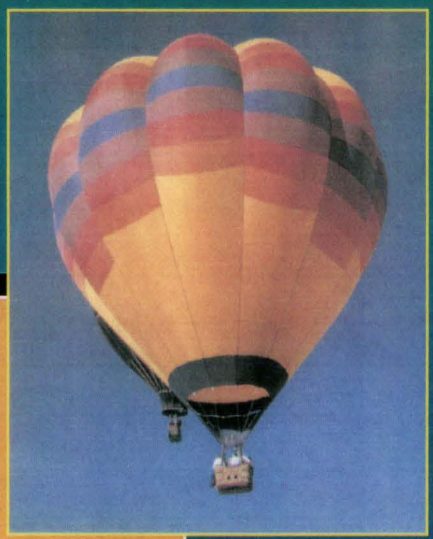
GLENDALE

MUNICIPAL AIRPORT



F.A.R. PART 150 NOISE COMPATIBILITY STUDY

NOISE COMPATIBILITY PROGRAM

GLENDALE MUNICIPAL AIRPORT

F.A.R. Part 150
Noise Compatibility Study

NOISE COMPATIBILITY PROGRAM

Prepared For

The City of Glendale, Arizona

By

Coffman Associates

November 1994

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Preface
NOISE COMPATIBILITY PROGRAM

INTRODUCTION

This document represents the Noise Compatibility Program (NCP) for Glendale Municipal Airport, owned and operated by the City of Glendale, Arizona.

The NCP is the second of two parts required in a Noise Compatibility Study and is composed of technical working papers for Chapters Five, Six, and Seven and three appendices. The first volume, the Noise Exposure Maps (NEM) document was published in April 1994 and officially accepted by the Federal Aviation Administration (FAA) in July 1994. The NEM includes Chapters One through Four of the study.

Chapter Five of the Noise Compatibility Program, Noise Abatement Alternatives, discusses and analyzes potential methods of reducing or shifting aircraft noise to be less disturbing to residential areas.

Chapter Six, Land Use Alternatives, analyzes potential land use planning and zoning techniques to prevent the development of new noise-sensitive land uses in areas exposed to aircraft noise. It also examines alternative ways of mitigating noise impacts on existing residential areas which must remain exposed to aircraft noise in the future.

Chapter Seven presents the final Noise Compatibility Plan. The plan is organized into three elements: noise abatement, land use management, and program management. The first two elements are based on the findings of Chapters Five and Six. The program management element includes measures to administer, refine, and update the overall program as needed in the future.

Appendices in this document include: Appendix E, Coordination, Consultation, and Public Involvement; Appendix F,

Historical Noise Exposure; and Appendix G, Draft Implementation Documents.

For the convenience of FAA reviewers, the FAA's official Noise Compatibility Program Checklist is presented on pages iii through vii. A certification statement by the Glendale City Manager is on page viii.

F.A.R. PART 150
NOISE COMPATIBILITY PROGRAM CHECKLIST

AIRPORT NAME: *Glendale Municipal Airport*
Glendale, Arizona

REVIEWER: _____

	Yes/No/NA	Page No./ Other Reference
I. IDENTIFICATION AND SUBMISSION OF PROGRAM:		
A. Submittal is properly identified:		
1. F.A.R. 150 NCP?	Yes	Title Page; p. i
2. NEM and NCP together?	No	
3. Program revision?	No	
B. Airport and Airport Operator's name identified?	Yes	Title Page, p. i
C. NCP transmitted by airport operator cover letter?	Yes	
II. CONSULTATION: [150.23]		
A. Documentation includes narrative of public participation and consultation process?	Yes	Appendix E; supplemental volume titled "Supporting Information on Project Coordination and Local Consultation"
B. Identification of consulted parties:		
1. all parties in 150.23(c) consulted?	Yes	Appendix E; supplemental volume titled "Supporting Information on Project Coordination and Local Consultation"
2. public and planning agencies identified?	Yes	Appendix E; supplemental volume titled "Supporting Information on Project Coordination and Local Consultation"
3. agencies in 2, above, correspond to those indicated on the NEM?	Yes	Appendix E; supplemental volume titled "Supporting Information on Project Coordination and Local Consultation"
C. Satisfies 150.23(d) requirements?		
1. documentation shows active and direct participation of parties in B, above?	Yes	Appendix E; supplemental volume titled "Supporting Information on Project Coordination and Local Consultation"
2. active and direct participation of general public?	Yes	Appendix E; supplemental volume titled "Supporting Information on Project Coordination and Local Consultation"
3. participation was prior to and during development of NCP and prior to submittal to FAA?	Yes	Appendix E; supplemental volume titled "Supporting Information on Project Coordination and Local Consultation"

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	Yes/No/NA	Page No./ Other Reference
4. indicates adequate opportunity afforded to submit views, data, etc.?	Yes	Appendix E; supplemental volume titled "Supporting Information on Project Coordination and Local Consultation"
D. Evidence included of notice and opportunity for a public hearing on NCP?	Yes	Appendix E; supplemental volume titled "Supporting Information on Project Coordination and Local Consultation"
E. Documentation of comments:		
1. includes summary of public hearing comments, if hearing was held?	Yes	Appendix E; supplemental volume titled "Supporting Information on Project Coordination and Local Consultation"
2. includes copy of all written material submitted to operator?	Yes	Supplemental volume titled "Supporting Information on Project Coordination and Local Consultation"
3. includes operator's responses/disposition of written and verbal comments?	Yes	Supplemental volume titled "Supporting Information on Project Coordination and Local Consultation"
F. Informal agreement received from FAA on flight procedures?	Yes	The FAA regional representative was involved in the Planning Advisory Committee meetings and indicated qualified acceptance of noise abatement measures.
III. **NOISE EXPOSURE MAPS: [150.23, B150.3, 150.35(f)]** (This section of the checklist is not a substitute for the Noise Exposure Map Checklist. It deals with maps in the context of the Noise Compatibility Program submission.)		
A. Inclusion of NEMs and supporting documentation:		
1. Map documentation either included or incorporated by reference?	N/A	
2. Maps previously found in compliance by FAA?	N/A	
3. Compliance determination still valid?	N/A	
4. Does 180-day period have to wait for map compliance finding?	N/A	
B. Revised NEMs submitted with program: (Review using NEM checklist if map revisions included in NCP submittal)		
1. Revised NEMs included with program?	N/A	

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	Yes/No/NA	Page No./ Other Reference
2. Has airport operator requested FAA to make a determination on the NEM(s) when NCP approval is made?	N/A	
C. If program analysis uses noise modeling:		
1. INM, HNM, or FAA-approved equivalent?	N/A	
2. Monitoring in accordance with A150.5?	N/A	
D. Existing condition and 5-year maps clearly identified as the official NEMs?	N/A	
IV. CONSIDERATION OF ALTERNATIVES: [B150.7, 150.23(e)]		
A. At a minimum, are the alternatives below considered?		
1. land acquisition and interests therein, including air rights, easements, and development rights?	Yes	Chapter 6, pp. 6-32 - 6-38
2. barriers, acoustical shielding, public building soundproofing?	Yes	Chapter 5, p. 5-18; Chapter 6, p. 6-38
3. preferential runway system?	Yes	Chapter 5, pp. 5-5 - 5-6, 5-31 - 5-39
4. flight procedures?	Yes	Chapter 5, pp. 5-6 - 5-9, 5-14 - 5-17
5. restriction on type/class of aircraft (at least one restriction below must be checked)	Yes	Chapter 5, pp. 5-11 - 5-17
a. deny use based on Federal standards?	Yes	Chapter 5, p. 5-14
b. capacity limits based on noisiness?	Yes	Chapter 5, pp. 5-12 - 5-13
c. noise abatement takeoff/approach procedures?	Yes	Chapter 5, pp. 5-15 - 5-17
d. landing fees based on noise or time of day?	Yes	Chapter 5, p. 5-12
e. nighttime restrictions?	Yes	Chapter 5, pp. 5-11 - 5-12
6. other actions with beneficial impact?	Yes	Chapter 5, pp. 5-13, 5-17 - 5-18
7. other FAA recommendations?	N/A	
B. Responsible implementing authority identified for each considered alternative?	Yes	Chapter 5, pp. 5-22 - 5-32
C. Analysis of alternative measures:		
1. measures clearly described?	Yes	Chapter 5, pp. 5-5 - 5-32; Chapter 6, pp. 6-4 - 6-42
2. measures adequately analyzed?	Yes	Chapter 5, pp. 5-5 - 5-41; Chapter 6, pp. 6-4 - 6-42
3. adequate reasoning for rejecting alternatives?	Yes	Chapter 5, pp. 5-5 - 5-41; Chapter 6, pp. 6-4 - 6-42; Chapter 7, p. 7-2
D. Other actions recommended by the FAA: Should other actions be added? (list separately or on back of this form actions and discussions with airport operator to have them included prior to the start of the 180-day cycle)	N/A	

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	Yes/No/NA	Page No./ Other Reference
V. ALTERNATIVES RECOMMENDED FOR IMPLEMENTATION: [150.23(c), B150.7(c); 150.35(b), B150.5]		
A. Document clearly indicates:		
1. alternatives recommended for implementation?	Yes	Chapter 7, pp. 7-3 - 7-7, 7-11 - 7-19; Table 7C, p. 7-20
2. final recommendations are airport operators, not those of consultant or third party?	Yes	Sponsor's Certification, p. viii
B. Do all program recommendations:		
1. relate directly or indirectly to reduction of noise and noncompatible land uses?	Yes	Chapter 7, pp. 7-3 - 7-7, 7-11 - 7-19
2. contain description of contribution to overall effectiveness of program?	Yes	Chapter 7, pp. 7-7 - 7-11
3. noise/land use benefits quantified to extent possible?	Yes	Chapter 5, pp. 5-33, 5-34, 5-40, 5-41 Chapter 7, pp. 7-7 - 7-11
4. include actual/anticipated effect on reducing noise exposure within noncompatible area shown on NEM?	Yes	Chapter 7, pp. 7-7 - 7-11 Exhibits 7B, 7C, 7D
5. effects based on relevant and reasonable expressed assumptions?	Yes	Chapter 5, pp. 5-20 - 5-41 Chapter 7, pp. 7-7 - 7-11
6. have adequate supporting data to support its contribution to noise/land use compatibility?	Yes	Chapters 5, 6, 7
C. Analysis appears to support program standards set forth in 150.35(b) and B150.5?	Yes	Chapters 5, 6, 7
D. When use restrictions are recommended:		
1. are alternatives with potentially significant noise/compatible land use benefits thoroughly analyzed so that appropriate comparisons and conclusions can be made?	N/A	No use restrictions recommended
2. use restrictions coordinated with APP-600 prior to making determination on start of 180-days?	N/A	
E. Do the following also meet Part 150 analytical standards:		
1. formal recommendations which continue existing practices?	N/A	
2. new recommendations or changes proposed at end of Part 150 process?	Yes	Chapter 7, pp. 7-3 - 7-7, 7-11 - 7-19
F. Documentation indicates how recommendations may change previously adopted plans?	N/A	
G. Documentation also:		
1. identifies agencies which are responsible for implementing each recommendation?	Yes	Chapter 7, pp. 7-3 - 7-7; 7-11 - 7-19; Table 7C, p. 7-20

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	Yes/No/NA	Page No./ Other Reference
2. indicates whether those agencies have agreed to implement?	Yes	Sponsor's Certification on p. viii. By approving NCP, City Council has agreed to implement the measures for which it has sole responsibility. It has also agreed to encourage other organizations and agencies to take any required actions.
3. indicates essential government actions necessary to implement recommendations?	Yes	Chapter 7, pp. 7-3 - 7-7; 7-11 - 7-19
H. Timeframe:		
1. includes agreed-upon schedule to implement alternatives?	Yes	Chapter 7, pp. 7-3 - 7-7, 7-11 - 7-19 Table 7C, p. 7-20
2. indicates period covered by the program?	Yes	Chapter 7, p. 7-3, Table 7C, p. 7-20
I. Funding/Costs:		
1. includes costs to implement alternatives?	Yes	Chapter 7, pp. 7-3 - 7-7, 7-11 - 7-19; Table 7C, p. 7-20
2. includes anticipated funding sources?	Yes	Chapter 7, pp. 7-3 - 7-7, 7-11 - 7-19; Table 7C, p. 7-20
VI. PROGRAM REVISION [150.23(e)(9)] Supporting documentation includes provision for revision?	Yes	Chapter 7, pp. 7-17 - 7-19

SPONSOR'S CERTIFICATION

The Noise Compatibility Program for Glendale Municipal Airport, including all accompanying documentation, was prepared with the best available information and is hereby certified as true and complete to the best of my knowledge and belief. It is certified that this documentation is the City of Glendale's official Noise Compatibility Program for Glendale Municipal Airport.

It is further certified that adequate opportunity has been afforded interested persons to submit their views, data, and comments concerning the correctness and adequacy of the Noise Compatibility Program, and the supporting documentation and forecasts.

_____
Date of Signature

_____
Martin Vanacour
City Manager
City of Glendale, Arizona

Chapter Five
NOISE ABATEMENT ALTERNATIVES

GLENDALE
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NOISE ABATEMENT ALTERNATIVES

The DOT/FAA Aviation Noise Abatement Policy of 1976, the Airport Safety and Noise Abatement Act of 1979, and the Airport Noise and Capacity Act of 1990 have outlined the framework needed to assure a coordinated approach to tackling the difficult task of noise abatement and mitigation of noise impacts. Responsibilities are shared among the airport users, aircraft manufacturers, airport proprietors, federal, state, and local governments, and residents of communities near the airport. The following is a brief synopsis of each participant's unique role and responsibility in this effort.

- The federal government has the authority and responsibility to control aircraft noise sources, implement and enforce flight operational procedures, and manage the air traffic control system in ways that minimize noise impacts on populated areas.

- The aircraft manufacturers have the responsibility for incorporating quiet engine technology into the new aircraft designs in order to meet federal noise standards.

- Airport proprietors are responsible for planning and implementing airport development actions designed to reduce noise. Such actions include improvements in airport design and noise abatement ground procedures, in addition to evaluating and recommending restrictions on airport use that do not unjustly discriminate against any user, impede the federal interest in safety and management of the air navigation system, or unreasonably interfere with interstate commerce.

- Local government and planning agencies have the responsibility

for providing land use planning, zoning, and housing regulation that will encourage development or redevelopment of land that is compatible with present and projected airport operations.

- General aviation operators have the responsibility to use proper aircraft maintenance and good neighbor flying techniques to minimize their noise output.

- Air travelers and shippers generally should bear the cost of noise reduction, consistent with established federal economic and environmental policy which states that the adverse environmental consequences of a service or product should be reflected in its price.

- Residents and prospective residents in areas surrounding airports should seek to understand the aircraft noise problem and what steps can and cannot be taken to minimize its effect on people. Prospective residents of areas impacted by aircraft noise should be aware of the effect of noise on their quality of life and act accordingly.

The development of a noise abatement program has three primary objectives. The program elements selected for implementation should:

1. Reduce the noise impacted population in the study area, within practical cost constraints.

2. Minimize, where practical, the exposure of the study area population to noise events of very high levels. These high levels, which are often manifested by single event noise levels outside of the DNL contours, can be an annoyance to airport neighbors and warrant attention.

3. Ensure maximum compatibility of existing and future land uses with noise generated by aircraft using the airport.

The achievement of a plan which meets these objectives can be accomplished only after a variety of realistic noise abatement alternatives have been evaluated independently and in combination with each other.

If the level of aircraft noise impacts in the airport vicinity is to be reduced, good-faith efforts are required from all responsible parties including airport and aviation system managers, owners and operators of aircraft, and land use regulatory agencies. While Chapter Six reviews the alternative measures which the land use regulatory agencies should consider, this chapter is concerned with measures which would alter the use or configuration of air space, flight tracks, and airport facilities so as to reduce or shift the location of noise.

Noise abatement techniques tend to produce one of two general effects. They either reduce the overall size of the noise contours, or they move the noise to other areas.

In order to reduce the overall noise levels around the airport it is necessary to reduce the total sound energy emitted by the aircraft activity at the airport. This can be accomplished through either the modification of aircraft operating procedures or the imposition of restrictions on the number or type of aircraft allowed to operate at the airport.

These measures are often difficult to implement and enforce as they can erode aircraft operational safety margins or discriminate against certain operators and cause an undue burden on interstate commerce.

As a result, it is often more effective and less disruptive to try to move the noise to areas that are either compatible or contain a minimum of noise sensitive areas. This opportunity is usually realized through runway use and flight routing techniques or airport facility development.

The subsequent sections of this chapter will review and evaluate a variety of potential noise abatement techniques. In order to judge the effectiveness and appropriateness of a particular technique, it is important to consider the magnitude of the noise impacts around the Glendale Municipal Airport. The previous chapter of this study has evaluated the population impacts around the airport. Based on the current conditions, there are 27 persons exposed to aircraft noise above 55 DNL around Glendale Municipal Airport. Eleven persons are exposed to aircraft noise above 60 DNL, while only two persons are exposed to noise of 65 DNL or greater. In the future, these impacts are expected to increase. This is partially due to anticipated increases in operations at Glendale, but also due to the residential growth potential in the areas surrounding the airport. When considering this future growth, the noise impacts in five years could increase to as many as 3,574 persons exposed to noise of 55 DNL or greater. This is largely due to the potential for residential growth around the airport as the five year noise contours are only slightly larger than the current contours. In the subsequent alternatives analysis, the noise impacts of each alternative and scenario are computed assuming the future residential growth occurs. This effectively presents a worst case condition and truly tests the benefits of each alternative.

While the current noise impacts around Glendale Municipal Airport indicate a need for concern and proper planning, they do not constitute a dramatic problem by most standards. The fact that current conditions are relatively good at Glendale should be considered when formulating expectations regarding the potential benefits of noise abatement techniques. Simply put, the smaller the problem, the smaller the potential benefit that a particular procedure will yield. Additionally, with each technique providing marginal benefits, the costs of the procedure become a more important factor in the evaluation. The cost of the solution must be commensurate with the magnitude of the problem.

POTENTIAL NOISE ABATEMENT MEASURES

A variety of measures for noise abatement merit investigation and should be reviewed for possible application at Glendale Municipal Airport. A preliminary review of a number of these measures was conducted during the Aviation Technical Conference which was held on March 10, 1994. This conference was a gathering of aviation professionals who are responsible for the administration, control, and operation of aircraft and facilities at and around Glendale Municipal Airport. During the conference, experts in air traffic control, airspace, safety, airports, noise, and aircraft piloting provided guidance on what is and is not feasible at Glendale.

The insights from this discussion have been incorporated into the subsequent alternatives analysis.

Other sources for noise abatement ideas have also been incorporated into the analysis. In 1990 a flight pattern study was conducted for the Glendale Municipal Airport by Aviation Information Resources of Phoenix. This report evaluated the training traffic pattern location over a two-month period during the summer of 1990. The study provided several recommendations which have been reviewed and included in the analysis as appropriate. Additionally, the Maricopa Neighbors Airport and Safety Committee provided the airport management with a 10-point plan for noise abatement at the airport. Several of these items are administrative in nature and are not noise abatement procedures per se. The noise abatement items from this plan are also included in the analysis.

This first portion of the discussion provides a comprehensive evaluation concerning all reasonable noise abatement techniques which deserve consideration. The extent to which these measures might apply at Glendale depends on the probable noise reduction over developed or developing areas, the extent to which the measures would likely compromise safety margins and the ability of the airport to perform its intended function, and their apparent ability to be implemented considering the legal, political and financial climate of the area. If a measure fails to be viable for noise reduction for one of the above reasons, its potential for use at Glendale would be limited and inclusion in a final program would not be warranted.

The second portion of the discussion provides a detailed analysis of those noise abatement procedures that merit more in-depth study. This analysis presents the alternative noise exposure pattern resulting from the procedure and compare it to the baseline conditions. Analysis of the population impacts is also provided. Other issues relating to the cost, safety, and viability of the alternative procedures are discussed.

After reviewing each measure based on the above criteria, a series of implementation scenarios are presented. These scenarios consider the probable consequences of various combinations of potentially useful measures based on future conditions at Glendale. The impacts in these scenarios are assessed based on operations and fleet mix as forecast in Chapter Two.

All analyses of noise abatement alternatives are conducted for the year 1999 to provide a consistency of evaluation and a look at the worst case future conditions within the FAA's five- year planning scope for a Part 150 document. The 2015 noise exposure is provided for each of the combined scenarios at the end of the chapter. This analysis provides a measure of the long-term effectiveness of the potential combined noise abatement procedures at Glendale.

Noise abatement measures considered in this study are procedures which have the potential to reduce the impact of aircraft noise on persons living in the airport environs. Described below are a number of these procedures which might be applied to Glendale Municipal Airport. The evaluation of a number of these alternatives is required under F.A.R. Part 150, even though they may have little utility for local application. These measures fall into four general categories:

- Runway Use and Flight Routing Changes
- Airport Regulation Changes and Facility Restrictions
- Aircraft Operational Procedure Changes
- Airport Facility Changes

Measures in the first three categories generally may be implemented within a relatively short period of time, while those in the last category usually require a longer time to implement due to environmental assessment and construction activities.

RUNWAY USE AND FLIGHT ROUTING CHANGES

The pattern of land use around the airport provides clues to the design of arrival and departure patterns for noise abatement. By redirecting air traffic over areas with more compatible land uses, noise impacts may often be significantly reduced.

Preferential Runway Use

Preferential runway use programs for noise abatement refer to the emphasized use of a particular runway by all aircraft. Preferential runway use programs are intended to direct as much noise as possible over the least noise-sensitive areas. A preferential runway flow results in increased noise exposure off of the departure end and reduced noise exposure off the arrival end of the runway. In cases where an imbalance in intensity of development off of the ends of a runway exists, a preferential runway use program provides noise abatement benefits by directing the major traffic flow toward the least developed area.

FAA Order 8400.9 describes national safety and operational criteria for establishing runway use systems. It defines two classes of systems: informal and formal. A formal system must be defined and acknowledged in a Letter of Understanding between FAA's Flight Standards Division and Air Traffic Service, the airport proprietor, and the airport users. Once established, participation by aircraft operators is mandatory. Formal programs can be extremely difficult to establish, especially at airports with many different users.

An informal system is an approved runway use system which does not require the Letter of Understanding. Informal systems are typically implemented through a Tower Order and publication of the procedure in the Airport Facilities Directory. Participation in the program is voluntary.

Glendale Municipal Airport is bordered by extensive residential development to the north and southeast. On the southeast side, the majority of these areas lie east of the extended runway centerline. The overall development pattern in this area tends to parallel the runway centerline and lies about a mile to the east. The residential development to the north is mostly to the west of the extended runway centerline close to the airport, with some residential areas along the runway centerline several miles further to the north.

Current runway use patterns favor departures to the south approximately 60 percent of the time at Glendale. Since the vast majority of departures from Glendale turn to the east due to airspace considerations, to avoid traffic at Luke

Air Force Base, and to avoid the tall power transmission lines immediately west of the airport, the residential areas to the southeast are exposed to the higher percentage of departure operations. On the other hand, departures to the north also turn to the east, but do so over the open areas which are located just north and east of the airport. Consequently, the north flow tends to result in fewer aircraft departing over close in residential developments. It would appear that a preferential north flow runway use might reduce overall noise impacts around the airport. This would put most of the louder departure noise to the north and east of the airport with the quieter arrivals to the south.

Development of an informal preferential runway use program using this technique could reduce the numbers of persons impacted by aircraft noise. Preliminary evaluations indicate there is some possibility for noise abatement utilizing a preferential runway use program. This is analyzed later in this chapter.

Rotational Runway Use

A rotational runway use program would distribute aircraft noise equally among the residents of areas off the ends of the runways. This type of program is designed so that all areas around an airport can share the burden of the noise exposure and is only appropriate when the residential areas are relatively evenly distributed around the airport. At Glendale, most of the traffic is heading to or coming from the east. The large concentration of residential development to the southeast indicates that it would be frequently overflown by departures to the south. A rotational runway use system would not likely be of benefit.

Departure Turns

The turning of departing aircraft to avoid populated areas is an accepted method of noise abatement which has been implemented in numerous areas. At Glendale, with the populated areas generally located to one side of the extended runway centerline, noise abatement departure turns away from the populated areas might be beneficial for noise reduction.

When considering noise abatement departure turns for Glendale, it is necessary to recall the need for aircraft to generally move to the east of the airport. This is necessary to join the VFR flyways (Exhibit 1D, after page 1-16) in the area, avoid air traffic at Luke Air Force Base west of the airport, and avoid the tall power transmission lines immediately west of the airport. With this in mind, the residential development pattern to the southeast of the airport precludes the possibility of an effective noise abatement turn. Since the residential areas are relatively close to the airport and extend from just north of Camelback Road to Thomas Road, there is no noise abatement corridor to the east or southeast.

On the north side of the airport, the residential patterns are much more favorable for the establishment of a noise abatement departure turn. The New River floodplain and the northeast-southwest segment of the Agua Fria Expressway (between Olive Avenue and Northern Avenue) provide an excellent open corridor for aircraft overflights. Aircraft departing Glendale could be routed over these areas while avoiding most of the residential development north of the airport. Since this turn would be consistent with the need to

keep traffic to the east of the airport, it is reasonable to consider this procedure in more detail.

Straight-Out Departures

In situations where noise-sensitive development occurs around the airport and off to the sides of the extended runway centerline, aircraft are often directed to maintain the runway heading until reaching a given altitude or downrange visual reference. Assignment of runway heading to a specified altitude, or for a specified distance, before turning to course headings could delay or avoid turns over noise-sensitive areas. This option was presented as one of the Maricopa Neighbors Airport Noise and Safety Committee's noise abatement plan.

Although the residential development north of the airport is generally west of the extended runway centerline, a straight-out departure procedure to the north would tend to impact the eastern edges of the close-in residential areas. A straight-out procedure is not nearly as attractive as the previously discussed departure turn for the north side. Consequently, it is not necessary to consider a straight-out procedure for Runway 1 departures.

The distribution of the residential development southeast of the airport is such that a straight-out procedure would possibly reduce noise impacts in this area. The extended runway centerline to the south runs down the Agua Fria River floodplain. Aircraft departing to the south and maintaining runway heading essentially fly over open undeveloped areas; however, continuation on a southerly course beyond Thomas Road will put the Glendale traffic in conflict with the Phoenix Goodyear airport traffic which can be as far north as I-10. Consequently, straight-out departures to the south at Glendale could only be maintained to Indian School Road before turning to the east. This would tend to increase the frequency of overflights in the Garden Lakes area, although aircraft generally would be higher and quieter than the current overflights of Camelback Farms and Villa de Paz resulting from the early turns to the east. As such, this procedure does merit a detailed analysis to quantify its benefits and trade-offs.

Another variant on the straight-out departure theme would be to require all aircraft departing to the south to maintain runway heading until crossing the end of the runway. This would reduce the number of very early turns and low overflights of the Camelback Farms area while still maintaining the dispersal of flight patterns immediately southeast of the airport. This procedure is also considered for further analysis.

Modified Local Pattern

Often at general aviation airports the majority of the aircraft operations are touch-and-goes. The nature of the operation is to provide for a number of practice take-offs and landings in a relatively short period of time. Both experienced and student pilots use touch-and-goes to maintain and enhance their pilot skills. This type of operation is generally conducted in an oval or rectangular pattern adjacent to the airport and parallel to the active runway. If the pattern is located such that aircraft overfly nearby residential areas, the frequency of the flights can be a source of concern to airport neighbors. The adjustment of the local pattern to avoid

the residential areas can be an effective noise abatement tool.

At Glendale, local pattern overflights were a significant concern of airport neighbors while Airline Training Center of Arizona (ATCA) was operating at the airport. While concerns about pattern overflights have diminished greatly since ATCA ceased operating at Glendale, training traffic will continue using the airport in the future. Consequently, modification of the local pattern may provide an effective means of noise abatement. This option was presented as part of the Maricopa Neighbors Airport Noise and Safety Committee's 10 point noise abatement plan.

Currently the traffic pattern at Glendale Municipal Airport is east of the airport in conditions of both north and south flow. This is to avoid the tall power lines immediately west of the airport as well as Luke Air Force Base traffic further to the west. Unfortunately, while airspace conflicts and hazards are west of the airport, the residential areas are southeast of the airport. Moving the traffic pattern to the west of the airport would certainly provide relief to the residents to the southeast, however the traffic conflicts and hazards are significant limitations.

Discussions with air traffic control personnel from Luke Air Force Base during the Aviation Technical Conference indicated that the establishment of a traffic pattern on the west side of Glendale would be unacceptable under most conditions. However, since traffic at Luke is significantly reduced on most weekends, it might be possible to establish a traffic pattern west of Glendale on those weekends when Luke is not busy. Since weekends tend to provide private pilots more opportunity to practice flying, an adjustment in the weekend pattern might be beneficial and should be analyzed further.

Another variant on moving the traffic pattern to the west would be the establishment of a standard right hand pattern. This would put the local pattern to the east of the airport during the less frequent periods of north flow at the airport. During the more common periods of south flow the pattern would be to the right on the west side of the airport. This puts the noisier departure portion of the pattern over open areas southwest of the airport. Conversely, during north flow, the pattern would overfly the residential areas to the southeast but only during the quieter arrival segments of the pattern. While this alternative would apply on any day the airport is in south flow, and thus is unacceptable to Luke RAPCON, it is modelled to show the extreme outer envelope of potential benefits.

A more common procedure would be the standard left hand pattern. This is the opposite of the previously discussed right hand system. A preliminary evaluation of this procedure was conducted for the Aviation Technical Conference. This procedure would put the local pattern to the west of the airport during the less frequent periods of north flow at the airport. During the more common periods of south flow the pattern would be on the east side of the airport. Intuitively, this procedure sets up the worst case conditions to the north and south of the airport. During the north flow, the noisier departure portion of the pattern would be over the residential areas to the northwest of the airport. Conversely, during south flow, the pattern would be to the east where the departure portion of the pattern

would overfly the residential areas to the southeast. The preliminary evaluation confirmed this intuition. Consequently, the left hand pattern procedure need not be considered further.

An additional modification to the traffic pattern on the east side is also possible. The open areas northeast of the airport could be used for touch and go departure overflights to the north as previously described under the Departure Turns section. This procedure would adjust the upwind leg of the north flow traffic pattern to bend to the east to overfly the New River floodplain and the Agua Fria Expressway. This modification was offered in a 1990 study of the airport traffic pattern by Aviation Information Resources, Phoenix AZ. As with the departure turn, the modified pattern would keep the louder departure portions of the local operations to the east of the residential areas north of the airport. The procedure would require a right turn at the runway end to a heading along the river and highway corridor. The crosswind leg of the pattern would be shortened to allow the downwind leg to remain unchanged. This type of a procedure could provide noise benefits alone or in conjunction with other procedures and should be analyzed further.

Visual Approach Procedures

Approaches involving turns relatively close to the airport can sometimes be defined over noise-compatible areas for use under VFR conditions. However, most aircraft typically require a stabilized approach of one to three miles. The greatest advantage to establishing visual approach procedures is to utilize a noise-compatible corridor when an airport is more or less surrounded by noise sensitive uses.

At Glendale, most aircraft enter the airport vicinity from the VFR flyways east of the airport. For approaches from the south, the residential development pattern to the southeast of the airport provides no clearly evident approach corridors. On the north side, the New River floodplain and Agua Fria Expressway corridor is free of residential development, but it is relatively close to the airport, making the corridor ideal for departures but not leaving much room for a stable final approach while still avoiding the residential areas.

Since approach noise is generally quieter than departure noise, the procedure would have little effect on the cumulative noise contours. Even if short approaches were attempted, parts of the residential areas north and south of the airport would still be overflown. Consequently, the procedure would offer little if any real benefit. Given the scope and nature of the noise concerns at Glendale, this procedure does not merit further consideration.

AIRPORT REGULATION CHANGES

The courts have recognized the right of airport proprietors to reduce their liability for aircraft noise by imposing restrictions which are reasonable, nondiscriminatory, and do not interfere with interstate commerce or violate a contractual agreement with the FAA that was agreed to as a condition of receiving federal aid.

These restrictions may be imposed by the airport proprietor at its option, but a restriction which would discriminate

against a class of user or cause an undue burden on interstate commerce would likely be struck down when challenged in court. There is no universal definition of what constitutes an undue burden, but restrictions such as an across-the-board nighttime curfew or the prohibition of a specific aircraft type do not appear to be viable and would probably be illegal.

With the passage of the Airport Noise and Capacity Act of 1990, Congress not only established a national phase out policy for Stage 2 aircraft, but it also set forth the analytical requirements that must be met in order for an individual airport to establish noise or access restrictions on Stage 2 or Stage 3 aircraft beyond the national policy. Although the act does not require the phase out of Stage 2 aircraft under 75,000 pounds, as would typically utilize Glendale, it does specifically require special analysis for any measure that restricts these aircraft. The FAA has implemented the national Stage 2 aircraft phase out through a method and schedule set forth in F.A.R. Part 91. The requirements that must be met by an individual airport to further restrict these aircraft are set forth in F.A.R. Part 161.

The actions required by F.A.R. Part 161 in order to establish a local restriction on Stage 2 aircraft generally include the following:

- Notice of the proposed restriction and opportunity for comment on the analysis.
- A technical analysis that evaluates costs and benefits of the proposed restriction, alternative restrictions, and alternative measures that do not include restrictions.

While implementation of a Stage 2 aircraft operating restriction does not require FAA approval, the FAA does determine whether adequate analysis and notification have been conducted.

In order to establish a local restriction on Stage 3 aircraft, Part 161 requires a much more rigorous analysis as well as final FAA approval of the restriction. The conditions for approval of a Stage 3 restriction require that the analysis provide evidence of the following conditions:

- The restriction is reasonable, nonarbitrary, and nondiscriminatory.
- The restriction does not create an undue burden on interstate or foreign commerce.
- The restriction maintains safe and efficient use of navigable airspace.
- The restriction does not conflict with any existing federal statute or regulation.
- The restriction does not create an undue burden on the national aviation system.

These requirements clearly indicate that restrictions on either Stage 2 or Stage 3 aircraft are considered as methods of last resort for noise abatement. The analytical requirements alone ensure that all other noise abatement alternatives should be exhausted prior to the implementation of these types of restrictions. Since virtually any regulatory alternative at Glendale would have the net effect of limiting either Stage 2 or Stage 3 aircraft access, it is certain that the requirements in Part 161 would have to be met.

Additionally, the FAA has made it clear that the approval of a restrictive measure in a F.A.R. Part 150 document would be predicated on the noise abatement benefit of the restriction at noise levels of 65 DNL or higher. These benefits would have to be demonstrated for the current or five-year conditions that are officially required in the document. As previously discussed, the noise abatement measures must be commensurate with the magnitude of the noise impacts. With only 2 persons currently exposed to noise levels of 65 DNL or higher, and no additional persons expected to be within the 65 DNL noise contour in five years, severe restrictions are not likely to be approved by the FAA at Glendale.

Specific regulatory options include the following:

- Establishment of nighttime curfews.
- Landing fees based on noise or time of arrival.
- Airport capacity limitations based on relative noisiness.
- Restriction of aircraft based on F.A.R. Part 36 noise levels.
- Restrictions on engine run-ups.
- Restrictions on training activity.

Curfews

FAA Advisory Circular 150/5020-1 indicates that curfews are an effective though costly method of controlling noise intrusion into areas adjacent or in proximity to an airport. Because of their drastic negative impacts upon both aviation and the community's benefit from aviation, they should be reserved as a strategy of last resort when all other options have been shown to be clearly inadequate. Since unwanted noise intrusions are most pronounced in the late evening or early morning hours, curfews are usually implemented to restrict operations that occur during those periods. The period of 10 p.m. to 7 a.m. is when most people are resting and are most sensitive to noise. It should also be pointed out, however, that curfews have economic impacts upon airport users, upon those providing airport-related services, and upon the community as a whole.

The prohibition of air traffic during the noise-sensitive hours would place undue constraints on those users of the airport who are not major contributors to the noise contours. Not only would the loudest operations be prohibited, but operations by quiet aircraft would be also banned by an across the board curfew. A measure of this nature would also impact local airport flight schools as the early daylight morning hours are often used for pilot training. Singling out one type of user or activity for a curfew, such as training activity, could be seen as discriminatory.

In the case of Glendale Municipal Airport, the relatively low percentage of nighttime operations coupled with the low level of noise impacts in the critical 65 DNL noise contour precludes any significant noise reductions. Preliminary investigations of curfews for the Aviation Technical Conference indicated that only slight reductions in noise exposure were possible which, in reality, are magnified by the arbitrary 10 dB penalty added to the nighttime operations in the DNL noise metric. Consequently, real reductions in noise exposure are virtually non-existent with

this procedure. Given the radical nature of curfews and the absence of any significant noise impact reduction potential, curfews need not be investigated further.

Landing Fees

The initiation of differential landing fees based on either the noise level or the time of arrival have been proposed as incentives to use quieter aircraft or operate at less sensitive times. Such a measure would put in place a variable schedule of landing fees based on the relative loudness of the aircraft, with arrivals by loud aircraft at night being charged the most and arrivals by quiet aircraft during the day being charged the least. To avoid charges of discrimination, the fee must relate to both time of day and certificated approach noise levels. Fees from such a program can finance noise abatement activities. This restriction does not provide a noise abatement benefit unless the fees are high enough to actually discourage use of the airport.

Glendale, like most general aviation airports, does not have landing fees. A program of this nature requires administrative personnel and presents the potential for discriminatory administration. Given the limited noise impacts at Glendale Municipal Airport, the development of a differential landing fee schedule does not warrant further consideration.

Capacity Limitations

Capacity limits based on either total operations or relative noisiness of aircraft have been used by severely impacted airports as a method of controlling the total cumulative noise exposure. Due to the uncontrolled and unscheduled nature of the operations at Glendale, the airport could not enforce a capacity limit to control noise. Additionally, a limitation of this nature would effectively restrict the access of both Stage 2 and Stage 3 aircraft. Consequently, the analytical requirements in F.A.R. Part 161 would have to be met. Given the relatively small number of noise impacts around the airport, it is not likely that the cost/benefit analysis would persuade FAA to approve such a restriction.

Restrictions Based on F.A.R. Part 36

A restriction of aircraft based on noise levels can be effective in the correct circumstances. The restriction can be based on maximum permitted noise levels (L-Max) measured off the airport or based on compliance with F.A.R. Part 36. The selection of an L-Max level without regard to currently operating aircraft and/or the ability of the various users to meet the level with existing technologies may lead to a substantial reduction in the level and quality of air service available within the community. Noise limits based on Part 36 certification tests have the virtue of being fixed national standards, but they do not consider how quietly an aircraft can be flown in normal operations. On the other hand, noise limits based on SEL readings are more specific to the airport and aircraft operators because they focus on noise produced in a particular situation. They have the disadvantage of requiring the installation of noise monitoring equipment and special administrative effort.

A restriction based on F.A.R. Part 36 would generally focus on turbojet

powered aircraft at Glendale. Preliminary analysis conducted for the Aviation Technical Conference indicated that marginal noise reductions were possible by restricting the operation of Stage 2 aircraft at Glendale. These reductions however, are based on the estimated current and future operational levels of Stage 2 jet aircraft at the airport. Should these estimates prove to be somewhat high, the potential noise reductions from this restriction are even less than marginal. As with the previously discussed restrictions, the noise impact reductions in the 65 DNL noise contour or higher would be the measure of acceptability for the restriction. Given the limited number of impacts in this area, the burden of the additional Part 161 analysis that would be required, and the questionable nature of the potential noise reductions, this restriction should not be considered further.

While approval of an official restriction would obviously be difficult if not impossible, a policy oriented-approach could achieve a similar net effect. The city, in its marketing of the airport, could seek out those corporate clients with Stage 3 aircraft and encourage them to base at Glendale. This policy could then avoid marketing the airport to those corporate users who would bring in Stage 2 aircraft. This would tend to keep the overall operational levels of Stage 2 jet aircraft at Glendale to a minimum which would keep the noise contours as small as possible.

Engine Run-up Restrictions

Engine run-ups are a necessary and critical portion of aircraft operation and maintenance, but they tend to last longer than an overflight and often are the subject of noise complaints. Restrictions on late-night engine maintenance runups can reduce single event impacts on residential areas located close by the terminal or maintenance areas. This option was presented as one of the Maricopa Neighbors Airport Noise and Safety Committee's noise abatement options.

While runups at Glendale have been an area of concern in the past, they are clearly not the major noise contributor around the airport. In fact, maintenance runups at Glendale are relatively rare. In the past, the concerns about runups have probably resulted from the normal pre-flight engine runups that are done at the end of the runway before a departure. These are generally of short duration (1 to 2 minutes) and are a necessary part of the pre-flight checks for a safe departure. Restrictions on these type of runups would not be conducive to the safe operation of aircraft at Glendale. As a result, such restrictions do not merit further consideration.

If an engine maintenance operation should be established in the future at Glendale, a place should be designated on the airport for engine run-ups. The site should be selected to minimize the exposure of homes to run-up noise. In addition, a preferred aircraft orientation should be established. If outdoor noise levels of approximately 80 decibels (Lmax) or higher would be experienced in residential areas, consideration should be given to the installation of a structure, such as a berm or run-up pen, to attenuate the run-up noise.

Training Restrictions

Restrictions on training operations can reduce noise when those operations are extremely noisy, unusually frequent, or occur at a very noise sensitive time of the day. This option was presented as part of the Maricopa Neighbors Airport Noise and Safety Committee's 10 point noise abatement plan. Currently, most of the training operations at Glendale are conducted with light and quiet aircraft. In the past, nearby airline pilot training schools have used the airport with noisier high performance aircraft. These operations were a significant concern to nearby residents. While a prohibition on training operations would certainly ensure that this concern would be alleviated in the future, it would also seriously reduce the business and revenues generated by the airport. Also, a prohibition of this nature would certainly have legal ramifications as it would put any flight schools or pilot training service that is currently at the airport out of business. This could easily be viewed as discriminatory.

A preliminary evaluation of this measure was developed for the Aviation Technical Conference. While reductions in noise exposure at the lower DNL noise contour levels were evident, there were less than significant reductions at the higher noise levels of 65 DNL and above. Given the requirement from FAA to show noise impact reductions at 65 DNL or higher along with the legal and financial considerations, this type of restriction does not merit further consideration.

Although an official restriction would obviously be difficult if not impossible to get approved, a marketing policy approach could achieve a similar net effect. The city could avoid emphasizing marketing efforts towards large training schools that would bring frequent operations by louder aircraft.

AIRCRAFT OPERATIONAL PROCEDURE CHANGES

Within this category fall those changes to flight procedures which may serve to decrease noise impacts on area population. They may apply to either departures or arrivals. Possible changes are as follows:

- Encourage the use of reduced thrust takeoffs by all aircraft capable of using the procedure.
- Request the use of thrust cutbacks after takeoff.
- Request the use of maximum climb departures by all aircraft.
- Establish a minimum approach altitude for downwind segments.
- Request the minimum use of flaps during approaches.
- Increase approach angles by glide slope change or two-stage approaches.
- Restrict the use of reverse thrust during landings.

Reduced Thrust Takeoffs

Reduced thrust takeoffs involve the use of a reduced power setting throughout both takeoff roll and climb. Use of the procedure depends upon aircraft weight, weather and wind conditions, pavement conditions and runway length available.

In fact, aircraft operators often use reduced thrust departures to conserve fuel, minimize engine wear, and abate noise. While these procedures are generally economical and effective at reducing noise, additional efforts to encourage deeper thrust reductions can only provide mixed results.

Requiring takeoff thrust settings to be reduced beyond the normal settings appropriate for the aircraft type, weight, temperature, etc., not only can erode safety margins but also tend to drag noise out further from the airport. At Glendale, with residential developments several miles from the airport, this procedure could actually increase noise impacts. Consequently, an airport policy mandating the use of reduced thrust takeoffs is not considered to be an effective noise abatement measure for Glendale Municipal Airport.

Thrust Cutbacks for Business Jets

As a service to the general aviation industry, the National Business Aircraft Association (NBAA) prepared a series of noise abatement takeoff and arrival procedures for its membership in 1967. This program has virtually become an industry standard for operators of business jet aircraft since that time. The departure procedures are of two types: the **standard departure procedure** and the **close-in departure procedure**. The selection of the applicable noise abatement departure procedure depends on the proximity of the nearest noise-sensitive area. This option was presented as one of the Maricopa Neighbors Airport Noise and Safety Committee's noise abatement options.

The NBAA standard departure procedure calls for a thrust cutback at 1,000 feet above ground level (AGL) and a 1,000 feet per minute climb to 3,000 feet altitude during acceleration and clean-up. The major difference between this and the close-in procedure is a thrust cutback at 500 feet AGL during the close-in procedure. While both procedures are effective in reducing noise impacts on surrounding land uses, the locations of the reduction vary with each. The standard procedure will result in higher altitudes over down-range locations, while the close-in procedure will result in lower noise levels near the airport. Neither NBAA procedure is intended to supplant a procedure recommended by the manufacturer, when one is included in the aircraft operating manual.

An attempt to actively enforce a procedure of this nature requires some type of verification of usage by the airport management. In order to ensure the promised changes in noise exposure, a permanent system of noise and flight track data acquisition is necessary. These systems typically cost in the $500,000 to $1,000,000 range and are also expensive to maintain. Additionally, a specialized staff is necessary to analyze and interpret the data, again, a substantial cost.

In the case of Glendale Municipal Airport, with relatively small noise impacts at greater than the 65 DNL level and a relatively low level of business jet operations, aggressive promotion of these thrust cutback procedures is not necessary; however, the airport should encourage and remind pilots to use quiet flying procedures whenever possible.

Maximum Climb Departure

The use of maximum climb, or best angle, departure procedures can, in some cases, help reduce noise exposure over populated areas some distance from the airport. This option was also presented as one of the Maricopa Neighbors Airport Noise and Safety Committee's noise abatement options. The nature of the procedure however, requires the use of maximum thrust with no cutback on departure. Consequently, the potential noise reductions in the outlying areas are at the expense of dramatic noise increases closer to the airport. Unfortunately, there are a number of residential areas near the airport. This type of procedure would, in effect, be raising the noise levels considerably on those people who are already exposed to higher levels than their outlying counterparts. These noise increases would be the cost for only a marginal noise reduction on areas that are already receiving lower noise levels.

This type of procedure can also be costly to operators at Glendale. The use of maximum thrust procedures would increase fuel usage and wear and tear on engines and equipment. Given today's economic climate, these types of costs can be critical to aircraft operators. As a result, this type of procedure is typically seen as a last resort for critical situations.

Maximum climb departures at Glendale would at best, slightly reduce noise impacts in the lower noise exposure areas while increasing noise close in to the airport. The costs of this questionable benefit are also high for aircraft operators at Glendale; therefore, the procedure is not considered effective and has been dropped from further consideration.

Minimum Approach Altitudes

A minimum approach altitude procedure would entail an ATC requirement that all positively-controlled aircraft approaches be conducted at a specified minimum altitude until the aircraft must begin its descent to land. This procedure would apply to aircraft some distance from the airport and well outside of the noise contour area. Currently the pattern altitude for propeller aircraft at Glendale is 2,000 feet MSL. This translates to about 1,000 feet above ground level (AGL). Even the doubling of the altitude of an aircraft in a downwind or circling approach will result in the reduction of noise by only four to six decibels. Additionally, raising the pattern altitude can have the effect of enlarging the pattern as departing aircraft have to extend their upwind and crosswind legs to achieve the pattern altitude as they turn on the downwind leg of the pattern. Implementation of modified arrival procedures is difficult to verify and does not significantly reduce cumulative noise levels because takeoff noise normally dominates the situation. Thus, the measure is not considered further.

