



Low Frequency Noise Impacts

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Minneapolis/St. Paul International Airport

Airport Noise Symposium

February 28, 2001

by Roy Fuhrmann

Manager, Metropolitan Airports Commission



Agenda

- ✍ Introduction
- ✍ Charge of the Low Frequency Noise Policy Committee
- ✍ Low Frequency Noise Expert Panel
- ✍ Findings of the Low Frequency Noise Policy Committee
- ✍ Recommendations of the Low Frequency Noise Policy Committee
- ✍ MAC's Part 150 Update



Introduction

- ✍ Low Frequency Policy Committee was Formed on December 18, 1998 as Part of an Agreement Between the City of Richfield and the MAC**
- ✍ The Catalyst for the Formation of the Committee Arose From Concerns Regarding the Impacts of Low-Frequency Noise From the New 17/35 Runway at MSP**

Minneapolis-St. Paul International Airport
Existing Closest Residential Area is approximately 1000 feet



Minneapolis-St. Paul International Airport







2005 MSP Runway Use - All Operations - EIS









Low Frequency Noise Policy Committee

Members:

-  City of Richfield – Mike Sandahl - Council Member
-  City of Bloomington – Larry Lee - Director of Community Development
-  City of Minneapolis – Sandy Colvin-Roy – Council Member
-  Metropolitan Airports Commission – John Himle* Commissioner
Alton Gasper – Commissioner

*John Himle resigned from MAC on March 31, 2000 and was replaced by Mr. Gasper

Technical Support:

-  Metropolitan Council – Nacho Diaz
-  Federal Aviation Administration – Glen Orcutt
-  Minnesota Pollution Control Agency – Brian Timerson
-  Metropolitan Aircraft Sound Abatement Council – Dick Saunders













LFNPC Tasks Per the Agreement

- ✍ **Review all existing information** pertaining to SFO, BOS, BWI and LAX and any other published studies of the audibility and impact of Low Frequency Noise, not excluding impacts outside of residential settings.
- ✍ **Conduct such studies as**, in the opinion of the Low Frequency Noise Policy Committee, **are necessary to address issues related to low frequency noise.**
- ✍ **Convene an Expert Panel** consisting of Sandford Fidell, Andrew Harris, and a third member to be named by these two (Louis Sutherland), to provide technical input and information to the Policy Committee for consideration.
- ✍ **Present recommendations** regarding the **appropriate noise metric, compatibility standards, and recommended mitigation programs, measures or techniques.**
- ✍ **Prepare a report or reports** documenting the Policy Committee's deliberations and conclusions.



Low Frequency Noise Expert Panel

Commissioned by the Policy Committee to undertake ten tasks including:

-  Literature Review
-  Identify relevant noise effects and descriptors
-  Determine existing and predicted low frequency noise levels at MSP
-  Identify criteria for acceptability of low frequency noise in residences
-  Determine low frequency noise reduction of existing typical homes
-  Determine low frequency noise reduction of Part 150 RSI treatment
-  Evaluate acceptability of low frequency noise environments in residences with and without Part 150 RSI treatments
-  Determine types of treatment required to improve LF noise reduction
-  Prepare Reports for Policy Committee
-  Measure noise in the vicinity of MSP for comparison with INM C-weighted values



Findings of Low Frequency Noise Policy Committee

✍ The Policy Committee developed twelve findings based on information developed by the Expert Panel and Committee discussion.

1. Effects on People:

- ✍ The primary effect of low frequency noise on residents is rattle-related annoyance
- ✍ Low Frequency aircraft noise poses no known risk of:
 - ✍ Adverse public health consequences
 - ✍ Structural damage
- ✍ Under Expected circumstances of residential Exposure, Low Frequency Noise:
 - ✍ Will not interfere with indoor speech
 - ✍ Is not likely to awaken people



Effects of Low Frequency Noise

- ✍ A Laboratory study in which test subjects judged the annoyance of recorded samples of low frequency noise confirmed the following facts:
 - ✍ LFN is more annoying than aircraft over flight noise heard at the same A-weighted sound level
 - ✍ The addition of even minor amounts of rattle to LFN increased its judged annoyance by about 5 dB in this study
 - ✍ Reductions in low frequency content of this noise proportionally decreases the annoyance of non-rattling test sounds



Findings of Low Frequency Noise Policy Committee cont.

2. Noise Descriptors:

- ✍ The preferred descriptor of low frequency noise is:
 - ✍ The sum of the maximum sound levels in the 25-80 Hz one-third octave bands during individual noise events
 - ✍ This measure is called the low frequency sound level (LFSL)
- ✍ The best available predictor of prevalence of annoyance due to multiple aircraft events is:
 - ✍ The arithmetic average of low frequency sound levels above a selected threshold
 - ✍ This measure is called the low frequency sound level dose (LFSL Dose)



Findings of Low Frequency Noise Policy Committee cont.

