.3
4	59.9	60.6	0.7	0.7
5	68.1	68.2	0.1	0.1
6	67.8	65.5	-2.3	2.3
7	59.8	57.5	-2.3	2.3
8	55.1	54.2	-0.9	0.9
9	44.9	44.6	-0.3	0.3
10	47.4	49.6	2.2	2.2
11	36.4	43.5	7.1	7.1
12	36.5	46.3	9.8	9.8
13	54.0	53.8	-0.2	0.2
14	60.9	60.2	-0.7	0.7
15	55.9	54.5	-1.4	1.4
16	64.1	62.8	-1.3	1.3
17	41.3	47.5	6.2	6.2
18	53.5	58.2	4.7	4.7
19	49.6	52.9	3.3	3.3
20	42.6	49.4	6.8	6.8
21	46.2	48.7	2.5	2.5
22	55.0	56.4	1.4	1.4
23	60.8	59.2	-1.6	1.6
24	59.1	59.0	-0.1	0.1
25	51.4	53.8	2.4	2.4
26	52.9	51.5	-1.4	1.4
27	55.2	55.0	-0.2	0.2
28	55.9	59.7	3.8	3.8
29	51.2	51.4	0.2	0.2
30	61.0	59.8	-1.2	1.2
31	46.6	49.6	3.0	3.0
32	41.7	47.1	5.4	5.4
33	47.3	49.4	2.1	2.1
34	44.7	47.6	2.9	2.9
35	52.3	52.5	0.2	0.2
36	51.8	50.7	-1.1	1.1
37	46.7	47.9	1.2	1.2
38	50.1	49.9	-0.2	0.2
39	50.4	50.8	0.4	0.4
			Average	2.1
			Median	1.4

Notes:

All units in dB DNL

(a) computed from daily DNLs

SOURCE: MAC RMT data and HNTB INM, 2016

2.3 2015 Noise Contour Impacts

Based on the 404,374 total operations in 2015, approximately 3,883 acres are in the 65 DNL noise contour (an increase of 404 acres, or 11.6 percent, from the 2014 actual noise contour) and approximately 9,772 acres are in the 60 DNL noise contour (an increase of 1,014 acres, or 11.6 percent, from the 2014 actual noise contour). 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 2015 actual noise contours. The MAC based the counts on the block intersect methodology where all structures on a block that are within or touched by the noise contour are counted.

Table 2.5
MINNEAPOLIS-ST.PAUL INTERNATIONAL AIRPORT
Summary of 2015 Actual DNL Noise Contour Single Family and Multi-Family Unit Counts
(Block Intersect Implementation Method, Completed Reflect All Units Completed prior to 2015)

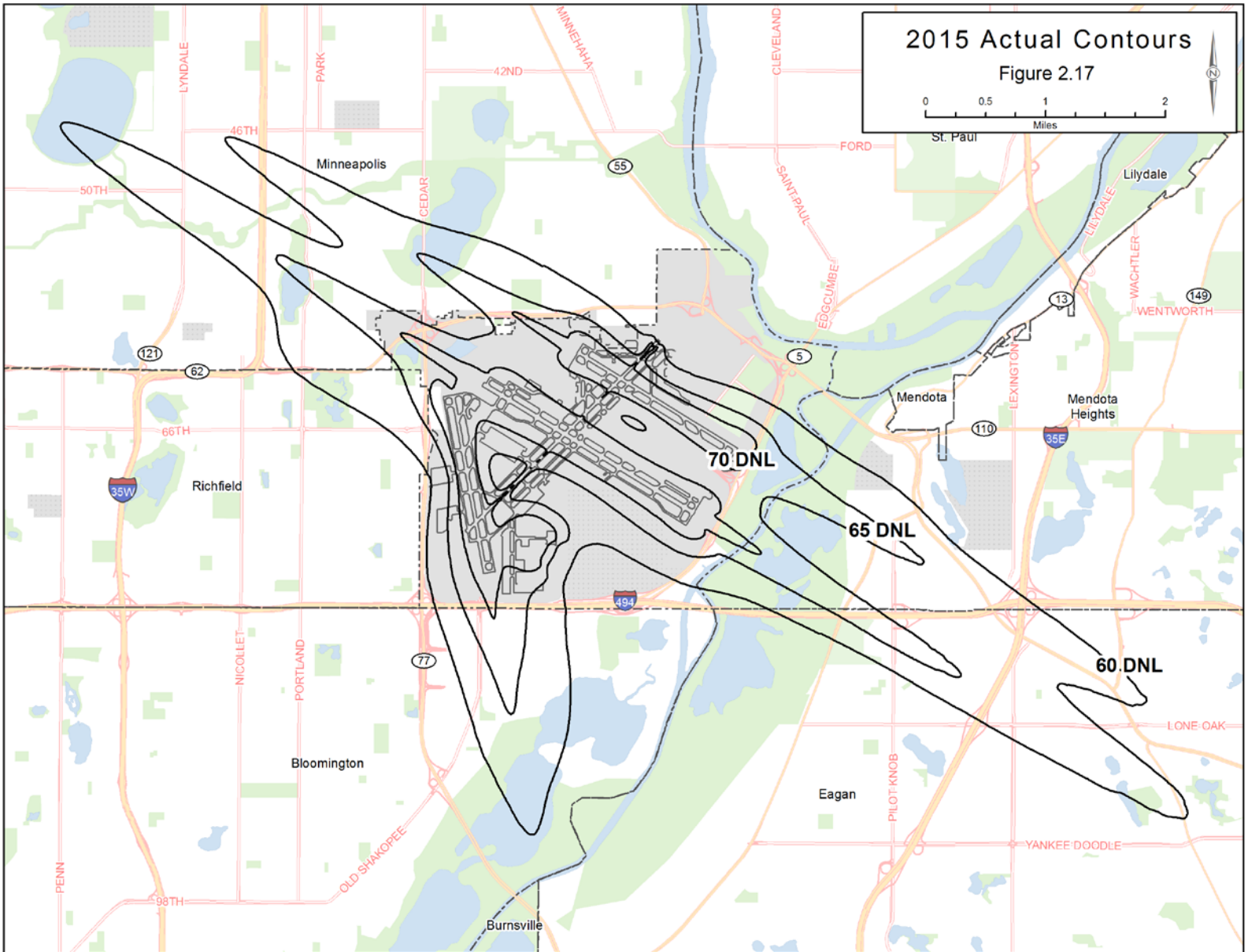
City	Count	Dwelling Units Within DNL (dB) Interval									
		Single Family					Multi-Family				
		60-64	65-69	70-74	75+	Total	60-64	65-69	70-74	75+	Total
Minneapolis	Completed	5970	1385	-	-	7355	508	427	-	-	935
	Additional	905	-	-	-	905	89	-	-	-	89
	Total	6875	1385	-	-	8260	597	427	-	-	1024
Bloomington	Completed	16	1	-	-	17	511	-	-	-	511
	Additional	-	-	-	-	-	-	-	-	-	-
	Total	16	1	-	-	17	511	-	-	-	511
Richfield	Completed	550	-	-	-	550	66	-	-	-	66
	Additional	-	-	-	-	-	-	-	-	-	-
	Total	550	-	-	-	550	66	-	-	-	66
Eagan	Completed	196	-	-	-	196	-	-	-	-	-
	Additional	-	-	-	-	-	-	-	-	-	-
	Total	196	-	-	-	196	-	-	-	-	-
Mendota Heights	Completed	13	1	-	-	14	-	-	-	-	-
	Additional	-	-	-	-	-	-	-	-	-	-
	Total	13	1	-	-	14	-	-	-	-	-
All Cities	Completed	6745	1387	-	-	8132	1085	427	-	-	1512
	Additional	905	-	-	-	905	89	-	-	-	89
	Total	7650	1387	-	-	9037	1174	427	-	-	1601

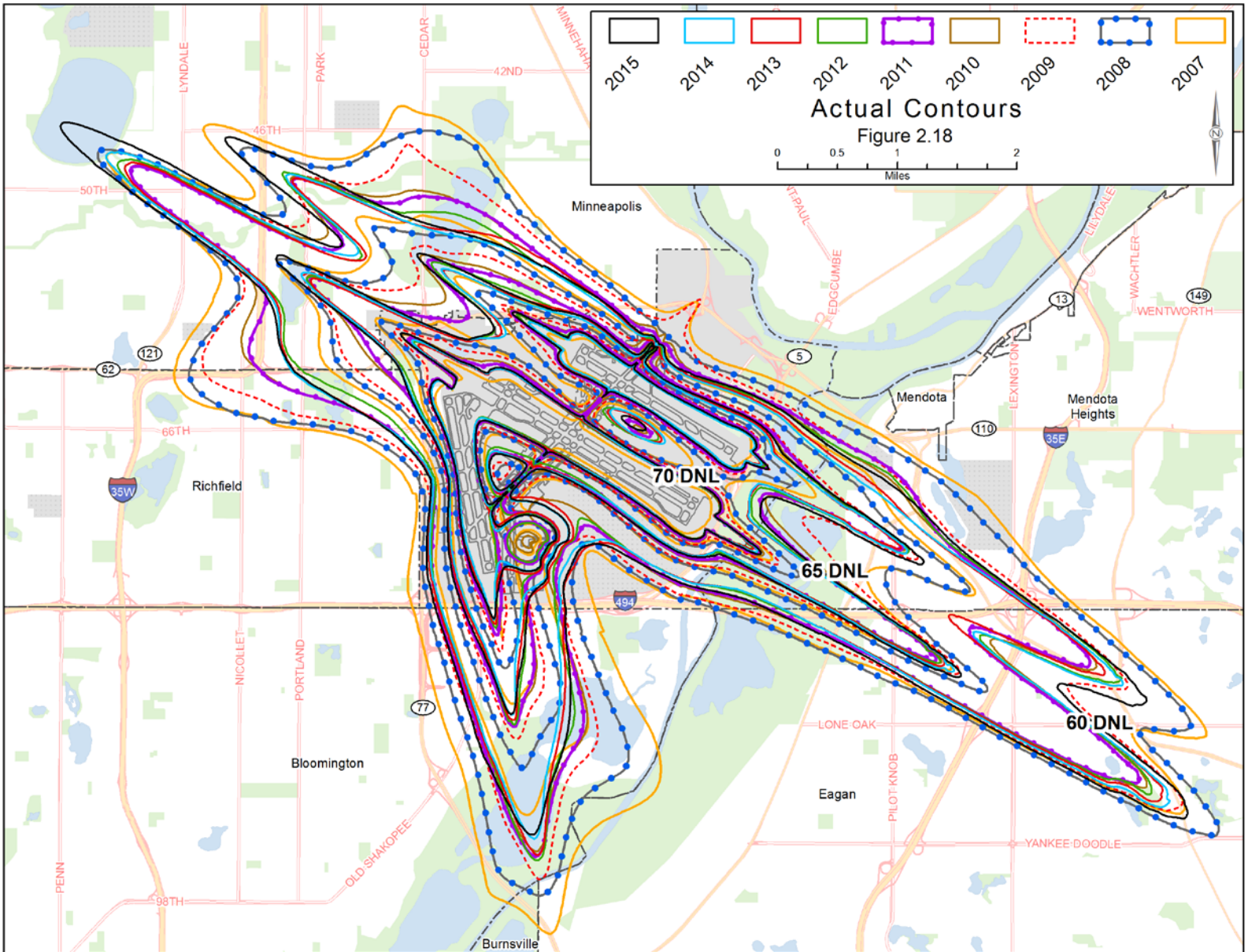
**Units that declined mitigation or were determined to be ineligible for participation in the current program are not included in the table.*

Source: HNTB provided INM contours, MAC analysis, 2016

The 2015 count of residential units within the actual 60 DNL noise contour that have not received noise mitigation around MSP is 994, an increase from the 391 based on the 2014 actual noise contours. The increase is due, in large part, to an increase in nighttime operations in 2015, particularly nighttime arrival operations on Runway 12R. All homes within the 2015 actual 65 DNL contour have received the 5 dB noise reduction mitigation package.

A depiction of the 2015 actual noise contour is provided in Figure 2.17. The actual noise contours from 2007-2015 are provided in Figure 2.18.





Comparison of the 2015 Actual Noise Contour and the 2007 Forecast Noise Contour

This chapter provides a detailed comparative analysis of the 2015 actual and 2007 forecast mitigated noise contours, focusing on the primary noise modeling variables and noise impacts at MSP.

3.1 Comparison of 2015 Actual and 2007 Forecast Noise Contour Inputs

3.1.1 Noise Model Considerations

To develop the actual 2015 contour, HNTB used Integrated Noise Model (INM) Version 7.0d, which incorporates lateral attenuation capabilities and updates to noise and performance data for commercial aircraft, updates to substitution aircraft data, and corrections to minor software issues. HNTB developed the 2007 forecast mitigated contour using INM Version 6.1.

It is important to note that changes to the model over time can change the size and shape of a noise contour. For example, the improvements to lateral attenuation adjustment algorithms and flight path segmentation in INM 7.0 (versus those used in version 6.1) 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.

