SECTION 8

ENVIRONMENTAL CONSIDERATIONS

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Airport development and operation interacts with both the natural and manmade environment. Environmental issues considered during the preparation of plans for Polacca Airport, and those important to off-airport planning are addressed in this section. The specific considerations addressed in this section are as follows:

- Noise Exposure
- Air Quality
- Visual Aesthetics
- Relocation of Persons
- Temporary Construction Impacts

The subsequent discussion of environmental considerations was an input to the airport systems design described in Section 7 of this report. This material should be consulted whenever development in the immediate vicinity of the airport is being considered. Further, this material is intended to serve as a planning tool, and is not an environmental assessment required by federal agencies for airport development projects.

8.1 NOISE EXPOSURE

Contours delineating lines of equal noise exposure are developed for estimating noise exposure surrounding the airport. Standards and guidelines promulgated by federal, state and local agencies are used to interpret land uses compatible with a given level of noise exposure. The noise contours and interpretations are combined as a basis for planning development of land surrounding the airport. Noise contours have been

developed for 1982 and 1997 forecast activity levels, to enable consideration of initial and long-range noise exposure in the planning process.

Numerous methodologies have been created for estimating and measuring noise exposure. The method used to develop noise contours for this analysis is the Day/Night Average Level (LDN) system.

The noise exposure contours presented herein were developed according to procedure outlined in the technical report entitled "Developing Noise Exposure Contours for General Aviation Airports." Generally, this procedure is to select noise contours from a compendium of computer generated noise contour drawings contained in the report. Selection of noise contours is based on a thorough description of the factors affecting the size of noise contours. It should be noted that the noise exposure contours presented herein represent noise generated by aircraft during flight operations, and do not include noise generated by aircraft during ground operations, or by other surface traffic in the airport vicinity. However, since these are relatively minor noise sources when compared to aircraft flight operations, and their omission will have an insignificant effect on planning land use with respect to noise exposure.

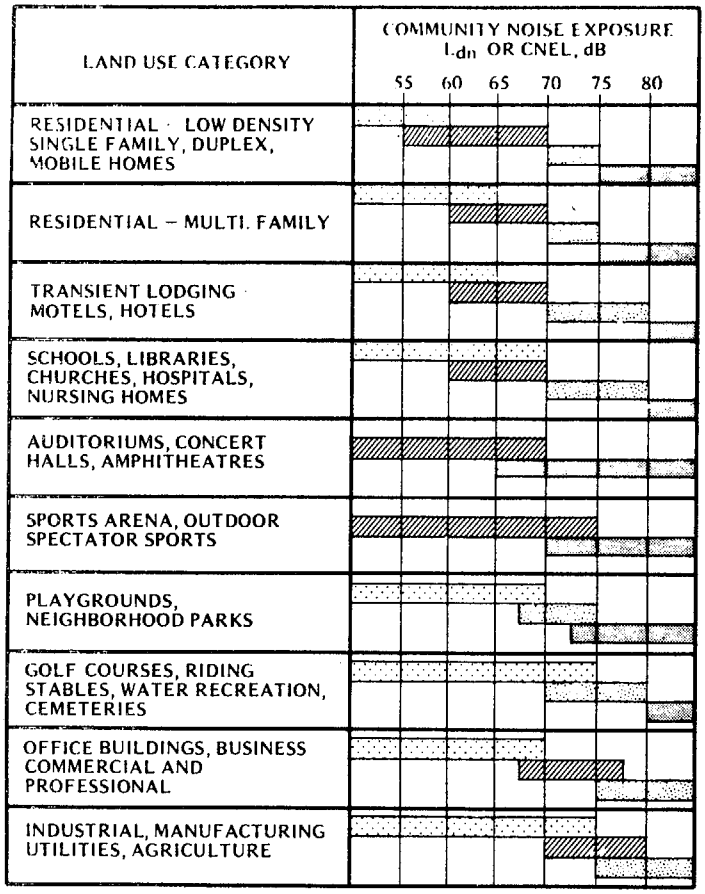
Factors relating specifically to Polacca Airport and used in the presentation of noise contours are listed below:

- The number of aircraft movements will reach 9,800 in 1982 and 33,000 in 1997.
- Of the total aircraft movements, 27 percent will be performed by multi-engine aircraft in 1982, and 25 percent in 1997.
- There will be no jet aircraft activity.
- Landings will be to the southwest approximately 85 percent of the time.
- More than 99 percent of all aircraft activity will occur during the daytime period (0700-2200).

