MANHATTAN
Regional Airport

Airport Master Plan

AIRPORT MASTER PLAN

For

MANHATTAN REGIONAL AIRPORT (MHK)
Manhattan, Kansas

Prepared for

City of Manhattan

By

Coffman Associates
Airport Consultants

NOVEMBER 2020

fly MHK
Manhattan Regional Airport

TABLE OF CONTENTS

TABLE OF CONTENTS

INTRODUCTION

CHAPTER 1 – INVENTORY

CHAPTER 2 – FORECASTS

CHAPTER 3 – FACILITY REQUIREMENTS

CHAPTER 4 – AIRPORT ALTERNATIVES

CHAPTER 5 – RECOMMENDED CONCEPT

CHAPTER 6 – CAPITAL PROGRAM

EXHIBITS

INTRODUCTION

Introduction

A master plan provides an evaluation of an airport's aviation demand and an overview of the systematic development that will best meet those demands. The master plan establishes development objectives and provides for a 20-year planning period that details the rationale for various study elements, including airfield configuration, facility development, on-airport land use recommendations, and support facilities. It also serves as a strategic tool for establishing airport improvement priorities and justifying the need for federal and state funding assistance.

The Federal Aviation Administration (FAA) recommends that airports update their long-term planning documents every seven to 10 years, or as necessary to address local changes at the airport. The last master plan update for Manhattan Regional Airport (MHK) was completed in 2009. The City of Manhattan (City), the sponsor of the airport, has received a grant from the FAA to update the Airport Master Plan. The FAA grant covers 90 percent of the fixed fee project cost, with the City of Manhattan providing a ten percent match.

Coffman Associates is an airport consulting firm that specializes in master planning and environmental studies. Coffman Associates will lead the team, with support from the following firms:

- *Olsson* | Engineering support primarily to offer estimates of probable costs and Runway 3-21 reconstruction option development and evaluations
- *Faith Industries* | Facilitation of Safety Risk Assessment (SRA) and Safety Management System (SMS) for Runway 3-21 repair/reconstruction options
- *DKMG* | Financial services including benefit/cost evaluations and a financial feasibility of future capital/maintenance programs
- *MTZ Geospatial* | Aerial photography, ground survey, and Geographic Information System (GIS) products to meet FAA 5300-18B requirements for Airports GIS data submittal.

The Airport Master Plan update will be prepared in accordance with FAA requirements, including Advisory Circular (AC) 150/5300-13A, *Airport Design* (as amended), and AC 150/5070-6C, *Airport Master Plans* (as amended). The master plan is intended to be a proactive document which identifies and then plans for future facility needs well in advance of the actual need. This is done to ensure the City can coordinate project approvals, design, financing, and construction in a timely manner, prior to experiencing the detrimental effects of deteriorating or inadequate facilities.

An important outcome of the master plan process is a recommended development plan which reserves sufficient areas for future facility needs. Such planning will protect development areas and ensure they will be readily available when required to meet future needs. The intended outcome of this study is a detailed on-airport land use concept which outlines specific uses for all areas of airport property, including strategies for revenue enhancement.

The preparation of this master plan is evidence that the City recognizes the importance of the airport to the surrounding region and the associated challenges inherent in providing for its unique operating and improvement needs. The cost of maintaining an airport is an investment which yields impressive benefits to the local community. With a sound and realistic Master Plan, the airport can maintain its role as an important link to the regional, state, and national air transportation systems. Moreover, the plan will aid in supporting decisions for directing limited and valuable City resources for future airport development. Ultimately, the continued investments in the airport will allow the City to reap the economic benefits generated by historical investments.

MASTER PLAN GOALS AND OBJECTIVES

The primary objective of the Manhattan Regional Airport Master Plan is to develop and maintain a financially feasible, long-term development program, which will satisfy aviation demand of the region; be compatible with community development, other transportation modes, and the environment; and enhance employment and revenue for the local area. Accomplishing this objective requires an evaluation of the existing airport facilities to decide what actions should be taken to maintain a safe, adequate, and reliable facility.

This master plan is intended to provide guidance through an updated capital improvement and financial program to demonstrate the future investments required by the City. The new planning study also provides justification for new priorities. The plan will be closely coordinated with other planning studies in the area and with aviation plans developed by the FAA. This study will also utilize past planning efforts, including the previous Airport Master Plan (2009), Terminal Area Master Plan (2011), and the most recent update to the Airport Layout Plan (ALP). The plan will also be coordinated with the City of Manhattan, as well as other local and regional agency plans as appropriate.

Specific objectives of the study include, but are not limited to, the following:

- To research factors likely to affect all air transportation demand segments in the City of Manhattan as well as the northcentral and northeastern Kansas regions over the next twenty years. The analysis will include the development of forecasts of airline passengers, air cargo shipments, general aviation activity, and military demand elements;

- To determine projected needs of airport users for the next twenty years, factoring in recent revisions to FAA airfield geometrical design standards, global positioning system (GPS) Next Generation (NexGen) approaches or other new technology, the impact of commercial and general aviation fleet transitions on design standards, and ongoing efforts to improve commercial service to the community. This analysis will also include considerations of military operations;

- To analyze the existing airfield system to determine the existing and ultimate runway length required to satisfy the airport's critical aircraft now and into the future. Airline aircraft fleet changes, including a move to larger regional jets at MHK which could require a longer runway. This planning effort will have a primary goal of determining the optimum runway length necessary to properly facilitate airline operations for the next 20 years and beyond;

- To produce accurate base maps of existing and proposed facilities and updated ALP drawings consistent with the FAA's Standard Operating Procedure (SOP) No. 2.0. The digital GIS data will be submitted into FAA's Airport GIS, or AGIS, system as an "airspace evaluation";

- To review future use and zoning of airport property, instrument approach areas, and nearby developments to ensure flight safety and land use compatibility. This will involve the development of new noise exposure contours, application of current land use compatibility guidelines, review of local land use controls and plans, and analysis of land use management techniques;

- To establish a schedule of development priorities and a program for improvements proposed in the master plan, consistent with the FAA's capital improvement program planning; and,

- Consider sustainability efforts, specifically waste and recycling improvements, as part of FAA's updated standards.

MASTER PLAN ISSUES

The MHK Master Plan specifically addresses the following issues:

- Assist the City, through the Airport Advisory Board and a series of Public Information Workshops, in determining a vision for the airport;

- Conduct a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis identifying strengths, weaknesses, realistic markets, goals, resources, and strategy to move forward. This analysis will factor the strengths and weaknesses of MHK to include physical and operational features. The analysis will also present the same for competing airports in the region;

- Prepare a detailed evaluation of existing and future commercial passenger, general aviation, and military demand for MHK;

- Based on the realistic evaluation of the facility in terms of configuration, condition, amenities, location, competition, and forecasted aviation demand, establish goals and priorities for the airport to meet that vision;

- Identify airfield alternatives based on goals and opportunities, as well as FAA applicable design standards. The analysis will include an evaluation of the airfield geometry to address potential runway incursion hot spots and non-standard conditions;

- Assess existing Runway 3-21 to determine needs to repair and/or replace. The analysis must factor maintaining an open runway environment to ensure commercial airline operations are disturbed as briefly as possible. The analysis will require SRA/SMS alternative evaluations to ensure the best resulting alternative is selected.

- Provide a landside development plan that identifies areas for accommodating the forecasted growth of aviation and aviation-related business and, if appropriate, areas for non-aviation revenue-producing opportunities. Consideration will be given to the potential for new or expanded aviation facilities, including but not limited to passenger terminal facilities, aircraft storage hangar capacity and ramp capacity, and airport support facilities, including aircraft rescue and firefighting (ARFF) equipment storage;

- Assess compatible land use near the airport;

- Prioritize preservation and rehabilitation recommendations in order of greatest overall positive impact; and,

- Identify elements of an ongoing maintenance plan.

BASELINE ASSUMPTIONS

A study such as this typically requires several baseline assumptions that will be used throughout this analysis. The baseline assumptions for this study are as follows:

- MHK will continue to operate as a primary commercial service airport through the 20-year planning period;
- MHK will continue to accommodate commercial passenger airline operators and general aviation tenants, as well as itinerant and/or local aircraft operations by commercial airlines, air taxi, general aviation, and military operators;
- The commercial passenger and general aviation industries will grow through the planning period as projected by the FAA. Specifics of projected growth in the national commercial airline and general aviation industries are contained in Chapter Two – Aviation Demand Forecasts;
- The socioeconomic characteristics of the region will generally grow as forecast; and,
- A federal airport improvement program will be in place through the planning period to assist in funding future capital development needs.

MASTER PLAN ELEMENTS AND PROCESS

This Airport Master Plan is being prepared in a systematic fashion following FAA guidelines and industry-accepted standards and practices. The study has nine specific elements that are intended to assist in the evaluation of future facility needs and provide the supporting rationale for their implementation. **Exhibit IA** provides a graphical depiction of the elements and process involved with the study.

Element 1 – Initiation includes the development of the scope of services, schedule, and study website. Study material will be assembled in a workbook format. General background information will be established that includes outlining the goals and objectives to be accomplished during the Master Plan.

Element 2 – Inventory is focused on collecting and assembling relevant data pertaining to the airport and the area it serves. Information is collected on existing airport facilities and operations. Local economic and demographic data is collected to define the local growth trends, and environmental information is gathered to identify potential environmental sensitivities that might affect future improvements. Planning studies which may have relevance to the master plan are also collected.

Element 3 – Aviation Demand Forecasts examines the potential aviation demand at the airport. The analysis utilizes local socioeconomic information, as well as national air transportation trends to quantify the levels of aviation activity which can reasonably be expected to occur at MHK over a 20-year period. An existing and ultimate critical design aircraft based upon AC 150/5000-17, *Critical Aircraft and Regular Use Determination,* is also established to determine future planning design standards. The results of this

PROJECT WORK FLOW

TAC #1 8-20-18

INVENTORY
- Airport Facilities
- Airspace and Air Traffic Activity
- Airport Access and Parking, Utilities, and Aerial Photography
- Area Socioeconomic Data
- Local Planning and Land Use

FORECASTS
- Based Aircraft and Fleet Mix
- Annual Operations
- Commercial Service

FACILITY REQUIREMENTS
- Design Categories
- Runway Length and Strength
- Support Facilities
- Taxiways
- Hangar Facilities
- Airfield Capacity
- Aprons
- Navigational Aids

TAC #2 11-27-18 — Working Papers

AIRPORT ALTERNATIVES
- Evaluate Development Scenarios
  - Airside
  - Landside
  - Support

Safety Risk Management Panel (SRMP)

SAFETY RISK ASSESSMENT
- Safety Risk Management (SRM) Analysis
- Safety Risk Management Assessment Documentation

TAC #3 — Working Papers

PIW #1

RECOMMENDED MASTER PLAN CONCEPT/ ENVIRONMENTAL REVIEW
- Detailed Master Plan Facility and Land Use Plans
- Review/Evaluation of NEPA Environmental Categories
- Noise Exposure

FINANCIAL PLAN/CAPITAL IMPROVEMENTS
- Airport Development Schedule
- Cost Estimates
- Funding Sources

TAC #4 — Working Papers

PIW #2

AIRPORT LAYOUT PLANS/LAND USE COMPATIBILITY
- Airport Layout Plan
- Landside Drawing
- Recycling Plan
- Airspace/Approach Drawings
- On-Airport Land Use Plan
- Property Map
- Land Use Plans

AIRPORTS GEOGRAPHIC INFORMATION SYSTEMS (AGIS)
- Aeronautical Survey to A/C 18b
- Information Uploaded into FAA AGIS Portal

TAC - Technical Advisory Committee
PIW - Public Information Workshop

effort are used to determine the types and sizes of facilities which will be required to meet the projected aviation demand at the airport through the planning period.

Element 4 – Facility Requirements determines the available capacities of various facilities at the airport, whether they conform with FAA standards, and what facility updates or new facilities will be needed to comply with FAA requirements and/or projected 20-year demand.

Element 5 – Airport Development Alternatives considers a variety of solutions to accommodate projected airside and landside facility needs through the long-term planning period. An analysis is completed to identify the strengths and weaknesses of each proposed development alternative, with the intention of determining a single direction for development. As noted earlier, a significant effort will be made to determine the best method to improve the Runway 3-21 pavement. The alternatives will evaluate the best methods to not only replace the pavement but also to do so in the least disruptive manner as practical. The analysis will be evaluated through the SMS process to ensure highest level of safety and best outcomes are determined.

Element 6 – Airport Plans/Land Use Compatibility provides both a graphic and narrative description of the recommended plan for the use, development, and operation of the airport. An environmental overview is provided to analyze potential environmental impacts of proposed airport development projects, and a recycling plan is also conducted to identify opportunities for the airport to be more sustainable in its approach to waste management. The official ALP drawings that are produced based on the recommended development concept and used by the FAA and in determining grant eligibility will also be included.

Element 7 – Financial Management/Development Program provides a proposed capital needs program which defines the schedules, costs, and funding sources for the recommended development projects.

Element 8 – Geographic Information Systems (GIS) Services includes capturing and utilizing very detailed survey data sets. GIS services included in the process involves the collection of data to comply with Table 2-1 of Advisory Circular 150/5300-18B, column Instrument Procedure Development. The dataset is a high precision, digital model of the safety critical features of the airport as defined in 18B, Table 4-1. The process includes collection of high-resolution aerial photography, high precision surveys of safety critical airport data (runway ends, NAVAIDS, airport elevation, airspace, obstructions, and others), and compilation of collected data into a uniform GIS dataset. A GIS dataset that meets the airport's needs and is acceptable to the FAA is the deliverable.

Element 9 – Final Reports and Approvals provide documents which depict the findings of the study effort and present the study and its recommendations to appropriate local organizations. The final document incorporates the revisions to previous working papers prepared under earlier elements into a usable master plan document.

COORDINATION

The Manhattan Regional Airport Master Plan is of interest to many within the local community and region. This includes local citizens and businesses, community organizations, City officials, airport users, airport tenants, and aviation organizations. As a component of the regional, state, and national aviation systems, MHK is of importance to both local and federal agencies responsible for overseeing the air transportation system.

To assist in the development of the master plan, a Technical Advisory Board (TAC) composed of a diverse group of airport stakeholders will act in an advisory role in the development of the master plan. TAC members will meet four times at designated points during the study to review study materials and provide comments to help ensure that a realistic, viable plan was developed.

Draft working paper materials will be prepared at various milestones in the planning process. The working paper process allows for timely input and review during each step within the master plan to ensure that all issues are fully addressed as the recommended program develops.

A series of open-house public information workshops are also conducted as part of the study coordination effort. These workshops are designed to allow all interested persons to become informed and provide input concerning the master plan process. Notices of meeting times and locations are advertised through local media outlets. All draft reports and meeting materials will be made available to the public on a website hosted by the City of Manhattan.

SWOT ANALYSIS

A SWOT analysis is a strategic business planning technique used to identify **S**trengths, **W**eaknesses, **O**pportunities, and **T**hreats associated with an action or plan. The SWOT analysis involves identifying an action, objective, or element, and then identifying the internal and external forces that are positively and negatively impacting that action, objective, or element in a given environment. For this study, the SWOT analysis factors are being applied to MHK within the confines of the master plan. As a result, it provides a continuous vision and direction for the development of the master plan.

SWOT DEFINITIONS

As previously discussed, this SWOT analysis groups information into two categories:

- Internal | attributes of the airport and market area that may be considered strengths or weaknesses to the action, objective, or element.
- External | attributes of the industry that may pose as opportunities or threats to the action, objective, or element.

The SWOT further categorizes information into one of the following:

- Strengths | internal attributes of the airport that are helpful to achieving the action, objective, or element.
- Weaknesses | internal attributes of the airport that are harmful to achieving the action, objective, or element.
- Opportunities | external attributes of the industry that are helpful to achieving the action, objective, or element.
- Threats | external attributes of the industry that are harmful to achieving the action, objective, or element.

SWOT ANALYSIS EXERCISE

The SWOT analysis for MHK was based upon information gathered during the project kickoff meeting with the TAC conducted August 20, 2018. **Figure IA** summarizes the results from the SWOT analysis exercise.

***Figure IA** – MHK SWOT Analysis Results*

Chapter One

INVENTORY

CHAPTER ONE

Inventory

The inventory chapter of existing conditions is the initial step in the preparation of the Manhattan Regional Airport (MHK) Master Plan. The inventory will serve as an overview of the airport's physical and operational features, including facilities, users, and activity levels, as well as specific information related to the airspace, air traffic activity, and role of the airport. Finally, a summary of socioeconomic characteristics and review of existing environmental conditions on and adjacent to the airport are detailed, which will provide further input into the study process.

Information provided in Chapter One serves as the baseline for the remainder of the master plan, which is compiled using a wide variety of resources, including: applicable planning documents; on-site visits; interviews with airport staff, tenants, and users; aerial and ground photography; federal, state, and local publications; and project record drawings. Specific sources include those listed below. Environmental resources are detailed at the end of this chapter.

- Manhattan Regional Airport, *Airport Master Plan Update*, 2009
- Manhattan Regional Airport, *Terminal Area Master Plan*, 2011
- *The Economic Impact of Manhattan Regional Airport*, 2012
- Manhattan Regional Airport website (flymhk.com)
- *Airport Certification Manual (ACM)*, Manhattan Regional Airport
- *Manhattan Urban Area Comprehensive Plan,* 2015

AIRPORT SETTING

LOCALE

MHK is located within the jurisdictional boundaries of the City of Manhattan and Riley County, Kansas. Located approximately 120 miles west of the Kansas City metropolitan area, the City of Manhattan has an estimated population of 54,832[1] residents in 2018. The city is a part of the larger Manhattan-Junction City Combined Statistical Area (CSA), redefined from the previous Metropolitan Statistical Area (MSA) by the Office of Management and Budget. The CSA consists of Riley, Geary, and Pottawatomie Counties, with an estimated 2018 resident population of 134,308[2].

Manhattan has a land area of approximately 18.79 square miles and is home to Kansas State University, which was founded in 1863 and is touted as the country's first operational land-grant university. In 2015, "the Little Apple," the nickname given to Manhattan, KS due to its shared name of the well-known New York City borough, was named the best college town in the nation.

Exhibit 1A depicts the airport in its regional setting.

MHK is the second-busiest commercial airport in Kansas, with only the Wichita Dwight D. Eisenhower National Airport processing more passengers annually. MHK is the only public-use airport in Riley County, and there are six other private-use airports in the region. Specific information for MHK as well as other regional airports will be further outlined in later sections.

LAND USE

MHK is situated on approximately 680 acres at an elevation of 1,066.2 feet mean sea level (MSL). Located approximately five miles southwest of downtown Manhattan, a variety of land uses surround the airport. Understanding the existing and planned land uses for the area surrounding the airport will assist in making appropriate recommendations for the future of the airport with regard to sustainability, environmental compatibility, and economic development.

The Manhattan Corporate Technology Park is a large, state-of-the-art development located on the adjacent 177 acres of land west of the runway intersection at MHK. The Technology Park, which is partially developed, is easily accessible from K-18 highway and I-70. The land north and south of the airport is primarily used for agricultural purposes, but there are pockets of rural residential areas east, northeast, and southwest. Also, the Midwest Raceway, a drag racing facility, is located one-half mile south of the airport.

The City of Ogden, located approximately one mile southwest of MHK, consists of mainly residential land use (both low- to medium-density and high-density). An elementary school, community center, several

[1] Woods & Poole Complete Economic and Demographic Data Source (CEEDS) 2018
[2] Woods & Poole Complete Economic and Demographic Data Source (CEEDS) 2018


KANSAS
Phillipsburg
Smith Center
Belleville
Washington
Marysville
Seneca
Sabetha
Hiawatha
Wathena
Elwood
Blue Rapids
Horton
Atchison
Concordia
Stockton
Osborne
Beloit
Holton
Clay Center
Valley Falls
Leavenworth
Lansing
Oskaloosa
Plainville
MANHATTAN REGIONAL AIRPORT
Manhattan
Minneapolis
Lincoln
Ogden
Rossville
Topeka
Kansas City
Overland Park
Lawrence
Ellis
Hays
Russell
Victoria
Abilene
Salina
Auburn
Carbondale
Gardner
Olathe
Ellsworth
Burlingame
Wellsville
Herington
Council Grove
Osage City
Lyndon
Ottawa
Louisburg
Paola
Lindsborg
La Crosse
Hoisington
Great Bend
Ellinwood
Lyons
McPherson
Hillsboro
Marion
Emporia
Osawatomie
La Cygne
Garnett
Larned
Sterling
Nickerson
Inman
Buhler
Moundridge
Hesston
Peabody
Burlington
Pleasanton
Hutchinson
Newton
Saint John
Stafford
Halstead
Sedgwick
Kinsley
Haven
Valley Center
Park City
El Dorado
Towanda
Eureka
Yates Center
Iola
Humboldt
Fort Scott
Chanute
Wichita
Andover


6000 Rd W
W 54th Ave
Airport Rd
S Scenic Dr
18
Eureka Dr
6800 Rd W
Sykes Blvd
Corporate Dr
Engineer Rd
MANHATTAN REGIONAL AIRPORT
S 20th St
S 24th St
W 32nd Ave
W 40th Ave
Skyway Dr
114
Riley Ave
S 33rd St

places of worship, and commercial development along Highway 18 are also located within Ogden. Fort Riley Military Reservation, a military installation of more than 100,000 acres, is located west of the airport with the primary developed areas positioned eight miles southwest of MHK. Additionally, Kansas Veterans' Cemetery at Fort Riley is located west of MHK across Wildcat Creek Road. To the east of MHK, land use includes mostly commercial and industrial areas with small pockets of rural residential areas as mentioned above.

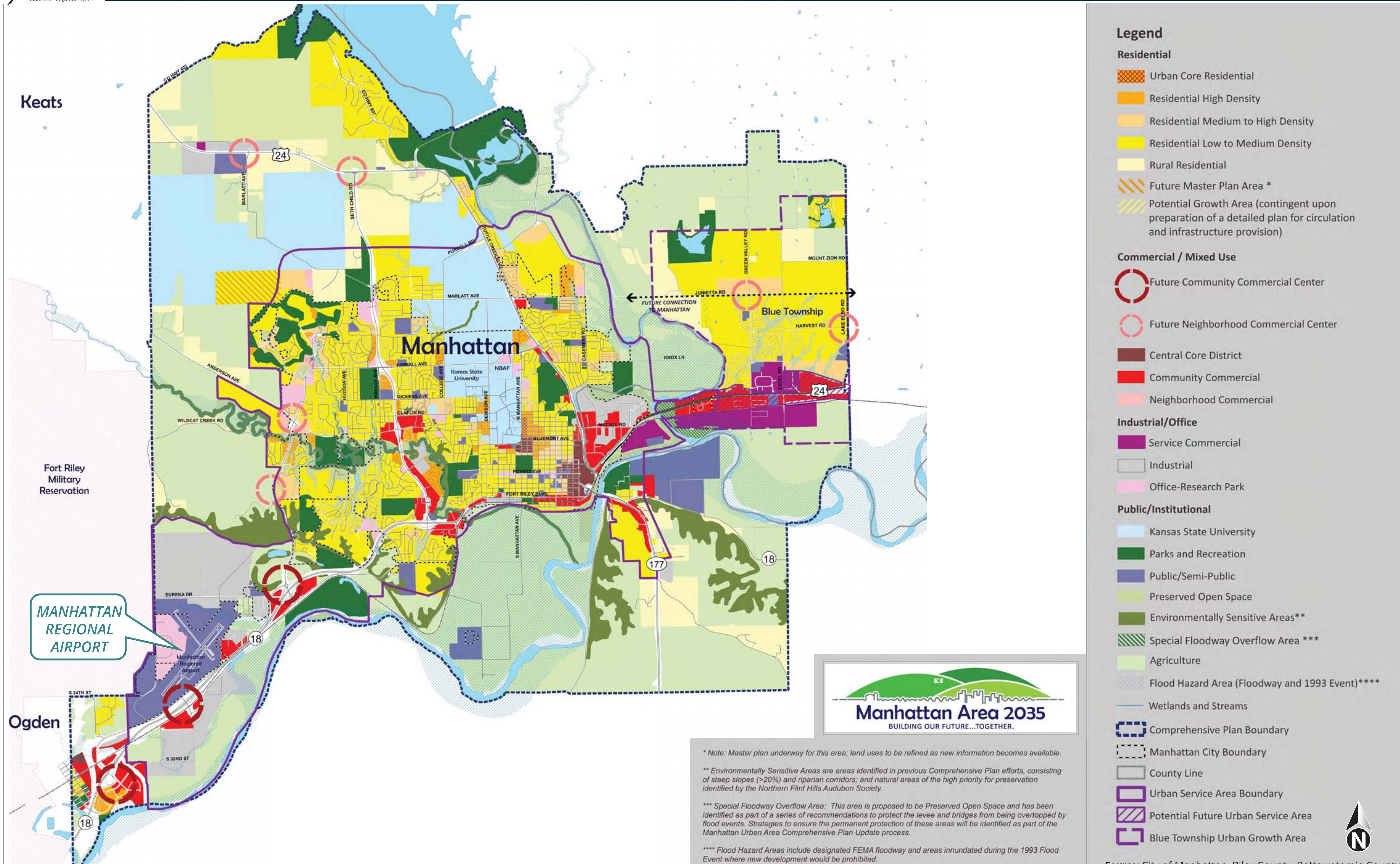
The City of Manhattan, City of Ogden, and Riley County each have land use planning jurisdiction for portions of land within the vicinity of the airport. Each of these entities has adopted a zoning ordinance and corresponding zoning map. The zoning ordinance outlines the allowable types of land use development on a property, and the map identifies the zoning designation that applies to a particular property. The lands west of the airport and within the City of Manhattan are zoned for commercial and industrial land uses. Land located northeast of the airport is zoned for industrial, commercial, and university land uses. The Riley County zoning map includes two areas of single-family residential development west of the airport, one of which is located on the east side of Wildcat Creek Road and the second located north of Skyway Drive and east of W 68th Avenue. To the east of the airport, the Riley County zoning map includes lands that are zoned for residential, industrial, and commercial land uses. Beyond these areas, much of the land is zoned for agricultural land uses. Land within the City of Ogden and located closest to the airport is zoned for general commercial and light industrial land uses. In addition to the zoning discussed above, the City of Manhattan and Riley County have also adopted airport overlay zoning. These overlay zones are discussed further in the environmental inventory found later in this chapter.

In 2015, the *Manhattan Urban Area Comprehensive Plan* was adopted by the City of Manhattan to guide future development for the city and surrounding areas. As depicted on **Exhibit 1B**, planned land uses within the vicinity of the airport include commercial, industrial, and business-research, which is largely consistent with the development in these areas that exists today. The plan also identifies three intersections near the airport as potential sites as Future Community Commercial Centers. These areas are located at the following intersections: Highway 18 and East Riley Avenue, Highway 18 and William Wood Road, and Highway 18 and Scenic Drive. Future Community Commercial Centers are described in the plan as areas that, "provide a mix of retail and commercial services in a concentrated and unified setting that serves the local community and may also provide a limited draw for the surrounding region. These centers are typically anchored by a larger national chain, between 120,000 and 250,000 square feet, which may provide sales of a variety of general merchandise, grocery, apparel, appliances, hardware, lumber, and other household goods."[3]

TRANSPORTATION PLANS

Within the *Manhattan Urban Area Comprehensive Plan* (Comprehensive Plan), the city has identified a goal focusing on MHK, which states:

[3] https://cityofmhk.com/DocumentCenter/View/728/23--Chapter-4-Land-Use--Growth-Management



Source: City of Manhattan, Riley County, Pottawatomie County

Exhibit 1B
MANHATTAN FUTURE LAND USE MAP

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"Leverage transportation and economic-development potential of the Manhattan Regional Airport (MHK) by providing convenient and economical commercial air service and promote general aviation growth, and by providing access and intermodal connections to MHK for all passenger modes. Ensure compatible land uses within 5 miles of the airport, and support use of MHK as Fort Riley's official Aerial Port of Embarkation (APOE)."

The Comprehensive Plan goes on to identify 11 other objectives/policies pertaining to the overall transportation objective. Objective 1.1D aims to:

"Provide a safe, convenient, affordable, and accessible public transportation system, designed and operated to maximize usage by providing scheduled public transit that serves identified needs throughout the community and supports connections to and from other local transportation modes (pedestrians, bicycles, auto), and to the Manhattan Regional Airport."

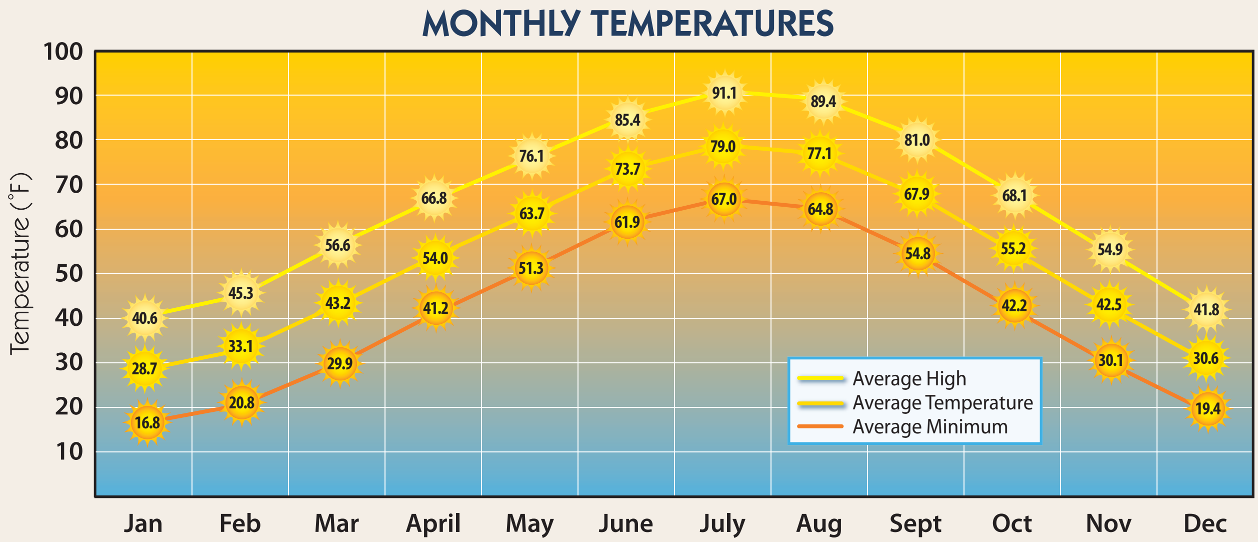
CLIMATE

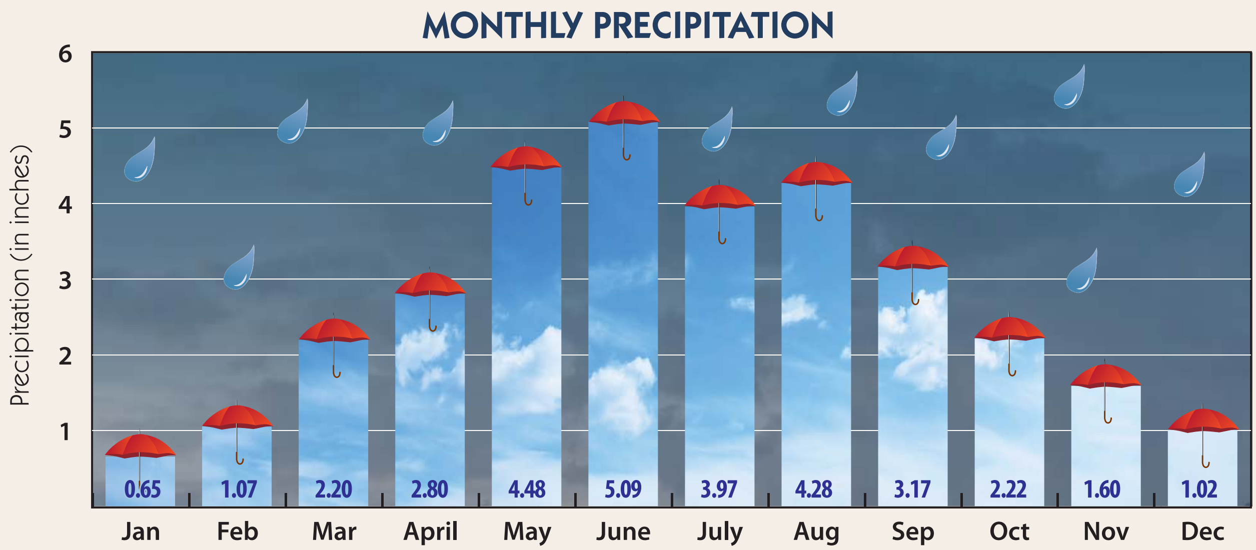
Knowledge of climate and typical regional weather conditions greatly enhances a pilot's flying capabilities. Likewise, the ability to prepare for these conditions enhances the use of an airport. High surface temperatures and high humidity increase runway length requirements, particularly and especially for aircraft powered by turbine engines. Runway orientation is dependent on predominant wind patterns for the area. Cloud cover percentages and frequency of other climatic conditions also determine the need for navigational aids and lighting.

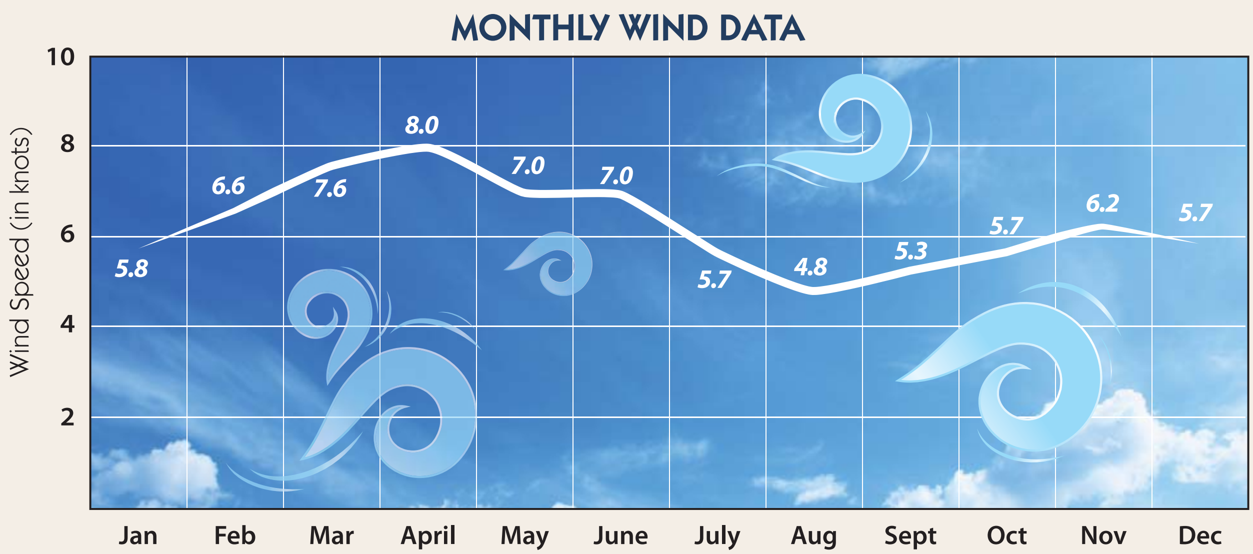
Manhattan's climate is described as a humid continental climate, characterized by hot, humid summers and cold, mainly dry winters. **Exhibit 1C** summarizes climatic data sourced from the National Oceanic and Atmospheric Administration (NOAA) MHK automated surface observation system (ASOS) weather station. Temperature and precipitation data are sourced from the MHK ASOS GHCND: USW00003936 from the period 1981-2010. This data shows an average annual high temperature of 66.43 degrees and an average annual low temperature of 41.68 degrees. July is the hottest month of the year with average highs reaching the low 90s, and January is the coolest month of the year with average lows in the teens. Precipitation is most plentiful during the month of June, which averages 5.09 inches of precipitation, more than 12 percent of the annual accumulation. The region experiences limited snowfall amounts, totaling approximately four inches on average during the winter months each year.

Visual meteorological conditions (VMC) at MHK[4] occur 81.4 percent of the time. When under VMC conditions, pilots can operate using visual flight rules (VFR) and are responsible for maintaining proper separation from objects and other aircraft. Instrument meteorological conditions (IMC) accounts for all weather conditions less than VMC conditions that still allows for aircraft to safely operate under instrument flight rules (IFR). Under IFR, pilots rely on instruments in the aircraft to accomplish navigation.

[4] VMC conditions – ≥3.0 statute miles visibility and ≥1,000-foot cloud ceilings.







Source: NOAA temperature and precipitation climate normal, Station ID: GHCND:USW00013964 (1981-2010).

IMC conditions[5] occur approximately 14.55 percent of the time. Less than IMC conditions[6] or poor visibility conditions (PVC) are present approximately 4.1 percent of the time.

AIRPORT HISTORY

Manhattan Regional Airport's history begins on June 13, 1938, when the temporary grass runways were developed. The following year, stone hangars were built to accompany turf Runway 13-31. Runway 13-31 was eventually paved in 1950, and the original terminal building constructed in 1953. Later in 1963, Runway 3-21 was added to the airfield system.

In 1976, the first airport master plan at MHK dictated the extension of Runway 3-21 and construction of the general aviation ramp. In 2010, the Runway Safety Area (RSA) was improved on Runway 3-21 to enhance aircraft safety and provide access to firefighting and rescue equipment. Perimeter fencing has also been installed at various points, with the most recent installation occurring in 2013. In 2012 and 2014, the passenger terminal building was expanded in two phases to improve security and efficiency as well as modernize facilities.

Since its founding, MHK has provided service from several different airlines. These include Continental, Frontier, Capital, Air Midwest, Allegiant, and Great Lakes Airlines. American Airline's subsidiary, American Eagle, currently serves MHK and offers three non-stop daily departures each to Chicago O'Hare International Airport and Dallas/Fort Worth International Airport (based on October 2018 schedule).

FAA AIRPORT IMPROVEMENT PROGRAM (AIP) PROJECTS

To assist in funding capital improvements, the Federal Aviation Administration (FAA) has provided funding assistance to the airport through the Airport Improvement Program (AIP). The AIP is funded through the Aviation Trust Fund, which was established in 1970 to provide funding for aviation capital investment programs (aviation development, facilities and equipment, and research and development). The Trust Fund also finances a portion of the operation of the FAA and is funded by user fees, taxes on airline tickets, aviation fuel, and various aircraft parts.

Table 1A summarizes FAA AIP grants for Fiscal Year (FY) 2005 through FY 2017. The FAA has granted approximately $34.0 million for planning, engineering, and capital improvements at MHK since 2005.

[5] IMC conditions – 1.0-3.0 miles visibility and <1000 feet but ≥500-foot cloud ceilings.
[6] Poor Visibility Conditions (PVC)- <1.0-mile visibility and/or <500-foot ceilings.

TABLE 1A
FAA AIP Grant History FY2005-2017
Manhattan Regional Airport

Fiscal Year	Grant Seq. No.	AIP Funds	Work Description
2005	24	$327,346	Conduct Environmental Study, Update Airport Master Plan Study
2005	26	$1,166,821	Rehabilitate Runway 3-21 Lighting, Rehabilitate Taxiway Lighting
2005	27	$$489,204	Construct Building
2006	28	$183,330	Install Perimeter Fencing
2007	29	$132,052	Rehabilitate Runway 3-21
2007	30	$299,673	Update Airport Master Plan Study
2007	31	$311, 879	Acquire Snow Removal Equipment
2007	32	$219,181	Conduct Noise Compatibility
2007	33	$615,947	Construct Snow Removal Equipment Building
2008	34	$888,250	Acquire Miscellaneous Land
2008	35	$488,220	Improve Runway 3-21 RSA, Rehabilitate Runway 13-31
2008	36	$1,796,758	Improve Runway 3-21 RSA
2009	37	$1,147,363	Improve Runway 3-21 RSA
2009	38	$2,746,884	Improve Runway 3-21 RSA
2009	39	$3,909,456	Rehabilitate Runway 13-31
2010	40	$135,009	Install Perimeter Fencing
2011	41	$254,701	Conduct Terminal Area Plan Study
2012	42	$911,565	Expand Terminal Building
2012	43	$1,890,734	Construct Apron
2013	44	$7,809,475	Expand Terminal Building
2013	45	$876,905	Install Perimeter Fencing
2014	46	$5,361,484	Expand Terminal Building
2016	47	$1,236,278	Acquire Miscellaneous Land
2017	48	$756,279	Acquire Aircraft Rescue & Fire Fighting Vehicle
Total AIP funds: $33,954,794			

Source: Airport grant history records
Note: All AIP funded projects included a locally funded match

AIRPORT ADMINISTRATION

MHK is publicly owned and operated by the City of Manhattan. Day-to-day operation of the airport is overseen by the Director of Aviation and a staff including operations, maintenance, and firefighting personnel. The airport's terminal hours of operation are 4:00 a.m. until the last flight arrives. The Airport Administration Office is in operation Monday through Friday from 8:00 a.m. to 5:00 p.m.

An 11-member Airport Advisory Board advises the City Commission and airport director regarding policies, planning, capital improvements, negotiation of major contracts, and other matters. Membership on the Airport Advisory Board includes representatives from Kansas State University, Fort Riley, the Manhattan Chamber of Commerce, and Junction City, Kansas, among additional members drawn from the local community.

ECONOMIC IMPACT

In 2012, a study was conducted by CDM Smith to identify the economic impacts of MHK in terms of employment, payroll, and output. A summary of MHK's economic impact is provided in **Table 1B**.

TABLE 1B
2012 Total Economic Impacts
Manhattan Regional Airport

Description	Employment	Payroll	Output
On-Airport Impacts	127	$4,690,700	$14,301,700
Capital Improvement Projects	55	$1,415,600	$7,349,500
Commercial Service Visitor Impacts	288	$6,821,900	$23,536,400
General Aviation Visitor Impacts	19	$466,400	$1,152,400
Total Economic Impacts	489	$13,394,600	$46,340,000

Sources: *The Economic Impact of Manhattan Regional Airport, 2012*, CDM Smith

THE AIRPORT'S SYSTEM ROLE

Airport planning takes place at the local, regional, state, and national levels. Each level has a different emphasis and purpose. On the national level, the airport is included in the *National Plan of Integrated Airport Systems* (NPIAS). On the state level, the airport is included in the *Kansas Airport System Plan*. The local planning document is the Airport Master Plan, which was last updated in 2009.

FEDERAL AIRPORT PLANNING

The role of the federal government in the development of airports cannot be overstated. Many of the nation's existing airports were either initially constructed by the federal government or their development and maintenance was partially funded through various federal grant-in-aid programs to local communities. Thus, the system of airports existing today is due, in part, to the existence of federal policy that promotes the development of civil aviation. As part of a continuing effort to develop a national airport system to meet the needs of civil aviation and promote air commerce, the United States Congress has continually maintained a national plan for the development and maintenance of airports.

The current national airport system plan is the *NPIAS 2019-2023*. A primary purpose of the NPIAS is to identify the airports that are important to national transportation, which includes all commercial service airports, all reliever airports, and selected general aviation airports. The NPIAS identifies 3,328 public-use airports (3,321 existing and 7 proposed) which are eligible to receive development grants under the FAA AIP that estimates for approximately $35.1 billion between 2019 and 2023.

MHK is classified as a nonhub primary commercial service airport in the NPIAS. The term "hub" is used by the FAA to identify very busy commercial service airports as measured by passenger enplanements (boardings). Primary commercial service airports are grouped into four categories. Large hubs are those airports that each account for at least one percent of total U.S. passenger enplanements; medium hubs for between 0.25 percent and one percent; small hubs for between 0.05 percent and 0.25 percent; and nonhubs for less than 0.05 percent of all enplanements, but more than 10,000 annual enplanements. There are 247 nonhub primary commercial service airports that together account for three percent of all enplanements. These airports are heavily used by general aviation aircraft and have an average of 88 based aircraft. **Table 1C** presents the types of airports included in the NPIAS.

TABLE 1C
NPIAS Distribution of Activity

Number of Airports	Airport Type	% of NPIAS Airports	% of 2016 Total Enplanements	% of Based Aircraft	% NPIAS Costs
30	Large Hub Primary Commercial	1%	72.48%	0.0%	23.5%
31	Medium Hub Primary Commercial	1%	15.87%	1.7%	10.5%
72	Small Hub Primary Commercial	2%	8.21%	4.8%	11.9%
247	Nonhub Primary Commercial	7%	3.26%	10.2%	15.2%
380	**Total Primary Airports**	**11%**	**99.83%**	**16.7%**	**61.1%**
88	General Aviation – National	3%	n/a	10.5%	5.3%
492	General Aviation – Regional	14%	n/a	22.3%	12.1%
1,278	General Aviation – Local	40%	n/a	21.3%	14.5%
840	General Aviation – Basic	25%	n/a	3.4%	6.2%
243	General Aviation – Not Classified	7%	n/a	1.1%	0.03%
2,941	**Nonprimary Subtotal**	**89%**	**0.13%**	**58.6%**	**38.1%**
3,321	**Total NPIAS Airports**	**100%**	**99.96%**	**75.3%**	**99.2%**

Source: 2019-2023 National Plan of Integrated Airport Systems (NPIAS)

14 CFR Part 139 Certification

An airport must have an Airport Operating Certificate (AOC) if it is serving air carrier aircraft with more than nine seats or serving unscheduled air carrier aircraft with more than 30 passenger seats. 14 CFR Part 139 (Part 139) describes the requirements for obtaining and maintaining an AOC. This includes meeting various Federal Aviation Regulations (FARs).

Airports are classified in the following categories based on the type of air carrier operations served:

- **Class I Airport** – an airport certificated to serve scheduled operations of large air carrier aircraft (31 passenger seats or more) that can also serve unscheduled passenger operations of large air carrier aircraft and/or scheduled operations of small air carrier aircraft. **MHK is a Class I airport.**

- **Class II Airport** – an airport certificated to serve scheduled operations of small air carrier aircraft (10 to 30 passenger seats) and unscheduled passenger operations of large air carrier aircraft. A Class II airport cannot serve scheduled large air carrier aircraft.

- **Class III Airport** – an airport certificated to serve scheduled operations of small air carrier aircraft. A Class III airport cannot serve scheduled or unscheduled large air carrier aircraft.

- **Class IV Airport** – an airport certificated to serve unscheduled passenger operations of large air carrier aircraft. A Class IV airport cannot serve scheduled large or small air carrier aircraft.

The regulation (which implemented provisions of the *Airport and Airway Development Act of 1970*, as amended Nov. 27, 1971) set standards for: the marking and lighting of areas used for operations; fire-fighting and rescue equipment and services; the handling and storing of hazardous materials; the identification of obstructions; and safety inspection and reporting procedures. It also required airport operators to have an FAA-approved Airport Certification Manual (ACM). A Class I airport must comply with all sections of Part 139.

The ACM is a required document that defines the procedures to be followed in the routine operation of the airport and for response to emergency situations. The ACM is a working document that is updated annually. It reflects the current condition and operation of the airport and establishes the responsibility, authority, and procedures as required. There are required sections for the ACM covering administrative detail and procedural detail. Each section independently addresses: who (primary/secondary), what, how, and when as it relates to each element. The ACM for MHK is updated periodically. The most recent update to the ACM was completed on November 16,2018.

AVIATION ACTIVITY

Records of airport operational activity are essential for determining required facilities (types and sizes), as well as eligibility for federal funding. Airport staff and the FAA record key operational statistics including aircraft operations, enplaned passengers, and based aircraft. Analysis of historical activity levels aid in projecting future trends which will enhance the airport's ability to plan for facility demands in a timely manner. The following sections detail specific operational activities.

OPERATIONS

Aircraft operational statistics at the airport are recorded by the airport traffic control tower (ATCT) that is operated by Midwest ATC Services Inc. daily from 7:00 a.m. to 9:00 p.m. Among other duties, the ATCT counts aircraft operations, which are defined as either a takeoff or a landing. Aircraft operations are not designated specifically by aircraft type but only segregated into four general categories: air carrier, air taxi, military, and general aviation. Air carrier operations are performed by commercial airline aircraft with greater than 60 seats. Air taxi operations are generally associated with commuter aircraft, but also include for-hire general aviation aircraft. Military operations are those conducted by airplanes and helicopters with a military identification. General aviation includes all other aviation activity, from small ultralights to large business jets.

Records of airport operational activities are essential for determining required facilities (types and sizes), as well as eligibility for federal funding. A detailed account of aircraft operations (takeoffs and landings) for MHK is available dating back to 2002. **Exhibit 1D** provides a summary of operational statistics, including the breakdown of itinerant and local operations. The operations that are available at MHK consist of air carrier, air taxi, general aviation local, general aviation itinerant, and military. Operations are further sub-categorized as either itinerant or local. Itinerant operations are those made by aircraft which arrive from or depart to destinations outside the local operating area. Local operations are associated primarily with touch-and-go or pilot training activity.

