



PHOTOS COURTESY OF HOUSTON AIRPORT SYSTEM

# WILLIAM P. HOBBY AIRPORT Master Plan Update | Executive Summary







# Airport Master Plan Update

## Executive Summary

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# 1. Introduction

This document is an Executive Summary of the 2014 *William P. Hobby Airport Master Plan* report. William P. Hobby Airport (HOU or the Airport) is one of three airports owned and operated by the Houston Airport System (HAS), along with George Bush Intercontinental Airport/Houston and Ellington Airport. Each airport plays a unique role within the system, and they collectively provide the Houston region with a full range of aviation activity.

The Airport is located approximately seven miles southeast of downtown Houston on approximately 32 acres, as shown on **Exhibit 1-1**. It is the airport of choice for many business travelers because of its proximity to downtown Houston and the availability of low-cost flights to many United States destinations. It is a key airport in Southwest Airlines' route system, and accommodates a significant level of general aviation activity. In 2012, HOU was the 32<sup>nd</sup> busiest airport in the United States in terms of total number of enplaned passengers and the 44<sup>th</sup> busiest in terms of aircraft operations.

## 1.1 Master Plan Update Goals

The overarching goal of the Master Plan Update is to ensure that natural market forces are not constrained in the future by facilities or operational limitations. As a result, the role of the Airport within the Houston Airport System would be driven by natural market forces, rather than specific strategic mandates from HAS.

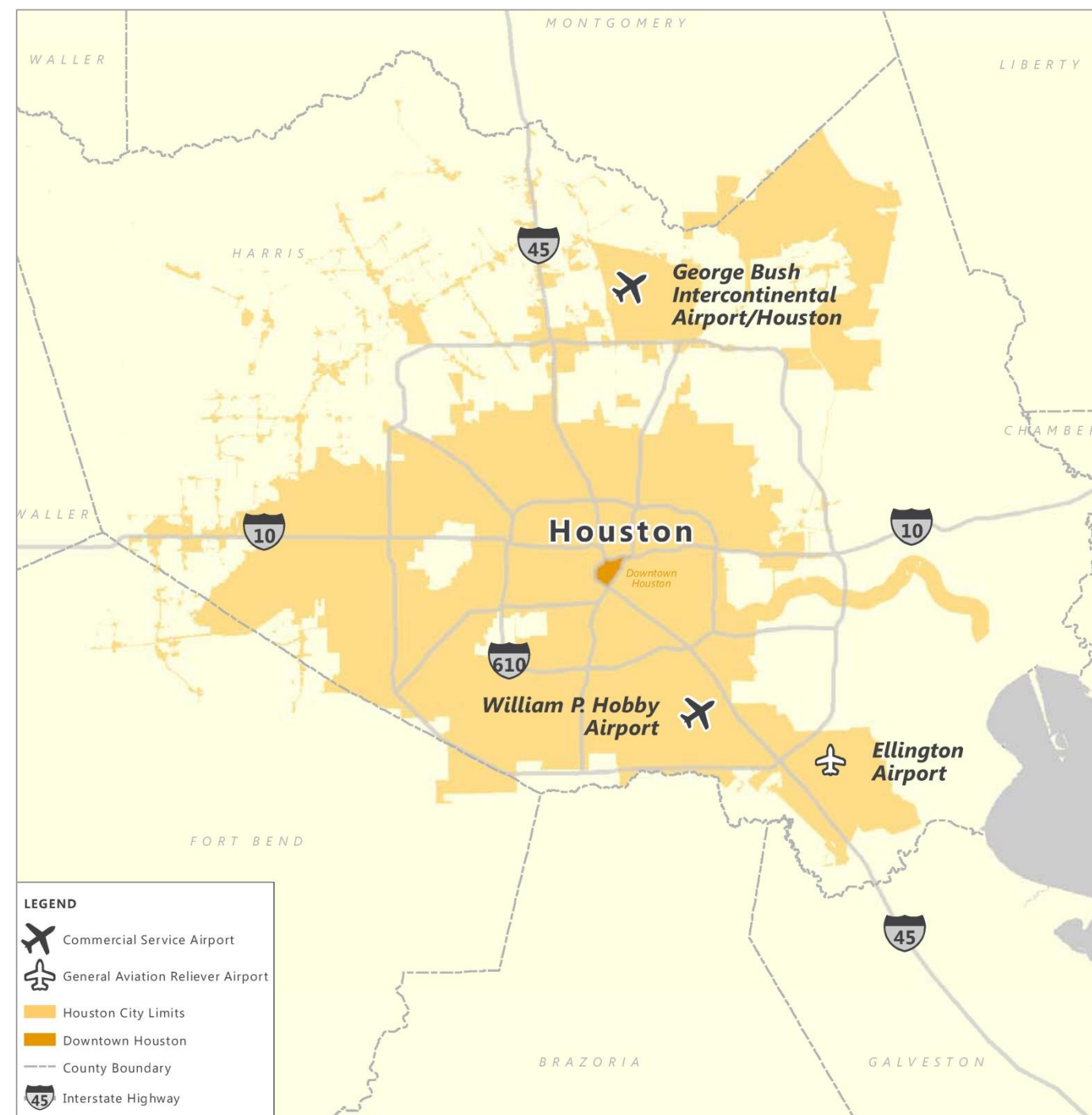
Specific goals that were established to guide the HOU Master Plan Update are summarized below:

- The Master Plan Update will identify the facilities and services that are necessary to accommodate unconstrained passenger, cargo, fixed-base operator, and corporate aviation demand through the year 2030.

The Airport will continue to serve as the Central Business District (CBD) airport that provides service to domestic markets and provides storage and support services for corporate aviation and fractional aircraft owners (Immediately upon initiation of the master plan update, it was announced that Southwest Airlines would be allowed to inaugurate international service from the Airport beginning in 2015. This announcement underscored HAS' commitment that market forces should be allowed to define the role of the Airport, rather than specific strategic goals set by HAS. The announcement also heightened the need to ensure that the master plan update included facility development concepts that would accommodate high levels of growth in the demand for parking, power, and vehicular access.)

- The Master Plan Update should identify strategies and incentives that could lead to improvement of the image of the Airport and its urban environs.
- The Master Plan Update should accommodate future demand for aircraft operations to the extent possible without requiring a large-scale property expansion program (this limitation is in contrast to the Airport Master Plan completed in 2003, which included the allowance for significant airport expansion if the need was warranted).
- The Master Plan Update should accommodate future aviation activity while balancing the capacity of the airfield, the passenger terminal, the ground transportation system, and support facilities at the Airport.

Exhibit 1-1: HAS Airports



SOURCES: Environmental Systems Research Institute, 2010 (USA Base Map); City of Houston Planning and Development Department (COGIS), 2011 (city limits).  
PREPARED BY: Ricondo & Associates, Inc., October 2013.

- Airport facilities are to be adequate to accommodate narrowbody aircraft operations (up to Boeing 757 aircraft) to all domestic and short-haul international markets.
- Future development plans must ensure that a high level of airport security is maintained while complying with new government regulations and mandated procedures. Also, the plans should:
  - be coordinated with related City and Regional development projects,
  - be implemented without disrupting the efficient operation of the Airport, and;
  - be sensitive to surrounding human and natural environments and wisely utilizes limited resources.

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## 1.2 Summary of Master Plan Update

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The Master Plan Update began with a vision setting process in the fall of 2011. The technical analysis started in early 2012 and concluded in late 2013. A series of public meetings were held in the first half of 2014 to present findings to the community.

This Master Plan Update addressed potential activity and related improvements through 2030. Recommendations include short, intermediate and long-term development to accommodate the growth that could occur. Some elements of airport development such as new runways can take 10 to 15 years to put in place once the need is identified. However, it is prudent for an airport to update its master plan periodically to ensure that planning initiatives respond to contemporary market conditions.

This Master Plan Update was designed so that projects could be initiated when demand dictates the need for development. The forecasts identify one timeline in which development could occur, however, if activity does not materialize as quickly as forecast, the development envisioned by this master plan would be delayed accordingly. Conversely, if growth were to accelerate, projects could be initiated prior to the timeline associated with the master plan forecasts. The need for implementation of various projects is based on actual activity reaching specific Planning Activity Levels (PAL) identified in the study. HAS would monitor aviation activity at HOU annually to determine whether activity is tracking as projected and which projects from the master plan should be programmed into the Airport's five-year Capital Improvement Program (CIP) based on that activity.

## 2. Inventory of Existing Conditions

An inventory of physical, operational, and functional characteristics of the Airport and its immediate environs is the initial step in the master planning process following establishment of the Airport vision and goals. The inventory information provides the basis for evaluating facilities and subsequently determining future facility needs. Data collection and inventory were completed for the following:

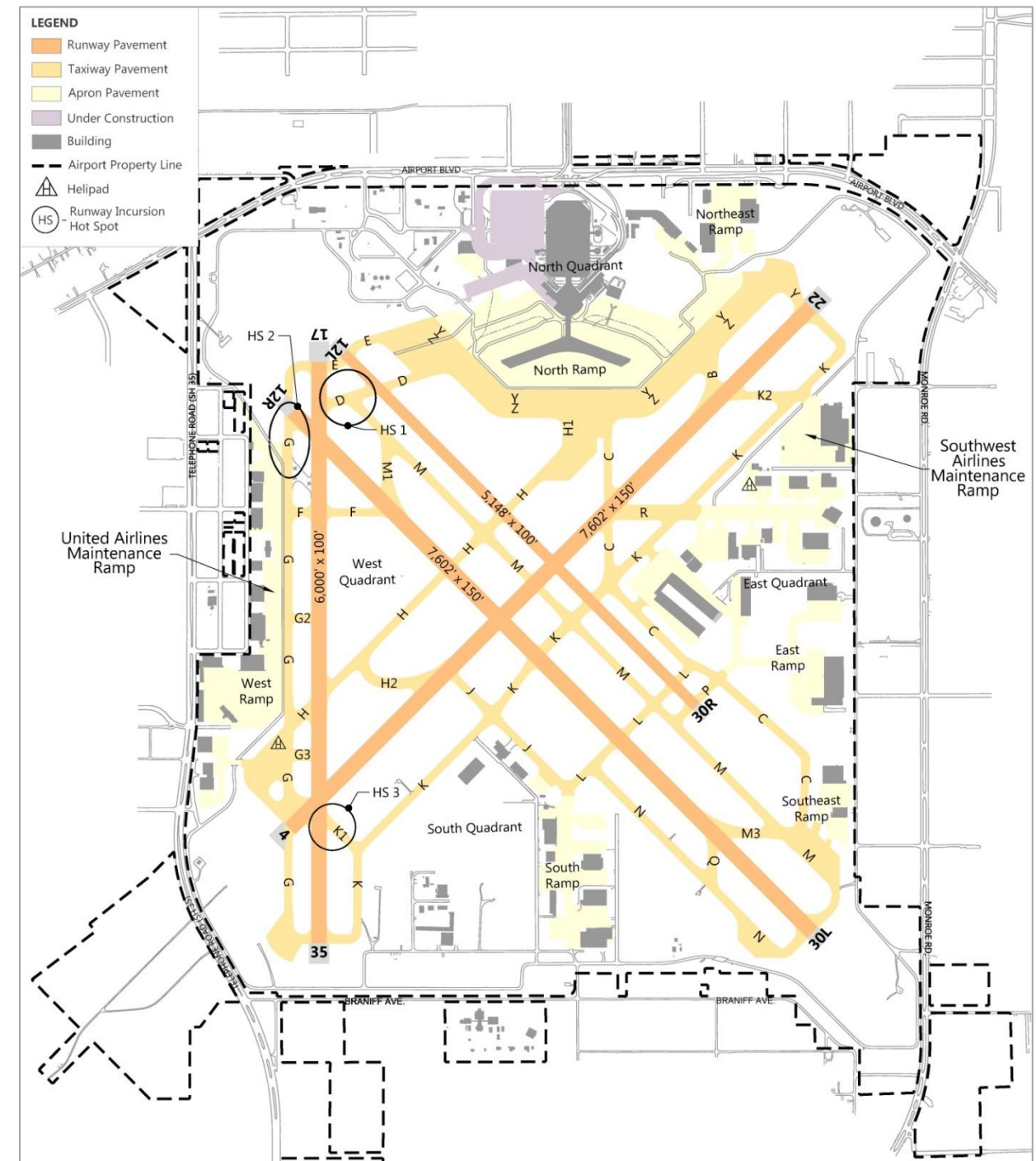
- Airfield Facilities
- Passenger Terminal Facilities
- Airport Access and Parking Facilities
- Airport Tenant and Support Facilities
- Airspace Environment
- Off-Airport Land Use
- Utility Infrastructure

### 2.1 Airfield Facilities

The Airport currently has four runways. Three of these runways (Runways 12R-30L, 4-22, and 17-35) are 150 feet wide and capable of accommodating commercial aviation traffic that occurs at the Airport. The fourth, Runway 12L-30R, is 100 feet wide and is used primarily for general aviation activity. The airfield layout is illustrated on **Exhibit 2-1**, with the respective runway lengths shown.

Instrumentation on each runway end allows aircraft to land in varying weather conditions. Currently, Runway 12R-30L is equipped with a Category I (CAT I) instrument landing system (ILS) and Runway 4 with a CAT III ILS, allowing landings in poor weather conditions.

Exhibit 2-1: Airfield Layout



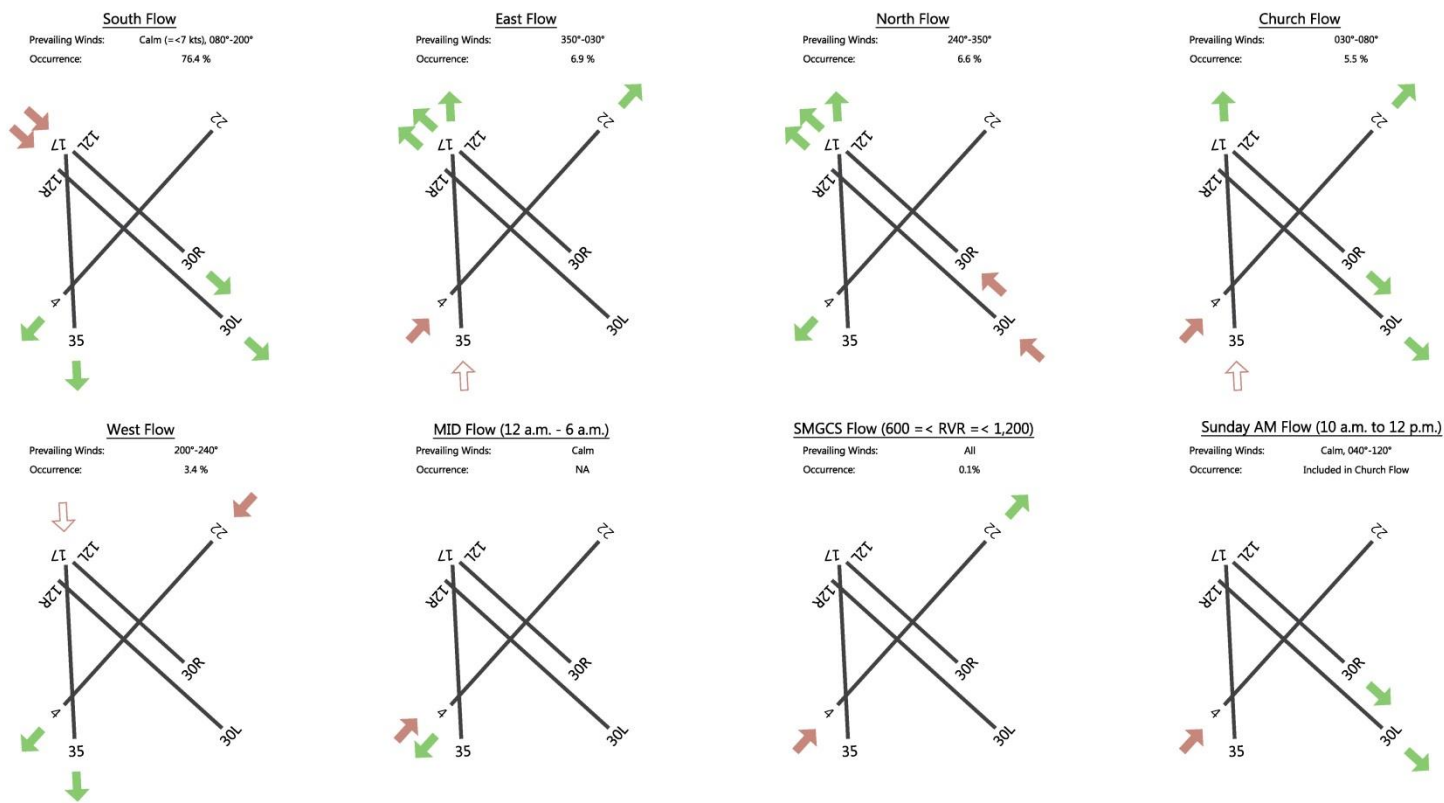
SOURCES: Ricondo & Associates, Inc., William P. Hobby Airport, Draft Airport Layout Plan, 2014..  
PREPARED BY: Ricondo & Associates, Inc., January 2013.

## 2.2 Airspace Environment

Several air traffic control (ATC) facilities, including the Hobby Airport Traffic Control Tower, provide services to aircraft arriving at or departing from the Airport, or overflying the immediate area, to assist in the safe, efficient, and expeditious movement of air traffic.

While all four runways are available for use by arrivals and departures, the weather conditions, runway characteristics (such as length, width, and location) and Airport noise policies define how the airfield is used. The current runway operating configurations are designated North Flow, South Flow, East Flow, West Flow, and Sunday A.M. Flow, Church Flow, Mid Flow and SMGCS Flow. **Exhibit 2-2** illustrates each of these runway operating configurations at the Airport.

**Exhibit 2-2: Runway Use Operating Configurations**



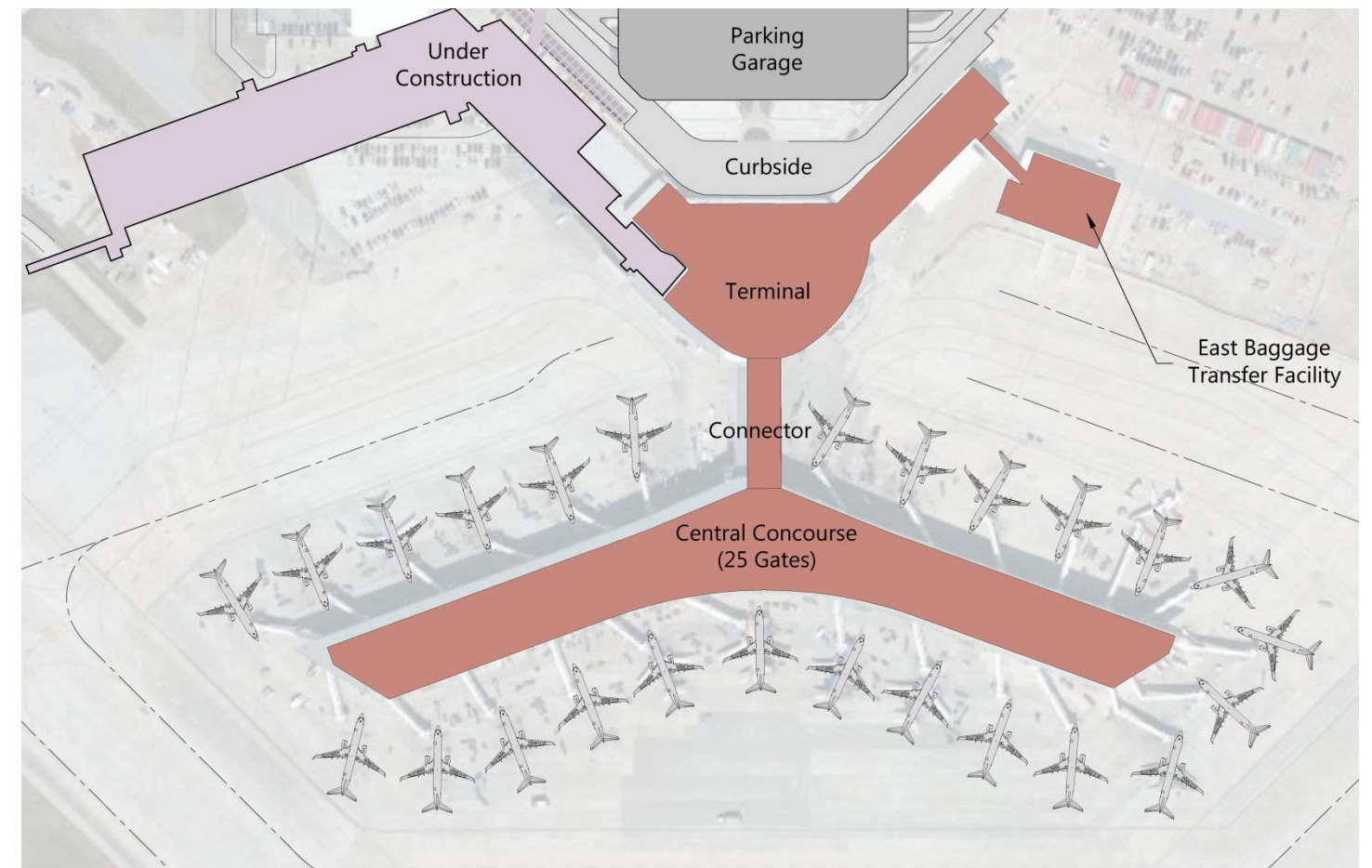
SOURCES: Houston Hobby Air Traffic Control, Hobby ATCT 7110.1W , August 15, 2011  
 PREPARED BY: Ricondo & Associates, Inc., January 2014.

## 2.3 Passenger Terminal Facilities

HAS is currently expanding the terminal complex to accommodate new international operations. This expansion will extend west from the Main Terminal, and will include five aircraft gates in its first phase of development (an additional seven gates can be accommodated through further expansion in the future). The expansion is scheduled to become operational in December 2015.

The existing passenger terminal complex consists of the Main Terminal, the Connector and the Central Concourse, which is comprised of 25 aircraft gates. Together, these facilities total approximately 650,000 square feet and serve major and regional airlines. The terminal facilities are currently used by AirTran Airways, American Airlines, Delta Air Lines, JetBlue Airways and Southwest Airlines. **Exhibit 2-3** depicts existing facilities, as well as the facilities under construction.

**Exhibit 2-3: Overview of Terminal Complex**



SOURCES: Ricondo & Associates, Inc., William P. Hobby Airport, Draft Airport Layout Plan, 2014; Houston Airport System, Hobby Planimetrics, 2012; Google Earth Pro, Aerial Photography, October 2013.  
 PREPARED BY: Ricondo & Associates, Inc., August 2012.

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## 2.4 Airport Tenant and Support Facilities

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Various Airport tenants located within the perimeter fence line can be grouped into the following categories: fixed base operators (FBOs), corporate aviation, aircraft maintenance, air cargo, and other, such as fueling, government, and helicopter operators. These are depicted on **Exhibit 2-4**. Presently, the Airport accommodates five FBOs, which provide general aviation passenger facilities, fueling services, aircraft storage, and aircraft maintenance. Eight corporate aviation tenants also store a variety of aircraft. The Houston Police Department bases its helicopter operations at HOU, along with another helicopter operator. The air cargo facility at the Airport handles aircraft provisioning and belly cargo operations. Other airfield tenants include the Southwest Airlines Fuel Farm, the Hudson Company Fuel Tender, and the Houston Aeronautical Heritage Society (Airport museum).

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## 2.5 Airport Access and Parking Facilities

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The Airport is generally bound by Airport Boulevard on the north, Monroe Road on the east, Braniff Street on the south, and Telephone Road on the west. Broadway Street provides access into the terminal area. These roads are the ones most commonly used by the traveling public. Local roads, such as Braniff Street, Scranton Street, and Old Telephone Road, provide access to FBO, maintenance, cargo, and other Airport facilities.

Currently, the Airport provides 3,438 public parking spaces in the parking garage. In addition, the Airport provides 1,022 surface lot spaces in a designated Economy Lot (Ecopark – Lot 2), for a total of 4,460 on-Airport public parking spaces. It is estimated that privately operated off-Airport parking lots provide 5,700 parking spaces for public use.

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## 2.6 Off-Airport Land Use

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**Exhibit 2-5** is a graphical representation of 2012 land uses in the vicinity of the Airport. Areas north, south and northwest of the Airport are mostly residential, while areas east, west, southeast and southwest are mostly industrial/commercial.

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## 2.7 Utility Infrastructure

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The utility infrastructure at the Airport consists of sanitary sewer collection, water, storm sewer, electrical power, communication lines and gas lines. Each system is linked to the utility infrastructure for the City of Houston. The detailed data collection process for each of these categories of utility infrastructure provided information such as responsible agency, current conditions, and whether there was flexibility for future expansion.



### 3. Aviation Demand Forecasts

The Master Plan Update aviation demand forecasts were developed for passenger enplanements, air cargo volume, air carrier and regional/commuter airline operations, general aviation, based aircraft and aircraft fleet mix through 2030. The forecasts provide the basis for determining facility requirements and for performing the environmental, financial, and other analyses necessary for preparation of the Airport Master Plan Update.

The forecasts were based on assumptions about aviation activity in the Houston region and other factors that may affect future aviation demand at the Airport, including:

- National aviation industry trends and factors affecting these trends, including events related to the economy, fuel cost changes and other factors since 2001.
- Policy goals and objectives of the Houston Airport System.
- The Airport's role in the Houston Airport System.
- Historical aviation demand and trends in airline service at the Airport, including comparisons with historical U.S. market shares.
- Local socioeconomic and demographic trends, compared with State of Texas and national trends.

The forecasts represent estimates of future activity at the Airport. Actual activity at the Airport may vary from the forecasts because of unforeseen events and changes in airline service at the Airport or at competing airports. In addition to the baseline forecasts (which serve as the basis for facility planning in this master plan update), alternative low- and high-growth forecast scenarios are presented in this section to account for potential changes in airline service patterns that could emerge during the planning horizon (through 2030).

#### 3.1 Historical Activity Levels and Trends

The FAA classifies the Airport as a medium hub airport. In 2012, it accommodated approximately 10.4 million passengers (enplaned and deplaned) and almost 200,000 aircraft operations.

The Airport primarily serves origin-destination (O&D) passenger traffic with a 75/25 percent split. Airlines at the Airport primarily serve short- and medium-haul destinations. **Table 3-1** presents nonstop markets historically served from HOU. The total number of domestic enplaned passengers at the Airport grew 1.7 percent annually over the historical period and the number of connecting passengers accommodated at the Airport grew an average of 3.4 percent per year between 2006 and 2012.

**Table 3-1: Passenger Markets Served Nonstop from the Airport, 2006 and 2011**

MARKET	AIRLINE(S)	JULY 2006		JULY 2011	
		SOUTHWEST	OTHER AIRLINES	SOUTHWEST	OTHER AIRLINES
Albuquerque	Southwest	•		•	
Atlanta	AirTran, Delta		•		•
Austin	Southwest	•		•	
Baltimore	Southwest	•		•	
Birmingham	Southwest	•		•	
Branson	AirTran			•	
Charleston	Southwest			•	
Chicago (Midway)	Southwest	•		•	
Cincinnati	Delta				•
Corpus Christi	Southwest	•		•	
Dallas (Love)	Southwest	•		•	
Dallas-Fort Worth	American		•		•
Denver	Frontier, Southwest	•	•	•	•
El Paso	Southwest	•		•	
Fort Lauderdale	Southwest	•		•	
Fort Myers	Southwest	•			
Greenville-Spartanburg	Southwest			•	
Harlingen	Southwest	•		•	
Jackson	Southwest	•		•	
Jacksonville	Southwest	•		•	
Kansas City	Frontier				•
Las Vegas	Southwest	•		•	
Little Rock	Southwest	•		•	
Los Angeles	Southwest	•		•	
Midland	Southwest	•		•	
Minneapolis-St. Paul	Sun Country		•		
Nashville	Southwest	•		•	
New Orleans	Southwest	•		•	
New York (Kennedy)	Delta, JetBlue		•		•
New York (LaGuardia)	American, ATA		•		
Newark (Liberty)	Southwest			•	
Oakland	Southwest	•		•	
Oklahoma City	Southwest	•		•	
Orlando	Southwest	•		•	
Panama City	Southwest	•		•	
Philadelphia	Southwest	•		•	
Phoenix	Southwest	•		•	
San Antonio	Southwest	•		•	
San Diego	Southwest	•		•	
St. Louis	Southwest	•		•	
Tampa	Southwest	•		•	
Tulsa	Southwest	•		•	

NOTE:

- 1/ On May 2, 2011, Southwest announced the closing on its acquisition of AirTran Holdings, Inc., the former parent company of AirTran Airways, Inc. (AirTran). The company plans to operate Southwest and AirTran separately for a period of time to address issues with integration, and expects full integration by the end of 2014. In April 2008, ATA filed for Chapter 11 bankruptcy protection and ceased all services.

SOURCE: Diio LLC, November 2012.

PREPARED BY: Ricondo & Associates, Inc., November 2012.

Air carrier (mainline) passenger airline aircraft operations decreased an average of 0.9 percent per year between 2001 and 2012. Aircraft operations levels in 2012 for air taxi/commuter are near 2001 levels; however, air taxi/commuter aircraft operations fluctuated greatly over the historical period. Between 2006 and 2012, air carrier aircraft operations increased slightly (0.4 percent per year), whereas air taxi/commuter aircraft operations decreased an average of 6.0 percent per year. General aviation operations decreased from 93,000 operations in 2001 to 53,000 operations in 2012, as HAS is trying to shift general aviation activity to Ellington Airport.

## 3.2 Factors affecting Aviation Activity

There are many factors that affect aviation demand at the Airport. The following subsections describe some of the aviation industry factors and local factors that influence aviation demand at the Airport.

### 3.2.1 AVIATION INDUSTRY FACTORS

- **Cost of Aviation Fuel:** the significant increases in the cost of jet fuel have contributed to airline capacity reductions, which place downward pressure on activity increases through higher fares and aircraft load factors.
- **Economic Conditions:** both domestic and international economic conditions have an effect. The overall state of the economy affects the propensity to travel, and therefore airline revenues.
- **Airport Security:** security requirements have increased the time required in the terminal to reach aircraft gates, as well as bag check decisions. Wait time expectations at a particular airport may affect passenger travel mode choice.
- **Threat of Terrorism:** any terrorist incident aimed at aviation during the planning period could immediately and significantly affect aviation demand.

It is expected that, in the long term, the Airport will continue to be a medium-hub airport, both in domestic passenger service and as an international gateway.

### 3.2.2 SOUTHWEST AIRLINES

- Southwest accommodates a high number of connecting passengers, in addition to local passengers.
- With the long-range Boeing 737-700 aircraft, the airline's ability to serve coast-to-coast and long-haul markets has expanded.
- The Airport is strategically placed (in terms of facilities and geographic location) to remain a key mid-continent focus airport for Southwest Airlines.
- **Expiration of the Wright Amendment in 2014:** in that year, flight stage lengths from Dallas Love Field will no longer be restricted. Passengers desiring to fly beyond the old limits will no longer need to fly to intermediate airports, such as HOU. This change is expected to significantly alter the connecting patterns for passengers on Southwest Airlines at HOU.

- Introduction of international service by Southwest Airlines at HOU in 2015. Because this will be a new connecting point for new markets in the Southwest Airlines system, a significant percentage of connecting passengers is expected on the flights.
- Acquisition of AirTran Airways by Southwest Airlines in 2011 should be noted. In 2011, AirTran Airways was the second busiest airline at HOU, with 222,872 enplaned passengers, approximately 4.5 percent of the market.

### 3.2.3 AIRLINE AIRCRAFT FLEET MIX

With approximately 88 percent market share of passenger airline operations at the Airport, Southwest Airlines (including AirTran Airways) dominates the aircraft fleet mix. Therefore, it is expected that Boeing 737 aircraft will be the primary aircraft serving the Airport. For other airlines, regional jets are projected to provide a significant portion of aircraft operations.

