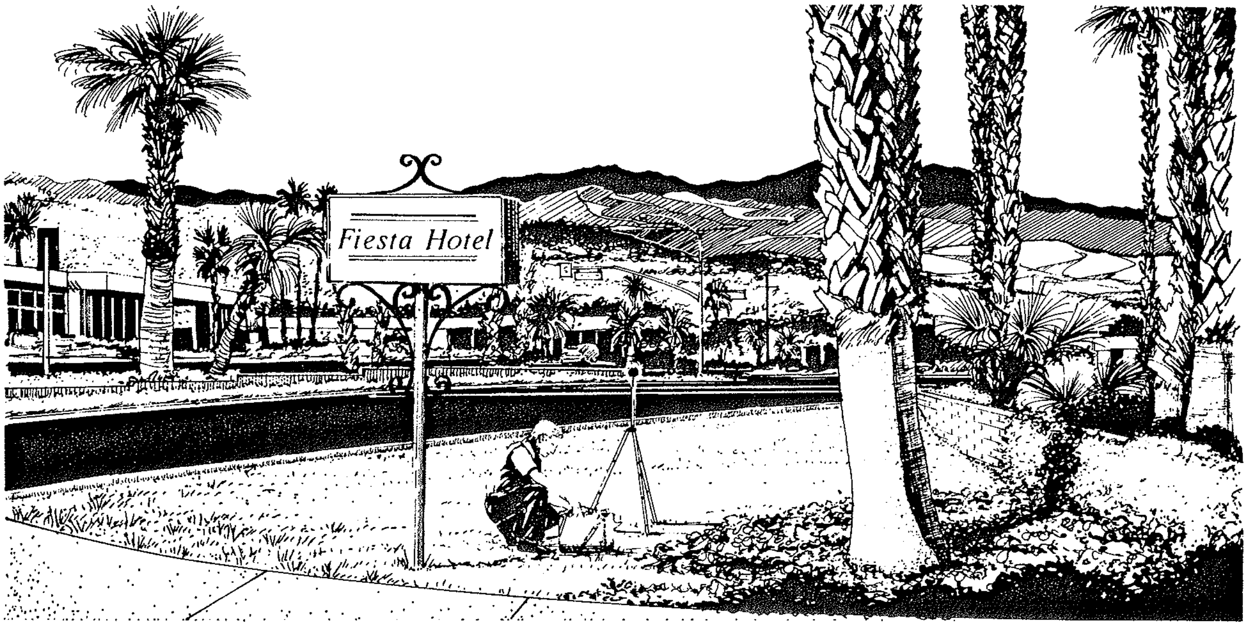
Chapter Three
COMMUNITY NOISE



Chapter Three
COMMUNITY NOISE

The aircraft noise exposure discussed in the previous chapter provides only a portion of the information necessary for the evaluation of aircraft noise impacts within the study area. Nonaviation noise sources in the vicinity of an airport can also play a role in the determination of the extent of these impacts.

This chapter contains a general description of the nonaircraft noise levels within the detailed study area, as defined in Chapter One, Existing Conditions. These nonaircraft noise levels have been developed from a series of mathematical models, as well as an ambient noise measurement program designed to supplement and check the results of the models. The resultant background noise levels may be used to identify areas where the increment between aircraft and nonaircraft noise is most significant and where overall noise reduction may be possible, or where land use compatibility programs may be advisable to support the aviation noise abatement efforts.

BACKGROUND NOISE EVALUATIONS

To those first encountering a map showing the contours of noise created by aircraft operating at a busy airport, it often appears that aircraft are the only contributors of noise exposure to the community. But, aircraft noise does not exist in a vacuum. If aircraft overflights were removed from the airport vicinity, residents would still be subjected to noise from various other sources. These include truck and automobile traffic on major roadways passing through the area, diesel engines and rail cars on local railroads, and the noise associated with urban land uses of various types. This factor has been recognized by the Environmental Protection Agency and its consideration was recommended in **Airport Noise Regulation Process,** Notice of Proposed Rulemaking (Federal Register, Vol. 41, p. 51522, November 22, 1976).

While it is beyond the scope of this evaluation to recommend procedures for the abatement of noise from these nonairport sources, the consideration of background noise allows the development of an overall perspective of how aircraft noise contours relate to study area-wide noise patterns and assists in the design of aviation and land use alternative scenarios. The purpose of background noise analysis is to assist in the development of aviation noise abatement alternatives by indicating areas where aircraft noise levels are most significant, particularly when they are on areas of noncompatible use. Conversely, they indicate areas where the average ambient noise level is equal to or greater than average aircraft noise levels. These are areas to which noise might be shifted if trade-offs are necessary to reduce total impact levels. Background noise analysis is not designed to indicate that aircraft noise is not present in an area, nor is it intended to conceal the impacts of such noise.

The effect of noise on the livability of a community has been found from extensive research to be of a cumulative nature, taking into account all noise sources associated with the area. For this reason, the separate noise patterns of urban land uses and surface transportation are predicted. These patterns are then combined to provide a composite pattern of nonaircraft (ambient) noise in the detailed study area. This pattern is combined with the most current (1987) aircraft noise pattern of Sky Harbor International Airport to provide a pattern of total noise exposure within the detailed study area. The presentation of this noise pattern is followed by an assessment of the differences between average aircraft and ambient noise levels.

INDIGENOUS NOISE EXPOSURE

The indigenous noise levels associated with general urban area activity--traffic on local streets, lawn mowers, air conditioning compressors, outdoor residential activity, etc.--have been shown to be essentially a function of population density. The functional relationship,

$$\mathbf{Ldn = 10 \log P + 22dB}$$

where P is the population density per square mile, is used to assign noise levels in urban residential areas. The relationship was derived from EPA-sponsored research (W.S. Galloway, et al, **Population Distribution of the United States as a Function of Outdoor Noise Level,** EPA-550-9-74-009, June 1972). The model applies only to locally generated noise, since other major sources such as major roadways, rail lines and aircraft were purposefully excluded from the research data base, and to fairly homogeneous residential areas. The standard deviation associated with the prediction model and its data base is about 4dB.

The process of determining indigenous noise levels requires the determination of population densities in the smallest geographical areas for which reliable statistical data are available. In the case of the study area, the traffic zone was the basic population statistical unit used in that process. Information drawn from the October, 1985 Phoenix area special census was used to develop TAZ population densities. The population density of each zone was determined by dividing the total population within the zone by the area of residential land developed within the zone (as derived from land use mapping presented in general in Chapter One). The resulting population density within each zone was then inserted into the predictive equation to provide a computed Ldn level for each residential area. Recent aerial photography of the study area was used to assure that quieter areas (parks, vacant land, etc.) were not assigned noise levels applicable to developed areas. In general, if the population density exceeds 9.8 persons per acre, the calculated ambient noise level will exceed 60 Ldn. If the residential density is more than 31.2 persons per acre, the calculated ambient noise level will exceed 65 Ldn.

Noise levels associated with nonresidential land uses are not predictable using the model and must be projected using a separate methodology. Extensive industrial and commercial areas vary greatly in their noise levels, depending upon the specific type of activity occurring there. In general, manufacturing districts may experience noise levels ranging from 60 to 75 Ldn, warehousing areas range from 55 to 70 Ldn, and commercial centers range from 60 to 70 Ldn. Most of the ambient noise in these districts is closely related to the volume of traffic into and out of the area, although industrial process noise may also contribute to the general outdoor noise level. Extensive evaluations over the past few years have indicated that application of 63-68 Ldn to large industrial and major office and commercial areas is appropriate for the generalization of background noise. These values are based on measurements for similar projects in other metropolitan areas and are generally supported by sample measurements made in the study area during the noise measurement program.

The portions of the detailed study area which the model indicates are exposed to indigenous noise in excess of 60 Ldn are shown on Exhibits 3A (east) and 3A (west). Their density over south Phoenix and north and central Tempe are indicative of the highly urbanized nature of the airport vicinity. Their relative absence in the southwestern and northeastern portions of the study area indicates either a low density of urbanized use or the presence of the undeveloped Salt River channel. An examination of the exhibit indicates that the central business districts of Phoenix and Tempe, industrial areas north, south and west of the airport, commercial areas along major thoroughfares, and scattered high-density multi-family developments throughout the study area are subject to indigenous noise levels of more than 65 Ldn. In contrast, less intensely developed residential areas north, northeast, and southeast of the airport have indigenous noise levels between 60 and 65 Ldn. For the most part, residential districts within the detailed study area are developed at densities of between 10 and 15 persons per acre, resulting in indigenous levels of 60 to 62 Ldn. The remainder of the study area is subject to indigenous noise of less than 60 Ldn.

SURFACE TRANSPORTATION NOISE EXPOSURE

To the individual residing in the center of a residential subdivision, the noise created by truck and automobile traffic on a major roadway may seem to be nonexistent. But, for the person whose backyard adjoins an interstate highway or rail line, the problem of surface transportation noise is an ever-present reality. To evaluate the extent of these noise sources within the detailed study area, noise contours were calculated for traffic along a number of major roadways and two railroads.

Roadway Noise

Noise exposure levels due to traffic on major study area roadways were computed using a methodology presented in **Interim Noise Assessment Guidelines** (HUD-CPD-586, October 1980) which is based on Federal Highway Administration models for detailed site-specific noise evaluations. The HUD model was selected as appropriate for the intended application of the results and for the level of detail available in the input data.

