F NOISE ANALYSIS AND LAND USE CONTROLS EVALUATION

INTRODUCTION. This chapter presents the existing and future aircraft generated noise analysis for Will Rogers World Airport. The purpose of this analysis is to provide support for land use planning tasks in later sections of the Master Plan Update.

Background

Noise is generally defined as unwanted sound and, as such, the determination of acceptable levels is subjective. Aircraft noise effects on land use compatibility are usually assessed using the day-night sound level (DNL) methodology, which is a 24-hour, time-weighted average noise level based on the "A" weighted decibel ("A" weighted refers to the sound scale pertaining to the human ear). It is a measure of the overall noise experienced during an entire day, with the noise occurring between the hours of 10:00 p.m. to 7:00 a.m. being penalized, or weighted, by ten decibels. This attempts to account for the higher sensitivity to noise during nighttime hours and the expected decrease in background noise levels.

DNL noise levels are usually depicted as grid cells or noise contours. Grid cells are squares of land of a specified size that are entirely characterized by a noise level. Noise contours are interpolations of noise levels based on the center of a grid cell and drawn to connect all points of similar level. Noise contours appear similar to topographical contours and form concentric "footprints" about a noise source. These footprints of DNL noise contours drawn around an airport are used to predict community response to the noise from aircraft using that airport.

The main advantage of DNL methodology is that it provides a common measure for a variety of differing noise environments. The same DNL level can describe both an area with very few high-level noise events and an area with many low-level events. Although DNL noise contours do not delineate areas that are either free from excessive noise or areas that will be subjected to excessive noise, it can be expected that the general aggregate community response to noise within the 65 DNL noise contour will be less than the public response from the 70 DNL noise contour, and even still less than the response from within the 75 DNL noise contour.

One of the community complaints with using the DNL methodology to identify compatible land use is that the DNL does not describe what an individual actually hears as an aircraft flies over a specific location. The sound level an individual reacts to is the maximum sound level each

individual aircraft makes, not necessarily the cumulative noise level. Therefore, supplemental noise metrics have been developed to better identify those individual noise levels that are annoying. The sound exposure level (SEL) is one such metric and represents the noise associated with an individual aircraft on either approach or departure. The 85 SEL has been identified as the level when sleep disturbance generally occurs.

The DNL and SEL noise contours were generated using the Integrated Noise Model (INM) Version 7.0 computer program. The INM was developed by the FAA specifically for modeling the noise environment at airports. It requires the input of the physical and operational characteristics of an airport. Physical characteristics include runway end data, airport altitude, and airport temperature. Operational characteristics include aircraft fleet mix, runway usage, and flight tracks. Using the existing and forecast aircraft operations presented earlier, three sets of noise contours have been generated, including an existing, a 10-year (2016), and a 20-year (2026) set.

Noise Analysis

The FAA has developed Land Use Compatibility Guidelines to help define land use compatibility associated with aircraft generated noise contours. The guidelines are just that, guidelines that can be used to help define land use compatibility; although, land use compatibility is clearly left to the discretion of the local jurisdiction. The federal guidelines state that noise sensitive uses such as residential dwellings, religious facilities, schools, hospitals, rest homes, and other such uses should be prohibited within the 65 and greater DNL noise contours.

Existing Noise

The existing aircraft operations are sufficient to generate the 60, 65, 70, 75, and 80 DNL noise contours, as illustrated in Figure F1, entitled *EXISTING 2006 DNL NOISE CONTOUR*. The existing 80, 75, and 70 DNL noise contours remain on Airport property. The 65 DNL noise contour extends beyond Airport property to the north of Runway 17R/35L by approximately 1,100 feet. The land uses contained in this off-airport noise contour are industrial, with no residential or other noise sensitive land uses nearby.

Future (2016) Noise

The forecasted 2016 aircraft operations are sufficient to generate the 60, 65, 70, 75, and 80 DNL noise contours, which are presented in Figure F2, entitled *FUTURE 2016 DNL NOISE CONTOURS*. As can be seen, even with the increase in projected aircraft operations, the 2016 noise contours

are not, for the most part, larger than the existing noise contour, and, the 65 DNL contour does not extend beyond the Airport boundary.