3. Information on Compatibility:

- ✍ HUD and the FAA place no restrictions on residential development where the exterior DNL is less than 65 dB
- ✍ Where DNL exceeds 75 dB new residential development is not allowed
- ✍ In the range between DNL of 65 dB and 75 dB, residential development is allowed if the noise reduction provided by the building structure prevents interior noise levels from exceeding a DNL of 45 dB

4. Community Response to Noise

- ✍ Is typically described in terms of the percentage of the community that reports a high level of annoyance to the noise



Findings of Low Frequency Noise Policy Committee cont.

5. FICON Relationship:

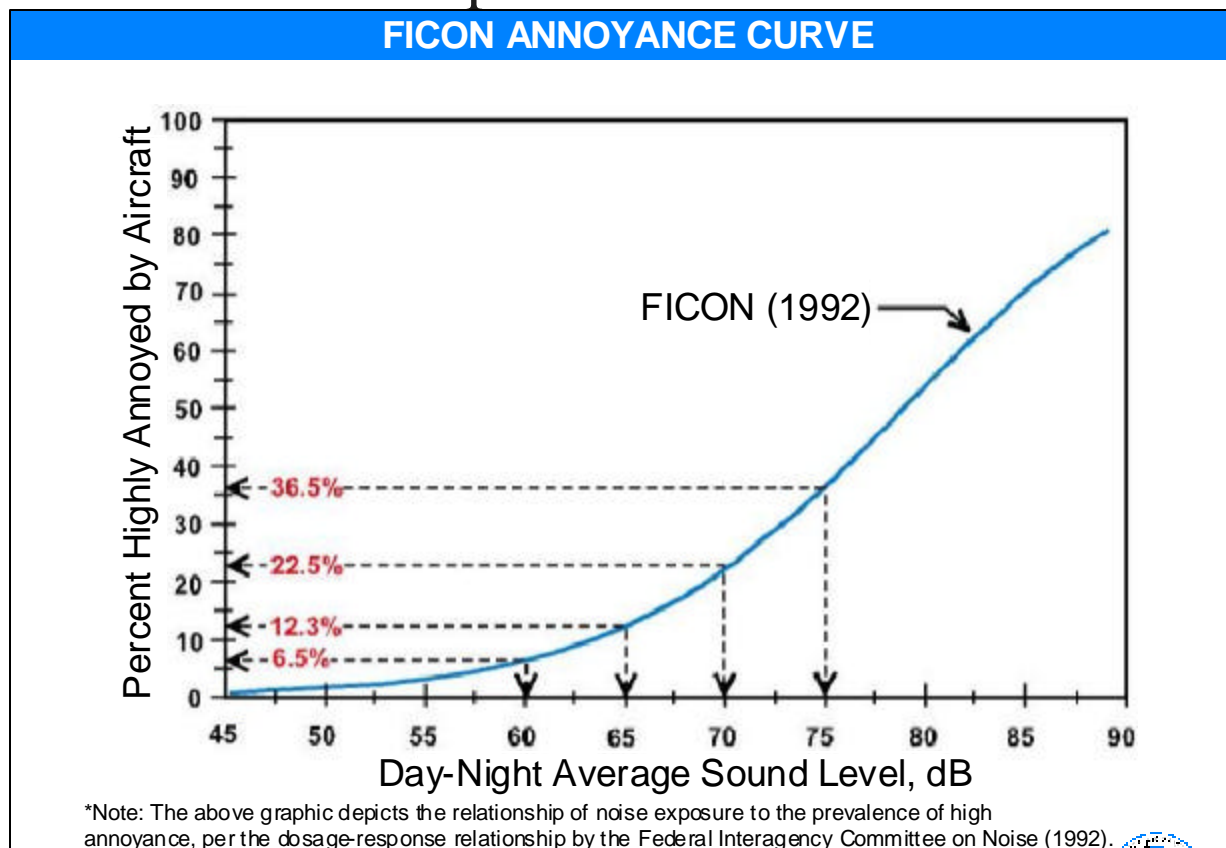


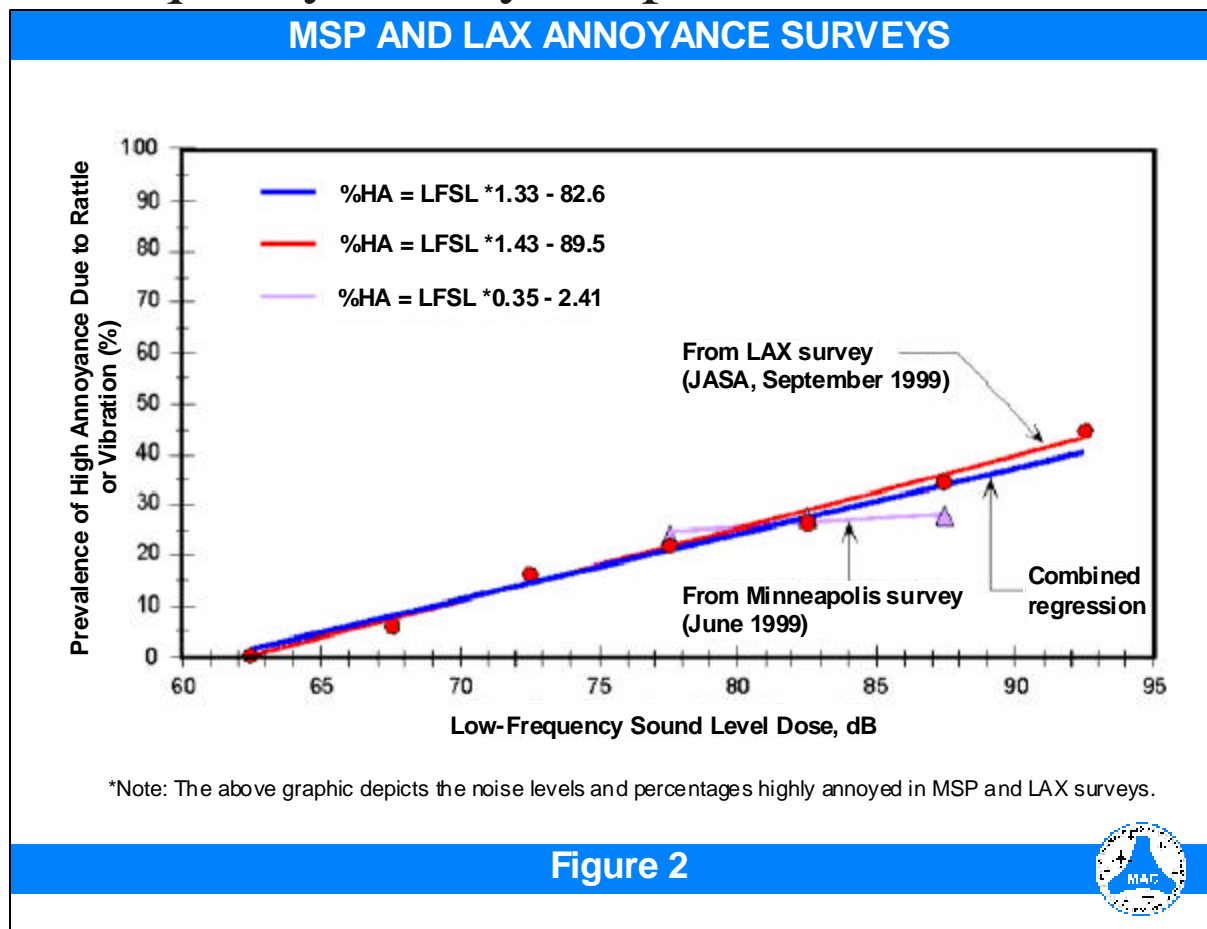
Figure 1





Findings of Low Frequency Noise Policy Committee cont.