PASSENGER ACTIVITY

Passenger traffic is collected and analyzed by recording the number of passengers who arrive (deplane) or depart (enplane) commercial service aircraft. Enplanement levels are the primary consideration by the FAA for determining certain available funding levels. Passenger enplanement figures are the planning yardstick utilized to determine terminal building space capacities, automobile parking requirements, automobile access capacities, etc. Also, the FAA provides annual entitlement funds based upon the level of enplanements reached at the airport. Passenger levels on each flight are recorded by the airlines and reported to the airport and the FAA on a monthly basis. Charter enplanements, such as those occurring for military personnel movements, KSU sports teams and/or fans, or general charters occurring through general aviation facilities at MHK, are also reported to the FAA.

TABLE 1D
Historical Enplanements
Manhattan Regional Airport

Year	Regular Scheduled Enplanements	Charter Enplanements	Total Enplanements
2006	10,860	4,109	14,969
2007	11,313	2,681	13,994
2008	11,649	4,311	15,960
2009	19,225	5,841	25,066
2010	39,246	5,333	44,579
2011	54,340	4,078	58,418
2012	62,236	6,713	68,949
2013	62,459	3,452	65,911
2014	63,229	2,811	66,040
2015	63,814	2,467	66,281
2016	60,035	3,212	63,247
2017	66,206	2,994	69,200
2018*	69,875	3,287	73,162

* Includes enplanements 12-months ending September 2018

In 2006, MHK had 14,969 total enplanements, with 10,860 carried via limited regularly scheduled commuter airline service. In August 2009, American Eagle service was initiated, and enplanements jumped immediately. Since that time, total enplanements have increased to a peak of 73,162, with 69,875 being carried solely by American Eagle for the 12-months ending September 2018. Historic enplanement data is summarized in **Table 1D**.

BASED AIRCRAFT

Identifying the current number of based aircraft is important to the master plan analysis as this number helps determine existing demand for several different facilities, including aircraft storage hangar space, parking aprons, pilot and passenger services, and various other aircraft support facilities.

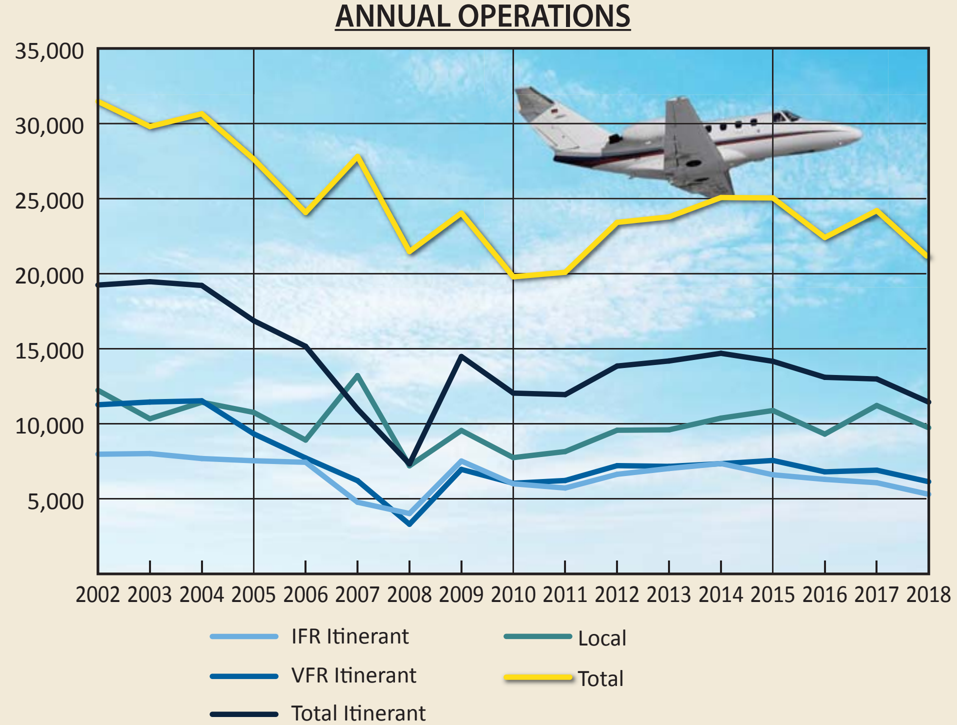
Historic data for based aircraft was retrieved from several sources including the FAA's *Terminal Area Forecast* (TAF) and from the airport's current based aircraft records. Based aircraft data from 2002 to 2018 shows the based aircraft count fluctuating between a high of 54 (2002-2005) and a low of 37 (2015). The based aircraft count rose to 42 in 2016, where it remains as of 2018.

Year	IFR Itinerant Operations					VFR Itinerant Operations					Total Itinerant Operations	Local Operations			Total Operations	Based Aircraft
	AC	AT	GA	MIL	SUB	AC	AT	GA	MIL	SUB		GA	MIL	SUB		
2002	140	3,022	4,147	663	7,972	28	31	10,815	394	11,268	19,240	11,572	658	12,230	31,470	54
2003	114	2,835	4,490	577	8,016	19	117	10,767	546	11,449	19,465	10,017	316	10,333	29,798	54
2004	85	2,481	4,754	364	7,684	33	248	10,373	876	11,530	19,214	11,152	284	11,436	30,650	54
2005	129	2,884	4,064	459	7,536	0	11	8,834	487	9,332	16,868	10,122	636	10,758	27,626	54
2006	125	2,740	4,151	419	7,435	3	2	7,409	309	7,723	15,158	7,810	1,106	8,916	24,074	45
2007	56	1,679	2,694	345	4,774	3	0	5,653	552	6,208	10,982	10,196	3,014	13,210	27,804	45
2008	100	2,104	1,647	169	4,020	0	47	3,151	109	3,307	7,327	7,037	165	7,202	21,472	45
2009	127	4,299	2,654	439	7,519	0	31	6,392	538	6,961	14,480	7,664	1,890	9,554	24,034	45
2010	100	3,042	2,531	329	6,002	0	106	5,747	187	6,040	12,042	7,515	232	7,747	19,789	45
2011	90	2,602	2,570	459	5,721	0	40	5,982	200	6,222	11,943	7,027	1,124	8,151	20,094	45
2012	167	2,935	3,022	511	6,635	0	112	6,634	465	7,211	13,846	7,802	1,768	9,570	23,416	45
2013	148	3,186	3,236	451	7,021	0	144	6,679	340	7,163	14,184	8,750	847	9,597	23,781	46
2014	118	3,263	3,365	604	7,350	0	187	6,700	456	7,343	14,693	9,407	970	10,377	25,070	46
2015	54	2,758	3,159	632	6,603	0	135	6,734	689	7,558	14,161	9,465	1,418	10,883	25,044	37
2016	97	2,974	2,762	464	6,297	1	141	5,792	864	6,798	13,095	6,622	2,690	9,312	22,407	42
2017	1,013	1,979	2,652	430	6,074	0	195	6,313	402	6,910	12,984	10,711	506	11,217	24,201	42
2018*	333	1,573	2,494	902	5,302	0	75	5,446	620	6,141	11,443	8,014	1,722	9,736	21,179	42

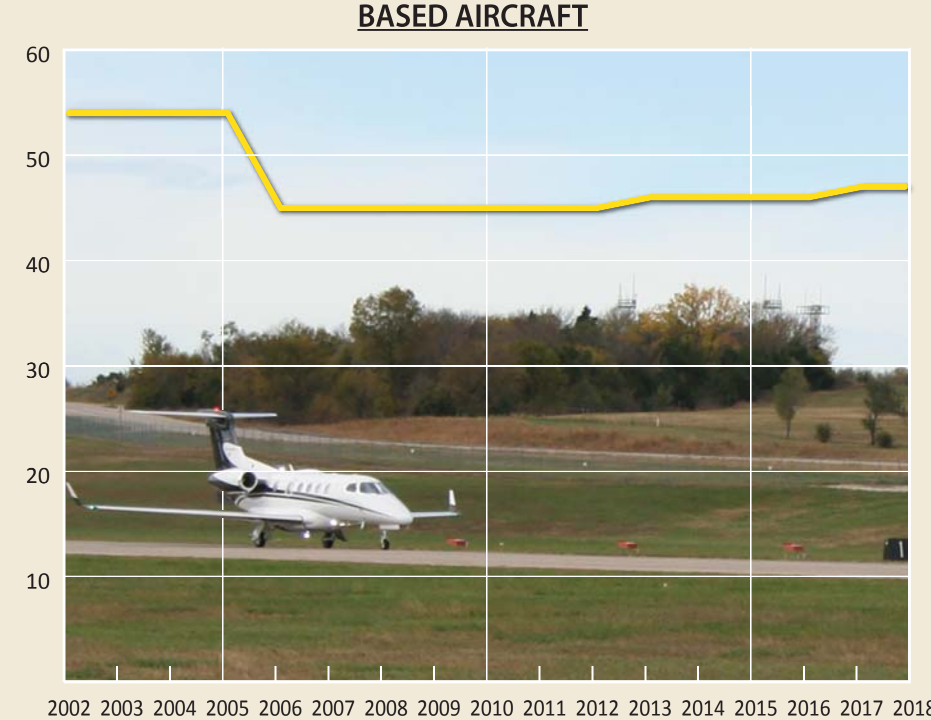
Source: Air Traffic Activity System; August 2018
* Operations for 2018 include January through August (only available at time of report)

Key:
AC - Air Carrier (commercially operated aircraft having seating capacity more than 60 seats or a maximum payload capacity of 18,000 pounds)
AT - Air Taxi (commercially operated aircraft having 60 or fewer passenger seats or less than 18,000 pounds maximum payload capacity)
GA - General aviation
MIL - Military
SUB - Subtotals

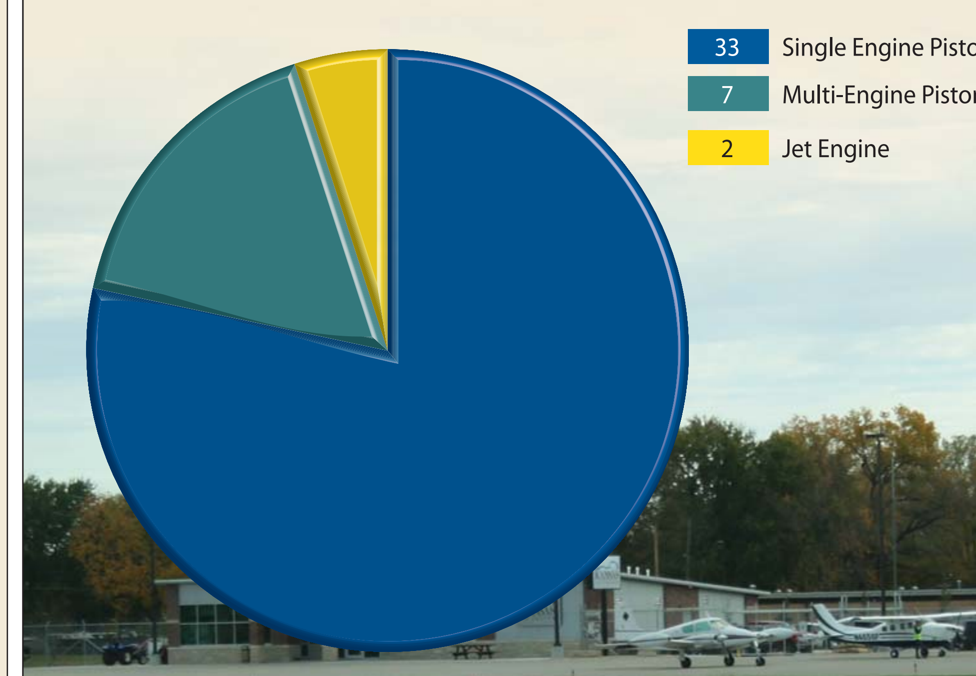
ANNUAL OPERATIONS



BASED AIRCRAFT



BASED AIRCRAFT FLEET MIX



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In 2018, small single-engine piston aircraft made up approximately 79 percent (33 aircraft) of based aircraft at MHK. The airport had seven based multi-engine aircraft, which account for 17 percent of the based aircraft. There are also two based jets, which account for five percent of the total based aircraft.

AIRFIELD FACILITIES

Airport facilities can be functionally classified into two broad categories: airfield and landside. The airfield category includes those facilities directly associated with aircraft operations. The landside category includes those facilities necessary to provide a safe transition from surface to air transportation and support aircraft parking, servicing, storage, maintenance, and operational safety. This section describes the airfield facilities, including runways, taxiways, lighting, marking, navigational aids, and weather reporting. Airfield facilities are depicted and detailed on **Exhibit 1E**.

RUNWAYS

MHK has two concrete runways, one in good condition, and one in excellent condition. Primary Runway 3-21 measures 7,000 feet long and 150 feet wide. Crosswind Runway 13-31 measures 5,000 feet long and 75 feet wide. Runway gradient describes the average slope of a runway. Gradient is determined by dividing the runway's high and low points by its length. Runway 3-21 slopes down from the Runway 3 end at a gradient of -0.18 percent, and Runway 13-31 slopes down from the Runway 13 end at a gradient of -0.43 percent.

Runway 3

Runway load bearing strength for both runways is shown on **Exhibit 1E**. Single wheel loading (SWL) refers to design aircraft landing gear with a single wheel on each main landing gear strut. Dual wheel loading (DWL) refers to design aircraft landing gear with two wheels on each main landing gear strut. FAA publications indicate that Runway 3-21 has a SWL capacity of 75,000 lbs. and a DWL capacity of 110,000 lbs. Runway 13-31 has a SWL capacity of 30,000 lbs. and a DWL capacity of 39,000 lbs.; however, the runway is published as being closed to aircraft weighing more than 33,000 pounds.

Runway 21

TAXIWAYS

The taxiway system, shown on **Exhibit 1E** and summarized in **Table 1E**, consists of parallel, connecting, access, and entrance/exit taxiways. All taxiway pavement is constructed of concrete and varies in width from 50 feet to 100 feet. For reference, runway to taxiway separation distances shown on **Exhibit 1E** are measured from centerline to centerline.

TABLE 1E
Taxiway Data
Manhattan Regional Airport

Designation	Width	Length	Description
A	50'	7,500'	Full length parallel to Runway 3-21; connector to west ramp and north ramp.
B	75'	300'	Entrance/exit for end of Runway 3.
C	75'	300'	Extends from the terminal apron and acts as an entrance/exit to Runway 3-21; located approximately 2,200' from the Runway 3 threshold.
D	50'	300'	Extends from the terminal apron to the mid-point of Runway 3-21.
E	50'	2,000'	Partial-parallel taxiway to Runway 13-31; connector to the east ramp.
F	100'	300'	Entrance/exit for end of Runway 21.

Source: Manhattan Regional Airport, Airport Certification Manual; Coffman Associates analysis.

AIRFIELD LIGHTING

Airfield lighting systems extends an airport's usefulness into periods of darkness and/or poor visibility. A variety of lighting systems are installed at the airport for this purpose. They are categorized by function as follows:

Airport Identification Lighting: The location of the airport at night or during low-visibility weather is universally identified by a rotating beacon. A rotating beacon projects two beams of light, one white and one green, 180 degrees apart. The rotating beacon at MHK is located atop the ATCT.

Runway Pavement and Edge Lighting: Pavement edge lighting utilizes light fixtures placed near the edge of the pavement to define the lateral limits of the pavement. This lighting is essential for safe operations during night and/or times of low visibility to maintain safe and efficient access to and from the runway and aircraft parking areas. Runway 3-21 is equipped with a high intensity runway lighting (HIRL) system, and Runway 13-31 is equipped with medium intensity runway lighting (MIRL). HIRL and MIRL lights are split between white and yellow within the runway caution zone (last 2,000 feet of the runway).

Approach Lighting System (ALS): An ALS is a configuration of lights positioned symmetrically along the extended runway centerline to supplement navigational aids, such as an instrument landing system (ILS), to provide lower visibility minimums. Airports equipped with an ILS are typically equipped with a Medium Intensity ALS with Runway Alignment (MALSR), which extends approximately 2,400 feet from the runway threshold. Runway 3 is equipped with a MALSR in support of the published ILS approach procedure to Runway 3.

Runways	Runway 3|21	Runway 13|31
Length (feet)	7,000	5,000
Threshold Displacement (feet)	None	None
Pavement Surface Material	Concrete	Concrete
Pavement Surface Treatment	Grooved	None
Pavement Condition	Good	Excellent
Pavement Markings (Type)	Precision/Nonprecision	Nonprecision
Traffic Pattern	Right|Left	Left|Right
Runway Pavement Load Bearing Strength (lbs.)		
Single Wheel Gear Loading (SWL)	75,000	30,000
Dual Wheel Gear Loading (DWL)	110,000	39,000
Double Tandem Wheel Gear Loading	N/A	N/A
Runway Lighting		
Runway Edge Lighting	HIRL	MIRL
Approach Lighting System (ALS)	MALSR|None	None
Touchdown Point	Yes (no lights)	Yes (no lights)
Runway End Identifier Lights (REILs)	No|Yes	No|Yes
Visual Approach Aids		
Type	3-PAPI-4 on left	13-VASI-2 on left
	21-PAPI-4 on left	31-VASI-4 on left
Visual Glide Angle	3.00 degrees	3.50|3.00 degrees

Instrument Approach Aids	Runway 3|21	Runway 13|31
Instrument Landing Systems (ILS)	Yes|No	No
Global Positioning System (GPS)	Yes|Yes	No
VOR	Yes|No	No

KEY

MALSR - Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
PAPI - Precision Approach Path Indicator
TVOR - Terminal Very High Frequency Omni-Directional Range
VASI - Visual Approach Slope Indicator

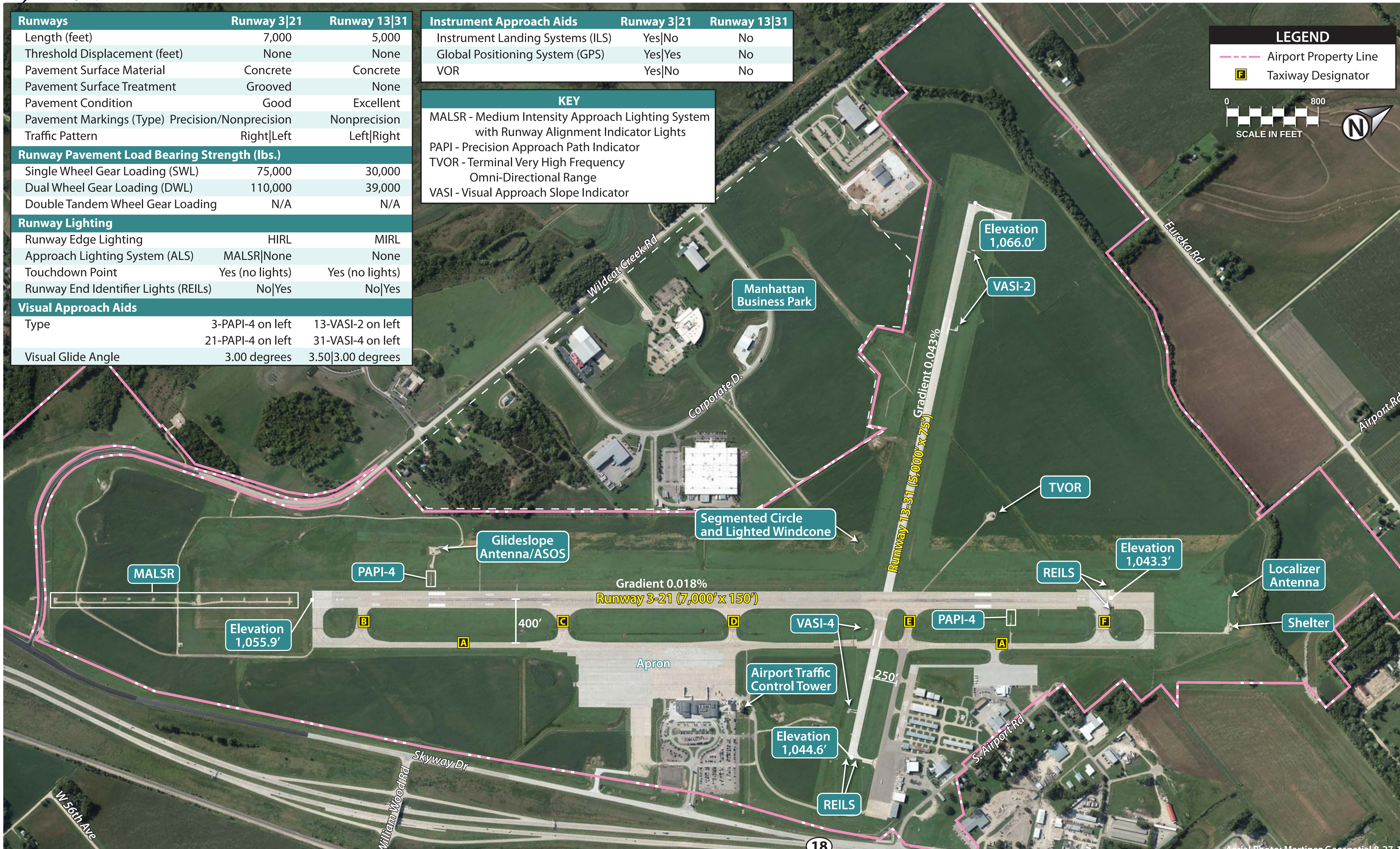

Exhibit 1E
EXISTING AIRSIDE FACILITIES

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Visual Approach Lighting: Visual approach aids have been installed at the airport to assist pilots in determining the correct descent path to the runway end during an approach to the airport. A precision approach path indicator (PAPI-4) is available on approaches to Runways 3 and 21. When the system of red and white lights is interpreted by the pilot, they are given an indication of being above, below, or on the designated descent path to the runway threshold. A PAPI system has a range of five miles during the day and up to twenty miles at night. Each PAPI-4 provides a standard 3.0-degree glide path.

Runways 13 and 31 are equipped with visual approach slope indicator (VASI) systems. Runway 13 has a two-box VASI and Runway 31 a four-box VASI. The VASI systems are older technology than PAPI systems but offer similar visual slope guidance to a runway end. The Runway 13 VASI-2 is set at a higher than standard 3.5-degree slope, while the VASI-4 on Runway 31 is set at the standard 3.0-degree slope.

Runway End Identifier Lights (REILs): REILs provide a visual identification of the runway end for landing aircraft and consist of two synchronized flashing lights, located laterally on each side of the runway end, facing the approaching aircraft. These flashing lights can be seen day or night for up to 20 miles depending on visibility conditions. The Runway 21 and 31 thresholds are equipped with REILs.

Runway Threshold Lights

Taxiway Lighting: All taxiways are equipped with blue medium intensity taxiway lights (MITL).

Pilot-Controlled Lighting: During nighttime hours when the ATCT is closed (9:00 p.m. to 7:00 a.m.), pilots can utilize the pilot-controlled lighting system (PCL) to activate certain airfield lights from their aircraft through a series of clicks of their radio transmitter utilizing the CTAF frequency (118.55 MHz).

AIRFIELD SIGNAGE

Airfield identification signs assist pilots in identifying runways, taxiway routes, and critical areas. The MHK airfield is equipped with lighted signs located at each taxiway intersection. Taxiways and holding positions are identified using lighted location and directional signs. **Exhibit 1F** identifies the existing airfield signage at MHK.

Holding Position for Taxiway/Runway Intersection Signage: Both runways are equipped with holding position signs for runway-taxiway intersections at every entrance/exit taxiway serving the runways. These signs alert pilots and ground service personnel where to hold before getting cleared onto the runway by ATCT personnel.

AIRPORT MARKINGS

Pavement markings aid in the movement of aircraft along airport surfaces and identify closed or hazardous areas on the airport. The airport provides and maintains parking systems in accordance with Part 139.311(a) and Advisory Circular 150/5340-1, *Standards for Airport Marking*.

Runway 3 offers the airport's only precision instrument approach procedure and is equipped with precision markings. The precision markings identify the runway centerline, designation, threshold, aiming points, touchdown zone, and edge markings. Runways 13, 21, and 31 are striped with non-precision markings, like the precision markings on Runway 3 except without the touchdown zone and edge markings.

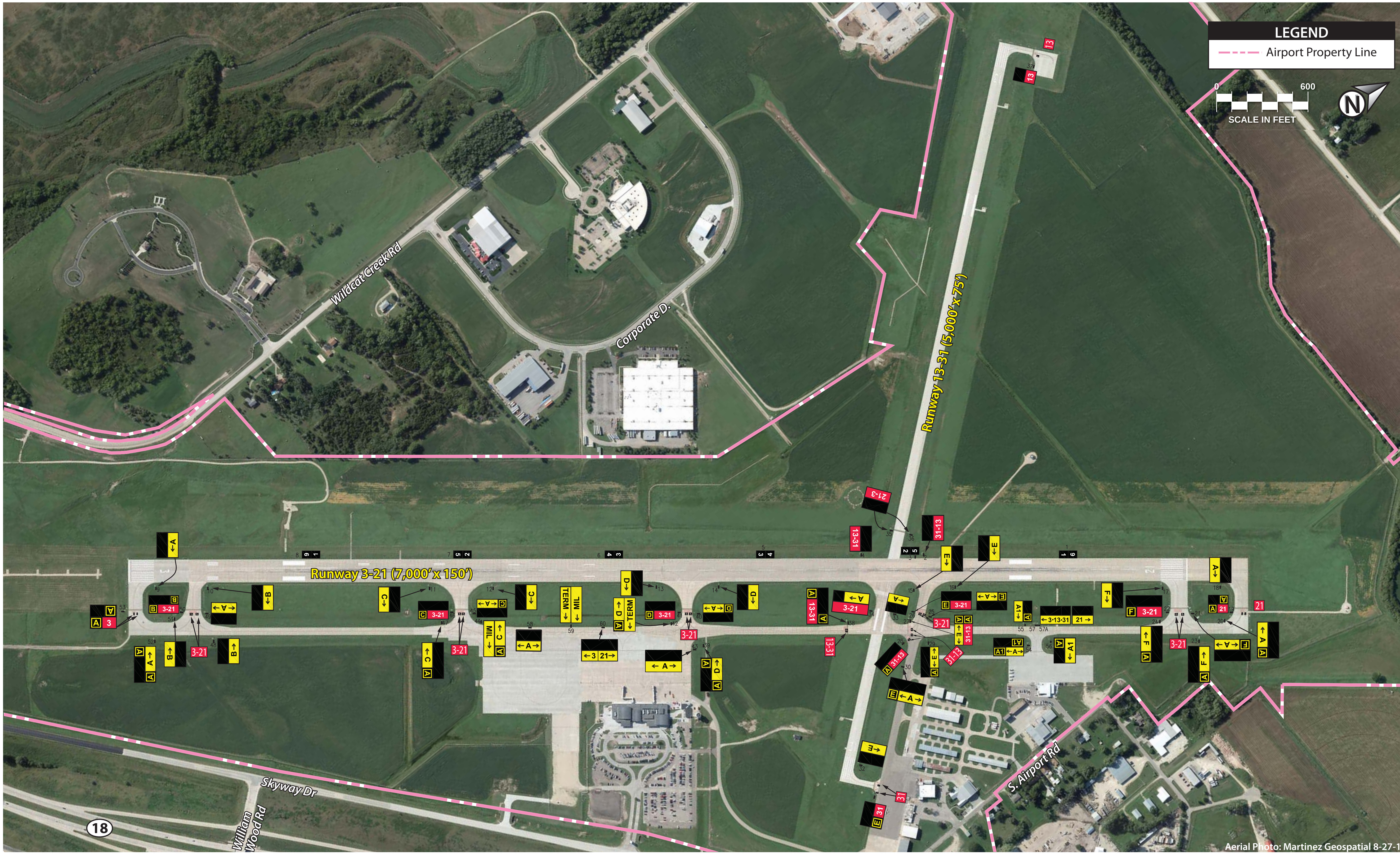
All taxiways at the airport are marked with yellow centerline and holding position markings. Centerline markings assist pilots in maintaining proper clearance from pavement edges and objects near the taxiway edges. Aircraft holding positions are marked at each runway/taxiway intersection. Yellow holding position markings for Runway 3-21 are located 250 feet from the runway centerline while holding position markings for Runway 13-31 are located at least 200 feet from the runway centerline. All holding positions on the airfield are enhanced by lead-in runway designation markings.

NAVIGATIONAL AIDS

Navigational aids are electronic devices that transmit radio frequencies, which pilots of properly equipped aircraft translate into point-to-point guidance and position information. The types of electronic navigational aids available for aircraft flying to or from MHK include the very-high frequency omnidirectional range (VOR) and global positioning system (GPS).

The VOR provides azimuth readings to pilots of properly equipped aircraft by transmitting a radio signal at every degree to provide 360 individual navigational courses. Frequently, distance measuring equipment (DME) is combined with a VOR facility to provide distance as well as direction information to the pilot. Military tactical air navigation aids (TACANs) and civil VORs are commonly combined to form a VORTAC. The VORTAC provides distance and direction information to both civil and military pilots. MHK has a VOR/DME located at the field that has a frequency of 110.20 Mhz. A VOR is located on the military airfield at Fort Riley. The nearest VORTAC is located at Salina Regional Airport.

GPS was initially developed by the United States Department of Defense for military navigation around the world. However, GPS is now used extensively for a wide variety of civilian uses, including civil aircraft navigation. GPS uses satellites placed in orbit around the globe to transmit electronic signals, which pilots of properly equipped aircraft use to determine altitude, speed, and navigational information. This provides more freedom in flight planning and allows for more direct routing to the final destination. GPS provides for enroute navigation and approach with vertical guidance (APV) instrument approaches to MHK.


LEGEND
Airport Property Line
0
600
SCALE IN FEET
N
Runway 3-21 (7,000' x 150')
Runway 13-31 (5,000' x 75')
Wildcat Creek Rd
Corporate D.
Skyway Dr
William Wood Rd
S. Airport Rd
18
Aerial Photo: Martinez Geospatial 8-27-18

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INSTRUMENT LANDING SYSTEM (ILS) EQUIPMENT

Airports with ILS approaches are equipped with both a glideslope antenna and localizer antenna array. The glideslope antenna provides vertical guidance to landing aircraft and can be located on either side of the runway; however, it is best to locate the glideslope antenna on the side of the runway with the least possibility of signal reflections from buildings, power lines, vehicles, aircraft, etc. The localizer antenna array is used to establish and maintain an approaching aircraft's position relative to the runway centerline until visual contact confirms the runway alignment and location.

As previously noted, Runway 3 at is served by a published ILS instrument approach procedure. The glideslope antenna is located on the west side of Runway 3 where potential signal obstructions are limited. The localizer antenna array is located approximately 1,050 feet northeast of the end of the runway (approximately 650 feet beyond the end of pavement).

WEATHER AND COMMUNICATION

MHK is served by an automated surface observing system (ASOS). The ASOS provides automated aviation weather observations 24 hours per day. The system updates weather observations every minute, continuously reporting significant weather changes as they occur. The ASOS system reports cloud ceiling, visibility, temperature, dew point, wind direction, wind speed, altimeter setting (barometric pressure), and density altitude (airfield elevation corrected for temperature). The ASOS equipment is located on the west side of the airfield, co-located with the ILS glideslope antenna equipment. Weather information can be obtained from the ASOS via radio frequency 119.075 MHz or by calling 785-537-1035.

MHK is equipped with one lighted wind cone and a segmented circle. The wind cone indicates wind direction and speed to pilots, and the segmented circle indicates aircraft traffic pattern information. A segmented circle is located west of the intersection of the runways.

Supplemental Wind Cone

LANDSIDE FACILITIES

Landside facilities are those that support the aircraft and pilot/passenger handling functions as well as other non-aviation facilities typically providing a revenue stream to the airport. These facilities include the passenger terminal complex, general aviation facilities, and support facilities such as fuel storage, automobile parking, roadway access, and aircraft rescue and firefighting. The primary landside facilities at the airport are identified on **Exhibit 1G**.

AIRCRAFT APRONS/RAMPS

Aircraft aprons/ramps are pavement areas sufficiently removed from aircraft taxiways and movement areas that facilitate the safe and efficient transition of passengers from the airside element (runway and taxiways) to the landside element. Aprons provide access to the terminal gates and hangars and provide for short-term and long-term aircraft parking. The west ramp at MHK is centered upon the passenger terminal building and is utilized for commercial and military purposes. The portion of apron fronting the terminal building has been designated as the commercial airline aircraft apron. The area at the southwestern end of the ramp is designated as a military aircraft parking area, while the north portion of the west ramp is usable for general aviation (GA). Additional GA aprons are designated as GA east and GA north. Combined, the apron area at MHK consists of approximately 98,100 square yards (sy) of concrete. These apron areas are designated on **Exhibit 1G**.

Commercial Apron

The commercial airline aircraft apron is located immediately adjacent to the commercial airline passenger service terminal building. The apron encompasses approximately 35,000 sy of pavement and is constructed of concrete. The central location of the apron and terminal building provides for convenient access to the entire airfield via Taxiway A. The commercial apron is marked with aircraft parking lines that coincide with the two gate bridges of the terminal building. This commercial apron has a total of four marked aircraft parking positions.

Passenger Aircraft Loading Bridge

General Aviation Aprons

The GA north apron is estimated at approximately 11,000 sy of concrete. This apron has approximately four marked aircraft parking positions. The GA north apron provides access to and supports the activities of the airport's fixed base operator (FBO), Kansas Jet Center.

The GA east apron, constructed of both concrete and asphalt, is estimated at approximately 15,100 sy and includes 17 marked aircraft parking positions. This apron provides access to and supports the activities of Heartland Aviation, five T-hangar facilities, the aircraft rescue and firefighting (ARFF) station, and the fuel farm for the FBO.

No.	OCCUPANCY	DESCRIPTION
1	Terminal Bldg	Terminal Building
2	Admin	AirportOffice
3	Tower	Airport Control Tower
4	Storage	Electrical Vault
5	KS Jet Center	FBO Facility
6	Storage/Tenant	Old Armory Bldg
7	Maintenance	Old Armory Bldg-Shop
8	Warehouse	Dry Material Storage Bldg
9	Tenants	Hangar E-2
10	Tenants	Hangar E-1
11	Tenant	Corporate Hangar - Land Lease
12	Tenants	Hangar D
13	Tenants	Hangar C
14	Tenants	Hangar B
15	Storage/Tenant	Office Space/Storage Space at end of A Row
16	Hangar	Hangar A
17	Tenants	Hangar H
18	ARFF	Fire Station #4
19	Storage/Tenant	Brick Bldg - Old FSS
20	Heartland Aviation	Old Terminal-Limestone Hangar
21	Vacant	Old Terminal
22	Tenants	Clearspan Hangar
23	Tenant	Corporate Hangar - Land Lease
24	Tenant	Corporate Hangar - Land Lease

Exhibit 1G
EXISTING LANDSIDE FACILITIES

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PASSENGER TERMINAL BUILDING

The Manhattan Regional Airport Terminal is located off Skyway Drive and serves passengers arriving and departing the airport. The terminal building was completely remodeled due to the influx of enplanements that the airport handled after American Eagle began service in 2009. The two-phased terminal remodeling project began in 2014 and was completed in 2017, at a total cost of approximately $18 million to the City of Manhattan. At approximately 42,000 square feet, the new terminal is more than three times the size of the old facility.

Manhattan Regional Airport Air Terminal Entrance at Skyway Dr.

Exhibit 1H presents the functional makeup of the airport passenger terminal building.

All primary passenger departure functions, including airline ticket counters and kiosks, are located on the east end of the ground floor. Currently, only American Eagle offers scheduled passenger service at MHK. The passenger security checkpoint is in a central location in the terminal, which is operated by the Transportation Security Administration (TSA). Baggage claim and rental car counters are located at the western end of the building.

MHK Terminal Exterior


GATE 2
GATE 1
Passenger Holding
Administrative Offices
Car Rental
Baggage Claim
Security Screening
Ticketing
FAMILY
Ticketing Lobby

Passenger Convenience

With the passage of the *FAA Modernization and Reform Act of 2012* (Section 131 of Public Law 112-95), Congress has mandated that airport master plan studies include analysis of passenger convenience related to the terminal complex. Passenger convenience will be perceived differently by every passenger at every phase of travel. It is a function of a passenger's trip purpose, demographic characteristics, place of residence, and travel habits. Guidance on the implementation of the Act is included in Change 2 of Advisory Circular (AC) 150/5060-6B, *Airport Master Plans*.

According to the AC, "Planners should consider the services provided to travelers at various points within the terminal building, the degree of congestion, and waiting and processing times. Shorter wait times, intuitive signage, shorter walking distances, airport amenities and ambiance, and reliable flight information will all contribute to passengers feeling as if they have had a successful travel experience. Providing resources to make passenger wait time more productive or more entertaining will improve passenger perception of their journeys. Examples include dedicated work areas, power connections, Wi-Fi, full-service concessions, exhibits, and entertainment."

Access to airport facilities is defined by the convenience of the airport layout for passengers, especially those with mobility and sensory impairments, the elderly, families with small children, and non-English speaking passengers. Passengers should be able to access the airport, the landside area, terminal building, and connections between each in a seamless flow. The evaluation of the terminal building complex will include analysis of the passenger convenience experience.

The MHK passenger terminal offers many passenger conveniences such as free Wi-Fi, public computer stations, and local art displays. Concessions are available, and the layout of the building appropriately separates arriving and departing passengers. The newly remodeled state-of-the art facility meets and exceeds FAA's modernization requirements.

Passenger Pick-up/Drop-off Area

The passenger pick-up/drop-off area is an important feature of any terminal building. This is where passengers are typically dropped off to connect with their flight or picked up after arriving on a flight. The pick-up/drop-off area is exclusively intended for picking up and dropping off passengers and vehicles transitioning from there to a parking area. The entirety of the terminal pick-up/drop-off area is approximately 300 feet in length.

AUTOMOBILE PARKING

The inset in the lower left corner of **Exhibit 1G** presents a more detailed aerial view of the terminal building parking areas at the airport. There are several designated parking lots to serve the airport. There are no longer separate areas to divide short-term and long-term parking. Parking is free at MHK but is limited to two weeks before vehicles are subject to towing. The airport employee parking lot is located on the far northeast corner of the parking lot and consists of 30 parking spots. Rental car parking can be found on both the north and south sides of the parking lot and consist of a total of 43 spots. The remaining 562 parking spaces in the lot are reserved for passengers and visitors.

FIXED BASE OPERATOR (FBO) AND SPECIALTY OPERATORS

MHK currently has one fixed base operator: Kansas Jet Center. MHK also has one aircraft maintenance facility, Heartland Aviation, and two flight training operators, Flex Air, Inc. and K-State Flying Club.

Kansas Jet Center is a full-service FBO offering a variety of general aviation services including: 24-hour executive line service, car rental on-site, crew cars provided, custom gourmet catering, ground transportation arrangements, and a pilot lounge. The Kansas Jet Center FBO is located along the GA north apron and is accessible via S. Airport Rd.

Heartland Aviation is an aircraft maintenance operator with services including: fueling, aircraft maintenance, aircraft parking (ramp or tiedowns), hangars, etc. They currently lease a conventional hangar facility located on the GA east apron and is accessible via S. Airport Rd.

K-State Flying Club offers three Cessna 172 aircraft for members-only use. K-State Flying Club has monthly meetings in the old terminal building (#20).

Flex Air Inc. is a flight training academy. Flex Air Inc. operates out of the old terminal building #20 and is accessible via S. Airport Rd.

AIRPORT BUILDINGS/FACILITIES

While designated a commercial service airport, MHK remains a vital link to general aviation in the region. **Exhibit 1G** identifies airport buildings, hangars, and other facilities along with the various tenants of each facility. The City of Manhattan owns all T-hangar facilities on the airport, while several corporate hangars are owned by private businesses and entities.

In addition to the hangar facilities occupied by the FBO and specialty operators, the airport has 37 individual T-hangar units among five separate facilities. These T-hangar facilities are located on the GA east apron.

SUPPORT FACILITIES

Several support facilities serve as critical links in providing the necessary efficiency and safety support to aircraft ground operations, such as ARFF, airport maintenance, and fuel storage.

Aircraft Rescue and Firefighting Facilities (ARFF)

Part 139 airports are required to provide ARFF services during air carrier operations. Each certificated airport maintains equipment and personnel based on an ARFF index established according to the length of aircraft and scheduled daily flight frequency. There are five indices, A through E, with A applicable to the smallest aircraft and E the largest (based on aircraft length). MHK currently offers ARFF index B. As such, the airport is required to maintain a fleet of equipment and properly trained personnel consistent with this standard. Index C equipment can be provided with prior request.

Manhattan Fire Department Station #4

The MHK ARFF facility (City of Manhattan Fire Department Station #4) is located on-airport and can respond to an on-airport emergency immediately.

The ARFF facility was constructed in 2002 and consists of two drive-through bays with office and living quarters for two personnel. The ARFF facility is staffed by two firefighters 24-hours a day, 365 days a year. The City has four firefighters trained, certified, and badged to work at MHK.

The ARFF facility houses the following equipment:

- **Primary Index B ARFF Vehicle:**
  2018 Oshkosh Striker 4x4 HRET with:
  1. 1,500 gallons of water/250 gallons of 3% aqueous film-forming foam (AFFF)
  2. Roof turret discharge rate - 375/750 gallons per minutes (GPM)
  3. Bumper turret discharge rate - 375/750 GPM
  4. Dry chemical system – 450-pound capacity

- **Reserve Index B ARFF Vehicle:**
  1999 Emergency One HPR 4X4 with:
  1. 1585 gallons of water/205 gallons of 3% AFFF
  2. Roof turret discharge rate – 375/750 GPM
  3. Bumper turret discharge rate – 500 GPM
  4. Dry chemical system – 500-pound capacity

The airport has an Airport Emergency Plan (AEP) in place to comply with CFR 14 Part 139.325 as administered by the FAA. The AEP presents the overall sequence and scope of the planned emergency response. The AEP was most recently approved by the FAA on November 16, 2018.

Airport Maintenance Facilities

The airport has an airport maintenance facility that operates out of the old armory building (#7) south of the GA north ramp. Equipment such as mowers and runway sweepers are located at this facility. The maintenance facility houses two Snow Removal Equipment (SRE) vehicles that are funded by the FAA.

The maintenance facility houses the following SRE equipment:

- 2007 Oshkosh P-2526 plow
- 2002 Oshkosh H-2718B2 with a 24-foot sweeper broom; comes with a blower attachment that is used depending on the needs of the airport

Fuel Storage

Fuel services at MHK are provided by Kansas Jet Center and Heartland Aviation. Kansas Jet Center owns its own fuel farm offering both Avgas (100LL) and Jet A fuel service around the clock. The fuel farm consists of one Jet A tank with a capacity of 30,000 gallons and one Avgas tank with a capacity of 12,000 gallons. Fuel is distributed via three fuel trucks including two Jet A trucks and one Avgas truck. The Jet A fuel trucks have capacities of 2,800 and 4,800 gallons, and the Avgas fuel truck has a capacity of 750 gallons. Kansas Jet Center expects to add a new Jet A fuel truck with a capacity of 5,000 gallons to their fleet in the near future. Heartland Aviation offers self-service Avgas and Mogas. Both of Heartland Aviation's fuel tanks have a capacity of 3,000 gallons each for both Avgas and Mogas.

In total, including the trucks, the airport currently has the capacity for 37,600 gallons for Jet A, 12,750 gallons for Avgas, and 5,000 gallons of Mogas fuel.

Heartland Aviation Self-Serve Fuel Farm


Kansas Jet Center Fuel Farm

Vehicle Airfield Access and Perimeter Fencing

Ground vehicles authorized by the airport to operate on movement and safety areas are limited to those vehicles necessary for airport operations. These include airport maintenance vehicles, police patrols, fire and rescue vehicles, aircraft fuel and service vehicles, and others authorized by the airport such as airline/FBO vehicles, construction vehicles, and FAA and airport staff vehicles. The entire perimeter of the airport is fenced with eight-foot chain-link fencing with barbed-wire outriggers at the top. The airport fencing complies with TSA security requirements in TSR Part 1542. Signs prohibiting unauthorized entry are displayed on gates, fences, buildings, and other prominent locations to control inadvertent entry to the airfield. Security gates are located at various locations around the perimeter fence and are controlled with keypads, proximity technology card readers, or combination padlocks. Each access point requires a proximity card that allows an individual to enter a personal identifier code to gain access to the airport. Proximity cards are only given to those individuals who require access to the apron through a particular point of entry; if/when that individual no longer requires access, their proximity card is revoked and their personal identification code cancelled. Proximity cards are typically granted to: airport personnel, airport tenants, emergency responders, and other authorized users who require access to the airfield A central computer located in the airport administration office controls the proximity readers.

Perimeter Security Fencing

UTILITIES

The availability and capacity of the utilities serving the airport are factors in determining the development potential of the airport property, as well as the land immediately adjacent to the facility. Of primary concern in the inventory process is the availability of electricity, water, gas, and sewer.

Electricity is provided to the airport by Westar Energy. The City of Manhattan provides water and wastewater handling service to the airport. Natural gas is provided by Kansas Gas Service. Telecommunications such as phone, cable, and internet are provided by multiple companies including AT&T, Spectrum, and Grande Communications.

AREA AIRSPACE AND AIR TRAFFIC CONTROL

The *Federal Aviation Administration (FAA) Act of 1958* established the FAA as the responsible agency for the control and use of navigable airspace within the United States. The FAA has established the National Airspace System (NAS) to protect persons and property on the ground and to establish a safe and efficient airspace environment for civil, commercial, and military aviation. The NAS covers the common network of U.S. airspace, including air navigation facilities; airports and landing areas; aeronautical charts; associated rules, regulations, and procedures; technical information; and personnel and material. The system also includes components shared jointly with the military.

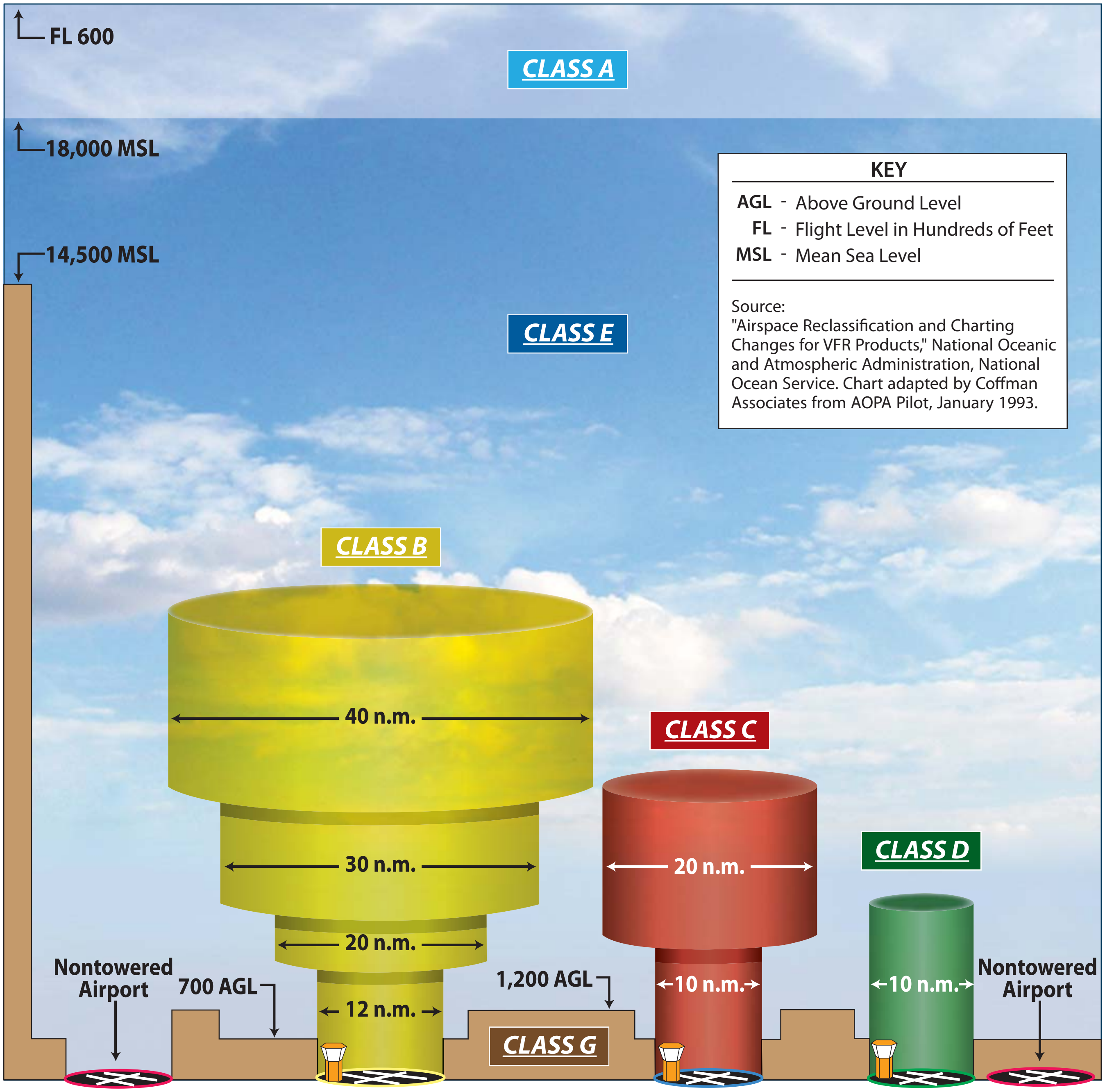
AIRSPACE STRUCTURE

Airspace within the United States is broadly classified as either "controlled" or "uncontrolled." The difference between controlled and uncontrolled airspace relates primarily to requirements for pilot qualifications, ground-to-air communications, navigation and air traffic services, and weather conditions. Six classes of airspace have been designated in the United States, as shown on **Exhibit 1J**. Airspace designated as Class A, B, C, D, or E is considered controlled airspace. Aircraft operating within controlled airspace are subject to varying requirements for positive air traffic control. Airspace in the vicinity of MHK is depicted on **Exhibit 1K**.