### 3.2.4 GENERAL AVIATION, OTHER AIR TAXI, AND MILITARY OPERATIONS

General aviation activity at U.S. airports decreased 2.3 percent in 2011, continuing a decade-long trend. This decrease parallels a decrease in general aviation aircraft fleet size. The changes taking place are primarily in the single engine and multiengine (non-jet) portion of the fleet.

### 3.2.5 AIR CARGO

As relatively low volumes of cargo and mail are shipped by air through the Airport, changes in the air cargo industry, particularly as a result of new security requirements, are not anticipated to have a significant effect on the airlines serving the Airport.

### 3.2.6 POLICY ISSUES

The following HAS goals guide the development of its airports:

- The role of the Airport will be primarily defined by natural market forces, rather than specific mandates set by HAS.
- This Master Plan Update is intended to document the facilities and services necessary to accommodate unconstrained aviation demand through 2030. Airport facilities are to be adequate to accommodate narrowbody aircraft operations (up to Boeing 757 aircraft) to all domestic and short-haul international markets.
- It is anticipated that the Airport will continue to serve as the Central Business District (CBD) airport that provides O&D service to numerous domestic markets and provides storage and support services for corporate aviation and fractional aircraft owners.



### 3.3 Passenger Enplanement Forecast

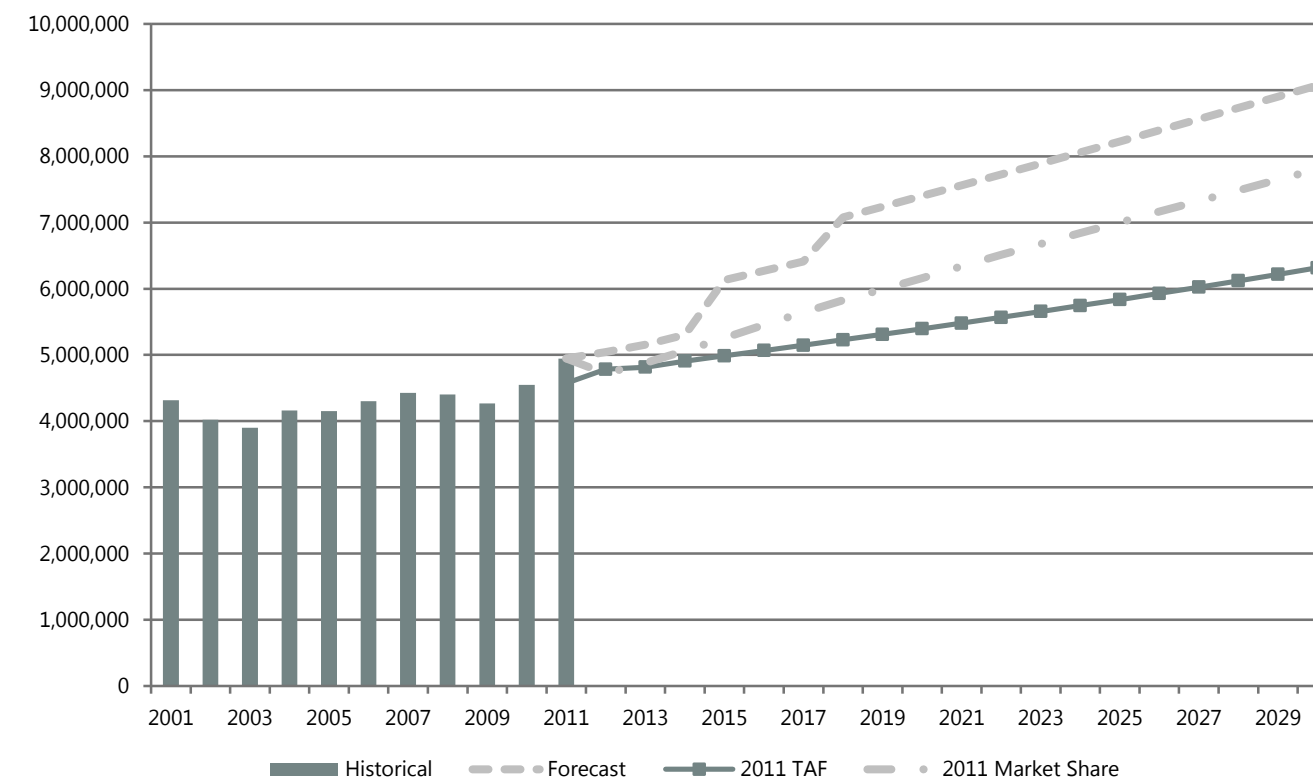
Enplanement forecasts are presented by domestic and international service at the Airport. **Table 3-2** and **Exhibit 3-1** summarize historical and forecast total enplaned passengers at the Airport. The forecast results were compared to the FAA TAF and *FAA Aerospace Forecasts* market shares and are shown graphically on Exhibit 3-1.

**Table 3-2: Historical and Forecast Enplaned Passengers**

YEAR	DOMESTIC SERVICE			INTERNATIONAL SERVICE			TOTAL	ANNUAL GROWTH RATE
	MAINLINE	REGIONAL/ COMMUTER	TOTAL	DOMESTIC	FOREIGN FLAG	TOTAL		
<b>Historical</b>								
2006	4,112,349	189,420	4,301,769	-	-	-	4,301,769	3.6%
2007	4,223,455	203,879	4,427,334	-	-	-	4,427,334	2.9%
2008	4,187,372	213,613	4,400,985	-	-	-	4,400,985	-0.6%
2009	3,981,672	285,615	4,267,287	-	-	-	4,267,287	-3.0%
2010	4,292,343	254,354	4,546,697	-	-	-	4,546,697	6.5%
2011	4,692,284	252,292	4,944,576	-	-	-	4,944,576	8.8%
<b>Forecast</b>								
2012	4,796,500	244,600	5,041,100	-	-	-	5,041,100	
2013	4,902,800	252,300	5,155,100	-	-	-	5,155,100	
2014	5,044,100	260,000	5,304,100	-	-	-	5,304,100	
2015	5,368,000	271,300	5,639,300	362,100	128,300	490,400	6,129,700	
2020	6,166,000	314,500	6,480,500	641,900	277,500	919,400	7,399,900	
2030	7,563,400	393,500	7,956,900	790,600	323,100	1,113,700	9,070,600	
<b>Compound Annual Growth Rate</b>								
2006 - 2011	2.7%	5.9%	2.8%	-	-	-	2.8%	
2011 - 2012	2.2%	-3.0%	2.0%	-	-	-	2.0%	
2011 - 2015	3.4%	1.8%	3.3%	-	-	-	5.5%	
2015 - 2020	2.8%	3.0%	2.8%	12.1%	16.7%	13.4%	3.8%	
2020 - 2030	2.1%	2.3%	2.1%	2.1%	1.5%	1.9%	2.1%	
2011 - 2030	2.5%	2.4%	2.5%	-	-	-	3.2%	

SOURCES: Houston Airport System (Historical), InterVISTAS Consulting (Forecast), Ricondo & Associates, Inc. (Forecast), March 2012.  
PREPARED BY: Ricondo & Associates, Inc., November 2012.

**Exhibit 3-1: Historical and Forecast Enplaned Passengers**



SOURCES: Houston Airport System (Historical), InterVISTAS Consulting (Projected), Ricondo & Associates, Inc. (Projected), March 2012.  
PREPARED BY: Ricondo & Associates, Inc., November 2012.

The share of connecting enplaned passengers is anticipated to grow slightly from 30 percent in 2012 to 34 percent in 2030.

### 3.4 Air Cargo Forecast

The volume of air cargo handled at the Airport is not anticipated to grow significantly over the forecast period. Passenger airlines carry the majority of air cargo volume at the Airport, and with the large investments by HAS in cargo facilities at George Bush Intercontinental Airport/Houston, it is not anticipated an all-cargo facility will be developed at the Airport during the forecast period.

### 3.5 Aircraft Operations Forecast

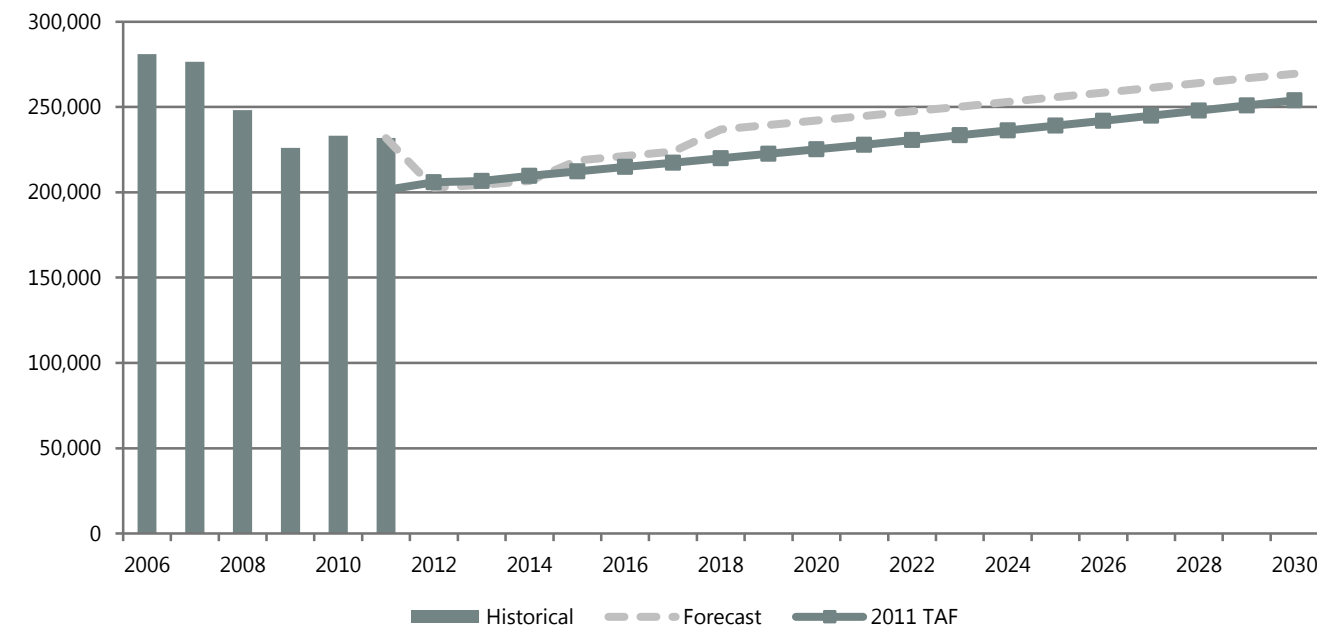
The forecast of aircraft operations at the Airport is presented in **Table 3-3**. The results are shown graphically on **Exhibit 3-2** with a comparison to the 2011 FAA TAF for the Airport. The various components of the forecast were developed as described in the following subsections.

**Table 3-3: Historical and Forecast Aircraft Operations**

PASSENGER AIRLINES									
DOMESTIC									
YEAR	MAINLINE	REGIONAL/COMMUTER	TOTAL	FOREIGN FLAG	TOTAL	GENERAL AVIATION	MILITARY	OTHER AIR TAXI	AIRPORT TOTAL
<b>Historical</b>									
2006	101,108	9,540	110,648	-	110,648	82,165	330	43,905	237,048
2007	104,460	8,780	113,240	-	113,240	83,371	437	39,694	236,742
2008	101,538	8,794	110,332	-	110,332	80,878	661	28,139	220,010
2009	94,720	11,586	106,306	-	106,306	69,875	1,019	24,454	201,654
2010	93,748	10,046	103,794	-	103,794	65,444	1,840	31,018	202,096
2011	98,060	9,288	107,348	-	107,348	57,812	2,828	31,932	199,920
<b>Forecast</b>									
2012	100,420	9,120	109,540	-	109,540	57,970	2,830	32,330	202,670
2013	101,230	9,360	110,590	-	110,590	58,130	2,830	32,760	204,310
2014	102,730	9,610	112,340	-	112,340	58,290	2,830	33,230	206,690
2015	110,840	9,850	120,690	2,920	123,610	58,450	2,830	33,670	218,560
2020	126,600	11,090	137,690	6,570	144,260	59,300	2,830	35,730	242,120
2030	144,930	13,610	158,540	6,570	165,110	61,100	2,830	40,500	269,540
<b>Compound Annual Growth Rate</b>									
2006 - 2011	-0.6%	-0.5%	-0.6%	-	-0.6%	-6.8%	53.7%	-6.2%	-3.3%
2011 - 2012	2.4%	-1.8%	2.0%	-	2.0%	0.3%	0.1%	1.2%	1.4%
2011 - 2015	3.1%	1.5%	3.0%	-	3.6%	0.3%	0.0%	1.3%	2.3%
2015 - 2020	2.7%	2.4%	2.7%	17.6%	3.1%	0.3%	0.0%	1.2%	2.1%
2020 - 2030	1.4%	2.1%	1.4%	0.0%	1.4%	0.3%	0.0%	1.3%	1.1%
2011 - 2030	2.1%	2.0%	2.1%	-	2.3%	0.3%	0.0%	1.3%	1.6%

SOURCES: FAA Air Traffic Activity Data System (Historical), InterVISTAS Consulting (Forecast), Ricondo & Associates, Inc. (Forecast), March 2012.  
PREPARED BY: Ricondo & Associates, Inc., November 2012.

**Exhibit 3-2: Historical and Forecast Aircraft Operations**



SOURCES: FAA Air Traffic Activity Data System (Historical), InterVISTAS Consulting (Forecast), Ricondo & Associates, Inc. (Forecast), March 2012.  
PREPARED BY: Ricondo & Associates, Inc., November 2012.

### 3.6 Based Aircraft Forecast

The decline in the number of based aircraft at HOU between 2006 and 2011 is forecast to continue through the planning period, although at lower overall rates. Single- and multiengine based aircraft have been decreasing at a much higher rate at HOU than nationwide, indicating a migration of the smaller general aviation aircraft to other regional airports. Single- and multiengine based aircraft at HOU are forecast to decrease an average of 0.6 percent per year, while based jet aircraft are forecast to increase an average of 0.6 percent per year. It is projected that there will be 293 based aircraft at HOU in 2030.

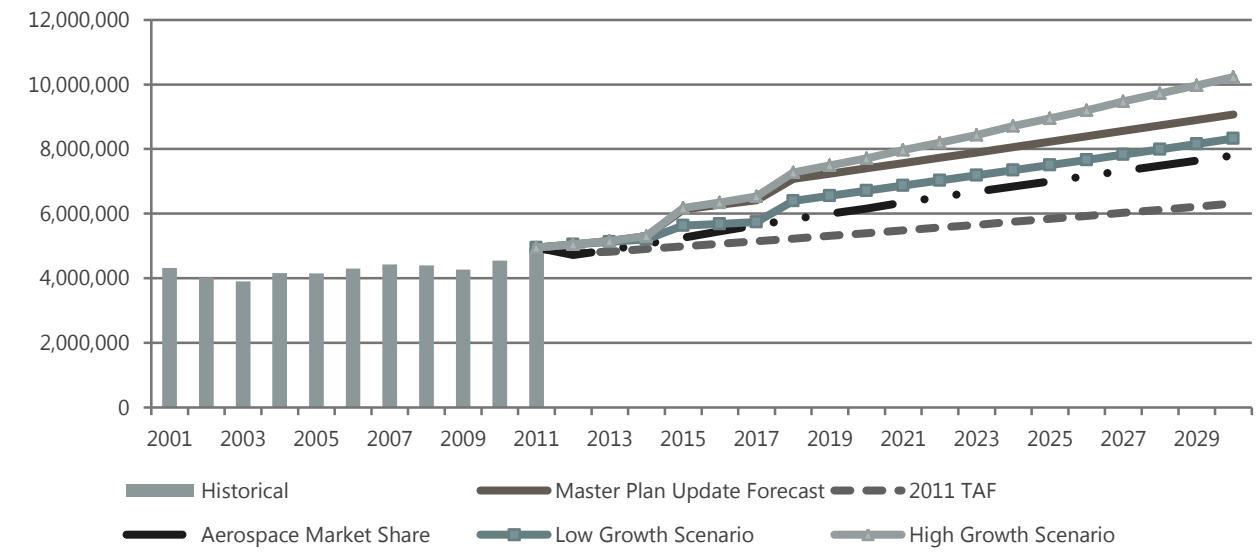
### 3.7 Peak Month and Peak Average Weekday Forecast

In addition to forecasting annual activity levels at the Airport, it was necessary to forecast design level activity, defined in this study as activity during the peak month and the peak average weekday. Design level projections of operational fleet mix activity by commercial and noncommercial user groups were developed.

### 3.8 Forecast Scenarios

To test the sensitivity of the baseline forecasts to changes in conditions that might affect aviation demand at the Airport, a low growth and a high growth scenario were developed. **Exhibit 3-3** depicts the comparison of the baseline, low-growth and high-growth forecasts. The baseline scenario was used to estimate facility requirements for this Master Plan Update.

**Exhibit 3-3: Historical and Forecast Enplaned Passenger Comparison**



SOURCES: Houston Airport System (Historical), InterVISTAS Consulting (Forecast), Ricondo & Associates, Inc. (Forecast), March 2012.  
 PREPARED BY: Ricondo & Associates, Inc., November 2012.

## 4. Facility Requirements

The purpose of the comparative analyses described in this section is to determine the relationship between demand and capacity in the context of various Airport systems, and to provide general assessments of the ability of existing facilities to accommodate future demand. The assessments were translated into specific facility requirements for a series of PALs based on the forecasts presented in Section 3. In this study, PALs are the baseline demand levels at the increments of 2015, 2020 and 2030. **Table 4-1** summarizes the projected demand level of each PAL.

**Table 4-1: Planning Activity Level Characteristics**

YEAR	PLANNING ACTIVITY LEVELS			
	2011	2015	2020	2030
Enplanements	4,944,576	6,129,700	7,399,900	9,070,600
Million Annual Passengers (MAP)	4.9	6.1	7.4	9.0
Aircraft Operations	199,920	218,560	242,120	269,540

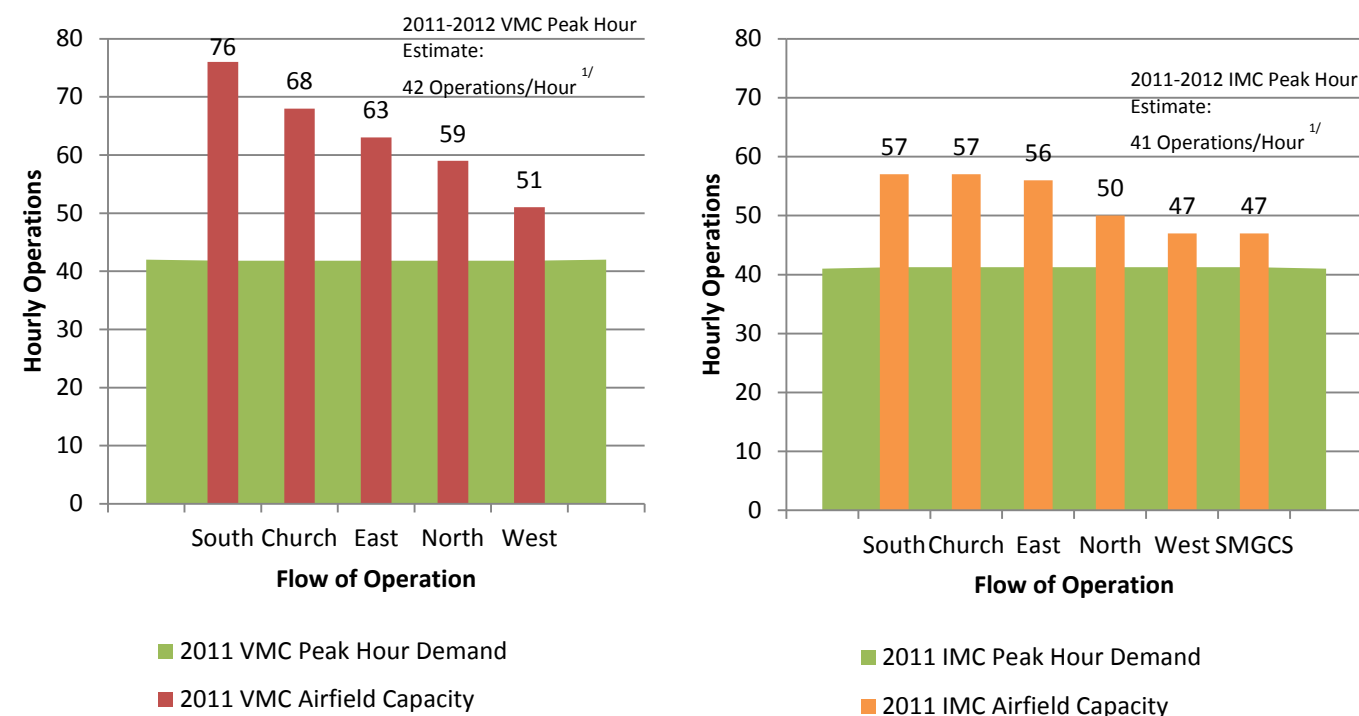
SOURCE: Ricondo & Associates, Inc., January 2014.  
 PREPARED BY: Ricondo & Associates, Inc., January 2014.

### 4.1 Airfield

The capability of the airfield facilities to accommodate the existing and forecast aircraft operations is assessed by an airfield demand/capacity analysis. Airfield capacity is the maximum number of aircraft operations that an airfield can accommodate during a specific period of time without incurring an unacceptable level of delay. Factors that may affect airfield capacity include weather conditions, types of aircraft, airfield configuration, and ATCT procedures. The number and location of runway exits and the amount of touch-and-go activity may also affect the airfield’s capacity. As aircraft demand nears or exceeds the airfield capacity for a specific operating condition, aircraft delays begin to increase exponentially. Detailed analyses of airfield demand/capacity and associated delay were completed. Capacity was estimated for current activity and future PALs for the six runway operating conditions occurring during the hours of 6 a.m. to 10 p.m., in both visual meteorological conditions (VMC) and instrument meteorological conditions (IMC).

**Exhibit 4-1** presents a comparison of hourly capacity with the peak hour demand estimated for the Airport in 2012. The exhibit provides a separate comparison for both VMC and IMC, assuming an arrival mix of 50 percent. As shown on Exhibit 4-1, the VMC and IMC peak hour aircraft demand typically reached 42 and 41 operations, respectively, during 2012. This demand did not exceed the hourly airfield capacity under any of the runway operating configurations. However, as peak hour demand increases through 2030, aircraft demand is forecast to increasingly exceed existing airfield capacity under most operating configurations.

**Exhibit 4-1: 2011-2012 Hourly Airfield Demand/Capacity Comparison – Existing Airfield**



NOTES:

1/ Assuming that peak hour operations occur during the peak hour for commercial operations (air carrier and commuter). During that period, it was assumed that general aviation operational demand would average 66 percent of its peak hour demand during VMC and IMC.

2/ Assuming 50 percent arrivals.

SOURCES: FAA Advisory Circular 150/5060-5, Airport Capacity and Delay, December 1, 1995 (Change 2); Ricondo & Associates, Inc., October 2012.

PREPARED BY: Ricondo & Associates, Inc., October 2012

The demand/capacity analysis for the airfield determined that the existing runway configuration is adequate to serve the current (2012) operational demand experienced at the Airport. As demand increases throughout the planning period, airfield capacity will be exceeded during peak demand periods. Inevitably, aircraft delay will increase, thereby increasing operational costs. Currently, the average delay is estimated to be less than two minutes per aircraft operation. This value is expected to increase to nearly 6 minutes per operation by 2030. At medium hub airports, an average delay of 4-6 minutes is typically the threshold of unacceptable delay to the airline industry. On that basis, exploration of airfield capacity enhancement opportunities that could be implemented prior to 2030 is warranted.

### 4.2 Terminal

Terminal demand/capacity analyses are focused on a terminal facility’s ability to accommodate passenger demand as well as user/tenant needs. The overall terminal facility was evaluated, as well as individual functional components (i.e., aircraft gates, ticket counters, departure lounges, bag claim areas) to determine their adequacy to serve existing and forecast demand.

From the demand/capacity analyses for the terminal, it was determined that the current international terminal construction project, which will be completed in 2015, will be adequate to serve 2012 and 2015 demand for terminal and gate facilities (Table 4-2), in accordance with recommended FAA planning factors. However, both the terminal area and the number of gates will become constrained in 2020. Some components of airline operational areas, concessions, public space, passenger security screening/TSA, and other areas, were not deemed of adequate size to meet passenger demand in 2012 and beyond. To meet these needs, the current and first phase of the international terminal will need to be expanded before 2020 demand levels.

**Table 4-2: Summary of Total Terminal Space Requirements (in square feet)**

	EXISTING BUILDING	2011	2015	2020	2030
Airline Facilities	265,079	282,717	335,143	416,256	459,009
Transportation Security Administration	35,292	44,797	60,445	72,660	84,590
Customs and Border Protection	0	0	84,312	84,312	84,312
Retail, Food and Beverage, Specialty Concessions	50,262	50,300	62,620	74,930	92,370
Ground Transportation	1,287	0	0	0	0
Amenities	1,612	1,620	1,620	1,620	1,620
HAS (Airport)	46,614	27,200	33,300	39,400	49,200
Other Agencies and Contractors		7,100	7,100	7,100	7,100
Circulation	137,039	140,902	199,435	238,533	267,800
Restrooms	18,341	16,550	24,490	32,150	39,600
Building Systems	71,938	73,966	104,692	125,217	140,580
Gross Allowance and Unassigned	36,364	8,606	12,181	14,569	16,356
<b>TOTAL PROGRAM (GROSS AREA)</b>	<b>663,828</b>	<b>646,657</b>	<b>833,927</b>	<b>1,015,336</b>	<b>1,151,125</b>

Note: Values may not equal due to rounding.

SOURCES: Houston Airport System, Composite Space Allocation, December 10, 2010 and Ricondo & Associates, Inc., August 2013.  
 PREPARED BY: Ricondo & Associates, Inc., August 2013.

Table 4-2 summarizes the total gross terminal space requirements for each future PAL, along with a breakdown of space requirements between major space types. The total existing building (without the current international terminal construction project) encompasses approximately 663,800 square feet. It is anticipated that an additional 487,300 square feet of space will be required at 9.0 million annual passengers (MAP), in 2030, which would be a 42 percent increase compared with existing conditions.

### 4.3 Terminal Curbside

The west section of the Departures Curbside (upper level) shows an initial deficit of 32 linear feet in 2011, increasing to a deficit of 128 feet by 2030. The central section is estimated to operate at a deficit of 73 feet in 2011, increasing to a deficit of 177 feet by 2030. The east section is estimated to operate at a deficit of 2 feet in 2011, increasing to a deficit of 95 feet

by 2030. The Arrivals Curbsides (lower level) show two areas operating at a deficit in 2011, the inner roadway that accommodates rental car shuttles (15 feet) and the outer roadway that accommodates parking shuttles (45 feet). These deficits are estimated to increase to 50 feet and 80 feet, respectively, by 2030. All curbside areas that would accommodate other modes—taxicabs (inner roadway), private vehicles (center roadway), and hotel shuttles, METRO buses, and shared ride/economy vans (outer roadway)—are estimated to operate at a surplus through 2030.

### 4.4 Airport Access

The on-Airport terminal area roadways have adequate capacity to accommodate demand through the planning period. The inner lanes of the Arrivals Curbside are estimated to experience congestion and it is recommended that the current taxicabs monitoring practices be continued to prevent curbside congestion.

### 4.5 Public Parking

Based on 2012 parking conditions, deficits in on-Airport public parking capacity begin to develop as early as 2014, with deficits in 2030 ranging from 1,853 spaces (in the Low Passenger Growth Forecast with Baseline Parking Demand) to 4,924 spaces (in the High Passenger Growth Forecast with Parking Demand Scenario 2 [High Growth]).

Based on 2012 parking conditions, deficits in off-Airport parking capacity begin to develop in 2023, with deficits in 2030 as high as 1,370 spaces (in the High Passenger Growth Forecast with Parking Demand Scenario 1 [Medium Growth]).

Based on 2012 parking conditions, deficits in total Airport parking capacity begin to develop as early as 2015, with deficits through 2030 ranging from 1,853 spaces (in the Low Passenger Growth Forecast with Baseline Parking Demand) to 5,584 spaces (in the High Passenger Growth Forecast with Parking Demand Scenario 2 [High Growth]).

### 4.6 Employee Parking, Taxicab Staging and Cell Phone Waiting Lot

It is estimated that the current capacity of 625 employee parking spaces will be sufficient to meet demand through 2030, with a surplus of 30 spaces.

The taxicab staging area, however, was estimated to operate at a slight deficit (three spaces) in 2030.

It appears that the cell phone waiting lot is not considered a primary option for Airport users waiting to pick up passengers. The existing configuration, which provides approximately 50 spaces, is expected to be sufficient through 2030.

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## 4.7 Rental Car Facilities

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Specific requirements for each of the following rental car facility components were evaluated: customer service area, ready/return and onsite vehicle storage area, and quick turnaround area (QTA).

The analysis shows that the space available for customer service is adequate through the planning horizon. However, space deficits in the ready/return area are anticipated to occur in 2030, while there is already a deficit in onsite vehicle storage area at the time of the analysis. Certain areas of the QTA also already experience deficits.

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## 4.8 Support Facilities

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Ancillary facilities needed to support the operation of the Airport include: general aviation/fixed base operators, cargo, airline maintenance, aircraft rescue and firefighting and aircraft fueling facilities. Each support facility is evaluated separately in the Master Plan Update to determine its adequacy for serving the existing and future demand through 2030.

It was determined in the demand/capacity analyses for the aviation support facilities that only general aviation facilities will need increased capacity to meet demand (approximately 15 acres).

## 5. Alternatives Development

A key objective of the master planning process is to identify the best solutions for addressing future development needs at the Airport, as identified in Section 4. Many of the alternatives discussed in this section will continue to be modified and refined prior to final design and construction.

### 5.1 Airfield Layout

Based on the Facility Requirements analysis in Section 4, additional runway capacity will be needed between 2020 and 2030. The preferred airfield development alternative identified in the 2004 Master Plan was reviewed to determine if it is still viable. The Airport's existing property envelope, anticipated development impacts, airfield safety issues, and facility requirements were considered.