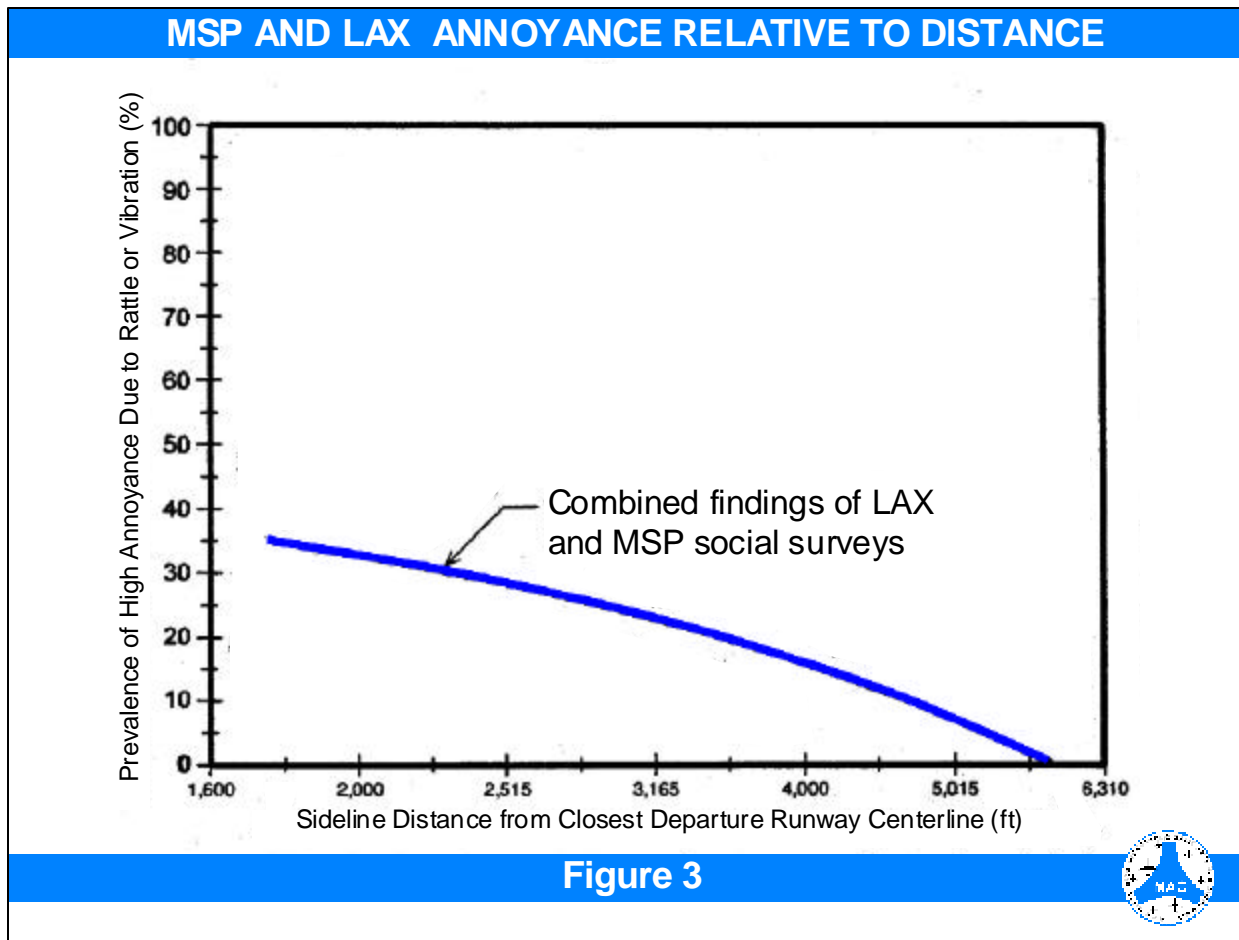
6. Low Frequency Survey Responses:





Findings of Low Frequency Noise Policy Committee cont.

7. Relationship between sideline distance of households to runway:





Findings of Low Frequency Noise Policy Committee cont.

8. LFSL Dose Relationship:

- ✍ The exterior LFSL Doses corresponding to various levels of the population highly annoyed are:
 - ✍ 12.3% Highly Annoyed at 70 dB
 - ✍ 22.5 % Highly Annoyed at 78 dB
 - ✍ 36.5 % Highly Annoyed at 87 dB
- ✍ Exterior LFSL Doses below 70 dB LFSL are considered fully compatible with residential use without any special treatment
- ✍ Exterior LFSL Doses at or above 87 dB are considered incompatible with residential use
- ✍ Exterior LFSL Doses at or above 78 dB and below 87 dB require structures that provide higher than normal low frequency noise reduction



Findings of Low Frequency Noise Policy Committee cont.

9. Low Frequency Noise Reduction Provided by Existing Residences:

- ✍ Typical residences in the MSP vicinity provide approximately 15 dB of low frequency noise reduction
- ✍ Residents that have been treated with the Part 150 RSI report levels of annoyance to low frequency noise that would be expected with a 20 dB low frequency noise reduction

10. Forecast Exterior LFSL Dose near MSP:

- ✍ Expert Panel did not reach consensus on a LFSL contour
- ✍ Policy Committee had uncertainty about certain aspects of both contours
- ✍ A policy contour was developed which takes the concerns into consideration