Future (2026) Noise

The projected 2026 aircraft operations are sufficient to produce the 60, 65, 70, 75, and 80 DNL noise contours, as illustrated in Figure F3, entitled *FUTURE 2026 DNL NOISE CONTOURS*. As presented, the increasing aircraft operations produce noise contours that, for the most part, are only slightly larger than the 2016 noise contours. This can be explained by the expected increase in use of quieter aircraft (particularly commercial passenger service aircraft) at Will Rogers World Airport and, therefore, as related to surrounding land uses, no significant increased noise effects are anticipated.

Airport Environs and Land Use Compatibility

Although aircraft noise is the most common aspect used in analyzing off-airport land use compatibility issues, there are several other factors to be considered. An airport is essentially an industrial facility and must be considered as such when examining options for adjacent development. Considerations such as vehicular traffic, fumes, light and on-airport vehicle noise, all of which are similar to other industrial land use concerns, should be evaluated when making adjacent land use decisions.

In addition to aircraft-generated noise, other off-airport land use considerations are unique to airports. These include:

- **Height hazards associated with tall structures;**
- **Individual aircraft approach and departure paths and local aircraft traffic patterns that may not be reflected in the DNL noise contours;**
- **Accident potential zones that may occur beyond airport property;**
- **Overflight areas that may not necessarily generate a DNL noise contour; and,**
- **The visual effect of low flying aircraft on approach to the runway.**