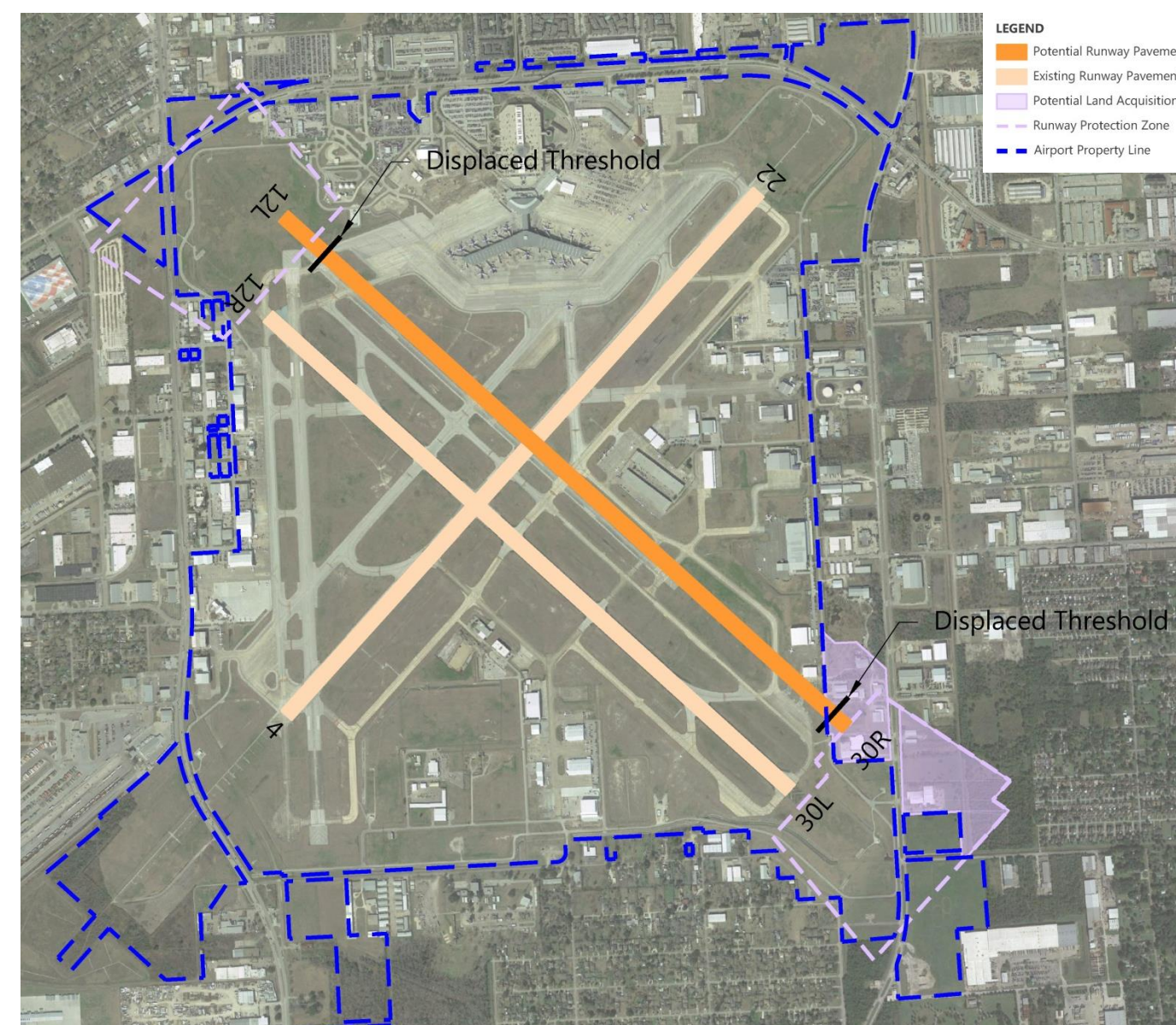
It was concluded from the review that the planned extension of Runway 17-35 was no longer viable, as the overall development costs had increased substantially since 2004. In addition, because Runway 17-35 intersects both Runways 12R-30L and 4-22 and thereby creates hot spots for runway incursions, the FAA and HAS concur that eliminating these safety issues should be a priority. Shortening Runway 17-35 on both the north and south ends to eliminate these hot spots would reduce the available runway length considerably. In addition, the closure of Runway 17-35 would reduce Airport maintenance expenses and make some additional land available for potential future development. On these bases, and despite a loss of runway capacity, all parties are in favor of decommissioning Runway 17-35 as part of the airfield development plan. The planned upgrade of existing Runway 12L-30R was determined to remain the most viable opportunity for enhancing the airfield throughput capacity. Because of the potential closure of both Runways 12R-30L and 4-22 during maintenance activities at the intersection of these two runways, the planned upgrade of Runway 12L-30R must occur prior to the decommissioning of Runway 17-35.

Three airfield development alternatives were considered. The preferred alternative, depicted in **Exhibit 5-1**, consists of:

- upgrading Runway 12L-30R to accommodate commercial airlines by shifting the runway centerline approximately 113 feet to the northeast, staggering the Runway 12L threshold approximately 604 feet to the northwest, widening the runway to 150 feet, and lengthening the runway to 8,206 feet.
- upon completion of the Runway 12L-30R upgrade, decommissioning of Runway 17-35.

Should additional runway capacity be required beyond the planning horizon, feasibility of constructing a parallel Runway 4R-22L could be evaluated.

Exhibit 5-1: Preliminary Phase 1 Airfield Layout



SOURCE: Ricondo & Associates, Inc., August 2013.  
PREPARED BY: Ricondo & Associates, Inc., August 2013.

## 5.2 Aviation Support Facilities

Various sites in the south and west quadrants of the Airport could accommodate the general aviation development requirements identified in Section 4.

To accommodate the upgrade of Runway 12L-30R, the main deicing pad located east of the Runway 12L end should be relocated to the intersection of Taxiways Z and H. The 30L Alternate deicing pad will be relocated to the west side of the Runway 30L end. Although there is no need for expansion of the existing air cargo and provisioning facility, a replacement site was identified in the east quadrant of the Airport should growth of belly cargo materialize, or if the space at its current location is needed to accommodate additional long-term parking or rental car facilities.

## 5.3 Passenger Terminal Facilities

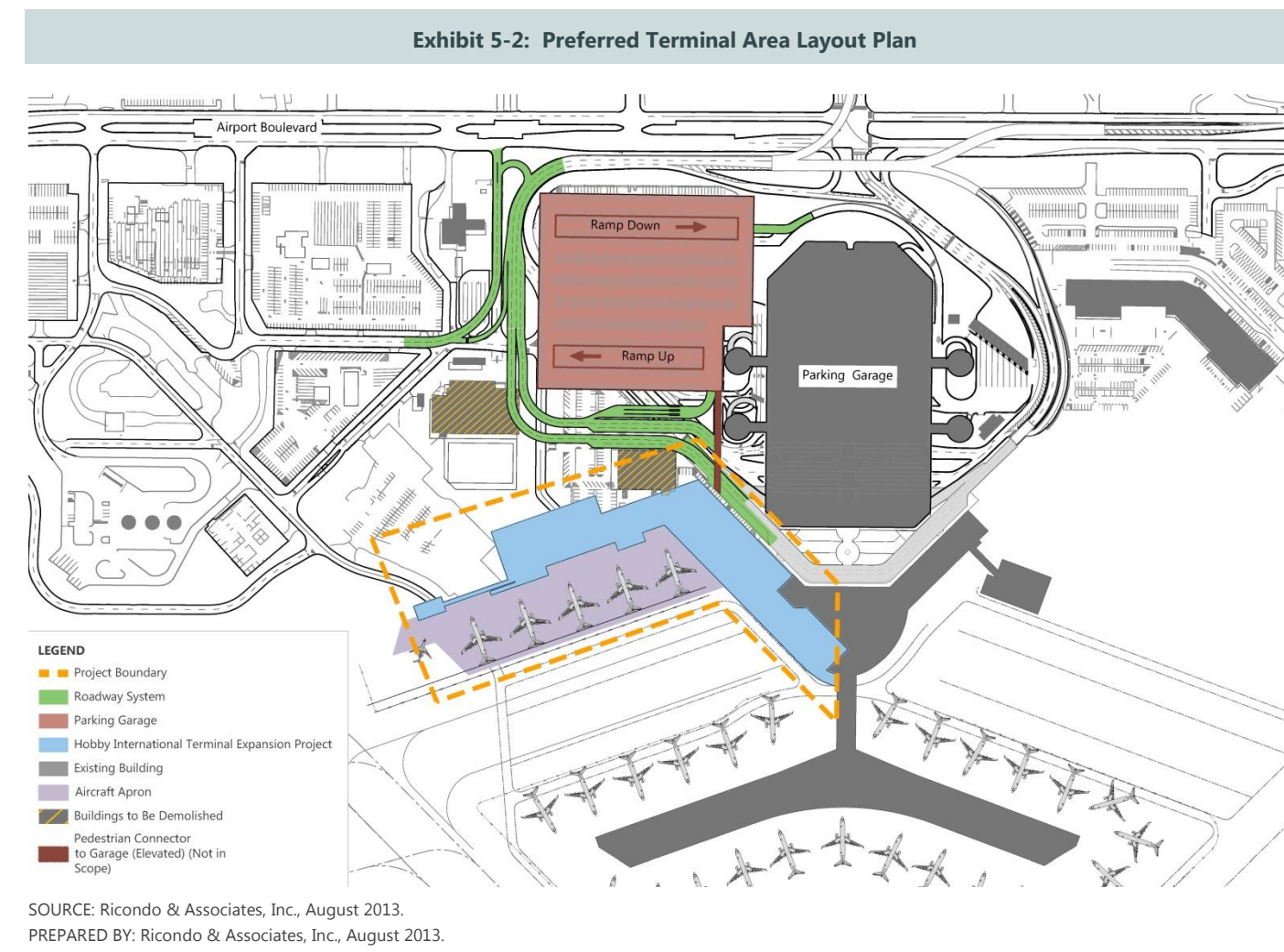
### 5.3.1 INTERNATIONAL TERMINAL UNDER CONSTRUCTION

Shortly after this Master Plan Update was initiated, Southwest Airlines announced the intent to initiate international service to/from HOU. A study separate from this Master Plan Update was conducted to (1) identify the optimal site for the international gates and associated FIS facility, and (2) assess how adjacent facilities (terminal curbsides, roadways, utilities, etc.) would be affected. The results of the planning effort are presented in a report entitled *William P. Hobby Airport International Expansion Project Definition Manual*. The recommended terminal area layout plan that emerged from this study is presented in **Exhibit 5-2**.

This terminal area layout provides for:

- A new international terminal;
- Five additional aircraft gates and parking positions, which can accommodate international operations;
- A new West Parking Garage, and;
- The realignment of the Hobby Loop around the new garage.

Implementation of this plan started in late 2013, and is scheduled for completion in the third quarter of 2015, when Southwest Airlines plans on initiating international service.



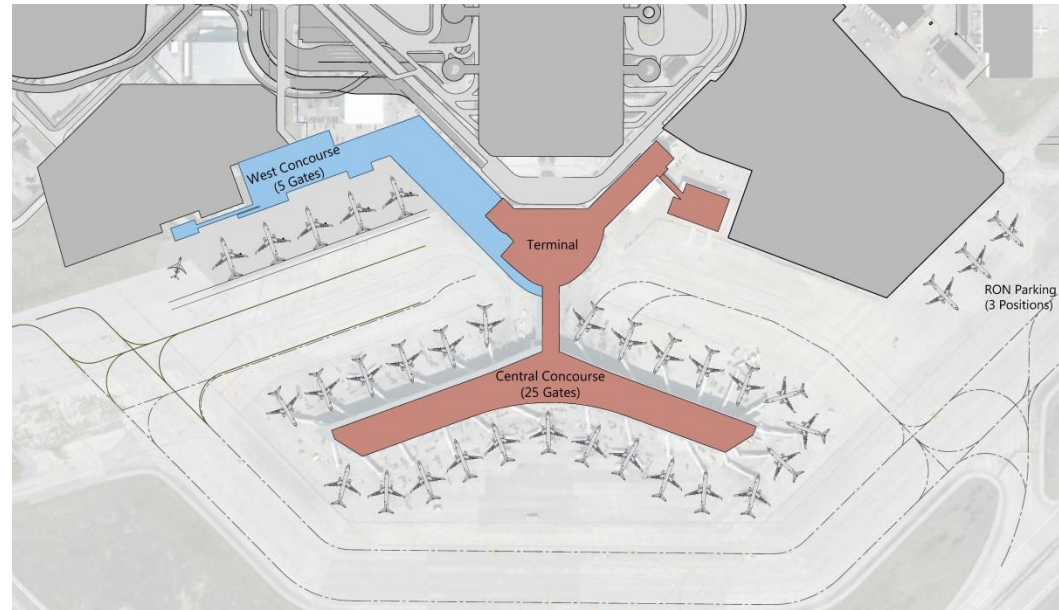
### 5.3.2 LONG-TERM TERMINAL DEVELOPMENT ALTERNATIVES

The alternatives developed for HOU to accommodate forecasted demand through the planning period (2030) focused on terminal and concourse expansion on the east side and/or the west side of the existing facility. Ultimately, terminal and concourse expansion would be required on both sides, but the location of new FIS facilities for international arriving flights was a key component in the initial phases. Additionally, the configuration of roads and parking facilities will affect the orientation and expansion of the terminal facility. The east concourse may be a single-loaded or double-loaded concourse, based on demand; as such, it is recommended that space be protected east of the main garage to accommodate a double-loaded east concourse.

**Exhibits 5-3** through **5-6** depict the proposed long-term terminal development phases.

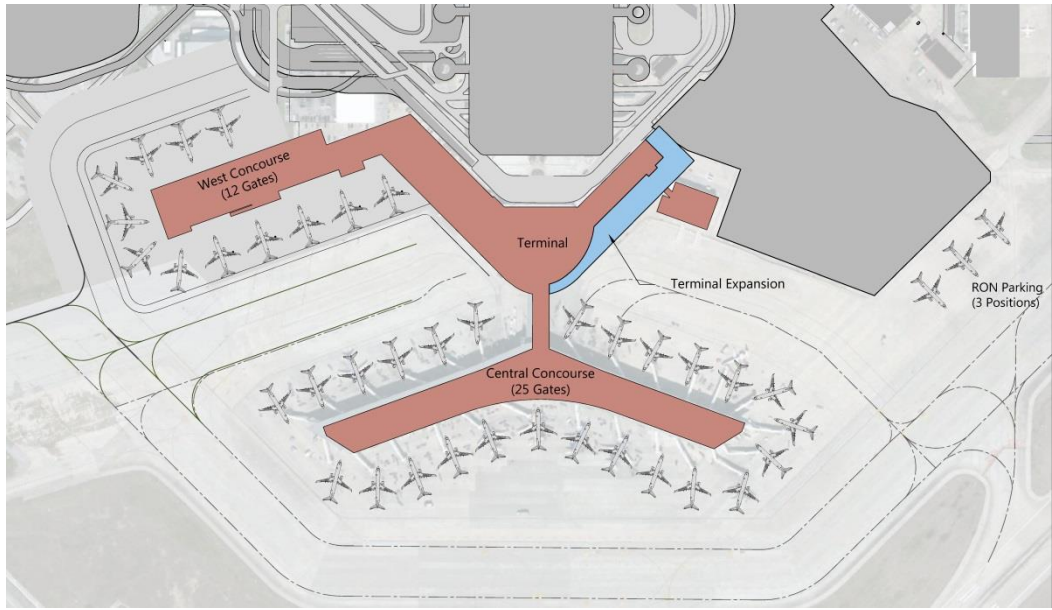


**Exhibit 5-3: Phase 1 Overview - Remain Overnight Aircraft Parking Positions East of the Terminal**



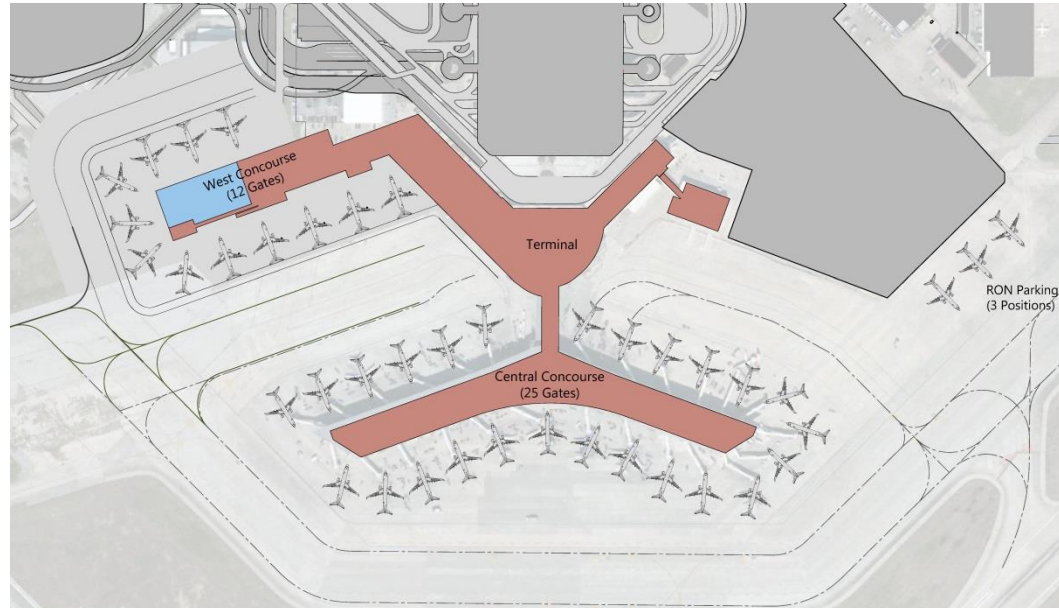
SOURCE: Ricondo & Associates, Inc., August 2013.  
PREPARED BY: Ricondo & Associates, Inc., August 2013.

**Exhibit 5-5: Phase 3 Overview - Terminal Expansion (East Side)**



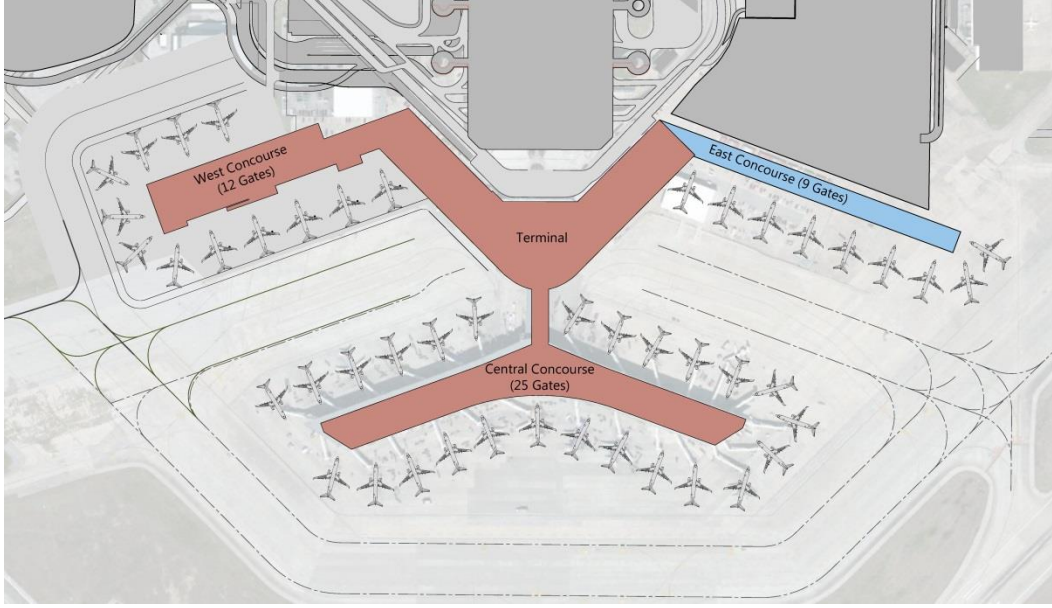
SOURCE: Ricondo & Associates, Inc., August 2013.  
PREPARED BY: Ricondo & Associates, Inc., August 2013.

**Exhibit 5-4: Phase 2 Overview - West Concourse Expansion**



SOURCE: Ricondo & Associates, Inc., August 2013.  
PREPARED BY: Ricondo & Associates, Inc., August 2013.

**Exhibit 5-6: Phase 4 Overview - East Concourse Construction**



SOURCE: Ricondo & Associates, Inc., August 2013.  
PREPARED BY: Ricondo & Associates, Inc., August 2013.

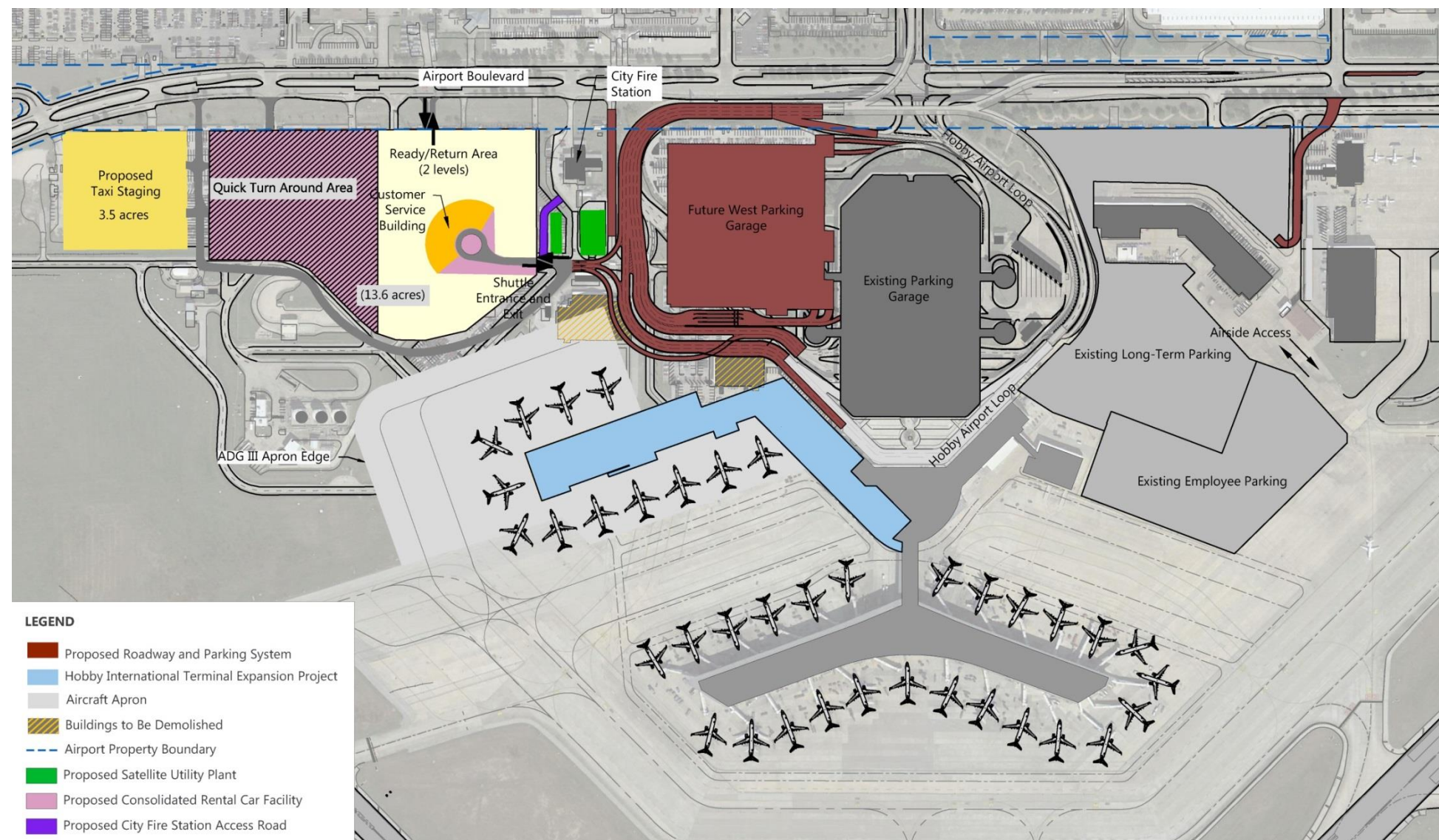
## 5.4 On-Airport Landside Improvements

The following airport functions were impacted by the proposed terminal area plan, and will be relocated or should be planned:

- Roadways:
  - realignment of the Hobby Loop around the proposed West Parking Garage
  - construction of a west roadway system
  - long-term surface parking lot access improvements
- Passenger and employee parking: construction of a new West Parking Garage west of the existing Main Parking Garage, and relocation of the employee parking lot east of the terminal facilities.
- Rental car facilities: construction of a Consolidated Rental Car Facility
- Taxicab staging: relocation of the taxicab staging area to the west end of the north quadrant
- Cell phone waiting lot: relocation of the cell phone waiting lot east of the terminal facilities
- Utility plant: construction of a new utility plant to support the existing utility plant

**Exhibit 5-7** provides an overview of the proposed layouts and/or locations of these functions.

**Exhibit 5-7: On-Airport Proposed Landside Improvements**



SOURCE: Ricondo & Associates, Inc., August 2013.  
 PREPARED BY: Ricondo & Associates, Inc., August 2013.

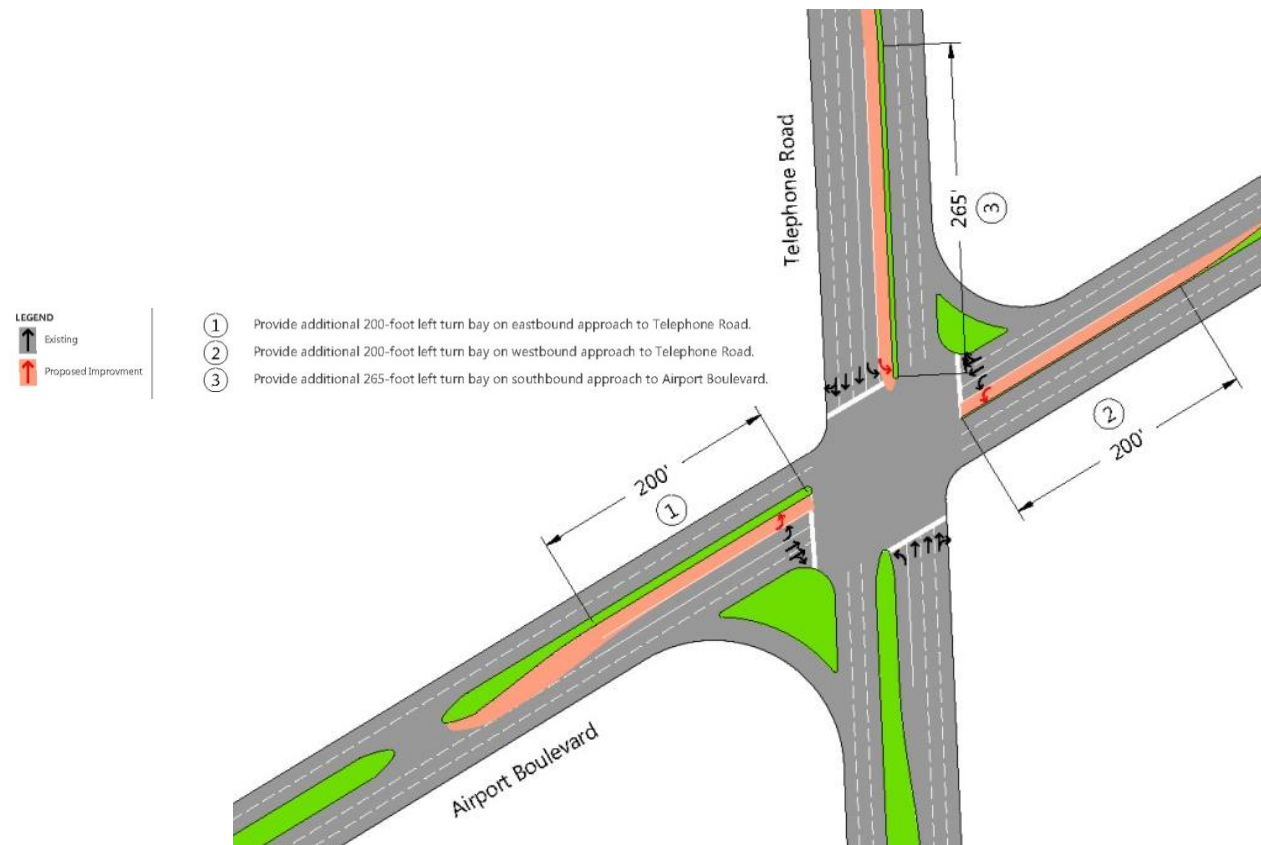
## 5.5 Off-Airport Roadway Intersections

The impacts of the proposed growth on the roadway intersections surrounding the Airport were analyzed. Improvements are needed to minimize traffic congestion at the following intersections:

- Telephone Road and Airport Boulevard
- Monroe Road and Airport Boulevard
- Airport Boulevard and Glencrest Street

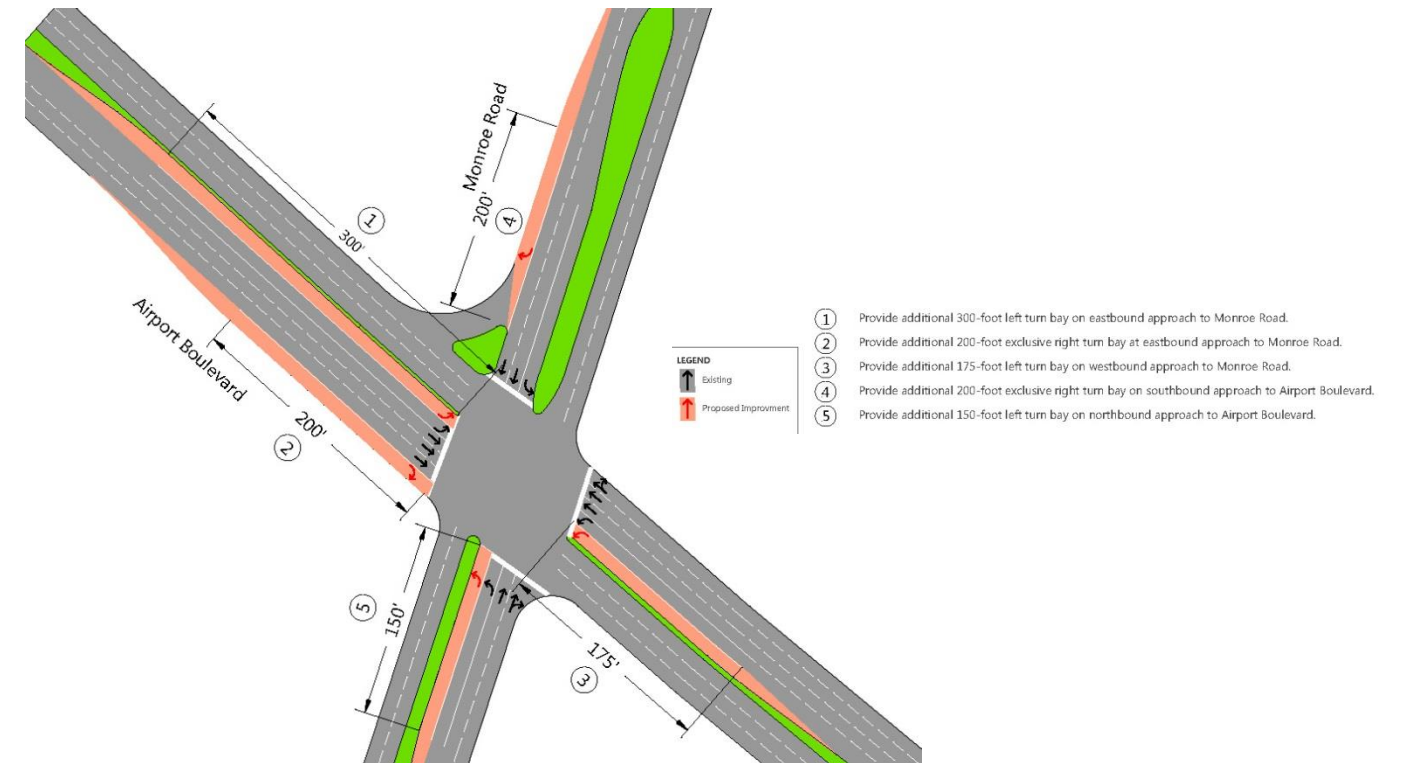
Exhibits 5-8 through 5-10 depict the proposed improvements.

