CHICAGO EXECUTIVE AIRPORT

AIRPORT MASTER PLAN UPDATE & AIRPORT LAYOUT PLAN

December 2021

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Chicago Executive Airport

Airport Master Plan Update
&
Airport Layout Plan

Final Report

Prepared for:
Chicago Executive Airport Board of Directors

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Section 1
Inventory

1.1. Introduction

The Chicago Executive Airport (PWK or CEA) completed a full Inventory of the existing conditions as part of a separate Planning Report in 2011. The general layout, usage and mission of CEA have not changed significantly enough since 2011 to warrant the development of a new Inventory section at the time of the Airport Master Plan. As such, the 2011 Inventory has been reviewed and deemed relevant to the existing conditions of PWK today. The inventory conducted as a part of this 2011 Airport Planning Report can be found in Appendix A.

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Section 2

Forecast

2.1. Introduction

Developing a comprehensive forecast for activity at an airport over a 20-year planning horizon involves the consideration and analysis of many factors. Due to the complex nature of aeronautical demand at an airport located within a major metropolitan area, the "demand" factors can vary greatly. A comprehensive forecast should include factors that range from complex data-based quantitative measures to anecdotal qualitative observations supported by the users. This assertion is especially true for Chicago Executive Airport (CEA or PWK).

2.1.1. Background

In 2014, a Phase 1 Master Plan was initiated at CEA to determine the future planning needs of the airport. The four guiding principles established as the foundation for future planning activity in this report included:

1) *Integrating the Airport within the local communities*
2) *Fulfilling the Airport's role*
3) *Enhancing the Airport's safety and compatibility*
4) *Maintaining the Airport's financial viability*

Based on the findings within the Phase 1 Master Plan report, the airport initiated a second phase of the master planning process. The purpose of the second phase is to further define future demand, constraints, and impacts that were identified within first phase.

This forecasting document will serve as a component of the Phase 2 Master Plan. It will help establish the Airport's constraints and potential demand scenarios to better understand the future planning needs of CEA.

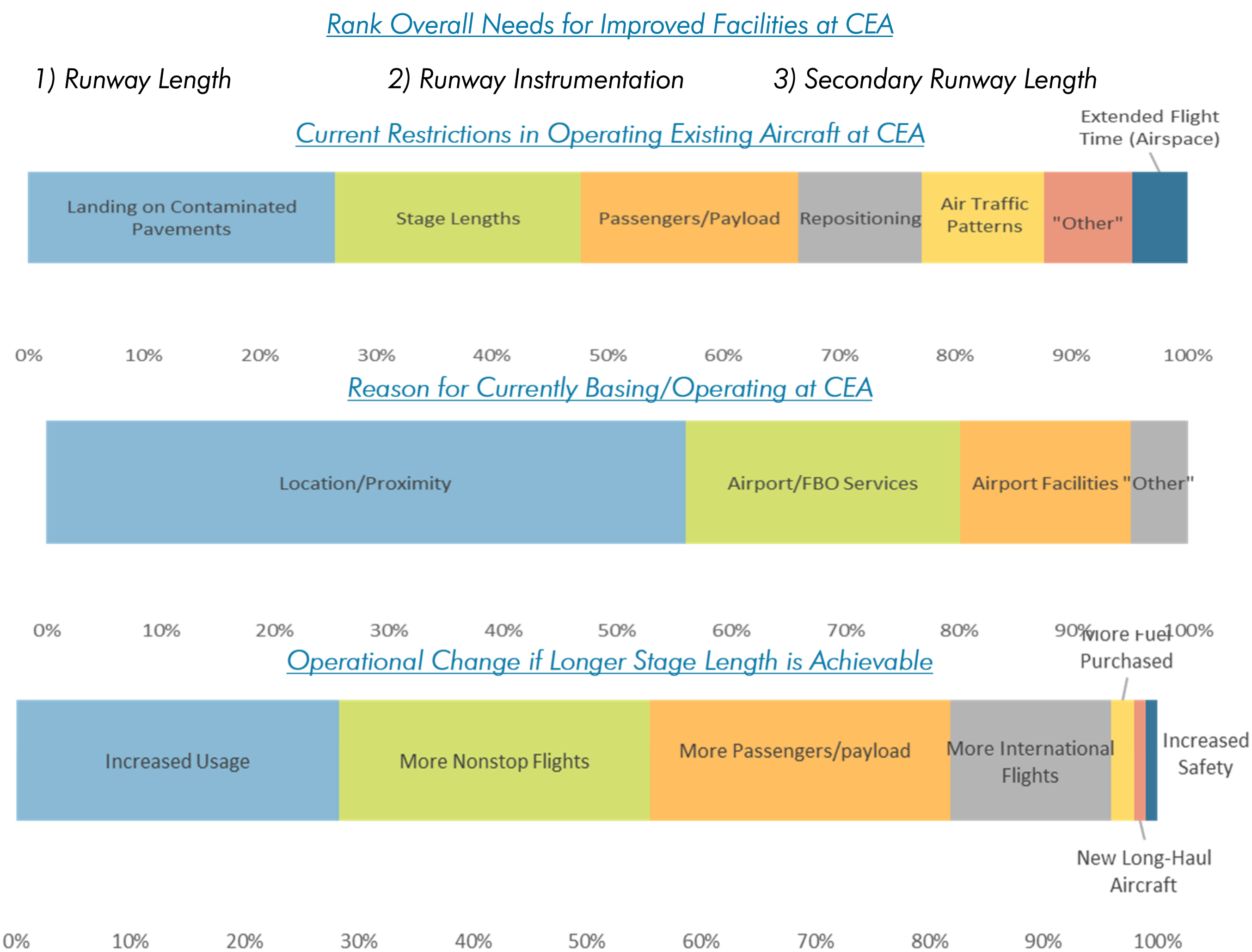
2.1.2. Constraints

CEA is unique because it serves as the top Chicago metropolitan area reliever in both itinerant and local operations, yet users consider it to be constrained relative to comparable relievers in the nation. These constraints have been generally understood by the airport and users for many years; however, they were further defined in the Phase 1 Master Plan through user surveys. As direct influencers of demand, these constraints are a major factor to consider when forecasting future operations.

<u>Phase 1 Master Plan Surveys</u>: The surveys within the Phase 1 Master Plan were distributed to both existing users and potential corporate users via two separate versions. The first version was provided electronically and in hardcopy to the users at CEA. The second, more condensed version was provided to pilots at a National Business Aviation Association Conference (NBAA) in October 2014. In total, there were over 300 participants that provided insight on CEA's constraints that impact existing users and

prevent potential users from operating at CEA. **Figure 2-1** provides a graphical summary of the key questions from the Phase 1 Master Plan survey.

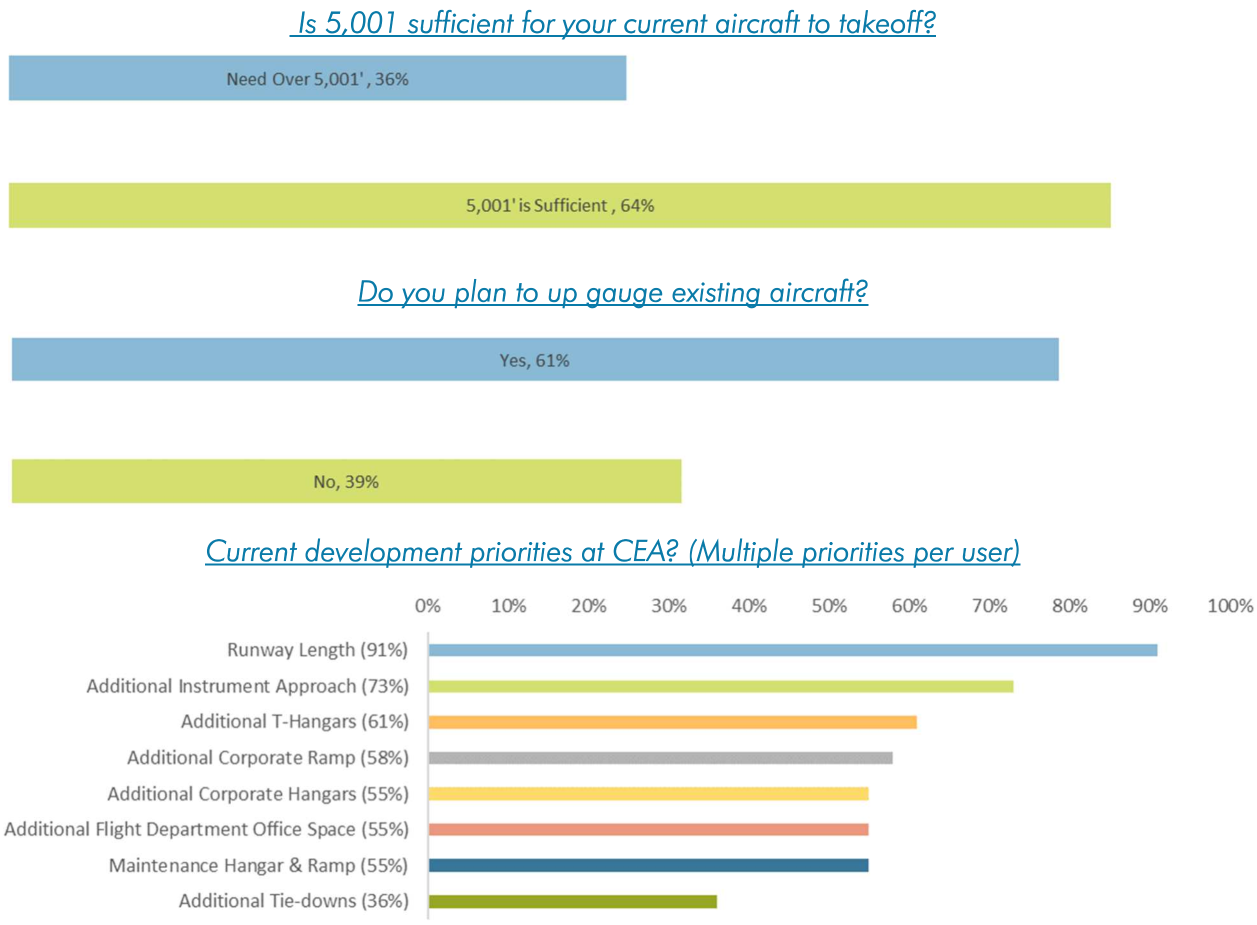
Figure 2-1:
Phase 1 User Survey



Source: CMT (2015)

Phase 2 Master Plan Survey: To better understand the constraints identified in the Phase 1 Master Plan, an additional survey was developed as an element of the Phase 2 Master Plan. The surveys in Phase 2 were distributed to existing tenants and users at CEA. The survey was an electronic form that included the participant's information, type of operation, and questions regarding the constraints identified in the Phase 1 Master Plan. The following are the key questions and responses included within the survey shown in **Figure 2-2** below.

Figure 2-2:
Phase 2 User Survey



Source: CMT (2015)

Survey Summaries: In both the Phase 1 and Phase 2 surveys, the primary constraint identified is related to the runway length. Phase 1 survey results show that CEA users consider additional runway length as the number one priority for future improvements. Further, the participants acknowledge that their operations would improve in a variety of ways should the runway be extended. In the Phase 2 survey, additional runway length is confirmed as the number one priority for users and over one third of the users indicate their aircraft cannot takeoff with 5,001' at max takeoff weight. One important response that may increase the magnitude of the runway length constraint is that 61% of the users intend to up-gauge, or increase the size of, their current jet. This would suggest that in the near future, the majority of users that are currently unconstrained, will potentially be constrained.

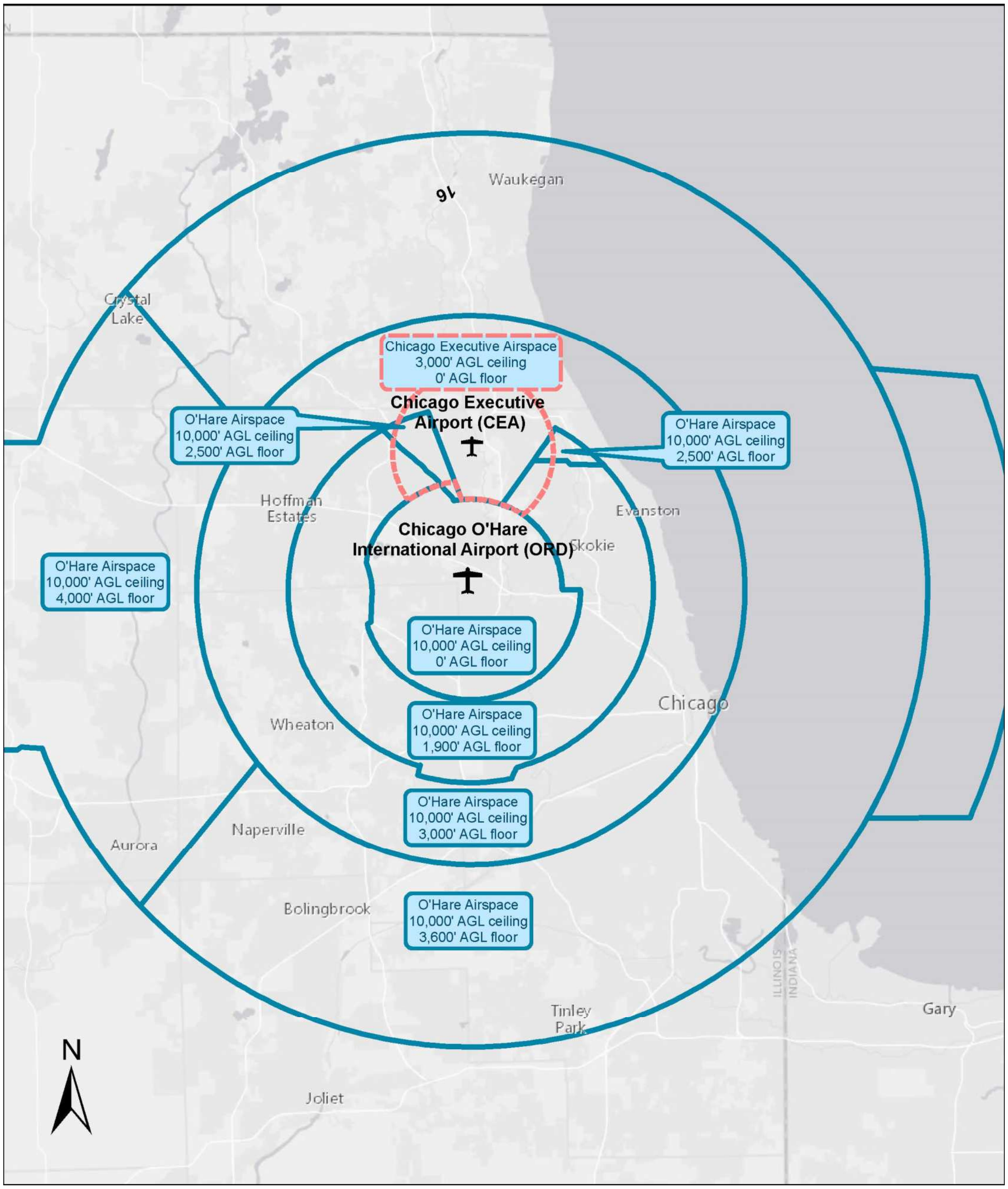
In addition to the identification of the runway length as the primary constraint, there were several other secondary constraints identified. These constraints include a need for additional instrument approaches with lower minimums, contaminated runway concerns, airspace delays, additional hangar space, additional corporate office space, and additional ramp space. All these constraints are extremely important to an operator, especially when considering an airport to base an aircraft at. These constraints *impact the efficiency and effectiveness of operations, deterring users from basing and/or operating at CEA.*

<u>*Phase 2 Master Plan Interviews*</u>*: In addition to the surveys, several interviews were conducted with select tenants at CEA, as well as fractional and charter users of the Airport. A fractional operation is defined as multiple parties that own or share a corporate jet. Charter operators are when a fully staffed corporate jet is essentially rented to a customer. Within the Chicago area, over 50% of all corporate jet operations are conducted by fractional or charter operators.*

The interviews confirmed many of the constraints that were identified in the surveys, with the primary constraint being the runway length. As a factor of runway length, a highly emphasized concern was landing during contaminated runway conditions by fractional and charter operations. As a fractional or corporate operator with a turbojet, the FAA has established more restrictive landing regulations to abide by compared to most private corporate fleets. These regulations require fractional and charter operators to factor in additional calculations when landing on precipitation-induced contaminated runways. Contaminated runway conditions are when precipitation (rain, snow, ice) has collected on the landing runway surface. These impacts will be discussed further within this report.

Interviews with users at CEA also brought attention to airspace constraints that were originally identified in the Phase 1 study. These airspace constraints result from CEA's location within the Chicago airspace system. CEA lies under Chicago O'Hare's (ORD) class B airspace which creates an extended routing scenario for aircraft traveling to CEA, especially from the south. Extended airspace routing can cause flight delays that impact and deter users from operating at the Airport. Another factor of CEA's proximity to ORD's class Bravo airspace is that it only allows for instrument approaches from the north. This severely limits access to the airport during inclement weather, especially when winds are not favoring the northerly Runway 16. ***Exhibit 2-1*** *depicts the location of CEA in comparison to ORD's Class B airspace.*

Exhibit 2-1:
Chicago O'Hare International Airspace



Source: CMT (2016)

The greatest takeaway from the surveys and interviews was the notion that the constraints are significant enough to discourage many users from either operating or basing their operations at CEA. With this understanding, it can be deduced that an unconstrained CEA would have a significant impact on both operations and based aircraft. This forecast will investigate the impact of these constraints, how they have an effect on existing operation, and the potential effect on operations if CEA was not constrained.

2.2. Economic Outlook

Aviation plays an extremely important role in the economies of the world. It facilitates the fast and efficient transportation of goods and people, allowing for a greater connectivity of markets and businesses.

Under most circumstances, the economy shares a direct relationship with the aviation industry. As the economy grows, the aviation activity within that economy also grows. Similarly, in many instances the development of aviation infrastructure has helped stimulate the local economy. Because of this important mutualistic connection between the economy and aviation industry, it is necessary to understand the economic factors that can influence the forecasting of aviation activity at an airport.

At CEA, there are three primary economies of concern, including: Chicago Metropolitan Statistical Area (MSA), U.S./national, and worldwide economies. These economies are listed in order of magnitude and influence on CEA's aviation demand.

2.2.1. Chicago Metropolitan Area Economy

The Chicago metropolitan area is a vast and diverse economic system. Chicago ranks number three in the Nation's Gross Domestic Product (GDP), trailing only behind New York and Los Angeles. When considering Chicago on the global scale, Chicago has the 23rd largest GDP out of all of the world economies.[1]

Having such an enormous economy and GDP does not come without pitfalls. Following the recession in the late 2000s, Chicago lost nearly 331,000 jobs, a 7% total decline in the metropolitan job market, since its peak in 2008.[1] Despite the significant drop in the job market during the recession, Chicago fared better than the majority of the other national metropolitan areas, showing considerable resiliency throughout the recession. In Q4 of 2015, Chicago has reached its pre-recession job peak which was in Q1 of 2008.[1]

Beyond the relatively quick recovery from the economic recession, Chicago's economy is showing tremendous growth. This growth has been primarily in the Loop and River North locations, both within Chicago's downtown business district. These locations have been hotspots for both tech start-ups and long-established Fortune 500 companies relocating headquarters. This great influx of companies to the Chicago downtown area has helped stimulate significant employment opportunities which further fuels the downtown economy.

> *"The explosion of tech-related hiring on the Near North and West sides and corporate relocation such as Motorola Mobility and United Continental Withholdings from their suburbs suggest that this new economic engine has reached a critical mass, enabling its growth to become self-perpetuating."*
> *-Moody's – State of Illinois Economic Forecast*

One of the quickest growing markets in Chicago is the technology and start-up industry. Chicago's tech center has grown more than 30%, placing it at number three in national tech markets in 2013. This tech market not only generates billions of dollars in investments but also thousands of high-income jobs, with *an average of $80,000 per year.[2] As a market driven by globally backed venture capitalist funding, it is an industry that promotes frequent national and worldwide travel.*

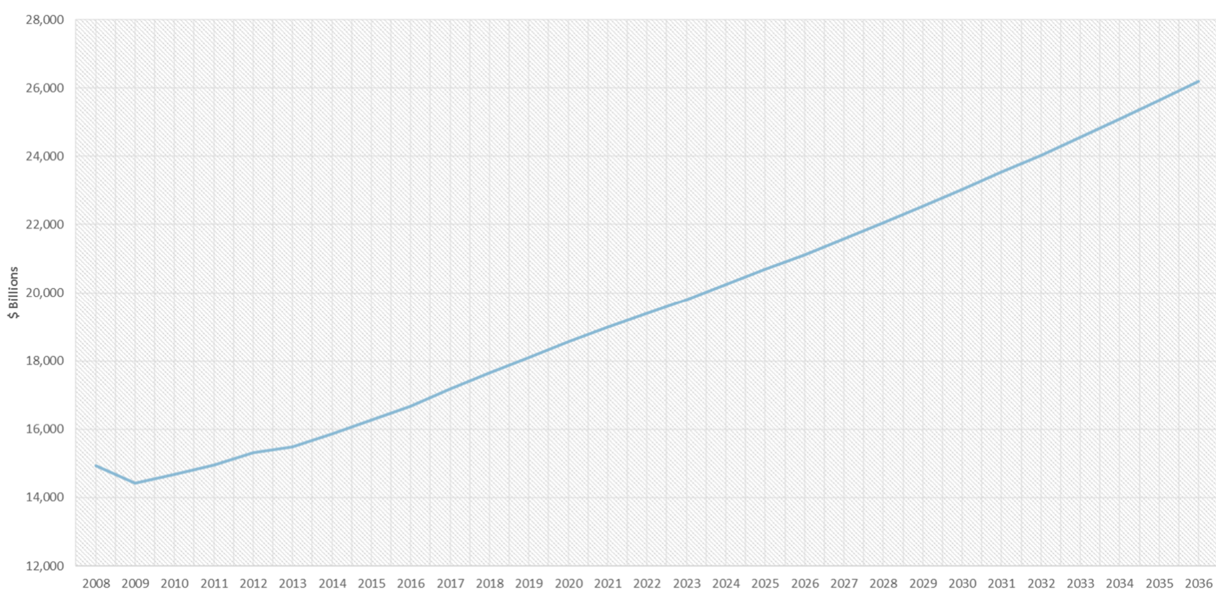
Often these technology start-ups are collocated in tech centers called incubators or accelerators. The largest 15 of these incubators, which house several start-ups in one location, are located in the downtown Loop or River North area.[2]

2.2.2. National Economy

As mentioned in the Chicago economic outlook, the U.S. national economy suffered a recession in the late 2000s. This recession resulted in millions of job losses and contraction of billions of dollars in GDP.

Despite this downturn from the recession, the national economy as a whole has rebounded and is showing positive signs. After a sharp decline of GDP in 2009, the national economy has grown at a Compound Annual Growth Rate (CAGR) of 2% through 2015. By 2036, the GDP will have grown at a CAGR of 2.3%.[4] Ultimately, this growth represents a stable economic economy, which provides a favorable indicator for the national aviation market, shown in Figure 2-3.

Figure 2-3:
United States Gross Domestic Product



Source: FAA Aerospace Forecast (2016)

2.2.3. Global Economy

The United States was not the only economy to experience a recession. During the same period of time, Europe experienced a similar recession and the global economy GDP declined for the first time since the 1930s. While some of the European countries are still struggling to recover, the global economy as a whole has improved considerably. Through 2036, the global GDP is forecasted to grow at an average annual growth of 3.4%

The greatest growth in the global economy has been found in the emerging economies. In 2015, the two largest emerging economies, India and China, grew 7.5% and 6.8%, respectively.4 These emerging markets are forecasted to continue growth above the average global rates. This is important because quickly growing emerging economies pose a significant beneficial impact to the aviation industry. Based on an Aviation Economic Benefit report published by the International Air Transportation Association 5, the relationship between economic connectivity and economic productivity is logarithmic, primarily in developing economies. This means that, as connectivity of a developing economy increases, the productivity of that economy grows exponentially in comparison to an already developed economy. When this is considered from the perspective that existing emerging economies are growing at such high rates, especially compared with the rest of the global economy, it would seem to indicate that the aviation connectivity is one of the primary contributors and/or resultants.

As the emerging economies continue to grow, it can be expected that the increase in connectivity and GDP will begin to influence the international aviation industry within the U.S. This will be necessary to facilitate business and trade with quickly growing emerging countries as their exporting capability and importing needs grow. As the top corporate reliever in the nation's third largest city in the United States, CEA could be well positioned to facilitate the influx of quickly growing international business.

2.3. Trends and Industry Forecasts

In order to accurately forecast demand at an airport, there needs to be a quantifiable basis for generating the proposed growth rates. The basis of this forecast is founded upon two core components: industry trends and industry forecasts.

2.3.1. Trends

To develop the most representative trends, they should be as specific as possible. Since general aviation (GA) airports and aircraft serve such diverse roles within in the aviation industry, GA aircraft and airports have been further specified by aircraft classification and airport for this trend analysis. The trends found within this section have been established from 2011-2015 using the FAA's Traffic Flow Management System Counts (TFMSC) data.

<u>Aircraft</u>: General Aviation aircraft can range from small experimental aircraft to large corporate jets. To develop trends for aircraft that operate at CEA, the aircraft classifications in Table 2-1 *have been established.*

Table 2-1:
Aircraft Classification

Aircraft Classification					
Propeller Engine	**Weight**	**Passengers**	**Range**	**Typical Model**	**Role**
Piston	< 12,500 lbs.	3	1,000 NM	Cessna 182	Recreational & Training
TurboProp	< 15,000 lbs.	12	1,500 NM	King Air 200	Regional Business
Jet Engine	**Weight**	**Passengers**	**Range**	**Typical Model**	**Role**
Light Jet	< 15,000 lbs.	6	1,500 NM	Embraer Phenom 100	Continental U.S. Business
Small Jet	15,001 - 40,000 lbs.	12	3,000 NM	Citation 680	Transcontinental Business
Medium Jet	40,001 - 70,000 lbs.	16	4,000 NM	Challenger 600	Intercontinental Business
Large Jet	> 70,000 lbs.	20	5,000 NM	Gulfstream 550	Global Business

Source: CMT (2016)

The aircraft in Table 2-1 *have been classified for two primary reasons. First, each category of aircraft has comparative operating characteristics such as weight, takeoff/landing requirements, and stage lengths. Second, as a function of the aircraft operating characteristics, each aircraft generally serves different user group needs. To accurately define the trends in such varying demand profiles, this forecast will consider growth rates of each aircraft classification separately.*

Airports: Airports can also vary greatly within the General Aviation system. For this trend analysis, the Chicago Area corporate airports and top 25 relievers in the nation by Instrument Flight Rules (IFR) operations have been selected. These groups have been chosen because they are most representative of CEA's operational profile for the regional and national trends, respectively. See Table 2-2.

Table 2-2:
Trend Analysis Airport Groups

Trend Analysis Airports		
Trend Group 1	Trend Group 2	Trend Group 3
Chicago Executive Airport	Chicago Area Airports	Top 25 IFR Relievers
CEA - Chicago	CEA - Chicago	CEA - Chicago
		TEB - Teterboro
		VNY - Van Nuys
		APA - Denver
		PDK - Atlanta
	MDW - Chicago	SDL - Scottsdale
		OPF - Miami
		FXE - Fort Lauderdale
		SUS - St Louis
		MMU - Morristown
	DPA - Chicago	ADS - Dallas
		MKC - Kansas City
		FTW - Fort Worth
		LUK - Cincinnati
		SMO - Santa Monica
	UGN - Chicago	SGR - Houston
		AGC - Pittsburgh
		DPA - Chicago
		ORL - Orlando
		YIP - Detroit
	GYY - Chicago	TMB - Miami
		ISM - Orlando
		HIO - Portland
		AFW - Fort Worth
		MYF - San Diego

Source: TFMSC, CMT (2016)

2.3.1.1. CHICAGO EXECUTIVE TRENDS (TREND GROUP 1)

Over the last 5 years, CEA has experienced a very moderate increase in total airport operations at a CAGR of .3% (TFMSC). This low growth in operations can be attributed to the sharp decline in piston aircraft operations with a CAGR of -3.6%.

Despite the downward trend in piston operations, CEA has seen a positive CAGR in turboprop (2.4%) and corporate jet aircraft (2%). The greatest growth in an individual classification has been in the large corporate jets at a CAGR of 5.2%.

These trends would indicate an increasing shift towards increased corporate presence at CEA through steady growth in both turboprop and jet aircraft. The decrease in piston operations would suggest a significant decrease in training and recreational activities.

2.3.1.2. CHICAGO AREA TRENDS (TREND GROUP 2)

The Chicago area airports used for this analysis include Chicago Executive Airport (CEA), DuPage Airport (DPA), Waukegan Regional Airport (UGN), Gary International Airport (GYY), and Chicago Midway International Airport (MDW). These airports were identified because they represent the most comparable airport profile to CEA in regard to fleet mix and services offered within the Chicago area. It is important to note that while MDW is a commercial service airport and much larger than the other airports within this group, MDW is a frequent destination for general aviation traffic. To establish a more parallel comparison between MDW and the other corporate airports within this group, only General Aviation traffic was analyzed, and all commercial service traffic was excluded from the study.

The operational trend of the Chicago area relievers shows a slightly negative CAGR of approximately -.4%. Similar to the trends at CEA, the aircraft classification with the greatest negative trend was the piston driven aircraft at -3.3%. Following the piston aircraft were the turboprop aircraft at -3.2%.

The Chicago area airport trend indicates similar growth rates in the light, small, and medium jet classification but showed a significantly higher growth in large jets compared to CEA. The large jet operations have grown 8.2% over the last 5 years in the Chicago area.

2.3.1.3. TOP 25 IFR RELIEVER TRENDS (TREND GROUP 3)

Like the Chicago area airports, the top 25 IFR relievers were also selected for similarities to CEA in fleet mix and services provided. There are two important distinctions that make these airports ideal comparisons to CEA, including "IFR" ranking and "Reliever" status.

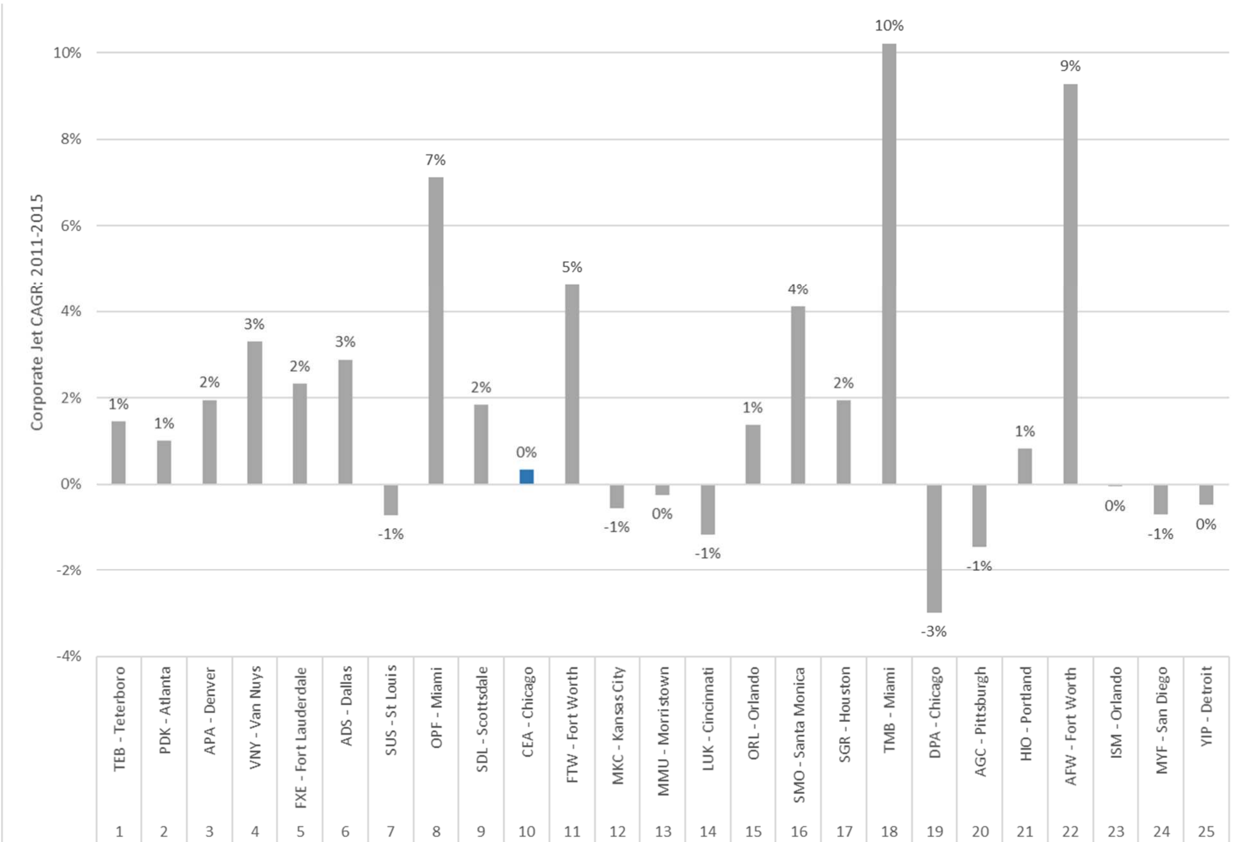
The IFR distinction is used because the majority of business and corporate-related traffic use IFR flight plans. With the majority of CEA's traffic being comprised of corporate traffic, comparing CEA to other airports with high corporate-related traffic is most fitting.

The "Reliever" status distinction is based upon the National Plan of Integrated Airport Systems (NPIAS) classification of Reliever airports. According to NPIAS, relievers are "high-capacity general aviation airports in major metropolitan areas." To gain the Reliever classification, an airport must have 100 or more based aircraft or 25,000 annual itinerant operations. CEA is considered a Reliever within the NPIAS system.

The top 25 relievers had an overall operation CAGR of 1.8%, showing a strong national growth relative to the Chicago area. When individual aircraft classifications are analyzed, each showed a positive growth.

Piston aircraft operations had higher growth rates than Chicago airports with a CAGR of 2% but a more comparable 1% for turboprops, and 4% for light jets. The large jet classification still maintains the highest growth at 7% among the top 25 IFR airports. Figure 2-4 *shows the overall operational CAGRs between each of the top 25 IFR airports from 2011-2015, ranked by total operations.*

Figure 2-4:
Top 25 IFR Reliever Airports Ranking by CAGR



Source: TFMSC (2016)

2.3.1.4. SUMMARY

The trend analysis between CEA, Chicago airports, and the national top 25 IFR airports provide an important insight into the operational trends from different levels of perspective. This insight allows for several observations to be made regarding why certain CEA trends may not be consistent with regional and/or national trends. Differences in trend groups are important assessments to better understand the individual influences that impact growth trends. The three main takeaways from this comparison include:

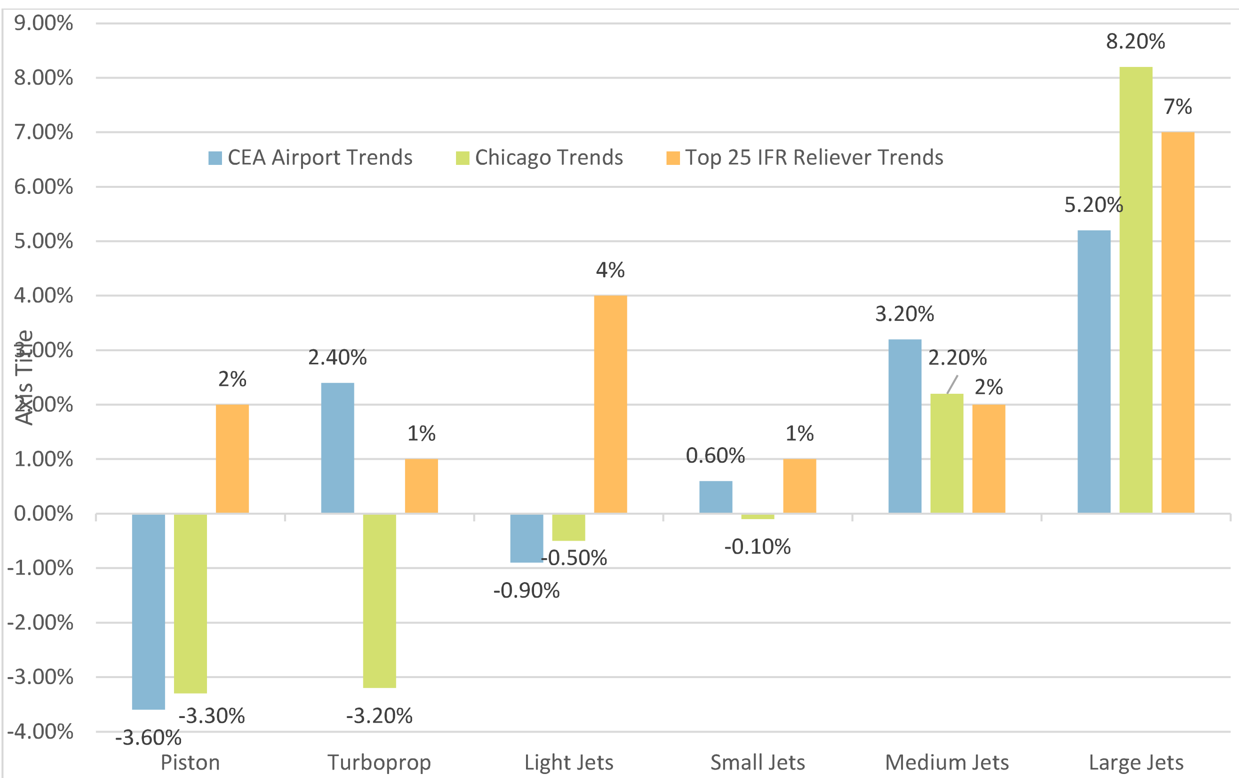
Piston Aircraft: For both CEA and the Chicago area airports, the trend in piston aircraft growth is approximately -3% compared to the top 25 IFR relievers at +2%. This would seem to indicate that regionally, piston aircraft operations are declining. While there are likely many causes of this, it may be due to the operational characteristics of piston aircraft as short stage-length, highly climate-influenced aircraft. With many of the top 25 IFR airports being located in moderate climates; it provides a much more accommodating environment for the smaller piston driven aircraft.

Turboprop Aircraft: In each trend profile, the turbo prop varies significantly. CEA shows a moderate growth of 2.4%, the Chicago area shows a considerable decline of -3.2%, and the national relievers show a slight growth of 1%. The disparity between CEA and the Chicago area airports indicates that CEA *is capturing an increasing amount of the Turboprop growth. This is most likely due to two factors. First, CEA is in an ideal location for business related traffic of which turboprops are most commonly used for. The second factor is a combination of the location and the fleet mix. The only other airport that accommodates corporate operations within the same distance from downtown Chicago is Midway International Airport. Since the majority of MDW's traffic consists of large commercial service and corporate traffic, CEA is a much less demanding airport to operate out of for a small to midsize turboprop aircraft.*

<u>Large/Medium Jets</u>: On both a regional and national level, large corporate jet aircraft are showing high operational GAGRs. CEA's large corporate jet CAGR is 5.3%, Chicago's is 8.3% and the top 25 IFR reliever's is 7%. This shows a consistent indication that large corporate jets operations are growing quickly on a large scale. Another consistent trend on a national level is the steady growth in medium jets. Each trend group shows a CAGR of 2-3% in medium corporate jet growth.

Despite the overall healthy growth in large corporate jets, CEA's large jet CAGR is 3% less than its peers in the Chicago area. With this difference in mind, it would be expected that the Top IFR reliever in Chicago would have a comparable large corporate jet growth to the average of the metropolitan area. Figure 2-5 *presents the trend rate of each aircraft classification for each trend group.*

Figure 2-5:
Aircraft Operational Trends



Source: TFMSC, TAF (2016)

2.3.2. Industry Forecasts

Aviation industry projections are helpful with identifying influences in the aviation industry by using industry metrics such as aircraft units shipped, and hours flown. These metrics can provide general guidance regarding the future growth or decline of pertinent sections of the aviation market, including general aviation.

Industry forecasts chosen for reference in this forecast include the 2016 Federal Aviation Administration (FAA) Aerospace Forecast, the 2015 General Aviation Manufacturers Association (GAMA) Forecast6, and the 2015 Bombardier Market Forecast7. Each of these forecasts provide some level of insight on the forecast of the general aviation industry and overall economy.

Another forecast that will be referenced throughout this document is the FAA's Terminal Area Forecast (TAF). This forecast is established by the FAA, and it is used as the official forecast for determining future aviation demand at specific airports. The TAF will be used as a baseline establishment of existing aircraft operations and based aircraft within this forecast, as well as a benchmark for forecasted operations and based aircraft.

2.3.2.1. 2016 FEDERAL AVIATION ADMINISTRATION (FAA) FORECAST

The FAA releases an annual aerospace forecast that provides historical, existing, and future air traffic activity. This forecast is established from 2016 through 2036 and is based on the FAA's General Aviation and Part 135 Survey, as well as industry interviews. While the FAA forecast does provide general categories for the aircraft classification, it does not specify the jet size classifications used within this forecast. As such, the growth rate of the "Jet" category is applied evenly among each jet size for the purposes of consistent forecasting.

Fleet Growth: The FAA forecasts the overall fleet to grow at an average annual growth (AAG) of 2%. This growth is attributed to steady growth in turboprop aircraft at an average of 1.3% per year, and a strong growth rate in jet aircraft at an average of 2.5% per year. The Piston aircraft fleet is shown to decrease in size by an average of -.7% per year.

Hours Flown: The total hours flown are projected to grow at an average of 2.5% per year. Similar to the fleet forecast, this growth is primarily attributed to the turboprop and jet aircraft. The Turboprop hours flown are projected to grow at an average of 1.6% and the Jet hours flown will grow 3.1%. The FAA states that the increase in jet hours flown results from the increase in size , efficiency, and utilization of corporate jet aircraft.

2.3.2.2. GENERAL AVIATION MANUFACTURERS ASSOCIATION (GAMA) - 2015 GENERAL AVIATION STATISTICAL DATABOOK AND 2016 INDUSTRY OUTLOOK

Every year, the GAMA develops a report that includes the historical shipments and billings of general aviation aircraft, as well as a forecast. The primary factors within this forecast are the same as the FAA forecast: fleet growth and hours flown. Also like the FAA forecast, all general aviation jets are grouped into one category, requiring the jet growth to be evenly applied to each jet classification in this forecast.

Fleet Growth: The GAMA forecast indicates that jets are projected to have the largest average annual growth among each category at approximately 2.8%. Following jets, turboprops are projected *to have an AAG of 1.5% and piston aircraft will decline at -0.6%. The overall general aviation fleet are projected to have an AAG of 0.4% through 2035.*

Hours Flown: The overall hours flown by 2035 are projected to increase by an AAG of 1.4%. Jets maintain the highest growth in hours flown at 3.6% AAG and turboprops as the second highest at 1.7% AAG. The piston aircraft are projected to continue to negatively trend at -.5% AAG.

2.3.2.3. 2015 BOMBARDIER BUSINESS AIRCRAFT MARKET FORECAST

The Bombardier forecast focuses on business jet growth through the year 2025. This forecast categorizes the business jets into three groups: small, medium, and large. Based on the types of aircraft noted within each group, the Bombardier small category aligns best with this forecast's "light" and "small" classifications. The medium and large groups in the bombardier group are similar to those identified in this forecast.

Fleet Growth: The light jets in the Bombardier forecast are projected to grow at an average annual rate of 2.4% and the medium jets have an average annual growth of 3.8%. The Large Jet category has the highest AAG at 9.6%. This forecast further states that the industry is transitioning to larger, longer stage length corporate aircraft which is the cause for the robust growth in forecasted large corporate jet fleet.

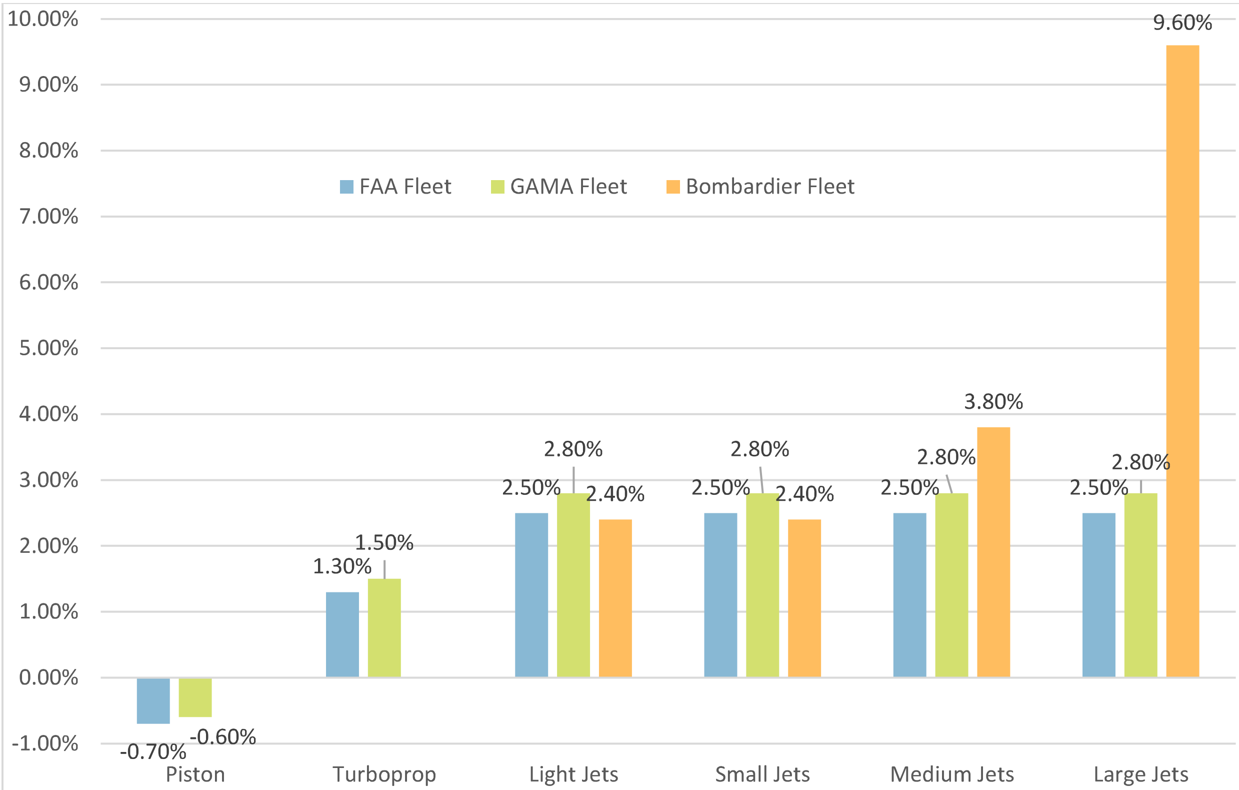
2.3.2.4. SUMMARY

Between the projected growth rates in fleet growth and hours flown among each forecast, there are three primary takeaways regarding the future general aviation industry.