Class A Airspace: Class A airspace includes all airspace from 18,000 feet MSL to flight level (FL) 600 (approximately 60,000 feet MSL) over the contiguous 48 states and Alaska. This airspace is designated in Federal Aviation Regulation (F.A.R.) Part 71.33 for positive control of aircraft. All aircraft must be on an IFR clearance to operate within Class A airspace.

Class B Airspace: Class B airspace has been designated around some of the country's major airports, such as Kansas City International Airport, to separate all aircraft within a specified radius of the primary airport. Each Class B airspace is specifically tailored for its primary airport. All aircraft operating within Class B airspace must have an air traffic control (ATC) clearance. Certain minimum aircraft equipment and pilot certification requirements must also be met. This airspace is the most restrictive controlled airspace routinely encountered by pilots operating under VFR in an uncontrolled environment.

Class C Airspace: The FAA has established Class C airspace at approximately 120 airports around the country (the closest being Wichita Dwight D. Eisenhower National Airport) that have significant levels of IFR traffic. Class C airspace is designed to regulate the flow of uncontrolled traffic above, around, and below the arrival and departure airspace required for high-performance, passenger-carrying aircraft at major airports. In order to fly inside Class C airspace, an aircraft must have a two-way radio, an encoding transponder, and have established communication with the ATC facility. Aircraft may fly below the floor of the Class C airspace or above the Class C airspace ceiling without establishing communication with ATC.



DEFINITION OF AIRSPACE CLASSIFICATIONS

CLASS A Generally airspace above 18,000 feet MSL up to and including FL 600.

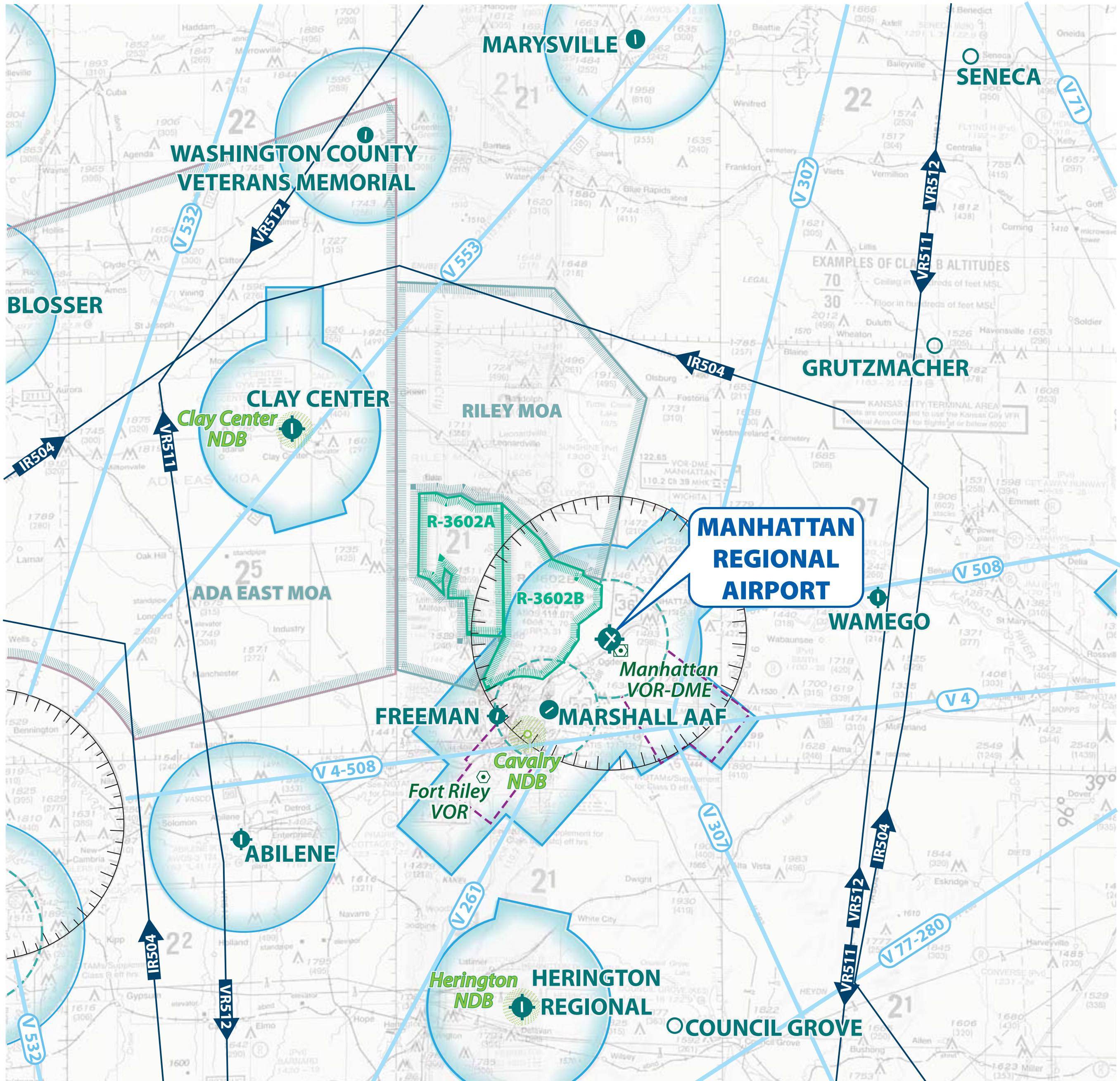
CLASS B Generally multi-layered airspace from the surface up to 10,000 feet MSL surrounding the nation's busiest airports.

CLASS C Generally airspace from the surface to 4,000 feet AGL surrounding towered airports with service by radar approach control.

CLASS D Generally airspace from the surface to 2,500 feet AGL surrounding towered airports.

CLASS E Generally controlled airspace that is not Class A, Class B, Class C, or Class D.

CLASS G Generally uncontrolled airspace that is not Class A, Class B, Class C, Class D, or Class E.



LEGEND

- Airport with other than hard-surfaced runway
- Airport with hard-surfaced runways 1,500' to 8,069' in length
- Airports with hard-surfaced runways greater than 8,069' or some multiple runways less than 8,069'
- Compass Rose
- Non-directional Radio Beacon (NDB)
- VOR
- VOR-DME
- Victor Airways
- Class D Airspace
- Class E Airspace
- Class E (sfc) Airspace with floor 700 ft. above surface that laterally abuts 1200 ft. or higher Class E airspace
- Military Training Route
- Alert Area - Military Opertions Area
- Prohibited, Restricted, and Warning Areas

NORTH

NOT TO SCALE

Source:
Omaha and Chicago Sectional Charts, US Department of Commerce, National Oceanic and Atmospheric Administration, July 19, 2018

Class D Airspace: Class D airspace is controlled airspace surrounding airports with an ATCT. MHK operates within Class D airspace while the ATCT is open (7:00 a.m. to 9:00 p.m.); when the tower is closed, MHK reverts to Class E airspace. Class D airspace typically constitutes a cylinder with a horizontal radius of four or five nautical miles (nm) from the airport, extending from the surface up to a designated vertical limit, typically set at approximately 2,500 feet above the airport elevation. Aircraft operators operating within the MHK Class D airspace are required to contact MHK ATCT prior to entering or departing MHK airspace and must maintain contact while within the controlled airspace to land at MHK or to transverse the area. **Exhibit 1K** depicts the MHK Class D airspace.

Class E Airspace: Class E airspace consists of controlled airspace designed to contain IFR operations near an airport and while aircraft are transitioning between the airport and enroute environments. Unless otherwise specified, Class E airspace terminates at the base of the overlying airspace. Only aircraft operating under IFR are required to be in contact with air traffic control when operating in Class E airspace. While aircraft conducting visual flights in Class E airspace are not required to be in radio communications with air traffic control facilities, visual flight can only be conducted if minimum visibility and cloud ceilings exist. When the ATCT is closed, MHK Class E airspace extends from the surface up to but does not include 18,000 feet MSL.

Class G Airspace: Airspace not designated as Class A, B, C, D, or E is considered uncontrolled, or Class G, airspace. Air traffic control does not have the authority or responsibility to exercise control over air traffic within this airspace. Class G airspace lies between the surface and the overlaying Class E airspace (700 to 1,200 feet above ground level).

While aircraft may technically operate within this Class G airspace without any contact with ATC, it is unlikely that many aircraft will operate this low to the ground. Furthermore, federal regulations specify minimum altitudes for flight. F.A.R. Part 91.119*, Minimum Safe Altitudes*, generally states that except when necessary for takeoff or landing, pilots must not operate an aircraft over any congested area of a city, town, or settlement, or over any open-air assembly of persons, at an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft.

Over less congested areas, pilots must maintain an altitude of 500 feet above the surface, except over open water or sparsely populated areas. In those cases, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure. Helicopters may be operated at less than the minimums prescribed above if the operation is conducted without hazard to persons or property on the surface. In addition, each person operating a helicopter shall comply with any routes or altitudes specifically prescribed for helicopters by the FAA.

Special Use Airspace

Victor Airways: For aircraft arriving or departing the regional area using VOR facilities, a system of Federal Airways, referred to as Victor Airways, has been established. Victor Airways are corridors of airspace eight miles wide that extend upward from 1,200 feet above ground level (AGL) to 18,000 feet MSL and extend between VOR navigational facilities. Victor Airways are shown with blue lines on **Exhibit 1K**. For aircraft enroute or departing MHK, there are four Victor Airways available converging at or near the MHK VOR-DME.

Military Operations Areas: Military Operating Areas (MOAs) are areas of airspace where military activities are conducted. The Riley MOA is west and northwest of MHK. The Riley MOA is controlled by the Kansas City Air Route Traffic Control Center (ARTCC) with active military aircraft operating from 7,000 feet up to but not including 18,000 feet MSL. The Riley MOAis operated intermittently by notices to airmen (NOTAM). The ADA East MOA is also controlled by the Kansas City ARTCC with active military operating from 7,000 feet up to 18,000 feet MSL. The ADA East MOA is operated sunrise to sunset Monday through Friday and occasionally on the weekends by NOTAMs.

Military Training Routes: Military training routes near MHK are identified with the letters IR or VR and a three-digit number. The arrows on the route indicate the direction of travel. Military aircraft travel on these routes below 10,000 feet MSL and at speeds in excess of 250 knots. **Exhibit 1K** depicts the military training routes in the vicinity of MHK.

Restricted/Prohibited Areas: Restricted areas are depicted on **Exhibit 1K** with blue hatched lines. Restricted areas in the vicinity of MHK are R-3602A and R-3602B located to the west of MHK. R-3602A and R-3602B are shared using Old U.S. Highway 77 and the Millford Reservoir shoreline. Both of these restricted areas are controlled by Kansas City ARTCC with an operational range from the surface to 29,000 feet MSL. As per the restricted area guidelines, aircraft cannot navigate through restricted airspace under VMC. They may, however, navigate through restricted airspace with ATC under IMC. Due to the restricted airspace, there are certain specific take-off procedures that are in effect during IMC conditions.

AIRSPACE CONTROL

The FAA has established 22 ARTCCs throughout the continental United States to control aircraft operating under IFR within controlled airspace and while enroute. An ARTCC assigns specific routes and altitudes along Federal Airways to maintain separation and orderly traffic flow. The Kansas City Center ARTCC controls IFR airspace enroute to and from MHK.

Flight service stations (FSS) are air traffic facilities which provide pilot briefings, flight plan processing, inflight radio communications, search and rescue (SAR) services, and assistance to lost aircraft and aircraft in emergency situations. FSSs also relay air traffic control clearances, process NOTAMs, broadcast aviation meteorological and aeronautical information, and notify Customs and Border Protection of trans border flights. The Wichita Flight Service Station is the nearest FSS to MHK.

Airport Traffic Control Tower (ATCT)

The MHK ATCT operates daily from 7:00 a.m. to 9:00 p.m. The tower is owned by the FAA and is operated by Midwest Air Traffic Control Service, Inc. (Midwest ATC). The ATCT became operational in 2002 and is located immediately east of the airport's administration building. ATCT employees utilize the employee parking lot south of the tower building.

MHK ATCT

As of October 2018, the MHK tower is staffed by four controllers, not including the ATCT manager; however, this figure fluctuates throughout the year as many controllers are cycled through the MHK tower for training purposes. The primary responsibilities for tower controllers are to sequence and separate local arriving and departing traffic and to provide ground control direction to aircraft taxiing on the ground. Tower radio frequencies are 118.55 MHz for Manhattan Tower and 121.85 MHz for Manhattan Ground. Approach and departure control at MHK are handled by Marshall Army Airfield (AAF) controllers at Fort Riley in Junction City, Kansas. Marshall AAF approach and departure control can be reached at 121.25. When the tower and Marshall AAF control are not operational, radio communications are provided by Kansas City ARTCC radio on radio frequency 127.35 MHz.

FLIGHT PROCEDURES

Flight procedures are a set of predetermined maneuvers established by the FAA, using electronic or visual navigational aids that assist pilots in locating and landing or departing from an airport. For MHK, there are five instrument approach procedures as shown on **Exhibit 1L**.

Instrument Approach Procedures

The capability of an instrument is defined by the visibility and cloud ceiling minimums associated with the approach. Visibility minimums define the horizontal distance the pilot must be able to see in order to complete the approach. Cloud ceilings define the lowest level a cloud layer (defined in feet above the ground) can be situated for the pilot to complete the approach. If the observed visibility or ceilings are below the minimums prescribed for the approach, the pilot cannot complete the instrument approach.

There are currently five published instrument approach procedures into MHK: ILS or LOC (Runway 3); RNAV (GPS) (Runways 3 and 21); VOR (Runway 3); and VOR (F). The ILS and RNAV LPV approaches provide both course and vertical guidance, while the LNAV/VNAV and VOR approaches provide only course guidance. The ILS and RNAV LPV approaches to Runway 3 provide the most sophisticated approach procedures, permitting pilots of aircraft with suitable equipment to land when cloud ceilings are as low as 200 feet and visibility as low as 3/4-mile.

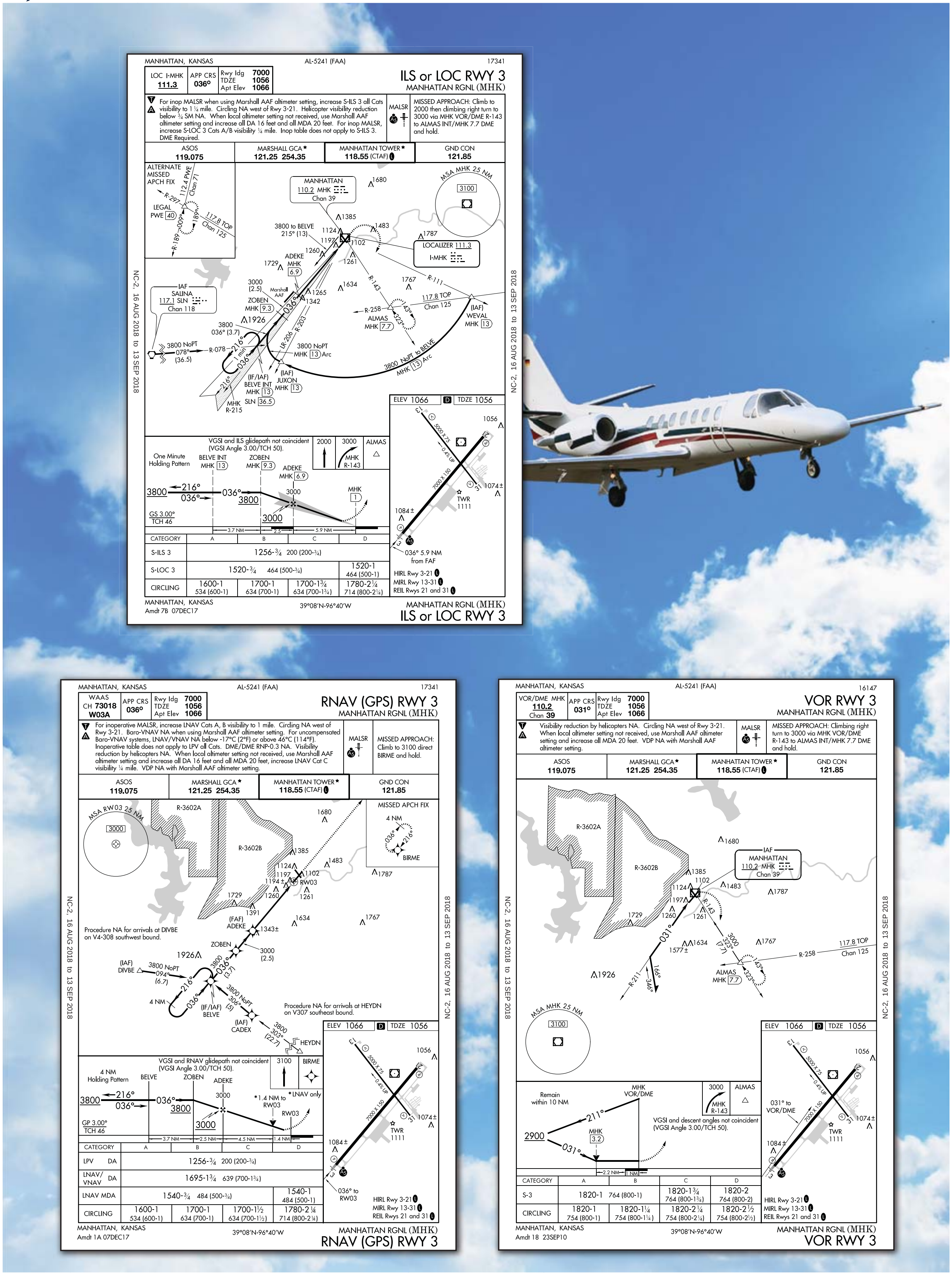


Exhibit 1L
INSTRUMENT APPROACH PROCEDURES

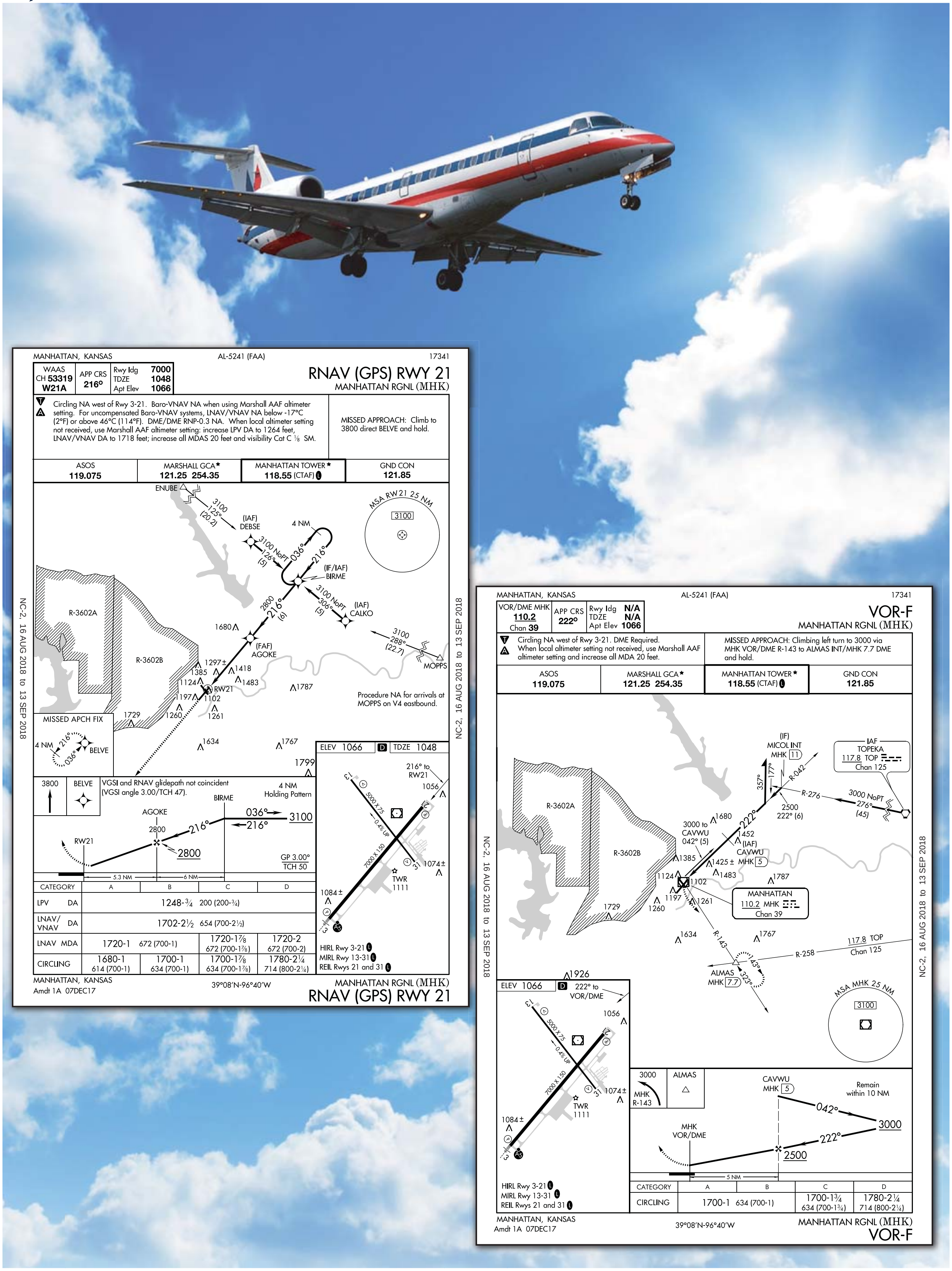


Exhibit 1L
INSTRUMENT APPROACH PROCEDURES

Local Operating Procedures

The traffic pattern at the airport is maintained to provide the safest and most efficient use of the airspace. A standard left-hand traffic pattern is published for each runway at MHK. The typical traffic pattern altitude for propeller aircraft is between 800 and 1,000 feet AGL and 1,500 feet AGL for turbine aircraft. The traffic pattern altitude at MHK is 843 feet AGL (1,909 feet MSL) for light aircraft and 1,443 feet AGL (2,509 feet MSL) for turbine aircraft.

MHK does not have aircraft restrictions, curfews, or a mandatory noise abatement program, as these programs would violate the federal *Airport Noise and Capacity Act* (ANCA) of 1990. Federal law requires the airport to remain open 24 hours a day, 7 days a week, and to accept all civilian and military aircraft that can be safely accommodated.

AREA AIRPORTS

A review of other public-use airports with at least one paved runway within a 30-nautical mile radius of MHK was conducted to identify and distinguish the types of air service provided in the region. It is important to consider the capabilities and limitations of these airports when planning for future changes or improvements at MHK. **Exhibit 1M** provides information on public-use airports within a 30-nautical mile vicinity of MHK. Information pertaining to each airport was obtained from FAA Form 5010-1, Airport Master Record.

SOCIOECONOMIC PROFILE

For an airport planning study, socioeconomic characteristics are collected and examined to derive an understanding of the dynamics of growth within the study area. Socioeconomic information related to the approximate airport service area is an important consideration in the master planning process. For MHK, a socioeconomic profile of the Manhattan-Junction City CSA has been prepared.

The historic trend in elements such as population, employment, income, and earnings provide insight into the long-term socioeconomic condition of the region. This information is essential in determining aviation service level requirements, as well as forecasting aviation demand elements for airports. Aviation forecasts are typically related to the population base, economic strength of the region, and the ability of the region to sustain a strong economic base over an extended period.

Historical and forecast socioeconomic data for the Manhattan-Junction City CSA was obtained from Woods & Poole Economics - Complete Economic and Demographic Data Source, 2018. Woods & Poole utilizes information from the U.S. Census Bureau, as well as other national and state organizations for historic data, to project future conditions. The information is presented on **Exhibit 1N**.

FREEMAN FIELD AIRPORT (3JC)

Airport NPIAS Classification .... GA
FAA Asset Study Classification ..... Local
Location from MHK .... 9.9 nm SW
Elevation .... 1,101.6 ft
Weather Reporting .... ASOS
ATCT .... None
Annual Operations.............. 2,700
Based Aircraft....................... 26
Enplaned Passengers............. None

RUNWAYS	18-36	13-31	5-23
Length	3,498′	1,903′	1,834′
Width	75′	140′	200′
Pavement Strength -			
SWL	10,000 lbs.	None	None
DWL	None	None	None
Lighting	MIRL	None	None
Marking	Basic	None	None
Approach Aids	PAPI-2	None	None
Instrument Approach Procedures	None	None	None

Services Provided: Aircraft hangars and tiedowns, 100LL and Jet A fuel, major airframe service and powerplant service.

WAMEGO MUNICIPAL AIRPORT (69K)

Airport NPIAS Classification ... Non-NPIAS
FAA Asset Study Classification .... N/A
Location from MHK .... 19.5 nm E
Elevation .... 966 ft
Weather Reporting .... ASOS
ATCT .... None
Annual Operations 8,024
Based Aircraft 64
Enplaned Passengers .... None

RUNWAY	18-36
Length	3,184′
Width	45′
Pavement Strength -	
SWL	None
DWL	None
Lighting	LIRL
Marking	Basic
Approach Aids	None
Instrument Approach Procedures	None

Services Provided: Aircraft tiedowns and 100LL.

CLAY CENTER MUNICIPAL (CYW)

Airport NPIAS Classification .... GA
FAA Asset Study Classification ..... Local
Location from MHK ...... 26.9 nm WNM
Elevation .... 1,208.9 ft
Weather Reporting .... AWOS
ATCT .... None
Annual Operations 31,000
Based Aircraft 15
Enplaned Passengers .... None

RUNWAY	17-35
Length	4,197′
Width	75′
Pavement Strength -	
SWL	12,000 lbs.
DWL	15,000 lbs.
Lighting	MIRL
Marking	Numbers Only
Approach Aids	PAPI-2
Instrument Approach Procedures	None

Services Provided: Aircraft tiedowns and hangars, 100LL fuel, major airframe service and major powerplant service.

HERINGTON REGIONAL AIRPORT (HRU)

Airport NPIAS Classification .... GA
FAA Asset Study Classification ..... Basic
Location from MHK .... 27.5 nm SSW
Elevation .... 1,480.6 ft
Weather Reporting .... None
ATCT .... None
Annual Operations 12,600
Based Aircraft 10
Enplaned Passengers .... None

RUNWAY	18-36
Length	4,184′
Width	75′
Pavement Strength -	
SWL	38,000 lbs.
DWL	52,500 lbs.
Lighting	MIRL
Marking	NPI
Approach Aids	PAPI-4
Instrument Approach Procedures	None

Services Provided: Aircraft hangars and tiedown and 100 LL.

COUNCIL GROVE MUNICIPAL AIRPORT (K63)

Airport NPIAS Classification ... Non-NPIAS
FAA Asset Study Classification .... N/A
Location from MHK .... 28.3 nm S
Elevation .... 1,409 ft
Weather Reporting .... None
ATCT .... None
Annual Operations 400
Based Aircraft 0
Enplaned Passengers .... None

RUNWAY	4-22	12-30
Length	1,845′	1,690′
Width	120′	75′
Pavement Strength -		
SWL	None	None
DWL	None	None
Lighting	None	None
Marking	None	None
Approach Aids	None	None
Instrument Approach Procedures	None	None

Services Provided: Aircraft tiedowns.

ABILENE MUNICIPAL AIRPORT (K78)

Airport NPIAS Classification .... GA
FAA Asset Study Classification ..... Local
Location from MHK ...... 29.9 nm WSW
Elevation .... 1,152.5 ft
Weather Reporting .... AWOS
ATCT .... None
Annual Operations 37,800
Based Aircraft 16
Enplaned Passengers .... None

RUNWAY	17-35
Length	4,100′
Width	75′
Pavement Strength -	
SWL	13,000 lbs.
DWL	16,000 lbs.
Lighting	MIRL
Marking	NPI
Approach Aids	PAPI-2
Instrument Approach Procedures	None

Services Provided: Aircraft hangars and tiedowns, 100LL and Jet A fuel, major airframe service and powerplant service.

KEY

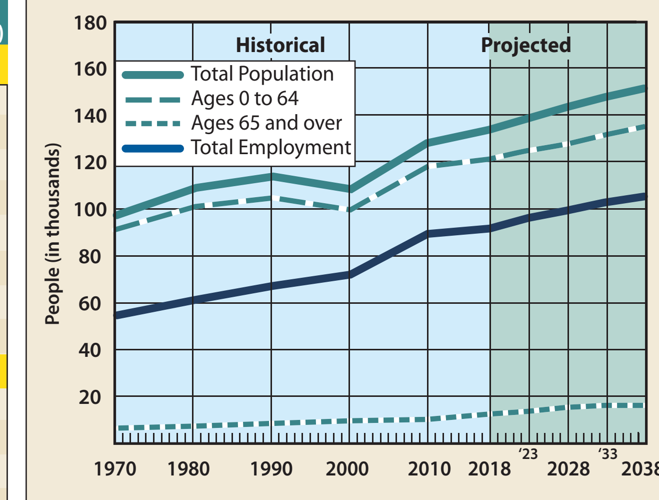
ASOS - Automated Surface Observation System
ATCT - Airport Traffic Control Tower
AWOS - Automated Weather Observation System
DWL - Dual Wheel Loading
FAA - Federal Aviation Administration
LIRL - Low Intensity Runway Lights
LL - Low Lead
MIRL - Medium Intensity Runway Lights
nm - Nautical Mile
NPIAS - National Plan of Integrated Airport Systems
PAPI - Precision Approach Path Indicator
SWL - Single Wheel Loading
VASI - Visual Approach Slope Indicator

SOCIOECONOMIC PROFILE FOR MANHATTAN-JUNCTION CITY CSA

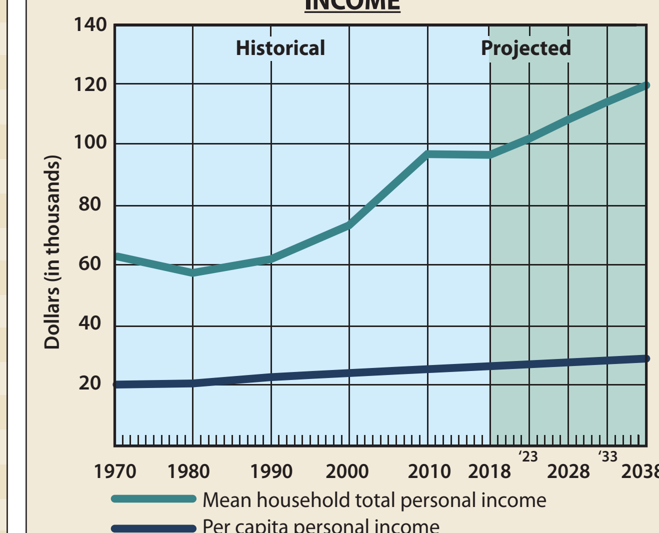
	HISTORICAL							PROJECTED				
	1970	1980	1990	2000	2010	2018	CAGR	2023	2028	2033	2038	CAGR (2018-2038)
POPULATION												
Total Population	97,442	108,741	113,901	109,384	128,604	134,308	0.70%	138,921	143,548	147,922	151,704	0.61%
Median Age (years)	22.20	23.00	24.91	25.96	25.95	26.67	0.40%	27.14	27.05	26.68	26.73	0.01%
Ages 0-64	90,637	100,981	104,974	99,557	118,075	121,477	0.64%	124,961	127,940	131,790	135,329	0.54%
Ages 65 and over	6,805	7,760	8,927	9,827	10,529	12,831	1.39%	13,960	15,608	16,132	16,375	1.23%
Male	55,157	59,170	60,685	56,464	65,727	70,723	0.54%	73,385	75,736	78,150	80,601	0.66%
Female	42,285	49,571	53,216	52,920	62,877	63,585	0.89%	65,536	67,812	69,772	71,103	0.56%
Total Households	26,841	34,887	37,960	39,462	46,894	51,303	1.42%	53,191	54,351	55,129	55,689	0.41%
Persons Per Household	2.89	2.66	2.63	2.51	2.52	2.42	-0.39%	2.41	2.44	2.47	2.52	0.20%
EMPLOYMENT												
Total Employment	55,027	61,054	67,443	72,182	89,361	91,560	1.11%	95,823	99,685	102,958	105,352	0.70%
Farm	2,292	2,342	2,120	1,858	1,597	1,644	-0.72%	1,671	1,666	1,654	1,641	-0.01%
Forestry,Fishing, Related Activities and Other	107	73	170	231	386	401	2.91%	419	443	468	495	1.06%
Mining	17	35	36	45	118	206	5.57%	218	231	245	260	1.17%
Utilities	189	254	243	208	279	262	0.71%	267	273	278	282	0.37%
Construction	1,756	2,355	2,510	3,148	4,306	3,636	1.59%	3,834	3,977	4,091	4,179	0.70%
Manufacturing	740	1,834	1,788	2,581	3,317	4,002	3.74%	4,168	4,348	4,536	4,724	0.83%
Wholesale Trade	624	858	1,007	1,295	1,649	2,170	2.75%	2,252	2,316	2,370	2,407	0.52%
Retail Trade	3,959	4,500	5,961	7,608	7,799	8,747	1.74%	9,384	9,816	10,188	10,448	0.89%
Transportation and Warehousing	1,281	2,734	2,194	1,968	1,029	1,933	0.90%	1,950	1,973	1,998	2,019	0.22%
Information	501	785	1,100	1,589	1,109	810	1.05%	826	843	860	877	0.40%
Finance and Insurance	1,316	1,849	2,180	2,272	2,478	2,980	1.79%	3,256	3,370	3,363	3,264	0.46%
Real Estate and Rental and Lease	971	1,281	1,478	1,627	2,342	3,314	2.70%	3,530	3,799	4,089	4,397	1.42%
Professional and Technical Services	653	922	1,486	2,041	2,676	3,419	3.66%	3,635	3,865	4,106	4,362	1.23%
Management of Companies and Enterprises	165	235	376	438	300	231	0.73%	229	229	226	224	-0.15%
Administrative and Waste Services	842	1,234	1,777	2,210	3,972	2,714	2.58%	2,744	2,769	2,787	2,793	0.14%
Educational Services	247	346	558	740	1,243	1,239	3.57%	1,396	1,545	1,679	1,791	1.86%
Health Care and Social Assistance	1,634	2,294	3,707	4,949	5,814	6,309	2.98%	7,365	8,511	9,388	9,726	2.19%
Arts, Entertainment, and Recreation	283	370	539	775	935	1,044	2.88%	1,135	1,236	1,341	1,447	1.65%
Accommodation and Food Services	1,795	2,274	3,301	4,170	5,816	6,615	2.88%	6,893	7,142	7,353	7,527	0.65%
Other Services, Except Public Administration	1,416	1,944	3,180	4,180	3,923	4,273	2.43%	4,386	4,494	4,595	4,691	0.47%
Federal Civilian Government	3,494	3,650	3,258	2,798	4,153	3,761	0.16%	3,780	3,798	3,815	3,832	0.09%
Federal Military	23,865	18,951	15,846	10,703	19,145	16,255	-0.83%	16,312	16,371	16,427	16,486	0.07%
State and Local Government	6,880	9,934	12,628	14,748	14,975	15,595	1.79%	16,173	16,670	17,101	17,480	0.57%
INCOME AND SPENDING												
Total Earnings (2009 Dollars)	1,595,590,000	1,821,500,000	2,036,650,000	2,392,480,000	4,283,580,000	4,248,960,000	2.15%	4,535,980,000	4,820,040,000	5,090,530,000	5,331,840,000	1.14%
Per Capita Personal Income (2009 Dollars)	20,688	20,893	22,974	24,347	25,604	26,609	0.55%	27,237	27,865	28,494	29,122	0.45%
Mean Household Total Personal Income (2009 Dollars)	62,900	57,514	62,057	73,278	96,858	96,614	0.94%	101,962	108,294	114,183	119,695	1.08%
Gross Regional Product (2009 Dollars)	2,452,310,000	2,848,270,000	3,191,960,000	3,629,740,000	6,922,020,000	6,762,360,000	2.23%	7,219,180,000	7,675,320,000	8,113,750,000	8,513,360,000	1.16%
Total Retail Sales (2009 Dollars)	660,324,000	884,457,000	966,813,000	1,212,160,000	1,471,040,000	1,785,720,000	2.19%	1,883,060,000	1,967,720,000	2,040,950,000	2,108,230,000	0.83%
Total Retail Sales Per Household (in 2009 Dollars)	24,601	25,352	25,469	30,717	31,369	34,807	0.76%	35,402	36,204	37,021	37,857	0.42%

Source: Woods & Poole Complete Economic and Demographic Data Source (CEEDS) 2018

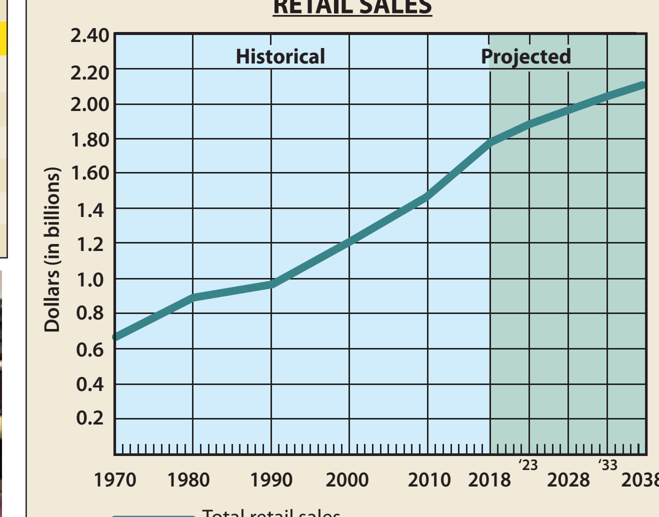
POPULATION AND EMPLOYMENT



INCOME



RETAIL SALES



ENVIRONMENTAL INVENTORY

This environmental inventory identifies potential environmental sensitivities, based on the 14 environmental impact categories outlined in FAA's Order 1050.1F *Environmental Impacts: Policies and Procedures*, that should be considered when planning future improvements at the airport.

- 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
- Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks
- Visual Effects (including light emissions)
- Water Resources (including wetlands, floodplains, surface waters, groundwater, and wild and scenic rivers)

It was determined that the following resources are not present with the airport environs or cannot be inventoried because they are evaluated as part of project implementation:

- Resources Not Present
  - Coastal Resources (Coastal Barriers and Coastal Zones) – the airport is inland and not subject to any coastal restrictions.
  - Wild and Scenic Rivers – There are no designated Wild and Scenic Rivers within the State of Kansas.
- Resources Not Inventoried
  - Visual effects (including light emissions)
  - Natural resources and energy supply

AIR QUALITY

The concentration of various pollutants in the atmosphere describes the local air quality. The significance of a pollution concentration is determined by comparing it to the state and federal air quality standards. In 1971, the U.S. Environmental Protection Agency (EPA) established 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 (O_3), Carbon Monoxide (CO), Sulfur Dioxide (SO_2), Nitrogen Oxide (NO_x), Particulate matter (PM_{10} and $PM_{2.5}$), and Lead (Pb).
Based on both federal air quality standards, a specific geographic area can be classified as either an "attainment," "maintenance," or "non-attainment" area for each pollutant. The threshold for non-attainment designation varies by pollutant. The airport is in Riley County, Kansas, which is designated as an attainment area for all federal criteria pollutants.[7]

BIOLOGICAL RESOURCES

Biotic resources include the various types of plants and animals that are present in an area. The term also applies to rivers, lakes, wetlands, forests, and other habitat types that support plants and animals.

The U.S. Fish and Wildlife Service (USFWS) is charged with overseeing the requirements contained within Section 7 of the *Endangered Species Act* (ESA). This Act was put into place to protect animal or plant species whose populations are threatened by human activities. Along with the FAA, the USFWS reviews projects to determine if a significant impact to these protected species will result with implementation of a proposed project. Significant impacts occur when the proposed action could jeopardize the continued existence of a protected species or would result in the destruction or adverse modification of federally designated critical habitat in the area.

According to the USFWS Information for Planning and Consultation (IPaC), there are four federally listed threatened or endangered species which have the potential to occur in the vicinity of the airport: northern long-eared bat (threatened, mammal), least tern (endangered, bird), piping plover (threatened, bird), and Topeka shiner (endangered, fish). Habitat for these species is not found on airport property. During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live and dead trees. In winter, northern long-eared bats hibernate in caves.[8] The least tern occupies base or sparsely vegetated sand, shell, and gravel beaches, often along rivers and reservoirs.[9] The piping plover lives on sandy beaches and lakeshores.[10] Topeka shiner is an aquatic species. There are no areas of designated critical habitat within five miles of the airport.

In addition to the ESA, the *Migratory Bird Treaty Act* (MBTA) is also applicable at the airport as much of the study area constitutes habitat for birds protected under this Act. The IPaC report lists 11 bird species that may be present at the airport.

TABLE 1F
Birds Protected Under the *Migratory Bird Treaty Act*
Riley County, Kansas

Bald eagle	Lesser yellowlegs
Boblink	Red-headed woodpecker
Eastern whippoorwill	Rusty Blackbird
Golden eagle	Semipalmated sandpiper
Henslow's sparrow	Wood thrush
Kentucky warbler	

Source: U.S. Fish and Wildlife Service, Information for Planning and Conservation, https://ecos.fws.gov/ipac/

Birds protected under the MBTA may nest, winter, or migrate throughout the area, including those protected by the ESA. Under the requirements of the MBTA, all project proponents are responsible for

[7] https://www3.epa.gov/airquality/greenbook/anayo_ks.html
[8] https://www.fws.gov/midwest/Endangered/mammals/nleb/nlebFactSheet.html
[9] https://www.fws.gov/midwest/endangered/birds/leasttern/intleastternfactsheet.html
[10] https://www.fws.gov/midwest/endangered/pipingplover/pipingpl.html

complying with the appropriate regulations protecting birds when planning and developing a project. Migratory birds with potential to occur in the study area are listed in **Table 1F**.

CLIMATE

The EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2016*, found that the transportation sector, which includes aviation, accounted for 28.5 percent of U.S. greenhouse gas (GHG) emissions in 2016. Of this, aviation contributed 168.0 million metric tons (MMT) of carbon dioxide equivalent (CO_2e), or nearly nine percent of all transportation emissions.[11, 12] Transportation sources include cars, trucks, ships, trains, and planes. Most of the GHG emissions from transportation are CO_2 emissions resulting from the combustion of petroleum-based products in internal combustion engines. Relatively insignificant amounts of methane (CH_4), hydrofluorocarbon (HFC) and nitrous oxide (N_2O) are emitted during fuel combustion.

From 1990 to 2016, total transportation emissions increased. The upward trend is largely due to increased demand for travel; however, much of this travel was done in passenger cars and light-duty trucks. In addition to transportation-related emissions, **Figure 1A** shows all GHG emissions sources in the U.S. in 2016.

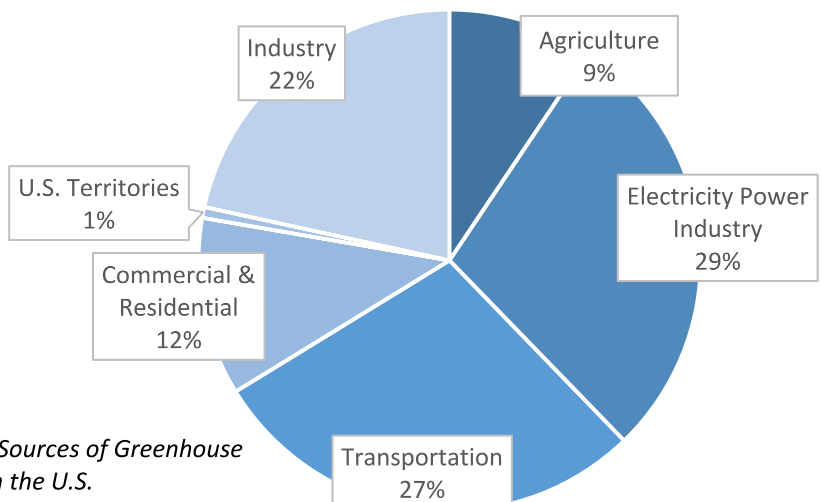


***Figure 1A** 2016 Sources of Greenhouse Gas Emissions in the U.S.*
Source: U.S. EPA (2018)

Increasing concentrations of GHGs can affect global climate by trapping heat in the Earth's atmosphere. Scientific measurements have shown that Earth's climate is warming, with concurrent impacts, including warmer air temperatures, rising sea levels, increased storm activity, and greater intensity in precipitation events. This climate change is a global phenomenon that can also have local impacts (Intergovernmental

[11] Aviation activity consists of emissions from jet fuel and aviation gasoline consumed by commercial aircraft, general aviation, and military aircraft.
[12] Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2016, Table 2-13 (available: https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2016)

Panel on Climate Change, 2014). GHGs, such as water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3), are both naturally occurring and anthropogenic (man-made).

Research has also shown a direct correlation between fuel combustion and GHG emissions. GHGs from anthropogenic sources include CO_2, CH_4, N_2O, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). CO_2 is the most important anthropogenic GHG because it is a long-lived gas that remains in the atmosphere for up to 100 years.

Information regarding the climate in Manhattan, including wind, temperature, and precipitation, are found earlier in this chapter.

DEPARTMENT OF TRANSPORTATION ACT, SECTION 4(f)

Section 4(f) of the *Department of Transportation Act* (DOT), which was recodified and renumbered as Section 303(c) of 49 USC, provides that the Secretary of Transportation will not approve any program or project that requires the use of any publicly owned land from a historic site, public parks, recreation areas, or waterfowl and wildlife refuges of national, state, regional, or local importance unless there is no feasible and prudent alternative to the use of such land, and the project includes all possible planning to minimize harm resulting from the use.

The following list summarizes the nearest properties of each type that may be protected under Section 4(f) of the DOT Act:

- National Register of Historic Places - Samuel D. Houston House, 3.2 miles northeast of the airport
- Recreation Area – Chickasaw National Recreation Area, 320 miles south of the airport
- Wilderness Area – Hercules-Glades Wilderness, 260 miles southeast of the airport
- Wildlife Refuge – Flint Hills National Wildlife Refuge, 64 miles southeast of the airport
- Locally Owned Park – Warner Memorial Park, 2.5 miles northeast of the airport.

FARMLANDS

Under the *Farmland Protection Policy Act* (FPPA), federal agencies are directed to identify and take into account the adverse effects of federal programs 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.

Information obtained from the Natural Resource Conservation Service's (NRCS) Web Soil Survey (WSS) indicates much of the airport property and land adjacent to the airport is classified as farmland of statewide importance or prime farmland. These soil classifications are shown on **Exhibit 1P.**

HAZARDOUS MATERIALS, SOLID WASTE, AND POLLUTION PREVENTION

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. According to the EPA's *EJSCREEN*, there are no Superfund or brownfield sites within five miles of the airport.[13]

HISTORICAL, ARCHITECTURAL, ARCHEOLOGICAL, AND CULTURAL RESOURCES

Determination of a project's environmental impact to historic and cultural resources is made under guidance in the *National Historic Preservation Act* (NHPA) *of 1966*, as amended, the *Archaeological and Historic Preservation Act* (AHPA) *of 1974*, the *Archaeological Resources Protection Act* (ARPA), and the *Native American Graves Protection and Repatriation Act* (NAGPRA) *of 1990*. In addition, the *Antiquities Act of 1906*, the *Historic Sites Act of 1935*, and the *American Indian Religious Freedom Act of 1978* also protect historical, architectural, archaeological, and cultural resources. Impacts may occur when the proposed project causes an adverse effect on a property which has been identified (or is unearthed during construction) as having historical, architectural, archaeological, or cultural significance.

The Samuel D. Houston House, located 3.2 miles northeast of the airport, is the only property listed on the National Register of Historic Places within five miles of the airport.