HARRIS LOW FREQUENCY SOUND LEVEL CONTOURS

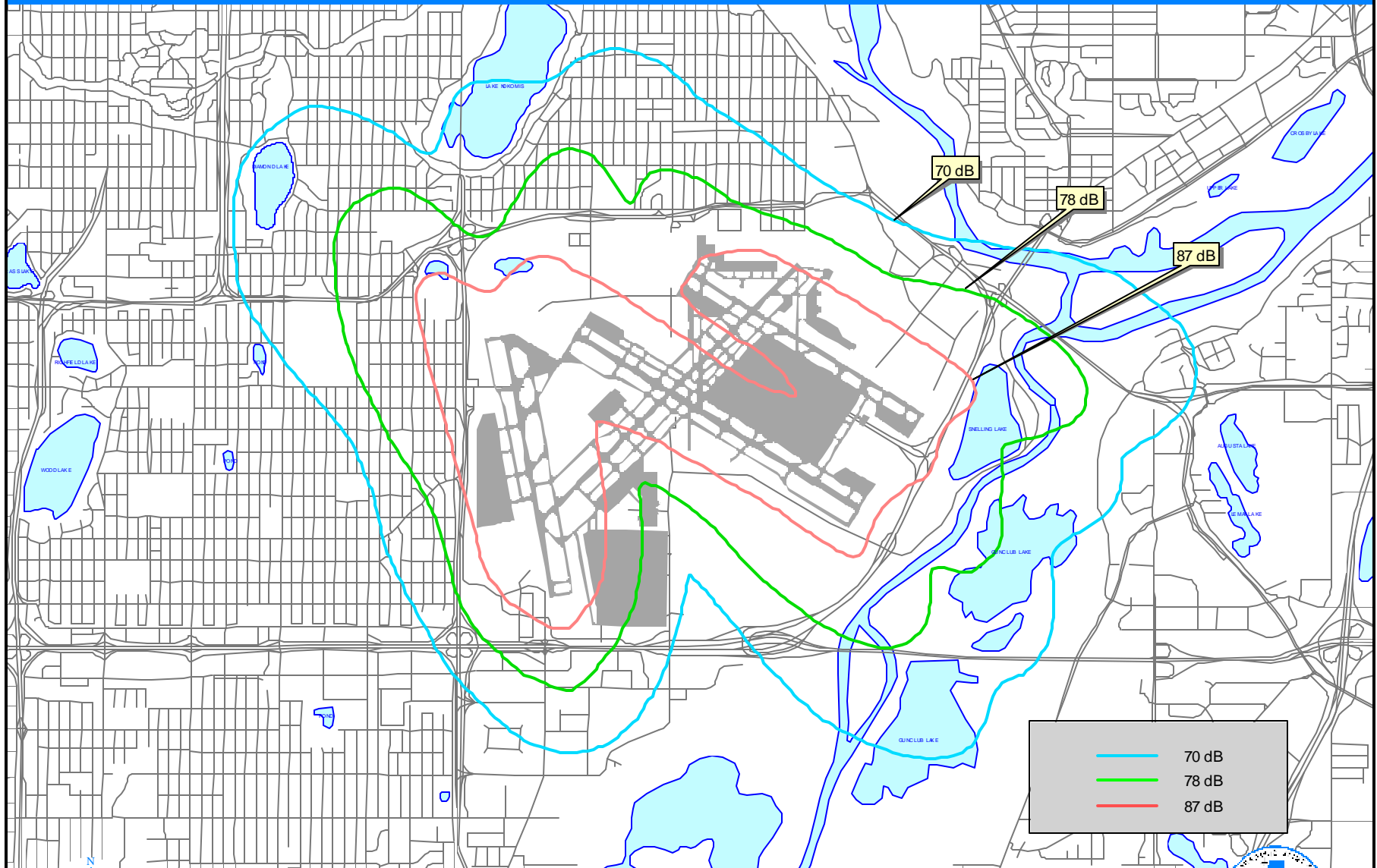


Figure 4

10. Takeoff dominated contour potentially understates impacts to ward the midpoint of runway and potentially overstates impacts at the north end of the runway