1) *Steady and to marginal decline in piston aircraft*
2) *Moderate growth in Turboprop aircraft*
3) *High growth in business jets with an emphasis on growth in large, long stage length jets.*

Figure 2-6 *provides the industry fleet growth percentages for each aircraft classification.*

Figure 2-6:
Industry Forecast Growth by Aircraft Type



Source: FAA, GAMA, and Bombardier Forecasts (2015/2016)

2.4. Factors Affecting Demand

In addition to determining the constraints, trends, and industry forecasts, it is necessary to determine the factors affecting demand at an airport. With CEA's position as the top reliever in Chicago, there are a variety of potential factors that can influence the forecasted aviation demand. These factors range from large scale locational factors to specific facilities found at the airport. This section will investigate and substantiate a number of factors that will likely have some level of impact on the demand at CEA.

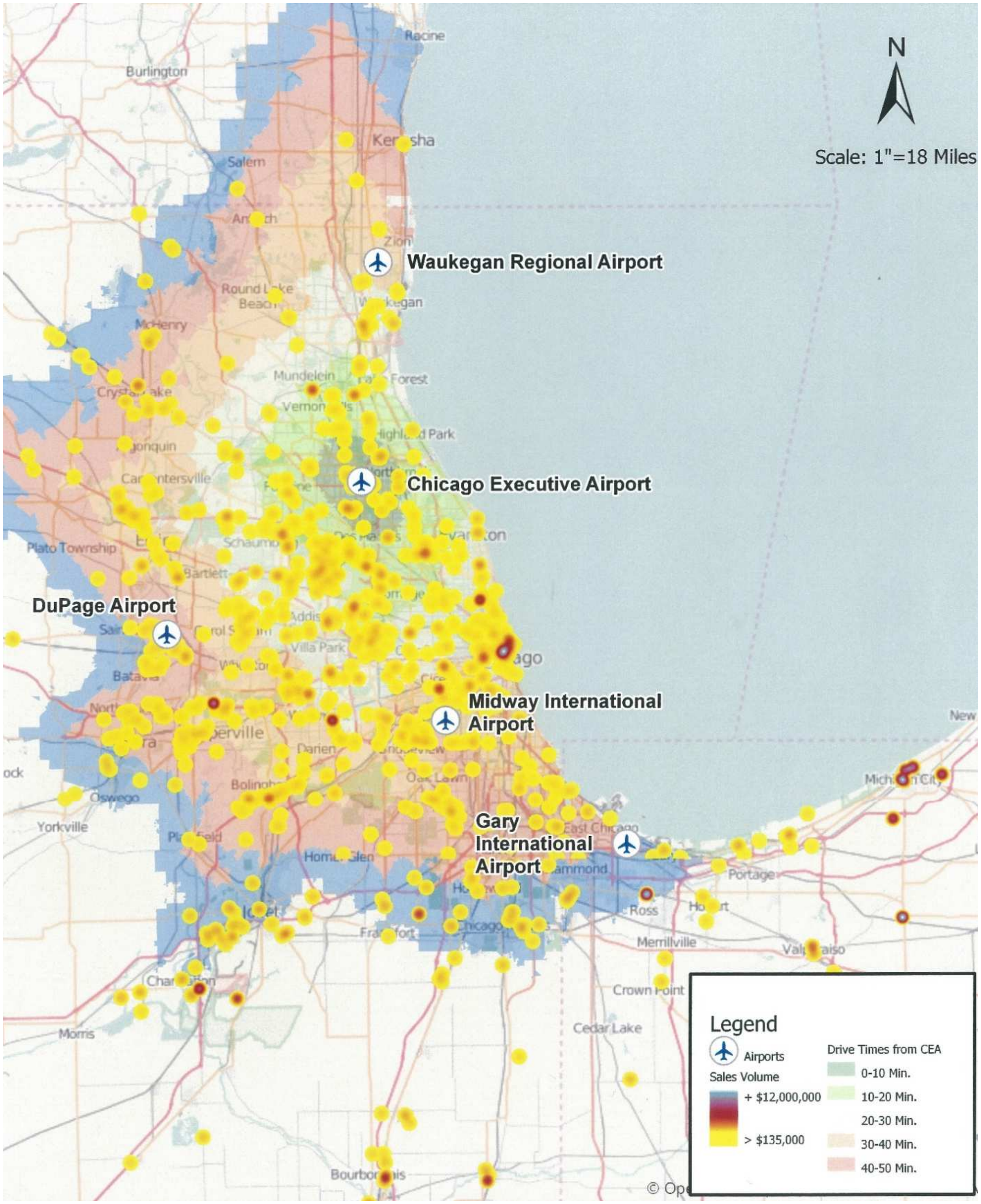
2.4.1. Location

Business Location

Location and convenience play enormous essential roles in selection by a customer in any transportation related industry. This is especially true for airports that serve corporate aviation users. Being Chicago's busiest reliever, CEA is ideally located for users traveling to the downtown business district or the corporate heavy northern suburbs. As previously mentioned in the economic outlook, the downtown economy is growing at an extraordinary rate due to corporate transitioning and the explosion of tech centers. With CEA's proximity to these core business and tech centers, CEA is optimally positioned to capture the large number of existing and future high-stake entities within this area that utilize corporate aviation.

To quantify the benefit of CEA's location is to users within the core Chicago business and tech centers, an analysis was conducted to determine where the concentrations of business sales and average net income are located. These two variables are illustrative gauges of where corporate users work and live. Exhibit 2-2 *has integrated a hot spot analysis of the sales generated in the Chicago metropolitan area with a drive time analysis from CEA.*

Exhibit 2-2:
Business Sales Hot Spots

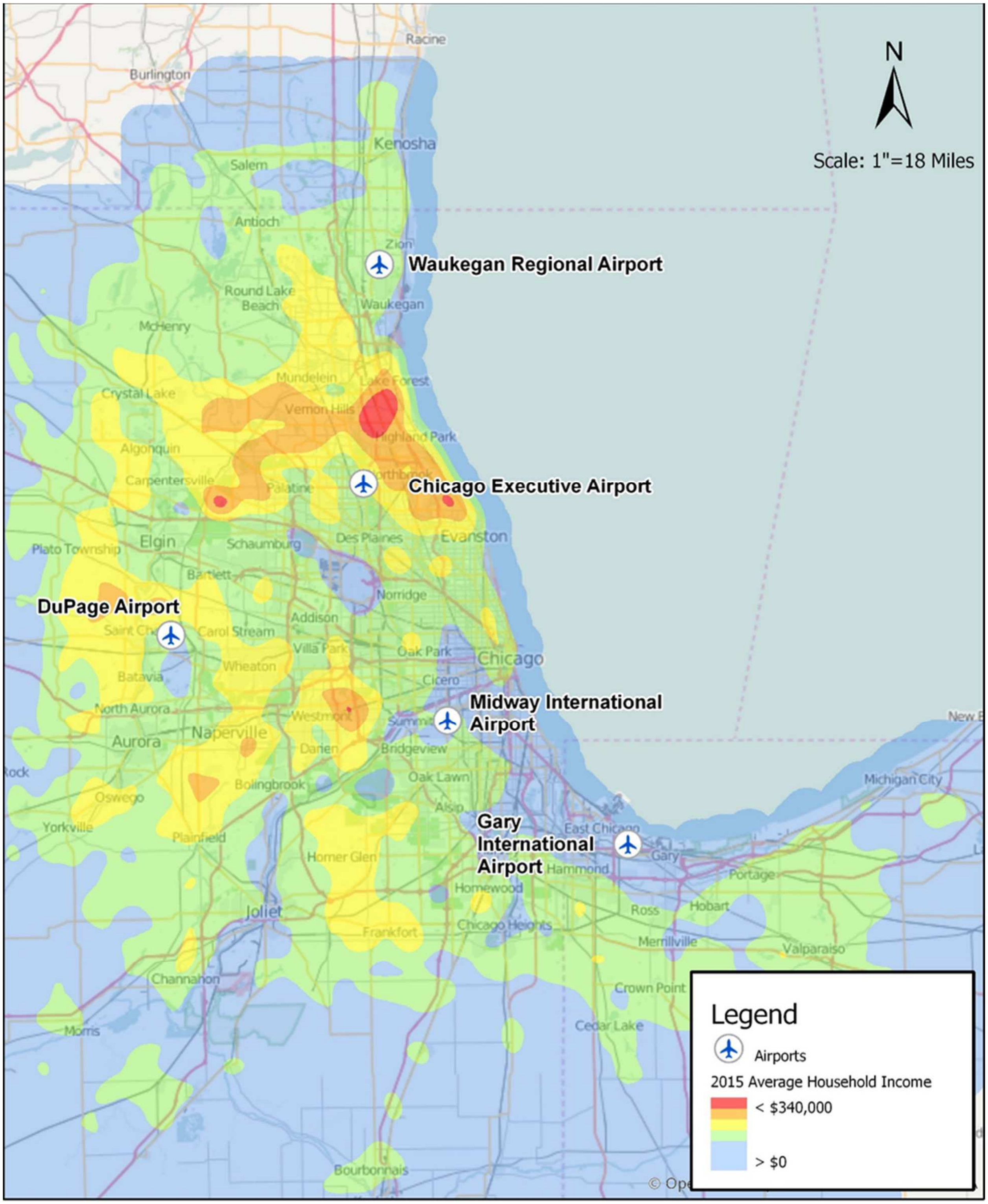


Source: ESRI Business Analyst (2016)

Hot spot analyses are useful in determining the statistically significant clusters within a study area. While there is a distribution of clusters throughout the Chicago area, there is a core clustering in the downtown and north/northwestern suburbs of Chicago. Understanding that corporate users will prefer convenient travel to and from their business headquarters, this places CEA in an ideal location to capture this market.

Not only do corporate users find value in proximity to their place of business, but it is also important to have access to air travel from their place of living. One of the best ways to identify the locations where corporate users may live is to analyze the concentrations of net worth within the Chicago area. Net worth is a good representation because most corporate users are C-level executives and top management in corporations, which earn some of the highest incomes within a given area. ***Exhibit 2-3*** *depicts the average net income by half mile grid which shows that the highest concentration of net worth is in the north suburbs of Chicago.*

Exhibit 2-3:
Average Annual Net Income



Source: ESRI Business Analyst (2016)

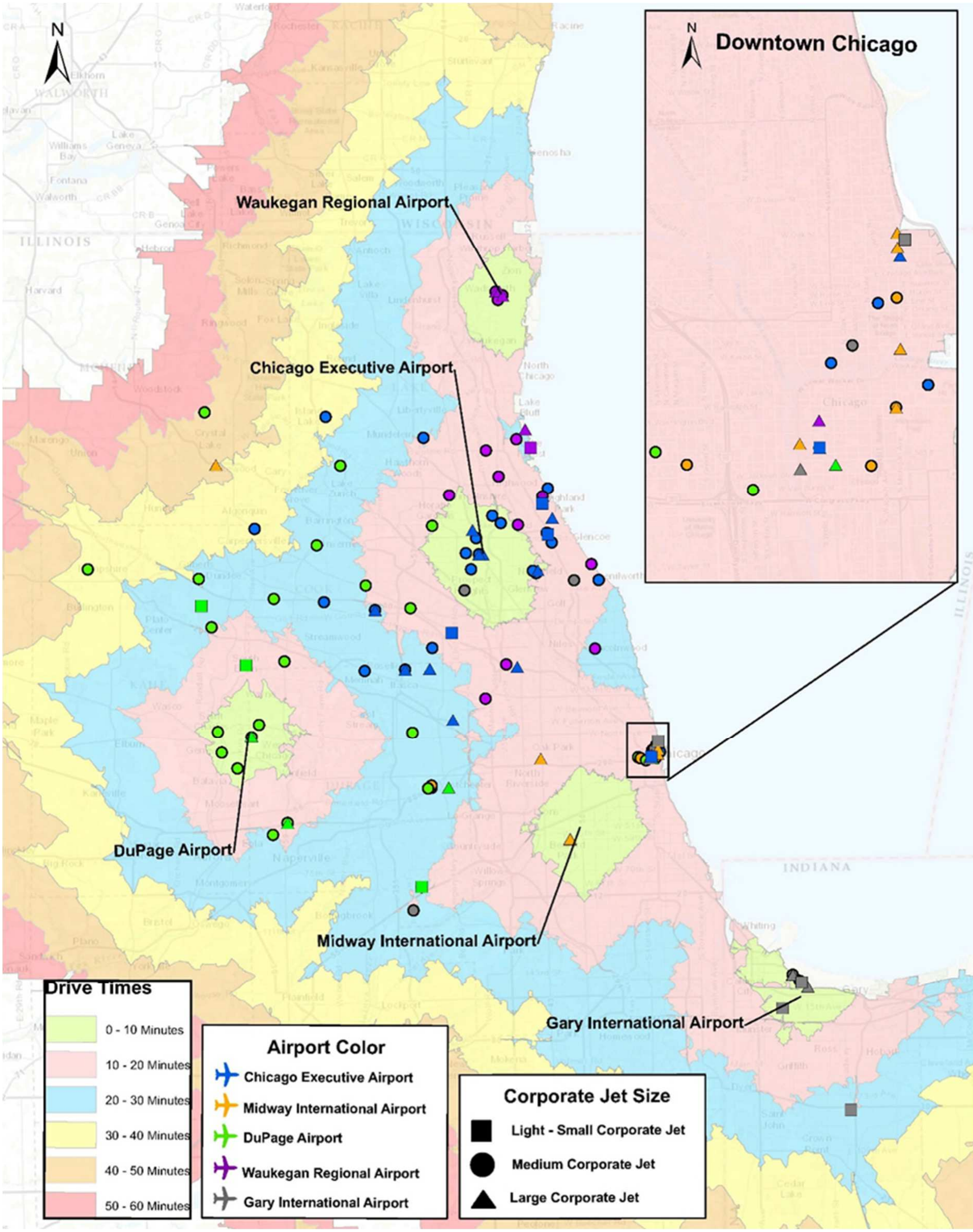
As identified throughout the survey and interview process, location and convenience are heavily weighted among the corporate aviation community. This analysis of high sales business centers and high net income communities shows that there are definite clusters where corporate aviation users are likely to be located. Due to its convenient location for businesses and high net worth individuals, CEA is well positioned to capture significant demand by corporate users.

Based Aircraft Locations:

Another method of defining the relationship between an airport's location and the corporate aviation community is to analyze the location of the existing based aircraft within the Chicago area. This analysis is completed by cross-referencing a known based aircraft's N-Number with the FAA's aircraft registry. The cross-reference provides all of the registration information associated with the aircraft, including the owner's address. These addresses were then applied to a drive-time analysis to the five main corporate airports within the Chicago metropolitan area. Applying the drive time analysis provides insight on a corporate user's emphasis on convenience and efficiency in locating their aircraft relative to their corporate address.

It is important to note, however that not every Chicago-based aircraft has a registered aircraft within Chicago. Approximately one third of the based aircraft are registered in another state which reduces the sample size for analysis. Each of the addresses that are in Chicago can be found in Exhibit 2-4.

Exhibit 2-4:
Corporate Locations with Chicago Based Aircraft



Source: FAA Aircraft Registry, PASSUR, CMT (2015)

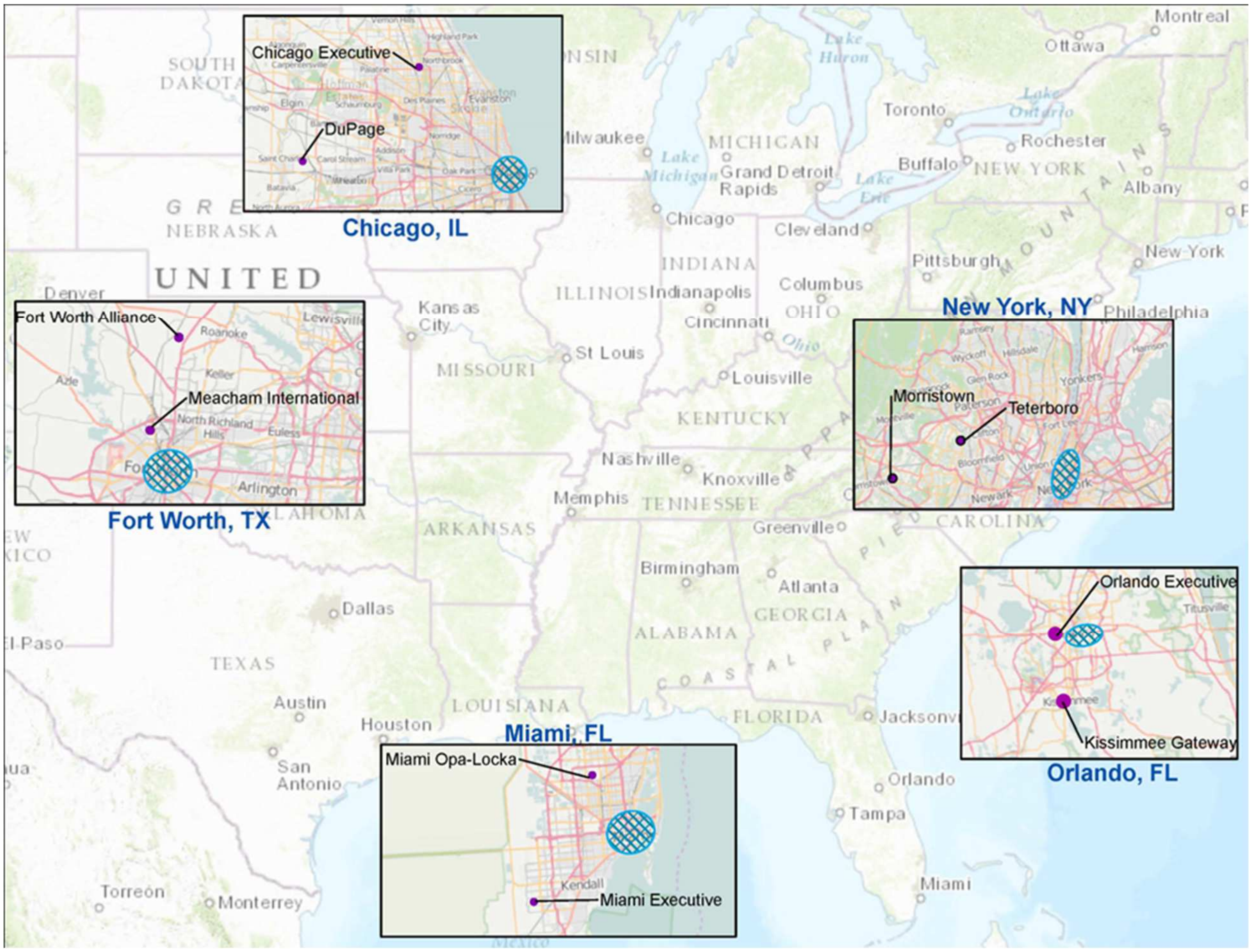
Exhibit 2-4 shows that there is a correlation between a company's physical address and the airport chosen for basing corporate aircraft operations. Distinct clusters of corporate addresses surround the airport in which their aircraft is based.

Despite this general correlation, there are a number of corporate users that are located within closer proximity to CEA but have their based aircraft at a competing airport. This is particularly evident with aircraft based at DPA and UGN. Excluding the aircraft located downtown, there are approximately 3 DPA aircraft and 11 UGN aircraft that are located within a closer drive time to CEA yet based further away. All of these aircraft are medium or large aircraft, which may support the concerns voiced in the user surveys and interviews related to constraints at CEA. Another noteworthy observation is that there are no CEA aircraft that have corporate addresses within a closer drive time to a competing airport (excluding downtown).

City Case Studies – Locational Analysis

A reoccurring factor for demand within this forecast is the relationship between an airport's location and a city's central business district. In an attempt to further refine this relationship, five case study cities were chosen for analysis. Each of these five cities were chosen because they host two out of the top 25 IFR reliever airports identified in Section 3. This creates a uniquely similar comparison to Chicago, which also hosts two of the top 25 IFR relievers: CEA and DPA. Exhibit 2-5 depicts each of these five case study cities and the location of their top two corporate reliever airports in relation to the central business district.

Exhibit 2-5:
Case Studies Cities



Source: CMT (2016)

The IFR operations at each of the above airports were analyzed, as well as number of highway miles each airport is from the central business district. In all five of the case study cities, there is a correlation between the proximity of the reliever airport to the central business district and number of corporate jet operations. This correlation shows that the closest reliever airport captures the majority of the corporate jet traffic.

The locational connection between airport and central business district is most apparent when considering medium and large corporate jet operations. In New York, Miami, and Fort Worth, three-quarters or more of the medium and large jet operations operate at the reliever airport closest to the central business district.

In Orlando and Chicago, there is a substantially lower average of corporate jet operations at the airport closest to the central business district. In Chicago, this lower proportional average may be due to the constraints identified in the surveys and interviews. In Orlando, the lower proportional average of corporate jet traffic may be due to two factors. First, Kissimmee Gateway's (ISM) proximity to Disney

World and the other vacation attractions south of Orlando may draw a large percentage of Orlando's jet traffic. Second, Orlando has a relatively small GDP compared to the GDP of the other case study cities which generates less overall corporate activity. Table 2-3 *contains the Top 25 IFR Reliever Airports Comparison.*

Table 2-3:
Top 25 IFR Reliever Airports Comparison

Top 25 Reliever Airports: City Pairs											
City	Metro GDP		Airport		Light Jet	Small Jet	Medium Jet	Large Jet	Runway Length	Distance From Central Business District (miles)
	U.S. Ranking	GDP (Billions)	Name	IFR Jet Ops Ranking						
Chicago	3	610	Chicago Executive (CEA)	7	64%	70%	76%	66%	5,001	27
			DuPage (DPA)	18	36%	30%	24%	34%	7,571	42
Orlando	30	115	Orlando Executive (ORL)	19	66%	62%	53%	53%	6,004	5
			Kissimmee Gateway (ISM)	22	34%	38%	47%	47%	6,001	23
New York	1	1431	Teterboro (TEB)	1	87%	86%	85%	88%	7,000	12
			Morristown (MMU)	10	13%	14%	15%	12%	6,000	33
Miami	11	296	Miami-Opa Locka Exec (OPF)	6	72%	77%	88%	94%	8,002	15
			Miami Executive (TMB)	21	28%	23%	12%	6%	6,000	25
Fort Worth	6	461	Meacham International (FTW)	14	86%	77%	82%	71%	7,502	8
			Fort Worth Alliance (AFW)	24	14%	23%	18%	29%	9,600	17
Average Market Share of Closer Pair:					**75%**	**75%**	**77%**	**74%**	-	-
						(green)	= Above Average			
						(orange)	= Below Average			

Source: TFMSC (2015)

2.4.2. Fixed Base Operator Influence

When owning or operating a multi-million-dollar business asset that is a business jet, corporate users expect the highest class in services to accompany their travel. This means that corporate aviation users place significant value on the number, type, and quality of services that are provided at an airport. One of the best representations of the quality and number of services provided at an airport includes the Fixed Base Operator(s) (FBO).

Chicago Executive Airport is home to three states of the art fixed based operators. These FBOs include Atlantic Aviation, Signature Aviation, and Hawthorne Aviation. Each is a full service FBO that provides a number of services, including but not limited to:

- *Maintenance and Inspection*
- *Fueling*
- *Aircraft Hangars*
- *Air Charter*
- *Aircraft Detailing*
- *Flight Planning and Lounge Facilities*
- *Local Transport/Rental Cars*

The corporate aviation community places heavy emphasis on the availability and convenience to stay within a specific FBO chain to maintain their flight experience and simplicity in securing aviation services. For example, if a corporate user flies of out of Teterboro (TEB) and frequently uses Signature Aviation at their base airport, the user is more likely to select an airport in the destination city with a Signature Aviation location. This is further promoted by the individual FBOs with their incentive-based membership programs that promote recurring customers across their network of locations.

Having three well established FBOs opens increased opportunity for user loyalty capture. Out of all the corporate airports in Chicago, CEA has the largest globally-extended network. Not only does this increase potential user capture, but it also represents the FBO's confidence to have selected and maintained a location at CEA. For comparison, Table 2-4 *represents the primary corporate relievers and the FBOs based at each corporate reliever airport within the Chicago area.*

Table 2-4:
Chicago Fixed Base Operator Networks

Fixed Base Operator Networks			
Airport	**Total FBOs**	**FBO Network**	**Location Extents**
Chicago Executive Airport	3	171+	Global
Midway International Airport	2	165+	Global
Waukegan Airport	1	100+	Global
DuPage Airport	1	23	National
Gary International Airport	2	2	Airport Only

Source: FBO Websites (2016)

2.4.3. Contaminated Runway Landing Considerations

There have been several regulations and advisory documents established over the last few decades to enhance operational safety of turbine powered aircraft during takeoff and landing operations. The majority of these regulations and/or publications are related to landing operating procedures on a contaminated runway (wet, snow, or icy pavements). Contaminated runways present a higher probability *of aircraft overruns because there is impaired effectiveness of aircraft breaking action on a contaminated surface. Due to the relationship between aircraft weight, breaking action, and landing distance/performance, the contaminated runway length regulations apply to turbine aircraft. Recognizing that many of CEA users operate turbine aircraft, operations by corporate jets are severely impacted when contaminated runway conditions are present.*

Regulation – 14 CFR 135.385 and 121.195: The fundamental regulation that impacts operators during contaminated runway conditions are 14 CFR 135.385 and 121.195. These regulations specifically apply to fractional and charter ("for hire") operators. The regulation, also known throughout the industry as "factored" runway lengths, does not allow the aircraft to depart if the following conditions do not exist for landing at the destination airport:

1) *In dry conditions, the airplane must be able to land within 60% of the usable runway*
2) *In wet conditions, landing usable runway must be at least 115% the length of the "factored" dry runway length.*

*When applied at CEA, the runway length available for dry landing is approximately 3,000' (5,000*0.6) and 2,610' (3,000/1.15) for a wet landing. Landing corporate jet aircraft in less than 3,000 feet places significant restrictions on "for hire" operator's choice to use or base at CEA.*

Advisory Circulars (AC) and Safety Alerts for Operators (SAFO): In addition to the regulatory requirements, there are several guidance documents the FAA has published that prescribe additional landing restrictions and considerations for turbine aircraft operators. The following includes a summary of each of these documents.

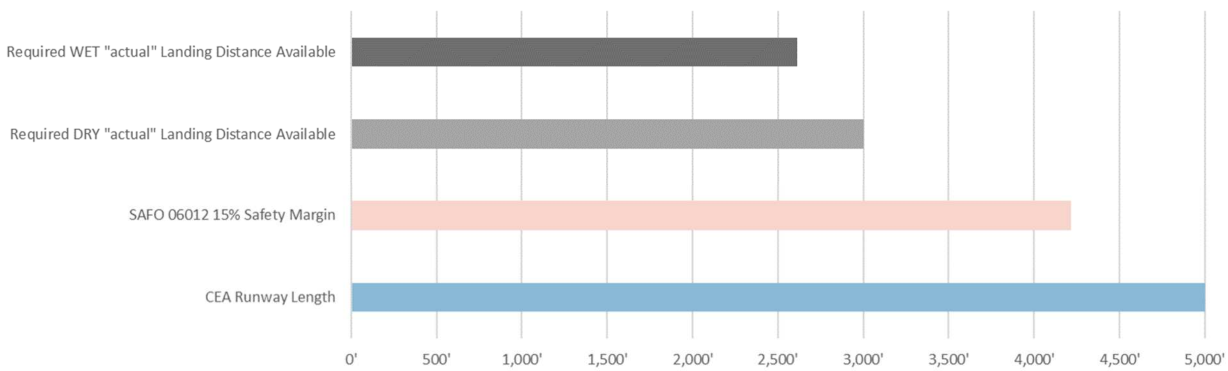
- *SAFO 06012 (2006): This SAFO recommends that flight crews assess conditions at time of arrival. Once the landing calculation is made with existing conditions, add at least a 15% safety margin to the "actual" landing distance.*
- *Advisory Circular 91-79A (2014): This AC is a revision of the 2007 AC 91-79. Both ACs provide enhanced guidance on developing Standard Operating Procedures (SOPs) for turbine aircraft to prevent overruns on runways. This incorporates additional restrictions based on runway conditions.*
- *Advisory Circular 25-32 (2015): This AC focuses on developing more accurate and standardized methods of establishing the landing performance at the time of arrival. A significant portion of this AC involves clarification on contaminated runway nomenclature.*
- *SAFO 15009 (2015): The SAFO strongly recommends that directors of flight operations take the appropriate action to address safety concerns on wet runways. This includes the notion that the 15% safety margin from SAFO 06012 may not be sufficient.*

Each of the advisory documents summarized above encourage turbine powered operators to incorporate some level of additional landing restrictions into their SOPs during contaminated runway conditions. Whether this is 15% or more than 15% depend on the actual operator and their SOP. Regardless, there is immense pressure for turbine aircraft operators to restrict operations on constrained runways during contaminated runway conditions.

Figure 2-7 represents the effect of the Code of Federal Regulations ("factored lengths") and SAFO 06012 (15% safety margin) on CEA's runway length of 5,001' during contaminated runway conditions.

It does <u>not</u> take into consideration any additional restrictions an operator may have initiated into their SOP for compliance with the remaining ACs and SAFOs.

Figure 2-7:
Contaminated Runway Landing Distance Considerations



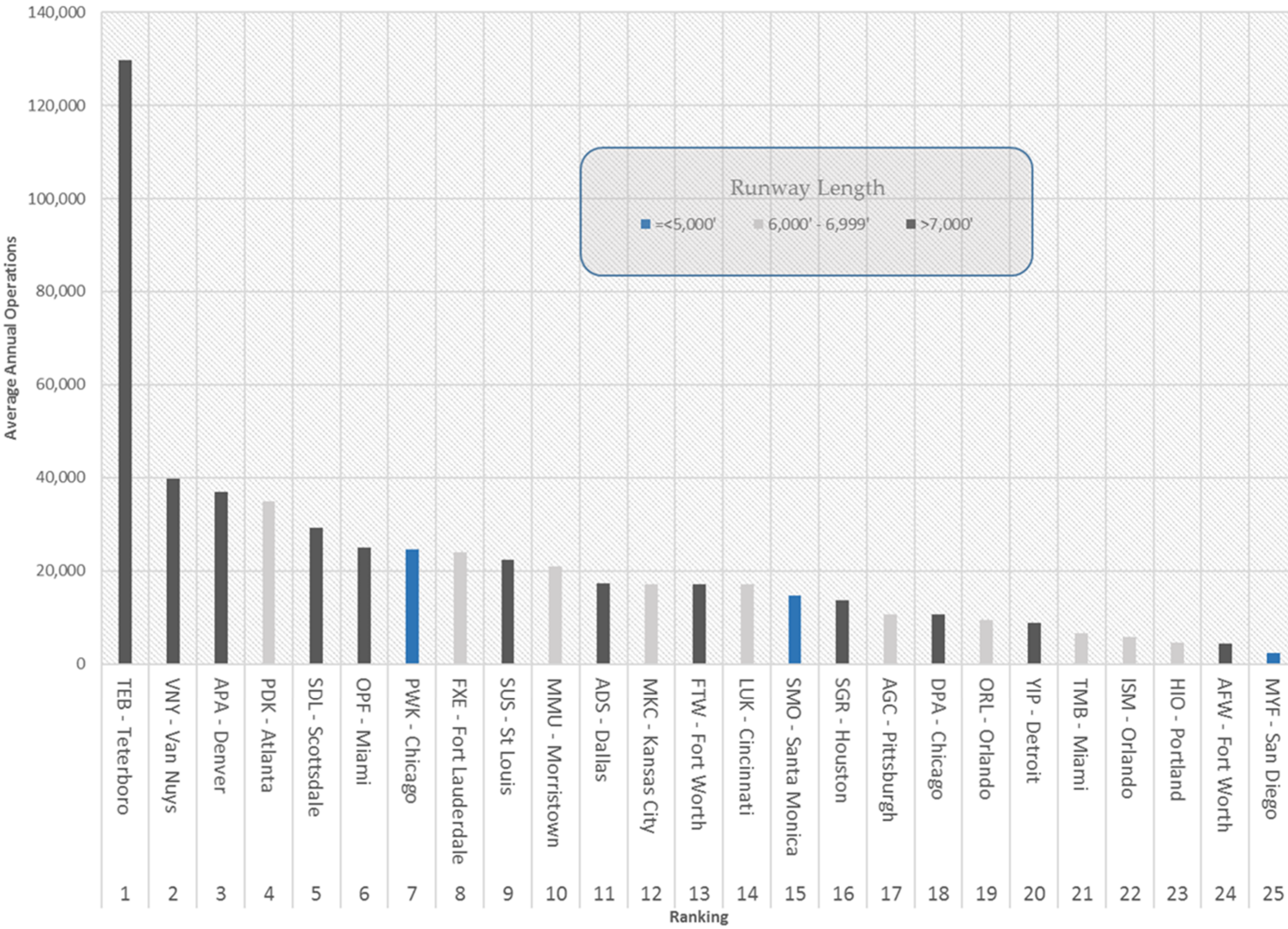
Source: FAA, CMT (2016)

2.4.4. Reliever Runway Length Comparison

As discussed previously in this report, the top 25 IFR relievers are relatively homogenous in terms of airport operations and fleet mix. Despite the operational similarities, it has been established that CEA is considered constrained by corporate users relative to the other relievers within the nation. To better understand the primary identified constraint, runway length, an analysis has been conducted to better understand what relationships exist between primary runway length and the Top 25 IFR relievers.

Figure 2-8 depicts the ranking of the top IFR relievers by total corporate jet operations. It further identifies which airports among the top 25 IFR airports have less than 5,000' of runway. Out of the 25 airports, only 3 have 5,000' or less of runway length. These three airports include CEA, Santa Monica Municipal Airport (SMO), and San Diego Montgomery Field Airport (MYF).

Figure 2-8:
Top 25 IFR Reliever Airports by Average Corporate Jet Operations

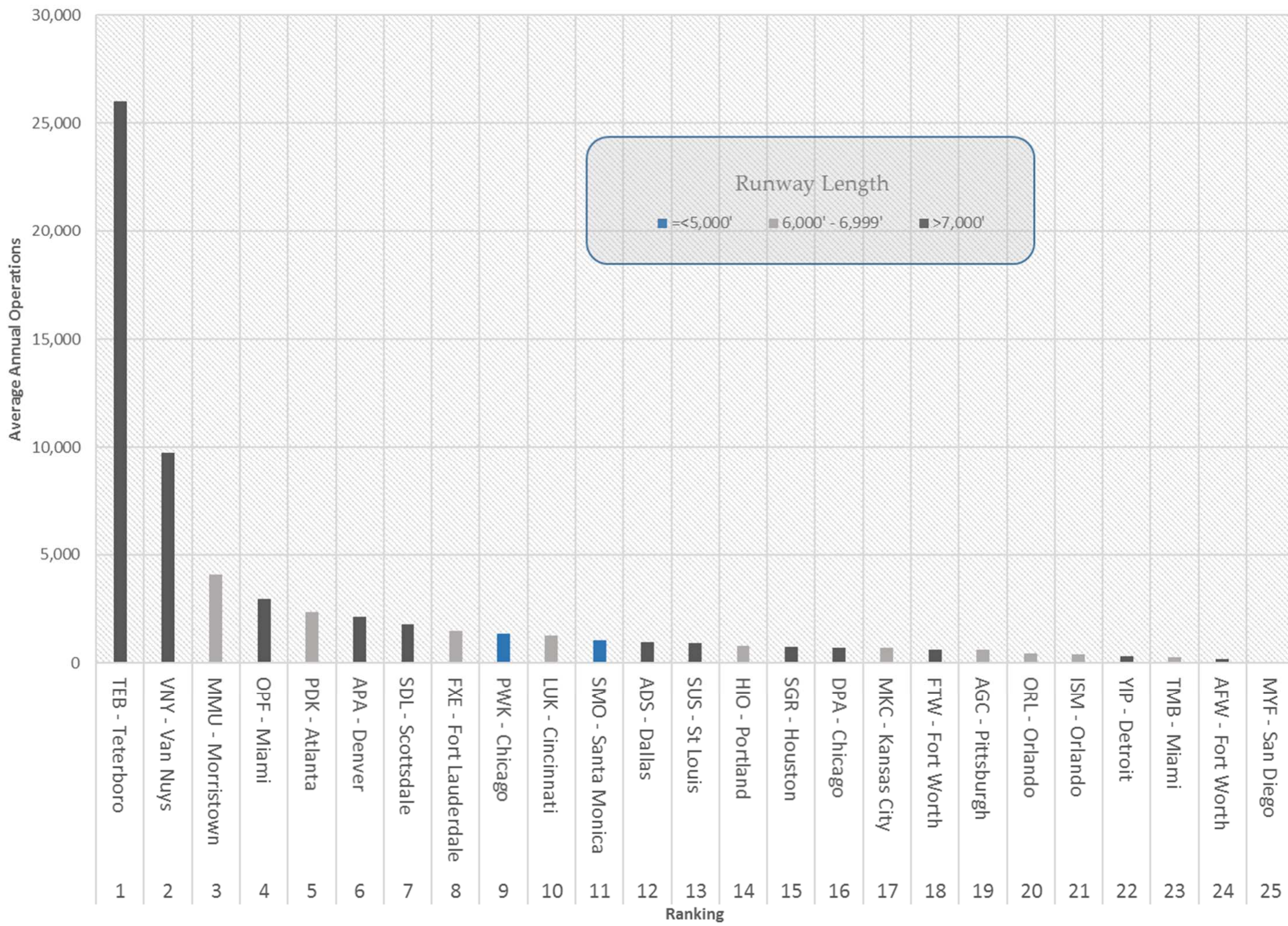


Source: TFMSC, Airnav, CMT (2016)

To further refine the effect of runway length, only large jets were analyzed to determine if there was a disproportionate impact on use for these aircraft. Figure 2-9 *displays the average annual large aircraft operations by airport. MYF, one of the three airports with less than 5,000' of runway, has had zero large jet operations over the last 5 years. Although both CEA and SMO retain their relative rankings, there remains a clear distinction that the airports with less than 5,000' are anomalies in the realm of corporate relievers.*

Ultimately, this reliever analysis provides insight into the relation between primary runway lengths and the most utilized corporate reliever airports in the country. The low number of top 25 relievers with 5,000' of runway or less corroborates the notion in the interviews and surveys that CEA's runway is constrained for its status as the top corporate reliever in a major metropolitan area.

Figure 2-9:
Top 25 IFR Reliever Airports by Average Large Corporate Jet Operations



Source: TFMSC (2015)

2.5. Fleet Mix & Critical Aircraft

A major theme in this forecast is identifying trends between different classifications of aircraft. These classifications, established in Section 3, provide insight into how the airport is being used and how to appropriately accommodate each classification. This section helps define the critical aircraft and fleet mix at CEA.

2.5.1. Fleet Mix

An analysis of TFMSC data from 2011-2015 was conducted to determine the average percentage of operations at CEA by each aircraft classification established in Section 3. Once the average percentages of each aircraft classification were determined, they were applied to the total operational count established in the TAF. The intention of this was to produce the most consistent fleet mix with the TAF that allocated the appropriate number of operations to each aircraft classification. The ultimate operational distribution per classification can be shown in Table 2-5.

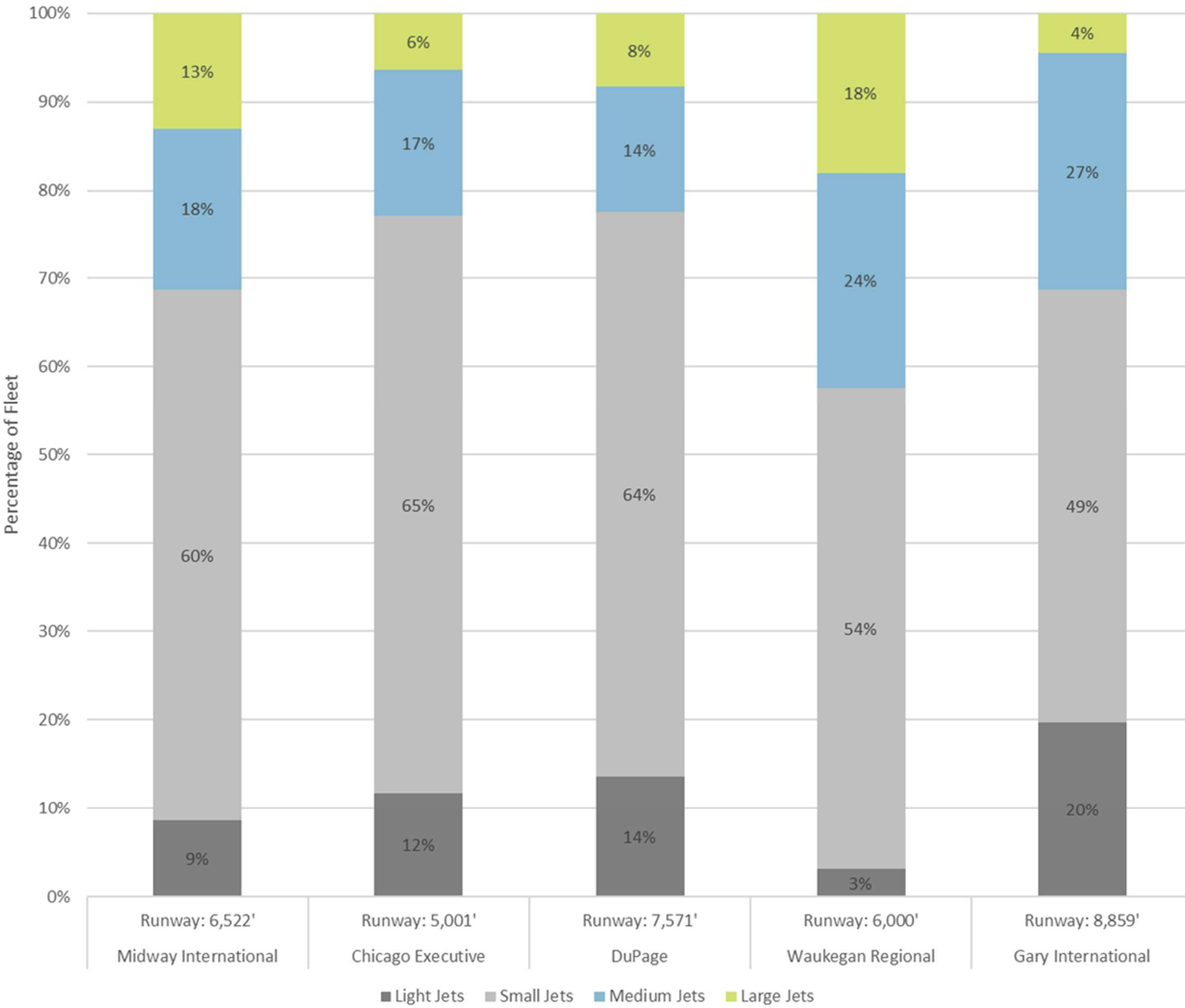
Table 2-5:
CEA Fleet Mix

CEA Fleet Mix						
Aircraft Type	Propeller		Jet			
Aircraft Classification	Piston	TurboProp	Light Jet	Small Jet	Medium Jet	Large Jet
2015 Operations	15,572	9,614	6,401	34,423	7,726	2,861
% of Fleet	20%	13%	8%	45%	10%	4%
	33%		67%			

Source: TFMSC, TAF (2015)

While the majority of CEA's fleet mix consists of jet traffic at 67%, the number of medium and large jets have relatively small proportions. To some extent, this disproportion is the result of the high number of small corporate jets in the aviation system. However, to compare CEA's proportions of corporate jet sizes, an analysis was performed to identify the fleet mix of other corporate airports in the Chicago area. Figure 2-10 *depicts the comparison between the Chicago corporate airport's operations proportionated by corporate jet classification.*

Figure 2-10:
Chicago Corporate Airports - 2015 Operations by Business Jet



Source: CMT Analysis (2016)

Out of the four other Chicago airports within this analysis, the average percentage of combined large and medium corporate aircraft is 32%. In comparison, CEA's percentage of medium and large corporate jet operations is a mere 23%. This disparity between CEA and the other Chicago area corporate airports may indicate that CEA is losing a number of medium and large corporate jet operations to the competing Chicago airports due to the aforementioned constraints.

2.5.2. Existing Critical Aircraft

The critical aircraft is defined by the FAA as the most demanding aircraft that has over 500 annual itinerant operations at an airport.[6] Table 2-6 *contains the critical aircraft established in CEA's 2009 ALP by runway.*

Table 2-6:
2009 Airport Layout Plan – Critical Aircraft

CEA 2009 ALP Critical Aircraft		
Runway	Aircraft	Design Group
16/34	Gulfstream 550	C-III Large
12/30	King Air B200	B-II Small
6/24	Cessna 421	B-I Small

Source: CEA ALP (2009)

To determine if the critical aircraft has changed since the 2009 ALP, an analysis of PASSUR IFR data was conducted. PASSUR IFR Data allows for analysis of aircraft movement specific to each runway.

Runway 16/34: As the primary runway, 16/34 has the most operations. The most demanding aircraft that utilizes Runway 16/34 with over 500 annual itinerant operations is the Gulfstream 550. In 2015, the Gulfstream 550 had a total of 546 operations, meeting the requirement of the critical aircraft (Design Group: C-III).