**Exhibit 5-8: Roadway Intersection Improvements at Telephone Road and Airport Boulevard**



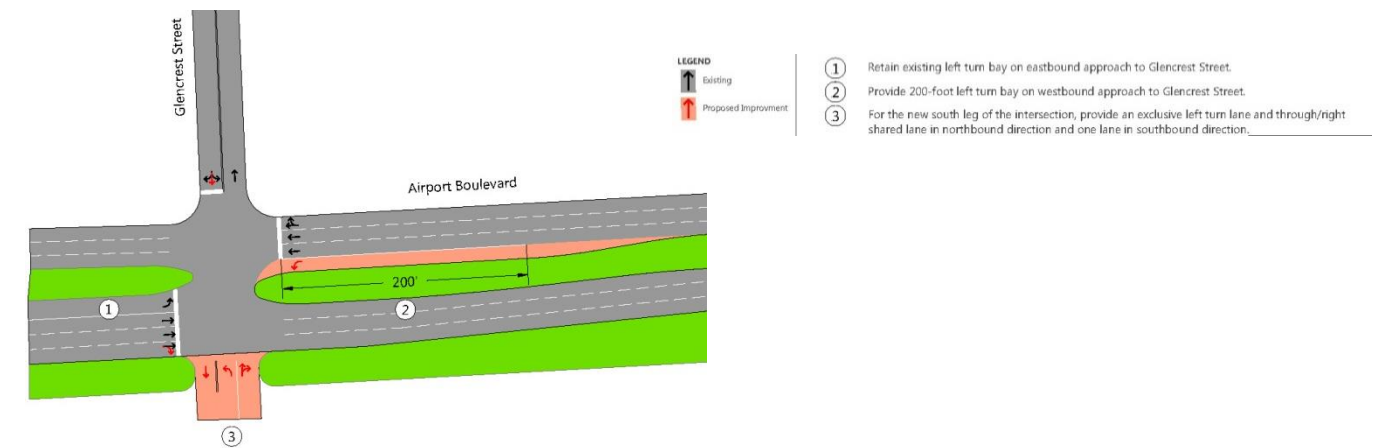
SOURCE: Ricondo & Associates, Inc., August 2013.  
 PREPARED BY: Ricondo & Associates, Inc., August 2013.

**Exhibit 5-9: Roadway Intersection Improvements at Monroe Road and Airport Boulevard**



SOURCE: Ricondo & Associates, Inc., August 2013.  
 PREPARED BY: Ricondo & Associates, Inc., August 2013.

**Exhibit 5-10: Roadway Intersection Improvements at Airport Boulevard and Glencrest Street**



SOURCE: Ricondo & Associates, Inc., August 2013.  
 PREPARED BY: Ricondo & Associates, Inc., August 2013.

## 6. Airport Environs Development Framework Plan

This section discusses the appropriate development for the areas surrounding HOU. The existing land uses around the Airport are described, as well as key facilities and supporting infrastructure that support the Airport's domestic (and soon to be international) transportation role.

### 6.1 Existing Land Use within the Area of Influence

The broad categories of off-airport land use and specific development proposals within the Airport's Area of Influence (AOI) as of 2012 are depicted in **Exhibit 6-1**, along with the anticipated 2030 airport noise contours. The AOI is densely developed to the north and less densely developed to the east and west. There are over 1,200 acres of vacant/undeveloped land. A majority of the vacant/underdeveloped land is located on the northeast, east and southwest of the AOI. A majority of the single-family residential parcels are located to the north, southeast and northwest of HOU. Multifamily residents cluster along Broadway Street north of HOU. There are several parks and recreation areas surrounding HOU, including Dow Park, Glenbrook Golf Course, Reveille Park, Garden Villas Park, Robert C. Stuart Park, Center Park, Blackhawk Park and Beverly Hills Park. Industrial land use clusters to the east and west of HOU, while commercial land uses border I-45, Telephone Road and Belfort Street.

**Exhibit 6-2** shows land uses in 2005 within the AOI. The AOI was densely developed to the north and less densely developed to the east and west. The majority of vacant/underdeveloped land was located on the northeast, east and southwest of the AOI. The majority of single-family residential parcels was located to the north, southeast and northwest of HOU. Multifamily residents clustered along Broadway Street, north of HOU. The majority of commercial land use bordered I-45, Telephone Road and Belfort Street.

Comparisons of the property value and total land area between 2005 and 2012 per HCAD illustrate the redevelopment opportunities (per the level of vacant land and low real property valuations). These are solid indicators that a successful and robust revitalization strategy could be implemented as the on-Airport terminal area improvements are made and as passenger demand increases. The targeted approach of City incentives and CIP improvement would be instrumental in driving a revitalization effort for the off-Airport properties. Commercial and industrial land uses increased in total land area in the study area in 2012 from 2005. Table 6-3 shows that the average property value for single-family residential units decreased \$5,024 per unit between 2005 and 2012. The average property value for commercial land use decreased \$2.96 per square foot over those seven years. Between 2005 and 2012, the amount of vacant land available in various land use categories decreased from approximately 1,514 acres to 869 acres. This suggests a growing development pattern within the study area boundary. All other land use categories have not changed significantly since 2005. The change in land use between 2005 and 2012 was not large enough to suggest a particular trend in future development within the study area. Real property redevelopment or revitalization is not occurring in a meaningful focused manner; therefore, land

use patterns are scattered and, absent a City of Houston economic development strategy to influence land use patterns, it can be assumed that the land uses characteristics present in 2005 and 2012 will remain in 2020.

Using economic tools to strategically realize a vision for off-Airport land uses and influence land use patterns could yield significant results in five to ten years.

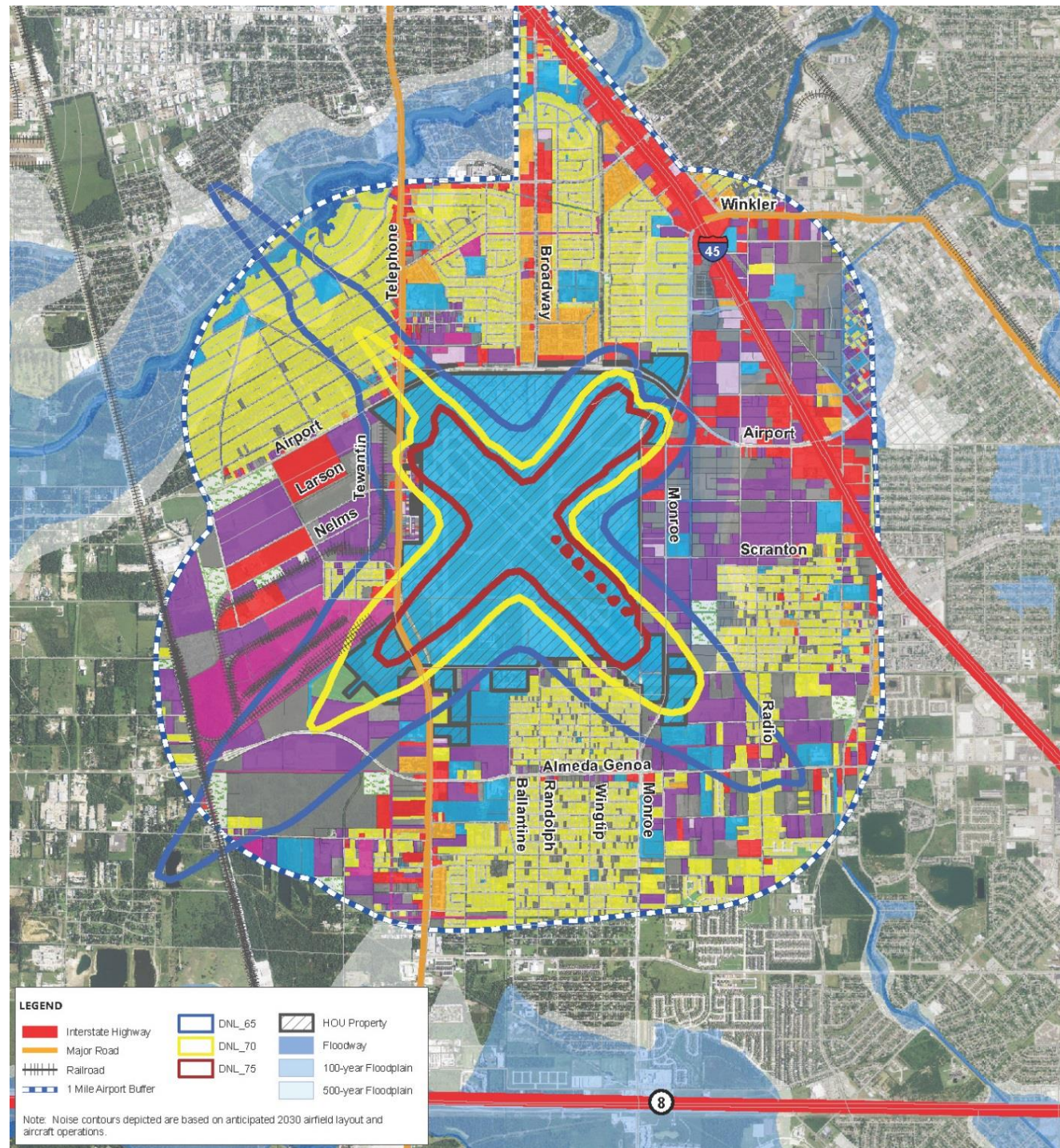
### 6.2 Land Use Analysis

HOU is accessible by five major thoroughfare corridors. All roadways within the AOI are maintained by the City of Houston with the exception of Telephone Road, which is maintained by the Texas Department of Transportation. Understanding the existing land use pattern surrounding each corridor will help HAS prepare for redevelopment strategies unique to the areas surrounding the particular corridor. The creation of new arrival gateways from each major thoroughfare to HOU will require multiple property owners to participate in an area-wide economic development initiative along each corridor to facilitate the renaissance of the area. There are too many small properties and too many multiple-property owners for a revitalization strategy to succeed with a "one property at a time" approach. The previous model for redevelopment of the corridors was unsuccessful. Seeking public-to-public partnerships across political jurisdictions is equally as important as public-to-private partnerships for off-Airport redevelopment, and is critical to the success of such redevelopment.

**Exhibit 6-3** is taken from the 2013 Major Thoroughfare and Freeway Plan (MTFP) for the City of Houston and shows the types of streets and connectivity surrounding HOU.

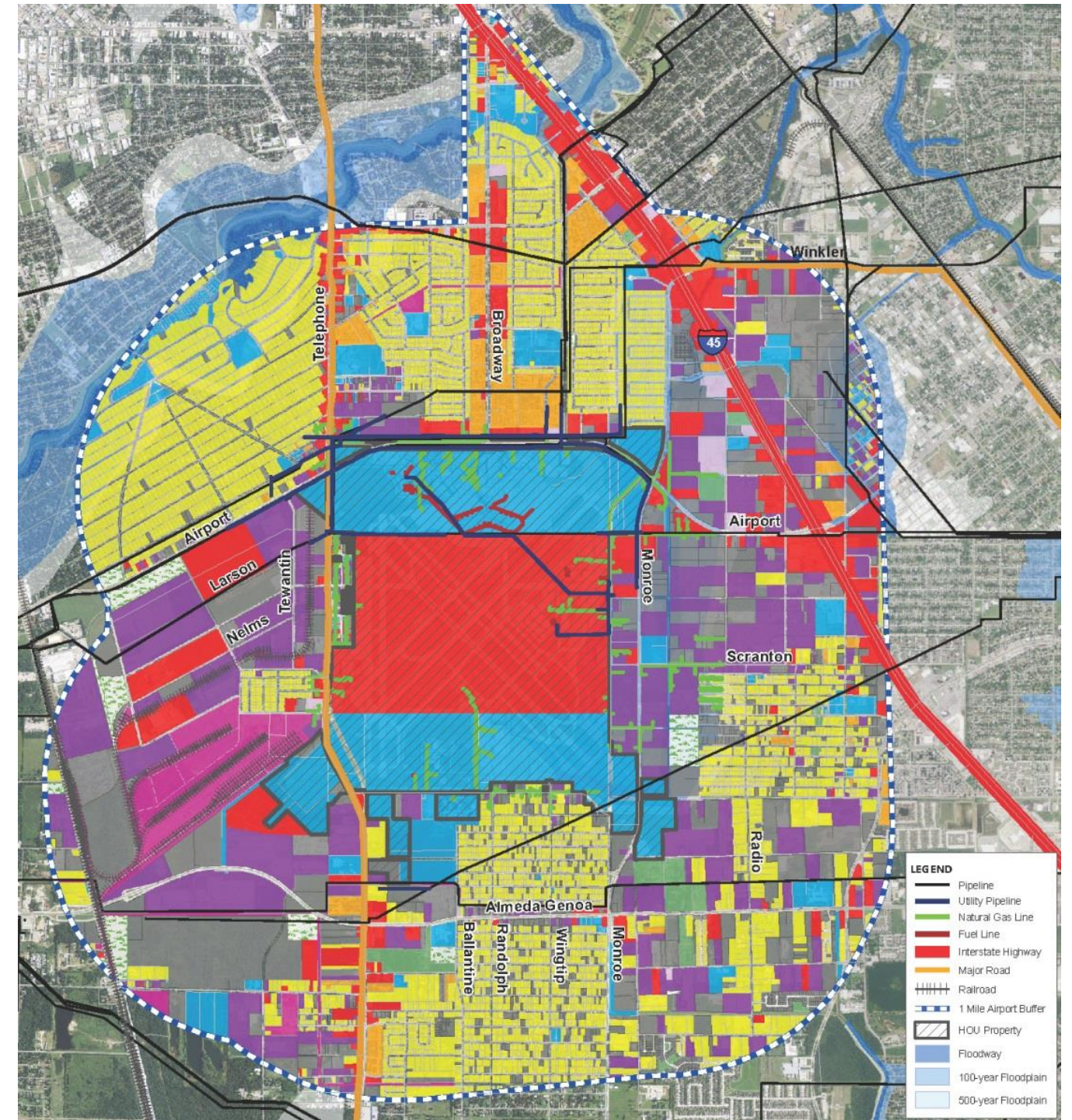
Most Capital Improvement Plans are short-range plans (four to ten years) that identify capital projects and equipment purchases, provide a planning schedule and identify options for financing the plan. Essentially, the plan provides a link between: (1) a municipality, school district, parks and recreation department and/or other local government entity, and (2) a comprehensive and strategic plan and the entity's annual budget. The City of Houston conducts public meetings on the City's Annual CIP in each council district. Since 1984, the City has held public meetings to obtain citizen input before preparation of the CIP. These meetings provide citizens the opportunity to participate in the CIP process by contributing comments and suggestions about needed services and improvements. The public meeting schedule is usually posted in early February of each year. The District information posted is updated annually after the last CIP Public Meeting held in the calendar year. The Capital Budget is a five-year plan updated annually, addressing the infrastructure needs for the City of Houston.

Exhibit 6-1: 2012 Land Use In the Vicinity of the Airport



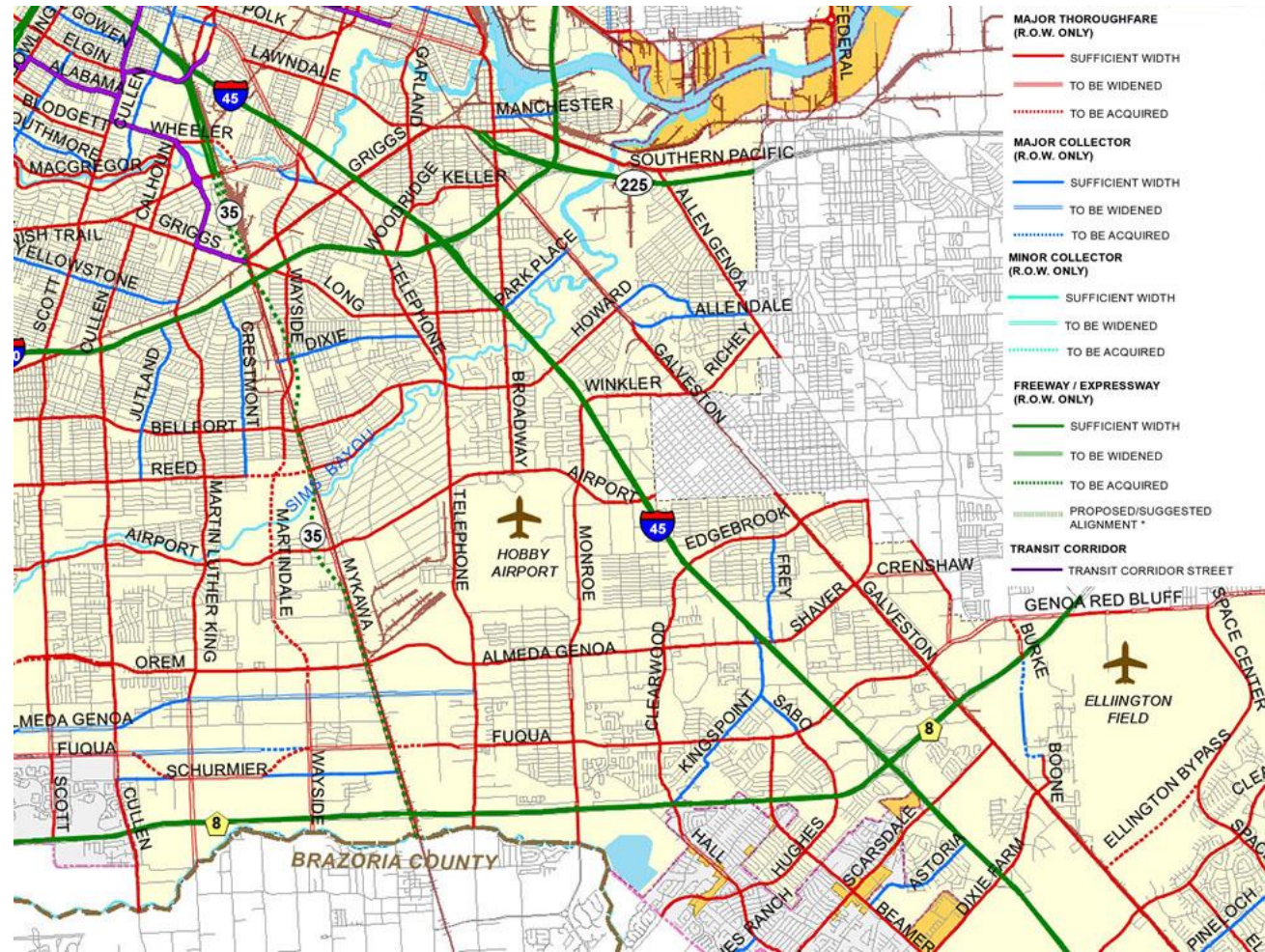
SOURCES: Houston Airport System, 2013; Harris County Appraisal District, 2012; Railroad Commission of Texas, 2013; Quadrant Consultants, Inc., August 2014 (2030 Noise Contours).  
 PREPARED BY: Knudson, LP, August 2014.

Exhibit 6-2: 2005 Land Use in the Vicinity of the Airport



SOURCES: Houston Airport System, 2013; Harris County Appraisal District, 2012; Railroad Commission of Texas, 2013.  
 PREPARED BY: Knudson, LP, August 2014.

Exhibit 6-3: 2013 City of Houston Major Thoroughfare and Freeway Plan



SOURCE: City of Houston, 2013.  
 PREPARED BY: City of Houston 2013.

Table 6-1: Development Opportunities and Constraints around the Airport

OPPORTUNITIES	CONSTRAINTS
<b>Market</b>	
Strong projected population and employment growth in short term	Requires area wide city economic development incentives Economic market subject to state and national economy. Forecast for oil and gas in Texas slowing in 2015 according to Greater Houston Partnership
Increased market for commercial, retail, and residential uses to support new International Terminal	Requires robust economic development incentives to jumpstart initiative; Lack of CIP funding for public project implementation
<b>Land Use</b>	
Predominance of older multifamily units (more than 30 years old) along Broadway Street corridor good are candidates for redevelopment	Sexually oriented businesses along Airport Boulevard and Telephone Road
Large vacant commercial and industrial lots on the west side of the Airport along the Telephone Road and Monroe Road corridors	Automobile-oriented land uses
Surface parking lots along Airport Boulevard	Rundown condition of commercial development along Telephone Road and Broadway Street corridors
Mid-size sites along Broadway Street, Monroe Road, and Airport Boulevard for hotel development	Lack of connectivity between different uses
Airport Management District created to provide security for off-airport property owners	Management District has not secure petitions necessary to tax property owners within the Management District to implement safety and security objectives of the Management District.
<b>Transportation</b>	
Good freeway access with pending rail line extension planned by METRO	Gateways along major thoroughfares are not attractive and land uses detract from redevelopment. No CIP funding for gateway improvements.
Future light rail transit stations along Telephone Road and Airport Boulevard connecting HOU to 33 miles of Houston Rail lines	Timeframe for extension is not funded.
Good regional bus service to be improved via Imagineering METRO study a new program being launched in 2014 which will identify local bus service improvements. by	Program recommendations should include access to HAS facilities and be timed for implementation as a priority.

SOURCE: UrbanCore Collaborative, Inc., September 2013.  
 PREPARED BY: UrbanCore Collaborative, Inc., September 2013.

### 6.3 Opportunities and Constraints

The off-Airport private properties in the vicinity of the Airport are very attractive candidate sites for redevelopment. **Table 6-1** provides a list of opportunities for and constraints to redevelopment around the Airport boundary.

**Exhibit 6-4** identifies current vacant tracts in red with no improvements, ready for development of hotels and/or retail centers in the AOI. A majority of the raw land is along Alameda-Genoa Road, Monroe Road and Airport Boulevard. Surface parking lots are shown in blue and identify areas of opportunity for a higher and better use of those lots or areas in which a higher density of parking is recommended, such as vertical parking structures. Existing multifamily residential tracts are shown in orange.

These multifamily units were built in the 1970s and the property values have been declining over the last ten years, which make these tracts good candidates for redevelopment; new housing products are a better investment than upgrading the existing apartments. Land located within the 100-year flood plain, as shown in Exhibit 6-5, could be purchased by Harris County Flood Control, the Hobby Area Management District and/or the City to create park and open space area for the AOI.

**6.1.1 BUSINESS CATEGORIES THAT FAVOR THE AIRPORT ENVIRONS**

Business categories that would be encouraged with the new international terminal would include hotels and new retail and restaurants catering to Latin American travelers.

**6.1.2 PROPERTY OWNERSHIP PATTERNS THAT MAY IMPEDE OR ENHANCE POTENTIAL REDEVELOPMENT**

An estimated 2,000 acres of vacant or underdeveloped commercial, industrial, aging multifamily apartments, and retail land uses, as well as surface parking lots, are available for redevelopment and could be used for a focused revitalization effort by the City to incentivize land uses compatible with the AOI. One complex issue that must be resolved is the conversion of previously approved multifamily apartments into condominiums located at 8200 Broadway Street.

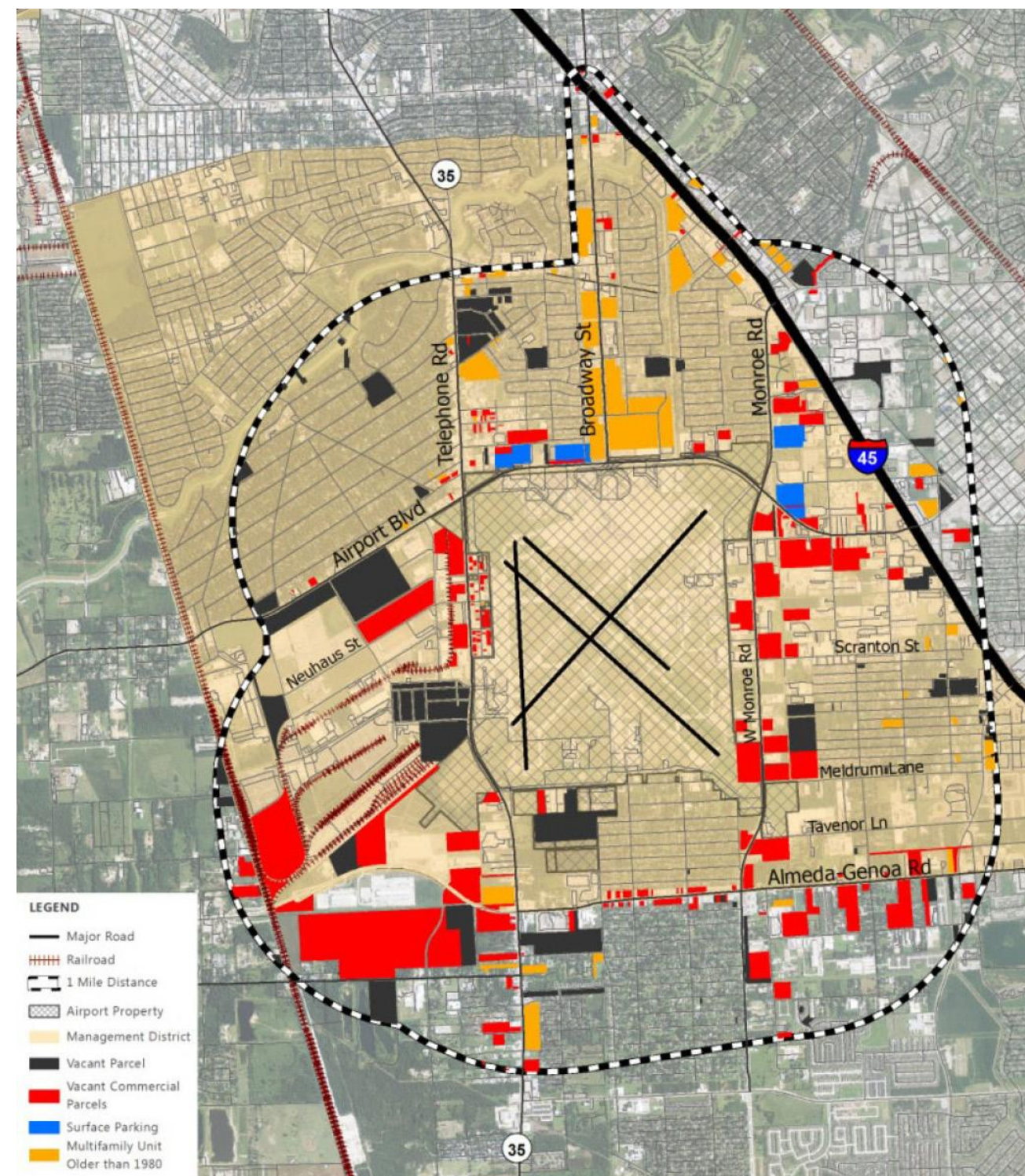
The 2003 *William P. Hobby Airport Master Plan Update* identified the need for creation of an Image Plan (Appendix D) that could be implemented within the public right-of-way to improve and enhance the visual corridors serving HOU.

**6.1.3 OPPORTUNITIES FOR ENHANCEMENT AND IMPROVED PUBLIC RIGHT-OF-WAY**

Improved streetscape and the addition of public art along Broadway Street, Monroe Road and Airport Boulevard will enhance the AOI. All thoroughfares within the AOI are at sufficient width per the 2013 MTFP.<sup>1</sup>

<sup>1</sup> Victoria Transport Policy Institute, *Streetscape Improvements*, <http://www.vtpi.org/tdm/tdm122.htm> (accessed July 2014).

**Exhibit 6-4: Land Use Opportunities and Constraints in the Vicinity of the Airport**



SOURCES: Houston-Galveston Area Council, 2012; Houston Airport System (OASIS), 2012; Harris County Appraisal District, 2012. PREPARED BY: UrbanCore Collaborative, Inc., September 2013.

### 6.1.4 GROUND TRANSPORTATION ACCESS TO THE AREA

To improve the image of the Airport and to improve the travel experience of passengers going through the AOI, land uses and services immediately adjacent to the major corridors serving HOU should be transformed into higher real estate property values to support the services needed by the Airport. Land uses such as hotels, restaurants, and commercial businesses would all be compatible with the Airport and would support travelers.

### 6.1.5 ECONOMIC DEVELOPMENT INCENTIVES

A number of economic development incentives are available under state or local law to encourage development and redevelopment around the AOI:

- Chapter 380/381 Texas Local Government Code
- Municipal Management Districts
- Neighborhood Empowerment Zones
- Public Improvement Districts
- Tax Abatements
- Tax Increment Reinvestment Zones
- Texas Emerging Technology Fund
- Texas Enterprise Zone Program
- Texas Product Development/Small Business Fund

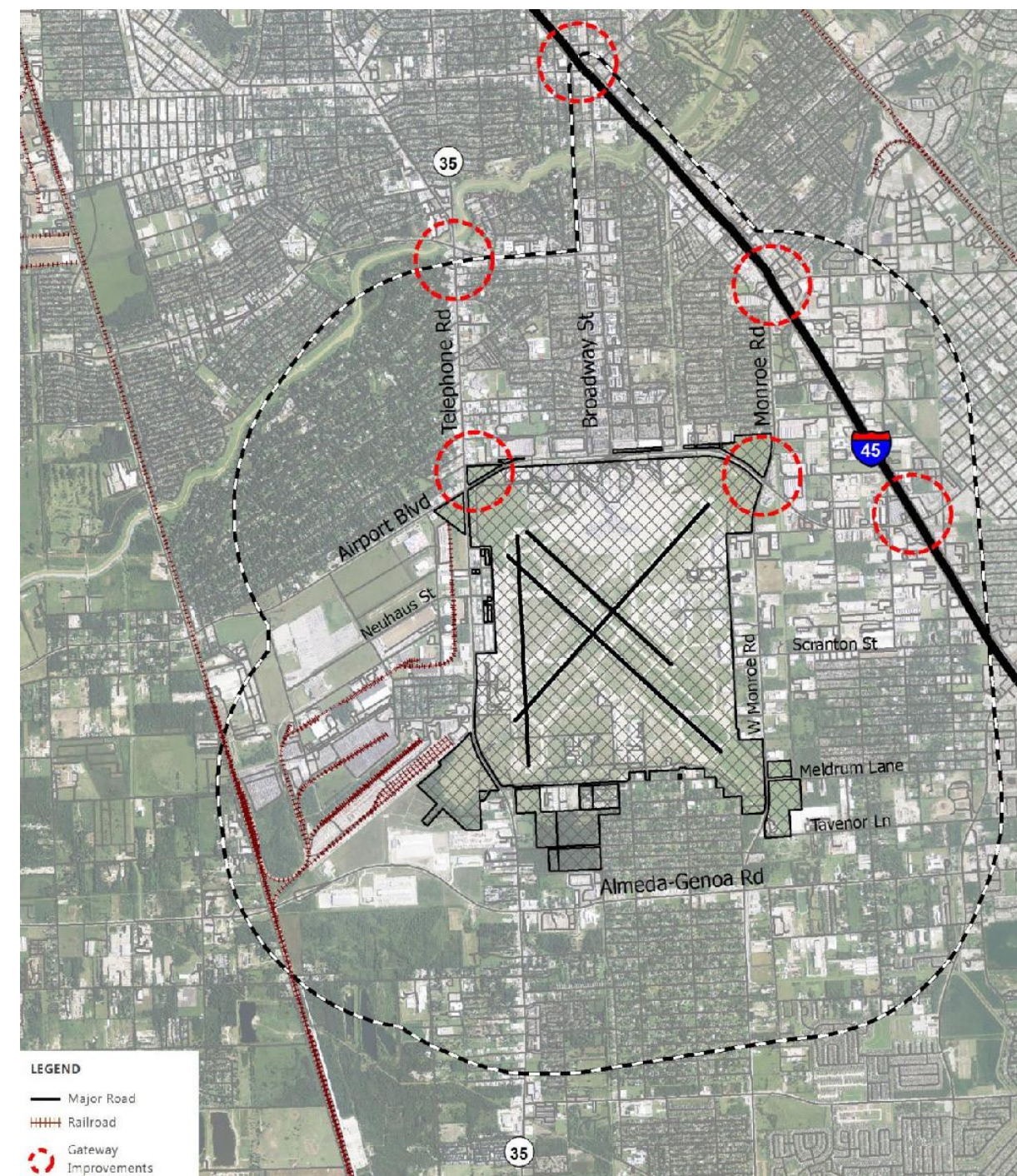
### 6.1.6 POTENTIAL INFLUENCE OF PLANNED ON- AND OFF-AIRPORT DEVELOPMENT OPPORTUNITIES

The amount of vacant land surrounding HOU presents an opportunity to target development that is compatible to HOU and an asset to the new international traveler, as well as the adjacent neighborhoods. The 2003 Image Plan should be used as a guide for public works plans, as well as public/private economic initiatives for the area.