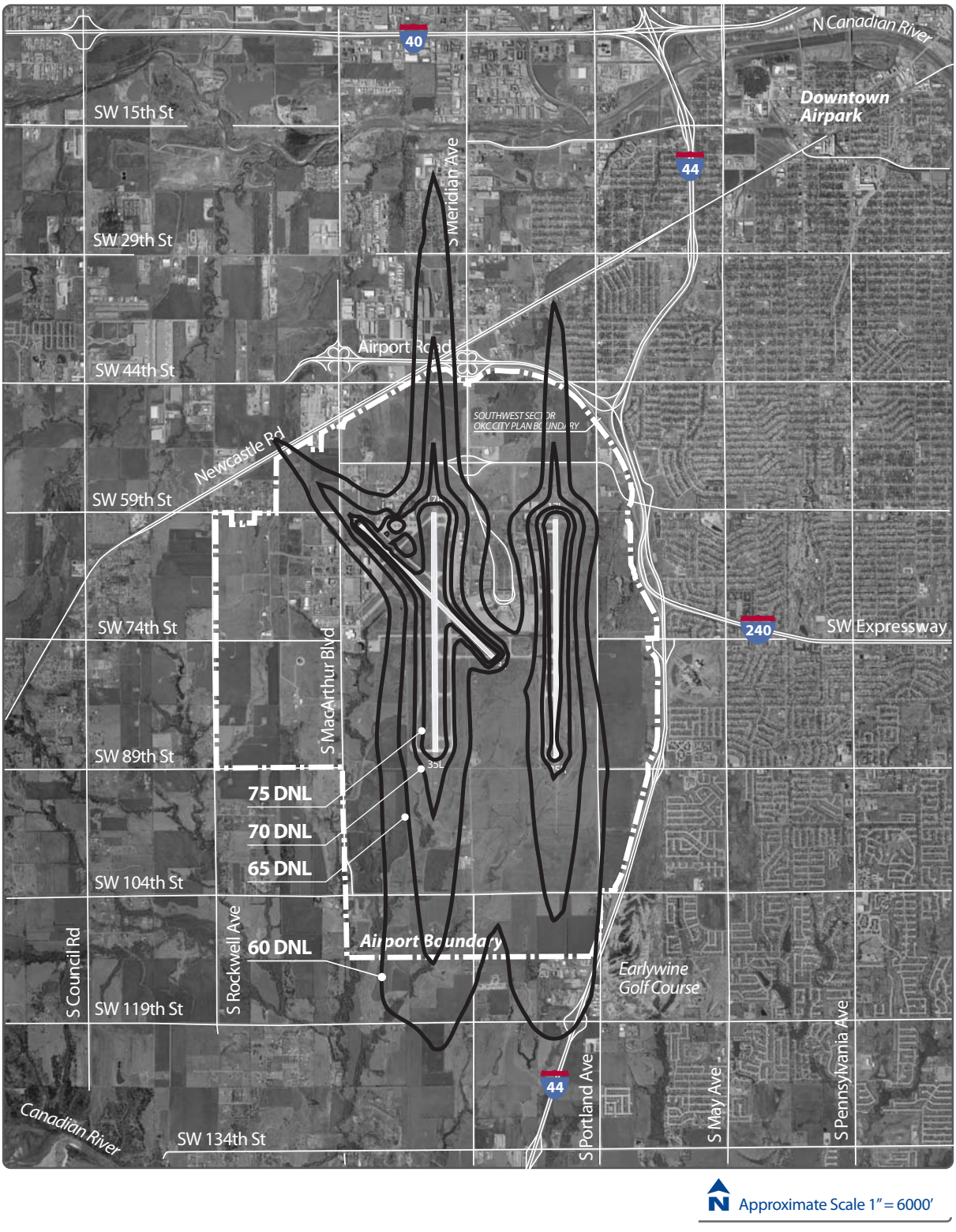

Figure F1 **Existing 2006 DNL Noise Contours**

Source: *Base Map:* Google Maps 2007.