3.1.2 Aircraft Operations and Fleet Mix Comparison

Table 3.1 provides a comparison of total MSP operations by operational category used in the 2007 forecast mitigated noise contour and the 2015 actual noise contour.

Table 3.1
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
Comparison of 2007 Forecast Mitigated and
2015 Actual Total Operations

Operations Category	2015 Actual*	2007 Forecasted
Scheduled Passenger Air Carrier (a)	367,778	523,472
Cargo	12,789	21,158
Charter	80	5,766
General Aviation (b)	20,898	28,846
Military	2,829	3,124
TOTAL	404,374	582,366

Notes:

(a) Includes both air carrier and regional carrier operations

(b) Includes both GA and non-scheduled air taxi operations

* Based on actual 2015 MACNOMS data adjusted to match FAA ATADS data (to account for unavailable MACNOMS operations data).

As indicated in Table 3.1, the 2015 actual total MSP operations number of 404,374 represents a 30.6 percent reduction from the 2007 forecast mitigated total operations number of 582,366. Scheduled passenger air carrier, cargo and general aviation operations accounted for the majority of the reduction. However, it is notable that charter operations were 98.6 percent below the 2007 forecast mitigated number.

Table 3.2 provides a comparison of the 2007 forecast mitigated noise contour fleet mix and the 2015 actual noise contour fleet mix³. An assessment of average daily operations per aircraft type with daytime and nighttime operation statistics is provided.

Table 3.2
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
Comparison of 2007 Forecast Mitigated Fleet Mix and 2015 Actual Fleet Mix Average Daily Operations

Group	Aircraft Type	Day		Night		Total		Difference Forecast and Actual
		2007 Forecast	2015 Actual	2007 Forecast	2015 Actual	2007 Forecast	2015 Actual	
Manufactured/ Re-engined Stage 3 Jet	7478	-	0.0	-	0.0	-	0.0	0.0
	717200	7.3	14.6	1.0	0.6	8.3	15.3	7.0
	737300	48.2	7.2	3.5	1.6	51.7	8.8	-42.9
	737400	0.1	0.2	-	0.1	0.1	0.3	0.2
	737500	5.7	-	0.5	-	6.2	-	-6.2
	737700	7.8	39.9	0.5	9.8	8.3	49.7	41.4
	737800	65.5	52.8	12.6	16.9	78.1	69.7	-8.4
	737900	5.7	24.7	0.5	4.2	6.2	28.9	22.7
	747400	1.9	0.2	0.2	0.1	2.1	0.3	-1.8
	74720B	-	0.0	-	-	-	0.0	0.0
	757300	34.1	14.4	1.1	0.9	35.1	15.3	-19.8
	757PW	88.4	39.2	8.6	7.0	97.1	46.2	-50.9
	757RR	-	2.4	-	1.9	-	4.3	4.3
	767200	1.2	-	0.5	-	1.7	-	-1.7
	767300	-	6.2	-	1.4	-	7.7	7.7
	767400	-	1.7	-	0.5	-	2.3	2.3
	767CF6	-	0.6	-	0.0	-	0.7	0.7
	767JT9	-	0.8	-	0.0	-	0.8	0.8
	777200	-	1.7	-	0.0	-	1.7	1.7
	7773ER	-	0.0	-	-	-	0.0	0.0
	A300-622R	4.8	0.6	4.2	0.2	9.1	0.8	-8.3
	A310-304	1.4	0.1	1.3	0.1	2.7	0.2	-2.5
	A318	5.7	-	0.5	-	6.2	-	-6.2
	A319-131	149.1	75.1	3.9	6.1	153.0	81.1	-71.9
	A320-211	173.4	-	16.5	-	189.9	-	-189.9
	A320-232	-	82.3	-	10.6	-	92.9	92.9
	A321-232	-	5.6	-	3.0	-	8.6	8.6
	A330-301	6.2	0.0	-	-	6.2	0.0	-6.2
	A330-343	-	7.2	-	0.3	-	7.5	7.5
	A340	2.1	-	-	-	2.1	-	-2.1
	A340-211	-	0.7	-	-	-	0.7	0.7
	AN124	-	0.0	-	-	-	0.0	0.0
ASTR	2.3	-	0.2	-	2.5	-	-2.5	
BA46	74.3	-	2.2	-	76.5	-	-76.5	

³ Some INM aircraft types were not available at the time of the preparation of the 2007 forecast noise contour.

Table 3.2
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
Comparison of 2007 Forecast Mitigated Fleet Mix and 2015 Actual Fleet Mix Average Daily Operations

Group	Aircraft Type	Day		Night		Total		Difference Forecast and Actual
		2007 Forecast	2015 Actual	2007 Forecast	2015 Actual	2007 Forecast	2015 Actual	
Manufactured/ Re-engined Stage 3 Jet (Cont'd)	BD100	-	4.2	-	0.4	-	4.6	4.6
	BD700	-	0.3	-	0.0	-	0.3	0.3
	BEC400	-	0.9	-	0.0	-	0.9	0.9
	CL600	-	-	-	-	-	-	0.0
	CL601	264.1	1.7	14.7	0.1	278.8	1.8	-277.0
	CLREGJ	-	169.1	-	8.2	-	177.3	177.3
	CNA500	1.4	0.3	0.1	0.0	1.4	0.3	-1.1
	CNA501	-	0.1	-	0.0	-	0.1	0.1
	CNA525	-	-	-	-	-	-	0.0
	CNA525C	-	0.6	-	0.0	-	0.7	0.7
	CNA550	-	0.1	-	0.0	-	0.1	0.1
	CNA551	-	-	-	-	-	-	0.0
	CNA55B	-	0.4	-	0.1	-	0.5	0.5
	CNA560	-	-	-	-	-	-	0.0
	CNA560E	-	1.3	-	0.1	-	1.4	1.4
	CNA560U	-	0.3	-	0.0	-	0.3	0.3
	CNA560XL	-	3.1	-	0.2	-	3.4	3.4
	CNA650	4.9	0.5	0.6	0.0	5.5	0.6	-4.9
	CNA680	-	1.7	-	0.1	-	1.9	1.9
	CNA750	4.6	3.5	0.3	0.3	4.9	3.7	-1.2
	CRJ701	-	32.2	-	2.7	-	34.9	34.9
	CRJ900	-	143.6	-	7.8	-	151.4	151.4
	D328J	-	0.2	-	0.0	-	0.2	0.2
	DC1010	9.6	1.9	3.8	0.6	13.4	2.5	-10.9
	DC820	-	-	-	-	-	-	0.0
	DC860	-	-	-	-	-	-	0.0
	DC870	-	-	1.4	-	1.4	-	-1.4
	EMB135	-	0.2	-	0.0	-	0.2	0.2
	EMB145	45.3	7.3	0.2	0.1	45.5	7.4	-38.1
	EMB14L	-	5.2	-	0.2	-	5.4	5.4
	EMB170	-	71.1	-	4.8	-	75.9	75.9
	EMB190	-	2.6	-	0.0	-	2.6	2.6
	F10062	-	0.1	-	0.0	-	0.1	0.1
FAL10	-	0.0	-	0.0	-	0.0	0.0	
FAL200	-	-	-	-	-	-	0.0	
FAL20A	1.0	1.2	0.7	0.0	1.7	1.3	-0.4	
FAL50	-	0.9	-	0.1	-	1.0	1.0	
FAL900	-	1.0	-	0.1	-	1.2	1.2	
G150	-	0.2	-	0.0	-	0.2	0.2	
G200	-	1.5	-	0.2	-	1.7	1.7	
GIV	2.6	1.5	0.2	0.1	2.8	1.7	-1.1	

Table 3.2
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
Comparison of 2007 Forecast Mitigated Fleet Mix and 2015 Actual Fleet Mix Average Daily Operations

Group	Aircraft Type	Day		Night		Total		Difference Forecast and Actual
		2007 Forecast	2015 Actual	2007 Forecast	2015 Actual	2007 Forecast	2015 Actual	
Manufactured/ Re-engined Stage 3 Jet (Cont'd)	GV	0.8	1.6	0.1	0.2	0.9	1.9	1.0
	HK4000	-	0.1	-	-	-	0.1	0.1
	HS125	-	0.0	-	-	-	0.0	0.0
	HS1258	-	2.5	-	0.1	-	2.6	2.6
	IA1124	-	0.0	-	0.0	-	0.1	0.1
	IA1125	-	0.1	-	-	-	0.1	0.1
	L101	0.6	-	0.2	-	0.8	-	-0.8
	LEAR31	-	0.1	-	0.0	-	0.1	0.1
	LEAR35	26.0	0.7	2.3	0.1	28.4	0.8	-27.6
	LEAR45	-	2.8	-	0.2	-	3.0	3.0
	LEAR55	-	0.1	-	0.0	-	0.1	0.1
	LEAR60	-	0.4	-	0.0	-	0.5	0.5
	MD11GE	0.3	1.5	0.4	1.3	0.7	2.8	2.1
	MD11PW	-	1.4	-	1.0	-	2.5	2.5
	MD80	-	0.0	-	-	-	0.0	0.0
	MD81	0.5	0.0	-	0.0	0.6	0.0	-0.6
	MD82	-	6.7	-	1.4	-	8.1	8.1
	MD83	17.0	7.0	1.6	1.6	18.6	8.5	-10.1
	MD88	-	18.6	-	0.9	-	19.5	19.5
	MD9025	-	36.4	-	1.8	-	38.2	38.2
	MD9028	-	45.0	-	1.8	-	46.8	46.8
	MU300	7.2	0.0	0.6	-	7.8	0.0	-7.8
	R390	-	0.2	-	0.0	-	0.2	0.2
SBR2	0.4	-	-	-	0.4	-	-0.4	
<i>Total</i>		<i>1,071.5</i>	<i>962.6</i>	<i>85.0</i>	<i>102.2</i>	<i>1,156.7</i>	<i>1,064.8</i>	<i>-91.9</i>
Modified ("hushkitted") Stage 3 Jet	727EM2	8.0	-	6.4	0.0	14.4	0.0	-14.4
	737N17	-	0.0	-	0.0	-	0.0	0.0
	DC93LW	-	0.0	-	0.0	-	0.0	0.0
	DC9Q	245.3	-	15.3	-	260.5	-	-260.5
	DC9Q7	-	0.0	-	-	-	0.0	0.0
	<i>Total</i>	<i>253.3</i>	<i>0.0</i>	<i>21.7</i>	<i>0.0</i>	<i>274.9</i>	<i>0.1</i>	<i>-274.8</i>
Microjet	CNA510	-	0.5	-	0.1	-	0.7	0.7
	ECLIPSE500	-	0.1	-	-	-	0.1	0.1
	<i>Total</i>	<i>-</i>	<i>0.6</i>	<i>-</i>	<i>0.1</i>	<i>-</i>	<i>0.7</i>	<i>0.7</i>
Stage 2 Less than 75,000 lb. MTOW ⁴	FAL20	-	0.7	-	1.5	-	2.3	2.3
	GII	2.1	0.0	0.2	-	2.3	0.0	-2.3
	GULF3	-	0.0	-	0.0	-	0.0	0.0
	LEAR24	-	0.0	-	-	-	0.0	0.0

⁴ As of January 1, 2016, all Stage 2 aircraft types are required to meet Stage 3 noise standards.