The comprehensive long-range noise planning in this country has been initiated under statutes enacted by the State of California. The state has gained extensive experience in land use planning relating to noise and, as such, has collected substantial information in support of its land use planning guidelines. The guidelines promulgated by the State of California for evaluating land use compatibility are presented in Exhibit 8-1. As might be expected, there is considerable latitude in the interpretation as to what level of noise exposure is compatible with a specific land use. The highest level of the "normally acceptable" band represents the maximum desirable noise level for existing or conventional construction not including special noise insulation. Evaluation of land uses within the "conditionally acceptable" or "normally unacceptable" bands should include consideration of interior noise reduction resulting from the structure, and the amount of time which activities are conducted outdoors as opposed to indoors.

The guidelines presented in Exhibit 8-1 are intended to aid a community in planning a noise environment which it deems to be permissible. However, since these guidelines were developed for a mean community (that is, an average community), it was necessary to also develop some type of correction that could be applied to more accurately reflect the specific community. Correction factors which were developed are presented in Exhibit 8-2. Generally, the correction factors reflect that a quiet environment will be more susceptible to noise impact than a noisy environment, and take into account the community's general understanding and awareness of the specific noise source.

Exhibit 8-3 illustrates the LDN noise contours for 1982 and 1997. All land use within all the noise contours is agricultural or cattle grazing. Future residential development should be prohibited within the area



INTERPRETATION

NORMALLY ACCEPTABLE

Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

CONDITIONALLY ACCEPTABLE

New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

NORMALLY UNACCEPTABLE

New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

CLEARLY UNACCEPTABLE

New construction or development should generally not be undertaken.

CONSIDERATIONS IN DETERMINATION OF NOISE-COMPATIBLE LAND USE

A. NORMALIZED NOISE EXPOSURE INFORMATION DESIRED

Where sufficient data exists, evaluate land use suitability with respect to a "normalized" value of CNEL or L_{dn}. Normalized values are obtained by adding or subtracting the constants described in EX. 3-7 to the measured or calculated value of CNEL or L_{dn}.

B. NOISE SOURCE CHARACTERISTICS

The land use-noise compatibility recommendations should be viewed in relation to the specific source of the noise. For example, aircraft and railroad noise is normally made up of higher single noise events than auto traffic but occurs less frequently. Therefore, different sources yielding the same composite noise exposure do not necessarily create the same noise environment. The State Aeronautics Act uses 65 dB CNEL as the criterion which airports must eventually meet to protect existing residential communities from unacceptable exposure to aircraft noise. In order to facilitate the purposes of the Act, one of which is to encourage land uses compatible with the 65 dB CNEL criterion wherever possible, and in order to facilitate the ability of airports to comply with the Act, residential uses located in Community Noise Exposure Areas greater than 65 dB should be discouraged and considered located within normally unacceptable areas.

C. SUITABLE INTERIOR ENVIRONMENTS

One objective of locating residential units relative to a known noise source is to maintain a suitable interior noise environment at no greater than 45 dB CNEL of L_{dn}. This requirement, coupled with the measured or calculated noise reduction performance of the type of structure under consideration, should govern the minimum acceptable distance to a noise source.

D. ACCEPTABLE OUTDOOR ENVIRONMENTS

Another consideration, which in some communities is an overriding factor, is the desire for an acceptable outdoor noise environment. When this is the case, more restrictive standards for land use compatibility, typically below the maximum considered "normally acceptable" for that land use category, may be appropriate.