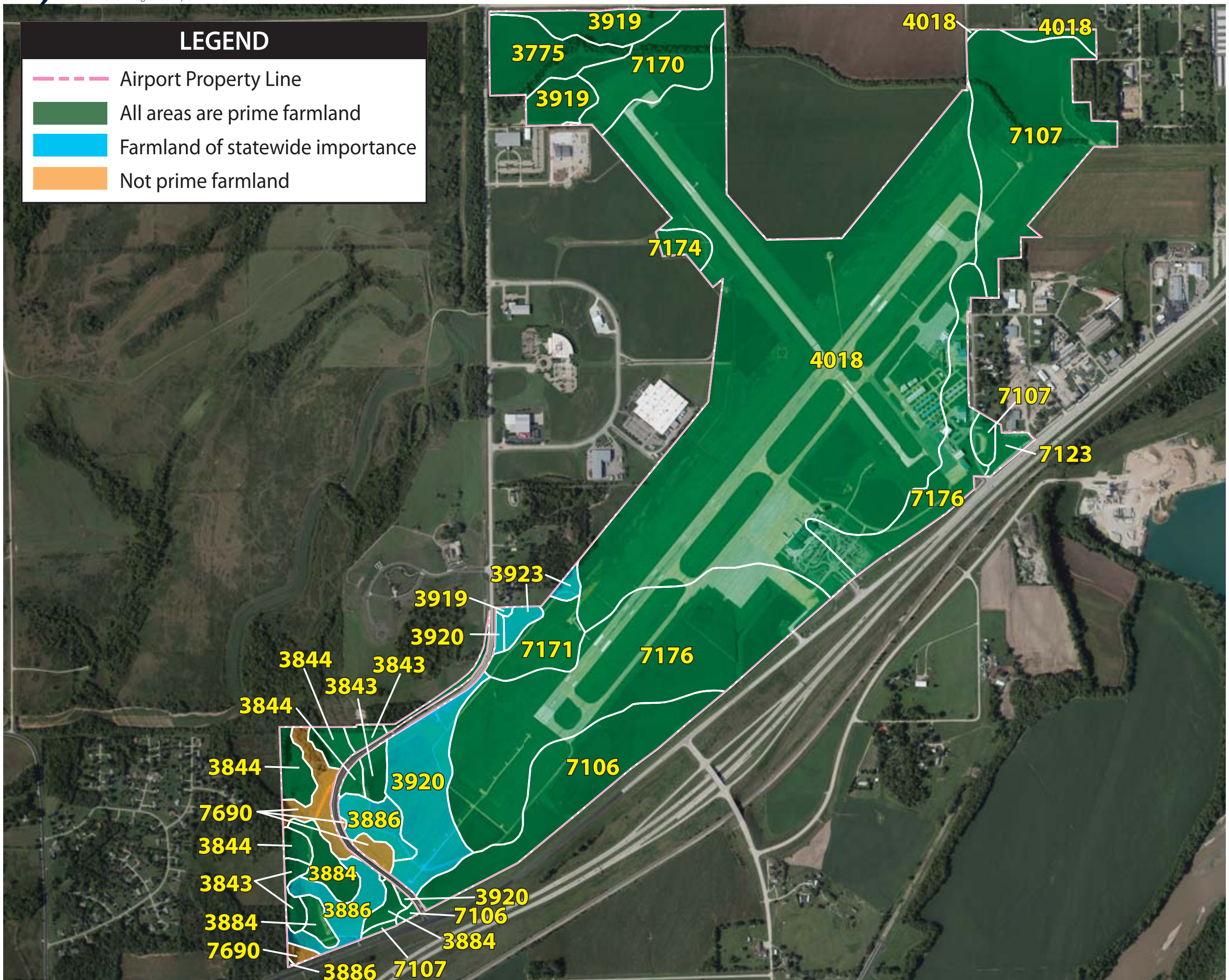
LAND USE

Land uses around the airport are described earlier in this chapter and are displayed on **Exhibit 1B**.

NOISE AND COMPATIBLE LAND USE

Federal land use compatibility guidelines are established under 14 CFR Part 150 (Part 150), *Airport Noise Compatibility Planning*. According to 14 CFR 150, residential land uses and schools are noise-sensitive land uses that are not considered compatible with a 65 decibel (dB) Day-Night Average Sound Level (DNL). Other noise-sensitive land uses (such as religious facilities, hospitals, or nursing homes), if located within a 65 dB DNL contour, are generally compatible when an interior noise level reduction of 25 dB is incorporated into the design and construction of the structure. Special consideration also needs to be

[13] https://ejscreen.epa.gov/mapper/



Map Unit Symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3775	Muir silt loam, rarely flooded	All areas are prime farmland	18.3	2.5%
3843	Geary silt loam, 1 to 3 percent slopes	All areas are prime farmland	8.6	1.2%
3844	Geary silt loam, 3 to 7 percent slopes	All areas are prime farmland	12.6	1.7%
3884	Kenesaw silt loam, 2 to 5 percent slopes	All areas are prime farmland	11.8	1.6%
3886	Kenesaw silt loam, 5 to 12 percent slopes	Farmland of statewide importance	18.8	2.5%
3919	Smolan silt loam, 1 to 3 percent slopes	All areas are prime farmland	18.8	2.5%
3920	Smolan silt loam, 3 to 7 percent slopes	Farmland of statewide importance	31.4	4.2%
3923	Smolan silty clay loam, 3 to 7 percent slopes, eroded	Farmland of statewide importance	4.2	0.6%
4018	Chase silty clay loam, very rarely flooded	All areas are prime farmland	316.2	42.8%
7106	Eudora-Bismarckgrove silt loams, rarely flooded	All areas are prime farmland	40.8	5.5%
7107	Bismarckgrove-Kimo complex, rarely flooded	All areas are prime farmland	64.2	8.7%
7123	Eudora silt loam, rarely flooded	All areas are prime farmland	2.9	0.4%
7170	Reading silt loam, rarely flooded	All areas are prime farmland	23.9	3.2%
7171	Reading silt loam, moderately wet, rarely flooded	All areas are prime farmland	12.8	1.7%
7174	Reading silt loam, 1 to 3 percent slopes	All areas are prime farmland	4.1	0.6%
7176	Rossville silt loam, very rarely flooded	All areas are prime farmland	137.9	18.7%
7690	Wymore-Kennebec complex, 0 to 17 percent slopes	Not prime farmland	12.1	1.6%
Totals for Area of Interest			**739.3**	**100.0%**

given to noise-sensitive areas within Section 4(f) properties where the land use compatibility guidelines in 14 CFR 150 do not account for the value, significance, and enjoyment of the area in question (FAA 2015).

Noise-sensitive land uses near the airport consist primarily of residential uses to the east, northeast, and southwest. A Part 150 study was prepared for MHK in 2009. At that time, there were noise-sensitive land uses within the 65 DNL noise contours for the airport.

The City of Manhattan Zoning Regulations establishes an Airport Overlay District which includes an Airport Noise Exposure Zone, based on the airport's 65 DNL noise contour, that restricts various land uses.[14] Within this zone, the following land uses are prohibited: residences and manufactured home parks. The following uses are conditionally permitted if appropriate noise attenuation is incorporated into the design and construction of the buildings: hotels, lodging/boarding houses, bed and breakfast; hospitals, nursing homes, retirement complexes; schools; churches, chapels, temples and synagogues; and auditoriums and concert halls.

Areas adjacent to the airport that are not within the City of Manhattan are subject to the Riley County zoning map and ordinance. Riley County has adopted a Noise Hazard designation which prohibits all residential land uses within the boundary of the Airport Noise Exposure Zone.[15]

Exhibit 1Q depicts the City of Manhattan and Riley County zoning overlay and zones.

SOCIOECONOMICS, ENVIRONMENTAL JUSTICE, AND CHILDREN'S ENVIRONMENTAL HEALTH AND SAFETY RISKS

General socioeconomic information, such as population and economic trends, are addressed earlier in this chapter. However, FAA Order 1050.1F specifically requires that a federal action causing disproportionate impacts to an environmental justice population (i.e., a low-income or minority population), be considered, as well as an evaluation of environmental health and safety risks to children. The EPA's *EJSCREEN* online tool was consulted regarding the presence of environmental justice areas within the airport environs. Within five miles of the airport, 27 percent of the population is considered low-income and 21 percent is considered a minority population.

WATER RESOURCES

The City of Manhattan holds a Kansas Water Pollution Control General Municipal Separate Storm Sewer (MS4) Permit which pertains to stormwater conveyance systems throughout the city, including the airport. Surface water runoff from the airport is collected through a system of underground storm sewers and surface drainage pipes over the runways, taxiways, streets, ditches and drainage canals. Any airport

[14] https://cityofmhk.com/DocumentCenter/View/645/Article-XI---Airport-Overlay-District--
[15] https://www.rileycountyks.gov/DocumentCenter/View/10218/N--Section-9A---Noise-Hazard-pdf

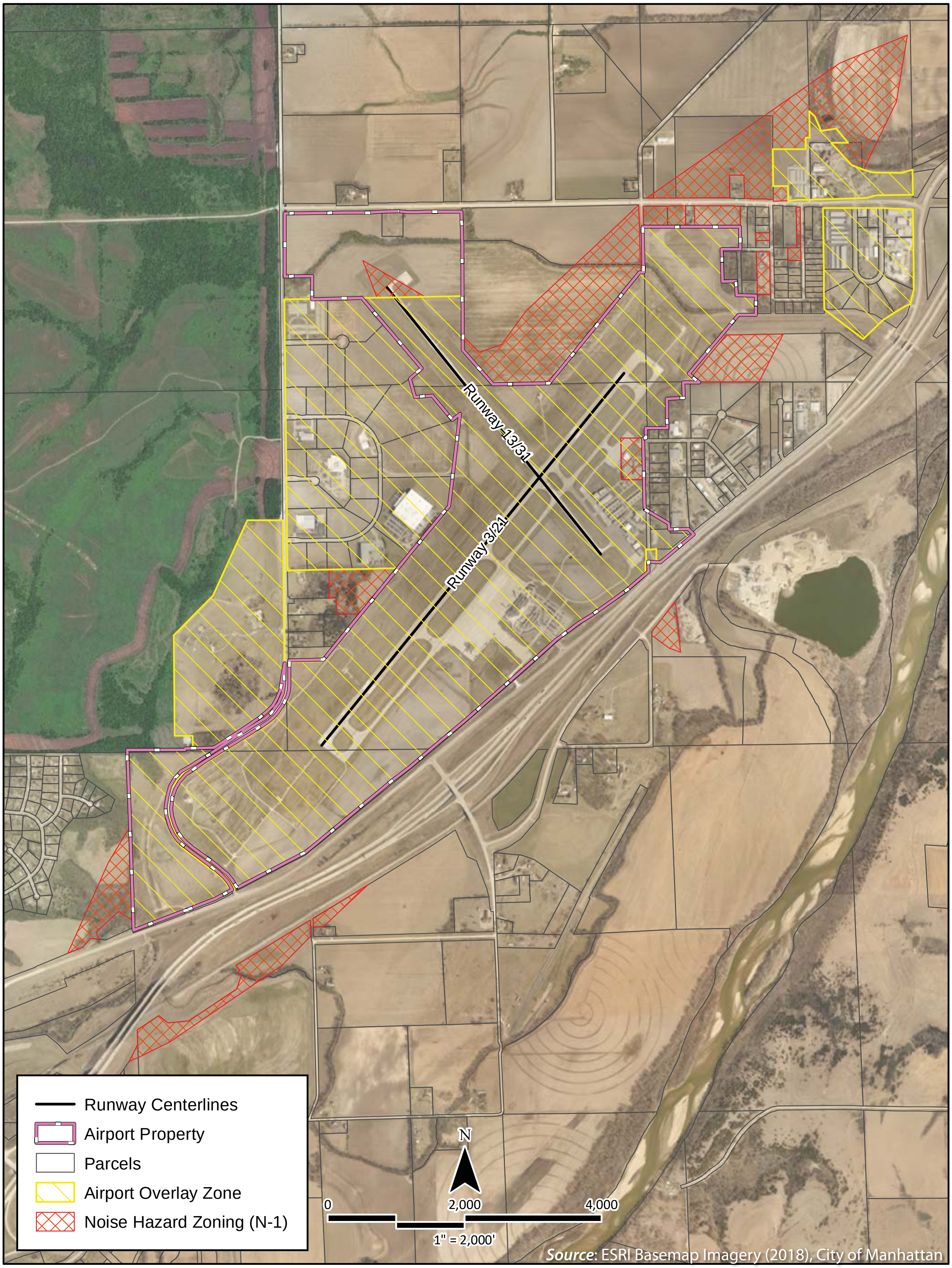


Exhibit 1Q
ZONING AND OVERLAY ZONES

tenant that conducts industrial activity participated in a survey at the time of the plan's creation to identify sources of storm water pollution. These point sources of pollution included everything from aircraft fuel and washing to landscape and green space maintenance. There is no evidence that suggests any of the present airport activities have contributed any significant amount of pollutants into the storm water system. Environmental sensitivities near the airport are depicted on **Exhibit 1R**.

Wetlands. The U.S. Army Corps of Engineers regulates the discharge of dredged and/or fill material into waters of the United States, including adjacent wetlands, under Section 404 of the *Clean Water Act*. Wetlands are defined in Executive Order 11990, *Protection of Wetlands*, as "those areas that are inundated by surface or groundwater with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetation or aquatic life that requires saturated or seasonably saturated soil conditions for growth and reproduction." Wetlands can include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mud flats, natural ponds, estuarine areas, tidal overflows, and shallow lakes and ponds with emergent vegetation. Wetlands exhibit three characteristics: the soil is inundated or saturated to the surface at some time during the growing season (hydrology), has a population of plants able to tolerate various degrees of flooding or frequent saturation (hydrophytes), and soils that are saturated enough to develop anaerobic conditions during the growing season (hydric).

According to USFWS, which manages the National Wetlands Inventory on behalf of all federal agencies, there are drainages identified as wetlands on the airport. It is important to note that these areas were identified as wetlands based on a review of aerial photography dated 1985 and may no longer be present. Additionally, based on information from the NRCS-WSS, there are no hydric soils present on airport property.

Floodplains. Executive Order 11988 directs federal agencies to take action to reduce the risk of flood loss, minimize the impact of floods on human safety, health, and welfare, and restore and preserve the natural and beneficial values served by the floodplains. Based on a review of Federal Emergency Management Agency (FEMA) maps dated March 16, 2015, much of the airport property north-northeast of Runway 13-31 and north of the Runway 13 end is identified as a Special Flood Hazard Area, which is subject to flooding by a 100-year flood event.

Surface Waters. The *Clean Water Act* provides the authority to establish water quality standards, control discharges, develop waste treatment management plans and practices, prevent or minimize the loss of wetlands, and regulate other issues concerning water quality. Water quality concerns related to airport development most often relate to the potential for surface runoff and soil erosion, as well as the storage and handling of fuel, petroleum products, solvents, etc. Additionally, Congress has mandated (under the *Clean Water Act*) the National Pollutant Discharge Elimination System (NPDES). Using NPDES permits, certain procedures are required to prevent contamination of water bodies from storm water runoff.

Examples of direct impacts to surface waters include any in-water work resulting from expansion of an existing FAA facility adjacent to surface waters, or a withdrawal of water from a surface water for construction or operations. Sevenmile Creek and the Kansas River, located 0.5 mile south of the airport, are listed as impaired waters under Section 303(d) of the *Clean Water Act*. A review of the National

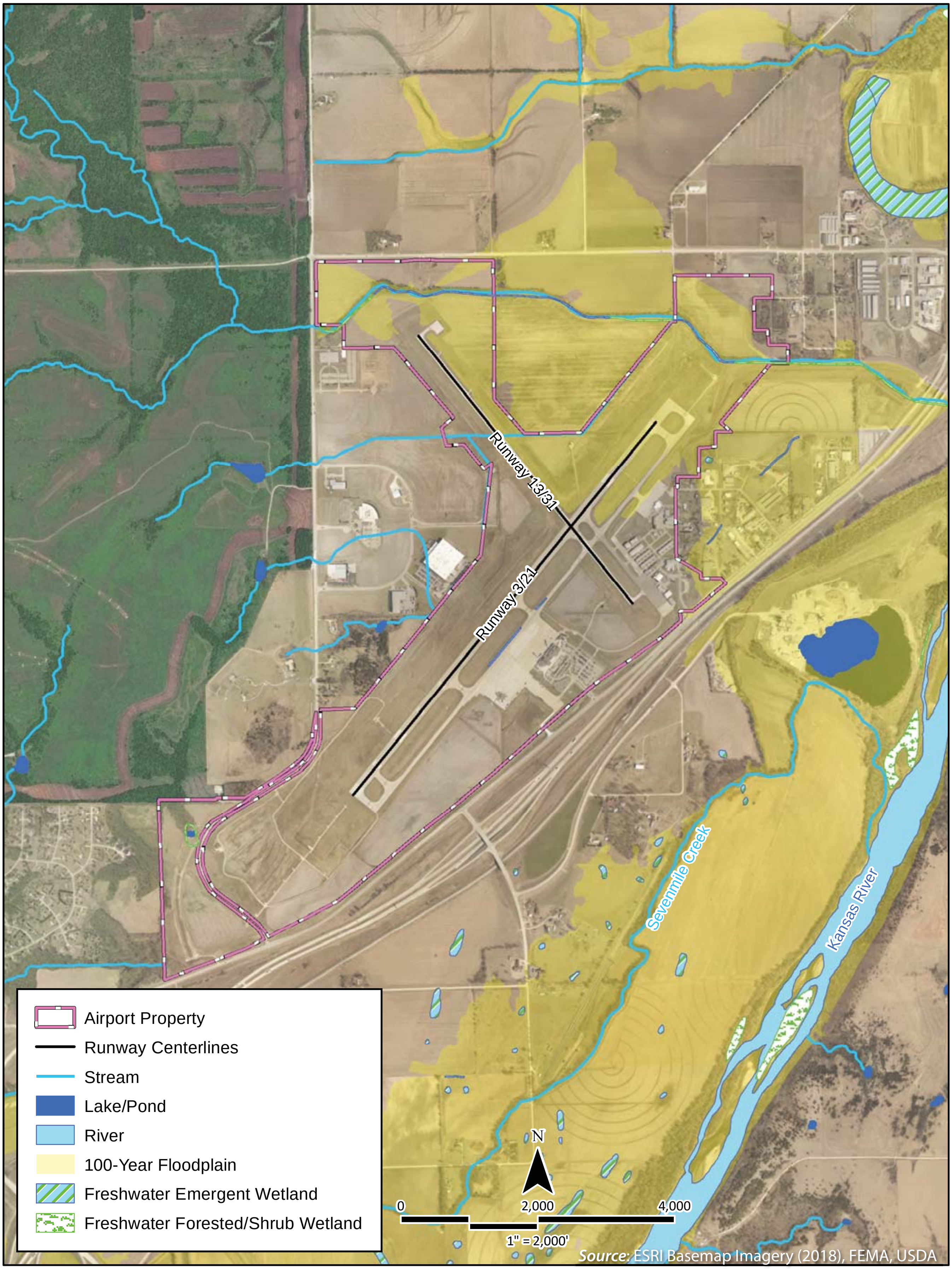


Exhibit 1R
ENVIRONMENTAL SENSITIVITIES

Hydrography Dataset, published by the United States Geological Survey, indicates there are drainage channels on airport property.

Groundwater. Groundwater is subsurface water that occupies the space between sand, clay, and rock formations. The term aquifer is used to describe the geologic layers that store or transmit groundwater, such as to wells, springs, and other water sources. Examples of direct impacts to groundwater could include withdrawal of groundwater for operational purposes, or reduction of infiltration or recharge area due to new impervious surfaces. There is no sole source aquifer near the airport. The airport is underlain by rock that is minimally permeable but may contact locally productive aquifers.[16]

ENVIRONMENTAL INVENTORY SOURCES

A variety of resources were used during the inventory process. The following listing reflects a compilation of these sources.

U.S. Environmental Protection Agency, Currently Designated Nonattainment Areas for All Criteria Pollutants:
https://www3.epa.gov/airquality/greenbook/anayo_ks.html

U.S. Environmental Protection Agency, *EJSCREEN*:
http://www.epa.gov/ejscreen

FEMA Flood Map Service Center:
https://msc.fema.gov/portal/search?AddressQuery=manhattan%20regional%20airport#searchresultsanchor

Natural Resources Conservation Service, Web Soil Survey:
http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

U.S. Fish and Wildlife Service Information, Planning and Consultation System:
https://ecos.fws.gov/ipac/

U.S. Fish and Wildlife Service National Wetlands Inventory:
http://www.fws.gov/wetlands/Data/Mapper.html

USGS National Map:
http://nationalmap.gov/

16 https://water.usgs.gov/ogw/aquifer/101514-wall-map.pdf

Chapter Two

FORECASTS

CHAPTER TWO

Forecasts

The definition of demand that may reasonably be expected to occur during the useful life of an airport's key components (e.g., runways, taxiways, terminal buildings, etc.) is an important factor in facility planning. In airport master planning, this involves projecting potential aviation activity for at least a 20-year timeframe. Aviation demand forecasting for Manhattan Regional Airport (MHK) will focus on demand indicators, including commercial airline passenger enplanements and operations, general aviation-based aircraft, based aircraft fleet mix, and operations, as well as military operations and overall operational peaking periods.

The Federal Aviation Administration (FAA) has oversight responsibility to review and approve aviation forecasts developed in conjunction with airport planning studies. In addition, aviation activity forecasts may be an important input to future benefit-cost analyses associated with airport development, and FAA reviews these analyses when federal funding requests are submitted.

The FAA will review individual airport forecasts with the objective of comparing them to its *Terminal Area Forecasts* (TAF) and the *National Plan of Integrated Airport Systems* (NPIAS). Even though the TAF is updated annually, it is developed by FAA personnel in Washington, D.C., and it is very common for a disparity to exist between the TAF and more localized master planning forecast efforts. Historically, the disparity was primarily due to the TAF forecasters' lack of knowledge about local conditions or recent trends. In recent years, however, the FAA has improved its forecast model to be a demand-driven forecast for aviation services based upon local and national economic conditions, as well as conditions within the aviation industry.

As stated in FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems* (NPIAS), forecasts should be:

- Realistic;
- Based on the latest available data;
- Reflective of current conditions at the airport (as a baseline);
- Supported by information in the study; and
- Able to provide adequate justification for airport planning and development.

This forecast effort was completed in October 2018 with a base year being the 12-months ending at various points of 2018 for varying demand segments as dictated by data availability. Thus, the FAA *Terminal Area Forecasts* published in January 2018 were utilized for comparison purposes. A summary of the TAF for MHK is presented in **Table 2A**. The following sections of this chapter will discuss the reasonableness of each forecast, as well as establish the opinion of range that will be utilized in the remainder of the master plan.

TABLE 2A
2018 FAA Terminal Area Forecast
Manhattan Regional Airport

	2018	2023	2028	2038
ENPLANEMENTS				
Air Carrier	2,514	2,514	2,514	2,514
Commuter	65,589	74,276	84,125	107,895
Total Enplanements	**68,103**	**76,790**	**86,639**	**110,409**
ANNUAL OPERATIONS				
Itinerant				
Air Carrier	689	689	689	689
Air Taxi	2,624	2,754	2,891	3,190
General Aviation	9,729	9,819	9,913	10,103
Military	927	927	927	927
Total Itinerant	**13,969**	**14,189**	**14,420**	**14,909**
Local				
General Aviation	10,602	10,762	10,925	11,256
Military	1,324	1,324	1,324	1,324
Total Local	**11,926**	**12,086**	**12,249**	**12,580**
Total Operations	**25,895**	**26,275**	**26,669**	**27,489**
Based Aircraft	**47**	**51**	**56**	**66**

Source: FAA Terminal Area Forecast (January 2018)

The forecast process for an airport master plan consists of a series of basic steps that vary in complexity depending upon the issues to be addressed and the level of effort required. The steps include a review of previous forecasts, determination of data needs, identification of data sources, collection of data, selection of forecast methods, preparation of the forecasts, and evaluation and documentation of the results. FAA Advisory Circular (AC) 150/5070-6B (Change 2), *Airport Master Plans*, outlines seven standard steps involved in the forecast process, including:

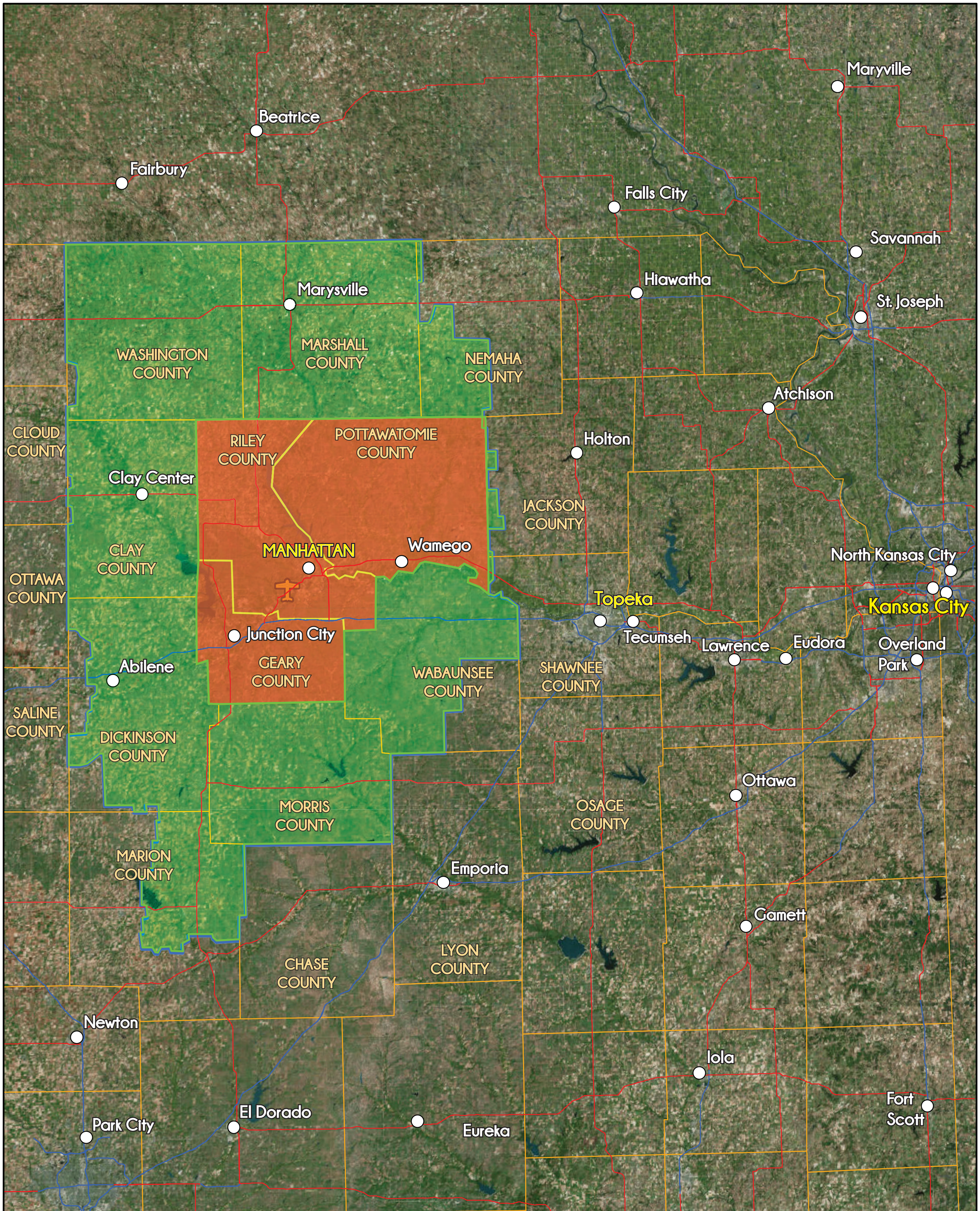
1) **Identify Aviation Activity Measures**: The level and type of aviation activates likely to impact facility needs. For general aviation, this typically includes based aircraft and operations.
2) **Review Previous Airport Forecasts**: May include the FAA *Terminal Area Forecast*, state or regional system plans, and previous master plans.
3) **Gather Data**: Determine what data are required to prepare the forecasts, identify data sources, and collect historical and forecast data.
4) **Select Forecast Methods**: There are several appropriate methodologies and techniques available, including regression analysis, trend analysis, market share or ratio analysis, exponential smoothing, econometric modeling, comparison with other airports, survey techniques, cohort analysis, choice and distribution models, range projections, and professional judgment.
5) **Apply Forecast Methods and Evaluate Results**: Prepare the actual forecasts and evaluate for reasonableness.
6) **Summarize and Document Results**: Provide supporting text and tables as necessary.
7) **Compare Forecast Results with FAA's TAF**: Follow guidance in FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*. In part, the Order indicates that forecasts should not vary significantly (more than 10 percent) from the TAF. When there is a greater than 10 percent variance, supporting documentation should be supplied to the FAA. (The FAA has provided additional guidance indicating forecasts are consistent with the TAF when they differ by less than 10 percent in the first five years, and less than 15 percent in the 10-year period.)

Aviation activity can be affected by many influences on the local, regional, and national levels, making it virtually impossible to predict year-to-year fluctuations of activity over 20 years with any certainty. Therefore, it is important to remember that forecasts are to serve only as guidelines, and planning must remain flexible enough to respond to a range of unforeseen developments.

The following forecast analysis for MHK was produced following these basic guidelines. Existing forecasts are examined and compared against current and historic activity. The historical aviation activity is then examined along with other factors and trends that can affect demand. The intent is to provide an updated set of aviation demand projections for MHK that will permit airport management to make planning adjustments as necessary to maintain a viable, efficient, and cost-effective facility.

COMMERCIAL PASSENGER AIRLINE AIRPORT SERVICE AREA

The initial step in determining the aviation demand for an airport is to define its generalized service area for various segments of aviation. The service area is determined primarily by evaluating the location of competing airports, their capabilities, their services, and their relative attraction and convenience. In determining the aviation demand for an airport, it is necessary to identify the role of the airport, as well as the specific areas of aviation demand the airport is intended to serve. For MHK, the primary roles are to accommodate commercial passenger airline service, as well as general aviation and even military demand in the region. **Exhibit 2A** presents the historically defined airport catchment area for MHK. The



LEGEND

Primary Service Area

Catchment (Secondary) Service Area

Aerial Source:
ESRI Basemap Imagery, 2017

Exhibit 2A: COMMERCIAL SERVICE AIRPORT SERVICE AREA catchment area generally outlines the area from which most of all demand at an airport will be generated. Most catchment areas are generously defined and include areas with high demand as well as more distant areas with very low influences.

Similarly, the airport service area is a geographic region from which an airport can be expected to attract the largest share of its aviation demand activity. The airport service area can further subdivided as either primary or secondary. The primary service area will offer the largest direct demand for airport services, while the secondary area generally follows a larger catchment definition where demand influences exist but are less abundant. It is important to begin all forecasting exercises by identifying or defining the service area, so it can then be used to identify other factors, such as socioeconomic and demographic trends, which influence aviation demand for the associated airport. Moreover, aviation demand will be impacted by the proximity of competing airports, the surface transportation network, and the strength of commercial airline and/or general aviation services provided by an airport and competing airports.

As in any business enterprise, the more attractive the facility is in terms of service and capabilities, the more competitive it will be in the market. If an airport's attractiveness increases in relation to nearby airports, so will the size of its service area. If facilities and services are adequate and/or competitive, some level of aviation activity might be attracted to an airport from more distant locales.

The most common criteria in an airline passenger's selection of an airport are the proximity (convenience) and airfare (ticket price); however, several other factors can influence the passenger's decision. Business travelers often prefer expedient travel and may pay higher airfares for that convenience. The business traveler also desires reliable service with the most options possible such as diverse destinations, frequency of flights, favorable departure or arrival times, etc. Leisure travelers typically make airfare the most important factor for choosing an airline and will often travel to a more distant airport for lower airfares. Discount airlines have proven nationwide that leisure passengers, and even some business travelers, will choose airports outside their local area due to low fares.

Another factor is the level of service offered from an airport. Level of service factors that can affect the secondary service area include frequency of service, number of airlines, size and/or type of aircraft, and nonstop destinations available. The biggest factor, however, tends to be airfare. Competition on routes and low-fare airlines are major factors that can draw vacation travelers to drive as much as three hours to a larger airport.

The service area of an airport is often generally defined by its proximity to other airports providing similar service. Currently, there are several airports in the region that offer varying levels of passenger commercial service. Many of these airports are in small regionalized markets served by a single commuter airline under Essential Air Service (EAS) contracts with very limited service options. MHK was historically similar, having been in the EAS program with service limitations; however, over the last ten years, the airport's passenger airline service has evolved away from a limited EAS model to a market competitive commuter airline via American Eagle. This service launched with scheduled daily service to Chicago's O'Hare International Airport (ORD), and then later with additional nonstop service to Dallas Fort Worth International Airport (DFW).

The most significant airports in the region offering commercial passenger airline service limiting the catchment area at MHK include Wichita Dwight D. Eisenhower National Airport (ICT) approximately 130 miles southeast, Lincoln Airport (LNK) approximately 140 miles north, and Kansas City International Airport (MCI) approximately 140 miles east/northeast of Manhattan. More proximate airports with historic and existing passenger airline service include those in Topeka, Salina, and Hays. These communities have had more limited offerings than the larger airports in Wichita, Lincoln, and Kansas City, although Hays' and Salina's current offering, United Express, links to both Denver and Chicago. All major airlines serve both Kansas City and Wichita as well as discount/low cost carriers. Lincoln is served by regional carriers for two major airlines.

MCI and ICT provide a much higher level of commercial airline passenger services than MHK, as they are served by all major and most low-cost passenger airlines. Both airports offer dozens of daily nonstop departures, with MCI directly linking to most U.S. major metropolitan areas and ICT to 13 cities. LNK also offers service which could be considered slightly higher than MHK, with both Delta and United Airlines offering 11 daily departures to three nonstop destinations (Minneapolis, Chicago, and Denver). All these factors notwithstanding, the two most significant factors for choosing an airport, convenience and airfare, place MHK in a strong position to continue to attract passengers, especially those within the primary service area of the Manhattan Combined Statistical Area (CSA).

The current and future concern for MHK would be the lack of frequency and/or non-stop destinations. MHK is currently served solely by American Eagle, providing six daily non-stops (three to ORD and three to DFW [October 2018]). American Eagle currently utilizes various regional jet aircraft in the Manhattan market with up to 70-passenger seats. In the future, the airline(s) will likely increase the aircraft size to include more 70-seat departures and/or the inclusion of 90-seat aircraft. In fact, American Airlines has indicated such, and this planning effort should include consideration of larger aircraft models in the near future. Future changes such as a western nonstop connection to Denver, or similar, would strengthen the airport's ability to attract passengers from its primary and secondary service areas.

Currently, MHK is served by a single scheduled airline, whereas MCI, ICT, and LNK are served by numerous airlines with multiple non-stop destinations. The only non-stop destinations served from MHK currently are ORD and DFW. Due to the proximity of several alternative airports that provide a wider range of carrier options and non-stop destinations, many people within the region can choose to drive to Kansas City, Wichita, or even Lincoln for flights, including low-cost options.

MHK's proximity to Interstate 70 and other regional traversing Interstates 29, 35 and 80 provides the greatest competition for airline passengers in Manhattan. These interstates offer convenient access to all major metropolitan areas in the region and provide direct linkage to competing airports. The interstate system also offers an inexpensive transportation mode for leisure travelers, especially families or other groups having several travelers.

In a highly competitive regional market such as this, it is unlikely that MHK will attract a significant number of travelers from outside the Manhattan CSA. Therefore, the planning analysis will consider the Manhattan CSA as the primary service area for MHK. The previously defined catchment area will be considered the secondary service area and will also influence aviation demand, albeit less significantly.

SOCIOECONOMIC TRENDS

The socioeconomic conditions provide an important baseline for preparing aviation demand forecasts. Local socioeconomic variables, such as population, employment, and income, are indicators for understanding the dynamics of the community and can relate to local trends in aviation activity. Analysis of the demographics of the airport service area will give a more comprehensive understanding of the socioeconomic situations affecting the region which supports MHK. The following is a summary of historical demographic trends as well as forecasts of those socioeconomic characteristics.

Exhibit 1N in the Inventory chapter summarized historical and forecast population, employment, and income estimates for the Manhattan CSA, which includes Riley, Geary, and Pottawatomie Counties. Over the next 20 years, the population of the Manhattan CSA is projected to add approximately 17,400 residents. This equates to a compound annual growth rate (CAGR) of 0.61 percent. Employment is projected to grow at a slightly faster rate of 0.70 percent CAGR. Total personal Income for Manhattan CSA is projected to grow at 1.38 percent CAGR.

FORECASTING APPROACH

The development of aviation forecasts proceeds through both analytical and judgmental processes. A series of mathematical relationships is tested to establish statistical logic and rationale for projected growth. However, the judgment of the forecast analyst, based upon professional experience, knowledge of the aviation industry, and assessment of the local situation, is important in the final determination of the preferred forecast. The most reliable approach to estimating aviation demand is through the utilization of more than one analytical technique. Methodologies frequently considered include trend line/time-series projections, correlation/regression analysis, and market share analysis.

Trend line/time-series projections are probably the simplest and most familiar of the forecasting techniques. By fitting growth curves to historical data, then extending them into the future, a basic trend line projection is produced. A basic assumption of this technique is that outside factors will continue to affect aviation demand in much the same manner as in the past. As broad as this assumption may be, the trend line projection does serve as a reliable benchmark for comparing other projections.

Correlation analysis provides a measure of direct relationship between two separate sets of historic data. Should there be a reasonable correlation between the data sets, further evaluation using regression analysis may be employed.

Regression analysis measures statistical relationships between dependent and independent variables, yielding a "correlation coefficient." The correlation coefficient (Pearson's "r") measures association between the changes in the dependent variable and the independent variable(s). If the "r^2" value (coefficient determination) is greater than 0.95, it indicates good predictive reliability. A value less than 0.95 may be used, but with the understanding that the predictive reliability is lower.

Market share analysis involves a historical review of the airport activity as a percentage, or share, of a larger regional, state, or national aviation market. A historical market share trend is determined, providing an expected market share for the future. These shares are then multiplied by the forecasts of the larger geographical area to produce a market share projection. This method has the same limitations as trend line projections but can provide a useful check on the validity of other forecasting techniques.

It is important to note that one should not assume a high level of confidence in forecasts that extend beyond five years. Facility and financial planning usually require at least a 10-year purview since it often takes more than five years to complete a major facility development program. However, it is important to use forecasts which do not overestimate revenue-generating capabilities or understate demand for facilities needed to meet public (user) needs.

NATIONAL AVIATION TRENDS

Each year, the FAA updates and publishes a national aviation forecast. Included in this publication are forecasts for the large air carriers, regional/commuter air carriers, general aviation, and FAA workload measures. The forecasts are prepared to meet budget and planning needs of the FAA and to provide information that can be used by state and local authorities, the aviation industry, and the general public. The current edition when this chapter was prepared was FAA *Aerospace Forecasts – Fiscal Years 2018-2038*, published in March 2018. The FAA primarily uses the economic performance of the United States as an indicator of future aviation industry growth. Similar economic analyses are applied to the outlook for aviation growth in international markets. The following discussion is summarized from the FAA Aerospace Forecasts.

Since its deregulation in 1978, the U.S. commercial air carrier industry has been characterized by boom-to-bust cycles. The volatility that was associated with these cycles was thought by many to be a structural feature of an industry that was capital intensive but cash poor. However, the great recession of 2007-09 marked a fundamental change in the operations and finances of U.S. airlines. Air carriers fine-tuned their business models to minimize losses by lowering operating costs, eliminating unprofitable routes, and grounding older, less fuel-efficient aircraft. To increase operating revenues, carriers initiated new services that customers were willing to purchase and started charging separately for services that were historically bundled in the price of a ticket. The industry experienced an unprecedented period of consolidation with three major mergers in five years. These changes, along with capacity discipline exhibited by carriers, have resulted in an eighth consecutive year of profitability for the industry in 2017. Looking ahead, there is optimism that the industry has been transformed from that of a boom-to-bust cycle to one of sustainable profits.

ECONOMIC ENVIRONMENT

According to the FAA forecast report, as the economy recovers from the most serious economic downturn and slow recovery since the Great Depression, aviation will continue to grow over the long run.

Fundamentally, demand for aviation is driven by economic activity. As economic growth picks up, so will growth in aviation activity. The FAA forecast calls for passenger growth over the next 20 years to average 1.9 percent annually. The uptick in passenger growth in 2016-2017 will continue into 2018 spurred on by favorable economic conditions in the U.S. and the world. The price of oil is projected to rise from around $48 per barrel in 2017 to $51 in 2018 and continue to rise, exceeding $100 by 2030 and approaching $119 by 2038.

U.S. economic performance in 2017 is estimated to have grown in real gross domestic product (GDP) to 17.0 trillion (inflation adjusted to 2009 dollars) and is forecast to grow at an average annual growth rate of 2.0 percent through 2038. Although the U.S. economy has managed to avoid a recession, a prolonged period of faster economic growth (e.g., > 3.0 percent) may not be forthcoming. Additional potential headwinds for the global economy include uncertainty surrounding "Brexit," recessions in Russia and Brazil, inconsistent performance in other emerging economies, a "hard landing" in China, and a lack of further stimulus in the advanced economies.

U.S. TRAVEL DEMAND

Mainline and regional carriers offer domestic and international passenger service between the U.S. and foreign destinations, although regional carrier international service is confined to the border markets in Canada, Mexico, and the Caribbean. According to FAA, four distinct trends are shaping today's commercial air carrier industry: (1) easing capacity discipline; (2) steady growth of seats per aircraft; (3) increasing competitive pressure due to ultra-low-cost carrier expansion; and (4) continued reliance on ancillary revenues.

With the approval of the Alaska Airlines/Virgin America merger, the outlook for further consolidation via mergers and acquisitions appears to be limited. There are now six major mainline airlines: American, Delta, United, Southwest, Alaska/Virgin, and JetBlue, which accounted for more than 85 percent of the U.S. airline industry capacity and traffic. It is highly unlikely the U.S. Government will approve any further mergers among these due to anti-trust regulations. In 2005, there were twelve major mainline airlines.

One of the most striking outcomes of industry restructuring has been the unprecedented period of capacity discipline (achieving higher passenger loads through scheduled flight and fleet mix consolidation primarily), especially in domestic markets. Between 1978 and 2000, available seat miles (ASMs) in domestic markets increased at an average annual rate of four percent per year, recording only two years of decline. Even though domestic ASMs shrank by 6.9 percent in fiscal year (FY) 2002, following the events of September 11, 2001, growth resumed and by FY 2007, domestic ASMs were 3.6 percent above the FY 2000 level. Since 2009, U.S. domestic ASMs have increased at an average rate of 2.1 percent per year while revenue passenger miles (RPMs) have grown 2.8 percent per year.

In 2017, mainline carriers provided nine percent more capacity than they did in 2007, while carrying 11.8 percent more passengers. Capacity flown by the regional group has shrunk by 2.8 percent over the same period (with passengers carried down 5.1 percent).

The regional market has continued to shrink as the regionals compete for even fewer contracts with the remaining dominant carriers; this has meant slow growth in enplanements and yields. The regionals have less leverage with the mainline carriers than they have had in the past and are facing large pilot shortages and tighter regulations regarding pilot training. Labor costs are also increasing as they raise wages to combat the pilot shortage. Their capital costs have increased in the short-term as they continue to replace their 50-seat regional jets with more fuel-efficient 70-seat jets. This move to the larger aircraft will prove beneficial in the future, however, since their unit costs are lower.

Another continuing trend is that of ancillary revenues. Carriers generate ancillary revenues by selling products and services beyond that of an airplane ticket to customers. This includes the un-bundling of services previously included in the ticket price, such as checked bags and on-board meals, and by adding new services, such as boarding priority and internet access. Although U.S. passenger carriers posted record net profits in 2016, profits declined in 2017 on rising fuel and labor costs and flat yields.

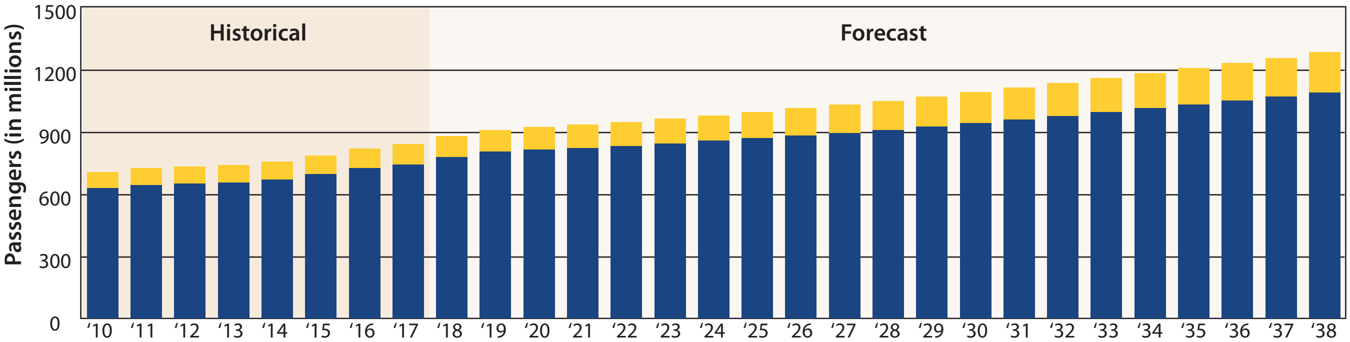
FAA COMMERCIAL AIR CARRIER FORECASTS

U.S. commercial air carriers' total number of domestic departures rose in 2016 for the first time since 2007, but then pulled back in 2017 and are about 18 percent below the 2007 level. ASMs, revenue passenger miles (RPMs), and enplanements all grew in each of the past six years; these trends underlie the expanding size of aircraft and higher load factors. In 2017, the domestic load factor came off a historic high reached the year before, but at 84.5 percent, remains near the peak for commercial air carriers. System capacity growth was up 2.9 percent in 2017, with U.S. carriers prioritizing domestic capacity over the international market. U.S. carrier domestic capacity growth will exceed their international capacity growth in 2018, but carriers will start expanding capacity in international markets faster than domestic markets beginning in 2019. This trend is projected to continue through 2038.

Supported by a growing U.S. and world economy, year-over-year RPM growth is forecast to be 2.4 percent on average over the period from 2018-2038. Over the same time, system capacity growth averages 2.3 percent per year and system enplanements are projected to increase an average of 1.9 percent a year, with mainline carriers growing at 2.0 percent a year – slightly higher than their regional counterparts (up 1.6 percent). By 2038, U.S. commercial air carriers are projected to fly 1.884 trillion ASMs and transport 1.284 billion enplaned passengers – a total of 1.596 trillion passenger miles. Planes will remain crowded, with load factors projected to grow to 84.7 percent in 2038 (up 1.2 points compared to the beginning of the forecast period in 2017).

Increases in passenger volume and traffic offset flat yields and, along with higher ancillary revenues and relatively low fuel prices, resulted in U.S. carriers being solidly profitable in 2017. Over the long-term, the FAA sees a competitive and profitable aviation industry characterized by increasing demand for air travel and airfares growing more slowly than inflation, reflective of a growing U.S. and global economy. **Exhibit 2B** presents the annual historical and forecast enplanement totals for both large air carriers and commuter airlines in the U.S. as forecast by the FAA.