Table 3.2
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
Comparison of 2007 Forecast Mitigated Fleet Mix and 2015 Actual Fleet Mix Average Daily Operations

Group	Aircraft Type	Day		Night		Total		Difference Forecast and Actual
		2007 Forecast	2015 Actual	2007 Forecast	2015 Actual	2007 Forecast	2015 Actual	
Stage 2 Less than 75,000 lb. MTOW (Cont'd)	LEAR25	2.1	-	0.4	-	2.5	-	-2.5
	SABR80	-	0.0	-	-	-	0.0	0.0
	<i>Total</i>	<i>4.2</i>	<i>0.8</i>	<i>0.6</i>	<i>1.5</i>	<i>4.8</i>	<i>2.3</i>	<i>-2.5</i>
Propeller	1900D	-	13.0	-	0.7	-	13.7	13.7
	AC50	-	-	-	0.0	-	0.0	0.0
	AC95	-	0.0	-	-	-	0.0	0.0
	ATR42	-	1.3	-	0.2	-	1.4	1.4
	BAEJ41	-	0.0	-	-	-	0.0	0.0
	BEC100	-	0.0	-	0.0	-	0.0	0.0
	BEC200	-	0.8	-	0.1	-	0.9	0.9
	BEC300	-	0.5	-	0.0	-	0.5	0.5
	BEC30B	-	0.2	-	0.0	-	0.2	0.2
	BEC33	-	0.0	-	-	-	0.0	0.0
	BEC58	14.3	0.1	4.7	0.0	19.0	0.1	-18.9
	BEC65	-	5.9	-	0.8	-	6.7	6.7
	BEC80	-	1.7	-	0.1	-	1.9	1.9
	BEC90	-	0.4	-	0.0	-	0.5	0.5
	BEC99	-	3.7	-	0.3	-	4.1	4.1
	BEC9F	-	0.0	-	-	-	0.0	0.0
	BECM35	-	0.1	-	-	-	0.1	0.1
	CNA172	-	0.1	-	0.0	-	0.1	0.1
	CNA180	-	0.0	-	0.0	-	0.0	0.0
	CNA182	-	0.0	-	0.0	-	0.0	0.0
	CNA206	-	0.0	-	-	-	0.0	0.0
	CNA208	-	1.0	-	0.0	-	1.0	1.0
	CNA210	-	0.0	-	0.0	-	0.0	0.0
	CNA303	-	0.0	-	0.0	-	0.0	0.0
	CNA310	-	0.1	-	0.0	-	0.1	0.1
	CNA340	-	0.0	-	-	-	0.0	0.0
	CNA402	-	0.0	-	-	-	0.0	0.0
	CNA404	-	0.0	-	0.0	-	0.0	0.0
	CNA414	-	0.1	-	0.0	-	0.1	0.1
	CNA421	-	0.1	-	0.0	-	0.2	0.2
	CNA425	-	0.0	-	0.0	-	0.0	0.0
	CNA441	-	0.1	-	0.0	-	0.1	0.1
DA42	-	0.0	-	-	-	0.0	0.0	
DHC6	22.5	0.0	4.4	-	26.8	0.0	-26.8	
DHC8	-	0.0	-	-	-	0.0	0.0	
DHC830	-	0.0	-	-	-	0.0	0.0	
DO328	-	0.0	-	-	-	0.0	0.0	
EMB110	-	0.0	-	-	-	0.0	0.0	

Table 3.2
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
Comparison of 2007 Forecast Mitigated Fleet Mix and 2015 Actual Fleet Mix Average Daily Operations

Group	Aircraft Type	Day		Night		Total		Difference Forecast and Actual
		2007 Forecast	2015 Actual	2007 Forecast	2015 Actual	2007 Forecast	2015 Actual	
Propeller (Cont'd)	EMB120	-	0.0	-	0.0	-	0.0	0.0
	FK27	0.1	-	-	-	0.1	-	-0.1
	GASEPF	1.3	-	0.3	-	1.6	-	-1.6
	GASEPV	3.7	0.0	0.5	-	4.3	0.0	-4.3
	M20J	-	0.2	-	0.0	-	0.2	0.2
	MU2	-	0.0	-	0.0	-	0.0	0.0
	P180	-	0.0	-	-	-	0.0	0.0
	PA23AZ	-	0.0	-	0.0	-	0.0	0.0
	PA24	-	0.0	-	-	-	0.0	0.0
	PA28	-	0.0	-	-	-	0.0	0.0
	PA28AR	-	0.0	-	0.0	-	0.0	0.0
	PA28DK	-	0.0	-	-	-	0.0	0.0
	PA31	-	0.1	-	0.0	-	0.1	0.1
	PA31T	-	0.1	-	-	-	0.1	0.1
	PA32LA	-	0.0	-	-	-	0.0	0.0
	PA32SG	-	0.0	-	-	-	0.0	0.0
	PA34	-	0.1	-	0.0	-	0.1	0.1
	PA42	-	0.0	-	-	-	0.0	0.0
	PA46	-	0.1	-	-	-	0.1	0.1
	PA60	-	0.0	-	-	-	0.0	0.0
	PC12	-	0.3	-	0.0	-	0.3	0.3
	RWCM69	-	0.0	-	0.0	-	0.0	0.0
	SA227	-	0.0	-	-	-	0.0	0.0
	SAAB20	-	0.0	-	-	-	0.0	0.0
	SAMER3	-	0.0	-	0.0	-	0.0	0.0
	SAMER4	-	4.0	-	0.3	-	4.3	4.3
SF340	93.3	-	5.9	-	99.2	-	-99.2	
SR22	-	0.4	-	0.0	-	0.4	0.4	
STBM7	-	0.0	-	0.0	-	0.0	0.0	
TED600	-	0.1	-	0.0	-	0.1	0.1	
<i>Total</i>		<i>135.2</i>	<i>35.5</i>	<i>15.8</i>	<i>2.8</i>	<i>151.0</i>	<i>38.3</i>	<i>-112.7</i>
Helicopter	B429	-	0.0	-	-	-	0.0	0.0
	R22	-	0.0	-	-	-	0.0	0.0
	S76	-	0.0	-	-	-	0.0	0.0
	SA355F	-	0.0	-	-	-	0.0	0.0
	<i>Total</i>		<i>-</i>	<i>0.1</i>	<i>-</i>	<i>-</i>	<i>0.1</i>	<i>0.1</i>
Military	C-130E	7.8	1.4	0.2	0.0	8.0	1.5	-6.5
	C17	-	0.0	-	-	0.1	0.0	-0.1
	C5	0.1	-	-	-	0.1	-	-0.1
	F16GE	0.1	-	-	-	0.1	-	-0.1
	F-18	-	0.0	-	-	-	0.0	0.0

Table 3.2
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
Comparison of 2007 Forecast Mitigated Fleet Mix and 2015 Actual Fleet Mix Average Daily Operations

Group	Aircraft Type	Day		Night		Total		Difference Forecast and Actual
		2007 Forecast	2015 Actual	2007 Forecast	2015 Actual	2007 Forecast	2015 Actual	
Military (Cont'd)	KC-135	-	0.0	-	-	-	0.0	0.0
	T33A	-	0.0	-	-	-	0.0	0.0
	T37	0.1	-	-	-	0.1	-	-0.1
	T38	0.1	-	-	-	0.1	-	-0.1
	T-38A	-	0.0	-	0.0	-	0.0	0.0
	T6	-	0.0	-	0.0	-	0.0	0.0
	<i>Total</i>	<i>8.2</i>	<i>1.5</i>	<i>0.2</i>	<i>0.1</i>	<i>8.5</i>	<i>1.6</i>	<i>-6.9</i>
<i>Grand Total</i>	<i>1,472.4</i>	<i>1,001.1</i>	<i>123.3</i>	<i>106.7</i>	<i>1,595.9</i>	<i>1,107.8</i>	<i>-488.1</i>	

Notes: Total may differ due to rounding

Source: MAC-provided INM Input Data, HNTB 2016. Average Daily Operations for 2007 Forecast were obtained from the November 2004 Part 150 document.

In general, many of the aircraft groups operating at MSP showed a reduction in the number of average daily operations from the 2007 forecast mitigated to the 2015 actual operations statistics. Manufactured or re-engined Stage 3 average daily operations in the 2015 actual statistics were down 7.9 percent from the 2007 forecast. The Modified (“hushkitted”) Stage 3 average daily operations in the 2015 actual statistics were down over 99.9 percent from the 2007 forecast number.

In total, the 2015 actual average daily number of operations was 1,107.8, which is a 30.6 percent reduction from the 2007 forecast number of 1,595.9 operations. Nighttime operations decreased by 16.6 average daily operations from the 2007 Forecast to the 2015 actual operations statistics.

3.1.3 Runway Use Comparison

Table 3.3 provides a comparison of the 2007 forecast mitigated noise contour and the 2015 actual noise contour runway use percentages.

Table 3.3
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
Comparison of 2007 Forecast Mitigated and 2015 Actual Runway Use

Operation	Runway	Day		Night		Total	
		2007 Forecast	2015 Actual	2007 Forecast	2015 Actual	2007 Forecast	2015 Actual
Arrivals	4	0.0%	0.0%	3.8%	0.1%	0.3%	0.0%
	12L	21.8%	23.0%	17.2%	18.3%	21.4%	22.5%
	12R	14.7%	25.0%	12.4%	28.4%	14.5%	25.4%
	17	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
	22	0.5%	0.1%	2.4%	0.4%	0.6%	0.1%
	30L	21.1%	18.9%	25.1%	31.3%	21.4%	20.2%
	30R	25.1%	20.3%	26.4%	20.2%	25.2%	20.3%
	35	16.9%	12.6%	12.7%	1.3%	16.5%	11.4%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Departures	4	0.2%	0.1%	0.4%	0.3%	0.2%	0.1%
	12L	8.9%	15.6%	14.1%	20.0%	9.3%	15.9%
	12R	15.9%	5.4%	18.3%	29.0%	16.1%	7.4%
	17	37.2%	31.4%	34.6%	11.9%	37.0%	29.8%
	22	0.1%	0.0%	0.8%	0.2%	0.1%	0.1%
	30L	15.0%	25.9%	12.8%	22.1%	14.8%	25.6%
	30R	22.7%	21.5%	19.2%	16.4%	22.4%	21.1%
	35	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Overall	4	0.1%	0.1%	2.1%	0.2%	0.3%	0.1%
	12L	15.3%	19.3%	15.6%	19.1%	15.4%	19.2%
	12R	15.3%	15.1%	15.3%	28.7%	15.3%	16.4%
	17	18.6%	15.9%	17.1%	5.3%	18.5%	14.9%
	22	0.3%	0.1%	1.6%	0.3%	0.4%	0.1%
	30L	18.0%	22.4%	19.0%	27.2%	18.1%	22.9%
	30R	23.9%	20.9%	22.8%	18.5%	23.8%	20.7%
	35	8.4%	6.2%	6.4%	0.8%	8.3%	5.7%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Total may not add up due to rounding.

Source: MAC-provided INM Input Data, HNTB 2016.

A general evaluation of the runway use percentages in Table 3.3 indicates that total and nighttime use of Runway 17 for departure operations in 2015 was well below those forecasted in the 2007 mitigated scenario. The departure percentages on Runways 30L and 12L were notably higher than the 2007 forecast mitigated scenario. The total departure percentage on Runway 12R was below the 2007 forecast mitigated scenario, while the nighttime percentage on this runway was higher than the 2007 forecast mitigated scenario. Total and nighttime use of Runway 12R for arrival operations in 2015 was notably higher than what was forecasted in the 2007 forecast mitigated scenario. The arrival percentages on Runways 30R and 35 were notably lower in total use and nighttime use as compared to the 2007 forecast mitigated scenario.

3.1.4 Flight Track Considerations

The INM departure flight track locations used to develop the 2015 actual noise contour were identical to those used for the 2014 actual noise contour. These flight tracks differ from those used to develop the 2007 forecast mitigated noise contour due to enhanced modeling methods and improved technologies. Sub-tracks were also added to each of the backbone tracks. The INM's standard distribution was used in distributing the flights to the sub-tracks.

The same methodology as in previous annual reports was used to assign 2015 radar data with the INM flight tracks. The radar-to-INM flight track correlation process employs a best-fit analysis of the radar flight track data based on linear trends. This approach provides the ability to match each radar flight track directly to the appropriate INM track.

3.1.5 Atmospheric Conditions Comparison

The MAC used an average annual temperature of 47.7 degrees Fahrenheit and an average annual wind speed of 5.3 knots in the 2007 forecast mitigated INM contour modeling process. The MAC also used an average annual pressure of 29.90 inches and an annual average relative humidity of 64 percent. As stated in Section 2.1.5, the 2015 actual noise contour used a 2015 annual average temperature of 48.6 degrees Fahrenheit and a 2015 average annual wind speed of 8.3 knots in the INM modeling process. In addition, a 2015 average annual pressure of 30.01 inches of Mercury and a 2015 annual average relative humidity of 63.3 percent were used.

3.2 Comparative Noise Model Grid Point Analysis

The INM was used to conduct a grid point analysis based on the 2007 forecast mitigated noise contour and 2015 actual noise contour INM input files. The MAC used INM Version 6.2a for the 2007 forecast mitigated noise contour grid point analysis because this was the oldest version of INM available to MAC staff to conduct the analysis in early 2008 when the annual noise contour report process began at MSP. When comparing the DNL values generated for the MACNOMS RMT locations with INM 6.1 in the November 2004 Part 150 Update document to the levels generated for those same locations with INM 6.2a, the differences were insignificant.