Runway 12/30: From an initial analysis of the data, there appears to be enough B-II large aircraft operations to change the critical aircraft from what is shown on the ALP. Since the existing critical aircraft is a B-II small aircraft, this would have several effects on the airfield and surfaces. The potential of changing the critical aircraft from a B-II small to a B-II large aircraft will be further evaluated in the Facility Requirements section.

Runway 6/24: The utilization of Runway 6/24 is relatively infrequent compared to the other runways at CEA. The majority of the aircraft operating on Runway 6/24 are B-I Small aircraft and smaller. The critical aircraft is recommended to remain a Cessna 421.

2.6. Forecast

When forecasting activity at general aviation airports, based aircraft and operations are the common metrics to best represent overall demand for facility needs. As previously presented, prior to any forecasting effort, it is critical to understand market dynamics which will influence the individual facility *demand due to their interconnectivity. It is also important to complete a comparative analysis of similar facilities to understand commonalities and uniqueness that will influence demand at CEA. Lastly, it is important to select the most applicable industry forecasts and trends to accurately define growth scenarios for the two forecast components. This forecast integrates each of the previously described trends and industry forecasts and applies the various factors that affect demand to establish the most realistic forecast for CEA.*

The FAA prescribes a forecasting process to represent unconstrained demand (i.e. demand independent of individual airport constraints). As it was noted through the user survey process that many users operate in a constrained fashion at CEA or choose other airports in the area due to constraints at CEA, it is relevant to also prepare a demand forecast assuming the current constraints exist in a future condition. In addition to the constrained forecast, there will also be projections to factor in a potential unconstrained scenario. While unconstrained facilities will be determined in a later phase of this Master Plan, this forecast will also include projections to consider an unconstrained scenario at CEA.

2.6.1. Forecasting Method

In order to create a consistent quantitative-based forecast, a procedural method was developed for both the based aircraft and operations forecast. The following steps outline how each growth rate for each aircraft classification was determined.

Step 1 – Industry Forecasts/Trends: Establish the growth rates in the industry forecasts and industry trends for each aircraft classification

Step 2 – Forecast Mix: Develop a forecast range by utilizing the lowest, average, and highest industry forecast/trends and apply them to a low, medium, and high CEA forecast, respectively.

Step 3a – Constrained Growth Rates: Apply the Constrained Scenario factor multipliers to each of the forecast ranges.

Step 3b – Unconstrained Growth Rates: Apply the Unconstrained Scenario factor multipliers to each of the forecast ranges

Step 4 – Forecast Development: Apply the growth rates to the existing based aircraft/operations mix proportionated from the 2015 TAF records.

Step 5 (Operations forecast only) - Operations per Based Aircraft: Apply the operations per based aircraft that are defined in the following subsection "Operations Per Based Aircraft"

2.6.1.1. FORECAST MULTIPLIERS

The multipliers applied to steps 3a and 3b in the method above are intended to account for operators' decisions in both the constrained and unconstrained scenarios. The multipliers differ for both the based aircraft and operations forecasts because the separate forecasts involve different considerations by the operator.

As an operator deciding to base an aircraft at an airport, there is more that goes into the decision than choosing to operate out of CEA from another based location. In an effort to accurately represent the *magnitude of these decisions, the multipliers vary depending on the forecast type, growth scenario, and aircraft classification.*

Each multiplier is approximately derived from survey and interview responses, corresponding to the approximate percentage of participant responses. There is additional consideration that incorporates the factors for demand within the rationale. The specific multiplier values and rationales with reference to surveys are provided in Table 2-7*.*

Table 2-7:
Forecast Multipliers

Based Aircraft Forecast Multipliers - Constrained Scenario				
Aircraft Classification	Multiplier	Rationale	Survey Question Reference	
			MP Phase 1	MP Phase 2
Piston	1.25	Ideal Location/Services; Less Influence on Piston	5a	-
Turboprop	1.3	Ideal Location/Services	5a	3
Light Jet	1.3	Ideal Location/Services	5a	3
Small Jet	1.3	Ideal Location/Services	5a	3
Medium Jet	1	Constraints Negate the Ideal Location/Services for Unchanged Trend	1, 3, 5a, 7	3, 5 -17
Large Jet	0.5	Constraints Impact - Runway Takeoff, Stage Length, and Wet Runway Landing	1, 3, 5a, 7	3, 5 -17
**Question 5a relates to basing aircraft*				

Based Aircraft Forecast Multipliers - Unconstrained Scenario				
Aircraft Classification	Multiplier	Rationale	Survey Question Reference	
			MP Phase 1	MP Phase 2
Piston	0.75	Mitigates the declining (-%) industry to adjust for the ideal location	5a	-
Turboprop	1.3	Ideal Location/Services	5a	3
Light Jet	1.3	Ideal Location/Services	5a	3
Small Jet	1.3	Ideal Location/Services	5a	3
Medium Jet	1.3	Ideal Location/Services; Influx of Previously Uncaptured Market	1,5a	3
Large Jet	1.3	Ideal Location/Services; Influx of Previously Uncaptured Market	1, 5a	3
**Question 5a relates to basing aircraft*				

Operations Forecast Multipliers - Constrained Scenario				
Aircraft Classification	Multiplier	Rationale	Survey Question Reference	
			MP Phase 1	MP Phase 2
Piston	1	Operations Continue as Existing; Unconstrained	-	-
Turboprop	1	Operations Continue as Existing; Unconstrained	-	-
Light Jet	1	Operations Continue as Existing; Unconstrained	-	-
Small Jet	1	Operations Continue as Existing; Unconstrained	-	-
Medium Jet	0.3	Constraints Impact - Runway Takeoff, Stage Length, and Wet Runway Landing	1, 3, 5b, 7	3, 5-11, 14-17
Large Jet	0.25	Constraints Impact - Runway Takeoff, Stage Length, and Wet Runway Landing	1, 3, 5b, 7	3, 5-11, 14-17
**Question 5b relates to operating aircraft*				

Based Aircraft Forecast Multipliers - Unconstrained Scenario				
Aircraft Classification	Multiplier	Rationale	Survey Question Reference	
			MP Phase 1	MP Phase 2
Piston	0.25	Increase of Unconstrained Jet Aircraft Ops Deter Small Piston Ops	5b	-
Turboprop	0.85	Increase of Unconstrained Jet Aircraft Ops Deter Turboprop Ops	5b	3
Light Jet	1.05	Ideal Location/Services	5b	3
Small Jet	1.05	Ideal Location/Services	5b	3
Medium Jet	1.15	Ideal Location/Services; Influx of Previously Uncaptured Market	1, 5b	3
Large Jet	1.25	Ideal Location/Services; Influx of Previously Uncaptured Market	1, 5b	3
*Question 5a relates to basing aircraft				

Based Aircraft Forecast Multipliers - Constrained Scenario				
Aircraft Classification	Multiplier	Rationale	Survey Question Reference	
			MP Phase 1	MP Phase 2
Piston	0	Operations continue as existing; unconstrained	-	-
Turboprop	0	Operations continue as existing; unconstrained	-	-
Light Jet	0	Operations continue as existing; unconstrained	-	-
Small Jet	0	Operations continue as existing; unconstrained	-	-
Medium Jet	0.5	Stage length/contaminated runway constraints	1, 3, 5b, 7	3, 5-11, 14-17
Large Jet	0.25	Stage length/contaminated runway constraints	1, 3, 5b, 7	3, 5-11, 14-17
*Question 5a relates to basing aircraft				

Based Aircraft Forecast Multipliers - Constrained Scenario				
Aircraft Classification	Multiplier	Rationale	Survey Question Reference	
			MP Phase 1	MP Phase 2
Piston	0.25	Mitigates the negative industry to adjust for the ideal location	5b	-
Turboprop	1.15	Ideal Location/Services	5b	3
Light Jet	1.05	Ideal Location/Services; Corporate fleet transitioning	5b	3
Small Jet	1.05	Ideal Location/Services; Corporate fleet transitioning	5b	3
Medium Jet	1.15	Ideal Location/Services; adjusted for influx of previously uncaptured market	1, 5b	3
Large Jet	1.25	Ideal Location/Services; adjusted for influx of previously uncaptured market	1, 5b	3
*Question 5a relates to basing aircraft				

Source: CMT (2016)

2.6.1.2. OPERATIONS PER BASED AIRCRAFT

The operations per based aircraft referenced in Step 5 of the forecasting method is used to determine the operational impact on an airfield by based aircraft.

To quantify the effect of based aircraft on operations, an analysis of the existing based aircraft at CEA was conducted. Each N-Number of an existing based aircraft was cross-referenced against the N-Numbers of the PASSUR IFR data to determine the number of annual operations each aircraft performed. Then, each aircraft was classified and an average operation per year was established.

Since each aircraft classification has different operational characteristics, each classification also has different operational utilization. Generally, the larger the aircraft, the more frequent the operations. Each aircraft classification is depicted with the associated annual operations in Table 2-8.

Table 2-8:
Number of Operations per Based Aircraft

CEA Based Aircraft Per Operation			
	Operations per Year	Number of Based Aircraft	Avg. Annual Operations (2011-2015)
Piston	68	94	6,392
TurboProp	68	27	1,836
Light Jet	70	6	420
Small Jet	72	38	2,736
Medium Jet	78	11	858
Large Jet	86	9	774
Total	442	185	13,016

Source: CMT (2016)

The existing based aircraft at CEA contribute to approximately 15% of all operations at the airport. As the based aircraft within this forecast grows, the corresponding operations forecast incorporates the number of operations per year for each additional based aircraft.

2.6.2. Based Aircraft Forecast

Based aircraft counts serve as good indicators of overall airfield demand. When there is an influx or high number of based aircraft at an airfield, it is often a positive indicator that the airport offers "greater benefits" than the competing airports. Additionally, there is a connection between the number of based aircraft at an airfield and the number of operations. The type of operation, including the aircraft model, can have a sizeable impact on operations.

In order to forecast based aircraft, the most representative data sets are industry fleet projections. These forecasts can be used as one of the "factors" in identifying airfield demand by based aircraft. The industry forecasts being used in this report are outlined in Section 3 and provide a forecast of the total change in based aircraft throughout the forecasting period. Since there are several different industry forecasts with varying growth rates, different growth scenarios have been developed. The scenarios *generated include low, medium, and high. Each scenario takes different combinations of the industry forecasts to develop a realistic spread of possible forecasted based aircraft.*

2.6.2.1. CONSTRAINED BASED AIRCRAFT FORECAST

Using the forecasting method described in Section 6.1, the following constrained forecasts have been developed:

Low Growth (1.3%): The low growth scenario is based on the lowest industry forecast and constrained based aircraft multipliers. The overall based aircraft CAGR is 1.3% while the jet CAGR is higher at 2.8%. The low growth rates are primarily due to the declining propeller aircraft and constrained jets.

Medium Growth (1.5%): The medium growth scenario uses an average of the industry forecasts and applies the constrained based aircraft multipliers. The overall CAGR is 1.5% while the jet CAGR 3.2%. This applies the above multipliers to the average of the industry forecasts. The overall based aircraft CAGR is 1.5% while the Jet CAGR is 3.1%. The majority of the jet growth is in the unconstrained light and small jets.

High Growth (1.7%): The high growth scenario uses the highest industry growth rate and applies the constrained based aircraft multiplier. There is a marginal increase from the medium growth scenario with an overall CAGR of 1.7% and jet CAGR of 3.5%. The minor increase from the medium forecast is due to the constrained growth of medium and large jets.

The chosen based aircraft forecast growth in the constrained scenario is the high rate of 1.7%. This forecast shows a strong growth in the turboprop, small, and light jets. Medium and large jets show somewhat lower growth compared the industry forecasts due to the constraints. This forecast also aligns with the FAA's TAF. The TAF shows a compound annual growth rate of 1.6% throughout the forecasting period. The 5-year interval of the chosen high growth based aircraft forecast are shown in the following Table 2-9.

Table 2-9
Constrained Based Aircraft Forecast – High Growth Scenario

Year	2015	2016	2021	2026	2031	2036
Piston	94	94	93	92	91	91
Turboprop	27	28	30	33	37	41
Light Jet	6	6	7	8	10	12
Small Jet	38	40	48	57	68	81
Medium Jet	11	11	14	17	20	24
Large Jet	9	9	10	12	13	15
Total	185	187	202	219	239	263

Source: CMT (2016)

2.6.2.2. UNCONSTRAINED BASED AIRCRAFT FORECAST

Using the same method as the constrained scenario, the unconstrained based aircraft multipliers in Table 2-7 *were applied to the industry forecasts.*

Low Growth (1.2%): The low growth scenario is based on the lowest industry forecast which results in an overall based aircraft CAGR of 1.4%. The jet growth is higher with a CAGR of 3.1%. The large increase in jet CAGR compared to the constrained forecast is due to the influx of previously uncaptured medium and large jet aircraft.

Medium Growth (1.8%): The medium growth uses an average of the industry forecasts. The overall CAGR is 1.6% while the jet CAGR is significantly higher at 3.9%. This scenario predicts a strong growth in each jet aircraft classification.

High Growth (3.1%): The high growth scenario is based on the highest of the industry forecasts which results in an overall CAGR of 3.1%. There is a tremendous growth in jets with a CAGR of 6%. This growth in jets is due to a strong growth in light, small, and medium jets with the most robust growth in the large jets. Now unconstrained the large jet growth should meet the highest industry forecast of 9.6% (Bombardier).

The chosen based aircraft forecast for the unconstrained scenario is the medium growth of 1.8%. The unconstrained condition at CEA will provide significantly more development area and incentive for corporate jet users. These factors will lead to a growth representative of the medium forecast scenario, as shown in Table 2-10.

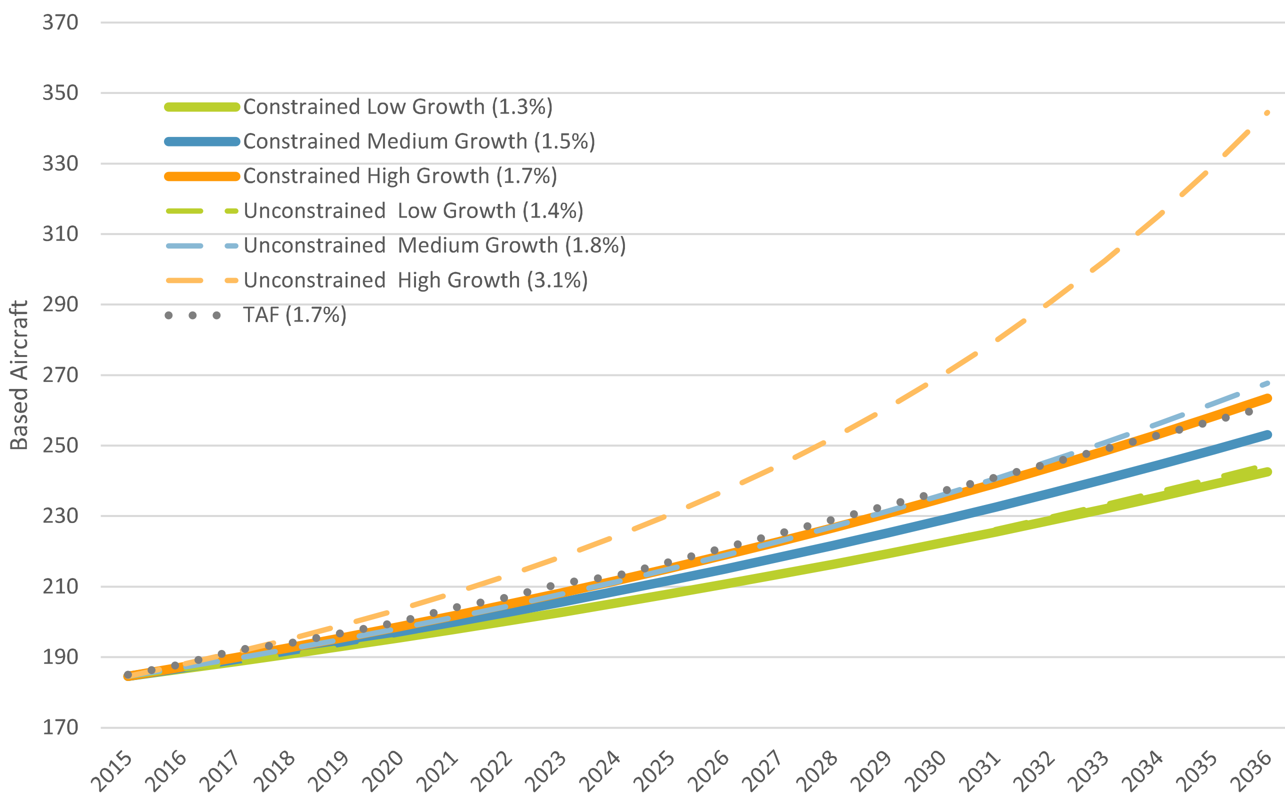
Table 2-10:
Unconstrained Based Aircraft Forecast - Medium Growth Scenario

Year	2015	2016	2021	2026	2031	2036
Piston	94	93	91	89	87	85
Turboprop	27	27	30	33	36	39
Light Jet	6	6	7	8	9	11
Small Jet	38	40	47	55	65	77
Medium Jet	11	11	14	17	20	25
Large Jet	9	9	13	17	23	31
Total	185	187	201	219	241	268

Source: CMT (2016)

To compare the constrained forecast scenarios with the unconstrained forecast scenario, see the following **Figure 2-11.** *The constrained scenarios are represented by the solid lines and the unconstrained by the dashed line. The TAF has been included as the dotted line to benchmark each forecasted scenario.*

Figure 2-11:
Based Aircraft Growth Scenarios – Constrained and Unconstrained



Source: CMT (2016)

2.6.3. Operations Forecast

The ultimate gauge in planning the future viability of an airport is assessing the number of aircraft operations. Aircraft operations provide a direct representation of the aeronautical demand that an airport will need to facilitate in both the near- and long-term future.

As Chicago's top reliever in terms of both local and itinerant operations, CEA has established itself as reputable destination for all aviation users. However, the aviation industry is continually evolving and CEA must take the appropriate steps to meet the future demand of the aviation system. The best way to proactively prepare for this future demand is to develop a forecast that will provide insight on future scenarios.

To accurately project future demand, an operations forecast should be based on operations-related data. As such, the operational forecast scenarios found within this forecast are founded upon on the operational trends identified in Section 3, which include trends from CEA, the corporate airports in Chicago, and the top 25 IFR reliever airports. These trends provide a basis in which to identify existing trends and then extrapolate realistic growth scenarios. To further improve upon the validity of operational forecast, industry fleet growth forecasts are incorporated into demand by function of including the *associated low, medium, and high based aircraft forecasts. By applying the growth in operations per growth in based aircraft, the industry fleet growth is effectively being incorporated into the operations forecast.*

In addition to developing a forecast based on the existing CEA facility, there must also be a component of this report that forecasts a CEA facility that would be unconstrained. As identified in the surveys and interviews, there are both real and perceived existing constraints that exist at CEA. Several analyses have been conducted within this report to further identify these constraints, as well as establish additional factors that may affect demand. The following elements within the operations forecast integrate all of these components to establish a constrained and unconstrained forecast of operations at CEA.

2.6.3.1. CONSTRAINED OPERATIONS FORECAST

Through application of the methods established in the beginning of this section, the following forecasted growth rates were defined under the constrained conditions.

Low Growth (-0.6%): The low growth scenario is based on the lowest trend rates with an overall compounded annual growth rate of -0.6%. This rate is attributed to the sharp decline in piston and turboprop operations and the relatively low jet growths, partially due to the constrained runway at CEA. The CAGR of the jets is 0.4% which is made up mostly by small and light jets.

Medium Growth (0.4%): The medium growth scenario is based on an average of the trend rates with an overall CAGR of 0.4%. This low growth is due to the continued decline in piston aircraft and the constrained growth of the large jets. The jet CAGR of 1.1% has a modest increase in growth which is further attributed to the constrained medium and large jets.

High Growth (2.1%): The high growth scenario is based on the highest of the trend growth rates with a total CAGR of 2.1%. This significant growth compared to the low and medium scenarios is based on the nationwide positive trend in piston aircraft. While this is unlikely at CEA, it is important to take into consideration. This scenario still constrains the medium and large jets, resulting in a corporate jet CAGR of 1.9%.

The chosen constrained forecast for this report is the medium growth scenario of 0.4%. When considering all of the constrained factors, the majority of the growth will be limited to only turboprops, light jets, and small jets. Further, this aligns well with the FAA's TAF CAGR of 0.3%. See Table 2-11.

**Table 2-11:
Constrained Operations Forecast – Medium Growth**

Year	2015	2016	2021	2026	2031	2036
Piston	15,572	15,047	12,675	10,669	8,974	7,541
Turboprop	9,614	9,658	9,887	10,136	10,407	10,700
Light Jet	6,401	6,470	6,831	7,222	7,645	8,106
Small Jet	34,423	34,693	36,113	37,665	39,371	41,255
Medium Jet	7,726	7,814	8,282	8,793	9,352	9,965
Large Jet	2,861	2,929	3,291	3,699	4,158	4,675
Total	76,597	76,611	77,080	78,184	79,907	82,242

Source: CMT (2016)

2.6.3.2. UNCONSTRAINED OPERATIONS FORECAST

The unconstrained operations forecast utilizes the previously established method using the unconstrained multipliers.

Low Growth (0.1%): The low growth scenario is based on the lowest trend rate and unconstrained operations multiplier. This results in an overall operations CAGR of 0.1%. The unconstrained medium and large jet growth significantly increases compared to the constrained forecast. This effectively negates the negative trend of the piston aircraft. The total jet CAGR is 1.3%, which grows quickly when unconstrained.

Medium Growth (1.4%): The medium growth scenario takes the averages of the trend mixes and applies the unconstrained operations multipliers. This results in a total operational CAGR of 1.4% and corporate jet CAGR of 2.4%. The influx of medium to large corporate jet aircraft help positively influence the further declining piston aircraft operations.

High Growth (3.3%): The high growth scenario takes the highest percentages in the trend mixes and applies the unconstrained multipliers. This results in a healthy total operational CAGR of 3.3% which is primarily represented by the growth in jet aircraft. The corporate jet CAGR is a strong 3.9%. This is attributed to combining the highest industry jet trend with the increase in operations from the highest based aircraft forecast.

The chosen growth for the unconstrained forecast is the medium growth of 1.2%. This is a modest overall CAGR that is supported by a robust growth in jets that would likely occur in an unconstrained scenario shown in Table 2-12.

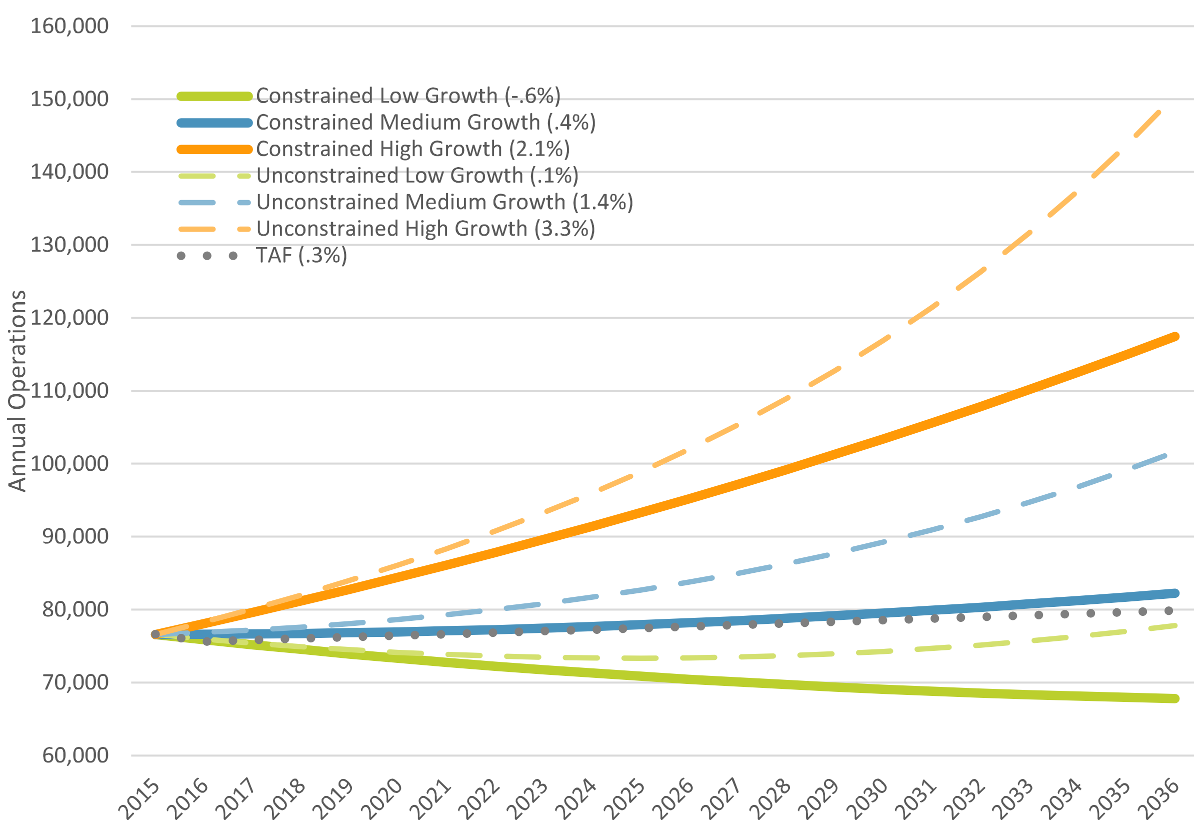
Table 2-12:
Unconstrained Operations Forecast – Medium Growth

Year	2015	2016	2021	2026	2031	2036
Piston	15,572	14,898	11,928	9,525	7,582	6,011
Turboprop	9,614	9,657	9,881	10,125	10,391	10,679
Light Jet	6,401	6,473	6,849	7,255	7,697	8,177
Small Jet	34,423	34,702	36,166	37,766	39,523	41,462
Medium Jet	7,726	7,979	9,377	11,029	12,980	15,287
Large Jet	2,861	3,152	5,071	8,073	12,745	19,984
Total	76,597	76,860	79,272	83,774	90,918	101,599

Source: CMT (2016)

A comparison of the constrained operations forecasts and the unconstrained operations forecast can be found in the following Figure 2-12*. The constrained scenarios are represented by the solid lines and the unconstrained by the dashed line. The TAF has been included as the dotted line to benchmark each forecasted scenario.*

Figure 2-12:
Constrained and Unconstrained Operations Forecast



Source: CMT (2016)

2.7. Forecast Summary

This forecast has reviewed a number of industry forecasts, trends, and factors so that CEA can better prepare for future demand. While this establishes a justifiable baseline for CEA, the ultimate impact on aviation demand at CEA is dependent on the Airport's constraints. In order for CEA to continue serving the Chicago area as the top corporate reliever, these constraints need to be further evaluated.

Regardless of unconstrained considerations, the forecasts chosen within this report best represents the potential demand at CEA under the current conditions at the airport. The high based aircraft forecast was chosen under the constrained scenario because of the strong growth in turboprop, light jet, and small jet aircraft. Despite this strong growth in the smaller corporate traffic, the medium and large corporate aircraft remain constrained, which ultimately curbs the growth of the high scenario to a CAGR of 1.7% by the end of the planning period. When comparing the based aircraft forecast to the FAA's TAF, they are nearly identical. Both have a CAGR of 1.7%, and the TAF only has 2 less based aircraft by 2036.

The medium forecast was selected for the operations forecast with a total CAGR of 0.4%. This marginal growth is primary attributed to the declining piston operations and the constrained medium and large corporate jet aircraft. Although the constraints restrict the larger corporate traffic, there is still a healthy *growth in the small corporate traffic. The FAA's TAF shows an operational growth of 0.3%, only one tenth of a percent below the forecast established in this report. A comparison of these growth rates can be shown in* Table 2-13*.*

Since the number of instrument approaches has a direct relationship to the number of operations at CEA, the anticipated number of instrument approaches have also been included in Table 2-13*. The 2015 instrument approaches are based upon a dataset that records the instrument flights at an airport.*

Table 2-13:
Forecast Summary

Forecast Summary							
Operations		**2015**	**2016**	**2021**	**2026**	**2031**	**2036**
CEA Forecast	**Jet Operations**	51,412	51,907	54,518	57,379	60,526	64,001
	Total Operations	76,597	76,611	77,080	78,184	79,907	82,242
	Instrument Operations	65,600	65,612	66,013	66,959	68,434	70,434
FAA TAF	**Total Operations**	76,597	75,632	76,630	77,667	78,745	79,868
Comparison: % Difference		0%	1%	1%	1%	1%	3%
Based Aircraft		**2015**	**2016**	**2021**	**2026**	**2031**	**2036**
CEA Forecast	**Jet Based Aircraft**	964	66	79	93	111	132
	Total Based Aircraft	27	28	30	33	37	41
FAA TAF	**Total Operations**	6	6	7	8	10	12
Comparison: % Difference		38	40	48	57	68	81

Source: CMT (2016)

Section 3

Facility Requirements

3.1. Introduction

The facility requirements act as an essential part of the planning process to assess the ability of existing facilities to meet current and future demand. These Facility Requirements are founded upon the demand established in the Chicago Executive Airport (CEA) forecast. Any difference between the forecast demand and the existing capacity will be identified to determine future Facility Requirements.

The two primary components of Facility Requirements are separated into airside and landside facilities. Airside facilities support aircraft related activities, which include runways, taxiways, hangars, and aprons. Landside facilities are areas that support the operation of the airport but are not directly involved with aircraft movement. These landside facilities include, but are not limited to, terminals, vehicle parking, access roadways, local economic development, and protection of environmental or airspace dedicated land.

3.2. Forecast Review

It is important to establish the amount of demand by aircraft classification when developing an airfield's Facility Requirements due to the facilities required for a large range in aircraft type at an airport. Once the demand by specific aircraft is identified, it can be compared to existing facilities to determine if they will be able to accommodate the demand or if new facilities will be required. This section will review the aircraft operations and based aircraft forecasts from the previous section.

3.2.1. Aircraft Operational Demand

In the previous section, forecast, the constrained medium growth scenario was selected as the forecast on which to base future facilities. Since this forecast is based on the constrained scenario, it limits the growth in the large aircraft operations. However, all categories of aircraft except for piston aircraft, are forecast to grow through the planning period. These specific growth trends for each aircraft size group are important to reference when developing future Facility Requirements. Table 3-1 *depicts the selected operational forecast.*

Table 3-1:
Constrained Operations Forecast – Medium Growth

Constrained Operations Forecast - Medium Growth						
Year	2015	2016	2021	2026	2031	2036
Piston	15,572	15,047	12,675	10,669	8,974	7,541
Turbo Prop	9,614	9,658	9,887	10,136	10,407	10,700
Light Jets	6,401	6,470	6,831	7,222	7,645	8,106
Small Jets	34,423	34,693	36,113	37,665	39,371	41,255
Medium Jets	7,726	7,814	8,282	8,793	9,352	9,965
Large Jets	2,861	2,929	3,291	3,699	4,158	4,675
Total	76,597	76,611	77,079	78,184	79,907	82,242

Source: CMT (2016)

3.2.2. Based Aircraft Demand

In addition to the operational forecast, the based aircraft forecast is important to determine future needs at CEA. The chosen based aircraft forecast was the constrained high growth. Similar to the operations forecast, all categories of aircraft, except piston, are forecast to grow, with small and medium jets seeing the largest percentage increase. The piston aircraft showed slight reduction in based aircraft at the end of the forecast period. The based aircraft forecast is shown in Table 3-2.

Table 3-2:
Constrained Based Aircraft Forecast – High Growth

Constrained Based Aircraft Forecast - High Growth						
Year	2015	2016	2021	2026	2031	2036
Piston	94	94	93	92	91	91
Turbo Prop	27	28	30	33	37	41
Light Jets	6	6	7	8	10	12
Small Jets	38	40	48	57	68	81
Medium Jets	11	11	14	17	20	24
Large Jets	9	9	10	12	13	15
Total	185	187	202	219	239	263

Source: CMT (2016)

3.3. Airside Facility Requirements

This section will first examine the airfield layout to determine if any changes are required to the physical layout of the airfield. Runway configuration, taxiway layout, apron and ramp locations, and navigational aids will be further examined. Doing so will also determine if the runway's critical aircraft and airport reference code need to change.

3.3.1. Airport Reference Code

The Airport Reference Code (ARC) is defined as the airport's highest Runway Design Code (RDC) of all runways. Currently, CEA is classified as a D-III ARC, and as shown by Table 3-3*, will remain a D-III.*

Table 3-3:
Airport Reference Code Classification System

Design Element	Runway		
	6/24	12/30	16/34
Existing Critical Aircraft	Cessna 421	King Air B200	Gulfstream G550
Existing RDC	B-I Small	B-II Small	D-III
Future Critical Aircraft	Cessna 421	Cessna Citation Sovereign	Gulfstream G550
Future RDC	B-I Small	B-II Large	D-III

Source: FAA Advisory Circular 150/5300-13A, Airport Design

3.3.2. Critical Aircraft

The critical aircraft determination is an important aspect of airport planning and design. It sets dimensional requirements on an airport, such as the distance between taxiways and runways. An accurate determination of the critical aircraft helps to ensure the proper development of airport facilities. Each runway is designated a critical aircraft based on runway operational usage.

Critical aircraft represent the most demanding Aircraft Approach Category (AAC) and Aircraft Design Group (ADG) with 500 or more operations on a single runway. The AAC is represented by a letter that signifies the approach speed of the particular aircraft. The ADG is represented by a roman numeral and indicates the size of the wingspan or tail height. The combination of these two attributes is also known as the RDC.

A preliminary analysis of the critical aircraft at CEA was conducted in the forecast. These critical aircraft have been further evaluated in this section using updated and new data sources. Based on a departure and arrival analysis using PASSUR data, the critical aircraft classification for Runway 12/30 is recommended to change, while Runway 16/34 and Runway 6/24 are recommended to remain the same.

3.3.3. Runway 12/30

Runway 12/30 has historically been developed as a B-II Small runway while utilizing the King Air B200 as the critical aircraft. Analysis of operational PASSUR data has revealed that there are sufficient B-II Large operations on Runway 12/30 to require a change in critical aircraft. Table 3-4 *presents the five-year average annual operations on Runway 12/30 for the eight most common B-II Large aircraft.*

Table 3-4:
Runway 12/30 Operational Data

Runway 12/30			
Aircraft	Make/Model	RDC	Avg Annual Operations
C680	Cessna Citation Sovereign	B-II Large	132
C56X	Cessna Citation Excel	B-II Large	103
C560	Cessna Citation V	B-II Large	66
H25B	Raytheon Hawker 800	B-II Large	63
F2TH	Dassault Falcon 2000	B-II Large	54
C550	Cessna Citation II/Bravo	B-II Large	41
CL30	Bombardier Challenger 300	B-II Large	40
BE40	Beech Jet 400	B-II Large	39
TOTAL		**B-II Large**	**538**

Source: CMT (2017)

The core difference between B-II Small and B-II Large aircraft is their weight classification. B-II Small aircraft have a weight classification less than 12,500 lbs while B-II Large aircraft have a weight classification more than 12,500 lbs. Therefore, it is recommended that Runway 12/30 be changed to a B-II Large RDC and the recommended critical aircraft change to the Cessna Citation Sovereign.

3.3.4. Runway 16/34

Runway 16/34 has historically been developed as a D-III runway while utilizing the Gulfstream G550 as it's critical aircraft. An analysis of 2015 operational data indicated that there were 244 departures of aircraft in the Gulfstream G550 and G650 families. According to FAA's Aircraft Characteristics Database dated September 2016, these aircraft families are classified as D-III aircraft. Assuming operations are equivalent to double the number of departures, there were 488 total operations of D-III aircraft in 2015. The approved forecast for CEA projected aggressive growth (2.3% annual growth rate) in the large aircraft segment of CEA's fleet mix. Based on this growth rate, it is anticipated that the total operations of D-III aircraft will exceed 500 annual operations by 2017. Based on this analysis, no change is recommended to the RDC of Runway 16/34. Likewise, the current critical aircraft for Runway 16/34 is recommended to remain the Gulfstream G550. This is consistent with the initial analysis performed in the previous Forecast section.

3.3.5. Runway 6/24

Runway 6/24 is recommended to remain B-I small. Previous planning efforts at CEA have utilized the Cessna 421 as the critical aircraft. Because there have not been any significant changes to the runway in recent years, it is recommended that the Cessna 421 be maintained as the critical aircraft.

3.3.6. Runway Orientation and Weather Conditions

The runway configuration at CEA has been constructed to minimize the percentage of time that strong crosswinds make the use of the airport inadvisable. In FAA Advisory Circular 150/5300-13A (AC 13A) Airport Design, the FAA states "a crosswind runway is recommended when the primary runway orientation provides less than 95% percent wind coverage." The 95% wind coverage is computed on the basis of crosswinds not exceeding10.5 knots for RDC A-I and B-I aircraft, 13 knots for RDC A-II and B-II aircraft, and 16 knots for RDC A-III, B-III, C-I, II, III and D-I, II, III aircraft. It is at these thresholds that a pilot may choose to use a more favorable runway, or if none are available, an alternative airport.

To determine if the existing runway configuration at CEA is sufficient to accommodate aircraft under the local wind conditions, weather data from the National Climactic Data Center (NCDC) was analyzed. It is necessary to calculate wind coverage for all aircraft types that consistently use the airport. In cases where the runway provides adequate wind coverage for the larger aircraft, but not for smaller aircraft, a crosswind runway may be maintained to ensure that all aircraft are accommodated during 95% of airport operations. Table 3-5 *provides a summary of the all-weather wind condition analysis for existing Runway 6/24, 12/30 and 16/34 at CEA. The wind information obtained is from the NCDC for the period between 2006 and 2015.*

Table 3-5:
Wind Coverage (All Weather Conditions)

All Weather Wind Coverage Table				
Runway	Crosswind Component			
	10.5 Knot	13 Knot	16 Knot	20 Knot
16/34	91.72%	95.96%	99.02%	99.82%
12/30	89.29%	93.88%	98.33%	99.69%
6/24	90.45%	95.05%	98.73%	99.78%

Source: NCDC data for CEA 2007-2016; CMT analysis (2017)

As Table 3-5 illustrates, individually, runways 6/24, 12/30, and 16/34 do not provide 95% wind coverage at a 10.5 knot maximum crosswind, as required for RDC A-I and B-I aircraft. However, when all three runways are analyzed, they in total provide 99% wind coverage for each runway's RDC crosswind component threshold.

IFR weather conditions are defined by the FAA as having a ceiling less than 1,000 feet above ground level and/or when visibility is less than three miles. According to historical wind and weather data for CEA that was obtained from the FAA Airports Geographic Information System (Airports GIS) Wind Analysis database, IFR conditions occur approximately 18.3% of the time. Poor visibility and low ceiling conditions (less than 300 feet and 1-mile visibility based on current approach minimums) occur 1.4 % of the time. CEA has one runway end that is equipped with an instrument approach for inclement weather conditions. Runway 16 is equipped with a Category I ILS with minimums of 300 feet and 1-mile visibility.

Table 3-6 provides a summary of IFR wind conditions that occur during IFR operations.

Table 3-6:
Wind Coverage (IFR Weather Conditions)

IFR Weather Wind Coverage Table				
Runway	Crosswind Component			
	10.5 Knot	13 Knot	16 Knot	20 Knot
16/34	92.40%	96.00%	98.70%	99.66%
12/30	88.65%	93.73%	98.42%	99.70%
6/24	89.84%	94.45%	98.45%	99.67%

Source: NCDC data for CEA 2007-2016; CMT analysis (2017)

This wind analysis concludes that the current runway layout provides adequate wind coverage for the existing and forecasted aircraft fleet operating at CEA, while also meeting FAA standards.

While it is the Airport's current desire to maintain all three active runways, FAA has previously stated that future AIP funds cannot be used to maintain Runway 6/24. Combined with the existing geographical constraints which face CEA , it is plausible that a runway could be decommissioned in the future for more *efficient land utilization. This scenario analyzed the two most utilized runways – Runway 16/34 and 12/30. As shown in* Tables 3-7 *and* 3-8*, runways 16/34 and 12/30 combined provide more than 95% wind coverage, for both all-weather and IFR, thereby meeting operational needs and FAA standards.*

Table 3-7:
Two Runway - Wind Coverage (All Weather Conditions)

All Weather Wind Coverage Table Runways 16/34 & 12/30				
Runway	Crosswind Component			
	10.5 Knot	13 Knot	16 Knot	20 Knot
16/34	91.72%	95.96%	99.02%	99.82%
12/30	89.29%	93.88%	98.33%	99.69%
Combined Runway Coverage	95.52%	98.38%	99.69%	99.97%

Source: NCDC data for CEA 2007-2016; CMT analysis (2017)

Table 3-8:
Two Runway - Wind Coverage (IFR Weather Conditions)

IFR Wind Coverage Table Runways 16/34 & 12/30				
Runway	Crosswind Component			
	10.5 Knots	13 Knots	16 Knots	20 Knots
16/34	92.40%	96.00%	98.70%	99.66%
12/30	88.65%	93.73%	98.42%	99.70%
Combined Runway Coverage	95.10%	97.98%	99.44%	99.91%

Source: NCDC data for CEA 2007-2016; CMT analysis (2017)

3.4. Runway Requirements

Runway 16/34 functions as the primary runway at CEA, primarily due to its length and instrument approach capability. As shown in Table 3-9 *below, based on five years of operational data, Runway 16/34 is utilized for nearly 97% of all arrivals into CEA. For departures, Runway 16/34 and Runway 12 comprise approximately 97% of all departures from CEA. Runway 6/24 is utilized for 1.2% of all arrivals and for 1.7% of all departures.*

Table 3-9:
Runway Utilization

Arrivals by Runway							
Runway	Aircraft Size						Total
	Piston	Turbo Prop	Light Jet	Small Jet	Medium Jet	Large Jet	
16	19%	11%	8%	43%	9%	3%	**94%**
34	1%	0%	0%	1%	0%	0%	**3%**
12	1%	0%	0%	0%	0%	0%	**1%**
30	1%	0%	0%	0%	0%	0%	**1%**
6	0%	0%	0%	0%	0%	0%	**0%**
24	1%	0%	0%	0%	0%	0%	**1%**
Total	**22%**	**12%**	**8%**	**45%**	**9%**	**4%**	**100%**

Departures by Runway							
Runway	Aircraft Size						Total
	Piston	Turbo Prop	Light Jet	Small Jet	Medium Jet	Large Jet	
16	5%	4%	3%	13%	3%	1%	**28%**
34	9%	7%	5%	28%	6%	2%	**56%**
12	3%	2%	1%	6%	1%	0%	**14%**
30	1%	0%	0%	0%	0%	0%	**1%**
6	1%	0%	0%	0%	0%	0%	**1%**
24	0%	0%	0%	0%	0%	0%	**1%**
Total	**18%**	**13%**	**9%**	**47%**	**10%**	**4%**	**100%**

Source: CMT Analysis (2017)

3.4.1. Runway Length

Runway length requirements should be designed to accommodate the most demanding aircraft (critical aircraft) expected to regularly use an airport. FAA Advisory Circular 150/5325-4B, Runway Length Requirements for Airport Design (AC 4B) provides the necessary guidance needed to make a runway length determination. Using the critical aircraft previously identified (the Gulfstream G550), and AC 4B, the required runway length analysis was calculated.

There are many variables that need to be considered when calculating runway length requirements. Some of these variables from AC 4B include:

- *Airport elevation above mean sea level*
- *Temperature*
- *Wind velocity*
- *Airplane operating weights*
- *Takeoff and landing flap settings*
- *Runway surface condition (dry or wet)*
- *Effective runway gradient*

Generally speaking, aircraft performance decreases as airport elevation, temperature and runway gradient increases, and also when runways are contaminated. These variables need to be considered when aircraft takeoff and landing performance calculations are computed and are therefore an integral part of the runway length planning process. Three of the general inputs used in the runway length analysis include the following and are shown in Table 3-10*:*

1. *Airport elevation above mean sea level*
2. *Mean daily maximum temperature of the hottest month*
3. *Effective runway gradient*

Table 3-10:
AC 4B Airport Input Data

Airport Input Data	
AC 4B Element	**Input**
Airport elevation above mean sea level	647'
Mean maximum temperature for the hottest month	83°F/28°C
Effective runway gradient	4.166'

Source: FAA AC 150/5325-4B, National Centers for Environmental Information (NCEI), Airnav.com; CMT Analysis (2018)

AC 4B lists the procedures to determine the takeoff and landing runway length requirements, as well as how to apply if necessary, any runway length adjustments. The Master Plan's previous Forecast section identified the Gulfstream G550 as the critical aircraft. AC 4B advises to use Chapter 4 of the advisory circular for aircraft that have a Maximum Certificated Takeoff Weight (MTOW) more than 60,000 lbs. Aircraft with a MTOW greater than 60,000 lbs., such as the G550, are required to use aircraft performance charts published in the G550 Airplane Planning Manual (APM).

Utilizing the procedures outlined in AC 4B a runway length analysis was calculated for both the takeoff and landing requirements for the G550, as well as allowable runway length adjustments. This analysis identified the recommended runway length at CEA to be 7,542 feet as shown in Table 3-11*, while the full step-by-step analysis can be found in the* Appendix B*.*

Table 3-11:
Recommended Runway Length Requirement

Critical Aircraft	Takeoff Length	Landing Length	Runway Length Adjustment	Recommended Runway Length
GLF5 - Gulfstream V/G550	7,500'	6,500'	42’	**7,542'**

Source: CMT Analysis (2018)

Although 7,542 feet is identified as the recommended runway length using the runway length analysis found in AC 4B, it may be necessary for future studies and subsequent sections of this report to consider other runway lengths as well. Due to the physical constraints of the Airport, as well as the proximity to Chicago O’Hare’s airspace, a runway extension of other lengths at CEA would be significant benefit to users. CEA users operate in a constrained condition on the existing 5,001 foot primary runway, therefore, any additional length should be considered.