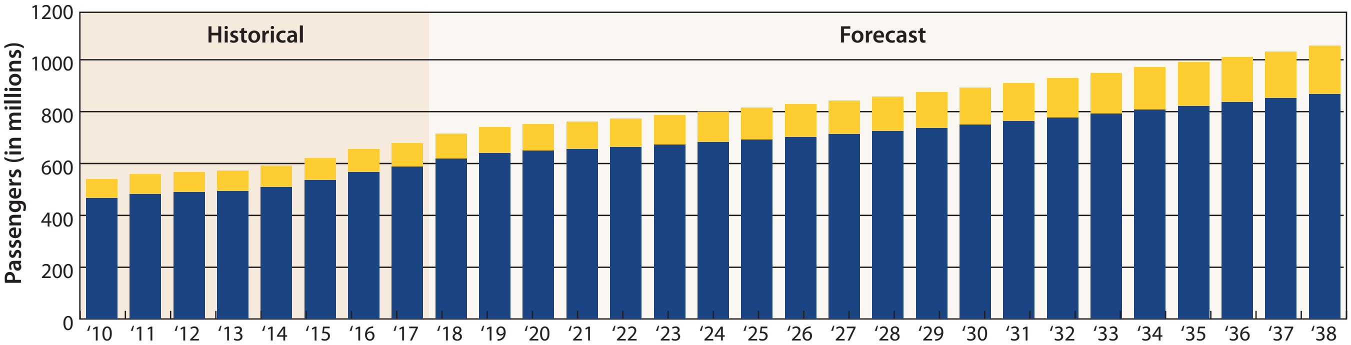
U.S. AIR CARRIER PASSENGER ENPLANEMENTS



SOURCE	2017	2023	2028	2038	AAGR 2018-2038
Domestic Revenue Enplanements	743	844	909	1,090	1.7%
International Revenue Enplanements	97	119	140	194	3.3%
TOTAL	840	964	1,050	1,284	1.9%

Note: All figures measured in millions

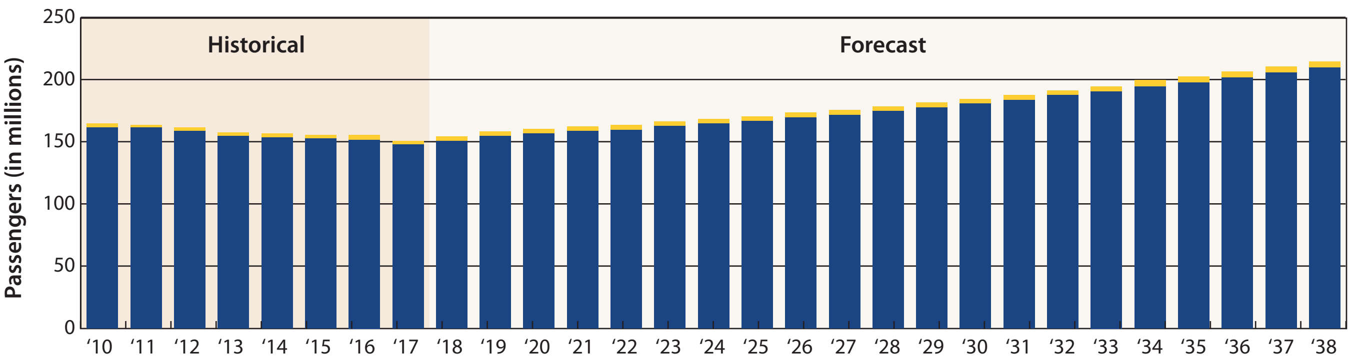
U.S. MAINLINE AIR CARRIER PASSENGER ENPLANEMENTS



SOURCE	2017	2023	2028	2038	AAGR 2018-2038
Domestic Revenue Enplanements	595	682	734	880	1.7%
International Revenue Enplanements	93	115	136	189	3.3%
TOTAL	689	797	871	1,069	2.0%

Note: All figures measured in millions

U.S. REGIONAL AIR CARRIER PASSENGER ENPLANEMENTS



SOURCE	2017	2023	2028	2038	AAGR 2018-2038
Domestic Revenue Enplanements	148	163	175	210	1.6%
International Revenue Enplanements	3	4	4	5	1.6%
TOTAL	152	166	179	215	1.6%

Note: All figures measured in millions. Totals may not equal due to rounding
Source: FAA Aerospace Forecast - Fiscal Years 2018-2038

FAA COMMERCIAL AIRCRAFT FLEET FORECAST

The number of aircraft in the U.S. commercial fleet is forecast to increase from 7,141 in 2017 to 8,290 in 2038 fueled by increased demand for air travel and air cargo. The number of jets in the fleet is forecast to add 45 new jets a year as carriers continue to remove older, less fuel-efficient narrow body aircraft. The narrow body fleet (including E-series aircraft at JetBlue and C-series at Delta) is projected to grow 27 aircraft a year as carriers replace the 757 fleet and current technology 737 and A320 family aircraft with the next generation MAX and Neo families. The regional carrier fleet is forecast to decline by 120 aircraft by 2038 as carriers remove 50-seat regional jets and retire older small turboprop and piston aircraft, while adding 70-90 seat regional jets, especially the E-2 family after 2020. By 2030, only a handful of 50-seat regional jets remain in the fleet. By 2038, the number of jets in the regional carrier fleet totals 1,910, up from 1,644 in 2017. Turboprop/piston aircraft in the fleet is forecast to shrink by 79 percent by 2038. **Exhibit 2C** presents the FAA commercial aircraft fleet forecast through 2038.

For a nonhub, primary commercial service airport, such as Manhattan Regional Airport, forecasts of commercial airline passenger enplanements and operations, general aviation-based aircraft and operations, and peak activity levels are the most basic indicators of future demand. Future facility requirements, such improved airfield facilities like runways and taxiways, airline terminal complex component spaces, general aviation hangars, and apron areas, are derived from these projections. The remainder of this chapter will examine differing aviation demand segments based on the airport's service area and other influential factors.

COMMERCIAL AIRLINE PASSENGER SERVICE FORECASTS

MHK is a primary commercial service airport categorized as a non-hub airport by the FAA. Non-hub primary commercial service airports account for less than 0.05 percent of domestic enplanements and have more than 10,000 enplanements. As of October 2018, MHK had scheduled passenger service provided by a single carrier, American Eagle (operated by Envoy and ExpressJet Airlines), which is a regional commuter carrier for American Airlines. American Eagle provides service to ORD and DFW utilizing the 44-, 50-, and 65-seat commuter airplanes (ERJ 135/140/145, CRJ 200/700). As of October 2018, there are five departure and arrival flights from MHK every day except Saturday, which has four departures and arrivals. Two daily departures link to ORD and three departures to DFW. The Saturday operation reduction is a DFW flight, leaving two flights each to ORD and DFW.

The airport is also utilized for nonscheduled charter passenger airline service in support of Kansas State University (KSU) athletic teams and military mobilization associated with Fort Riley. These operations are based solely on need and are irregular; however, the overall demand levels have remained relatively stable over the last decade as will be defined in following sections.

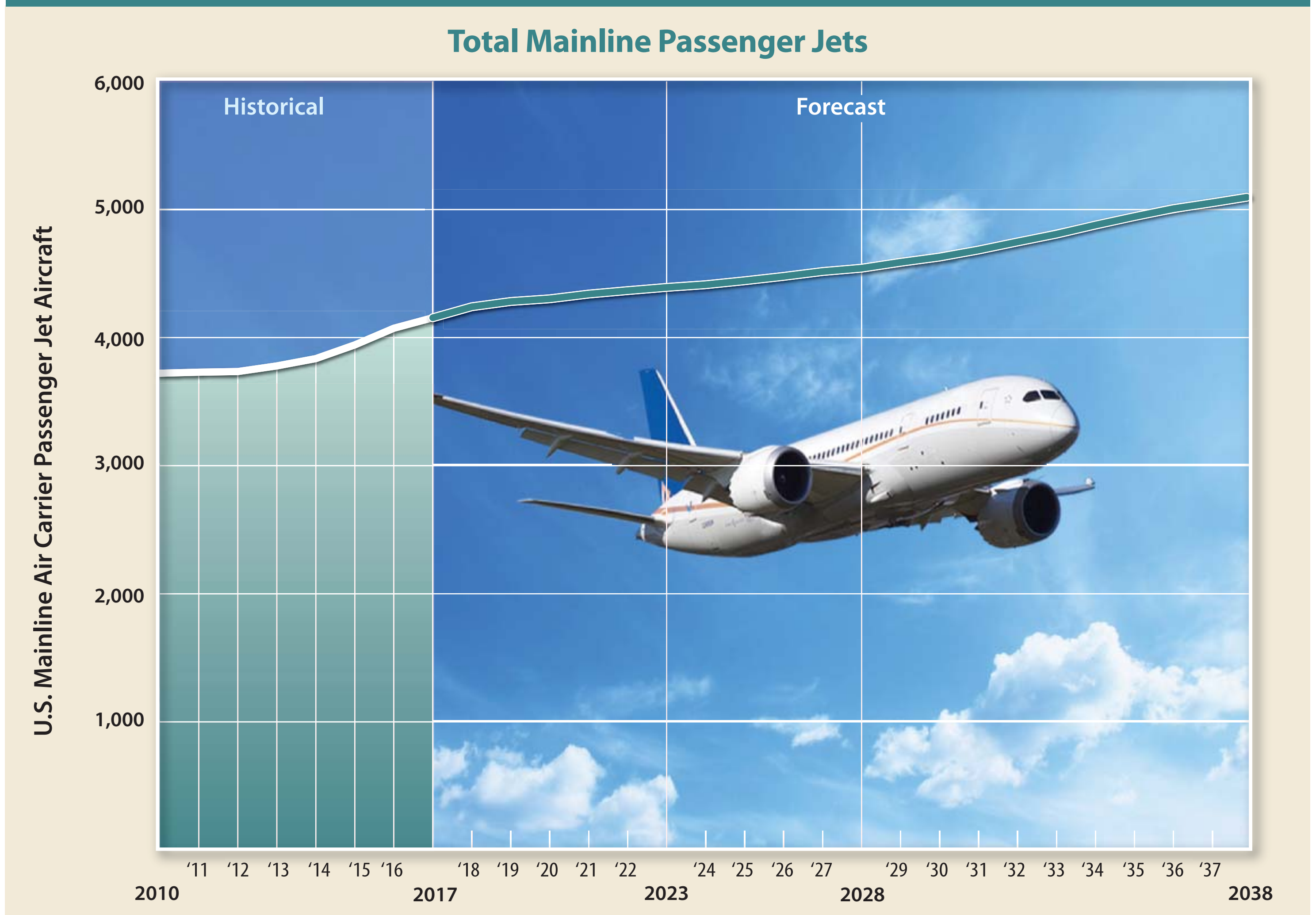
To evaluate commercial service potential at MHK and the facilities necessary to properly accommodate present and future airline activity, two basic elements must be forecast: annual enplaned passengers and annual airline operations. Annual enplaned passengers serve as the most basic indicator of demand

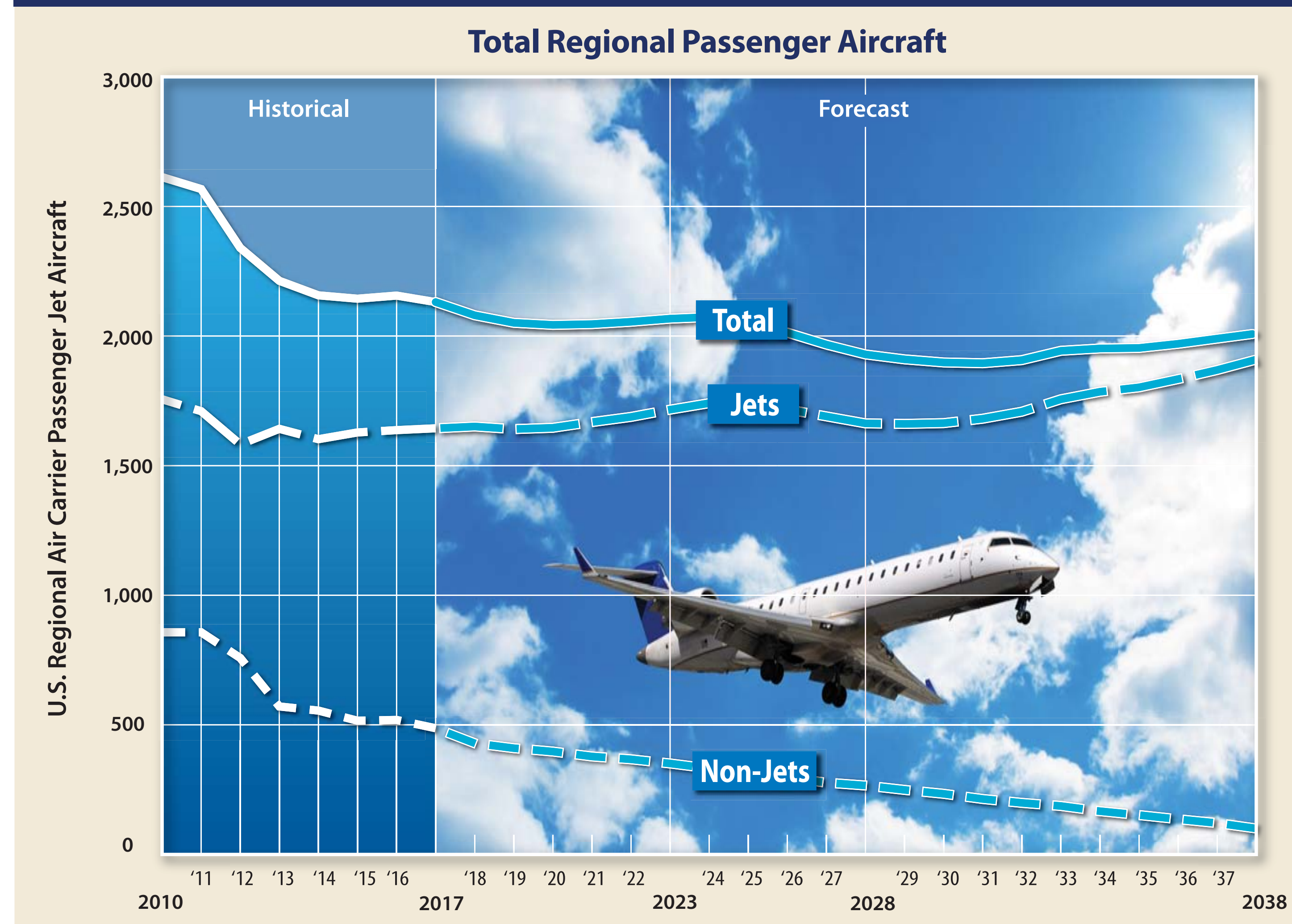
U.S. MAINLINE AIR CARRIER PASSENGER JET AIRCRAFT

	2017	2023	2028	2038	AAGR 2018-2038
Large Narrow Body					
2 Engine	3,539	3,710	3,844	4,190	0.7%
3-4 Engines	1	1	0	0	N/A
Large Wide Body					
2 Engine	517	601	619	833	2.3%
3-4 Wide Body Engines	0	0	0	0	N/A
Total Large Jets	4,057	4,312	4,463	5,023	1.0%
Total Regional Jets	98	80	79	78	-1.1%
Total Mainline Passenger Jets	4,155	4,392	4,542	5,101	0.9%

U.S. REGIONAL AIR CARRIERS PASSENGER AIRCRAFT

	2017	2023	2028	2038	AAGR 2018-2038
Less than 30 Seats					
Turboprop	396	278	200	49	-9.3%
31-40 Seats					
Turboprop	26	20	14	4	-8.8%
Over 40 Seats					
Turboprop	65	53	52	48	-0.7%
Jet	1,644	1,716	1,663	1,910	0.7%
Non-Jet Total	487	351	266	101	-7.0%
Jet Total	1,644	1,716	1,663	1,910	0.7%
Total Regional Passenger Aircraft	2,131	2,067	1,929	2,011	-0.2%





Source: FAA Aerospace Forecast - Fiscal Years 2018-2038

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for commercial passenger service activity. The combination of enplanements and deplanements generally equals the total passengers using an airport. The annual number of enplanements is the figure utilized by the FAA to determine various entitlement funding levels for commercial service airports.

The term "enplanement" refers to a passenger boarding an airline flight. Enplaning passengers are then described in terms of either "originating" or "connecting/transferring." Originating passengers depart a specific airport for a destination or hub airport to connect/transfer to another flight. Connecting/transferring passengers are those who have departed from another location and are using the airport as an intermediate stop. These passengers may disembark their originating flight to wait in the terminal for their next flight or could simply remain on the aircraft at an intermediary stop as a "through" passenger. MHK and airports like it have almost exclusively originating passengers, while larger hubs like those in Denver, Dallas, or Chicago could have a more significant percentage of passengers who are connecting/transferring.

HISTORICAL AIRLINE PASSENGER ACTIVITY

Table 2B provides a history of commercial airline passenger enplanements at MHK since 2006. The data includes both regularly scheduled airline enplanements and nonscheduled charter enplanements. Over the past 12 years, MHK has experienced increasing passenger activity year-over-year with the only exceptions being 2007, 2013, and 2016. The CAGR over the 12-year period is 14.4 percent, slowing to 6.3 percent since 2010 and an even reduced 2.11 percent over the last five years (since 2013). Obviously, the rapid enplanement growth from 2006 to 2012 is the direct result of improved airline service including markets served and aircraft utilized. While continued growth has followed, it has slowed to a more typical rate.

TABLE 2B
Historical Total Enplanements
Manhattan Regional Airport

Year	Regular Scheduled Enplanements	Charter Enplanements	Total Enplanements
2006	10,860	4,109	14,969
2007	11,313	2,681	13,994
2008	11,649	4,311	15,960
2009	19,225	5,841	25,066
2010	39,246	5,333	44,579
2011	54,340	4,078	58,418
2012	62,236	6,713	68,949
2013	62,459	3,452	65,911
2014	63,229	2,811	66,040
2015	63,814	2,467	66,281
2016	60,035	3,212	63,247
2017	66,206	2,994	69,200
2018*	69,875	3,287	73,162

* Includes enplanements for 12 months ending September 2018

EXISTING FORECASTS OF TOTAL PASSENGER ENPLANEMENTS

There are three existing forecasts of total enplanement activity at MHK to consider:

- 2009 Airport Master Plan (base year 2007)
- 2011 Terminal Area Master Plan (base year 2010)
- FAA *Terminal Area Forecast* (base year 2017)

While the 2009 Master Plan and 2011 Terminal Area Master Plan, or TAP, provide important background information, it should be noted that the forecasts from each are somewhat dated. The previous Master Plan forecasts are now 11 years old, and those from the TAP are eight years old. During that time period, significant events occurred that greatly impacted the industry, including a recession and airline restructuring and consolidation.

As previously noted, the FAA TAF forecast is published annually and is utilized by the FAA as a starting point for considering the reasonableness of master plan forecasts. **Table 2C** and **Exhibit 2D** present the three total enplanement forecasts developed previously for MHK. The actual historical enplanements for MHK are also included for comparative purposes. As can be seen, the previous master plan enplanement projection trails actual enplanements by more than 10,000 in 2017. The 2011 TAP total enplanement projection exceeded actual 2015 totals by more than 15,000, and still remains well above actual counts. As a result, the previous master plan and TAP projections are no longer reliable for use in this study and will only be utilized for comparative purposes. Only the 2018 FAA TAF will be given further consideration.

TABLE 2C
Historical Total Enplanement Forecasts
Manhattan Regional Airport

Year	2009 Master Plan	2011 TAP Master Plan	2018 TAF	Actual
2007	20,273			13,994
2010		44,483		44,579
2012	20,273			68,949
2015		81,451		66,281
2017	58,950		66,491	69,200
2020		92,480	71,448	
2023			76,790	
2027	73,950		84,571	
2028			86,639	
2030		111,031	90,930	
2038			110,409	
CAGR	6.7%	4.7%	2.4%	17.3%

REGULARLY SCHEDULED COMMERCIAL AIRLINE PASSENGER ENPLANEMENT FORECASTS

As discussed in this chapter's introduction, the first step involved in updating an airport's forecasts includes reviewing previous forecasts in comparison to actual activity to determine what changes, if any, may be necessary. After that comes the consideration of any new factors that could impact the forecasts, such as changes in the socioeconomic climate or the effects of changes in passenger air carrier services.

Top 20 Destination Markets

The U.S. Department of Transportation (DOT) maintains a rolling quarterly survey of 10 percent of all airline tickets sold for each commercial service airport. This Origin & Destination (O&D) Survey provides information on passengers' starting and ending cities and shows the volume of traffic between city pairs. The figures do not include "through" connecting/transfer passengers.

Year	ENPLANEMENTS			ITINERANT OPERATIONS					LOCAL OPERATIONS				Based Aircraft
	AC	Com	Total	AC	AT	GA	Mil	Subtotal	GA	Mil	Subtotal	TOTAL	
2009 MHK MASTER PLAN													
2007	6,930	13,343	20,273	210	3,196	12,543	1,341	17,290	10,685	4,245	14,930	32,220	43
FORECASTS													
2012	6,930	20,040	26,970	210	3,152	13,500	1,000	17,862	11,300	5,800	17,100	34,962	45
2017	28,510	30,440	58,950	864	3,152	14,600	1,740	20,356	11,800	5,960	17,760	38,116	49
2027	28,510	45,440	73,950	864	3,880	16,900	1,740	23,384	12,600	5,960	18,560	41,944	55
2011 MHK TERMINAL AREA MASTER PLAN													
2010	N/A	N/A	44,483	100	3,148	8,278	516	12,042	7,515	232	7,747	19,789	45
FORECASTS													
2015	N/A	N/A	81,451	972	2,339	9,371	1,066	13,748	7,229	761	7,990	21,738	47
2020	N/A	N/A	92,480	1,227	2,501	9,993	1,066	14,787	7,708	761	8,469	23,256	50
2030	N/A	N/A	111,031	1,723	2,548	11,823	1,066	17,160	9,120	761	9,881	27,041	60
2018 FAA TAF													
1990	-	20,691	20,691	-	7,122	21,000	500	28,622	15,000	-	15,000	43,622	48
1991	859	17,160	18,019	-	4,086	13,936	3,396	21,418	17,094	-	17,094	38,512	46
1992	821	19,827	20,648	-	3,633	14,247	3,396	21,276	14,977	-	14,977	36,253	50
1993	1,598	19,258	20,856	100	3,633	14,247	3,396	21,376	14,977	-	14,977	36,353	50
1994	3,474	19,731	23,205	100	3,880	12,950	2,780	19,710	10,030	-	10,030	29,740	40
1995	1,586	16,816	18,402	100	4,380	12,950	2,780	20,210	10,030	-	10,030	30,240	40
1996	1,510	16,318	17,828	100	4,246	13,919	2,626	20,891	11,213	-	11,213	32,104	47
1997	1,306	19,037	20,343	100	4,177	14,642	2,375	21,294	9,004	-	9,004	30,298	47
1998	3,072	18,486	21,558	68	4,277	14,911	2,375	21,631	9,321	-	9,321	30,952	50
1999	3,247	15,288	18,535	54	4,322	14,970	1,296	20,642	9,567	-	9,567	30,209	45
2000	2,133	12,459	14,592	33	4,343	14,970	1,296	20,642	9,567	-	9,567	30,209	45
2001	2,700	11,866	14,566	100	4,029	19,075	1,713	24,917	17,690	-	17,690	42,607	54
2002	5,020	9,216	14,236	139	2,224	10,979	792	14,134	8,928	470	9,398	23,532	54
2003	1,786	7,164	8,950	141	3,103	15,527	1,071	19,842	10,257	370	10,627	30,469	54
2004	1,909	4,646	6,555	64	2,721	14,909	1,226	18,920	10,924	310	11,234	30,154	54
2005	2,656	10,432	13,088	180	2,836	13,876	989	17,881	10,614	426	11,040	28,921	54
2006	2,248	10,919	13,167	81	2,809	11,681	768	15,339	8,258	664	8,922	24,261	45
2007	2,451	11,586	14,037	130	2,357	11,179	1,145	14,811	9,465	3,740	13,205	28,016	45
2008	1,689	12,068	13,757	104	2,988	10,980	533	14,605	8,398	185	8,583	23,188	45
2009	4,140	13,723	17,863	181	4,035	8,683	832	13,731	5,972	1,196	7,168	20,899	45
2010	1,370	36,763	38,133	102	3,652	8,386	712	12,852	7,869	928	8,797	21,649	45
2011	1,732	50,681	52,413	75	2,720	8,568	485	11,848	7,817	462	8,279	20,127	45
2012	3,260	61,644	64,904	163	3,029	9,465	971	13,628	7,824	1,944	9,768	23,396	45
2013	3,533	60,653	64,186	100	3,231	9,890	900	14,121	8,794	1,293	10,087	24,208	46
2014	6,434	59,815	66,249	175	3,443	10,236	897	14,751	8,831	640	9,471	24,222	46
2015	1,904	63,141	65,045	50	3,010	10,279	1,229	14,568	10,352	1,428	11,780	26,348	46
2016	2,320	62,034	64,354	90	2,939	7,838	1,430	12,297	5,409	2,040	7,449	19,746	46
2017	2,514	63,977	66,491	689	2,598	9,096	927	13,310	9,664	1,324	10,988	24,298	47
2018	2,514	65,589	68,103	689	2,624	9,729	927	13,969	10,602	1,324	11,926	25,895	47
PROJECTIONS													
2023	2,514	74,276	76,790	689	2,754	9,819	927	14,189	10,762	1,324	12,086	26,275	51
2028	2,514	84,125	86,639	689	2,891	9,913	927	14,420	10,925	1,324	12,249	26,669	56
2038	2,514	107,895	110,409	689	3,190	10,103	927	14,909	11,256	1,324	12,580	27,489	66

KEY: AC - Air Carrier; **COM** - Commercial; **AT** - Air Taxi; **GA** - General Aviation; **MIL** - Military

Exhibit 2D
OTHER HISTORICAL FORECASTS

Information obtained from the O&D Survey provides final destinations for those traveling from MHK. Destination data is typically useful in examining the strength of the local market to and from other markets. **Exhibit 2E** shows the top 20 markets for 2008, 2013, and 2018 (12 months ending June 2018). The top 20 market enplanements account for 55 percent of all scheduled enplanements in 2018.

The results of the destination markets analysis show that Dallas has the strongest hold as a passenger destination for travelers from MHK, with Chicago second. Following those are a distant Los Angeles, Washington, D.C., and New York City. The Atlanta market has steadily increased from non-top 20 in 2008, to number 16 in 2013, finishing at seventh in 2018. The Houston market has similarly increased over the time period.

Time-Series and Regression Analysis Projections

A variety of time-series extrapolation and regression analyses using multiple variables, including aviation and socioeconomic factors, were tested. It is optimal to have an "r^2" value near or above 0.90, which would represent a very strong correlation and greater statistical reliability. Four time-series trend lines were analyzed and are shown in **Table 2D**. As can be seen, none of them produced an "r^2" value that met the threshold for reliability.

TABLE 2D
Scheduled Airline Enplanement Regression Analysis Projection Results
Manhattan Regional Airport

Variables Used for Analysis	r^2	2023	2028	2038
Time Series 2006-2018	0.831	106,892	134,692	190,294
Population	0.932	75,608	89,244	113,300
Population, Employment	0.940	70,809	82,064	103,182
Population, Total Earnings	0.953	72,962	83,780	102,601
Population, Earnings, Persona Income	0.977	86,095	102,870	127,619
Population, Employment, Total Earnings	0.957	77,439	89,427	108,453
Population, Employment, Net Earnings, PCPI	0.972	77,533	89,816	109,764
Population, Employment, Total Earnings, Total Personal Income, Net Earnings	0.982	89,221	109,509	146,043
Population, Employment, Total Earnings, Total Personal Income, Net Earnings, PCPI	0.982	93,514	119,475	169,250

PCPI: Per Capita Personal Income
Source: Enplanements from airport records; Socioeconomics for Manhattan CSA from Woods & Poole CEDDS

Several variables were tested to determine if they might produce more reliable statistical trends. The variables tested were all Manhattan CSA socioeconomic variables using data provided by Woods & Poole Complete Economic and Demographic Data Source (CEDDS 2018). The results of the regression analysis offered several outcomes with r^2 values above 0.90. The forecasts generated from those regressions are included in **Table 2D**. The values presented in the table are only a sampling of many that offered similar

TOP TWENTY DOMESTIC DESTINATIONS/ NON-STOP SERVICE CITY PAIRS

Top Twenty Domestic Destinations

Rank	2008		2013		3Q 2017 - 2Q 2018	
1	Dallas (DFW)	540	Dallas (DFW)	6,400	Dallas (DFW)	7,630
2	Chicago (ORD)	240	Chicago (ORD)	5,780	Chicago (ORD)	5,700
3	Los Angeles (LAX,BUR,ONT,SNA)	230	Washington DC (DCA, IAD)	2,330	Los Angeles (LAX,BUR,ONT,SNA)	2,350
4	Phoenix (PHX)	200	Phoenix (PHX)	2,030	Washington DC (AEX, DCA, IAD)	2,250
5	Philadelphia (PHL)	160	Los Angeles (LAX,BUR,ONT,SNA)	1,900	New York City (JFK, LGA, EWR)	1,890
6	Las Vegas (LVS)	150	New York (JFK, LGA, EWR)	1,410	San Antonio (SAT)	1,770
7	San Francisco (SFO)	130	San Antonio (SAT)	1,350	Atlanta (ATL)	1,700
8	Washington DC (DCA, IAD)	130	Austin (AUS)	1,280	Houston (HOU, IAH)	1,480
9	Fayetteville (FAY)	120	Miami (FLL)	1,270	Orlando (MCO)	1,390
10	Baltimore (BWI)	110	Seattle (SEA)	1,240	San Francisco (OAK, SFO, SJC)	1,350
11	Norfolk, VA (ORF)	100	Houston (HOU, IAH)	1,230	Miami (FLL, MIA, PBI)	1,330
12	Tucson (TUS)	100	Orlando (MCO)	1,220	Phoenix (PHX)	1,270
13	Seattle (SEA)	90	Boston (BOS)	1,160	Raleigh/Durham (RDU)	1,120
14	New York City (JFK, LGA, EWR)	80	Philadelphia (PHL)	1,060	Seattle (SEA)	1,120
15	Sacramento (SMF)	80	Phoenix (PHX)	1,040	Nashville (BNA)	1,060
16	San Antonio (SAT)	80	Atlanta (ATL)	930	Boston (BOS)	960
17	Denver (DEN)	70	San Diego, CA	870	Killeen (GRK)	960
18	San Diego (SAN)	70	Nashville (BNA)	850	San Diego (SAN)	960
19	Albany (ALB)	60	Las Vegas (LAS)	840	Baltimore (BWI)	890
20	Charlotte (CLT)	60	Raleigh/Durham (RDU)	810	Tampa (TPA)	880
TOTAL		2,800		35,000		38,060
TOTAL ORIGINATIONS		4,780		56,660		62,230
TOTAL ENPLANEMENTS		16,489		65,683		68,791
% Originations		28.99%		86.26%		90.46%

results. As presented in the table, the regression-based projections range from a low of 102,601 to a high of 190,294 enplanements by 2038.

Travel Propensity Factor Projections

There are a variety of local factors that affect the potential for passengers within an area to travel. A key statistic to consider is the relationship between an airport's enplanement levels to the populace it serves. The ratio of enplanements to population is termed the Travel Propensity Factor (TPF).

The TPF is predominantly impacted by the proximity of an airport to other regional airports with higher levels of service or "hub" airports. Regional airports with higher TPF ratios tend to be located farther from hub airports in relatively isolated areas. These airports generally have a service area that extends into adjacent, well-populated regions or have some type of air service advantage that attracts more of those passengers that might otherwise choose to drive to a more distant hub airport. Generally, the higher the TPF, the more likely air travelers are to utilize the local airport for commercial service.

Nationally, TPFs generally range between 0.3 and 2.0 or higher based on several factors. The most common factor for airports with a higher TPF is a diverse airline offering, especially with competitive airfare structures. Most of the time, the higher TPFs are for hub sized airports, although some smaller communities have exceeded the 1.0 level. Generally, though, regionalized communities within a reasonable drive distance to a larger, better served airport will experience TPF levels below 1.0.

TPF history for MHK since 2006 is presented in **Table 2E**. The TPF for MHK has generally trended strongly upward over this period. As previously noted, the current level of service provided by American Eagle far exceeds previous commuter airline services under EAS contracts. The TPF increased sharply between a low of 0.095 in 2006 to 0.456 in

TABLE 2E
MHK TPF Enplanement Projections

	MHK Scheduled Enplanements	CSA Population	TPF
2006	10,860	114,356	0.095
2007	11,313	115,675	0.098
2008	11,649	120,604	0.097
2009	19,225	122,738	0.157
2010	39,246	128,604	0.305
2011	54,340	130,671	0.416
2012	62,236	136,555	0.456
2013	62,459	135,006	0.463
2014	63,229	134,179	0.471
2015	63,814	135,487	0.471
2016	60,035	132,590	0.453
2017	66,206	133,398	0.496
2018[1]	69,875	134,308	0.520
TPF PROJECTIONS			
Constant Share TPF			
2023	72,239	138,921	0.520
2028	74,645	143,548	0.520
2038	78,886	151,704	0.520
Increasing TPF - 2012-2018 Ratio			
2023	77,875	138,921	0.561
2028	86,256	143,548	0.601
2038	103,388	151,704	0.682
Increasing TPF - 2006-2018 Ratio			
2023	81,824	138,921	0.589
2028	107,948	143,548	0.752
2038	163,689	151,704	1.079

[1] 12-month period ending September 2018 serves as base year

2012. Since 2012, the TPF has increased, but at a slower rate, reaching 0.520 for the 12-month period ending September 2018 (base year total).

Table 2E presents three TPF projections, the first based upon maintaining the current TPF over the forecast period. This would result in 78,886 enplanements by 2038. The second projection utilizes the slower but steady TPF growth rate experienced between 2012 and 2018, which yields 103,388 regularly scheduled commercial airline passenger enplanements by 2038. The final TPF projection extends the overall TPF growth period to 2018, reaching 1.079 by 2038 which yields 163,689 enplanements.

Market Share of U.S. Domestic Enplanement Projections

The next forecasting method employed considers MHK's market share of U.S. domestic enplanements. National forecasts of U.S. domestic enplanements are compiled each year by the FAA and consider the state of the economy, fuel prices, and prior year developments. The most recent publication is FAA *Aerospace Forecasts – Fiscal Years 2018-2038*. Three enplanement forecasts based on MHK's market share of total U.S. regional airline carrier enplanements have been developed and are presented in **Table 2F**. Like its TPF, MHK's market share of regional airline enplanements increased sharply between 2006 (0.0071 percent) and 2012 (0.0391 percent) due to significantly improved air service. Since 2012, MHK's market share has increased annually, with only one exception being 2016, reaching 0.0463 percent in 2018.

TABLE 2F
MHK Market Share of U.S. Regional Enplanement Forecasts

Year	MHK Scheduled Enplanements	U.S. Regional Enplanements	Market Share of Regional
2006	10,860	152,200,000	0.0071%
2007	11,313	156,200,000	0.0072%
2008	11,649	159,100,000	0.0073%
2009	19,225	154,000,000	0.0125%
2010	39,246	161,700,000	0.0243%
2011	54,340	161,700,000	0.0336%
2012	62,236	159,000,000	0.0391%
2013	62,459	155,500,000	0.0402%
2014	63,229	154,100,000	0.0410%
2015	63,814	153,000,000	0.0417%
2016	60,035	152,000,000	0.0395%
2017	66,206	148,000,000	0.0447%
2018[1]	69,875	151,000,000	0.0463%
MARKET SHARE PROJECTIONS			
Decreasing Share of U.S. Regional Enplanements			
2023	74,980	163,000,000	0.0460%
2028	78,750	175,000,000	0.0450%
2038	89,250	210,000,000	0.0425%
Maintain Constant Share of U.S. Regional Enplanements			
2023	75,428	163,000,000	0.0463%
2028	80,981	175,000,000	0.0463%
2038	97,177	210,000,000	0.0463%
Increasing Share of U.S. Regional Enplanements			
2023	83,371	163,000,000	0.0511%
2028	98,036	175,000,000	0.0560%
2038	142,202	210,000,000	0.0677%

[1] MHK enplanements 12-month period ending September 2018; FAA U.S. Regional Enplanements from FAA Aerospace Forecasts 2018-2038 where 2018 value is a projection

The table presents three enplanement market share projections. The first projection considers a change in market share trend to a decreasing share of U.S. regional airline enplanements over the next 20 years. The decreasing share is more common for airports like MHK being served by a single airline with a proximate hub airport(s). The decreasing share projection presented in the table yields 89,250 enplanements by 2038. The second projection is based upon MHK maintaining the 2018 market share into the future. This would result in a slow but steady increase over the planning period, following along with national growth trends, and resulting in 97,177 enplanements by 2038. The final projection considers similar growth since 2006 with the increasing market share reaching 0.0677 percent yielding 142,202 enplanements by 2038. The three market share projections would follow a 1.23 percent, 1.66 percent, and 3.62 percent CAGR respectively.

Selected Scheduled Airline Enplanement Forecast

Exhibit 2F includes all forecast projections mentioned in the previous sections including the FAA TAF for comparison purposes. The various enplanement projections presented above resulted in a broad forecast range. On the high end, the time-series analysis, which simply utilized the 2006-2018 growth curve as a basis, resulted in 190,294 enplanements by 2038. On the low end, the constant TPF projection resulted in 78,886 enplanements by 2038, which would equate to a 0.61 percent CAGR.

After careful examination of these forecasts, it was determined that the most reasonable forecast is the regression analysis utilizing the primary service area, Manhattan CSA, with population as its independent variable. The selected forecast reaches 113,300 scheduled airline enplanements by 2038 at a CAGR of 2.45 percent. This forecast is also within the 10 and 15 percent ranges of the TAF for the 5- and 10-year forecasts, so it would be considered consistent with the TAF. Therefore, this forecast appears to be reasonable for use in the master plan development.

NONSCHEDULED CHARTER AIRLINE FORECASTS

MHK experiences numerous charter and on-demand flights supporting KSU athletics and military personnel movements associated with Fort Riley. These passengers are revenue passengers and must be considered as part of the overall enplanement forecast for the airport as they can and do utilize airport facilities. **Table 2G** presents the annual nonscheduled enplanements for MHK. Historical data for nonscheduled enplanements was available from 2006 through October 2018. For those years, nonscheduled enplanements ranged between a low of 2,467 in 2015 and a high of 6,713 in 2012. The overall period average was 3,945 nonscheduled enplanements. It should be noted that the higher enplanements generally point to a higher military use as KSU associated enplanements generally remain between 1,500 and 3,000 annually.

TABLE 2G
Charter Enplanements and Operations Projections
Manhattan Regional Airport

	Aircraft Operations		
Year	Air Carrier	Air Taxi	Enplanements
2006	[redacted]		4,109
2007			2,681
2008			4,311
2009			5,841
2010			5,333
2011			4,078
2012	278	55	6,713
2013	121	28	3,452
2014	87	80	2,811
2015	90	69	2,467
2016	114	70	3,212
2017	98	118	2,994
2018[1]	68	110	3,287
FORECASTS			
2023	80	110	3,500
2028	90	120	4,000
2038	110	150	5,000

[1] 2018 enplanements not yet fully reported and are estimated based on aircraft operations and seating capacities

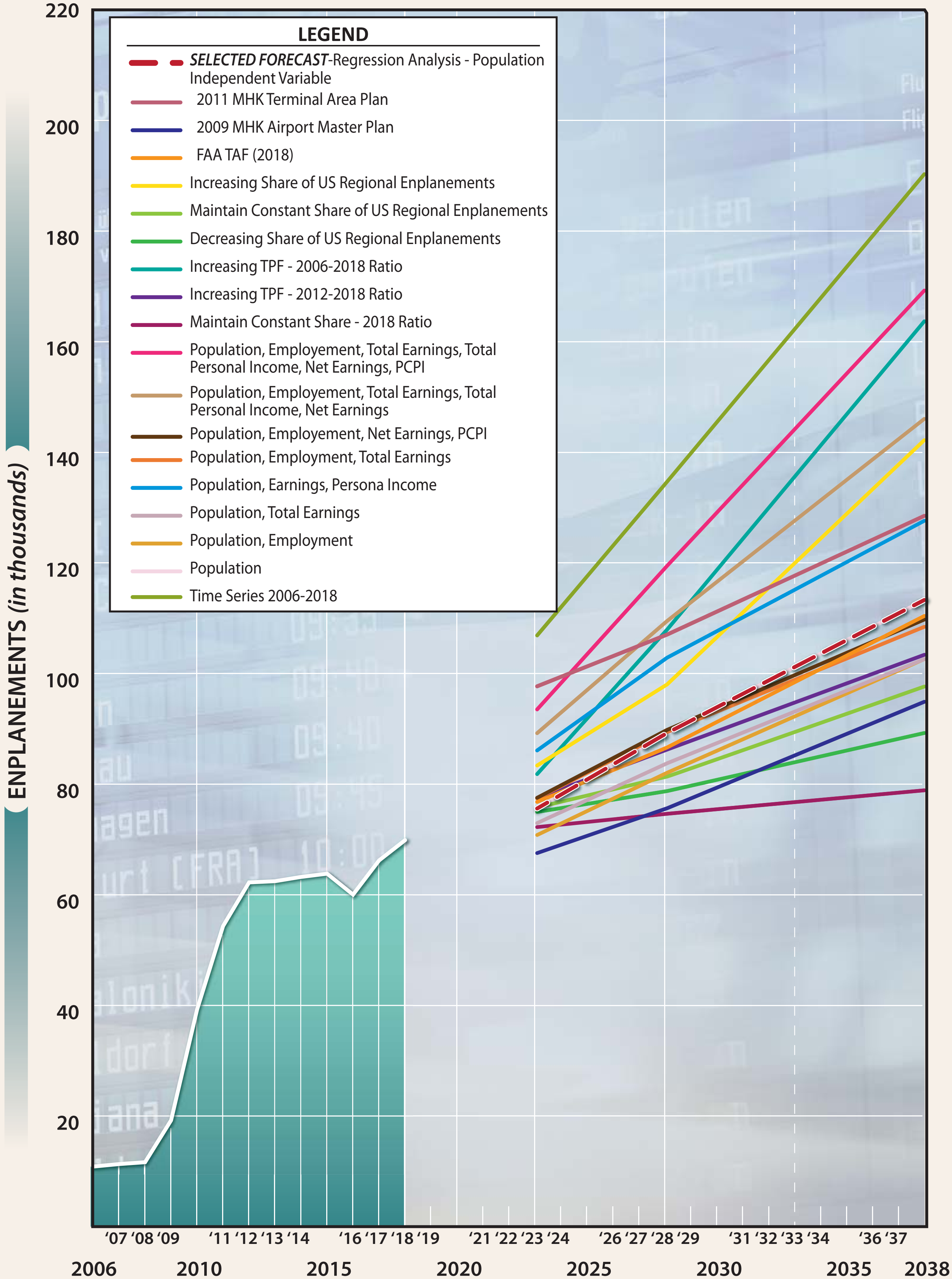


Exhibit 2F
PASSENGER ENPLANEMENTS

Most of the nonscheduled enplanement activity is associated with various intercollegiate athletics team flights by KSU or their opponents utilizing the airport. These flights include air carrier aircraft, such as the Embraer 145, 175, MD83, Boeing 737 (all variants up to the 900 model), Boeing 757, Boeing 767, and Airbus 319/320/321. The larger aircraft are used for football team or military charters. Other non-scheduled military and commercial passenger charters utilize MHK as well on an infrequent basis.

Enplanement levels for nonscheduled operations have not fluctuated greatly since the late 2000s, averaging nearly 4,000 enplanements since 2006. For the purposes of this study, the selected forecast considers 3,500 charter enplanements by 2023, 4,000 by 2028, and 5,000 by 2038. The values will allow for proper facility sizing to prepare for charter levels that have been common in the airport's recent past.

Table 2G also presents historic and forecast charter aircraft operations. The operations are categorized as air carrier, those configured with more than 59 passenger seats, and air taxi, those with up to 59 passenger seats. As shown, the air carrier operations vary while the air taxi operations have generally increased over the period. The operation projections in the table were determined based on historic aircraft seating trends. They consider a return to a higher level of air carrier operations (more military) and a steadily increasing air taxi operational growth.

SCHEDULED AIRLINE FLEET MIX AND OPERATIONS FORECAST

The airline fleet mix defines several key parameters in airport planning, including critical aircraft (for pavement design and ramp geometry), terminal complex layout, and maximum stage length capabilities (affecting runway length evaluations). American Eagle currently operates a variety of regional jet aircraft with a seating capacity of up to 65 passengers. The aircraft mix has been in flux over the last three years, trending to a higher use of larger seat configured aircraft.

Changes in equipment, airframes, and engines have always had a significant impact on airlines and airport planning. There are many ongoing programs by the manufacturers to improve performance characteristics. These programs continue to focus on improvements in fuel efficiency. Regional jets also became a larger factor as the airlines looked for ways to reduce costs. Many airlines replaced larger commercial jets, as well as commuter turboprops, on smaller emerging routes with regional jets.

Commuter airlines are transitioning to advanced turboprop aircraft and larger regional jets to fit their market needs. Many of these aircraft have greater seating capacity, lower operating costs, and are considerably more comfortable for the flying public. The regional jets made their initial impact in the 44- to 50-seat range. Regional jet aircraft eventually became available with as few as 37 seats and as many as 100 seats. This bridged a long-existing gap in seating capacity, making regional jets the aircraft of choice at non-hub and small-hub airports.

As the price of fuel rose, however, the 50-seat and smaller regional jets have been found to be less cost-effective than their counterparts over 60 seats. In fact, the higher seat capacity turboprops, such as the Q400 and even ATR-72, have been more cost-effective than the 50-seat jet carrying the same number of passengers. As a result, the 50-seat regional jets are no longer in production and can be expected to be eliminated from the fleet altogether, with some experts projecting complete removal by 2025. This will occur gradually, however, as some regional carriers will maintain them for some services, as well as in codesharing with major airlines that have restrictive scope clauses with pilots' unions that restrict codesharing on aircraft above a certain seating capacity.

In addition, turboprops that have been the workhorses for the small commuter markets are also no longer in production. In fact, the only commuter turboprops still in production are the ATR 42 in the 40- to 60-seat range, as well as the Q-400 and ATR-72, each with more than 60 seats. Unless there is a new aircraft manufactured in the range of 10 to 39 seats, smaller markets that cannot support the larger turboprops could lose service from anything over nine-seat aircraft.

Table 2H presents the historical airline operational fleet mix by seat capacity for 2016 and 2018, along with the forecast operational fleet mix. In 2016, 64.66 percent of the airport's airline flights were by the ERJ 145/CRJ 200 with a seating capacity of 44. By 2018, the fleet had transitioned to include the CRJ 700, a 65/70-seat regional jet, which accounted for 32.5 percent of airline flights.

TABLE 2H
Scheduled Airline Fleet Mix and Operations Forecast
Manhattan Regional Airport

Fleet Mix	HISTORICAL		FORECAST		
Seating Capacity/Example Aircraft	2016	2018*	2023	2028	2038
100-180/MD88, B737, A319	0.00%	0.00%	0.00%	0.00%	0.00%
75-99/ERJ 190	0.00%	0.00%	5.00%	10.00%	40.00%
60-74/CRJ-700, Q-400	0.00%	32.50%	65.00%	70.00%	60.00%
50-59/ERJ 145, CRJ 200	64.66%	56.48%	30.00%	20.00%	0.00%
30-49/ERJ 135, 140	35.34%	11.02%	0.00%	0.00%	0.00%
Total	100.00%	100.00%	100.00%	100.00%	100.00%
Avg. Seats per Departure	47.88	54.21	61.75	64.50	75.00
Boarding Load Factor	72.65%	73.23%	75.00%	76.00%	77.00%
Enplaned per Departure	34.78	39.70	46.31	49.02	57.75
Annual Enplanements	60,035	69,875	75,600	89,250	113,300
Annual Departures	1,726	1,760	1,632	1,821	1,962
Annual Operations	3,452	3,520	3,265	3,641	3,924
Air Carrier Ops (>59 seats)	0	1,144	2,285	2,913	3,924
Commuter/Air Taxi Ops (<60 seats)	3,452	2,376	979	728	0

* 12-month period from October 2017 through September 2018

The average seats per departure increased from 47.88 in 2016 to 54.21 in 2018. Over time, the average number of seats per departure can be expected to increase as more capacity (i.e., larger aircraft) continues to be introduced into the system; however, the total number of seats available could eventually decline if the frequency of flights decreases in order for airlines to continue to generate a profit. At present, the opposite has been true for MHK, where seat availability has been increasing, as depicted on

Exhibit 2G. The exhibit shows the 12-month moving total for three data points including enplanements and seat availability, which appear to be directly correlated since 2013.

The boarding load factor (BLF) is defined as the ratio of passengers boarding aircraft compared to the seating capacity of the aircraft. The BLF at MHK was 72.65 percent in 2016, increasing to 73.23 percent in 2018. **Exhibit 2G** also depicts the relatively stable 12-month moving BLF since 2013. Since the 2007 recession, airlines have worked to improve efficiency and reduce costs, including a decrease in overall system capacity. A return to slowly increasing capacity occurred in 2015; however, airlines still aim to keep BLF high. In the future, BLFs for MHK are forecast to continue to grow to 77 percent, which is slightly below the FAA's projected BLF target for the regional air carrier industry in the long term.

With an increase in both seating capacity and boarding load factors, the number of passengers on each aircraft flight has also grown. The average enplanements per departure were 34.78 in 2016. By 2018, the ratio had grown to 39.70 enplanements per departure.

As the airlines retire older aircraft that are no longer in production, they are likely to utilize aircraft with more seats primarily because these are the aircraft in production. Most airline operations are forecast to transition to the 60-74 and 75-99 seat aircraft by 2028, with this continuing through 2038 as shown in **Table 2H**. Those aircraft with 60 or more seats are considered air carrier aircraft as noted earlier. As a result, the number of operations by commuter aircraft (air taxi) will decrease while air carrier aircraft operations will increase.

GENERAL AVIATION FORECASTS

The FAA forecasts the fleet mix and hours flown for single engine piston aircraft, multi-engine piston aircraft, turboprops, business jets, piston and turbine helicopters, light sport, experimental, and others (gliders and balloons). The FAA forecasts "active aircraft," not total aircraft. An active aircraft is one that is flown at least one hour during the year. From 2010 through 2013, the FAA undertook an effort to have all aircraft owners re-register their aircraft. This effort resulted in a 10.5 percent decrease in the number of active general aviation aircraft, mostly in the piston category.

The long-term outlook for general aviation is favorable, led by gains in turbine aircraft activity. The active general aviation fleet is not forecast to grow significantly in the next 20 years, adding just 1,040 new aircraft to the fleet by 2038. While steady growth in both GDP and corporate profits results in continued growth of the turbine and rotorcraft fleets, the largest segment of the fleet – fixed-wing piston aircraft – continues to shrink over the FAA's forecast.

In 2017, the FAA estimated there were 146,670 piston-powered aircraft in the national fleet. The total number of piston-powered aircraft in the fleet is forecast to decline by 0.8 percent from 2018-2038, resulting in 124,320 by 2038. This includes -1.0 percent annually for single engine pistons and -0.4 percent for multi-engine pistons.