Noise Abatement Approach Procedures

Approach procedures to reduce noise impacts were attempted in the early days of noise abatement, but are no longer favorably received. This option was presented as one of the Maricopa Neighbors Airport Noise and Safety Committee's noise abatement options. The procedures include the minimal use of flaps in order to reduce power settings and airframe noise, the use of increased approach angles, and two

stage descent profiles. Follow-up studies have found that all of these techniques cause concern for safety because they are nonstandard and require an aircraft to be operated outside of its optimal safe operating configurations. Unfortunately, some of these procedures actually were found to increase noise because of power applications required to arrest high sink rates. The increase of an approach slope angle requires that the aircraft be landed at more than optimal approach speed. These higher sink rates and faster speeds associated with steeper descent approaches can reduce pilot reaction time and erode safety margins. Again, this is particularly a concern with inexperienced student pilots. Noise abatement approach procedures for Glendale are not considered further.

Reverse Thrust Restrictions

Restrictions on the use of reverse thrust to slow aircraft immediately after touchdown can reduce noise impacts off the sides of the runways. Given the location of noise-sensitive uses in the Glendale Municipal Airport vicinity, a restriction on thrust reversal would not result in significant benefits. In addition, reverse thrust restrictions tend to erode landing safety margins, increase runway capacity time, and increase brake wear on aircraft.

AIRPORT FACILITY CHANGES

The development of or changes to on-airport facilities to improve off-airport noise levels is an accepted technique in noise abatement. Airport facilities can be constructed or modified to reduce aircraft noise or shift it to compatible areas. Other facility changes which may offer some degree of noise abatement are displaced runway thresholds and acoustical barriers or shielding.

Runway Extensions and New Runways

At Glendale Municipal Airport, several facility change proposals are discussed in the Airport Master Plan document which was completed in 1989. The primary among these was the potential extension of Runway 1-19 and the long-term possibility of a new parallel runway.

The noise effects for these developments have been considered in the baseline noise analysis presented in Chapter 2 of this document. Aside from the small noise impact benefits resulting from moving the point of the start of takeoff roll further south, meaning that aircraft departing to the north will be higher as they fly over areas north of the airport, the extension to Runway 1L-19R presents little or no opportunity for additional noise abatement. The proposed parallel runway also presents little or no opportunity for enhanced noise abatement. Since it is located so close to the existing runway, it essentially can be used no differently than the existing runway from a noise abatement perspective.

The development of other runway orientations that could reduce noise impacts is severely restricted by the nearby floodplains and high tension power transmission lines, as well as the Luke Air Force Base traffic flow to the west. The cost of such a development is also a significant restriction as the current airfield capacity would not be enhanced by additional crossing

runways. Given the constraints, additional runway development for noise abatement does not merit further consideration.

Displaced and Relocated Thresholds

A displaced threshold can provide some measure of noise abatement. To displace a threshold means that the touchdown zone for landing aircraft is moved further down the runway. The determination of the amount of displacement must consider the required runway lengths for landing as well as the amount of noise reduction associated with the displacement. For example, if the threshold of a runway were displaced 1,000 feet, the altitude of an aircraft along the approach path would be increased by only 50 feet. The single event noise levels associated with displaced thresholds would decrease slightly along the flight track, but by no more than two to three decibels over the closest noise-sensitive use area under the approach track. These areas are much more impacted by departure noise.

Threshold relocation, where the point of touchdown and the point of takeoff are both shifted, can offer some small additional noise benefits to areas near a runway end by shifting takeoff noise associated with the start of the takeoff roll away from the former runway end.

Threshold displacement and relocation generally offer only small noise reduction benefits. They are most helpful to residential areas located very near the end of the runway. Displaced or relocated runway thresholds would provide little or no benefit at Glendale and are not considered further.

Acoustical Barriers

Acoustical barriers include noise walls, berms, and hush houses or run-up pens for containing engine maintenance run-up noise. Acoustical barriers are only useful for attenuating noise from aircraft activity on the ground. They have very limited application in special situations, act best over relatively short distances, and their benefits are greatly affected by surface topography and wind conditions. Furthermore, the effectiveness of a barrier is directly related to the distance of the noise source from the receiver and the distance of each from the barrier itself, as well as the angle between the ends of the berm and the receiver.

While noise berms and noise walls can attenuate noise, they are often criticized by airport neighbors because they obstruct views. Another frequent complaint is that airport noise can become more alarming, particularly noise from unusual events, because people are unable to see the cause of the noise.

At Glendale Municipal Airport, noise berms or walls would be largely ineffective for attenuation of aircraft overflight noise. Given the location of the residential areas around the airport, there are really no areas suited for effective placement of an acoustical barrier. As such, this measure is not considered further. (As discussed previously on page 5-13, an engine run-up enclosure should be considered if a future engine maintenance operation at the airport would expose homes to outdoor noise levels of approximately 80 decibels (Lmax) or higher.)

SELECTION OF MEASURES FOR DETAILED EVALUATION

Preliminary analysis of the preceding noise abatement techniques indicates some measures as having particular local applicability and potential effectiveness in reducing aircraft noise levels. These measures primarily focus on runway use and flight routing strategies that could enhance the current and future noise compatibility around the airport. They present real possibilities for noise control yet still permit a relatively flexible and efficient operation of the airport.

It is important to emphasize that although there are some extremely restrictive measures which could be effective in reducing noise, the certainty of their litigation and resulting delays of potential implementation, their questionable acceptability to FAA, and their potential harm to air service at Glendale, preclude the consideration of such measures.

Evaluation Criteria

A variety of potential measures which may provide noise abatement at Glendale Municipal Airport were presented in the first section of this chapter. The extent to which these measures warrant inclusion in a noise compatibility program is dependent on such factors as the probable noise impact reduction resulting from their use, the extent to which the measures would likely compromise safety margins and the ability of the airport and its users to perform their intended functions.

The noise abatement measures that have been found to have potential in reducing noise impacts around the airport will be individually addressed in this section. The noise analysis for each alternative was based on the 1999 NEM baseline analysis presented in Chapter 2, Aviation Noise, of the Noise Exposure Maps document. The 1999 baseline was chosen to offer a common base of comparison for all alternatives. These measures were evaluated using the following criteria:

Noise Reduction Effects. The purpose of this evaluation is to reduce aircraft noise impacts on people. It was also determined whether a reduction in noise impacts over residential areas occurred. This analysis considered both existing residential areas and undeveloped areas available for future residential development. Reductions of population impacts in the 55 DNL and above contours are considered in this analysis.

Operational Issues. These factors consider the effects of the specified change on the operation of the airspace or airport and on aircraft using the airport. The type and extent of conflicts or strain which the procedure will impose on the existing ATC system in the vicinity of the airport, and the means by which these could be resolved are identified. Impacts on operating safety which would be associated with the noise abatement procedure are also addressed. FAA regulations and procedures will not permit aircraft operation and pilot workload to be handled other than in a safe manner, but within this limitation, differences in safety margins occur. A significant reduction in these safety margins will render an abatement procedure unacceptable.

Air Service Factors. These factors relate to a decline in the quality of air transportation service which would be expected from adoption of an abatement measure. Such a decline may result from lowered capacity or restrictions on operations or aircraft types.

Costs. Costs include both the cost of operating aircraft to meet the noise abatement measure and the cost of construction or operation required for various noise abatement facilities. The difference in flight time operating costs between the potential noise abatement procedures and current operational procedures is discussed.

Environmental Issues. Environmental factors related to noise are of primary concern in a F.A.R Part 150 analysis. The impacts, if any, of a noise abatement measure on other environmental issues, such as air and water quality, is also considered in the potential for its implementation.

Implementation Factors. This evaluation identifies the agency responsible for implementing the noise abatement procedure and the difficulties of introducing the procedure. This is based on the extent to which it departs from accepted standard operating procedures; the need for changes in FAA procedures, regulations, or criteria; the need for changes in airport administration procedures; and the likelihood of community acceptance.

Upon completion of a review of each measure based on the above criteria, an assessment of the feasibility of each measure and the strategies required for its implementation are presented. Preliminary recommendations are made as to alternatives which deserve serious consideration for inclusion into a final program.

At the end of the section a summary comparison of the noise impacts of each alternative is presented.

ALTERNATIVE 1 - MOVE LOCAL PATTERN TO THE WEST ON WEEKENDS

Goals

This alternative seeks to use the Agua Fria River floodplain and other open areas west of the airport to route local traffic over more noise compatible areas on weekends. By concentrating the local traffic over the river floodplain, reductions in noise exposure over the residential areas southeast of the airport could be achieved.

Procedure

This procedure would only apply on weekends when Luke Air Force Base has no scheduled operations. The alternative flight patterns for this procedure are illustrated on Exhibit 5A. During periods of south flow (Runway 19) the procedure would require that aircraft reach the pattern altitude prior to turning onto the crosswind leg of the pattern. This would ensure that aircraft are at a safe altitude to pass over the high tension power lines immediately west of the airport. The procedure would concentrate local traffic over the Agua Fria River floodplain and avoid overflights of the residential areas south and southeast of the airport.

For noise modelling purposes, the 1999 NEM baseline input was modified to

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Exhibit 5A
ALTERNATIVE 1
MOVE LOCAL TRAFFIC PATTERN WEST OF THE AIRPORT, WEEKENDS ONLY

SUR-PRISE TOWN
COUNTY
PEORIA AVENUE
YOUNG TOWN
MARICOPA COUNTY
PEORIA
COUNTY
ARIZONA LOOP 101
OLIVE AVENUE
LITCHFIELD ROAD
EL MIRAGE
PEORIA
CO.
95TH AVENUE
AGUA FRIA EXPRESSWAY
83RD AVENUE
NORTHERN AVENUE
MARICOPA COUNTY
COUNTY
91ST AVENUE
S
LUKE AIR FORCE BASE
GLENDALE AVENUE
GLENDALE
99TH AVENUE
MARICOPA COUNTY
55
60
65
70
75
BETHANY HOME ROAD
DYSART ROAD
MARICOPA COUNTY
PHOENIX
S
S
GLENDALE
CAMELBACK ROAD
EL MIRAGE ROAD
AGUA FRIA RIVER
LITCHFIELD PARK
S
COUNTY
INDIAN SCHOOL ROAD
C
AVONDALE
59TH AVENUE
AVONDALE
PHOENIX
THOMAS ROAD
GOODYEAR
MARICOPA COUNTY
PHOENIX

LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- 1999 Baseline DNL Contour-Marginal Impact
- 1999 Baseline DNL Contour-Significant Impact
- Alternative DNL Contour-Marginal Impact
- Alternative DNL Contour-Significant Impact
- Alternative Traffic Pattern
- Existing Residential
- Undeveloped
- Existing Public and Institutional
- School
- Church
- ▲ Community Center
- N Nursing/Rest Home
- A Amphitheater
- ● Site on National Register of Historic Places
- Potentially Available for Residential Development
- C Future Church Site
- S Future School Site

NORTH

0 4000 8000

SCALE IN FEET

GLENDALE MUNICIPAL AIRPORT

reflect the new flight patterns. Since weekends offer more opportunity for private pilots to fly it was assumed that local traffic on the weekends was slightly higher than during the week. For this analysis 35 percent of the touch and go traffic was assumed for the weekends and moved to the alternative flight patterns. All other traffic assignments and runway use percentages remained unchanged.

Noise Reduction Effects

The noise contours presented in **Exhibit 5A** illustrate the effects of this procedure. The overall shape of the alternative noise contours remains similar to the 1999 NEM baseline contours. Only slight changes are evident in the alternative noise contour due to the procedural change.

The southeastern lobes of the 55 DNL noise contour that were over the Camelback Farms area in the baseline have shifted to the west. Smaller reductions are also evident along the remainder of the eastern edge of the 55 DNL noise contour. To the north, the 55 DNL contour shrinks slightly to the south reflecting the additional dispersion of flight tracks in the area. On the south side the 55 DNL noise contour shows a slight increase along the extended runway centerline. This is due to the extended upwind leg of the pattern to allow aircraft to reach the pattern altitude before turning to the west.

The 60 DNL noise contour for the alternative is nearly identical to its baseline counterpart. Only a slight increase is evident along the runway centerline on the south side of the airport. The remaining alternative noise contours are virtually identical to those in the baseline condition.

The noise impact analysis for this alternative indicates that significant reductions in the potential future population exposed to aircraft noise are possible. Some 599 people would be removed from the 55-60 DNL contour. In the higher 60-65 DNL contour there would be about 28 more people exposed to aircraft noise at this level. There would be only 2 persons exposed to noise above 65 DNL with this alternative. Detailed population impact analysis results are presented at the end of this section.

Operational Issues

There are several concerns with the operational feasibility and safety of this procedure. The establishment of any local pattern west of Glendale Municipal Airport would mean that traffic is routinely crossing over the high tension power lines near the airport. These lines extend some 100 feet above the airport and are less than a quarter mile west of the runway. Requiring aircraft to climb to the pattern altitude before turning onto the crosswind leg of the pattern should allow for safe crossing of the lines. However, unusual procedures can occasionally be confusing to the student pilot and it is usually safer to avoid flying toward hazards whenever possible.

Another serious concern is the proximity of the alternative pattern to Luke Air Force Base. It would certainly be unacceptable to mix general aviation traffic from Glendale with high speed fighter aircraft from Luke. Since operations on the weekends at Luke are

generally minimal, safe training activity west of Glendale might be possible during these periods. Occasionally, however, Luke is busy on the weekends, meaning that the west traffic pattern at Glendale would not be feasible. Use of this procedure would require extremely careful coordination between Luke ATC and Glendale ATC. The inconsistency in the availability of the procedure also would be confusing to pilots.

Air Service Factors

No negative effect is anticipated.

Costs

The only operational costs relating to this procedure might be slightly increased administrative costs to Glendale ATC and Luke ATC. There would be no other costs to the airport, FAA, or other airport users.

Environmental Issues

While there are no additional direct environmental impacts other than noise, there is an issue of increased overflights of residential areas northwest of the airport. As the alternative flight tracks in **Exhibit 5A** illustrate, this procedure would increase air traffic over the Country Meadows development. Although the noise contours do not show any significant increase in the area, the frequency of single events would increase. This would have to be considered somewhat of a trade-off for the impact reductions generated by the alternative.

Implementation Factors

This procedure would be implemented by publishing the new pattern procedures along with their availability. The Glendale Air Traffic Control Tower would coordinate with the Luke RAPCON to determine the specific usage of the alternative pattern. Information regarding the procedure could also be published in a Notice to Airmen (NOTAM).

Preliminary Recommendations

This procedure is somewhat effective in reducing the aircraft noise impacts around Glendale Municipal Airport. Safe and consistent implementation, however, are highly questionable. The potential encroachment into Luke's airspace which this procedure would involve makes it undesirable for implementation.

ALTERNATIVE 2 - ESTABLISH A STANDARD RIGHT HAND PATTERN

Goals

Similar to Alternative 1, this alternative seeks to use the Agua Fria River floodplain and other open areas west of the airport to route local traffic on Runway 19 over more noise compatible areas. By establishing a standard right hand pattern, the local traffic would be west of the airport during periods of south flow. This would place some 60 percent of the local pattern traffic over the Agua Fria River floodplain. Reductions in noise exposure over the residential areas southeast of the airport could be achieved.

Procedure

This procedure would mean that the local patterns would be to the right of the direction of departure flow. During north flow, the pattern would be east of the airport as it is now. During the more predominant south flow, however, the pattern traffic would be west of the airport. The alternative flight patterns for this procedure are illustrated on **Exhibit 5B**. In order to maintain a margin of safety over the power lines just west of the airport, the procedure would require that aircraft reach the pattern altitude prior to turning onto the crosswind leg of the pattern. The procedure would concentrate most of the touch and go traffic over the Agua Fria River floodplain and avoid overflights of the residential areas south and southeast of the airport.

For noise modelling purposes, the 1999 NEM baseline input was modified to reflect the new flight patterns for weekend training traffic. The local pattern traffic assigned to Runway 19 in the baseline case was assigned to the new tracks west of the airport. All other traffic assignments and runway use percentages remained unchanged.

Noise Reduction Effects

The noise contours presented in Exhibit **5B** illustrate the effects of this procedure. The overall shape of the alternative noise contours remains similar to the 1999 NEM baseline contours; only slight changes are evident.

At the 55 DNL contour level the alternative shows similar but slightly larger changes than were evident in the Alternative 1 noise contour. This is due to the higher percentage of traffic in this alternative that is assigned to the patterns west of the airport. In Alternative 1 only 35 percent (weekend) of the local pattern traffic was put west of the airport. In this alternative some 60 percent of the local traffic has been reassigned.

As with the previous alternative, the 60 DNL noise contour for this alternative is nearly identical to its baseline counterpart. Only a slight increase is evident along the runway centerline on the south side of the airport. The remaining alternative noise contours are virtually identical to those in the baseline condition.

The noise impact analysis for this alternative indicates that reductions in the future population exposed to aircraft noise are possible and are better than the previous alternative. Approximately 1,328 people would be removed from the 55-60 DNL contour. In the higher 60-65 DNL contour however, there would be 72 additional people exposed to aircraft noise at this level. There would be 2 persons exposed to noise above 65 DNL with this alternative. Detailed population impact analysis results are presented at the end of this section.

Operational Issues

As with Alternative 1, there are several concerns regarding the operational feasibility and safety of this procedure. The establishment of any traffic pattern west of Glendale Municipal Airport would mean that traffic is routinely crossing over the high tension power lines near the airport. Requiring aircraft to climb to the pattern altitude before turning onto the crosswind leg of the

pattern should allow for safe crossing of the lines. Again, unusual procedures can be confusing to the student pilot, and it is usually safer to avoid flying toward hazards whenever possible.

A serious obstacle is the proximity of the alternative pattern to Luke Air Force Base. It would be completely unacceptable to mix general aviation traffic from Glendale with high speed fighter aircraft from Luke. Since this procedure assumes that the pattern west of Glendale would always be used during south flow, there would definitely be a conflict with Luke traffic during the week. Putting general aviation aircraft, possibly with student pilots, in close proximity to heavy fighter jet traffic at Luke Air Force Base is not safe.

Air Service Factors

No negative effect is anticipated.

Costs

The only operational costs relating to this procedure might be slightly increased administrative costs to Glendale ATC.

There would be no other costs to the airport, FAA, or other airport users.

Environmental Issues

While there are no additional direct environmental impacts other than noise, there is an issue of increased overflights of residential areas northwest of the airport. As the alternative flight tracks in Exhibit 5B illustrate, this procedure would increase air traffic over the Country Meadows development. Although the noise contours do not show any significant increase in the area, the frequency of single events would increase. This would have to be considered somewhat of a trade-off for the impact reductions generated by the alternative.

Implementation Factors

This procedure would be implemented by publishing the new pattern procedures along with their availability. Information regarding the procedure could also be published in a Notice to Airmen (NOTAM).

Preliminary Recommendations

Although this procedure could reduce aircraft noise impacts around Glendale Municipal Airport, the safety issues and operational conflicts are overwhelming problems. This procedure is not recommended for further consideration.

ALTERNATIVE 3 - MODIFY NORTH FLOW PATTERN

Goals

This procedure attempts to use the New River floodplain and other open areas northeast of the airport to reroute the pattern traffic. By concentrating the pattern traffic over the floodplain, reductions in noise exposure over the residential areas just north and northwest of the airport might be achieved.

Procedure

This alternative would incorporate a turn in the upwind leg of the Runway 1

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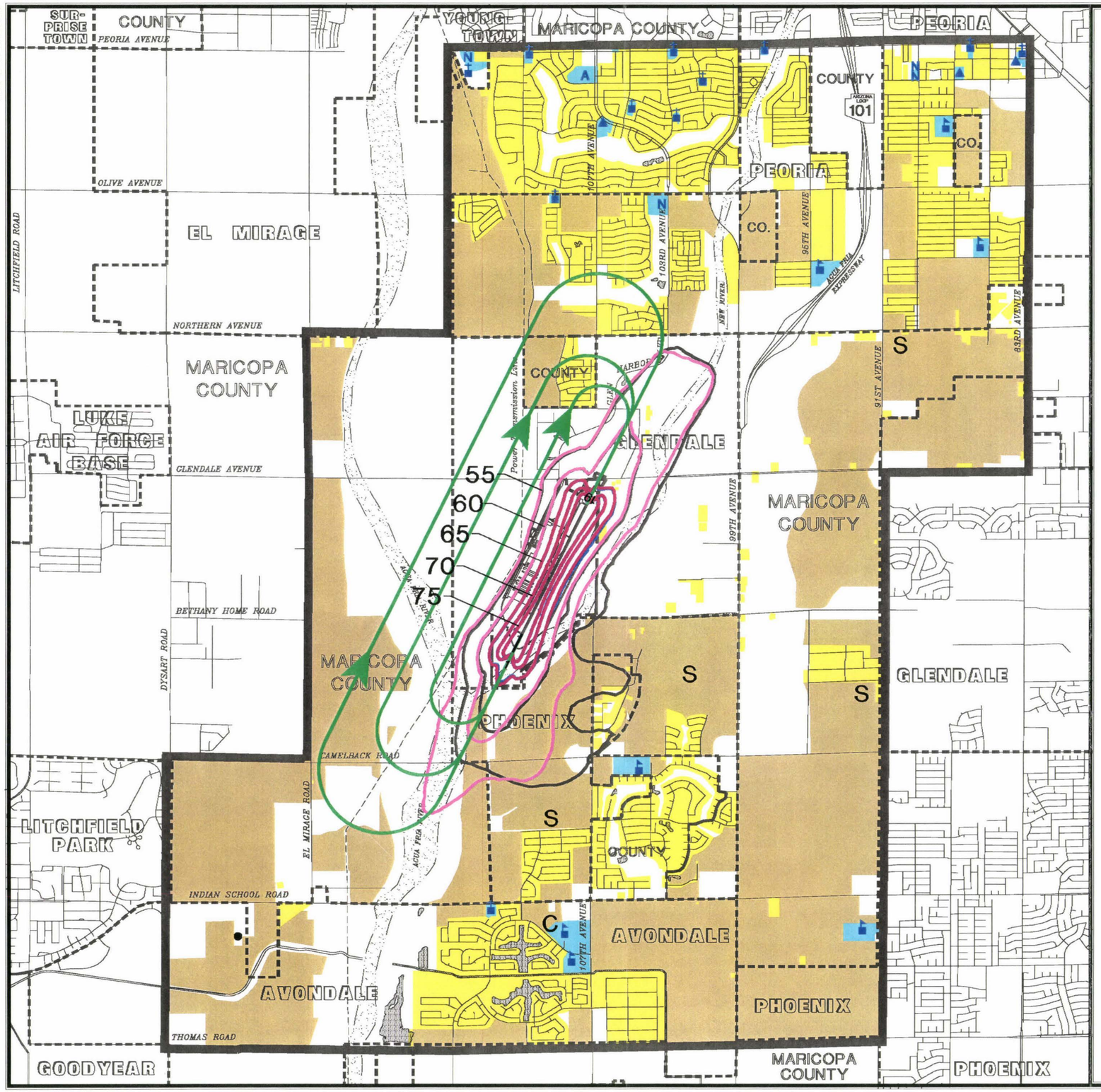
Exhibit 5B
ALTERNATIVE 2
ESTABLISH A RIGHT HAND TRAFFIC PATTERN



LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- 1999 Baseline DNL Contour-Marginal Impact
- 1999 Baseline DNL Contour-Significant Impact
- Alternative DNL Contour-Marginal Impact
- Alternative DNL Contour-Significant Impact
- Alternative Traffic Pattern
- Existing Residential
- Undeveloped
- Existing Public and Institutional
- School
- Church
- Community Center
- N Nursing/Rest Home
- A Amphitheater
- Site on National Register of Historic Places
- Potentially Available for Residential Development
- C Future Church Site
- S Future School Site

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traffic pattern. The turn would be initiated at the end of the runway. A right turn to approximately an 040 heading would keep the aircraft away from the residential areas. The aircraft would continue to climb and turn on a short crosswind leg at approximately 1,700 feet MSL. The remaining pattern procedures would remain unchanged. The alternative flight patterns for this procedure are illustrated on Exhibit 5C.

For noise modelling purposes the 1999 NEM baseline input was modified to reflect the new flight patterns for the north flow traffic pattern. All other traffic assignments and runway use percentages remained unchanged.

Noise Reduction Effects

The noise contours presented in Exhibit 5C illustrate the effects of this procedure. The shape of the alternative noise contours reflects a slight shift in the 55 DNL noise contour north of the airport. The noise contour is shifted south some 500 to 1000 feet along its northern edge. The eastern edge of the 55 DNL contour expands to the east slightly due to the adjusted traffic pattern.

The 60 DNL noise contour for the alternative is similar to its baseline counterpart. A slight shift to the south and east is evident along the runway centerline on the north side of the airport. The remaining alternative noise contours are virtually identical to those in the baseline condition.

As expected, the alternative noise contours on the south side are identical to the baseline contours. This is because the alternative procedure would only affect the traffic patterns north and northeast of the airport.

A population impact analysis for this alternative indicates that the procedure provides no impact reductions. This is due to the fact that the procedure only adjusts the noise contours over the open areas northeast of the airport. Detailed population impact analysis results are presented at the end of this section.

Operational Issues

This alternative is generally consistent with the current Runway 1 departure procedures published by the airport. The turn on departure at the end of the runway, however, may be too soon for aircraft with slow climb rates. Another concern is the fact that unusual pattern procedures such as this can be confusing to the student or occasional pilot. The Glendale ATC would be able to assist by calling turns and informing pilots. The procedure might also slightly reduce the capacity of the airport by requiring more time between each training flight to maintain proper separation.

Air Service Factors

No negative effect is anticipated.

Costs

The only operational costs relating to this procedure might be slightly increased administrative costs to Glendale ATC. There would be no other costs to the airport, FAA, or other airport users.

Environmental Issues

There would be no additional direct environmental impacts other than noise.

Implementation Factors

This procedure would be implemented by publishing the new pattern procedures in a pilots guide as well as various facility directories. The Glendale Air Traffic Control Tower would also assist by informing pilots of the special procedures and possibly calling pattern turns when necessary. Information regarding the procedure could also be published in a Notice to Airmen (NOTAM).

Preliminary Recommendations

Although, this procedure does not create any impact reductions in the 1999 case, it is possible that it could be effective in the long-term future. The potential benefits of the alternative in the absence of severe implementation constraints make it attractive for further consideration.

ALTERNATIVE 4 - STRAIGHT-OUT DEPARTURES FROM RUNWAY 19 TO INDIAN SCHOOL ROAD

Goals

One area of concern in this analysis is the residential areas immediately east and southeast of the airport. These areas are currently subjected to the majority of departure overflights and is a source of noise complaints. In order to alleviate these concerns flight routes could be shifted slightly to the west, thereby concentrating the overflights over the undeveloped areas in the Agua Fria River floodplain. The use of this corridor could possibly reduce noise impacts and complaints in these areas.

Procedure

This alternative looks at the effectiveness of establishing a straight-out departure procedure for aircraft on Runway 19. The preferred flight routes for this procedure are illustrated on **Exhibit 5D**. The procedure would simply delay turns to the east until the aircraft have had an opportunity to climb higher and possibly reduce thrust to a cruise setting.

The procedure would be defined visually and require that departing aircraft maintain runway heading until crossing Indian School Road. This would result in most aircraft flying straight for about two miles before turning east to their desired course.

This procedure would be informal in nature and would not preclude turns in emergency conditions or for safety needs. This alternative also assumes that the procedure would only apply to VFR itinerant traffic departing the Glendale airport area and not to local pattern traffic.

For noise modelling purposes the 1999 NEM baseline input was modified to reflect the extended straight-out flight paths for traffic turning north from Runway 19. All other traffic assignments and runway use percentages remained unchanged.

Noise Reduction Effects

Exhibit 5D presents the alternative flight patterns and the resulting noise exposure pattern for this alternative. The shape of the alternative noise contours is similar to the 1999 NEM baseline contours with the exception of the contours on the

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Exhibit 5C
ALTERNATIVE 3
MODIFIED UPWIND LEG FOR NORTH FLOW TRAFFIC PATTERN

SURPRISE TOWN
COUNTY
PEORIA AVENUE
YOUNG TOWN
MARICOPA COUNTY
PEORIA
OLIVE AVENUE
EL MIRAGE
LITCHFIELD ROAD
NORTHERN AVENUE
MARICOPA COUNTY
LUKE AIR FORCE BASE
GLENDALE AVENUE
BETHANY HOME ROAD
DYSART ROAD
MARICOPA COUNTY
GLENDALE
PHOENIX
CAMELBACK ROAD
EL MIRAGE ROAD
LITCHFIELD PARK
INDIAN SCHOOL ROAD
AVONDALE
THOMAS ROAD
GOODYEAR
PHOENIX
MARICOPA COUNTY
PHOENIX
ARIZONA LOOP 101
AGUA FRIA FREEWAY
107TH AVENUE
103RD AVENUE
NEW RIVER
96TH AVENUE
91ST AVENUE
83RD AVENUE
HARBOR BLVD
GLEN
Power Transmission Line
99TH AVENUE
AGUA FRIA RIVER
107TH AVENUE
55
60
65
70
75

LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- 1999 Baseline DNL Contour-Marginal Impact
- 1999 Baseline DNL Contour-Significant Impact
- Alternative DNL Contour-Marginal Impact
- Alternative DNL Contour-Significant Impact
- Alternative Traffic Pattern
- Existing Residential
- Undeveloped
- Existing Public and Institutional
- School
- Church
- Community Center
- N Nursing/Rest Home
- A Amphitheater
- Site on National Register of Historic Places
- Potentially Available for Residential Development
- C Future Church Site
- S Future School Site

NORTH

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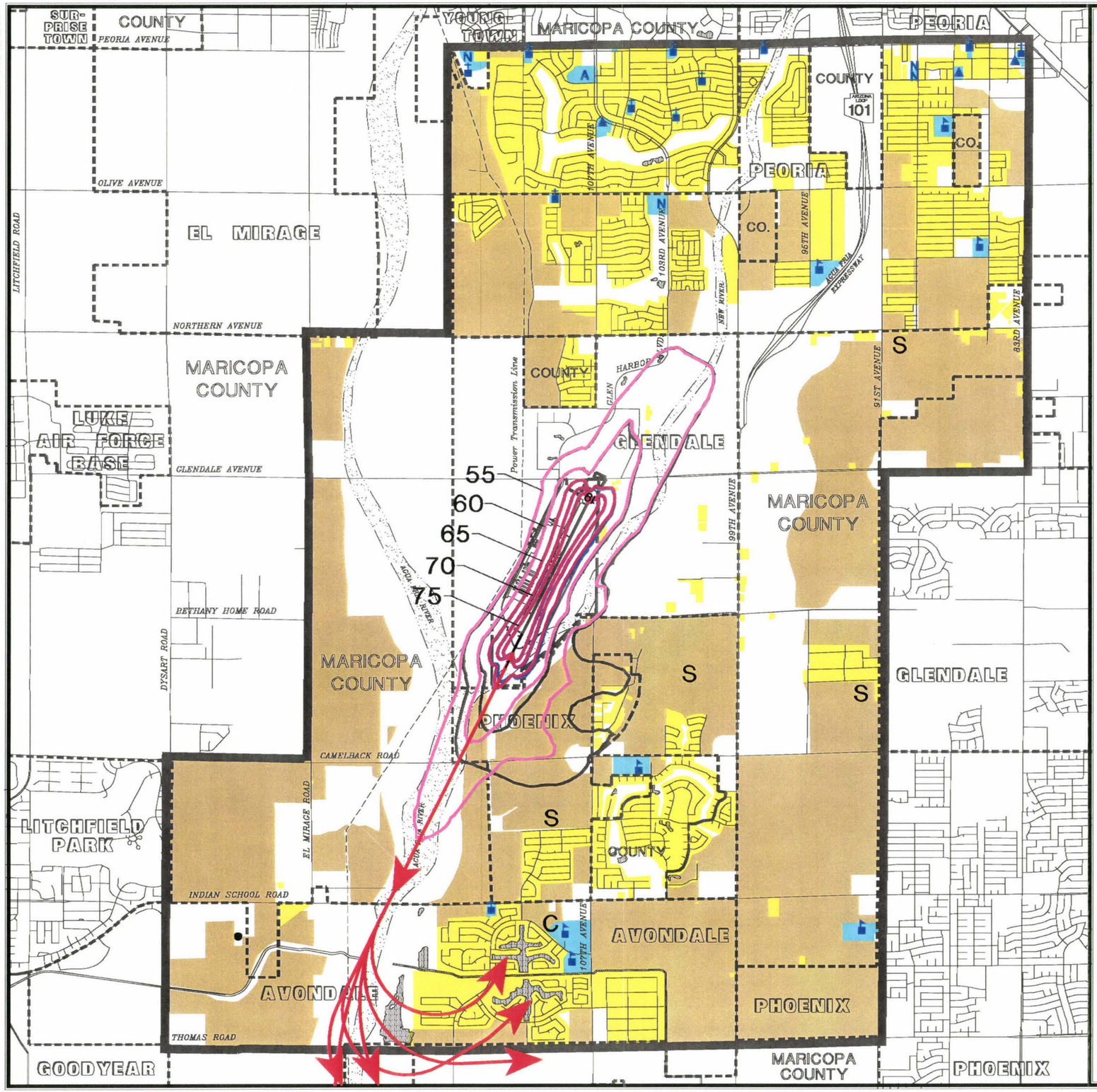
Exhibit 5D
ALTERNATIVE 4
RUNWAY 19 VFR DEPARTURES FLY RUNWAY HEADING UNTIL SOUTH OF INDIAN SCHOOL ROAD



LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- 1999 Baseline DNL Contour-Marginal Impact
- 1999 Baseline DNL Contour-Significant Impact
- Alternative DNL Contour-Marginal Impact
- Alternative DNL Contour-Significant Impact
- Alternative Departure Tracks
- Existing Residential
- Undeveloped
- Existing Public and Institutional
- School
- Church
- Community Center
- N Nursing/Rest Home
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south side of the airport. The contour lobes that turn eastward towards Camelback Farms in the baseline case are much less evident in the alternative contour. This noise has been transferred along the Runway 19 extended centerline into the Agua Fria River floodplain. The 55 and 60 DNL contours illustrate this effect. The higher level noise contours remain unchanged by the procedure. Although the 55 DNL noise contour is shifted away from existing residential areas just to the east, both the 55 and 60 DNL noise contours expand over future residential areas immediately south of the runway.

The noise impact analysis for this alternative indicates that significant reductions in the population exposed to aircraft noise are possible. Approximately 1,980 people would be removed from the 55-60 DNL contour. In the 60-65 DNL contour however, there would be about future residents added to the noise contours. Detailed population impact analysis results are presented at the end of this section.

Operational Issues

This procedure might slightly reduce the airport capacity by holding departing aircraft on runway heading longer and requiring additional departure separations. Another area of concern might be traffic conflicts with Phoenix Goodyear Airport south of Glendale. Extending the Glendale departing traffic further south would bring it closer to the Phoenix Goodyear Airport Class D airspace which extends to just north of I-10. Turns at Indian School Road should allow for adequate room to stay away from the Goodyear traffic. Any turns further to the south would be problematic.

Air Service Factors

No negative effect is anticipated.

Costs

The only possible costs relating to this procedure might be slightly increased departure delays due to the departure separation requirements. These would likely be minimal. Also, there would be slightly increased fuel costs for most departing aircraft destined north or northeast as they would have to fly further south before turning to their desired heading. There would be no other costs to the airport, FAA, or other airport users.

Environmental Issues

While there are no additional direct environmental impacts other than noise, there is an issue of increased overflights of residential areas to the southeast of the airport. As the alternative flight tracks in **Exhibit 5D** illustrate, this procedure would increase air traffic over the Garden Lakes area considerably. Although the noise contours do not show any significant increase in the area, the frequency of single events would increase. This would have to be considered somewhat of a trade-off for the impact reductions generated by the alternative. Unfortunately, this problem cannot be abated by extending the procedure further south because of the conflicts with Phoenix Goodyear Airport.

Implementation Factors

This procedure would primarily be implemented by Glendale ATC and through publishing the procedures. The

ATC could encourage the use of the procedure with each VFR departure clearance. Information regarding the procedure could also be published in a Notice to Airmen (NOTAM) and a pilot guide.

Preliminary Recommendations

Although this procedure has significant drawbacks, it is effective in reducing the aircraft noise impacts around the airport. The possible increases in overflights of existing residential areas must be considered carefully; however, the procedure might have value in conjunction with other noise abatement techniques and should be considered further.

ALTERNATIVE 5 - RUNWAY 1 DEPARTURES TURN RIGHT TO 040 HEADING

Goals

This procedure is similar to Alternative 3 and attempts to use the New River floodplain and the Agua Fria Expressway northeast of the airport to reroute the departing traffic over more noise compatible corridors. By concentrating the departing traffic over the river floodplain and the highway, reductions in noise exposure over the residential areas just north and northwest of the airport might be achieved.

Procedure

This alternative would incorporate an early turn for aircraft departing Runway 1 at Glendale. The turn would be initiated at the end of the runway. A right turn to approximately an 040 heading would keep the aircraft away from the residential areas. The aircraft would continue to climb to the northeast and overfly the Agua Fria Expressway. As aircraft pass the expressway interchange at Northern Avenue they would be released to turn to desired heading. This procedure would not apply to touch and go traffic. The alternative flight patterns for this procedure are illustrated on **Exhibit 5E.**

This procedure would be informal in nature would not preclude turns in emergency conditions or for safety needs. This alternative also assumes that the procedure would only apply to itinerant VFR traffic departing the Glendale airport area and not to local pattern traffic.

For noise modelling purposes, the 1999 NEM baseline input was modified to reflect the new flight tracks for the north flow departing traffic. All other traffic assignments and runway use percentages remained unchanged.

Noise Reduction Effects

The noise contours presented in **Exhibit 5E** illustrate the effects of this procedure. The shape of the alternative noise contours reflects a shift in the 55 DNL and 60 DNL noise contours north of the airport. Both contours have a clearly defined lobe along the new consolidated flight corridor to the northeast.

The 55 DNL contour is reduced along the runway centerline near the Country Meadows area and is expanded to the northeast over the expressway. The western edge of the 55 DNL contour on the north side is also shifted slightly to

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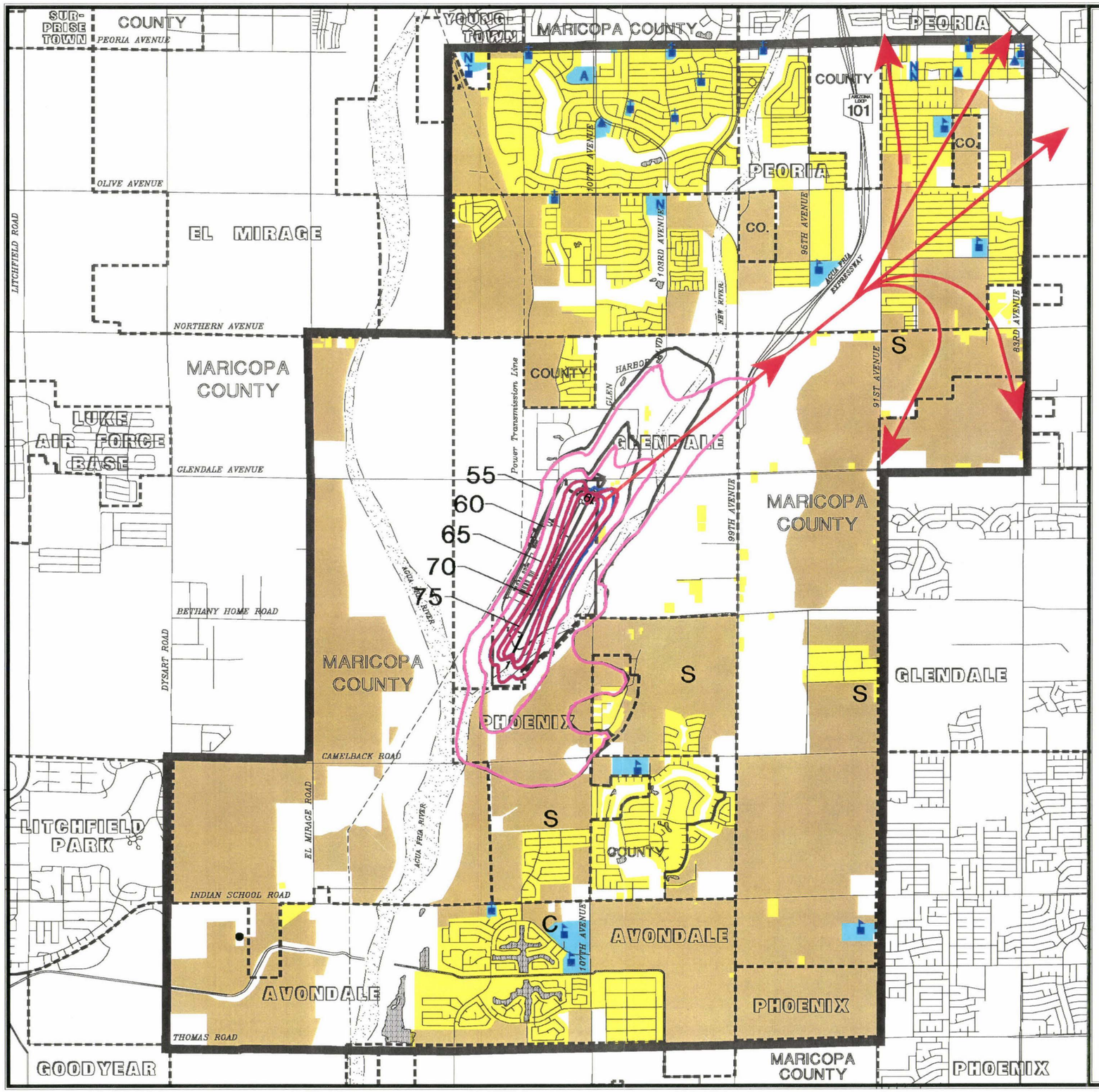
Exhibit 5E
ALTERNATIVE 5
RUNWAY 01 VFR DEPARTURES TURN RIGHT TO 040 HEADING; MAINTAIN 040 HEADING UNTIL OVER EXPRESSWAY



LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- 1999 Baseline DNL Contour-Marginal Impact
- 1999 Baseline DNL Contour-Significant Impact
- Alternative DNL Contour-Marginal Impact
- Alternative DNL Contour-Significant Impact
- Alternative Departure Tracks
- Existing Residential
- Undeveloped
- Existing Public and Institutional
- School
- Church
- Community Center
- N — Nursing/Rest Home
- A — Amphitheater
- Site on National Register of Historic Places
- Potentially Available for Residential Development
- C — Future Church Site
- S — Future School Site

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the east due to the adjustment in traffic density.

The 60 DNL shifts slightly to the south along the runway centerline but also expands to the northeast along the alternative flight corridor. The remaining alternative noise contours are virtually identical to those in the baseline condition.

The alternative noise contours on the south side are identical to the baseline contours. This is because the alternative procedure would only affect the flight corridors to the north of the airport.

A population impact analysis for this alternative indicates that marginal reductions in the future population exposed to aircraft noise are possible. About 31 fewer people would be in the 55-60 DNL contour. In the 60-65 DNL contour the alternative is similar to Alternative 3 by showing no reductions in the impacts There would be only 2 persons exposed to noise above 65 DNL with this alternative. Detailed population impact analysis results are presented at the end of this section.

Operational Issues

This alternative is generally consistent with the current Runway 1 departure procedures published by the airport. As previously mentioned, the turn on departure at the end of the runway may be too soon for aircraft with slow climb rates. Another concern is the fact that unusual procedures such as this can be confusing to the student or occasional pilot. The Glendale ATC would be able to assist informing pilots of the noise abatement procedure as part of their departure clearance.

Air Service Factors

No negative effect is anticipated.

Costs

The only possible costs relating to this procedure might be slightly increased departure delays due to the departure separation requirements. These would likely be minimal. Also, there would be slightly increased fuel costs for most departing aircraft destined south or southeast as they would have to fly further north before turning to their desired heading.

There would be no other costs to the airport, FAA, or other airport users.

Environmental Issues

There would be no additional direct environmental impacts other than noise.

Implementation Factors

This procedure would primarily be implemented by Glendale ATC and through publishing the procedures. The ATC could encourage the use of the procedure with each departure clearance. Information regarding the procedure could also be published in a Notice to Airmen (NOTAM).

Preliminary Recommendations

This procedure is somewhat effective in reducing the aircraft noise impacts around Glendale Municipal Airport. The benefits of the alternative in the

absence of severe implementation constraints, make it attractive for further consideration.

ALTERNATIVE 6 - DEPARTURES FROM RUNWAY 19 FLY TO END OF RUNWAY

Goals

This alternative seeks to avoid the increased overflight of the Garden Lakes area problem that is inherent in Alternative 4. If early departure turns on Runway 19 were eliminated, it could be possible to reduce noise impacts in the Camelback Farms and northern Villa de Paz areas without adding overflights to new areas.

Procedure

This alternative looks at the effectiveness of requiring all departing aircraft on Runway 19 to fly to the end of the runway before turning to the east. This would result in a small adjustment in several of the consolidated departure tracks that were presented in Chapter Two. The alternative flight patterns for this procedure are illustrated on Exhibit 5F.

This procedure would be informal and would not preclude turns in emergency conditions or for safety needs. This alternative assumes that the procedure would apply to both local and itinerant traffic departing on Runway 19.

For noise modelling purposes, the 1999 NEM baseline input was modified to reflect the extended straight-out flight tracks and training patterns for traffic departing from Runway 19. All other traffic assignments and runway use percentages remained unchanged.

Noise Reduction Effects

Exhibit 5F presents the alternative flight patterns and the resulting noise exposure pattern for this alternative. The shape of the alternative noise contours is similar to the 1999 NEM baseline contours with the exception of the contours on the south side of the airport. The contour lobes that turn eastward towards Camelback Farms in the baseline case have been consolidated into one lobe in the alternative contour. The shifted flight tracks have moved the noise further down the runway centerline. The higher level noise contours remain unchanged by the procedure. Although the 55 DNL noise contour is shifted away from some existing residential areas just to the east, both the 55 and 60 DNL noise contours expand over future residential areas immediately south of the runway.

The noise impact analysis for this alternative indicates that marginal reductions in the population exposed to aircraft noise are possible. Approximately 61 people would be removed from the 55-60 DNL contour. In the 60-65 DNL contour however, this alternative would add some 139 persons into the noise contours. Detailed population impact analysis results are presented at the end of this section.