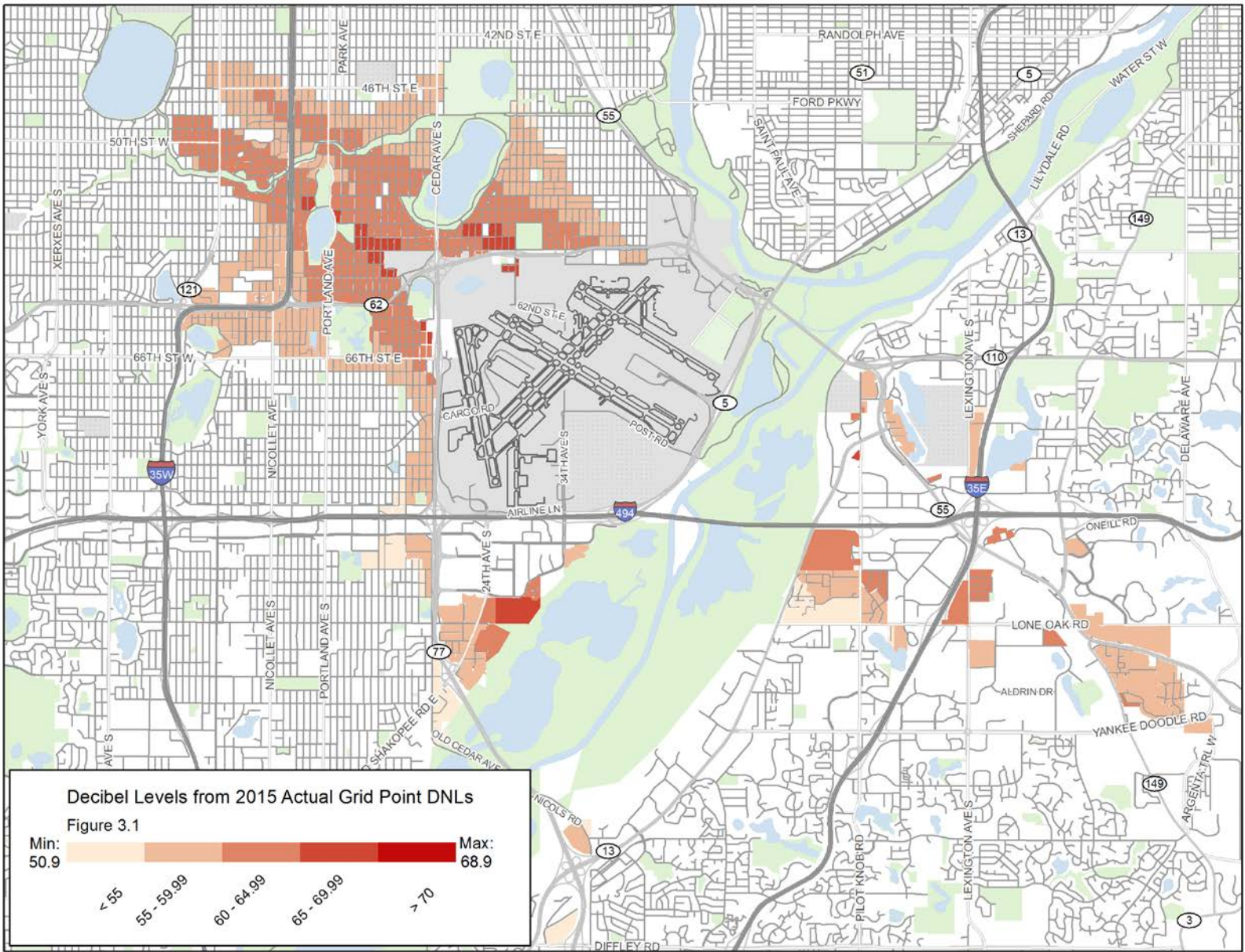
The INM was used to calculate DNL values for the center points of each city block included in the mitigation programs outlined in the Consent Decree. Figures 3.1 to 3.5 depict the 2015 actual grid point analysis area and the DNL levels calculated for each block by city. Figures 3.6 to 3.10 depict the 2007 forecast mitigated grid point analysis area and the DNL levels calculated for each block by city. Figures 3.11 to 3.15 depict the difference in DNL levels, on a block-by-block basis, between the 2007 forecast mitigated noise contours and the 2015 actual noise contours.

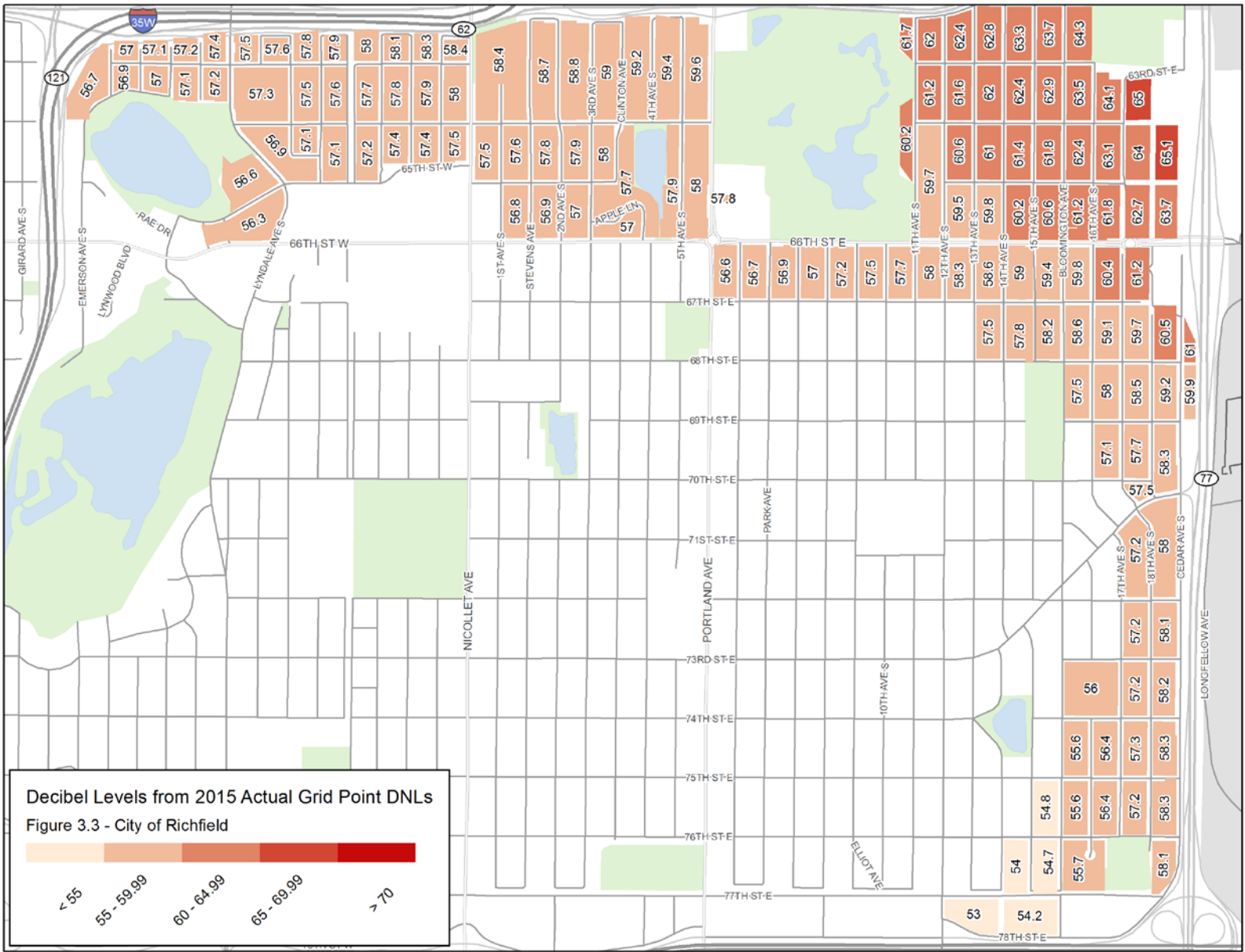
3.3 Contour Comparison Summary

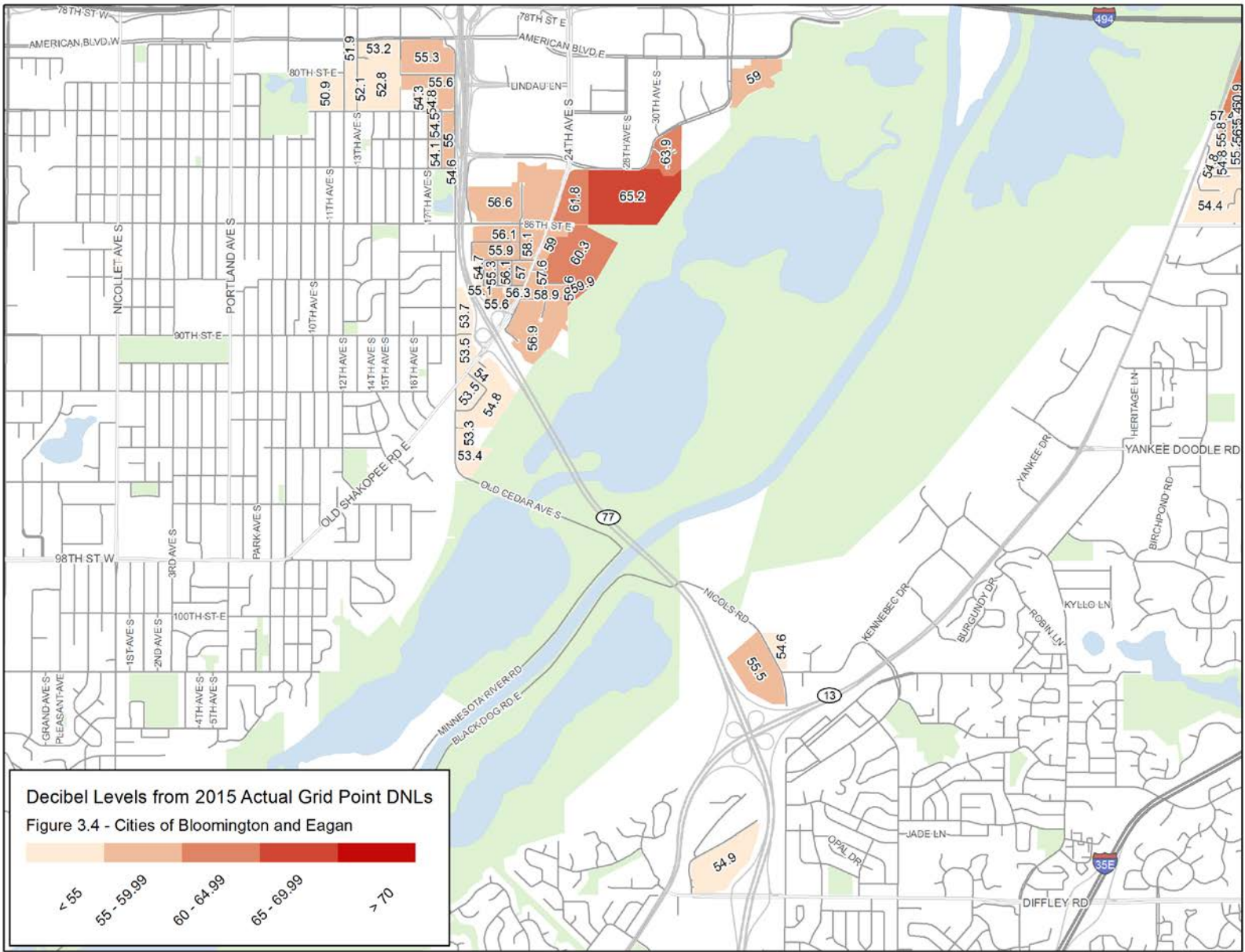
The 2015 actual noise contour is smaller than the 2007 forecast mitigated contour by 5,936 acres (37.8 percent reduction) in the 60 DNL contour and by 3,352 acres (46.3 percent reduction) in the 65 DNL contour. As depicted in Figure 3.16, there is a small area in South Minneapolis where the 2015 actual noise contours extend beyond the 2007 forecast mitigated noise contours. Chapter 4 provides an analysis of mitigation eligibility relative to the 2015 actual contour consistent with the requirements of the First Amendment to the Consent Decree. There is an overall decrease of 3,811 residential units in the 65 DNL contour and 1,740 residential units in the 60 to 64 DNL noise contours around MSP when comparing the 2007 forecast mitigated contour with the 2015 actual contour that was developed under the requirements of the Consent Decree.