3.4.2. Runway Width

The runways at CEA have been analyzed to determine if existing facilities meet future requirements. Runway widths are determined by the standards set forth in AC 13A and are based off a runway’s RDC.

Runway 16/34 is 150 feet wide and is in compliance with FAA design standards. Runway 6/24 is a RDC B-I Small runway and FAA design standards for this RDC is a 60-foot-wide runway - currently runway 6/24 is 50 feet. Therefore, it is recommended that runway 6/24 be widened ten feet to meet FAA designs standards.

Runway 12/30 is 75 feet wide and while this is in compliance with FAA design standards, coordination with CEA users have indicated that widening Runway 12/30 to 100 feet would provide a substantial runway safety and utility benefit. As discussed in Section 3.3, nearly 15% of all departures at CEA utilize Runway 12/30. Historically, the Dassault Falcon family of corporate aircraft fell into the B-II RDC and would routinely use Runway 12/30 at its current 75-foot width. Recent guidance published by Dassault indicates that 75-foot width runways are considered “narrow.” The guidance has recommended that their aircraft not utilize runways less than 100 feet wide. Dassault cites a statistic indicating that the most common type of accident observed in Falcon aircraft is a runway excursion. Only utilizing wider runways is intended to mitigate the risk associated with runway excursions. It is recommended that CEA further evaluate the feasibility of widening Runway 12/30 in future report sections.

3.4.3. Runway Capacity

FAA Guidance Circular 150/5060-5, Airport Capacity and Delay, provides guidance to measure an airport’s ability to accommodate the number of future operations. This circular provides approximate hourly aircraft capabilities for VFR and IFR conditions, and the annual service volume (ASV) for different common runway configurations. When an airport reaches 60% of ASV, the airport should begin to plan for additional runway capacity.

Based on CEA's runway layout configuration, it would be capable of accommodating up to 230,000 annual operations. 60% of this ASV equates to 138,000 operations. Based on forecasted operations, CEA has sufficient runway capacity to meet current and future levels of operations.

3.5. Runway Design Standards

An airport is developed to specific standards defined by FAA. The main source for defining the airside facilities at an airport is FAA's AC 13A. Use of AC 13A is required for all projects funded with federal grants. AC 13A acknowledges, however, that it may not always be feasible to meet all current standards at existing airports. Due to a number of factors such as development constraints and funding prioritization, some facilities may remain non-standard for a period of time.

At CEA, the greatest consideration when evaluating facility compliance with AC 13A is development constraints. CEA's origins as a privately-owned facility, combined with a location that is bound by several types of high-use public infrastructure, limits the existing facility's compliance with AC 13A standards. Regardless of these constraints, it is important to understand the future requirements of enhancing compliance. This chapter of the Facility Requirements will establish the existing standards that are established in AC 13A and what future development will be needed to enhance compliance.

3.5.1. Runway Safety Areas

The Runway Safety Area (RSA) is a rectangular area around a runway that enhances the safety in the event an aircraft undershoots, overruns, or veers off the runway. The dimensions of an RSA are established in AC 13A and vary based on the RDC. AC 13A requires the clearing of objects in an RSA, except for objects that need to be located in the RSA because of their function (primarily navigational aids for the runway). CEA's three runways each have a different RDC (B-I, B-II and D-III) and therefore each have different RSA dimensions which are listed in Table 3-12.

Table 3-12:
Runway Safety Area (RSA) Dimensions

Runway Safety Area Dimensions			
Design Surface	AC 150/5300-13A Standards		
	Runway 16/34	Runway 12/30	Runway 6/24
RSA Length Beyond End	1,000'	300'	240'
RSA Length Prior to Threshold	600'	300'	240'
RSA Width	500'	150'	120'

Source: AC 150/5300-13A, Airport Design

Runway 16/34 Runway Safety Area

Throughout the past two decades, CEA has a credible record of enhancing safety and making strides towards RSA compliance, specifically for Runway 16/34. Since the last full RSA determination for Runway 16/34 was issued in 2001, CEA has worked with IDA and FAA to enhance safety on Runway 16/34 by installing engineered material arresting system (EMAS). EMAS beds were installed on the Runway 16 end *in 2015 and on the Runway 34 end in 2014 as a means of mitigating non-standard RSA's. This constitutes an acceptable level of non-standard RSA mitigation.*

Runway 12/30 and Runway 6/24 Runway Safety Areas

Both Runway 6/24 and Runway 12/30 use the declared distance concept to provide the required RSA dimensions. Declared distances are a methodology used to mitigate non-compliance issues pertaining to RSA and Runway Object Free Area (ROFA) requirements. Due to land constraints, CEA cannot utilize the full-length pavement of either runway as there is not sufficient space for a fully compliant RSA off the end of runways 12, 30 and 24. The existing declared distances are shown in Table 3-13. *Additionally,* Exhibits 3-1 *and* 3-2 *depict the RSA's of Runway 12/30 and Runway 6/24.*

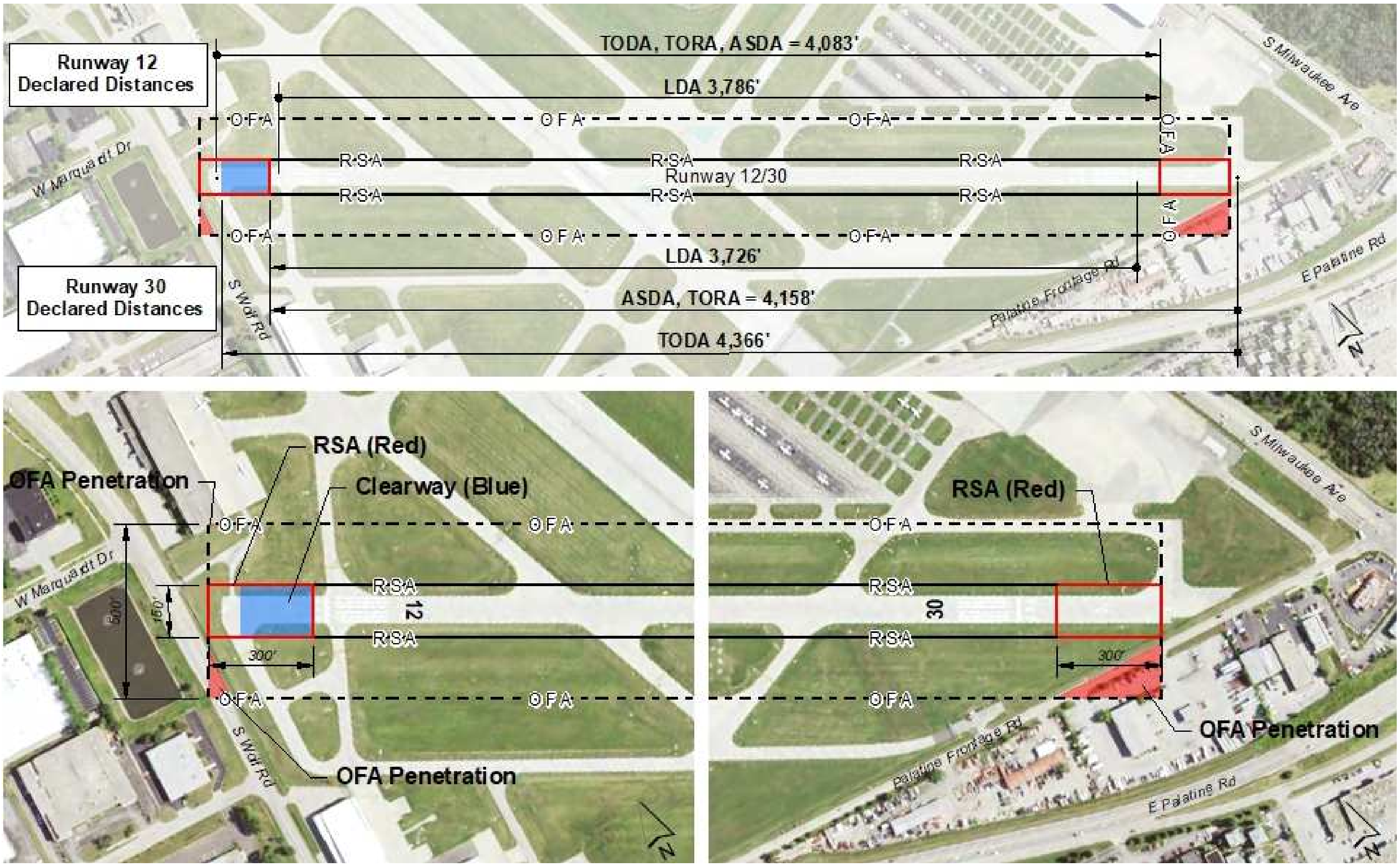
Table 3-13:
Existing Declared Distances

Declared Distances Data Table

Item	Runway 12	Runway 30	Runway 6	Runway 24
Accelerate Stop Distance Available (ASDA)	4,083'	4,158'	3,463'	3,660'
Landing Distance Available (LDA)	3,786'	3,726'	3,109'	2,409'
Takeoff Distance Available (TODA)	4,083'	4,366'	3,463'	3,660'
Takeoff Run Available (TORA)	4,083'	4,158'	3,463'	3,660'

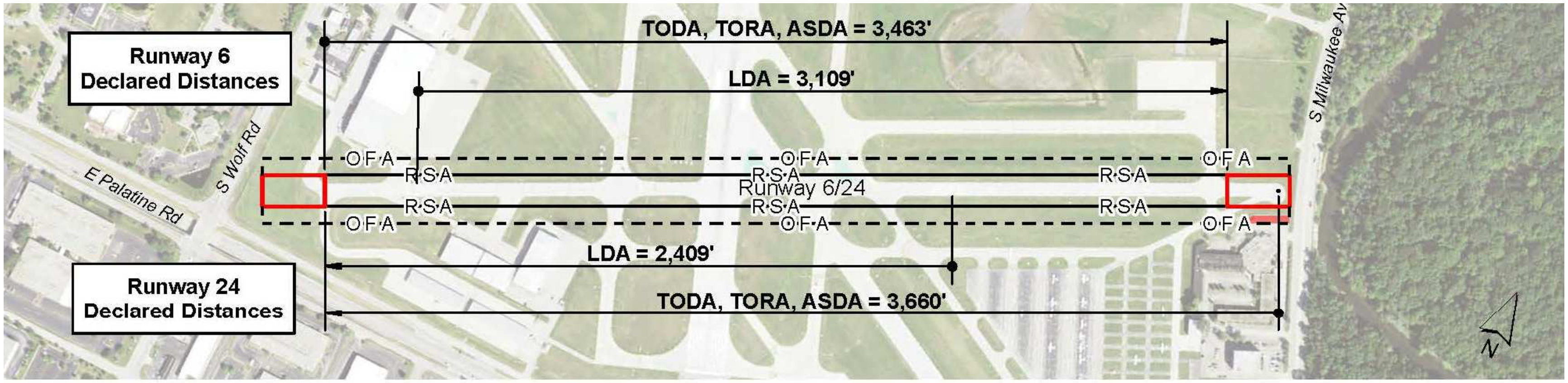
Source: FAA Approved ALP 2009

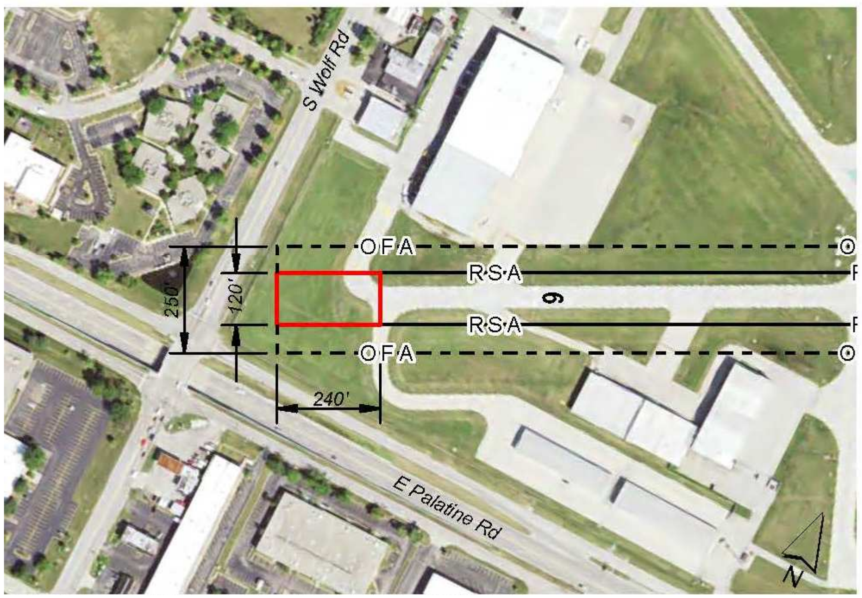
Exhibit 3-1:
Runway 12/30 RSA & ROFA

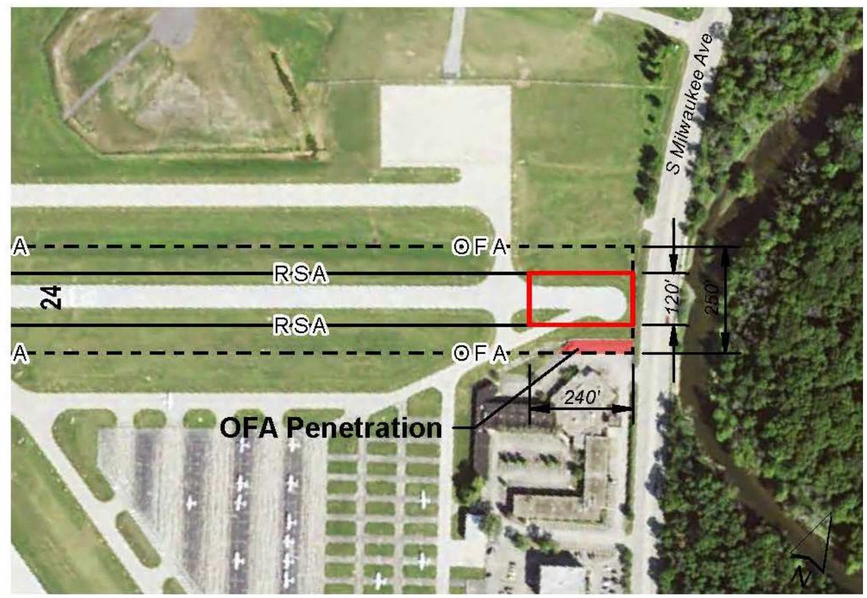


Source: 2010 Runway Safety Area Determination

Exhibit 3-2:
Runway 6/24 RSA & ROFA







Source: 2010 Runway Safety Area Determination

3.5.2. Runway Object Free Area

The Runway OFA is similar in shape and purpose to the RSA. It establishes a rectangular buffer around a runway from objects and operating aircraft. Airport facilities required for navigation or maneuvering such as NAVAIDs and taxiways are allowed within the ROFA. Some facilities that are typically not allowed within the ROFA can be permitted with an approved Modification to Standard (MOS). ***Table 3-14*** *shows the ROFA dimensions at CEA based on AC 13A standards.*

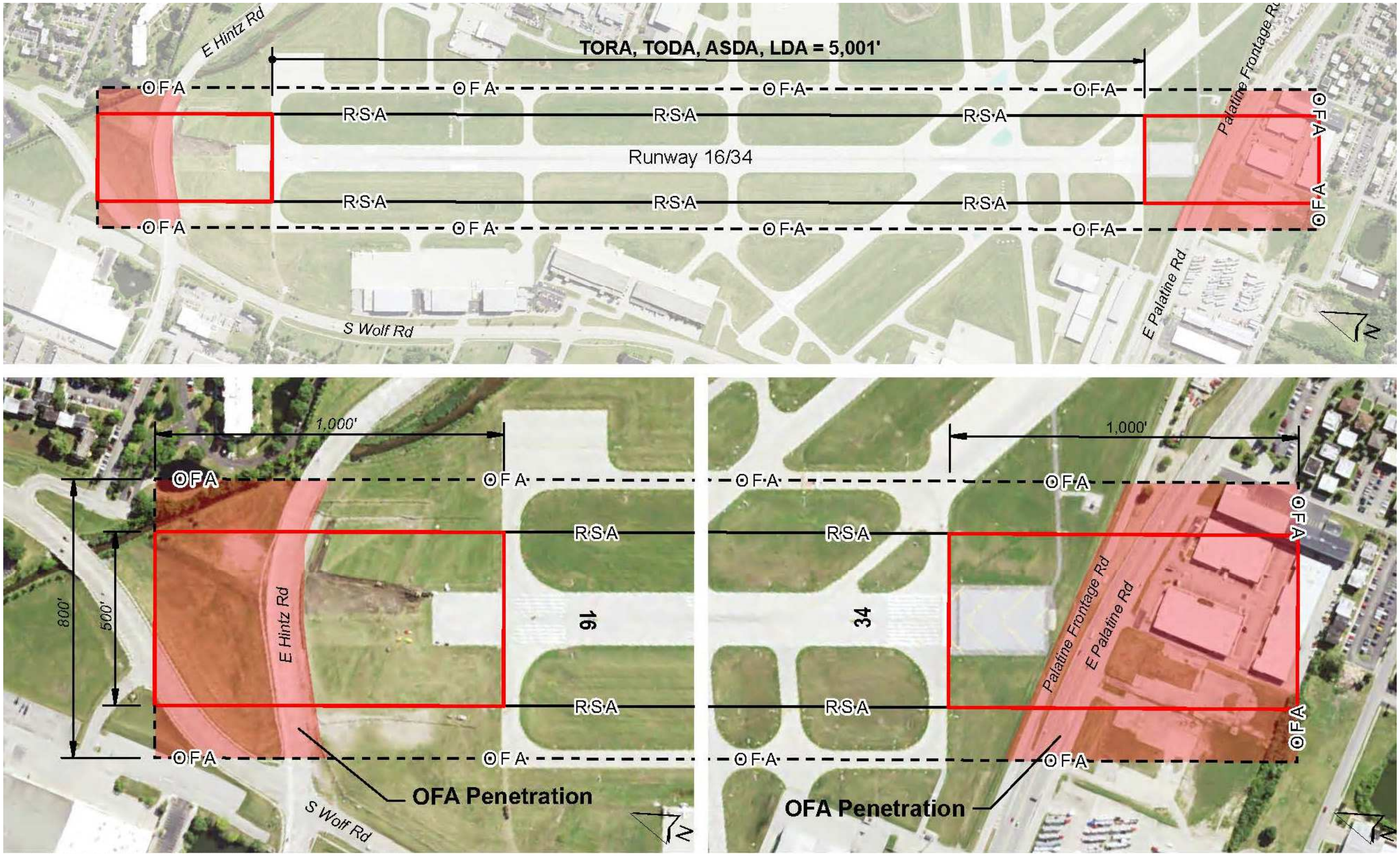
Table 3-14:
Runway Object Free Area (ROFA) Dimensions

Runway Object Free Area Dimensions			
Design Surface	AC 150/5300-13A Standards		
	Runway 16/34	Runway 12/30	Runway 6/24
ROFA Length Beyond End	1,000'	300'	240'
ROFA Length Prior to Threshold	600'	300'	240'
ROFA Width	800'	500'	250'

Source: AC 150/5300-13A, Airport Design

<u>Runway 16/34 Object Free Area</u>
Similar to the RSA for Runway 16/34, a full-length ROFA is required and the existing ROFA does not fully comply with FAA standards. ***Exhibit 3-3*** *depicts the Runway 16/34 Object Free Area and the non-compliant areas.*

Exhibit 3-3:
Runway 16/34 ROFA



Source: CMT Analysis (2017)

Runway 12/30 and Runway 6/24 Object Free Areas

While both Runway 12/30 and Runway 6/24 achieve RSA compliance by utilizing declared distances to mitigate non-compliant RSA's, the declared distances do not completely mitigate non-compliant OFA's for Runways 12/30 and 6/24. **Exhibits 3-1** *and* **3-2** *depict the OFA's and areas of non-compliance for Runway 12/30 and Runway 6/24.*

3.5.3. Runway Protection Zone (RPZ)

The Runway Protection Zone (RPZ) is a trapezoid located on each end of the runway. The RPZ acts as a protective horizontal surface to people and property on the ground. Similar to the RSA, RPZ dimensions are established in AC 13A and are based on the RDC. For runways with declared distances, there are both a "departure" and "approach" RPZ. Although Runway 16/34 ends have two different approach visibility minimums (Runway 16 is 1-mile and Runway 34 is a visual), they have the same size RPZs. **Table 3-15** *depicts the RPZ dimensions at CEA based on AC 13A standards.*

Table 3-15:
Runway Protection Zone (RPZ) Dimensions

Approach RPZ Dimensions				
Surface	Runway 16	Runway 34	Runway 12/30	Runway 6/24
Length	1,700'	1,700'	1,000'	1,000'
Inner Width	500'	500'	250'	250'
Outer Width	1,010'	1,010'	450'	450'

Departure RPZ Dimensions				
Surface	Runway 16	Runway 34	Runway 12/30	Runway 6/24
Length	1,700'	1,700'	1,000'	1,000'
Inner Width	500'	500'	250'	250'
Outer Width	1,010'	1,010'	450'	450'

Source: AC 150/5300-13A, Airport Design

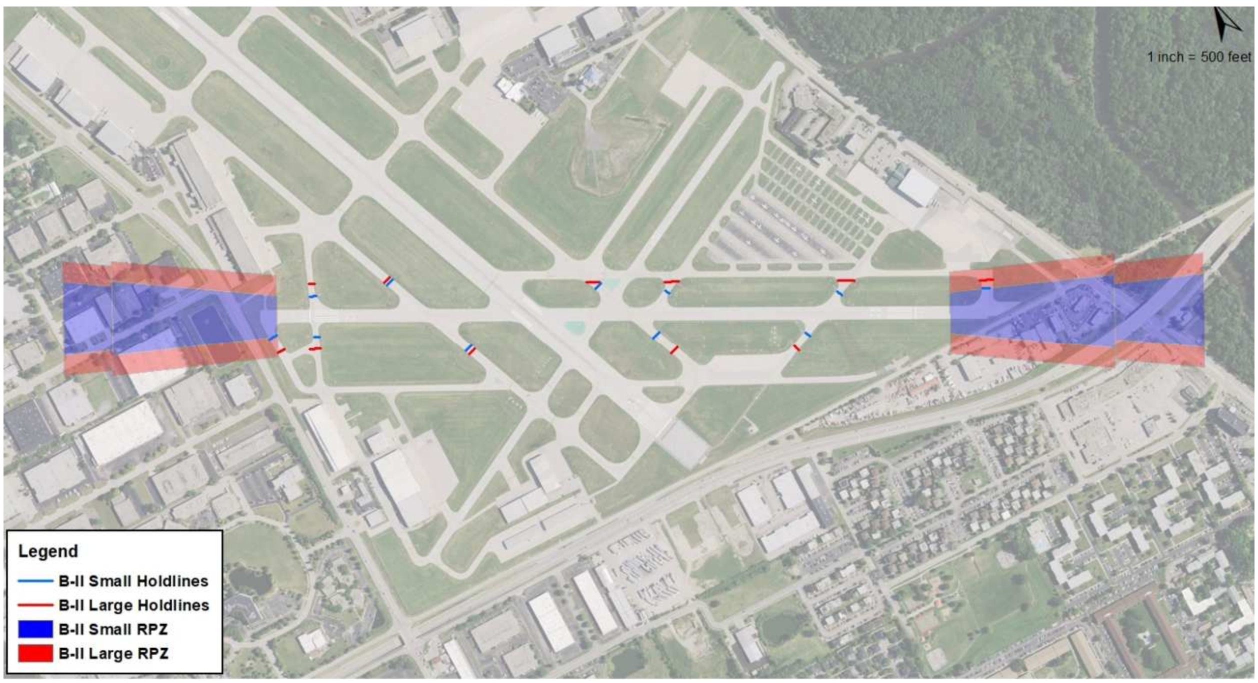
Due to the constrained nature of CEA, each RPZ contains some level of incompatible land use. At the time that this Facility Requirements was written, the FAA memorandum, "Interim Guidance on Land Uses within an RPZ," allows for incompatible land to exist within RPZs that were established prior to the publication of the memo. The language in this memo appears to exempt Runway 16/34 and Runway 6/24 from needing future modification because these runways will remain unchanged. However, since the critical aircraft for Runway 12/30 is recommended to increase in size from B-II Small to B-II Large, the inner and outer width dimensions of the RPZ will increase as well. **Table 3-16** *shows existing dimensions of a B-II Small runway RPZ and a future B-II Large runway RPZ, and* **Exhibit 3-4** *graphically depicts the RPZ dimensions. While the RSA and OFA do not change when the Runway 12/30 RDC increases, the runway holding position markings will change in addition to the RPZ dimensions. The holding position marking changes are also shown on* **Exhibit 3-4**. *It is recommended that CEA coordinate with FAA and IDA during review of this section to understand the requirements (if any) pertaining to the Runway 12/30 RPZ.*

Table 3-16:
Existing and Future RPZ Dimensions – Runway 12/30

Runway 12/30 RPZ Dimensions For Increased RDC		
Design Surface	AC 150/5300-13A Standards	
	Existing B-II Small	Future B-II Large
RSA	300' x 300' x 150'	300' x 300' x 150'
ROFA	300' x 300' x 500'	300' x 300' x 500'
RPZ	1,000' x 250' x 450'	1,000' x 500' x 700'

Source: AC 150/5300-13A, Airport Design

Exhibit 3-4:
Runway 12/30 RDC B-II Small vs. B-II Large RPZ & Holding Position Markings



Source: CMT Analysis (2017)

3.6. Taxiway Design Standards

Taxiway design at CEA should meet the standards set forth in AC 13A, Airport Design. Taxiways should be able to accommodate the most demanding aircraft anticipated at the airport, for both existing and anticipated aircraft. Sufficient taxiway width, taxiway safety area, taxiway object free (TOFA) area and taxiway/runway and taxiway/taxiway separation distances should be met.

Taxiway Design Groups (TDG) are established by aircraft characteristics of the aircraft operating on the taxiway. The TDG is a byproduct of the RDC and the type of aircraft operating on the runway (ADG), as a taxiway associated with the runway should be able to accommodate the same type aircraft. The TDG *and ADG will determine the taxiway design standards that should be used.* Table 3-17 *illustrates taxiway design standards based on TDG.*

Table 3-17:
Design Standards Based on Taxiway Design Group (TDG)

ITEM	DIM (See Figure 4-6)	TDG							
		1A	1B	2	3	4	5	6	7
Taxiway Width	W	25 ft (7.5 m)	25 ft (7.5 m)	35 ft (10.5 m)	50 ft (15 m)	50 ft (15 m)	75 ft (23 m)	75 ft (23 m)	82 ft (25 m)
Taxiway Edge Safety Margin	TESM	5 ft (1.5 m)	5 ft (1.5 m)	7.5 ft (2 m)	10 ft (3 m)	10 ft (3 m)	15 ft (4.6m)	15 ft (4.6m)	15 ft (4.6m)
Taxiway Shoulder Width		10 ft (3 m)	10 ft (3 m)	15 ft (3 m)	20 ft (6 m)	20 ft (6 m)	30 ft (9 m)	30 ft (9 m)	40 ft (12 m)

Source: FAA Advisory Circular 150/5300-13A, Airport Design

3.7. Taxiway Requirements

The RDC for Runway 16/34 is D-III, and of the largest aircraft in the D-III group (ex. Gulfstream G550 family) require a TDG 3 to operate. Therefore, all taxiways associated with Runway 16/34, and any other taxiways on the airfield that would be used by this group of aircraft, should be to the standards of TDG 3. Other taxiways on the airfield would include taxiways that are utilized to taxi to and from the FBOs and other corporate aircraft hangars.

The RDC of Runway 12/30 is recommended to be upgraded from a B-II Small to a B-II Large. The larger aircraft (ex. Cessna Citation Excel) using the runway and associated taxiways have characteristics that recommends a TDG 2. Table 3-18 *illustrates all the taxiway widths and TDG categories at CEA.*

Table 3-18:
CEA Taxiway Design Group

Taxiway	Width	TDG	Taxiway	Width	TDG
A between Twy E & Twy F	35'	2	K2	50'	3
A between Twy E & Rwy 2/20	40'	2	K3	50'	3
A south of Rwy 12/30	35'	2	K5	50'	3
B between Rwy 12/30 & NE Corner of ramp	35'	2	L	50'	3
B between Rwy 24 hold & NE Corner of ramp	23'-27'	1	L1	50'	3
C between Twy K & C-ramp	50'	3	L2	50'	3
C between C-ramp & Rwy 6/24	35'	2	L3 east of Twy L	50'	3
D east of 34 Pad	40'	2	L3 west of Twy L	35'	2
D west of 34 Pad	35'	2	L4	50'	3
D between Twy Y & Twy L	35'	2	L5	50'	3
D between Rwy 12/30 & Twy Y	50'	3	P	35'	2
E	35'	2	Q	35'	2
E1	35'	2	T	35'	2
F	30'	1	Y	35'	2
K	50'	3	Z	35'	2

Source: CMT (2017)

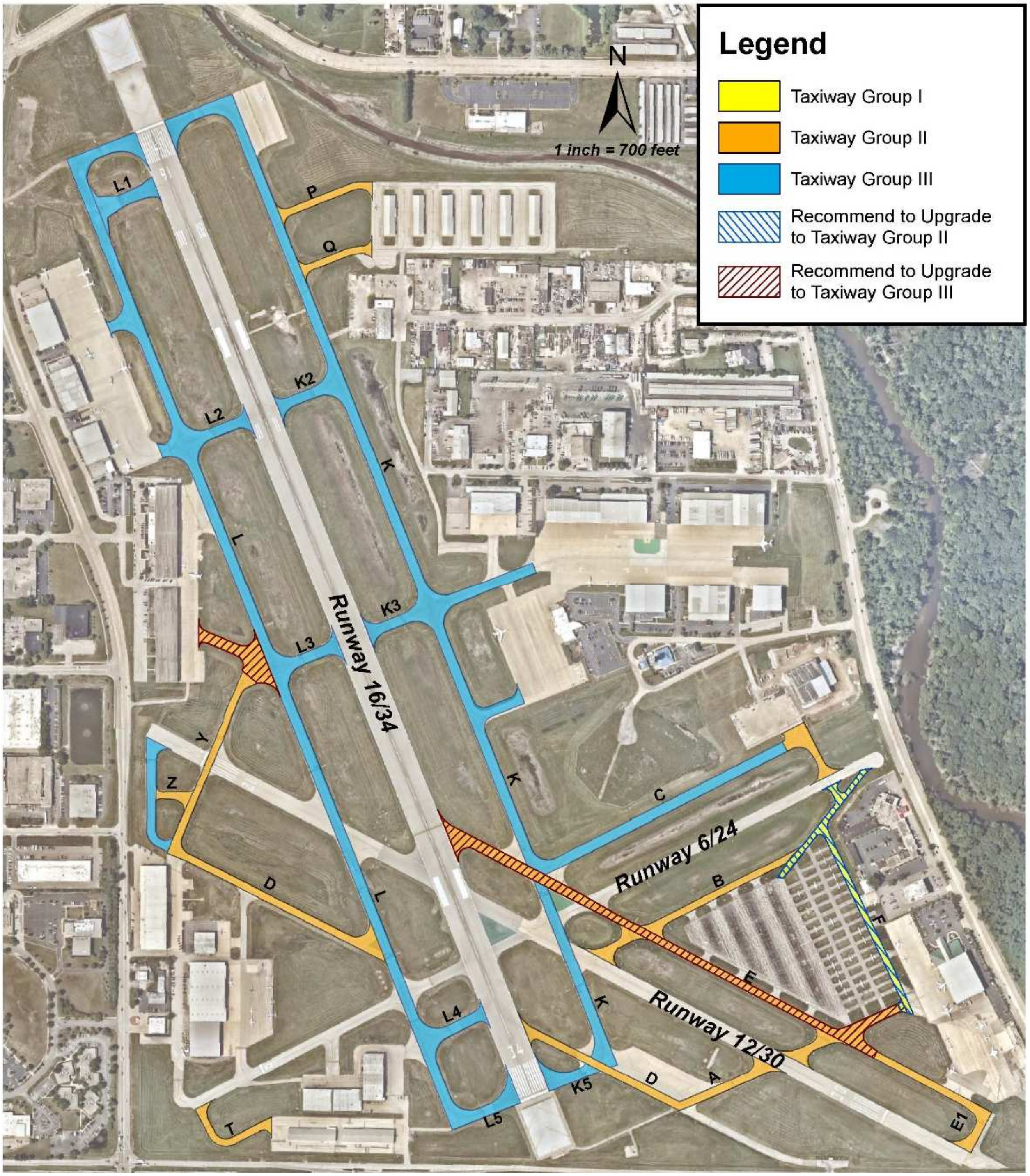
As shown in Table 3-18, with an exception to part of Taxiways B and F, the smallest taxiway width is 35 feet which falls under TDG 2.

As discussed in the forecast section, based aircraft and aircraft operations are projected to have negative growth in the piston aircraft segment, while showing positive growth within the turboprop and jet categories. For this reason, it is recommended that at a minimum, all taxiways not associated with Runway 16/34, the FBOs and other corporate hangars be designed per TDG2 standards

3.7.1. Taxiway Width and Shoulder Requirements

Taxiways that utilize the TDG 3 design standard require a taxiway width of 50 feet and taxiways that utilize the TDG 2 design standard require a taxiway width of 35 feet. Taxiway A, Taxiway E, and Taxiway L3 west of Taxiway L are all TDG II taxiways. Given their proximity to FBOs or corporate hangars, these taxiways could be utilized by ADG III aircraft. Therefore, it is recommended that Taxiway A between Taxiways E and F, Taxiway E between Taxiway A and Runway 16/34, and Taxiway L3 between Taxiway L and the west ramp be upgraded to TDG III as Exhibit 3-5 illustrates.

Exhibit 3-5:
Recommended TDG Upgrades



Source: FAA Advisory Circular 150/5300-13A, Airport Design, CMT Analysis (2017)

According to AC 13A, paved shoulders are only required for taxiways accommodating ADG-IV or higher. Since CEA's highest ADG will be ADG-III, the advisory circular states that paved shoulders are not required for ADG-III. Because of this, no upgrades to the existing turf shoulders are recommended.

3.7.2. Taxiway Safety Area

The Taxiway Safety Area (TSA) is an area surrounding the area of a taxiway that prevents damage to aircraft that veer from the taxiway. The TSA dimension is based on the ADG of the aircraft. There are currently no penetrations to the airfield TSAs. Table 3-18 *represents the TSA dimension requirements.*

3.7.3. Taxiway Obstruction Free Area

The Taxiway Object Free Area (TOFA)is similar to the TSA but wider. It is also based on the ADG of aircraft that uses the taxiway. Table 3-19 *depicts the TOFA dimension of each taxiway at CEA. There are no existing penetrations to the CEA TOFA.*

Table 3-19:
Design Standards Based on Airplane Design Group (ADG)

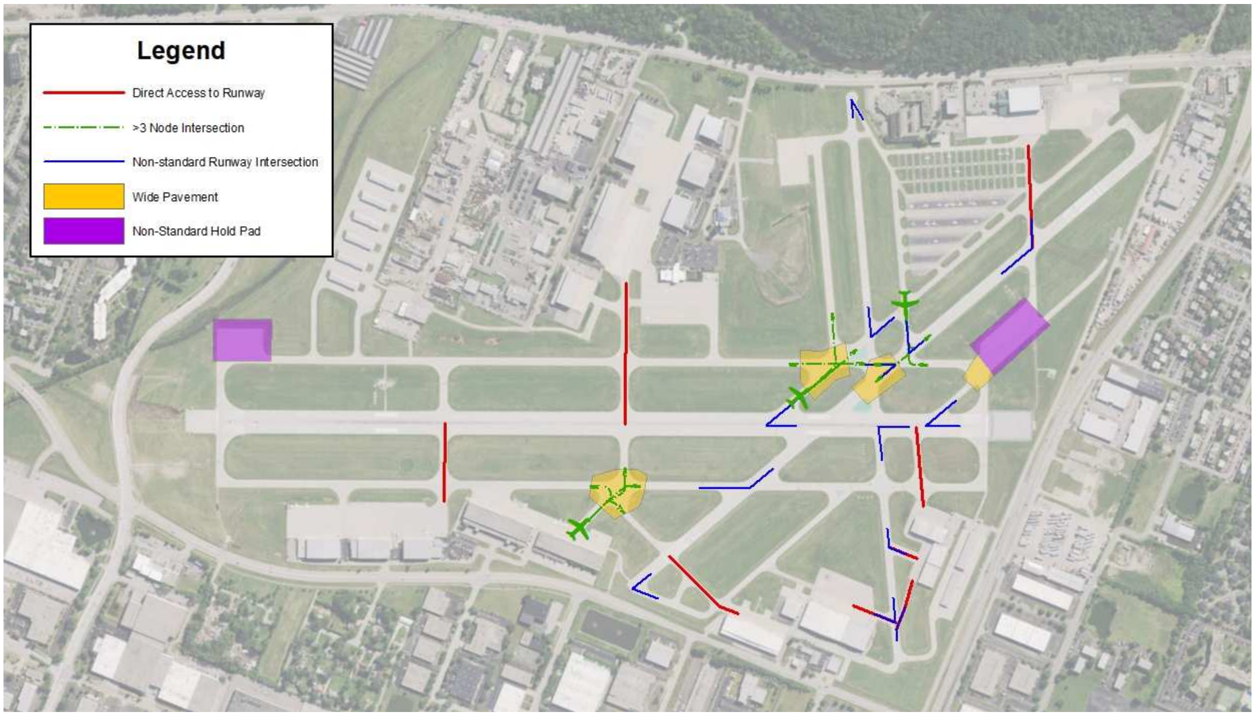
ITEM	DIM (See Figure 3-26)	ADG					
		I	II	III	IV	V	VI
TAXIWAY PROTECTION							
TSA	E	49 ft (15 m)	79 ft (24 m)	118 ft (36 m)	171 ft (52 m)	214 ft (65 m)	262 ft (80 m)
Taxiway OFA		89 ft (27 m)	131 ft (40 m)	186 ft (57 m)	259 ft (79 m)	320 ft (98 m)	386 ft (118 m)
Taxilane OFA		79 ft (24 m)	115 ft (35 m)	162 ft (49 m)	225 ft (69 m)	276 ft (84 m)	334 ft (102 m)

Source: FAA Advisory Circular 150/5300-13A, Airport Design

3.7.4. Taxiway Geometry

AC 13A includes new guidance on taxiway geometry. The guidance contained in AC 13A strives to enhance airfield safety by avoiding runway incursions through the use of airfield geometric improvements that require more deliberate taxi movements and increase pilot situational awareness. An analysis of this geometry was conducted at CEA to determine the number of non-compliant elements. Exhibit 3-6 *shows the locations of non-compliant geometry.*

Exhibit 3-6:
Taxiway Geometry Compliance Assessment



Source: FAA Advisory Circular 150/5300-13A, Airport Design

Potential mitigation options for the following non-compliant locations will be further evaluated in the Alternatives section of this master plan. The locations of non-compliant geometry areas shown above are described below.

Direct Access to Runway
As stated in AC 13A "do not design taxiways to lead directly from an apron to a runway without requiring a turn." As shown in Exhibit 3-6*, there are eight locations that do not comply with direct access guidance. The eight direct access locations are also displayed as a matrix in* Table 3-20*.*

3 Node Intersection
This concept states that a pilot should be presented with no more than three choices at an intersection – ideally, left, right, and straight ahead. There are three areas, as shown in Exhibit 3-6*, that are non-compliant with the 3-node concept. These three locations are also displayed as a matrix in* Table 3-20*.*

Non-standard Intersection Angles
Taxiway and runway intersections should be designed so that turns are at 90-degree angles wherever possible. This gives a pilot the best view, both to the left and right, when approaching or crossing a runway. The preferred standard intersection angles are 30, 45, 60, 90, 120, 135, and 150 degrees. There are 13 taxiway/runway intersection that are non-standard as in Exhibit 3-6*. The 13 locations are also displayed as a matrix in* Table 3-20*.*

<u>Wide Pavement</u>

AC 13A states "taxiway to runway interface encompassing wide expanses of pavement is not recommended." Wide expanses of pavement can cause a loss of situational awareness as signs and other visual cues are placed farther from the pilot's view. There are four areas that have been identified as "wide expanses of pavement" as shown on the map in **Exhibit 3-6***. The four areas locations are also displayed as a matrix in* **Table 3-20***.*

<u>Non-standard Hold Pad</u>

A holding pad (or holding bay) is used to provide a space for aircraft waiting clearance and to permit aircraft already cleared to move to their runway takeoff position. The design of a holding pad should have clearly marked entrance/exit points and allow for aircraft to bypass one another to taxi to the runway. As shown is **Exhibit 3-6** *there are two non-standard hold pads. These locations are also displayed as a matrix in* **Table 3-20***.*

Table 3-20:
Taxiway Geometry Compliance Assessment

Intersecting Taxiway Location	Direct Access Ramp to Runway	More than 3 Node Intersection	Non-Standard Intersection Angles	Wide Expanses of Pavement	Non-Standard Holding Pad
Taxiway A					
12/30	✓		✓		
Taxiway B					
K & 12/30		✓			
6/24			✓		
12/30			✓		
Taxiway C					
E/K		✓		✓	
Taxiway D					
K/K5				✓	
12/30			✓		
16/34			✓		
34 Pad					✓
Taxiway E					
6/24			✓		
16/34			✓		
Taxiway K					
6/24 & 12/30				✓	
12/30			✓		
16 Pad					✓
Taxiway K3					
16/34	✓				
Taxiway L					
L3/Y		✓		✓	
12/30			✓		
Taxiway L2					
16/34	✓				
Taxiway L4					
16/34	✓				
Taxiway Y					
12/30	✓				
Runway 6/24					
16/34			✓		
Hangar 6 Access Pavement					
6/24	✓		✓		
Hangar 7 East Access Pavement					
6/24	✓		✓		
Hangar 7 West Access Pavement					
6/24	✓		✓		

Source: CMT Analysis (2017)

3.8. NAVAIDS

3.8.1. Weather Analysis

An airport's NAVAIDs serve the important function of aiding aircraft with the safe navigation, approach, and operation at an airport. NAVAIDs can include radio navigation facilities, approach lighting systems, and airfield lighting. NAVAIDS are also important to providing all weather access to the airport.

Most NAVAIDs are utilized under inclement weather or under Instrument Flight Rules (IFR) operations. These conditions are associated with lower visibility and cloud clearances at an airport which increase a pilot's reliance on NAVAIDs to operate. As such, an assessment of historical weather at CEA was made to evaluate whether upgrades to the existing NAVAIDs are needed to accommodate future demand.

Five years of CEA's historic weather data from the NCDC was evaluated to estimate the number of times an instrument approach would be needed under different visibilities. Further analysis of this assessment will be evaluated in the following section.

3.8.2. Instrument Approaches

Instrument approaches are developed at an airport to guide an aircraft for landing under instrument weather conditions. There are many requirements that the airport and surrounding airspace must meet in order for an instrument approach to be implemented. CEA's location in Chicago's airspace is unique. CEA is immediately adjacent to Chicago O'Hare's Class Bravo airspace. Because of this location, CEA's airspace is constrained and limits accessibility by instrument approaches.

CEA currently has three instrument approaches – an ILS/LOC, RNAV (GPS) and VOR. Each of these approaches only serve Runway 16 and have visibility minimums of 1 mile.

To determine the degree at which visibility conditions would warrant lower visibility minimums to instrument approaches at CEA, an analysis of instrument weather conditions was conducted. This analysis calculated the average number of arrivals per hour under visibility conditions that would require an instrument approach. Table 3-21 *displays the analysis for potential approaches impacted when visibility conditions fell below 1 mile in 2016. Using the constrained forecast,* Table 3-21 *also displays the approximate number of impacted approaches in 2036 when visibility conditions fall below 1 mile.*

Table 3-21:
Instrument Approach Analysis 2016 & 2036

	Estimated Annual Impacted Approaches 2016				
Time	Average Hourly Arrivals	*0 Vis*	*.25 Vis*	*.5 Vis*	*.75 Vis*
12:00 AM	1	0	2	4	5
1:00 AM	1	0	1	2	2
2:00 AM	0	0	1	0	1
3:00 AM	0	0	0	0	1
4:00 AM	0	0	1	1	3
5:00 AM	1	0	2	1	4
6:00 AM	2	0	4	4	10
7:00 AM	4	1	8	7	28
8:00 AM	5	0	7	9	16
9:00 AM	5	1	7	3	25
10:00 AM	6	0	7	5	16
11:00 AM	6	1	15	6	22
12:00 PM	7	3	14	20	22
1:00 PM	7	0	17	15	35
2:00 PM	8	0	17	11	30
3:00 PM	9	0	14	24	26
4:00 PM	9	0	16	21	48
5:00 PM	8	0	2	8	32
6:00 PM	7	0	4	8	26
7:00 PM	6	0	4	12	27
8:00 PM	4	0	3	9	16
9:00 PM	3	0	1	3	11
10:00 PM	3	0	2	5	13
11:00 PM	2	0	3	2	8
	Impacted Approaches	766	758	608	425

	Estimated Annual Impacted Approaches by 2036				
Time	Average Hourly Arrivals	*0 Vis*	*.25 Vis*	*.5 Vis*	*.75 Vis*
12:00 AM	1	0	2	4	6
1:00 AM	1	0	2	2	2
2:00 AM	0	0	1	1	1
3:00 AM	0	0	0	0	1
4:00 AM	0	0	1	1	3
5:00 AM	1	0	2	1	4
6:00 AM	2	0	5	4	10
7:00 AM	4	2	9	8	31
8:00 AM	5	0	8	10	17
9:00 AM	6	1	8	3	27
10:00 AM	6	0	7	5	17
11:00 AM	7	1	17	7	24
12:00 PM	7	3	15	22	23
1:00 PM	7	0	18	16	37
2:00 PM	8	0	18	12	32
3:00 PM	9	0	15	26	28
4:00 PM	10	0	17	23	52
5:00 PM	9	0	2	9	35
6:00 PM	7	0	4	9	28
7:00 PM	7	0	4	13	30
8:00 PM	4	0	4	10	17
9:00 PM	3	0	1	4	12
10:00 PM	3	0	2	5	14
11:00 PM	2	0	3	2	8
	Impacted Approaches	825	817	655	458

Source: CMT Analysis (2017)

In previous project phases, CMT conducted a CEA user survey to gain a better understanding of facility needs by users. One of the top two constraints users identified in the survey was the need for improved runway instrumentation. Based on this feedback combined with the analysis in Table 3-21*, it is recommended CEA further investigate the feasibility of an improved instrument approach to Runway 16 below 1-mile visibility, as well as constructing new instrument approaches to Runways 12, 30 and 34.*

3.9. Aircraft Parking, Storage and Hangar Development

Aircraft parking and storage requirements are largely driven by aircraft size and owner preference. At CEA, aircraft are stored inside of a hangar or on an apron. The previous section, Forecast, illustrates the trend that piston aircraft will be declining while turboprop and jet aircraft will be growing throughout the forecast period. As future demand increases the airside requirements (i.e. hangars and access pavement), landside facility requirements such as access roadways and automobile parking lots will also increase. The requirements of this section rely on the forecast demand and compare it with existing facilities to determine the additional future development requirements. There are three areas that primarily influence future hangar development requirements:

- *Aircraft hangar space*
- *Apron/access space*
- *Automobile parking/access space*

For the purpose of this analysis, it is assumed that all new based aircraft will desire covered storage. This results in a greater future need for large box hangars rather than additional apron space. While specific aircraft storage will be further analyzed in the Alternatives section, the ability of the existing available development space at CEA to accommodate future demand can be assessed.