Source: Guidelines for the Preparation and Content of Noise Elements of the General Plan, Office of Noise Control, California Department of Health, February 1976.

prc R. Dixon Speas Associates, Inc.	**HOPI TRIBE** **ORAIBI, ARIZONA** LAND USE COMPATIBILITY FOR COMMUNITY NOISE ENVIRONMENTS	EXHIBIT 8-1

EXHIBIT 8-2

CORRECTIONS TO BE ADDED TO THE
MEASURED COMMUNITY NOISE EQUIVALENT LEVEL (CNEL)
TO OBTAIN NORMALIZED CNEL

Type of Correction	Description	Amount of Correction to be Added to Measured CNEL in dB
Seasonal Correction	Summer (or year-round operation).	0
	Winter only (or windows always closed).	-5
Correction for Outdoor Residual Noise Level	Quiet suburban or rural community (remote from large cities and from industrial activity and trucking).	+10
	Quiet suburban or rural community (not located near industrial activity).	+5
	Urban residential community (not immediately adjacent to heavily traveled roads and industrial areas).	0
	Noisy urban residential community (near relatively busy roads or industrial areas).	-5
	Very noisy urban residential community.	-10
Correction for Previous Exposure and Community Attitudes	No prior experience with the intruding noise.	+5
	Community has had some previous exposure to intruding noise but little effort is being made to control the noise. This correction may also be applied in a situation where the community has not been exposed to the noise previously, but the people are aware that bona fide efforts are being made to control the noise.	0
	Community has had considerable previous exposure to the intruding noise and the noise-maker's relations with the community are good.	-5
	Community aware that operation causing noise is very necessary and it will not continue indefinitely. This correction can be applied for an operation of limited duration and under emergency circumstances.	-10
Pure Tone or Impulse	No pure tone or impulsive character.	0
	Pure tone or impulsive character present.	+5

Source: Guidelines for the Preparation and Content of Noise Elements of the General Plan, Office of Noise Control, California Department of Health, February 1976.

TO ORAIBI

HIGHWAY 264

TO POLACCA

ACCESS ROAD

RESIDENTIAL

Polacca

Wash

Five

Well

Spring

BM 5634

BM 5589

BM 5601

BM 5667

BM 5706

A

B

C

D

LDN NOISE CONTOURS				
YEAR	A	B	C	D
1982	40	45	50	55
1997	45	50	55	60

NOTE: LAND USE WITHIN NOISE CONTOURS – AGRICULTURAL / GRAZING

MAGNETIC

14°30'

1000 0 1000 2000

SCALE IN FEET

SOURCE: USGS QUADRANGLE MAP – 1966
POLACCA, ARIZONA – 15 MIN. SERIES

No.	Revision	By	Appr.	Date

Approved

By

Date

R. DIXON SPEAS ASSOCIATES

Designed MFR

Checked MFR

Drawn JRH

Date APR. 1978

HOPI TRIBE
ORAIBI, ARIZONA

NOISE CONTOUR-LAND USE-ACCESS PLAN
POLACCA AIRPORT

EXHIBIT 8-3

described by noise contour "C", and should only be conditionally permitted within the area described by noise contour "A". The nearest existing residential development is located at Walpi Village, far removed from any potential noise disturbance.

8.2 AIR QUALITY

Planning with respect to air quality is undertaken in a manner similar to that for noise exposure. At large metropolitan airports pollutant concentration contours are developed; however, at low activity general aviation airports such as Polacca Airport, pollutant emissions are insufficient, and instead, pollutant concentrations are estimated for given areas or points. The projected pollutant concentrations are compared with national air quality standards and used as a basis for planning the location of pollutant sources and sensitive receptors.

Atmospheric concentrations of pollutants projected herein were calculated using a hand model developed by the San Francisco Bay Area Pollution Control District. The model is described in the publication "Guidelines for Air Quality Impact Analysis of Projects," dated June, 1975. In addition, two supportive publications (References 1 and 2) were used in the calculation of pollutant emissions.