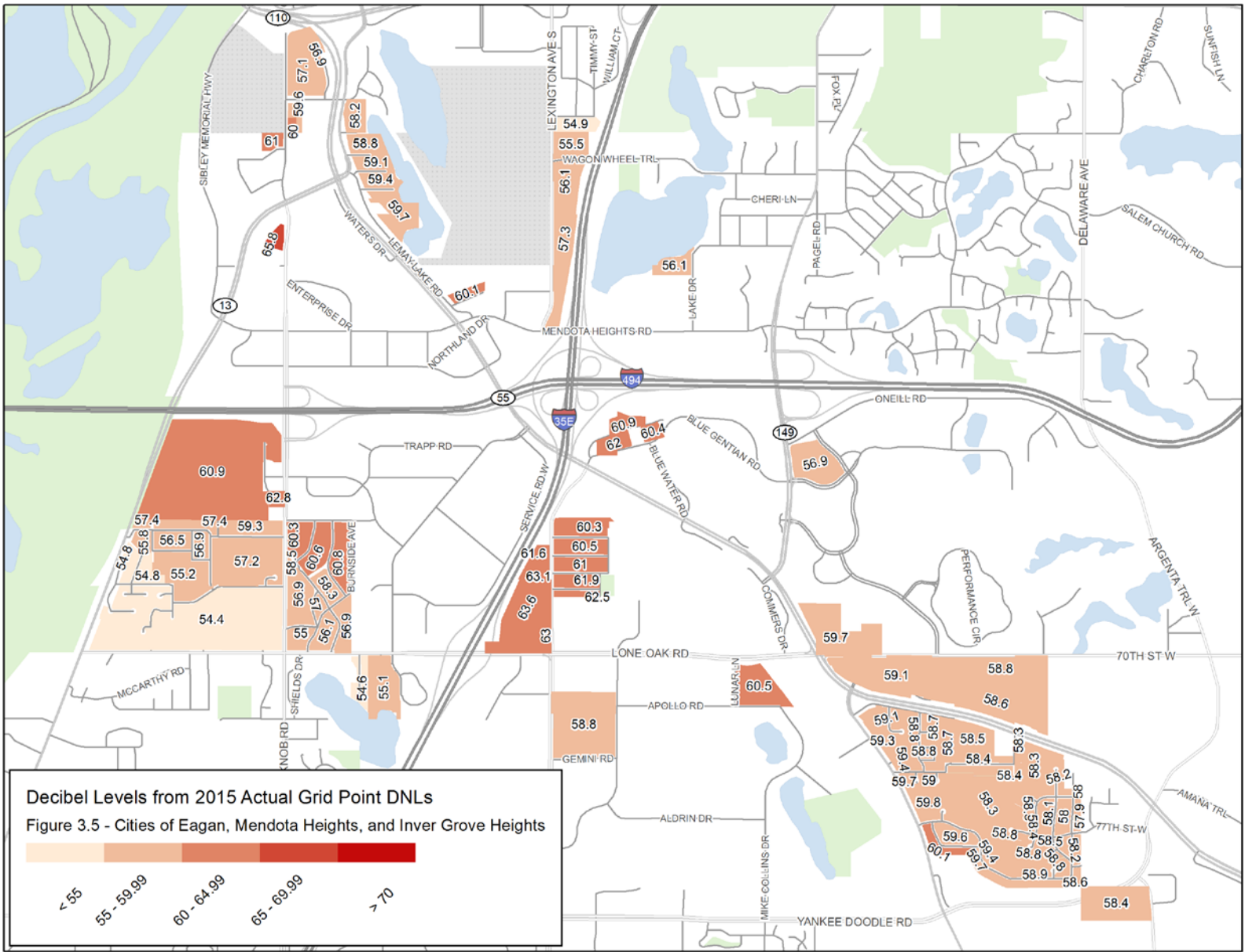
The predominant contraction in the contours from the 2007 forecast mitigated to the 2015 actual noise contour scenarios is driven largely by fleet mix changes (including a significant reduction in Modified (“hushkitted”) Stage 3 aircraft operations), and a significant reduction of total annual operations, including a reduction of 16.6 average daily nighttime operations. The extension of the 2015 actual noise contour beyond the 2007 forecast mitigated noise contour can largely be attributed to nighttime runway use variances between what was forecasted for 2007 and what occurred in 2015, particularly an increase in nighttime arrival operations on Runway 12R.

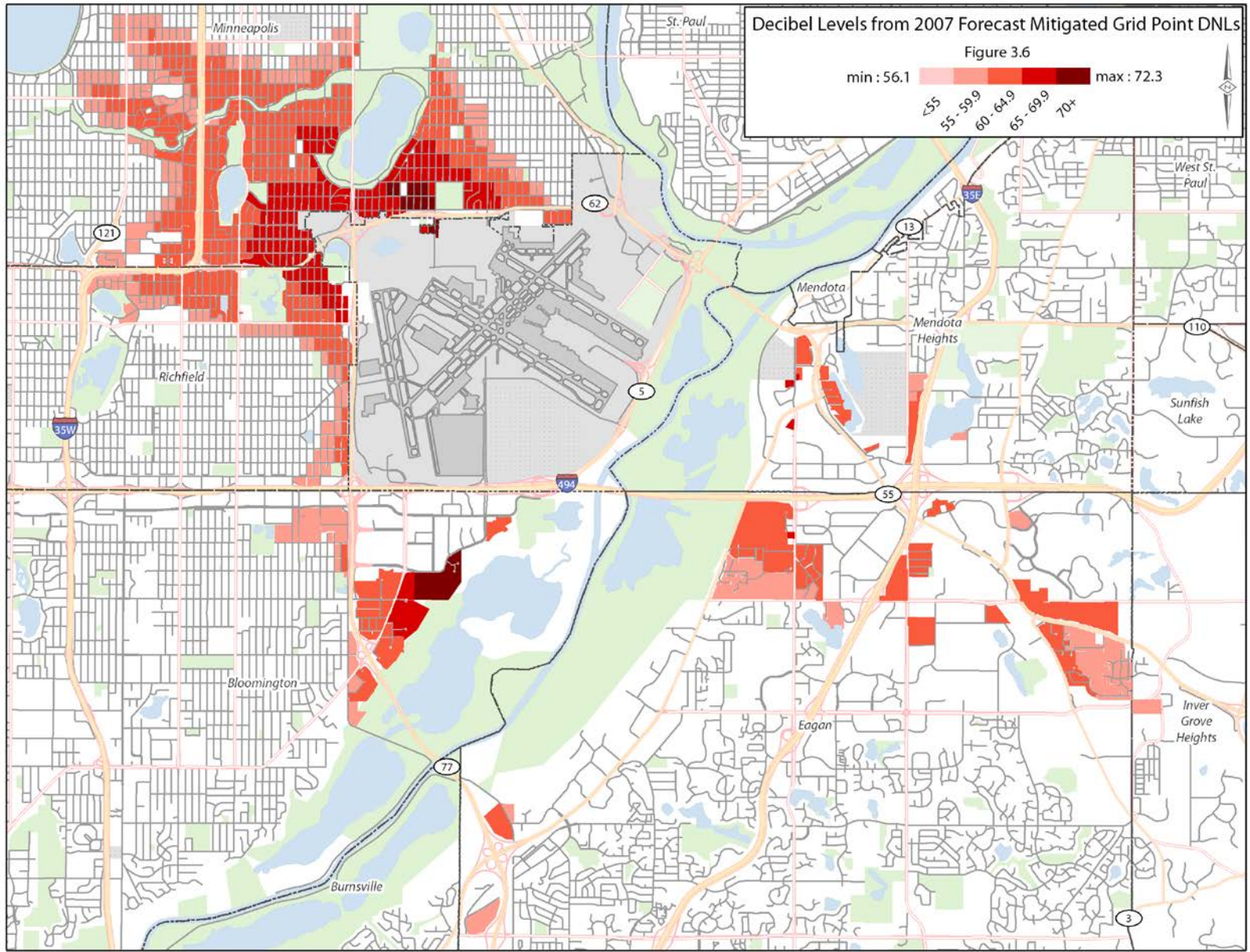
In summary, in addition to INM modeling enhancements, the primary factors to consider when comparing the 2007 forecast mitigated noise contours to the 2015 actual noise contours are total operation numbers, fleet mix, nighttime operations, and runway use.