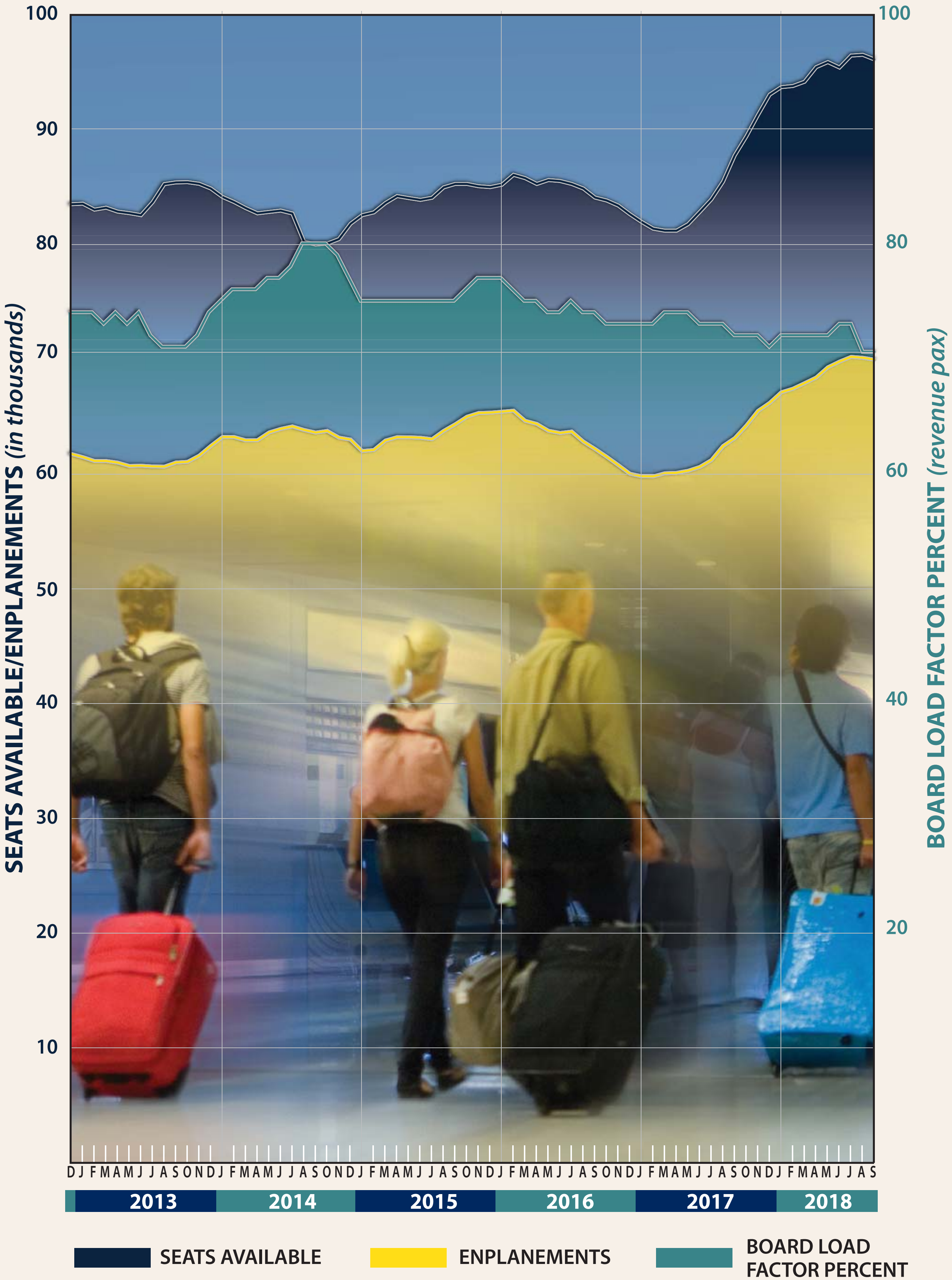


Exhibit 2G: 12-MONTH MOVING AIRLINE CHARACTERISTICS

Total turbine aircraft are forecast to grow at an annual growth rate of 2.0 percent through 2038. The FAA estimates there were 30,905 turbine-powered aircraft in the national fleet in 2017, and there will be 46,160 by 2038. This includes annual growth rates of 1.7 percent for turboprops, 2.2 percent for business jets, and 1.9 percent for turbine helicopters.

While comprising a much smaller portion of the general aviation fleet, experimental aircraft, typically identified as home-built aircraft, are projected to grow annually by 0.8 percent through 2038. The FAA estimates there were 27,865 experimental aircraft in 2017, and these are projected to grow to 33,105 by 2038. Sport aircraft are forecast to grow 3.6 percent annually through the long term, growing from 2,585 in 2017 to 5,440 by 2038. **Exhibit 2H** presents the historical and forecast U.S. active general aviation aircraft.

The FAA also forecasts total operations based upon activity at control towers across the U.S. Operations are categorized as air carrier, air taxi/commuter, general aviation, and military. General aviation operations, both local and itinerant, declined significantly with the 2008-2009 recession and subsequent slow recovery. Through 2038, total general aviation operations are forecast to grow 0.3 percent annually. Air taxi/commuter operations are forecast to decline by 2.1 percent through 2028, and then increase slightly through the remainder of the forecast period. Overall, air taxi/commuter operations are forecast to decline by 0.6 percent annually from 2018 through 2038.

GENERAL AVIATION AIRCRAFT SHIPMENTS AND REVENUE

The 2008-2009 economic recession has had a negative impact on general aviation aircraft production, and the industry has been slow to recover. Aircraft manufacturing declined for three straight years from 2008 through 2010. According to the General Aviation Manufacturers Association (GAMA), there is optimism that aircraft manufacturing will stabilize and return to growth, which has been evidenced since 2011. **Table 2J** presents currently available historical data related to general aviation aircraft shipments.

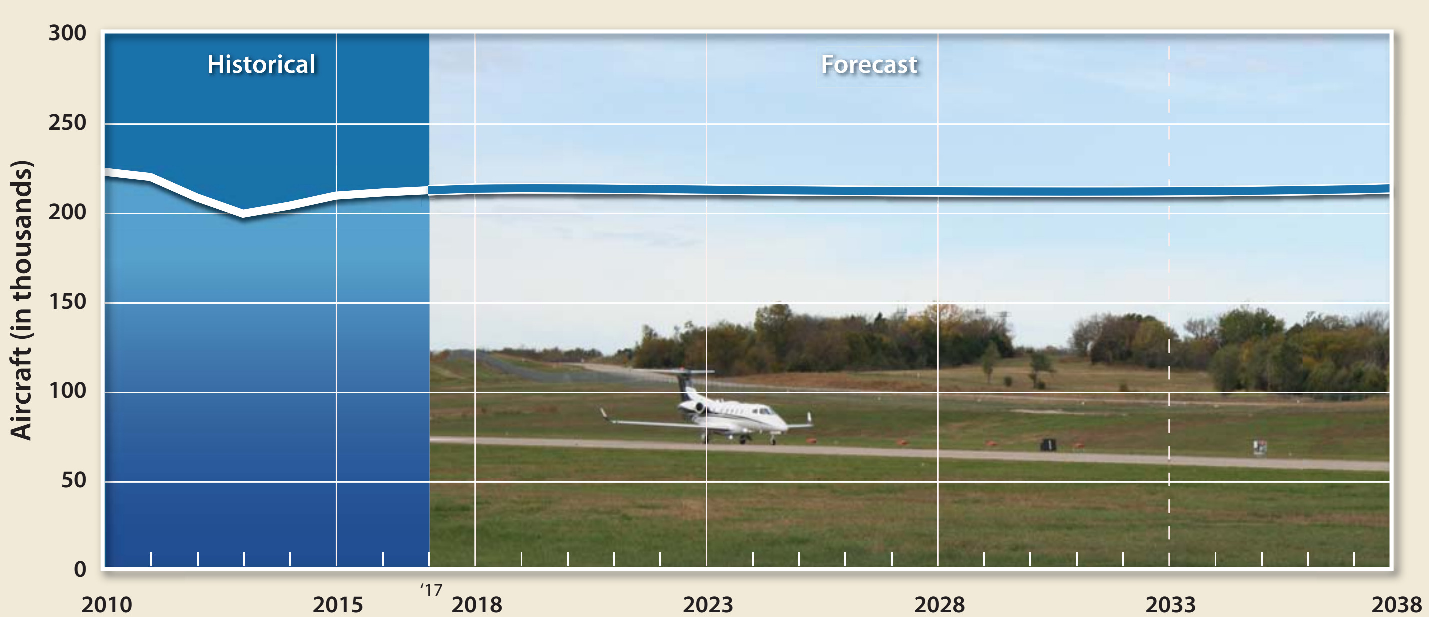
Worldwide shipments of general aviation airplanes increased in 2017 with a total of 2,324 units delivered around the globe, compared to 2,268 units in 2016. However, worldwide general aviation billings were lower than the previous year. In 2017, $20.2 billion in new general aviation aircraft were shipped, but year-end results were mixed across the market segments. North America is the largest market for general aviation aircraft. The Asian-Pacific region is the second largest market for piston-powered aircraft, Latin America is the second largest market for turboprops, and Europe is the second largest market for business jets.

Business Jets: Business jet deliveries grew from 667 units in 2016 to 676 units in 2017. The North American market accounted for 63.8 percent of business jet deliveries, which is a 1.8 percent increase in market share compared to 2016.

Turboprops: Turboprop shipments were down from 582 in 2016 to 563 in 2017. North America's market share of turboprop aircraft dropped by 3.6 percent in the last year, while the European, Asian-Pacific, and Latin American markets increased their market share.

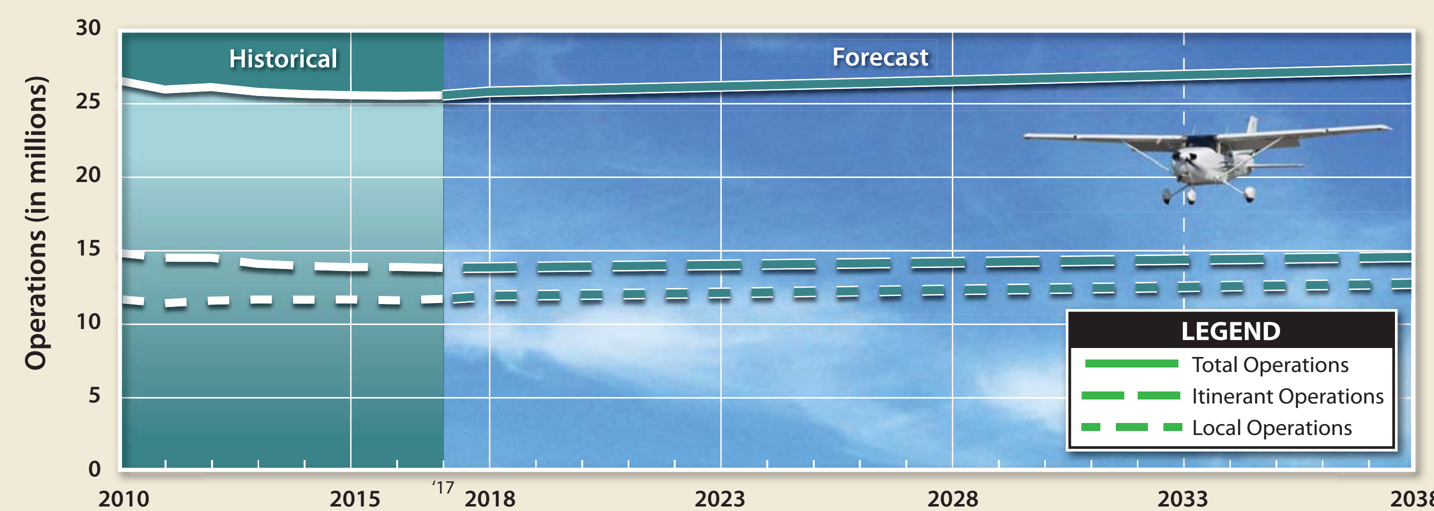
U.S. ACTIVE GENERAL AVIATION AIRCRAFT

	2017E	2023	2028	2038	AAGR 2018-2038
Fixed Wing					
Piston					
Single Engine	130,330	125,330	118,740	107,800	-1.0%
Multi-Engine	12,935	12,720	12,465	11,845	-0.4%
Turbine					
Turboprop	9,430	9,025	9,870	12,855	1.7%
Turbojet	14,075	16,220	18,120	22,195	2.2%
Rotorcraft					
Piston	3,405	3,750	4,035	4,675	1.5%
Turbine	7,400	8,375	9,200	11,110	1.9%
Experimental					
	27,865	29,595	30,980	33,105	0.8%
Sport Aircraft					
	2,585	3,330	3,995	5,440	3.6%
Other					
	5,025	5,045	5,060	5,065	0.0%
Total Pistons	**146,670**	**141,800**	**135,240**	**124,320**	**-0.8%**
Total Turbines	**30,905**	**33,620**	**37,190**	**46,160**	**2.0%**
Total Fleet	**213,050**	**213,390**	**212,465**	**214,090**	**0.0%**



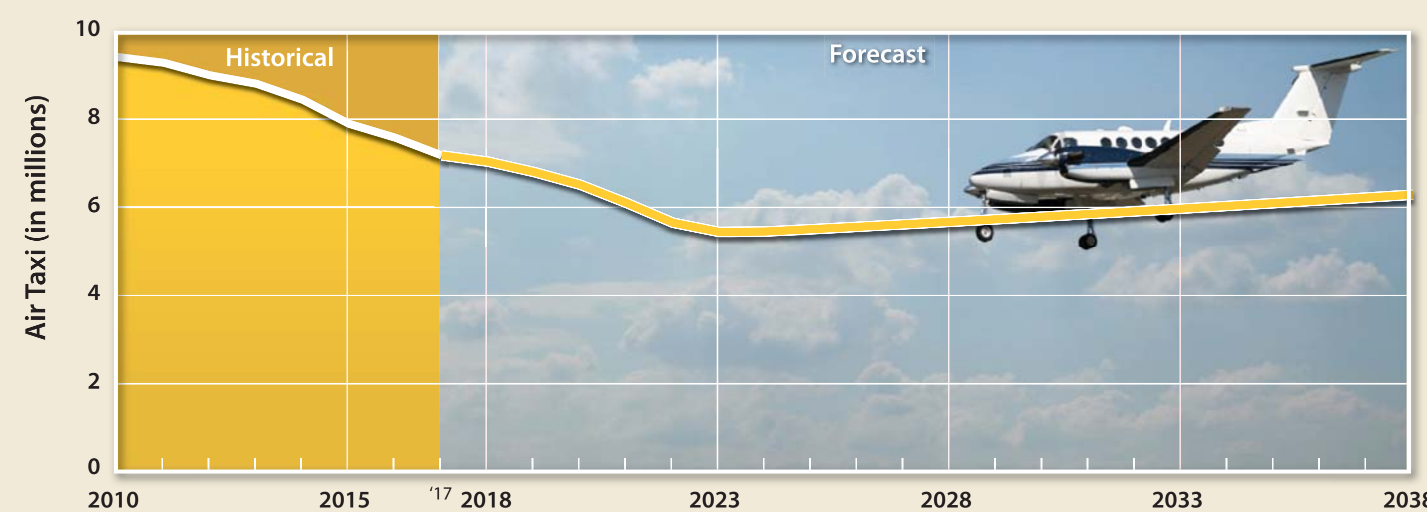
U.S. GENERAL AVIATION OPERATIONS

	2017E	2023	2028	2038	AAGR 2018-2038
Itinerant					
	13,838,029	14,039,925	14,217,031	14,587,442	0.3%
Local					
	11,731,596	12,135,595	12,338,286	12,763,556	0.3%
Total GA Operations	**25,569,625**	**26,175,520**	**26,555,317**	**27,350,998**	**0.3%**



U.S. AIR TAXI

	2017E	2023	2028	2038	AAGR 2018-2038
Air Taxi/Commuter Operations					
Itinerant	7,179,301	5,442,448	5,671,740	6,287,749	-0.6%



Notes: An active aircraft is one that has a current registration and was flown at least one hour during the calendar year.
Source: *FAA Aerospace Forecast - Fiscal Years 2018-2038*

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Pistons: In 2017, piston airplane shipments grew to 1,085 units over last year's shipment of 1,019 units for a 6.5 percent increase. However, North America's market share of piston aircraft deliveries dropped from 69.6 percent in 2016 to 65.6 percent in 2017. The Asian-Pacific market saw the largest increase in market share at 3.2 percent growth.

TABLE 2J
Annual General Aviation Airplane Shipments
Manufactured Worldwide and Factory Net Billings

Year	Total	SEP	MEP	TP	J	Net Billings ($millions)
1994	1,132	544	77	233	278	3,749
1995	1,251	605	61	285	300	4,294
1996	1,437	731	70	320	316	4,936
1997	1,840	1043	80	279	438	7,170
1998	2,457	1508	98	336	515	8,604
1999	2,808	1689	112	340	667	11,560
2000	3,147	1,877	103	415	752	13,496
2001	2,998	1,645	147	422	784	13,868
2002	2,677	1,591	130	280	676	11,778
2003	2,686	1,825	71	272	518	9,998
2004	2,962	1,999	52	319	592	12,093
2005	3,590	2,326	139	375	750	15,156
2006	4,054	2,513	242	412	887	18,815
2007	4,277	2,417	258	465	1,137	21,837
2008	3,974	1,943	176	538	1,317	24,846
2009	2,283	893	70	446	874	19,474
2010	2,024	781	108	368	767	19,715
2011	2,120	761	137	526	696	19,042
2012	2,164	817	91	584	672	18,895
2013	2,353	908	122	645	678	23,450
2014	2,454	986	143	603	722	24,499
2015	2,331	946	110	557	718	24,129
2016	2,268	890	129	582	667	21,092
2017	2,324	936	149	563	676	20,197

SEP - Single Engine Piston; MEP - Multi-Engine Piston; TP - Turboprop; J - Turbofan/Turbojet
Source: General Aviation Manufacturers Association, *2017 Annual Report*

BASED AIRCRAFT

The number of based aircraft is the most basic indicator of general aviation demand. By first developing a forecast of based aircraft for the airport, other general aviation activity and demand can be projected. The process of developing forecasts of based aircraft begins with an analysis of aircraft ownership in the primary general aviation service area through a review of historical aircraft registrations.

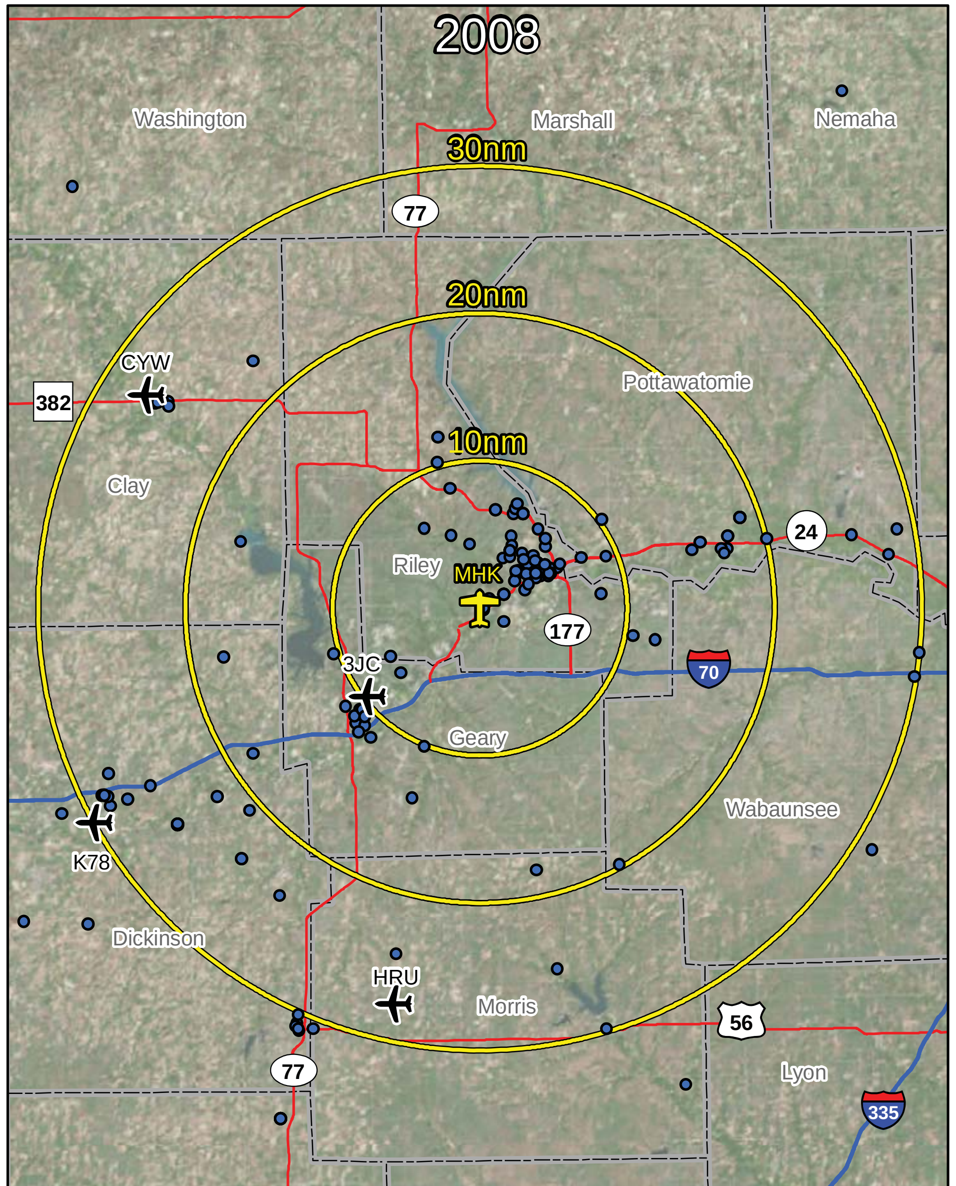
Area Aircraft Ownership (Registered Aircraft)

The general aviation service area is most commonly defined by the FAA and for planning purposes as the area extending outward from the airport 30 miles. Aircraft ownership trends for the primary service area typically outline the service area market demand for an airport. **Table 2K** presents detailed aircraft ownership data for the service area since 1993. **Exhibit 2J** illustrates the 30-mile radius service area as well as the specific location of aircraft registered within the area. The information presented in the table and on the exhibit is derived from the FAA aircraft registration database that categorizes registered aircraft by county based on the zip code of the registered aircraft. Although this information generally provides a correlation to based aircraft, it is not uncommon for some aircraft to be registered in a county but based at an airport outside the county or vice versa.

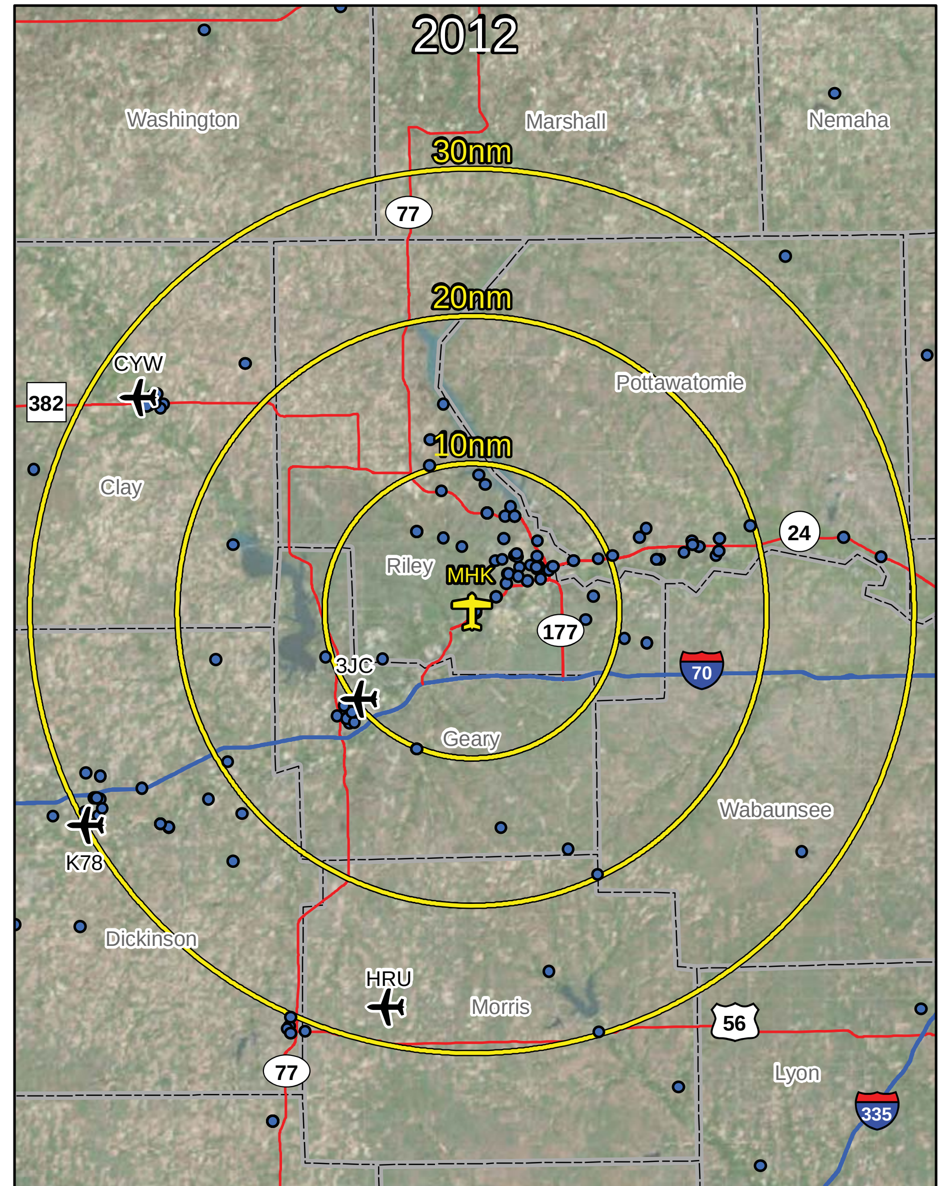
TABLE 2K
Historical Registered Aircraft
Manhattan General Aviation Service Area (30-mile radius)

Year	SEP	MEP	Turboprop	Turbojet	Helicopter	Other*	Total
1993	133	13	3	0	2	2	153
1994	138	18	2	0	2	2	162
1995	137	19	1	0	3	2	162
1996	126	23	1	0	5	2	157
1997	128	22	1	0	6	1	158
1998	129	22	2	0	8	3	164
1999	99	18	1	0	5	2	125
2000	102	18	1	0	4	2	127
2001	106	16	7	0	5	2	136
2002	105	16	7	0	5	2	135
2003	120	12	10	2	6	2	152
2004	125	12	10	2	6	2	157
2005	123	10	8	3	6	2	152
2006	130	15	2	3	7	2	159
2007	135	12	2	1	7	6	163
2008	134	12	2	1	7	6	162
2009	142	13	3	1	7	6	172
2010	146	12	3	1	6	8	176
2011	141	12	2	1	6	11	173
2012	133	10	3	1	3	10	160
2013	145	11	3	1	1	10	171
2014	147	9	3	2	0	11	172
2015	145	9	2	2	1	11	170
2016	139	6	2	3	1	11	162
2017	147	7	2	2	1	13	172
2018	144	6	1	2	4	9	166

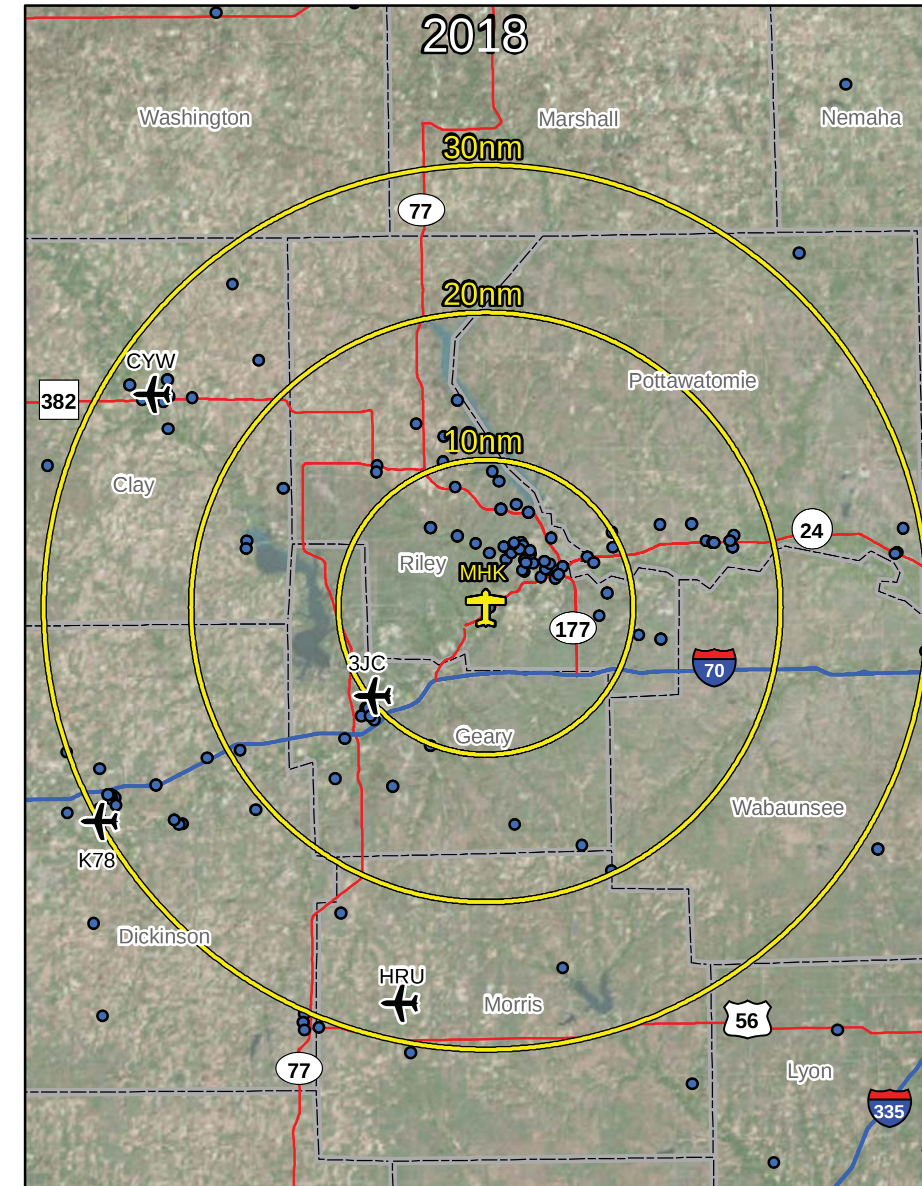
MEP: Multi-Engine Piston
SEP: Single Engine Piston
*The “Other” aircraft category refers to aircraft such as gliders, electric aircraft, balloons, and dirigibles.
Source: FAA Registered Aircraft



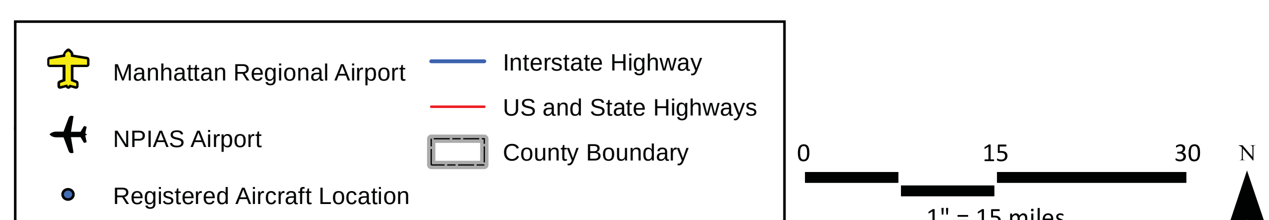
2008	
Distance	Registered Aircraft Count
0 - 10nm	77
11 - 20nm	44
20 - 30nm	41
Total	**162**



2012	
Distance	Registered Aircraft Count
0 - 10nm	61
11 - 20nm	49
20 - 30nm	50
Total	**160**



2018	
Distance	Registered Aircraft Count
0 - 10nm	61
11 - 20nm	59
20 - 30nm	46
Total	**166**



Source: ESRI Basemap Imagery (2017),
FAA Registered Aircraft Database

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In 2018, there were 166 aircraft registered in the defined service area. Riley County accounts for 70 of the total registered aircraft in the area. Overall registered aircraft in the service area has remained relatively constant since 1993, increasing from 153 to 166 over the period. A period high of 176 registered aircraft was recorded in 2010. The decline reported in 2012 is likely due to the FAA's effort to create a more accurate aircraft registration database by requiring aircraft owners to re-register their aircraft. On July 20, 2010, the FAA issued a rule that terminated the registration of all aircraft registered before October 1, 2010 over a three-year period and required re-registration to retain U.S. civil aircraft status. As a result, previously registered aircraft that may have been sold, scrapped/destroyed, or registered to multiple addresses were dropped from the database. Clearly, the market demand in the service area has remained relatively flat since 1993. With the number of registered aircraft identified, a based aircraft forecast for MHK can be considered.

Based Aircraft Forecast

Determining the number of based aircraft at an airport can be a challenging task. Aircraft storage can be somewhat transient in nature, meaning aircraft owners can and do move their aircraft. Some aircraft owners may store their aircraft at an airport for only part of the year. For many years, the FAA did not require based aircraft records; therefore, historical records are often incomplete or non-existent. For this study, MHK provided a current based aircraft count of 42 aircraft.

The scoping requirements of this study effort indicated that the FAA TAF would be utilized as the forecast source for based aircraft at MHK if considered reasonable. The 2018 TAF estimated that there were 47 based aircraft in 2018 with forecast growth to 66 by 2038, for a CAGR of 1.7 percent. The 2018 TAF slightly overestimates the current number of based aircraft by five aircraft.

After examining the TAF projection in light of the service area available and aircraft market demand, the TAF based aircraft projection is considered reasonable for planning purposes. It is somewhat aggressive and would require a shift of local and regional market demand away from other airports to MHK. While possible, this shift could be challenged by the operating environment of the airport's primary function – commercial airline service. Many airports similar to MHK have difficulty attracting a high percentage of their market demand due to factors such as an ATCT, higher security protocols, and other constraining influences. This holds especially true for smaller aircraft and recreational operators. Business aircraft users, both piston and turbine, will not be dissuaded similarly and may welcome higher security and ATCT services. As such, planning analysis will consider the TAF with the understanding that actual demand experienced in the future could be lower.

BASED AIRCRAFT FLEET MIX

The fleet mix of based aircraft is oftentimes more important to airport planning and design than the total number of aircraft. For example, the presence of one or a few large business jets can impact design standards for the runway and taxiway system more than many smaller single engine piston-powered aircraft.

The based aircraft fleet mix forecast for MHK is presented in **Table 2L**. Most based aircraft (78.57 percent) are small single engine piston aircraft. Forecasts of based aircraft fleet mix have been developed based upon the FAA's projections of the national fleet mix over the same time period and considering the potential for growth in business aviation activity at MHK. The result is an increase in more sophisticated aircraft within the turboprop, jet, and helicopter categories.

TABLE 2L
Based Aircraft Fleet Mix
Manhattan Regional Airport

	EXISTING		FORECAST					
Aircraft Type	**2018**	**%**	**2023**	**%**	**2028**	**%**	**2038**	**%**
Single Engine	33	78.57%	39	76.47	41	73.22	48	72.79
Multi-Engine	6	14.29%	6	11.76	5	8.93	4	6.07
Turboprop	1	2.38%	2	3.92	4	7.14	5	7.59
Jet	2	4.76%	3	5.88	4	7.14	6	9.10
Helicopter	0	0.00%	1	1.97	2	3.57	3	4.55
Totals	**42**	**100.00%**	**51**	**100.00%**	**56**	**100.00%**	**66**	**100.00%**

Source: Airport/FAA Records; Coffman Associates Analysis

GENERAL AVIATION OPERATIONS

General aviation (GA) operations are classified by the airport traffic control tower (ATCT) as either local or itinerant. A local operation is a take-off or landing performed by an aircraft that operates within sight of an airport, or which executes simulated approaches or touch-and-go operations at an airport. Itinerant operations are those performed by aircraft with a specific origin or destination away from an airport. Generally, local operations are characterized by training operations. Itinerant operations typically increase with business and commercial use, since business aircraft are operated on a higher frequency.

Itinerant Operations

Table 2M depicts general aviation itinerant operations at MHK from 2002 through 2018. General aviation itinerant operations have been on a gradual decline since 2002, but numbers have increased each of the past three years reaching 11,514 in 2018. National general aviation itinerant operations have been declining since at least 2002 but have been slowing over the last several years. In fact, the FAA forecasts a reversal in 2018. Through 2038, the FAA forecasts an annual growth rate of 0.25 percent for itinerant general aviation operations.

Three forecasts were examined for future itinerant general aviation operations. The first forecast considers maintaining constant MHK's market share (0.08 percent) of national itinerant general aviation operations as forecast by the FAA, which yields 12,100 operations by 2038.

The next projection considers the relationship between based aircraft and itinerant general aviation operations. In 2018, there were 274 itinerant general aviation operations per based aircraft. When maintaining this ratio, the forecast results in 18,100 itinerant general aviation operations by 2038. This represents a CAGR of 2.29 percent, increasing at the same rate as based aircraft.

TABLE 2M
Itinerant General Aviation Operations Forecasts
Manhattan Regional Airport

Year	MHK GA Itinerant Ops[1]	U.S. GA Itinerant Ops[2] (millions)	Market Share Itinerant Ops	MHK Based Aircraft[3]	Itinerant Ops Per Based Aircraft
2002	14,962	21.45	0.07%	54	277
2003	15,257	20.23	0.08%	54	283
2004	15,127	20.01	0.08%	54	280
2005	12,898	19.32	0.07%	54	239
2006	11,560	18.74	0.06%	45	257
2007	8,347	18.58	0.04%	45	185
2008	4,798	17.49	0.03%	45	107
2009	9,046	15.57	0.06%	45	201
2010	8,278	14.86	0.06%	45	184
2011	8,552	14.53	0.06%	45	190
2012	9,656	14.52	0.07%	45	215
2013	9,915	14.12	0.07%	46	216
2014	10,065	13.98	0.07%	46	219
2015	9,893	13.89	0.07%	37	267
2016	8,554	13.90	0.06%	42	204
2017	8,965	13.84	0.06%	42	213
2018	11,514	13.87	0.08%	42	274
CAGR (2002-2018)	-1.62%	-2.69%		-1.56%	
Constant 2018 Market Share of U.S. GA Itinerant Ops					
2023	11,700	14.04	0.08%	51	229
2028	11,800	14.22	0.08%	56	211
2038	12,100	14.59	0.08%	66	183
CAGR (2018-2038)	0.25%	0.25%		2.29%	
Constant 2018 Operations Per Based Aircraft/Increasing Share of U.S. Itinerant Operations – Selected Forecast					
2023	**12,900**	14.04	0.09%	51	253
2028	**14,800**	14.22	0.10%	56	264
2038	**18,100**	14.59	0.12%	66	274
CAGR (2018-2038)	2.29%	0.25%		2.29%	
2018 FAA TAF Projection					
2023	9,819	14.04	0.07%	51	193
2028	9,913	14.22	0.07%	56	177
2038	10,103	14.59	0.07%	66	153
CAGR (2018-2038)	-0.65%	0.25%		2.29%	

[1] Historical data from ATCT records as reported to FAA
[2] FAA Forecasts Fiscal Years 2018-2038
[3] Airport records and FAA TAF
CAGR - Compound Annual Growth Rate
Source: Coffman Associates analysis

The 2018 FAA TAF also presents an itinerant general aviation operations forecast which is included in the table. The TAF forecasts an initial decline in itinerant operations through 2023, then a slow growth to 10,103 by 2038. The overall 20-year CAGR for the TAF is -0.65 percent. It should be noted that the TAF was developed with an estimated 2018 itinerant operations of 9,729, as was previously depicted on **Exhibit 2D**. As such, the TAF did not project an initial decline, and instead has considered 2018 itinerant operations lower than the actual. Obviously, MHK itinerant general aviation operations have grown faster than accounted for in the TAF.

The constant operations per based aircraft forecast projects reasonable itinerant general aviation growth; therefore, it will be carried forward as the selected forecast.

Local Operations

A similar methodology was utilized to forecast local general aviation operations. **Table 2N** depicts the history of local operations at MHK and examines its historic market share of GA local operations at towered airports in the United States. Historical local operations range from a low of 6,622 in 2016 to a high of 11,935 in 2018 (12-month period ending September 2018). Local operations experienced a significant drop-off after the 2007 recession, which has been common for most airports in the U.S. As with national itinerant operations, local operations have been declining for some time. The FAA TAF and the national projections estimate a modest annual growth rate of approximately 0.33 percent going forward.

The first forecast of local general aviation operations considers MHK's market share of national local general aviation operations as counted by the FAA. This forecast maintains MHK's 2018 market share at 0.10 percent, resulting in 12,800 local general aviation operations by 2038 with a CAGR of 0.35 percent. The second forecast applies a constant number of local general aviation operations per based aircraft. This forecast results in 18,800 local general aviation operations by 2038 and a CAGR of 2.3 percent. The 2018 FAA TAF projection is also presented in the table, which forecasts local operations growing to 11,256 by 2038 at a CAGR of -0.29 percent as the estimated 2018 figured used in the TAF projection was below the actual for 2018.

Due to the declining trend of training activity and lower projected growth for this market segment by the FAA, it is reasonable to utilize the constant market share projection for MHK. This selected forecast results in a steady but slowly increasing local general aviation operations forecast for use in facility planning.

TABLE 2N
Local General Aviation Operations Forecasts
Manhattan Regional Airport

Year	MHK GA Local Ops[1]	U.S. GA Local Ops[2] (millions)	Market Share Local Ops	MHK Based Aircraft[3]	Local Ops Per Based Aircraft
2002	11,572	16.17	0.07%	54	214
2003	10,017	15.29	0.07%	54	186
2004	11,152	14.96	0.07%	54	207
2005	10,122	14.85	0.07%	54	187
2006	7,810	14.38	0.05%	45	174
2007	10,196	14.56	0.07%	45	227
2008	7,037	14.08	0.05%	45	156
2009	7,664	12.45	0.06%	45	170
2010	7,515	11.18	0.07%	45	167
2011	7,027	11.44	0.06%	45	156
2012	7,802	11.61	0.07%	45	173
2013	8,750	11.69	0.07%	46	190
2014	9,407	11.68	0.08%	46	205
2015	9,465	11.69	0.08%	37	256
2016	6,622	11.63	0.06%	42	158
2017	10,711	11.70	0.09%	42	255
2018	11,935	11.94	0.10%	42	284
CAGR (2002-2018)	0.19%	-1.88%		-1.56%	
Constant 2018 Market Share of U.S. GA Local Ops/Increasing Share of U.S. GA Local - Selected					
2023	**12,100**	12.14	0.10%	51	237
2028	**12,300**	12.34	0.10%	56	220
2038	**12,800**	12.76	0.10%	66	194
CAGR (2018-2038)	0.35%	0.33%		2.29%	
Constant 2018 Operations Per Based Aircraft					
2023	13,400	12.14	0.06%	51	263
2028	15,300	12.34	0.07%	56	273
2038	18,800	12.76	0.08%	66	285
CAGR (2018-2038)	2.30%	0.33%		2.29%	
2018 FAA TAF Projection					
2023	10,762	12.14	0.09%	51	211
2028	10,925	12.34	0.09%	56	195
2038	11,256	12.76	0.09%	66	171
CAGR (2018-2038)	-0.29%	0.33%		2.29%	

[1] Historical data from ATCT records as reported to FAA
[2] FAA Forecasts Fiscal Years 2018-2038
[3] Airport records and FAA TAF
CAGR - Compound Annual Growth Rate
Source: Coffman Associates analysis

AIR CARRIER CHARTER/OTHER AIR TAXI

Air carrier charter and other air taxi operations as reported by the ATCT include the air charter operators associated with various intercollegiate athletics team flights by KSU or their opponents utilizing the airport, as well as for-hire general aviation operations. Some operations by aircraft operated under fractional ownership programs are also counted as other air taxi operations. Since the airline operations have been forecast, this section reviews the growth potential for the air carrier charters and other air taxi operations.

Air carrier charter operations are those conducted commercially by aircraft having a seating capacity of 60 or more and/or a maximum payload capacity of 18,000 pounds. Air taxi operations can include small commercial service aircraft operations as well as general aviation type aircraft for the "on-demand" commercial transport of persons and property in accordance with 14 Code of Federal Regulations (CFR) Part 135 and Subchapter K of 14 CFR Part 91. A summary of all air taxi operations since 2012 is provided in **Table 2P**.

TABLE 2P
Other Air Taxi Operation Forecasts
Manhattan Regional Airport

Year	Scheduled Airline	Nonscheduled KSU or FBO Charters	Other Air Taxi	Total Air Carrier/ Air Taxi
2012	3,450	333	1,387	5,170
2013	3,448	149	1,633	5,230
2014	3,418	167	1,735	5,320
2015	3,462	159	1,309	4,930
2016	3,452	184	1,364	5,000
2017	3,348	216	1,696	5,260
2018	3,520	178	1,702	5,400
FORECASTS				
2023	3,265	190	1,930	5,375
2028	3,641	210	2,180	6,021
2038	3,924	260	2,790	6,964

FBO: Fixed base operator

Since some air carrier/air taxi operations occur during hours in which the ATCT is closed (9:00 p.m. to 7:00 a.m.), the FAA's Traffic Flow Management System Count (TFMSC) counts of estimated after-hours operations was utilized to inflate the ATCT count of air carrier and air taxi operations. Then, subtracting out the scheduled airline operations and nonscheduled KSU or FBO charter operations, a count of "other air taxi" operations is determined. Based upon this information, there were 1,702 "other air taxi" operations in 2018. As noted in the table, "other air taxi" operations have ranged between a low of 1,309 in 2015 to a high of 1,735 in 2014. Forecasts for other air taxi operations were developed utilizing the FAA's forecast range of 2.5 percent CAGR over the planning period. This projection, as shown in **Table 2P**, results in 2,790 other air taxi operations by 2038. The forecasts for scheduled airline and nonscheduled charter air taxi operations were outlined earlier in the chapter and are shown here for informational purposes.

MILITARY OPERATIONS FORECAST

Military operators routinely utilize MHK for various training operations and activities, often in support of Fort Riley. **Table 2Q** presents a summary of military operations, both local and itinerant, for the past 16 years. Tower records indicate a wide variety of military aircraft have utilized MHK in recent years, including turboprops such as the Lockheed C-130, jet cargo aircraft such as the C-17 Globemaster, and even fighter aircraft such as the F-16 and F-18. Between 2002 and 2017, military operations have remained relatively stable, ranging between a low of 443 in 2008 to a high of 4,018 in 2016.

Developing a reliable forecast of military activity is inherently difficult primarily because military missions can change rapidly. Therefore, this forecast assumes current levels will remain static at 2,200 annual itinerant operations and 1,000 local operations into the forecast years.

TABLE 2Q
Military Operations Forecasts
Manhattan Regional Airport

Year	Itinerant	Local	Total
2002	1,057	658	1,715
2003	1,123	316	1,439
2004	1,240	284	1,524
2005	946	636	1,582
2006	728	1,106	1,834
2007	897	3,014	3,911
2008	278	165	443
2009	977	1,890	2,867
2010	516	232	748
2011	659	1,124	1,783
2012	976	1,768	2,744
2013	791	847	1,638
2014	1,060	970	2,030
2015	1,321	1,418	2,739
2016	1,328	2,690	4,018
2017	832	506	1,338
2018	2,000	2,228	4,228
FORECASTS			
2023	1,000	2,200	3,200
2028	1,000	2,200	3,200
2038	1,000	2,200	3,200

ATCT Count Adjustment and Total Operations

As previously mentioned, the MHK ATCT is not a 24-hour tower and, as such, its air traffic counts are not all-inclusive of aircraft operations at the airport. Some aspects of the master plan require that all airport activity be considered. For these evaluations, it is necessary to estimate and adjust for operations that occur when the tower is closed. The MHK ATCT operates from 7:00 a.m. to 9:00 p.m. daily.

Data from the FAA's TFMSC Distributed OPSNET, which provides hourly operations data including after-hours estimates, was utilized. The air carrier and air taxi forecasts were already inflated to account for after-hours operations, so this section considers only general aviation and military nighttime operations forecasts. According to the TFMSC data, 63 percent of military operations occur during the hours the tower is closed. TFMSC data indicated minimal after-hours general aviation operations, so no adjustment has been made for general aviation operations.

Table 2R presents a summary of the ATCT operations, as well as the adjusted operations, when considering the increases for after-hours activity. Factoring for the adjustment, total annual operations are estimated at 46,708 for the 12-month period ending October 2018. Through the 20-year planning period, annual operations, including nighttime operations, are forecast to be 57,336.