3.9.1. Existing Hangar and Apron Space Assessment

To define how future aircraft storage space should be allocated, an assessment of the current aircraft parking inventory was completed. The assessment shows that there is approximately 830,000 square feet of existing hangar space and approximately 1,400,000 square feet of existing apron space at CEA. The existing hangar space includes aircraft storage and parking space, as well as "non-aircraft storage" areas of the hangars. Many hangars at CEA have additional space in the hangar buildings that are dedicated to office space, training rooms, pilot lounges, flight planning, parts inventory, etc. (non-aircraft storage areas). The "non-aircraft storage" areas appear to account for an additional 15%-20% space requirement. Table 3-22 *depicts the existing hangar space, calculating both aircraft storage and "non-aircraft storage" areas, and the existing apron space.*

Table 3-22:
Hangar and Apron Space

Hangar & Apron Space	
Hangar Space (sq.ft.)	**Apron Space (sq.ft.)**
830,000	1,400,000
Total Space	**2,230,000**

Source: CMT Analysis (2017)

Apron areas at CEA vary greatly in size, configuration and use. For the purpose of the forthcoming analysis, it is assumed that any new apron area required to support proposed hangar storage area will be of equal size to the hangar storage area it supports.

Similarly, taxiway and taxilane configuration that is used to access a hangar development can vary greatly depending on the location of hangar to the airfield. Hangar development in close proximity to the airfield would require far less access pavement (taxiway/taxilane) than a hangar that is located a further distance to the airfield. Therefore, for the purpose of this analysis, it is assumed that the access pavement (taxiway/taxilane) required will be commensurate to the apron area requirement.

3.9.2. Existing Aircraft Storage and Space Allocation

In order to determine existing and future parking and storage space requirements, the approximate footprint of the aircraft utilizing the parking and storage need to be determined. There are many ways *aircraft can be stored inside a hangar; various sized aircraft can be staggered with minimal space in between, maximizing the usage of hangar space, or aircraft can be parked independently, with large clearances in between. The first step is to identify how many and what type of aircraft are based at CEA, and then determine the footprint each aircraft consumes.*

The current Based Aircraft/Hangar Tenant list provided by CEA shows that 100% of based rotary, turbo prop, and jet aircraft are stored inside of hangars. Of the based piston aircraft, only 18% utilize tiedowns. Based on CEA's Based Aircraft/Tenant list Table 3-23 *illustrates how aircraft parking and storage is allocated CEA.*

Table 3-23:
Based Aircraft Parking Allocation

CEA Based Aircraft Parking and Storage			
Aircraft Type	**Hangar Storage**	**Apron Storage**	**Total**
Large Jet	15	0	15
Medium Jet	28	0	28
Small Jet	29	0	29
Light Jet	8	0	8
Turbo Prop	20	0	20
Piston	108	24	132
Rotary	6	0	6
Grand Total	214	24	238

Source: CEA Based Tenant/Hangar List

It should be noted that there is a significant variance between the FAA count of based aircraft and the airport's Based Tenant/Hangar list. The FAA count, which was used in the previous forecast section of this report, shows 185 based aircraft at CEA, while the airport's Based Tenant/Hangar list shows 238. There can be several reasons why there is a variance in the two sources, but the most common and typical reason is that some aircraft are registered to multiple airports. Table 3-24 *illustrates the based aircraft count from both the FAA and CEA.*

Table 3-24:
Based Aircraft Count – FAA & CEA

CEA Based Aircraft		
Aircraft Type	**FAA Count**	**CEA Count**
Large Jet	9	15
Medium Jet	11	28
Small Jet	38	29
Light Jet	6	8
Turbo Prop	27	20
Piston	94	132
Rotary	0	6
Grand Total	185	238

Source: FAA and CEA Based Tenant/Hangar List

The top five most common aircraft models from each aircraft type that operate at CEA were used as the sample to establish a baseline for calculating aircraft parking and storage requirements. To establish a square footage footprint of space each type of aircraft would approximately utilize, the average of all five aircraft's length times the width was used. AC 13A suggests using a minimum of 10 feet wingtip clearance when parking general aviation aircraft on aprons. This would add an additional 20 feet to the length and width of each aircraft when calculating the square footage. It appears that a more realistic scenario that mirrors the way aircraft are currently parked at CEA, would be to add only 10 feet to the total length and width of aircraft when calculating square footage. Table 3-25 *illustrates the square footage requirements by aircraft type that were calculated.*

Table 3-25:
Aircraft Square Footage

Aircraft Type & Space Requirements (Sq.Ft.)							
Aircraft Size	Rotary	Piston	Turbo-Prop	Light Jet	Small Jet	Medium Jet	Large Jet
Square Feet	2,650	2,118	3,582	2,957	4,105	5,713	10,011

Source: CMT Analysis (2017)

With the baseline of aircraft square footage space requirements established, it can be determined how existing and future aircraft utilize aircraft parking and storage at CEA.

3.9.3. Future Hangar Requirements

When planning future aircraft parking and storage requirements, both constrained and unconstrained growth scenarios from the forecast section should be considered. Additionally, since there is a discrepancy in the total based aircraft count between the FAA and airport, this section will examine both of these scenarios as well.

Table 3-26 *illustrates the minimum requirements needed to park and store aircraft only in hangars and does not consider any office or "non-aircraft storage" areas. The table depicts approximate additional* *hangar square footage required when applying both forecasting methods, constrained and unconstrained, and to both the FAA's and CEA's based aircraft count. The aircraft square footage values computed above in* Table 3-25 *were applied to the various forecasts.*

Table 3-26:
Forecasted Aircraft Storage Requirements

Constrained Based Aircraft Forecast (FAA Count)							Total Hangar
Year	Piston	Turbo -Prop	Light	Small	Medium	Large	Sq.Ft. Req'd
2015	94	27	6	38	11	9	**620,588**
2036	91	41	12	81	24	15	**992,001**
						Additional Hangar Space Required	**371,413**

Unconstrained Based Aircraft Forecast (FAA Count)							Total Hangar
Year	Piston	Turbo -Prop	Light	Small	Medium	Large	Sq.Ft. Req'd
2015	94	27	6	38	11	9	**620,588**
2036	85	39	11	77	25	31	**1,121,769**
						Additional Hangar Space Required	**501,181**

Constrained Based Aircraft Forecast (CEA Count)							Total Hangar
Year	Piston	Turbo Prop	Light	Small	Medium	Large	Sq.Ft. Req'd
2015	132	20	8	29	28	15	**804,046**
2036	128	30	17	61	61	25	**1,281,978**
						Additional Hangar Space Required	**477,932**

Unconstrained Based Aircraft Forecast (CEA Count)							Total Hangar
Year	Piston	Turbo -Prop	Light	Small	Medium	Large	Sq.Ft. Req'd
2015	132	20	8	29	28	15	**804,046**
2036	119	29	16	58	63	53	**1,533,582**
						Additional Hangar Space Required	**729,536**

Source: CMT Analysis (2017)

It is important to note that the calculations above represent area required to store aircraft in hangars and are not intended to represent total development area.

Although the difference in square footage requirements differ based on forecast method and the number of based aircraft, the areas calculated provide a range that can serve as a foundation for additional calculations.

When additional hangar development items such as "non-aircraft storage" space is added to the calculations above, the required total hangar space can be calculated. Table 3-27 *shows the total hangar space required, which accounts for the additional aircraft storage space (identified in* Table 3-26*) and adds in the "non-aircraft storage" space (20%). The sum of these two calculations provides the total additional hangar space requirements.*

Table 3-27:
Future Hangar Space Requirements

Forecast Scenario	Hangar Space				Total Additional Hangar Space Required (sq.ft.)
	Additional Aircraft Storage Space (sq.ft.) *From Table 4-5*		Non-Aircraft Storage Space (sq.ft.)**		
FAA Constrained	371,413	+	74,283	=	**445,695**
FAA Unconstrained	501,181	+	100,236	=	**601,417**
CEA Constrained	477,932	+	95,586	=	**573,518**
CEA Unconstrained	729,536	+	145,907	=	**875,443**

***20% used in calculation*

Source: FAA and CEA Based Tenant/Hangar List; CMT Analysis (2017)

3.9.4. Future Apron and Access Requirements

As previously stated, apron areas at CEA and access pavement vary greatly in size, configuration and use. For the purpose of determining required apron/access pavement space it was determined that future apron/access space would be equivalent to the additional aircraft storage requirement (from Table 3-27, footprint of aircraft plus 10' buffer added to length and width). With this metric identified, apron/access space calculations were added together to determine the total additional apron/access space requirement. Table 3-28 shows the additional apron/access space required for the various forecast scenarios. Once the total hangar and apron/access space requirements are known, future automobile parking and access requirements are needed next.

Table 3-28:
Future Apron and Access Space Requirements

Forecast Scenario	Apron Space		Access Space		Total Additional Apron & Access Space Required (sq.ft.)
	Additional Apron Space Required (equivalent to aircraft storage) (sq.ft) From Table 4-6		Access Pavement Required (sq.ft.) *Taxiway/Taxilane space needed to access hangar development*		
FAA Constrained	371,413	+	371,413	=	**742,825**
FAA Unconstrained	501,181	+	501,181	=	**1,002,362**
CEA Constrained	477,932	+	477,932	=	**955,863**
CEA Unconstrained	729,536	+	729,536	=	**1,459,071**

Source: FAA and CEA Based Tenant/Hangar List; CMT Analysis (2017)

3.9.5. Future Automobile Access and Parking Requirements

Planning for adequate vehicle parking requirements is a necessary element for CEA. Vehicle parking is used by employees who work at the airport, based aircraft tenants, and transient passengers utilizing the airport facility. A vehicle parking analysis was conducted at CEA to determine future vehicle parking requirements.

In the previously conducted CEA user survey, automobile parking capacity was not raised as a specific concern by the users. Some areas, however, have been observed to be at or near their capacity. For example, it has been observed that vehicle parking near Atlantic Aviation in the northwest quadrant may reach capacity at times, as vehicles have been seen parking in grass areas due to parking stalls being filled. Parking utilization is highly variable. For example, FBO's may utilize the available parking space more than other tenants. Because of this variability, the current ratio of hangar space to parking stalls was assumed to remain constant in the future and will be utilized in this calculation.

Currently, there are approximately 883 parking stalls and approximately 830,000 square feet of hangar space at CEA. This represents one vehicle parking stall per 940 square feet of hangar space. A typical parking stall dimension is 9 feet by 19 feet, thus requiring 171 square feet per stall. Consideration also needs to be given to ancillary access roadways, parking lot aisles and land required for landscaping between parking lots and streets and/or facilities. To account for this space, 300 square feet per required parking stall is applied.

Of the four scenarios illustrated in Table 3-29*, CEA will need approximately 474 – 931 additional parking stalls by 2036. The total automobile parking space requirement (parking stalls, parking aisles, ancillary parking roadways) is shown in the last column of* Table 3-29.

Table 3-29:
Automobile Parking Requirements

Forecast Scenario	**Total Addition Hangar Space Required (sq.ft.)** *From Table 3-27*	**# of Additional Parking Stalls Required** *(hangar space/940 = # parking stalls required)*	**Parking Lot Space Requirement (sq.ft.)** ***(stalls x 300 = parking lot space required)***
FAA Constrained	445,695	474	**142,243**
FAA Unconstrained	601,417	640	**191,942**
CEA Constrained	573,518	610	**183,038**
CEA Unconstrained	875,443	931	**279,397**

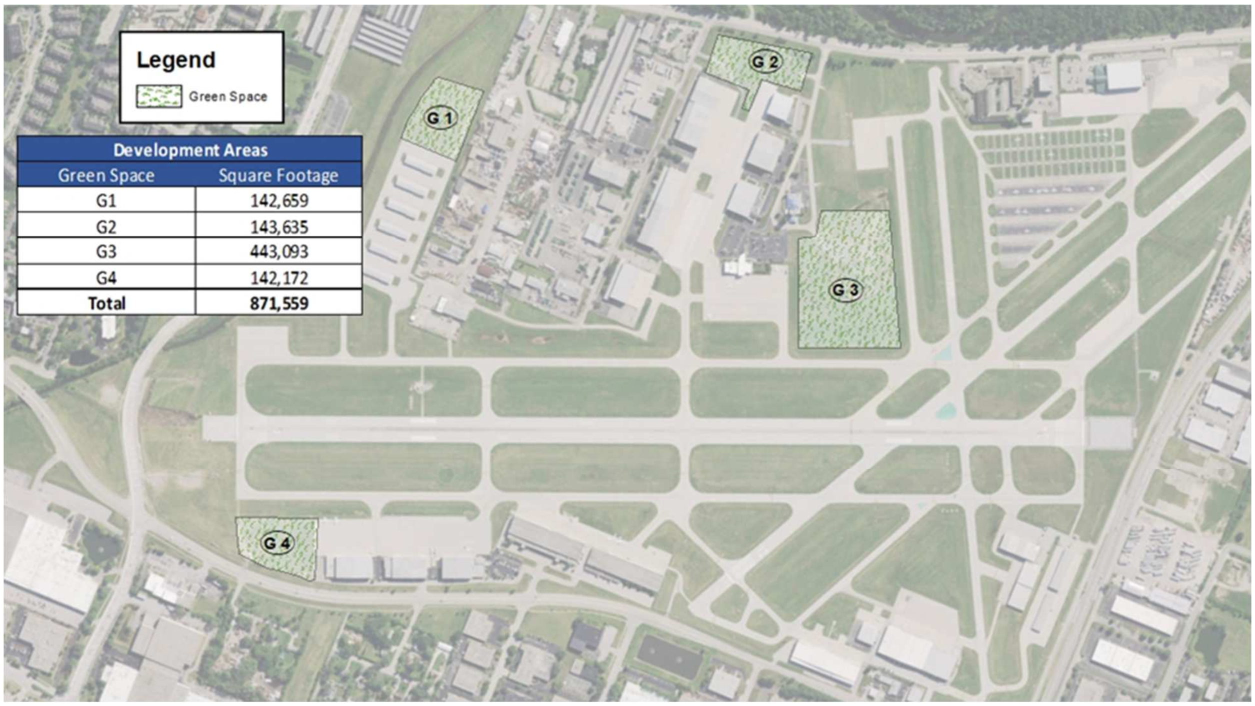
Source: CMT Analysis (2017)

The required hangar space, apron/access space and automobile parking requirements have been determined, the next step is to assess the quantity of existing undeveloped land at CEA.

3.9.6. Existing Development Space

*"Green space" at CEA consists of land that currently is undeveloped and would not require any change in airport surfaces or facilities to develop aircraft storage. **Exhibit 3-7** summarizes these areas and includes the approximate square footage of each area.*

Exhibit 3-7:
Green Space – Airfield Development Map



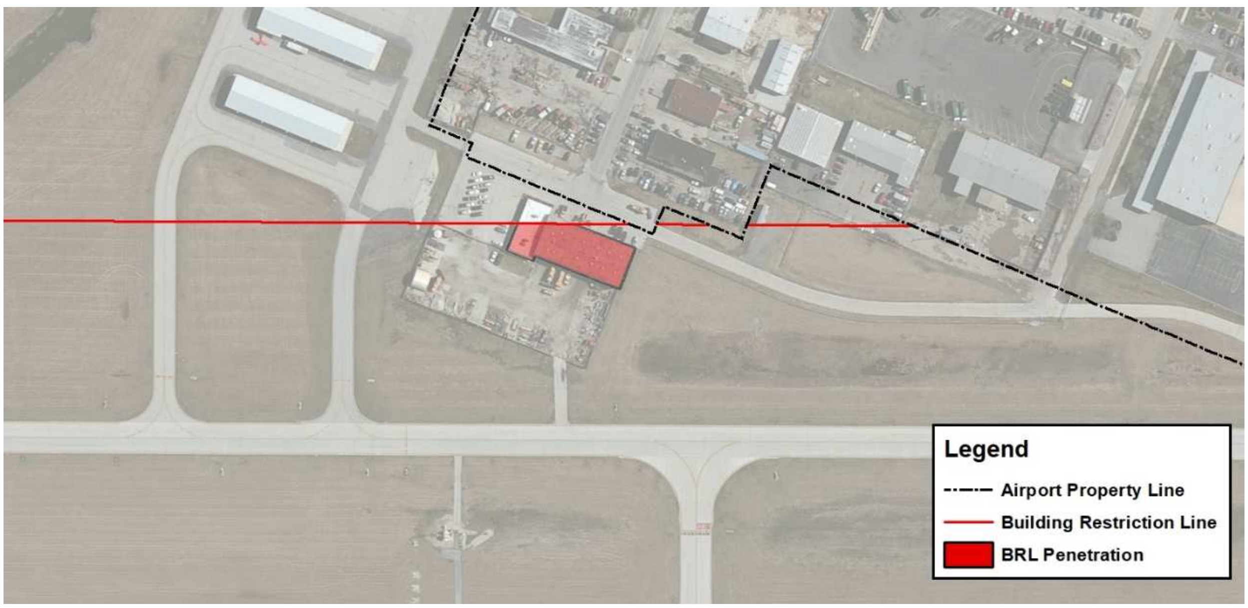
Source: CMT (2017)

*There is a total of approximately 872,000 square feet of available green space. Without considering apron/access pavement or ancillary roadways and vehicle parking lots, the CEA unconstrained forecast scenario would be the only scenario to which there would not be enough green space to construct new hangar facilities (see **Table 3-27** Future Hangar Space Requirements). However, when space requirements for apron/access pavement and vehicle roadway and auto parking is taken into account, it is anticipated that all forecast scenarios will exceed available development area.*

3.9.7. Building Restriction Line

When planning for future facility locations, it is important to consider the Building Restriction Line (BRL). The BRL is the line that identifies suitable and unsuitable building locations at the airport. The BRL must be setback and clear of the RPZ, OFZ, OFA, runway visibility zone, NAVAID critical areas, areas required for terminal approach procedures (TERPS) and the air traffic control tower line of sight. There are several areas on the airfield where a building/facility penetrates the BRL. Exhibits 3-8, 3-9 and 3-10 *depict these penetrations. It is recommended that potential feasible mitigation options be evaluated in future report sections, and that any future development on the airfield does not penetrate the BRL.*

Exhibit 3-8:
BRL Penetrations – NE Quadrant

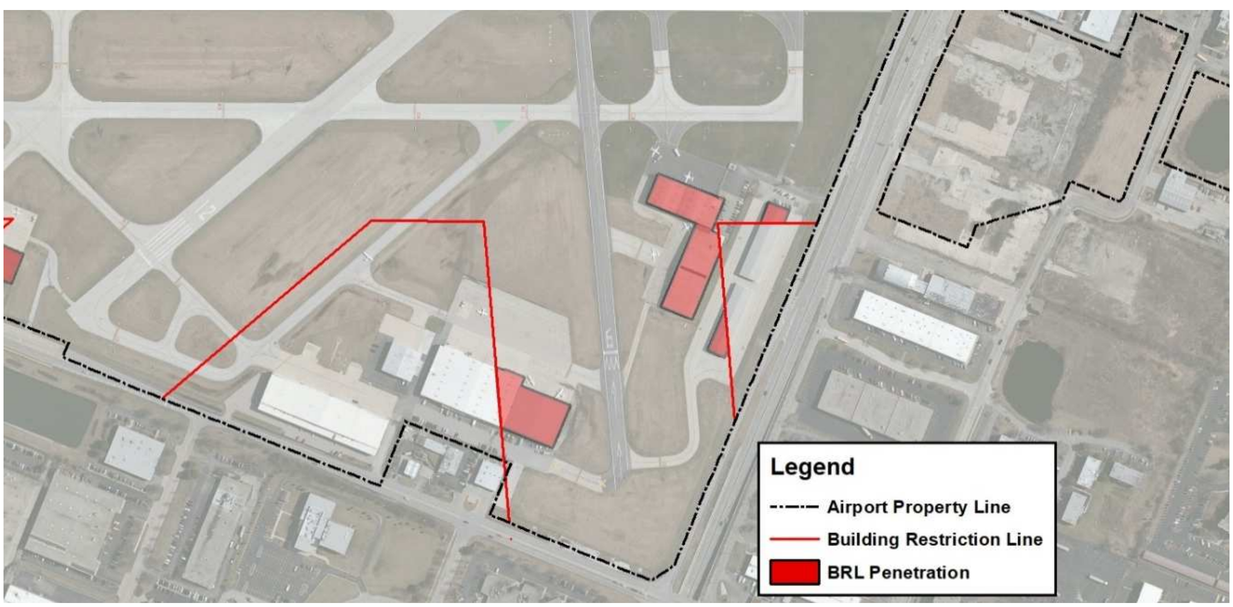


Source: CMT (2017)

Exhibit 3-9:
BRL Penetrations – NW Quadrant

Source: CMT (2017)

Exhibit 3-10:
BRL Penetrations – SW Quadrant



Source: CMT (2017)

3.9.9. Aircraft Parking and Storage Summary

Regardless of the forecast scenario, growth is anticipated at CEA. The limited amount of green space available at CEA will most likely not be sufficient to accommodate future growth. It is recommended that future report sections evaluate alternatives to meet future demand. Table 3-30 *summarizes the total development space required, which is the total of the hangar space requirement, apron/access space requirement and automobile parking space requirement.*

Table 3-30:
Total Development Space Required

Forecast Scenario	Required Hangar Space *Table 3-27*		Required Apron/Access Space *Table 3-28*		Required Automobile Parking Space *Table 3-29*		Total Development Space Required (sq.ft.)
FAA Constrained	445,695	+	742,825	+	142,243	=	**1,330,764**
FAA Unconstrained	601,417	+	1,002,362	+	191,942	=	**1,795,721**
CEA Constrained	573,518	+	955,863	+	183,038	=	**1,712,418**
CEA Unconstrained	875,443	+	1,459,071	+	279,397	=	**2,613,910**

Source: CMT Analysis (2017)

The total development space required in Table 3-30 *is the additional development space required. Assuming the existing aircraft storage and infrastructure remains, and available green space would be utilized to accommodate much of future development, there is still a shortage of space in all forecast scenarios.* Table 3-31 *shows the additional space requirements needed for each forecast scenario after allocating the available green space.*

Table 3-31:
Additional Space Requirements

Forecast Scenario	Total Development Space Required (sq.ft.)		Available Green (sq.ft.)		TOTAL Additional Space Required
FAA Constrained	1,330,764	-	871,559	=	**459,205**
FAA Unconstrained	1,795,721	-	871,559	=	**924,162**
CEA Constrained	1,712,418	-	871,559	=	**840,859**
CEA Unconstrained	2,613,910	-	871,559	=	**1,742,351**

Source: CMT Analysis (2017)

3.10. Landside Facility Requirements

3.10.1. Airport Administration Building

The airport administration office is located in the northeast quadrant of the airport off Industrial Lane and Plant Road. The building that is currently occupied is outdated and adjacent to the airport maintenance facility. Additionally, the building is located within the BRL as shown in Exhibit 3-8*. Replacement of this facility is recommended. Subsequent sections of this master plan will address the needs and location of a new airport administration building.*

3.10.2. Airport Maintenance

The current maintenance building is adjacent to the airport's administration offices in the northeast quadrant of the airfield just south of Taxiway Q. The maintenance building provides access from landside and airside. It is a dual-purpose facility, doubling as a maintenance building and a Snow Removal Equipment (SRE) storage building. The building is outdated and undersized. Additionally, as shown in Exhibit 3-8*, it is within the Building Restriction Line (BRL). It is recommended that CEA plan on building a new, modern facility that can accommodate the airport's needs. Subsequent sections of this master plan will further examine location and size criteria for a new maintenance facility.*

3.10.3. United States Customs and Border Protection

The United States Customs and Border Protection (CBP) is part of the U.S. Department of Homeland Security (DHS) and carries out the mission of facilitating lawful international travel and trade. At CEA, CBP typically provides screening services to accommodate international arriving passengers. CBP is currently occupying space in the Atlantic Aviation FBO facility to conduct screening services, as well as utilizing the apron space for aircraft parking. CEA has been notified by CBP that, due to changes in DHS standards, the airport will be required to develop a new standalone facility to accommodate their operations and services. Additionally, the new facility will also need to incorporate apron space for international arrival aircraft to park while CBP services are being conducted. It is recommended that a new location for a CBP facility be sited in a neutral airfield area, that is not associated with any of the three existing FBOs.

3.10.4. Aircraft Fueling

Fueling operations at CEA are conducted by and are the responsibility of the FBOs. For this reason, this section will concentrate on fuel capacity requirements as it relates to land and space requirements and will not focus on the governance of fueling operations. This section will include an examination of the airport's existing fuel capacity and will be compared to the forecasted demand for fuel.

Each FBO has its own fuel farm area located in the vicinity of its building. Currently, there is a cumulative fuel capacity among all the FBOs of 154,000 gallons of Jet-A and 47,500 gallons of 100LL. According to the constrained operations forecast – medium growth, jet and turbo-prop operations are forecast to increase 21% throughout the next 20 years and piston aircraft are forecasted to decline 50% during the same period. Given current capacity and fuel tank refueling schedule, calculations can be made for *gallons per operation. Therefore, as shown in* Table 3-32*, demand for 100LL fuel will decrease while the need for Jet-A will increase according to the constrained forecast.* Table 3-32 *also illustrates fuel capacity given an unconstrained forecast growth occurs.*

Table 3-32:
Aircraft Fuel Storage Requirements

Constrained - Medium Growth Forecast		
100 LL - 50% Decrease		
(Capacity 47,500 gal)		
	2016	2036
Operations	15,047	7,541
Fuel Capacity (gal)	47,500	23,805

Unconstrained - Medium Growth Forecast		
100LL - 40% Decrease		
(Capacity 47,500 gal)		
	2016	2036
Operations	14,898	6,011
Fuel Capacity (gal)	47,500	19,165

Jet-A - 21% Increase		
(Capacity 154,000 gal)		
	2016	2036
Operations	61,564	74,701
Fuel Capacity (gal)	154,000	186,862

Jet-A - 54% Increase		
(Capacity 154,000 gal)		
	2016	2036
Operations	61,963	95,589
Fuel Capacity (gal)	154,000	237,572

Source: CMT Analysis (2015)

In order to accommodate future fuel demand, either the frequency of fuel tank refills will need to increase, or, to reduce or maintain the current refill frequency, additional Jet-A tank capacity will be needed. The analysis above assumes that gallons per operation will remain constant across both constrained and unconstrained forecast scenarios. It should be noted that, in the unconstrained scenario, it is likely that gallons per operation will increase due to changes in the projected fleet mix, particularly in the medium and large jet segments, and the reduction on weight restricted takeoffs. Therefore, the fuel capacity projections for the unconstrained growth scenario may actually underestimate the actual requirement. It is recommended that future master plan phases provide appropriate areas to allow for expansion of each respective FBO fuel farm to accommodate projected increases in future fuel demand.

3.10.5. Rental Car Facilities

Car rental facilities at an airport provide customers the convenience of being able to rent a vehicle on airport property rather than travel off airport property. Car rental facilities at CEA are currently provided through all three FBO's rather than standalone rental companies. Customers can make reservations and rent vehicles from well-known rental agencies, such as National or Hertz, and pick up the vehicle at one of the FBO's. The FBO's do not stock a large inventory of vehicles and therefore do not require many parking stalls for these vehicles. As the airport continues to grow in the future, the number of parking stalls required that are outlined in Section 4.5 should be able to accommodate future rental car parking.

3.10.6. Airport Access

The airport facilities can be accessed from the East, West and South sides of the airport. Hangars and FBO's on the west side of the airfield are accessible via entrance roads from S. Wolf Rd. The hangars in the southeast corner of the airfield can be accessed from Palatine Frontage Rd. The T-hangars, corporate hangars, airport administration and maintenance building, and air traffic control tower on the east side of the airfield can all be accessed via roads (Industrial Lane, Sumac Road, and Tower Drive) that connect to South Milwaukee Avenue. The existing roadway and ground access appears to be sufficient for the existing airport facilities layout. However, any future airport expansion could potentially warrant new access roadways. It is recommended that future roadways be considered during the Alternatives section of this report.

Direct public access to CEA can be accomplished by either cab (or other car service) or bus. Pace bus Route 272 provides weekday and Saturday service between Golf Mill Shopping Center in Niles and Hawthorn Mall in Vernon Hills via Wheeling along Milwaukee Ave. There are numerous bus stops along Milwaukee Avenue that would provide direct public access to the airport. Additionally, there are two Metra train stations within one and half miles of CEA. The Wheeling train station is north of CEA off of Wheeling Road and the Prospect Heights train station is south of CEA off of Wolf Road. CEA's current role does not warrant enhancements to the existing public transportation network. However, if significant future expansion occurs, it is recommended that CEA coordinate with the various public transportation agencies for future service enhancements.

3.10.7. Utilities

Utilities at the CEA are anticipated to be sufficient throughout the planning period. Additional utility infrastructure may be required to support construction of new or expanded facilities is specific areas, as depicted in previous sections of this report.

3.10.8. Drainage

CEA's existing Master Drainage Study dates back to 2002 and permitted improvements to the airfield and adjacent developments. Most of the improvements that were depicted in the Study have been constructed and the basins permitted in the Study have nearly reached capacity. Should significant expansion occur in the future, it is recommended that a new Master Drainage Study be undertaken as a companion study to create a new roadmap for achieving regulatory compliance.

Section 4

Alternatives Development

4.1. Introduction

The Alternatives Development section of the Master Plan identifies and evaluates scenarios and concepts (known as alternatives) needed to accommodate the facility requirements presented in the preceding section of this Master Plan. As an essential component in the planning process, this section will review several alternatives the Chicago Executive Airport (CEA) could develop to meet the needs of airport users and satisfy future demand. Through an evaluation process, alternatives will be analyzed, ultimately identifying a Preferred Development Concept. The Preferred Development Concept will be brought forward and used in the development of the Airport Layout Plan (ALP).

There are endless possibilities of scenarios and concepts that can be developed during the alternative's development phase. Therefore, professional judgment and experience have been applied in order to identify alternatives with the greatest potential for implementation. As such, the alternatives scenarios presented in this section are organized by facility type:

1. *Runways*
2. *Taxiways*
3. *Aircraft Storage*

As part of the Alternatives Development process, efforts were made to involve the public and Airport stakeholders for participation and input. A Stakeholder Involvement Group (SIG) was formed comprising of community and political representation from the surrounding areas, as well as Airport stakeholders such as corporate tenants and fixed based operators (FBO). Additionally, two open houses were held to engage the public, and to solicit comments and alternative development options.

4.2. Development Objectives & Evaluation

Using guidelines presented in FAA Advisory Circular 150/5070-6B Airport Master Plan Change 2 (AC 6B), this section will identify the Airport's development needs while balancing the needs and feasibility of certain objectives. Prior to the process of evaluating alternatives it was necessary to identify specific objectives that would guide the evaluation process and development decisions:

1. *Operational – Facilities should be developed in a way that promotes efficiency, safety and security in accordance with federal regulations, Federal Aviation Administration (FAA) design standards, and the interest of the surrounding communities and users of the facility.*
2. *Capacity – Development should be planned to meet long-term planning space requirements and accommodate forecast aviation activity.*
3. *Financial – Development should be accomplished in a way that considers construction costs, external funding resources, and maximizes the long-term financial sustainability of the Airport.*
4. *Scalable/Flexible – Development should allow short-term requirements the ability to support long-term infrastructure requirements.*

5. *Environmental – Consideration for development should consider factors such as noise, air quality, water quality, land use, socioeconomic and other environmental impacts.*

These objectives, combined with facility-specific evaluation criteria, provided guidance to the alternatives analysis and evaluation.

4.2.1. Evaluation Criteria

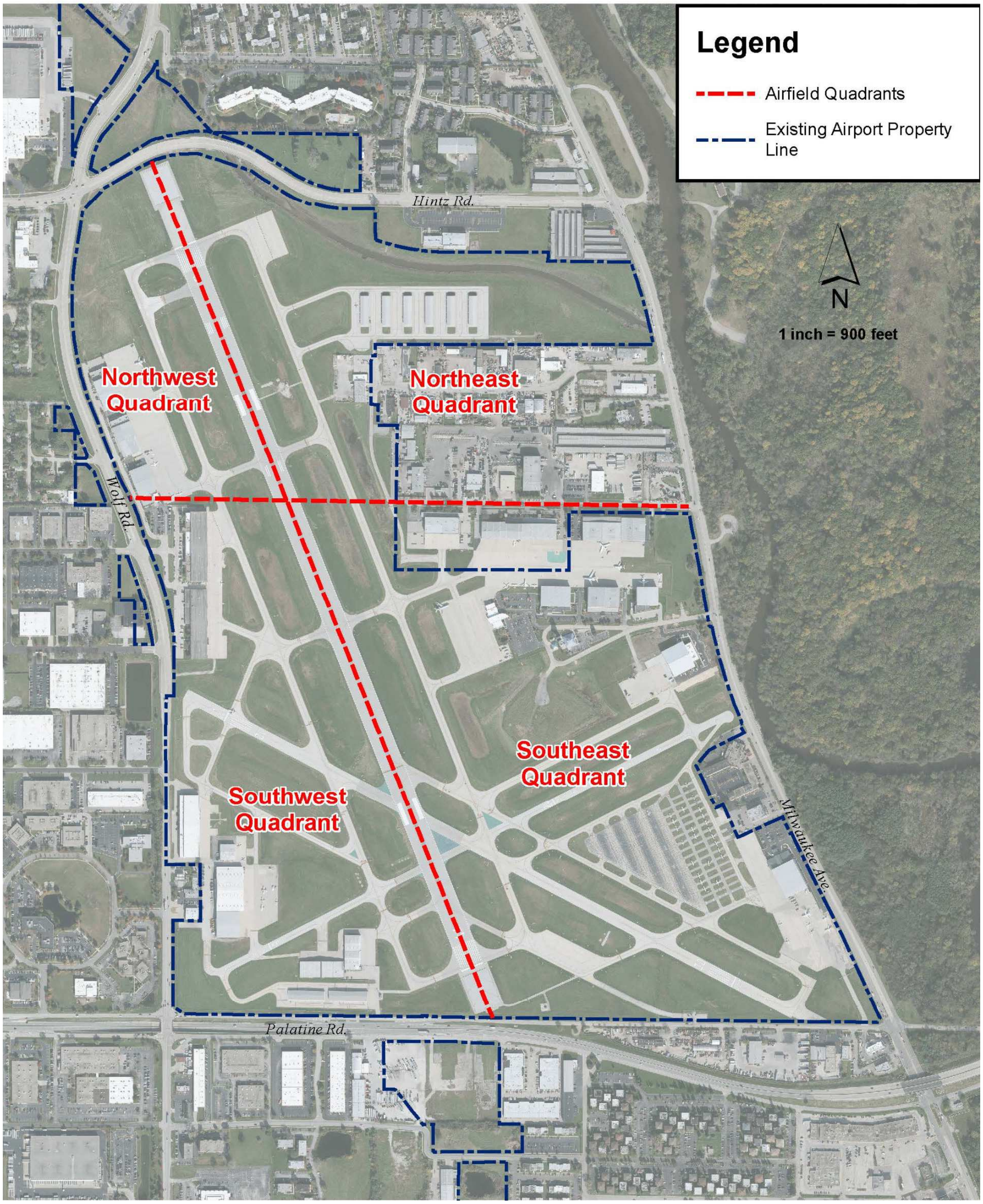
While the objectives provided guidance to the evaluation process, specific evaluation criteria were needed to assess the feasibility of the alternatives. The following criteria were selected as the basis of balancing the needs of the Airport while maintaining responsibility to the community and users, and environmental and financial impacts:

- *Improves safety*
- *Enhance/maintains operational efficiency*
- *Meets design standards*
- *Accommodates forecast demand*
- *Financial feasibility*
- *Minimize environmental impacts*
- *Operates within existing airport boundary*

4.3. Airfield Quadrants

The Development Alternatives section identifies and refers to areas on and around the Airport defined by quadrants; the northeast (NE) quadrant, southeast (SE) quadrant, southwest (SW) quadrant, and the northwest (NW) quadrant. To better understand the general location of an alternative and the respective quadrant it pertains to, Exhibit 4-1 shows the quadrant areas.

Exhibit 4-1:
Airfield Quadrants



Source: CMT (2019)

4.4. Runways

The runway system at CEA consists of three runways: primary Runway 16-34, crosswind Runway 12-30, and third runway 6-24. The Facility Requirements section of this Master Plan indicates that the runway system is sufficient from an orientation and capacity perspective, but has identified several deficiencies within the runway system, including:

- *Runway Length*
- *Runway Width*
- *Compliance With Design Standards*

4.4.1. Runway Length Requirements

The Development Alternatives section of a master plan would typically address all of the runway deficiencies identified in the Facility Requirements section, including runway length requirements. However, the runway development alternatives presented in the following section will address the runway deficiencies previously identified, except runway length.

Facility Requirements developed during Phase 1 of the Master Plan identified the current 5,001' primary runway as being insufficient and recommended a primary runway length of 7,542'. Additionally, due to the physical constraints of CEA, it was recommended that other lengths between 5,000' and 7,542' be considered and evaluated as well. The intent of the Master Plan team was to provide runway expansion alternatives that would address the inadequate runway length. However, the concept of a runway expansion at CEA generated significant controversy in the communities surrounding the Airport. As a result of this controversy, the Master Plan team was directed by CEA staff to no longer consider lengthening the runway outside the Airport's existing property boundary as part of this Master Plan. All proposed Airport development discussed in this report chapter will remain inside CEA's physical roadway constraints: Hintz Road to the north, Wolf Road to the west, Milwaukee Avenue to the east and mainline Palatine Road to the south. The following report sections will discuss improvements to the runway system for each runway individually, although runway length alternatives will not be evaluated.

The preliminary alternatives depicting runway expansion that were developed prior to staff's directive can be viewed in Appendix C. *Additional public involvement material can be viewed in* Appendix D.

4.4.2. Runway 16-34

Runway 16-34 is CEA's primary runway, having a length of 5,001' and a width of 150'. Runway 16-34 is categorized as a D-III runway design code (RDC) and has engineered materials arresting systems (EMAS) installed on either end of the runway as means of Runway Safety Area (RSA) compliance. The Facility Requirements section identified the runway deviating from FAA design standards by having a non-compliant Runway Object Free Area (ROFA).

4.4.3. Non-compliant ROFA

FAA Advisory Circular 150/5300-13A Airport Design Change 1 (AC 13A) provides design standards criteria for ROFA's. For a D-III runway, AC 13A requires ROFA dimensions to be 1,000' beyond the end of the runway and a width of 800'. Full length and width ROFA compliance on Runway 16-34 is impeded by Wolf Road, Hintz Road, and Palatine Road, as well as other infrastructure, residential and commercial properties. An alternative analysis was conducted for design alternatives to be developed. These alternatives provided design standard compliance.

4.4.3.1. ALTERNATIVE A1 "ROFA MAINTAIN EXISTING CONDITION"

This ROFA alternative maintains the existing condition and allows for the ROFA to remain as is with no improvements. Although the EMAS does not provide ROFA compliance, it does provide an additional layer of safety to the ROFA. This alternative does not impact infrastructure or roadways, nor does it cause community or environmental impacts. FAA has granted a Modification of Standards (MOS) to the Airport that allows for this deviation from design standards. Alternative A1 is presented in Exhibit 4-2.

4.4.3.2. ALTERNATIVE A2 "ROFA COMPLIANCE OFF-AIRPORT PROPERTY"

The ROFA compliance off-airport property alternative would require significant infrastructure removal and roadway relocation, removal, and/or tunneling of Hintz Road, Wolf Road and Palatine Road and the Wheeling Drainage Ditch. This alternative would also require the Airport to acquire land north and south of the runway and would displace businesses south of Palatine Road. Alternative A2 is presented in Exhibit 4-3.

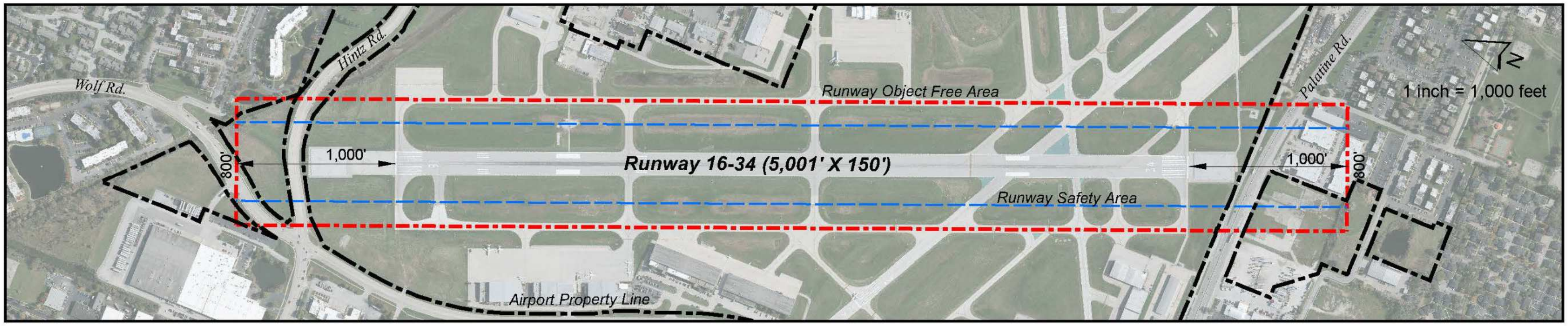
4.4.3.3. ALTERNATIVE A3 "ROFA COMPLIANCE ON-AIRPORT PROPERTY"

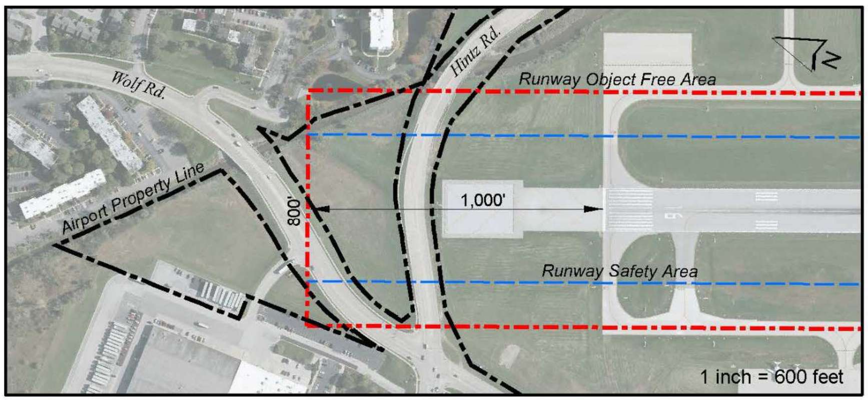
The ROFA compliance on-airport property alternative would provide the required ROFA dimensions by modifying Runway 16-34 to keep the ROFA inside the Airport's existing roadway boundaries. Full width ROFA would begin at the Airport's existing property boundary and extend 1,000' towards the runway. This alternative would require the runway thresholds to be relocated and would reduce the overall effective runway length to 3,606'. Alternative A3 is presented in Exhibit 4-4.

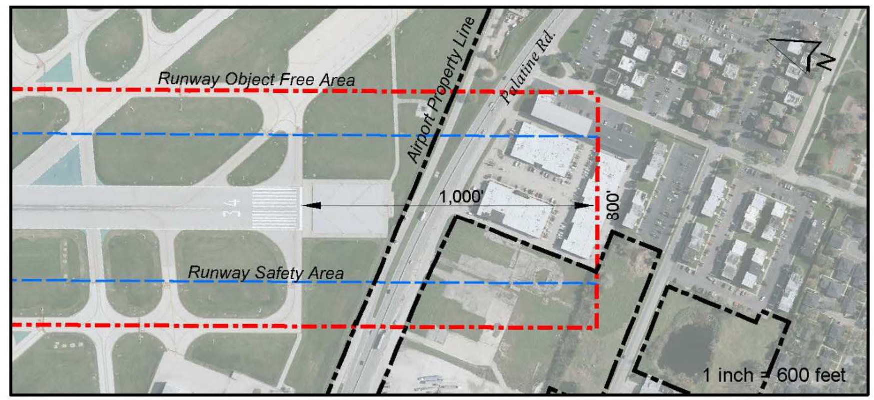
4.4.3.4. ALTERNATIVE A4 "DECLARED DISTANCES"

The declared distances alternative would allow the Airport to obtain the required ROFA dimensions by implementing declared distances to the runway. The declared distance technique affects four aircraft performance distances: takeoff run available (TORA), takeoff distance available (TODA), accelerate-stop distance available (ASDA), and landing distance available (LDA). Declared distances that are implemented in this alternative in order to obtain required ROFA dimensions would impact both the ASDA and LDA. Alternative A4 is presented in Exhibit 4-5.