FIDELL / SUTHERLAND LOW FREQUENCY SOUND LEVEL CONTOURS

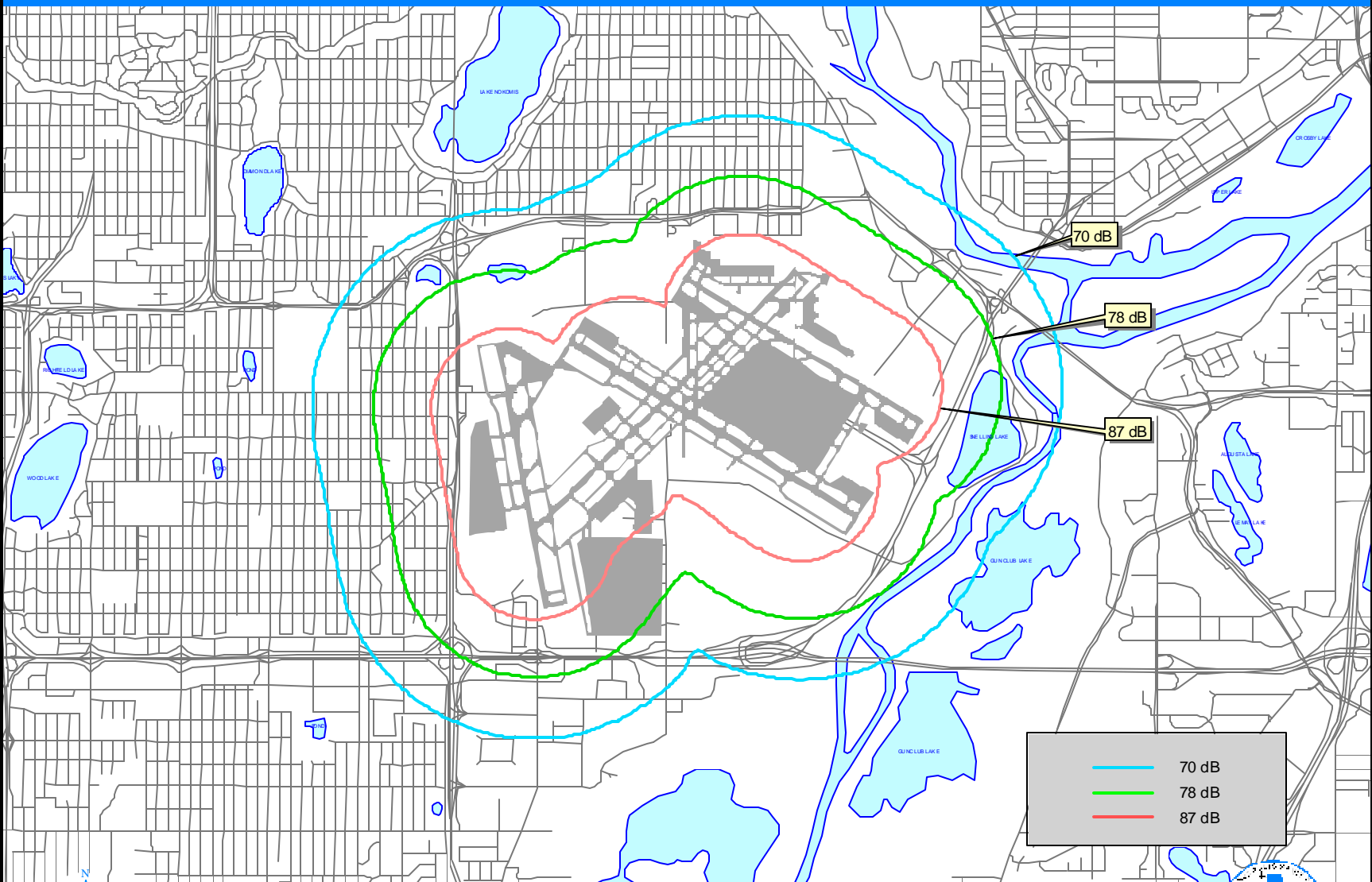
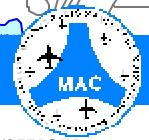