## 6.2 Framework Plan (Area Concept Plan)

The Area Concept Plan is intended to provide an overview of the layout and design features of development expected to take place in the Airport area. It should be noted that HAS is only able to invest funds for projects on Airport property. The concept plan, shown on **Exhibit 6-5**, provides a visual interpretation of the potential development patterns for the Airport area. Major Airport signage and area-wide designed landscape monumentation features should be created at each major thoroughfare corridor announcing the arrival to HOU. Residential neighborhoods surrounding the Airport should also be incorporated in the overall Area Concept Plan to promote the compatible residential development characteristics of streets entering the adjacent neighborhoods, and to promote the sustainable protection of those areas. The economic development strategies should include onsite and offsite beautification elements as a component of the public-private partnerships between the private sector and the City.

Exhibit 6-5: Area Concept Plan



SOURCES: Houston-Galveston Area Council, 2012; Houston Airport System (OASIS), 2012; Harris County Appraisal District, 2012.  
 PREPARED BY: UrbanCore Collaborative, Inc., September 2013.



6.2.1 POTENTIAL NONAERONAUTICAL ACTIVITIES

The areas immediately adjacent to HOU may attract:

- Services directly supporting operation of the Airport (additional flight kitchens, aircraft maintenance services)
- Services for airline employees and passengers (additional hotels, restaurants, and additional rental car facilities)
- Additional Airport-related freight services (shipping, freight forwarding, Customs, and foreign trade zone)

6.2.2 NEEDED IMPROVEMENTS TO PUBLIC FACILITIES AND INFRASTRUCTURE

The City’s 5-year CIP is updated annually to include new projects, reflect changes in priorities and circumstances, and to extend the capital improvement program on a rolling 5-year basis as projects are approved for each additional year. It is imperative for the area revitalization that projects in the study area are included in the CIP annually to further the revitalization of the major thoroughfares that serve HOU.

Other possible infrastructure improvements could be completed through the Hobby Area Management District/Harris County Improvement District #9 approved in 2007 by the Texas Legislature. Its boundaries are depicted on **Exhibit 6-6**.

6.2.3 POTENTIAL LINKAGES TO THE METRORAIL SYSTEM

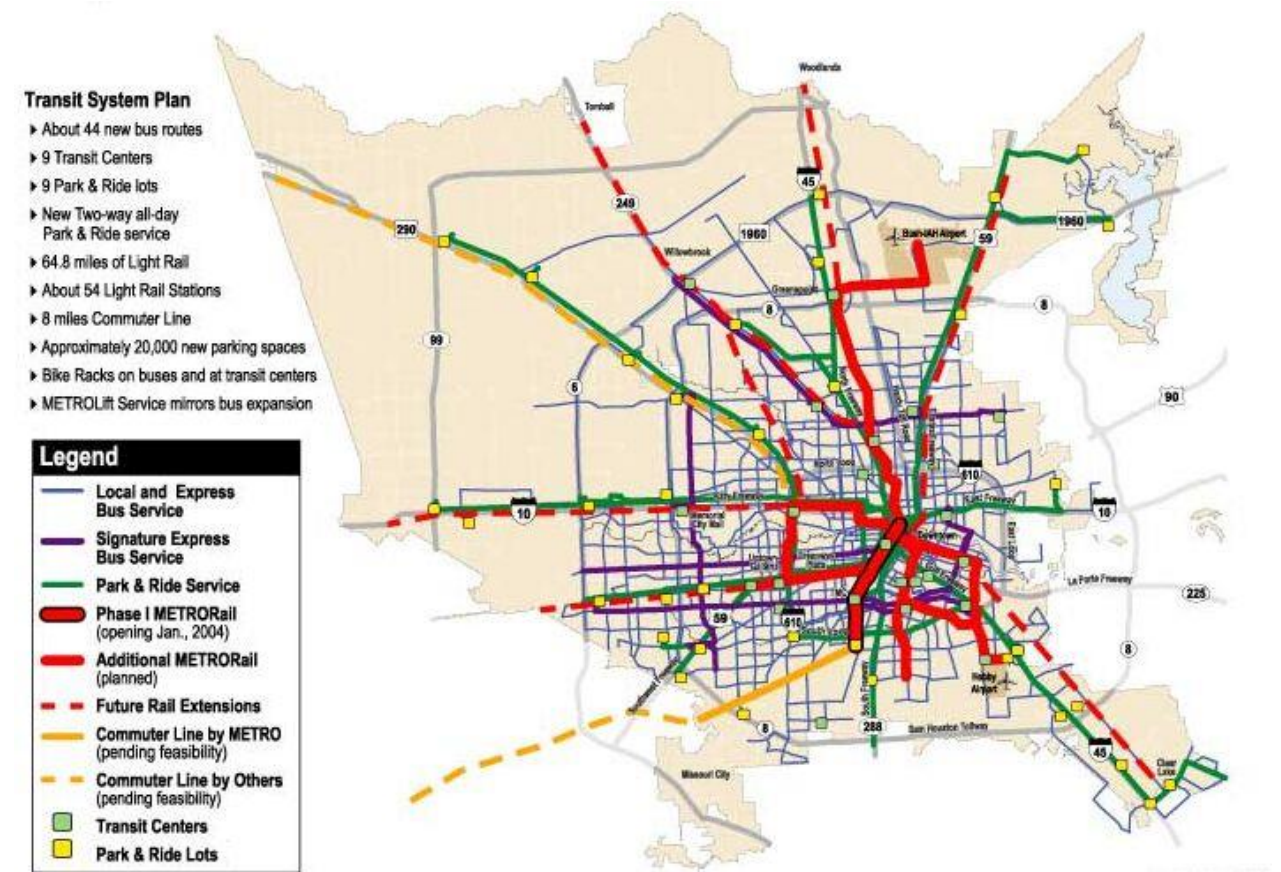
Current bus service to HOU provides the level of service expected by METRO in serving the expected demand in the region. Demand for METRO is not sufficient to significantly increase or change the service currently offered to HOU. METRO has a long-term plan to extend the Southeast Light Rail Transit Line to HOU; however, funding is not currently available. It is proposed to be extended at grade to the south on Telephone Road and to the east on Airport Boulevard, terminating just east of Airport Boulevard and Broadway Street, as shown on **Exhibit 6-7**.

**Exhibit 6-6: Hobby Area Management District/Harris County Improvement District #9 Boundaries**



SOURCE: Harris County Improvement District #9 (Hobby Area), 2012.  
 PREPARED BY: Harris County Improvement District #9 (Hobby Area), 2012.

**Exhibit 6-7: METRO Solutions Transit System Plan Including Bus and Rail**



SOURCE: LightRailNow!, *As Houston’s Light Rail Project Nears Finish, Major Vote Looms Nov. 4<sup>th</sup>*, October 2003. [http://www.lightrailnow.org/news/n\\_hou003.htm](http://www.lightrailnow.org/news/n_hou003.htm).  
 PREPARED BY: Metropolitan Transit Authority of Harris County, Houston, Texas, October 2003.

6.2.4 IMPROVEMENT OF THE APPEARANCE AND IMAGE OF THE AREA

There are key areas in the airport environs that may merit special urban design treatments to improve the appearance and image of the area. The recommendations made in the 2003 Image Plan are still valid and should be implemented with the updated 2014 Master Plan.

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## 6.3 Recommendations

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The program for revitalization of the area should include the following:

- Coordinate CIP improvements to enhance public infrastructure to serve 10 million HOU passengers annually, including intersection improvements, flood abatement, beautification, and wayfinding;
- Develop a multijurisdictional strategy with Harris County as well as private developers to leverage public and private economic development participation to accelerate redevelopment on off-airport properties;
- Establish incentives to encourage the development of hotels and other airport-compatible commercial development along all thoroughfares serving HOU in an aggressive manner;
- Provide developer incentives and economic development tools such as a TIRZ, area Chapter 380 Agreement, NEZ, or other tools to promote and preserve compatible development in the areas surrounding HOU;
- Preserve the ability to provide light rail transit access to the Airport as part of METRO expansion and encourage mixed-use development and infill development to serve international service.

Redevelopment should be focused specifically along the major corridors. The AOI could be designated a special district and multiple economic incentives could directly assist private developers in creating compatible and desirable land uses in support of the new Hobby International Terminal. A special district could also be used to preserve and protect the residential communities, improving the safety of the area for over 500,000 passengers on international trips.

## 7. Airport Development Plan

The Airport Development Plan (ADP) is a comprehensive plan that refines the recommended facility development strategies, defines individual projects necessary to meet future demand, and discusses general development initiatives and development plans that are outside the jurisdiction of the HAS to implement in the future, but that are nonetheless critical for ensuring that the Airport and its environs are positively affected by implementation of the Master Plan projects.

### 7.1 Primary Airport Development Plan Initiatives

The ADP is essentially a composite of the four recommended facility development strategies (airfield, terminal, ground access, and tenant/land use). However, in the process of consolidating the four facility development strategies into the Master Plan, many of the development projects were refined to ensure that each of the facility development strategies formed a compatible development plan, and maximized land-use efficiency, while preserving flexible expansion options.

### 7.2 Airport Development Plan Projects

The ADP incorporates a number of major development initiatives. Each initiative includes a variety of specific projects that must be carefully coordinated and planned to ensure that operational impacts are minimized throughout implementation. The development plan for the Airport is divided into four categories: airfield, terminal area, ground access, and tenant/land use development. The major initiatives were grouped into the corresponding categories, as listed below, generally, in chronological order with a description of each initiative. In addition, a land acquisition program would be needed to support all of the individual facility development initiatives. The following subsections list and describe the projects recommended as a result of the analyses conducted in this Master Plan Update.

#### 7.2.1 AIRFIELD

Airfield initiatives and improvements included in the ADP are as follows:

- Runway 12R-30L obstruction clearing and threshold relocation
- Runway 12L-30R upgrade
- Construction of a partial parallel taxiway to the upgraded Runway 12L-30R
- Relocation/installation of navigational aids associated with the upgrade of Runway 12L-30R
- Northwest airfield taxiway reconfiguration
- Decommissioning of Runway 17-35 (upon the upgrade of Runway 12L-30R)
- Extension of Taxiway N between Taxiways G and H
- Realignment of the perimeter road and fence in the north and east quadrants of the Airport

Prior to the upgrade of Runway 12L-30R, an Environmental Assessment (EA) of the potential impacts of all near-term projects should be conducted.

#### 7.2.2 PASSENGER TERMINAL BUILDING

The terminal area improvements are projects that will enhance capacity at various facilities. The specific projects are listed below:

- Expansion of the West Concourse and associated apron could add up to seven gates to accommodate forecast international demand at the Airport. RON parking will be available to provide scheduling flexibility for the airlines.
- Terminal Expansion to the east will add ticketing space for new entrant airlines serving the Airport.

#### 7.2.3 GROUND ACCESS

##### 7.2.3.1 Roadway Intersection Improvements

A variety of ground access improvements will be implemented to ease vehicular congestion, particularly along Airport Boulevard where significant congestion exists from mixing Airport-related traffic with local pass-through traffic. Improvements to public streets would require a joint effort between HAS, the City of Houston, and possibly TxDOT. Potential improvements include roadway intersection improvements, such as longer turn bays or additional lanes to improve the level of service at each of the following intersections:

- Intersection improvements at Telephone Road and Airport Boulevard
- Intersection improvements at Monroe Road and Airport Boulevard
- New intersection at Airport Boulevard and Glencrest Street

##### 7.2.3.2 Long-Term Parking Lot Access Road Improvements

The expansion of the long-term parking lot located east of the terminal, Ecopark – Lot 2, will require improvements to the roadway access to accommodate additional traffic. These improvements include building a new roadway intersection at Airport Boulevard and Glencrest Street, which would become the main access point to Ecopark – Lot 2. The realignment of the Atlantic Aviation FBO access road would be required.

##### 7.2.3.3 West Terminal Area Roadways

In order to accommodate the proposed improvements on the west side of the terminal area (CRCF, SUP, relocated taxi staging area), a new roadway network is required to provide adequate access to these facilities.

##### 7.2.3.4 Road Closures

Prior to completion of the Runway 12L-30R upgrade, portions of West Monroe Road and Freeland Street would be closed.

## 7.2.4 AIRPORT SUPPORT

Implementation of proposed airfield and terminal projects, as well as capacity enhancements, will require the relocation or construction of airport support facilities, as listed below:

- Relocation of the West (main) Deicing Pad and 30L Deicing Pad
- Construction of the Hobby Cargo Building
- Expansion of the long-term surface parking lot (Ecopark – Lot 2)
- Relocation of the cell phone waiting lot inside the long-term parking lot
- Relocation of the taxi staging area
- Temporary relocation of Avis and Budget Rent A Car facilities
- Construction of a Consolidated Rental Car Facility
- Realignment of the Southwest Airlines Fuel Farm boundary and the adjacent service
- Construction of general aviation and corporate business operator aircraft hangars in the south quadrant of the Airport.

## 7.2.5 TENANT/LAND USE

The project proposed for tenant/land use development will facilitate the implementation of the Runway 12L-30R upgrade:

- Demolition of two Signature Flight Support buildings and two Jet Aviation buildings.

## 7.2.6 OFF-AIRPORT

### 7.2.6.1 Obstruction Removal

Removal of obstructions to the upgraded Runway 12L-30R ground and airspace surfaces will be required before the runway becomes operational.

### 7.2.6.2 Land Acquisition

The land acquisition planned throughout the planning period includes approximately 75 acres northwest and southeast of the Airport. **Exhibit 7-1** shows these parcels, by parcel number. In some instances, after the property is purchased, the existing structures will be demolished to clear obstructions or to make the land available for additional airfield or tenant development. Owners of the property with compatible land uses in place could be allowed to lease the facilities back from HAS and continue operating until the property is needed for Airport development. These operational continuance periods could vary from six months to a number of years, depending on the location of the property, the speed of acquisition, and the schedule for Airport expansion.

**Exhibit 7-2** presents a composite view of the Airport after completion of the projects included in the ADP.



## 8. Implementation Plan

The Implementation Plan outlines a possible development sequence and schedule based on the character and rates of growth anticipated through the planning period (2030). The development initiatives shown on the ALP and described in the previous sections were categorized into distinct projects with budgeted costs and durations, which are the basis for the implementation plan.

The timing by which projects are implemented is based on demand. As such, the sequencing is based on the PALs. These PALs are tied to calendar years. Since actual growth will probably vary from that which has been forecast, the Implementation Plan includes an overview of factors that are anticipated to prompt a development action.

### 8.1 Factors Affecting Implementation and Development Phasing

Implementation of the ADP should be phased so that development corresponds with the anticipated demand discussed in Section 3, "Aviation Demand Forecasts." Preferably, projects should be implemented in sufficient time to accommodate growing demand, but not so early that facilities are underutilized. The ability to phase implementation correctly requires an understanding of the factors that prompt development, and ongoing data monitoring and analysis to identify when actions should be taken. It is anticipated that Airport development projects recommended as part of the Master Plan Update will be constructed as demand growth materializes, but it must also be recognized that HAS will continually need to replace or modernize older facilities.

#### 8.1.1 VOLUME AND CHARACTER OF ACTIVITY GROWTH

The volume and character of activity, factors addressed in detail in Section 3, determine when development should occur throughout the planning period. Recognizing that activity may not increase as forecast (it may occur sooner or later), it is crucial to continuously monitor overall activity and assess the individual characteristics of that activity. For example, an increase in the number of operations by Boeing 737-type aircraft may not require the same improvements as the same increase in the number of Boeing 757 aircraft operations. The use patterns and facility needs to accommodate the type of demand placed on individual Airport facilities may be more important than overall activity statistics.

Factors that could influence the volume and character of activity growth at the Airport are changes in the fleet mix, the introduction of service by other low cost or regional airlines, use of the Airport as a mid-continent connecting point for Southwest Airlines, significant fluctuation in O&D traffic versus connecting traffic, and fluctuations in the type and amount of general aviation operations.

As the Airport and aviation services offered continue to grow and expand, the ADP and Implementation Plan should be periodically reviewed to ensure that the actual trends are similar to those forecast.

#### 8.1.2 RELOCATION AND REPLACEMENT OF DISPLACED FACILITIES

Expansion of terminal and airfield facilities to meet growing demand will affect existing Airport tenants or other Airport facilities. Facility replacement and the need to minimize the disruption of tenant activities will be a factor in determining project phasing. Therefore, detailed planning, design, financing, and construction of replacement facilities must occur prior to expansion that affects existing facilities. Likewise, the HAS Airport Property Management & Commercial Development Division should review the ADP in consultation with the HAS Planning Division prior to initiating lease negotiations with tenants to ensure that new facilities are not constructed in areas that will be needed for expansion, and that lease renewals are negotiated to include requirements for planned expansion.

#### 8.1.3 GENERAL CRITERIA FOR IMPLEMENTATION

The primary criteria used to phase the ADP include:

- Initiating detailed project planning and design so that improvements can be in place when needed.
- Minimizing operational impacts on the airfield, terminal and ground access routes.
- Maintaining a logical sequence of development, building with individual projects toward the ultimate Airport Development Plan.
- Meeting Houston Airport System goals and objectives.

#### 8.1.4 IMPLEMENTATION INDICATORS

Two types of indicators or activity levels that will trigger development were identified as useful to activity monitoring and implementation: primary and secondary. Primary indicators are considered "triggers" for implementation when a specific level of activity is reached. Secondary indicators do not trigger implementation actions, but provide more insight into the type of demand that is occurring. Secondary indicators may provide another way to measure activity or guide how the element is implemented once the trigger is reached.

Indicators for each area of Airport development are discussed in the subsections that follow. These indicators are intended to identify an impending need for additional facilities given existing demand/capacity relationships. Once these triggers are reached, in depth analyses should be undertaken to confirm the continued validity of the triggers and the facility concepts.

##### 8.1.4.1 Airfield Indicators

As previously discussed, the planning for additional airfield capacity should begin when demand exceeds 60 percent of the Annual Service Volume (ASV). By initiating planning at that point, additional capacity could be expected to become operational as demand begins to exceed 100 percent of the ASV. The current airfield demand at the Airport is approximately 85 percent of the ASV. Therefore, it is recommended that airfield capacity-enhancing projects remain a priority to implement the Phase 1 airfield layout before the airfield reaches capacity, which is anticipated to occur in 2025. The upgrade of Runway 12L-30R will increase airfield capacity, and the decommissioning of Runway 17-35 will eliminate two runway incursion hot spots.

### 8.1.4.2 Terminal/Gate Indicators

The timing of terminal/gate expansion or development is typically based on airline demand for additional facilities, the need to replace old or insufficient facilities, or the need to enhance passenger service. These needs may or may not be specifically linked to demand. As such, the following triggers were identified for terminal gate development, in chronological order:

- Need for Remain Over Night (RON) gates under existing conditions
- Turns per gate equal 10 or more
- Need for additional facilities to accommodate non-Southwest Airlines activity beyond existing surplus capacity
- Need for additional concourse gates.

### 8.1.4.3 Access and Curbside Indicators

Peak hour curbside operations should be observed to determine whether congestion is affecting operations. Typically, this occurs when the level of service (LOS) reaches LOS E. Planning should be initiated when PMAD Peak hour operations reach LOS D. Additionally, operational modifications should be considered to improve curbside use prior to implementing improvements.

### 8.1.4.4 Parking Indicators

A primary indicator for public parking facility development is parking lot occupancy during the peak month. Planning should be initiated when average peak month occupancy reaches 80 percent to 85 percent of total capacity so that improvements can be in place when occupancy reaches approximately 90 percent to 95 percent of capacity. Typically, 90 to 95 percent occupancy represents the effective capacity of parking facilities. In addition to parking occupancy, secondary indicators such as the split of parking facility occupancies among the hourly, daily, and remote lots, and the total parkers by month and type of lot should be monitored for demand shifts that may indicate shortfalls in capacity.

### 8.1.4.5 General Aviation Indicators

Two principal types of general aviation tenants have facilities at the Airport: corporate tenants and FBOs. The development of new or improved general aviation facilities is typically driven by tenant initiatives rather than by an Airport owner (i.e., HAS). However, activity indicators may provide insight into overall general aviation demand. With a multiple-airport system, HAS has the flexibility to offer development options at another airport (such as Ellington Airport). The based aircraft fleet and the annual number of general aviation operations indicate the overall demand for general aviation facilities and services at the Airport. Growth in the based aircraft fleet by tenant (corporate or FBO) can indicate a demand for hangar, terminal, or apron expansion.

## 8.2 Phased Implementation Plan

For purposes of the Implementation Plan, existing conditions for the terminal area were assumed to consist of the recommended layout of this area in December 2015, when the Hobby International Terminal is scheduled to open. Enabling projects for the Hobby International Terminal are not included in the Implementation Plan, and are labeled on the phasing exhibits included in this section as “2015 Existing Conditions.”

ADP phasing is based on specific demand levels that will trigger the need for implementation of the individual projects and a logical progression of development that will allow critical projects to be in place to meet that demand. **Table 8-1** presents the relationship between the phases and total annual aircraft operations and enplaned passengers. Although the demand will dictate when development should occur at the Airport rather than a particular date or timeframe, for purposes of the implementation and funding plans, a timeline was applied.

**Table 8-1: Correlation between Phases and Activity**

PHASE	YEARS	AIRCRAFT OPERATIONS AT END OF PHASE	ENPLANED PASSENGERS AT END OF PHASE
1	2014-2016	221,210	6,270,300
2	2017-2019	239,430	7,237,300
3	2020-2023	250,220	7,890,800
4	2024-2030	269,540	9,070,600

NOTE: 2025 aircraft operations and enplaned passenger numbers are averages between 2020 and 2030.

SOURCE: Ricondo & Associates, Inc., December 2013.

PREPARED BY: Ricondo & Associates, Inc., December 2013.

**Exhibit 8-1** presents a simple bar chart schedule for the recommended implementation of each Master Plan Update project listed in Phases 1 through 4 of the Implementation Plan.

**Exhibits 8-2** through **8-5** graphically depict project implementation, by phase, as shown in the implementation plan.

**Exhibit 8-1: Recommended Implementation Plan**

		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>Phase 1 (2014-2016)</b>																		
Phase 1 Master Plan Projects - Environmental Study	2014																	
Roadway Intersection Improvements - Airport/Telephone	2015																	
Roadway Intersection Improvements - Airport/Monroe	2015																	
Roadway Intersection Improvements - Airport/Glencrest	2015																	
Long-Term Surface Parking Lot Access Road Improvements	2015																	
GA/CBO Development in South Quadrant	2015																	
CRCF Enabling - West Terminal Area Roadways	2016																	
Rwy 12L Upgrade - Land Acquisition	2016																	
Phase 2 Master Plan Projects - Environmental Study	2015/2016																	
<b>Phase 2 (2017-2019)</b>																		
CRCF Enabling - Temporary Relocation of Rental Car Facilities	2018																	
CRCF Enabling - Relocation of Taxi Staging Area	2018																	
Consolidated Rental Car Facility (CRCF) Construction	2018/2019																	
West Concourse Expansion (7 gates, apron)	2018/2019																	
Phase 3 Master Plan Projects - Environmental Study	2019																	
<b>Phase 3 (2020-2023)</b>																		
Hobby Cargo Building	2020/2021																	
Rwy 12L Upgrade - Relocation of Main Deicing Pad	2021																	
Rwy 12L Upgrade - Signature Buildings Demolition	2021																	
Rwy 12L Upgrade - Jet Aviation South Hangars Demolition	2021																	
Rwy 12L Upgrade - Taxiway Construction	2021/2023																	
Rwy 12L Upgrade - Runway Construction	2021/2023																	
SWA Cargo & Provisioning Facility Demo & Expansion of Long-Term Surface Parking Lot	2022																	
Relocation of West Cell Phone Waiting Lot to Long-Term Parking Lot	2022																	
Rwy 12L Upgrade - Perimeter Road/Fence Realignment	2022																	
Rwy 12L Upgrade - Closure of a portion of West Monroe Road and Freeland Street	2022																	
Rwy 12L Upgrade - SWA Fuel Farm Boundary Changes	2022																	
Rwy 12L Upgrade - Obstruction Removal	2023																	
Rwy 12L Upgrade - Nav aids Installation (ALS, LOC, PAPI, GS)	2023																	
Decommissioning of Rwy 17-35	2023																	
Rwy 12R Displaced Threshold Removal	2023																	
Phase 4 Master Plan Projects - Environmental Study	2023																	
<b>Phase 4 (2024-2030)</b>																		
Terminal Expansion (East Side)	2028/2030																	

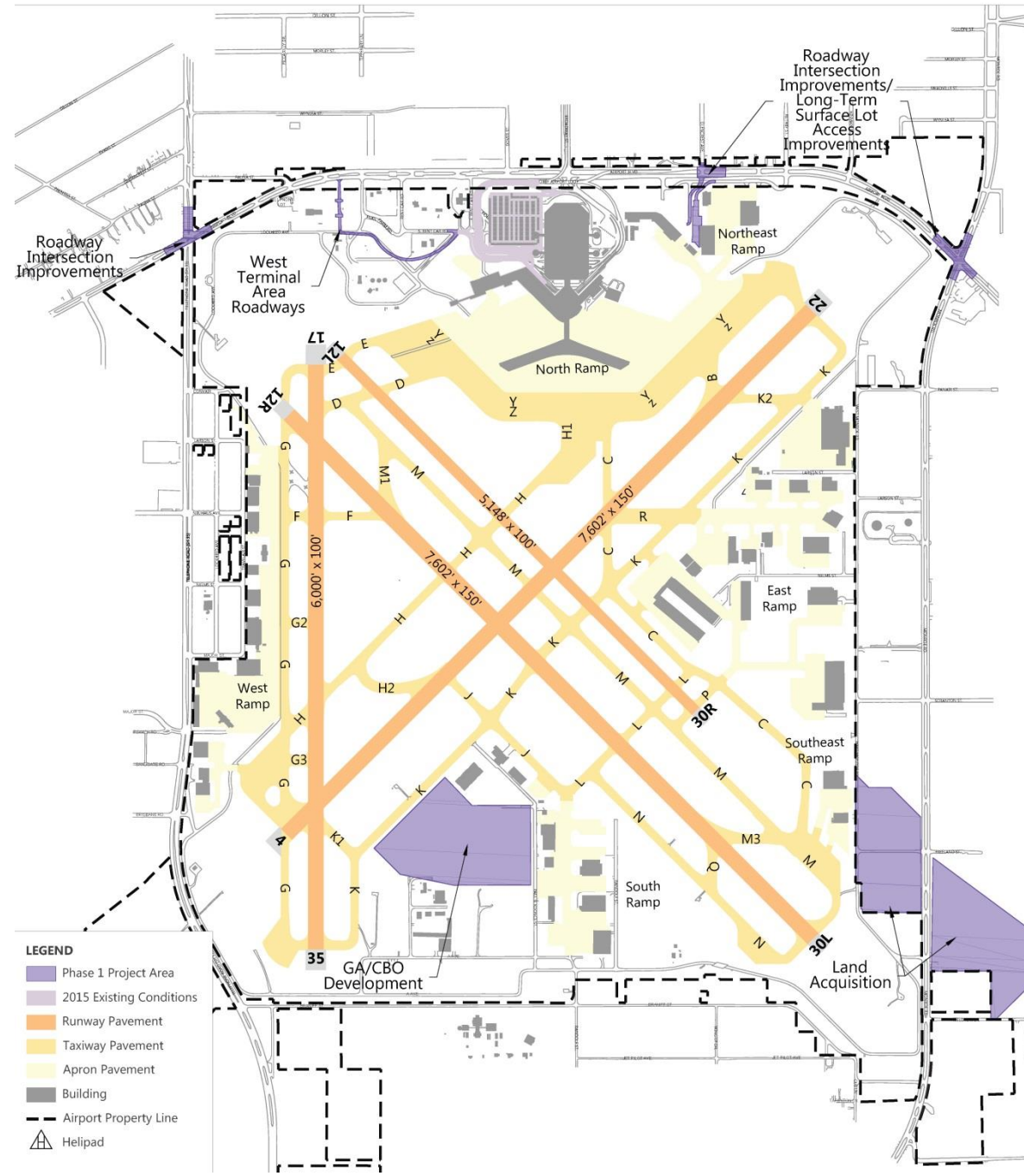
**LEGEND:**

Design Phase	
Construction Phase	

SOURCE: Houston Airport System, 2014; Ricondo & Associates, Inc., 2014.  
 PREPARED BY: Ricondo & Associates, Inc., 2014.