Exhibit 4-2:
Alternative A1: Runway 16-34 ROFA Maintain Existing Condition







Advantages

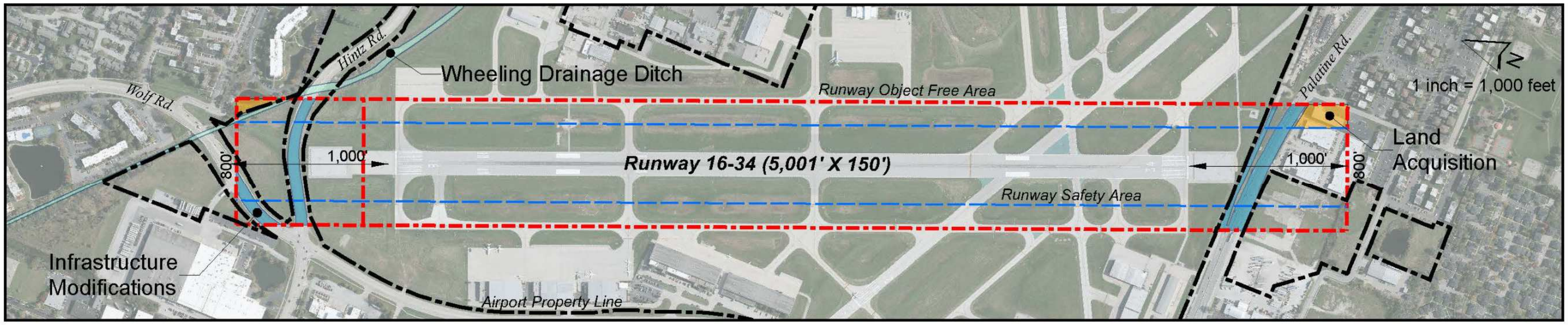
- No modification to existing facilities and adjacent community required.

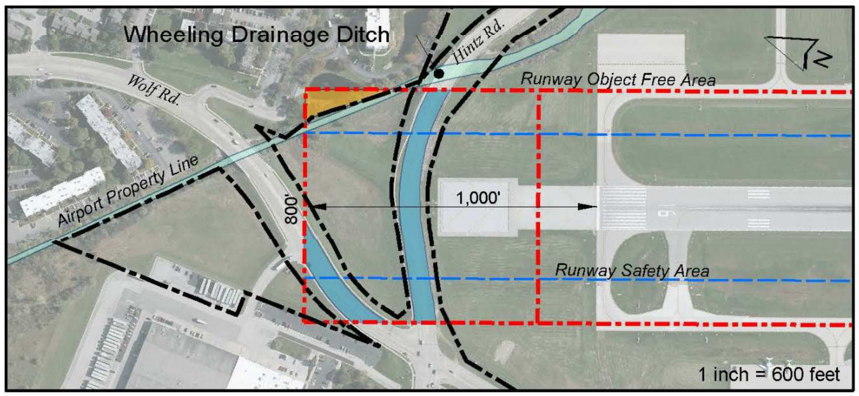
Disadvantages

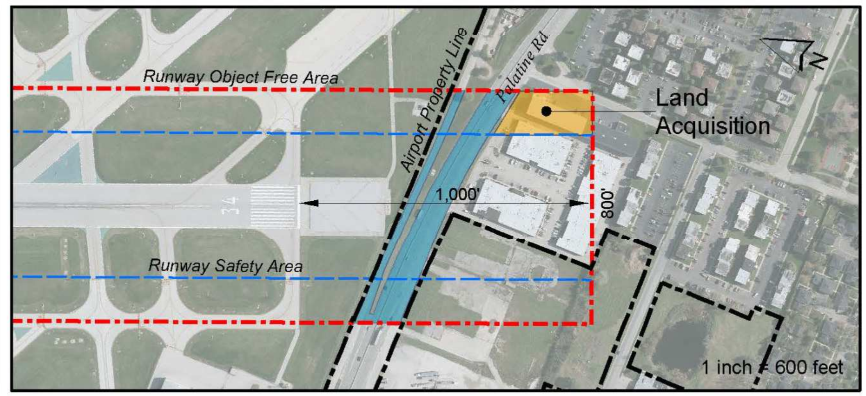
- Non-standard condition remains

Source: CMT (2019)

Exhibit 4-3:
Alternative A2: Runway 16-34 ROFA Compliance Off-Airport Property







Advantages

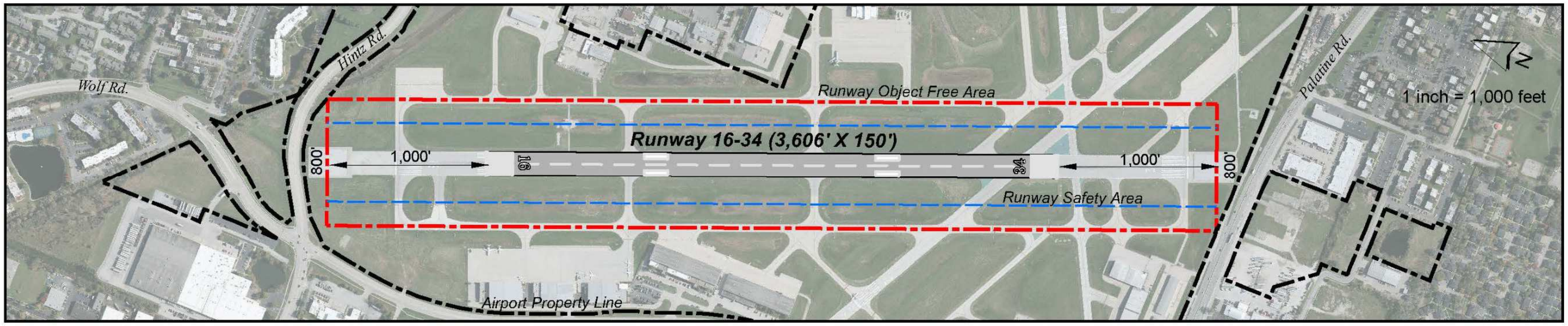
- Provides ROFA compliance
- No loss of effective runway length

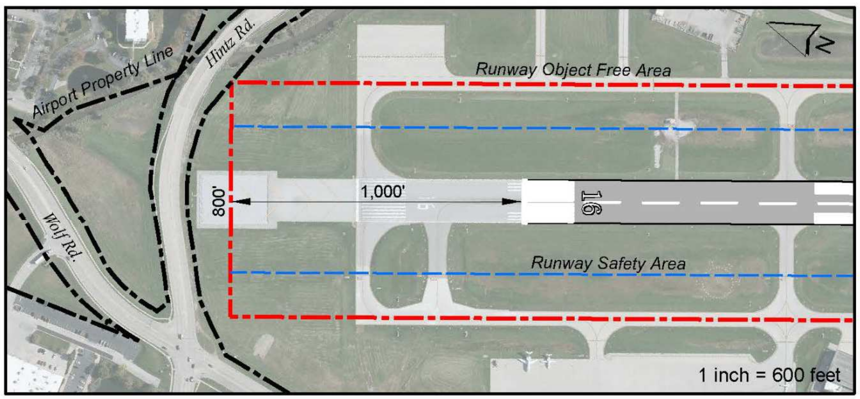
Disadvantages

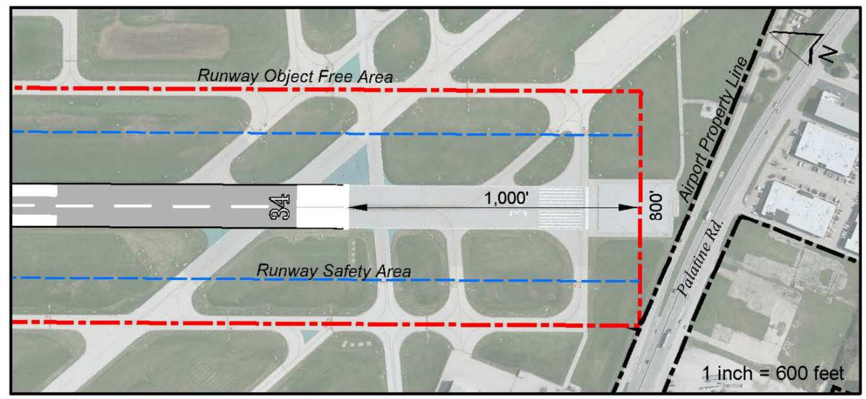
- Significant infrastructure removal, relocation and/or tunneling
- Land acquisition required
- Potential environmental impacts
- Displacement of local businesses in adjacent communities

Source: CMT (2019)

Exhibit 4-4:
Alternative A3: Runway 16-34 ROFA Compliance On-Airport Property







Advantages

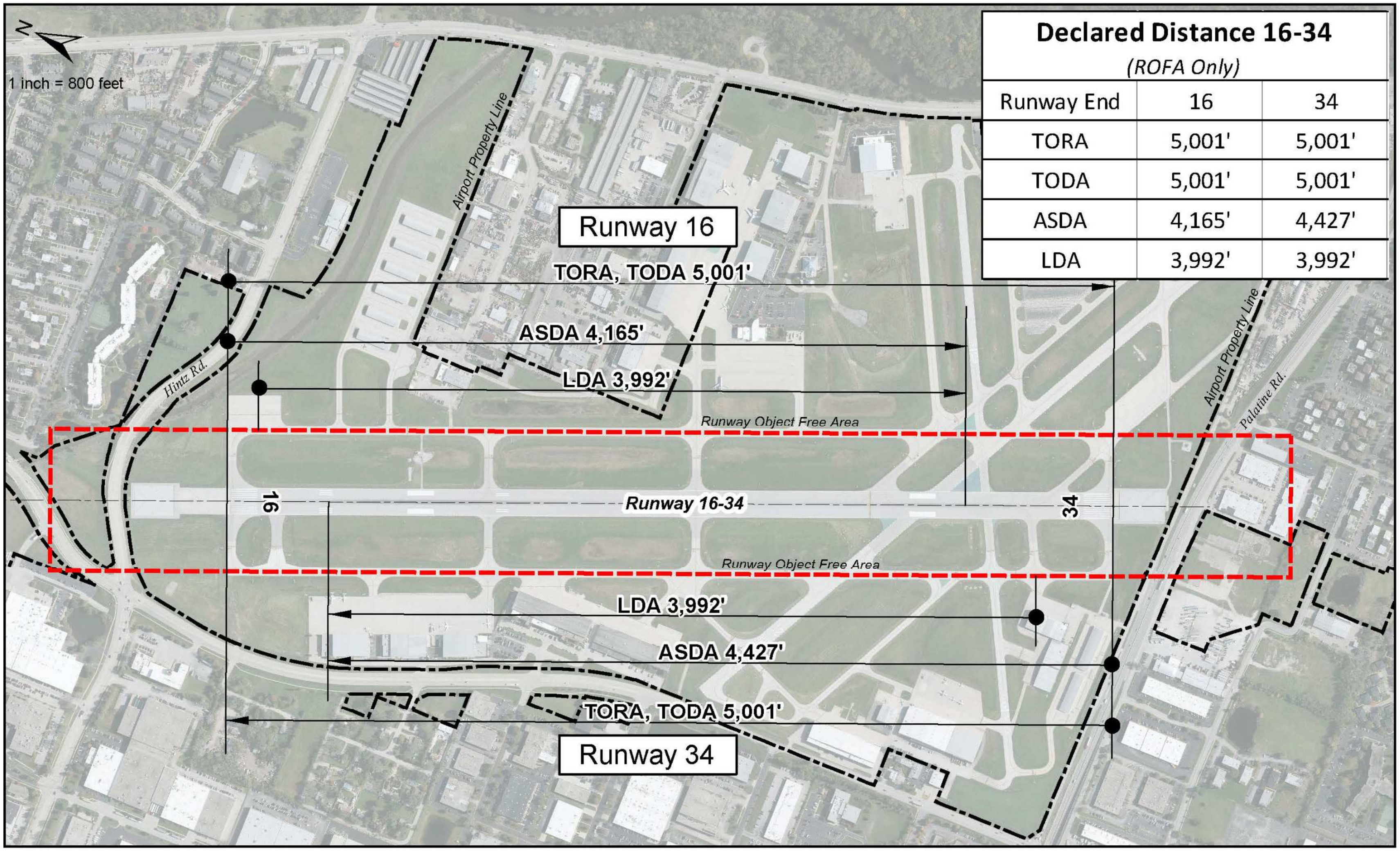
- Provides ROFA compliance

Disadvantages

- Loss of effective runway length
- Relocation of Runway 16 ILS
- Potential removal of EMAS

Source: CMT (2019)

Exhibit 4-5:
Alternative A4: Runway 16-34 ROFA Compliance Declared Distances



Declared Distance 16-34
(ROFA Only)

Runway End	16	34
TORA	5,001'	5,001'
TODA	5,001'	5,001'
ASDA	4,165'	4,427'
LDA	3,992'	3,992'

Source: CMT (2019)

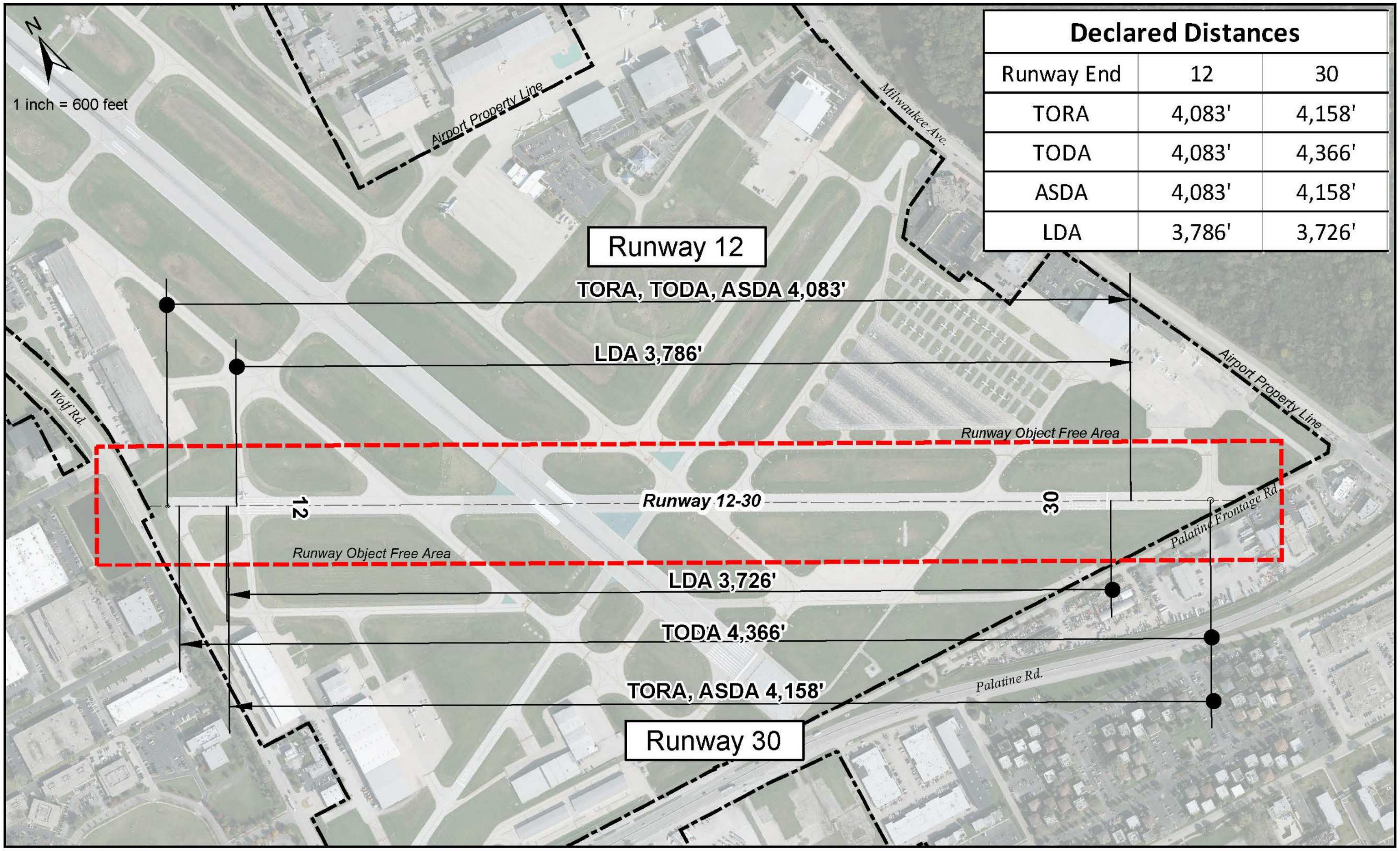
The four alternatives were evaluated utilizing the criteria previously identified. It is recommended that Alternative A1 "ROFA Maintain Existing Condition" be the Preferred Development alternative. This will require the existing ROFA Modification of Standards (MOS) be maintained and submitted with the new ALP.

4.4.4. Runway 12-30

Runway 12-30 is the crosswind runway at CEA. It is categorized as a B-II Small runway that has a full pavement length of 4,414' and is 75' wide. Wolf Road prevents full length RSA and ROFA compliance off the end of Runway 12 and the Palatine Frontage Road prevents full length RSA and ROFA compliance off the end of Runway 30. To provide a compliant RSA, the runway thresholds are displaced and declared distances are implemented on this runway. FAA has granted an MOS for the non-compliant ROFA off both runway ends.

Although the Facility Requirements section has recommended full length RSA and ROFA dimensions be provided off the ends of the runway, full utilization of the existing runway pavement is not feasible due to the physical constraints adjacent to CEA. Therefore, it is recommended that declared distances remain implemented to provide compliant RSA's and the existing MOS be maintained for the ROFA. The declared distance lengths are shown in Exhibit 4-6*.*

Exhibit 4-6:
Runway 12-30 Declared Distances



Declared Distances		
Runway End	12	30
TORA	4,083'	4,158'
TODA	4,083'	4,366'
ASDA	4,083'	4,158'
LDA	3,786'	3,726'

Source: CMT (2019)

The Facility Requirements section also identified the following recommendations to Runway 12-30:

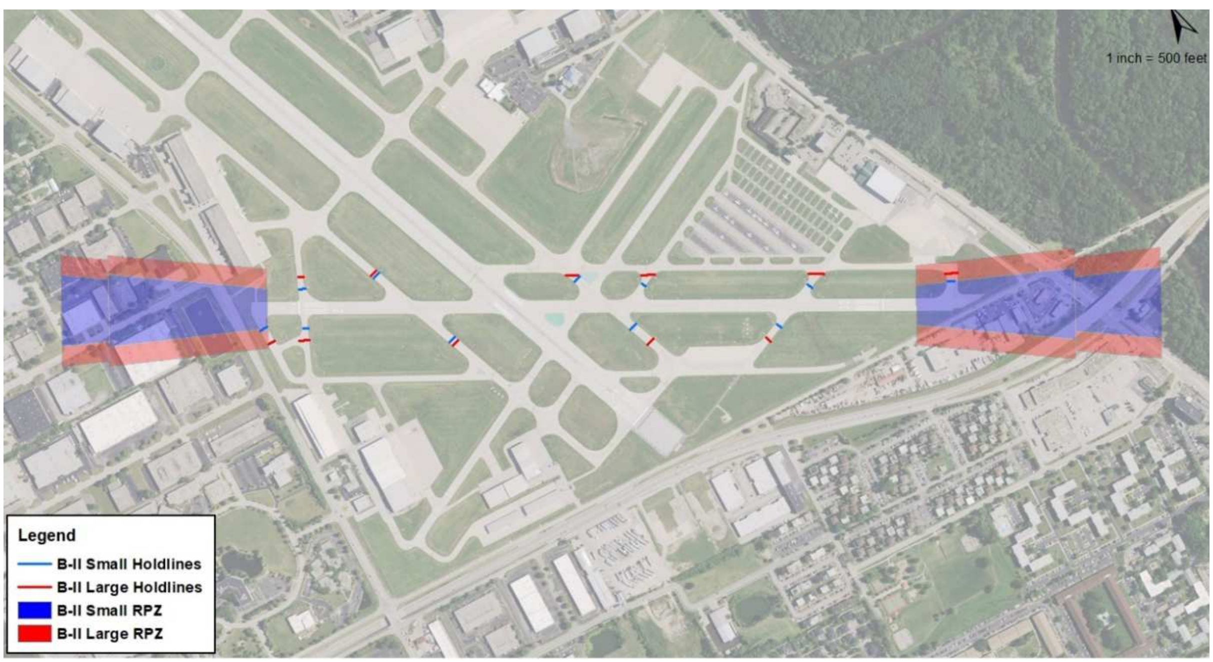
- *Upgrade runway to B-II Large*
- *Widen beyond standards*

4.4.4.1. UPGRADE RUNWAY TO B-II LARGE

As stated in the Facility Requirements section, there are sufficient B-II Large aircraft operations that utilize Runway 12-30 to require a change in the RDC and critical aircraft. From an FAA design standards perspective, an upgrade to a B-II Large RDC would change the RPZ dimensions and would require the hold position markings to be relocated further from the runway centerline. This RDC upgrade would increase incompatible land use with the larger RPZ dimensions. FAA's Interim Guidance on Land Uses Within a Runway Protection Zone indicates coordination with FAA would be required based on the change of critical aircraft that would increase the RPZ dimensions.

No alternatives were evaluated as there are not multiple ways to implement this change. However, it is recommended that the Preferred Development concept show the upgraded RDC RPZ's and hold position markings. For the purpose of showing this change, the same exhibit from the Facility Requirements report section is shown in Exhibit 4-7.

Exhibit 4-7:
Runway 12/30 RDC B-II Small vs. B-II Large RPZ & Holding Position Markings



Source: CMT Analysis (2017)

4.4.4.2. WIDEN BEYOND STANDARDS

AC 13A criteria for B-II Small (and B-II Large) runways require a runway width of 75'. As discussed in the Facility Requirements section, Runway 12-30 meets this design standard. However, it is recommended *that the runway be widened beyond design standards. The recommended runway width is 100' and would enhance runway safety and utility for airport users.*

No alternatives were evaluated as there are not multiple ways to implement this change. It is recommended that the preferred development for Runway 12-30 show an additional 12.5' of runway width on both sides of the runway.

4.4.5. Runway 6-24

Runway 6-24 is CEA's third runway and supports approximately 3% of all aircraft operations. The runway is categorized as a B-I Small RDC and has a runway length of 3,677' and a width of 50'. The Runway 24 end does not have a full-length RSA, and both runway ends do not have full length ROFA's due to the presence of Milwaukee Avenue and Wolf Road. Declared distances are implemented on Runway 6-24 to provide a compliant RSA. FAA has granted an MOS for the non-compliant ROFA off both runway ends.

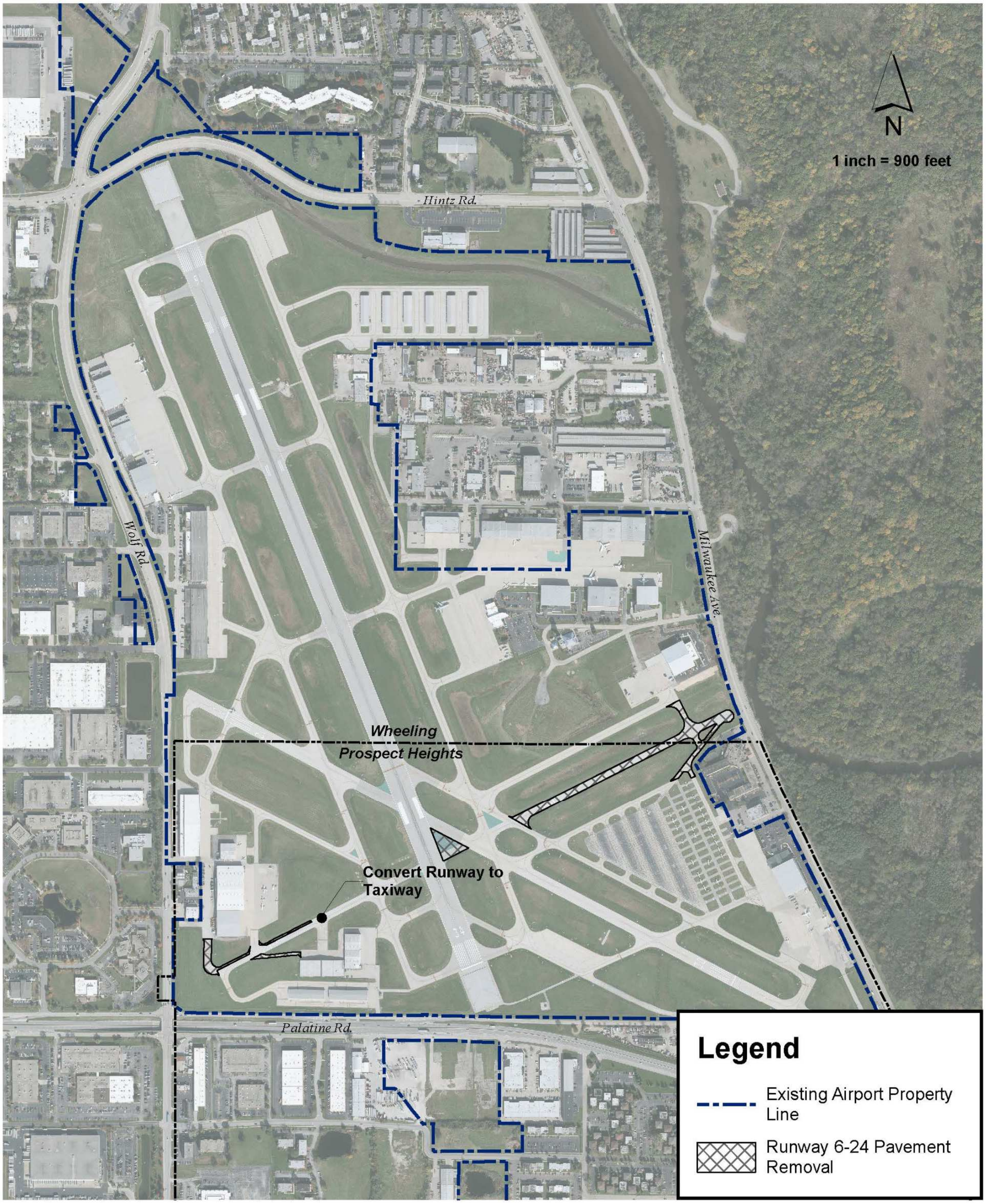
The Airport sponsor has requested that the Master Plan assess the permanent closure of Runway 6-24. The following development alternatives will evaluate Runway 6-24 remaining in its existing condition and the runway being decommissioned.

Alternative B1 – *This alternative will decommission Runway 6-24. Safety will be enhanced by the removal of Hot Spots and the opportunity to reconfigure several airfield areas that do not comply with FAA geometry standards. Additionally, by decommissioning the runway, the Airport will no longer have to budget local-only funds for operations and maintenance (O&M) as third runways are not supported by FAA grant funding. Alternative B1 is presented in* Exhibit 4-7.

Advantages	*Disadvantages*
• *All three Hot Spots associated with Runway 6-24 are removed* • *Opportunity to improve airfield geometry* • *Eliminates the need for local only O&M funding* • *Land could be used to accommodate future aircraft storage demand*	• *Loss of runway utility in specific crosswind conditions*

Alternative B2 – *The alternative would maintain the existing condition and Runway 6-24 would remain in place. No exhibit is presented for Alternative B2, as no changes to the existing runway would be required.*

Exhibit 4-8:
Alternative B1: Runway 6-24 Decommissioning



Source: CMT (2019)

The two alternatives were evaluated utilizing the criteria previously identified. It is recommended that Alternative B1 "Runway 6-24 Decommission" be the preferred development alternative.

4.5. Approach Upgrades

Previous Master Plan phases included user surveys that indicated a high desire from Airport users for improved runway instrumentation. Currently, only Runway 16 supports instrument approach procedures (IAPs) with visibility minimums down to 1-mile. The Facility Requirements section recommended investigating the feasibility of enhanced approach capabilities below 1-mile to Runway 16, as well as the feasibility of developing new approaches to Runways 12, 30 and 34.

Development of an IAP is primarily driven by two factors: obstructions in the surrounding airspace and facilities on the airport. FAA Order 8260.3D United States Standard for Terminal Instrument Procedures (TERPS) is used to evaluate, design, and implement IAP's. TERPS is used to ensure all airspace and obstruction standards are being met. Facilities on the airport pertaining to IAP's primarily include ground-based equipment (if required) and compliance with design standards.

Required ground-based facilities are determined by the type of approach (precision or non-precision) and desired visibility minima to a runway. Compliance with design standards for facilities on the airport can be found within Table 3-4 Standards for Instrument Approach Procedures of AC 13A (updated with Engineering Brief 99). The complete Table 3-4 can be found in Appendix E, *and includes items such as:*

- *Minimum runway length*
- *Runway markings*
- *Holding position signs and markings*
- *Runway edge lights*
- *Parallel taxiway*

Design standards compliance also includes ensuring compatible land use within the runway protection zones.

This section will provide an overview of the requirements needed to improve, and develop new, instrument approaches at CEA, specifically the required facilities on the Airport. It should be noted that although any improved or new approaches shown on the future ALP will be subject to a cursory airspace review, they will not be evaluated by FAA's Flight Procedures division. Therefore, from an airspace perspective, any improved, or new, IAP's should be evaluated and coordinated with FAA to ensure that TERPS surfaces will allow for the desired visibility and decision height minima. Coordination with FAA would also ensure the feasibility of desired minima given the proximity of CEA to the airspace of Chicago O'Hare International Airport.

4.5.1. Runway 16 Enhanced Instrumentation

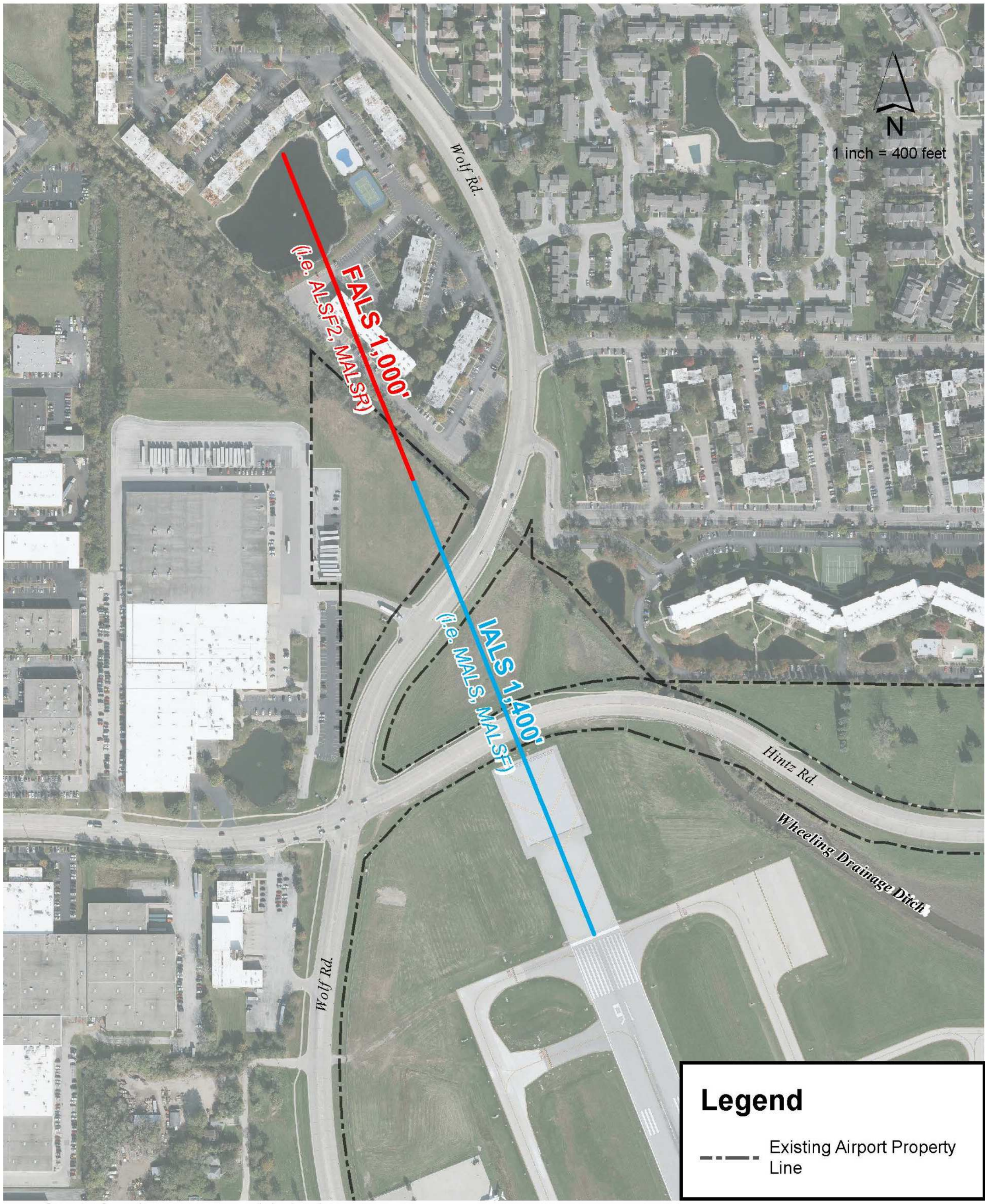
Enhancing approach capabilities by reducing visibility minima to Runway 16 can be achieved in various ways depending on the desired visibility minima and decision height (also known as the height above touchdown). Minima below ¾-mile visibility would require an approach lighting system (ALS). ALS design standards would require the lighting system to extend off Airport property. Additionally, as visibility *minimums decrease, size requirements for the RPZ would consequently increase. Both the installation of an ALS and increase in RPZ size will impact the facilities and standards on the Airport.*

There are different types of ALS's, and the requirement for each is dependent on the decision height. To illustrate the extent of off-Airport property impacts of an ALS, **Exhibit 4-9** *depicts the general size of an intermediate approach lighting system (IALS) and a full approach lighting system (FALS). As depicted in the exhibit, both the IALS and FALS traverse two major roadways and significant incompatible land uses likely rendering a fully-compliant ALS not feasible.*

Additional consideration needs to be given to RPZ design standards. As visibility minima decrease, the dimensions of the RPZ increase. Potential increased RPZ sizes at varying levels of visibility minima are shown in **Exhibit 4-10***.*

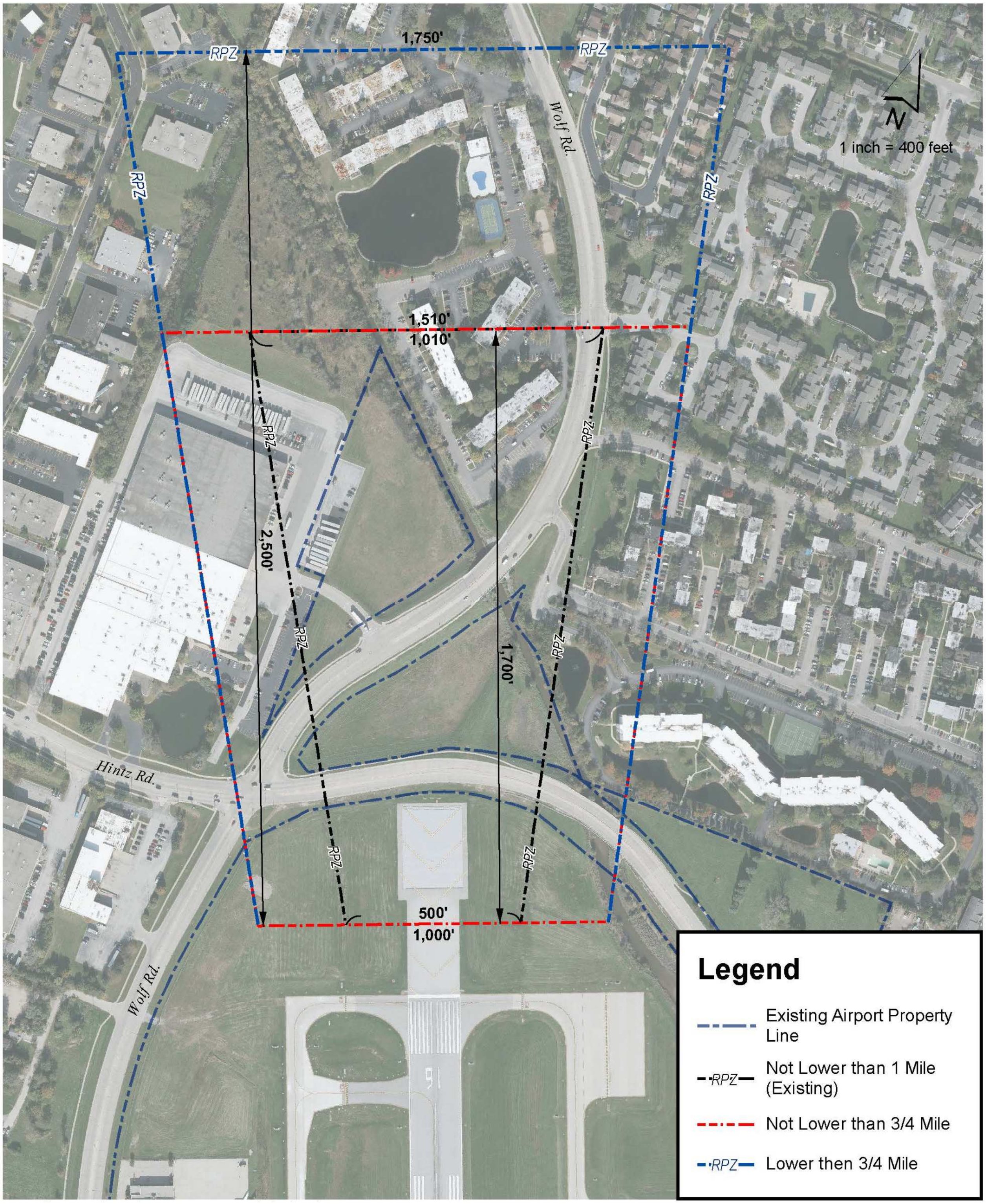
Therefore, it is recommended that the Airport pursue enhanced instrumentation to Runway 16 to ¾-mile visibility, which would not require an ALS. This would require compliance with the appropriate standards in Table 3-4 of AC 13A. As previously stated, coordination with FAA would be required to verify that appropriate TERPS standards can be achieved. Furthermore, an RPZ analysis may be required to assess compatible land use.

**Exhibit 4-9:
Approach Lighting System Property Impacts**



Source: FAA JO 6850.2B; CMT (2019)

Exhibit 4-10:
RPZ Requirements for Various Visibility Minima



Source: CMT (2019)

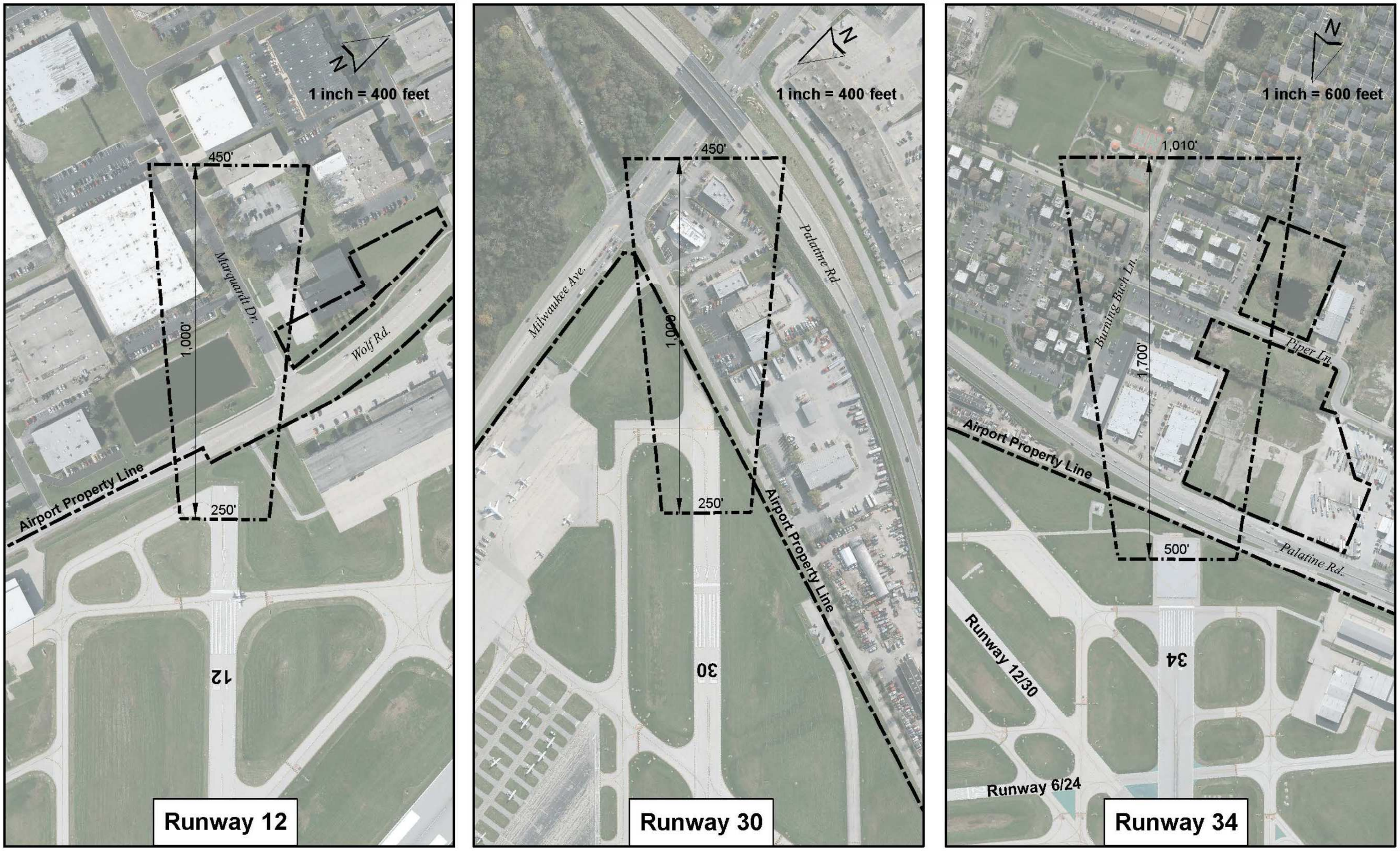
4.5.2. New IAPs Runways 12, 30, and 34

CEA's desire to enhance instrumentation and improve access to the Airport necessitates analyzing the feasibility of developing new IAP's to Runways 12, 30 and 34. All three runways operate as visual-only runways in their existing condition. As previously stated, from an airspace perspective, any new IAP's would need to be coordinated with FAA to verify appropriate TERPS standards can be achieved. Similarly, depending on the visibility minima of the desired approach, compliance would be required with the standards of AC 13A Table 3-4 criteria.

New IAP's to these runways could require RPZ compliance, potentially impacting off-Airport property. An RPZ analysis and coordination with FAA is recommended at the outset of pursuing new approaches to these runways. Given the physical geographic constraints the Airport operates in, it does not appear feasible to increase the size of the existing RPZ's if full compliance (ownership) to FAA RPZ standards would be required. The existing RPZ requirements for all three visual only runways are the same dimensions required for runways with 1-mile visibility. It is recommended that any new IAP's to these runways maintain the existing RPZ dimensions thereby pursuing 1-mile visibility minimums. Additionally, efforts should be made to protect the future airspace within the approach corridors to these runways. Therefore, it is also recommended that the future ALP depict 1-mile visibility surfaces (i.e. Part 77 and TERPS) to these runways. Exhibit 4-11 *shows the existing/1-mile visibility approach RPZ dimensions for Runways 12, 30 and 34.*

To the extent practical, it is recommended the Airport own all property within the limits of the RPZ. Where this is impractical, it is recommended that the Airport maintain the RPZ clear of all facilities supporting incompatible land use.

Exhibit 4-11:
1-Mile Visibility RPZ Requirements Runways 12, 30 and 34



Source: CMT (2019)

4.6. Taxiways

The taxiway system provides airport users the safe and efficient means to access runways and parking positions. It is the goal of the Airport, and FAA, to enhance safety by making improvements to taxiway geometry in efforts to reduce hot spots and problematic geometry. An AC 13A airfield geometry compliance assessment within the Facility Requirements section identified several non-compliant areas of CEA's airfield and taxiway system.

The following geometry improvements are recommended based on the airfield geometry compliance assessment. The improvements incorporate the decommissioning of Runway 6-24 and are predicated on no major airfield development (such as runway or taxiway improvements). Future airfield development projects in subsequent sections of this report will incorporate AC 13A geometry principals. The following section presents the recommended development alternatives to address the non-compliant areas of the airfield.

4.6.1. SE Quadrant Geometry Improvements

The SE Quadrant taxiway geometry improvements include a combination of decommissioned Runway 6-24, new proposed airfield pavement, and removal of existing airfield pavement. The improvements described in this section are intended to improve complex taxiway geometry, remove Hot Spot #1 and make airfield land available for future development.

The following airfield improvements are recommended in the SE Quadrant to enhance safety and compliance with AC 13A design principles.

Decommissioned Runway 6-24

The safety enhancements gained by decommissioning and removing the pavement associated with Runway 6-24 east of Taxiway Kilo include eliminating several non-standard runway intersection angles, two wide expanses of pavement and assist in improving two intersections that do not conform to the 3-node design principle. However, the most significant safety enhancement with decommissioning the runway is the potential removal of Hot Spot #1. Removal of Runway 6-24 adjacent to Hot Spot #1 will significantly reduce the opportunity for runway incursions and will allow for the removal of Hot Spot #1.

In addition to the runway being decommissioned, the following sections of taxiways would also be closed:

- *Taxiway Bravo between Runway 6-24 and Taxiway Foxtrot*
- *Taxiway Bravo between Runway 12-30 and Taxiway Echo*
- *Taxiway Charlie between Runway 6-24 and the Charlie Pad*
- *Taxiway Echo between Runway 6-24 and Taxiway Bravo*
- *Taxiway Echo between Runway 6-24 and Taxiway Charlie*

Removing these sections of taxiways would also eliminate two intersections that do not conform to the 3-node intersection concept – intersections Charlie/Echo/Kilo and Bravo/Kilo/12-30. In place if these taxiway sections, a new taxiway would be constructed connecting Taxiways Bravo and Charlie.