TABLE 2R
Forecast Adjustment for ATCT After-Hours Operations
Manhattan Regional Airport

	2018*	2023	2028	2038
ATCT OPERATIONS				
Itinerant				
Air Carrier	778	2,365	3,003	4,034
Air Taxi	2,321	3,019	3,028	2,920
General Aviation	11,514	12,900	14,800	18,100
Military	2,000	1,000	1,000	1,000
Local				
General Aviation	11,935	12,100	12,300	12,800
Military	2,228	2,200	2,200	2,200
Total ATCT Operations	***30,776***	***33,585***	***36,331***	***41,074***
ADJUSTED OPERATIONS				
Itinerant				
Air Carrier	1,144	2,365	3,003	4,034
Air Taxi	4,256	3,019	3,028	2,940
General Aviation	11,514	12,900	14,800	18,100
Military	5,403	2,701	2,701	2,701
Local				
General Aviation	11,935	12,100	12,300	12,800
Military	6,018	5,943	5,943	5,943
Total Adjusted Operations	***40,270***	***39,029***	***41,775***	***46,518***

* Operations for the 12-month period ending September 2018.
Adjustment accounts for the hours (9:00 p.m. - 7:00 a.m.) when the ATCT is closed.
No adjustment is made for air carrier and air taxi operations as the master plan forecasts have already accounted for the after-hours adjustment. No adjustment is made for general aviation operations as records indicated minimal after-hours operations in this category.

PEAKING CHARACTERISTICS

Many airport facility needs are related to the levels of activity during peak periods. The peak periods that will be used in developing facility requirements for this study are as follows:

- **Peak Month** – The calendar month when peak aircraft operations occur.
- **Design Day** – The average day in the peak month. This indicator is derived by dividing the peak month operations by the number of days in a month.
- **Busy Day** – The busy day of a typical week in the peak month. This peaking factor is used primarily to determine transient ramp parking requirements.
- **Design Hour** – The peak hour within the design day or busy day.

It is important to note that only the peak month is an absolute peak within a given year. All other peak periods will be exceeded at various times during the year. However, they do represent reasonable planning standards that can be applied without overbuilding or being too restrictive.

SCHEDULED AIRLINE PEAKING CHARACTERISTICS

Table 2S outlines the peak baseline and forecast peaking characteristics for scheduled airline activity at MHK. In general, airport capacity and facility needs related to specific activity types will typically consider the levels of activity during a peak or design period. Determination of peaking characteristics related to commercial activity is important for the planning and design of the passenger terminal building, as well as associated facilities and services. The analysis is commonly utilized as a basis for determining the appropriate size of the terminal building and the functional areas therein. Terminal building elements include hold rooms, security checkpoints, concessions, restrooms, baggage claim area, etc. The airline peaking characteristics also relate to aircraft gates and apron space.

TABLE 2S
Scheduled Airline Peaking Characteristics
Manhattan Regional Airport

	2018	2023	2028	2038
Enplanements				
Annual	69,875	75,600	89,250	113,300
Peak Month	6,525	7,333	8,657	10,990
Design Day	233	262	309	393
Design Hour	81	86	98	173
Total Passengers				
Design Hour	161	172	196	347
Operations				
Annual	3,520	3,265	3,641	3,924
Peak Month	313	291	324	349
Design Day	10	10	12	14
Design Hour	3	4	4	6
Departures				
Design Day	5	5	6	7
Design Hour	2	2	2	3

Source: Coffman Associates analysis.

The peak month projections for airline activity was based upon the average peak month over the past five years for operations and the past eight years for enplanements. The average peak month for enplanements over the last five years has been May, with 9.7 percent of annual enplanements, and the average peak month for operations was July, with 8.9 percent of annual operations. The design day is based upon the average day of the peak month, as activity during the peak month tends to be distributed relatively evenly through any given week.

The design hour enplanement estimate is based on the airline schedule, which includes two early morning departures in the same hour between 5:30 and 6:30 a.m. The flights are conducted on the 44-seat ERJ 145 and the 65-seat CRJ-700 regional jet aircraft. Utilizing the current BLF for both flights, the current estimated design hour passenger is 81. As the airline fleet mix transitions over time to larger aircraft, so will the average available seats per departure. As a result, the ultimate design hour enplanement level increases to 173 by 2038, accounting for this increase in available seats/departure, as well as the potential for an additional design hour departure.

CHARTER PEAKING

Since charter operations are nonscheduled and include a much broader fleet of aircraft, they tend to result in higher peaking characteristics. Examining enplanement data for the charter operators from 2015 through 2018 identified fall and winter months as the most active, which coincides with KSU's football season and a portion of men and women's basketball season. Statistically, February, September, and October were the peak months, with each capable of generating up to 20 percent of yearly charter enplanements. The largest charter aircraft used regularly at the airport are the Boeing 737 variants. The Boeing 737-900 has a seating capacity of 179 passengers.

Design hour enplanements factors a fully loaded Boeing 737-900 as well as additional smaller air taxi sized aircraft. Charter peaking characteristics are summarized in **Table 2T**.

TABLE 2T
Charter Peaking Characteristics
Manhattan Regional

	2018	2023	2028	2038
Enplanements				
Annual	3,287	3,500	4,000	5,000
Peak Month	657	700	800	1,000
Design Day	198	198	217	236
Design Hour	179	179	179	179
Operations				
Annual	178	190	210	260
Peak Month	36	38	42	52
Design Day	4	4	6	8
Design Hour	2	2	3	4

Source: Coffman Associates analysis.

COMBINED COMMERCIAL ACTIVITY

Airline and charter peaking characteristics were combined to give a sense of the potential enplanement and operational demands on the passenger terminal building when handling large charter operators or diversion aircraft along with scheduled airline activity. It will be important to consider these peaking characteristics when examining the various functional area needs of the terminal building so that it can efficiently accommodate the combination of commercial activities that occur at MHK. The total combined commercial activity peaking characteristics are summarized in **Table 2U**.

TABLE 2U
Combined Commercial Peaking Characteristics
Manhattan Regional Airport

	2018	2023	2028	2038
Enplanements				
Annual	73,162	79,100	93,250	118,300
Peak Month	7,182	8,033	9,457	11,990
Design Day	431	460	526	629
Design Hour	260	265	277	352
Total Passengers				
Design Hour	519	530	554	705
Operations				
Annual	3,698	3,455	3,851	4,184
Peak Month	349	329	366	401
Design Day	14	14	18	22
Design Hour	6	6	7	10
Departures				
Design Day	9	9	12	15
Design Hour	4	4	5	7

Source: Coffman Associates analysis.

TOTAL OPERATIONS PEAKING

The peaking characteristics of total aircraft operations (when adjusted to account for after-hours operations), include commercial airline, general aviation, air taxi, and military operations. This information is utilized in examin-

TABLE 2V
Total Operations Peaking Characteristics
Manhattan Regional Airport

	2018	2023	2028	2038
Annual	40,270	39,029	41,775	46,518
Peak Month	3,624	3,513	3,760	4,187
Design Day	129	125	134	150
Busy Day	258	316	338	377
Design Hour	23	22	23	26

Source: Coffman Associates analysis.

ing the operational capacity of the airfield. The peak month for total operations has averaged 9.0 percent over the last five years. Design hour operations were estimated at 17.5 percent of the design daily operations, which is forecast to remain constant through the planning period. Busy day operations were calculated as the average of the top 25 busy days at MHK over the last five years. Total operations peaking characteristics are summarized in **Table 2V** on the previous page.

FORECAST COMPARISON TO THE *TERMINAL AREA FORECAST*

The FAA will review the forecasts presented in this Master Plan for consistency with the *Terminal Area Forecast*. The local FAA Airport District Office (ADO) or Regional Airports Division (RO) are responsible for forecast approvals. When reviewing a sponsor's forecast, FAA must ensure that the forecast is based on reasonable planning assumptions, uses current data, and is developed using appropriate forecast methods. Forecasts of enplanements, operations, and based aircraft are considered consistent with the TAF if they differ by less than 10 percent in the five-year period and 15 percent in the 10-year forecast period. If the forecast is not consistent with the TAF, differences must be resolved if the forecast is to be used for FAA decision-making. **Table 2W** presents the direct comparison of the master planning forecasts with the TAF published in January 2018.

TABLE 2W
Forecast Comparison to the Terminal Area Forecast
Manhattan Regional Airport

	BASE YEAR	FORECAST			
	2018	**2023**	**2028**	**2038**	**CAGR 2018-2038**
Passenger Enplanements					
Master Plan Forecast	73,162	79,100	93,250	118,300	2.43%
2018 FAA TAF	68,103	76,790	86,639	110,409	2.45%
% Difference	7.16%	2.96%	7.35%	6.90%	
Total Operations					
Master Plan Forecast	40,270	39,029	41,775	46,518	0.72%
2018 FAA TAF	25,895	26,275	26,669	27,489	0.30%
% Difference	43.45%	39.06%	44.14%	51.42%	
Based Aircraft					
Master Plan Forecast	42	51	56	66	2.29%
2018 FAA TAF	47	51	56	66	1.71%
% Difference	11.24%	0.00%	0.00%	0.00%	

KEY: CAGR – Compound annual growth rate
Source: Coffman Associates analysis

The reason the FAA allows this differential is because the TAF forecasts are not meant to replace forecasts developed locally (i.e., in this master plan). While the TAF can provide a point of reference for comparison, their purpose is much broader in defining FAA national workload measures.

As discussed previously, the master plan enplanement forecast is well within the FAA tolerances. The five-year total operations forecast differs from the FAA TAF by 39.06 percent, which is outside of the FAA tolerance level. This is primarily due to the master plan adjusting for after-hours operations and the TAF utilizing a base year estimate for 2018 that is 43.45 percent different than the actual 2018 tower count operational level used as a base year in developing the master plan forecasts. By the 10-year mark, the total operations forecast in the master plan are 44.14 percent different than the TAF. If the TAF's base year was adjusted to actual 2018 operations (including after-hours operations), the master plan forecast would be within the 15 percent tolerance.

For based aircraft, the master plan forecast trails the TAF until 2038, where they are equal. **Exhibit 2K** presents a summary of the master plan forecasts. Moderate growth is forecast for all activity demand indicators.

AIRCRAFT/AIRPORT/RUNWAY CLASSIFICATION

The FAA has established several aircraft classification systems that group aircraft types based on their performance (approach speed in landing configuration) and design characteristics (wingspan and landing gear configuration). These classification systems are used to determine the appropriate airport design standards for specific airport elements, such as runways, taxiways, taxilanes, and aprons.

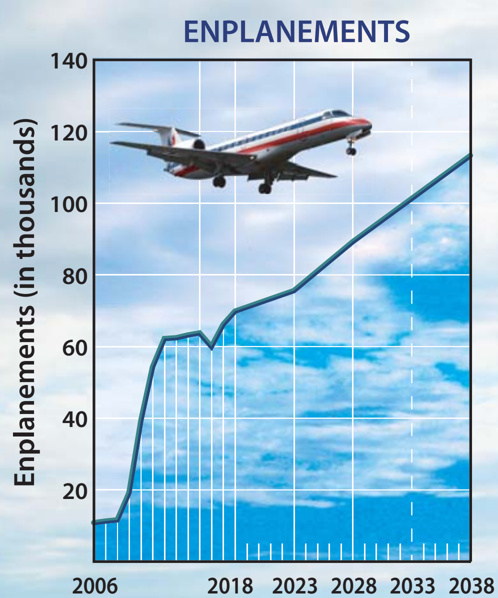
AIRCRAFT CLASSIFICATION

The selection of appropriate FAA design standards for the development and location of airport facilities is based primarily upon the characteristics of the aircraft which are currently using or are expected to use an airport. The critical design aircraft is used to define the design parameters for an airport. The design aircraft may be a single aircraft type or, more commonly, is a composite aircraft representing a collection of aircraft with similar characteristics. The critical design aircraft is defined by three parameters: Aircraft Approach Category (AAC), Airplane Design Group (ADG), and Taxiway Design Group (TDG). FAA AC 150/5300-13A, *Airport Design*, describes the following airplane classification systems, the parameters of which are presented on **Exhibit 2L**. **Exhibit 2M** presents the aircraft classification of the most common jet aircraft in operation today.

Aircraft Approach Category (AAC): A grouping of aircraft based on a reference landing speed (V_{REF}), if specified, or if V_{REF} is not specified, 1.3 times stall speed (V_{SO}) at the maximum certificated landing weight. V_{REF}, V_{SO}, and the maximum certificated landing weight are those values as established for the aircraft by the certification authority of the country of registry.

The AAC generally refers to the approach speed of an aircraft in landing configuration. The higher the approach speed, the more restrictive the applicable design standards. The AAC, depicted by a letter A through E, is the aircraft approach category and relates to aircraft approach speed (operational charac-

DEMAND SEGMENT	BASE YEAR	2023	2028	2038
COMMERCIAL AIRLINE PASSENGER ENPLANEMENTS				
Scheduled Airline	69,875	75,600	89,250	113,300
Charter	3,287	3,500	4,000	5,000
TOTAL	**73,162**	**79,100**	**93,250**	**118,300**
ADJUSTED AIRCRAFT OPERATIONS				
Itinerant				
Air Carrier	1,144	2,365	3,003	4,034
Air Taxi	4,256	3,019	3,028	2,940
GA	11,514	12,900	14,800	18,100
Military	5,403	2,701	2,701	2,701
Subtotal Itinerant	***22,317***	***20,985***	***23,532***	***27,775***
Local				
GA	11,935	12,100	12,300	12,800
Military	6,018	5,943	5,943	5,943
Subtotal Local	***17,953***	***18,043***	***18,243***	***18,743***
Total Adjusted Operations	**40,270**	**39,028**	**41,775**	**46,518**
BASED AIRCRAFT				
Single Engine	33	39	41	48
Multi-Engine	6	6	5	4
Turboprop	1	2	4	5
Jet	2	3	4	6
Helicopter	0	1	2	3
TOTAL BASED AIRCRAFT	**42**	**51**	**56**	**66**



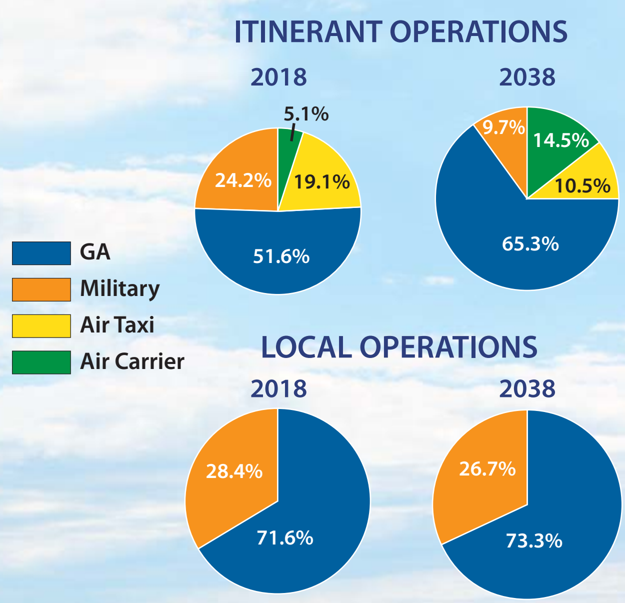


Exhibit 2K
ADJUSTED FORECAST SUMMARY

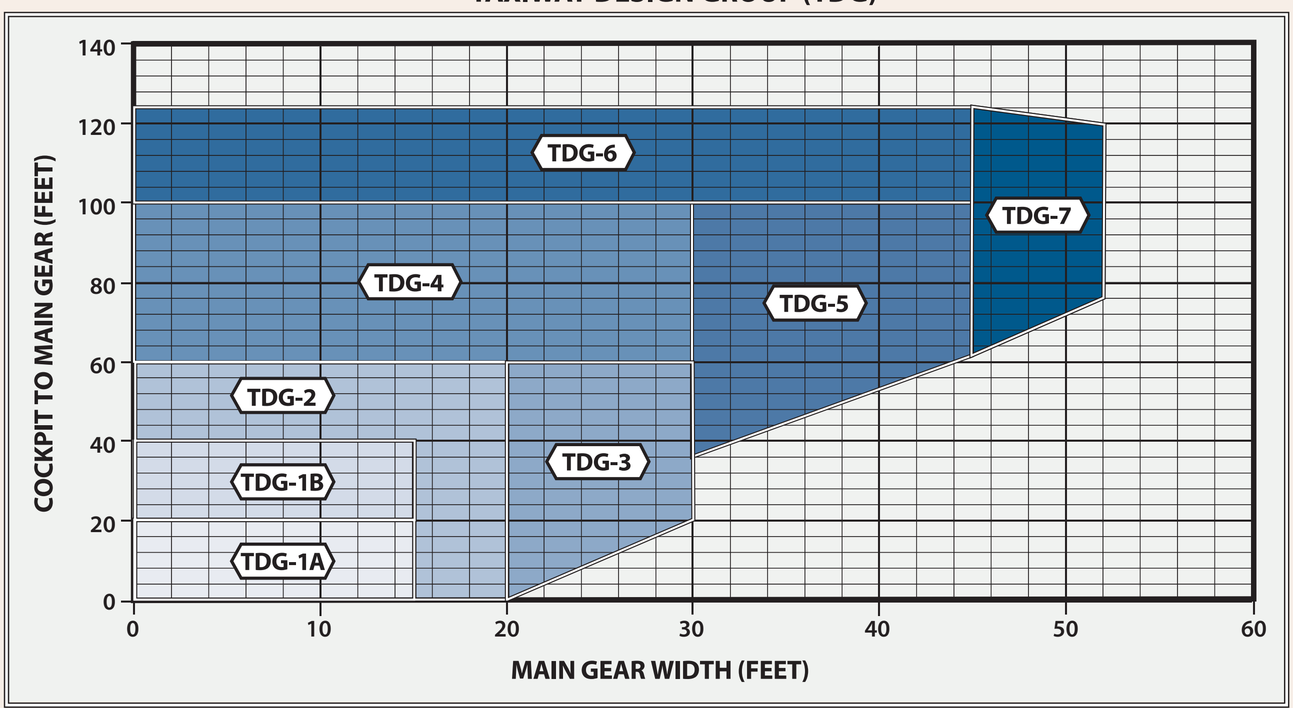
AIRCRAFT APPROACH CATEGORY (AAC)	
Category	**Approach Speed**
A	less than 91 knots
B	91 knots or more but less than 121 knots
C	121 knots or more but less than 141 knots
D	141 knots or more but less than 166 knots
E	166 knots or more

AIRPLANE DESIGN GROUP (ADG)		
Group #	**Tail Height (ft)**	**Wingspan (ft)**
I	<20	<49
II	20-<30	49-<79
III	30-<45	70-<118
IV	45-<60	118-<171
V	60-<66	171-<214
VI	66-<80	214-<262

VISIBILITY MINIMUMS	
RVR* (ft)	**Flight Visibility Category (statute miles)**
VIS	3-mile or greater visibility minimums
5,000	Not lower than 1-mile
4,000	Lower than 1-mile but not lower than ¾-mile
2,400	Lower than ¾-mile but not lower than ½-mile
1,600	Lower than ½-mile but not lower than ¼-mile
1,200	Lower than ¼-mile

***RVR**: Runway Visual Range

TAXIWAY DESIGN GROUP (TDG)



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

A-I

- Beech Baron 55
- **Beech Bonanza**
- Cessna 150
- Cessna 172
- Cessna Citation Mustang
- Eclipse 500/550
- Piper Archer
- Piper Seneca

B-I

- Beech Baron 58
- Beech King Air A90/100
- Cessna 402
- **Cessna 421**
- Piper Navajo
- Piper Cheyenne
- Swearingen Metroliner
- Cessna Citation I (525)

B-II

- Super King Air 200
- Cessna 441
- DHC Twin Otter
- Super King Air 350
- **Cessna Caravan**
- Citation Excel (560), Sovereign (680)
- Falcon 50, 900, 2000
- **Citation Bravo (550)**
- Embraer 120

A-III, B-III

- DHC Dash 7
- **DHC Dash 8**
- DC-3
- Convair 580
- Fairchild F-27
- ATR 72
- ATP

C-I, D-I

- Beech 400
- Lear 31, **35,** 45, 60
- Israeli Westwind

C-II, D-II

- **Cessna Citation X (750)**
- Gulfstream 100, 200,300
- Challenger 300/600
- ERJ-135, 140, 145
- CRJ-200/700
- Embraer Regional Jet
- Lockheed JetStar
- Hawker 800

less than 100,000 lbs. C-III, D-III

- ERJ-170
- CRJ 705, 900
- Falcon 7X
- **Gulfstream 500**, 550, 650
- Global Express, Global 5000
- Q-400

over 100,000 lbs. C-III, D-III

- ERJ-90
- Boeing Business Jet
- B-727
- **B-737**-300, **700,** 800
- MD-80, DC-9
- A319, A320

C-IV, D-IV

- **B-757**
- B-767
- C-130 Hercules
- DC-8-70
- MD-11

D-V

- **B-747-400**
- B-777
- B-787
- A-330, A-340

Note: Aircraft pictured is identified in bold type.

AIRCRAFT REFERENCE CODES

teristic). The AAC generally applies to runways and runway-related facilities, such as runway width, runway safety area (RSA), runway object free area (ROFA), runway protection zone (RPZ), and separation standards.

Airplane Design Group (ADG): The ADG, depicted by a Roman numeral I through VI, is a classification of aircraft which relates to aircraft wingspan or tail height (physical characteristic). When the aircraft wingspan and tail height fall in different groups, the higher group is used. The ADG influences design standards for taxiway safety area (TSA), taxiway object free (TOFA), taxilane object free area, apron wingtip clearance, and various separation distances.

Taxiway Design Group (TDG): A classification of airplanes based on outer-to-outer Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance. The TDG relates to the undercarriage dimensions of the design aircraft. The taxiway design elements determined by the application of the TDG include the taxiway width, taxiway edge safety margin, taxiway shoulder width, taxiway fillet dimensions, and, in some cases, the separation distance between parallel taxiways/taxilanes. Other taxiway elements, such as the taxiway safety area (TSA), taxiway/taxilane object free area (TOFA), taxiway/taxilane separation to parallel taxiway/taxilanes or fixed or movable objects, and taxiway/taxilane wingtip clearances are determined solely based on the wingspan (ADG) of the design aircraft utilizing those surfaces. It is appropriate for taxiways to be planned and built to different TDG standards based on expected use.

AIRPORT AND RUNWAY CLASSIFICATION

These classifications, along with the aircraft classifications defined previously, are used to determine the appropriate FAA design standards to which the airfield facilities are to be designed and built.

Airport Reference Code (ARC)**:** An airport designation that signifies the airport's highest Runway Design Code (RDC), minus the third (visibility) component of the RDC. The ARC is used for planning and design only and does not limit the aircraft that may be able to operate safely on the airport. **The current ALP for the airport, which will be updated as part of this planning effort, identifies an ARC of D-III.**

Runway Design Code (RDC): A code signifying the design standards to which the runway is to be built. The RDC is based upon planned development and has no operational component. The AAC, ADG, and runway visual range (RVR) are combined to form the RDC of a particular runway. The RDC provides the information needed to determine certain design standards that apply.

The first component of the RDC, depicted by a letter, is the AAC and relates to aircraft approach speed (operational characteristics). The second component, depicted by a Roman numeral, is the ADG and relates to either the aircraft wingspan or tail height (physical characteristics), whichever is most restrictive. The third component relates to the visibility minimums expressed by RVR values in feet of 1,200 (⅛-mile); 1,600 (¼-mile); 2,400 (½-mile); 4,000 (¾-mile); and 5,000 (1-mile). The RVR values approximate standard visibility minimums for instrument approaches to the runways. The third component should read "VIS" for runways designed for visual approach use only.

Approach Reference Code (APRC): A code signifying the current operational capabilities of a runway and associated parallel taxiway with regard to landing operations. Like the RDC, the APRC is composed of the same three components: the AAC, ADG, and RVR. The APRC describes the current operational capabilities of a runway under particular meteorological conditions where no special operating procedures are necessary, as opposed to the RDC which is based upon planned development with no operational component. The APRC for a runway is established based upon the minimum runway-to-taxiway centerline separation.

Departure Reference Code (DPRC): A code signifying the current operational capabilities of a runway and associated parallel taxiway with regard to take-off operations. The DPRC represents those aircraft that can take off from a runway while any aircraft is present on adjacent taxiways, under particular meteorological conditions with no special operating conditions. The DPRC is similar to the APRC but is composed of two components: ACC and ADG. A runway may have more than one DPRC depending on the parallel taxiway separation distance.

CRITICAL DESIGN AIRCRAFT

The selection of appropriate FAA design standards for the development and location of airport facilities is based primarily upon the characteristics of the aircraft which are currently using or are expected to use an airport. The critical design aircraft is used to define the design parameters for an airport. The design aircraft may be a single aircraft or a composite aircraft representing a collection of aircraft classified by the three parameters: AAC, ADG, and TDG. In the case of an airport with multiple runways, a design aircraft is selected for each runway.

The first consideration is the safe operation of aircraft likely to use an airport. Any operation of an aircraft that exceeds design criteria of an airport may result in either an unsafe operation or a lesser safety margin; however, it is not the usual practice to base the airport design on an aircraft that uses the airport infrequently.

The critical design aircraft is defined as the most demanding aircraft type, or grouping of aircraft with similar characteristics, that make regular use of the airport. Regular use is 500 annual operations, excluding touch-and-go operations. Planning for future aircraft use is of importance since the design standards are used to plan separation distances between facilities. These future standards must be considered now to ensure that short term development does not preclude the reasonable long-range potential needs of the airport. Therefore, if the critical design aircraft is anticipated to change within the next five years, that aircraft (or family of aircraft) should be used as the current critical design aircraft.

AIRPORT CRITICAL DESIGN AIRCRAFT

The FAA maintains the TFMSC database which documents aircraft operations at most NPIAS airports. Information is added to the TFMSC database when pilots file flight plans and/or when flights are detected by the National Airspace System, usually via radar. The database includes documentation of commercial traffic (air carrier and air taxi), general aviation, and military aircraft. Due to factors such as incomplete flight plans and limited radar coverage, TFMSC data does not account for all aircraft activity at an airport by a given aircraft type. Some visual flight rules (VFR) and some non-enroute instrument flight rules (IFR) traffic is excluded. Therefore, it is likely that there are more operations at an airport than are captured by this methodology. TFMSC data is available for activity at MHK and was utilized in this analysis.

Current Critical Design Aircraft

Exhibit 2N presents a full range of aircraft turbine aircraft operations annually since 2008 as reported by the FAA TFMSC for MHK. The data was broken down into individual aircraft operations and then placed into each aircraft's ARC as well as the appropriate subcategories AAC and ADG for analysis. As can be seen, MHK experiences activity by the full range of business jets, including some of the largest in the national fleet. In addition, the airport has been utilized by a wide variety of commercial airline aircraft such as the MD-83, Boeing 737 (all variant models), Airbus 319/320/320, as well as the full array of regional jets. Activity by the larger commercial type aircraft has typically been associated with non-scheduled charter flights either supporting KSU athletics or the military. Military aircraft operations are shown for information purposes only as they cannot be considered for use in critical aircraft determination.

Over the period, MHK has averaged 6,150 total annual turbine operations as reported by TFMSC. Based on the data, aircraft in AAC A, B, and C account for 98.2 percent of all reported turbine operations. AAC D operations have historically ranged between 100 and 160 annual operations. **As a result, the Master Plan will consider AAC C as the current critical design AAC.**

According to **Exhibit 2N**, the airport has experienced an average of more than 5,500 annual operations by turbine aircraft in ADG I and II. ADG I and II aircraft operations have generally accounted for more than 95 percent of all reported turbine operations. ADG III and IV aircraft operations have annually averaged 157 and 114 respectively, which is well below the 500 annual operations requirement to be considered for current critical aircraft design. **Therefore, the Master Plan will consider ADG II as the current critical design ADG. As a result, the current critical design aircraft for MHK is best described as ARC C-II.**

Future Critical Design Aircraft

The future transition of the airline fleet mix to larger aircraft will ultimately impact the future critical design of the airport, very possibly in the next few years. The 44/50-seat ERJ-145 (ADG II) is being phased out and will eventually be replaced by the 70-90 seat CRJ-700 (ADG II), CRJ-900 (ADG III), and ERJ-175/190 series (ADG III). The forecast of airline operations identified the potential for 40 percent of airline operations to be conducted by the CRJ-900/ERJ-190 aircraft, which would account for 1,570 annual operations. In addition, nonscheduled charter flights routinely utilize the Boeing 737 aircraft and those like it, which is also an ADG III aircraft. Operations by these types of aircraft are anticipated to continue to grow over the forecast period and will likely far exceed the 500 annual operations threshold.

AIRCRAFT REFERENCE CODES

ARC	Aircraft	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018*
A-I	Eclipse 400/500	8	22	4	4	6	20	8	10	14	14	14
	Lancair 4	2	6	2	0	0	0	0	0	0	0	0
	Mitsubishi MU-2	16	18	4	12	16	18	4	6	10	10	4
	Piper Malibu/Meridian	16	102	168	162	164	152	148	140	218	230	164
	Socata TBM 7/850/900	18	26	30	28	36	40	38	20	70	40	46
	TOTAL	60	174	208	206	222	230	198	176	312	294	228
A-II	Cessna Caravan	8	14	2	2	8	12	8	10	12	12	10
	De Havilland Twin Otter	2	2	0	0	0	0	4	0	0	0	0
	Pilatus PC-12	26	28	48	46	66	44	80	94	78	36	38
	TOTAL	36	44	50	48	74	56	92	104	90	48	48
B-I	Aero Commander 690	0	4	4	8	4	8	2	0	0	4	6
	Beech 99 Airliner	0	0	2	0	0	0	0	0	0	0	0
	Beechjet 400	34	32	42	104	104	108	86	90	64	86	74
	Cessna 425 Corsair	42	52	44	38	40	62	34	46	54	52	40
	Cessna 526 Jet Trainer	0	0	0	0	0	0	0	0	2	0	0
	Citation CJ1/CJ2	546	366	380	236	262	262	244	224	212	276	224
	Citation I/SP	4	8	18	6	10	4	32	74	86	26	0
	Citation M2	0	0	0	0	0	0	0	0	0	2	4
	Citation Mustang	10	14	8	20	44	48	40	36	52	44	10
	Falcon 10	6	0	8	2	0	4	2	2	2	2	2
	Hawker 1000	0	2	6	4	4	4	0	0	0	0	0
	King Air 90/100	372	316	352	370	404	368	294	226	230	154	158
	Phenom 100	0	2	6	16	14	8	8	4	4	16	16
	Piaggio Avanti	56	52	60	74	34	24	0	0	2	0	0
	Piper Cheyenne	276	46	30	36	66	66	64	98	98	60	54
	Premier 1	28	20	2	10	10	2	4	2	16	6	4
	Rockwell Sabre 40/60	0	2	2	0	4	16	2	0	0	0	0
	T-6 Texan	6	24	12	36	22	30	2	12	22	10	2
	TOTAL	1,380	940	976	960	1,022	1,014	814	814	844	738	594
B-II	BAe Jetstream	2	0	0	4	0	2	0	14	24	2	0
	Beech 1900	3,656	4,056	660	56	36	8	4	0	0	0	0
	Cessna Conquest	22	20	28	10	8	18	32	40	34	22	22
	Citation CJ3/CJ4	34	38	30	28	22	22	34	60	66	50	76
	Citation II/SP/Latitude	28	36	120	214	100	88	70	36	28	28	66
	Citation V/VII/Sovereign	104	66	84	182	362	324	274	126	168	200	196
	Citation X	4	6	14	26	8	36	50	36	22	26	36
	Citation XLS	46	30	48	56	40	58	78	106	132	120	88
	Dornier 328	74	64	46	36	44	24	24	22	30	30	28
	Embraer 500/450 Legacy	0	0	0	0	0	0	0	0	0	14	20
	Embraer EMB-110/120	2	4	28	44	16	2	0	0	0	2	4
	Falcon 20/50	6	8	12	12	12	14	16	8	4	14	8
	Falcon 2000	4	2	2	4	12	12	4	18	16	24	10
	Falcon 900	0	0	0	2	2	0	0	2	6	2	4
	King Air 200/300/350	340	274	278	230	346	374	396	334	300	326	344
	King Air F90	6	6	4	6	6	12	8	6	4	4	0
	Phenom 300	0	0	0	0	12	20	18	18	16	42	46
	Saab 340	8	6	0	0	4	2	0	0	0	0	0
	Shorts 330/360	22	14	0	0	0	0	0	0	2	0	0
	Swearingen merlin	78	44	20	38	26	8	10	6	6	14	4
	TOTAL	4,436	4,674	1,374	948	1,056	1,024	1,018	832	858	920	952
B-III	Bombardier Global 5000	0	0	0	0	0	0	0	0	2	0	0
	Bombardier Global Express	2	0	0	0	0	0	2	16	2	2	0
	De Havilland Dash 8 Series	0	0	2	0	0	0	0	0	0	0	0
	Saab 2000	0	0	0	0	4	30	12	20	22	14	16
	TOTAL	2	0	2	0	4	30	14	36	26	16	16
C-I	AV-8B Harrier	2	0	0	0	0	0	0	0	0	0	0
	BAe HS 125 Series	2	2	0	0	4	0	0	0	0	0	0
	Fuji T-1	12	6	2	0	0	0	0	0	0	0	0
	Learjet 20 Series	4	0	6	0	0	0	4	0	0	0	0
	Learjet 31	10	18	12	6	10	4	4	8	26	48	32
	Learjet 40 Series	28	34	32	26	20	20	38	20	22	22	36
	Learjet 50 Series	4	4	2	2	6	4	2	2	2	0	0
	Learjet 60 Series	6	6	10	4	12	28	22	16	38	20	14
	Westwind II	0	0	4	4	0	4	2	10	0	0	0
	TOTAL	68	70	68	42	52	60	72	56	88	90	82
C-II	Bombardier CRJ 100/200/700	4	0	0	0	4	18	308	192	0	1,838	1,366
	Challenger 300/600/604	22	30	32	34	38	56	58	64	64	60	86
	Embraer ERJ-135/140/145	44	568	2,120	2,978	3,562	3,536	3,334	3,422	3,566	1,648	2,294
	Fairchild A-10	0	0	2	0	6	2	0	0	0	0	0
	Gulfstream 100/150	18	8	6	6	16	2	6	10	6	12	24
	Gulfstream 200/280	20	10	16	8	8	14	30	40	18	32	34
	Gulfstream G-III	10	2	0	0	0	2	4	2	0	2	4
	Hawker 4000	0	0	0	0	0	0	4	12	22	42	46
	Hawker 800	20	30	20	16	10	18	34	28	30	32	36
	Learjet 70 Series	0	0	0	0	0	0	0	2	8	8	10
	Lockheed Jetstar	16	12	8	12	4	10	0	2	0	0	0
	TOTAL	154	660	2,204	3,054	3,648	3,658	3,778	3,774	3,714	3,674	3,900
C-III	Airbus A319/320/321	20	22	20	24	24	48	56	2	2	4	6
	Boeing 737 (200 thru 700 series)	44	52	52	18	98	82	22	38	22	28	4
	Embraer EMB 170/175/190	0	0	0	0	0	0	0	4	16	12	18
	McDonnell Douglas DC-9	24	6	12	8	8	4	0	0	0	0	0
	McDonnell Douglas MD-81/82/87/90	0	0	10	0	0	2	0	0	8	0	0
	P-3 Orion	0	0	0	0	0	0	4	2	0	0	0
	TOTAL	88	80	94	50	130	136	82	46	48	44	28

Source: FAA database **ARC** - Airport Reference Code

Exhibit 2N
TRAFFIC FLOW MANAGEMENT SYSTEM COUNT (TFMSC)

AIRCRAFT REFERENCE CODES

ARC	Aircraft	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018*
C-IV	Boeing 707	0	0	0	0	0	0	6	4	2	0	0
	Boeing 757-200	20	14	20	14	22	14	4	14	2	4	0
	Boeing 767-200/300	0	0	0	0	2	0	0	0	0	0	0
	Boeing C-17	0	16	8	16	6	14	10	6	12	8	4
	Boeing E-6 Mercury	0	0	0	0	2	0	0	0	0	0	0
	C-130 Hercules	110	98	144	172	102	42	96	30	32	72	100
	TOTAL	130	128	172	202	134	70	116	54	48	84	104
D-I	F/A-18 Hornet	8	0	0	0	0	0	0	0	0	6	6
	Learjet 35/36	62	60	74	24	26	44	16	18	24	22	24
	T-38 Talon	0	0	0	0	2	0	0	0	0	0	0
	TOTAL	70	60	74	24	28	44	16	18	24	28	30
D-II	Gulfstream 450	4	4	20	2	8	18	20	16	8	0	4
	TOTAL	4	4	20	2	8	18	20	16	8	0	4
D-III	Boeing 737 800/900	58	90	50	56	54	22	22	26	66	50	52
	Gulfstream 500/600	4	8	8	10	8	16	20	24	20	20	16
	McDonnell Douglas MD-83/88	2	0	0	2	14	14	10	2	2	2	2
	TOTAL	64	98	58	68	76	52	52	52	88	72	70
D-IV	Boeing 757-300	0	0	0	0	0	4	0	4	0	0	0
	TOTAL	0	0	0	0	0	4	0	4	0	0	0
E-I	F-16 Falcon/Viper	0	0	0	0	0	0	0	2	0	2	2
	TOTAL	0	0	0	0	0	0	0	2	0	2	2

ARC CODE SUMMARY

ARC	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018*
A-I	60	174	208	206	222	230	198	176	312	294	228
A-II	36	44	50	48	74	56	92	104	90	48	48
B-I	1,380	940	976	960	1,022	1,014	814	814	844	738	594
B-II	4,436	4,674	1,374	948	1,056	1,024	1,018	832	858	920	952
B-III	2	0	2	0	4	30	14	36	26	16	16
C-I	68	70	68	42	52	60	72	56	88	90	82
C-II	154	660	2,204	3,054	3,648	3,658	3,778	3,774	3,714	3,674	3,900
C-III	88	80	94	50	130	136	82	46	48	44	28
C-IV	130	128	172	202	134	70	116	54	48	84	104
D-I	70	60	74	24	28	44	16	18	24	28	30
D-II	4	4	20	2	8	18	20	16	8	0	4
D-III	64	98	58	68	76	52	52	52	88	72	70
D-IV	0	0	0	0	0	4	0	4	0	0	0
E-I	0	0	0	0	0	0	0	2	0	2	2
Total	6,492	6,932	5,300	5,604	6,454	6,396	6,272	5,984	6,148	6,010	6,058

AIRCRAFT APPROACH CATEGORY (AAC)

AAC	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018*
A	96	218	258	254	296	286	290	280	402	342	276
B	5,818	5,614	2,352	1,908	2,082	2,068	1,846	1,682	1,728	1,674	1,562
C	440	938	2,538	3,348	3,964	3,924	4,048	3,930	3,898	3,892	4,114
D	138	162	152	94	112	118	88	90	120	100	104
E	0	0	0	0	0	0	0	2	0	2	2
Total	6,492	6,932	5,300	5,604	6,454	6,396	6,272	5,984	6,148	6,010	6,058

AIRPLANE DESIGN GROUP (ADG)

ADG	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018*
I	1,578	1,244	1,326	1,232	1,324	1,348	1,100	1,066	1,268	1,152	936
II	4,630	5,382	3,648	4,052	4,786	4,756	4,908	4,726	4,670	4,642	4,904
III	154	178	154	118	210	218	148	134	162	132	114
IV	130	128	172	202	134	74	116	58	48	84	104
Total	6,492	6,932	5,300	5,604	6,454	6,396	6,272	5,984	6,148	6,010	6,058

Exhibit 2N
TRAFFIC FLOW MANAGEMENT SYSTEM COUNT (TFMSC)

This potential for increased operations by larger airline/charter aircraft and continued growth by the business jet operators provides a reasonable justification to consider the ultimate critical design aircraft for the airport as ARC C-III.

RUNWAY DESIGN CODE

Each runway is assigned an RDC. The RDC relates to specific FAA design standards that should be met in relation to each runway. The RDC takes into consideration the AAC, ADG, and the RVR. In most cases, the critical design aircraft will also be the RDC for the primary runway.

Runway 3-21 RDC

Runway 3-21 is the primary runway and is designed to accommodate the critical design aircraft. This runway is 7,000 feet long and 150 feet wide. It has a precision instrument approach via an instrument landing system (ILS) to Runway 3 and vertically guided GPS approach to Runway 21, both providing for visibility minimums as low as ¾-milee with ceilings down to 200 feet. Consideration in later chapters will likely promote even lower ½-mile visibility minimum capability for one or both ends of Runway 3-21. **Therefore, the current RDC for Runway 3-21 is C-II-4000 and the ultimate RDC for planning purposes is C-III-2400**.

Runway 13-31 RDC

Crosswind runways, such as Runway 13-31, are intended to provide a crosswind alternative for smaller aircraft that operate to the airport, which primarily includes aircraft up to small to mid-sized business jet aircraft such as the Cessna Citation family of aircraft. Therefore, Runway 13-31 should sufficiently meet the design standards of those smaller aircraft. The runway is not currently served by any instrument approach procedures. **Therefore, the current RDC for Runway 13-31 is B-I-VIS**. **Ultimately, consideration will be given to planning Runway 13-31 to meet RDC B-II-5000** design standards so that it may serve as a back-up commercial service runway to those aircraft in the fleet that could operate from a 5,000-foot by 75-foot surface. This option will be further explored and examined later in the Master Plan.

SUMMARY

This chapter has outlined the various activity levels byp demand indicators that might reasonably be anticipated over the planning period. A summary of all forecasts is provided on **Exhibit 2K**. MHK provides an important and convenient air passenger link to the national airspace system for the local area. Nonetheless, the availability of various flight options from Kansas City and Wichita, as well as direct links via regional interstates and highways, results in passenger leakage to these airports. Through local and regional economic and population growth and improved service options including a diversification of destinations, the airport could expect increased passenger levels. Regularly scheduled commercial passenger enplanements are forecast to grow from 69,875 in 2018 to 113,300 by 2038 for a CAGR of 2.45 percent. Charter operations and enplanements supporting KSU and the military will continue to occur on par with historic amounts.

General aviation operations are forecast to increase modestly over the planning period. Based aircraft are forecast to increase from 42 in 2018 to 66 in 2038, for a CAGR of 2.29 percent. The fleet mix is anticipated to see increases in turbine aircraft over the planning period. When inflated to account for after-hours activity, total annual operations are forecast to grow from 46,708 in 2018 to 57,336 in 2038 for a CAGR of 1.03 percent.

The current critical design aircraft for MHK is ARC C-II, which is represented by a family of aircraft that includes business jets and commuter airline jets up to the CRJ-700. Operational growth by commuter airlines to include larger 70- and 90-seat aircraft are anticipated and continued charter operations by larger narrow-bodied commercial airline aircraft will continue as in the past, resulting in a future critical design aircraft within ARC C-III. The existing RDC for Runway 3-21 is C-II-4000 and the ultimate is C-III-2400. The existing RDC for Runway 13-31 is B-I-VIS and consideration will be given to upgrading to higher design standards in the future, possibly to B-II-5000.

The next step in the planning process is to assess the capabilities of the existing facilities to determine what upgrades may be necessary to meet future demands. The range of forecasts developed here will be taken forward in the next chapter as planning horizon activity levels that will serve as milestones or activity benchmarks in evaluating facility requirements.

Chapter Three

FACILITY REQUIREMENTS

CHAPTER THREE

Facility Requirements

To properly plan for the future at Manhattan Regional Airport (MHK), it is necessary to translate forecast aviation demand into the specific types and quantities of facilities that can adequately serve projected demand levels. This chapter uses the results of the aviation demand forecasts, as well as established planning criteria, to determine the airfield (i.e., runways, taxiways, navigational aids, marking and lighting, and support facilities) and landside (i.e., terminal building, hangars, aircraft parking apron, fueling, vehicle parking and access) facility requirements.

The objective of this effort is to identify, in general terms, the adequacy of the existing airport facilities and outline what new facilities may be needed and when they may be needed to accommodate forecast demands. Having established these facility requirements, alternatives for providing the facilities will be evaluated to determine the most cost-effective and efficient means for implementation.

PLANNING HORIZONS

Cost-effective, safe, efficient, and orderly development of an airport should rely more upon actual demand than a time-based forecast figure. Thus, in order to develop a master plan that is demand-based rather than time-based, a series of planning horizon milestones have been established, as discussed in Chapter Two - Forecasts, that take into consideration the reasonable range of aviation demand projections.

It is important to consider that, over time, the actual activity at the airport may be higher or lower than what the annualized forecast portrays. Forecasting efforts generally outline the market demand, but many factors will influence actual demand at an airport. Some factors will attract and accommodate the demand while others will shift demand to other locations due to limitations. By planning according to activity milestones, the resultant plan can accommodate unexpected shifts or changes in the area's aviation demand. It is important to plan for these milestones, so airport officials can respond to unanticipated changes in a timely fashion. As a result, these milestones provide flexibility while potentially extending this plan's useful life if aviation trends slow over the period.

The most important reason for utilizing milestones is to allow the airport to develop facilities according to need generated by actual demand levels. The demand-based schedule provides flexibility in development, as the schedule can be slowed or expedited according to actual demand at any given time over the planning period. The resultant plan provides airport officials with a financially responsible and needs-based program. **Table 3A** presents the planning horizon milestones for each activity market demand category.

TABLE 3A
Planning Horizon Activity Levels
Manhattan Regional Airport

	BASE YEAR	PLANNING HORIZONS		
	2018	Short Term	Intermediate Term	Long Term
Total Enplaned Passengers	**73,162**	**75,600**	**89,250**	**118,300**
Regular Scheduled Airline	69,875	75,600	89,250	113,300
Charter (KSU/Military/On Demand)	3,287	3,500	4,000	5,000
ANNUAL AIRCRAFT OPERATIONS				
Itinerant Aircraft Operations				
Air Carrier	1,144	2,365	3,003	4,034
Air Taxi	4,256	3,019	3,028	2,940
General Aviation	14,675	16,442	18,863	23,069
Military	5,403	2,701	2,701	2,701
Total Itinerant Operations	*25,478*	*24,528*	*27,596*	*32,744*
Local Aircraft Operations				
General Aviation	15,212	15,422	15,677	16,314
Military	6,018	5,943	5,943	5,943
Total Local Operations	21,230	21,365	21,620	22,257
Total Airport Operations	**46,708**	**45,893**	**49,216**	**55,002**
Based Aircraft	42	51	56	66

EXISTING AIRPORT PLAN

Before analyzing the facility requirements for the airport based on forecast market demand factors presented in Chapter Two, a review of the existing airport plan should be made. **Exhibit 3A** is a two-sided exhibit, both depicting the current Airport Layout Drawing (ALD). The difference in the two illustrations is one depicts the plan on an aerial base and the other as the standard drafted drawing including in the Airport Layout Plan (ALP) drawing set. An updated ALP is the desired outcome of any airport planning effort as it details the existing facility and the ultimate plan. The FAA requires that any capital improvement to be funded through federal grant-in-aid programs be shown on the approved ALP.

The current ALP as shown includes an existing runway design code (RDC) for Runway 3-21 as C-III with not lower than ½-mile published instrument approach visibility minimums to Runway 3, and visual conditions only approach minimums to Runway 21. It should be noted that the instrument landing system (ILS) approach minimums have subsequently been raised to not lower than ¾-mile since completion of the ALP. The ultimate planned RDC for the runway was C-IV with Runway 21 planned for not lower than ¾-mile visibility minimums, now currently offered. The current ALP RDC for Runway 3-21 differs from what was determined to be the existing and ultimate RDC for this study. This study is proffering an existing RDC of C-II and ultimate of C-III, squarely based on the actual aircraft operational data for those exceeding the critical design aircraft threshold of 500 annual operations, as detailed in the previous chapter.

The existing plan depicted on **Exhibit 3A** identified Runway 13-31 as an existing RDC B-I with visual approach conditions. The ultimate plan for the runway included a designation of RDC B-II having not lower than one-mile visibility approach procedures. These are the same variables being considered in this planning effort. It should be noted that the existing ALD was completed prior to the extension of Runway 13-31, which at the time was 3,800 feet long but is now 5,000 feet long after being extended as planned. Moreover, the runway had been 100 feet wide but has since been narrowed to a width of 75 feet.

The remainder of this chapter will be dedicated primarily to an examination of airside facilities. One of the primary goals of this study is to determine the ideal method to improve airfield pavements while minimizing runway closure periods. As such, this chapter will examine a variety of airfield components based on the identified current and ultimate critical design aircraft, being C-II and C-III respectively. The analysis to follow will also consider generalized landside requirements based on limited study scoping parameters.

AIRFIELD CAPACITY

An airfield's capacity is expressed in terms of its annual service volume (ASV). ASV is a reasonable estimate of the maximum level of aircraft operations that can be accommodated in a year without incurring significant delay factors. As aircraft operations near or surpass the ASV, delay factors increase exponentially. MHK's ASV was examined utilizing the Federal Aviation Administration's (FAA) Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay*.

FACTORS AFFECTING ANNUAL SERVICE VOLUME

This analysis considers specific factors about the airfield in order to calculate MHK's ASV. These various factors are depicted in **Exhibit 3B**. The following describes the input factors as they relate to the airport and include airfield layout, weather conditions, aircraft mix, and operations.

- **Runway Configuration –** The existing airfield configuration consists of two runways, with the primary runway supported by a full-length parallel taxiway. Primary Runway 3-21 is 7,000 feet long and 150 feet wide. Runway 13-31 is 5,000 feet long and 75 feet wide.