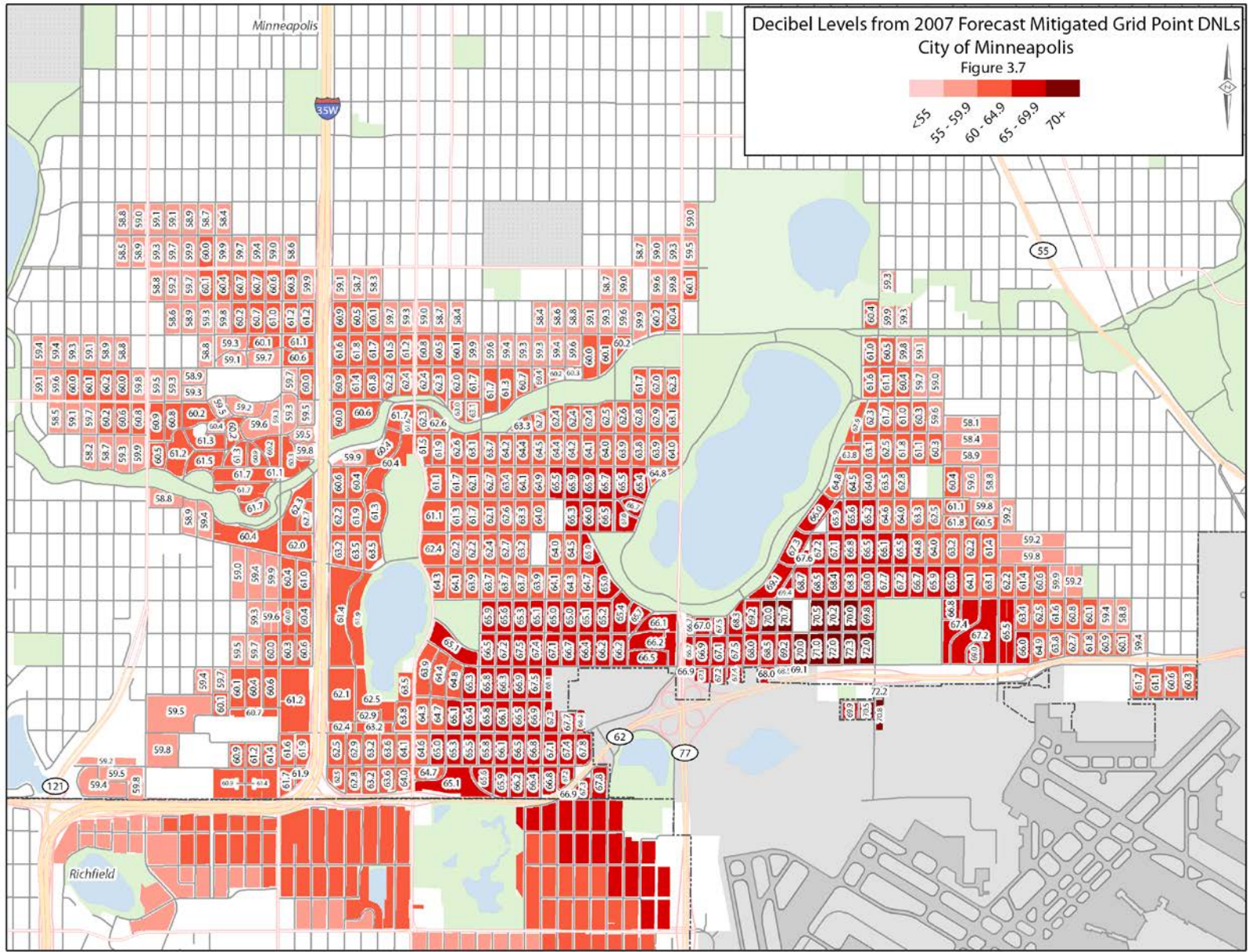


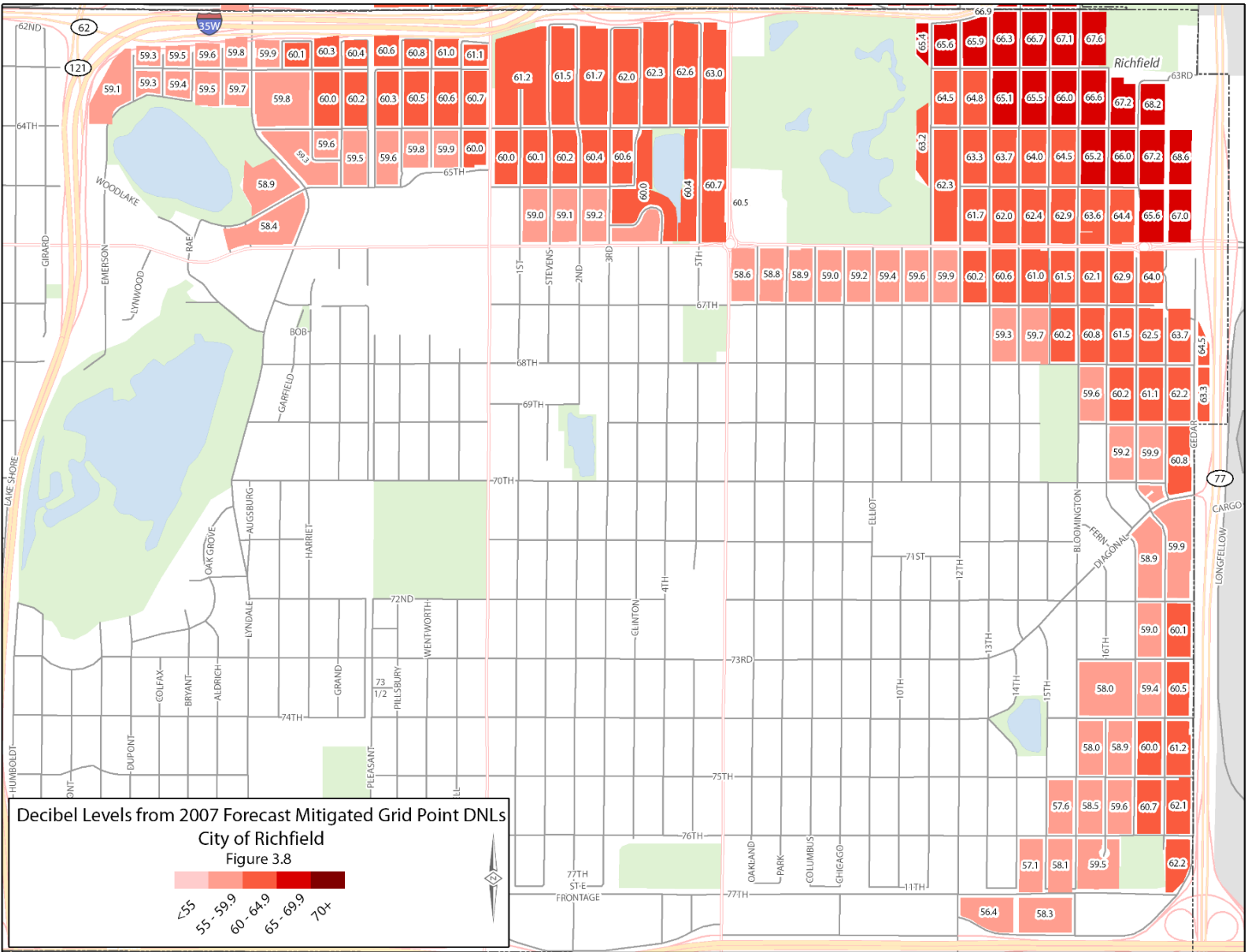


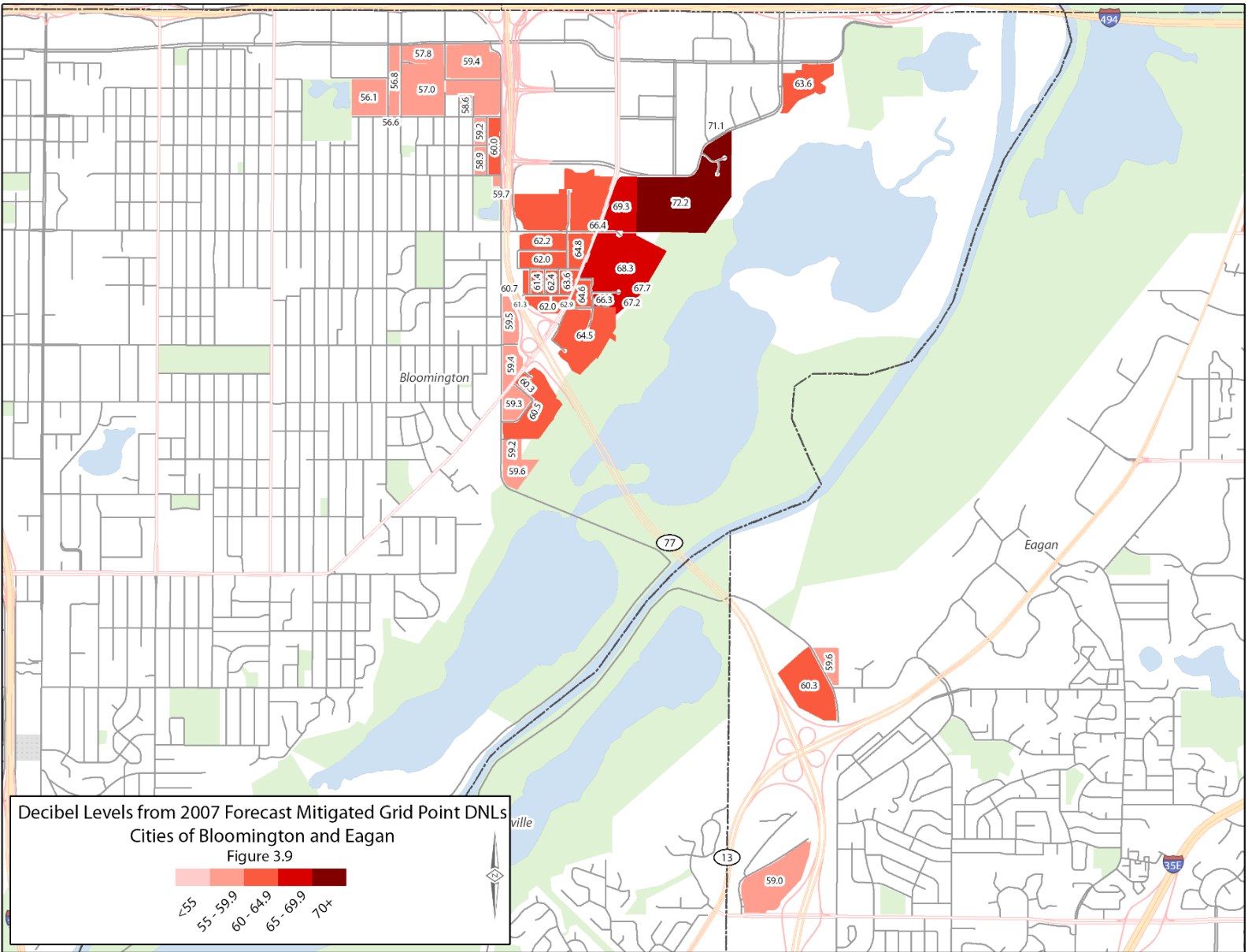


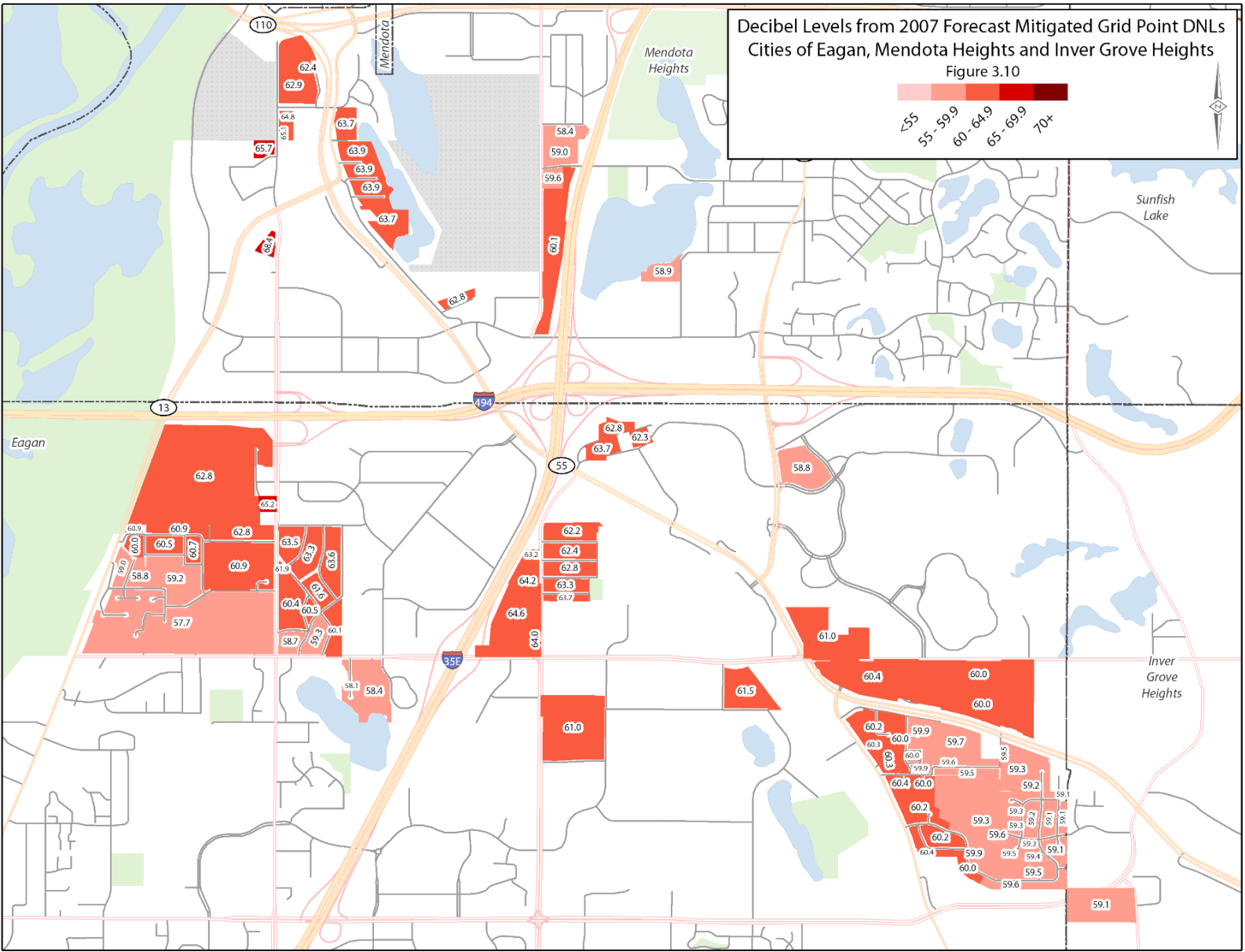


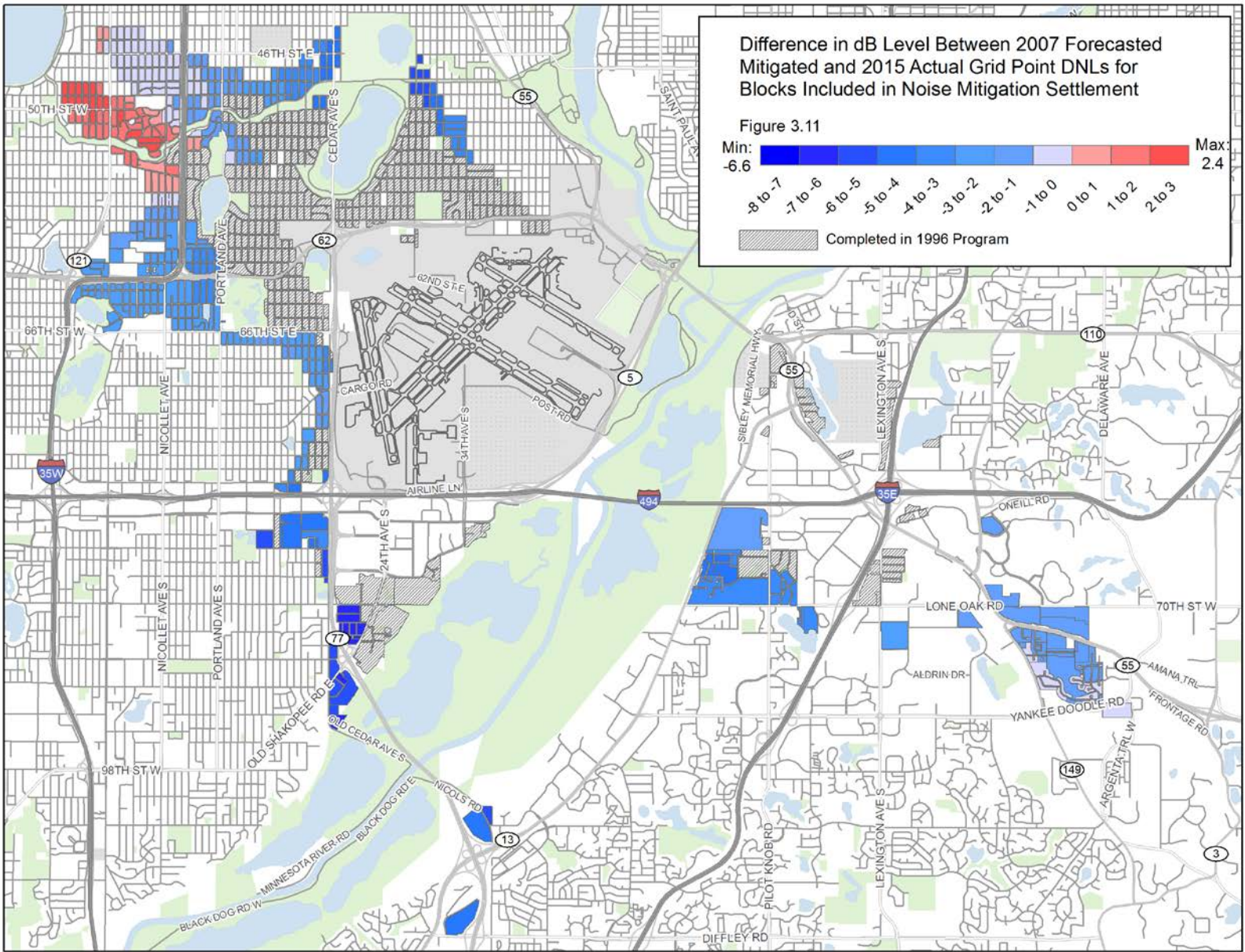


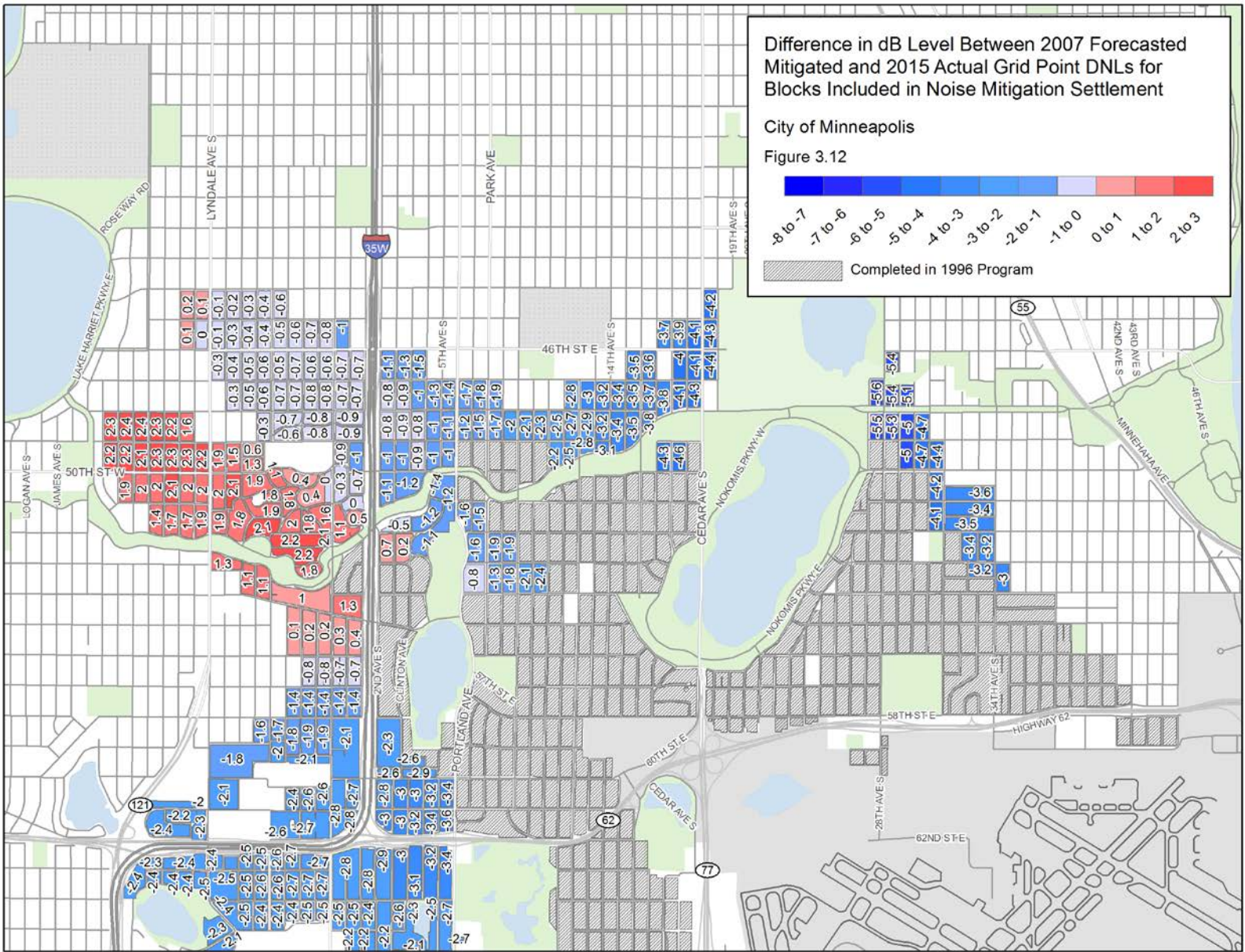


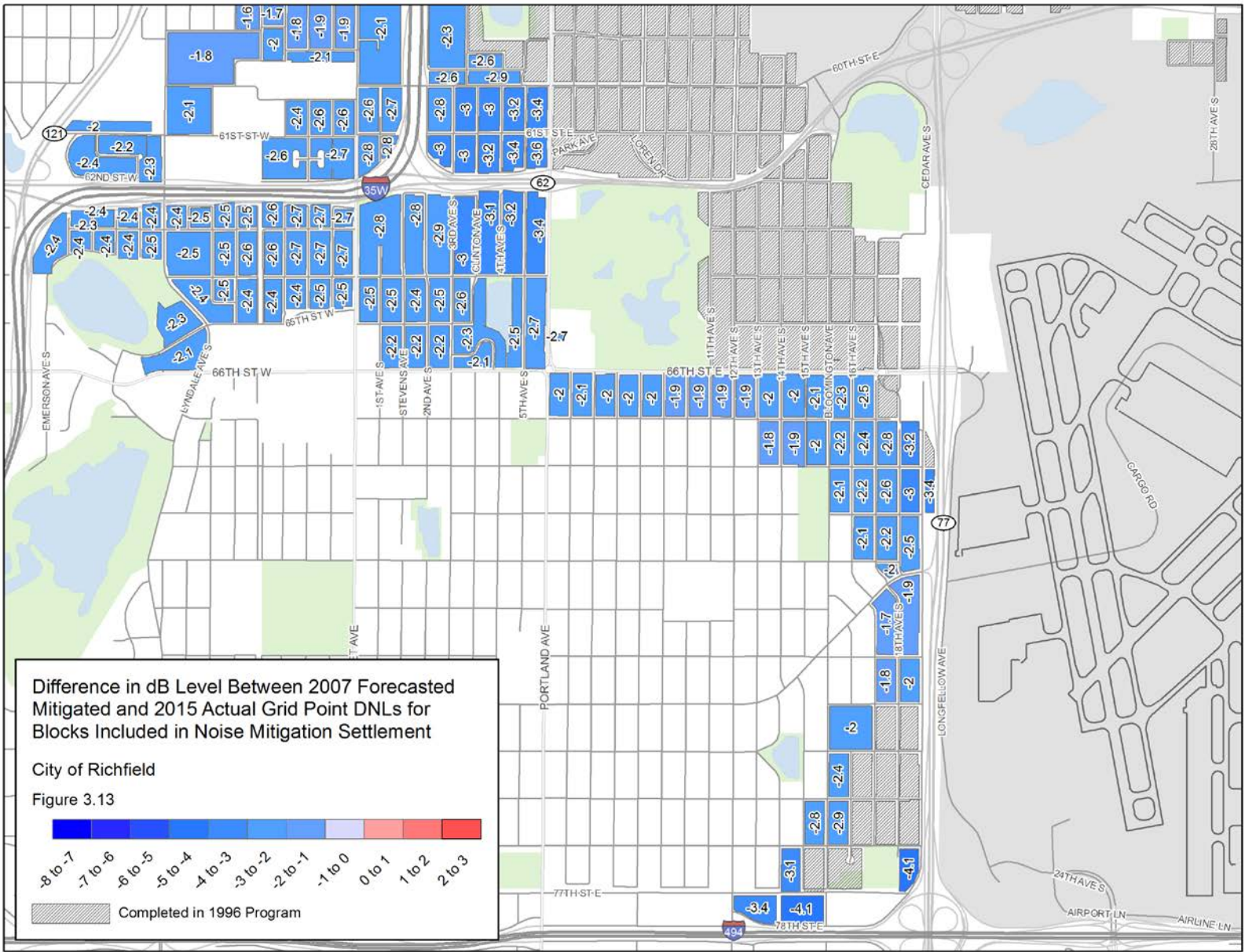


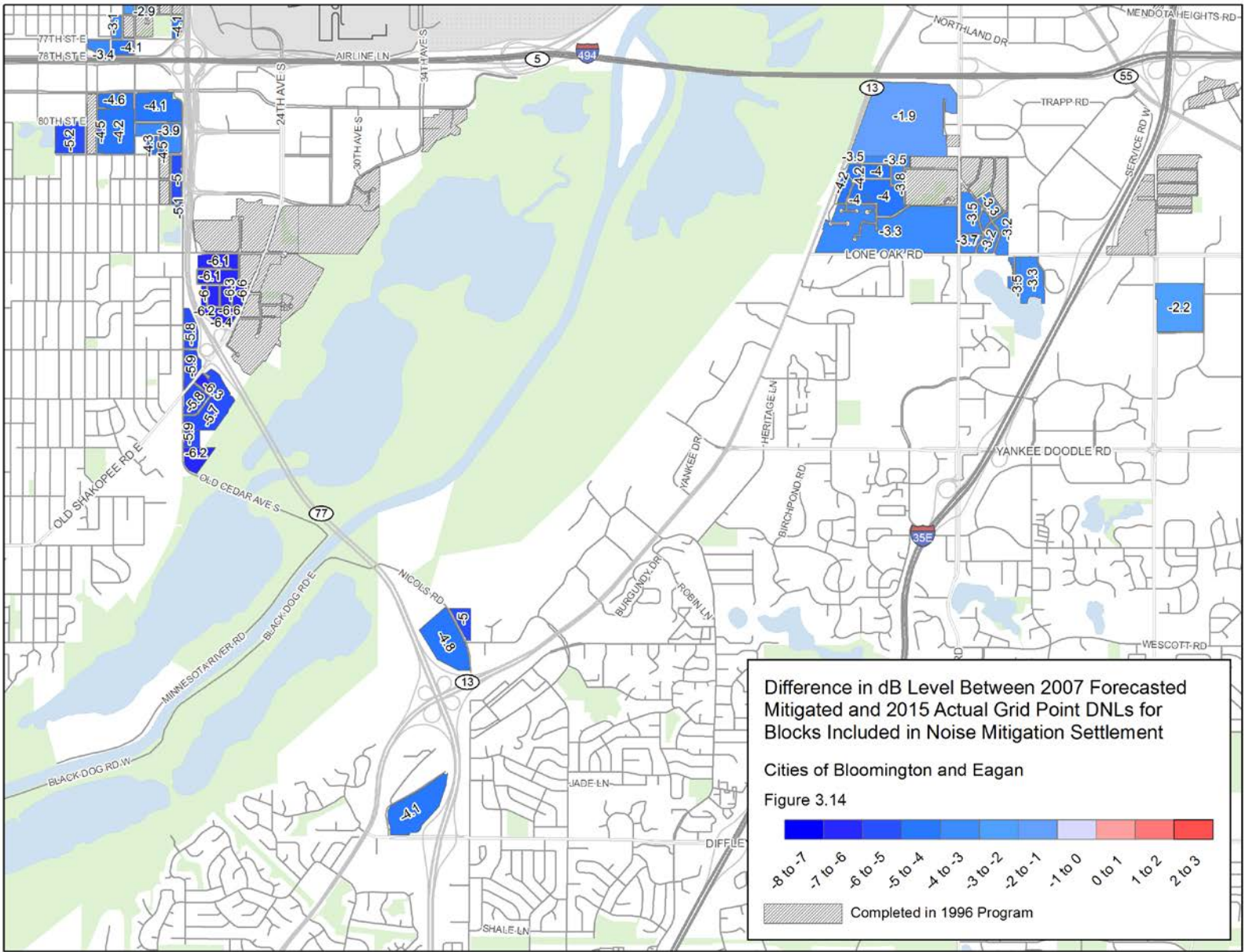


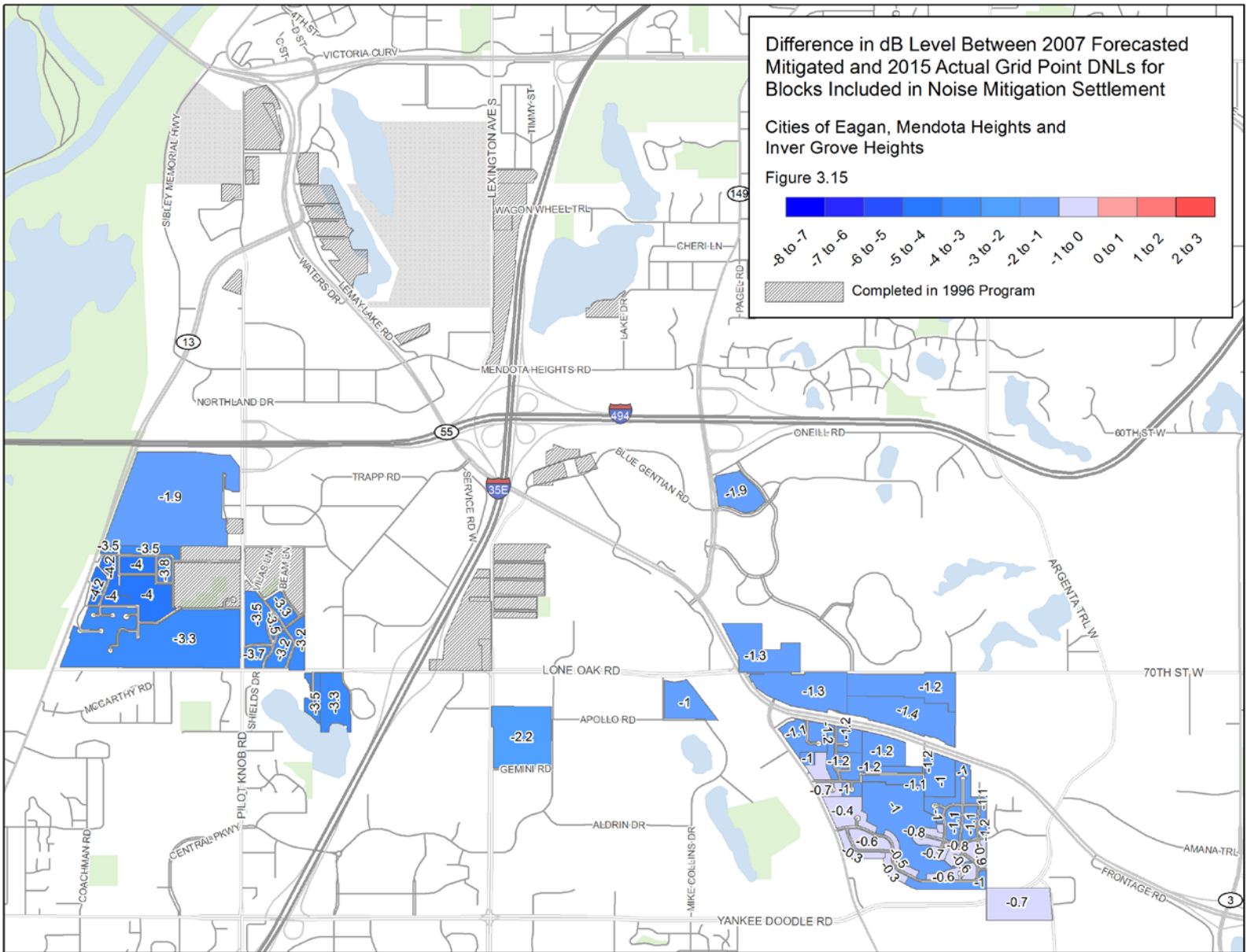


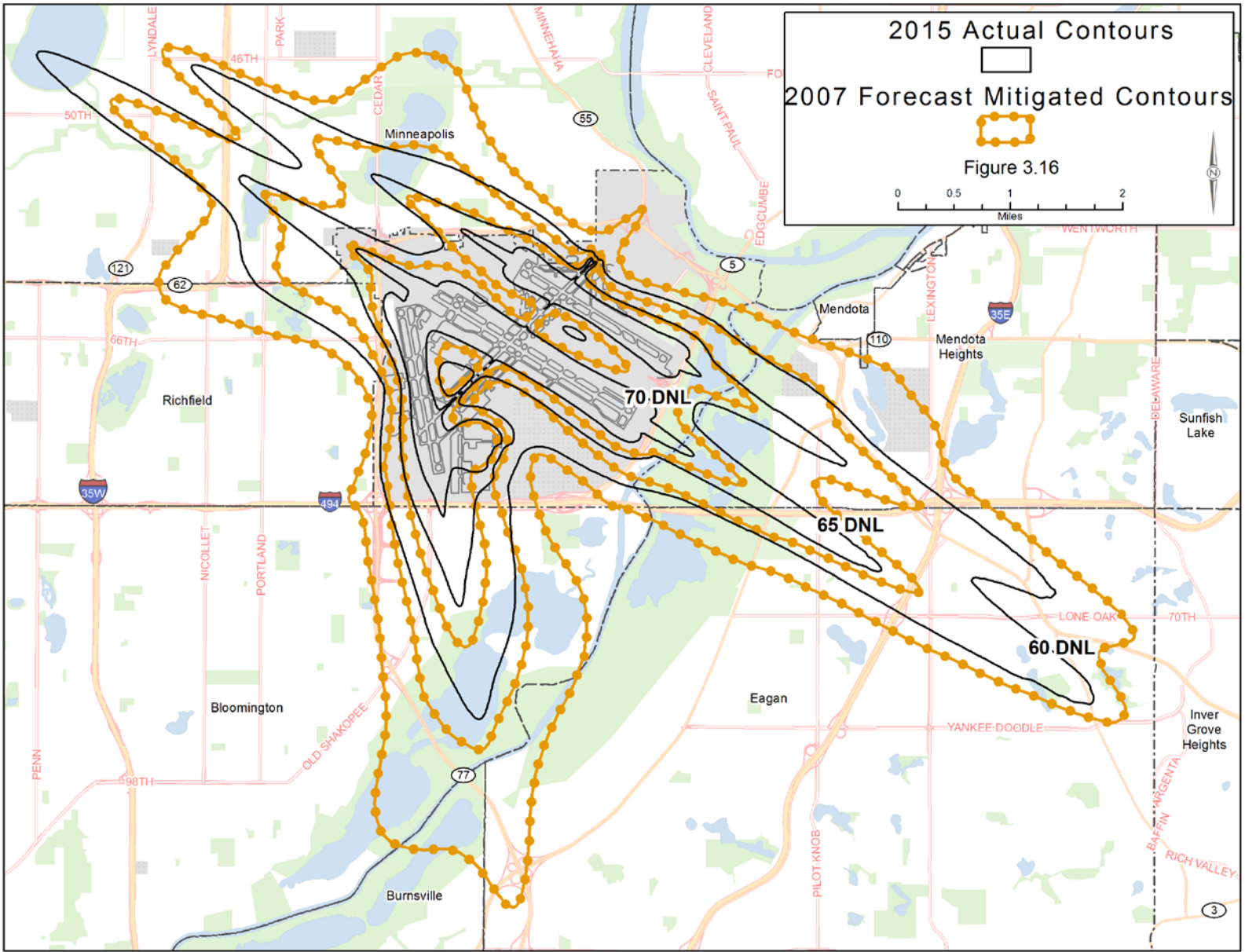












2015 Actual Noise Contour and the First Amendment to the Consent Decree

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 2015 actual noise contour at MSP.

4.1 First Amendment to the Noise Mitigation Consent Decree

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 (“Amendment”) to Hennepin County Court. The Amendment contains language that binds the MAC to provide noise mitigation services consistent with the noise mitigation terms described in the Final MSP 2020 Improvements Environmental Assessment/Environmental Assessment Worksheet (EA/EAW).

On September 25, 2013, Hennepin County Court Judge Ivy Bernardson approved the First Amendment to the 2007 Consent Decree.

The Amendment incorporates text in the eligibility section and the related mitigation program as defined by the Consent Decree.

In 2014 the Annual Noise Contour Report format was updated in consultation and agreement with the parties to the Consent Decree (including the Cities of Minneapolis, Richfield and Eagan) to address the mitigation program requirements detailed in the Amendment. In addition to the background information provided in Chapter 1, Section 1.5, the report was updated to provide maps analyzing changes that occur in noise mitigation eligibility as compared to the 2007 Consent Decree, and associated trends relative to consecutive yearly impacts.

4.2 2015 Actual Contour Noise Mitigation Impact

Under the provisions of the Amendment properties must meet certain criteria to be considered eligible for participation in the MAC noise mitigation program.

First, as stated in the 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 DNL Contour within the community in which the home is located.”

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

Second, as stated in the 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 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 2015 60 DNL noise contour, as well as changes in mitigation and the number of years of eligibility achieved by virtue of the 2015 actual noise contour. The colors in the tables relate to the colored blocks in Figures 4.1 and 4.2

Table 4.2 provides the number of multi-family living units within the 2015 60 DNL noise contour, as well as changes in mitigation and the number of years of eligibility achieved by virtue of the 2015 actual noise contour. The colors in the tables relate to the colored blocks in Figures 4.1 and 4.2

Table 4.1
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
Summary of 2015 Actual DNL Noise Contour Single-Family Unit Counts by Block

Year of Eligibility	City	Mitigation	Fig 4.1 & 4.2 Key	DNL Contours					Total
				60-62	63-64	65-69	70-74	75+	