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MASTER PLAN UPDATE

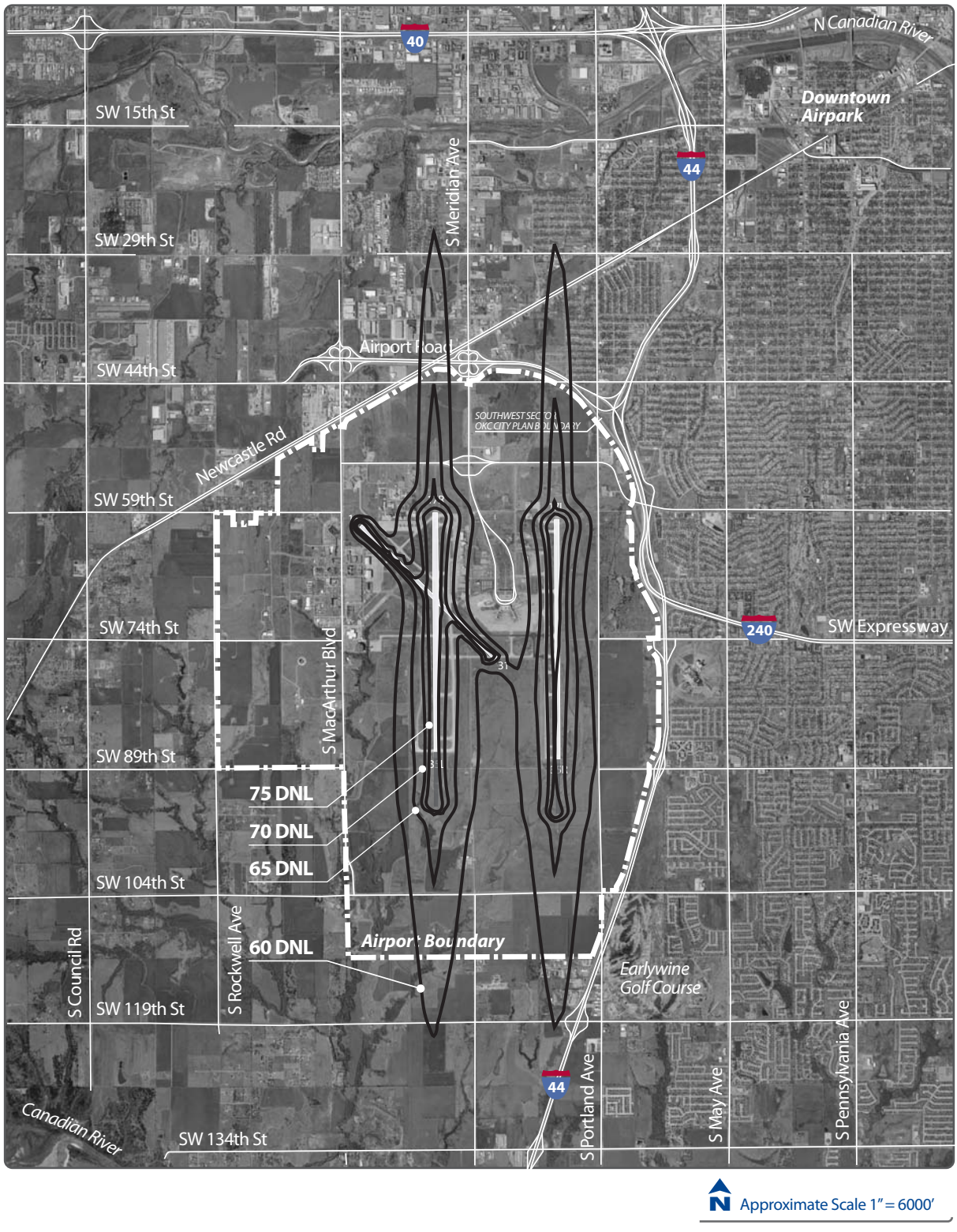

Figure F2 **Future 2016 DNL Noise Contours**

Source: *Base Map*: Google Maps 2007.
Zoning Overlay Districts: City of Oklahoma City, Planning and Zoning Code.