Operational Issues

This procedure might slightly reduce the airport capacity by holding departing aircraft on runway heading longer and

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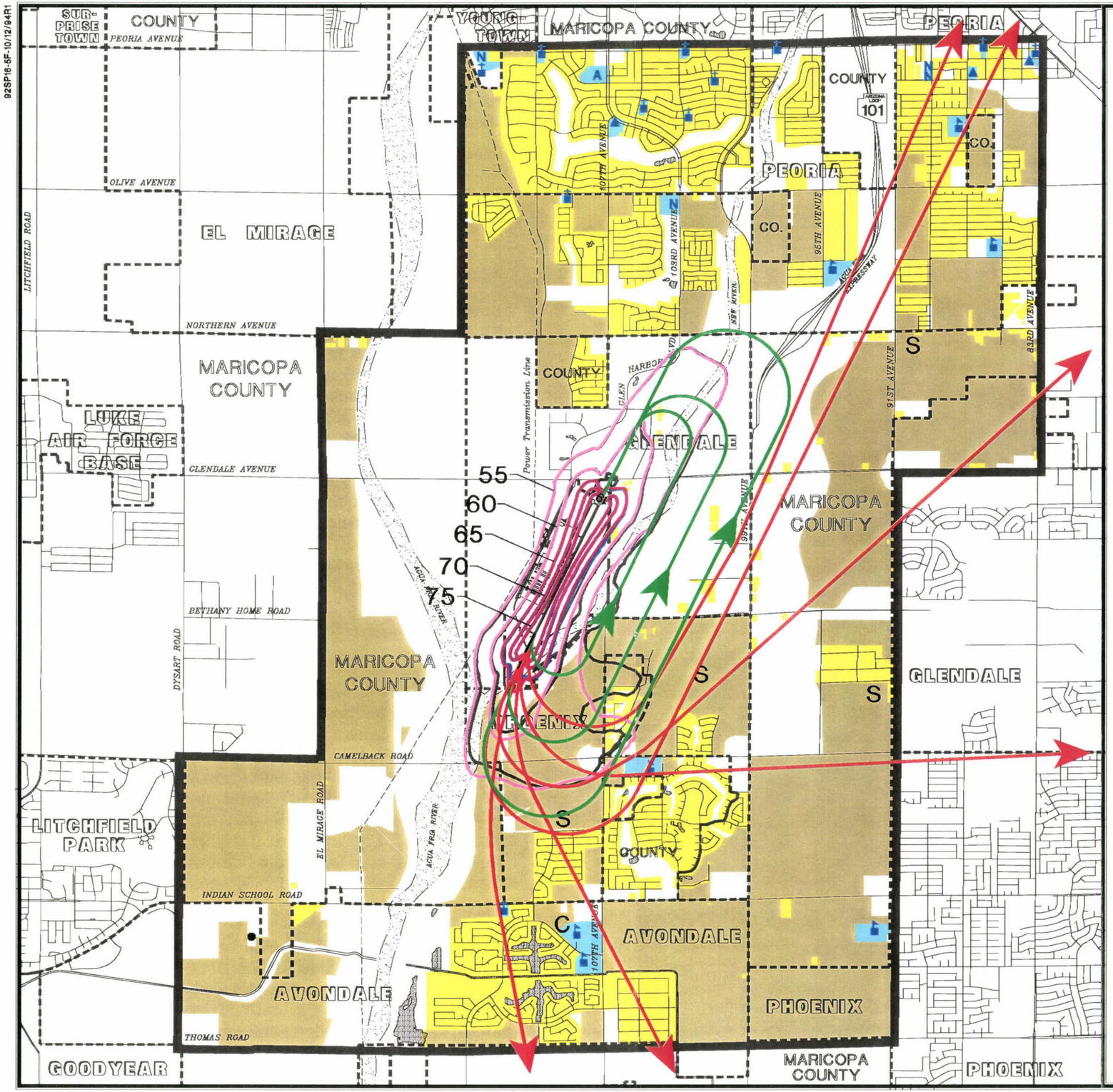
Exhibit 5F
ALTERNATIVE 6
RUNWAY 19 DEPARTURES FLY RUNWAY HEADING UNTIL END OF RUNWAY



LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- 1999 Baseline DNL Contour-Marginal Impact
- 1999 Baseline DNL Contour-Significant Impact
- Alternative DNL Contour-Marginal Impact
- Alternative DNL Contour-Significant Impact
- Alternative Flight Tracks
- Existing Residential
- Undeveloped
- Existing Public and Institutional
- School
- Church
- Community Center
- N Nursing/Rest Home
- A Amphitheater
- Site on National Register of Historic Places
- Potentially Available for Residential Development
- C Future Church Site
- S Future School Site

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requiring additional departure separations.

Air Service Factors

No negative effect is anticipated.

Costs

The only possible costs relating to this procedure might be slightly increased departure delays due to the departure separation requirements. These would be minimal. There would be no other costs to the airport, FAA, or other airport users.

Environmental Issues

There are no additional direct environmental impacts other than noise.

Implementation Factors

This procedure would primarily be implemented by Glendale ATC and through publishing the procedures. The ATC could encourage the use of the procedure with each departure clearance. Information regarding the procedure could also be published in a Notice to Airmen (NOTAM) and a pilot guide.

Preliminary Recommendations

Although this procedure is only marginally effective in reducing the aircraft noise impacts around Glendale Municipal Airports, there are minimal operational and implementation constraints. The procedure might have value in conjunction with other noise abatement techniques and should be considered further. The increased future impacts at the 60-65 DNL level should be considered carefully.

ALTERNATIVE 7 - PREFERENTIAL NORTH FLOW

Goals

A comparison of the current and future development patterns around Glendale Municipal Airport indicates that the most densely populated areas will generally remain south and southeast of the airport. Since departures are generally louder than arrivals, it is reasonable to try to divert them over the least populated areas. With increased residential development south and southeast of the airport in the future, a preferential north flow might be effective in reducing overall noise impacts around the airport.

Procedure

This alternative investigates the effectiveness of using a northerly traffic flow at Glendale when wind and weather permit. Currently the airport operates in a north flow approximately 40 percent of the time. The alternative assumes that the majority of the traffic would be assigned to Runway 1. The program would be informal in nature and would comply with FAA Order 8400.9 regarding runway use programs.

Wind analysis indicates that conditions at Glendale are favorable for a north flow operation approximately 60 percent of the time. This assumes no more than a four knot tailwind. This percentage was adjusted in the 1999 baseline

runway use percentage. All other flight track assignments remained unchanged.

Noise Reduction Effects

Exhibit 5G illustrates the noise contours resulting from this procedure. The overall shape of the alternative noise contour is similar to that of the baseline contour. On the north side, the lobe of the alternative contour is shifted 500 to 1,000 feet to the north. This results from the higher percentage of departure traffic on this side. Most of the increases in the 55 and 60 DNL noise contours are over the industrial park and the New River basin. Only a small increase in the 65 DNL noise contour is evident and is over non-residential areas.

On the south side of the airport the noise pattern is reduced slightly. The eastern lobes of the 55 DNL contour have shifted west away from Camelback Farms and over open areas designated for future residential areas. The 60 DNL contour also shrinks slightly to the north over future residential areas. Only a small change in the 65 DNL noise contour is evident on the south side and it occurs on airport property.

A population impact analysis for this alternative indicates that significant reductions in the future population exposed to aircraft noise are possible. About 1,162 fewer people would be in the 55-60 DNL contour. In the 60-65 DNL contour the alternative is also effective by removing some 48 persons from the noise contour. There would be a total of three additional persons exposed to noise above 65 DNL with this alternative. Detailed population impact analysis results are presented at the end of this section.

Operational Issues

Since a north flow is used at Glendale some 40 percent of the time currently, there are really no operational difficulties.

Air Service Factors

No negative effect is anticipated. Since the procedure is informal in nature it does not preclude the use of other runways at Glendale.

Costs

Occasionally there could be slightly increased fuel costs for aircraft which are destined south of Glendale but depart to the north when winds are calm. There would be no other costs to the airport, FAA, or other airport users.

Environmental Issues

There are no additional direct environmental impacts other than noise.

Implementation Factors

This procedure would primarily be implemented by the airport management and the Glendale Tower. The airport management would designate Runway 1 as the "calm wind" runway. Implementation would be fairly simple as the procedure is wind-directed and favors the north flow whenever winds and traffic permit.

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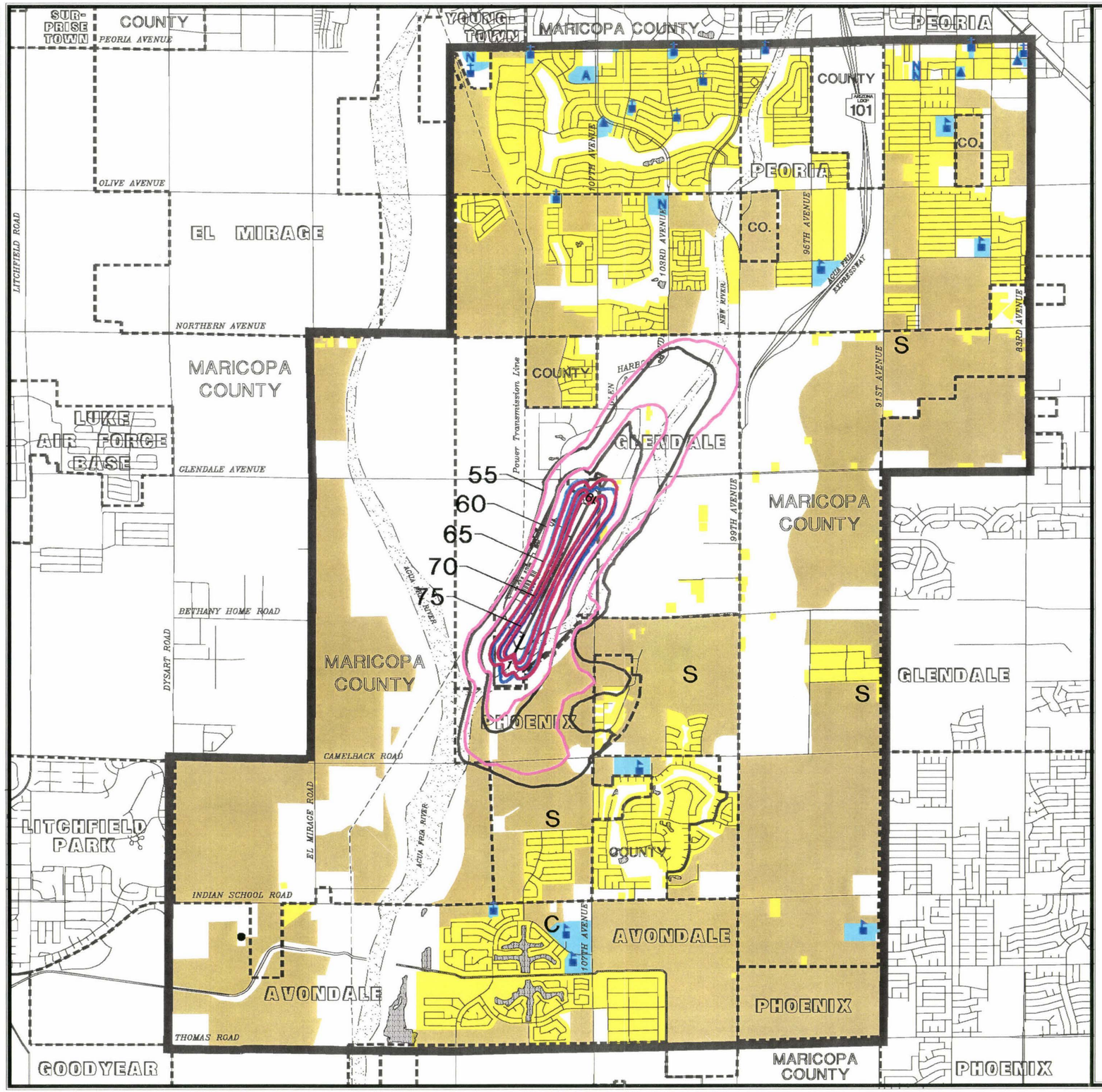
Exhibit 5G
ALTERNATIVE 7
PREFERENTIAL NORTH FLOW



LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- 1999 Baseline DNL Contour-Marginal Impact
- 1999 Baseline DNL Contour-Significant Impact
- Alternative DNL Contour-Marginal Impact
- Alternative DNL Contour-Significant Impact
- Existing Residential
- Undeveloped
- Existing Public and Institutional
- School
- Church
- Community Center
- N Nursing/Rest Home
- A Amphitheater
- Site on National Register of Historic Places
- Potentially Available for Residential Development
- C Future Church Site
- S Future School Site

NORTH

0 4000 8000

SCALE IN FEET

GLENDALE MUNICIPAL AIRPORT

Preliminary Recommendations

This procedure is effective in reducing aircraft noise impacts around Glendale Municipal Airport. It might effectively combine with other procedures to provide significant benefits. The current and possible future benefits of the alternative make it valuable for further consideration in conjunction with other alternatives.

NOISE IMPACTS SUMMARY - ALTERNATIVES

The population impacts associated with a given noise abatement alternative are a valuable tool in determining the relative merits of each alternative. A fair and informative comparison is sometimes difficult through a long detailed discussion and analysis. A side by side comparison of the alternatives is often more revealing and compelling than the details themselves.

In order to provide a broad understanding of the potential implications of each alternative, two types of noise impacts were calculated. **Table 5A** compares the population impacts, including future growth risk, associated with each alternative. The future growth risk analysis conducted in Chapter 4 provides a "worst case" look at the potential residential growth risks around Glendale Municipal Airport for the next twenty years. The data indicates that Alternatives 2, 4, and 7 are significantly more effective at reducing future noise impacts than the other alternatives.

TABLE 5A
Noise Abatement Alternatives
Future Population Impacts

DNL Noise Contour Range	1999 NEM Baseline	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7
55-60	3,475	2,876	2,147	3,475	1,495	3,444	3,414	2,313
60-65	97	125	169	97	166	97	236	49
65-70	2	2	2	2	2	2	2	5
70-75	0	0	0	0	0	0	0	0
75+	0	0	0	0	0	0	0	0
Total	3,574	3,003	2,318	3,574	1,663	3,543	3,652	2,367
LWP[1]	472	408	333	472	250	468	517	311

[1] Level-weighted population - an estimate of the number of people actually annoyed by aircraft noise. It is derived by multiplying the population in each DNL contour range by the appropriate LWP response factor: 55-60 = .125; 60-65 DNL = .375; 65-70 DNL = .625; 70-75 DNL = .875; 75+ DNL = 1.000.

Note: Numbers have been rounded.

Source: Coffman Associates analysis.

Although this analysis does project a worst case impact for each alternative, it is somewhat overly conservative. The approach does not allow for the possibility of effective land use planning in any of the areas used by the alternatives to redistribute the noise away from the current population.

Another impact comparison is presented in **Table 5B**. These impacts are based on the current residential developments around the airport and do not assume 20 years or more of growth in 5 years. This is more or less a presentation of the impacts assuming that the undeveloped areas within the noise contours would be protected from future residential growth. The table illustrates that Alternatives 1, 2, 4, and 7 are significantly more effective at reducing noise impacts than the other alternatives.

TABLE 5B
Noise Abatement Alternatives
Existing Population Impacts

	1999							
DNL Noise Contour Range	Baseline	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7
55-60	43	14	14	43	16	40	56	0
60-65	9	11	11	9	11	9	11	21
65-70	2	2	2	2	2	2	2	5
70-75	0	0	0	0	0	0	0	0
75+	0	0	0	0	0	0	0	0
Total	54	27	27	54	29	51	69	26
LWP[1]	10	7	7	10	7	10	12	11

[1] Level-weighted population - an estimate of the number of people actually annoyed by aircraft noise. It is derived by multiplying the population in each DNL contour range by the appropriate LWP response factor: 55-60 = .125; 60-65 DNL = .375; 65-70 DNL = .625; 70-75 DNL = .875; 75+ DNL = 1.000.

Note: Numbers have been rounded.

Source: Coffman Associates analysis.

One important factor, however, has not yet been tested for these alternatives. That is, the ability of various alternatives to synergize with each other to generate additional noise reduction capabilities. Often a single measure may have limited utility in reducing noise impacts, but if used in conjunction with another measure, may have significant ability to improve the overall noise condition surrounding the airport. In order to determine the most effective noise abatement program for Glendale, combinations of these alternatives must be tested for their combined effects.

NOISE ABATEMENT SCENARIO EVALUATION

To evaluate the combined effectiveness of techniques in reducing noise impacts, four test scenarios were designed for input to the noise predictive computer model, INM 4.11. These scenarios were constructed using combinations of operationally compatible alternatives presented in the previous section. Alternatives that affected the same type of operations under the same conditions could not be combined. The last task to be conducted in this process is to find a

series of alternatives which would provide the maximum noise impact reduction at Glendale. The subsequent analysis provides the noise exposure and impacts based on the five-year forecast of operations for the airport. As in the individual alternatives analysis, this meets the FAA's need for the evaluation to be based on the official future noise exposure for the airport. Analysis for the 2015 case is also included for each scenario. This provides additional guidance as to the long-term effects of each scenario.

SCENARIO A - LOCAL PATTERN TO THE WEST ON WEEKENDS; PREFERENTIAL NORTH FLOW

This scenario evaluates the effects of combining the procedures evaluated in Alternatives 1 and 7. Essentially the scenario tests the effects of adding the preferential north flow to the weekend traffic patterns that could be established to the west of the airport. These patterns have the drawback of adding additional overflights of the Country Meadows area. Adding the preference for north flow could reveal additional impacts or concerns in this area.

This scenario was modelled based on the modifications to the baseline case discussed for Alternatives 1 and 7. The noise exposure was computed for both the 1999 case and the 2015 case in order to evaluate the long-term effects of the procedures. For the 2015 case, the shifting of the weekend pattern to the west of the airport was not included in the modelling. This is due to the inclusion of the planned short parallel runway in the 2015 case. This runway would be located east of the existing runway and would be primarily used for local pattern traffic. Its location would preclude the use of a pattern west of the airport as that would require local pattern traffic to cross the extended centerline of the primary and active runway.

The noise contours presented in **Exhibit 5H** illustrate the results of combining the procedures for the 1999 conditions. The alternative contour illustrates the telltale signs of the preferential north flow procedure. The eastern lobes of the 55 DNL contour have shifted to the west due to the reduced percentage of traffic on the south side. On the north side of the airport, the preferential north flow has expanded the 55 and 60 DNL noise contours as expected. A shift in the western edge of the 55 DNL noise contour is also evident due to the weekend training traffic on the west side.

The overall future population impact reductions for the scenario are significantly better than those of any of the individual alternatives. There are some 1,620 fewer people within the 55 to 60 DNL contour band, compared to the 1999 baseline. In the 60 to 65 DNL band there is a reduction of 42 people over the 1999 baseline contour. These reductions are much better than either Alternative 1 or Alternative 7 could achieve alone. A detailed comparison of the noise impacts for this scenario is presented at the end of this section.

Exhibit 5J illustrates the noise exposure for the scenario for the 2015 case. The 2015 baseline noise contour is also presented for comparison purposes. As the analysis in Chapter Two has indicated, the 2015 baseline noise contour is significantly larger than the 1999 contour because of the forecast

increase in operations to be expected over the next 20 years. The alternative contour exhibits shifts relative to the baseline that are similar to those shown for the 1999 case, but on a larger scale. As previously mentioned, this contour reflects only the preferential north flow procedure.

The future population impact analysis indicates that this scenario is only marginally effective at reducing noise impacts. In 2015 the contours are large enough that the relatively small shifts do not move them from populated areas to open areas, but from one populated area to another. The scenario would result in the removal of some 315 persons from the 55 to 60 DNL noise contour band. About 1,014 persons would be removed from the 60 to 65 DNL noise contour band. At the more significant noise levels of 65 to 70 DNL, the scenario would only leave 14 of the 34 persons exposed to this noise level in the baseline case.

SCENARIO B - MODIFIED NORTH FLOW LOCAL PATTERN; RUNWAY 1 DEPARTURE TURN; PREFERENTIAL NORTH FLOW

This scenario evaluates the effects of combining the procedures that affect changes to the north of the airport. This scenario was modelled based on the modifications to the baseline case discussed for Alternatives 3, 5, and 7. The noise exposure was computed for both the 1999 case and the 2015 case in order to evaluate the long-term effects of the procedures.

The noise contours presented in Exhibit 5K illustrate the results of combining the procedures for the 1999 conditions. The alternative contour shows a significant shift due to the modified departure and training tracks to the north. These shifts are magnified by the preferential north flow procedure. On the south side, the eastern lobes of the 55 DNL contour have shifted to the west due to the reduced percentage of traffic on the south side. On the north side of the airport, the preferential north flow has expanded the 55 and 60 DNL noise contours over the New River basin and the Agua Fria Expressway. A small bulge in the 65 DNL contour is also evident due to the new flight routes.

The overall future population impact reductions for the scenario are only marginally better than those of any of the individual alternatives. There are some 1,179 fewer people within the 55 to 60 DNL contour band. In the 60 to 65 DNL band there is a reduction of 64 people over the 1999 baseline contour. A detailed comparison of the noise impacts for this scenario is presented at the end of this section.

Exhibit 5L illustrates the noise exposure for the scenario for the 2015 case. The alternative contour exhibits shifts relative to the baseline that are similar to those shown for the 1999 case, but on a larger scale. The contour illustrates the advantage of using the river basin and highway corridor for overflights in the long-term future. Much of the noise north of the airport is kept off of existing and future residential developments. To the south, the preferential north flow has reduced the noise exposure pattern to minimize the impacts in this area.

The future population impact analysis indicates that this scenario is effective at reducing noise impacts. As is evident in the baseline contour, the impacts on the

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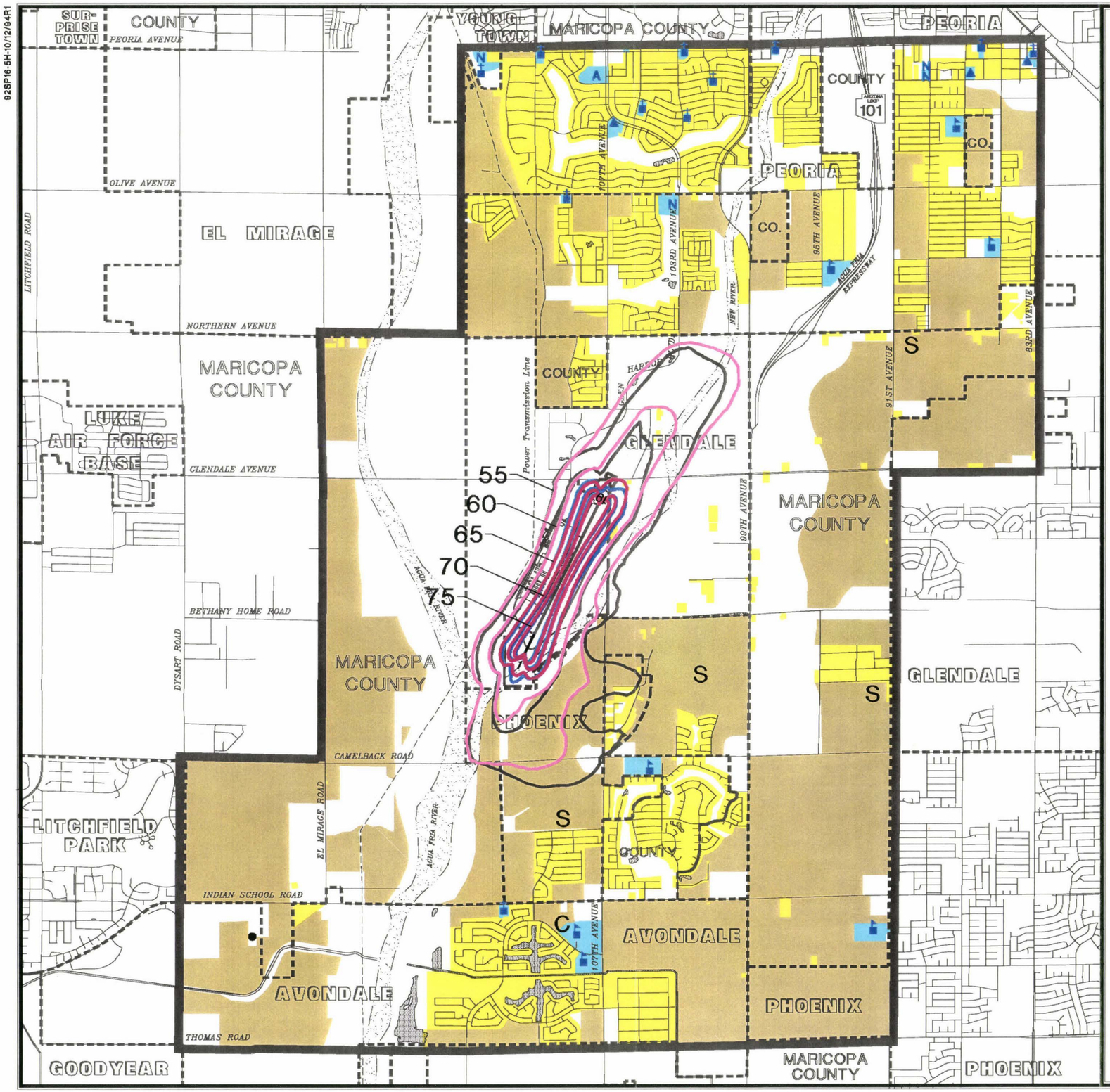
Exhibit 5H
SCENARIO A - 1999
MOVE LOCAL TRAFFIC PATTERN WEST OF AIRPORT, WEEKENDS ONLY; PREFERENTIAL NORTH FLOW



LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- 1999 Baseline DNL Contour-Marginal Impact
- 1999 Baseline DNL Contour-Significant Impact
- Alternative DNL Contour-Marginal Impact
- Alternative DNL Contour-Significant Impact
- Existing Residential
- Undeveloped
- Existing Public and Institutional
- School
- Church
- Community Center
- N — Nursing/Rest Home
- A — Amphitheater
- Site on National Register of Historic Places
- Potentially Available for Residential Development
- C — Future Church Site
- S — Future School Site

NORTH

0 4000 8000

SCALE IN FEET

GLENDALE MUNICIPAL AIRPORT

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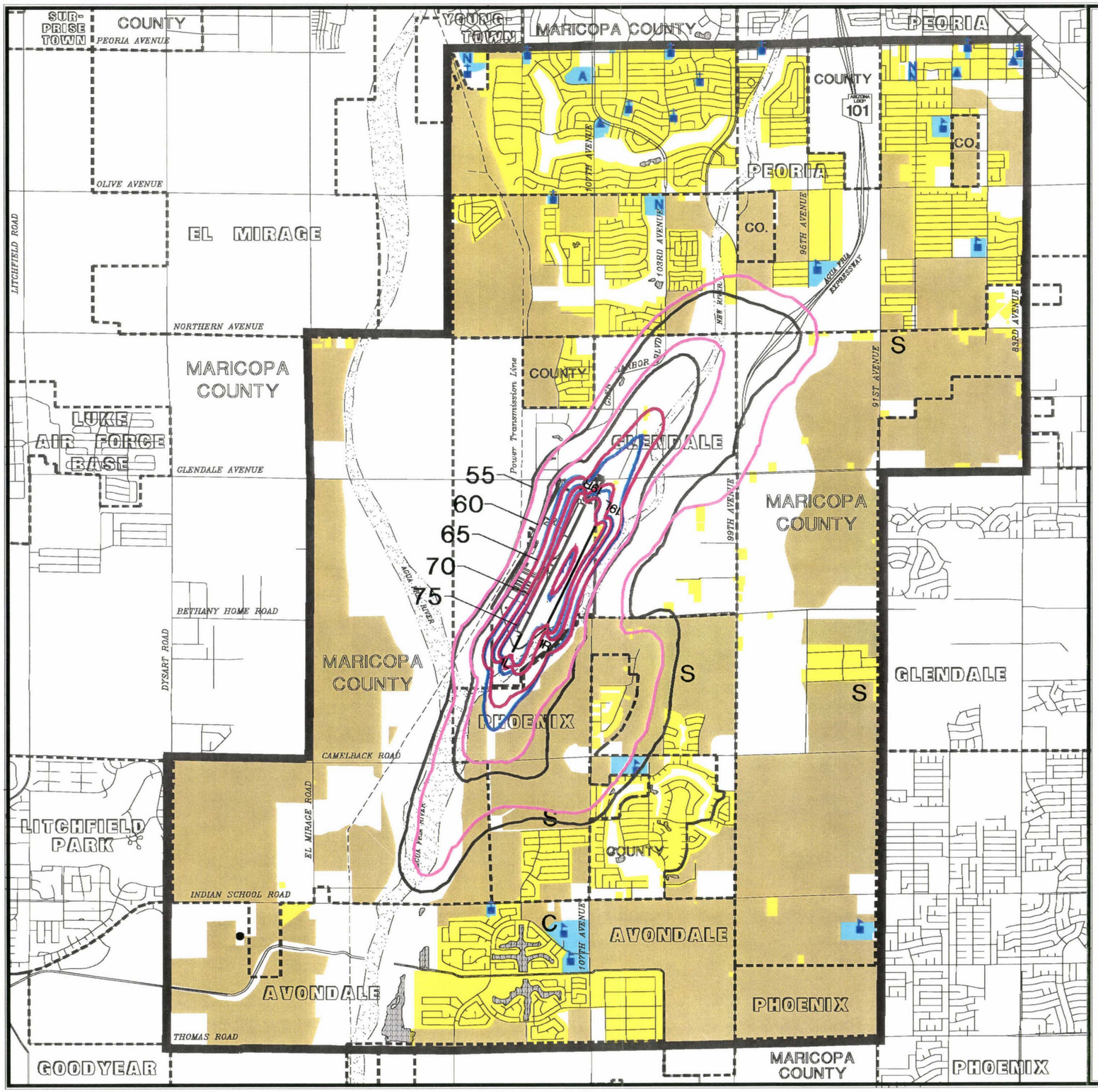
Exhibit 5J
SCENARIO A - 2015
PREFERENTIAL NORTH FLOW



LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- 2015 Baseline DNL Contour-Marginal Impact
- 2015 Baseline DNL Contour-Significant Impact
- Alternative DNL Contour-Marginal Impact
- Alternative DNL Contour-Significant Impact
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- Undeveloped
- Existing Public and Institutional
- School
- Church
- Community Center
- N Nursing/Rest Home
- A Amphitheater
- Site on National Register of Historic Places
- Potentially Available for Residential Development
- C Future Church Site
- S Future School Site

NORTH

0 4000 8000

SCALE IN FEET

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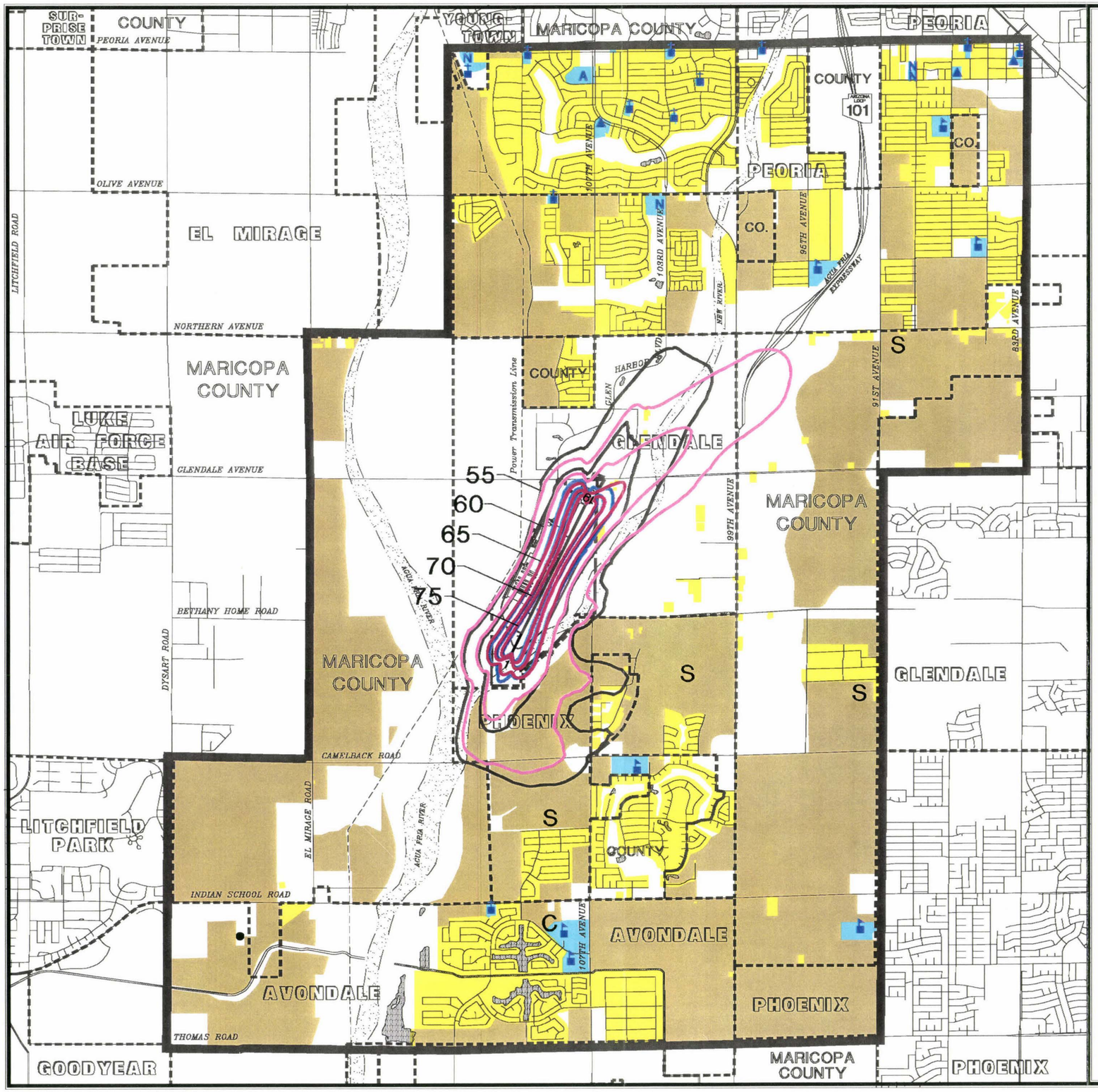
Exhibit 5K
SCENARIO B - 1999

MODIFIED UPWIND LEG FOR NORTH FLOW LOCAL PATTERN; RUNWAY 01 VFR DEPARTURES TURN RIGHT 040 HEADING AT RUNWAY END, MAINTAIN 040 HEADING UNTIL OVER EXPRESSWAY; PREFERENTIAL NORTH FLOW



LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- 1999 Baseline DNL Contour-Marginal Impact
- 1999 Baseline DNL Contour-Significant Impact
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- Community Center
- N Nursing/Rest Home
- A Amphitheater
- Site on National Register of Historic Places
- Potentially Available for Residential Development
- C Future Church Site
- S Future School Site

NORTH

0 4000 8000

SCALE IN FEET

GLENDALE MUNICIPAL AIRPORT

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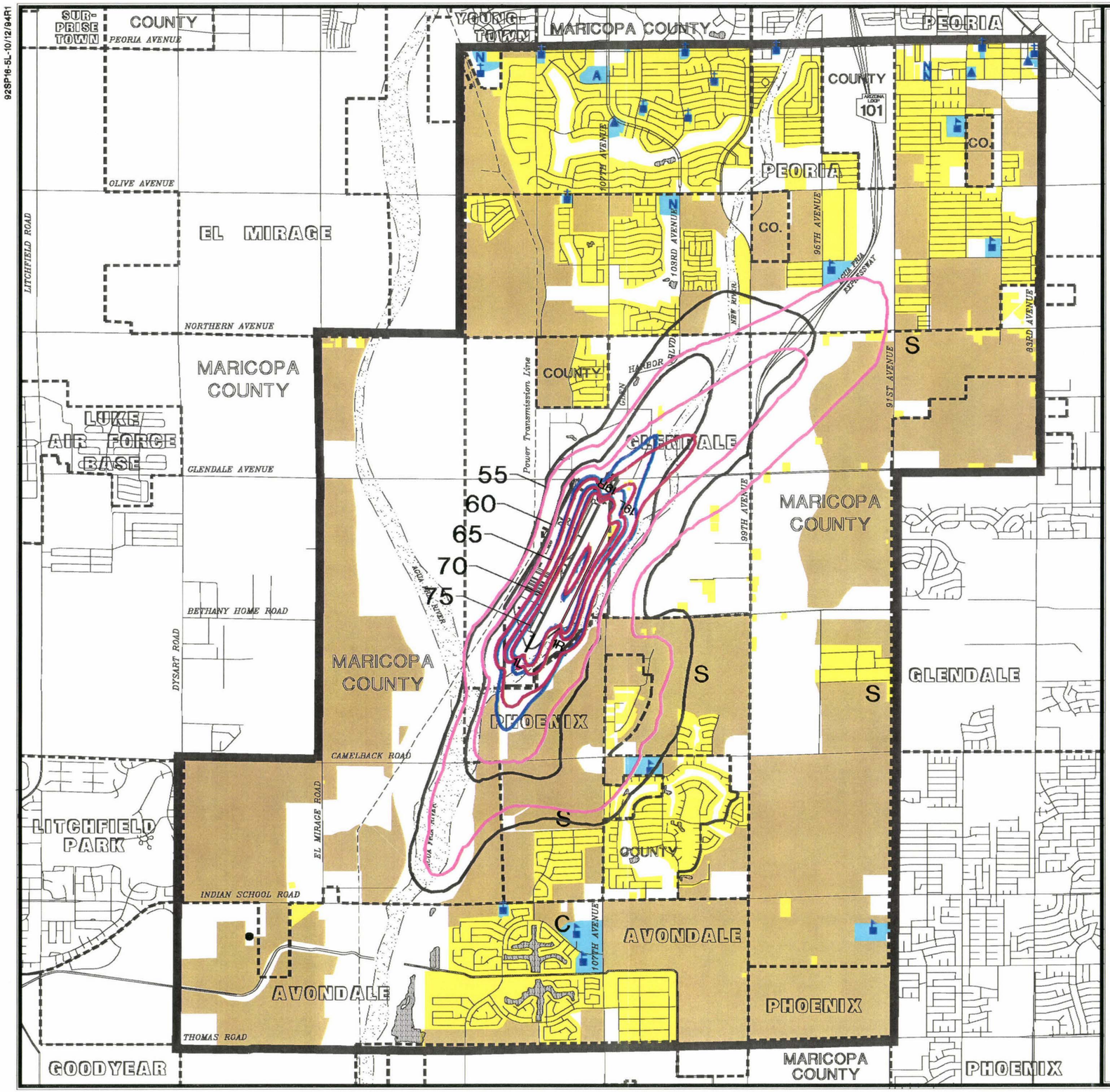
Exhibit 5L
SCENARIO B - 2015

MODIFIED UPWIND LEG FOR NORTH FLOW LOCAL PATTERN; RUNWAY 01 VFR DEPARTURES TURN RIGHT TO 040 HEADING AT RUNWAY END, MAINTAIN 040 HEADING UNTIL OVER EXPRESSWAY; PREFERENTIAL NORTH FLOW



LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- 2015 Baseline DNL Contour-Marginal Impact
- 2015 Baseline DNL Contour-Significant Impact
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SCALE IN FEET

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south side dominate the overall picture. Consequently, the procedures that focus on the north side only serve to ensure future compatibility while offering the opportunity to achieve some impact reductions to the south. The scenario would result in the removal of some 624 persons from the 55 to 60 DNL noise contour band. About 1,025 persons would be removed from the 60 to 65 DNL noise contour band. At the more significant noise levels of 65 to 70 DNL, the scenario would only leave 5 of the 34 persons exposed to this noise level in the baseline case.

SCENARIO C - LOCAL PATTERN TO THE WEST ON WEEKENDS; MODIFIED NORTH FLOW LOCAL PATTERN; RUNWAY 1 DEPARTURE TURN; STRAIGHT-OUT DEPARTURES RUNWAY 19

This scenario evaluates the effects of combining all of the procedures relating to adjusted flight tracks or flight patterns. This consists of the procedures in Alternatives 1, 3, 4, 5, and 6. The scenario evaluates all of the viable alternatives except the preferential north flow procedure.

The noise modelling for this scenario was based on all of the adjustments discussed for the alternatives that are included. The itinerant departures from Runway 19 were modelled according to the straight-out to Indian School Road procedure in Alternative 4. The local pattern traffic on Runway 19 was modelled with the Alternative 6 procedure where traffic flies to the runway end before turning. For the 2015 case, the shifting of the weekend pattern to the west of the airport was not included in the modelling due to the inclusion of the future parallel runway.

The noise contours presented in **Exhibit 5M** illustrate the results of combining the procedures for the 1999 case. The alternative contours illustrate the shifts in the noise exposure pattern due to the flight route procedures. On the north side of the airport, the contour bends to the northeast illustrating the effect of the Runway 1 departure turn and modified training pattern. Impacts to the south and southeast are reduced by the straight-out departure procedure for Runway 19 departures.

Overall future population impact reductions for the scenario are better than those of any of the individual alternatives. There are some 2,206 fewer people within the 55 to 60 DNL contour band. Impacts in the 60 to 65 DNL contour band are increased with 96 persons added to the contour area. A detailed comparison of the noise impacts for this scenario is provided at the end of this section.

Exhibit 5N illustrates the noise exposure for the scenario for the 2015 case. The alternative contour exhibits shifts relative to the baseline that are similar to those shown for the 1999 case, but on a larger scale. The contour illustrates the advantage of using the river basin and highway corridor on the north side for overflights in the long-term future. To the south, the straight-out procedures and the preferential north flow has shifted a portion of the noise exposure pattern over the open areas of the Agua Fria River floodplain to reduce the impacts in this area. This is particularly evident in the 60 DNL contour where it has shifted to the west off of a large area

of future residential development at the expense of a much smaller area which is included as the contour extends further to the south. The 65 DNL noise contour however, actually shifts from an open area to a portion of future residential development.

The future population impact analysis for the 2015 case of this scenario indicates that it is very effective at reducing noise impacts at the lower noise levels. As previously mentioned, the impacts on the south side dominate the overall picture. By adding the procedures that focus on the south side, the overall impacts can be reduced significantly. The scenario would result in the removal of some 3,205 persons from the 55 to 60 DNL noise contour band. About 1,249 persons would be removed from the 60 to 65 DNL noise contour band. One area of concern however, is at the more significant noise levels of 65 to 70 DNL. At these levels the scenario would actually add some 103 people into the noise contour band. This is a relatively unattractive trade-off for this scenario.

SCENARIO D - LOCAL TRAFFIC PATTERN TO THE WEST ON WEEKENDS; MODIFIED NORTH FLOW LOCAL PATTERN; RUNWAY 1 DEPARTURE TURN; STRAIGHT-OUT DEPARTURES RUNWAY 19; PREFERENTIAL NORTH FLOW

This scenario effectively evaluates all of the viable alternatives that were presented in the previous section. This scenario was modelled based on the modifications to the baseline case as discussed for Scenario C with the addition of the preferential north flow modification from Alternative 7. The noise exposure was computed for both the 1999 case and the 2015 case in order to evaluate the long-term effects of the procedures. For the 2015 case, the shifting of the weekend pattern to the west of the airport was not included in the modelling due to the inclusion of the future parallel runway.

The noise contours presented in **Exhibit 5P** illustrate the results of combining the procedures for the 1999 conditions. The eastern lobes of the 55 DNL contour have shifted to the west due to the reduced percentage of traffic on the south side and the straight-out departure procedures. On the north side of the airport, the preferential north flow and the revised flight patterns have expanded the 55 and 60 DNL noise contours over the open areas along the New River and the expressway.

The future population impact reductions for the scenario are significantly better than those of any of the individual alternatives. They represent the best reductions of all of the scenarios. There are some 2,576 fewer people within the 55 to 60 DNL contour band, compared to the 1999 baseline. In the 60 to 65 DNL band there is an increase of 16 people. A detailed comparison of the noise impacts for this scenario is presented at the end of this section.