It should be noted that this methodology does not attempt to incorporate any extraordinary attenuation of noise resulting from closely-spaced buildings adjacent to the ground transportation sources. Rather, the model assumes an uninterrupted flow of noise from the source, generally declining by approximately four decibels with each doubling of distance from the linear source. For the purposes of this ambient noise analysis, this methodology is adequate, but if detailed information is required on the noise impacts of specific surface sources on specific parcels, other techniques are available which provide detailed single-site analyses.

Four types of input data are required in modeling road-traffic noise: traffic volume, traffic speed, percentage of traffic volume occurring at night, and vehicle mix. A variation in any one of these factors may influence the location of noise contours along the lineal noise source. Roadway traffic volumes were obtained from traffic counts assembled by the Maricopa Council of Governments, Transportation and Planning Office, for the year 1984. Speed data were derived from posted speed limits. For time of day splits, 15 percent of the total traffic volume is assumed by the model to occur between 10:00 p.m. and 7:00 a.m. The MAG Transportation and Planning Office provided information indicating 9 percent truck usage on the interstate highway system and 2 percent trucks on all other arterials within the airport environs. These input data and assumptions are in accordance with experienced vehicle mix levels encountered in other major metropolitan areas where such data are available.

After all data were compiled, separate calculations were made for automobile and truck traffic using a series of mathematical factors to derive adjusted traffic volumes along each specific segment of roadway. The adjusted volumes provide factored traffic counts relative to a standard traffic flow at 55 miles per hour. These adjusted volumes were then used in a series of formulae which predict the distance from the center of the roadway to specific Ldn contours. The daily adjusted automobile and truck volumes are used in the following formula to determine distances from the roadway centerline to predicted Ldn contours:

$$\text{Log } D = (\text{Log}(AADT))/1.47 + K$$

where D is the distance to a predicted noise contour, AADT is the adjusted average daily traffic, and K is a constant related to the specific noise level considered.

Calculations were made for both trucks and automobiles at 60, 65, 70, and 75 Ldn contours along the major roadways in the study area. These values were then combined to derive a distance to specific noise contours associated with specific road segments. The resultant roadway noise contours are shown on Exhibits 3B (east) and 3B (west). Only the most heavily used road (I-10) has associated traffic levels yielding noise in excess of 75 Ldn beyond the right-of-way. Most heavily traveled arterials have an associated contour of 70 Ldn, but these seldom pass beyond the first row of structures along the road, and in many cases are of insufficient width to plot on the maps. The 65 Ldn contour may be found along all but the least traveled roadways.