Taxiway C/E/K Intersection

Improvements to the intersection of Taxiways Charlie, Echo and Kilo include removing sections of existing taxiways and constructing a new taxiway. These improvements will enhance safety by eliminating non-standard taxiway and runway intersection angles, a wide expanse of pavement, and a complex intersection that does not conform to the 3-node concept.

Taxiway Echo between Runway 16-34 and Taxiway Bravo would be closed, and the pavement removed, excluding the section of Taxiway Kilo. Removal of this taxiway section would eliminate the wide expanse of pavement and non-standard runway and taxiway intersection angles that exist at Hot Spot #1. Also, closing this portion of Taxiway Echo would eliminate the complex geometry intersection that does not conform to the 3-node concept. A new 90-degree taxiway connector would be constructed between Runway 16-34 and Taxiway Kilo.

Taxiway D/K/K5 Intersection

Improvements to the intersection of Taxiways Delta, Kilo and Kilo 5 include removing a section of Taxiway Delta and constructing a new taxiway to provide access across Runway 12-30 between Taxiways Delta and Echo. These improvements would correct a non-standard runway intersection angle, a non-standard runway holdline, and a wide expanse of pavement.

Removing Taxiway Delta between Runway 16-34 and Taxiway Kilo improves all three non-compliant features identified at this intersection. Additionally, because two taxiway exits on Runway 12-30 are being removed (Bravo and Alpha eastbound) a new runway exit would be constructed allowing aircraft to exit Runway 12-30 both northbound and southbound. This would also create a new taxiway connector between the 34 Pad and Taxiway Echo.

Taxiway A

Taxiway Alpha provides direct access from the FBO apron to Runway 12-30. To improve this area of non-compliant geometry, a section of Taxiway Alpha between Runway 12-30 and Taxiway Echo would be closed. This would provide pilots with only two options when taxiing from the FBO apron: turn left or right on Taxiway Echo – removing the opportunity to accidentally taxi directly onto Runway 12-30. The removal of this section of taxiway also removes a non-standard runway intersection angle.

4.6.2. SW Quadrant Geometry Improvements

Safety enhancements are accomplished in the SW Quadrant through pavement removal, construction of a new taxiway and converting a portion of decommissioned Runway 6-24 into a taxiway. The improvements recommended in this section remove Hot Spots #2 and #3, and correct non-standard runway intersection angles, and intersections that do not conform to the 3-node concept and direct access to runways.

The following airfield improvements are recommended to enhance safety and compliance with AC 13A design principles:

Decommissioned Runway 6-24

Decommissioning Runway 6-24 would allow the decommissioned runway pavement west of Runway 16-34 to be converted into a taxiway. Consideration was given to future development in the SW Quadrant. During Phase 3 of the Master Plan, the Airport concluded the site selection process for a United States

Customs and Border Protection General Aviation Facility (GAF). The future site will be the location of existing Hangar 4, near the intersection of Taxiway Lima and Lima 4. Taking this into consideration during the planning process, the section of the decommissioned runway between Runway 16-34 and the entrance pavement to Hangar 7, will be converted to a 50' wide taxiway. Pavement of the decommissioned runway west of the Hangar 7 entrance will be reduced in width by 15', resulting in a 35' wide taxiway. This would provide aircraft access to the SW T-Hangars and Hangars 5 and 6. Converting the runway into a taxiway would remove Hot Spots #2 and #3. Decommissioning the runway would also remove direct access and non-standard runway intersection angles identified by the geometry compliance assessment.

Taxiway L/L3/Y Intersection

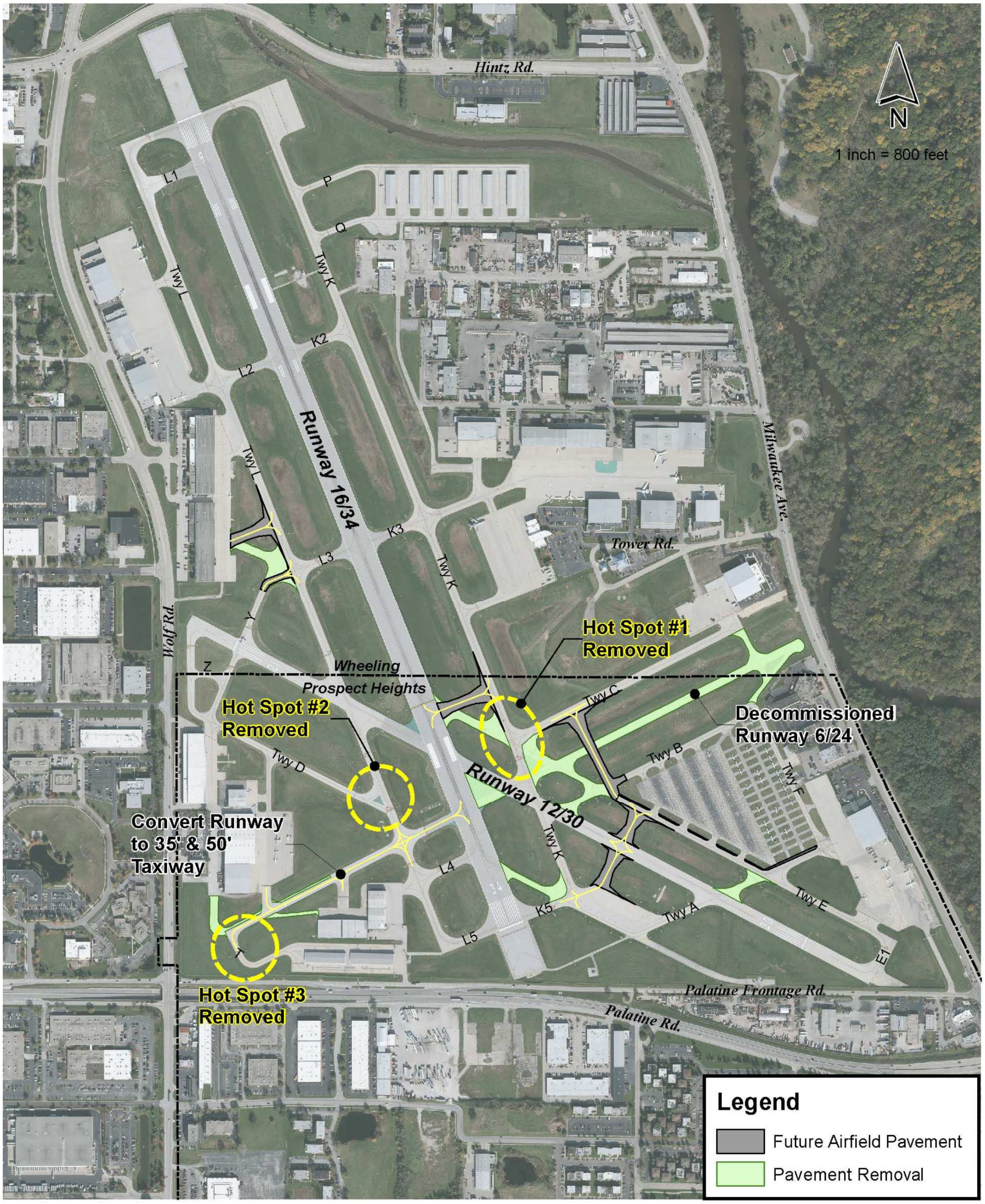
Taxiway improvements to the intersection of Taxiways Lima, Lima 3 and Yankee include constructing a new taxiway, and removing taxiway pavement. These improvements are intended to correct non-compliant geometry including a 3-node intersection violation and a wide expanse of pavement.

This existing intersection provides pilots with four options to maneuver when taxiing. Removing the segment of Taxiway Lima 3 between the Hangar 10 apron and Taxiway Yankee will enhance safety by reconfiguring this intersection utilizing the 3-node design principle. Additionally, to provide access to the Hangar 10 apron, a new taxiway is proposed between the apron and Taxiway Lima.

4.6.3. Recommended Geometry Implementation

As previously stated, the recommended airfield geometry and taxiway improvements can be implemented in the airfield's existing condition and are not dependent on future airfield development. Subsequent sections of this report will evaluate alternatives that propose development throughout CEA, and AC 13A design concepts and principles will be applied to those alternatives. Exhibit 4-12 *depicts all of the aforementioned recommended airfield geometry and taxiway improvements.*

Exhibit 4-12:
Recommended Taxiway Improvements



Source: CMT (2019)

4.7. Aircraft Storage

The Facility Requirements section identified aircraft storage requirements to accommodate projected future aviation demand. Four scenarios were evaluated, two using the FAA based aircraft count and two using CEA's based aircraft count. Each scenario forecasted space requirements for both a constrained and unconstrained forecast. The direction given to remain within the Airport's existing physical roadway constraints is the reason subsequent aircraft storage alternatives will be compared to the constrained forecast using CEA's based aircraft count.

Various hangar sizes are used throughout the aircraft storage alternatives. In addition to T-hangars, the alternatives show three hangar sizes: small, medium and large. These sizes are intended to represent the type of aircraft that would potentially utilize the hangar. To accommodate future demand, many of the hangars must house multiple aircrafts of different sizes (light, small, medium and large jets). To better understand the hangar sizes and intended aircraft usage throughout the alternatives, Table 4-1 *provides an explanation of aircraft and hangar sizes.*

Table 4-1
Hangar Sizes Used in Aircraft Storage Alternatives

Aircraft Size Examples	
✈ Large Jet - Global Express, Gulfstream G550 ✈ Medium Jet - Citation X, Challenger 605 ✈ Light Jet - Citation Mustang, Eclipse 500 ✈ Small Jet - Citation Excel, Hawker 800 ✈ Turbo Prop – Pilatus PC-12, King Air 350 ✈ Piston - C172, PA-28	
Potential Hangar Utilization by Aircraft Type	
Large Hangar	✈ Large Jet ✈ Medium Jet
Medium Hangar	✈ Medium Jet ✈ Small Jet ✈ Light Jet ✈ Turbo Prop
Small Hangar	✈ Piston

Source: CMT (2019)

In addition to aircraft storage (hangar/tie-down areas), the alternatives also considered the development of taxiways/taxilanes, aprons, vehicle parking and roadway access. Given the proximity of the Airport to the Des Plaines River stormwater management was given significant consideration in each of the alternatives. Stormwater management facilities could be constructed in numerous ways, shapes and sizes – all dependent on the type and location of development. Therefore, for planning purposes, the alternatives assumed reservation of approximately one-third (1/3) of a site's development area for stormwater management. Similarly, consideration was also given to maintain development outside the building restriction line (BRL).

The following aircraft storage alternatives present concepts of development in the various airfield quadrants. It should be noted that several alternatives show development on property not owned by CEA. This is consistent with past planning efforts and all proposed development remains inside CEA's physical roadway constraints.

4.7.1. NE Quadrant

The NE Quadrant generally consists of the NE T-Hangars and the industrial park areas. Key development concepts for the NE Quadrant include:

- *Separation between smaller piston aircraft and larger jet aircraft*
- *Provide additional tie-down areas that could be converted to hangar space*
- *Incremental development as industrial park parcels become available*
- *Provide space for stormwater management*

Alternatives developed for the NE Quadrant show additional development east of the NE T-Hangars. Flexibility is maintained by providing tie-downs or aircraft storage; whichever is required by demand. Two alternatives show development concepts on just the northern half of the industrial park, and two show development on the entire industrial park. It was assumed that the southern portion of the industrial park would be the most difficult to acquire due to the waste transfer station that currently occupies the land. Alternatives show two development concepts that assume the southern portion was unable to be acquired.

The Airport has already begun purchasing parcels in the industrial park, and alternatives were developed to provide incremental expansion as more parcels are acquired. Ideally, development would be constructed closest to the airfield first, thereby displacing the Airport's administration and maintenance building.

*It is recommended the Airport acquire the entire industrial park to accommodate future aviation demand. **Exhibit 4-13** shows the alternatives considered for the NE Quadrant. The four alternatives were evaluated and presented to the Airport, and Alternative One was selected as the Preferred Development alternative for the NE Quadrant.*

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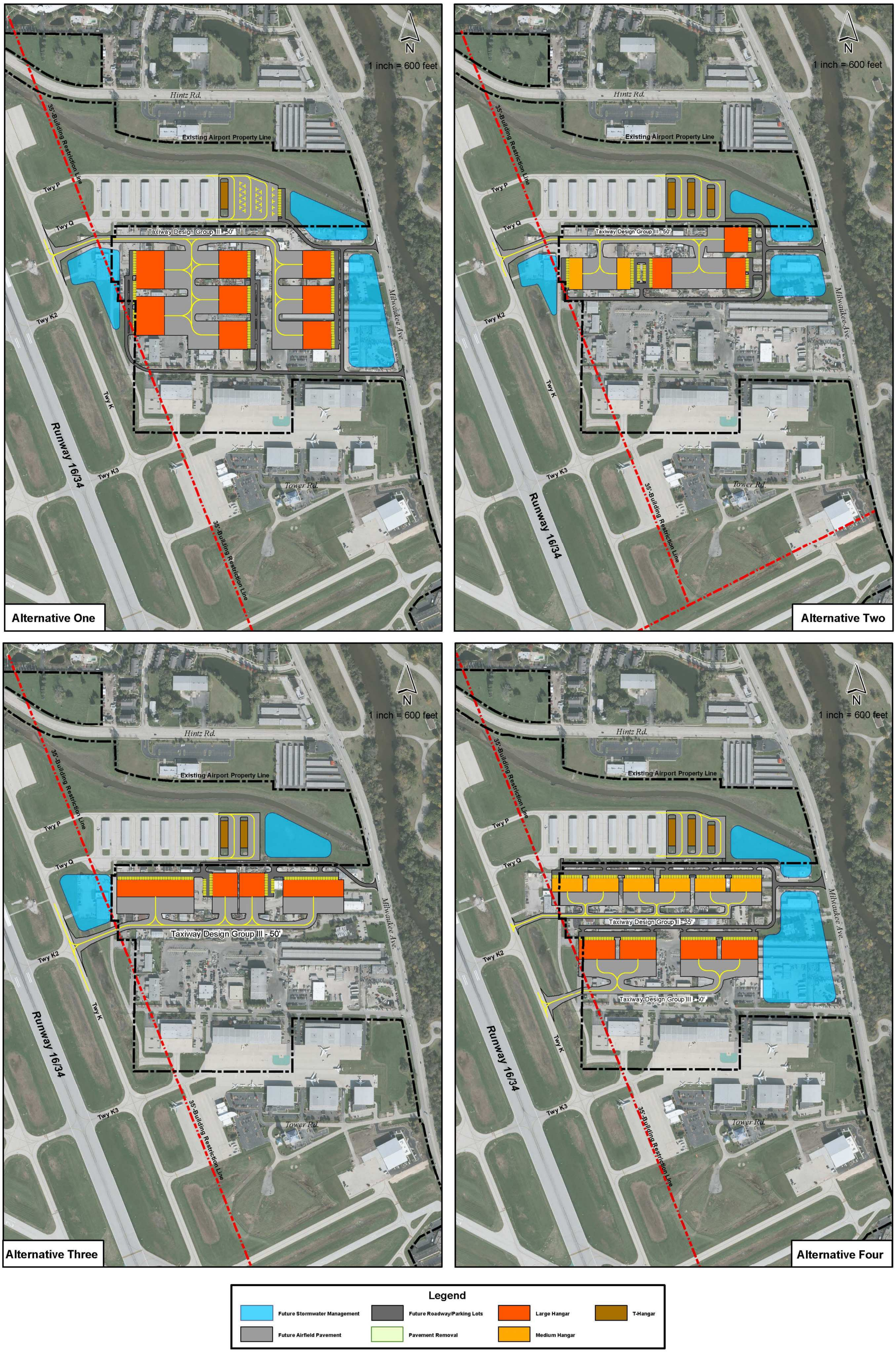
Exhibit 4-13:
NE Quadrant Alternatives



Source: CMT (2019)

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4.7.2. SE Quadrant

The SE Quadrant generally consists of the area of airfield between Taxiway Kilo and Milwaukee Avenue, and Sumac Road and East Palatine Road. Key development concepts for the SE Quadrant include:

- *Runway 6-24 will be decommissioned*
- *Redevelop Area 3 (triangular tie-down area) for future hangar development*
- *Acquire and develop area (from previous ALP) between Palatine Frontage and East Palatine Roads*
- *Provide space for stormwater management*

All four alternative concepts developed for the SE Quadrant decommission Runway 6-24 and maintain previous planning efforts for acquiring parcels south of the Palatine Frontage Road. Additionally, several alternatives show the Airport acquiring the Ramada Plaza and the 1098 building along Milwaukee Avenue. The Hawthorne Global Aviation Services FBO has expressed future interest in expanding their facilities within their leased space both at their main hangar (adjacent to Milwaukee Avenue) and at the Charlie pad. Therefore, all four alternatives reserved land for Hawthorne's desire to expand their operations and show two hangars developed at both locations.

Decommissioning Runway 6-24 and re-developing the Area 3 (tie-down) space allows the Airport to potentially construct five to six additional revenue generating hangars. Aircraft displaced by developing Area 3 would be potentially relocated to the NE T-Hangar area. Hangar development in this area would require line of sight (LoS) compliance with the air traffic control tower (ATCT). FAA guidance states that an existing ATCT must have clear LoS to all runways and operational surfaces (taxiways & movement areas) controlled by the ATCT.

To accommodate future aviation demand, it is recommended that the Airport continue previous planning efforts by depicting the property between the Palatine Frontage Road and East Palatine Road as being acquired by the Airport. The acquisition of these parcels would allow for the development of approximately ten revenue generating hangars, a substantially sized apron adjacent to the hangars, and a west parallel taxiway to Runway 12-30 to be constructed between Taxiway Alpha and the approach end of Runway 30. It is also recommended that the Ramada Plaza and 1098 building property be acquired as well. The intent of this future land acquisition is to maximize area available for aviation development inside CEA's physical roadway constraints. Additionally, all of the alternatives show hangar development north (over the old 94th Aero Squadron restaurant parcel) and south (over decommissioned Runway 6-24) of Taxiway Charlie.

The four alternatives were evaluated and presented to the Airport, and Alternative One was selected as the Preferred Development alternative for the SE Quadrant. All four SE Quadrant alternatives are shown in **Exhibit 4-14***. Furthermore, a preliminary LoS study was completed utilizing the hangar layout from Alternative One. Using this preferred alternative layout, there would be a height restriction of approximately 25-feet placed on the three medium hangars (oriented northwest-southeast that face Taxiway Echo) over Area 3. It is recommended that any future development in this area perform a detailed LoS study prior to any development.*

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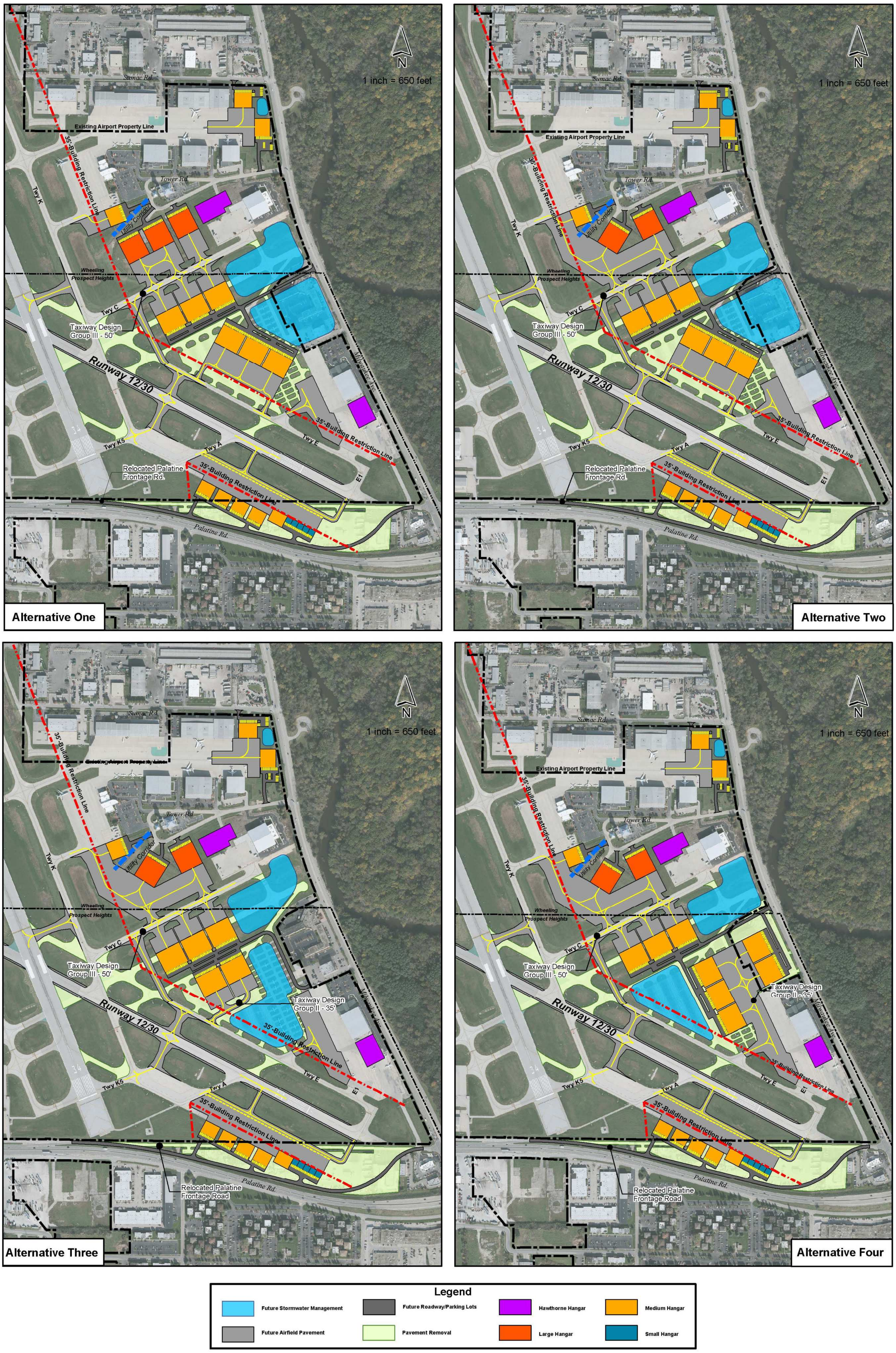
Exhibit 4-14:
SE Quadrant Alternatives



Source: CMT (2019)

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4.7.3. SW Quadrant

The SW Quadrant is situated between Wolf Road and Taxiway Lima, and the Palatine Frontage Road and Runway 12-30. Key development concepts for the SW Quadrant included:

- *Maximize developable area*
- *Relocate Taxiway D to increase developable area*
- *Maintain SW T-Hangars*
- *Consider BRL when planning development*
- *Preserve area for GAF*
- *Provide space for stormwater management*

The four alternatives developed for the SW Quadrant show variations of development while maintaining the key development concepts. All alternatives shift Taxiway Delta north to maximize developable area. Alternative 2 is the only alternative that maintains Runway 6-24; however, this alternative does not maximize the developable area of the SW Quadrant as the development depicted is essentially a one-to-one (1:1) replacement of the existing hangars. Decommissioning Runway 6-24 in the three other alternatives not only provides the safety benefit of improving airfield geometry, but also makes land available for development and removes the restrictions of the BRL. Removing the constraints of Taxiway Delta and Runway 6-24 significantly enhances the utility of the SW Quadrant.

Consideration was given to reserve the area selected for the GAF and to also maintain the SW T-Hangars. This essentially prevents any new development south of Runway 6-24. If Runway 6-24 is decommissioned and development begins in the SW Quadrant, a new taxiway/taxilane would be needed to access the SW T-Hangars. It should be noted that an alternative was evaluated that showed development over the GAF area and SW T-Hangars. The alternative was dismissed on the basis there was no substantial benefit gained by developing over these areas.

To most efficiently utilize the SW Quadrant area, it is recommended that the Airport decommission Runway 6-24, shift Taxiway Delta north, and maintain previous planning efforts showing the acquisition of property along Wolf Road that includes the Citgo gas station and Station 39 fire house.

The four alternatives were evaluated and presented to the Airport, and Alternative One was selected as the Preferred Development alternative for the SW Quadrant. All four SW Quadrant alternatives are shown in Exhibit 4-15*.*

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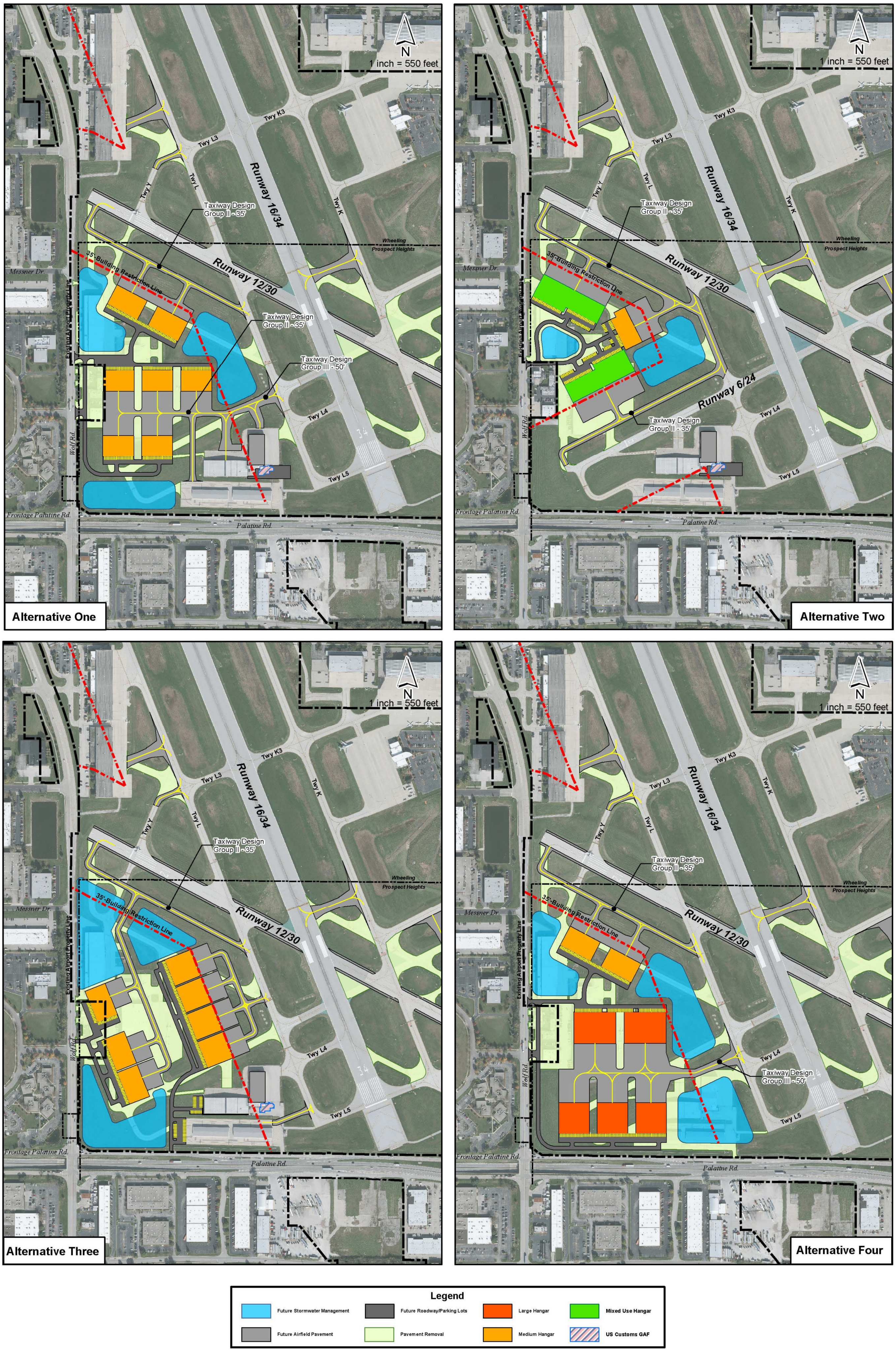
Exhibit 4-15:
SW Quadrant Alternatives



Source: CMT (2019)

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4.7.4. Miscellaneous Aircraft Storage Development Concepts

There are several aircraft storage development areas that will be shown on the Preferred Development Concept that have not been discussed in this section. This includes both hangar and tie-down areas in the NE Quadrant, SE Quadrant and NW Quadrant areas of the airfield.

4.7.4.1. NE QUADRANT

The NE T-Hangars are currently configured in six parallel rows with access via Taxiways Papa and Quebec. The Preferred Development will depict one additional T-Hangar row and 23 new tie-down spaces. The intent of the new tie-downs is to accommodate relocated aircraft that utilize Area 3 (triangular tie-down area) in the SE Quadrant when this area is redeveloped. Over time, as demand for sheltered aircraft storage increases, additional T-Hangars could be developed over the tie-down rows.

4.7.4.2. SE QUADRANT

The Preferred Development will show two new hangars adjacent to the East Apron in the SE Quadrant. The new hangar development is located along Milwaukee Avenue, in between Sumac Road and Tower Drive. A shared apron is depicted connecting the two new hangars to the East Apron, and airfield access is provided via Taxiway Kilo Three.

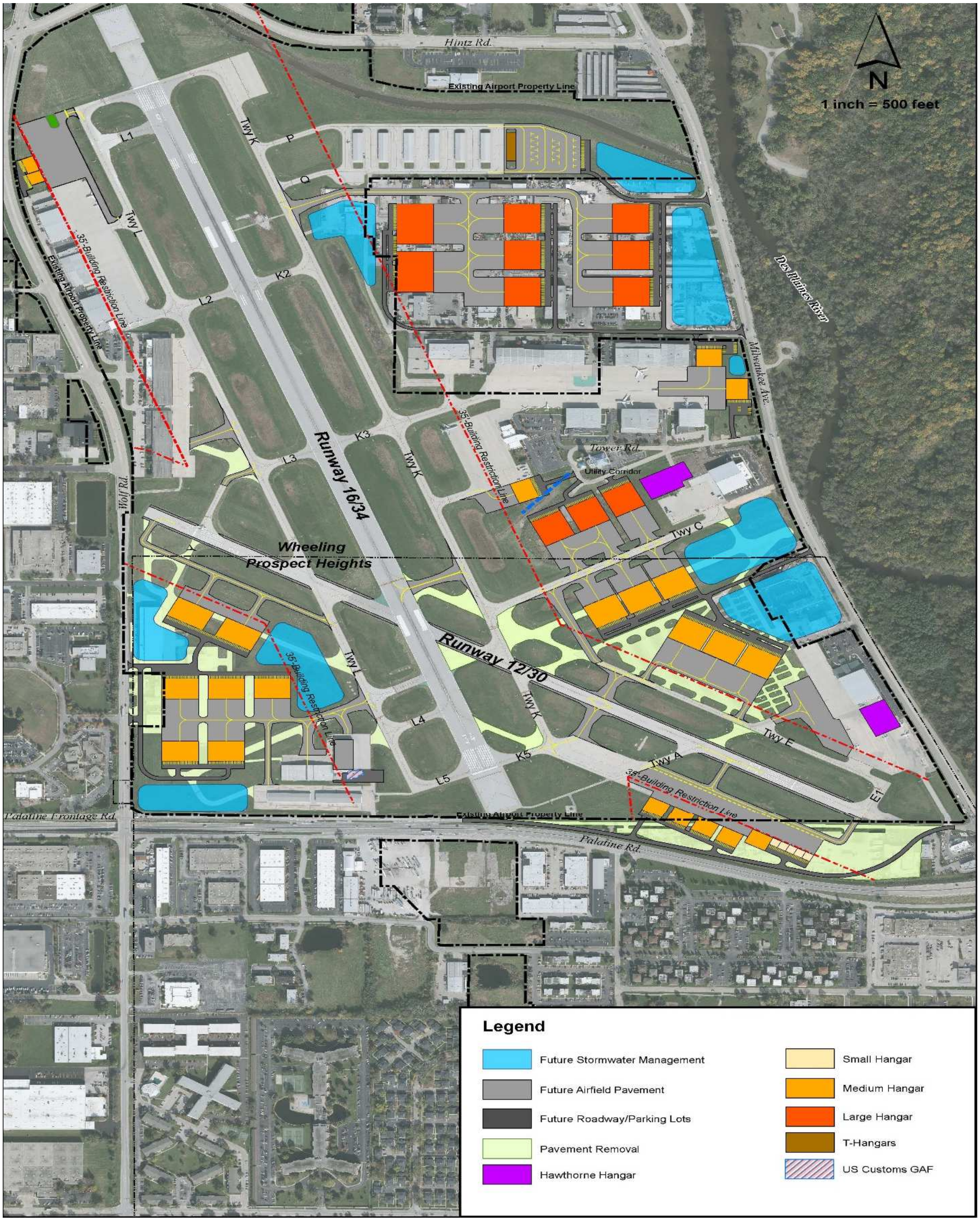
4.7.4.3. NW QUADRANT

Two new hangars are depicted on the Preferred Development located north of the existing Hangar 42 facility. This development has been previously identified in past planning efforts and is being carried forward from the previous ALP. A new apron would be developed in front of the new hangar development and adjacent to the existing apron. A new taxiway connector would be constructed to provide airfield access.

4.8. Preferred Development Alternative Summary

To best accommodate future aviation growth at CEA it is recommended that the Airport implement the Preferred Development described in this section. Each alternative presented was analyzed to meet the objectives and evaluation criteria stated in the beginning of this section. The Preferred Development ultimately being selected will be carried forward and shown on the ALP. The Preferred Development represents the conclusion of the planning process that will allow the Airport to continue to develop in order to enhance design standards compliance, improve existing operational efficiency and airport accessibility, and to accommodate future demand. Exhibit 4-16 *shows the overall Preferred Development.*

Exhibit 4-16: Preferred Development



Source: *CMT (2019)*

Section 5

Implementation Plan

5.1. Introduction

The following section presents a description of the long-term physical development program for Chicago Executive Airport (PWK). The facility improvements identified in the previous sections as potentially being necessary over the 20-year planning period will be added to the Capital Improvement Plan (CIP). The following implementation plan has been developed using 2021 dollars. Implementation of individual projects within their specific development years may require adjustments for inflation and specific funding resources that are available.

5.2. Capital Improvement Plan (CIP) and Schedule

The long-term physical development program for the Airport has been separated into three planning phases, short-term (0-5 years), long-term (5-20 years) and demand driven. The demand driven planning phase represents a group of development or re-development projects divided into various airfield quadrants that address based aircraft storage capacity issues associated with potential future aviation demand but are still very speculative in terms of the exact timing of the trigger point. While these projects have not been slotted into a program timeframe, estimated costs per quadrant have been provided to understand the potential magnitude of the projects and the entire quadrant's complete development, including any required land acquisition. As based aircraft demand approaches the need for these improvements, it is recommended that a reevaluation be conducted to assess the most appropriate improvement and a more specific timeframe for implementation.

5.2.1. Short-Term CIP

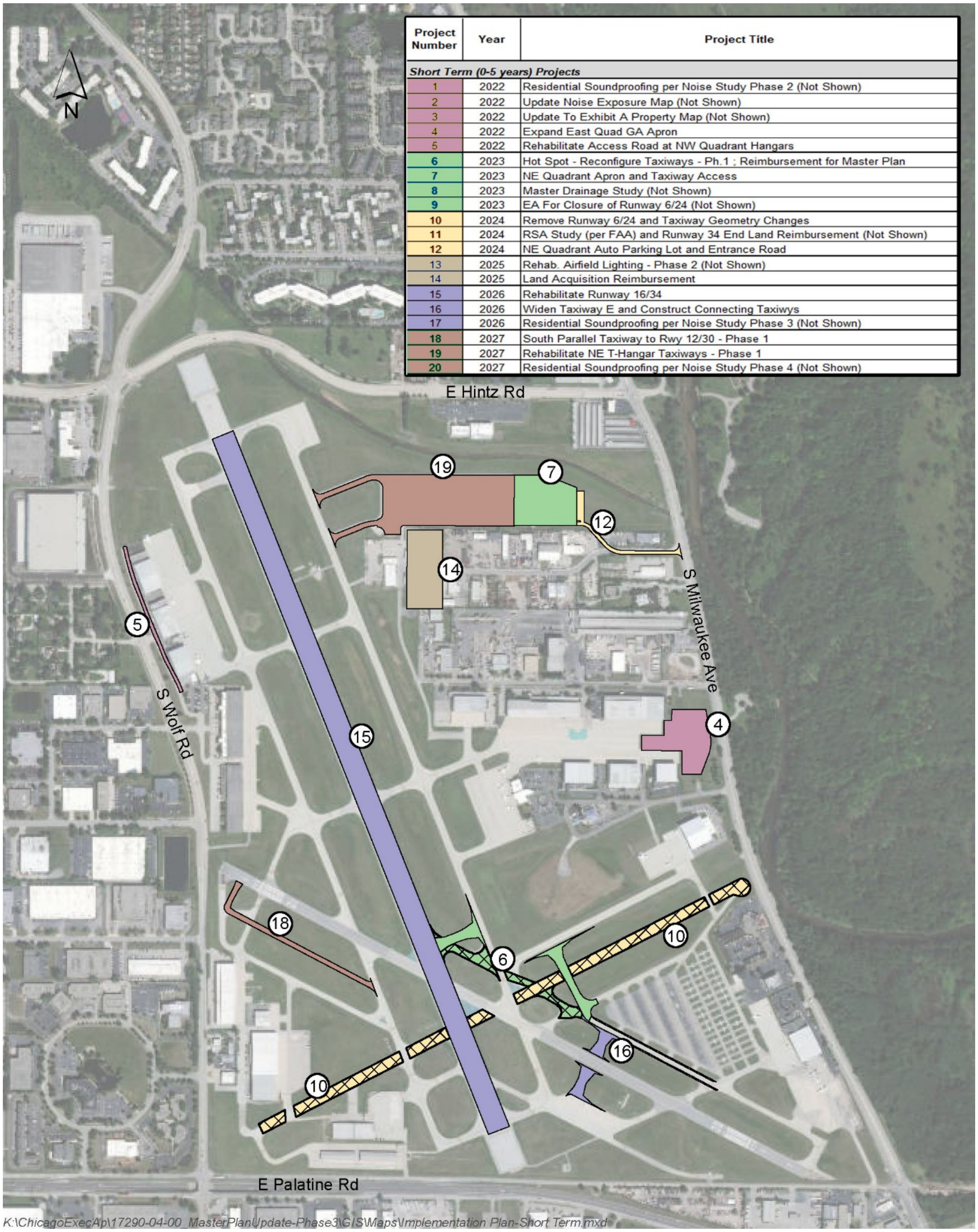
The focus of the short-term CIP is on PWK's existing airfield infrastructure. Included in the first two years are projects intended to reconfigure airfield geometry, continue planning efforts and expand existing aprons. Highlights of later years of the short-term CIP include projects related to rehabilitation of airfield pavement and lighting, noise mitigation, taxiway widening and reconfiguration and land acquisition reimbursement.

The general approach of the short-term CIP is to propose a high-priority airfield project as PWK's top priority each year. These types of projects typically capture high levels of FAA AIP Discretionary Funding. Beyond these high-priority airfield projects, secondary priority development projects are also proposed each year. While AIP funding of these projects is less certain, they represent an opportunity for PWK to increase annual funding levels.

PWK's short-term CIP is intended to allow the Airport to commit resources to reconfiguring and maintaining existing airfield infrastructure while continuing on-going planning and noise mitigation efforts. Continued upkeep of existing facilities and planning are intended to facilitate aviation development projects that are forecast to occur during the planning period.

Total development cost for projects identified in the short-term CIP equals approximately $28.7 million. The costs to reconfigure airfield geometry (approximately $8.5 million), and runway and taxiway widening (approximately $8.1 million) are the largest project elements identified in the short-term CIP. Exhibit 5-1 *and* Table 5-1 *provide a list of projects identified in the short-term CIP with total project costs. The projects anticipated to receive state and federal funding were taken from PWK's Final 2021 Transportation Improvement Proposal (TIPS) submitted to the Illinois Department of Transportation Division of Aeronautics (IDA) in December 2021. Also, included is a detailed cost allocation table (federal, state, local participation) for the short-term CIP projects.*

Exhibit 5-1:
Short Term CIP



Project Number	Year	Project Title
Short Term (0-5 years) Projects		
1	2022	Residential Soundproofing per Noise Study Phase 2 (Not Shown)
2	2022	Update Noise Exposure Map (Not Shown)
3	2022	Update To Exhibit A Property Map (Not Shown)
4	2022	Expand East Quad GA Apron
5	2022	Rehabilitate Access Road at NW Quadrant Hangars
6	2023	Hot Spot - Reconfigure Taxiways - Ph.1 ; Reimbursement for Master Plan
7	2023	NE Quadrant Apron and Taxiway Access
8	2023	Master Drainage Study (Not Shown)
9	2023	EA For Closure of Runway 6/24 (Not Shown)
10	2024	Remove Runway 6/24 and Taxiway Geometry Changes
11	2024	RSA Study (per FAA) and Runway 34 End Land Reimbursement (Not Shown)
12	2024	NE Quadrant Auto Parking Lot and Entrance Road
13	2025	Rehab. Airfield Lighting - Phase 2 (Not Shown)
14	2025	Land Acquisition Reimbursement
15	2026	Rehabilitate Runway 16/34
16	2026	Widen Taxiway E and Construct Connecting Taxiwys
17	2026	Residential Soundproofing per Noise Study Phase 3 (Not Shown)
18	2027	South Parallel Taxiway to Rwy 12/30 - Phase 1
19	2027	Rehabilitate NE T-Hangar Taxiways - Phase 1
20	2027	Residential Soundproofing per Noise Study Phase 4 (Not Shown)

Source: CMT (2021)

Table 5-1:
Short Term CIP

Project Number	Year	Project Title	Total Project Cost	Funding Source	Federal Discretionary Share	Federal Entitlement Share	State Share	Local Share
1	2022	Residential Soundproofing per Noise Study Phase 2	**$ 1,633,000**	*F/L*	$ 1,469,700			$ 163,300
2	2022	Update Noise Exposure Map	**$ 367,000**	*F/S/L*	$ 330,300			$ 36,700
3	2022	Update To Exhibit A Property Map	**$ 166,666**	*F/S/L*		$ 150,000	$ 8,333	$ 8,333
4	2022	Expand East Quad GA Apron	**$ 1,040,000**	*S/L*			$ 936,000	$ 104,000
5	2022	Rehabilitate Access Road at NW Quadrant Hangars	**$ 180,000**	*S/L*			$ 162,000	$ 18,000
6	2023	Hot Spot - Reconfigure Taxiways - Ph.1 ; Reimb. for Master Plan	**$ 3,200,000**	*F/S/L*	$ 2,730,000	$ 150,000	$ 160,000	$ 160,000
7	2023	NE Quadrant Apron and Taxiway Access	**$ 2,000,000**	*F/S/L*	$ 1,800,000		$ 100,000	$ 100,000
8	2023	Master Drainage Study	**$ 450,000**	*S/L*			$ 225,000	$ 225,000
9	2023	EA For Closure of Runway 6/24	**$ 166,667**	*L*				$ 166,667
10	2024	Remove Runway 6/24 and Taxiway Geometry Changes	**$ 2,500,000**	*F/S/L*	$ 2,100,000	$ 150,000	$ 125,000	$ 125,000
11	2024	RSA Study (per FAA) and Runway 34 End Land Reimbursement	**$ 500,000**	*F/S/L*	$ 450,000		$ 25,000	$ 25,000
12	2024	NE Quadrant Auto Parking Lot and Entrance Road	**$ 890,000**	*S/L*			$ 801,000	$ 89,000
13	2025	Rehab. Airfield Lighting - Phase 2	**$ 2,000,000**	*F/S/L*	$ 1,650,000	$ 150,000	$ 100,000	$ 100,000
14	2025	Land Acquisition Reimbursement	**$ 1,150,000**	*F/S/L*	$ 1,035,000		$ 57,500	$ 57,500
15	2026	Rehabilitate Runway 16/34	**$ 6,000,000**	*F/S/L*	$ 5,250,000	$ 150,000	$ 300,000	$ 300,000
16	2026	Widen Taxiway E and Construct Connecting Taxiwys	**$ 2,117,000**	*F/S/L*	$ 1,905,300		$ 105,850	$ 105,850
17	2026	Residential Soundproofing per Noise Study Phase 3	**$ 2,000,000**	*F/L*	$ 1,800,000			$ 200,000
18	2027	South Parallel Taxiway to Rwy 12/30 - Phase 1	**$ 2,750,000**	*F/S/L*	$ 2,325,000	$ 150,000	$ 137,500	$ 137,500
19	2027	Rehabilitate NE T-Hangar Taxiways - Phase 1	**$ 950,000**	*F/S/L*	$ 855,000		$ 47,500	$ 47,500
20	2027	Residential Soundproofing per Noise Study Phase 4	**$ 2,000,000**	*F/L*	$ 1,800,000			$ 200,000

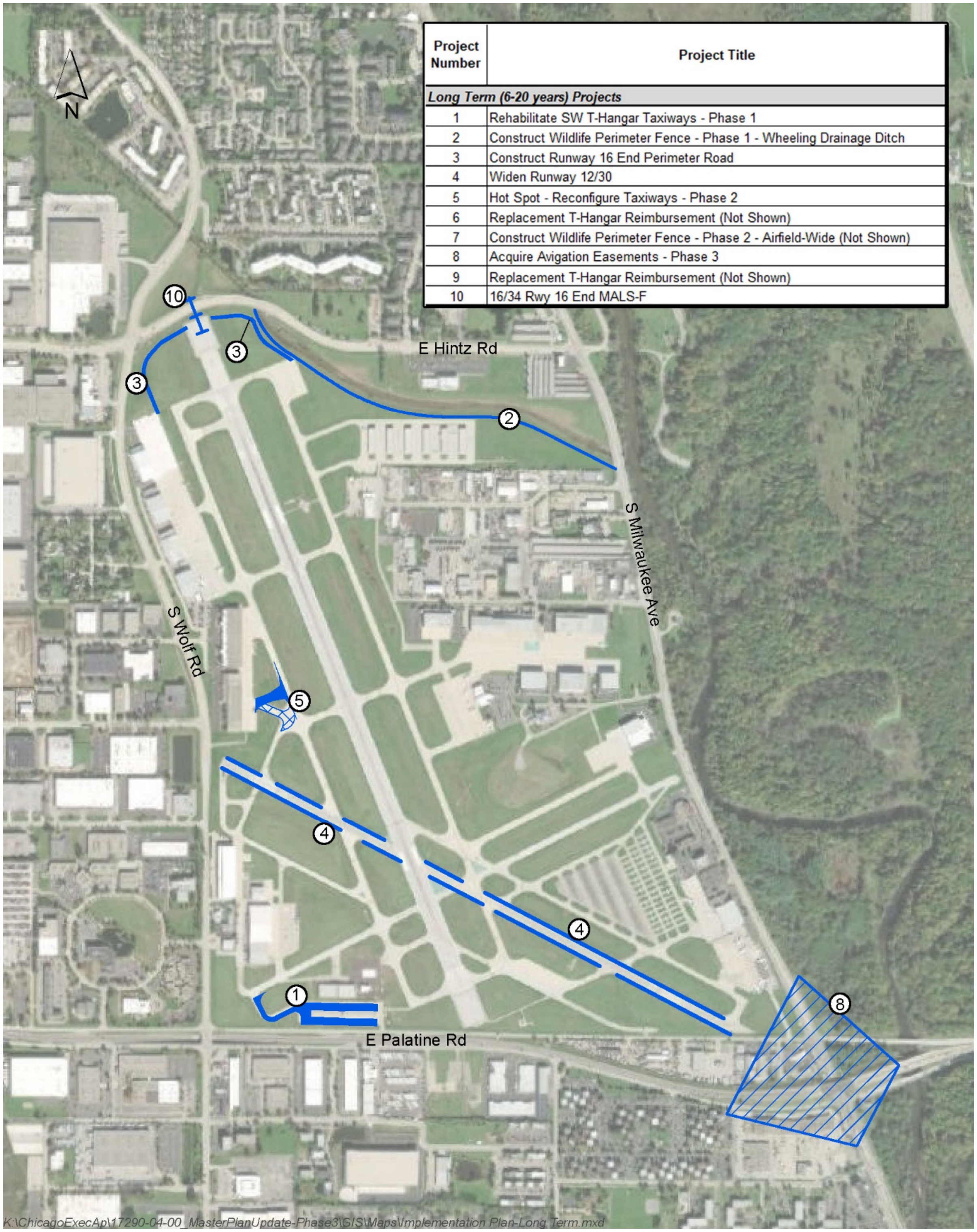
Source: (CMT 2021)

5.2.2. Long-Term CIP

The long-term CIP is intended to be a list of projects that would be candidates for inclusion in the short-term CIP in future years. Specific years or priorities are not assigned to these projects to provide PWK with the flexibility to configure future short-term CIP's as future conditions require. This project list includes a wide array of project types which includes airfield pavement rehabilitation, widening and reconfiguration projects, security fencing projects, a perimeter roadway project, t-hangar reimbursements and a NAVAID project.