Exhibit 5Q illustrates the noise exposure for the scenario for the 2015 case. The 2015 baseline noise contour is also presented for comparison. The shifts in the noise pattern seen in Scenario C are also evident in this scenario. The addition of the preferential north flow has generated slight trade-offs. To the north, the 55 DNL noise contour has now expanded over the expressway to encroach on some future residential areas just west of 91st Avenue. On the

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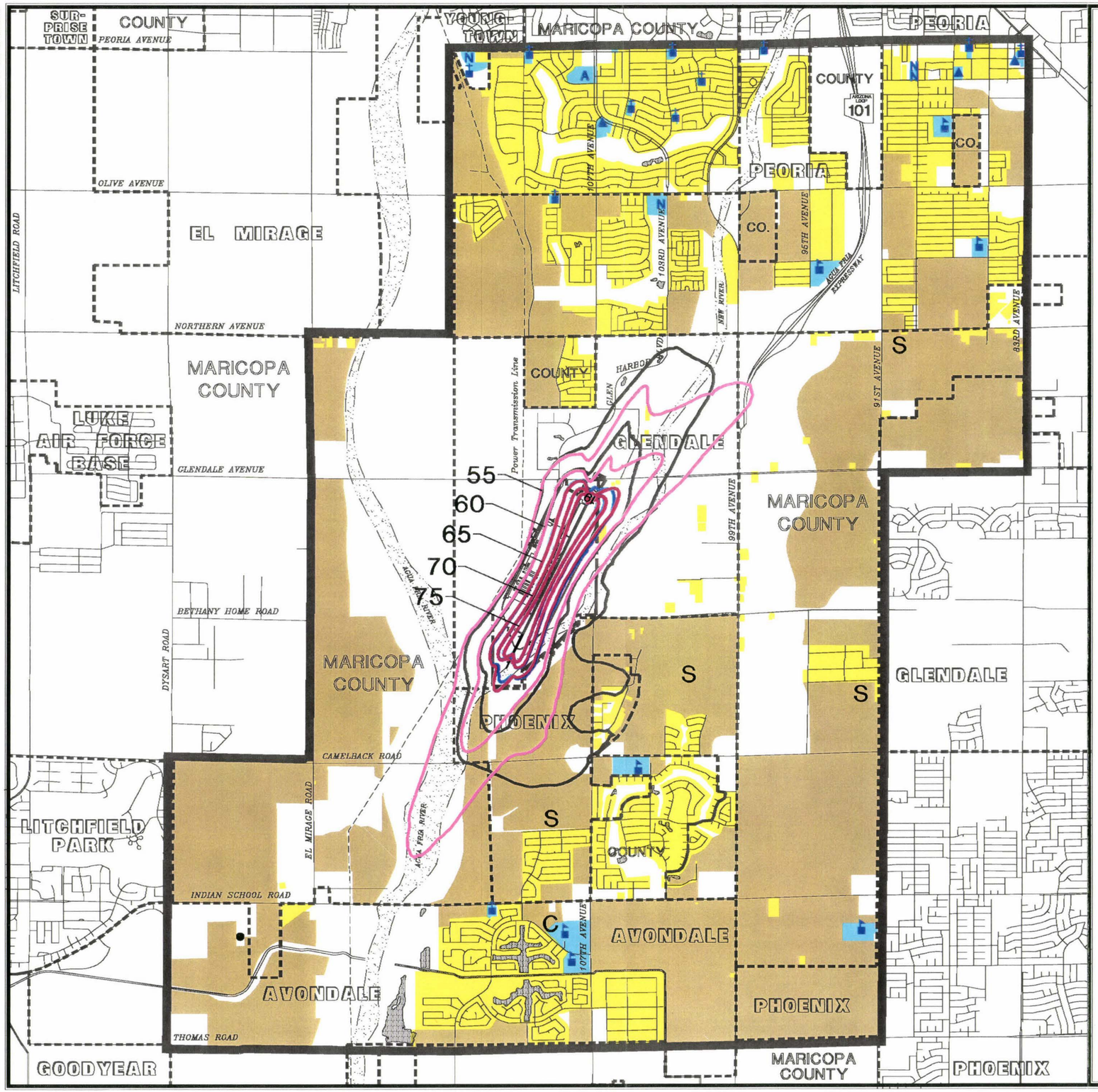

Exhibit 5M
SCENARIO C - 1999

MOVE LOCAL TRAFFIC PATTERN WEST OF THE AIRPORT, WEEKENDS ONLY; MODIFIED UPWIND LEG FOR NORTH FLOW TRAFFIC PATTERN; RUNWAY 19 VFR DEPARTURES FLY RUNWAY HEADING TO INDIAN SCHOOL ROAD; RUNWAY 01 VFR DEPARTURES TURN RIGHT TO 040 HEADING, MAINTAIN 040 HEADING UNTIL OVER EXPRESSWAY

LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- 1999 Baseline DNL Contour-Marginal Impact
- 1999 Baseline DNL Contour-Significant Impact
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- Existing Residential
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- School
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- Community Center
- N — Nursing/Rest Home
- A — Amphitheater
- Site on National Register of Historic Places
- Potentially Available for Residential Development
- C — Future Church Site
- S — Future School Site

NORTH

0 4000 8000

SCALE IN FEET

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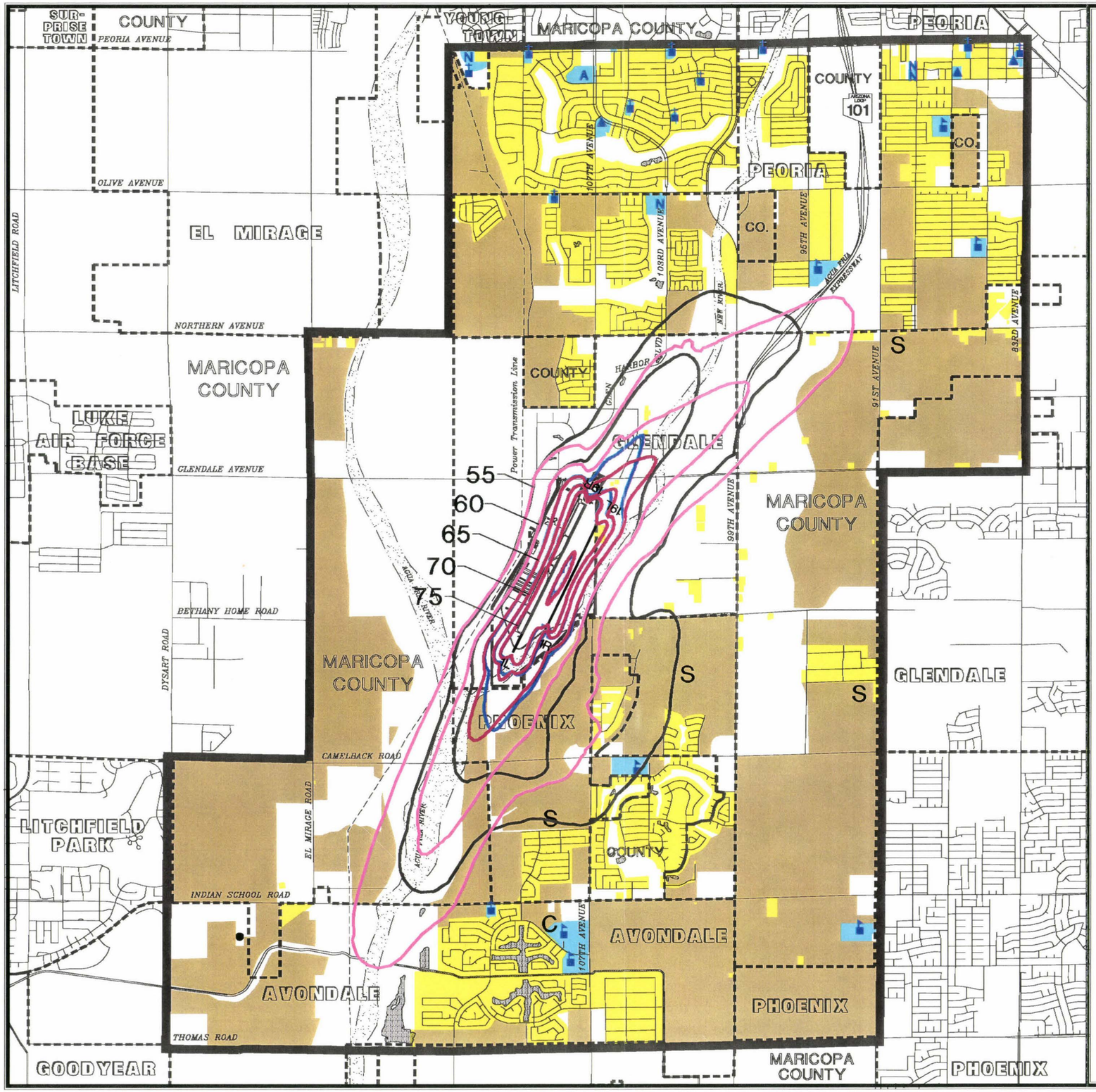
Exhibit 5N
SCENARIO C - 2015

MODIFIED UPWIND LEG FOR NORTH FLOW TRAFFIC PATTERN; RUNWAY 19 VFR DEPARTURES FLY RUNWAY HEADING TO INDIAN SCHOOL ROAD; RUNWAY 01 VFR DEPARTURES TURN RIGHT AT RUNWAY END, MAINTAIN 040 HEADING UNTIL OVER EXPRESSWAY



LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- 2015 Baseline DNL Contour- Marginal Impact
- 2015 Baseline DNL Contour- Significant Impact
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NORTH

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SCALE IN FEET

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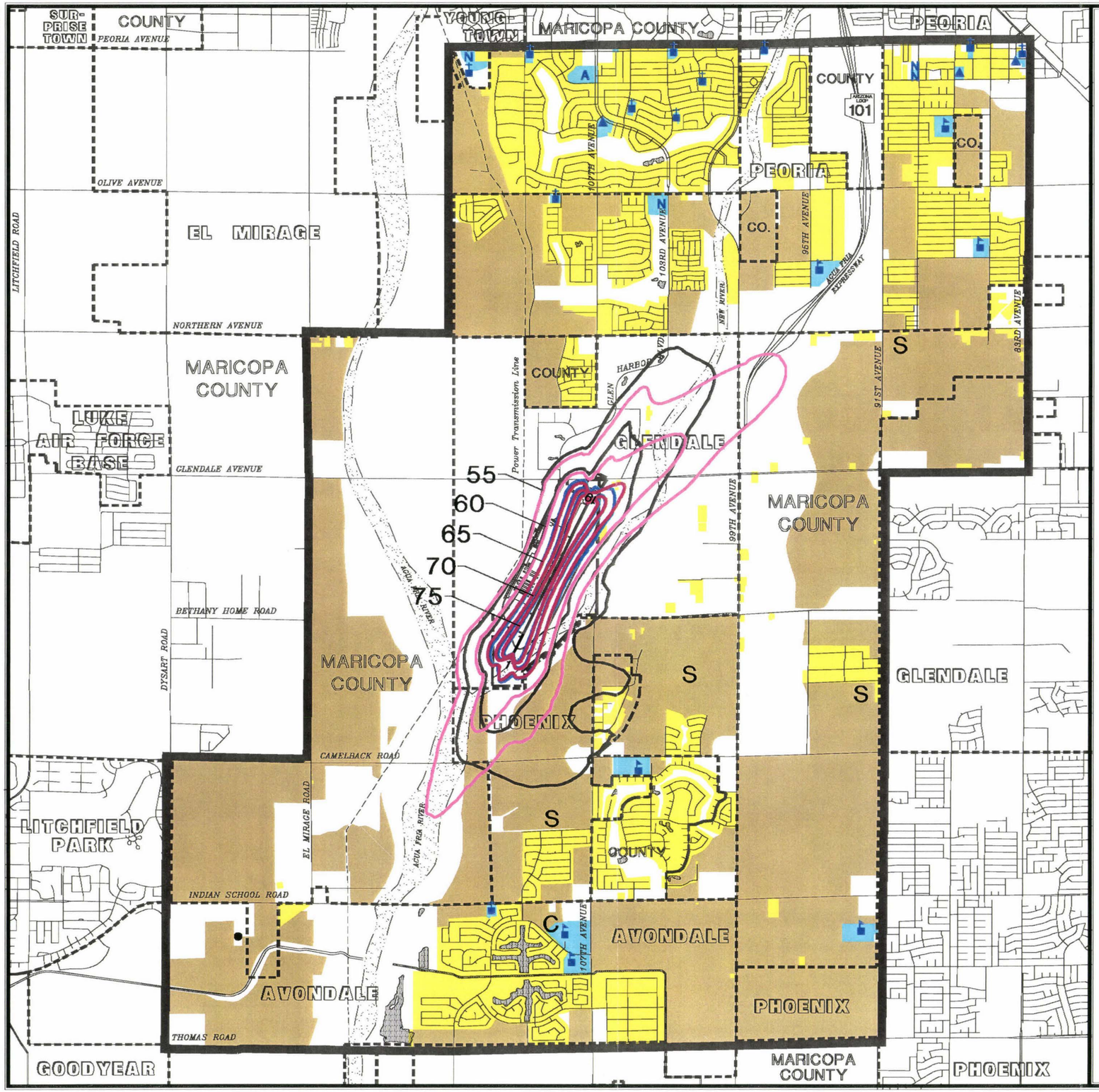
Exhibit 5P
SCENARIO D - 1999

MOVE LOCAL TRAFFIC PATTERN WEST OF THE AIRPORT, WEEKENDS ONLY; MODIFIED UPWIND LEG FOR NORTH FLOW TRAFFIC PATTERN; RUNWAY 19 VFR DEPARTURES FLY RUNWAY HEADING TO INDIAN SCHOOL ROAD; RUNWAY 01 VFR DEPARTURES TURN RIGHT TO 040 HEADING AT RUNWAY END, MAINTAIN 040 HEADING UNTIL OVER EXPRESSWAY; PREFERENTIAL NORTH FLOW



LEGEND

- Study Area Boundary
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- Site on National Register of Historic Places
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NORTH

0 4000 8000

SCALE IN FEET

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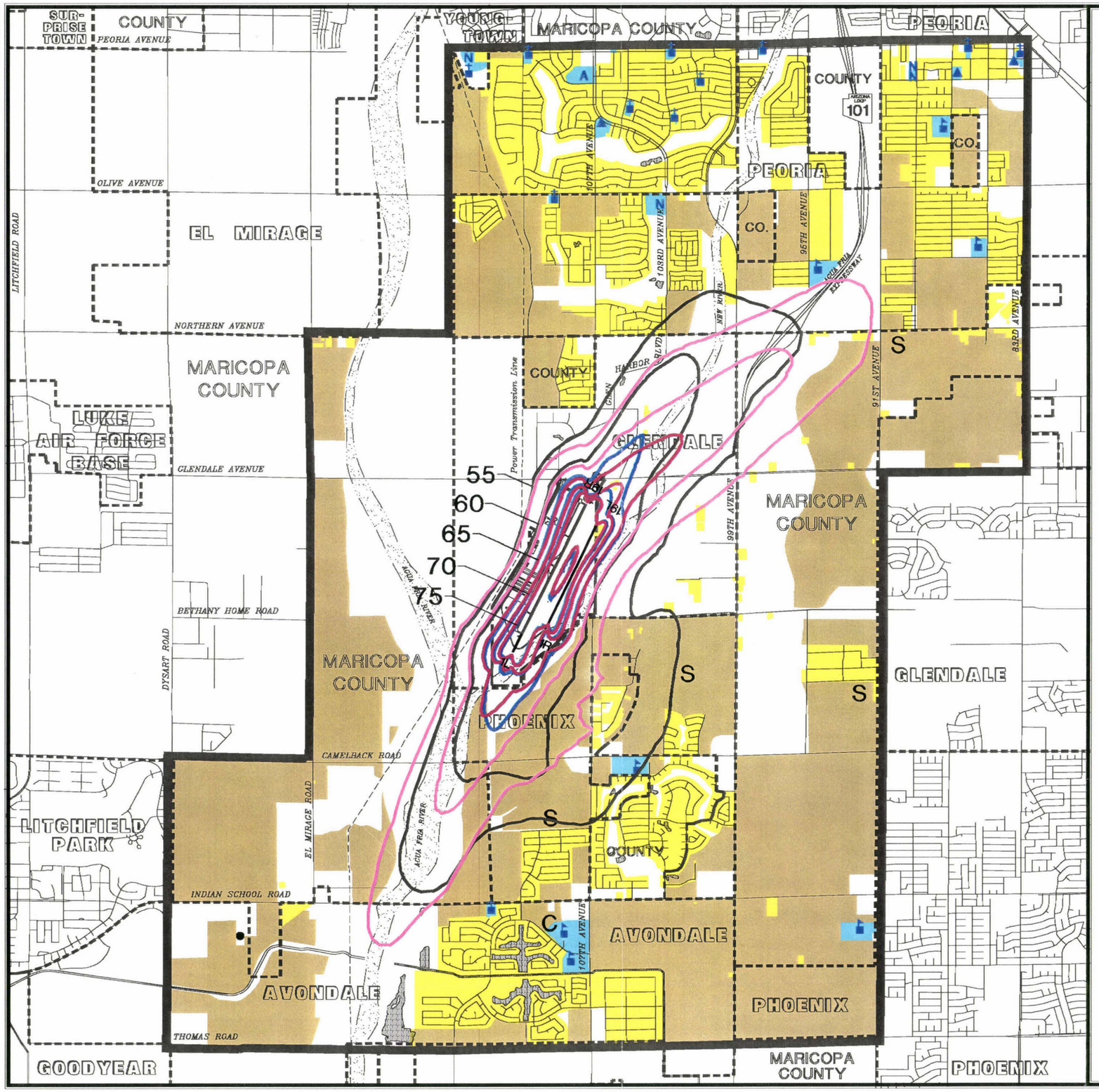
Exhibit 5Q
SCENARIO D - 2015

MODIFIED UPWIND LEG FOR NORTH FLOW TRAFFIC PATTERN; RUNWAY 19 VFR DEPARTURES FLY RUNWAY HEADING TO INDIAN SCHOOL ROAD; RUNWAY 01 VFR DEPARTURES TURN RIGHT TO 040 HEADING AT RUNWAY END, MAINTAIN 040 HEADING UNTIL OVER EXPRESSWAY; PREFERENTIAL NORTH FLOW



LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
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- 2015 Baseline DNL Contour-Marginal Impact
- 2015 Baseline DNL Contour-Significant Impact
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NORTH

0 4000 8000

SCALE IN FEET

GLENDALE MUNICIPAL AIRPORT

other hand, the north flow has minimized the new impacts generated by the straight-out procedures on the south side. The 60 DNL contour to the south has shrunk along the runway centerline so that the new impacts in the future residential areas adjacent to the river are minimized. Additionally, the 65 DNL noise contour has also been reduced and does not shift to impact the future residential area south of the runway as it did in Scenario C.

The future population impact analysis indicates that this scenario is very effective at reducing noise impacts. By adding the north flow procedure, the impacts from Scenario C can be further reduced. This scenario would result in the removal of some 3,231 persons from the 55 to 60 DNL noise contour band. About 1,465 persons would be removed from the 60 to 65 DNL noise contour band. At the more significant noise levels of 65 to 70 DNL, the scenario would remove about 4 persons from the contour band.

NOISE IMPACTS SUMMARY - SCENARIOS

Table 5C provides a comparison of the population impacts associated with each noise abatement scenario based on the existing residential development around the airport. The population impacts are shown for both the 1999 and 2015 cases.

Under the 1999 conditions each scenario has nearly identical total population impacts. Scenarios B, C and D provide slightly better LWP impacts due to their lower impacts in the higher level noise contours. The 2015 conditions reveal a greater disparity of impacts between the scenarios. Scenarios C and D clearly provide significantly smaller population impacts than the other scenarios. Scenario C just edges Scenario D, with lower overall impacts and a slightly lower LWP impact.

TABLE 5C
Noise Abatement Scenarios
Existing Population Impacts

	1999				
DNL Noise Contour Range	Baseline	Scenario A	Scenario B	Scenario C	Scenario D
55-60	43	0	14	14	14
60-65	9	21	5	7	9
65-70	2	5	7	5	2
70-75	0	0	0	0	0
75+	0	0	0	0	0
Total	54	26	26	26	25
LWP[1]	10	11	8	8	6
	2015				
DNL Noise Contour Range	Baseline	Scenario A	Scenario B	Scenario C	Scenario D
55-60	376	333	241	33	42
60-65	12	2	7	5	7
65-70	9	14	5	5	5
70-75	0	5	2	2	2
75+	5	5	5	5	5
Total	402	359	260	50	61
LWP[1]	62	61	43	16	18

[1] Level-weighted population - an estimate of the number of people actually annoyed by aircraft noise. It is derived by multiplying the population in each DNL contour range by the appropriate LWP response factor: 55-60 = .125; 60-65 DNL = .375; 65-70 DNL = .625; 70-75 DNL = .875; 75+ DNL = 1.000.

Note: Numbers have been rounded.

Source: Coffman Associates analysis.

In order to fully understand the benefits of each scenario, the future residential growth in the area must also be considered. The data presented in Table 5D represents the population impact results when this future growth is considered. Again, impacts for both the 1999 and 2015 cases are presented.

TABLE 5D
Noise Abatement Scenarios
Future Population Impacts

	1999				
DNL Noise Contour Range	Baseline	Scenario A	Scenario B	Scenario C	Scenario D
55-60	3,475	1,855	2,296	1,269	899
60-65	97	55	33	193	113
65-70	2	5	7	5	2
70-75	0	0	0	0	0
75+	0	0	0	0	0
Total	3,574	1,915	2,336	1,467	1,014
LWP[1]	472	256	304	234	156
	2015				
DNL Noise Contour Range	Baseline	Scenario A	Scenario B	Scenario C	Scenario D
55-60	7,556	7,241	6,932	4,351	4,325
60-65	2,249	1,235	1,224	1,000	784
65-70	34	14	5	137	30
70-75	0	5	2	2	2
75+	5	5	5	5	5
Total	9,844	8,500	8,168	5,495	5,146
LWP[1]	1,814	1,386	1,335	1,011	860

[1] Level-weighted population - an estimate of the number of people actually annoyed by aircraft noise. It is derived by multiplying the population in each DNL contour range by the appropriate LWP response factor: 55-60 = .125; 60-65 DNL = .375; 65-70 DNL = .625; 70-75 DNL = .875; 75+ DNL = 1.000.

Note: Numbers have been rounded.

Source: Coffman Associates analysis.

The scenarios under the 1999 conditions show larger differentials when the future residential development is considered. However, the general relationship remains constant, with Scenarios C and D generating the lowest impacts. In this case Scenario D edges out Scenario C with the fewest noise impacts. The future impacts of the scenarios under the 2015 conditions also bear a similar relationship to the existing population case. When the future population is considered, Scenario D is again slightly superior to Scenario C for the 2015 contours.

The results of this analysis must be reviewed by the study advisory committee, airport management, and general public before final recommend-

ations can be made. Final recommendations will be presented in Chapter Seven, the Noise Compatibility Plan.

SUMMARY

The previous sections have analyzed the noise exposure and population impacts of a variety of noise abatement alternatives for the Glendale Municipal Airport. Individual alternatives were also reviewed based on operational feasibility, costs, and implementation factors. The alternatives that appeared to be feasible and to provide reasonable noise reduction benefits were then combined and evaluated as scenarios. The scenarios evaluated several combinations of potential noise abatement procedures to identify any synergistic relationships.

Each case provides some reductions in the noise exposure around Glendale Municipal Airport. Scenario D, involving all of the most feasible alternatives, generates the least amount of noise impacts. Scenario C, which is similar to Scenario D but without the preferential north flow also provides significant noise impact reductions.

While it is easy to judge the objective effects of a scenario, such as noise contour location or noise impacted population counts, it is often difficult to weigh the subjective effects, such as operational issues, implementation factors, or noise impact trade-offs. Several options offer noise impact reductions at the expense of increased overflights of residential areas with lower noise levels. These trade-offs must be carefully considered when evaluating the alternatives.

The alternatives and scenarios evaluated in detail tend to have similar implementation elements and costs. There are some variations on the possible operational issues regarding the option moving the training patterns to the west of the airport. These issues are safety related and should be considered accordingly when recommending a final plan.

Table 5E provides a summary of the alternatives that appear to deserve serious consideration. It includes several "soft" alternatives, or procedures that would not necessarily be mandated as part of the program, but would be encouraged through the philosophy of the airport management.

The next chapter provides a detailed analysis of possible land use solutions to the noise impacts around Glendale Municipal Airport. This is a particularly important aspect of the planning effort at Glendale. The minimal current noise impacts around the airport indicate that it is possible to protect areas and maintain noise compatibility well into the future.

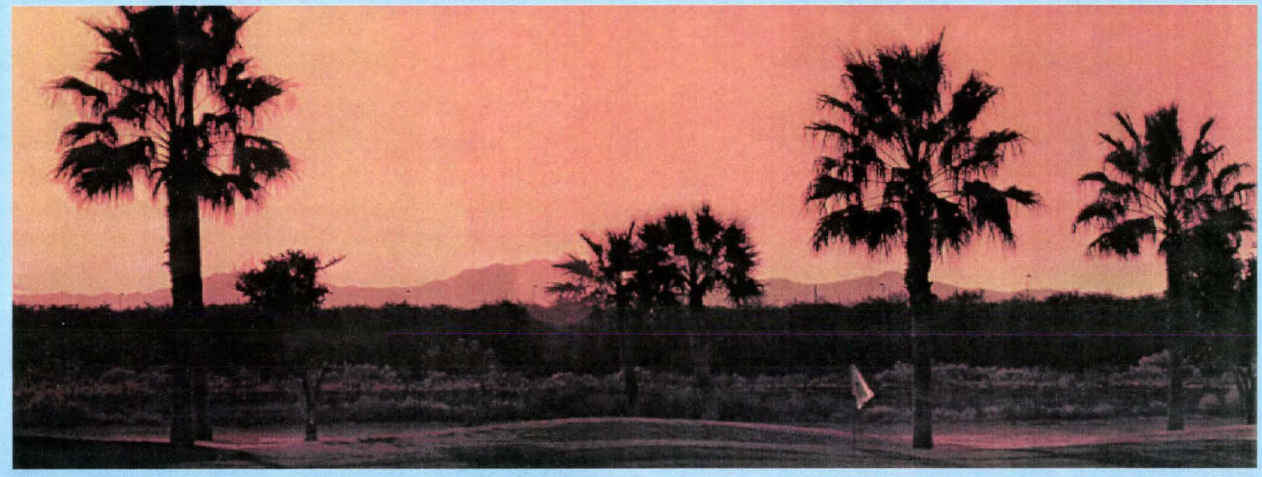
TABLE 5E
Summary Of Potential
Noise Abatement Alternatives

Alternative	Procedure	Advantages	Disadvantages
Problematic Alternative		Small noise benefit.	Potential safety concerns.
# 1	Move Weekend Training Pattern to the West		
Preliminary Preferred Alternatives		Small to significant noise benefits.	Little or no operational difficulty.
# 3	Modified North Flow Pattern Upwind Leg		
# 4	Runway 19 Itinerant Departures Straight-Out To Indian School Road		
# 5	Runway 1 Departures Turn Right to 040 Heading		
# 6	Runway 19 Local Pattern Departures Fly Runway Heading to End of Runway		
# 7	Preferential North Flow		
"Soft" Alternatives		Potential for benefit. Administrative policy implementation.	Noise benefit not quantifiable.
*	Encourage AOPA Quiet Flying Procedures and NBAA Standard Thrust Cutbacks for Jets		
**	Marketing Efforts to Avoid Based Stage 2 Jet Aircraft		
***	Marketing Efforts to Avoid Large Pilot Training Operations		

Chapter Six
LAND USE ALTERNATIVES

GLENDALE
MUNICIPAL AIRPORT

LAND USE ALTERNATIVES



INTRODUCTION

The evaluation of noise abatement alternatives in Chapter Five resulted in tentative proposals to promote aircraft noise abatement measures in the area of Glendale Municipal Airport. Even if such measures are implemented, however, there will continue to be land around the airport impacted by aircraft noise.

This chapter discusses land use management alternatives intended to prevent or reduce future noise impacts. It begins by identifying broad planning issues and mitigation objectives to be addressed by the land use management plan. Alternative land use management techniques are then evaluated to determine their potential usefulness in the Glendale Municipal Airport study area. Finally, preliminary recommendations are presented, to be reviewed by the Planning Advisory Committee and local citizens. The final land use management and noise abatement recommendations will be presented in the next chapter, Noise Compatibility Plan.

LAND USE ISSUES AND OBJECTIVES

Five broad noise compatibility planning issues and their mitigation objectives for the Glendale Municipal Airport study area have been identified. These items are described below and listed on **Table 6A.**

1. **Noise impacts on existing noise-sensitive land uses within the baseline annual 1994 DNL 65-70 noise contour.**

This contour impacts one mobile home located east of the airport and south of Glendale Avenue in Glendale. Land use expenditure measures addressing noise

impacts within this contour would be eligible for federal funding.

2. **Noise impacts on existing, scattered homes located in the vicinity of the airport and within the baseline 1999 and 2015 65 DNL noise contours.**

In the future, this contour is expected to impact additional homes and population north and northeast of the airport in Glendale. In 1999, approximately one existing home will be located within the 65 DNL contour. In 2015, three existing homes are anticipated to be within the 65-70 DNL range and two existing homes within the 70-75 DNL range. Federal funding for this item is available only for those homes impacted by the 1999 65 DNL or greater noise contours.

3. **Noise impacts on undeveloped land north, south and east of the airport. This area is located beneath flight tracks, within the 55 DNL contour and is designated for future residential use.**

Large land parcels situated north, south and east of the Glendale Municipal Airport are within the baseline annual 55 DNL contour. These areas, located in Phoenix, along Camelback Road east of the Agua Fria River, and Peoria, north of Northern Avenue at 103rd Avenue, are currently proposed for residential development. The growth risk analysis for the Phoenix area reveals a high likelihood for development within the next few years, pending final plan approval and installation of flood control measures. The Peoria area has a medium-low probability for development indicating that due to its proximity to other nearby development centers and/or services it may potentially be developed. Consideration should be given to reducing the level of residential development, or other non-compatible use, in this area.

4. **Noise impacts on existing noise-sensitive land uses between the baseline annual 1994 DNL 55-65 noise contours.**

The 55 DNL contour impacts homes and population northeast of the airport in Glendale. Approximately eleven dwelling units, including nine mobile homes, and 25 persons are impacted. Land use expenditure measures addressing noise impacts within this contour would not be eligible for federal funding due to the impacts being outside FAA's significant noise threshold level (65 DNL contour). This issue will, therefore, be addressed primarily through noise abatement techniques presented in Chapter Five.

5. **Noise impacts from aircraft overflights of residential areas within or near the 55 DNL contour.**

Aircraft overflights outside the 55 DNL contour cause reasonably low cumulative noise levels which may, nonetheless, be annoying to some residents. They also cause loud, annoying single events. Among the affected neighborhoods are Camelback Farms, Villa de Paz and Garden Lakes on the south side of the airport, and Country Meadows on the north side. The impacts of overflights on residential areas will be addressed primarily through noise abatement techniques discussed in Chapter Five.

While the final aviation noise abatement plan has not yet been defined, the discussion in Chapter Five analyzed a number of noise abatement alternatives. This analysis determined that none of the alternatives change the size, shape or

location of the noise contours significantly enough to affect the overall land use planning issues. The issues listed in **Table 6A** are, therefore, likely to remain the same regardless of which noise abatement options are recommended for implementation.

TABLE 6A
Noise Compatibility Issues

(1) **Noise impacts on existing noise-sensitive land uses within the baseline annual 1994 DNL 65-70 noise contour.** Noise impacts a home and population located east of the airport and south of Glendale Avenue, in Glendale. **Mitigation Objective:** Review land use compatibility alternatives to mitigate noise impacts within the DNL 65-70 contour range.
(2) **Noise impacts on existing, scattered homes located in the vicinity of the airport and within the baseline 1999 and 2015 65 DNL noise contours.** Noise impacts to homes and population located east and north of the airport, both north and south of Glendale Avenue, in Glendale. **Mitigation Objective:** Review land use compatibility alternatives to mitigate noise impacts within the DNL 65-70 contour range.
(3) **Noise impacts on undeveloped land north, south and east of the airport. This area is located beneath flight tracks, within the 55 DNL contour and is designated for future residential use.** Noise impacts large, undeveloped areas located along Camelback Road and 107th Avenue, in Phoenix, and along Northern Avenue in Peoria. **Mitigation Objective:** Review land use compatibility alternatives to reduce further residential development or to reduce adverse affects of noise.
(4) **Noise impacts on existing noise-sensitive land uses within the baseline annual 1994 DNL 55-65 noise contour.** Noise impacts homes and population located east and north of the airport, south of Northern Avenue, in Glendale. **Objective:** Depend on noise abatement procedures to reduce noise impacts within the DNL 55-65 contour range.
(5) **Noise impacts from aircraft overflights of residential areas within or near the 55 DNL contour.** Noise from overflights impacts residential areas north, south and east of the airport, including Country Meadows, Camelback Farms, Villa de Paz, and Garden Lakes. **Objective:** Depend on noise abatement procedures to reduce noise impacts from overflights within the 55 DNL contour.

LAND USE MANAGEMENT TECHNIQUES

This section discusses land use management techniques which can promote noise compatibility in the vicinity of an airport. These include policy and regulatory techniques which guide future development, and expenditure techniques which involve potential payments for mitigation assistance.

Generalized land use techniques are listed in **Table 6B**. The potential suitability of each is discussed in this chapter and evaluated based on effectiveness and feasibility. The criteria for judging effectiveness include near and long-term effectiveness, indirect impacts and side effects.

If a technique appears to be effective and does not create undesirable side effects, the feasibility of implementing it is evaluated. The feasibility criteria include cost to local governments and citizens, eligibility for FAA financial aid, political acceptability, state statutory authorization, and administrative ease or complexity.

LAND USE COMPATIBILITY PLANNING SCENARIO

It is important that land use compatibility measures be based on the largest noise contours which may reasonably be expected to occur at the Glendale Municipal Airport in the future. A review of the noise contours presented in Chapter Five of this study shows that changes in the contours are possible over time. One way to deal with these changes is to revise the boundaries as the noise contours change. This method is wise only if the contours get smaller over time; however, in the case of Glendale Municipal Airport, the boundaries are expected to get larger because of an increase in air traffic.

For the purposes of this chapter, a "Land Use Compatibility Planning Scenario" noise contour was used. This contour represents the 2015 noise condition based on Scenario D. See **Exhibit 5Q** in Chapter Five. (A final land use planning scenario should be defined using the recommended Noise Compatibility Plan contour for 2015.) This contour defines an area that may reasonably be considered to be at risk of aircraft noise exposure over the long-term future. Each of the land use alternatives were evaluated assuming these contours to better consider their long-term suitability and effectiveness.

POLICY TECHNIQUES

Policy techniques are non-regulatory land use planning programs, generally encompassed by: General Planning, Capital Improvement Programming (CIP) and Discretionary Project Review.

General Planning

A community's General Plan, or Comprehensive Plan, establishes policies for the growth and improvement of the community. With respect to a public airport, the general purposes of a community's General Plan are to (1) support the efficient operation of the airport, (2) identify environmentally sensitive lands so as to guide development away from those areas which could be adversely impacted by airport operations, and (3) encourage new development designed in harmony with the airport and surrounding area.

TABLE 6B
Alternative Land Use Management Techniques

TECHNIQUES FOR GUIDING NEW DEVELOPMENT OR PREVENTING FUTURE NOISE IMPACTS

POLICY TECHNIQUES - Non-regulatory, governmental actions to encourage development in harmony with the airport.

General Planning - Policies supporting land use compatibility near the airport. Involves specific land use plans and policies to guide consideration of rezonings, variances, conditional uses, and public projects.

Capital Improvements Programming - Investments in utilities and public facilities supporting land use compatibility.

Discretionary Project Review - Adoption of guidelines which ensure that noise compatibility issues are considered during reviews of development proposals.

REGULATORY TECHNIQUES - Local land use regulations intended to require compatible development in the airport area.

Compatible Use Zoning - Commercial, industrial, agriculture, or open space zoning.

Zoning Changes, Residential Density - Large-lot zoning or planned unit development.

Noise Overlay Zoning - Special regulations within high-noise areas.

Subdivision Regulations - Require dedication of noise and avigation easements, plat notes.

Building Codes - Require sound insulation in new construction.

Transfer of Development Rights - Zoning framework to authorize private sale of development rights to encourage sparse development in high-noise areas.

Environmental Zoning - Environmental protection zoning to support airport land use compatibility.

Fair Disclosure Regulations - Require seller to notify buyer of aircraft noise.

TECHNIQUES FOR THE MITIGATION OF EXISTING NOISE IMPACTS

EXPENDITURE TECHNIQUES

Property Acquisition - Outright, fee-simple purchase of property.

Noise and Avigation Easement Purchase - Acquisition of easement only.

Development Rights Purchase - Acquisition of rights to develop property.

Purchase Assurance - Airport acts as buyer of last resort to sell property and retain easement.

Sales Assistance - Provide assistance to property owners in selling homes and retaining noise easements.

Sound Insulation - Installation of sound insulation in existing homes and noise-sensitive institutions.

A General Plan serves two main functions: it is an expression of what a community wants and, once prepared, it serves as a guide to decision making. Typically, the General Plan is the guide under which properties are zoned and developed. It is important to note, however, that as a community grows or evolves, the General Plan must be periodically re-examined. A General Plan provides an understanding of what a community's goals are for only a brief period; these goals will change as land is developed and as the population increases or ages.

To be effective General Plans should periodically be updated and recommended land uses and goals reconsidered. As communities initiate this process, consideration should be given to what is happening outside their jurisdictional boundaries. Sometimes neighboring communities do not feel it is necessary for them to "support the efficient operation of an airport," as suggested above; however, these communities can benefit from their proximity to an airport. In addition, neighboring communities have a responsibility to protect the interests of their existing and future residents. This includes protecting them from adverse noise impacts which can be avoided or mitigated.

- EVALUATION

Glendale: According to the Glendale General Plan and Development Guide, illustrated on Exhibit 1H, the City of Glendale has already taken into account the airport's proximity in determining future land uses in their portion of the study area. The General Plan targets the majority of land between 115th Avenue and 95th Avenue, from Northern to the Bethany Home Road alignment, for commercial or industrial uses. The exception is a small area south of Northern, between 107th and 111th Avenues, which is proposed for residential use.

In addition, the General Plan sets the policy to require developers to file an avigation easement with the FAA, if the proposed development is within a two-mile radius of the airport.

Phoenix: The General Plan for the City of Phoenix designates land within the study area for future residential use. Of particular concern is the area south of the airport, along Camelback Road between the Agua Fria River and 107th Avenue. Some of this area is located within the Land Use Compatibility Planning Scenario's 65 DNL noise contour; most of it is likely to be affected by aircraft overflights.

The General Plan also recognizes that excessive noise is a hazard to public safety and well-being. Regarding airport noise, it specifies policies to do the following.

- Encourage new development to include noise attenuation in the project design.
- Encourage the use of noise reduction and suppression techniques.
- Encourage the use of quieter aircraft.
- Encourage safe and noise compatible land uses within airport noise zones.

In addition, regarding aircraft and airport safety, the General Plan provides a policy to "continually reevaluate the operational and development plans for all City-owned airports, as well as other airports within the Phoenix sphere of influence, to keep abreast of changing

needs and demands, technological changes and land use considerations."

The City of Phoenix should consider redesignating land uses in the area between the Agua Fria River and 107th Avenue from residential to a compatible land use such as commercial, office/ professional, industrial, or dedicated open space. The benefit of doing this would be to eliminate the potential for a resident population within an area of high cumulative noise and frequent overflights. (See **Exhibit 6A.**)

As a negative, the area in question is of significant size; therefore, given the local market, designating all of it for commercial, industrial or office may not be realistic. Also, until the Agua Fria Expressway is completed, access north or south is limited. An additional detraction is that this area is near several large residential developments. A large-scale commercial, industrial or office development may have an impact on these neighbors (e.g. traffic, noise, light emissions, and other emissions).

If it is determined not to be feasible to redesignate the entire area, additional consideration should be given to, at a minimum, redesignate the areas most severely affected by aircraft noise and overflights.

Avondale: No changes to the City of Avondale's General Plan are necessary because the anticipated 55 DNL noise contour falls within an area designated for future parks and open space use south of Indian School Road, as shown in **Exhibit 6A.**

Peoria: The City of Peoria updated its Comprehensive Master Plan in January 1992. As part of the plan's framework, several goals and policies were developed to outline the City's philosophy toward land use and development.

Within the study area, Peoria's Comprehensive Master Plan targets much of its land for low-density residential use. It designates land along the New River for parks and open space and designates industrial uses along the Agua Fria Expressway right-of-way.

The City of Peoria recognizes the relationship of noise and community development in its Comprehensive Master Plan. Policy A-5c reads: "[t]he City shall limit residential development from areas of 60 LDN [sic] noise levels or greater (e.g. truck routes, airports, highways)."

While the 60 DNL does not and is not expected to extend into the City of Peoria, according to the Land Use Compatibility Planning Scenario, the 55 DNL contour is expected to cross Northern Avenue, between the New River and 91st Avenue. The City of Peoria should consider revising its Comprehensive Master Plan to redesignate the property on the northeast corner of Northern and 103rd Avenues from residential to a use more compatible with the airport (see **Exhibit 6A**). This area is along the extended runway centerline and is just outside the 55 DNL contour. It is subject to some cumulative noise and likely frequent aircraft overflights. A more appropriate use would be commercial, as it is currently zoned, or office/professional.

Maricopa County: The future planning for the portion of the study area west of the Agua Fria River is provided by Maricopa County in their 1982 White Tanks - Agua Fria Policy and Development Guide. Within its

planning area, west and southwest of the airport, the County recommends low and very low-density residential development or open space. It is suggested that redesignation of an area within the 60 DNL south of Camelback Road and east of the Agua Fria River from residential to commercial, office, or industrial. No other changes to the Development Guide are suggested given the location of the existing and anticipated base case 55+ DNL noise contours.

Long-range planning for remaining County land within the study area is provided by the community's which have strip-annexed around the parcels or sections. Future planning for these areas was considered in the discussions for the those jurisdictions.

- CONCLUSION

Maricopa County and the cities of Phoenix and Peoria should update their general plans and related land use regulations in consideration of the findings of this noise study. Specifically, the City of Phoenix should consider designating land within the Land Use Compatibility Planning Scenario's 55 and 60 DNL contours for land uses compatible with the airport. Maricopa County should consider a similar change on property south of Camelback Road. The City of Peoria should consider redesignating the area on the northeast corner of Northern and 103rd Avenues to a non-residential/non-institutional use such as commercial, as it is currently zoned. All five jurisdictions should coordinate with each other regarding development in the vicinity of Glendale Municipal Airport.

Capital Improvements Programming

The Capital Improvements Program (CIP) provides the governing body a means of control to direct community growth by effectively planning the location of capital improvements, especially roads and utility systems (e.g. water and sewer lines). The CIP can be an effective way to encourage the implementation of the land use policies of the General Plan. For example, the provision of facilities large enough to serve business and industry can help encourage industrial development where desired. In contrast, the withholding of sewer and water facilities from an area can discourage any development from occurring there. Effective use of the CIP results in overall land development consistent with local policies, plans and funding considerations.

Capital improvements programming is important in noise compatibility planning in areas with large amounts of vacant land that will be ready for development during the planning period.

- EVALUATION

Each of the jurisdictions have capital improvement programs which they update on an annual basis. These budgets are used to determine the locations for necessary infrastructure improvements, such as roadway widenings/resurfacings, utility line expansions and drainage system improvements. Because of budget constraints common to all jurisdictions, these improvements tend to be based on existing needs and service demands, rather than on future needs.

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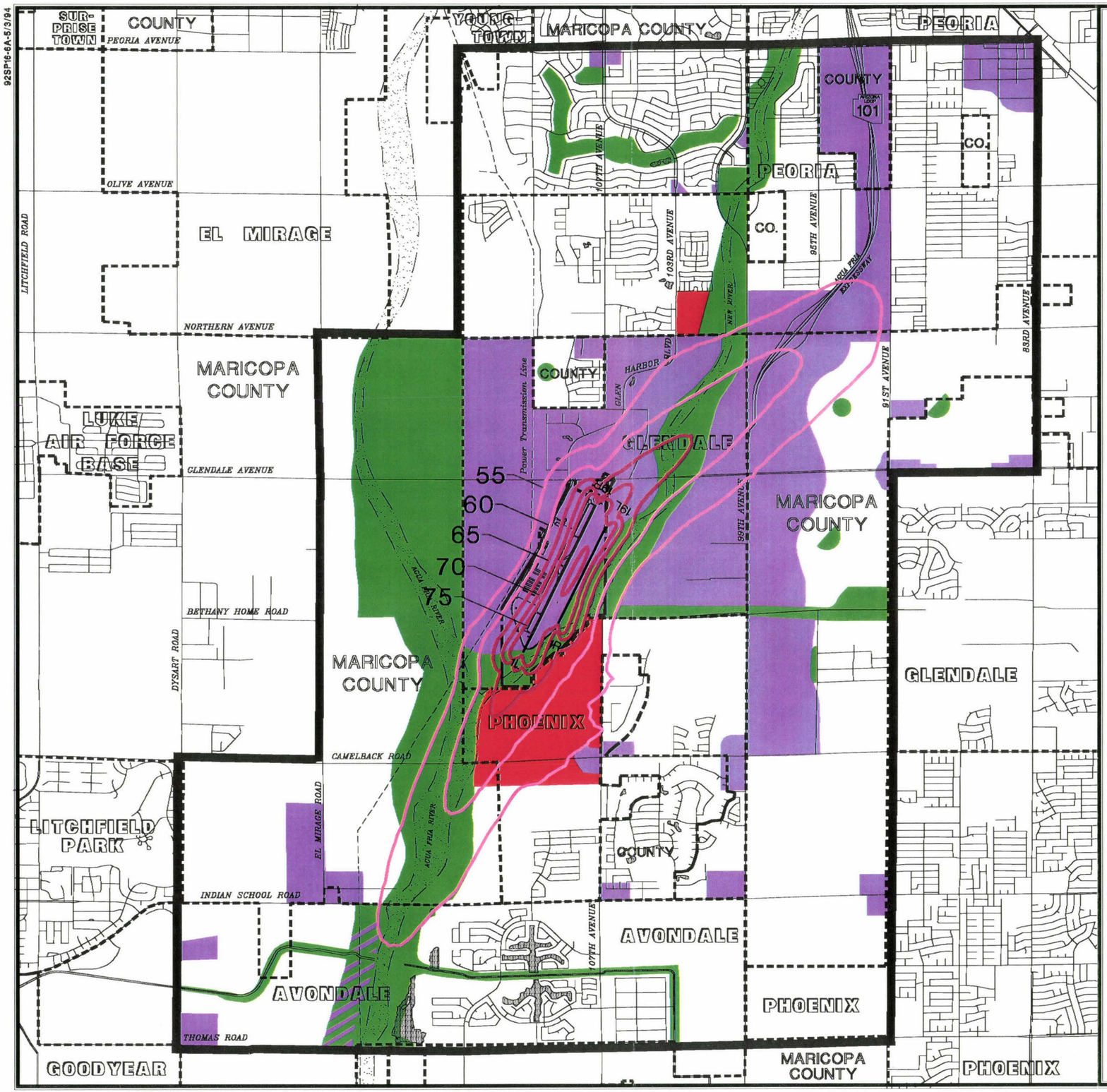

Exhibit 6A
GENERAL PLAN AMENDMENT CONSIDERATIONS

LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- Land Use Compatibility Planning Contour[1] - Marginal Impact
- Land Use Compatibility Planning Contour[1] - Significant Impact
- Commercial, Industrial, or Office - Current General Plan Designation
- Parks and Open Space - Current General Plan Designation
- Amend General Plan - Residential to Commercial, Industrial, Office

[1] Based on 2015 Scenario D noise contours.

NORTH

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SCALE IN FEET

GLENDALE MUNICIPAL AIRPORT

In addition, as is typical to actively growing communities, developers are required to front the money for infrastructure improvements which are done to benefit their development project. This may also include off-site improvements such as water or sewer line expansions, as well as those located within the property boundaries.

The exception to these practices is the Maricopa Association of Governments Transportation Improvement Program (see Chapter One). This 5-year program includes the development of new highways in anticipation of future demand. Further development of the Agua Fria Expressway is anticipated to be included in updates of the program.

The Flood Control District of Maricopa County also operates under a capital improvement program. Projects funded through the CIP are prioritized based on numerical guidelines. Noise impacts to a given parcel are not considered under the existing prioritization system. The current CIP for the Flood Control District provides for the acquisition of the Camelback Ranch property and either the installation of flood control devices or the dedication of flowage easements. The long-term goal of the District would be to minimize their expenses on the project by selling the property after they complete their flood control measures.

- CONCLUSION

The capital improvement programs of the various jurisdictions are currently in keeping with their respective general plans. Also, capital projects are currently not necessary or commonly used to provide amenities to attract future residential or institutional development; these are typically provided by the developer.

The Flood Control District of Maricopa County should be approached to revise its prioritization system to consider environmental impacts from exterior sources, such as noise. By lowering the priority of noise-impacted parcels and leaving floodplains undeveloped, these areas can provide land use compatibility for the airport. Consideration should also be given for retaining the natural floodway for one mile north and one and a half miles south of the airport. This would accommodate the Land Use Compatibility Planning Scenario's noise contours and the areas experiencing the greatest number of overflights.

Discretionary Project Review

Discretionary project review involves the adoption of guidelines to ensure that noise compatibility issues are considered by planning boards and local governing bodies during the discretionary review of development proposals.

Planning commissions, zoning boards of adjustment, and local governing bodies are often required to use their own discretion and judgement in making recommendations and decisions on community development issues such as rezoning, subdivision applications, and proposed public improvement projects. The exercise of this discretion is constrained by the legal requirements of the applicable ordinances. In the case of noise compatibility planning, it may be appropriate to ensure that the development control ordinances are amended to clearly set forth requirements for ensuring noise compatible development. Where opportunities remain for planning

commissions, zoning boards of adjustment, and governing bodies to use their own discretion on development matters, it may be appropriate to adopt procedures ensuring the consideration of noise compatibility issues in their discretionary review of development proposals.

General plans can be used to establish criteria for reviewing future development proposals to ensure that overall goals and policies of the plans are maintained, while yet allowing for a certain amount of flexibility to respond to changing circumstances. Review procedures could be included in the general land use plans requiring that boards and commissions consider the impacts of aircraft noise on development proposals. By maintaining an awareness of this factor, the boards and commissions can help to avoid or reduce noise impacts. For example, areas of high aircraft noise tend to be located off the ends of a runway alignment. It is preferable to place amenities which would be likely to attract industrial and commercial development to these areas, as opposed to residential uses. If residential development is inevitable in that general area, then schools and detached single-family dwellings should be located out of the higher noise corridor, with linear parks and neighborhood commercial uses encouraged for the middle of the corridor.

- EVALUATION

This policy would result in the adoption of official guidelines to encourage planning staffs, land use boards and commissions, and local government officials to consider airport noise and predominant flight tracks when reviewing development proposals, conditional use permits, variance applications, and rezoning requests. The guidelines could be incorporated into community general plans or included within a separate policy document.

In implementing discretionary project review procedures, a simple checklist could be prepared, listing the important factors to consider in reviewing development proposals. This process would add little cost or administrative burden to the review process.

The following checklist criteria are suggested:

- Determine the sensitivity of the subject land use to aircraft noise exposure levels. Utilize the FAA Part 150 Land Use Compatibility Guidelines table for this purpose (Exhibit 4B), as modified for local application. (In the Glendale Municipal Airport area, uses considered noncompatible with noise above 65 DNL are considered only marginally compatible with noise between 55 and 65 DNL.)