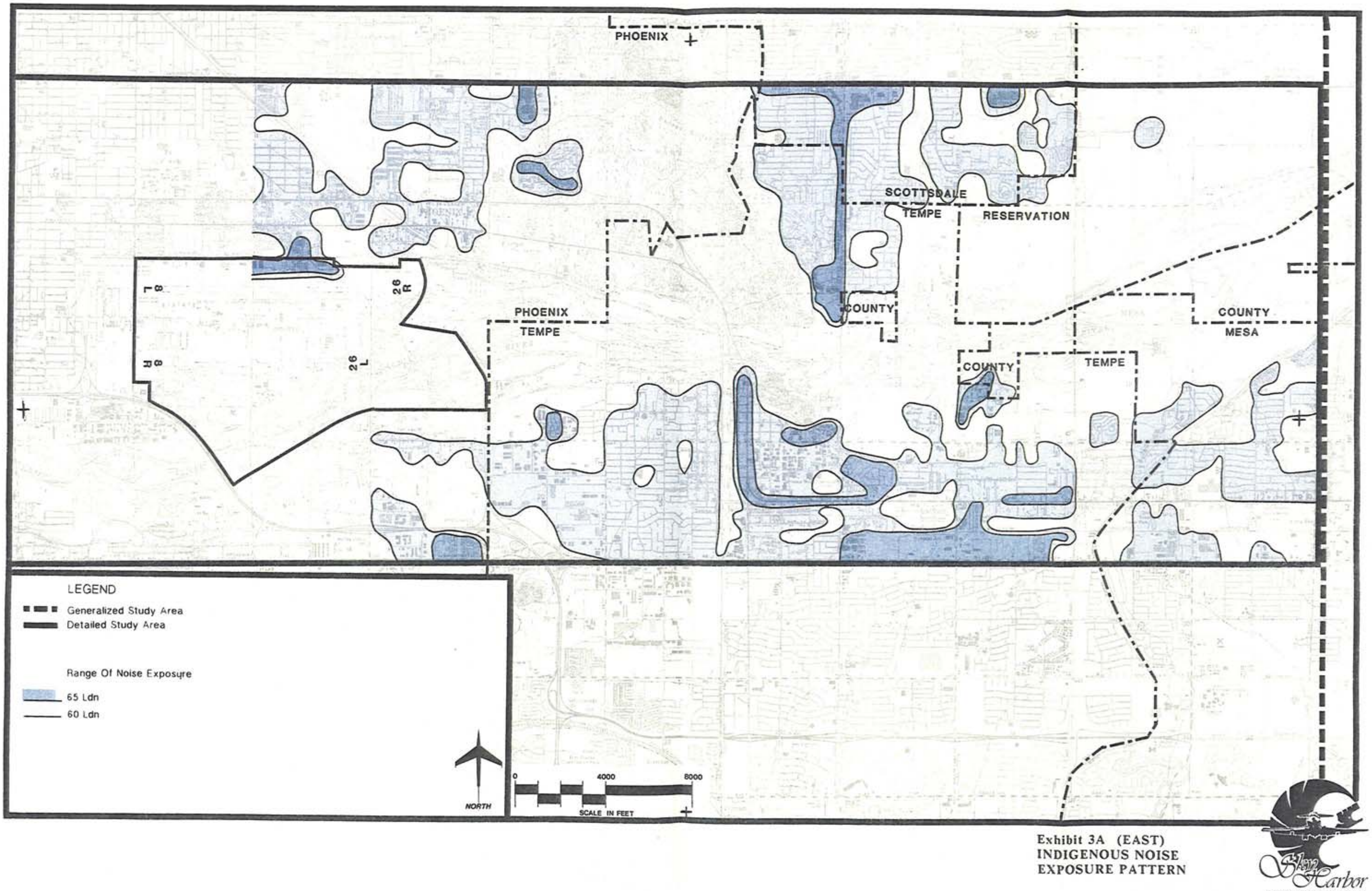


Exhibit 3A (EAST)
INDIGENOUS NOISE
EXPOSURE PATTERN

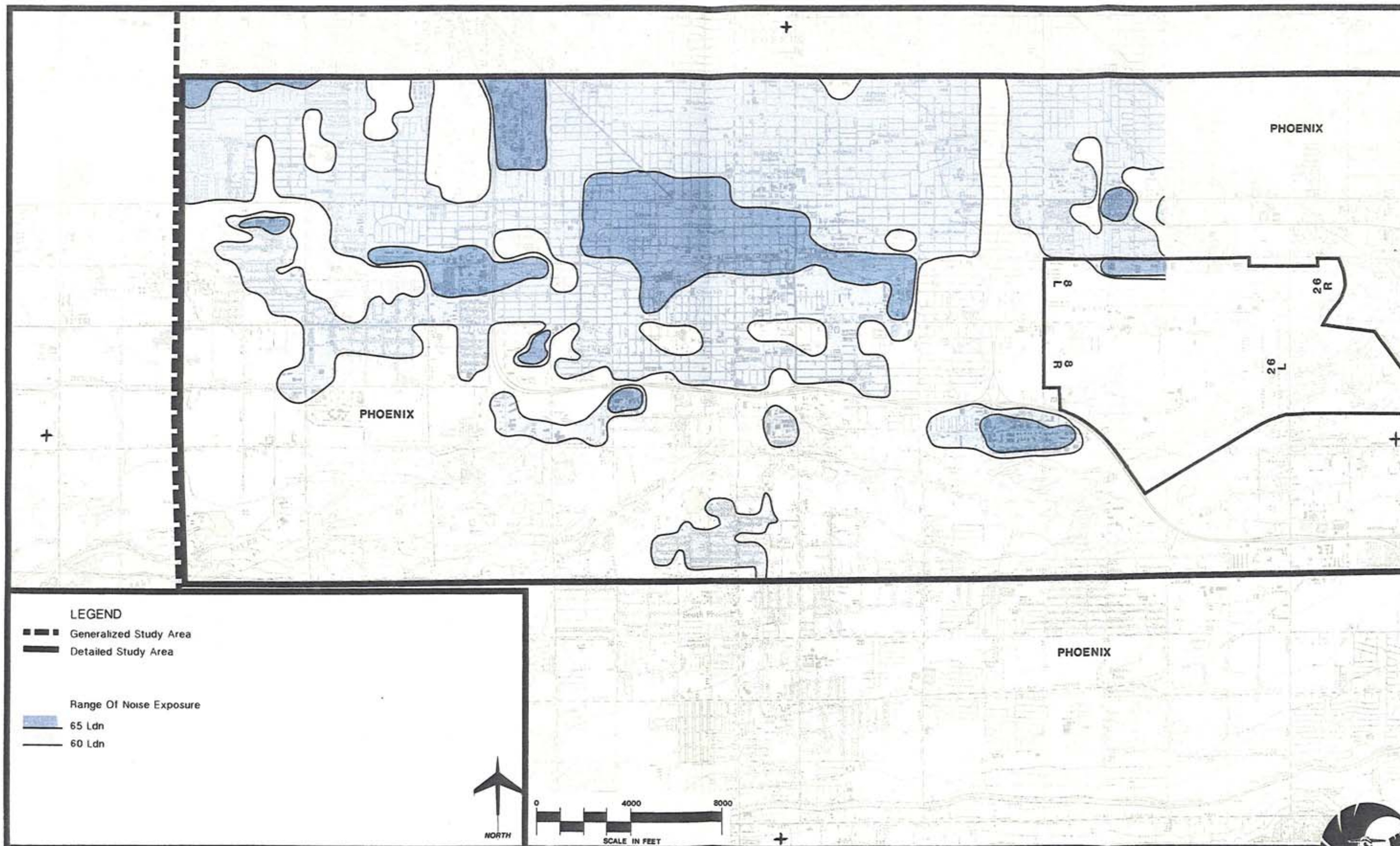


Exhibit 3A (WEST)
INDIGENOUS NOISE
EXPOSURE PATTERN

Sky Harbor International Airport

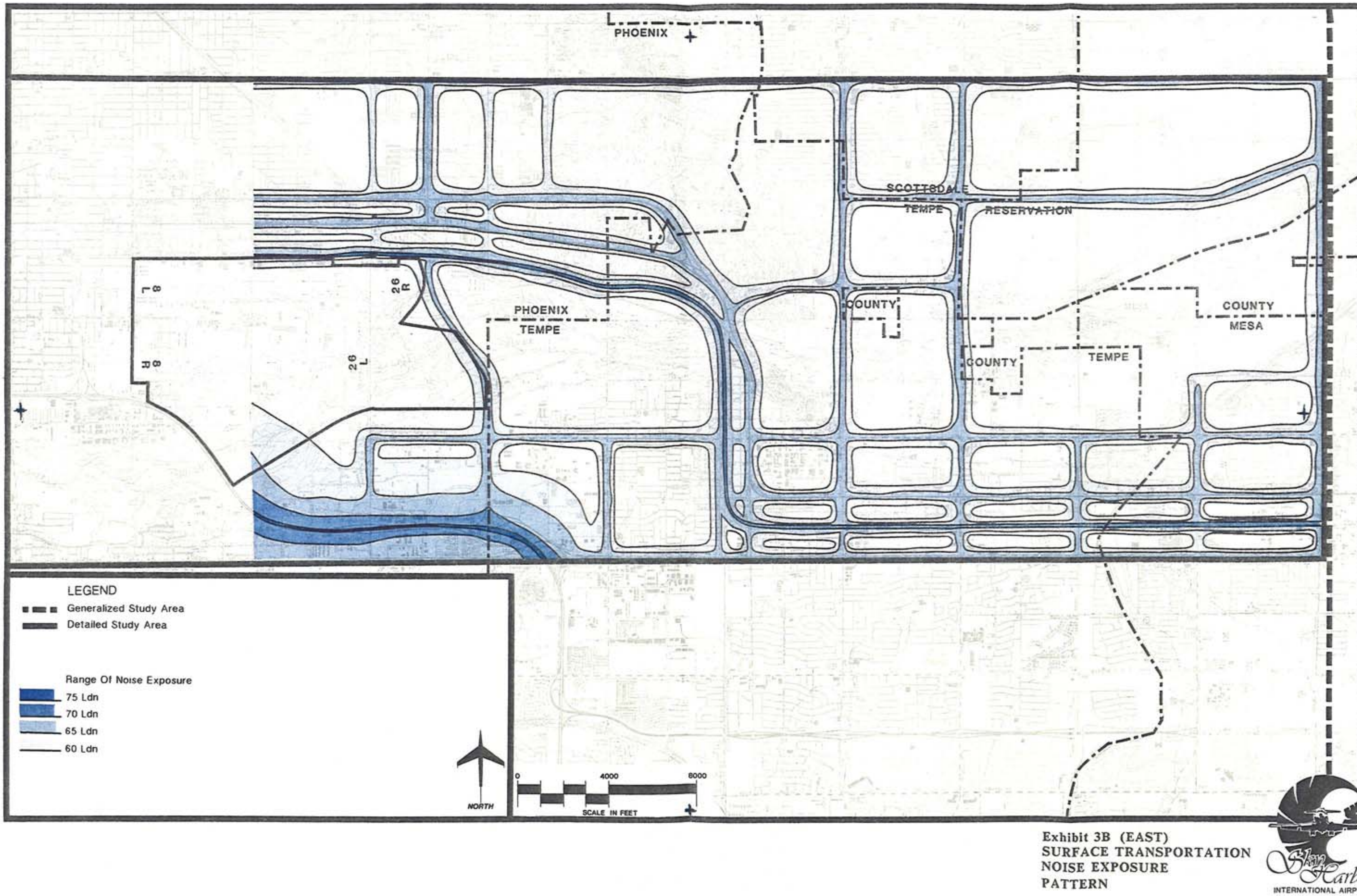


Exhibit 3B (EAST)
SURFACE TRANSPORTATION
NOISE EXPOSURE
PATTERN

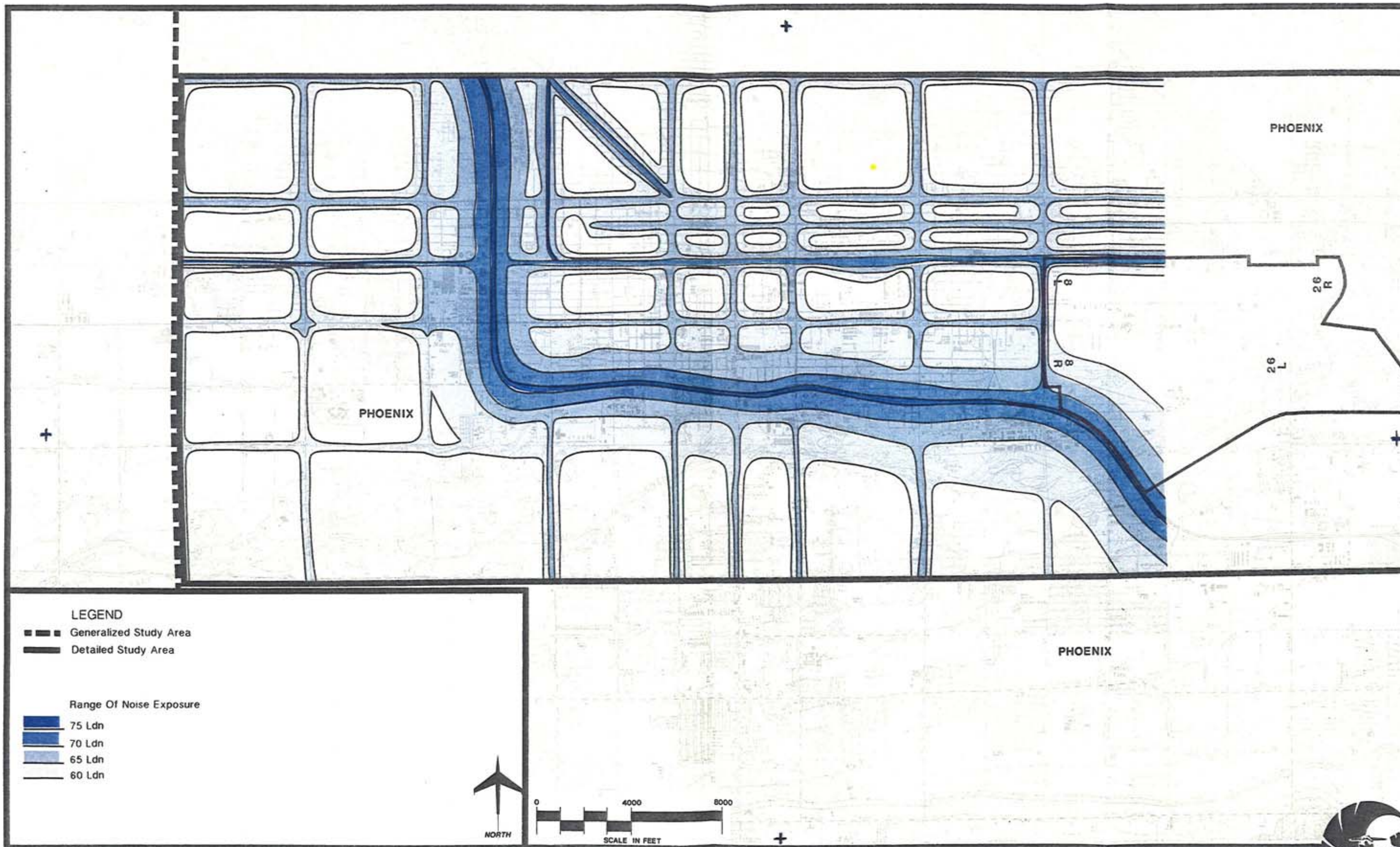


Exhibit 3B (WEST)
SURFACE TRANSPORTATION
NOISE EXPOSURE
PATTERN

Sky Harbor
INTERNATIONAL AIRPORT

Railway Noise

The basic model used for railroad noise prediction is a procedure outlined in **Interim Noise Assessment Guidelines.** Input data required for this procedure include the average daily number of train movements, number of engines and rail cars per movement, average train speed, percent of operations at night and rail type.

A Southern Pacific Railroad line runs from west to east through the study area, passing along the north boundary of the airport. It then turns south and passes just west of downtown Tempe, before turning again to the east between Apache Boulevard and Broadway Road and proceeding out of the study area. A large SPRR switching yard is located one mile west of Runway 8L-26R. The Atchison, Topeka and Santa Fe Railroad operates a line and switching yard along Grand Avenue and North 19th Avenue in the northwest quadrant of the detailed study area.