Figure 5

10. Reverse thrust dominated contour potentially understates impacts at the north end of the runway



LOW FREQUENCY SOUND LEVEL POLICY CONTOURS

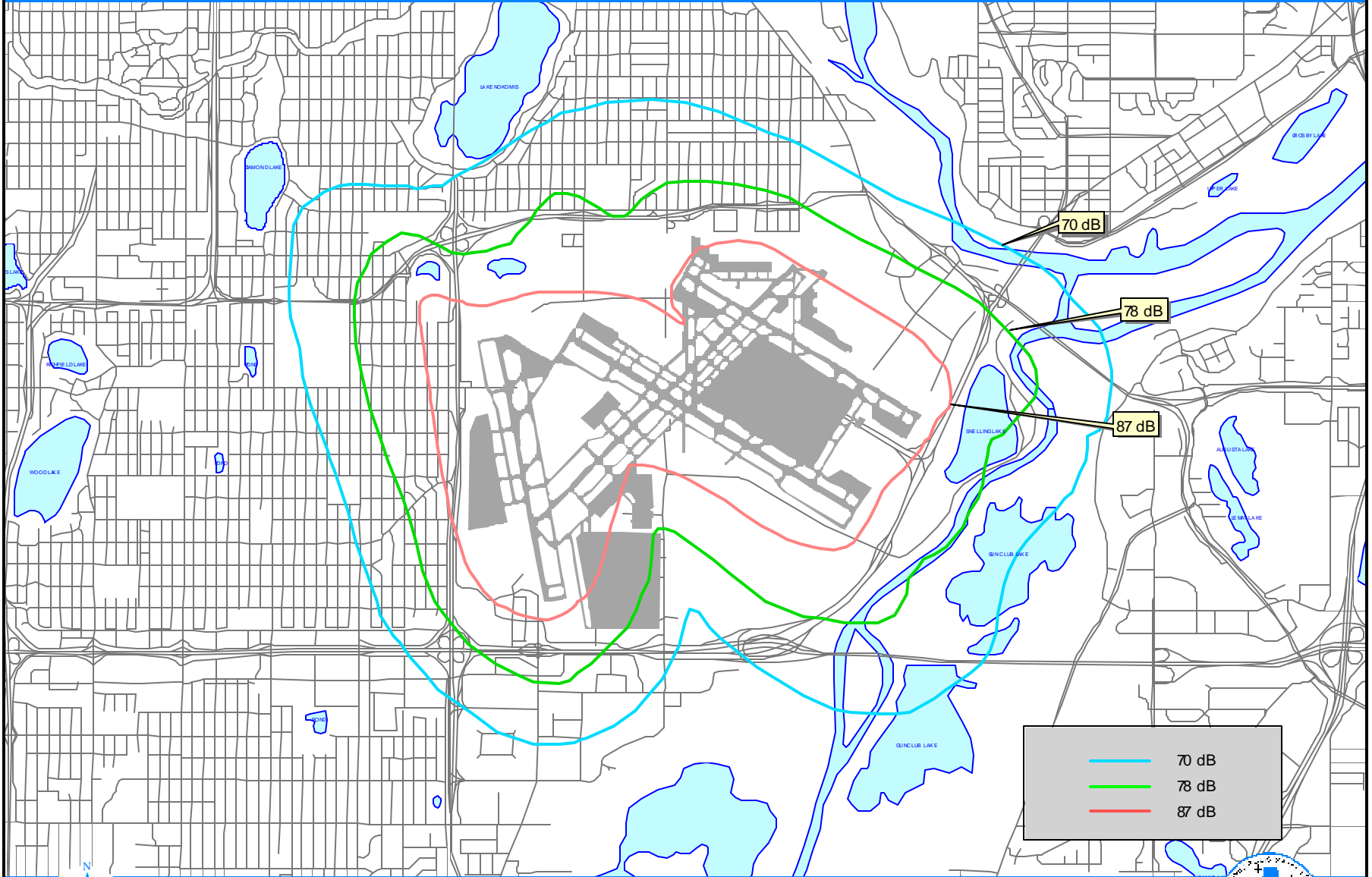
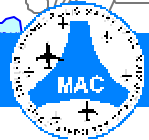


Figure 6





Recommended LFSL Treatment for Existing Residential

- ✍ **<70 dB LFSL:** no treatment to reduce rattle and no requirement to reduce interior LFSL.
- ✍ **70-77 dB LFSL:** treat rattle directly and decrease interior LFSL by 5 dB (Based on findings of the social survey, the existing Part 150 Residential Sound Insulation Program provides the equivalent of 5 dB reduction, therefore no further reduction is necessary.)
- ✍ **78-86 dB LFSL:** treat rattle directly (may not be fully adequate) and decrease interior LFSL by 5 dB and consider reducing by more than 5 dB.
- ✍ **>87 dB LFSL:** treat rattle directly (probably not fully adequate) and decrease interior LFSL by at least 10 dB (probably not economically feasible).



Recommended Rattle Prevention and Limits for Interior LFSL for **New Construction**

- ✍ **<70 dB LFSL:** no rattle treatment and no special requirement for interior LFSL reduction.
- ✍ **70-77 dB LFSL:** rattle prevention and 15 dB interior LFSL reduction.
- ✍ **78-86 dB LFSL:** rattle prevention and 20 dB interior LFSL reduction.
- ✍ **>87 dB LFSL:** do not develop for residential use.