- Advise the airport management of development proposals involving noise-sensitive land uses within the 55 DNL noise contour, or within any adopted noise overlay zone.

- Locate noise-sensitive public facilities outside the 55 DNL contour, where possible. Otherwise, encourage building construction to provide an outdoor to indoor noise level reduction of 25 decibels.

- Discourage the approval of rezonings, exceptions, variances or conditional uses which introduce noise-sensitive development into

areas impacted by aircraft noise exceeding 55 DNL.

- In large, mixed-use developments, locate open space, recreational areas and commercial areas toward the higher noise levels. Locate low-density, single-family detached dwellings as far from the airport noise as possible.

- Use the orientation, design, height and landscaping of noise compatible uses to the best advantage to screen residences located near the airport from ground noise.

- In buildings with mixed uses, place noise-sensitive activities on the side of the building opposite the airport and/or flight tracks.

With the exception of Glendale, no community within the study area is required to consider the proximity of the airport or aircraft overflights when reviewing development proposals. Implementation of such a policy would likely reduce noise impacts on future development.

- CONCLUSION

Avondale, Glendale, Phoenix, Peoria and Maricopa County should consider formally adopting airport land use compatibility guidelines for discretionary review of development projects. The guidelines would encourage planning and local government officials to further consider airport noise and land use compatibility needs when reviewing development proposals, conditional uses, variance applications, and rezoning requests within the 55 DNL noise contour. It would be appropriate to adopt these guidelines as part of the communities' general plans.

REGULATORY TECHNIQUES

Regulatory techniques are land use and development controls established through local legislation. These typically include: Compatible Use Zoning, Zoning Changes/Residential Density, Noise Overlay Zoning, Subdivision Regulations, Building Codes, Transfer of Development Rights, Environmental Zoning, and Fair Disclosure Regulations.

Compatible Use Zoning - Rezoning from Residential to Commercial/ Industrial

The most common zoning technique in noise compatibility planning is to eliminate residential zoning from the noise-impacted area and replace it with, for example, commercial, industrial, or open space zoning.

In some zoning ordinances, residential and other noise-sensitive uses are permitted in commercial or industrial districts. In Chapter One and Appendix B, the zoning ordinances for the cities of Glendale, Phoenix, Avondale, and Peoria, and for Maricopa County were summarized. These jurisdictions permit at least some noise-sensitive uses in commercial or industrial zoning districts, but, in general, they do not permit substantial residential development. Zoning areas in the vicinity of the airport for commercial or industrial use cannot guarantee, therefore, that all noise-sensitive uses will be avoided although, large-scale residential development would be effectively prohibited.

A potential limitation of compatible use zoning is the need to balance the supply of industrial and commercial-zoned land with demand. If the market for commercial or industrial land is weak, and if the property owners perceive that they are unable to develop or use their land, they can exert political pressure or, in extreme cases, sue in court to force rezoning of their land. This could occur if the total supply of commercial and industrial land vastly exceeds demand, or if the land which has been zoned for commercial and industrial use is not suited for that use because of site problems, such as poor access or inadequate water and sewer service.

In making rezoning decisions, the impact of the proposed zoning on the neighboring area must also be recognized. Problems can occur where the vacant land being considered for commercial or industrial zoning is near an established residential area. The residents may strongly object to the intrusion of non-residential uses into their neighborhood.

- EVALUATION

Glendale: Currently, land within the study area and within the jurisdiction of the City of Glendale is zoned either for commercial/industrial use or is zoned A-1 for agricultural use (see Exhibit 1J). The City considers A-1 a holding zone until the parcels are ready to be developed. Upon application for rezoning, the City relies on the designations called for within their approved general plan to determine the new zoning designation.

The A-1 zone does allow residential development at extremely low densities (40 acres per dwelling unit). It also allows schools, group homes, guest houses and living quarters for employees. A significant portion of this land is located within the New River floodplain.

Some of the land designated A-1 is located beneath the baseline annual 1994, 1999 and Land Use Compatibility Planning Scenario's 65 DNL noise contours. Based on the uses permitted in the zone, this area is currently available for the development of noise-sensitive land uses. Because of this, the City of Glendale should consider rezoning the parcel between the airport and the New River to M-1, Light Industrial (see **Exhibit 6B**). The agricultural use could continue as a legal nonconforming use, but no noise-sensitive land uses could be constructed on-site.

Future land uses, as provided for in the Glendale General Plan and Development Guide will provide for compatible land uses out to the Land Use Compatibility Planning Scenario's 55 DNL noise contour. These areas ultimately should be rezoned in accordance with the General Plan as shown in **Exhibits 6A** and **6B**. This, in combination with a noise overlay zone (discussed below), should be sufficient to protect noise-sensitive uses between the 55 and 65 DNL contours without requiring further rezonings.

Phoenix: Zoning within the City of Phoenix and within the base case 55 DNL noise contour is currently residential and planned community (PC). Uses proposed within the two PC's (Camelback Ranch and D-C Ranch) are predominantly single-family detached residential with some commercial located on the west corners of Camelback Road and 107th Avenue.

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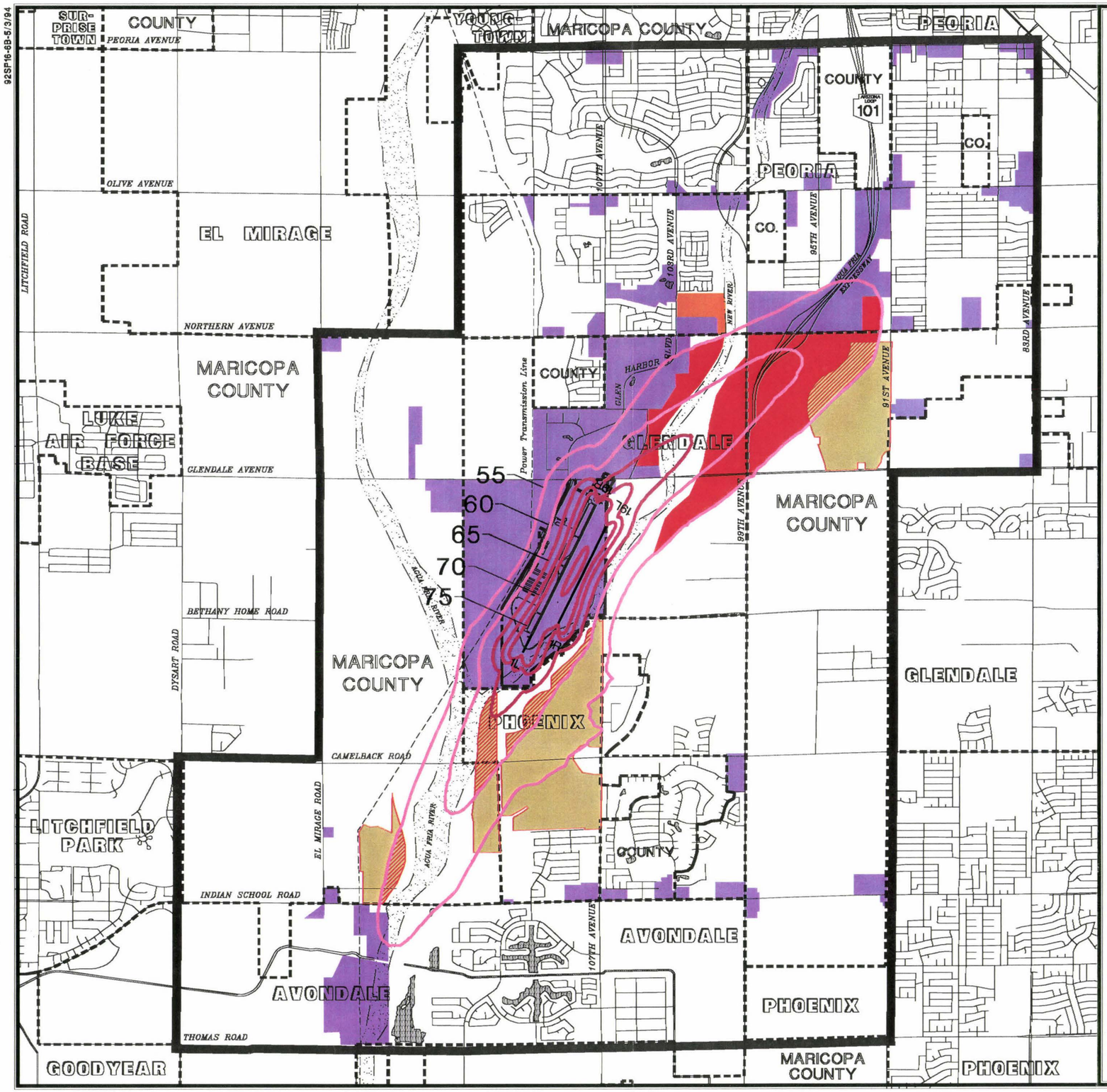

Exhibit 6B
ZONING AMENDMENT
CONSIDERATIONS

LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- Land Use Compatibility Planning Contour[1] - Marginal Impact
- Land Use Compatibility Planning Contour[1] - Significant Impact
- Commercial, Industrial - Current Zoning Designation
- Rezone to Commercial, Industrial, or Office - per General Plan
- Rezone to Commercial, Industrial, or Office
- Planned Unit Development
- Dwellings
- Open Space

[1] Based on 2015 Scenario D noise contours.

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Both of these developments require an extension of their PC approval.

According to the Land Use Compatibility Planning Scenario, the 60 DNL noise contour is expected to extend over the northwest edge of the Camelback Ranch PC. The anticipated 55 DNL noise contour extends over the eastern and southern portion of the Camelback Ranch property. In addition, given their locations, these properties experience a number of overflights from aircraft flying within the airport's air traffic pattern.

In the previous section discussing General Plan changes, the redesignation of the Camelback Ranch area from residential to commercial, industrial, or office use was suggested. After the General Plan was changed, the area could then be rezoned accordingly. From a noise compatibility perspective, this would be an ideal solution. Given the existing and forecast noise levels and flight tracks over the Camelback Ranch area, residential development is strongly discouraged. The outdoor lifestyle typical of Valley of the Sun residents would be impacted by cumulative aircraft noise and frequent overflights.

Local planners, however, indicate the Camelback Ranch project has developed tremendous momentum and, from a practical viewpoint, the property is not likely to be rezoned. In such a case, other zoning options should be investigated to reduce the potential for land use conflicts at Camelback Ranch. These are discussed in later sections on residential density changes and noise overlay zoning.

Avondale: Because the Land Use Compatibility Planning Scenario's 55 DNL noise contour extends only over the Agua Fria River floodplain in Avondale, and the area is designated for future open space, no zoning amendments are considered necessary.

Peoria: The City of Peoria is located outside of the modelled 1994 and 1999 55 DNL noise contours. Under the Land Use Compatibility Planning Scenario, however, the 55 DNL does extend over Northern Avenue from the New River east to 91st Avenue. Current zoning of this area provides for Intermediate Commercial (C-2), Planned Light Industrial (PI-1), Office (O-1), and General Agriculture (AG) land uses.

The City of Peoria should retain the commercial, light industrial, commercial, and office zoning in this area.

In addition, the City should consider rezoning a portion of a parcel northeast of 103rd and Northern Avenue RMH-2 (recreational vehicle resort) to a non-sensitive land use such as commercial, office or industrial (see **Exhibit 6B**). In addition to being more compatible with the airport and aircraft overflights, this land use would also be compatible with the future land uses of adjacent properties in both Peoria and Glendale. This RMH-2 parcel is of particular concern because the City is experiencing a trend to rezone these parcels to straight residential uses of medium to high densities. (This area was also discussed in the previous section on general plan changes.)

Maricopa County: Land under the jurisdiction of Maricopa County and affected by aircraft noise associated with Glendale Municipal Airport is located on both the north and south ends of the Land Use Compatibility Planning Scenario's 55 DNL noise contour. This

land is currently zoned Rural-43 which allows for a variety of noise-sensitive land uses including residences, churches, group homes, and schools.

According to the County Zoning Ordinance, the principal purpose of the R-43 zoning district is to conserve and protect farms and other open land uses. When government facilities and services, public utilities and street access are available, or can reasonable be made available, however, the County will look favorably on requests to rezone these areas to any single-family residential zoning district. According to existing County policy, the County will consult with that jurisdiction likely to annex the area in the future. In this instance, this means Glendale for the area on the north side of the airport and Phoenix for the area on the south side.

- CONCLUSION

As depicted on Exhibit 6B, the cities of Glendale, Phoenix, and Peoria should consider rezoning several parcels of land from ones that provides for residential land use to ones that provide for uses more compatible with the airport and frequent aircraft overflights. Rezoning to provide for residential use, particularly at densities greater than already provided for, should be discouraged.

Zoning Changes - Residential Density

Another way of using conventional zoning to promote noise compatibility is to reduce the potential number of future residents in the high noise areas rather than preventing residential development altogether. This can be done by reducing the permitted housing densities in the noise-impacted areas. As a second-best approach, this should be considered only where compatible use zoning is not feasible.

Large-lot zoning is sometimes used as a "holding zone" in areas that are not considered ready for development. The zoning is intended to keep development at a minimum until such time as public facilities to support quality development are in place.

While there are obvious benefits in rezoning an area to reduce the potential number of people exposed to aircraft noise, the approach has limitations. Single-family homes appear to be more noise-sensitive than high-density, multi-family structures. It is possible that zoning for higher densities, rather than lower densities, could enhance land use compatibility if only the least noise-sensitive structures were permitted in the area. In general, the greatest incompatibility problems arise with medium-density, one and two-family developments. Actions either to reduce the density of single-family homes or to switch to high-density, multi-family use could be equally beneficial. Significant increases in residential densities very near the airport or extended runway centerlines should be avoided, however, to guard against the remote risk of aircraft accidents.

Planned Unit Development (PUD) is another technique which combines many of the benefits of large-lot zoning. It allows development without having to follow the standard lot layout and siting requirements of the zoning ordinance. Planned unit developments can involve the clustering of buildings and the reservation of open space, as long as the overall dwelling unit density in the development is basically the same as the

density permitted in the underlying zoning district. In addition, a variety of housing types, including townhouses, apartments and condominiums are often permitted.

- EVALUATION

Glendale: Based on the Land Use Compatibility Planning Scenario, some land designated for residential use in Glendale's planning area south of Northern Avenue and west of 91st Avenue will be impacted by noise above 55 DNL. The affected area is part of a large expanse of undeveloped land. It would be appropriate for Glendale to encourage planned unit development of this area. Specifically, the area within the 55 DNL contour should be reserved for open space or support facilities which are not noise-sensitive (such as parking lots). Dwellings should be clustered in areas not exposed to noise above 55 DNL. This is shown in Exhibit 6B.

Phoenix: According to the City of Phoenix's adopted future land use plan, the area closest to Glendale Municipal Airport is designated for very-low density residential development (see Exhibit 1H). This provides for a maximum of 2 dwelling units per acre. Further south and east the Plan calls for densities of from 2 to 5 dwelling units per acre. Zoning for most of the area affected by the Land Use Compatibility Planning Scenario's 55 DNL noise contour is currently dependent on one outstanding, approved Planned Community (PC), or PUD -- Camelback Ranch.

Located immediately south of the airport along both the existing and proposed runway centerlines, Camelback Ranch is directly below the airport's air traffic pattern and is, therefore, subject to greater DNL noise levels and a number of overflights. Portions of this development fall below the existing 55 and 60 DNL noise contours. Virtually all of the development will be located within the Land Use Compatibility Planning Scenario's 55 DNL noise contour. According to the most recently approved PC plan (dated November 1989), the City has approved a variety of densities within this development, from a low of 3.5 to a high of 22 units per acre. Generally, lower densities (from 3.5 to 4.36 units per acre) are proposed on the north end of the development with higher densities (from 5.3 to 22 units per acre) located further south. The City is currently considering whether to extend the approval for the development plan for Camelback Ranch.

Prior to extending the PC approval for Camelback Ranch, the City should apply the discretionary project review guidelines which were previously discussed, to the proposals. The City should also consider utilizing the densities described in the approved General Plan, thereby reducing the number of residences constructed off the south end of the runway. The City should seriously consider prohibiting the construction of homes within the Land Use Compatibility Planning Scenario's 60 DNL noise contour. It should also consider prohibiting the development of homes immediately along the runway and parallel runway alignments, possibly relocating these units elsewhere in the development. These areas should be reserved for open space or support facilities which are not noise-sensitive.

Two other unincorporated areas within the Phoenix planning area should be considered for planned unit develop-

ment. One is immediately west of Camelback Ranch and east of the Agua Fria River. The northern part of this area is within the 60 DNL contour based on the Land Use Compatibility Scenario. It would be appropriate for this area to be reserved for open space, with the dwellings clustered on the south part of the tract, as shown in **Exhibit 6B.**

The other area is west of the Agua Fria River, east of the power transmission lines, on the north side of Indian School Road. If this area is proposed for rezoning and residential development, planned unit development would be appropriate. The eastern edge of the tract within the 55 DNL contour could be reserved for open space with the housing clustered on the west side of the tract, as shown in **Exhibit 6B.**

In considering and reviewing future PC's or other residential development proposals, the City should utilize discretionary project review guidelines to ensure that noise impacts are considered and mitigation options are evaluated.

Avondale: Because the Land Use Compatibility Planning Scenario's 55 DNL noise contour extends only over the Agua Fria River floodplain in Avondale and the area is designated for future open space, no zoning amendments were considered necessary.

Peoria: No specific density reductions are recommended for land within the City of Peoria.

Maricopa County: According to the County Zoning Ordinance, Rural-43 provides for one residence per acre, an acceptable density as it limits the number of residences potentially impacted by noise; however, Rural-43 also encourages the rezoning of the land for higher residential densities, allowing up to seven units per acre. Maintaining the density at one unit per acre is preferable to approving any higher densities.

Because residential development at higher densities would require a zoning amendment, the County should utilize the discretionary project review guidelines to ensure that noise impacts are considered and mitigation options are evaluated first. Planned unit development, as discussed for Phoenix and Glendale, should be seriously considered if the areas within the 55 DNL contour are proposed for rezoning and development before being annexed.

- CONCLUSION

Special policies to promote large lot zoning within the Land Use Compatibility Planning Scenario's 55 DNL noise contour are needed for the City of Phoenix and Maricopa County. Given that the Camelback Ranch approval is up for review, the City should take this opportunity to utilize the proposed discretionary project review guidelines and make further efforts to reduce development densities, consistent with the approved General Plan.

Maricopa County should also apply the discretionary project review guidelines and implement a policy to maintain the one dwelling unit per acre density of the Rural-43 zoning district and discourage the rezoning of these parcels within the Land Use Compatibility Planning Scenario's 55 DNL noise contour.

The use of PUDs should be considered in selected locations by Glendale,

Phoenix, and Maricopa County to direct housing to quieter parts of large tracts, reserving the loudest areas for open space and support facilities which are not noise-sensitive.

Noise Overlay Zone

Overlay zoning is an increasingly common zoning technique. It is intended to provide a layer of special purpose regulations to address special environmental constraints or problems, setting performance standards to protect the public. Overlay zoning involves the creation of one or more special zoning districts, based on boundaries such as noise contours, supplementing the regulations of the general purpose zoning districts.

Airport noise overlay zoning is used around many airports in the country to establish land use controls to protect the public's health, safety and welfare from conflicts which may arise between aviation and urban development issues. For example, these controls are often used to regulate the height of structures within runway approach areas and in other areas near an airport. They are also used to promote development which is compatible with aircraft noise levels. By its establishment, the underlying zoning is supplemented by the requirements of the overlay zone. In other words, the land within the overlay zone is subject to the requirements of two zoning districts; the strictest requirements of the combined zones apply to the affected property. This is similar to what occurs with floodplain zoning, only relating to airport noise.

Airport noise overlay zoning is intended to avoid the problems associated with incompatible development in high noise areas. Regulations in noise overlay zones can prohibit noise-sensitive uses, as long as the underlying zone permits enough other land uses to provide an opportunity for the economically viable use of the land. The regulations also can require sound insulation in the construction of noise-sensitive uses.

The boundaries of noise overlay zones are usually based on the critical noise contours based on local perceptions -- often the 65, 70 and 75 DNL contours, but with increasing emphasis on the 60 and, sometimes, the 55 DNL contours. The boundary may follow the actual contours, or, for the sake of simplified administration, nearby streets, property lines, or natural features.

Airport noise overlay zoning can be administered by the local land use regulatory agency. In areas where noise crosses several jurisdictional boundary lines, as occurs here, it is important for the various jurisdictions to cooperate and implement a unified approach to airport land use compatibility.

Among the advantages of noise overlay zoning are the simplicity of the required amendments, the simplicity of administration, the clear relationship of the regulations to their purpose, and the minimum impact of the noise overlay regulations on the application of the zoning ordinance in other parts of the community.

- EVALUATION

- Regulatory Structure

The only community with noise overlay zoning is the City of Glendale; however, while the City has an ordinance on the books, it has yet to adopt the

corresponding amendment to the zoning map, which is necessary for its implementation. The Airport Impact Overlay districts (AIO) are intended to provide for interior noise level reductions of from 20 to 30 decibels where noise levels exceed 65 DNL. The AIO ordinance does not restrict land uses within the four overlay districts. These districts are defined as: between the post 2010 65 and 70 DNL noise contours, between the post 2010 70 and 75 DNL noise contours, within the post 2010 75 DNL noise contour, and within the runway and proposed parallel runway clear zones.

The Cities of Avondale, Glendale, Phoenix and Peoria, and Maricopa County should all consider adopting airport noise overlay zoning within the 55 DNL noise contour. Each jurisdiction has zoning authority which would make this possible. Adoption of such zoning, which would apply to noise-sensitive land uses within the Land Use Compatibility Planning Scenario's 55 DNL noise contour, would primarily affect sections of Glendale and Phoenix, and small portions of Avondale, Peoria, and Maricopa County.

Within the Glendale Municipal Airport study area, the noise overlay zoning could be useful in preventing non-residential, noise-sensitive uses from being developed in noise-impacted areas of the participating communities. For example, overlay zoning could be used to prohibit selected noise-sensitive uses that would otherwise be permitted (e.g. schools, nursing homes, mobile homes, and amphitheaters). Other noise-sensitive uses could be conditionally permitted; for example, housing could be permitted if it was sound-insulated. Such zoning would supplement the standard zoning requirements of the five jurisdictions. The dedication of noise and avigation easements to the airport should also be considered for new development within the noise contours. In built-up areas, these regulations could apply to new construction or major remodeling projects.

- Establishing Overlay Zoning Boundaries

As depicted in **Exhibit 6C**, adoption of a noise overlay zoning district within the 55 DNL noise contour would mostly affect the cities of Glendale and Phoenix, in addition to some of Avondale, Peoria, and Maricopa County.

Prior to adopting the overlay zoning, a determination needs to be made as to which noise abatement scenario should be used as the basis for the district boundaries. A review of the noise contours presented in Chapter Five of this study shows that changes in the contours are possible over time.

Problems of a political and practical nature could result from planning to enlarge district boundaries in the future. For example, property owners who have been outside the overlay zoning boundaries may be planning to develop their land; a sudden change in the boundaries may significantly affect their plans. It is also possible that development, which would otherwise have been prohibited had the overlay zoning regulations been in place, could occur in the area before the overlay zoning boundaries are changed, thereby defeating the value and purpose of the overlay zone.

If noise overlay zoning is to be effective in promoting long-range land use compatibility, the boundaries should be

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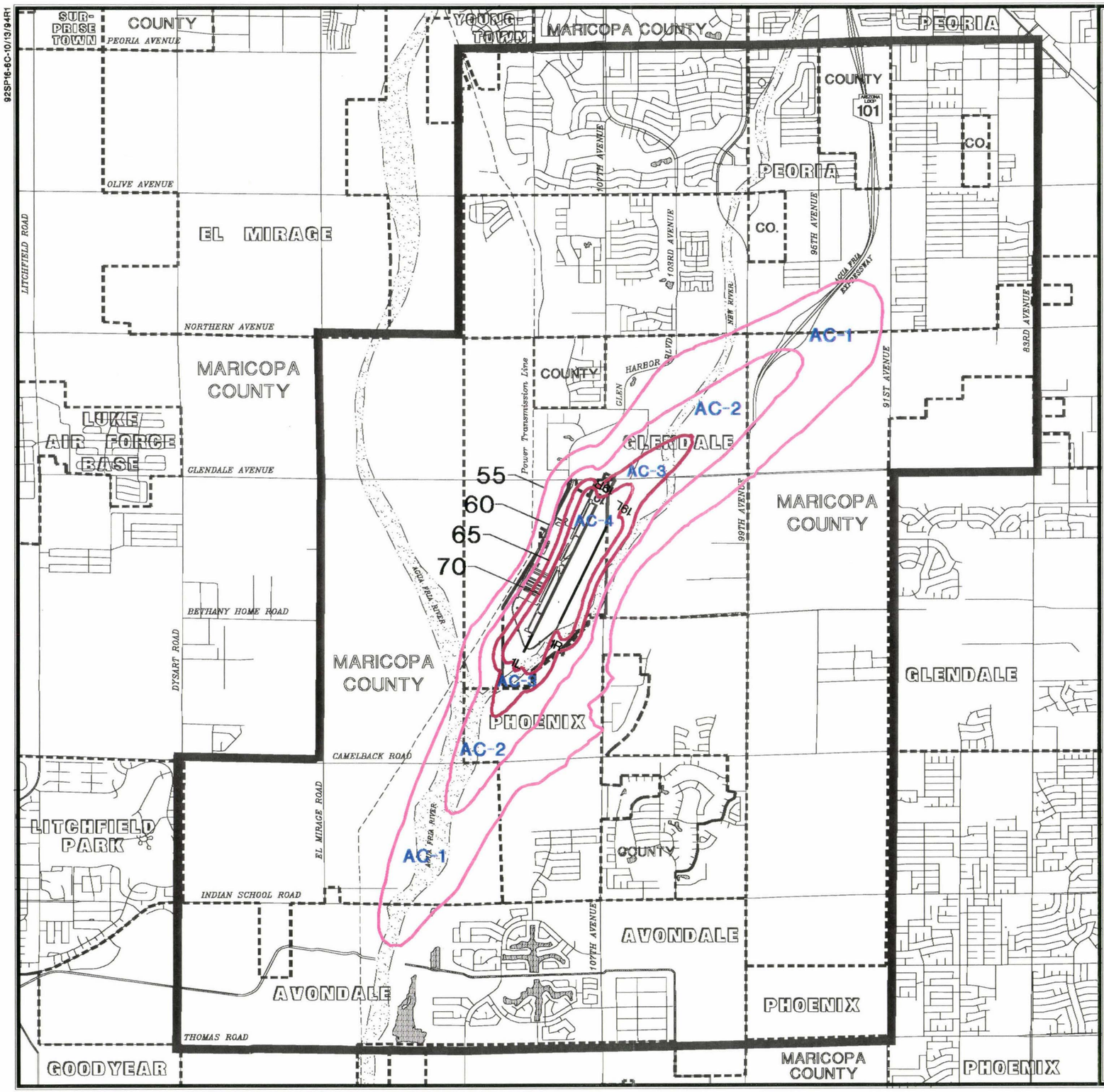
Exhibit 6C
POTENTIAL NOISE OVERLAY ZONING DISTRICTS



LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- Potential Land Use Compatibility Planning Contour[1] - Marginal Impact
- Potential Land Use Compatibility Planning Contour[1] - Significant Impact
- **AC-1** Airport Noise Overlay Zone 55 - 60 DNL
- **AC-2** Airport Noise Overlay Zone 60 - 65 DNL
- **AC-3** Airport Noise Overlay Zone 65 - 70 DNL
- **AC-4** Airport Noise Overlay Zone 70+ DNL

[1] Based on 2015 Scenario D noise contours.

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as large as possible and accommodate the range of likely alternative futures. As it becomes clear that certain alternative futures have been precluded from implementation, the boundaries of the overlay district can then be amended. This method increases the chance that all critical areas around the airport will be appropriately protected. It also increases the probability that future changes to the zoning boundaries will reduce the area being regulated, and not increase it.

The initial noise overlay zoning district boundaries could be based on the Land Use Compatibility Planning Scenario's noise contours. Because the airport is expected to experience a significant increase in operations over what occurred in 1993 and what is expected to occur in 1999, it is important to base the district boundaries on the largest, foreseeable noise condition. Utilizing the Planning Scenario's noise contours would ensure that developments which may be affected by future aircraft noise are developed appropriately.

Four airport compatibility (AC) districts could be developed: AC-1, AC-2, AC-3 and AC-4. AC-1 would apply to the land area between the 55 and 60 DNL noise contours, AC-2 would apply to the area between the 60 and 65 DNL noise contours, AC-3 would apply to the area between the 65 and 70 DNL noise contour, and AC-4 would apply to the area within the 70 DNL noise contour. Within the first and second districts, avigation easements could be required to be granted to the Glendale Municipal Airport. Within the second, third and fourth districts, easements and sound attenuation measures for noise-sensitive land uses could be required to achieve an outdoor to indoor noise level reduction of 25 decibels. These sensitive land uses are depicted in **Table 6C** which provides model land use compatibility standards. Some sensitive land uses, among them residential, schools and nursing homes, could be prohibited within the AC-3 and AC-4 overlay districts.

Exhibit 6C shows the potential airport noise overlay zoning districts boundaries based on the Land Use Compatibility Planning Scenario's noise condition.

- Potential Land Use Regulations

The City of Glendale could revise its existing overlay zone to provide for the new overlay district boundaries. In addition, **Table 6C** could be included in the ordinance to provide land use compatibility standards applicable to the AC-1, AC-2, AC-3, and AC-4 districts. The existing Airport Impact Overlay zoning district is intended to address future, industrial and commercial land uses and does not account for some noise-sensitive land uses which are permitted under the existing zoning designations in the area. With the inclusion of **Table 6C**, these uses would be addressed. The boundaries of the new overlay zoning districts could be added to the City's official zoning map.

TABLE 6C
Potential Land Use Compatibility Standards
For Airport Noise Overlay Zone

		Overlay Zones/DNL Levels			
SLUCM No.	Land Use Name	AC-1 55-60	AC-2 60-65	AC-3 65-70	AC-4 70+
10	**Residential**				
11	Household Units				
11.11	Single Units - detached	Y[1]	Y[2]	N	N
11.12	Single Units - semi-detached	Y[1]	Y[2]	N	N
11.13	Single Units - attached row	Y[1]	Y[2]	N	N
11.21	Two Units - side by side	Y[1]	Y[2]	N	N
11.22	Two Units - one above the other	Y[1]	Y[2]	N	N
11.31	Apartments - walk up	Y[1]	Y[2]	N	N
11.32	Apartments - elevator	Y[1]	Y[2]	N	N
12	Group Quarters	N	N	N	N
	Elderly board and care facilities	N	N	N	N
13	Residential Hotels	N	N	N	N
14	Mobile Home Park or Courts	N	N	N	N
15	Transient Lodgings	Y	Y[3]	Y[3]	N
16	Other Residential	N	N	N	N
20	**Manufacturing**				
21	Food and Kindred products - manufacturing	Y	Y	Y	Y[3]
22	Textile mill products - manufacturing	Y	Y	Y	Y[3]
23	Apparel and other finished products made from fabrics, leather, and similar materials - manufacturing	Y	Y	Y	Y[3]
24	Lumber and wood products (except furniture) - manufacturing	Y	Y	Y	Y[3]
25	Furniture and fixtures - manufacturing	Y	Y	Y	Y[3]
26	Paper and allied products - manufacturing	Y	Y	Y	Y[3]
27	Printing, publishing, and allied industries	Y	Y	Y	Y[3]
28	Chemicals and allied products manufacturing	Y	Y	Y	Y[3]
29	Petroleum refining and related industries	Y	Y	Y	Y[3]
31	Rubber and misc. plastic products - manufacturing	Y	Y	Y	Y[3]
32	Stone, clay, and glass products - manufacturing	Y	Y	Y	Y[3]
33	Primary metal industries	Y	Y	Y	Y[3]
34	Fabricated metal products - manufacturing	Y	Y	Y	Y[3]
35	Professional, scientific, and controlling instruments; photographic and optical goods, watches and clocks - manufacturing	Y	Y	Y	Y[3]
39	Miscellaneous manufacturing	Y	Y	Y	Y[3]
40	**Transportation, communication, and utilities**				
41	Railroad, rapid rail transit, transit and street railway transportation	Y	Y	Y	Y[3]
42	Motor vehicle transportation	Y	Y	Y	Y[3]
43	Aircraft transportation	Y	Y	Y	Y[3]

TABLE 6C (Continued)
Potential Land Use Compatibility Standards
For Airport Noise Overlay Zone

SLUCM No.	Land Use Name	Overlay Zones/DNL Levels AC-1 55-60	AC-2 60-65	AC-3 65-70	AC-4 70+
44	Marine craft transportation	Y	Y	Y	Y[3]
45	Highway and street right-of-way	Y	Y	Y	Y[3]
46	Automobile parking	Y	Y	Y	Y[3]
47	Communication -	Y	Y	Y	Y[3]
	TV and radio studios	Y	N	N	N
48	Utilities	Y	Y	Y	Y[3]
49	Other transportation, communication, and utilities	Y	Y	Y	Y[3]
50	**Trade**				
51	Wholesale trade	Y	Y	Y	Y[3]
52	Retail trade - building materials, hardware and farm equipment	Y	Y	Y	Y[3]
53	Retail trade - general merchandise	Y	Y	Y	Y[4]
54	Retail trade - food	Y	Y	Y	Y[4]
55	Retail trade - automotive, marine craft, aircraft and accessories	Y	Y	Y	Y[4]
56	Retail trade - apparel and accessories	Y	Y	Y	Y[4]
57	Retail trade - furniture, home furnishings, and equipment	Y	Y	Y	Y[4]
58	Retail trade - eating and drinking establishments	Y	Y	Y	Y[4]
59	Other retail trade	Y	Y	Y	Y[4]
60	**Services**				
61	Finance, insurance and real estate services	Y	Y	Y	Y[3]
62	Personal services	Y	Y	Y	Y[3]
62.4	Cemeteries	Y	Y	Y	Y[3]
63	Business services	Y	Y	Y	Y[3]
64	Repair services	Y	Y	Y	Y[3]
65	Professional services	Y	Y	Y	Y[3]
65.1	Hospitals, nursing homes	N	N	N	N
65.2	Other medical facilities	Y	Y	Y[3]	Y[3]
66	Contract construction services	Y	Y	Y	Y[3]
67	Governmental services -	Y	Y	Y	Y[3]
	Libraries	N	N	N	N
68	Educational services	N	N	N	N
69	Miscellaneous	Y	Y	Y	Y[3]
70	**Cultural, entertainment, and recreational**				
71	Cultural activities (including churches)	N	N	N	N
71.2	Nature exhibits	Y	Y	Y[3]	N
72	Public assembly	N	N	N	N
72.1	Auditoriums, concert halls	N	N	N	N
72.11	Outdoor music shells, amphitheaters	N	N	N	N
72.2	Outdoor sports arenas, spectator sports	Y	Y[5]	N	N
73	Amusements	Y	Y	N	N
74	Recreational activities (including golf courses, riding stables, water recreation)	Y	Y	Y[3]	Y[3]
75	Resorts and group camps -	Y	Y[3]	N	N
	Recreational vehicle parks	N	N	N	N
76	Parks	Y	Y	Y	N
79	Other cultural, entertainment	Y	Y	Y[3]	N

TABLE 6C (Continued)
Potential Land Use Compatibility Standards
For Airport Noise Overlay Zone

SLUCM No.	Land Use Name	Overlay Zones/DNL Levels AC-1 55-60	AC-2 60-65	AC-3 65-70	AC-4 70+
80	**Resource Production and extraction**				
81	Agriculture (except livestock)	Y	Y	Y	Y[6]
81.5 to 81.7	Livestock farming and animal breeding	Y	Y	Y	Y[6]
82	Agricultural - related activities	Y	Y	Y	Y[6]
83	Forestry activities and related services	Y	Y	Y	Y[6]
84	Fishing activities and related services	Y	Y	Y	Y
85	Mining activities and related services	Y	Y	Y	Y
89	Other resource production and extraction	Y	Y	Y	Y

NOTES

[1] Noise and avigation easements shall be granted to the City of Glendale as a condition of development approval.

[2] Sound attenuation measures to achieve an outdoor to indoor Noise Level Reduction (NLR) of 25 dB are required. Noise and avigation easements shall be granted to the City of Glendale as a condition of development approval.

[3] Measures to achieve an outdoor to indoor NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, sleeping areas, and other noise sensitive areas.

[4] Measures to achieve an outdoor to indoor NLR of 25 dB must be incorporated into design and construction of structure.

[5] Land use is compatible provided special sound reinforcement systems are installed.

[6] Residential buildings not permitted.

KEY

SLUCM	**Standard Land Use Coding Manual,** (U.S. Urban Renewal Administration and Bureau of Public Road, 1965, 1977).
Y(Yes)	Land Use and related structures are compatible without restrictions.
N(No)	Land Use and related structures are not compatible and shall be prohibited.
Y*(Yes with restrictions)	Land Use and related structures generally compatible; see notes 1 through 6.

The cities of Phoenix, Avondale, and Peoria, and Maricopa County could utilize the revised Glendale ordinance as a basis for developing and adopting noise regulations appropriate to their jurisdictions. By utilizing the same ordinance as a base, land use compatibility would be consistent within the airport impact area. This ordinance would provide for protection of noise-sensitive land uses through either the prohibition of the use, in AC-3 and AC-4, or through the required installation of noise attenuation measures to ensure that outdoor to indoor noise levels are reduced by 25 decibels. The ordinance also provides for interior noise level reductions for the office or reception areas of businesses located within AC-2, AC-3, and AC-4. These jurisdictions could also consider requiring the granting of a standard avigation easement and nonsuit covenant to the City of Glendale, in recognition of the airport's proximity.

- CONCLUSION

The current Airport Impact Overlay zone could be revised to reflect the larger noise contours and the additional consideration of noise-sensitive land uses. This ordinance could then be adopted by the cities of Glendale, Phoenix and Peoria and Maricopa County. Consideration should be given to having the Maricopa Association of Governments coordinate the adoption of the model ordinance.

Noise overlay zoning would be an effective way to promote land use compatibility in the airport area. Among its advantages are the relative simplicity of the required ordinance and the clear relationship of the regulations to their purpose. Such zoning would not involve significant costs to the general public and local governments, although it would put an additional administrative load on local zoning and building officials.

The regulations described in **Table 6C** are appropriate as a starting point in determining regulations for the study area. The zoning boundaries should be based on the noise contours developed for this noise compatibility study. In order to ensure long-term protection, they should be designed to cover the worst case noise exposure area, in this case the Land Use Compatibility Planning Scenario's noise condition.

Subdivision Regulations

Subdivision regulations control the platting of land by setting standards for site planning, lot layout and the design of utilities and public improvements. They can encourage compatible development around an airport by requiring the consideration of aircraft noise during the plat review by public officials. This might take the form of requiring further noise attenuation features in the design or a decrease or shift in the proposed population densities in portions of the development.

Subdivision regulations also can be used to inform prospective property owners of the risk of aircraft noise. In some communities, noise levels are shown on the final subdivision plats either by drawing the noise contours on the plats or by assigning noise levels to the lots. this makes the noise information a matter of public record. An important disadvantage is that, while the plat is recorded and on file forever, noise levels can change.

Another approach is to write a note on the plat, or record a covenant with the plat, stating that the property is subject to potentially disruptive aircraft noise and advising consultation with local planning officials and the airport proprietor to get current information about the noise situation. As a practical matter, however, buyers of property rarely look at the plats.

Subdivision regulations can help protect the airport from the risk of noise damage suits while providing for notice to potential buyers of property by requiring, as a condition of subdivision approval, the dedication of noise and avigation easements and non-suit covenants in high-noise areas. This is similar to requirements for the dedication of street right-of-way or utility easements usually found in subdivision regulations.

An easement is a limited right to use property owned by another. A noise and avigation easement gives the airport,

as owner of the easement, the right to direct aircraft over the property and thus to make noise. These easements serve notice that the property is subject to significant aircraft noise which may, at times, infringe on a resident's enjoyment of property and may, depending on the degree of acoustical treatment of the dwelling and the individual's sensitivity to noise, affect his or her well-being. The easement should state clearly that noise levels might increase in the future and that flight patterns or operating times might change.

A noise and avigation easement often includes a covenant waiving the property owner's right to sue the airport proprietor for disturbances caused by aircraft noise. This protection from lawsuit is not intended to apply to any entity other than the airport proprietor.

- EVALUATION

Glendale, Phoenix, Peoria, and Avondale each administer subdivision regulations within their jurisdictions. Maricopa County has subdivision control in the unincorporated area. None of these jurisdictions include any specific requirements for the dedication of noise and avigation easements and the recording of notices describing potentially high noise levels on final plats.

While subdivision regulations offer only limited benefits for noise compatibility planning, they can help support a comprehensive program of noise compatibility regulations. For example, subdivision regulations could provide an efficient means of securing noise and avigation easements for an entire development at the time of plat approval. When easements are not granted until the application for building permits of individual dwelling units, the result is more time and administrative costs for building officials because the process is being repeated so often.

By applying to future land divisions within the individual noise overlay districts, subdivision regulations could be used to support noise overlay zoning. This is accomplished by ensuring that a notice describing the potential for noise disturbance is included in the official land record, thereby advancing the opportunity for full disclosure.

Subdivision regulations would be advisable if local jurisdictions wish to provide an extra measure of insurance to inform prospective property owners of the risk or potential for disturbing aircraft noise. The most appropriate measures to consider would be for the cities of Avondale, Glendale, Phoenix and Peoria, and Maricopa County to amend their subdivision regulations and require that final plats show the dedication of noise and avigation easements.

The easement, which would remain with the land, would declare that the property is subject to frequent aircraft overflights resulting in potentially high noise levels. Property owners would surrender their right to sue the airport proprietor for airport-related disturbances.

- CONCLUSION

The cities of Glendale, Phoenix and Peoria, and Maricopa County should consider amending their subdivision regulations to provide for the dedication of avigation easements for subdivisions

within the airport noise overlay zoning boundary.

Building Codes

Building codes regulate the construction of buildings, setting standards for materials and construction techniques to protect the health, safety and welfare of residents. These codes address structural concerns, ventilation and insulation, each of which influences the noise attenuation capabilities of a building. Building codes commonly apply to both new construction and major alterations.

Building codes can require sound insulation in the construction of noise-sensitive uses in areas subject to high aircraft noise levels. Although they are sometimes used within the 55 and 60 DNL, requirements for sound insulation customarily are applied within the 65 DNL with increasingly stringent standards in the 70 and 75 DNL contours. Most sound insulation code standards describe in detail the required improvements needed to achieve a given level of noise reduction. The building inspector must see that the improvements have been properly made. If so, the builder is presumed to have met the sound insulation target without being required to do any special noise measurement tests.

- EVALUATION

Building codes apply throughout the study area to ensure construction of safe buildings. The municipalities are responsible for building code administration within their corporate limits and Maricopa County is responsible for the unincorporated areas. All of the jurisdictions have adopted a version of the Uniform Building Code (UBC). While this code establishes uniform thermal insulation standards for new construction, it has no special sound insulation standards to provide protection from external noise sources. The cities of Glendale, Phoenix and Peoria, and Maricopa County could consider amending building codes to require soundproofing for new homes and noise-sensitive uses within the 60 DNL noise contour.

While the zoning proposals discussed previously would greatly reduce the risk of future noise-sensitive development in the study area, special sound insulation measures may be appropriate in the event that scattered noise-sensitive development should occur. An outdoor to indoor noise level reduction of 25 decibels is recommended for all residences, classrooms, offices and reception areas. Where noise sensitive land uses are permitted within the 60 DNL noise contour, additional noise attenuation construction practices should be implemented to ensure aircraft noise is reduced by 25 decibels.

Amending the building code to provide noise attenuation would support the requirements of the proposed noise overlay zoning ordinance for the communities and county. The capability of the cities and the county to administer this is of critical importance and would require careful inspections and special training of building inspectors. Before implementing this technique, each city and the county would need to adopt local amendments to the Uniform Building Code currently in use.

Sound insulation standards would be an effective way to enhance land use compatibility in the airport area,

especially if used as part of a comprehensive land use management approach. The noise overlay zoning ordinance could declare which noise-sensitive uses should be sound-insulated within each noise overlay zone. The specific construction standards would be described in the building code. It would be the duty of the local building inspectors to ensure that sound insulation is properly installed.

The additional administrative burdens posed by sound insulation standards should not be severe. Local communities already have a building inspections process. It is possible that a need for additional inspections could increase the costs to local regulatory agencies. If so, these costs could be passed on to builders through inspection fees.

Sound insulation will cost local builders more than conventional construction. Most of the additional cost would be for acoustical windows. Other sound insulation construction techniques should result in only very minor, if any, cost increase as they involve primarily special installation techniques with a minimum of unusual or expensive materials. Of course, not only is a properly sound-insulated home quieter, it is also a highly energy efficient home. The additional costs are buying real value for the future homeowner; therefore, the additional costs of sound insulation may be able to be recouped through wise marketing.

There are a number of models to choose from in considering the specific sound insulation standards. These are discussed in the following sections.

Prescriptive Standards: The noise overlay zone could declare which noise-sensitive uses should be sound-insulated within each noise overlay zone. The specific construction standards would be described in the building code. It would be the duty of the local building inspectors to ensure that sound insulation is properly installed. As stated earlier, sound insulation will cost local builders more than conventional construction.

Flexible Code Standards: This alternative would describe the required "sound transmission class" (STC) rating of all building components. STC is a system for rating the effectiveness of partitions, floors, ceilings, windows, and doors in attenuating the transmission of sound. The ratings are determined through standardized laboratory tests of sound transmission at various frequencies. The higher the STC rating, the better the sound reduction. A builder would be free to use any materials desired as long as evidence is provided that the required STC rating has been met.

Jurisdictions desiring to undertake such an approach should retain the assistance of a qualified acoustical engineer in drafting the standards. The objective of the regulations should be to specify the STC ratings of various building components needed to achieve an overall noise level reduction of 25 decibels, depending on the noise contour where the proposed development is located.

Performance Standards: A performance-based standard would focus on the final result to be achieved by the construction. The standard would describe the required level of outdoor to indoor noise reduction. The builder could use any materials or techniques he desires as long as he can certify that the plans and final

construction meet the standard. This would require the assistance of an acoustical engineer in designing the building and checking construction. It would also require testing of the building after construction.

The performance standards could be set in the zoning ordinance and would be particularly easy to administer in the case of conditional uses, special uses and planned developments. These kinds of developments are already subject to special reviews and performance standards.

The advantage of this approach is that the builder has the flexibility to design the building as he deems best. It also avoids the complexity of drafting, adopting, and administering special sound insulation building code amendments. In addition, verification of compliance with the requirements is the responsibility of the builder and his engineer. The disadvantage is that the cities and county would have to verify the certifications made by the builder and the engineer. Builders also may lack confidence in regulations which are subject to case-by-case verification and approval.

- CONCLUSION

Building code amendments setting sound insulation standards for use within noise overlay zones should be considered by the cities of Avondale, Glendale, Phoenix and Peoria, and Maricopa County.

Transfer of Development Rights

Land ownership actually includes a number of rights to the use of that land, including rights of access, mineral rights, rights to the airspace above the land, and rights to develop the land. Transfer of development rights (TDR) is based on the idea that each right has a market value which can be separated and sold without selling the entire property.