Previously Mitigated	Bloomington	In 2015 Actual Contours previously mitigated (No mitigation eligibility change)		9	7	1	-	-	17
Previously Mitigated	Eagan	In 2015 Actual Contours previously mitigated (No mitigation eligibility change)		154	42	-	-	-	196
Previously Mitigated	Mendota Heights	In 2015 Actual Contours previously mitigated (No mitigation eligibility change)		13	-	1	-	-	14
Previously Mitigated	Minneapolis	In 2015 Actual Contours previously mitigated (No mitigation eligibility change)		4,282	1,688	1,385	-	-	7,355
1	Minneapolis	In 2015 Actual 60 DNL previously outside 2005 and 2007 60 DNL (After 3 consecutive years will become eligible for mitigation)		177	-	-	-	-	177
		In 2015 Actual 60 DNL previously between 2005 and 2007 60 DNL (After 3 consecutive years will become eligible for additional mitigation, less previous reimbursements)		72	-	-	-	-	72
		In 2015 Actual 63 DNL previously in 2007 60-62 DNL (After 3 consecutive years will become eligible for additional mitigation to achieve 5 dB reduction)		-	234	-	-	-	234
2	Minneapolis	In 2015 Actual 60 DNL previously outside 2005 and 2007 60 DNL (After 3 consecutive years will become eligible for mitigation)		126	-	-	-	-	126
		In 2015 Actual 60 DNL previously between 2005 and 2007 60 DNL (After 3 consecutive years will become eligible for additional mitigation, less previous reimbursements)		39	-	-	-	-	39
		In 2015 Actual 63 DNL previously in 2007 60-62 DNL (After 3 consecutive years will become eligible for additional mitigation to achieve 5 dB reduction)		-	120	-	-	-	120
3	Minneapolis	In 2015 Actual 60 DNL previously outside 2005 and 2007 60 DNL (To be mitigated in 2017)		18	-	-	-	-	18
		In 2015 Actual 60 DNL previously between 2005 and 2007 60 DNL (To receive additional mitigation in 2017, less previous reimbursements)		119	-	-	-	-	119
Previously Mitigated	Richfield	In 2015 Actual Contours previously mitigated (No mitigation eligibility change)		389	161	-	-	-	550
Grand Total				5,398	2,252	1,387			9,037

Note: Block Intersect Methodology: Single-Family = 1-3 Units
Source: HNTB provided INM Contours, MAC analysis 2016

Table 4.2
MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT
Summary of 2015 Actual DNL Noise Contour Multi-Family Unit Counts by Block

Year of Eligibility	City	Mitigation	Fig 4.1 & 4.2 Key	DNL Contours				Total
				60-64	65-69	70-74	75+	
Previously Mitigated	Bloomington	In 2015 Actual Contours previously mitigated (No mitigation eligibility change)		511	-	-	-	511
-	Eagan	No multi-family units in 2015 Actual Contours		-	-	-	-	-
-	Mendota Heights	No multi-family units in 2015 Actual Contours		-	-	-	-	-
Previously Mitigated	Minneapolis	In 2015 Actual Contours previously mitigated (No mitigation eligibility change)		508	427	-	-	935
3	Minneapolis	In 2015 Actual 60 DNL previously outside multi-family mitigation area (To be mitigated in 2017)		88*	-	-	-	89
Previously Mitigated	Richfield	In 2015 Actual Contours previously mitigated (No mitigation eligibility change)		66	-	-	-	66
Grand Total				1,174	427			1,601

*Includes Creek Terrace Apartments with 82 units located at 616 53rd Street West, Minneapolis.

Note: Block Intersect Methodology: Multi-Family = 4 or more units

Source: HNTB provided INM Contours, MAC analysis 2016