LOW FREQUENCY SOUND LEVEL MITIGATION AREAS

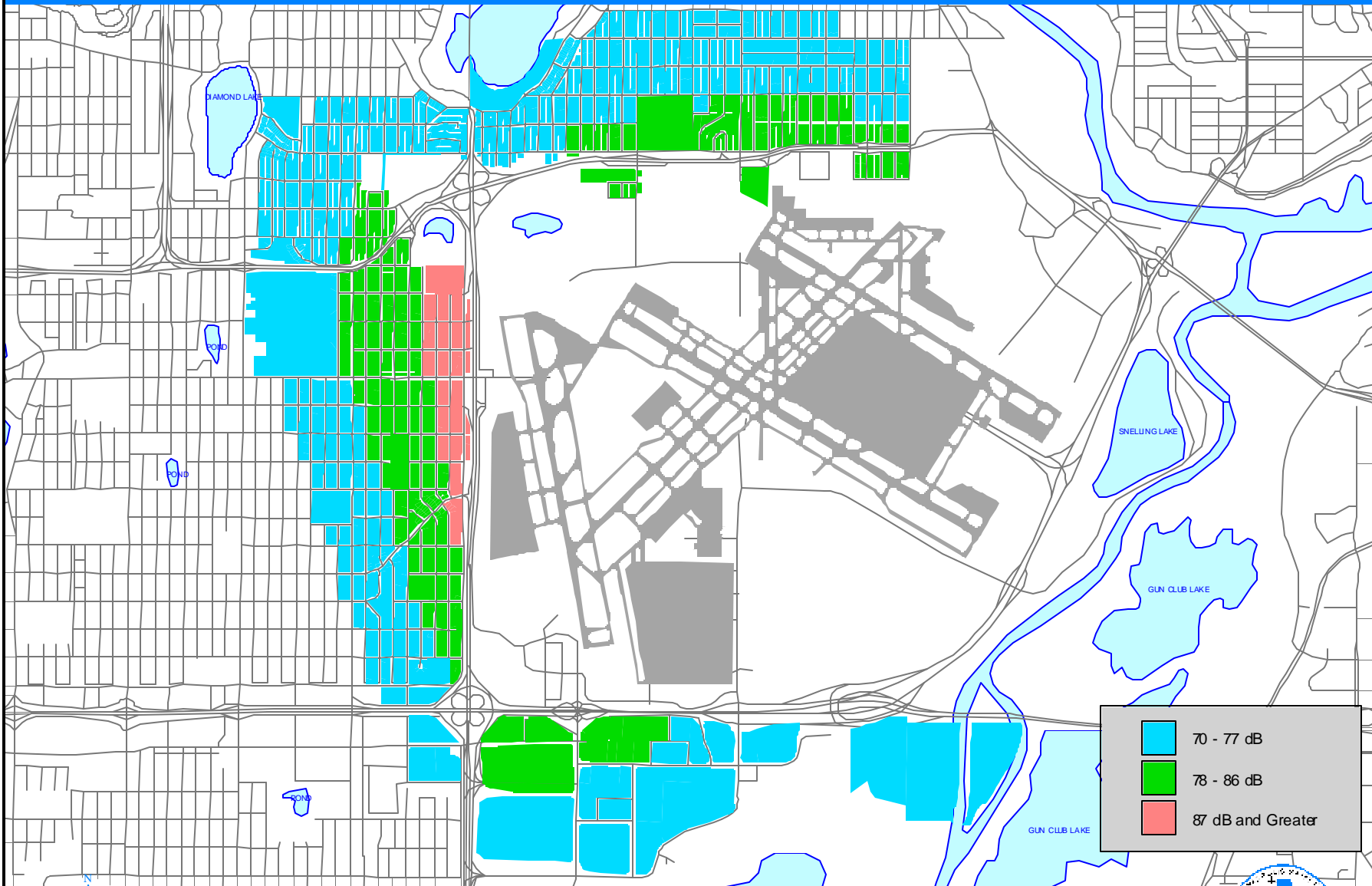
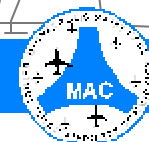


Figure 7





Recommendations of Low Frequency Noise Policy Committee

Other recommendations of the LFN Policy Committee included:

- ✍ Blocks intersected by LFN contours be treated as if the whole block is included within the contour
- ✍ Land use conversion be used as the preferred method of mitigation inside the 87 dB LFSL contour
- ✍ Apply mitigation measures as previously indicated within the 70 dB, 78 dB and 87 dB LFSL contour areas
- ✍ Provide additional low frequency noise mitigation for homes previously insulated under the Part 150 RSI
- ✍ FAA should move expeditiously with development of national standards for determining both the impacts of LFN as well as appropriate mitigation measures
- ✍ Include LFN Policy Committee recommendations with the 2000 MSP Part 150 Study Update to the FAA



Summary

- ✍ August 10, 2000 LFNPC Approved the Report**
- ✍ LFNPC Report was approved by MAC**
- ✍ A courtesy copy was forwarded to FAA for review and has been forwarded to FICAN**
- ✍ LFSL Mitigation Options are Being Evaluated**
- ✍ LFNPC Report is incorporated in the MSP's 2000 Part 150 Update Document and will be officially submitted to the FAA for review as a Noise Mitigation Land Use Measure**