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MASTER PLAN UPDATE

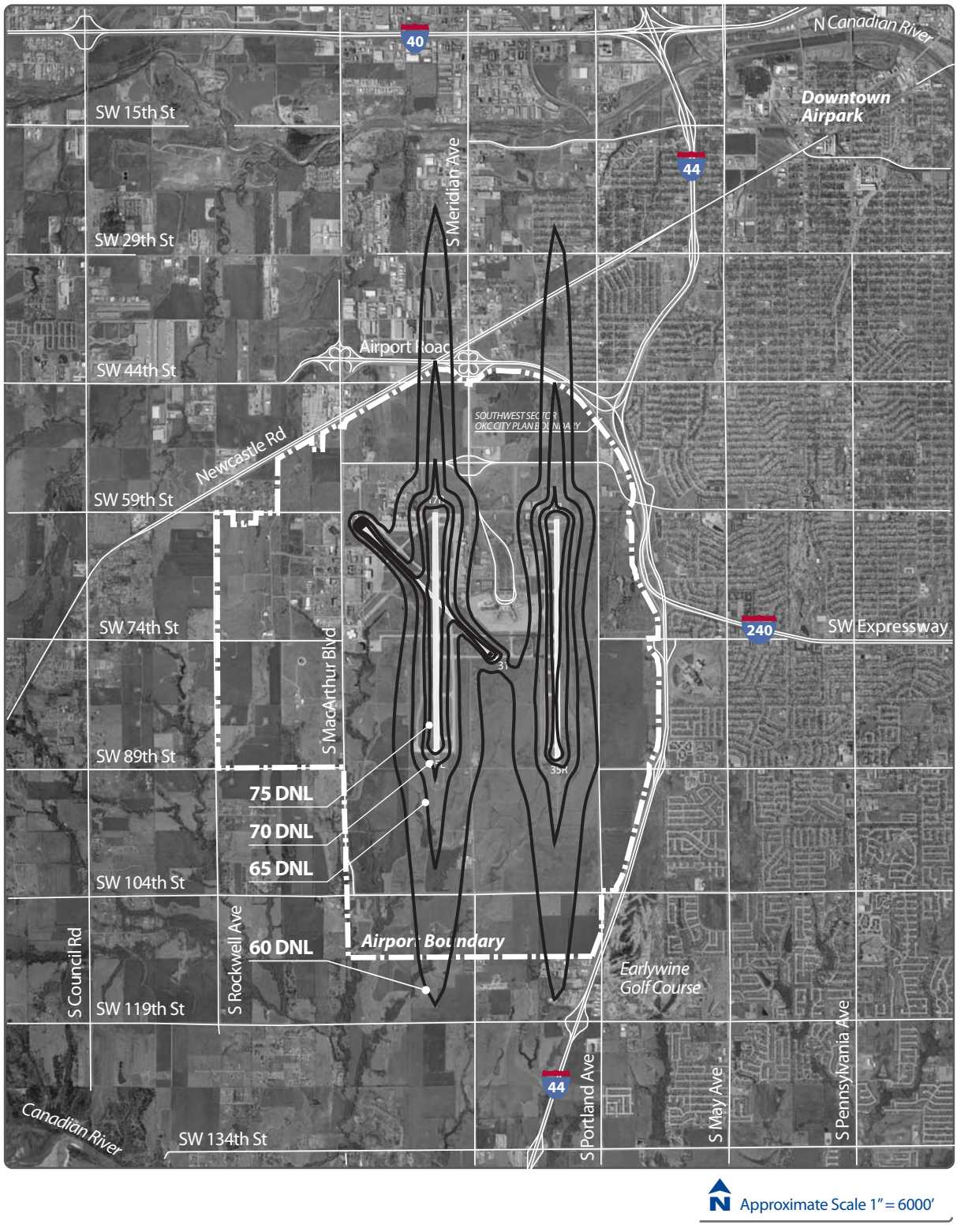

Figure F3 **Future 2026 DNL Noise Contours**

Source: *Base Map*: Google Maps 2007.
Zoning Overlay Districts: City of Oklahoma City, Planning and Zoning Code.

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MASTER PLAN UPDATE

Existing Land Use Controls Evaluation

Zoning

The City of Oklahoma City utilizes zoning to control land uses within its corporate boundary. In addition to traditional land use zoning, in the area around the Airport, the City of Oklahoma City has established Airport Zoning Overlay Districts that limit both the height and types of development within the area surrounding the Airport. The purpose of the Airport Zoning Overlay Districts is to:

- **Promote public health, safety, and general welfare of the City;**
- **Prevent the creation of airport hazards, which are public nuisances and an injury to the region served by the Airport;**
- **Protect the City and the utilization of the airports against potential litigation; and,**
- **Reduce the adverse impact of airports on surrounding properties.**

The Airport Zoning Overlay Districts were implemented in the early 1980s for Oklahoma City's three municipally-operated airports and the area surrounding Tinker Air Force Base (AFB), following the preparation of the *Oklahoma City Airports Land Use & Zoning Report & Ordinances*. These overlay zoning guidelines are specified within Chapter 59 of the Planning and Zoning Code/Article XIII, Zoning Overlay Districts, §59-13150 Airport Zoning Overlay Districts.

Existing Oklahoma City airport zoning regulations for Will Rogers World Airport are made up of two components, which include an Airport Zone related to height restrictions that is reflected on an Airport Height Zoning Map, and, an Airport Environs Zone Map that regulates land use within the vicinity of the Airport.

The *Airport Environs Zone Map* for Will Rogers World Airport, presented in the following illustration entitled *AIRPORT OVERLAY ZONING MAP*, consists of two zones [i.e., the *Airport Environs Zone One (AE-1)* and the *Airport Environs Zone Two (AE-2)*]. The AE-1 and the AE-2 Airport Environ Zones were mainly defined by the 65 and 60 Day-Night Average Sound Level (LDN)[1] noise contours, respectively, that extend beyond existing airport property.