In this third year (2015) of actual noise contour mapping as established by the terms of the Amendment, the only residential properties that meet the mitigation eligibility criteria are located within the City of Minneapolis.

There are 234 single-family units that meet the first year of eligibility within the 63 DNL contour for the 5 Decibel Reduction Package described in the Consent Decree, as amended. In addition, there are 72 single-family units that were previously eligible for the homeowner reimbursement noise mitigation program and another 177 single-family units previously outside of the program that meet the first year of eligibility in 2015 for the 60-62 DNL noise contour noise mitigation package options described in the Consent Decree, as amended.

All single-family and multi-family units that met the first year of the higher noise impact mitigation eligibility requirement by virtue of the 2014 actual noise contour achieved a second consecutive year of increased noise impact with the 2015 actual noise contour. There are 120 single-family units that meet the second year of eligibility within the 63 DNL contour for the 5 Decibel Reduction Package described in the Consent Decree, as amended. In addition, there are 39 single-family units that were previously eligible for the homeowner reimbursement noise mitigation program and another 126 single-family units previously outside of the program that meet the second year of eligibility in 2015 for the 60-62 DNL noise contour noise mitigation package options described in the Consent Decree, as amended.

All single-family and multi-family units that met the second year of the higher noise impact mitigation eligibility requirement by virtue of the 2014 actual noise contour achieved a third year of consecutive increased noise impact with the 2015 actual noise contour. There are 119 single-family units within the 2015 60-62 DNL noise contour that were previously eligible for the homeowner reimbursement noise mitigation program and another 18 single-family units previously outside of the program that meet the third and final year of eligibility in 2015 for the 60-62 DNL noise contour noise mitigation package options described in the Consent Decree, as amended.

There are 88 multi-family living units within the 2015 60-64 DNL noise contour that were previously outside the program that meet the third and final year of eligibility in 2015 for the Multi-Family Home Mitigation Package described in the Consent Decree, as amended.

Beginning in 2017, the MAC will offer additional mitigation, based on previous mitigation provided, to single-family homes and multi-family units achieving their third and final year of eligibility by virtue of the 2015 actual noise contour. In cases where homes have received previous reimbursements or mitigation from the MAC, those improvements will be deducted from the efforts required to increase the homes' mitigation relative to the actual noise level, per the amended Consent Decree.

The blocks meeting the first, second and third consecutive year(s) of noise mitigation eligibility are shown in Figures 4.1 and 4.2 below.