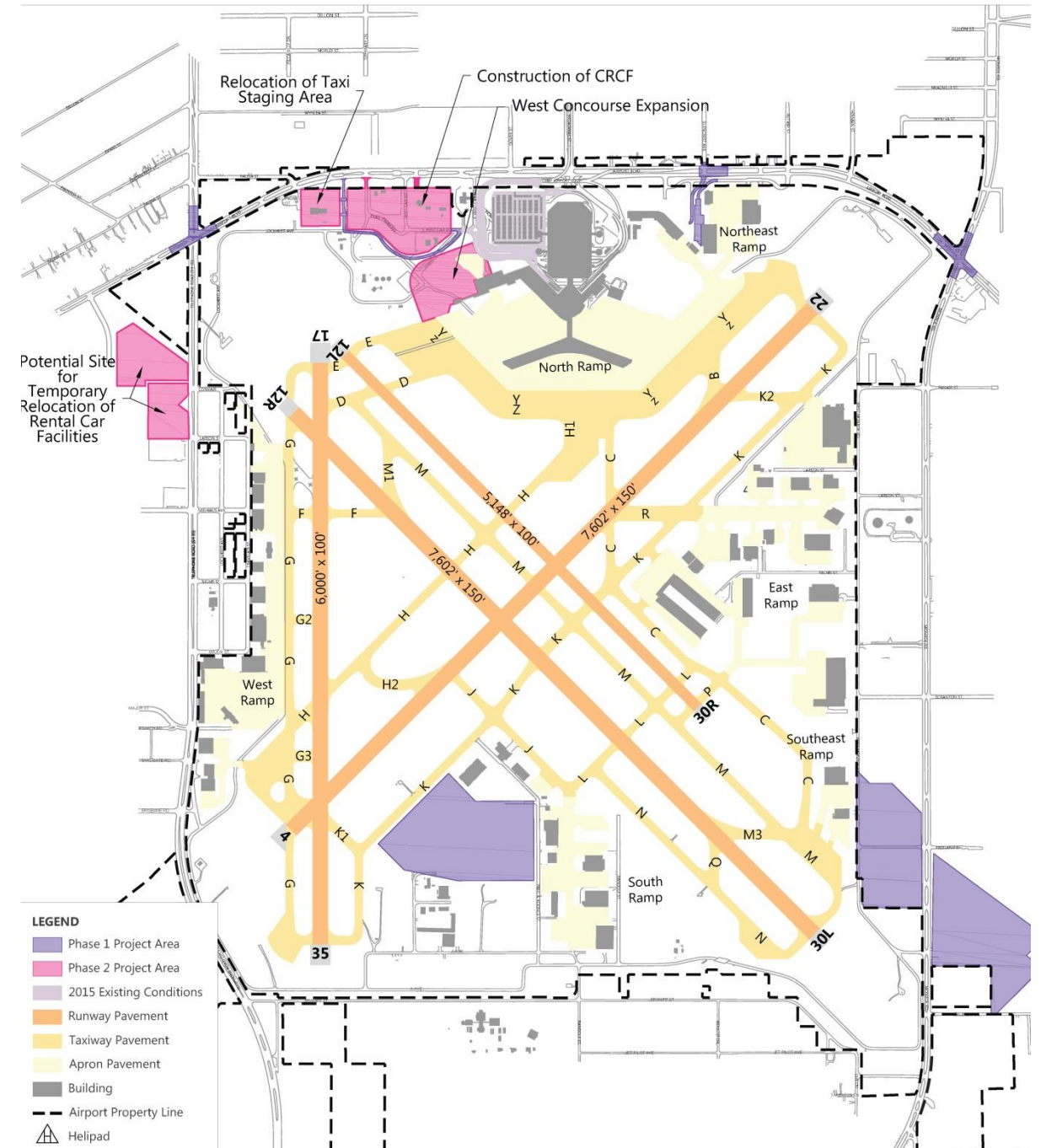


Exhibit 8-2: Project Areas – Phase 1 (2014-2016)



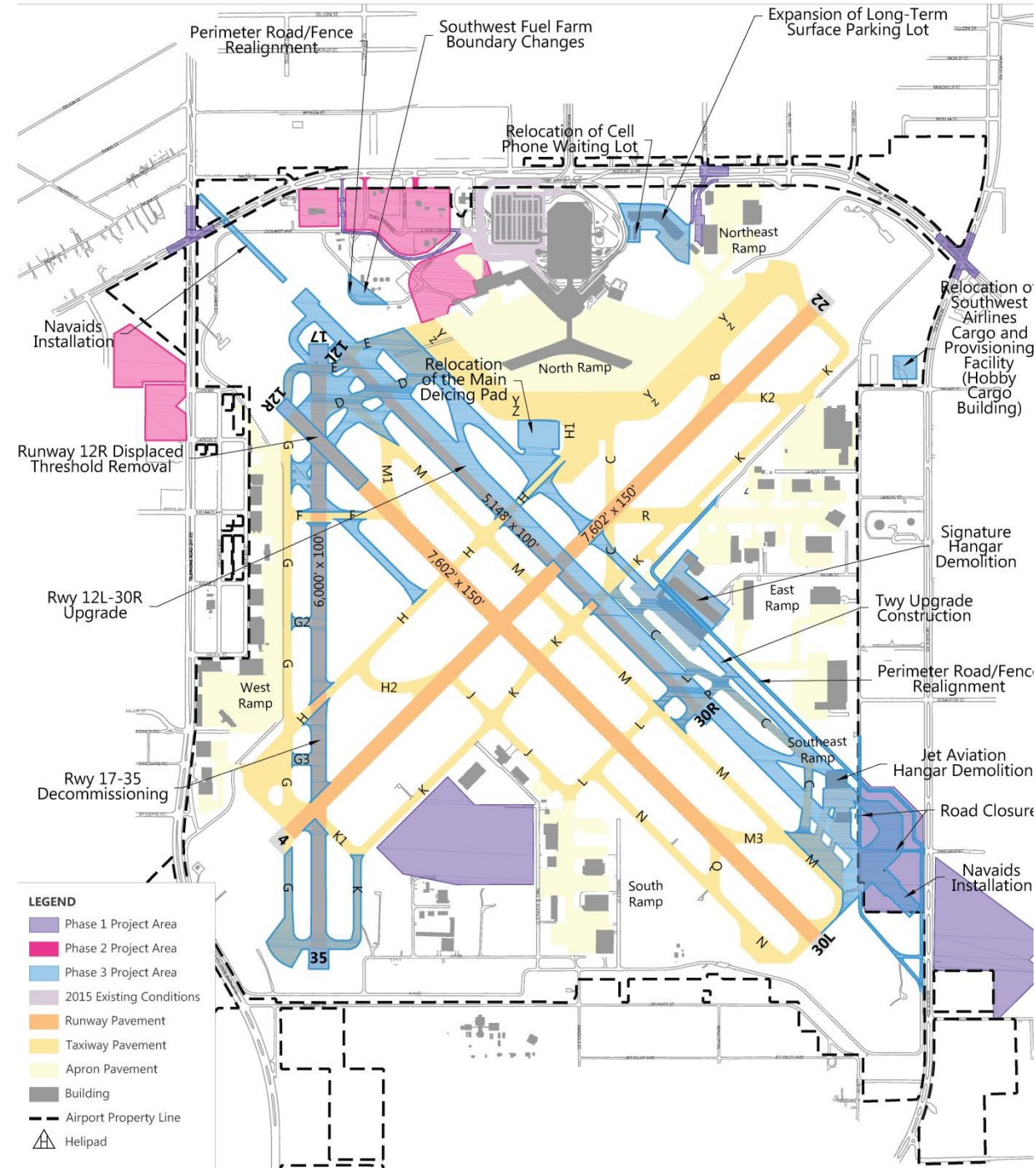
SOURCES: William P. Hobby Airport, DRAFT Airport Layout Plan, 2014; Houston Airport System, 2014; Ricondo & Associates, Inc., August 2014.  
PREPARED BY: Ricondo & Associates, Inc., August 2014.

Exhibit 8-3: Project Areas – Phase 2 (2017-2019)



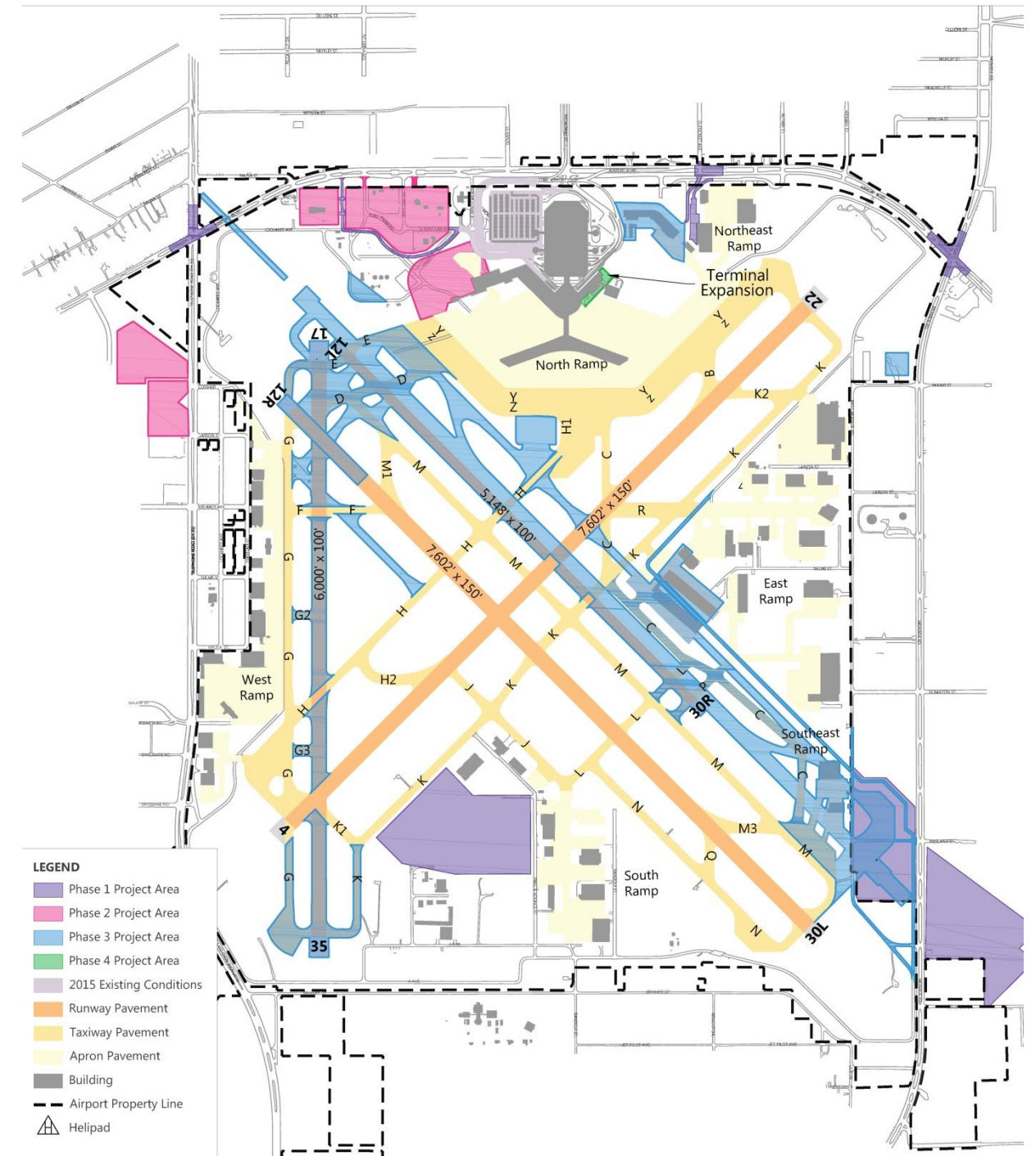
SOURCES: William P. Hobby Airport, DRAFT Airport Layout Plan, 2014; Houston Airport System, 2014; Ricondo & Associates, Inc., August 2014.  
PREPARED BY: Ricondo & Associates, Inc., August 2014.

Exhibit 8-4: Project Areas – Phase 3 (2020-2024)



SOURCES: William P. Hobby Airport, DRAFT Airport Layout Plan, 2014; Houston Airport System, 2014; Ricondo & Associates, Inc., August 2014.  
PREPARED BY: Ricondo & Associates, Inc., August 2014.

Exhibit 8-5: Project Areas – Phase 4 (2025-2030)



SOURCES: William P. Hobby Airport, DRAFT Airport Layout Plan, 2014; Houston Airport System, 2014; Ricondo & Associates, Inc., August 2014.  
PREPARED BY: Ricondo & Associates, Inc., August 2014.

### 8.3 Annual Activity Monitoring

HAS currently monitors passenger, aircraft operations, and cargo data to assess growth. To help ensure that the monitoring process provides a deeper understanding of activity at the Airport and a deeper understanding of the rate of growth, it is recommended that additional activity statistics be monitored as well. This will enhance HAS' ability to determine if the schedule for future projects needs to be adjusted and, therefore, if the CIP should also be adjusted.

As the data is collected and analyzed, they should be compared to the forecasts for the corresponding functional area of the Airport. This comparison will help HAS determine what phase of planning is necessary given present conditions. Analyzing data to assess facility use, and comparing the data to PALs or demand thresholds set forth in this Master Plan Update can provide HAS early indications of the need for implementation. By reviewing activity levels in conjunction with implementation triggers, HAS will be prepared to initiate implementation of the ADP as justified by demand.

HAS should begin monitoring activity and the progress of the Master Plan Update implementation. Actual activity should be compared with forecast activity to determine if demand is exceeding the capacity of Airport facilities. For other areas of consideration, such as tenant growth, a review of existing facilities should be completed to assess growth (i.e., the need for additional hangars or ramp space for an FBO) compared with the previous year, to assess conditions at the Airport, and to determine if actual growth is similar to the forecasts presented in Section 3. **Table 8-2** shows the planning factors for the various activities, which will enable HAS to decide if projects need to be initiated or postponed.

If actual operations lag the forecasts, then the next phase of projects may not need to be implemented as presented herein, and if the triggers occur in advance of the forecasts, projects could be implemented more quickly. Furthermore, by reviewing operations and Airport growth in the summer, HAS would have sufficient opportunity to include projects in the following year's CIP and funding cycles, which occur around the first of the year.

In addition to Airport activity statistics, other capital improvements and general maintenance projects separate from those identified in the Master Plan Update should also be monitored. These projects could increase the costs or delay implementation of CIP projects. Therefore, prior to implementation of other capital improvements and maintenance projects, the potential impacts on CIP projects should be considered and a strategy developed to minimize these impacts.

**Table 8-2: Planning Factors**

ACTIVITY STATISTICS	INDICATES	ACTIVITY TRIGGERS	ACTION REQUIRED
<b>Aircraft Operations:</b> total, air carrier, cargo, military, GA/Air taxi, peak hour operations	Traffic segments in which growth is occurring	Master Plan Aviation Demand Forecasts, Table 3-22	Monitor for long term trends and compare with operations forecasts
<b>Aircraft Delay</b>	Airfield capacity	Demand is > 60% of ASV	Monitor for increase in delay as indication that additional airfield capacity may be required.
<b>Commercial Aircraft Fleet Mix</b>	Type of aircraft utilizing the airfield and terminal facilities	No trigger	Monitor to determine if fleet is increasing and the nature of increase.
<b>Hourly Distribution of Activity in Peak Month, Average Day (PMAD)</b>	Peaking factor, impacts ASV	4 minutes average annual runway delay per aircraft	Monitor for long-term trends. Assess changes in seasonal distribution of activity.
<b>Observe Peak Hour Passenger Flows</b> at security checkpoints, within the terminal, at baggage claim and on the curbside	Utilization of specific functional areas of the terminal	Master Plan Demand/Capacity Analysis, Tables in Section 4-2; Curbside: PMAD Peak hour operations reach LOS D	Monitor the demand for each functional area. May indicate the need for additional area for the specific function.
<b>Commercial Enplanements/Gate:</b> overall, commuter, by airline, by terminal	Passenger demand at terminal gates	See Section 8.1.4.2.	Monitor for indication of overall demand at gates.
<b>Number of departing seats per gate:</b> overall, by terminal, and by carrier	Seating availability in departure lounge(s)	< 70% of passengers waiting to board flight are seated	Monitor for long term trends by terminal and carrier to develop understanding of typical utilization, assess changes in number of scheduled seats. May indicate the need for additional seating and/or larger departure lounges.
<b>Cargo:</b> Enplaned/Deplaned	Amount of enplaned and deplaned cargo	N/A	Monitor for growth in cargo volume. An increase in cargo volume may indicate the need for additional facilities.
<b>Based Aircraft:</b> general aviation itinerant and based operations	General Aviation activity levels	Master Plan Demand/Capacity Analysis, Table 4-105	Monitor to assess whether activity is increasing.
<b>Parking:</b> total parkers by month and type of lot, entry and exit data from lots and toll plaza	Utilization of individual lots	80-85% occupancy for on-Airport parking:	Monitor demand for each facility to determine averages and track shifts in demand of various lots. May be used to assess effectiveness of rate changes on lot utilization.
<b>Tenant Improvements</b> (new hangars, ramp, fuel storage and maintenance facilities)	Utilization of tenant facilities	No trigger	Monitor tenant activity/improvements with respect to Master Plan recommendations.
<b>Other CIP and Maintenance</b>	Additional considerations for CIP costs, scope, and timing	No trigger	Coordinate with PDC managers and HAS Program Managers to identify ongoing or planned activities in vicinity of proposed CIP projects.

SOURCE: Ricondo & Associates, Inc., January 2014.  
 PREPARED BY: Ricondo & Associates, Inc., January 2014.

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## 8.4 Additional Development Initiative

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In recent years, METRO has indicated interest in developing a Ground Transportation Center at the northwest corner of the intersection of Airport Boulevard and Broadway Street to accommodate a METRO bus transfer and rail station (this project was illustrated in the 2003 Master Plan for HOU). If this project is pursued by METRO in the future, consideration should be given to designing the project in such a way that the passenger terminal and employee-screening checkpoint at HOU could be accessed via an elevated walkway that crosses Airport Boulevard. The walkway should be an interior moving walkway, climate controlled. This initiative would benefit the Airport environs and the residents and communities around the Airport, as well as its users and employees. However, planning and implementation of such a facility is largely outside HAS's control. The timing of this facility is yet to be determined, and may even be jeopardized by the recent purchase of land on this corner by a private developer.

Additionally, if METRO is able to extend rail service to HOU in the future, they have indicated that the plan would call for the rail line to be located in the median of Airport Boulevard. If this rail extension reaches the planning/design phase, HAS should coordinate closely with METRO to seek a design that allows for vertical circulation from the rail stop and an elevated walkway that connects to the passenger terminal, similar to what was described above. This would ensure that passengers would have safe access to the terminal without having to cross lanes of Airport Boulevard. An at-grade crossing would also cause a reduction in the vehicle capacity of Airport Boulevard.

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## 8.5 Implementation Conclusions

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The ADP will be implemented in phases so that development corresponds with the demand discussed in Section 3, "Aviation Demand Forecasts." Detailed planning, design, and construction information is important in the phasing process to minimize impacts on the airfield, terminal, and ground access routes. The ability to effectively phase implementation requires an understanding of the factors that prompt development and the various characteristics of Airport growth. Implementation indicators are specific activity levels that trigger the initiation of development. In the event that actual demand varies significantly from that forecast, the Master Plan Update should be updated to reflect the differences between forecast and actual demand. These potential differences may also change the ADP and the implementation of projects listed in the ADP. Therefore, it is recommended that the ADP and Implementation Plan be reviewed annually through activity monitoring and comparative analysis for comparison to actual activity levels prior to the initiation of development.

Additionally, HAS should continue to work collaboratively with the Texas Department of Transportation, METRO, and other agencies to help influence and encourage appropriate development within the Airport environs, as defined in this Master Plan Update. Just as on-Airport elements of the Implementation Plan will be incorporated into the HAS CIP for HOU, off-Airport projects should be incorporated into the development plans of other agencies. Through active coordination with these agencies, HAS can help ensure that critical off-Airport projects are implemented in a manner and on a schedule consistent with plans for the Airport. The specific means for this coordination should be determined by HAS and other agencies.

## 9. Funding Plan

In its financial decision-making, HAS considers the needs of the overall Airport System rather than isolating one facility. As such, it was not feasible to separate funding decisions regarding HOU's Master Plan CIP without considering the impacts on the other HAS facilities. As recommended by HAS, this chapter only focused on the Master Plan CIP and its potential funding sources.

### 9.1 HAS Financial Structure

HAS manages and operates the Airport System Fund (the Fund), as an enterprise fund of the City. The Fund is used to account for services provided to the general public using the Airport System, and its costs are recovered primarily through user rentals, fees, and charges (e.g., landing fees, building and ground rentals, parking fees, concession fees).

HAS accounts for Airport System operating revenues and expenses using five - soon to be seven - direct (revenue-producing) cost centers and six indirect (allocated) cost centers, as follows:

- Direct Cost Centers
  - Airfield
  - Central Concourse Apron
  - Terminal Building
  - Parking and Ground Transportation
  - Other
  - International Concourse (once it opens in 2015)
  - International Apron (once it opens in 2015)
- Indirect Cost Centers
  - Roads
  - Systems and Utilities
  - Airport Management/HAS Allocation
  - Police Protection
  - Fire Protection
  - Drainage Fee

The rate-setting methodology for the HOU terminal, concourse, and apron rentals is cost center compensatory. Cost-center-specific operating expenses, allocated indirect operating expenses, allocated Renewal and Replacement Fund

replenishment, and amortized capital improvements are combined in the Airline Requirement. This requirement is divided by cost-center-specific usable square footage to determine the average rental rate per square foot. The HOU landing fee methodology is also cost center compensatory, but with a reconciliation. It combines Airfield-specific expenses listed above, less credits for fuel flowage fees (paid by general aviation aircraft in lieu of landing fees). This net Airline Requirement is divided by airline landed weight (of passenger and all-cargo aircraft) to determine the landing fee rate per 1,000-pound units of landed weight.

### 9.2 Master Plan CIP Capital Costs

**Table 9-1** presents a summary of phased capital costs for the Master Plan CIP. Construction costs were either provided by HAS or estimated by Connico, Inc., with the exception of a few minor projects whose costs were estimated by R&A. HAS-provided costs covered construction and (when applicable) design, art, and Construction Management at Risk (CMAR). Vertical structures must have an allowance for an art element, and CMAR is a soft cost quantified for already-committed projects. For projects with Connico-provided construction costs, a 10 percent design premium was assumed. For all projects, a 20 percent soft cost premium was assumed (in addition to CMAR). Construction, design, art, CMAR, and soft costs compose project costs.

For this analysis, estimated project costs were inflated at an annual compounded growth rate of 2.4 percent. As shown, the Master Plan CIP for HOU is estimated to cost approximately \$656.6 million in 2014 dollars (\$734.0 million in inflated dollars) through the end of the fourth and final planning phase in 2030. For ease of presentation, the costs discussed in the remainder of this section are presented in inflated dollars.

### 9.3 Funding Sources

Based on the recommended Master Plan CIP, its associated costs, and available funding sources, a recommended Funding Plan was developed to maximize the use of external resources and minimize the amount of funding to be derived from local sources. The sources of funds available to implement the Master Plan CIP at HOU and the recommended funding sources are discussed below.

#### 9.3.1 FEDERAL AIRPORT IMPROVEMENT PROGRAM GRANTS

Projects were reviewed to determine their eligibility for federal Airport Improvement Program (AIP) grant funding. As a general rule, only those projects that do not generate revenues are eligible for federal funding. (A typical example is an airfield construction project.) Federal grant eligibility is generally assumed to be 75 percent for airfield, ramp, and roadway projects. Federal funds are either in the form of entitlement grants based on numbers of enplaned passengers or discretionary grants distributed by the FAA on the basis of availability and the priority of projects at airports nationwide. In determining eligibility for federal grant funding from the AIP, it was assumed that the AIP would continue to be in effect throughout the planning period, without any major changes.

**Table 9-1 (1 of 2): Master Plan Capital Improvement Program**

PROJECT	PURPOSE	COST IN 2014 \$	COST IN INFLATED \$
<b>Phase 1 (2014-2016)</b>			
Phase 1 Master Plan Projects - Environmental Study	Planning	\$92,000	\$92,000
New Parking Garage at HOU	Expansion	77,660,000	77,660,000
Hobby Loop Relocation	Maintenance/replacement	13,801,000	13,801,000
Houston International Facility - Lease Agreement	Expansion	20,470,000	21,411,000
Pavement Replacement at HOU (R&R) - Phase I	Maintenance/replacement	676,000	676,000
Satellite Utilities Plant (SUP)	Expansion	16,257,000	16,257,000
Rwy 12L Upgrade – Land Acquisition	Safety/security	1,412,000	1,477,000
Design and Install Canopy at Passenger Drop-Off Area	Expansion	10,133,000	10,133,000
HOU TSA EDS/CBRA Recapitalization	Expansion	13,518,000	13,525,000
Consolidated Maintenance Facility	Expansion	11,013,000	11,013,000
Remodel of West Cell Lot & Construction of East Cell Lot	Expansion	737,000	737,000
Roadway Intersection Improvements - Airport/Telephone	Maintenance/replacement	1,650,000	1,689,000
Roadway Intersection Improvements - Airport/Monroe	Maintenance/replacement	2,310,000	2,364,000
Roadway Intersection Improvements - Airport/Glencrest	Maintenance/replacement	990,000	1,013,000
Long-Term Surface Parking Lot Access Road Improvements	Maintenance/replacement	1,980,000	2,027,000
GA/CBO Development in South Quadrant	Expansion	33,660,000	34,451,000
Parking Technology for HOU	Maintenance/replacement	3,685,000	3,769,000
Rehabilitate & Expand ARFF Station 81	Maintenance/replacement	1,335,000	1,365,000
Phase 2 Master Plan Projects - Environmental Study	Planning	184,000	193,000
CRCF enabling – West Terminal Area Roadways	Expansion	3,300,000	3,455,000
<b>Phase 1 Total</b>		<b>\$214,863,000</b>	<b>\$217,101,000</b>
<b>Phase 2 (2017-2019)</b>			
West Concourse Expansion (7 gates, apron)	Expansion	\$99,155,000	\$110,811,000
CRCF enabling - Temporary Relocation of Rental Car Facilities	Expansion	5,544,000	6,065,000
CRCF enabling - Relocation of Taxi Staging Area	Maintenance/replacement	2,640,000	2,888,000
HOU Drainage - Roadway Flooding - Planning	Planning	430,000	469,000
Pavement Replacement at HOU (R&R) - Phase II	Maintenance/replacement	676,000	738,000
Perimeter Security Intrusion Detection System (PIDS)	Safety/security	614,000	671,000
Reconstruct Rwy 12R-30L (Asphalt to Concrete)	Maintenance/replacement	8,106,000	8,851,000
Consolidated Rental Car Facility	Expansion	101,072,000	112,954,000
Pavement Replacement at HOU (R&R) - Phase III	Maintenance/replacement	676,000	753,000
Phase 3 Master Plan Projects - Environmental Study	Planning	307,000	342,000
Install 12-4-7 Back-Up Generators	Maintenance/replacement	9,212,000	10,270,000
<b>Phase 2 Total</b>		<b>\$228,432,000</b>	<b>\$254,812,000</b>

**Table 9-1 (2 of 2): Master Plan Capital Improvement Program**

PROJECT	PURPOSE	COST IN 2014 \$	COST IN INFLATED \$
<b>Phase 3 (2020-2023)</b>			
Hobby Cargo Building	Expansion	\$7,524,000	\$8,585,000
Rwy 12L Upgrade – Relocation of Main Deicing Pad	Maintenance/replacement	6,864,000	7,994,000
Rwy 12R Displaced Threshold Removal	Safety/security	891,000	1,080,000
Reconstruct Rwy 4-22 – Phase I	Planning	7,369,000	8,893,000
Relocation of West Cell Lot to Long-Term Parking Lot	Maintenance/replacement	660,000	784,000
Rwy 12L Upgrade - Signature Buildings Demolition	Asset removal	3,828,000	4,458,000
Rwy 12L Upgrade - Jet Aviation South Hangars Demolition	Asset removal	1,848,000	2,152,000
SWA Cargo Facility Demolition and Parking Lot Expansion	Expansion	3,300,000	3,921,000
Rwy 12L Upgrade - Taxiway Construction	Maintenance/replacement	40,524,000	49,099,000
Rwy 12L Upgrade - Runway Construction	Maintenance/replacement	42,636,000	51,658,000
Rwy 12L Upgrade - Perimeter Road/Fence Realignment	Maintenance/replacement	1,452,000	1,725,000
Rwy 12L Upgrade - Partial Closure of W Monroe Rd and Freeland St	Maintenance/replacement	1,056,000	1,255,000
Rwy 12L Upgrade - SWA Fuel Farm Boundary Changes	Maintenance/replacement	1,003,000	1,192,000
Remove Phone/Utility Poles - Re-Run Power Lines	Maintenance/replacement	843,000	998,000
Hobby Drainage - Roadway Flooding - Mitigation	Safety/security	3,869,000	4,669,000
Rwy 12L Upgrade - Obstruction Removal	Maintenance/replacement	660,000	800,000
Rwy 12L Upgrade - Navais Relocation (ALS, LOC, PAPI, GS)	Maintenance/replacement	6,864,000	8,316,000
Decommissioning of Rwy 17-35	Asset removal	1,228,000	1,482,000
Phase 4 Master Plan Projects - Environmental Study	Planning	92,000	111,000
<b>Phase 3 Total</b>		<b>\$132,511,000</b>	<b>\$159,172,000</b>
<b>Phase 4 (2024-2030)</b>			
Shortening of Rwy 17-35 (Discretionary)	Asset removal	\$1,228,000	\$1,510,000
Reconstruct Rwy 4-22 – Phase II	Maintenance/replacement	39,303,000	48,331,000
Twys M3, H2 H & G (Discretionary)	Maintenance/replacement	7,369,000	9,401,000
Terminal Expansion (on east side)	Expansion	32,868,000	43,687,000
<b>Phase 4 Total</b>		<b>\$80,768,000</b>	<b>\$102,929,000</b>
<b>MASTER PLAN CIP TOTAL COSTS</b>		<b>\$656,574,000</b>	<b>\$734,014,000</b>

SOURCES: Houston Airport System, January 2014; Connico, Inc., and Ricondo & Associates, Inc., September 2014.  
 PREPARED BY: Ricondo & Associates, Inc., September 2014.

**Table 9-2** presents potential sources of funds for the Master Plan CIP, including federal grants, other funds, and HAS (local) funds. Other funds are comprised of CFC revenues (for the Consolidated Rental Car Facility), TxDOT funds (for certain roadway intersection improvements), TSA grants and tenant contributions. As shown, the maximum federal share of eligible projects is 75 percent; however, the federal share for the West Concourse Expansion in Phase 2 was reduced to 25 percent to account for revenue-producing portions of the project that would not be eligible for AIP funding. As also shown, eligible projects could receive maximum federal grants totaling approximately \$191.5 million (26.1 percent of the total cost of the Master Plan CIP). As shown in Table 9-2, approximately \$45.1 million in federal AIP entitlement grants is projected for the Master Plan CIP, or 6.1 percent of the total cost. These AIP entitlement grants were assigned to eligible projects based on the priority system recommended by HAS.

Table 9-2 (1 of 2): Potential Sources of Funds for the HOU Master Plan Capital Improvement Program

PROJECT	TOTAL COSTS (INFLATED)	MAXIMUM ELIGIBLE AIP SHARE	MAXIMUM ELIGIBLE AIP GRANTS	SOURCES OF FUNDS		
				EXPECTED AIP GRANTS	OTHER FUNDS	HAS SHARE
<b>Phase 1 (2014-2016)</b>						
Phase 1 Master Plan Projects - Environmental Study	\$92,000	0%	\$0	\$0	\$0	\$92,000
New Parking Garage at HOU	77,660,000	0%	-	-	-	77,660,000
Hobby Loop Relocation	13,801,000	0%	-	-	-	13,801,000
Houston International Facility - Lease Agreement	21,411,000	0%	-	-	-	21,411,000
Pavement Replacement at HOU (R&R) - Phase I	676,000	0%	-	-	-	676,000
Satellite Utilities Plant (SUP)	16,267,000	0%	-	-	-	16,257,000
Rwy 12L Upgrade – Land Acquisition	1,477,000	75%	1,108,000	1,108,000	-	369,000
Design and Install Canopy at Passenger Drop-Off Area	10,133,000	75%	7,600,000	3,800,000	-	6,333,000
HOU TSA EDS/CBRA Recapitalization	13,518,000	0%	-	-	13,518,000	-
Consolidated Maintenance Facility	11,013,000	0%	-	-	-	11,013,000
Remodel of West Cell Lot & Construction of East Cell Lot	737,000	0%	-	-	-	737,000
Roadway Intersection Improvements - Airport/Telephone	1,689,000	0%	-	-	1,689,000	-
Roadway Intersection Improvements - Airport/Monroe	2,364,000	0%	-	-	2,364,000	-
Roadway Intersection Improvements - Airport/Glencrest	1,013,000	0%	-	-	1,013,000	-
Long-Term Surface Parking Lot Access Road Improvements	2,027,000	0%	-	-	-	2,027,000
GA/CBO Development in South Quadrant	34,451,000	0%	-	-	17,225,500	17,225,500
Parking Technology for HOU	3,769,000	0%	-	-	-	3,769,000
Rehabilitate & Expand ARFF Station 81	1,365,000	0%	-	-	-	1,365,000
Phase 2 Master Plan Projects - Environmental Study	193,000	0%	-	-	-	193,000
CRCF enabling – West Terminal Area Roadways	3,455,000	75%	2,591,000	1,296,000	0	2,159,000
<b>Phase 1 Total</b>	<b>\$217,101,000</b>		<b>\$11,299,000</b>	<b>\$6,204,000</b>	<b>\$35,809,500</b>	<b>\$175,087,500</b>
<b>Phase 2 (2017-2019)</b>						
West Concourse Expansion (7 gates, apron)	\$110,811,000	25%	\$27,703,000	\$0	\$0	\$110,811,000
CRCF enabling - Temporary Relocation of Rental Car Facilities	6,065,000	0%	-	-	-	6,065,000
CRCF enabling - Relocation of Taxi Staging Area	2,888,000	0%	-	-	-	2,888,000
Hobby Drainage - Roadway Flooding - Planning	469,000	75%	352,000	352,000	-	117,000
Pavement Replacement at HOU (R&R) - Phase II	738,000	0%	-	-	-	738,000
Perimeter Security Intrusion Detection System (PIDS)	671,000	75%	503,000	503,000	-	168,000
Reconstruct Rwy 12R-30L (Asphalt to Concrete)	8,851,000	0%	-	-	-	8,851,000
Consolidated Rental Car Facility	112,954,000	0%	-	-	112,954,000	-
Pavement Replacement at HOU (R&R) - Phase III	753,000	0%	-	-	-	753,000
Phase 3 Master Plan Projects - Environmental Study	342,000	0%	-	-	-	342,000
Install 12-4-7 Back-Up Generators	10,270,000	0%	-	-	-	10,270,000
<b>Phase 2 Total</b>	<b>\$254,812,000</b>		<b>\$28,558,000</b>	<b>\$855,000</b>	<b>\$112,954,000</b>	<b>\$141,003,000</b>

Table 9-2 (2 of 2): Potential Sources of Funds for the HOU Master Plan Capital Improvement Program

PROJECT	TOTAL COSTS (INFLATED)	MAXIMUM ELIGIBLE AIP SHARE	MAXIMUM ELIGIBLE AIP GRANTS	SOURCES OF FUNDS		
				EXPECTED AIP GRANTS	OTHER FUNDS	HAS SHARE
<b>Phase 3 (2020-2023)</b>						
Hobby Cargo Building	\$8,585,000	0%	\$0	\$0	\$8,585,000	\$0
Rwy 12L Upgrade – Relocation of Main Deicing Pad	7,994,000	75%	5,996,000	5,996,000	-	1,998,000
Rwy 12R Displaced Threshold Removal	1,080,000	75%	810,000	810,000	-	270,000
Reconstruct Rwy 4-22 – Phase I	8,893,000	75%	6,670,000	6,670,000	-	2,223,000
Relocation of West Cell Lot to Long-Term Parking Lot	784,000	0%	-	-	-	784,000
Rwy 12L Upgrade - Signature Buildings Demolition	4,458,000	75%	3,344,000	3,344,000	-	1,114,000
Rwy 12L Upgrade - Jet Aviation South Hangars Demolition	2,152,000	75%	1,614,000	1,614,000	-	538,000
SWA Cargo Facility Demolition and Parking Lot Expansion	3,921,000	0%	-	-	-	3,921,000
Rwy 12L Upgrade - Taxiway Construction	49,099,000	75%	36,824,000	36,824,000	-	12,275,000
Rwy 12L Upgrade - Runway Construction	51,658,000	75%	38,744,000	38,744,000	-	12,914,000
Rwy 12L Upgrade - Perimeter Road/Fence Realignment	1,725,000	75%	1,294,000	1,294,000	-	431,000
Rwy 12L Upgrade - Partial Closure of W Monroe Rd and Freeland St	1,255,000	75%	941,000	941,000	-	314,000
Rwy 12L Upgrade - SWA Fuel Farm Boundary Changes	1,192,000	75%	894,000	894,000	-	298,000
Remove Phone/Utility Poles - Re-Run Power Lines	998,000	75%	749,000	749,000	-	249,000
Hobby Drainage - Roadway Flooding - Mitigation	4,669,000	75%	3,502,000	-	-	4,669,000
Rwy 12L Upgrade - Obstruction Removal	800,000	75%	600,000	600,000	-	200,000
Rwy 12L Upgrade - Navaids Relocation (ALS, LOC, PAPI, GS)	8,316,000	75%	6,237,000	6,237,000	-	2,079,000
Decommissioning of Rwy 17-35	1,482,000	0%	-	-	-	1,482,000
Phase 4 Master Plan Projects - Environmental Study	111,000	75%	83,000	83,000	-	69,000
<b>Phase 3 Total</b>	<b>\$159,172,000</b>		<b>\$108,302,000</b>	<b>\$104,759,000</b>	<b>\$8,585,000</b>	<b>\$45,828,000</b>
<b>Phase 4 (2024-2030)</b>						
Shortening of Rwy 17-35 (Discretionary)	\$1,510,000	0%	\$0	\$0	\$0	\$1,510,000
Reconstruct Rwy 4-22 – Phase II	48,331,000	75%	36,248,000	36,248,000	-	12,083,000
Twys M3, H2 H & G (Discretionary)	9,401,000	75%	7,051,000	3,526,000	-	5,875,000
Terminal Expansion (on east side)	43,687,000	0%	-	-	-	43,687,000
<b>Phase 4 Total</b>	<b>\$102,929,000</b>		<b>\$43,299,000</b>	<b>\$39,774,000</b>	<b>\$0</b>	<b>\$63,155,000</b>
<b>TOTAL</b>	<b>\$734,014,000</b>		<b>\$191,458,000</b>	<b>\$151,592,000</b>	<b>\$157,348,500</b>	<b>\$425,073,500</b>

SOURCES: Houston Airport System; Connico, Inc.; Ricondo & Associates, Inc., January 2014.  
 PREPARED BY: Ricondo & Associates, Inc., January 2014.