Total estimated development cost for projects identified in the long-term CIP equals about $13 million. The airfield pavement projects account for approximately $6 million of the total development cost for the long-term CIP. ***Exhibit 5-2 and Table 5-2*** *provides a list of projects identified in the long-term CIP with total estimated project costs.*

Exhibit 5-2:
Long Term CIP



Project Number	Project Title
Long Term (6-20 years) Projects	
1	Rehabilitate SW T-Hangar Taxiways - Phase 1
2	Construct Wildlife Perimeter Fence - Phase 1 - Wheeling Drainage Ditch
3	Construct Runway 16 End Perimeter Road
4	Widen Runway 12/30
5	Hot Spot - Reconfigure Taxiways - Phase 2
6	Replacement T-Hangar Reimbursement (Not Shown)
7	Construct Wildlife Perimeter Fence - Phase 2 - Airfield-Wide (Not Shown)
8	Acquire Avigation Easements - Phase 3
9	Replacement T-Hangar Reimbursement (Not Shown)
10	16/34 Rwy 16 End MALS-F

Source: CMT (2021)

Table 5-2:
Long Term CIP

Project Number	Project Title	Total Project Cost	Funding Source	Federal Discretionary Share	Federal Entitlement Share	State Share	Local Share
1	Rehabilitate SW T-Hangar Taxiways - Phase 1	**$ 400,000**	*F/S/L*	$ 360,000		$ 20,000	$ 20,000
2	Construct Wildlife Perimeter Fence - Ph. 1 - Wheeling Drainage Ditch	**$ 730,000**	*F/S/L*	$ 657,000		$ 36,500	$ 36,500
3	Construct Runway 16 End Perimeter Road	**$ 2,250,000**	*F/S/L*	$ 2,025,000		$ 112,500	$ 112,500
4	Widen Runway 12/30	**$ 3,950,000**	*F/S/L*	$ 3,555,000		$ 197,500	$ 197,500
5	Hot Spot - Reconfigure Taxiways - Phase 2	**$ 1,780,000**	*F/S/L*	$ 1,602,000		$ 89,000	$ 89,000
6	Replacement T-Hangar Reimbursement	**$ 150,000**	*F*		$ 150,000		
7	Construct Wildlife Perimeter Fence - Phase 2 - Airfield-Wide	**$ 690,000**	*F/S/L*	$ 621,000		$ 34,500	$ 34,500
8	Acquire Avigation Easements - Phase 3	**$ 2,000,000**	*F/S/L*	$ 1,800,000		$ 100,000	$ 100,000
9	Replacement T-Hangar Reimbursement	**$ 150,000**	*F*		$ 150,000		
10	16/34 Rwy 16 End MALS-F	**$ 1,000,000**	*F/S/L*	$ 900,000		$ 50,000	$ 50,000

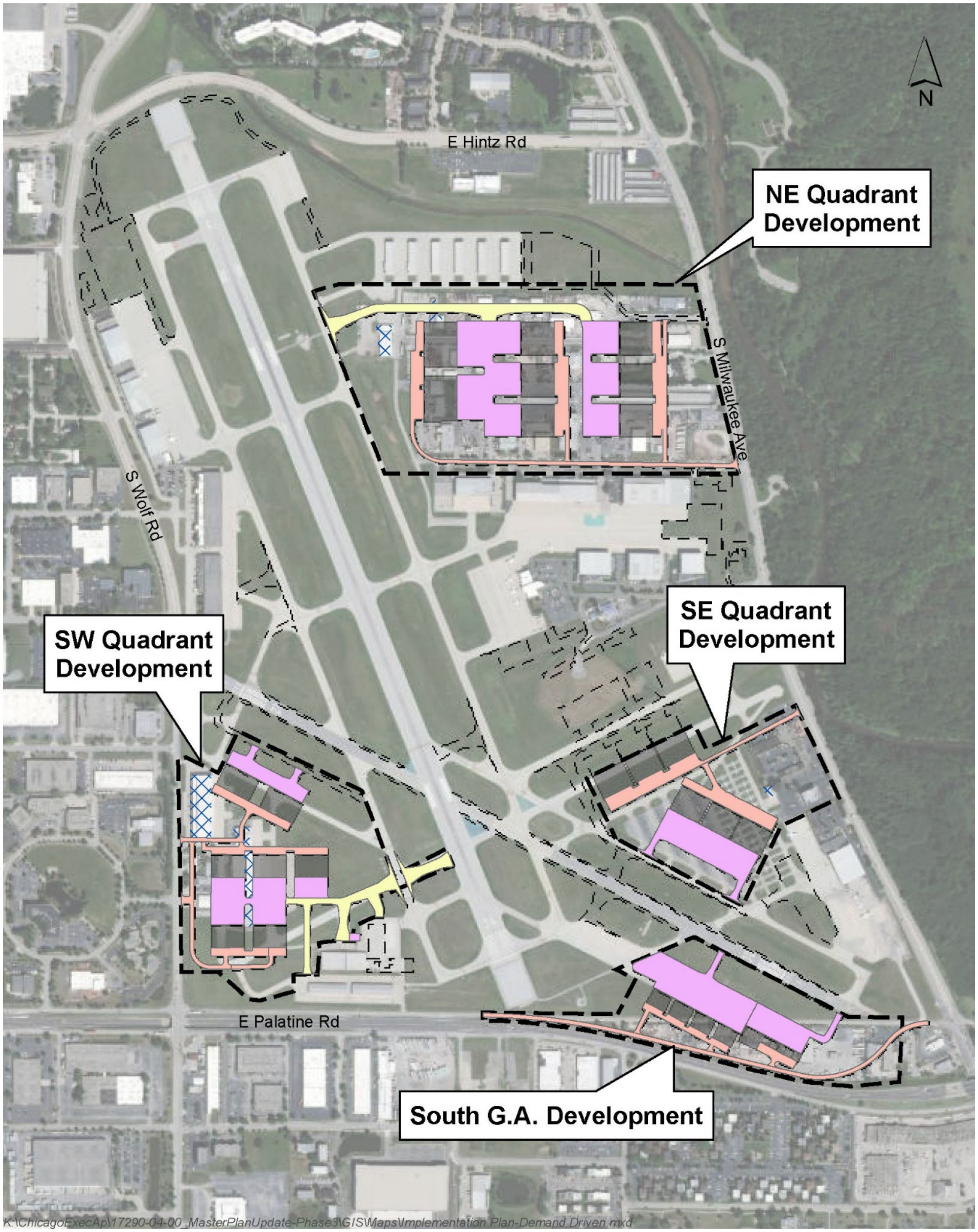
Source: CMT (2021)

5.2.3. Demand Driven CIP

The demand driven CIP projects represent projects with uncertain timeframes that will be required if aviation demand warrants their implementation. Demand driven CIP projects include hangar developments and associated supporting airfield and landside infrastructure in the northeast, southeast, south, and southwest quadrants of PWK. Land acquisition is also included in each quadrant to facilitate ultimate build out. Development and re-development projects for each quadrant were identified in the previous section, Alternatives Analysis, of this master plan for development should the based aircraft demand be realized. Preferred alternatives for all quadrants will be shown on the Airport Layout Plan (ALP) to allow each alternative to be fully implemented in the future without an ALP revision.

Total estimated development cost for projects identified in the airfield demand-driven CIP would be approximately $134 million. This total cost includes land acquisition, demolition and site preparation, airside and landside pavements, grading and drainage and sewer and water utilities. Building construction and private utility costs are not included. ***Exhibit 5-3*** *and* ***Table 5-3*** *provides a list of projects identified in the demand-driven CIP with total project cost ranges. Detailed cost allocations will not be provided for the demand-driven CIP due to likelihood of changes in funding levels and participation levels/eligibility in future federal and state regulations. Due to the high costs anticipated for land acquisition and demolition, it is recommended that PWK begin to acquire land parcels in these areas whenever possible to spread the financial burden over as long of a time period as possible.*

Exhibit 5-3:
Demand Driven CIP



Source: CMT (2021)

Table 5-3: Demand Driven CIP

Northeast Quadrant	
NE Quadrant Taxiway and Apron - Phase 1	**$ 7,868,000**
NE Quadrant Taxiway and Apron - Phase 2	**$ 4,374,000**
NE Quadrant Entrance Road and Auto Parking - Phase 1	**$ 2,381,000**
NE Quadrant Entrance Road and Auto Parking - Phase 2	**$ 1,326,000**
NE Quadrant Entrance Road and Auto Parking - Phase 3	**$ 1,478,000**
Land Acquisition and Demolition for NE Quadrant Development	**$60M - $96M**

South Quadrant	
Relocate Palatine Frontage Road	**$ 4,147,000**
South GA Apron - Phase 1	**$ 5,383,000**
South GA Apron - Phase 2	**$ 2,762,000**
South GA Entrance Road and Auto Parking - Phase 1	**$ 1,362,000**
South GA Entrance Road and Auto Parking - Phase 2	**$ 901,000**
Land Acquisition and Demolition for Palatine Road Relocation	**$13M - $22M**

Southwest Quadrant	
SW Quadrant Taxiways and Aprons - Phase 1	**$ 1,831,000**
SW Quadrant Taxiways and Aprons - Phase 2	**$ 8,193,000**
SW Quadrant Entrance Road and Auto Parking - Phase 1	**$ 2,137,000**
SW Quadrant Entrance Road and Auto Parking - Phase 2	**$ 1,288,000**
SW Quadrant Entrance Road and Auto Parking - Phase 3	**$ 1,533,000**
Land Acquisition and Demolition for SW Quadrant Development	**$2M - $4M**

Southeast Quadrant	
SE Quadrant Taxiways & Apron	**$ 3,893,000**
SE Quadrant Entrance Road and Auto Parking - Phase 1	**$ 1,704,000**
SE Quadrant Entrance Road and Auto Parking - Phase 2	**$ 1,334,000**
Land Acquisition and Demolition for SE Quadrant Development	**$7M - $12M**

Source: CMT (2021)

5.3. Financial Plan

The following section will provide information on the financial framework of PWK and potential funding sources for projects identified in the short-term CIP.

5.3.1. Financial Framework

The Airport is co-owned and jointly operated by the Village of Wheeling and the City of Prospect Heights. Joint municipal ownership and operation of an airport is not common throughout the United States and leads to a unique financial structure. PWK operates independently but requires budget approval from the two owning municipalities. In general, Airport revenues are adequate for PWK to be financially self-sufficient.

5.3.2. Funding Sources

The following funding sources may be utilized during implementation of PWK's CIP.

5.3.2.1. AIRPORT IMPROVEMENT PROGRAM (AIP)

Airports such as PWK rely heavily on the AIP to finance airport development. AIP is a cost-sharing program that assists in the development of a nationwide system of public-use airports by providing funding for airport planning and development projects, including runways, taxiways, aprons, land purchases, airport access roads, safety and security projects, and certain terminal development. Funds obligated for AIP are drawn from the Airport and Airway Trust fund, which is supported by ticket taxes, fuel taxes, and other similar revenues sources.

AIP funding is administered through both non-primary entitlement and discretionary grant programs. The non-primary entitlement program is apportioned by Congress to general aviation airports. The current funding level is $150,000 per year. Discretionary grants are distributed based upon a system of set-aside categories and national priority ratings and administered through FAA's state apportionment funds. Airport projects must compete with other Illinois airports for these funds based upon their national priority, a value based upon both the type of project and airport. AIP funding can only be used on construction and planning related projects. AIP funding cannot be used for maintenance items, operating expenses or debt repayment. The federal share of eligible projects seeking AIP entitlement and/or discretionary funding is currently 90% for general aviation reliever airports like PWK.

5.3.2.2. BIPARTISAN INFRASTRUCTURE LAW (BIL) FUNDING

In November 2021, the Bipartisan Infrastructure Law (BIL) (previously known as the 2021 Infrastructure Investment and Jobs Act) was enacted that provided an additional $25 billion (over a five-year period) in grant funding opportunities to airports for airport infrastructure, terminal development, and airport owned air traffic control towers (ATCT) improvements. These funds will be distributed through the Airport Infrastructure Grant (AIG) and Airport Terminal Program (ATP) programs. AIG funds are apportioned in two ways: AIG Allocated and AIG Competitive. Like AIP Entitlement funds, AIG Allocated funds are based on a formula that will be guaranteed to airports for the five-year period. The AIG Competitive and ATP are both competitively awarded grant programs for which projects are awarded based on program specific criteria. The ATP program provides competitive funding to airports for terminal development and *airport owned ATCT improvement projects. AIG funds have the same statutory eligibility requirements as AIP. AIG Allocated funding levels have been released for FY2022 and PWK was allocated $763,000. The airport industry is currently waiting for further guidance regarding AIG Discretionary funding.*

This CIP does not have BIL or ATP-funded projects, as additional guidance and timing of grant releases is not know at this time.

5.3.2.3. STATE OF ILLINOIS FUNDING

The primary State funding agency for Airports in Illinois is the Illinois Department of Transportation (IDOT), Division of Aeronautics (IDA). IDA provides an additional funding source for all federally eligible aviation developments and may provide certain levels of funding for ineligible or low priority projects. IDA uses several funding options. Additional description of these options is as follows:

State Matching on Federal Fund Sources (AIP entitlement and discretionary funds) – These funding options can be used to reduce the Airport Sponsor's total financial participation. Normally, funding percentages (percentages can vary) are 90% Federal Share, 5% State Share and 5% Local Share. These funding percentage options can vary depending on the availability of State funds.

State-Local Funding Using General Revenue/Motor Fuel Tax (MFT) Funds – In the past, State-Local funds have come from the State's General Revenue source of funding. However, several years ago, IDA stepped away from using General Revenue funds due to the State's poor financial condition. The use of MFT funds has been a small source of State-Local project funding. For ineligible or low priority projects which will not receive federal funding, IDA has historically funded Planning and Environmental projects at 50%-50% State-Local, and Airport development options ranging from 75%-25% to 90%-10% State-Local, depending on the type of airport requesting funding. The timing of past State-Local funding programs has been somewhat inconsistent, and it is unclear when and/or if additional future programs can be anticipated.

State-Local Funding Using Capital Bill Funding – In August 2021, the Capital Bill, or Rebuild Illinois Program, identified a $144M of funding to be administered by IDA and used on Airports throughout Illinois. Nearly every public airport in Illinois will be state-local funding for at least one project. PWK will be receive funding for two projects, shown in the 2022 CIP. Project start timing in 2022 is unknown at this time, as IDA has not released details on potential timing of the project kick-offs.

5.3.2.4. LOCAL FUNDING

The balance of capital project costs, after consideration has been given to FAA grants, State and other funding sources, must be funded through airport resources. This direct payment of capital costs is accomplished through the use of airport operating revenues or reserves. If bonds or borrowing are used, they are also repaid by collecting rent, fees, and other charges. Revenue sources include hangar rent, fuel flowage fees, land leases, etc.

5.4. Key Actions and Responsibilities

5.4.1. Project Development Tasks

Capital improvements at airports require a number of steps to be completed prior to construction activities begin. The following actions with associated responsibility are required:

Sponsor Approval - PWK must approve the proposed capital improvement project including Chicago Executive Airport Board of Directors approval, if required.

Funding Applications - PWK must submit federal and state applications for funding well in advance of the anticipated construction date. Federal funding for capital improvement projects at airports is extremely competitive.

Environmental Documentation - PWK, under the National Environmental Protection Act (NEPA), and in accordance with FAA policies, must submit the necessary environmental documentation and receive approval by the appropriate agencies prior to federal funding being allocated to the proposed capital improvement project. Environmental documentation should be submitted early in the planning/design stage of a project due to the amount of time required to complete the environmental review process. If the project is seeking AIP discretionary funding, the NEPA document is typically submitted in August or September in the year prior (approximately11-12 months before) to the anticipated AIP grant issuance.

Aeronautical Study Determination - the FAA must formally approve the airspace for Airport development/improvement projects. The Airport must submit the necessary airspace information and receive approval from the FAA as part of the FAA's grant assurances. Similar to environmental documentation, the airspace submittal should also be submitted early in the project planning/design stage due to the lengthy airspace review process.

Land Acquisition - the Airport must secure any additional land resources (fee simple or avigation easement) necessary for the proposed capital improvement project. The Airport should begin the acquisition process as soon as practicable as this process can take anywhere from 9 months to 2 or 3 years to complete depending on level of complexity. PWK's Short-Term CIP does not anticipate significant land acquisition, there are numerous demand-driven projects that would require land acquisition. The land acquisition timeframe should be noted when developing a demand-driven project.

Project Design - this process involves the design of the proposed capital improvement project and typically takes between 36 and 60 weeks to complete depending on the level of complexity and the level of agency coordination.

Agency Coordination Activities - depending on the size and complexity of the proposed capital improvement project, coordination and permitting with a number of agencies may be required. The time to complete coordination and permitting efforts with agencies is dependent on specific project details.

Public Coordination Activities - depending on the size and complexity of the proposed capital improvement project (i.e., new runway or runway expansion), the Airport may need to complete a public outreach program to identify the benefits of the project and allow the public to provide critical feedback *on potential impacts. The level of effort necessary to conduct a public outreach program is dependent on specific project details.*

Section 6

Environmental Overview

6.1. Introduction

This section provides a preliminary review of the environmental conditions at the Airport and identifies potential documentation necessary to implement the major development items identified in the Capital Improvement Plan (CIP). This chapter does not replace the completion of an environmental analysis to conform with National Environmental Policy Act (NEPA) guidelines, but rather identifies the likely required studies.

Federal regulations require on of the three forms of environmental documentation to be completed for each proposed airport development project. Each form of environmental documentation identified in FAA Order 1050.1E, Environmental Impacts: Policies and Procedures, and FAA Order 5050.4B, NEPA Implementing Instructions for Airport Projects, are briefly explained below. Identification of the level of environmental documentation necessary to comply with NEPA in this section does not preclude the possibility that additional environmental evaluations, or level of documentation, may be required as a result of changes in Federal policies or modifications to the proposed project after the completion of the Master Plan. Therefore, it is recommended that the level of documentation be coordinated with all appropriate agencies prior to commencing. In addition, it is recommended that all environmental documentation be completed well in advance of the proposed construction date but not more than three years, the typical shelf-life, of an approved NEPA document.

6.2. Forms of Environmental Documentation

Federal regulations require an airport operator to submit the necessary NEPA documentation, and receive approval, to accept federal funding for proposed development. The following forms of environmental documentation are relevant to airport development:

6.2.1. Categorical Exclusion (Cat Ex):

A Cat Ex applies to actions that, based on historical experience, the FAA has found, do not normally require an Environmental Assessment (EA) or an Environmental Impact Statement (EIS). Federal processing for a Cat Ex can typically be completed within three to six months depending on the scope of the proposed project(s) and the level of agency coordination required. A Cat Ex is considered valid for three years, after which a written reevaluation is required.

6.2.2. Environmental Assessment (EA):

An EA applies to actions that 1) are not categorically excluded, 2) are categorically excluded but involves one extraordinary circumstance, or 3) are not known to require an Environmental Impact Statement (EIS) but is not categorically excluded. This level of documentation can be completed as an EA. When an EA is approved, a Finding of No Significant Impact (FONSI) is issued. If additional study is required, an Environmental Impact Statement (EIS) may be requests. An EA can typically be completed within 12 to

18 months depending on the scope of the proposed project(s) and level of agency coordination. An EA is considered valid for three years, after which, a written evaluation is required.

6.2.3. Environmental Impact Statement (EIS):

An EIS applies to actions that cause impacts that, even when mitigated, still meet or exceed applicable thresholds of the affected resources. An EIS provides additional, detailed evaluations of the proposed action and its alternatives. Following the publication of the accepted EIS in the Federal Register, the FAA may issue a Record of Decision (ROD). Federal processing for an EIS is largely dependent upon the nature of the proposed project(s) and the environmental category that required the preparation of an EIS. Similar to an EA, an EIS is considered valid for three years after which, a written reevaluation is required.

6.3. Environmental Considerations

The identification of areas of environmental consideration enables the Chicago Executive Airport (PWK or Airport) to implement a plan for airport development that minimizes impacts to the environment. FAA Order 1050.1E identifies 18 environmental impact categories to be reviewed when considering proposed actions. These categories must be evaluated as part of any environmental analysis according to the guidelines and thresholds identified. The following is a list of the 14 categories outlined in FAA Order 1050.1F:

- *Air Quality*
- *Biological Resources (including fish, wildlife, and plants)*
- *Climate*
- *Coastal Resources*
- *Department of Transportation Act, Section 4(f)*
- *Farmlands*
- *Hazardous Materials, Solid Waste, and Pollution Prevention*
- *Historical, Architectural, Archeological, and Cultural Resources*
- *Land Use*
- *Natural Resources and Energy Supply*
- *Noise and Compatible Land Use*
- *Socioeconomic, Environmental Justice, and Children's Environmental Health and Safety Risk*
- *Visual Effects (including light emissions)*
- *Water Resources (including wetlands, floodplains, surface waters, groundwater, and wild and scenic rivers)*

Prior to implementing proposed improvements, any development will be analyzed against each of these categories, some of which may not be applicable due to geographic setting of the Airport (e.g., Coastal Resources). Below is a summary of considerations for the environmental categories considered most relevant to proposed Airport development at PWK.

6.3.1. Air Quality

The U.S. Environmental Protection Agency (EPA) has adopted air quality standards that specify the maximum permissible short-term and long-term concentrations of various air contaminants. The National Ambient Air Quality Standards (NAAQS) consist of primary and secondary standards for six criteria pollutants which include: Ozone (O3), Carbon Monoxide (CO), Sulfur Dioxide (SO2), Nitrogen Oxide (NO), Particulate matter (PM10 and PM2.5), and Lead (Pb).

Various levels of review apply within both National Environmental Policy Act (NEPA) and permitting requirements. Potentially significant air quality impacts, associated with an FAA project or action, would be demonstrated by the project or action exceeding one or more of the NAAQS for any of the time periods analyzed.

According to the Environmental Protection Agency's (EPA) Greenbook, Cook County is classified as being in nonattainment for 8-Hour Ozone (2008) and portions of Cook County are classified for 8-Hour Ozone (2015). Cook County is classified as non-attainment for these two elements because the area does not meet the national primary or secondary ambient air quality standard for the National Ambient Air Quality Standards (NAAQS).

6.3.2. Biological Resources (Including Fish, Wildlife, And Plants)

Biological resources are valued for their intrinsic, aesthetic, economic, and recreational qualities and include fish, wildlife, plants, and their respective habitats. Typical categories of biological resources include terrestrial and aquatic plant and animal species, game and non-game species, special status species, and environmentally sensitive or critical habitats.

A number of regulations have been established to ensure that projects do not negatively impact protected plants, animals, or their designated habitat. Section 7 of the Endangered Species Act (ESA), as amended, applies to federal agency actions and sets forth requirements for consultation to determine federal actions that may affect federally endangered or threatened species. Federally funded projects require, through NEPA documentation, must verify that there will be no disturbance to threatened and endangered species.

Based upon review of habitat descriptions for Federal threatened and endangered species, Table 6-1 *provides a summary of existing species and known habitat for these species as they exist in Cook County.*

Table 6-1
Threatened and Endangered Species – Cook County, Illinois

Threatened & Endangered Species - Cook County			
County	**Group**	**Common Name**	**Status**
Cook	Birds	Piping plover (Charadrius melodus)	Endangered
		Rufa Red knot (Calidris canutus rufa)	Threatened
	Insects	Hine's emerald dragonfly (Somatochlora hineana)	Endangered
		Rattlesnake-master borer moth (Papaipema eryngii)	Candidate
		Rusty patched bumble bee (Bombus affinis)	Endangered
	Mammal	Northern long-eared bat (Myotis septentrionalis)	Threatened
	Plants	Eastern prairie fringed orchid (Platanthera leucophaea)	Threatened
		Leafy-prairie clover (Dalea foliosa)	Endangered
		Mead's milkweed (Asclepias meadii)	Threatened
		Prairie bush clover	Threatened
	Reptile	Eastern massasauga (Sistutus catenatus)	Threatened

Source: USFWS (2020)

6.3.3. Climate

Scientific research is ongoing to better understand climate change, including any incremental atmospheric impacts that may be caused by aviation. Uncertainties are too large to accurately predict the timing, magnitude, and location of aviation's climate impacts; however, it is clear that minimizing Green House Gas (GHG) emissions and identifying potential future impacts of climate change are important for a sustainable national airspace system.

Increasing concentrations of GHGs in the atmosphere affect global climate. GHG emissions result from anthropogenic sources including the combustion of fossil fuels. GHGs are defined as including carbon CO2, methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6). CO2 is the most important anthropogenic GHG because it is a long-lived gas that remains in the atmosphere for up to 100 years.

6.3.4. Coastal Resources

Coastal resources include all-natural resources occurring within coastal waters and their adjacent shorelands. Coastal resources include islands, transitional and intertidal areas, salt marshes, wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as fish and wildlife and their respective habitats within these areas. Coastal resources include the coastlines of the Atlantic and Pacific oceans, the Great Lakes, and the Gulf of Mexico.

PWK is not subject to any coastal restrictions.

6.3.5. Department of Transportation Act, Section 4(f)

The U.S. DOT Act of 1966[1] protects significant publicly owned parks, recreational areas, wildlife and waterfowl refuges, and public and private historic sites. Section 4(f) provides that the Secretary of Transportation may approve a transportation program or project requiring the use of publicly owned land off a public park, recreation area, or wildlife or waterfowl refuge of national, state, or local significance, or land of an historic site of national, State, or local significance, only if there is no feasible and prudent alternative to the using that land and the program or project includes all possible planning to minimize harm resulting from the use.

No publicly owned land from a public park, recreational area, or wildlife and waterfowl refuge of national, state, or local significance; or any land from a historic site of national, state, or local significance is present within the Airport environs.

6.3.6. Farmlands

Farmlands are defined as those agricultural areas considered important and protected by Federal, state, and local regulations. Important farmlands include all pasturelands, croplands, and forests (even if zoned for development) considered to be prime, unique, or of statewide or local importance.

Under the Farmland Protection Policy Act (FPPA), federal agencies are directed to identify and take into account the adverse effects of federal actions on the preservation of farmland, to consider appropriate alternative actions which could lessen adverse effects, and to assure that such federal programs are, to the extent practicable, compatible with state or local government programs and policies to protect farmland. The FPPA guidelines developed by the U.S. Department of Agriculture (USDA) apply to farmland classified as prime or unique, or of state or local importance as determined by the appropriate government agency, with concurrence by the Secretary of Agriculture.

There is no known FPPA designated farmland present within the Airport environs.

6.3.7. Hazardous Materials, Solid Waste, and Pollution Prevention

Hazardous materials, solid waste, and pollution prevention as an impact category includes an evaluation of the following:

[1] Section 4(f) of the U.S. DOT Act of 196631 (now codified at 49 U.S.C. § 303)

- *Waste streams that would be generated by a project, potential for the wastes to impact environmental resources, and the impacts on waste handling and disposal facilities that would likely receive the wastes.*
- *Potential hazardous materials that could be used during construction and operation of a project, and applicable pollution prevention procedures.*
- *Potential to encounter existing hazardous materials at contaminated sites during construction, operation, and decommissioning of a project.*
- *Potential to interfere with any ongoing remediation of existing contaminated sites at the proposed project site or in the immediate vicinity of a project site.*

The terms hazardous material, hazardous waste, and hazardous substance are often used interchangeably when used informally to refer to contaminants, industrial wastes, dangerous goods, and petroleum products.

Federal, state, and local laws regulate hazardous materials use, storage, transport, and disposal. These laws may extend to past and future landowners of properties containing these materials. In addition, disrupting sites containing hazardous materials or contaminates may cause significant impacts to soil, surface water, groundwater, air quality, and the organisms using these resources.

The EPA's Enviromapper for Enviro-facts was consulted regarding the presence of impaired waters or regulated hazardous sites in the vicinity of the airport. According to the EPA Enviromapper, there are no known impaired waters under Section 303(d) of the Clean Water Act on Airport property. Furthermore, there are no known hazardous sites on airport property, however, there are several businesses surrounding the Airport that participate in the EPA's Hazardous Waste Program and Solid Waste Program.

6.3.8. Historical, Architectural, Archeological, and Cultural Resources

Historical, architectural, archeological, and cultural resources encompass a range of sites, properties, and physical resources relating to human activities, society, and cultural institutions. Such resources include past and present expressions of human culture and history in the physical environment, such as prehistoric and historic archaeological sites, structures, objects, districts, which are considered important to a culture or community. Historical, architectural, archeological, and cultural resources also include aspects of the physical environment, namely natural features and biota, that are a part of traditional ways of life and practices and are associated with community values and institutions.

Under NEPA, the FAA is responsible for analyzing the impacts of its action on historical, architectural, archeological, and cultural resources as part of a broader review of the human environment. The Illinois State Historic Officer (SHPO) is located within the Illinois Department of Natural Resources (IDNR). The State of Illinois has created a research arm within the University of Illinois (U of I) at Urbana Champaign known as the Prairie Institutes. One of the institutes is the Illinois State Archaeological Survey (ISAS) which is responsible for surveying transportation projects in the state of Illinois. Chicago Executive Airport has seen tremendous construction and ground disturbance. While it appears that there are no Section 106 resources in the Airport environ, validation of future projects should be made to verify that no significant findings are present. If future projects require a validation, ISAS would be requested to conduct an Environmental Survey Request (ESR) through the IDOT Bureau of Design and Environment (BDE).

6.3.9. Land Use

The compatibility of existing and planned land uses with an aviation or aerospace proposal is usually associated with noise impacts. In addition to the impacts of noise on land use compatibility, other potential impacts of FAA actions may also affect land use compatibility (e.g., disruption of communities, relocation, induced socioeconomic impacts, land uses protected under Section 4(f) of the DOTAct).

Future Airport development projects should be compatible with local municipal land use planning and zoning ordinances.

6.3.10. Natural Resources and Energy Supply

As an impact category, natural resources and energy supply provides an evaluation of a project's consumption of natural resources (such as water, asphalt, aggregate, wood, etc.) and use of energy supplies (such as coal for electricity; natural gas for heating; and fuel for aircraft, commercial space launch vehicles, or other ground vehicles). Consumption of natural resources and use of energy supplies may result from construction, operation, and/or maintenance of the proposed action or alternative(s).

6.3.11. Noise and Compatible Land Use

Aviation noise primarily results from the operation of fixed and rotary wing aircraft, such as departures, arrivals, overflights, taxiing, and engine run-ups. Noise is often the predominant aviation environmental concern of the public. Significant levels of aircraft noise in communities around airports generate the most issues. However, there are increasing concerns in areas of moderate noise exposure, and noise issues are raised by residents in suburban and rural areas where ambient noise is lower than in the more urbanized areas that tend to surround many commercial service airports.

To address the growing concern of noise impacts on the local communities, PWK updated their Noise Exposure Map (NEM) in 2018. The updated NEM defined current noise contours and flight patterns to identify how much, how from what locations, noise was being generated and distributed throughout the surrounding communities. The NEM was the first step in PWK's efforts to reduce noise levels to certain neighboring households. Using the NEM, in 2020, the Airport launched a Residential Sound Insulation Program (RSIP) to address aircraft noise concerns throughout the nearby communities. The RSIP provides sound insulating materials at no cost to eligible homes, and its launch continues CEA's years-long efforts to reduce aircraft noise for local residences near the airport. The RSIP is a comprehensive, multi-year effort that proposes to benefit hundreds of homes, and its launch marks the culmination of mitigation strategies that have reduced overall airport noise 30% since 1986.

6.3.12. Socioeconomic, Environmental Justice, and Children's Environmental Health and Safety Risk

Socioeconomics is an umbrella term used to describe aspects of a project that are either social or economic in nature. A socioeconomic analysis evaluates how elements of the human environment such as population, employment, housing, and public services might be affected by the proposed action and alternative(s). Low-income housing units are located south of PWK.

6.3.13. Visual Effects (including light emissions)

Visual effects deal broadly with the extent to which the proposed action or alternative(s) would either: 1) produce light emissions that create annoyance or interfere with activities; or 2) contrast with, or detract from, the visual resources and/or the visual character of the existing environment. Visual effects can be difficult to define and assess because they involve subjectivity. Proposed aviation and aerospace actions do not commonly result in adverse visual effects, but these effects may occur in certain circumstances.

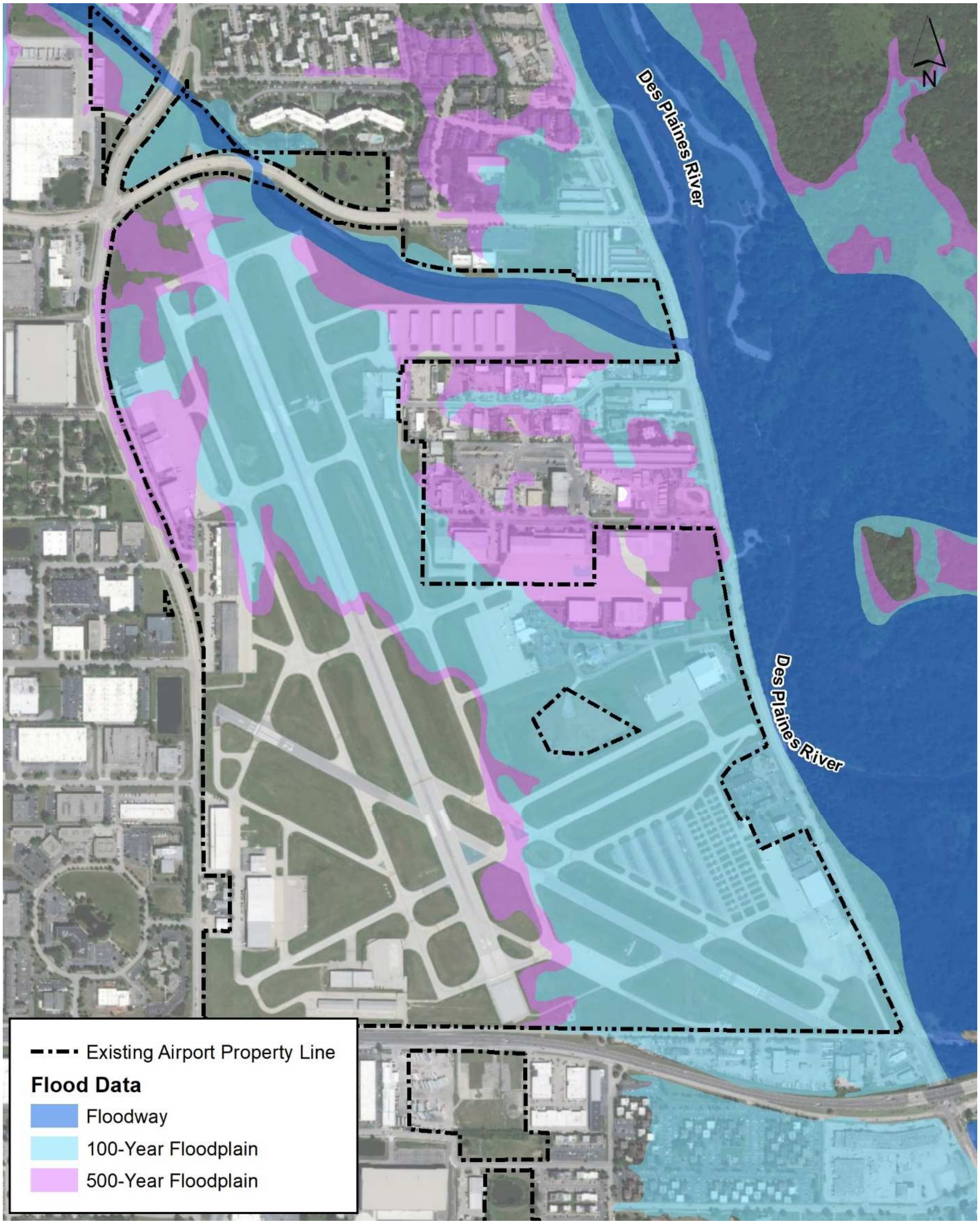
6.3.14. Water Resources (including wetlands, floodplains, surface waters, groundwater, and wild and scenic rivers)

Water resources are surface waters and groundwater that are vital to society; they are important in providing drinking water and in supporting recreation, transportation and commerce, industry, agriculture, and aquatic ecosystems. Surface water, groundwater, floodplains, and wetlands do not function as separate and isolated components of the watershed, but rather as a single, integrated natural system. Because of the close and integrated relationship of these resources, their analysis is conducted under the all-encompassing impact category of water resources. Wild and Scenic Rivers are included because impacts to these rivers can result from obstructing or altering the free-flowing characteristics of a designated river, an impact more closely resembling an impact to a water resource.

Floodplains and wetlands are two of the larger impacts an Airport project could have within this environmental category. The Des Plaines River is located east of the Airport just across Milwaukee Avenue. Exhibit 6-1 *depicts the location of the Des Plaines River and the floodplains on and within the Airport's environ. The Des Plaines River is a major source of flooding during large amounts of rainfall. As depicted in the exhibit, the Des Plaines River floodplains extend onto Airport property. To mitigate the flooding of the Airport, PWK has been actively engaged in a stormwater detention management program. The Airport's engagement in this program not only benefits the Airport, but also helps flood control in the Village of Wheeling and City of Prospect Heights. Airport mitigation efforts include developing the infield areas (grass areas between taxiways and runways) to serve as stormwater detention and floodplain compensatory storage. When the Des Plaines River water level rises during rainfall events, the infield areas on the Airport begin to take on water from the river and act as temporary holding basins. It should be noted that past Master Drainage Study recommendations have all been development on Airport property and stormwater detention is near capacity. It is recommended that the Airport conduct an update to the drainage study as soon as possible.*

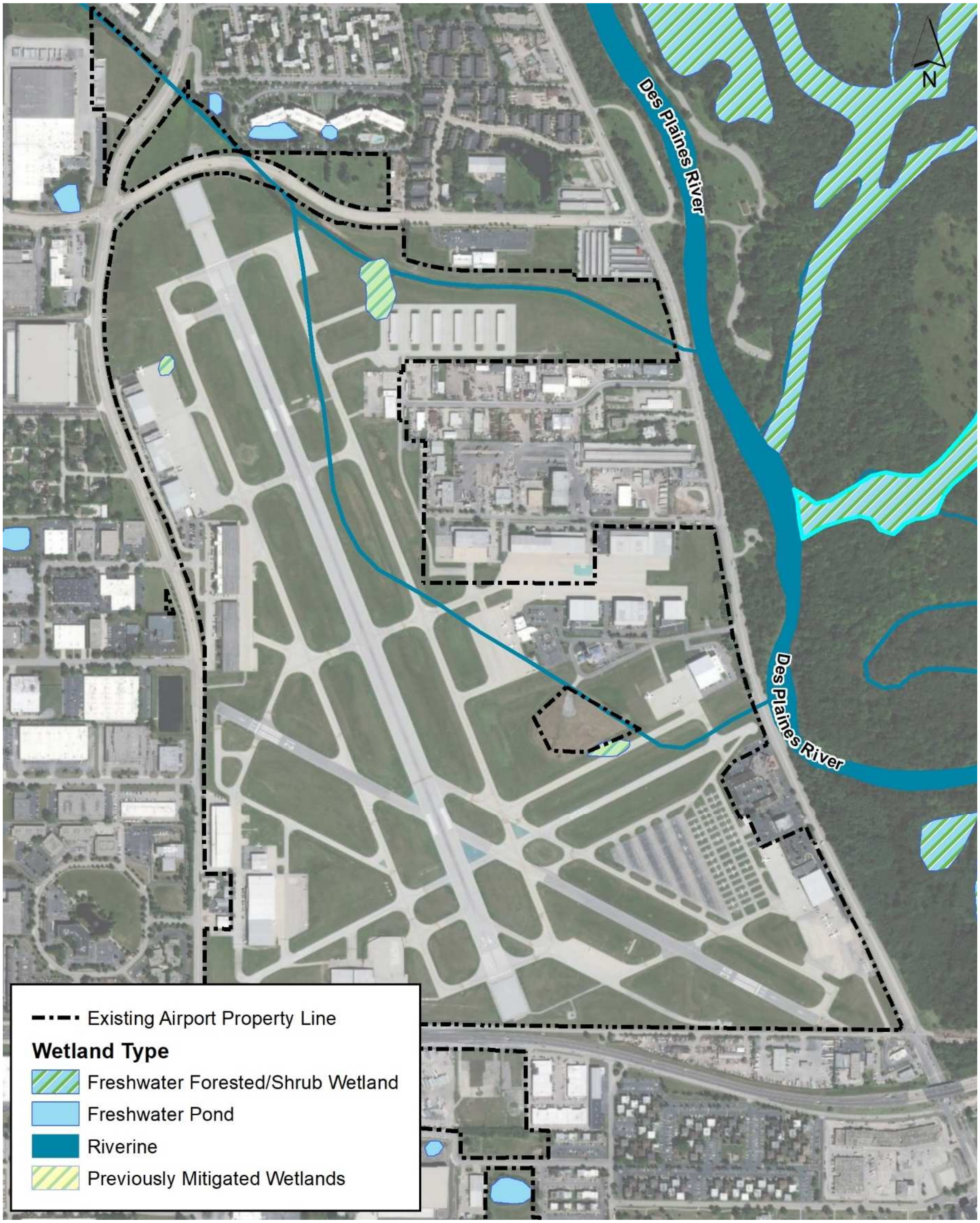
As defined by the EPA, wetlands are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods of time during the year, including during the growing season. Water saturation (hydrology) largely determines how the soil develops and the types of plant and animal communities living in and on the soil. Wetlands may support both aquatic and terrestrial species. The prolonged presence of water creates conditions that favor the growth of specially adapted plants (hydrophytes) and promote the development of characteristic wetland (hydric) soils. Exhibit 6-2 *depicts the wetlands present on and in the Airport environ. As shown in the exhibit, there are minimal wetlands on Airport property.*

Exhibit 6-1
Floodplains in Airport Environment



Source: CMT (2019)

Exhibit 6-2
Wetlands in Airport Environment



Source: CMT (2019)

6.4. Summary

Any future Airport development will require environmental analysis to determine compliance with NEPA guidelines before development begins. Table 6-2 *provides the required NEPA documentation for Airport development projects identified in this Master Plan and Airport Layout Plan.*

Table 6-2
Required NEPA Documentation for Airport Development

Project Description	Required NEPA Description
Runway 12-30 Widen to 100'	Environmental Assessment
Decommission Runway 6-24	Environmental Assessment
Airfield Geometry, Hot Spot and Taxiway Improvements	CatEx
NE Quadrant T-Hangar, Tie-down & Apron Development	CatEx
NE Quadrant Box Hangar & Apron Development (includes land acquisition along Industrial Lane)	Environmental Assessment
SE Quadrant Box Hangar & Apron Development (within existing airport property boundaries)	CatEx
SE Quadrant Box Hangar & Apron Development (includes land acquisition between Frontage Road and Palatine Road)	Environmental Assessment
SE Quadrant GA Apron Expansion	CatEx
SW Quadrant Box Hangar & Apron Development	CatEx
NW Quadrant Box Hangar and Apron Development	CatEx
Construct New Fuel Farm in NW Quadrant	Environmental Assessment (condensed EA)
Construct Perimeter Road Runway 16 End	CatEx

Source: CMT (2019)

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