Operational data were obtained from the railroad companies. This data indicated that a significant proportion (39 percent) of the rail traffic occurred during the nighttime hours. An average of 9 trains used the SPRR line east of the marshalling yard each day, while west of the yard, two trains use the line daily. Traffic along the AT&SF tracks averaged 6.9 trains daily. The data were factored relative to a standard train using two diesel engines and fifty cars to develop the total equivalent number of operations. The distances from the center of each segment of the rail network to specific Ldn Contours were then determined from graphs provided in the reference document. The results were used to plot the rail contour portion of Exhibits 3B (east) and 3B (west).

Investigation of the railroad noise in the area indicates that railroad noise exposure, in terms of Ldn, is less significant than road noise because of its limited number of routes in the study area. The largest contour beyond the mainline railroad right-of-way is typically 70 Ldn.

AMBIENT NOISE EXPOSURE

Upon completion of the separate considerations of indigenous and surface transportation noise levels in the study area, a compilation of ambient noise levels was prepared. This analysis results in a composite pattern of overall nonaircraft noise exposure. Aircraft noise may then be related to the nonaircraft exposure pattern to give an indication of locations where reduction in aircraft noise exposure will most significantly reduce noise impacts, or indicate areas where the ambient or self-generated noise levels exceed aircraft noise.

The development of composite non-aircraft noise exposure contours requires an analysis of every portion of the detailed study area. The study area was divided into a grid of forty acre cells for analysis. This grid was then laid over individual contour maps of exposure from various nonaircraft sources and the noise levels within each cell were recorded. A compilation of the values within each cell was made to determine a composite ambient noise exposure for that cell. For example, assume a grid cell in which highway noise is 66 Ldn, rail noise exposure is 64 Ldn and indigenous noise is 61 Ldn. The resultant composite noise level is obtained by a complex logarithmic equation designed to sum the noise energy generated by multiple noise sources:

$$\mathrm{Ldn(amb)} = 10 \log \sum_{s} 10^{\mathrm{Ldn(s)}/10} = 68.9$$

where s is the Ldn noise level from individual sources.

A simpler process of summation is also available and often used where a level of accuracy of less than one decibel is not required. Table 3A presents a listing of additive factors applicable to the difference between the Ldn levels of two sources.

The sample noise values should be arrayed from lowest to highest and consecutively added to the appropriate additive factor. Thus, the resultant composite noise level would be developed as shown in Table 3B and the composite nonaircraft noise level of the example grid cell would be 69 Ldn.

TABLE 3A
Additive Factors For Composite Noise Levels

Difference in Sound Level (Ldn)	Add To Larger Level
0	3.0
1	2.5
2	2.1
3	1.8
4	1.5
5	1.2
6	1.0
7	0.8
8	0.6
9	0.5
10	0.4
12	0.3
14	0.2
16	0.1
> 16	0

TABLE 3B
Resultant Noise Level Calculations

Noise Levels To Be Added	Summation Process	
61 Ldn		
64 Ldn	Add 1.8 to 64 = 65.8	
66 Ldn		Add 3 to 66 = 69 Ldn

Upon completion of the compilation of nonaircraft noise levels within each grid, contour lines were drawn to represent the combined levels composing ambient noise, with care given to accurately reflect the different patterns resulting from areal (indigenous) and linear (surface transportation) sources. The results are presented on Exhibits 3C (east) and 3C (west). It is clear from the ambient noise pattern that there is widespread exposure to nonaircraft noise sources above 60 Ldn. Comparison of the patterns associated with exposure to specific types of background noise presented earlier indicates that there are areas dominated by each source. In general, the composite background pattern is directly related to the highly urbanized nature of the study area. The highest noise levels are related to activity along major surface transportation corridors. The interstate highways dominate the portion of the study area south and west of the airport, while local traffic arterials are dominant in the northern and eastern portions of the detailed study area. Indigenous noise levels are dominant only in the centers of areas bounded by major transportation routes. Most portions of the study area, where ambient noise is greater than 60 Ldn, are influenced by the combination of both roadway and indigenous noise.