### 9.3.2 PASSENGER FACILITY CHARGES

In May 1991, the FAA issued 14 CFR Part 158, allowing public agencies controlling commercial service airports to impose a PFC per eligible enplaned passenger. In 2006, HAS successfully applied to impose a PFC of \$3.00 per eligible enplaned passenger at HOU. For this analysis, it was not assumed that HAS will submit an application to the FAA during the planning period to use PFC revenues to help fund Master Plan CIP projects. Also, it is not expected that HAS will amend its existing application to increase the PFC level imposed at HOU. However, if the incremental PFC revenue generated at HOU were used solely for eligible Master Plan CIP projects from 2014 through 2030, PFC revenues at a \$4.50 PFC level could provide an increment of nearly \$200 million, while also reducing entitlement grants by 50 percent (-\$22.5 million).

### 9.3.3 OTHER FUNDING

Other funding sources were identified for certain Master Plan CIP projects, including general aviation/corporate business operator developments and construction of a cargo building. These projects are estimated to cost approximately \$157.3 million, or 21.4 percent of the total cost of the CIP. These projects are best suited for third-party funding based on the following rationale:

- Tenant/developer funding for belly freight facilities and general aviation
- TxDOT funding is assumed to cover project costs for improvements to certain roadway intersections outside Airport property.
- The Consolidated Rental Car Facility would be funded by bonds, the debt service on which would be paid by rental car customer facility charges.

### 9.3.4 LOCAL FUNDING

The remaining \$425.1 million (57.9 percent) of project costs would be funded through HAS. As shown in Table 9-4, the plurality of local funding would be required in Phase 2 (2017-2019), with \$141.0 million required, chiefly for the West Concourse Expansion. Major projects in other phases requiring local funding include the upgrade of Runway 12L-30R and terminal expansion on the east side. These projects are demand-driven and would not be constructed until demand warrants.

Project costs not funded with federal grants or third-party funding would most likely be funded through some combination of Airports Improvement Fund moneys and the sale of general airport revenue bonds. Project costs that are airfield- or terminal/apron-related would be amortized over a 15-, 20-, or 25-year period and included in the airline rate base. (Equipment would be amortized over a 15-year period, renovations over a 20-year period, and new projects over a 25-year period.) Airfield project costs would be recovered entirely through landing fees and terminal/apron project costs would be recovered based on the airlines' share of the total square footage in that particular cost center.

## 9.4 Other Airport Capital Improvements

In addition to the Master Plan CIP, HAS maintains an ongoing 6-year CIP. The current Airport CIP differs from the Master Plan CIP in that the phasing and implementation of projects are in finer detail than that required for the Master Plan CIP. Whereas projects in the Master Plan CIP are grouped into broad categories, in HAS's current Airport CIP, these projects are phased over many years.

## 9.5 Summary

A broad, aggregate approach was used in developing the Master Plan CIP, as projects will be refined before implementation. As discussed earlier, the financial analysis presented in this section differs from the typical master plan financial analysis. Given the dynamics of the three airports included in the Houston Airport System, neither a financial feasibility analysis nor a detailed financial analysis could be conducted without isolating HOU from the other airports in the system. This isolation is inconsistent with the financial decision-making conducted by HAS for the three facilities. As a result, HAS recommended that this section be limited to the Master Plan CIP and potential funding levels from various sources to implement the Master Plan CIP.

## 10. Environmental Overview

Major Airport development projects are recommended for implementation throughout the planning period for this Master Plan Update, as described in previous chapters. In general, these projects consist of taxiway improvements, roadway improvements, land acquisition, runway upgrade, concourse/terminal expansion, and environmental analyses. This chapter provides a general overview of potential environmental consequences related to the development.

### 10.1 Aircraft Noise

#### 10.1.1 GENERAL CHARACTERISTICS OF AIRCRAFT NOISE

Aircraft noise originates from both the engines and the airframe of an aircraft, but the engines are by far the most significant source of aircraft noise. Although propeller-driven aircraft (mostly commuter and general aviation) noise can be annoying, jet aircraft are the primary source of disturbing noise from the Airport.

Generally, sounds that differ by 2 dBA (A-weighted decibels) or less are not perceived to be noticeably different by most listeners. A noise event produced by a jet aircraft flyover is usually characterized by a buildup to a peak noise level as the aircraft approaches, then a decrease in noise level through a series of lesser peaks or pulses after the aircraft passes and the noise recedes.

#### 10.1.2 AIRCRAFT NOISE ANALYSIS METHODOLOGY

The methodology used for this aircraft noise analysis involved the:

- use of noise descriptors developed for aircraft noise analyses,
- application of a computer model that provides estimates of aircraft noise levels, and;
- development of basic data and assumptions as input to the computer model.

As a result of extensive research into the characteristics of aircraft noise and human response to that noise, a standard system of descriptors has been developed. The descriptors used in this aircraft noise analysis are as follows:

- **A-Weighted Sound Pressure Level (dBA):** dBA is a frequency-weighted sound level (expressed in decibels) that correlates with the way sound is heard by the human ear.

- **Maximum Noise Level ( $L_{max}$ ):**  $L_{max}$  is the maximum, or peak, sound level during a noise event.
- **Sound Exposure Level (SEL):** SEL is a time-integrated measure, expressed in decibels, of the sound energy of a single noise event. The sound level is integrated over the period that the level exceeds a threshold (normally 65 dBA for aircraft noise events). Therefore, SEL accounts for the duration of the sound.
- **A-weighted Day-Night Average Sound Level (DNL):** DNL is expressed in dBA and represents the average A-weighted sound level over a 24-hour period.

The Integrated Noise Model (INM) is an FAA computer model used to develop aircraft noise exposure maps and is the accepted *industry standard*, state-of-the-art tool for determining the total effect of aircraft noise at and around airports. INM uses the aircraft characteristics combined with conditions specific to an airport, such as runway geometry, runway use flight tracks, etc., to develop noise exposure contours. These noise exposure contours are based on the DNL noise descriptor.

Noise exposure values of DNL 75, 70, and 65 were used as the criterion levels for the aircraft noise analysis. Three specific ranges of noise exposure were estimated and analyzed: DNL 75+, DNL 70 to 75, and DNL 65 to 70. The area within the DNL 75+ noise exposure contour is considered to experience “severe” aircraft noise conditions and the area within the DNL 65 to 70 contour is considered to experience “significant” aircraft noise conditions.

#### 10.1.3 BASIC DATA AND ASSUMPTIONS

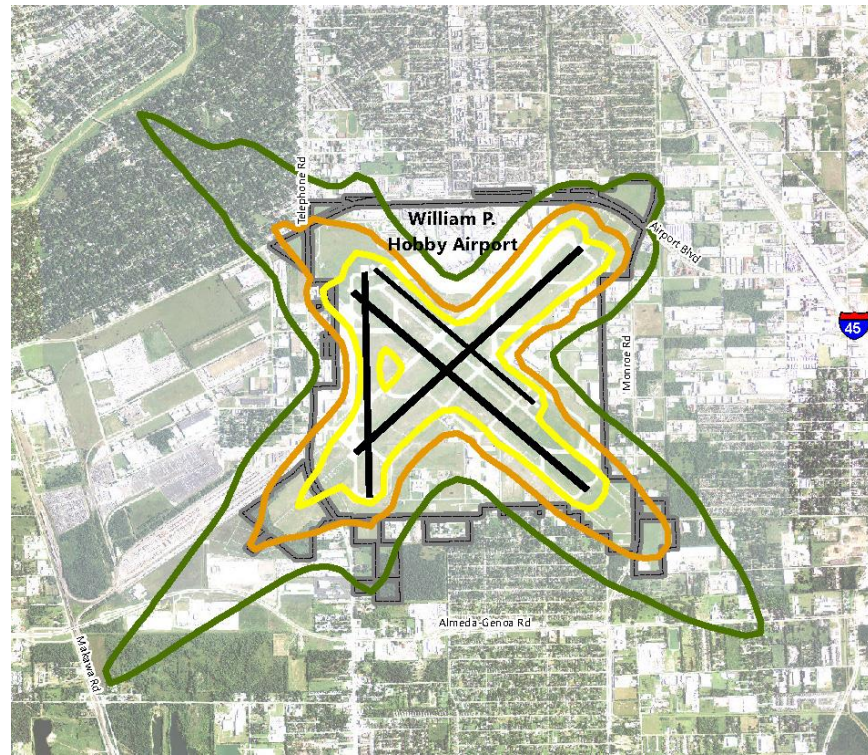
The following data for 2011, 2020 and 2030 were used in this INM analysis:

- Average daily aircraft operations by time of day, aircraft type and stage length (nonstop departure distance).
- Locations of representative flight tracks (aerial paths used by aircraft around the Airport). No actual radar tracks were available; as a result, flight track assumptions were based on published arrival and departure procedures, and typical aircraft performance.
- Annual percentage of operations on each runway, by aircraft type, for each general wind direction (North or South Flow) and assigned flight track.
- Departure profiles and current noise abatement procedures.

#### 10.1.4 RESULTS

The aforementioned assumptions were used to create the inputs to the INM Version 7 model developed specifically for the Airport. The resulting noise exposure contours for 2011, 2020 and 2030 are depicted in **Exhibits 10-1, 10-2** and **10-3**, respectively.

**Exhibit 10-1: 2011 Noise Contours**



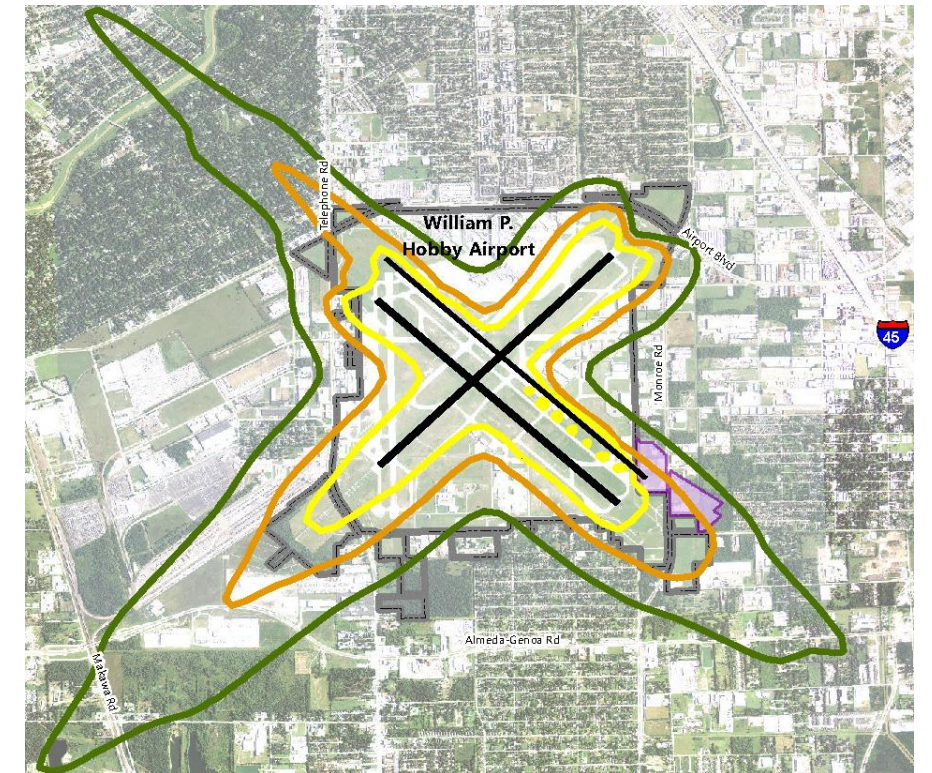
SOURCE: Quadrant Consultants Inc., August 2014.  
PREPARED BY: Quadrant Consultants Inc., August 2014.

**Exhibit 10-2: 2020 Noise Contours**



SOURCE: Quadrant Consultants Inc., August 2014.  
PREPARED BY: Quadrant Consultants Inc., August 2014.

**Exhibit 10-3: 2030 Noise Contours**



SOURCE: Quadrant Consultants Inc., August 2014.  
PREPARED BY: Quadrant Consultants Inc., August 2014.

- LEGEND**
-  Airport Runway
  -  Airport Property
  -  Potential Land Acquisition
  -  DNL 65
  -  DNL 70
  -  DNL 75

## 10.2 Compatible Land Use

All land uses are generally considered compatible with yearly day-night average sound levels below DNL 65, although FAR Part 150 states that “acceptable” sound levels should be subject to local conditions and community decisions.

### 10.2.1 EXISTING STUDY AREA LAND USES

Development in the Airport environs consists of a mixture of land uses that can be grouped into the following categories:

- Residential (single-family, multifamily, mobile homes)
- Public, including public parks, institutional sites (schools, churches, public places of assembly) and transportation rights-of-way
- Commercial, including business and professional offices, retail and utility rights-of-way
- Manufacturing and Production, including industrial sites and warehouses
- Recreational, including private golf courses and outdoor arenas
- Undeveloped (vacant land)

In general, areas northwest, north, northeast, east, and southeast of the Airport are densely developed in mostly residential use and areas south, southwest, and west of the Airport are less densely developed in mostly industrial and commercial land uses, with some residential land uses. Most multifamily residential land uses are along major roadways; a large cluster of multifamily residences is located just north of the Airport, along Broadway Street. Two recreational use areas (Glenbrook Golf Course and Law Park) are located north and west of the Airport, respectively.

### 10.2.2 EXISTING AND FUTURE NOISE EXPOSURE

**Exhibits 10-4** through **10-6** depict the 2011, 2020 and 2030 noise contours, respectively, overlaid on a map of existing land uses in the Airport environs.

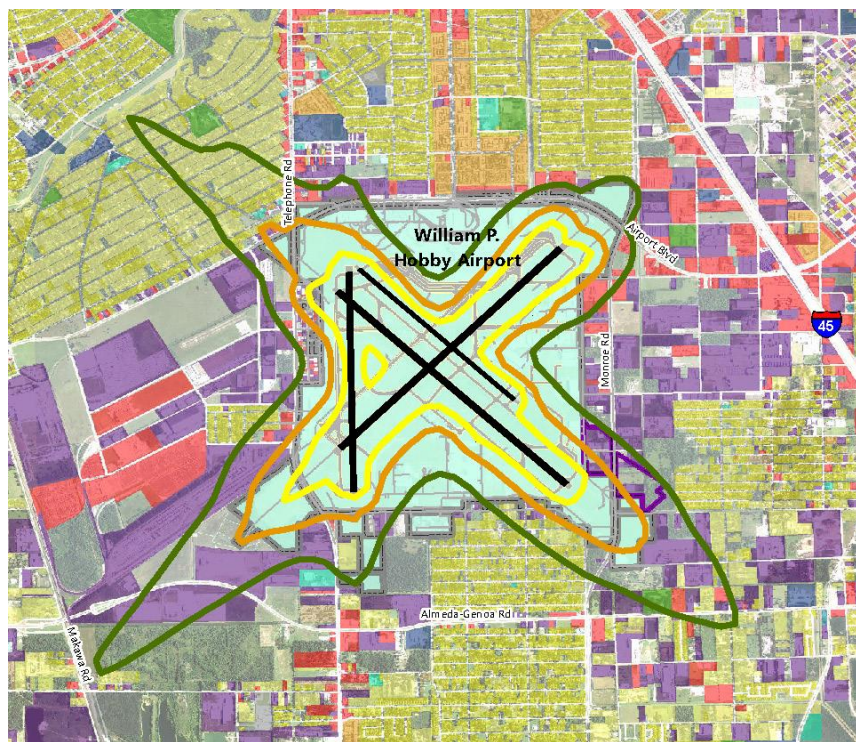
**Table 10-1** summarizes the effects of noise exposure in the Airport environs on population and noise-sensitive facilities. As shown in Table 10-1, the population that would be exposed to aircraft noise of DNL 65 and greater is projected to increase between 2011 and 2020 and increase again between 2020 and 2030. FAA Order 5050.1B defines a “significant noise impact” as “causing noise sensitive areas in the DNL 65 dB contour to experience at least a DNL 1.5 dB noise increase when compared to the no action alternative for the same time frame.” Therefore, implementation of the ADP would result in continued aircraft noise exposure in the Airport vicinity, and noise mitigation measures may be appropriate.

**Table 10-1 Population and Land Use Exposed to Aircraft Noise**

	DNL 65-70	DNL 70-75	OVER DNL 75	OVER DNL 65
<b>2011</b>				
Total population	933	18	0	1,051
Racial and ethnic minorities	818	15	0	833
Total families	360	7	0	367
Low-income families	42	7	0	49
Noise-exposed residential single family units	320	7	0	327
Noise-exposed residential multi-family units	46	0	0	46
Schools	0	0	0	0
Churches	2	0	0	2
Hospitals	0	0	0	0
Nursing homes	0	0	0	0
Day care centers	0	0	0	0
<b>2020</b>				
Total population	1,501	57	0	1,558
Racial and ethnic minorities	1,263	45	0	1,308
Total families	435	25	0	460
Low-income families	57	9	0	66
Noise-exposed residential single family units	454	27	0	481
Noise-exposed residential multi-family units	46	0	0	46
Schools	0	0	0	0
Churches	3	1	0	4
Hospitals	0	0	0	0
Nursing homes	0	0	0	0
Day care centers	0	0	0	0
<b>2030</b>				
Total population	2,075	135	0	2,210
Racial and ethnic minorities	1,744	116	0	1,860
Total families	565	44	0	609
Low-income families	80	11	0	91
Noise-exposed residential single family units	560	41	0	601
Noise-exposed residential multi-family units	63	10	0	73
Schools	0	0	0	0
Churches	3	1	0	4
Hospitals	0	0	0	0
Nursing homes	0	0	0	0
Day care centers	0	0	0	0

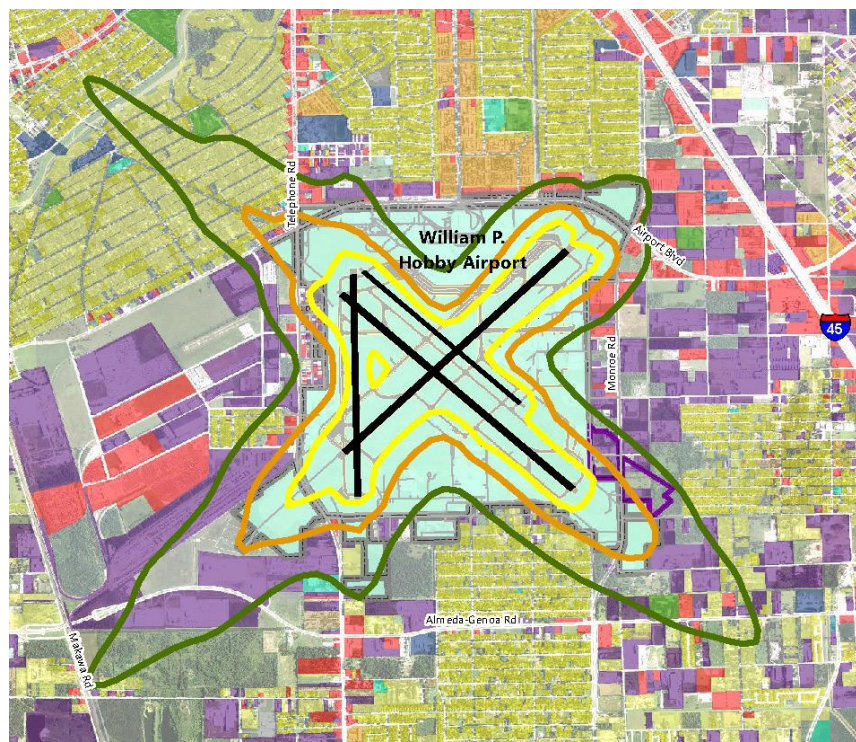
SOURCES: U.S. Census Bureau, 2010 Census and 2007-2011 American Community Survey; Quadrant Consultants Inc., 2014.  
 PREPARED BY: Quadrant Consultants Inc., 2014.

**Exhibit 10-4: 2011 Noise Contours Overlaid on Land Use**



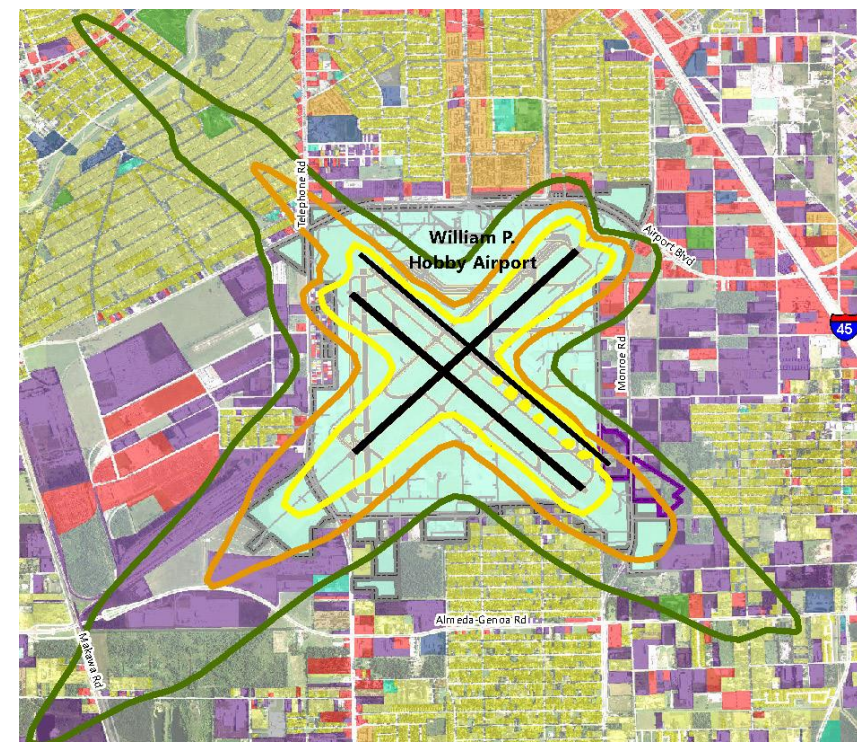
SOURCES: Houston-Galveston Area Council and Quadrant Consultants Inc., August 2014.  
 PREPARED BY: Quadrant Consultants Inc., August 2014.

**Exhibit 10-5: 2020 Noise Contours Overlaid on Land Use**



SOURCES: Houston-Galveston Area Council and Quadrant Consultants Inc., August 2014.  
 PREPARED BY: Quadrant Consultants Inc., August 2014.

**Exhibit 10-6: 2030 Noise Contours Overlaid on Land Use**



SOURCES: Houston-Galveston Area Council and Quadrant Consultants Inc., August 2014.  
 PREPARED BY: Quadrant Consultants Inc., August 2014.

LEGEND	
	Airport Runway
	Airport Property
	Potential Land Acquisition
	DNL 65
	DNL 70
	DNL 75

Land Use	
	Low Density Residential
	High Density Residential
	Multifamily Residential
	Mobile Home Residential
	School
	Church
	Public Park
	Private Park
	Noise Sensitive Institutional
	Other Institutional
	Commercial
	Industrial
	Utility
	Undeveloped

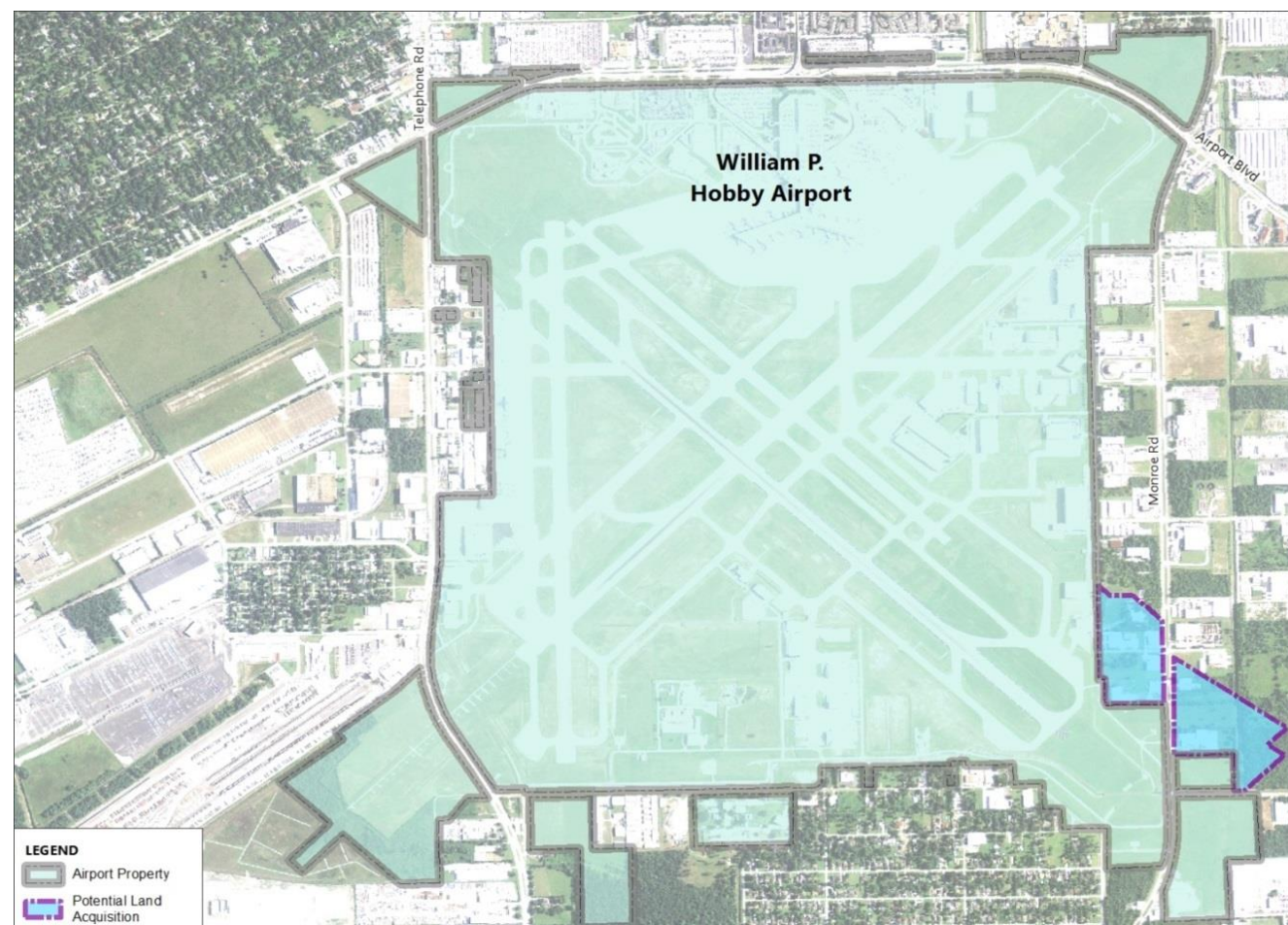
## 10.3 Socioeconomic Impacts and Environmental Justice

Airport development can affect the human environment by displacing homes and businesses or by changing access, traffic patterns and aesthetics. Potential social and economic impacts that may result from Airport development are discussed below

### 10.3.1 RELOCATION OF RESIDENCES AND/OR BUSINESSES

Development projects at the Airport will occur in several phases, as discussed in Section 7. Developments would include acquiring approximately 40.6 acres of land adjacent to the Airport for runway and taxiway extensions. **Exhibit 10-7** depicts the proposed land acquisition areas on the southeast side of the Airport. The proposed acquisition areas include industrial and undeveloped land uses. Only nine industrial businesses are proposed for acquisition, requiring the relocation of the affected businesses.

**Exhibit 10-7: Proposed Land Acquisition Areas**



SOURCE: Ricondo & Associates, Inc., August 2014.  
 PREPARED BY: Quadrant Consultants, Inc., August 2014.

### 10.3.2 SOCIOECONOMIC CHARACTERISTICS OF ADJACENT POPULATIONS

**Exhibit 10-8** depicts the existing population density in the Airport environs. A relatively large population base is concentrated north of the Airport in the apartment complex at the corner of Airport Boulevard and Broadway Street. Areas to the northwest, north, northeast, east, southeast, and south of the Airport are moderately populated, while areas to the west and southwest are less populous.

**Exhibit 10-9** shows low-income populations near the Airport. Much of the area around the Airport has some population that is low-income, and many of the populations in the area directly north of the Airport range from 33 percent to 50 percent below the poverty level. Large proportions of low-income residents are also located northwest, east and south of the Airport.