TDR was developed as a way to preserve environmentally important areas without having to buy them with public funds. The technique begins by dividing the municipality into sending and receiving zones. The sending zones are areas where environmental preservation and minimal development are desired, and the receiving zones are areas where additional development is desired. Development rights, measured in terms of development density, are assigned through the zoning ordinance. If developers in the receiving areas can get additional development rights, they are allowed to build to higher densities than normally allowed by the zoning ordinance. They would buy these rights from landowners in the sending zones. In this way, the public can benefit from preserving environmentally valuable land, the owner of that land can be paid for preserving it, and developers can reap higher profits.

Based on experience with these programs around the country, several conditions for the successful use of TDR have been identified. The receiving districts must be capable of immediate development, the regulatory process must have integrity and be trusted by developers, the regulatory agency must be able to inform and help property owners and developers, and programs must be as simple as possible and facilitate the self-interest of all involved parties. (See "Making TDR Work," by Peter J. Pizor, in the *Journal of the*

American Planning Association, Vol. 52, No. 2, Spring 1986.)

A variation of TDR is Density Transfer Zoning. This allows the developer of several large tracts of land to move the allotted densities among the tracts to reduce densities in areas worthy of preservation. This differs from TDR because only one owner is involved in the transfer, and a system for sale and purchase of development rights is not required. Density transfer zoning often can be achieved through creative use of the planned unit development process. In rapidly growing areas with large amounts of vacant land, TDR can be an effective tool for airport land use compatibility planning. At no cost to the taxpayers, it can neatly deal with the problem of what to do with land in high noise zones when there are no practical alternatives to residential development.

- EVALUATION

TDR would not be considered a practical land use alternative as it is a very complicated technique that is very difficult to fully justify for the purposes of airport land use compatibility alone. If jurisdictions in the study area decide to consider the technique in the future, they would do well to include airport compatibility criteria with other environmental criteria when designing the program.

- CONCLUSION

TDR does not appear to be appropriate in the study area for the purposes of airport noise compatibility alone. Because there are no independent local efforts underway to implement a TDR scheme in the study area, the technique will not be considered further as part of the Noise Compatibility Study.

Environmental Zoning

Special zoning regulations to preserve environmentally sensitive areas or protect development from environmental hazards also can promote land use compatibility near airports. Floodplain overlay zoning, which restricts or prohibits development in all or part of the floodplain, is the most common form of environmental zoning. Other environmental zoning regulations may include steep slope zoning, requiring low development densities and special construction standards, wetland preservation zoning, also limiting densities and regulating the design of drainage facilities, and groundwater recharge zones, limiting building densities and lot coverage. All can be used to restrict the development of noise-sensitive uses in environmentally sensitive areas that are also impacted by aircraft noise.

- EVALUATION

Most of the jurisdictions in the study area deal with some form of environmental zoning to protect sensitive land areas. For example, Maricopa County and the City of Phoenix have enacted hillside development standards, and Peoria administers a floodplain protection district. These regulations tend to have the effect of discouraging development in these sensitive land areas. To the extent that areas covered by these regulations coincide with noise-impacted areas, the regulations tend to support airport compatibility.

The Flood Control District of Maricopa County was established to protect property from flood damage. Sometimes the construction of flood control measures makes land developable which otherwise would have remained within a flood hazard area. This is not always in keeping with either environmental planning or resource protection. More and more often, the unique ecosystems that exist along rivers are being preserved in their natural state. The value of preserving floodplains to provide flood protection is also being given greater weight. Dikes can, and do, often fail, inundating acres of developed land and causing thousands or even millions of dollars worth of damage. Had the dikes never been built, it is possible the development would not have occurred.

The Flood Control District should consider adopting a floodplain preservation policy for the undeveloped portions of the Agua Fria and New Rivers which would encourage the protection of existing floodplains and the unique habitat they provide. The application of a floodplain preservation policy in the study area would protect from development a significant amount of land which experiences or will experience high noise levels and frequent overflights.

- CONCLUSION

Various forms of environmental zoning regulations are already being used in the area. Further use of environmental zoning regulations to support airport land use compatibility will not be considered in this study beyond those that are already in existence. The Flood Control District of Maricopa County should consider adopting a floodplain preservation policy which would provide flood protection and preserve existing floodplains from development.

Fair Disclosure Regulations

Fair disclosure regulations are intended to ensure that prospective buyers of property are informed that the property is or will be exposed to potentially disruptive aircraft noise. It is not uncommon around even major airports for newcomers to report having bought property without having been informed about airport noise levels.

At the most formal level, fair disclosure can be implemented through regulations requiring the seller or his agent to provide a notice of aircraft noise exposure on the real estate listing sheet and at the time that a sales contract is executed. In addition, any easements should be revealed at the time of closing. Although these measures are intended to protect buyers of property from being unaware of aircraft noise, a potential problem is that they can be difficult to enforce.

For example, fair disclosure regulations can place a serious responsibility on real estate agents and lenders. It is important that they understand something about aircraft noise and land use compatibility issues. Because of the complexity of these subjects, real estate agents and lenders may be concerned about making errors in explaining the aircraft noise situation to their clients. They may fear the risk of dampening sales, harming customer relations, or of being sued for failure to properly carry out their assigned role.

If the regulations are properly drafted, however, the responsibilities of real

estate agents and sellers should be clearly defined and should be limited to simply making the disclosure of airport noise levels affecting the property. It should not be their legal responsibility to explain the meaning of these noise levels nor to predict a buyer's reaction to the noise level.

Fair disclosure regulations also can disturb existing property owners within a noise-impacted area. They may fear that the regulations, by drawing special attention to the noise environment, would make it difficult to sell their homes and lower their property values. In these situations, a fair disclosure program may have to be coupled with a compensatory program (such as sound insulation or the purchase of avigation easements) to be acceptable.

Another approach would require the dedication of avigation easements as a condition of development approval within high-noise areas. A more limited approach to fair disclosure is to require the recording of a notice with the plats of new subdivisions in the noise-impacted area. It would identify the subdivision as potentially impacted by aircraft noise and would advise that local planners and airport officials be contacted for the most recent information about noise levels impacting the property. Another approach would require the dedication of avigation easements as a condition of development approval within high-noise areas. These approaches have been discussed above in the sections on noise overlay zoning and subdivision regulations.

It is also possible to try to achieve fair disclosure through voluntary programs rather than regulations. Assistance could be sought from local groups in the housing industry such as the Board of Realtors or Homebuilders Association and their ethics committees and local lending institutions. Voluntary disclosure programs also can be developed without involving the real estate and home financing agencies. Airport proprietors, for example, could send out information about the noise environment through occasional announcements, posting of public notices, or advertisements in the real estate sections of local newspapers.

- EVALUATION

As described above, there are basically four approaches to fair disclosure regulations.

(1) **Formal fair disclosure regulations involving adoption of laws regulating real estate transfers, and which require notice when homes are offered for sale.**

Fair disclosure regulations could be made to apply within the airport overlay zone or any other reasonable boundary. Property owners and real estate industry representatives often express concerns about the impact of fair disclosure ordinances on the values of existing homes. This implies that many prospective buyers would choose not to buy a home in the airport area if they knew in advance of the likely impact of aircraft noise on the property. The argument also implies that, without special regulations, this knowledge may be kept hidden from many prospective buyers.

The cities within the study area could consider adoption of formal regulations requiring sellers of property and their authorized agents to notify potential

buyers that homes may be impacted by aircraft noise.

Before implementing this technique, a determination would be needed regarding the legal authority of the local jurisdictions to enact such regulations. Even if the cities have the ability to adopt these regulations, enforcement can be difficult. It would require the establishment of a totally new enforcement and verification process.

(2) Require fair disclosure agreements and covenants as a condition of development approval within the noise overlay zone.

This would require developers to enter into an agreement with the respective city to notify prospective buyers of property of noise exposure in the area. The agreement would be a covenant running with the land; therefore, all future property owners would also have to disclose airport noise information when they offer the land for sale.

This approach would be appropriate within the study area and could be implemented through the subdivision regulations and the noise overlay zone regulations. Enforcement would be a private matter between buyer and seller. **Appendix G** depicts fair disclosure agreements and statements which could be incorporated into either local subdivision regulations or noise overlay regulations.

(3) Promoting fair disclosure by relying on the closing process of land use development/real estate transactions to reveal any easements.

Avigation easements must be revealed to buyers of property prior to closing the sale. This approach would simply rely on the land use development/real estate industry to facilitate its implementation.

(4) Informal fair disclosure procedures which rely on voluntary efforts.

Even if formal fair disclosure regulations cannot be adopted, it may be possible to enact a program of informal fair disclosure. Activities could include occasional presentations to mortgage lenders and real estate professionals and the provision of accurate materials to these groups. Signs posted in noise-impacted areas may be a way to guard against people unwittingly buying property in a noise-impacted area. Care should be taken in any such effort not to over-dramatize the noise problem, but to provide accurate and balanced information.

The Arizona Association of Realtors currently suggests property sellers and their listing agents complete a Sellers Property Disclosure Statement which is filed with the listing. Completion of the statement is not mandatory. The purpose of this document is to advise buyers of any known environmental issues which may affect the property, including noise. No specific information, such as noise levels, is required to be provided. Also, the individuals completing the form may not be sensitive to the airport noise and, therefore, may not note that such noise is an issue. Finally, because the statement is directed more toward disclosure regarding the house and property and less toward the community-at-large, some issues, such as highways, landfills and airports, receive little attention.

- CONCLUSION

Local jurisdictions within the study area should consider the second, third and fourth approaches to facilitate fair disclosure regulations. The first approach would be very difficult to enforce and, therefore, is not considered for further study.

EXPENDITURE TECHNIQUES

Land use management strategies include: Property Acquisition, Development Rights Acquisition, Noise and Avigation Easement Purchase, Purchase Assurance, Sales Assistance, and Soundproofing. These measure are usually considered as a last resort because they are expensive, often disruptive and sometimes controversial. They are most often justified when noise impacts are severe and cannot be mitigated through aircraft noise abatement alone.

Property Acquisition

Fee simple purchase, or acquisition, of land impacted by high noise levels is one method of ensuring noise compatibility around an airport. The primary intent of land acquisition is to prevent incompatible uses from being developed near the airport and to remove residents from severely noise impacted areas. If necessary, land parcels can be purchased, consolidated and resold or leased for commercial and industrial redevelopment uses which are compatible with the airport. Property acquisition is the simplest and most complete way to ensure noise compatibility around an airport.

The obvious drawback is its high cost. Land may be bought for noise compatibility by an airport owner, by other public agencies and by quasi-public agencies, such as industrial development corporations. The FAA supports airport ownership of land impacted by noise above 75 DNL. Acquisition of areas impacted by noise down to 65 DNL may be justified to ensure land use compatibility. Property acquisition within the 65 DNL contour, based on the current year and five-year forecast, is eligible for funding through the noise set-aside of the Federal Airport Improvement Program. It is difficult, however, to secure federal grants for acquisition outside the 70 DNL contour.

Typically, property acquisition needed for noise mitigation is accomplished through voluntary programs. The airport will notify property owners in a given area when it is ready to negotiate the purchase of their land and homes. Property owners are assured that the airport will buy their land, assuming a fair price can be negotiated.

Where Federal funds are used for property acquisition, the airport must comply with the Federal Uniform Relocation Assistance and Real Property Acquisition Act (49 CFR Part 24). Under these regulations, the fair market value of the home is established through two professional appraisals. The homeowner is also entitled to the reimbursement of moving expenses and to compensation for other relocation expenses (such as closing costs and incidental expenses for a new home, and compensation for a higher interest rate on the new mortgage) up to a maximum of $22,500. If the maximum relocation benefit, in addition to the sale price of the home, is not enough to assure the displaced person of acquiring decent, safe and sanitary housing, additional relocation

payments may be available, subject to a case by case review.

- EVALUATION

Within the study area, only one residence, located in Glendale, is located within the 1999 65 DNL noise contour. This mobile home is on a lot which includes one other mobile home and a site-built home. Part of a large tract of land, zoned A-1, Agriculture, which permits very low-density residential use is also inside the 65 DNL contour. The tract has one mobile home which is just outside the 65 DNL contour. Part of this area is also within the planned future airport property line, as shown in **Exhibit 6D.**

It is appropriate to consider acquisition of the mobile home within the 65 DNL contour. Since the remaining homes on the lot are very close to the 65 DNL, acquisition of these should be considered as well. Acquisition of that part of the large tract within the 65 DNL contour also should be considered as well as the mobile home just outside the 65 DNL. If subdivision of the tract is not agreeable to the owner or if it appears to be economical, acquisition of the entire tract should be considered.

A voluntary acquisition program would enable individuals and families to have their homes and properties acquired and to be relocated elsewhere. Other land use alternatives could be explored for those who choose not to relocate and instead remain in the community (such as soundproofing and noise easements).

Although property acquisition does have its benefits, there are potential problems inherent with this approach including: very high monetary costs to implement, depending on the amount and location of land to be acquired, and the likelihood of such acquisitions being a low priority for FAA funding.

Another key issue involves identifying alternative uses for the cleared or purchased land. For example, acquired land could be maintained as buffer area around the airport or it could be developed into noise compatible land uses, such as parks and recreation areas for local residents, or it could be sold for commercial/industrial development.

The FAA is sympathetic to putting the land to use for activities that are compatible with aircraft noise and which do not compromise the runway approaches. The land can be resold or leased by the airport for compatible development. It is also possible for the airport to use the property for some public purpose, as long as it is compatible with the airport. If the airport chooses to offer the acquired land for resale, it should retain a noise and avigation easement and a land use easement restricting the use of the land to compatible uses.

The cost of an acquisition program will be eligible for up to 90 percent funding assistance through the noise set-aside of the Federal Airport Improvement Program, assuming the recommend-ations are approved by the FAA. (Large and medium hub airports are eligible for only an 80 percent share, while small hub and non-hub airports are eligible for 90 percent.)

Total acquisition, relocation, and demolition costs of the site-built home are estimated at $134,000 ($80,000 for acquisition, $22,500 for relocation, $5,000 for demolition, and 25 percent for contingencies). Costs for the mobile

homes are estimated at $47,000 each. Acquisition costs for the large, undeveloped tract of 51.4 acres are estimated at $803,000, assuming a cost of $12,500 per acre with a 25 percent contingency. Total acquisition costs could run as high as $1,078,000.

- CONCLUSION

In general, property acquisition is a last resort technique as it is usually expensive, disruptive and controversial. This approach is justifiable only when residual noise impacts are severe and cannot reasonably be mitigated through noise abatement actions. In the Glendale area, acquisition of the four mobile homes in or near the 1999 65 DNL noise contour should be considered.

Acquisition of Noise and Avigation Easements

An avigation easement gives the owner of the easement the right to fly aircraft over the property. Purchase of noise and avigation easements may be appropriate if noise is so disturbing that it substantially interferes with the full enjoyment of the property. It may also be appropriate where, as part of a noise abatement or airport development program, noise is introduced to areas which formerly were not impacted.

Noise and avigation easements would give the airport the right to direct aircraft over the homes, creating related annoyances, without the threat of a lawsuit. The easements would run with the land and would serve as a limited means of notifying prospective property owners of the impact of airport noise. The purchase of noise and avigation easements within the 65 DNL contour is eligible for federal funding assistance through the noise set aside on the Airport Improvement Program.

- EVALUATION

The advantages of noise and avigation easements include some legal protection for the airport and limited fulfillment of fair disclosure objectives. When they are purchased, they also compensate airport neighbors who have been heavily impacted by noise and who may have lost some of the potential enjoyment of their property. To the negative, the purchase of a noise and avigation easement does not mitigate noise, it merely compensates people for the inconvenience caused by noise.

As an acquisition of an interest in property, easement acquisition is subject to the requirements of the Uniform Relocation Assistance and Real Property Acquisition Act (49 CFR Part 24), meaning the value of easements must be determined through professional appraisals. The costs of easement acquisition are very difficult to estimate because of the limited market data available, making it difficult to establish their value. Easements are generally valued at a significant proportion of the total home value. For planning purposes only, one can estimate the value of a noise and avigation easement at between 5 and 15 percent of the value of the home.

An additional disadvantage is that there is a risk that despite the expense of purchasing the easements, the airport may again become the target of complaints, controversy, political pressure, and even lawsuits, it the noise environment or the attitude of easement grantors changes substantially.

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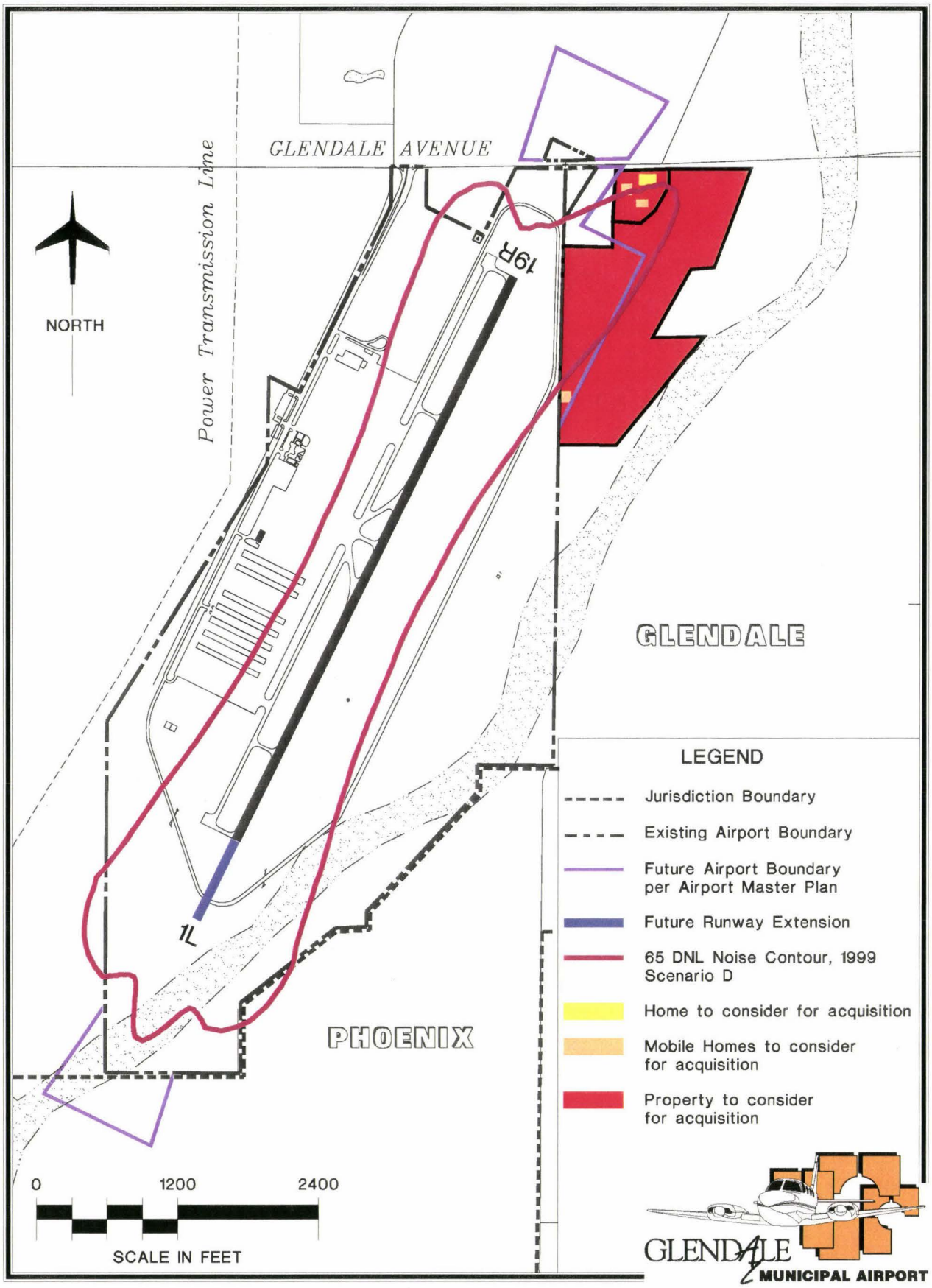

Exhibit 6D
POTENTIAL PROPERTY ACQUISITION

- CONCLUSION

The purchase of noise and avigation easements should only be necessary for existing homes which are or will be located within the 65 DNL noise contour. Future developments within the 65 DNL noise contour should be required to provide such easements through the development approval process, as a condition of their approval. As an alternative to the purchase of the homes which are located within or near the 1999 65 DNL noise contour, the purchase of noise and avigation easements could be considered.

Development Rights Acquisition

The ownership of land involves the ownership of a bundle of rights to the use of that land, to the extent permitted by government regulations such as zoning regulations, health and safety laws, and environmental laws. The principle of development rights acquisition involves a property owner who sells some of these rights while still retaining title. Selling these rights prevents land from being developed. For example, a property owner surrenders some of the rights to their property when they grant someone an easement or sells the mineral rights to the property.

The purchase of development rights is appropriate when there is insufficient legal justification to use zoning to prevent incompatible uses or where there is strong local opposition to the use of zoning. Development rights purchase also can be an alternative to fee simple acquisition. This is especially appropriate where the land is undeveloped and being farmed or used for private recreation.

The extent of the acquired development rights can vary depending on the situation. The chief concern is to acquire the rights to develop noise-sensitive land uses. In some cases, that will be sufficient. The property owner would retain the right to develop the property for commercial and industrial use as well as low-intensity uses such as parks, recreation, agriculture, grazing, and forestry. In other cases, it may be appropriate to acquire the rights for commercial and industrial development as well as noise-sensitive development.

The advantage of purchasing development rights is that complete protection from incompatible development can be assured, and the property owners can receive compensation for any perceived loss. In addition, the property can be kept in private ownership, in productive use, and on the tax rolls while protecting the airport from incompatible development. The main disadvantage is the potentially high cost of the development rights, in return for which the buyer receives only a very limited interest in the property.

- EVALUATION

Development rights acquisition, or a land use easement, would essentially extinguish rights to develop the land for residential use and thereby eliminate incompatible land uses. From the airport's perspective, this could be an attractive alternative to outright acquisition of undeveloped property significantly impacted by noise.

Acquisition of development rights could be cheaper than outright property acquisition. The property owner would keep the land, but would be unable to develop it for residential or other noise-

sensitive uses. The land could be farmed or used for other open space purposes. At the airport's option, the right to develop the land for commercial or industrial uses would remain with the property.

Development rights acquisition is most appropriate in rural areas. Within urban areas, the costs can be as high as full fee simple acquisition. Because of its location, the study area, as it exists today, would be considered "suburban," meaning the development rights could potentially be costly.

Within the study area, the majority of land potentially available for future residential development is located south and southeast of the airport, in Phoenix and Maricopa County. These are primarily large properties which have obtained initial planning approvals for residential development. Even though these approvals need to be extended and most of the land remains in the 100-year floodplain, acquisition of development rights in these areas is likely to be close to the cost of acquiring full title for readily developable land and, therefore, very expensive.

- CONCLUSION

Outside of the 65 DNL noise contour, the acquisition of development rights would not be eligible for FAA funding assistance, leaving the onus for funding this program on the City of Glendale. Within the 65 DNL contour, however, this program is eligible for funding. Because the 1999 65 DNL noise contour will fall over a planned city park to the south, and over planned industrial land to the north instead of land proposed for residential use, this alternative will not be further considered.

Purchase Assurance

Purchase assurance programs are intended to assure homeowners in noise-impacted areas that they will be able to sell their property for fair market value. The airport proprietor would acquire the property if the homeowner was unable to sell it on the open market. The airport would then sell the home, retaining a noise and avigation easement and, perhaps, after making sound-proofing or other property improvements.

Purchase assurance programs are most appropriate where there is a widespread concern that homeowners have difficulty selling homes because of noise intrusion. They are appropriate where the noise levels are not so severe as to make the neighborhood unlivable, or where it is impractical or otherwise inappropriate to acquire and clear neighborhoods.

A purchase assurance program allows the airport to address the concerns of people who are very annoyed by aircraft noise and who desire to leave the neighborhood without suffering financial loss. It can be fairly economical because, in many areas, property values do not experience declines because of aircraft noise; therefore, it may be possible for the airport to sell the home at or near the cost of purchase.

Purchase assurance programs can be fairly complex and time-consuming to administer. They also open up the risk that the airport will have to become a property manager or landlord if market conditions should make it difficult to sell homes. The program should be carefully staged to prevent a glut of applicants at any one time. Otherwise, an adverse reaction in the larger real estate market could be caused.

Purchase assurance programs are usually intended to address the concerns of people who are highly sensitive to noise and worried about the potential for serious hardship. Program guidelines should be designed to make the program fair without being so attractive that applicants would flock to the program, regardless of their noise sensitivity.

- EVALUATION

In evaluating this measure, perhaps the most serious concern is its complexity and the level of administrative support that would be required. The program also raises the risk that the airport would have to be involved in property ownership and management with the resulting problems of security and maintenance.

This program is designed for use in large residential areas; however, using the 1999 base case scenario, only one home would be eligible for purchase assurance (within the 65 DNL) in the Glendale Municipal Airport study area.

- CONCLUSION

Given the program's complexity and that application would be limited to a single mobile home which has already been recommended for acquisition, this alternative is not being further considered.

Sales Assistance

With a sales assistance program, the airport would offer to supplement any bona fide purchase offer up to an amount equal to fair market value. These programs are typically structured very much like purchase assurance programs except that the airport never takes title to the property. The airport guarantees the property owner of receiving the appraised value, or some increment thereof, regardless of the final sales value that is negotiated with a buyer. In order to prevent collusion between buyer and seller, to the detriment of the airport, the airport must approve the listing price for the home and any downward adjustments of that price. In return for participation in the program, the airport would require that property owners give a noise and avigation easement to the airport. In other respects, the program guidelines would be similar to those described above for purchase assurance programs.

- EVALUATION

Although still complex and requiring considerable commitments of staff time, this program would be somewhat easier to administer and would achieve generally the same objectives as a purchase assurance program. It would lack the potential to facilitate housing rehabilitation and sound insulation as easily as the purchase assurance program. One major advantage of sales assistance, as compared to purchase assurance, is that the airport would never take title to the property.

Again, this program was designed for use in large residential areas, whereas in the Glendale study area, only one mobile home would be eligible for sales assistance.

- CONCLUSION

Given the program's complexity and that application would be limited to a single

mobile home which has already been recommended for acquisition, this alternative is not being further considered.

Sound Insulation

Dwellings and other noise-sensitive buildings can be sound-insulated, thus reducing interior noise levels. Sound insulation does not actually eliminate outdoor noises; however, it typically provides an outdoor to indoor noise level reduction of from 25 to 35 decibels. Soundproofing may involve thermal insulation and weatherproofing, the baffling of vents and mail slots, the installation of solid-core wood doors or foam-core steel doors, the installation of windows with special noise attenuation characteristics, the installation of new interior walls along existing walls, and the installation and use of year-round air conditioning and ventilation systems.

The FAA will participate in soundproofing noise-sensitive buildings within the 65 DNL noise contour if the buildings cannot achieve an outdoor to indoor noise level reduction of 20 decibels or more. (Within the 70 DNL contour, the noise level reduction threshold increases to 25 decibels.) Sound insulation projects must be designed to achieve at least a five decibel improvement in noise level reduction. The target is to reduce interior noise levels to 45 DNL or less. Often, a supplementary criterion is used in actual project design to ensure that interior noise levels from individual overflights not exceed an SEL of 65 dB. (This is an estimate of the average speech interference level.)

Although fresh air ventilation systems are eligible for FAA funding, air conditioning is only partially eligible. FAA will fund the cost of installing air conditioning up to the amount that would have been required to install a fresh air ventilation system. The FAA requires that property owners and residents be notified of the utility and maintenance costs associated with these systems.

A publicly sponsored sound insulation program is most appropriate where many noise-sensitive land uses are impacted by high noise levels and where it is not possible to design a noise abatement program to reduce noise significantly. Sound insulation of schools or other noise-sensitive institutions can also be done and is most appropriate, particularly if most of the noise occurs during the day.

- EVALUATION

Only one home falls within the 65 DNL noise contour under both the existing and 1999 base case noise contours. Due to their construction, adequate sound insulation cannot be accomplished in mobile homes. Because the impacted residence is a mobile home, this program would likely have a low priority with the FAA.

Sound insulation for any future residences or other noise-sensitive land uses within the impact area should be provided through the noise overlay zoning and building code amendment programs discussed earlier.

- CONCLUSION

Based on the above information, a formal sound insulation program will not be given further consideration.

PRELIMINARY LIST OF LAND USE MEASURES

Table 6D illustrates the preliminary list of land use management alternatives. The Planning Advisory Committee, airport management and general public reviewed these options to determine their feasibility.

TABLE 6D
Preliminary List of Land Use Management Measures

I. Policy Techniques

Comprehensive Planning

1. Cities of Avondale, Glendale, Peoria, Phoenix - Preserve existing General Plan designations for compatible land uses (industrial, commercial, office, open space) within the 55 DNL contour.

2. City of Peoria - Redesignate future land use on northeast corner of 103rd and Northern Avenues for industrial, commercial, or office.

3. City of Phoenix - Redesignate future land use in Camelback Ranch area (generally west of 107th and north of Camelback) from residential to commercial, industrial, or office.

Capital Improvement Programming

4. Flood Control District of Maricopa County - Revise existing prioritization system to consider the impacts of off-site environmental issues, such as noise, and acquire and retain the property south of the airport for flood control purposes.

Discretionary Project Review

5. Cities of Avondale, Glendale, Phoenix and Peoria, and Maricopa County - Consider adopting airport land use compatibility guidelines for discretionary review of development projects. These would apply to the review of development proposals within the 55 DNL noise contour.

II. Regulatory Techniques

Compatible Use or Lower Density Zoning

6. Cities of Avondale, Glendale, Peoria - Retain existing compatible use zoning within the 55 DNL contour.

7. City of Glendale - Rezone property northeast of airport for compatible use (BP, Business Park) in accordance with General Plan.

TABLE 6D (Continued)
Preliminary List of Land Use Management Measures

8. City of Glendale (or Maricopa County) - Consider use of planned unit development for land south of Northern, north of Glendale Avenue, and west of 91st Avenue. Prevent homes from being built within 55 DNL. Allow compensating development credit to be used in the rest of the development.

9. City of Peoria - Rezone property at northwest corner of 91st and Northern Avenues for business park/industrial use in accordance with General Plan.

City of Phoenix -

10. A. Rezone the property south of the airport and east of Agua Fria River, within the 55 DNL noise contour to land uses compatible with cumulative airport noise and frequent aircraft overflights, such as commercial, industrial, parks and open space, and business/office developments; OR

    B. Use planned unit development process to prevent the construction of homes along the runway alignments and within the 60 DNL, relocating these units elsewhere in the development; OR

    C. Where residential development within the 55 DNL noise contour is permitted, consider reducing the densities previously approved to be consistent with the designations in the approved General Plan, thereby reducing the number of residences constructed off the south end of the runway(s).

11. City of Phoenix (or Maricopa County) - Consider use of planned unit development for land north of Indian School Road and west of Agua Fria River. Prevent homes from being built within 55 DNL. Allow compensating development credit to be used in the rest of the development.

12. Maricopa County - Discourage the rezoning of Rural-43 areas for higher density residential development.

Noise Overlay Zoning

13. Cities of Avondale, Glendale, Phoenix, and Peoria, and Maricopa County - Consider establishing overlay zoning to reduce or eliminate impacts on future noise-sensitive land uses. These overlay districts should be based on the Land Use Compatibility Planning Scenario noise contours and may prohibit certain uses, require sound insulation construction, and require the granting of noise and avigation easements to the City of Glendale.

TABLE 6D (Continued) Preliminary List of Land Use Management Measures
Subdivision Regulations
14. Cities of Avondale, Glendale, Phoenix, and Peoria, and Maricopa County - Consider amending respective subdivision regulations to provide for the dedication of avigation easements and fair disclosure agreements within the noise overlay zone.
Building Codes
15. Cities of Glendale and Phoenix, and Maricopa County - Consider adopting local amendments to building codes to provide sound insulation standards for noise-sensitive uses within noise overlay zones (65 DNL and above).
Environmental Zoning
16. Flood Control District of Maricopa County - Consider the establishment of a floodplain preservation policy.
Fair Disclosure Procedures
17. Cities of Avondale, Glendale, Phoenix, and Peoria, and Maricopa County - Consider using informal fair disclosure procedures to advise potential future property owners of the existence of the airport and its impacts.
III. Expenditure Techniques
Property Acquisition
18. City of Glendale - Consider acquiring the property, one home, and three mobile homes, located within the 1999 65 DNL noise contour. Estimated Cost: Up to $1,078,000.

REFINEMENT OF LAND USE ALTERNATIVES

After the release of the land use management alternatives working paper, the preliminary list of alternatives was discussed with the Planning Advisory Committee and with local government planning officials. As a result of these consultations, refinements were made in the alternatives. These refinements led to several alternatives being dropped from consideration.

Alternatives Dropped From Consideration

The alternatives listed in Table 6D which have been dropped from consideration are discussed in this section.

2. Peoria -- Redesignate Future Land Use at 103rd and Northern: Local officials are concerned that there is already a glut of commercial, office, and industrial-zoned land in the study area.

They are concerned that the market may be unable to absorb much more commercial-zoned land for many years. In addition, Peoria officials were concerned about the potential effects of commercial rezoning of this area on nearby residential neighborhoods.

3. Phoenix – Redesignate Future Land Use in Camelback Ranch: Phoenix officials expressed the same concerns about the abundance of commercial, office, and industrial-zoned land in the study area. Local officials did not see this proposal as being economically viable.

8. Glendale – Consider Planned Unit Development for Land in 55 DNL: Proposals for land use compatibility actions within the 55 DNL were the subject of considerable discussion by the Planning Advisory Committee. It was concluded that while noise within the 55 DNL contour may be a concern of some residents some of the time, the impacts were not so severe as to justify actions tending to prohibit new housing within the 55 DNL.

10. Phoenix – Various Alternatives for Camelback Ranch: After the initial draft of the working paper was released, the Flood Control District bought this property. While it may someday be developed, development is not imminent. A different way of dealing with potential future development of this land is described below in the discussion of alternatives 13 and 14.

13, 14. Noise Overlay Zoning and Subdivision Regulations: Local planners were concerned about the political acceptability of overlay zoning. An alternative way of dealing with this was developed after consultations. No significant development in the immediate airport area can occur without rezoning. Local officials suggested that the rezoning process could be used to attach land use compatibility stipulations to the rezoned land. The prohibition of housing within the highest noise impact levels (65 DNL) and off the runway approaches could be done through this process. Elsewhere, the recording of fair disclosure covenants could be done to promote the disclosure of information about the airport to prospective property buyers.

15. Building Codes: If housing is not to be permitted within the 65 DNL contour, sound insulation requirements for new construction are not strictly necessary. Nevertheless, providing developers with information about sound insulation guidelines for their voluntary use may be appropriate.

SUMMARY

This chapter has discussed and evaluated the range of land use management alternatives available to promote long-term land use compatibility in the airport environs. It also evaluated various mitigation techniques, or programs, to reduce the adverse impacts of noise on existing residents of the area. The final noise abatement and land use recommendations are presented in Chapter Seven. That chapter also addresses implementation and continuing review and update of the plan.

Chapter Seven
NOISE COMPATIBILITY PLAN

GLENDALE
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CHAPTER 7

NOISE COMPATIBILITY PLAN

The Noise Compatibility Plan for Glendale Municipal Airport, includes measures to abate aircraft noise, control land development, mitigate the impact of noise on non-compatible land uses, and implement and update the program. F.A.R. Part 150 requires that the plan apply to a period of no less than five years into the future, although it may apply to a longer period if the sponsor so desires. This Noise Compatibility Plan has been developed based on a 20-year planning period.

The objective of the noise compatibility planning process has been to improve the compatibility between aircraft operations and noise-sensitive land uses in the area, while allowing the airport to continue to serve its role in the community, state, and nation. The Noise Compatibility Plan includes three elements that are aimed at satisfying this objective.

- The **Noise Abatement Element** includes noise abatement measures selected from the alternatives evaluated in Chapter Five, Noise Abatement Alternatives.

- The **Land Use Management Element** includes measures to mitigate or prevent noise impacts on existing noise-impacted land uses and future land use development in the airport influence area. Potential land use management techniques were evaluatedin Chapter Six, Land Use Alternatives.

- The **Program Management Element** includes procedures and documents for use in bringing the recommended noise abatement and land use measures to reality, monitoring the progress of the program, and updating the Noise Compatibility Plan.

Each measure of the Noise Compatibility Plan is summarized in **Table 7C** at the end of the chapter. That table includes a brief description of the noise abatement, land use, and program management measures, the entity responsible for implementing each measure, the cost of each measure, the proposed timing for implementation of the measure, and potential sources of funding.

NOISE ABATEMENT MEASURES DROPPED FROM CONSIDERATION

A number of noise abatement alternatives were developed in this study. These were discussed with the Planning Advisory Committee, airport users, local citizens, and government officials. As a result of the public review process, consultation with the airport and city staff, and the analyses presented in Chapter Five, several measures are recommended.

Before describing the selected noise abatement actions, it is appropriate to discuss the measures that were discussed in Chapter Five but eliminated in the review process.

Chapter Five considered the possibility of establishing a traffic pattern to the west of the airport. The measure was evaluated in two forms, as Alternatives 1 and 2. Alternative 1 evaluated a local pattern on the west side during weekends only while Luke Air Force Base was not busy. Alternative 2 evaluated the establishment of a standard right-hand pattern which would put the local pattern on the west side during all periods of south flow. Both alternatives have several drawbacks. Any pattern traffic west of Glendale would only be feasible when Luke is not busy. These periods occur almost exclusively on the weekends. Consequently, a standard right-hand pattern would only be feasible on the weekends. Additionally, the establishment of any traffic pattern west of Glendale could begin a slow encroachment on Luke Air Force Base. Since there are indications that Luke is likely to increase operations in the future as the national defense system is consolidated, it is not reasonable to establish procedures that press the margins of an already crowded and constricted airspace. Also, any encroachment on Luke is a step against a major employer and a significant economic engine for the west valley. Because of these drawbacks, Alternatives 1 and 2 were not included in the recommended noise compatibility plan.

Chapter Five also considered a procedure that would require all aircraft departing on Runway 19 to maintain a runway heading until passing over the runway end. This procedure, Alternative 6, would generate only a slight change in the current flight tracks around the airport. The impact analysis in Chapter Five indicates that this alternative provides only slight decreases in the future population impacts at lower noise levels while increasing the impacts at higher noise levels. In fact, based on the current population distribution, the procedure actually increases impacts at all noise levels. Given these considerations, Alternative 6 was not included in the plan.

NOISE ABATEMENT ELEMENT

The final noise abatement measures are described in this section.

1. ***Encourage right turns on upwind leg of Runway 1 local traffic pattern.***

Description. The current and future residential development around Glendale Municipal Airport indicates that there are areas to the northeast of the airport that currently do not contain residential development. Maintaining a local traffic pattern that uses these areas will help reduce noise exposure to airport neighbors. The ideal local pattern procedure would be as follows:

Runway 1: Right-hand Traffic

> Turn right to 040 heading at the end of the runway for upwind leg.
>
> Turn crosswind leg as appropriate.
>
> Fly short crosswind leg.
>
> Turn downwind leg west of 99th Avenue.

The revised traffic pattern is shown in **Exhibit 7A**. This procedure is proposed as a voluntary procedure when traffic and safety permit.

Implementation Actions. The airport management should encourage the airport users to follow these procedures whenever possible. The Air Traffic Control Tower should also encourage pilots to follow the procedures. The procedures should be clearly identified and shown in a pilots guide that is distributed via the airport management and the local FBO. The noise abatement procedures should also be published in the *Airport/Facility Directory*. **Appendix G** has information on how to arrange for publication of information in the Directory.

Costs and Funding. Small administrative costs would be incurred by the airport management and Air Traffic Control Tower. These should be easily absorbed in the normal operating budget of each group.

Timing. This is proposed for implementation when the necessary coordination, the Part 150 approvals, and the pilots guide can be completed.

2. ***Encourage straight-out VFR departures from Runway 19.***

Description. The Agua Fria River basin offers a wide undeveloped corridor for air traffic south of Glendale. Itinerant departures could use this corridor to avoid low altitude turns to the east over the residential areas to the south and east of the airport. The procedure would call for itinerant aircraft departing on Runway 19 to fly the runway heading to Indian School Road before turning east as shown in **Exhibit 7A**. (Turns should be made shortly after passing Indian School Road to avoid potential conflicts with traffic at Phoenix-Goodyear Municipal Airport to the south.) This would reduce the low overflights of most residential areas near the airport. This procedure would be for VFR aircraft only which constitute the vast majority of the traffic at Glendale. IFR traffic routes would not be affected.

Implementation Actions. The airport management should encourage the airport users to follow this procedure whenever possible. The Air Traffic Control Tower should also encourage

pilots to follow the procedure. The procedure should be clearly identified and shown in a pilots guide that is distributed via the airport management and the local FBO. The noise abatement procedures should also be published in the *Airport/Facility Directory.*

This measure does not increase noise over any existing homes in the 65 DNL noise contour.

Costs and Funding. Small administrative costs would be incurred by the airport management and Air Traffic Control Tower. These should be easily absorbed in the normal operating budget of each group.

North and northeast bound aircraft departures will incur slightly increased fuel burns and somewhat longer flight times than they otherwise would.

Timing. This is proposed for implementation as soon as the necessary coordination, the Part 150 approvals, and the pilots guide can be completed.

3. ***Encourage right turns for VFR departures from Runway 1.***

Description. The New River basin and the Agua Fria Expressway offer a noise abatement corridor for air traffic north of Glendale. Itinerant departures should turn over this corridor to avoid overflights of the residential areas directly north of the airport. The procedure would require that itinerant aircraft departing on Runway 1 would fly the runway heading to the end of the runway and then turn right to a 040 heading. This heading would be maintained until the aircraft is over the curve in the expressway just south of Olive Avenue. The aircraft would then turn to the desired heading. The proposed flight path is shown in **Exhibit 7A.** This procedure would be for VFR aircraft only which constitute the vast majority of the traffic at Glendale. IFR traffic routes would not be affected.

Implementation Actions. The airport management should encourage the airport users to follow this procedure whenever possible. The Air Traffic Control Tower should also encourage pilots to follow the procedure. The procedure should be clearly identified and shown in a pilots guide that is distributed via the airport management and the local FBO.

Costs and Funding. Small administrative costs would be incurred by the airport management and Air Traffic Control Tower. These should be easily absorbed in the normal operating budget of each group.

Timing. This is proposed for implementation as soon as the necessary coordination, the Part 150 approvals, and the pilots guide can be completed.

4. ***Establish informal north flow preferential runway use program.***

Description. The current and future residential development around Glendale suggest that areas south and southeast of the airport are likely to develop for residential use in contrast to areas to the north, which are planned for commercial and industrial uses. Consequently, a preferential north flow procedure, coupled with the noise abatement turn in Measure 3 will focus the louder departure operations over open areas north of the airport.

Although prevailing winds at Glendale are from the south approximately 40 to 50 percent of the time, there is a period

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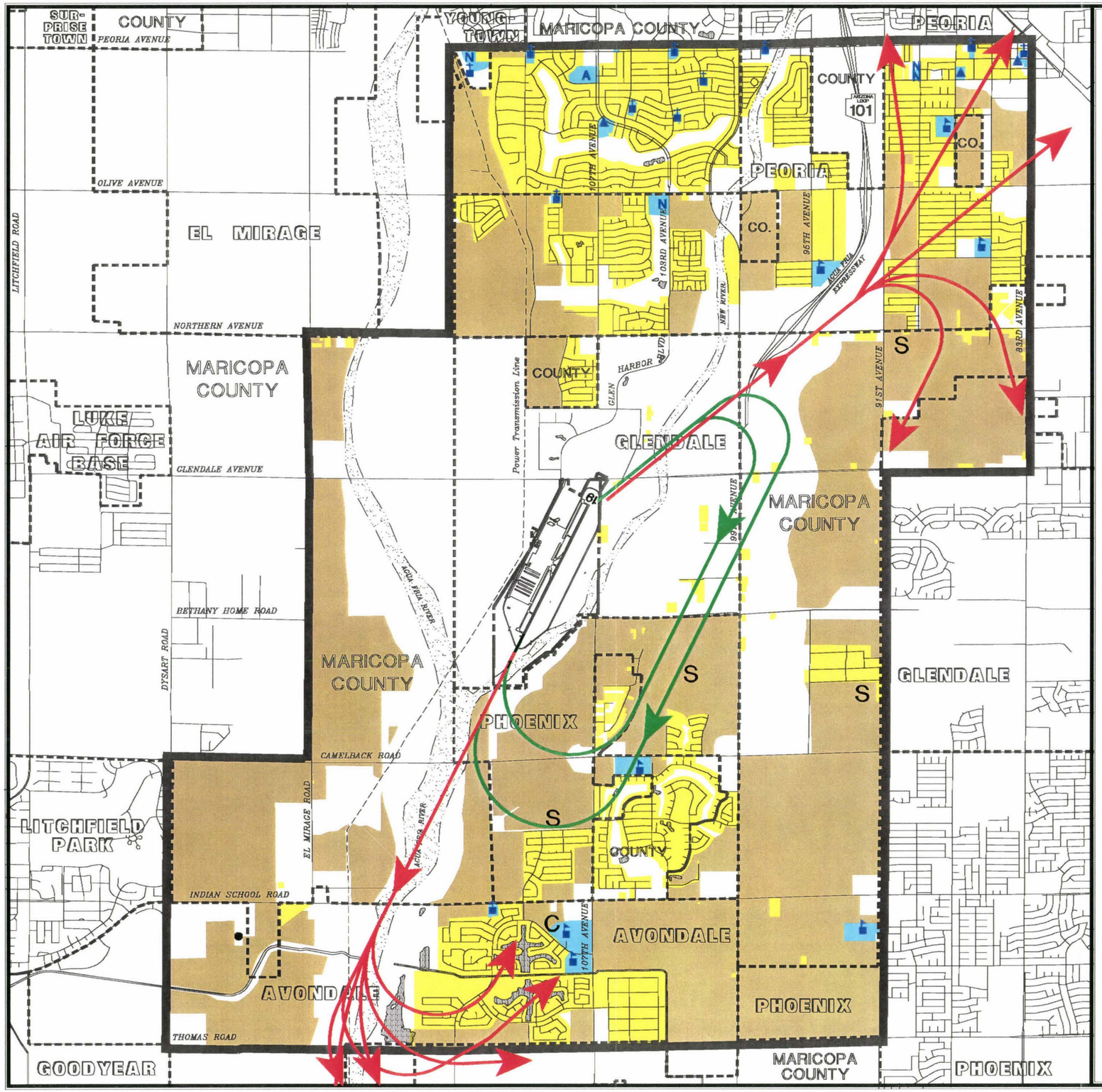
Exhibit 7A
NOISE ABATEMENT FLIGHT TRACKS



LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- Alternative Departure Tracks
- Alternative Traffic Pattern
- Existing Residential
- Undeveloped
- Existing Public and Institutional
- School
- Church
- Community Center
- N — Nursing/Rest Home
- A — Amphitheater
- Site on National Register of Historic Places
- Potentially Available for Residential Development
- C — Future Church Site
- S — Future School Site

NORTH

0 4000 8000

SCALE IN FEET

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of calm winds (3 to 5 knots or less) of about 20 percent. By designating Runway 1 as the calm wind runway, the airport could achieve a north flow of operations about 60 percent of the time. This change would reduce the number of people affected by noise.