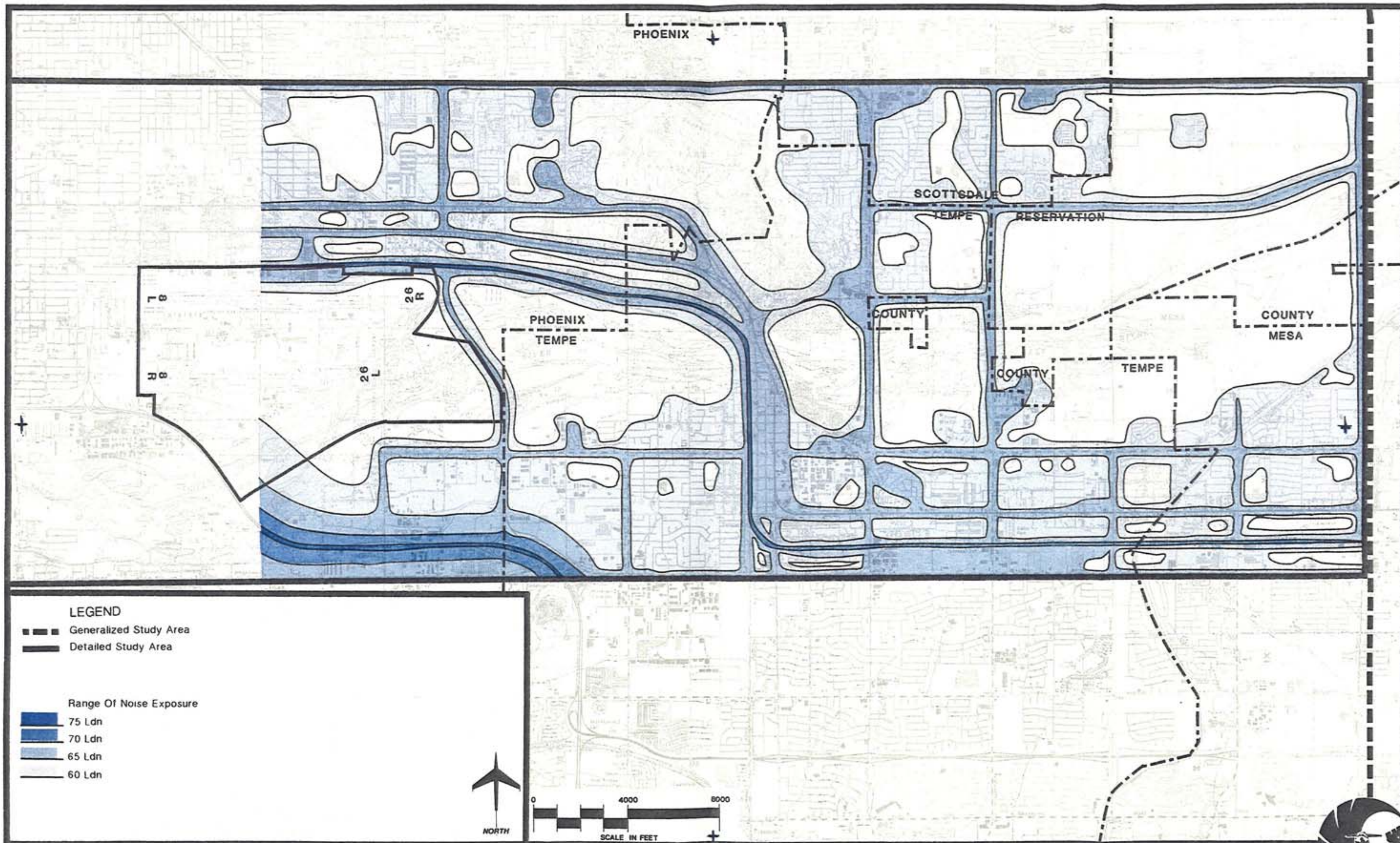


Exhibit 3C (EAST)
AMBIENT NOISE EXPOSURE
PATTERN

Sky Harbor
INTERNATIONAL AIRPORT

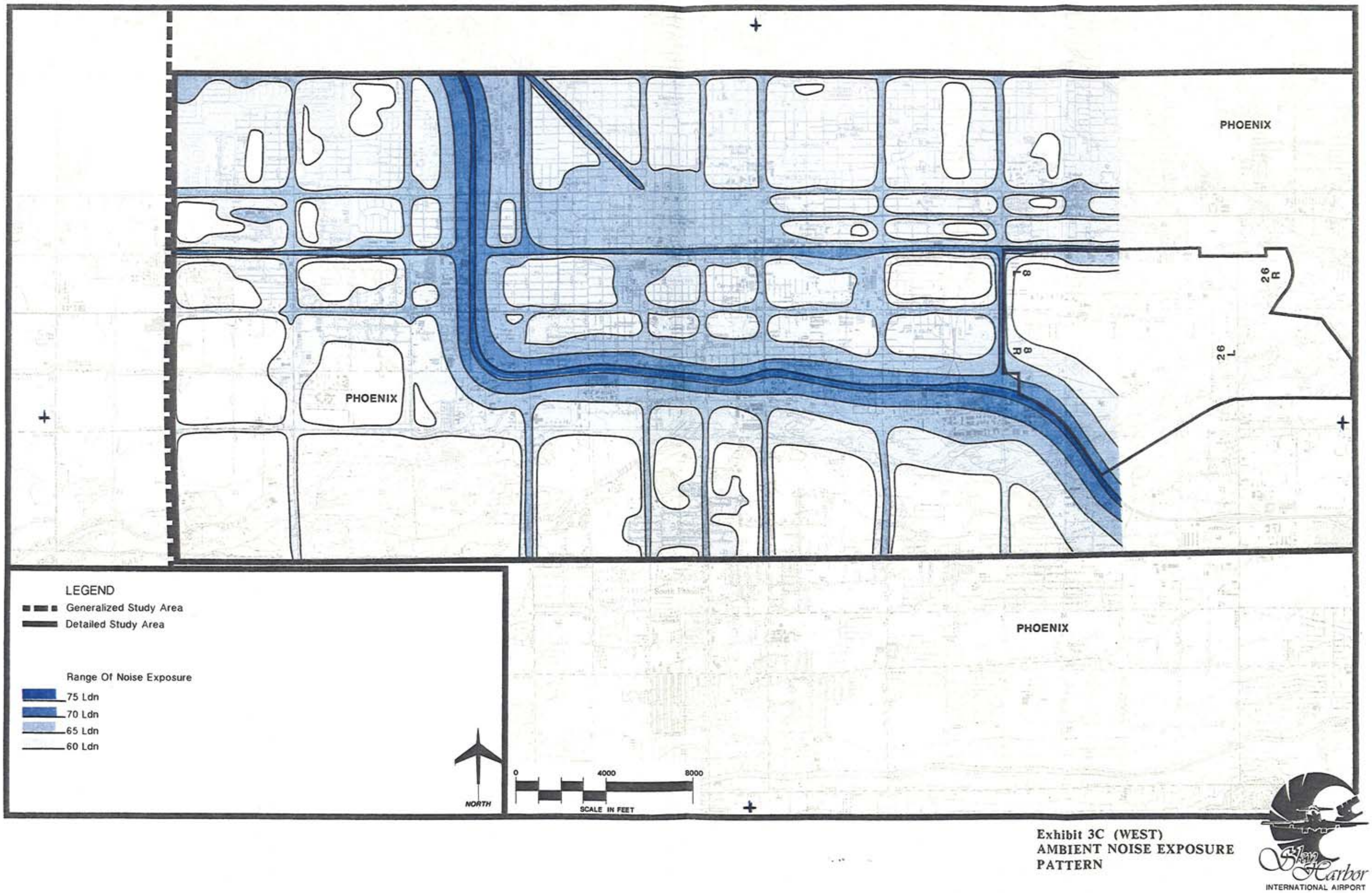


Exhibit 3C (WEST)
AMBIENT NOISE EXPOSURE PATTERN

TOTAL NOISE

Total or area-wide noise exposure is the combination of the several noise exposure patterns developed from both aircraft and nonaircraft sources of noise within the community. The method used to determine the total noise exposure pattern of the study area is the summation of the previously prepared aircraft and composite ambient noise exposure patterns. The results of this process assist in placing aircraft noise contours in perspective with the general noise patterns of the community.

The technique used to develop the patterns of total noise is the same as was used to develop patterns of ambient noise. The study area was divided into a series of analytical grid cells, within which the calculated levels of ambient noise and aircraft noise were assessed and summed using the following formula:

$$Ldn(Total) = 10 \log \left(10^{Ldn(Amb/10)} + 10^{Ldn(Acft/10)} \right)$$

To derive a composite total noise value, use the sample grid cell discussed in the previous section and its ambient noise level of 68.9 Ldn, and assume that aircraft noise exposure in the grid cell is 68 Ldn. Adding logarithmically, the resultant noise exposure from all sources would be 71.5 Ldn. After each cell was compiled, contours of equal noise exposure were interpolated between cells, taking care to reflect the inclusion of both areal and linear patterns.

The results of the grid summation process for the study area are presented in Exhibits 3D (east) and 3D (west). In the southern and eastern portions of the detailed study area there is a clear demarcation of areas dominated by aircraft noise above 65 Ldn. With the exception of the heavy traffic levels associated with the most heavily traveled roads and concentrated rail activity, the 70 Ldn contour is entirely related to aircraft and is located predominantly along the paths of flight closest to the airport.

North and west of the airport, the 65 Ldn contour reflects both aircraft and ambient noise sources. Bands of noise above 70 Ldn are associated with the major streets and the two rail lines. The 65 Ldn contour from aircraft noise blends with ambient noise pattern near both the Phoenix and Tempe Central Business Districts where roadway, rail, industrial/commercial, and some multi-family sources generate noise at that level.

The 60 Ldn contour becomes much less identifiable with aircraft noise within the developed area. Average ambient Ldn levels are similar to average aircraft Ldn levels below 65 Ldn (although peak aircraft levels directly under flight tracks are normally ten to twenty decibels greater than peak ambient levels). The blending of aircraft and ambient noise sources at similar Ldn levels does not mean that aircraft noise does not impact the community in these areas, but rather, that the intrusiveness of aircraft noise normally decreases as the ambient level increases.

DIFFERENTIAL NOISE EXPOSURE

F.A.R. Part 150 recognizes that aircraft noise levels are occasionally less noticed in a community if the ambient levels of noise are high. Consequently, the regulation states that "No land use shall be identified as noncompatible where the self-generated noise from that use and/or the ambient noise from other nonaircraft and nonairport services is equal to or greater than the noise from aircraft and airport sources" (F.A.R. Part 150, A150.101(e)(5)). In some portions of the study area, the average ambient noise level is greater than the noise generated by aircraft or the airport. If the noise is internally or self-generated these areas are, under the regulation, not to be considered as containing noncompatible land uses. Thus, a high-density apartment complex that generates noise levels of 67 Ldn would not be considered to be adversely impacted by aircraft noise levels of 65 Ldn.

Exhibits 3E (east) and 3E (west) indicate those portions of the study area within which the aircraft noise above 60 Ldn exceeds ambient noise levels. The exhibit shows four areas within which aircraft noise exceeds ambient noise above 60, 65, 70, and 75 Ldn respectively. The latter three areas, under the definitions of Part 150, fall within land use compatibility constraints (to be discussed in Chapter Four, Noise Impacts). While the area within the 60-65 Ldn range is not considered constrained under Part 150, its location is provided for information. The areas within which aircraft noise exceeds ambient noise are essentially restricted to locations under the paths of flight and are partially broken by linear noise sources (streets and rail lines) with high ambient noise levels. The innermost area is the most impacted under the Part 150 guidelines and represents that portion of the study area where aircraft noise impacts are classified as "severe". The area between 65 and 75 Ldn is considered to be "significantly impacted". A variety of measures are available for noise abatement or mitigation, and are often dependent upon the intensity of the noise impact. These measures will be delineated in Chapters Five and Six (Aviation Alternatives and Land Use Alternatives, respectively). The delineation of the four areas of differential impact are made available as a tool to assist the development of techniques and procedures designed to abate aircraft noise and to foster prudent land use management decisions.

The point should also be made that although Part 150 concentrates on noise in excess of 65 Ldn, aircraft noise abatement programs are not required to be limited to procedures and methodologies for abatement of noise solely within the 65 Ldn contour. They may also include mitigation techniques designed to reduce aircraft noise beyond the area legally recognized as subject to Part 150 scrutiny. The improvement of conditions within the 65 Ldn contour nearly always results in the improvement of conditions beyond that boundary.

BACKGROUND NOISE MEASUREMENTS

The various noise levels derived from use of the ambient noise predictive models were checked by sample field measurements to assure that they did not excessively over- or underestimate actual noise levels and are valid for the Sky Harbor International Airport environment. Sample measurements were made at the locations shown on Exhibit 3F and described in the following paragraphs.

The acoustical measurement instrumentation consisted of the same Metrosonics db-604 Sound Level Analyzers and supporting equipment as was used for measuring aircraft noise. The use of the same equipment provides a consistency of measured levels between the different types of noise sources.

AMBIENT NOISE MEASUREMENT SITES

Noise monitors were located at 11 sites specifically to measure background noise levels. Of these, ten are located within the detailed study area and are