Generally, the model's methodology is a pyramid approach. First, pollutant emissions are calculated for aircraft sources, line sources, and point sources within each local project impact area. A local project impact area is defined as a one kilometer square containing the areas of greatest vehicular traffic on and adjacent to the airport. Secondly, an area concentration is calculated by assembling the individual source emissions. Finally, area source emissions are combined as the basis for estimating a regional concentration.

The purpose of calculating an area concentration is to provide an indication of the average impact of project (airport) emissions on a mobile receptor traveling in areas of substantial project-related emissions. The regional concentration provides a conservative estimate of the concentrations resulting from project emissions after they become thoroughly mixed, vertically and horizontally, after traveling a considerable distance downwind. To estimate the impact downwind of a runway, an end-of-runway concentration is calculated for a point 100 meters downwind of each runway.

Investigation of the proposed airport layout, the surface transportation system, and surrounding land uses led to the definition of one local project impact area: the apron area. This area is centered at the airport automobile parking apron and contains pollutant emissions from all aircraft ground operations, plus emissions from airport related vehicular traffic. Ground service vehicle emissions were not calculated as part of this analysis because light general aviation aircraft require very little ground service. Emissions from non-airport related vehicular traffic was omitted because surveys and projections of traffic were not available.

The regional concentration was calculated by adding the emissions from aircraft flight operations to the emissions calculated for the apron area. The forecast aircraft and highway vehicular traffic, and emission factors used in the calculation of pollutant concentrations are tabulated in Appendix III of this report.

Projected pollutant concentrations for Polacca Airport are presented in Exhibit 8-4. The national primary standard shown is the level of air quality necessary, with an adequate margin of safety, to protect the public health; the secondary standards represent the level of air quality

EXHIBIT 8-4

LONG-RANGE (1977) PROJECTED
PROJECT POLLUTANT CONCENTRATIONS

Pollutant	Averaging Time	National Ambient Air Quality Standards		Calculated Air Quality Concentrations (ug/m^3)			
		Primary	Secondary	Regional Concentration	Terminal Area	Point 100 Meters Off Runway End To: Southwest	Northeast
CO - Carbon Monoxide	8 hrs	10,000	10,000	<1	132	115	651
	1 hr	40,000	40,000	1	241	230	1,302
HC - Hydrocarbons	3 hrs (6-9 a.m.)	160[1/]	160[1/]	<1	5	4	28
NOx - Oxides of Nitrogen	Annual Avg.	100[2/]	100[2/]	-	<1	-	-
	1 hr	None	None	<1	3	2	16
Suspended Particulate [3/]	Annual Geometric Mean	75	60	-	<1	-	-
	24 hrs	260	150	<1	<1	<1	1

[1/] Standard is for non-methane hydrocarbons

[2/] Standard is for nitrogen dioxide

[3/] Calculated concentrations are annual average

(-) Not calculated

ug/m^3 Micrograms per cubic meter

Source: PRC-R. Dixon Speas Associates
July 1977

necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. The four pollutants are described below:

Carbon Monoxide (CO) is an odorless, colorless, toxic gas commonly produced by oxygen-deficient combustion. Emission of carbon monoxide by turboprop aircraft is greatest during the taxi and idle modes, whereas for piston aircraft the emission rates are greatest during the takeoff and climbout modes. Highway vehicle emission rates decrease as the speed of the vehicle is increased, decreasing about 70 percent between 15 mph and 60 mph.

Hydrocarbons (HC) are often introduced into the atmosphere as a pollutant through the incomplete combustion or evaporation of liquid hydrocarbon fuels. In addition to its own harmful effects, reactive hydrocarbons (non-methane hydrocarbons) are associated with the formation of photochemical oxidants. This analysis has projected total hydrocarbons, which includes the reactive hydrocarbons as a subgroup. Emission of hydrocarbons is similar to the emission of carbon monoxide, highest for turboprop aircraft during taxi and idle, and highest for piston aircraft during takeoff and climbout. For highway vehicles, the emission rate decreases approximately 60 percent as speed increases from 15 mph to 60 mph.