The intent of specifying appropriate land uses, building practices, and requirements for avigation easements in the vicinity of the Airport is to promote public safety, and, to reduce

[1] The LDN acronym for Day-Night Average Sound Level has since been revised to DNL.

adverse impacts of the Airport on the surrounding properties. As specified by the City of Oklahoma City Planning and Zoning Code, the two zones are listed as having the following regulations:

- *Airport Environs Zone One (AE-1):* The AE-1 regulations include: 1) Certain land uses, such as agricultural, airport property and related uses, industrial uses, wholesale and retail commercial uses, and areas zoned for open space or recreational uses, are deemed compatible and, therefore, shall be exempted from the provisions of Division 4 of Article II of Chapter 12 of the Oklahoma City Municipal Code. 2) Other uses allowed within the AE-1 Zone shall meet or exceed building code requirements for a minimum noise level reduction of thirty (30) decibels inside the structure as set forth in Division 4 of Article II of Chapter 12 of the Oklahoma City Municipal Code. 3) All uses allowed within this zone shall grant an avigation easement right as a condition of subdivision or building permit approval, except as otherwise provided herein. Said avigation easement right shall be granted to the Oklahoma City Airport Trust for uses within the AE-1 Zones for Will Rogers World Airport. 4) Single family or two-family residential uses, as well as institutional uses such as schools, community centers, churches, etc., are prohibited in this zone.

- *Airport Environs Zone Two (AE-2):* The AE-2 regulations include: 1) Certain land uses, such as agricultural, airport property and related uses, industrial uses, wholesale and retail commercial uses, and areas zoned for open space or recreational uses, are deemed compatible and, therefore, shall be exempted from the provisions of Division 4 of Article II of Chapter 12 of the Oklahoma City Municipal Code. 2) Other uses allowed within the AE-2 Zone shall meet or exceed building code requirements for a minimum noise level reduction of twenty-five (25) decibels inside the structure as set forth in Division 4 of Article II of Chapter 12 of the Oklahoma City Municipal Code. 3) All uses allowed within this zone shall grant an avigation easement right as a condition of subdivision or building permit approval, except as otherwise provided herein. Said avigation easement right shall be granted to the Oklahoma City Airport Trust for uses within the AE-2 Zones for Will Rogers World Airport.

Land Use Compatibility Considerations

One of the main challenges facing airports today is the encroachment of incompatible land uses near and around airports. Development of incompatible land uses can degrade airport operations, impede airport improvements and, perhaps most importantly, reduce the quality of life for airport neighbors. Encroachment is a key factor contributing to escalating operating costs and restriction of airport operations; it has even resulted in closures of many general aviation and military airports in the United States.