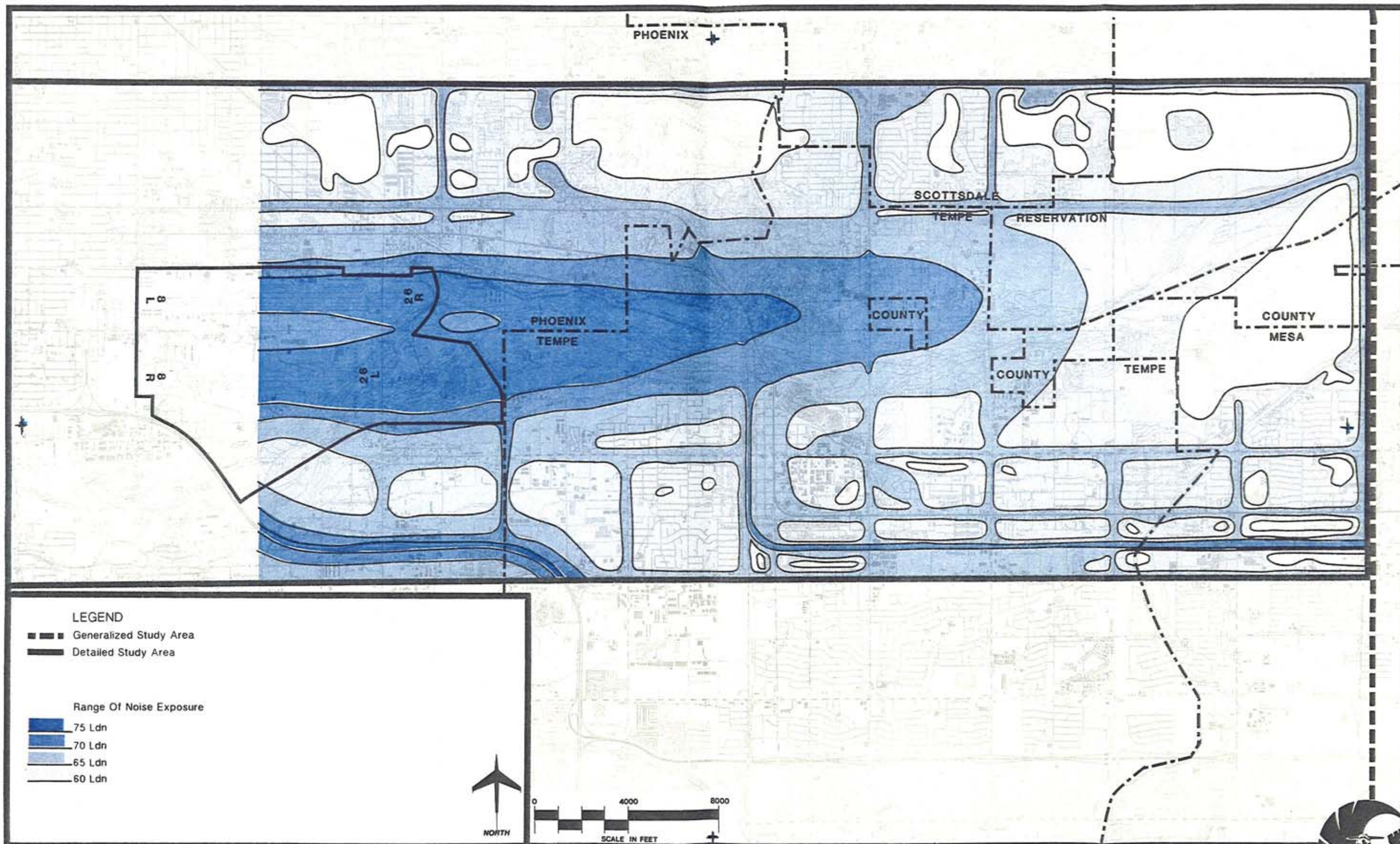


Exhibit 3D (EAST)
TOTAL NOISE EXPOSURE
PATTERN

Sky Harbor
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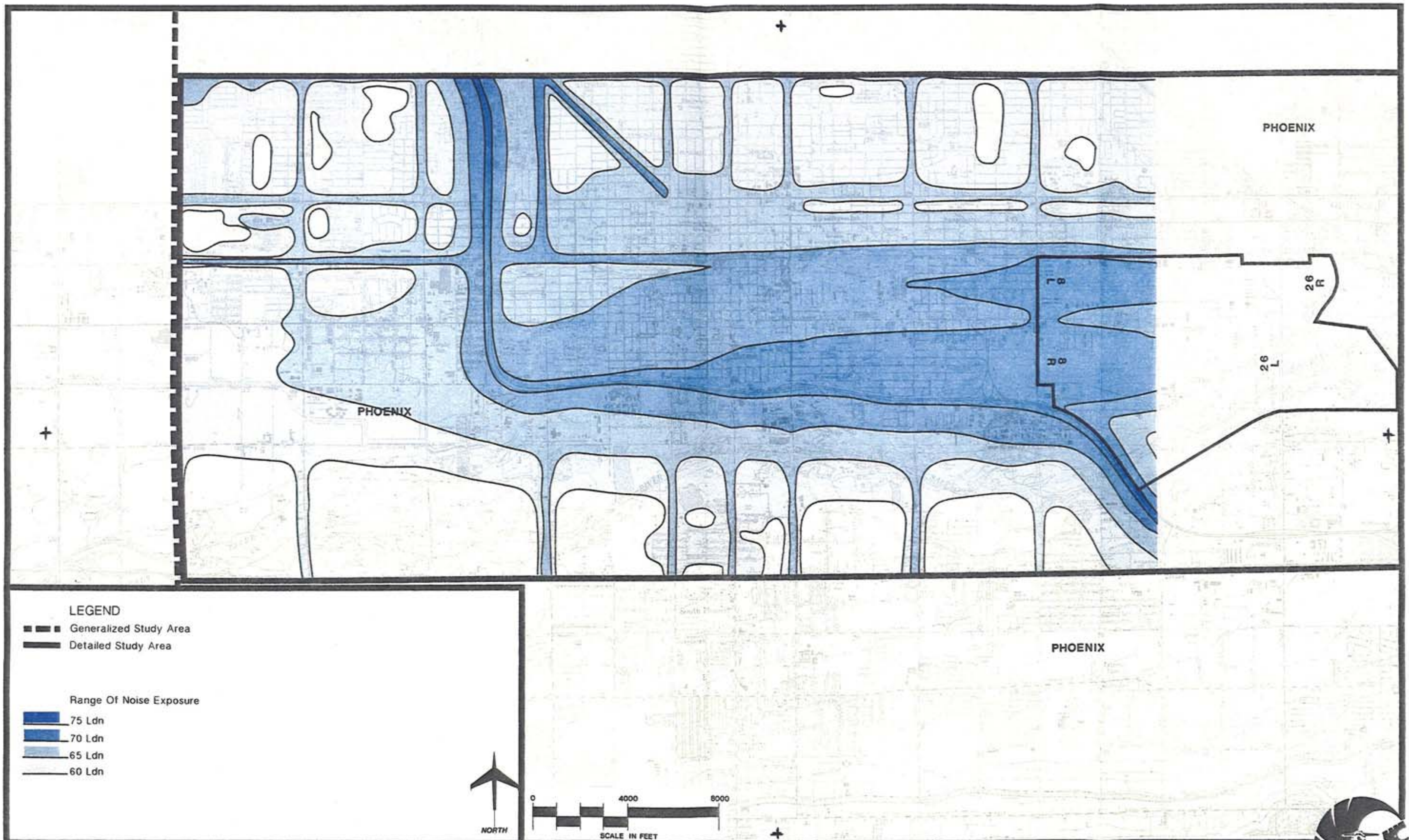