This program is proposed as an official, informal preferential runway use program.

FAA Order 8400.9 describes national safety and operational criteria for establishing runway use programs. It defines two classes of programs: informal and formal. A formal program must be defined and acknowledged in a Letter of Understanding between FAA's Flight Standards Division and Air Traffic Service, the airport proprietor, and the airport users.

An informal program is an approved runway use program which does not require the Letter of Understanding. Informal programs are typically implemented through a Tower Order and publication of the procedure in the *Airport/Facility Directory*. Participation in the program is voluntary.

Implementation Actions. The airport management should encourage the airport users to follow this program whenever possible. The Air Traffic Control Tower should also encourage pilots to follow the program. The Tower Manager should be encouraged to issue a Tower Order to reflect the revised procedure. (A draft Tower Order is in **Appendix G.**) The Order should be written to comply with FAA Order 8400.9. That document sets forth safety and operational criteria for runway use programs. The program should be identified in a pilots guide that is distributed via the airport management and the local FBO.

Costs and Funding. Small administrative costs would be incurred by the airport management and Air Traffic Control Tower. These should be easily absorbed in the normal operating budget of each group.

Southbound aircraft departures will incur slightly increased fuel burns and somewhat longer flight times than they otherwise would. Conversely, northbound aircraft would benefit from decreased fuel burns and slightly shorter flight times. Similarly, arrivals from the north would incur an increase in costs while arrivals from the south would see a small reduction in costs.

Timing. This is proposed for implementation as soon as the necessary coordination, the Part 150 approvals, and the pilots guide can be completed.

5. ***Encourage the use of AOPA Noise Awareness Steps for propeller aircraft and NBAA noise abatement departure and arrival procedures.***

Description. The Aircraft Owners and Pilots Association (AOPA) and the National Business Aircraft Association (NBAA) both encourage quiet and neighborly flying by distributing generalized noise abatement procedures. While the NBAA provides specific thrust management procedures for turbojet aircraft, the AOPA provides a number of general recommendations for propeller aircraft.

The AOPA has recommendations on how to fly the aircraft, as well as where to fly and when to fly. The majority of the steps provide guidance on pilot

technique when maneuvering near noise-sensitive areas. The steps also encourage cooperation with airport staff on noise abatement issues.

The NBAA procedures provide specific profiles for departures and VFR and IFR arrivals near noise-sensitive locations. The procedures promote noise abatement thrust management and flight procedures.

The noise abatement recommendations from each organization are presented in **Appendix G** of this document.

Due to the inherent randomness of general aviation operations and the limited authority that the airport and Air Traffic Control have over pilot technique, it is not reasonable, or possible, to mandate these procedures at Glendale. It is, however, reasonable to encourage their use whenever possible by as many pilots as possible. It is not possible to predict how often these procedures would be used, so it is impossible to quantify the effects of these procedures. Nevertheless, it is certain that any usage will help the overall noise conditions around the airport. Consequently, the airport should encourage their use as often as possible.

Because the use of these procedures is not quantifiable, no adjustments to the NCP noise modelling were made for this measure.

Implementation Actions. The airport management should encourage the airport users to follow these procedures whenever possible. The procedures should be identified in a pilots guide that is distributed via the airport management and the local FBO. Signs should be posted at each runway end requesting pilots to use noise abatement procedures. The following, or similar, wording could be used: "Quiet please. Use noise abatement procedures." The pilot guide is being provided as a final product of this Part 150 Study. Runway signs could cost as much as $10,000 depending on how they are designed and whether they are internally lighted.

Costs and Funding. None.

Timing. This is proposed for implementation as soon as the necessary coordination, the Part 150 approvals, and the pilots guide can be completed.

6. ***Adopt noise-sensitive marketing policies.***

Description. The discussions in Chapter 5 regarding airport restrictions show that operational restrictions at Glendale would not be feasible. Even under the strictest of measures, the 65 DNL noise contour would be only slightly affected. Since noise impact reductions within the 65 DNL noise contour would be the primary factor in justifying any type of restriction, mandatory restrictions were dropped from consideration. Discussions by the Planning Advisory Committee about airport restrictions focused on concerns about potential future operations which could cause noise problems. While the City lacks the justification to address these concerns through regulations, it could at least partially address them through appropriate marketing policies.

The City of Glendale should establish marketing polices that promote the use of quiet aircraft and avoid large training operations at the airport. The two policies would generally be stated as follows:

- The City shall encourage corporate jet operators to use Stage 3 aircraft.

- The City shall avoid marketing Glendale Municipal Airport to operators of large airline pilot training schools.

It should be understood however, that the airport would be available to Stage 2 aircraft and pilot training operators should they seek out the use of the airport. This measure simply identifies the active marketing policies that the City of Glendale would follow, discouraging the basing of these operators at Glendale.

The nature of this measure is such that it is very difficult, if not impossible, to predict the results of the efforts. Any assumptions regarding the results of the measure would thus be speculative at best. Consequently, no adjustments to the NCP noise modelling were made for this measure.

Implementation Actions. The Glendale City Council should adopt a resolution which identifies the noise-sensitive marketing policies of the city regarding the airport.

Costs and Funding. None.

Timing. This is proposed for implementation when the necessary coordination, the Part 150 approvals, and City Council action can be completed.

OTHER CONSIDERATIONS

NDB Approach

The City of Glendale has requested FAA approval of a non-precision NDB instrument approach to Glendale Municipal Airport. This would be a circling approach from the east. It would be based on the non-directional beacon (NDB) on the airfield.

Since this is a non-precision approach and would be defined so that aircraft would be entering the Glendale area from the east, aircraft following this approach would utilize the same flight corridors as those presented in Chapter Two of this study. Consequently, there would be no effect on the cumulative noise exposure patterns around the airport.

Local Traffic Pattern on South Side

South of the airport, existing and potential residential development is east of the Agua Fria River from the airport property line to Thomas Road. No matter where the pattern is located, at least some of these neighborhoods will be under the downwind, crosswind, and base legs of the pattern. In general, however, the smaller the pattern, the fewer the homes that will be overflown. Thus, pilots should be encouraged to keep the pattern as close to the airport as possible. This is reflected in Step 9 of the recommended AOPA Noise Awareness Steps in **Appendix G.** This is consistent with current practice, and no changes in the location of the pattern on the south side of the airport are expected.

RESIDUAL NOISE IMPACTS

1994 NOISE WITH THE PLAN

Noise exposure for the recommended plan, based on current activity, is shown in **Exhibit 7B.** The 1994 baseline

contours are also shown for comparison. The noise compatibility plan (NCP) contours reflect the changes in the noise pattern due to the recommended noise abatement procedures.

North of the airport, the combination of the local pattern procedure and the noise abatement departure turn for Runway 1 has shifted the contour to the east over the New River basin and the Agua Fria Expressway.

To the south, changes in noise are less dramatic and are most evident in the 55 DNL noise contour. The eastern lobes of the 55 DNL contour are no longer evident due to the preferential north flow and the straight-out departure procedure for Runway 19. These procedures result in a minimum of traffic immediately southeast of the airport over the Camelback Farms area.

The 1994 NCP contours were modelled based on the 1994 baseline contours presented in Chapter Two. The noise abatement procedures were incorporated into the baseline model input. The adjustments were made as described in Chapter Five for each procedure.

Table 7A shows the population impacted by noise with implementation of the noise abatement procedures, compared with the baseline conditions. For the 1994 Noise Compatibility Plan, the population impacted by noise above 55 DNL is 25 compared to 27 under the baseline conditions. The level-weighted population (LWP) with the Plan is eight compared to seven for baseline conditions. These figures are based on the existing population around the airport with no consideration for future growth.

Table 7B shows the noise-sensitive land uses impacted by noise. Eleven dwellings are impacted by noise above 55 DNL. This includes five within the 55 to 60 DNL range. Within the 60-65 DNL range, three dwellings are impacted. Three dwellings are also within the 65 to 70 DNL range and none are impacted by noise above 70 DNL.

There are no noise-sensitive institutional uses (schools or churches) impacted by noise above 55 DNL.

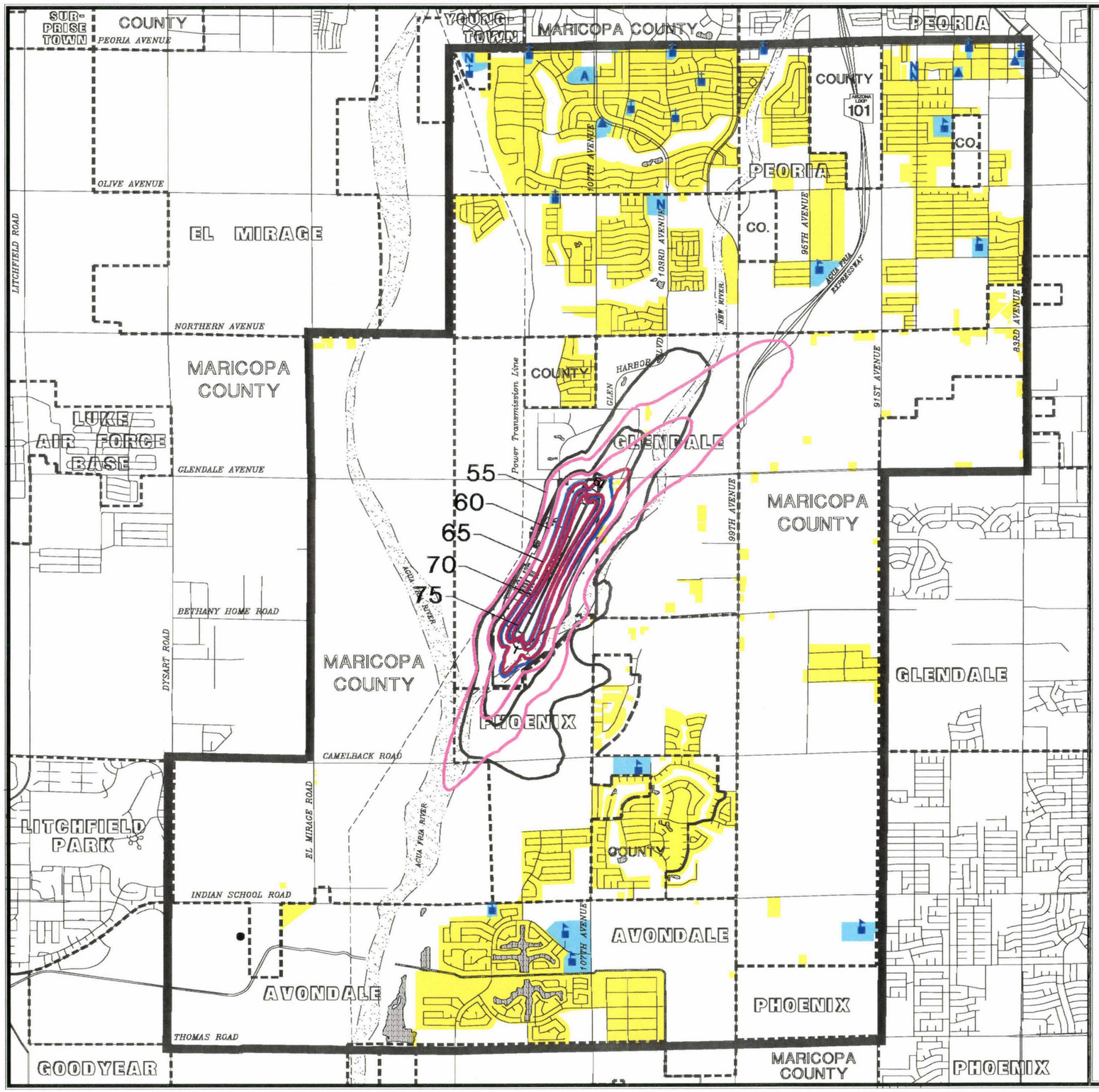
1999 NOISE WITH THE PLAN

For 1999, the Noise Compatibility Plan contours are similar in shape to the 1994 NCP contours. **Exhibit 7C** shows the aircraft noise contours for 1999 with the Plan. The contours are slightly larger than their 1994 counterparts due to the anticipated increased use of the airport by 1999. The 1999 baseline noise contours are also shown to illustrate the effects of the noise abatement procedures. The effects are similar to those shown in the 1994 noise contour comparison with the 1999 contours being slightly larger.

The 1999 NCP contours were modelled based on the 1999 baseline contours presented in Chapter Two. The Noise Compatibility Plan procedures were incorporated into the baseline model input. The adjustments made were as described in Chapter Five for each of the procedures. Both the baseline and the NCP cases reflect the future runway extension of 750 feet at the south end of Runway 1-19.

92SP16-7B-10/13/94R2

Exhibit 7B
1994 NOISE EXPOSURE WITH NOISE COMPATIBILITY PLAN



LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Baseline DNL Contour-Marginal Impact
- Baseline DNL Contour-Significant Impact
- NCP DNL Contour-Marginal Impact
- NCP DNL Contour-Significant Impact
- Existing Residential
- Undeveloped
- Existing Public and Institutional
- School
- Church
- Community Center
- N Nursing/Rest Home
- A Amphitheater
- Site on National Register of Historic Places

NORTH

0 4000 8000

SCALE IN FEET

GLENDALE MUNICIPAL AIRPORT

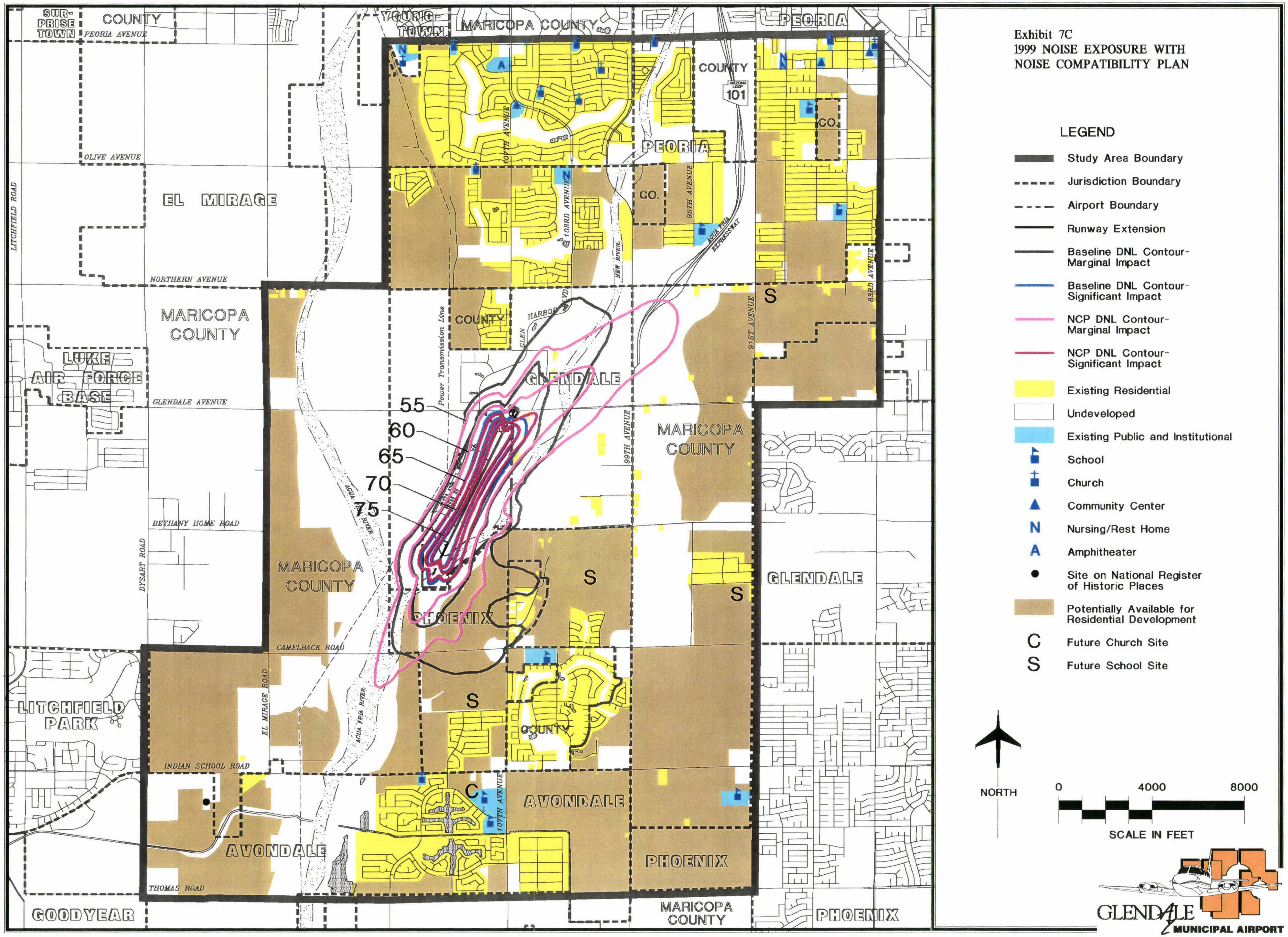

92SP16-7C-10/13/94R2
Exhibit 7C
1999 NOISE EXPOSURE WITH
NOISE COMPATIBILITY PLAN
LEGEND
Study Area Boundary
Jurisdiction Boundary
Airport Boundary
Runway Extension
Baseline DNL Contour-Marginal Impact
Baseline DNL Contour-Significant Impact
NCP DNL Contour-Marginal Impact
NCP DNL Contour-Significant Impact
Existing Residential
Undeveloped
Existing Public and Institutional
School
Church
Community Center
Nursing/Rest Home
Amphitheater
Site on National Register of Historic Places
Potentially Available for Residential Development
Future Church Site
Future School Site
NORTH
0 4000 8000
SCALE IN FEET
GLENDALE MUNICIPAL AIRPORT
SURPRISE TOWN
COUNTY
PEORIA AVENUE
YOUNGTOWN
MARICOPA COUNTY
PEORIA
COUNTY
101
CO.
OLIVE AVENUE
EL MIRAGE
107TH AVENUE
103RD AVENUE
95TH AVENUE
AGUA FRIA EXPRESSWAY
NEW RIVER
83RD AVENUE
91ST AVENUE
NORTHERN AVENUE
MARICOPA COUNTY
LUKE AIR FORCE BASE
GLENDALE AVENUE
Power Transmission Line
HARBOR BLVD
GLEN
GLENDALE
55
60
65
70
75
99TH AVENUE
MARICOPA COUNTY
BETHANY HOME ROAD
DYSART ROAD
LITCHFIELD ROAD
AGUA FRIA RIVER
MARICOPA COUNTY
GLENDALE
PHOENIX
S
CAMELBACK ROAD
LITCHFIELD PARK
EL MIRAGE ROAD
INDIAN SCHOOL ROAD
C
107TH AVENUE
AVONDALE
PHOENIX
THOMAS ROAD
GOODYEAR
MARICOPA COUNTY
PHOENIX

TABLE 7A
Comparison Of Noise Impacts
With and Without Noise Compatibility Plan

Type of Impact/ DNL Range	BASELINE NOISE WITHOUT NOISE COMPATIBILITY PLAN			WITH NOISE COMPATIBILITY PLAN		
	1994[1]	1999	2015	1994[1]	1999	2015
Acres of Land Within						
55-60	768	928	1,715	723	832	1,628
60-65	250	282	582	269	307	708
65-70	115	115	211	115	109	242
70-75	58	64	102	58	64	97
75+	58	70	147	58	70	170
Total, 55+	1,249	1,459	2,757	1,223	1,382	3,034
Total, 65+	231	249	460	231	243	506
Existing & Future Population						
55-60	14	3,475	7,556	12	1,019	3,696
60-65	11	97	2,249	7	77	760
65-70	2	2	34	7	7	30
70-75	0	0	0	0	0	2
75+	0	0	5	0	0	5
Total, 55+	27	3,574	9,843	25	1,103	4,493
Total, 65+	2	2	39	7	7	37
LWP[2], 55+	7	472	1,814	8	161	768

[1] 1994 values represent current population. 1999 and 2015 include current population and potential future population on land committed to future residential development.

[2] LWP - level-weighted population is an estimate of the number of people actually annoyed by noise. The actual population within each 5 DNL range is multiplied by the appropriate response factor to compute LWP. The factors are: 60-65 DNL - .375; 65-70 DNL - .625; 70-75 DNL - .875; 75+ DNL - 1.00.

Source: Coffman Associates analysis.

Aircraft noise above 55 DNL in the 1999 baseline conditions affects 3,574 persons (472 LWP). This includes residents of existing and potential future homes. **Table 7A** shows that with implementation of the Plan, the affected population would decrease to 1,103 (161 LWP).

According to **Table 7B**, 11 current homes and 341 potential future homes would be impacted by noise above 55 DNL in 1999. Only three existing homes and no future homes would be impacted by noise above 65 DNL. No noise-sensitive institutions would be impacted by noise above 55 DNL.

2015 NOISE WITH THE PLAN

For 2015, the Noise Compatibility Plan continues the efforts of the 1999 Plan. **Exhibit 7D** presents the aircraft noise contours for 2015 with the Plan. The exhibit also illustrates the 2015 baseline noise conditions for comparative purposes.

The 2015 noise contour set with the Plan reflects the eastward bend in the contours north of the airport due to the training pattern and departure turns procedures for Runway 1. These procedures pull the noise contours off of

existing and future residential areas near Country Meadows and onto the open areas along the New River basin and the Agua Fria Expressway.

TABLE 7B
Noise-Sensitive Land Uses Impacted By Aircraft Noise With Noise Compatibility Plan

	DNL CONTOUR RANGE					
LAND USE	55-60	60-65	65-70	70-75	75+	TOTAL
1994 NOISE						
Existing Residential						
Single-family dwellings	1	0	1	0	0	2
Mobile homes	4	3	2	0	0	9
Multi-family dwellings	0	0	0	0	0	0
Total	5	3	3	0	0	11
Noise-Sensitive Institutions						
Churches	0	0	0	0	0	0
Schools	0	0	0	0	0	0
1999 NOISE						
Existing Residential						
Single-family dwellings	1	0	1	0	0	2
Mobile homes	5	2	2	0	0	9
Multi-family dwellings	0	0	0	0	0	0
Total	6	2	3	0	0	11
Potential Future Residential[1]						
Single-family dwellings	318	23	0	0	0	341
Noise-Sensitive Institutions						
Churches	0	0	0	0	0	0
Schools	0	0	0	0	0	0
2015 NOISE						
Existing Residential						
Single-family dwellings	10	0	1	0	0	11
Mobile homes	7	3	1	1	2	14
Multi-family dwellings	0	0	0	0	0	0
Total	17	3	2	1	2	25
Potential Future Residential[1]						
Single-family dwellings	1,017	235	8	0	0	1,260
Multi-family dwellings	170	0	0	0	0	170
Noise-Sensitive Institutions						
Churches	0	0	0	0	0	0
Schools	1	0	0	0	0	1

[1] Potential future dwellings are expected to be developed on undeveloped land considered committed to future residential development.

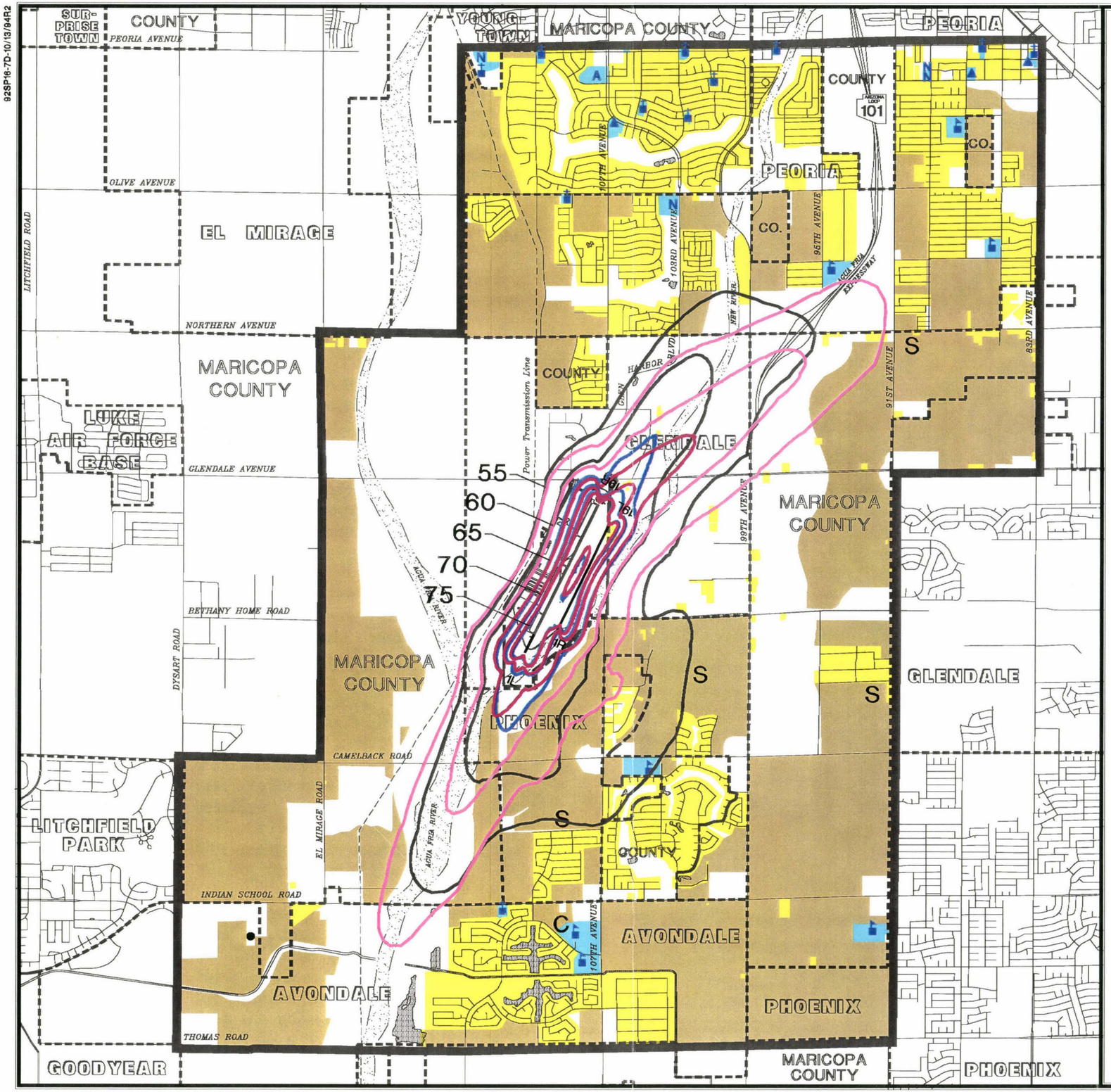
Source: Coffman Associates analysis.

To the south, the contours reflect the straight-out departure procedure for Runway 19 along the river basin. The preferential north flow and the straight-out procedure have combined to reduce the extent of the noise contour bulge to the southeast over the Camelback Farms and Villa de Paz areas.

The 2015 NCP contours were modelled based on the 2015 baseline contours

92SP16-7D-10/13/94R2

Exhibit 7D
2015 NOISE EXPOSURE WITH NOISE COMPATIBILITY PLAN



LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- Runway Extension, New Runway
- Baseline DNL Contour-Marginal Impact
- Baseline DNL Contour-Significant Impact
- NCP DNL Contour-Marginal Impact
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- A Amphitheater
- Site on National Register of Historic Places
- Potentially Available for Residential Development
- C Future Church Site
- S Future School Site

NORTH

0 4000 8000

SCALE IN FEET

GLENDALE MUNICIPAL AIRPORT

presented in Chapter Two. The Noise Compatibility Plan procedures were incorporated into the baseline model input. The adjustments were made as described in Chapter Five for each procedure. Both the baseline and the NCP cases reflect the future runway extension and the future parallel runway as described in Chapter Two.

It is shown in **Table 7A** that 9,843 existing and potential future residents would be affected by noise in 2015 under the baseline conditions. Implementation of the Noise Compatibility Plan will reduce those numbers to 4,493. This corresponds to an LWP value of 768 compared to 1,814 for baseline conditions. Most of the impacted people are in the 55 to 60 DNL range. Only 37 persons are impacted by noise above 65 DNL.

As shown in **Table 7B**, 25 existing dwellings would be impacted by noise above 55 DNL, while more than 1,400 potential future dwellings would be impacted by aircraft noise at this level. Most are in the 55 to 60 DNL range. No future dwellings would be in the 70+ DNL range with only eight in the 65 to 70 DNL range.

LAND USE MANAGEMENT ELEMENT

The recommended land use management measures for use in the vicinity of Glendale Municipal Airport are presented below.

Some of the recommended land use measures are to apply within an "airport influence area". This is the area within which frequent overflights can be expected, many of them at low altitudes, by aircraft operating out of Glendale. Noise events also can be expected in this area which may be disturbing to some people some of the time, especially in view of the generally quiet background noise in this area. The boundaries of this area were defined by referring to the exhibits showing where actual flight tracks were observed (Exhibits 2D and 2E in Chapter Two) and the 2015 noise contours (Exhibit 7D). Areas where large numbers of flight tracks converge are considered to be within the airport influence area. The boundaries have been squared off to enable them to be readily identified on local maps and in the field.

1. Preserve existing General Plan designations for compatible land uses (industrial, commercial, office, open space) in the airport influence area.

Description: The City of Glendale should preserve, and encourage Avondale, Peoria, and Phoenix to preserve, current commercial, industrial and open space designations in the airport influence area. The land should be rezoned in the future only for those compatible land uses. In addition, the jurisdictions should strongly discourage rezoning for residential and other noise-sensitive land uses that are not consistent with the General Plan. This will ensure noise-compatible land use development around the airport.

The boundary of the airport influence area, illustrated on **Exhibit 7E**, is based on the observed flight tracks (see Exhibits 2D and 2E) and anticipated future flight tracks which are consistent with the noise abatement recommendations discussed earlier. This area is subject to frequent aircraft overflights and aircraft noise.

Implementation Actions: The City of Glendale should adopt the Noise Compatibility Program (NCP) as an element of its General Plan in order to ensure that the policy recommendations of the NCP are given the same weight as other land use policies. The cities of Avondale, Peoria and Phoenix, and Maricopa County should also adopt the NCP or relevant portions of the NCP as part of their local general plans.

Cost and Funding: This measure would involve relatively small administrative expenses. Funding would come from the operating budgets of each jurisdiction.

Timing: This is an ongoing effort. The airport management should encourage the local jurisdictions to adopt general plan policies consistent with the NCP as soon as possible after the program has been approved by the Glendale City Council. For planning purposes, this approval is projected for 1994.

2. ***Retain existing compatible use zoning within the airport influence area.***

Description: The City of Glendale should retain, and encourage Avondale and Peoria to retain, current commercial and industrial zoning designations in the vicinity of the airport, as shown in **Exhibit 7E.** In addition, the jurisdictions should strongly discourage rezoning for residential and other noise-sensitive land uses that are not consistent with the General Plan. This will ensure noise-compatible land use development around the airport.

Implementation Actions: The City of Glendale should adopt the NCP as an element of its General Plan. The cities of Avondale and Peoria should also adopt the NCP, or relevant portions thereof, as part of their local general plans.

Cost and Funding: This measure would involve relatively small administrative expenses. Funding would come from the operating budgets of each jurisdiction.

Timing: This is an ongoing effort. The airport management should encourage the local jurisdictions to retain their existing compatible use zoning after the Noise Compatibility Program has been approved by the City of Glendale. For planning purposes, this is projected for 1994.

3. ***Encourage Flood Control District to include impact of airport noise in priority-setting system for flood control projects, and encourage natural floodplain preservation in areas impacted by aircraft noise.***

Description: The Flood Control District of Maricopa County currently utilizes numerical guidelines for determining the priority of constructing and funding flood control improvements. The City of Glendale should coordinate with other airport operators in the Phoenix Metropolitan area to encourage the Flood Control District to revise its existing priority-setting system for flood control projects. The impacts of airport noise on flood hazard areas should be considered as a factor. Specifically, flood control projects which would encourage residential development in airport noise-impacted areas should be given a lower priority than other projects. Ideally, these projects would not be constructed or funded by the District.

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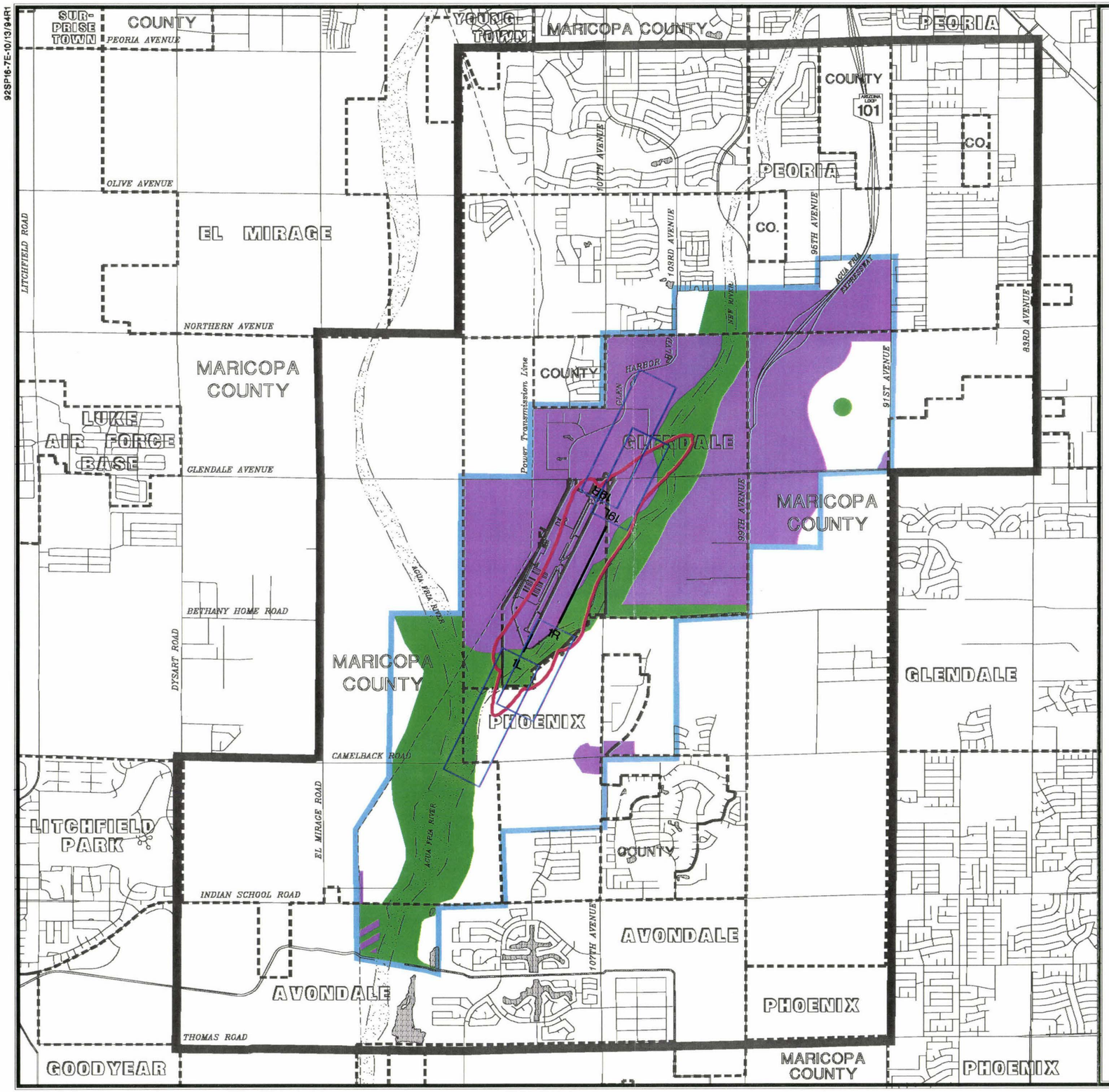
Exhibit 7E
LAND USE PLANNING RECOMMENDATIONS



The City of Glendale, in cooperation with other airport operators in the Phoenix Metropolitan area, also should encourage the Flood Control District to consider a policy of natural floodplain preservation within areas impacted by aircraft noise. The Flood Control District of Maricopa County was established, in part, to provide flood control and stormwater runoff measures to protect existing development from being flooded. This measure would modify that policy to encourage the preservation of natural floodplains in areas adjacent to airports or impacted by airport noise and frequent low overflights. This would promote both flood control and compatible land use near airports.

Implementation Actions: The City of Glendale should adopt the NCP as an element of its General Plan. The City of Glendale should then initiate discussions with other jurisdictions in the Phoenix Metropolitan area. The jurisdictions should encourage the Flood Control District of Maricopa County to revise its existing policies and numerical guidelines to reflect these proposed policies.

Cost and Funding: This measure would involve some relatively small administrative expenses. Funding would come from the operating budget of the City of Glendale.

Timing: The City of Glendale should begin discussions with other local government airport operators after the Noise Compatibility Program has been approved by the City and after other land use measures have been moved toward implementation. For planning purposes, action on this measure is projected for 1995 and 1996.

4. ***In the unincorporated part of airport influence area, discourage the rezoning of Rural-43 areas to higher density residential zones.***

Description: Maricopa County's existing zoning ordinance provides for rural, low-density residential development in the vicinity of the airport (Rural-43 zoning district); however, the ordinance also suggests that where "governmental facilities and services, public utilities and street access are available, or can reasonably be made available, applications for change of this zoning district to any single-family residential zoning district will be given favorable consideration." This could permit rezonings allowing greater housing densities than are permitted in the Rural-43 district. The City of Glendale should encourage the County to adopt a formal policy discouraging or prohibiting the higher density single-family residential development in the airport influence area.

Implementation Actions: The City of Glendale should adopt the NCP as an element of its General Plan. The City should then encourage Maricopa County to amend the White Tanks - Agua Fria Policy and Development Guide by adopting a policy reflecting this recommendation.

Cost and Funding: This measure would involve some relatively small administrative expenses on the part of both Glendale and Maricopa County. Funding would come from their respective operating budgets.

Timing: This is an ongoing effort. The City of Glendale should encourage Maricopa County to adopt a policy

regarding this recommendation after the Noise Compatibility Program has been approved by the City Council. For planning purposes, this is projected for 1994.

5. *Encourage fair disclosure of airport impacts to potential future property owners.*

Description: The City of Glendale should enact a program of fair disclosure procedures within the airport influence area. The City also should encourage Avondale, Peoria, Phoenix, and Maricopa County to adopt fair disclosure procedures. Informal fair disclosure procedures are currently being implemented to some degree within the study area by real estate industry professionals; however, the existing system is dependent on the seller's sensitivity to airport noise and any impacts directly to the property. It does not specifically result in the disclosure of the proximity of the airport, specific noise contours or aircraft flight tracks.

The following specific actions are recommended:

a. Within the "airport influence area", stipulations should be attached to any rezonings requiring the recording of fair disclosure agreements and covenants with the plats and deeds to the rezoned property. Copies of the proposed documents are in Appendix G. These agreements and covenants would require that property owners inform buyers of the presence of the airport and the potential for annoyances, including noise. The covenant would run with the land, binding all future property owners to make the same disclosure.

b. The Glendale staff should periodically meet with real estate professionals, mortgage lenders, and title insurers to inform them about the airport and the need for fair disclosure of information about the airport.

c. Glendale should consider posting signs throughout the "airport influence area" noting the presence of the airport and the potential for low-flying aircraft.

d. Glendale staff should ensure that local planning departments remain informed about the airport and any updated airport noise studies.

Implementation Actions: The City of Glendale should adopt the NCP as an element of its General Plan. The City should then coordinate with the other jurisdictions regarding the importance of ensuring that future property owners have been apprised of the proximity of the airport before finalizing the purchase of the property.

Implementation of this measure would also involve occasional presentations to mortgage lenders and real estate professionals, including the provision of accurate materials to these groups, posting signs in noise-impacted areas to guard against people unwittingly buying property in a noise-impacted area, or notifying potential buyers of general aircraft noise in the airport vicinity.

Cost and Funding: This will involve administrative costs which can be covered through the operating budgets of the various jurisdictions.

Timing: The cities of Glendale, Avondale, Peoria, and Phoenix, and

Maricopa County should consider implementing this recommendation after the Noise Compatibility Program has been approved by the City of Glendale. For planning purposes, implementation of this measure would be anticipated for 1994.

6. ***Through the rezoning process, prohibit homes in 65 DNL and "runway approach areas." Require fair disclosure agreements and covenants in airport influence area.***

Description: The City of Glendale should use the rezoning process to attach land use compatibility stipulations to property in the airport influence area. Glendale should encourage Phoenix, Peoria, Avondale, and Maricopa County to do the same. The policies should be designed to avoid the development of homes and noise-sensitive institutions within the 65 DNL contour, based on 2015 noise with the compatibility plan, and within runway approach areas. It would be appropriate for the cities to consider compensating the developer for this restriction by allowing a credit for the prohibited units to be used on another part of the same development.

A second policy would provide for fair disclosure to future property owners of the proximity of Glendale Municipal Airport. This would be accomplished by requiring developers to include fair disclosure agreements and covenants when recording plats and deeds for developments within the airport influence area. Recommended language for the fair disclosure agreements and covenants is in Appendix G.

Exhibit 7E, shows the areas where noise-sensitive land uses should be prohibited and where fair disclosure agreements and covenants should be required.

The runway approach areas for the primary runway are defined as extending 5,000 feet off the ends of the primary surface of the primary runway, 1,500 feet in width. The approach areas for the proposed future parallel runway are 1,500 feet wide, extending 3,500 feet off the primary surface. (The primary surface terminates 200 feet off the runway end.) These areas are subject to frequent aircraft overflights at very low altitudes and are thus subject to high single event aircraft noise, in addition to relatively high cumulative noise levels. The approach area off the primary runway is larger than off the future parallel runway because it will be used by larger, and generally noisier, aircraft, including jets, while the shorter runway will tend to be used most often by light single engine aircraft.

The dimensions of these areas are based on criteria for "runway safety zones" defined in the 1983 *Airport Land Use Planning Handbook* developed by the California Department of Transportation. Within these areas, the "Handbook" recommends minimal development of any kind, and, in particular, recommends that noise-sensitive development be avoided. These guidelines have been used by airport land use commissions in California in developing airport vicinity land use plans. In addition, these dimensions generally correspond to "approach areas" formerly defined in the Federal Airport Improvement Program Handbook as eligible for acquisition by airport proprietors. While the current edition of the Handbook no longer specifically defines these areas, it continues to make it clear that land within 5,000 feet of a

runway end can be considered for acquisition by the airport operator. (See FAA Order 5100.38A, subsection 602.b(2), page 69.)

Implementation Actions: The City of Glendale should adopt the NCP as an element of its General Plan. The City also should encourage the City of Phoenix to adopt either the NCP or relevant portions thereof as part of its General Plan to ensure that the land use compatibility stipulations are given the same weight as other land use policies within the vicinity of the Glendale Municipal Airport.

Cost and Funding: This measure will involve administrative costs which can be covered through the operating budgets of both jurisdictions.

Timing: The cities of Glendale and Phoenix should consider implementing this recommendation after the Noise Compatibility Program has been approved by the City of Glendale. For planning purposes, implementation of this measure would be anticipated for 1994.

7. ***Acquire homes and undeveloped land in the 65 DNL noise contour, based on 1999 noise with the Noise Compatibility Plan.***

Description: The City of Glendale should purchase the residences located within the abated 1999 65 DNL noise contour, as illustrated on **Exhibit 7F.** These include one conventional home and three mobile homes. The homes are south of Glendale Avenue, between the airport and the New River. The City also should buy the undeveloped land within the 65 DNL contour that is presently zoned "Agriculture". This zoning district permits a very limited amount of residential development. This area includes about 18 acres from a 48-acre tract. After acquisition, the airport should hold the property for future approach protection.

The purchase of the homes is proposed as a voluntary program. If the owner of the conventional home prefers not to sell his or her property, the City should consider offering to purchase a noise and avigation easement or to install sound insulation as an alternative.

Implementation Actions: Land acquisition is subject to the requirements of the Uniform Relocation Assistance and Real Property Acquisition Act (49 CFR Part 24). This includes establishing the home and land values through professional appraisals. It also establishes procedures for setting relocation assistance payments. The acquisition program should be managed by the airport management. At the City's option, it can wait for receipt of a Federal grant before it starts the program, or it can use local funding and apply later for Federal reimbursement.

Cost and Funding: One site-built home and three mobile homes would be involved in the proposed acquisition. The total cost of this measure is estimated at $675,000. Total acquisition, relocation, and demolition costs of the site-built home are estimated at $134,000. Costs for the mobile homes are estimated at $47,000 each. The cost for the land on which the homes are located (4.8 acres) and the undeveloped land (18 acres) is estimated at $400,000 assuming $14,000 per acre plus a 25 percent contingency factor.

It is anticipated that the cost of this measure will be eligible for Federal

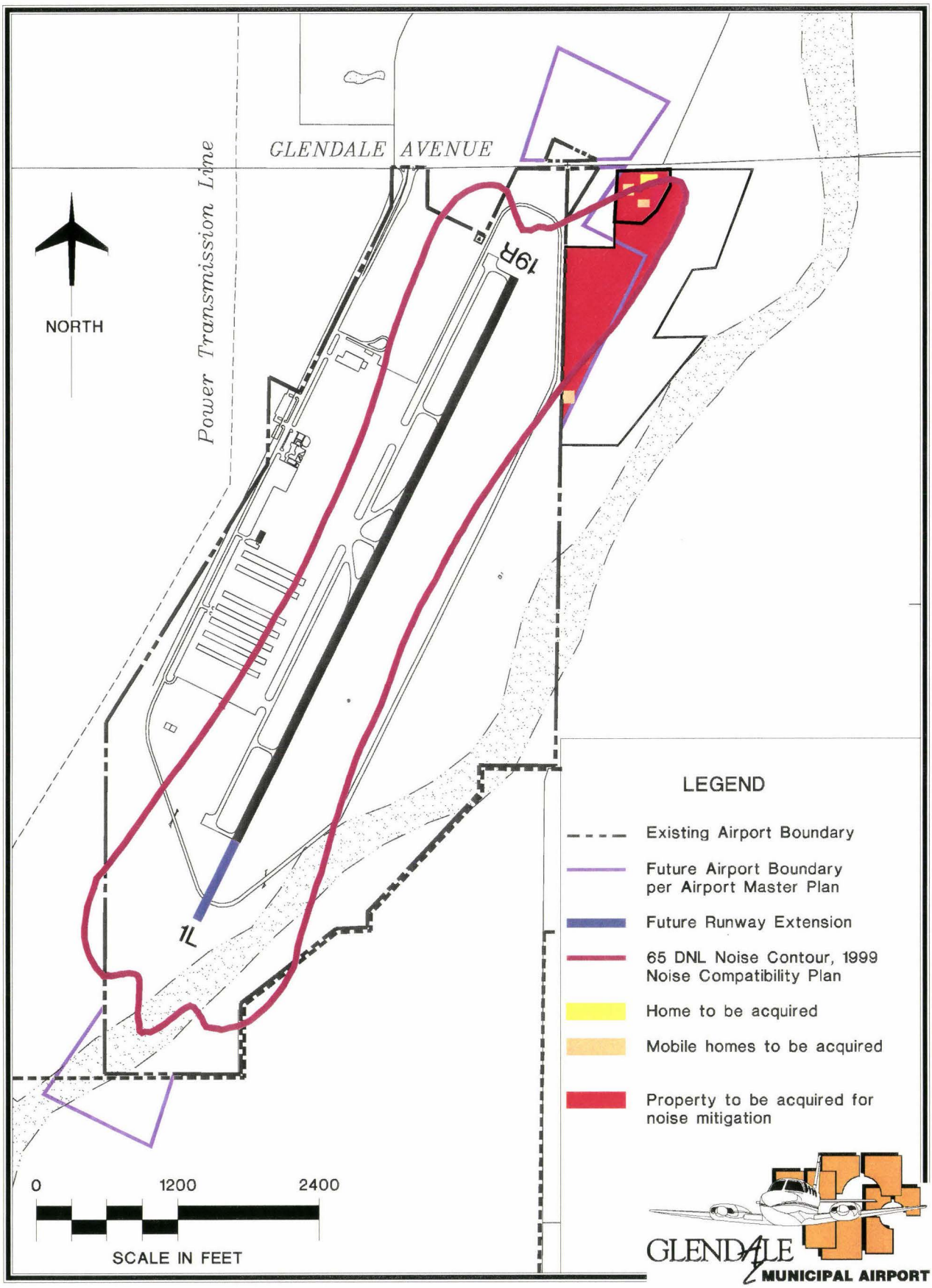


Exhibit 7F
PROPOSED PROPERTY ACQUISITION

funding assistance through the noise set-aside of the Federal Airport Improvement Program. The Federal government will fund up to 91.06 percent of the total cost. The balance of the acquisition costs will be divided between the State of Arizona (4.47 percent) and the City of Glendale (4.47 percent). The local match should be provided from the airport capital budget.