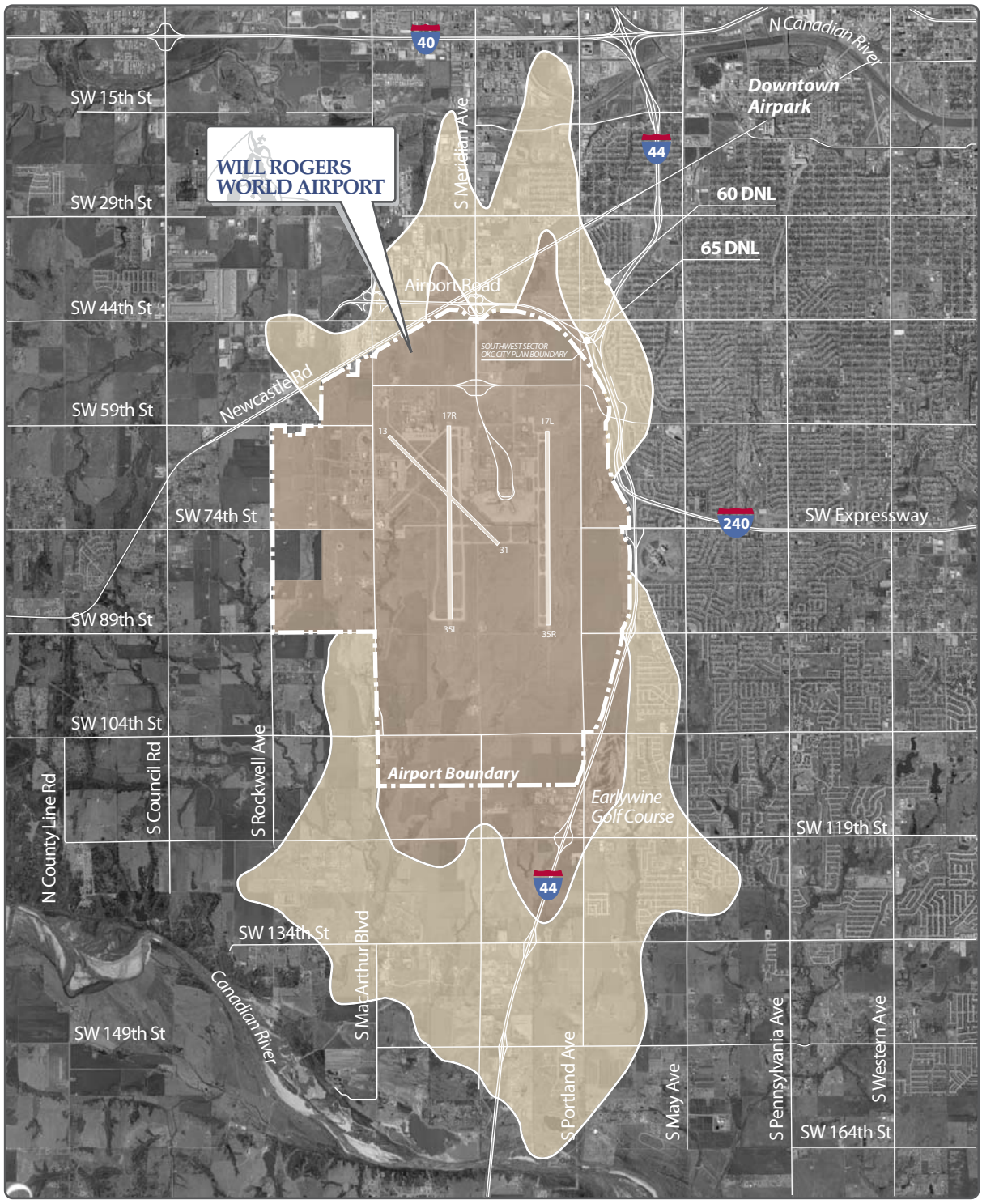

Figure F4 **Airport Overlay Zoning Map**

Source: *Base Map*: Google Maps 2007.
Zoning Overlay Districts: City of Oklahoma City, Planning and Zoning Code.

WILL ROGERS WORLD AIRPORT
MASTER PLAN UPDATE

It is also important to point out that the City of Oklahoma City is obligated through federal grant assurances to:

"It (the Airport's sponsor) will take appropriate action, to the extent reasonable, including the adoption of zoning laws, to restrict the use of land adjacent to or in the immediate vicinity of the airport to activities and purposes compatible with normal airport operations, including landing and takeoff of aircraft."

Land use compatibility issues go beyond aircraft noise. Other considerations are the proximity where aircraft frequently fly near the Airport (traffic patterns and flight paths), accident potential zones to minimize the risks associated with an off-airport aircraft accident or emergency landing, protecting the airspace around the Airport from natural or man-made objects that can constitute a hazard to aircraft in flight, and single event noise exposure in the vicinity of an airport.

Recommendation

Historically, aircraft noise, as described by the DNL contour methodology, has been the primary tool used in the identification of areas where land use incompatibilities are likely to occur near an airport. In recent years, it has become evident that the DNL noise metric does not fully depict areas that are potentially affected by high noise exposure. In addition, other considerations such as accident potential zones, frequent aircraft overflights, and single event noise exposure should be taken into consideration when identifying areas of incompatibility with certain land uses and providing guidelines for ensuring public health, safety, and welfare within the airport environs.

With this in mind, it is recommended that the existing Airport Overlay Zones be retained. The Zones have proven effective over the years in achieving the balance between protecting the Airport from encroachment of incompatible land uses, while simultaneously protecting the community from any negative effects of the Airport.