Exhibit 3D (WEST)
TOTAL NOISE EXPOSURE PATTERN

Sky Harbor International Airport

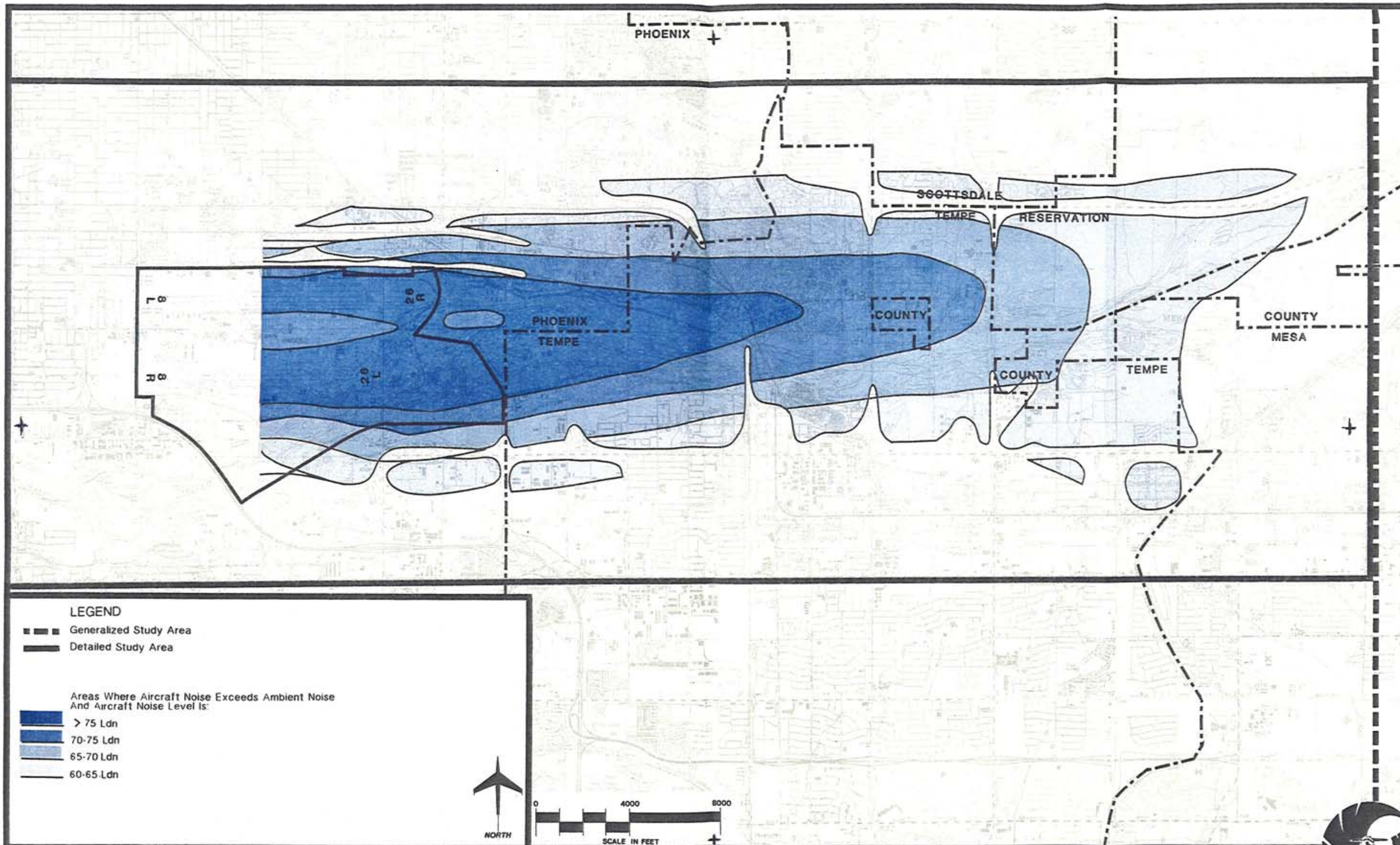

Exhibit 3E (EAST)
DIFFERENTIAL NOISE EXPOSURE

Sky Harbor International Airport

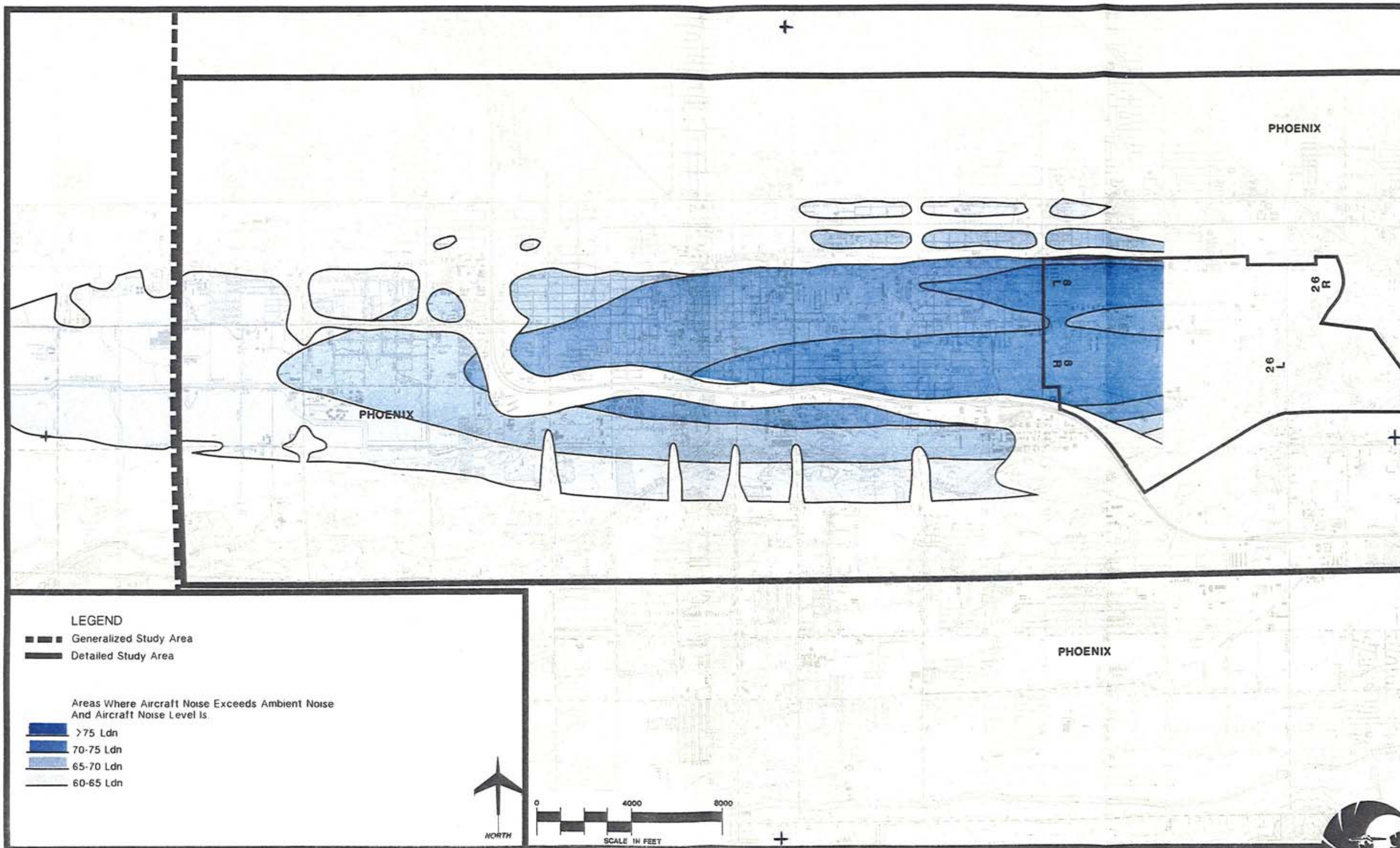

Exhibit 3E (WEST)
DIFFERENTIAL NOISE EXPOSURE

Sky Harbor INTERNATIONAL AIRPORT

addressed in the following paragraphs. An effort was made to sample background noise levels in areas not significantly impacted by aircraft noise. In some cases, this goal was not attainable, and aircraft noise was factored out of the resulting measurements by subtraction of that portion of the total noise energy related to events in excess of preset thresholds. Furthermore, with the exception of selected sites, an attempt was made to avoid the measurement of heavily traveled surface transportation routes during their peak hours of operation so that measured values would be more reflective of indigenous noise levels. Such measurements permit a comparison with ambient noise levels predicted by the mathematical models.

Site B-1 is located on a cul-de-sac at the corner of Latham and 71st Streets in southern Scottsdale. The neighborhood is characterized by single family residential units, with a multi-family complex south of the site. The site was not effected by significant levels of noise during the measurement period. Aircraft arrivals were observed approximately 1 1/2 miles south of the site. The site is also subject to noise from commercial activity along Scottsdale Road, but this source was attenuated by a wall between the site and the thoroughfare. The peak noise level from aircraft flybys was 60.0 dBA, while the peak from local vehicular traffic was 65.2 dBA.

Site B-2 was located on a road adjacent to the Phoenix zoo in Papago Park, approximately 1,000 feet north of Van Buren Street. Although the site was undeveloped, the noise of traffic on the major highway was relatively constant during the entire measurement period. Aircraft flew approximately 3/4 mile south of the location during the measurement period and were deleted from the overall noise measurement at the location. Peak levels from aircraft departures were 76.5 dBA and a bus passing the site produced an ambient peak noise level of 77.5 dBA.

Site B-3 was located near the intersection of 6th Street and Maple in downtown Tempe. The site experienced considerable noise from traffic on local streets and general commercial activity (slamming doors, horns, etc.) as well as a train. Aircraft departing from Runway 8R/L were observed north of the location during the measurement period. These aircraft noises were deleted from the total noise energy to calculate ambient noise exposure. The peak level at the site from ambient sources was 75.8 dBA, while the aircraft peak was 83.5 decibels.

The fourth sampling site was located outside the detailed study area adjacent to the Shalimar Golf Course in eastern Tempe. Ambient noise levels at the location were similar to those within the study area, with peak noise levels from local traffic at 71.2 decibels. The aircraft noise peak from B-727 aircraft directly overflying the site was 86.1 decibels.

The fifth sampling site for ambient noise was located in a single-family residential neighborhood in west Tempe. Located near the intersection of 18th Street and Beck Avenue, Site B-5 is 1 1/2 to 2 miles south of the jet flight tracks from Runways 8R/L. Aircraft were observed during the measurement period, but with the exception of a direct overflight by a light propeller aircraft, were not heard above ambient noise levels. The single overflight was recorded at 77.0 dBA, while the peak ambient noise levels were 71.5 decibels from barking dogs.

The sixth site, B-6, was located in the parking lot of the Lutheran Campus Center on McAllister Road, immediately south of Arizona State University. The location is approximately 1 1/2 miles south of the observed flight tracks for Runway 8 R/L departures. Several departures were noted during the measurement period, but none exceeded 70 decibels for more than three seconds. Noise sources in the vicinity, in addition to the aircraft, included residential dormitories for ASU and local street traffic. The peak ambient level recorded at the site was 72.0 decibels. While located near a rail track, no train operations were observed during the sampling period.

Site B-7 was near the intersection of 33rd Street and McKinley Street in Phoenix. The location is approximately one mile directly north of the airport in a quiet neighborhood of single-family structures. The principal ambient noise source in the area was traffic on local streets, with peak levels of 73.0 dBA. Aircraft noise, particularly at takeoff thrust, was identifiable at the location; these takeoffs had peak levels of 72.0 decibels. Overflights by single engine propeller aircraft were observed in the area.

Site B-8 was located in a nonresidential setting on the edge of downtown Phoenix. The site was near 12th Street and Jackson Street, in an area of warehousing and light manufacturing. Trucks, heavy machinery and rail switching at the Southern Pacific yard were the dominant ambient noise sources at the location. During the sampling period, several departures to the west were noted: their peak levels barely exceeded ambient peak levels, 81.8 and 81.6 dBA respectively.

An office park on Magnolia Street, just west of 24th Street, was selected for measurement of background noise levels of office complexes. Site B-9 is approximately 3,000 feet from the end of Runway 8R, and during east departures, the aircraft could be heard at levels between 74 and 83 dBA. Arrivals to Runway 8R could not be heard over the general noise levels generated by the Maricopa Freeway and 24th Street. The local and freeway road traffic created a generally constant level of slightly less than 70 decibels, with peaks of 75 dBA.