Nitrogen Oxide (NO) is formed by the oxidation of atmospheric nitrogen during the high-temperature combustion of fuels. NO reacts in the atmosphere to form Nitrogen Dioxide (NO_2). In this analysis, the concentrations of NO and NO_2 have been combined and referred to as Oxides of Nitrogen (NOx). Oxides of nitrogen are toxic and corrosive. They are also associated with the formation of photochemical oxidants. Emission of oxides of nitrogen is greatest during the takeoff and climbout modes for both turboprop and piston aircraft. Unlike carbon monoxide

and hydrocarbons, the emission rate of oxides of nitrogen for highway vehicles increases linearly as the speed of the vehicle increases.

Suspended Particulate Matter (PT) are produced by a variety of sources. High particulate concentrations in the atmosphere reduce visibility, damage vegetation, and are associated with respiratory ailments in humans. In numerical terms, suspended particulate matter is the smallest of airport pollutants. Whereas particulate emission rates for highway vehicles are available for both exhaust emissions and tire wear, only exhaust emissions are available for aircraft. Since tire wear on aircraft is very substantial, estimation of particulate emission for aircraft is correspondingly understated. In fact, there are no exhaust emission factors for piston aircraft, only for turboprop aircraft.

Investigation of Exhibit 8-4 reveals that none of the projected pollutant concentrations exceed the national standards. In numerical terms, carbon monoxide represents the largest component of airport related pollutants. However, the greatest concentration is projected to reach seven percent of the national secondary standard. Within the apron area, where persons are normally present for extended periods, the concentration of carbon monoxide is projected to reach only one percent of the standard. The high level of aircraft landings and takeoffs (85 percent of the total) conducted to the southwest results in the greatest concentration of pollutants being found northeast of the runway.

It can generally be said that activity at Polacca Airport will not cause concentrations of pollutants that will inhibit human recreational activity or cause measurable physiological effects. Furthermore, sufficient air pollution will not be generated to noticeably increase the probability of photochemical smog development.

Development of additional pollutant sources in the airport vicinity should be avoided to maintain air pollutant concentrations representative of a pristine environment. Undesirable pollutant sources would include commercial development requiring large automobile parking facilities, or production facilities with which exhaust stacks are associated. In particular, these types of pollutant sources should not be developed under aircraft approach and departure paths, or in line with the extended centerline of the runway.

With respect to non-pollutant facilities, the development of sensitive receptors in the airport vicinity should be avoided. Representative of sensitive receptors would be a hospital in which some people may be afflicted with respiratory ailments, or a school where an extensive amount of outdoor recreational activity is undertaken. As with the development of pollutant sources, the development of sensitive receptors should particularly avoid areas under the extended runway centerline.

8.3 VISUAL AESTHETICS AND RELOCATION OF PERSONS

The development recommended for Polacca Airport is of a type that improvements will not rise to a height substantially above the earth's surface. Additionally, the recommended improvements have a relatively small surface area. These improvements will not be visible from Highway 264 or any of the nearby villages.

None of the improvements recommended for Polacca Airport will require, now or in the future, the relocation of persons, businesses, farming or grazing rights.

8.4 TEMPORARY CONSTRUCTION IMPACTS

There will be temporary unavoidable adverse impacts during construction of recommended improvements. These impacts will primarily be noise caused by heavy machinery and workmen, and degradation of air quality

by dust associated with clearing land and ground vehicular traffic.

During the construction phase, measures should be taken to minimize adverse air and water quality impacts. A description of these measures is contained in the FAA's Advisory Circular 150/5370-7, "Airport Construction Controls to Prevent Air and Water Pollution." Resources consumed as part of construction can be minimized by close scrutiny of design economies.