Timing: The airport management should proceed with this measure as soon as possible after the Noise Compatibility Program (NCP) has been approved by FAA. The time frame for implementation is anticipated for no earlier than 1996, allowing for FAA review and approval of the NCP and the application for a Federal grant.

OTHER CONSIDERATIONS

There is the potential for some future housing development in parts of the airport influence area. It is not necessary to require the sound insulation of new homes in this area, as long as they are prohibited in the 65 DNL contour and runway approach areas. Nevertheless, it would be appropriate for the local governments (Avondale, Glendale, Peoria, Phoenix, or Maricopa County) to encourage developers and builders to install sound insulation and to provide them with appropriate guidelines. Sound insulation standards that can be used for this purpose are in **Appendix G.**

PROGRAM MANAGEMENT ELEMENT

The success of the Noise Compatibility Program requires a continuing effort to monitor compliance and identify new or unanticipated problems and changing conditions. Three program management measures are recommended at Glendale Municipal Airport. The City of Glendale is responsible for implementing all of these measures. They are discussed below and summarized in **Table 7C.**

1. *Maintain system for receiving and responding to noise complaints (City of Glendale).*

Description. The airport has a system of recording and responding to noise complaints. In addition to recording and filing complaints, it is important for the airport management to respond to complaints, even if it is not possible to take remedial action.

Complaints are only an imperfect indicator of noise problems. The tendency of an individual to file a complaint depends on many personal variables including socioeconomic status, feelings about the aviation industry, expectations about overall neighborhood livability, housing tenure, and sensitivity to noise. Recognizing that complaints are limited in their ability to clearly reveal the existence and scope of noise problems, the staff should nevertheless periodically analyze the complaint records. If the geographic pattern of complaints, or the causes of complaints, indicate that consistent problems exist, the airport management should investigate and, if possible, seek corrective action.

It is important to record as much relevant data as possible when complaints are filed. This will help in investigating and potentially resolving

the sources of complaints. A form which can be used for this purpose is in Appendix G.

Implementation Actions. This is an existing activity. No special implementation efforts are required.

Cost and Funding. This involves administrative costs which are financed through the airport operating budget.

Timing. This is an ongoing activity that should be continued.

2. ***Review Noise Compatibility Plan implementation (City of Glendale).***

Description. The City of Glendale should maintain communications with planning officials of other local governments to follow their progress in implementing the relevant measures of the Land Use Management Element.

The airport management also must monitor compliance with the Noise Abatement Element. This includes checking periodically with the air traffic control manager regarding compliance with the preferred visual flight tracks and the informal preferential runway use program. Where appropriate, the airport management also should check with airport users. This is especially appropriate in checking on compliance with AOPA quiet flying procedures (Noise Abatement Measure 5). This can serve as a friendly reminder to users that the airport management places high regard on the program. It also may help in identifying any difficulties in implementing the noise abatement measures.

It may be necessary from time to time to arrange for noise monitoring, noise modeling, or flight track analysis to study issues that may arise in the future. The airport should hire consultants as needed for these special studies.

Implementation Actions. No specific actions, other than those discussed above, are necessary.

Costs and Funding. This would involve administrative costs to the airport. In addition, expenditures for special noise monitoring or modeling studies could be necessary from time to time. For budgeting purposes, this cost is estimated at $15,000 every three years. This would be covered through the airport operating budget.

Timing. This is an ongoing activity that should begin as soon as the Noise Compatibility Program is approved by the City Council.

3. ***Update Noise Exposure Maps and Noise Compatibility Program (City of Glendale).***

Description. The airport management should review the Noise Compatibility Plan (NCP) and consider revisions and refinements as necessary. A complete plan update will be needed periodically to respond to changing conditions in the local area and in the aviation industry. This can be anticipated every five to eight years. An update may be needed sooner, however, if major changes occur and later if conditions at the airport and in the surrounding area remain stable.

Proposed changes to the NCP should be reviewed by the FAA and all affected aircraft operators and local agencies. Proposed changes should be submitted to FAA for approval after local

consultation and a public hearing in order to comply with F.A.R. Part 150.

Even if the NCP does not need to be updated, it may become necessary to update the Noise Exposure Maps (NEMs). F.A.R. Part 150 requires the NEMs to be updated if any change in the operation of the airport would create a substantial, new non-compatible use. FAA interprets this to mean an increase in noise levels of 1.5 DNL or more, above 65 DNL, over non-compatible areas that had formerly been compatible.

As a general rule, the trigger for determining the need for contour updating is a 17 percent change in equivalent operations by the loudest aircraft regularly using the airport. To calculate "equivalent operations", any nighttime operations, (between 10:00 p.m. and 7:00 a.m.) must be multiplied by ten and added to daytime operations.

Implementation Actions. No specific implementation actions, other than those discussed above, are required.

Cost and Funding. Costs of a complete update of the Noise Compatibility Program are estimated at $225,000. This would be eligible for up to 91.06 percent funding from the FAA. The State Transportation Department and the City of Glendale would each be responsible for 4.47 percent. The City's share would come from the airport operating budget.

Timing. This should be done as necessary. Updates are typically needed every five to eight years, depending on how much change occurs at the airport. For planning purposes, three updates can be expected over the next 20 years.

SUMMARY

The Noise Compatibility Plan for Glendale Municipal Airport, summarized in **Table 7C** on the next page, can reduce the number of people impacted by aircraft noise. The land use planning measures also can help to limit the potential for future noise-sensitive development in the airport area.

Continuing program management will provide for a timely response to conditions that may change over time and require a reevaluation of future noise conditions. While the airport management must provide leadership and coordination of the entire program, success hinges on the cooperation of all involved parties.

TABLE 7C
Summary Of Noise Compatibility Plan, 1994-2015

Measure	Cost to Airport or Local Gov't.	Cost to Users[1]	Timing	Lead Responsibility[2]	Potential Funding Sources
NOISE ABATEMENT ELEMENT					
1. Encourage right turns on upwind leg of Runway 1 local traffic pattern.	Administrative	None	1994-95	Glendale	Operating budget
2. Encourage straight-out VFR departures from Runway 19.	Administrative	Increase in time and fuel burn for east and north bound departures.	1994-95	Glendale (Air traffic control tower)	Operating budgets
3. Encourage right turns for VFR departures from Runway 1.	Administrative	None	1994-95	Glendale (Air traffic control tower)	Operating budgets
4. Establish informal north flow preferential runway use program.	Administrative	Small increase in costs for traffic headed south or coming from the north.	1994-95	Glendale (Air traffic control tower)	Operating budgets
5. Encourage use of AOPA "Noise Awareness Steps" and NBAA noise abatement arrival and departure procedures.	$10,000+ Administrative	Negligible	1994-95	Glendale	FAA-91.06% State DOT-4.47% Airport Capital Budget-4.47%
6. Adopt noise-sensitive marketing policies.	Administrative	None	1994-95	Glendale	Operating budget
LAND USE MANAGEMENT ELEMENT					
1. Preserve existing General Plan designations for compatible land uses in airport influence area.	Administrative	None	Ongoing	Glendale (Avondale, Peoria, Phoenix)	Operating budgets
2. Retain existing compatible zoning in airport influence area.	Administrative	None	Ongoing	Glendale (Avondale, Peoria)	Operating budgets
3. Encourage Flood Control District to include impact of airport noise in priority-setting system for flood control projects and encourage natural flood-plain preservation in areas impacted by airport noise.	Administrative	None	1995-96	Glendale (Flood Control District of Maricopa County)	Operating budgets

TABLE 7C (Continued)
Summary Of Noise Compatibility Plan, 1994-2015

Measure	Cost to Airport or Local Gov't.	Cost to Users[1]	Timing	Lead Responsibility[2]	Potential Funding Sources
LAND USE MANAGEMENT ELEMENT (Continued)					
4. In unincorporated part of airport influence area, discourage the rezoning of "Rural-43" areas to higher density residential zones.	Administrative	None	1994	Glendale (Maricopa County)	Operating budgets
5. Encourage fair disclosure of airport impacts to potential future property owners.	Administrative	None	1994	Glendale (Avondale, Peoria, Phoenix, Maricopa County)	Operating budgets
6. Through the rezoning process, prohibit homes in 65 DNL and "runway approach areas." Require fair disclosure agreements and covenants in airport influence area.	Administrative	None	1994	Glendale (Avondale, Peoria, Phoenix, Maricopa County)	Operating budgets
7. Acquire homes in 65 DNL based on 1999 noise with the Noise Compatibility Plan.	$675,000	None	1996 or later	Glendale	FAA-91.06% State DOT-4.47% Airport capital budget-4.47%
PROGRAM MANAGEMENT ELEMENT					
1. Maintain system for receiving and responding to noise complaints.	Administrative	None	Ongoing	Glendale	Operating budget
2. Review Noise Compatibility Plan Implementation.	$90,000 ($15,000/3 yrs.)	None	Ongoing	Glendale	Operating budget
3. Update Noise Exposure Maps and Noise Compatibility Program.	$450,000 ($225,000/5-8 yrs.)	None	Update every 5 to 8 years	Glendale	FAA-91.06% State DOT-4.47% Airport operating budget-4.47%
TOTAL COSTS OF NCP (1994-2015)	$1,225,000	FAA ..... $1,033,531 State DOT ..... $50,734 Airport Capital Budget ..... $30,620 Airport Operating Budget $110,115			

Footnotes:

1 Airport users indirectly will be responsible for at least part of the City's share of funding through lease payments and user fees.

2 Jurisdictions in parentheses are to be encouraged by City of Glendale to implement actions as described.

APPENDIX E

GLENDALE

MUNICIPAL AIRPORT

Appendix E
COORDINATION, CONSULTATION, AND PUBLIC INVOLVEMENT

As part of the planning process, the public, airport users, and local, state, and Federal agencies were given the opportunity to review and comment on the Noise Compatibility Program and supporting documentation. Materials prepared by the consultant were submitted for local review, discussion, and revision at several points during the process. The Planning Advisory Committee (PAC) reviewed and commented on these submissions and was requested to provide direction for future study efforts. Most comments were made orally during the meetings, but many comments were followed by written confirmation. All comments were appropriately incorporated into this document or otherwise addressed. A list of the members of the PAC is on page E-3.

The PAC met five times during the preparation of the Noise Compatibility Program. On December 13, 1993 a meeting was held to introduce the participants, describe the study process, discuss goals and objectives, distribute committee workbooks and study initiation brochures, review Chapter One, Inventory, and hear comments and views pertaining to conditions at the airport. Many comments and questions were raised at the meeting. Comments about existing land use and future development were offered. Additional comments and concerns were raised about noise levels in the recent past when Airline Training Center of Arizona (ATCA) was operating frequently at Glendale. The noise measurement program which had recently been completed was discussed. Several

questions and comments related to the role of the PAC, procedures for keeping and reviewing meeting notes, and a preference for night meetings in the future. The scheduled public information meeting for the evening of December 13 was also announced. Some PAC members expressed a desire to see better publicity about future public information meetings.

The second PAC Meeting was held on March 9, 1994. Working papers on aviation noise, community noise, and noise impacts were presented and discussed. Many questions and comments were raised about the aviation noise analysis. These included questions about the DNL noise metric, forecasts of operations and aircraft types, noise measurements, and flight tracks used for noise modeling. There was considerable discussion about the possibility of modeling past operations and flight tracks based on ATCA's use of the airport. It was agreed to do this at the next step in the study, as a technical appendix or as part of the noise abatement alternatives chapter. The next step of the study, involving the analysis of noise abatement and land use management alternatives was also discussed.

On March 10, 1994, the day after the second PAC meeting, technical conferences were held on potential noise abatement and land use management alternatives. At the Aviation Technical Conference, ten potential noise abatement alternatives were discussed. The alternatives involved adjustments to the local traffic pattern, flight tracks routing traffic over non-residential areas, preferential runway use, and restrictions on certain types of aircraft operations.

At the Land Use Technical Conference, several alternative land use planning and regulatory techniques to promote compatible development near the airport were discussed. The constraints on compatible development, given emerging residential development trends in the area, were discussed at length.

At the third PAC meeting, held on May 23, 1994, working papers on noise abatement alternatives and land use alternatives were discussed. There was considerable discussion about the desirability and feasibility of adjusting the local traffic pattern to minimize overflights of residential areas. There was also much discussion of the potential for airport operating restrictions at Glendale to help reduce noise exposure. The discussion of land use alternatives focused on economic obstacles to more commercial or industrial zoning near the airport and the need for fair disclosure of airport noise when people consider buying homes near the airport.

The fourth PAC meeting was held on July 25, 1994. The proposed Noise Compatibility Plan was reviewed and discussed. There was considerable discussion about how the noise abatement recommendations would be implemented. There was some discussion about whether the planned future parallel runway should be shown on the long-range noise exposure forecasts. The merits of airport operating restrictions were also discussed as were fair disclosure procedures.

The fifth PAC meeting was held on October 3, 1994. The revised version of the Noise Compatibility Plan was

discussed. There was considerable discussion about the local traffic pattern. Other discussion dealt with the planned future parallel runway and potential non-precision instrument approaches to the airport.

In addition to the Planning Advisory Committee Meetings, the general public was invited to five public information workshops. Structured as open houses, with display boards and information posted throughout the meeting room, these meetings were intended to encourage two-way communication between the airport staff and consultants and local citizens.

The first public information meeting was held on December 13, 1993. The material presented was the same as was discussed at the Planning Advisory Committee meeting earlier in the day. A second public information meeting was held on January 27, 1994, presenting the same information. The third public information meeting was held on March 10, 1994. Information on aircraft noise, community noise, and noise impacts was presented. The fourth public meeting was on May 24, 1994 where the potential noise abatement and land use management alternatives were discussed. The fifth public meeting was on July 26, 1994 where the proposed noise compatibility plan was presented and discussed.

A public hearing on the proposed Noise Compatibility Program was held on October 4, 1994. An informal open house was held for one hour before the hearing to enable people to review and discuss the plan informally.

In addition to these formal meetings, many written and verbal contacts were made between project management staff and officials of local, state, and Federal agencies and representatives of various aviation user groups. These were related to the day-to-day management of the project, as well as the resolution of specific questions and concerns arising from the working papers.

For more information on project coordination, consultation, and public involvement, please refer to the supplemental volume to the *Noise Compatibility Program* entitled *Supporting Information on Project Coordination and Local Consultation*. That supplement includes copies of meeting announcements, summary notes from the meetings, sign-in sheets, a transcript of the public hearing, written comments received on the study, and responses to the questions and comments raised at the public hearing.

GLENDALE MUNICIPAL AIRPORT
F.A.R. PART 150 NOISE COMPATIBILITY STUDY
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APPENDIX F

GLENDALE

MUNICIPAL AIRPORT

Appendix F
HISTORICAL NOISE EXPOSURE

INTRODUCTION

This appendix presents the analysis which evaluates the historical noise exposure around Glendale Municipal Airport for the year 1990. The analysis was requested by a number of Planning Advisory Committee members and airport neighbors. It was felt that some type of historical noise analysis would provide a reference by which the current and future noise exposure could be compared to what has been experienced in the past.

The year 1990 was chosen for the analysis because it represents the highest activity levels in the history of the airport. Additionally, this was during the peak usage of Glendale by Airline Training Center of Arizona (ATCA) which was then based at Glendale and conducted extensive training operations at the airport. Since then, ATCA has moved from Glendale and has reduced their use of the airport significantly. Consequently, the current noise analysis presented in Chapter Two of this study does not reflect a significant impact from the ATCA operation. Using the capabilities of the INM computer noise model, it is possible to simulate those historical conditions for comparison to the current and projected future conditions at Glendale.

1990 NOISE EXPOSURE

The 1990 noise exposure was developed using version 4.11 of the INM as described in Chapter Two. The 1990 operational levels reported in Appendix C, Table C4, page C-6 of this study were used for the analysis. While operational information was readily available for historic years at the airport, a number of other statistics that are necessary to the modelling process were not available. In these cases, the INM input data presented in Chapter Two was used or modified according to reasonable

assumptions regarding historical airport operations. The following sections discuss the input data and assumptions for this analysis.

OPERATIONS

As previously discussed, the analysis focuses on the average annual DNL noise exposure for the calendar year 1990. The data presented in Appendix C indicates that during 1990 there were some 151,662 aircraft operations at Glendale. Of these, there were 109,035 local operations. One of the primary concerns of the airport neighbors in the past has been the training (touch-and-go) operations conducted by ATCA. In order to address these concerns in this analysis it is necessary to attempt to identify the number of training operations that were attributable to ATCA in 1990.

Local operations are generally considered touch-and-go for noise simulation purposes. Unfortunately, no specific records of ATCA activity are available. It is possible however, to estimate that activity with some assumptions and comparisons to current activity. It is reasonable to conclude that some portion of the 109,035 local operations for 1990 were conducted by ATCA aircraft, while perhaps a smaller portion were conducted by other general aviation users. In 1988, prior to ATCA's use of the airport, general aviation local operations numbered 59,207. Assuming that this is a reasonable representation of the non-ATCA traffic, the 1990 ATCA operations would number about 50,000, leaving about 59,000 local operations by other general aviation users. This number was incorporated into the analysis.

FLIGHT PROCEDURES

Various flight procedures can also have an effect on the noise exposure around an airport. Usually, the random nature of the activity at a general aviation airport precludes the modelling of custom flight procedures. At Glendale, however, the presence of a single flight school which accounted for a significant portion of the operations at the airport, allows for the opportunity to specifically model their procedures for their operations.

Discussions with ATCA staff provided the specific procedures that were used by the Beech Bonanza aircraft operating at Glendale. Since most of the ATCA operations at Glendale were touch-and-go operations, the training procedures were quantified and converted into the INM. The ATCA procedure is as follows:

- Takeoff weight is 3,400 pounds.
- Start takeoff roll with full power, full prop, flaps=0.
- Maintain approximately 700 to 800 feet per minute climb rate.
- Climb to 400 feet above ground level (AGL) and reduce power to 2,500 RPM and 25 inches of manifold pressure.
- Climb to 500 feet AGL and turn to crosswind leg of pattern.
- Climb to 1,000 feet AGL and turn to downwind leg and reduce power to 2,500 RPM. and 17 inches of manifold pressure.
- Maintain 105 knots on downwind leg.
- When abeam landing threshold + 30 seconds lower landing gear and reduce power to 13-14 inches of manifold pressure.

92SP16-F-1-4/20/94

Exhibit F-1
1990 NOISE EXPOSURE WITH ATCA PROCEDURES

SURPRISE TOWN
COUNTY
PEORIA AVENUE
YOUNGTOWN
MARICOPA COUNTY
PEORIA
COUNTY
ARIZONA LOOP 101
OLIVE AVENUE
LITCHFIELD ROAD
EL MIRAGE
PEORIA
CO.
103RD AVENUE
95TH AVENUE
AGUA FRIA FREEWAY
NEW RIVER
83RD AVENUE
NORTHERN AVENUE
MARICOPA COUNTY
COUNTY
HARBOR BLVD
GLEN
Power Transmission Line
91ST AVENUE
LUKE AIR FORCE BASE
GLENDALE AVENUE
GLENDALE
99TH AVENUE
MARICOPA COUNTY
55
60
65
70
75
AGUA FRIA RIVER
BETHANY HOME ROAD
DYSART ROAD
MARICOPA COUNTY
PHOENIX
GLENDALE
CAMELBACK ROAD
EL MIRAGE ROAD
AGUA FRIA RIVER
LITCHFIELD PARK
COUNTY
INDIAN SCHOOL ROAD
107TH AVENUE
AVONDALE
AVONDALE
PHOENIX
THOMAS ROAD
GOODYEAR
MARICOPA COUNTY
PHOENIX

LEGEND

- Study Area Boundary
- Jurisdiction Boundary
- Airport Boundary
- DNL Contour- Marginal Impact
- DNL Contour- Significant Impact
- Modified Training Tracks
- Existing Residential
- Undeveloped
- Existing Public and Institutional
- School
- Church
- Community Center
- N Nursing/Rest Home
- A Amphitheater
- Site on National Register of Historic Places

NORTH

0 4000 8000

SCALE IN FEET

GLENDALE MUNICIPAL AIRPORT

- Turn to base leg, adjust prop to full, set power at 12-13 inches of manifold pressure, set flaps to 15.
- Maintain 500 feet per minute descent through base and final legs to touchdown.
- At touchdown, flaps up, set full power, set full prop.

From this information custom approach and departure profiles were developed using the methodologies presented in Appendix B of the Integrated Noise Model Version 4.11 User's Guide - Supplement, and the Society of Automotive Engineers (SAE) Aerospace Information Report (AIR) #1845. These profiles were then assigned to all of the 50,000 ATCA training operations in the simulation.

FLEET MIX

Specific information regarding the type of aircraft operating at Glendale in 1990 was not available. Consequently, the fleet mix for 1994 presented in Chapter Two of this document was assumed for this analysis. ATCA has always primarily used the Beech Bonanza aircraft, therefore it was incorporated in the model to simulate these operations. All model substitutions discussed in Chapter Two were applied to this analysis.

FLIGHT TRACKS AND RUNWAY USE

Historical runway use and flight track information was not available for 1990. Given the minimal changes in the airspace and constraints around Glendale, it is reasonable to use the field data presented in Chapter Two for this analysis. Additionally, because of the concerns regarding the ATCA operations and the training patterns, the touch-and-go patterns were refined for this analysis.

Although no radar tracking data was available, several video tapes shot from the Garden Lakes area were reviewed to provide insights into the pattern location during busy periods at the airport in the past. These observations were compared with those presented in the traffic pattern study conducted for the airport during the summer of 1990. The results indicated that a slight adjustment in the largest training patterns (TG1A and TG4A) presented in Chapter Two on Exhibits 2F and 2G is warranted. For this analysis these two tracks have been relocated and divided into a total of four tracks.

The tracks illustrated in **Exhibit F-1** show the location of the resulting adjusted training track. These tracks merely replace tracks TG1A and TG4A that are presented in the Chapter Two exhibits. All other flight patterns and tracks from the Chapter Two analysis were unchanged for this evaluation.

In order to simulate the worst case, all of the ATCA training operations were assigned to these new tracks. The ATCA operations were distributed to the track with a 50/50 split. the remaining miscellaneous general aviation training operations were distributed among these tracks as well as the other training pattern tracks presented in Chapter Two.

NOISE CONTOURS

Exhibit F-1 illustrates the noise exposure pattern resulting from the analysis. The noise contours exhibit an overall shape similar to the 1994 and 1999 noise

contours presented in Exhibits 2H and 2J in Chapter Two. The 1990 contours are generally larger than the 1999 contours but are smaller than those projected for 2015. This is reasonable given the 1990 operational levels in comparison with those forecast for 1999 and 2015. The 1990 contours exhibit somewhat longer and narrower lobes along the runway centerline to the north and south of the airport. These result from the concentration of ATCA activity on the larger training patterns in conjunction with the custom profiles associated with this activity. Table F1 compares the areas within the 1990 noise contours with those of the current and future noise contours presented in Chapter Two of this document.

TABLE F1
Comparative Areas Of Noise Exposure

	Area in Square Miles			
DNL Contour	1990	1994	1999	2015
55	2.54	1.95	2.28	4.31
60	0.95	0.75	0.83	1.63
65	0.43	0.36	0.39	0.72
70	0.21	0.18	0.21	0.39
75	0.11	0.09	0.11	0.23

CONCLUSION

The preceding analysis has evaluated the average annual noise exposure for 1990 at Glendale Municipal Airport. The analysis provides a frame of reference for airport neighbors and users to compare the current and projected future noise exposure with conditions experienced in the past. The results of the analysis indicate that the noise exposure in 1990 is significantly larger than the current conditions. In fact, the 1990 noise contours are slightly larger in some areas than those that have been projected for 1999 in Chapter Two. The projected noise contours for 2015 however, are significantly larger than those calculated for 1990. The 2015 noise contours, therefore, can be taken as a reasonable worst case that is appropriate to use as a guide for future noise and land use compatibility planning.

APPENDIX G

GLENDALE

MUNICIPAL AIRPORT

Appendix G
DRAFT IMPLEMENTATION DOCUMENTS

This appendix includes examples of documents that can be used to implement parts of the Noise Compatibility Program for Glendale Municipal Airport. These are referred to in Chapter Seven, Noise Compatibility Plan. They include:

- Sound insulation guidelines.
- Model fair disclosure agreement and covenant.
- AOPA Noise Awareness Steps.
- NBAA Standard Departure Procedure.
- NBAA Approach and Landing Procedure.
- Proposed language for official U.S. government facility directory.
- Proposed language for Glendale tower order on noise abatement.
- Model noise complaint form.

SOUND INSULATION GUIDELINES

These construction standards are based on guidelines developed by City Design Collaborative, Inc. and Acentech.

SECTION 1.00. DEFINITIONS. The special terms used in these provisions are defined as follows:

2.01. Decibel (dB) - A unit of measure of a sound expressed from a calibrated sound level meter utilizing an A-level weighting scale.

2.02. Noise - Sound from aircraft or other sources which interferes with speech and hearing, or is intense enough to damage hearing, oris otherwise annoying.

2.03. Interior Noise Level - Sound level of noise in any habitable room with windows and doors closed.

2.04. OITC Rating - Outdoor Indoor Transmission Class. A description of the noise level reduction, in decibels, achieved by a product or construction assembly. The OITC rating system was developed by the American Society of Testing Materials. It takes into account the influence of environmental noise, such as transportation-related noise, on the product being tested. It takes into account a wider range of frequencies that the STC rating which better reflect the spectrum of exterior noise. This is a newer rating system than the STC rating. Increasingly, manufacturers are testing their products using the OITC system.

2.06. STC Rating - Sound Transmission Class. A description of the noise level reduction, based on a numerical index, achieved by a product or construction assembly. The STC rating can be taken as approximately 10 decibels higher than the actual noise level reduction, in decibels, achieved by the product. The STC rating system was developed by the American Society of Testing Materials. It is the rating system traditionally used by manufacturers and designers.

SECTION 3.00. SCOPE

3.01. Design Objective. The standards in this chapter are intended to insulate the interior of buildings to achieve an outdoor to indoor noise level reduction of at least 25 decibels.

SECTION 4.00. BUILDING STANDARDS

4.01 General

1. Attic ventilation shall be provided at gable ends where practical. Louvers shall be sized to meet code ventilation requirements and no larger.

2. All penetrations in the exterior walls by pipes, drier vents, utility services, etc. shall be caulked.

3. Window air conditioners shall not be used. If though-wall units are installed, removable acoustical covers shall be provided.

4. Mail slots or through-wall mail boxes shall not be used.

4.02. Performance Standards. As an alternative to the prescriptive building standards described in this Section, builders may install, at their option, building components, including, but not limited to, windows and doors, which have been certified as having an STC rating of 35 or higher or an OITC rating of 25 or higher.

4.03. Exterior Walls

1. Stud walls shall be at least 4 inches thick (nominal) and finished with siding on sheathing, stucco, or brick veneer.

2. Interior wall finishes shall be of 1/2 inch gypsum wall board or plaster, installed directly to the face of studs if the exterior is stucco, brick veneer or siding on sheathing.

3. Continuous composition board, plywood, or exterior gypsum board sheathing shall cover the exterior side of the stud wall.

4. Insulation shall be installed throughout the exterior wall cavity between the exterior sheathing and the interior wall finishes. Insulation shall be of glass fiber composition, at least 3 1/2 inches in thickness in 4-inch nominal walls and 5 1/2 inches in thickness in 6-inch nominal walls.

4.04. Windows

1. Windows shall be of wood or metal and configured to permit a minimum of a 2-inch airspace between the prime window and a storm window, or between the glazing in a "double" window. Vinyl windows that permit installation of a storm window are also acceptable.

2. Window types shall be operable and/or fixed in a double or single hung (vertical opening), sliding configuration (horizontal opening), or fixed units. In new construction, casement awning, hopper or jalousie type windows shall not be used since they do not permit the application of a storm window with a 2-inch air space.

3. Windows shall be well constructed, well gasketed, well sealed and installed in the exterior wall using a resilient caulking.

4.05. Doors

1. All exterior doors (swing type) shall be solid wood core in a flush or panel style at least 1 3/4 inches in thickness, and weatherstripped at the jamb and head with an extruded aluminum with bulb type weatherstripping. A flip type, vinyl door sweep shall also be provided.

2. Solid core, aluminum or vinyl clad storm doors shall be installed at all exterior wood doors. Glazing shall not exceed 75 percent of the door area.

3. Sliding glass doors or atrium type doors shall have sliding storm doors installed in combination where these are located at bedrooms, family rooms or living rooms.

4. All doors shall be installed in the exterior wall using a resilient caulking.

4.06. Roofs

1. Attic or dormered spaces which serve as bedrooms shall have at least a 6-inch deep rafter space, with a ceiling or sloped wall below, with insulation and a roof of 1/2 inch composition board or plywood topped by roofing as required.

2. Window or dome skylights shall have a removable or operable glazing panel installed on a grounding frame with gasketing to provide at least a 4-inch air space between the glazing panel and the skylight glazing.

3. Insulation in attics shall be of spun fibre glass insulation to meet R values set forth by the Building Code.

4.07. Ceilings

1. Ceilings shall be either 1/2 inch thick gypsum board or plaster installed on resilient channel in bedroom areas located directly under roof areas or 2 layers of 1/2 inch thick gypsum board or 1-inch plaster directly applied to the underside of rafters for cathedral type ceilings or dormered areas with spun fiberglass insulation in the cavity ventilation per code.

4.08. Floors

Where crawl spaces are located directly below living areas in the dwelling, either:

1. At least 6 inches of spun fibre glass insulation shall be installed within the floor cavity or between floor joints; or

2. Install soffit on the underside of floor joints (minimum 1/2 inch plywood); or

3. Install concrete block or brick foundation walls, or continuous perimeter skirting of at least 1/2 inch plywood.

4.09. Ventilation

1. Either a mechanical ventilation system or air conditioning system shall be installed in order to provide the minimum code requirements for air circulation and fresh air supply for various uses in the occupied rooms of the dwelling without the need to open any windows, doors or other openings to the exterior.

MODEL FAIR DISCLOSURE AGREEMENT AND COVENANT

FOR THE CITIES OF AVONDALE, GLENDALE, PEORIA, PHOENIX, AND MARICOPA COUNTY

This Agreement made and entered into this _____ day of _____, 199__, by and between the City/County of _____, Arizona, herein referred to as "City/County", and _____, herein referred to as the "Developer."

WITNESS, that

WHEREAS, Developer has an interest in a tract of land generally located at _____ in _____, Maricopa County, Arizona, more specifically described in Exhibit "A" which is attached hereto and incorporated herein by reference, to be platted as _____, and referred to herein as "Developer's Property"; and

WHEREAS, the City of Glendale, Arizona owns and operates a certain airport known as Glendale Municipal Airport located _____ of Developer's Property; and

WHEREAS, it is in the best interest of the City/County and Developer to advise all future purchasers and lessees of the noise attributable to aircraft operations at Glendale Municipal Airport; and

WHEREAS, the Glendale Noise Map referred to herein shall be defined as the map showing projected noise in the year 2015 assuming implementation of the Federal Aviation Regulation (F.A.R.) Part 150 Noise Compatibility Plan for Glendale Municipal Airport; and

WHEREAS, this Agreement is entered into for the purpose of advising said purchasers and lessees of the noise exposure;

NOW, THEREFORE, for and in consideration of the mutual covenants and considerations herein contained, it is agreed by the two parties as follows:

1. City/County and Developer enter into this Agreement for the purpose of advising future purchasers and lessees of the noise attributable to aircraft operations at Glendale Municipal Airport.

2. Developer agrees that as a part of closing of any real estate transaction conveying a fee simple interest or any lesser estate including leasehold interest that Developer will provide the transferee a copy of the Glendale Noise Map and further that Developer shall secure the acknowledgement on four copies of the Fair Disclosure Statement as set forth in Exhibit "B" attached hereto and incorporated herein by reference.

3. City/County shall provide Developer with copies of the Glendale Noise Map at the request of Developer. Any request for said Map shall be in writing to _____, and shall be made not more than ninety (90) days prior to the date of Fair Disclosure Statement and not less than thirty (30) days prior to the date thereof.

4. After the execution of the Fair Disclosure Statement (Exhibit "B"), Developer shall file one copy with the Planning Department of the City/County, the Aviation Department for the City of Glendale, Arizona, retain one copy, and deliver the fourth copy to the transferee.

5. Developer further agrees that all transferees shall take subject to the terms of this Agreement and require the execution of the Fair Disclosure Statement as a part of any subsequent conveyance.

6. This Agreement shall be considered a covenant running with the land and be binding on all future transferees, assigns and successors of Developer inasmuch as the Airport operation is associated with the use of the land and indiscriminate of ownership.

7. This Agreement shall not be amended, modified, canceled, or abrogated without the written consent of the parties.

8. Invalidation of any part of parts of this Agreement by judgment or other court action shall in no way affect any of the other provisions which shall remain in full force and effect.

9. This contract shall be construed and enforced in accordance with the laws of the State of Arizona.

10. Upon the effective date of this Agreement, the Agreement shall be recorded in the Office of the Recorder of Deeds, Maricopa County, Arizona.

11. This Agreement shall be binding on the parties hereto only after all legal requirements relating to City/County entering into this Agreement have been satisfied.

FOR THE CITY/COUNTY OF _____, ARIZONA

By: _____
Its Director of Planning and Development

ATTESTED TO:

_____
City Clerk

Approved as to form and legality:

_____
Assistant City Attorney

FOR THE DEVELOPER

By: _____

ATTESTED TO:

_____
Secretary

State of Arizona)
) ss
County of Maricopa)

BE IT REMEMBERED that on this _____ day of _____, 199__, before me, the undersigned, a notary public in and for the county and state aforesaid, came _____, _____ of _____, Arizona, a corporation duly organized, incorporated and existing under and by virtue of the laws of the State of Arizona, and _____ _____, _____ of _____, Arizona, who are personally known to me to be the same persons who executed, as officials, the within instrument on behalf of said municipal corporation, and such persons duly acknowledge the execution of the same to be the act and deed of said municipal corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal, the day and year last above written.

_____
Notary Public

My commission expires:

_____

EXHIBIT "B"
MODEL FAIR DISCLOSURE STATEMENT

NOTICE TO PROSPECTIVE BUYERS OF REAL PROPERTY OR LESSEES OF RESIDENTIAL PROPERTY WITHIN AIRCRAFT NOISE EXPOSURE AREAS.

1. An aircraft noise exposure area exists in the environs of Glendale Municipal Airport. All land within the area is or may be at a future date exposed to aircraft noise levels of 55 DNL or higher. Noise levels of 55 DNL can be annoying or disturbing.

2. No person who acquires property or an interest therein, or who leases property or an interest therein within the aircraft noise exposure area after the date on which this statement is signed, shall be entitled to recover damages from the City of Glendale, Arizona, with respect to the noise attributable to aircraft operations at Glendale Municipal Airport unless, in addition to any other elements for recovery of damages, such person can show that said damage occurred as a result of one or more of the following, any one or all of which occurred after the date of the acquisition or lease of such property or interest therein:

   A. A major change in the approved Airport Layout Plan or interest therein which results in an increase of noise exposure of 1.5 DNL or more above that shown in the Glendale Noise Map.

   B. A significant change in flight patterns which were used in producing the attached noise exposure map which results in an increase of noise exposure of 1.5 DNL or more above that shown in the Glendale Noise Map.

3. The undersigned acknowledges that he or she has been informed that the property being considered for (purchase) (lease) at:

   Address _____

   City _____

   State _____ Zip Code _____

   is within the aircraft noise exposure area for Glendale Municipal Airport. He or she further acknowledges that he or she has been given a copy of the Glendale Noise Map, (a copy of which is attached hereto).

The undersigned has read and fully understands all of the provisions relating to this Fair Disclosure statement.

IN WITNESS WHEREOF, the parties have executed this Statement as of the day and year written below.

Date: _____, 19____.

_____	_____
PRINT NAME OF BUYER OR LESSEE	PRINT NAME OF SELLER, LESSOR, BROKER
_____	_____
Current Address	Company
_____	_____
City State Zip Code	Address
	_____
	City State Zip Code
_____	_____
Signature	Signature

State of _____)
) ss
County of _____)

BE IT REMEMBERED that on the _____ day of _____, 19___, before me, the undersigned notary public in and for the county and state aforesaid, came _____, to me personally known, who being by me duly sworn did say that he is the _____ _____ of _____, a corporation, and that the seal affixed to the foregoing instrument is the corporate seal of said corporation and that said instrument was signed and sealed on behalf of said corporation by authority of its board of directors and said _____ acknowledged said instrument to be the free act and deed of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal, the day and year last above written.

_____
Notary Public

My commission expires:

_____

AOPA
NOISE AWARENESS STEPS

Following are some general guidelines and techniques to minimize the noise impact produced by aircraft operating near the ground:

1. If practical, avoid noise-sensitive areas such as residential areas; open-air assemblies (e.g., sporting events and concerts), and national park areas. Make every effort to fly at or above 2,000 feet over the surface of such areas when overflight cannot be avoided.

2. Consider using a reduced power setting if flight must be low because of cloud cover or overlying controlled airspace or when approaching the airport of destination. Propellers generate more noise than engines; flying with the lowest practical rpm setting will reduce the aircraft's noise level substantially.

3. Perform stalls, spins, and other practice maneuvers over uninhabited terrain.

4. Many airports have established specific noise abatement procedures. Familiarize yourself and comply with these procedures.

5. Work with airport managers and fixed-base operators to develop procedures to reduce the impact on noise-sensitive areas.

6. To contain aircraft noise within airport boundaries, avoid performing engine runups at the ends of runways near housing developments. Instead, select a location for engine runup closer to the center of the field.

7. On takeoff, gain altitude as quickly as possible without compromising safety. Begin takeoffs at the start of a runway, not at an intersection.

8. Retract the landing gear either as soon as a landing straight ahead on the runway can no longer be accomplished or as soon as the aircraft achieves a positive rate of climb. If practical, maintain best-angle-of-climb airspeed until reaching 50 feet or an altitude that provides clearance from terrain or obstacles. Then accelerate to best-rate-of-climb airspeed. If consistent with safety, make the first power reduction at 500 feet.

9. Fly a tight landing pattern to keep noise as close to the airport as possible. Practice descent to the runway at low power settings and with as few power changes as possible.

10. If a VASI or other visual approach guidance system is available, use it. These devices will indicate a safe glidepath and allow a smooth, quiet descent to the runway.

11. If possible, do not adjust the propeller control for flat pitch on the downwind leg; instead, wait until short final. This practice not only provides a quieter approach, but also reduces stress on the engine and propeller governor.

12. Avoid low-level, high-power approaches, which not only create high noise impacts, but also limit options in the event of engine failure.

13. Flying between 11 p.m. and 7 a.m. should be avoided whenever possible. (Most aircraft noise complaints are registered by residents whose sleep has been disturbed by noisy, low-flying aircraft.)

Note: These recommendations are general in nature; some may not be advisable for every aircraft in every situation. No noise reduction procedure should be allowed to compromise flight safety.

Source: *AOPA's Aviation USA* - 1994

NBAA NOISE ABATEMENT PROCEDURES

STANDARD DEPARTURE PROCEDURE

1) Climb at maximum practical rate at V2+20 Knots indicated airspeed (KIAS) to 1,000 feet above field level (AFL) with takeoff flap setting.

2) At 1,000 feet AFL, accelerate to final segment speed (Vfs) and retract flaps. Reduce to a quiet climb power setting while maintaining 1,000 FPM maximum climb rate and airspeed not to exceed 190 KIAS until reaching 3,000 feet AFL. If ATC requires level off prior to reaching 3,000 feet AFL, power must be reduced so as not to exceed 190 KIAS until at or above 3,000 feet AFL. (See note below)

3) At 3,000 feet AFL and above, resume normal climb schedule with gradual application of climb power.

4) Observe all airspeed limitations and ATC instructions.

Note: It is recognized that aircraft performance will differ with aircraft type and takeoff conditions; therefore, the business aircraft operator must have the latitude to determine whether takeoff thrust should be reduced prior to, during, or after flap retraction.

APPROACH AND LANDING PROCEDURE VFR & IFR

1) Inbound flight path should not require more than a 20 degree bank angle to follow noise abatement track.

2) Observe all airspeed limitations and ATC instructions.

3) Initial inbound altitude for noise abatement areas will be a descending path from 2,500 feet AFL or higher. Maintain minimum airspeed (1.3Vs+20KIAS) with gear retracted and minimum approach flap setting.

4) At the final approach fix (FAF) or not more than 4 miles from runway threshold, extend landing gear. Final landing flap configuration should be delayed at pilot's discretion to enhance noise abatement.

5) During landing, use minimum reverse thrust consistent with safety for runway conditions and available length.

Source: National Business Aircraft Association. Inc., Washington, D.C.
NBAA Noise Abatement Program, Rev. 1/1/93

PROPOSED LANGUAGE FOR OFFICIAL U.S. GOVERNMENT FACILITY DIRECTORY

FOR CIVILIAN PILOTS:

Airport/Facility Directory, Southwest U.S. Published by National Ocean Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Noise abatement procedures would be in the "remarks" section under the listing for Glendale Municipal Airport. For revisions, updates, or corrections, send changes to:

Federal Aviation Administration
National Flight Data Center, ATM-600
800 Independence Avenue
Washington, DC 20591
Telephone 202-267-9277
FAX 202-267-5322

Suggested Language on Noise Abatement

Runway 1 is calm wind runway. Avoid noise-sensitive areas north and southeast of airport. VFR departing aircraft from Runway 1 turn to 040 ASAP and hold for 1 mile. VFR departing aircraft from Runway 19 fly runway heading for 1.5 mile. Follow AOPA and NBAA noise abatement procedures.

PROPOSED LANGUAGE FOR GLENDALE TOWER ORDER ON NOISE ABATEMENT

1. PURPOSE. This order is intended to implement portions of the F.A.R. Part 150 Noise Compatibility Program developed for Glendale Municipal Airport, adopted by the City of Glendale. It is intended to promote noise abatement in residential areas north and south of the airport. It is an informal runway use program, as defined in FAA Order 8400.9, which does not require a "letter of understanding". Participation is voluntary for aircraft operators and pilots.

2. DISTRIBUTION. This order is distributed to all personnel at the Glendale Air Traffic Control Tower, the superior officer at Luke RAPCON, the Glendale Municipal Airport Director, FAA Regional Air Traffic Division, and [other required FAA offices].

3. EFFECTIVE. [Note effective date here.]

4. ACTION.

   a. Runway 1 shall be designated the calm wind runway.

   b. VFR departing aircraft on Runway 1 shall be directed to turn right to 040 as soon as safe and practicable. They shall be directed to hold that heading until passing the first interchange of the Agua Fria Expressway on Northern Avenue.

   c. VFR departing aircraft on Runway 19 shall be directed to fly on runway heading until crossing Indian School Road.

   d. Pilots shall be advised of noise-sensitive areas north and south-southeast of the airport.

   e. Aircraft in the local traffic pattern for Runway 1 shall be advised to turn to 040 as soon as safe and practicable on the upwind leg.

   f. Aircraft entering the local traffic pattern shall be advised to keep as close to the airport as safe and practicable.

5. OPERATIONAL SAFETY CRITERIA. The following criteria shall apply to this runway use program.

   a. *Wind Shear or Thunderstorms.* There should be no significant wind shear or thunderstorms which affect the use of the selected runway(s) such as:

      (1) That reported by an operating Low Level Wind Shear Alert System (LLWSAS), or

(2) Pilot report (PIREP) of wind shear, or

(3) No thunderstorms on the initial takeoff departure path or final approach path (within 5 nm) of the selected runway(s).

b. *Visibility.* In order to utilize landing runways associated with a runway use program, the reported visibility shall not be less than one statute mile (runway visual range [RVR] 5000).

c. *Runway Braking Effectiveness.* There should be no snow, slush, ice, or standing water present or reported (other than isolated patches which do not impact braking effectiveness) on that width of the applicable runway or stopway (overrun) to be used. Braking effectiveness must be "good" (i.e., not "fair," "poor," or "nil") and no reports of hydroplaning or unusual slippery runway surfaces (e.g., as may occur on ungrooved new pavement or contaminated surfaces).

d. *Winds.*

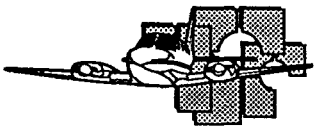
(1) The crosswind component (including gust values) must not exceed 15 knots. The following table illustrates the maximum components for wind directions in 10-degree increments relative to a runway. No headwind component limitation is stated because strong headwinds would dictate use of a runway aligned into the wind due to the crosswind limitation. Velocity values are rounded down to the nearest whole number.

Crosswind Component Table

Wind Angle (Degrees) From Runway Heading	Wind Velocity (Knots)
10	86
20	44
30	30
40	23
45	21
50	19
60	17
70	16
80	15
90	15

(2) No tailwind component may be present except the nominal range of winds reported as calm (0-3 knots) may be considered to have no tailwind component.

NOISE COMPLAINT FORM
GLENDALE MUNICIPAL AIRPORT



Check every box applicable and attempt to obtain all the information possible.

NATURE OF COMPLAINT

❑ Noise ❑ Safety ❑ Low Flying ❑ Other _____

Date of Occurrence _____ Time _____ am/pm Location of Occurrence _____

❑ G.A. Jet ❑ G.A. Prop ❑ Military Jet ❑ Military Prop ❑ Helicopter

No. of Engines _____ Color _____ N-Number _____

❑ Inbound ❑ Outbound ❑ Pattern ❑ Unknown

Runway Used (if applicable): ❑ 1 ❑ 19

Weather Conditions: ❑ Rain ❑ Fog ❑ Clear ❑ Wind

Temperature: _____ ° F Winds: Speed _____ Direction _____

Other Comments: _____

_____

ACTION REPORT

Name _____ Phone _____

Address _____

City/State _____ Zip _____

Date _____ Time _____ Taken By _____

Action Recommended _____

_____

Action Taken _____

_____

Other Comments: Investigvation/Follow-up _____

_____

KANSAS CITY
(816) 942-9200

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Suite 100
Kansas City, MO 64131

PHOENIX
(602) 993-6999

11022 N. 28th Drive
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