Site B-10 was located three miles directly west of Site B-9, near the intersection of Magnolia Street and 7th Avenue. The location is in an area of mixed residential, commercial and industrial uses just south of the Maricopa Freeway. Dominant ambient noise sources in the area are the freeway, an auto salvage yard, and trucks frequenting local businesses. These produce peak levels of 73.5 decibels. Arrival operations were observed just north of the site, but had peak noise levels less than to those of the trucks in the neighborhood (70.6-72.3 decibels).

Site B-11 was located in downtown Phoenix near 1st Street and Washington Street. Typically, the urban center of a major metropolitan area would generate high ambient noise levels. Downtown Phoenix is no exception, as traffic and construction activity combined to produce ambient noise levels in excess of 65 Ldn, with peaks of 80.7 decibels from construction equipment. Several arrival operations were observed during the measurement sample, but the loudest recorded was 73.0 decibels.

While ambient noise was recorded at each aircraft noise validation noise measurement site, the selection of those sites precluded the recording of significant levels of ambient noise and consequently, they are of limited value in the assessment of ambient noise patterns. For example, several aircraft noise validation sites were located so as to specifically exclude loud noise from traffic on local streets by placement in the rear yard, and shielded by a residential structure. Other validation measurement sites were located on the roof of structures above and shielded from ambient street noise. Thus, while the validation measurements may provide

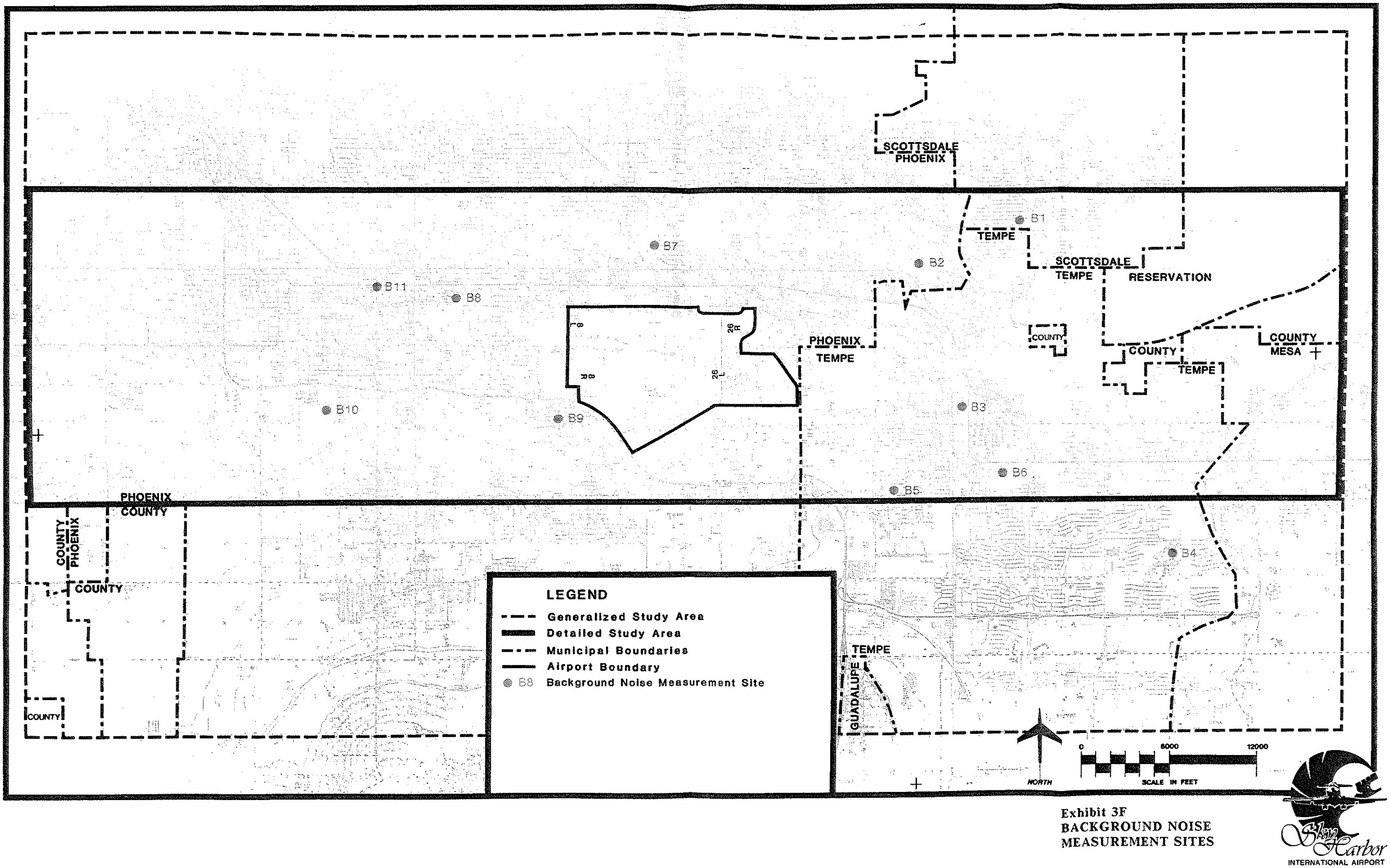

Exhibit 3F
BACKGROUND NOISE
MEASUREMENT SITES

general guidance to investigations of ambient noise levels, greater variability between those levels and calculated levels developed from ambient noise models may be expected.

AMBIENT NOISE MEASUREMENT RESULTS

The Equivalent Continuous Sound Levels (Leq) that were computed by the monitors from noise measurements collected during the ambient noise measurement program are presented in Table 3C. Leq is the summation metric that indicates the logarithmic average of the A-weighted sound levels that were recorded over 30 to 60 minute time samples at each location. Unlike the Ldn metric, there are no penalties for night operations added to Leq. As a general rule of thumb, and where nighttime noise accounts for approximately fifteen percent of the 24-hour activity, Ldn levels will be between two and four decibels higher than sample Leq levels.

In many cases, the average 24-hour noise level at any one location will be very dependent upon large volumes of noise energy received during short bursts. For example, a location subject to rail noise may be exposed to that energy only for ten minutes a day, but the exposure may result in high average noise levels. Therefore, the predicted indigenous, road, and rail noise levels for each location are also presented in Table 3C to provide a greater insight into the composition of the noise within the measurement sample and its relativity to the total ambient noise to which a site is exposed.

At several industrial and commercial area sites, the Leq measurements served to more accurately define the ambient Ldn values within the local environment. Measured data was used for guide definition of indigenous noise levels at Sites B-3, B-8, B-9, and B-11.

Table 3C lists, by site, the measured Leq values, the estimated Ldn level based on the measured Leq value, and the predicted ambient Ldn values calculated from the models described in the previous sections. The primary contributory source(s) of ambient noise at each site are also indicated. Comments are provided which might account for variances in excess of three decibels between the modeled ambient Ldn noise level and the mid-point of the estimated Ldn based on measurement.

Noise levels at nine of the 10 background measurement sites were well within the range of acceptability for the models used. The estimated Ldn based on measured noise levels at Site B-2, in Papago Park, exceeded modeled Ldn levels by approximately five decibels. During measurement at this site, a frontal system moved through the area, resulting in relatively high winds and consequent noise from blowing gravel and dead leaves. The passage of heavy busses on the little used nearby park road also contributed to increased ambient measured noise.

In general, the measurements indicate an acceptable degree of correlation between the recorded and modeled levels of noise in the community. Therefore, the models are considered acceptable for the definition of ambient Ldn levels. Evaluation of noise abatement procedures and land use management techniques should be directed at abatement of the differences between aircraft and self-generated ambient noise levels. That is, the differential analysis previously presented should be supplemented with assessments of total impacts within each contour level and abatement alternatives should address both the total and single-event impacts of aircraft noise.

TABLE 3C
Comparative Ambient Noise Data

Site*	Measured Leq	Estimated Ldn	Modeled Ldn Level			
			Indigenous	Road	Rail	Ambient
B-1	59.0	61-63	**61**	60	NA	64
B-2	63.0	65-67	<60	**60**	NA	61
B-3	65.3	67-69	**65****	**63**	62	68
B-4	61.2	Site Located Beyond Detailed Study Area Boundary				
B-5	58.7	61-63	60	58	NA	63
B-6	60.1	62-64	**63**	55	58	65
B-7	57.9	60-62	**61**	NA	NA	61
B-8	64.0	66-68	**65****	55	**67**	69
B-9	69.4	71-73	**68****	**65**	NA	70
B-10	58.7	60-62	51	**63**	NA	63
B-11	69.4	71-73	**68****	67	NA	71

* Sites designated on Exhibit 3F.
** Measurement data used to direct definition of indigenous noise level.
Note: Noise levels in bold indicate the principal influence(s) on measured levels.

SUMMARY

Separate noise exposure patterns were delineated for a variety of nonaircraft sources (indigenous, road, and rail) which are present in the study area. These patterns were combined through a summation process to depict the overall pattern of ambient noise in the study area. Subsequently, this ambient pattern was combined with the 1987 aircraft noise exposure pattern (as defined in Chapter Two) to form a pattern of total noise exposure for the study area. A comparative assessment was then conducted to determine those areas where aircraft noise exceeded the noise levels associated with ambient noise.

These data may be used in the following chapters as tools to assist in the determination of potential noise abatement or mitigation techniques.

This chapter also outlined the results of a program of ambient noise measurements conducted at 11 sites in the area designed either to validate or to adjust the noise levels predicted through an ambient noise modeling process. The comparison of the results of the modeling process and the measurements indicated that, for the purposes of this study, the ambient noise levels projected by the models were sufficiently accurate to generally define background noise levels.