**Exhibit 10-10** shows the proportions of racial minorities (black, American Indian, Asian, other, and more than one race) in populations near the Airport. The exhibit shows that the populations northwest and north of the Airport are mostly racial minorities, and that racial minorities account for about half of the population in most of the area near the Airport.

**Exhibit 10-11** shows the proportions of residents in census block groups near the Airport who identified themselves as Hispanic. This exhibit shows that Hispanic populations are established in most of the area around the Airport, especially areas to the north, northeast and east.

The population within three miles of the Airport consists mostly of racial and ethnic minorities that are disproportionately below the poverty level (when compared to the greater Houston metropolitan area). Consequently, actions that affect populations near the Airport (such as property acquisition and changes in noise exposure) could affect minority or low-income populations disproportionately, and an environmental justice assessment will be required during the planning process for specific Airport projects in the ADP.

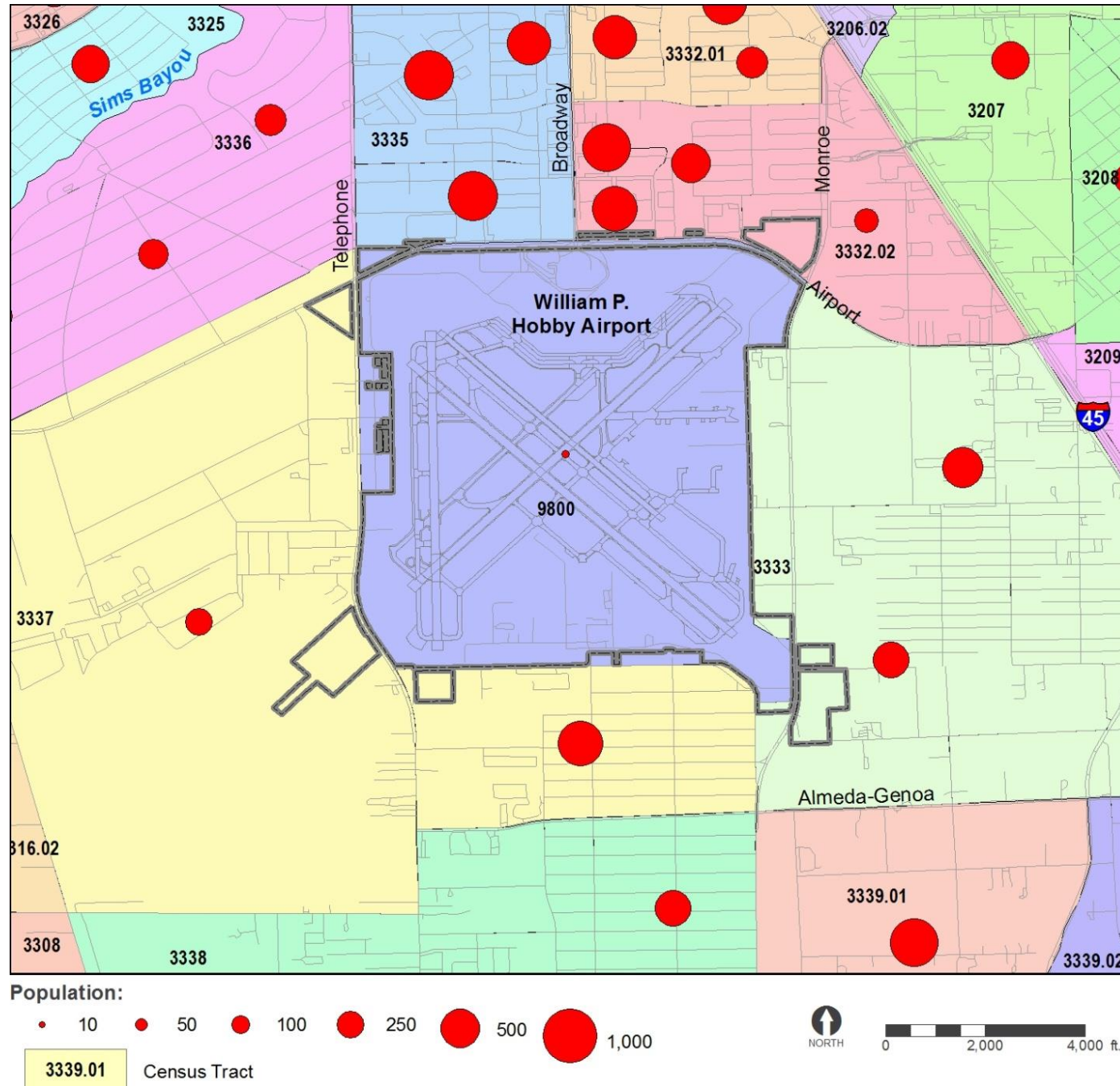
### 10.3.3 DISRUPTION OF ESTABLISHED COMMUNITIES

Master Plan projects would not disrupt established communities around the Airport.

### 10.3.4 ORDERLY DEVELOPMENT

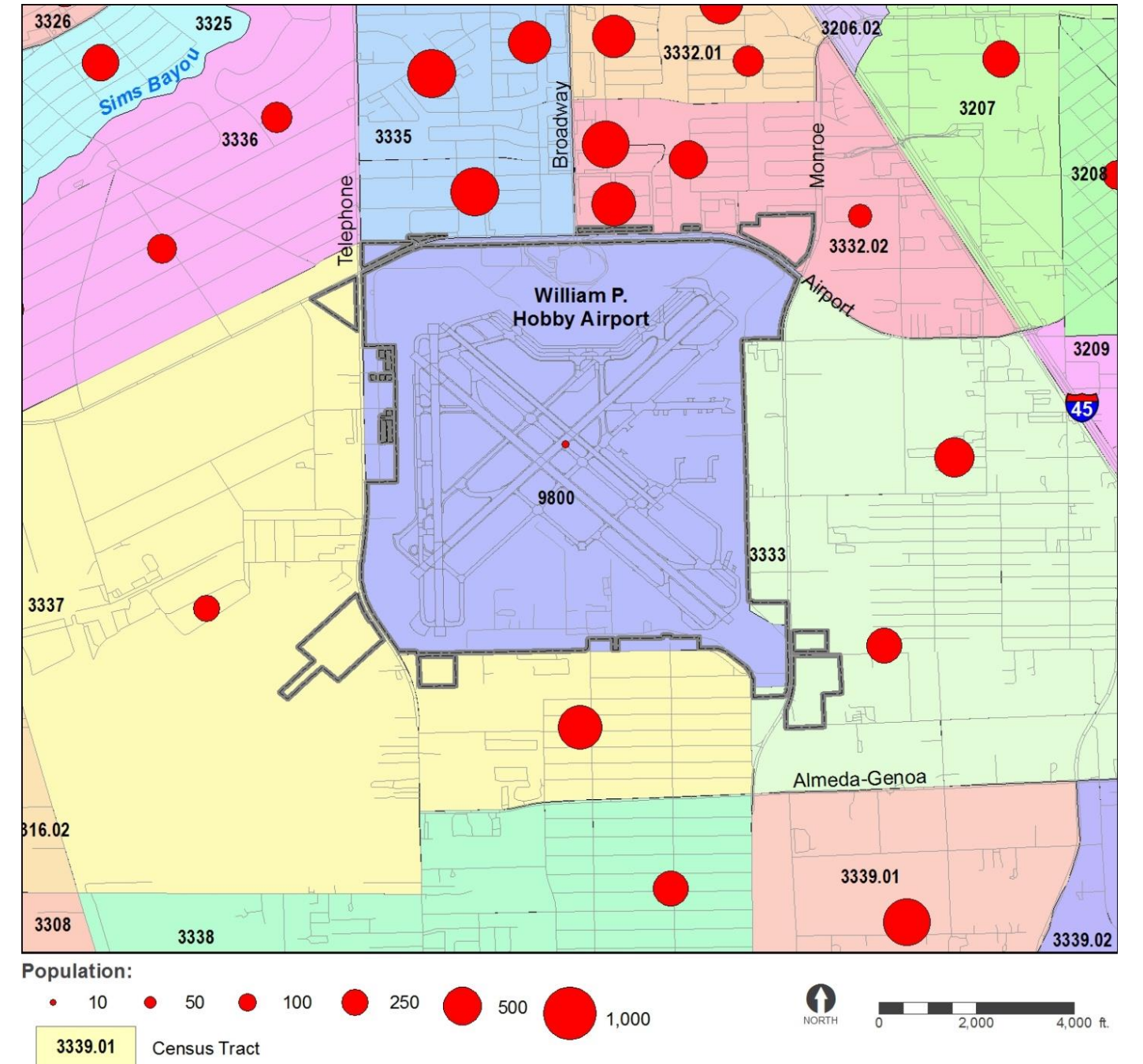
The ADP maintains compatible land uses and responds to increased ground access demand because of increased Airport use. Although the ADP would not affect current or planned development, it would change noise exposure in the community. Therefore, the ADP should be accompanied by an amendment to the City of Houston’s land use control ordinance for land use around the Airport. This ordinance protects the Airport from height hazards and protects surrounding land from incompatible land uses. As the Airport runways are expanded, the locations of incompatible land uses will change and, therefore, the areas designated for land use control tiers should also change. Timely amendment to the land use control ordinance would ensure the orderly development of compatible land uses near the Airport.

Exhibit 10-8: Population Density Map



SOURCE: U.S. Department of Commerce, Bureau of the Census, *American Community Survey 2007-2011*, December 2012.  
PREPARED BY: Quadrant Consultants Inc., 2014.

Exhibit 10-9: Low-Income Population



SOURCE: U.S. Department of Commerce, Bureau of the Census, *American Community Survey 2007-2011*, December 2012.  
PREPARED BY: Quadrant Consultants Inc., 2014.





### 10.3.5 EMPLOYMENT

The ADP would not displace many businesses. In addition, expansion of the Airport would provide jobs during construction, and new and expanded facilities at the Airport would provide permanent employment opportunities.

### 10.3.6 ROADWAY TRAFFIC NOISE

Increased automobile and truck traffic on Broadway Street, Airport Boulevard, Telephone Road, and Monroe Road as the result of increased activity at the Airport would also increase traffic noise. Apartments on Broadway Street and some residences adjacent to Telephone Road would be affected. However, most residential land is at sufficient distance from the major thoroughfares that they would not be significantly affected by increased roadway traffic noise.

## 10.4 Secondary Impacts

It is anticipated that the recommendations of the Master Plan will positively contribute to the business and overall economic climate of the area. The planned Airport development projects would increase the capacity of the Airport and, therefore, increase passenger and cargo traffic at the Airport over the planning period (through 2030). New businesses would be created on and around the Airport to handle the increased Airport activity.

## 10.5 Air Quality

Procedures to analyze and evaluate air quality at airports are described in the FAA report entitled *Air Quality Procedures for Civilian Airports and Air Force Bases*<sup>2</sup> and the U.S. Environmental Protection Agency's report *An Air Pollution Impact Methodology for Airports: Phase I*.<sup>3</sup> Existing air quality conditions in the Airport environs and ADP projects requiring air quality assessments are discussed below.

### 10.5.1 EXISTING CONDITIONS

The Airport is located in the Houston-Galveston-Brazoria Air Quality Control Region, which is currently designated a marginal non-attainment area for ozone. As such, the applicable *de minimis* emission levels are 25 tons per year for Nitrogen Oxides (NO<sub>x</sub>) and Volatile Organic Compounds (VOC). NO<sub>x</sub> and VOC are "ozone precursors" and their emissions are regulated in order to control the creation of ozone.

<sup>2</sup> Federal Aviation Administration. *Air Quality Procedures for Civilian Airports and Air Force Bases*, Report No. FAA-AEE-97-03, Washington, D.C., April 1997.

<sup>3</sup> U.S. Environmental Protection Agency. *An Air Pollution Impact Methodology for Airports: Phase I*, EPA Report No. APTD-1470, National Technical Information Service, Springfield, VA, 1973.

### 10.5.2 PROJECTS REQUIRING AIR QUALITY ASSESSMENTS

**Table 10-2** lists the major Master Plan Update projects, and indicates which types of air quality assessments may be required before each project receives FAA approval.

PROJECT	OPERATIONS EMISSIONS INVENTORY	CONSTRUCTION EMISSIONS INVENTORY	CARBON MONOXIDE ASSESSMENT	GENERAL POLLUTION ASSESSMENT
<b>Phase 1 (2014-2016)</b>				
Roadway improvements	✓	✓	✓	
General Aviation development	✓	✓		
Land acquisition				
<b>Phase 2 (2017-2019)</b>				
Concourse expansion	✓	✓		
Consolidated rental car facility		✓	✓	
<b>Phase 3 (2020-2023)</b>				
New cargo building	✓	✓		
Taxiway extension		✓		✓
Runway 12L-30R upgrade	✓	✓		✓
Runway 17-35 decommissioning				
<b>Phase 4 (2024-2030)</b>				
Terminal improvements	✓	✓	✓	

SOURCE: Ricondo & Associates, Inc., September 2014.  
 PREPARED BY: Quadrant Consultants Inc., 2014.

## 10.6 Water Quality

A comprehensive Storm Water Pollution Prevention Plan exists for HOU. When a specific project is planned, an approved storm water plan to control pollution and erosion must be developed. Since the area directly surrounding the Airport is already developed, drainage systems are in place to accommodate storm water runoff. The Airport area is closely monitored for the collection and treatment of liquid and solid wastes. However, with flooding that occurs during heavy rain events, particularly on the east side of the Airport, HAS and the City of Houston are concerned about ensuring that adequate detention is provided in association with new development.

Expansion plans related to future development is not expected to affect current drainage systems.

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## 10.7 Department of Transportation, Section 4(f) Lands

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Section 4(f) of the Department of Transportation Act of 1966 specifies that transportation projects cannot take land from public parks, historic sites, or wildlife refuges without first determining that there is no reasonable and prudent alternative. Takings can include physical acquisition of lands or significant environmental impacts to such lands due to noise, pollution, etc., which make the lands unsuitable for their desired use. No public park is recommended for acquisition under this Master Plan Update.

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## 10.8 Historic, Architectural, Archaeological, and Cultural Resources

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The original passenger terminal (which was also the original U.S. Customs building) is the most recognized structure on the Airport with historical and architectural significance. This structure is listed as a historic site by the Texas Historical Commission, but is not currently listed on the National Register of Historic Places. The two-story, open floor plan building was constructed in 1937 as the primary facility for processing departing and arriving passengers. The Houston Aeronautical Heritage Society has been renovating the building, and the 1940 Air Terminal Museum was opened in early 2004. The museum is being restored to the style of its original era. Eventually the building will include a restaurant. The building is on Airport property, within the area exposed to DNL 65, but because it is aviation related, it is compatible with aircraft noise.

A second building with potential historical and architectural interest is the Continental Airlines Aircraft Parts Hangar. This building is also not on the registry of the Texas Historical Commission. The hangar is located on the west side of Airport property, parallel to and at the midpoint of Runway 17-35. This hangar, constructed in 1937, appears to be in good condition. It is currently used as an aircraft parts hangar. There are no plans to change its use.

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## 10.9 Biotic Communities

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The Airport is in an urban environment. Highly managed biotic communities typical of urban areas can be found on and around the Airport. As projects from this Master Plan Update are developed, further surveys and assessments of biotic communities that may be affected will be performed. Runway expansion projects and roadway relocation projects would have greater potential to affect biotic resources than apron expansion or building re-development.

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## 10.10 Endangered and Threatened Species of Flora and Fauna

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The U.S. Fish and Wildlife Service (USFWS) is the primary agency responsible for determining which species are threatened or endangered with regard to extinction, and providing for their continued survival. The Texas Parks and Wildlife Department (TPWD) also lists endangered and threatened species in Texas, along with species and habitats of concern (which have no protection status), and works to preserve them.

A field reconnaissance was conducted on August 7, 2013, to observe areas subject to land acquisition and Airport property expansion. These areas consist primarily of vacant grass lots of the prairie and woodlot types, as well as industrial buildings or properties. Therefore, it is not anticipated that these types of biotic communities present in the undeveloped lots are rare or endangered or that these areas are habitats to rare or endangered species.

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## 10.11 Wetlands

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Wetlands are habitats that are frequently inundated or saturated with water, have soils that show the effects of saturation, and support species of plants that are suitable for wet conditions. The potential presence of wetlands was assessed by offsite methods for the proposed acquisitions and the future Airport boundary. Color infrared aerial photographs and soil surveys were reviewed for this assessment. The photograph presented on **Exhibit 10-12** shows that the vicinity of the project area is mostly developed with impermeable surfaces. Three potential wetlands were found from the inspection of aerial photographs and observations of public rights-of-way. However, field verification would be required to determine whether these potential wetlands are actually wetlands.

As projects are developed from this Master Plan Update, fieldwork and coordination with the U.S. Army Corps of Engineers would be required to determine whether wetlands are present, delineate their boundaries and determine whether they are jurisdictional under Section 404 of the Clean Water Act.

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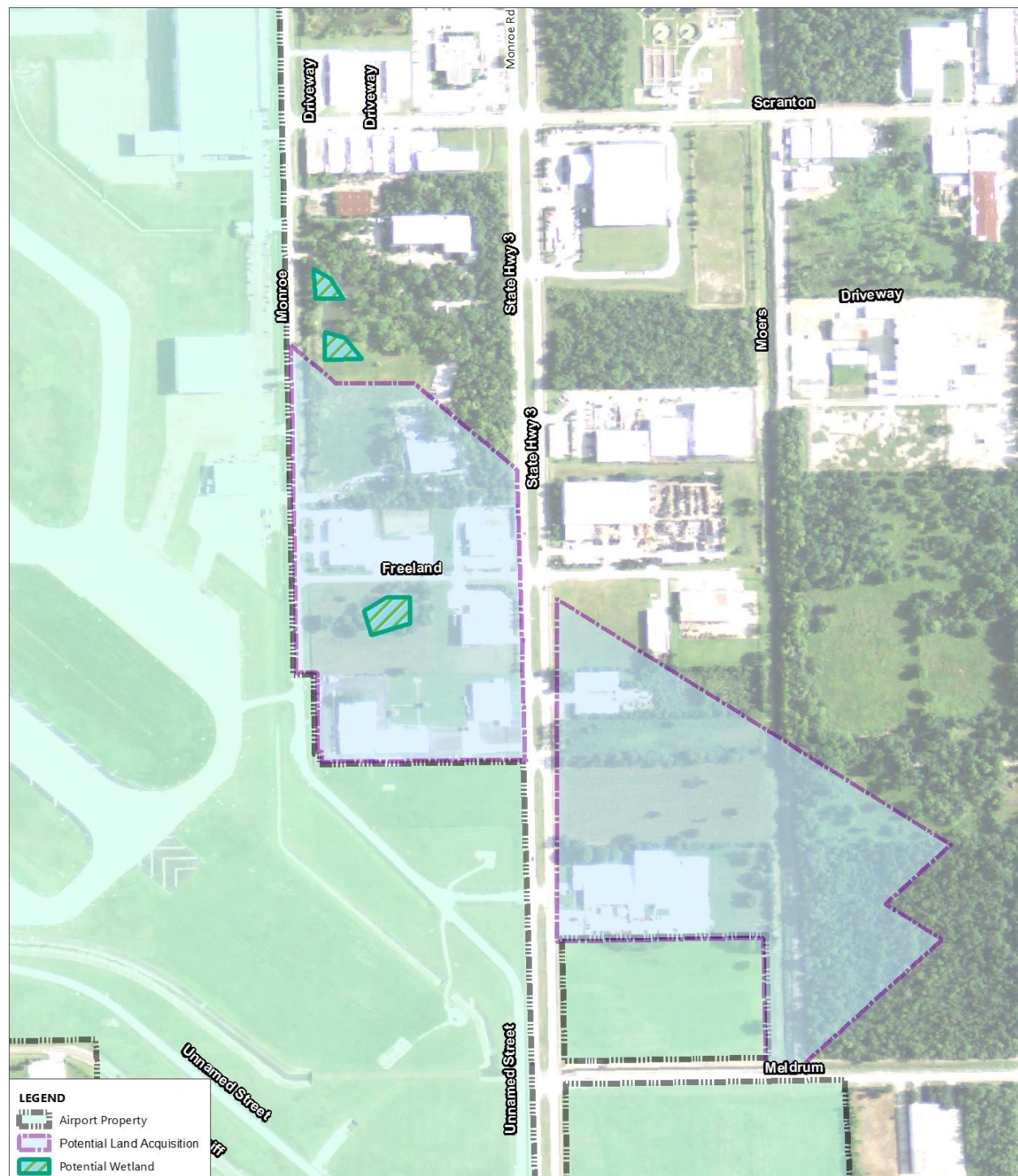
## 10.12 Floodplains

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Executive Order 11988, Floodplain Management, requires federal agencies to avoid or minimize activities that directly or indirectly result in developing floodplain areas. The City of Houston is a participant in the National Flood Insurance Program. The Flood Insurance Rate Map (**Exhibit 10-13**) prepared by the Federal Emergency Management Agency shows that 199 acres of Airport property are within the 100-year floodplain. Acquisition of land for Master Plan Update projects would add 30 acres of land in the 100-year floodplain, resulting in 229 total acres of Airport property in the 100-year floodplain by 2030.

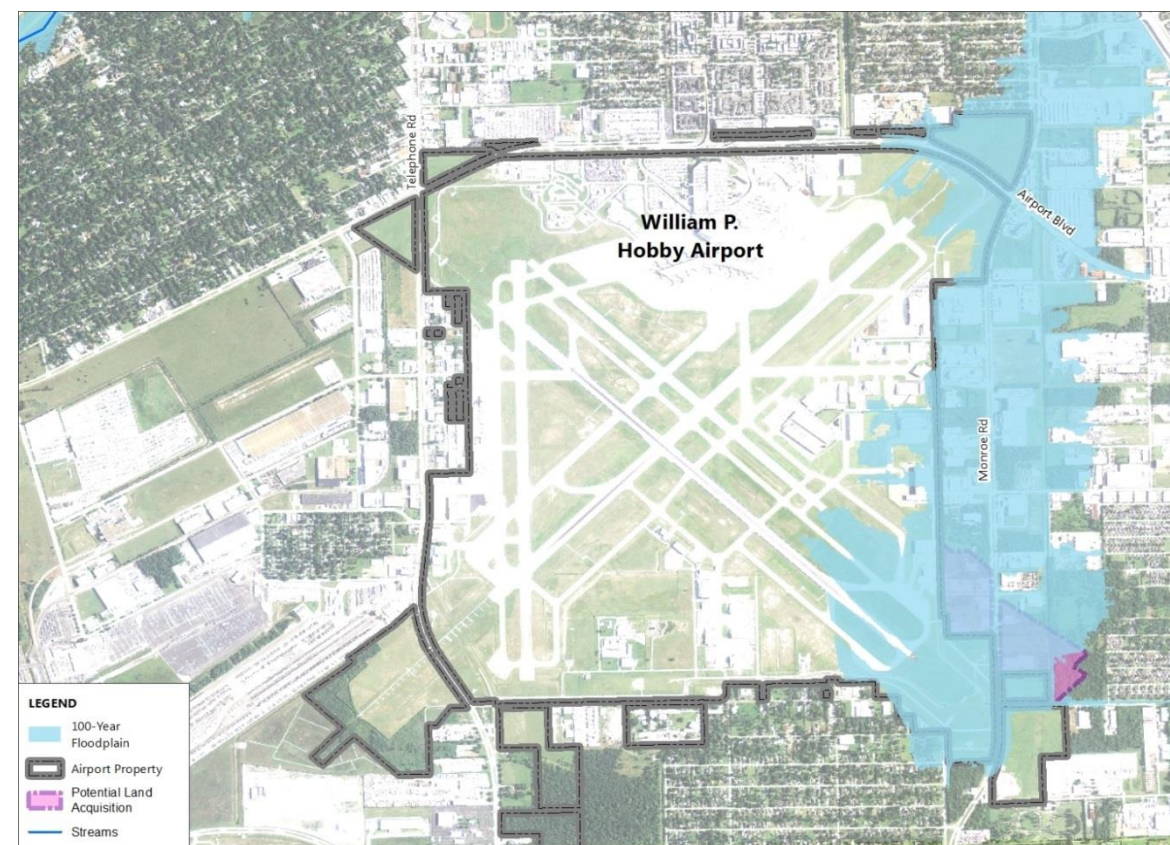
For development areas larger than 10 acres, onsite or offsite detention ponds would be required to mitigate the storm water runoff. For development areas that are 10 acres or less, a fee must be paid to the Harris County Flood Control District to compensate for the increased water runoff. The District is responsible for providing the necessary drainage infrastructure improvements to accommodate the increase in water runoff from the development areas that are less than 10 acres.

**Exhibit 10-12: Potential Wetlands on Lands to Be Acquired**



SOURCE: Quadrant Consultants, Inc., August 2014.  
 PREPARED BY: Quadrant Consultants, Inc., August 2014.

**Exhibit 10-13: 100-Year Floodplains**



SOURCE: Federal Emergency Management Agency, *Flood Insurance Rate Map*, No. 48201 C 0895L, June 2007.  
 PREPARED BY: Quadrant Consultants, Inc., August 2014.

### 10.13 Coastal Zone Management Program

The Texas Coastal Management Plan, administered by the Texas General Land Office, governs the management of coastal resources along the Texas Gulf Coast. Projects for which State support is sought must be consistent with the Coastal Management Plan. The Airport is not within the area covered under the Coastal Management Plan and, therefore, Airport expansion will not affect the coastal management program.

### 10.14 Coastal Barriers

Coastal barriers are narrow islands or margins along the Texas Gulf Coast with active dunes (or structures built to replace them). In Texas, these barriers are managed to prevent beach erosion. The Airport is not on a coastal barrier. Therefore, the ADP will not affect coastal barriers.

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## 10.15 Wild and Scenic Rivers

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Wild and scenic rivers are designated by the U.S. Department of the Interior to protect the most beautiful and unspoiled rivers in the nation under the Wild and Scenic River Act. These rivers have exceptional beauty, historic and natural sources, aquatic and wildlife habitats and geological values. Only one river in Texas, the Rio Grande at Big Bend, is currently designated a wild and scenic river. The Airport is not near this river. Therefore, Airport expansion will not affect a wild and scenic river.

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## 10.16 Farmland

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The preservation of prime farmland is a priority goal for the U.S. Department of Agriculture, and the effects of projects with federal support on prime farmland must be assessed. The Airport is in an urban area. No farmland is on or adjacent to the Airport, and no farmland would be lost because of the proposed Airport Master Plan Update projects.

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## 10.17 Energy Supply and Natural Resources

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The Airport is not an energy-producing facility, nor does it produce mineral resources. The effects of Airport development on energy and natural resources are generally related to the amount of energy required for stationary facilities (i.e., terminal building cooling or heating equipment, electrical lighting for interior and airfield, and approach or radar control systems), and movement of aircraft and ground vehicles. The energy and natural resource providers for the Airport will be able to meet the future demand for energy at the Airport.

### 10.17.1 ELECTRICITY

It is estimated that electricity consumption would increase less than 10 percent of current consumption, with increasing power-using facilities partly offset by energy conservation measures. Currently, Reliant Energy provides electric power to the Airport.

### 10.17.2 PETROLEUM-BASED FUELS

It was estimated during the master planning process that fuel consumption at the Airport may increase by about 35 percent between 2011 and 2030. Fuel suppliers are projected to have adequate fuel to supply the Airport throughout the planning period.

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## 10.18 Light Emissions and Visual Impacts

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Emissions from navigational aids and illumination on the airfield and terminal, and from parking areas can annoy residents near the Airport if their homes are on a line of sight with Airport light sources. Light sources are located throughout the airfield and beyond the ends of the runways, and around the terminal building. The consolidated rental car facility would

be lit at night, but these areas are already illuminated at night and the new facilities would not introduce lighting to formerly unlit areas.

Light emissions would also occur during construction. Airfield construction operations would likely occur at night, and construction lighting would be local and shielded to reduce interference with ongoing aircraft operations. These areas are far from residential areas, so light emissions should not affect them. It is not anticipated that nighttime construction would occur for the consolidated rental car facility.

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## 10.19 Solid Waste and Hazardous Materials

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The Airport currently generates about 6,530 tons of solid waste per year. Solid waste concerns the Airport and the surrounding community in two ways. The first is disposal to secure and regulated disposal sites. The second is the effect of larger quantities of solid waste in the future due to Airport improvement projects on the disposal sites serving the Airport.

### 10.19.1 MUNICIPAL SOLID WASTE LANDFILL SITES

Municipal solid waste landfill sites near an airport pose a potential hazard to aircraft operations because they tend to attract birds that feed on rodents and other food sources found at these sites. Birds flying or migrating to and from the area can cross into the arrival and departure path of an aircraft and impede the overall safety of the flight.

The Airport's solid waste is accumulated in four 30-yard compactors and three 30-yard open-top disposal units. The refuse is collected on call or at scheduled times for each compactor. The refuse is disposed of by McCarty Road Landfill of Texas, LP, at the McCarty Road Landfill in northeast Houston. This landfill is more than 14 miles from the Airport, and is anticipated to be able to handle refuse collection beyond 2022. Adequate storage capacity is available in area landfills to handle solid waste from the Airport during the planning period.

### 10.19.2 HAZARDOUS MATERIALS

Databases maintained by the U.S. EPA and the TCEQ were searched on April 26, 2013, for sites on or near the Airport with soil or groundwater that may have been contaminated by hazardous substances. 331 records of sites with potential for contamination were found, 77 of which are on Airport property and one is on land proposed to be acquired for projects recommended in this Master Plan Update.

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## 10.20 Construction Impacts

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Construction activities can create impacts at the construction site and in the surrounding area. These impacts are generally temporary in nature, and subside once construction is completed. Through prudent engineering and construction practices, construction impacts associated with the proposed project can be minimized. The affected environmental categories include air quality, noise, water quality, and solid and hazardous waste. The traffic can also affect the environment.

### 10.20.1 AIR QUALITY

Construction activities can affect air quality around the Airport through emissions of pollutants from construction equipment and through the generation of fugitive dust from demolition, construction, and material and waste hauling. A general conformity analysis may be necessary for each construction project.

Construction of the Master Plan Update projects would generate fugitive dust when dry bare soil is exposed to wind erosion, especially during clearing and earth-moving operations. The effect of fugitive dust generation during construction would be to increase dust fall downwind of the area of active construction, generally within the construction area. Construction contracts will include provisions to water bare soil to minimize wind erosion and fugitive dust generation.

### 10.20.2 NOISE

Noise would be generated during construction by onsite equipment and heavy vehicles entering and leaving construction sites. Most vehicles delivering items to the construction sites would be expected to be active only during daylight hours. All construction would be on Airport property, at sufficient distance from residential areas and other noise-sensitive land uses to not cause significant noise impacts.

### 10.20.3 WATER QUALITY

Construction activities for the Master Plan Update projects can cause erosion or siltation mainly resulting from storm water runoff. A National Pollutant Discharge Elimination System (NPDES) construction permit application, which is required for all construction areas of 5 acres or more, must be filed with U.S. EPA Region 6 for all construction activities related to the proposed projects. As part of the NPDES permit application, a construction Storm Water Pollution Prevention Plan will also be prepared. This plan will require erosion and siltation control measures, such as silt fences, hay bales and retention basins, to protect water quality during construction.

### 10.20.4 SOLID AND HAZARDOUS WASTE

Construction would generate solid waste from demolitions and excavations. This construction material would be removed from Airport property and disposed of in an appropriate landfill. Construction of proposed projects would not be expected to generate hazardous materials, but further analysis will be required to confirm this, as stated in Section 10.19. Any hazardous waste would be disposed of according to applicable local, State of Texas and federal regulations.

### 10.20.5 TRAFFIC

Construction vehicles would access the Airport via major thoroughfares wherever possible and not via residential streets. The temporary disruption of traffic flow is possible during construction, but, where possible, such disruption would occur during off-peak hours.





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