- **Runway Use –** Runway use in capacity conditions will be controlled by wind and/or airspace conditions. For MHK, the direction of takeoffs and landings are generally determined by the speed and direction of the wind. It is generally safest for aircraft to takeoff and land into the wind, avoiding a crosswind (wind that is blowing perpendicular to the travel of the aircraft) or tailwind components during these operations.

  Based upon available wind data, winds are generally more favorable out of the south, resulting in Runways 21 and 13 being preferred for wind conditions. The availability of instrument approaches is also considered. While each runway end provides instrument approach capability, Runway 3 is primarily utilized in instrument weather conditions since it is equipped with an ILS, which provides approach visibility minimums down to ¾-mile.

- **Exit Taxiways –** Exit taxiways have a significant impact on airfield capacity since the number and location of exits directly determine the occupancy time of an aircraft on the runway. The airfield capacity analysis gives credit to taxiway exits located within the prescribed range from a runway's threshold. This range is based upon the mix index of the aircraft that use the runways. Based upon mix, only exit taxiways between 2,000 feet and 4,000 feet from the landing threshold count in the exit rating at MHK. The exits must be at least 750 feet apart to count as separate exit taxiways. Utilizing these standards, two exit taxiways are provided for aircraft landing on both ends of Runway 3-21, and one exit taxiway is considered for aircraft landing on Runways 13 and 31.

- **Weather Conditions –** Weather conditions can have a significant impact on airfield capacity. Airport capacity is usually highest in clear weather, when flight visibility is at its best. Airfield capacity is diminished as weather conditions deteriorate and cloud ceilings and visibility are reduced. As weather conditions deteriorate, the spacing of aircraft must increase to provide allowable margins of safety and air traffic vectoring. The increased distance between aircraft reduces the number of aircraft which can operate at the airport during any given period, thus reducing overall airfield capacity.

  According to meteorological data collected from the on-airport automated surface observation system (ASOS), MHK operates under visual meteorological conditions (VMC) approximately 88 percent of the time. VMC exist whenever the cloud ceiling is greater than 1,000 feet above ground level (AGL) and visibility is greater than three statute miles. Instrument meteorological conditions (IMC) are defined when cloud ceilings are between 500 and 1,000 feet AGL or visibility

DECLARED DISTANCES

	RUNWAY 3	RUNWAY 21
TORA	9,000′	9,000′
TODA	9,000′	9,000′
ASDA	9,000′	9,000′
LDA	8,000′	8,000′

TODA - Takeoff Distance Available
TORA - Takeoff Run Available
ASDA - Accelerate/Stop Distance Available
LDA - Landing Distance Available

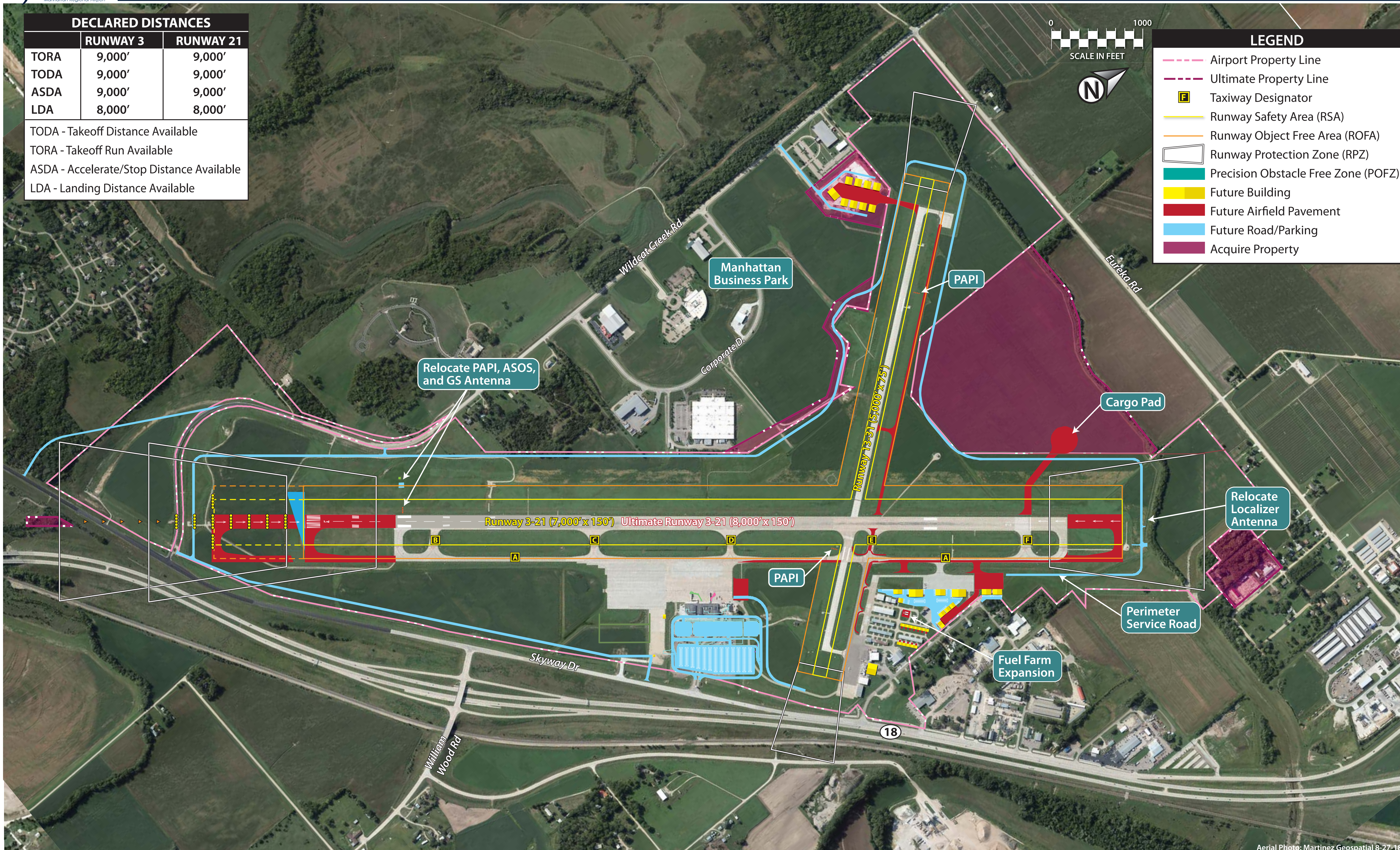


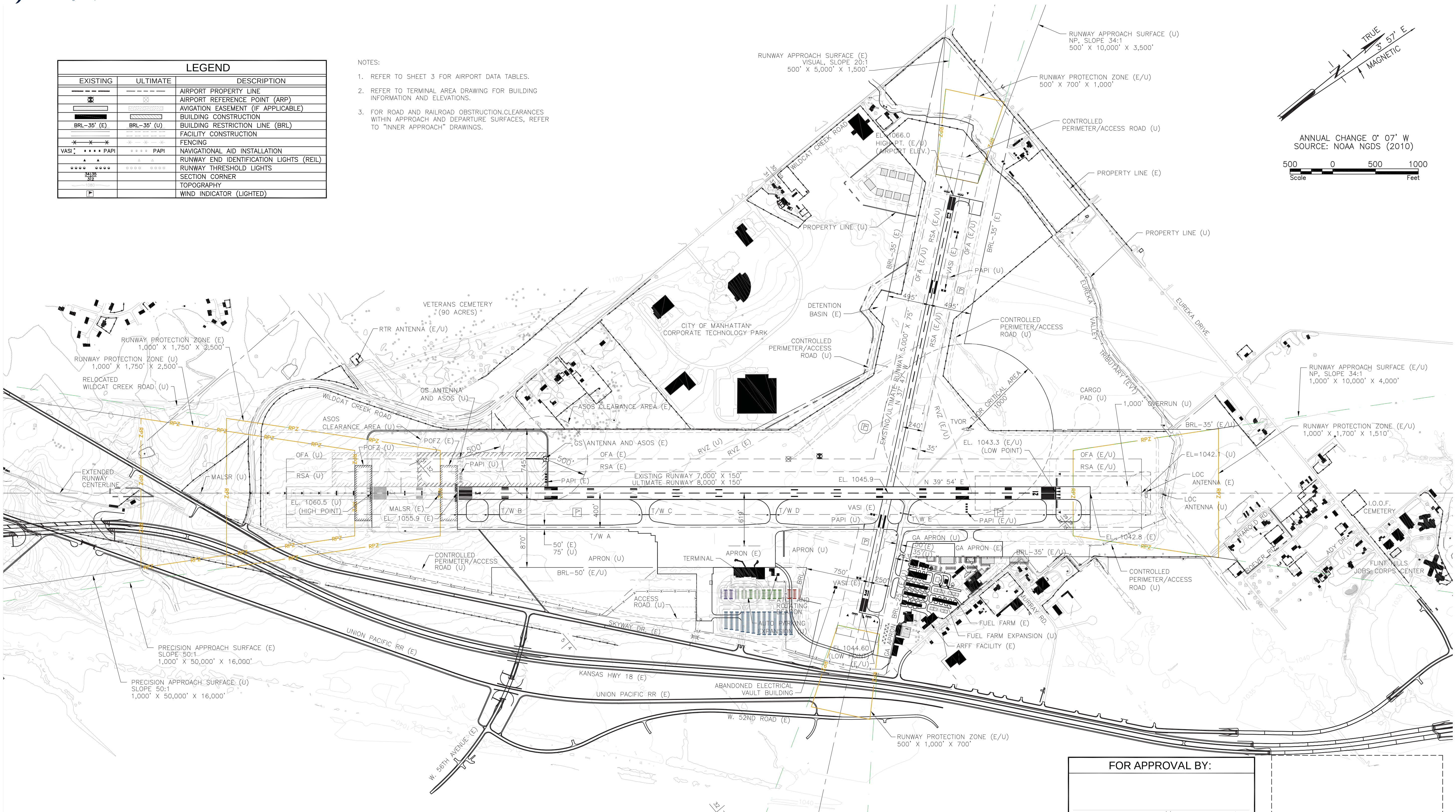
Exhibit 3A
EXISTING AIRPORT LAYOUT PLAN

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
		AIRPORT REFERENCE POINT (ARP)
		AVIGATION EASEMENT (IF APPLICABLE)
		BUILDING CONSTRUCTION
BRL–35' (E)	BRL–35' (U)	BUILDING RESTRICTION LINE (BRL)
		FACILITY CONSTRUCTION
		FENCING
VASI PAPI	PAPI	NAVIGATIONAL AID INSTALLATION
		RUNWAY END IDENTIFICATION LIGHTS (REIL)
		RUNWAY THRESHOLD LIGHTS
		SECTION CORNER
		TOPOGRAPHY
		WIND INDICATOR (LIGHTED)

NOTES:

1. REFER TO SHEET 3 FOR AIRPORT DATA TABLES.
2. REFER TO TERMINAL AREA DRAWING FOR BUILDING INFORMATION AND ELEVATIONS.
3. FOR ROAD AND RAILROAD OBSTRUCTION CLEARANCES WITHIN APPROACH AND DEPARTURE SURFACES, REFER TO "INNER APPROACH" DRAWINGS.



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FOR APPROVAL BY:

Peter C. Van Kuren, C.M. — DATE
AIRPORT DIRECTOR

SUBMITTED BY: — DATE
Lisa L. Kinsman, P.E.
MEAD & HUNT, INC.

AREA RESERVED FOR FAA APPROVAL BLOCK STICKER

Exhibit 3A
EXISTING AIRPORT LAYOUT PLAN

AIRFIELD LAYOUT

Runway Configuration

Runway Use

Number of Exits

WEATHER CONDITIONS

VMC
Visual Meteorological Conditions

IMC
Instrument Meteorological Conditions

PVC
Poor Visibility Conditions

AIRCRAFT MIX

Category A & B Aircraft

Category C Aircraft

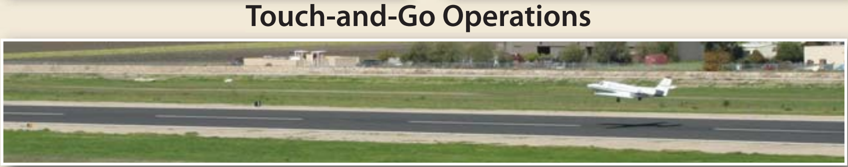
Category D Aircraft

OPERATIONS

Arrivals

Departures

Touch-and-Go Operations



Total Annual Operations

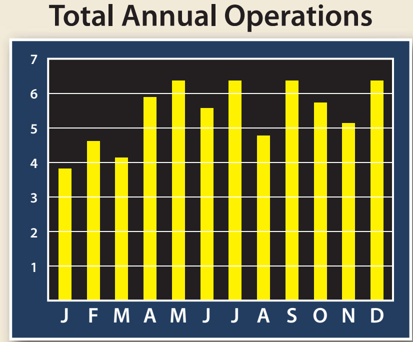


Exhibit 3B
AIRFIELD CAPACITY FACTORS

is between one and three miles. According to the weather observations, IMC prevailed approximately eight percent of the time. Poor visibility conditions (PVC) apply for cloud ceilings below 500 feet and visibility minimums below one mile. PVC conditions occur approximately 3.5 percent of the year. **Table 3B** summarizes the weather conditions experienced at the airport over a 10-year period.

TABLE 3B
Weather Conditions
Manhattan Regional Airport

Condition	Cloud Ceiling	Visibility	Percent of Total
VMC	> 1,000' AGL	> 3 statute miles	88.35 %
IMC	≥ 500' AGL and ≤ 1,000' AGL	1-3 statute miles	8.17 %
PVC	< 500' AGL	< 1 statute mile	3.49 %

VMC - Visual Meteorological Conditions
IMC - Instrument Meteorological Conditions
PVC - Poor Visibility Conditions
AGL - Above Ground Level
Source: National Oceanic and Atmospheric Administration (NOAA)

- **Aircraft Mix –** Aircraft mix for the capacity analysis is defined in terms of four fixed-wing aircraft classes. Classes A and B consist of small- and medium-sized propeller and some jet aircraft, all weighing 12,500 pounds or less. These aircraft are associated primarily with general aviation activity. A significant number of aircraft operations at MHK are those in Classes A and B. Class C consists of aircraft weighing between 12,500 pounds and 300,000 pounds. These aircraft include airline aircraft, most business jets and large turboprop aircraft, as well as larger charter aircraft that utilize the airport. Class D aircraft consists of large aircraft weighing more than 300,000 pounds. The airport experiences limited operations by Class D aircraft that include large charter airline and military transport aircraft. In the future, aircraft in Class C will continue to constitute a substantial number of fixed-wing operations; however, Class D aircraft are projected to contribute minimal operational activity at MHK as part of the overall aircraft fleet mix at the airport and generally will include the Boeing 757/767 and some military aircraft. it should be noted that for purposes of determining airfield capacity, helicopter activity is not included in the aircraft mix classification.

- **Percent Arrivals –** The percentage of arrivals as they relate to total operations of the airport is important in determining airfield capacity. Under most circumstances, the lower the percentage of arrivals, the higher the hourly capacity. The aircraft arrival-departure percentage split is typically 50/50, which is the case at MHK.

- **Touch-And-Go Activity –** A touch-and-go operation involves an aircraft making a landing and then an immediate takeoff without coming to a full stop or exiting the runway. A high percentage of touch-and-go traffic normally results in a higher operational capacity because one landing and one takeoff occurs within a shorter time period than individual operations. Touch-and-go operations at MHK have historically averaged 23 percent of total annual operations.

- **Peak Period Operations –** For the airfield capacity analysis, average daily operations and average peak hour operations during the peak month are utilized. Typical operations activity is important in the calculation of an airport's ASV as "peak demand" levels occur sporadically. The peak periods used in the capacity analysis are representative of normal operational activity and can be exceeded at various times throughout the year. For MHK, the peak periods typically occur during the spring and fall months.

AIRFIELD CAPACITY SUMMARY

Given the factors outlined above, the airfield's ASV will range between 150,000 and 200,000 annual operations. The ASV does not indicate a point of absolute gridlock for the airfield; however, it does represent the point at which operational delay for each aircraft operation will increase exponentially.

As previously detailed, during the past ten years, the airport has experienced between 20,000 and 30,000 annual operations based on airport traffic control tower (ATCT) counts. Even with the additional after-hours adjustments, annual operations have not exceeded 50,000 over the period. This operational level for the airport represents no more than 33 percent of the airfield's ASV, if the ASV is considered at the low end of the typical range of 150,000 annual operations. By the end of the long-term planning period, total annual operations (adjusted) are projected to represent 36 percent of the airfield's ASV.

FAA Order 5090.3B, *Field Formulation of the National Plan of Integrated Airport Systems* (NPIAS) indicates that improvements for airfield capacity purposes should begin to be considered once operations reach 60 to 75 percent of the annual service volume. This is an approximate level to begin the detailed planning of capacity improvements. At the 80 percent level, the planned improvements should be made. While no significant capacity improvements will be necessary, options to improve airfield efficiency will still be considered in the master plan.

AIRFIELD REQUIREMENTS

The analyses of the operational capacity and the critical design aircraft are used to determine airfield needs. This includes runway configuration, dimensional standards, and pavement strength, as well as navigational aids, lighting, and marking.

RUNWAY CONFIGURATION

Key considerations in the runway configuration of an airport involve the orientation for wind coverage and the operational capacity of the runway system. FAA AC 150/5300-13A, *Airport Design*, recommends that a crosswind runway should be made available when the primary runway orientation provides less than 95 percent wind coverage for any aircraft forecast to use the airport on a regular basis.

The 95 percent wind coverage is computed on the basis of the crosswind component not exceeding 10.5 knots (12 mph) for ARC A-I and B-I; 13 knots (15 mph) for ARC A-II and B-II; 16 knots (18 mph) for ARC A-III, B-III, and C-I through D-II; and 20 knots (23 mph) for ARC C-III through D-IV.

The previous 10 years of wind data was obtained from the on-airport ASOS and has been analyzed to identify wind coverage provided by the existing runway orientations. At MHK, the orientation of Runway 3-21 provides 95.25 percent coverage for 10.5-knot component, 97.88 percent coverage for 13 knots, and greater than 99 percent coverage for 16- and 20-knot components. Runway 13-31 provides 88.56 percent coverage for 10.5-knot crosswind component, 93.68 percent coverage for 13 knots, and at least 98 percent coverage for 16 knots or greater. The combination of both runways provides 99 percent coverage for 10.5 knots and greater. Thus, the two runways at MHK provide adequate wind coverage. Both the instrument flight rules (IFR) and visual flight rules (VFR) wind roses are presented on **Exhibit 3C**.

FAA design criteria recommend that a crosswind runway be made available when wind coverage for the primary runway is less than 95 percent. The crosswind runway should continue to primarily serve aircraft up to ARC B-II. It offers a suitable secondary runway for most aircraft operations when the primary runway is closed for extended periods of time.

RUNWAY LENGTH

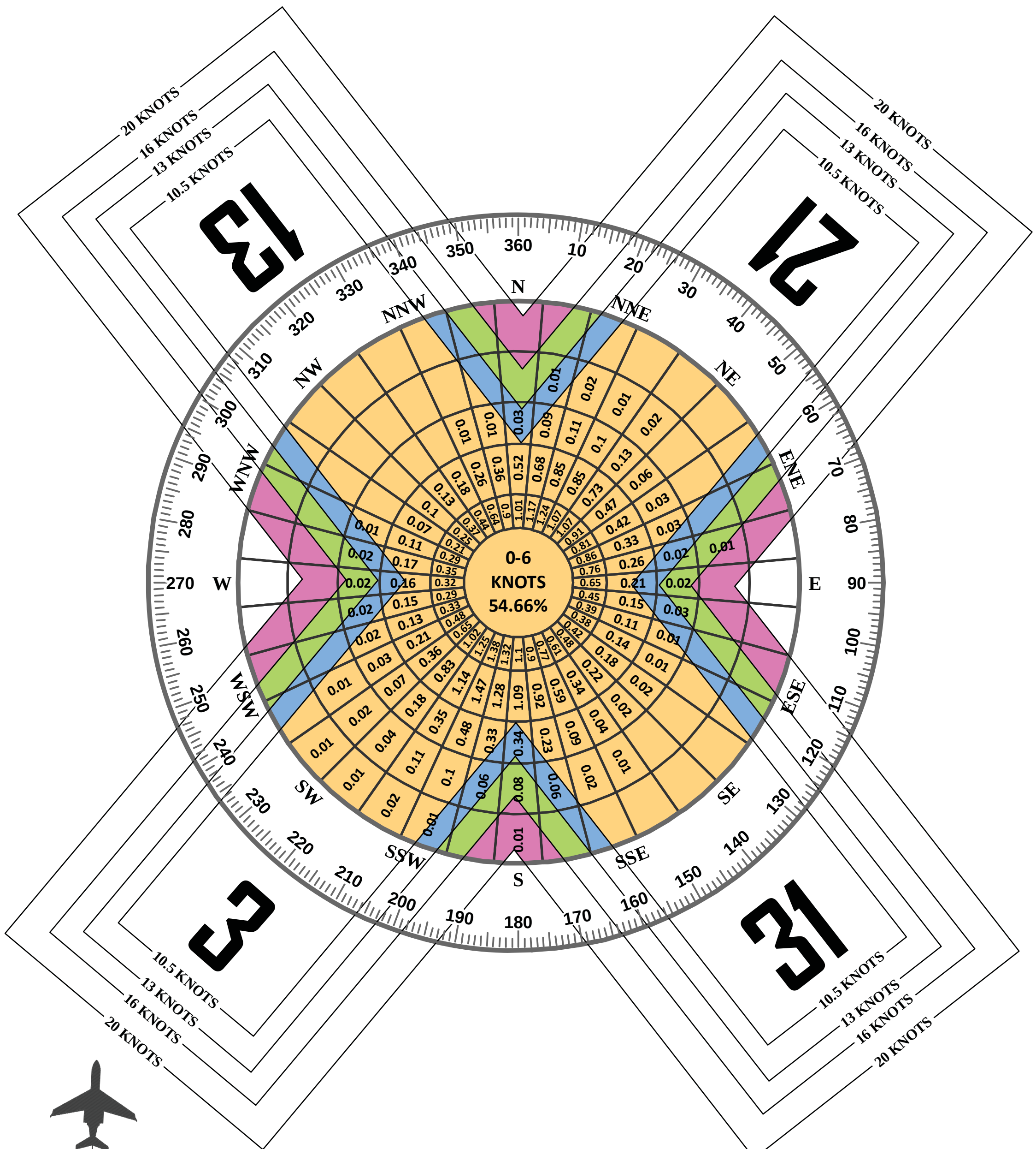
The aircraft performance capability is a key factor in determining the runway length needed for takeoff and landing. The performance capability and, subsequently, the runway length requirement of a given aircraft type can be affected by the elevation of the airport, the air temperature, the gradient of the runway, and the operating weight of the aircraft. Aircraft performance capabilities decline as each of these factors increase.

The airport elevation at MHK is 1,066.2 feet above mean sea level (MSL). The temperature used for airport design is the mean maximum daily temperature during the hottest month. According to the National Climatic Data Center, the mean maximum temperature is 91.1 degrees Fahrenheit (F) in Manhattan during the hottest month. The change in elevation (gradient) varies by 12.6 feet along Runway 3-21 (0.1 percent gradient) and by 21.4 feet along Runway 13-31 (0.4 percent gradient). This information is utilized in the following runway length analyses.

Commercial Aircraft

Runway length needs for commercial aircraft must factor the conditions described above but also the load carried. The aircraft load is dependent upon the payload of passengers and/or cargo, plus the amount of fuel it has on board. For departures, the amount of fuel varies depending upon the length of non-stop flight or trip length. In some cases, airlines will ferry fuel due to availability/pricing; therefore, some aircraft will operate from an airport with more fuel (load) than necessary.

ALL WEATHER WIND COVERAGE				
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 3-21	95.25%	97.88%	99.53%	99.91%
Runway 13-31	88.56%	93.68%	98.00%	99.47%
All Runways	98.95%	99.77%	99.95%	99.99%

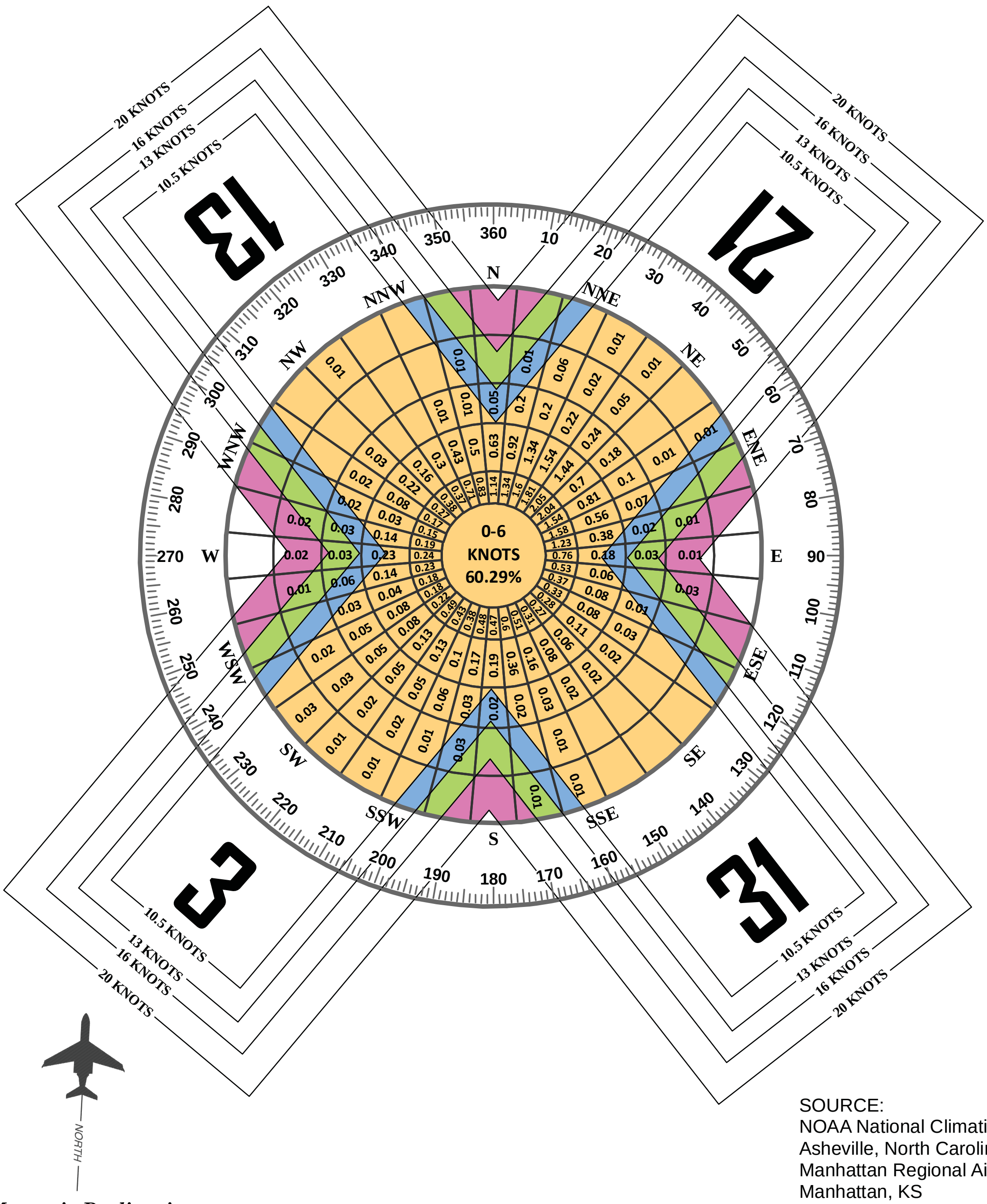


Magnetic Declination
03° 04' 00" East (July 2018)
Annual Rate of Change
00° 06' 00" West (July 2018)

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Manhattan Regional Airport
Manhattan, KS

OBSERVATIONS:
102,834 All Weather Observations
Jan. 1, 2008 - Dec, 31 2017

IFR WIND COVERAGE				
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 3-21	96.79%	98.59%	99.64%	99.90%
Runway 13-31	90.33%	94.35%	98.18%	99.48%
All Runways	99.28%	99.80%	99.94%	100.00%



Magnetic Declination
03° 04' 00" East (July 2018)
Annual Rate of Change
00° 06' 00" West (July 2018)

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Manhattan Regional Airport
Manhattan, KS

OBSERVATIONS:
11,983 IFR Observations
Jan. 1, 2008 - Dec, 31 2017

As of October 2018, three regularly scheduled daily airline departures (except Saturdays) from MHK were available to Dallas-Fort Worth International Airport (375 nautical miles [nm]) and three daily departures to Chicago O'Hare International Airport (435 nm). Any future destinations could include traditional hub airports such as Denver (374 nm), Atlanta (678 nm), or Houston (552 nm).

All common commercial turboprop aircraft can operate at the existing airfield at maximum certified takeoff weight (MTOW). This includes the ATR-42/72 (no longer in service), Saab-340B, Dash8, and Q-400. These aircraft are unlikely options for the existing airline serving MHK; however, another future airline entrant could elect to utilize the Q-400 at some point in the future.

Table 3C presents the runway length needs for various regional jet aircraft utilizing the maximum ambient temperature conditions available in each aircraft's airport planning manual. Each of the regional jets can operate at MHK at or above 80 percent useful load; however, additional runway length could be necessary for certain regional jets on very hot days, especially with useful loads above 80 percent. The maximum runway length calculated was for the ERJ-190 and CRJ-900, which need 8,300 feet when fully loaded on hot days.

Charter operators, typically ferrying athletic teams or military units to and from Manhattan, utilize a variety of aircraft types, including both medium and large commercial passenger aircraft. To some degree, all these types of aircraft are weight-restricted on hot days.

TABLE 3C
Runway Length Analysis
Manhattan Regional Airport

Aircraft Type	Rwy Length (ft.) @ 60% Load	Rwy Length (ft.) @ 70% Load	Rwy Length (ft.) @ 80% Load	Rwy Length (ft.) @ 90% Load	Rwy Length (ft.) @ 100% Load
MAINLINE COMMERCIAL PASSENGER AIRCRAFT					
737-700	5,000	5,900	6,700	8,200	10,400
737-800	5,200	6,100	6,600	7,500	8,300
737-900	6,100	7,200	8,200	9,100	10,400
757-200	4,700	5,400	6,200	7,000	8,100
757-300	5,200	5,900	6,600	7,300	8,200
767-200	4,500	5,100	5,400	6,000	6,500
A319	4,000	4,500	4,700	5,100	6,100
A320	5,100	5,500	6,100	6,800	7,500
MD-83	5,000	5,900	6,600	7,500	9,000
REGIONAL COMMERCIAL PASSENGER AIRCRAFT					
ERJ-145	4,400	5,100	6,400	7,200	8,000
ERJ-175	4,800	5,200	5,400	6,000	7,300
ERJ-190	4,400	4,800	6,400	7,200	8,300
CRJ-700	4,400	4,600	5,100	5,400	6,700
CRJ-900	5,300	5,900	6,300	7,800	8,300

Source: Aircraft planning manuals.
Note: Temperature conversions from operating manuals as close to airport's design temperature (91 degrees) as possible

Forecasts prepared for the master plan do include larger commercial aircraft conducting activity at the airport such as the Airbus 319/20/21, Boeing 737 (700/800 models), Boeing 757, or MD-83 on an infrequent basis; however, if those aircraft do eventually reach the 500 annual operations threshold, additional runway length may be justified.

The current length of Runway 3-21 is adequate to meet the needs of the current critical design aircraft (ARC C-II) and the existing commercial fleet under normal circumstances. During hot summer days, some of these aircraft could be weight-restricted, but those are rare occurrences considering the relatively short distances currently flown. As a result, the existing runway length is adequate to meet the existing commercial carrier runway length requirements.

In the near future, as the airline fleet mix will likely transition to the larger regional jets as forecast, additional runway length could be justified. A runway length of 8,300 feet would accommodate all regional jets during the hottest weather conditions as well as most medium-sized commercial airliners up to 90 percent useful load. Most could also operate at 100 percent useful load. Therefore, future planning will consider the potential for the airport to provide a primary runway length of up to 8,300 feet. While this length would be ideal, physical constraints may prohibit the reality of any additional runway length. Analysis in the next chapter will detail alternatives for providing additional runway length at MHK.

Runway Length – General Aviation

MHK serves a substantial level of general aviation activity. While most of the general aviation activity is conducted by small piston-powered aircraft, MHK is also used extensively by itinerant business jet aircraft (Challenger, Citation, Hawker, Learjet, and Gulfstream models), which have a greater impact upon runway length needs.

Exhibit 3D provides a detailed runway length analysis for the most common business jet aircraft in the national fleet. This data was obtained from Ultranav software which computes operational parameters for specific aircraft based on flight manual data. The analysis includes the MTOW allowable and the percent useful load for both current runway lengths. This analysis shows that the primary runway length of 7,000 feet is capable of accommodating the majority of business jet aircraft during wet runway conditions up to 90 percent useful loads. Some aircraft models would be weight-restricted above the 90 percent levels. The crosswind runway length of 5,000 feet is also capable of accommodating many of the business jet aircraft, but some must operate with restrictions to their takeoff weight due to operational limitations. The crosswind runway is closed to aircraft weighing more than 33,000 pounds at present due to pavement design.

Exhibit 3D also presents the runway length required for landing under three operational categories: Title 14 Code of Federal Regulations (CFR) Part 25, CFR Part 135, and CFR Part 91k. CFR Part 25 operations are those conducted by individuals or companies which own their aircraft. CFR Part 135 applies to all for-hire charter operations, including most fractional ownership operations. CFR Part 91k includes op-

Aircraft Name	MTOW lbs.	60% Useful Load Takeoff Length (ft)	70% Useful Load Takeoff Length (ft)	80% Useful Load Takeoff Length (ft)	90% Useful Load Takeoff Length (ft)	100% Useful Load Takeoff Length (ft)
King Air C90B	10,100	2,700	3,000	3,200	3,400	3,600
Citation I/SP	11,850	2,900	3,100	3,400	3,700	4,000
Citation CJ3	13,870	3,000	3,200	3,400	3,700	4,000
King Air 200 GT	12,500	3,500	3,600	3,700	3,900	4,000
Citation Mustang	8,645	2,900	3,200	3,600	4,000	4,400
Citation (525A) CJ2	12,375	3,300	3,500	3,800	4,100	4,400
King Air 350	15,000	3,500	3,700	3,900	4,100	4,500
Citation Encore	16,630	3,200	3,500	3,800	4,200	4,600
Citation Encore Plus	16,830	3,200	3,500	3,900	4,200	4,600
Citation 560 XL	20,000	3,500	3,800	4,100	4,400	4,800
Citation Bravo	14,800	3,600	3,900	4,200	4,500	4,900
Beechjet 400A	16,300	4,100	4,400	4,700	5,100	5,400
Citation (525) CJ1	10,600	3,500	4,000	4,500	5,000	5,500
Premier 1A	12,500	3,900	4,400	4,900	5,400	5,900
Gulfstream 350	70,900	4,300	4,600	5,100	5,500	6,000
Hawker 900 XP	28,000	4,500	4,600	5,000	5,500	6,000
Lear 31A	17,000	3,900	4,200	4,600	5,000	6,000
Hawker 4000	39,500	4,300	4,700	5,100	5,500	6,100
Gulfstream IIB	69,700	4,500	5,000	5,500	6,000	6,500
Global 5000	92,500	4,400	4,900	5,400	6,000	6,500
Gulfstream 150	26,100	5,000	5,300	5,500	6,000	6,600
Citation X	35,700	4,700	5,100	5,600	6,100	6,700
Gulfstream 450	74,600	4,600	5,000	5,600	6,100	6,700
Gulfstream IV/SP	74,600	4,600	5,100	5,600	6,100	6,700
Falcon 7X	70,000	4,500	5,000	5,600	6,100	6,800
Gulfstream 100	24,650	5,000	5,600	6,100	6,700	7,300
Global XRS	98,000	4,800	5,400	6,000	6,700	7,500
Gulfstream 550	91,000	4,700	5,400	6,100	6,900	7,600
Lear 60	23,500	5,200	5,700	6,300	6,900	7,600
Canadair 601-3A/R (Challenger 601)	45,100	5,200	5,800	6,400	7,200	8,000
Citation III	21,500	4,600	5,000	5,500	6,000	O/L
Gulfstream 200	35,450	5,500	6,200	7,000	7,800	O/L
Hawker 800 (Non-T/R)	27,400	5,400	6,000	6,700	7,500	O/L
Lear 35A	19,600	5,600	6,500	7,000	O/L	O/L
Westwind II	23,500	5,100	5,700	6,200	O/L	O/L
	Average	**4,200**	**4,600**	**5,100**	**5,400**	**5,800**

O/L = Out of Limits

SHORTER **7,000'** **LONGER**

RUNWAY LENGTH REQUIREMENTS

Aircraft Name	MTOW lbs.	Landing Lengths Required for:					
		Dry Runway Condition			Wet Runway Condition		
		Part 25	80% Rule	60% Rule	Part 25	80% Rule	60% Rule
King Air C90B	9,600	1,400	1,700	2,300	N/A	N/A	N/A
King Air 200 GT	12,500	1,900	2,400	3,200	N/A	N/A	N/A
Citation I/SP	11,350	2,400	3,000	4,100	2,800	3,500	4,700
Westwind II	19,000	2,500	3,100	4,100	2,800	3,500	4,700
Westwind I	19,000	2,500	3,200	4,200	2,900	3,600	4,900
Citation Mustang	8,000	2,600	3,200	4,300	3,600	4,500	6,000
Hawker 900 XP	23,350	2,700	3,400	4,500	4,000	5,000	6,700
Global 5000	78,600	2,700	3,400	4,500	3,100	3,900	5,200
Global XRS	78,600	2,700	3,400	4,500	3,100	3,900	5,200
Gulfstream 550	75,300	2,800	3,500	4,700	5,100	6,400	8,600
King Air 350	15,000	2,900	3,600	4,800	3,300	4,100	5,500
Citation (525) CJ1	9,800	2,900	3,700	4,900	4,000	5,000	6,600
Falcon 7X	62,400	3,000	3,700	5,000	3,400	4,300	5,700
Hawker 800 (Non-T/R)	23,350	3,000	3,800	5,000	3,900	4,900	6,500
Lear 31A	16,000	3,100	3,800	5,100	4,300	5,400	7,200
Citation CJ3	12,750	3,100	3,900	5,200	4,200	5,300	7,000
Citation Encore	15,200	3,100	3,900	5,200	4,700	5,800	7,800
Citation Encore Plus	15,200	3,100	3,900	5,200	4,700	5,900	7,900
Gulfstream 150	21,700	3,200	4,000	5,300	4,600	5,800	7,700
Gulfstream 100	20,700	3,200	4,000	5,300	6,100	7,600	10,100
Gulfstream IIB	58,500	3,200	4,000	5,400	6,200	7,700	10,300
Gulfstream IV/SP	66,000	3,200	4,000	5,400	3,700	4,700	6,200
Citation (525A) CJ2	11,500	3,300	4,100	5,500	4,700	5,900	7,900
Hawker 4000	33,500	3,300	4,100	5,500	3,800	4,700	6,300
Lear 35A	15,300	3,300	4,100	5,500	4,600	5,800	7,700
Gulfstream 350	66,000	3,300	4,200	5,600	3,800	4,800	6,400
Gulfstream 450	66,000	3,300	4,200	5,600	3,800	4,800	6,400
Canadair 601-3A/R (Challenger 601)	36,000	3,400	4,300	5,700	4,100	5,100	6,800
Premier 1A	11,600	3,400	4,300	5,700	4,400	5,500	7,400
Citation 560 XL	18,700	3,500	4,400	5,800	5,600	7,000	9,300
Gulfstream 200	30,000	3,600	4,500	6,000	4,100	5,200	6,900
Lear 60	19,500	3,700	4,600	6,100	5,000	6,200	8,300
Citation Bravo	13,500	3,700	4,600	6,200	5,800	7,200	9,700
Beechjet 400A	15,700	3,800	4,700	6,300	5,600	7,000	9,400
Citation X	31,800	3,900	4,900	6,500	5,600	7,000	9,300
Citation III	19,000	4,200	5,300	7,000	6,100	7,700	10,200
Average Landing Length		3,100	3,900	5,100	4,300	5,400	7,300

Exhibit 3D (continued)
RUNWAY LENGTH REQUIREMENTS

erations in fractional ownership which utilize their own aircraft under direction of pilots specifically assigned to said aircraft. The landing length analysis shows an average landing length of 5,400 feet for aircraft operating under CFR Part 91k during wet runway conditions and an average of 7,300 feet for aircraft operating under Part 135 during wet runway conditions.

The FAA will typically only support runway length planning to the 60 percent useful load factor for business jets unless it can be demonstrated that these jets are frequently operating fully loaded (90 percent). Since this has not been demonstrated at MHK, the runway length analysis indicates that the existing runway lengths for both runways are adequate to accommodate the business jet aircraft fleet at 60 percent useful load; however, additional runway length could be justified if business jets that cannot operate at 60 percent useful load or greater on the available runway length should exceed the regular use threshold of 500 annual operations in the future.

Runway Width

Runway 3-21 is 150 feet wide. FAA design standard for ARC C-II runway width is 100 feet wide unless the critical aircraft has an MTOW greater than 150,000 pounds. The current scheduled airline operations fall within ARC C-II, but forecasts project that larger 90-seat models within C-III will operate greater than 500 times annually at MHK. For airplane design group (ADG) III airplanes, the runway width standard remains 100 feet unless the critical design aircraft is certified having MTOW greater than 150,000 pounds. Several ADG III airplanes with MTOWs greater than 150,000 pounds currently operate at the airport, including the Boeing 737 models, Boeing 757, and the MD-83; however, their operational numbers do not currently, and are not forecast, to exceed the 500 annual operations threshold to be considered a critical design aircraft. While the current width may exceed current design criteria, it certainly provides added safety enhancement for these operations. This is especially true to larger mainline aircraft used for charter operations and for precision instrument landing operations. As such, the existing width of Runway 3-21 should be maintained in the future.

Runway 13-31 is 75 feet wide and should be planned to meet the needs of general aviation aircraft up to mid-sized business jets up to RDC B-II. The FAA design standard for ARC B-I/II runway width is 75 feet wide. The runway’s current width meets FAA standard and would sufficiently meet the needs of most business jets using the airport on a frequent basis.

Pavement Strength

An important feature of airfield pavement is its ability to withstand repeated use by aircraft of significant weight. At MHK, the pavement for Runway 3-21 should be able to accommodate regular usage by commercial aircraft serving the airport, as well as occasional use by larger commercial passenger jets for charter operations. Runway 13-31 should be able to accommodate frequent activity by all general aviation aircraft using the airport on a regular basis. It would be ideal for Runway 13-31 to also serve occasional scheduled commercial aircraft currently and planned to use the airport, so the airport can remain operational when the primary runway is closed, or winds dictate.

The current strength rating on Runway 3-21 is 75,000 pounds single wheel loading (SWL) and 110,000 dual wheel loading (DWL), while crosswind Runway 13-31 is rated at 30,000 SWL and 39,000 DWL. As noted above, Runway 13-31 is currently not usable (closed per official publication) for aircraft weighing more than 33,000 pounds. Runway 3-21's current weight bearing strength is adequate to support regular operations by the current and forecast fleet of regularly scheduled commercial airlines and general aviation aircraft currently serving the airport. Most narrow and wide body passenger aircraft will exceed the rated pavement strength on Runway 3-21; however, the published strength is only an indication of its design bearing strength for regular use. Aircraft weighing more than the published amount can operate on an infrequent basis, but regular use above the design strength will diminish the pavement's useful life. Runway 13-31 cannot currently serve any commercial airline operations due to published pavement limitations.

The forecasts project increased operations by larger capacity regional jets such as the Embraer ERJ-190, which has an MTOW of up to 114,200 pounds DWL. Future planning should consider increasing the pavement strength of Runway 3-21 to at least 120,000 upwards of 150,000 pounds DWL to accommodate these larger regional jets and better support the infrequent larger charter commercial airline operations. The existing pavement strength of Runway 13-31 is adequate for the general aviation aircraft it is planned to serve and should be maintained, at a minimum. Consideration could be given to increasing the runway's pavement strength to better serve larger aircraft for periods when the primary runway is closed.

It should be noted that the pavement serving Runway 3-21 is aged and in need of maintenance. Analysis in the next chapter will evaluate the alternative options available for improving and/or replacing the pavement in the least operationally disruptive manner.

Taxiways

The design standards associated with taxiways are determined by the taxiway design group (TDG) or the airplane design group (ADG) of the critical design aircraft. As determined previously, the applicable ADG for both runways is ADG-II currently, and ultimately ADG-III for Runway 3-21. **Table 3D** presents the various taxiway design standards related to ADG-II/III.

The table also shows those taxiway design standards related to TDG. The TDG standards are based on the Main Gear Width (MGW) and the Cockpit to Main Gear (CMG) distance of the critical design aircraft expected to use those taxiways. Different taxiways/taxilane pavements can and should be designed to the most appropriate TDG design standards.

The existing critical TDG for MHK is 2, based primarily upon the CRJ700. This means that the taxiways associated with the runways should be at least 35 feet wide. All taxiways on the airfield are at least 35 feet wide, with some even wider. The ultimate critical TDG for MHK is 3, based upon the forecasted transition of the airline fleet to larger regional jet aircraft such as the ERJ-175/190. TDG 3 standards specify a taxiway width of 50 feet. Moreover, the infrequent use of the airport by larger charter air carrier aircraft in TDG 3 and 4 support the need to keep the taxiways at least 50 feet wide. All taxiways meet or exceed the existing and ultimate FAA design standard and therefore should be maintained through the planning period of this master plan.

TABLE 3D
Taxiway Dimensions and Standards
Manhattan Regional Airport

STANDARDS BASED ON WINGSPAN	ADG II	ADG III
Taxiway Protection		
Taxiway Safety Area (TSA) width	79'	118;
Taxiway Object Free Area (TOFA) width	131'	186’
Taxilane Object Free Area width	115’	162’
Taxiway Separation		
Taxiway Centerline to: Fixed or Movable Object Parallel Taxiway/Taxilane	 65.5' 105’	 93’ 152’
Taxilane Centerline to: Fixed or Movable Object Parallel Taxilane	 57.5' 97’	 81’ 140’
Wingtip Clearance		
Taxiway Wingtip Clearance	26'	34’
Taxilane Wingtip Clearance	18’	27’
STANDARDS BASED ON TDG	**TDG 2**	**TDG 3**
Taxiway Width Standard	35’	50’
Taxiway Edge Safety Margin	7.5’	10’
Taxiway Shoulder Width	15’	20’

ADG: Airplane Design Group
TDG: Taxiway Design Group
Source: FAA AC 150/5300-13A, *Airport Design*

Taxiway Design Considerations

FAA AC 150/5300-13A, Change 1, *Airport Design*, provides guidance on recommended taxiway and taxilane layouts to enhance safety by avoiding runway incursions. A runway incursion is defined as “any occurrence at an airport involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft.”

The taxiway system at MHK generally provides for the efficient movement of aircraft; however, AC 150/5300-13A, Change 1, *Airport Design*, provides recommendations for taxiway design. The following is a list of the taxiway design guidelines and the basic rationale behind each recommendation:

1. **Taxi Method**: Taxiways are designed for “cockpit over centerline” taxiing with pavement being sufficiently wide to allow a certain amount of wander. On turns, sufficient pavement should be provided to maintain the edge safety margin from the landing gear. When constructing new taxiways, upgrading existing intersections should be undertaken to eliminate “judgmental oversteering,” which is where the pilot must intentionally steer the cockpit outside the marked centerline in order to assure the aircraft remains on the taxiway pavement.

2. **Steering Angle**: Taxiways should be designed such that the nose gear steering angle is no more than 50 degrees, the generally accepted value to prevent excessive tire scrubbing.

3. **Three-Node Concept**: To maintain pilot situational awareness, taxiway intersections should provide a pilot a maximum of three choices of travel. Ideally, these are right and left angle turns and a continuation straight ahead.

4. **Intersection Angles**: Turns should be designed to 90 degrees wherever possible. For acute angle intersections, standard angles of 30, 45, 60, 120, 135, and 150 degrees are preferred.

5. **Runway Incursions**: Taxiways should be designed to reduce the probability of runway incursions.
   - *Increase Pilot Situational Awareness*: A pilot who knows where he/she is on the airport is less likely to enter a runway improperly. Complexity leads to confusion. Keep taxiway systems simple using the "three node" concept.
   - *Avoid Wide Expanses of Pavement*: Wide pavements require placement of signs far from a pilot's eye. This is especially critical at runway entrance points. Where a wide expanse of pavement is necessary, avoid direct access to a runway.
   - *Limit Runway Crossings*: The taxiway layout can reduce the opportunity for human error. The benefits are twofold – through simple reduction in the number of occurrences, and through a reduction in air traffic controller workload.
   - *Avoid "High Energy" Intersections*: These are intersections in the middle third of runways. By limiting runway crossings to the first and last thirds of the runway, the portion of the runway where a pilot can least maneuver to avoid a collision is kept clear.
   - *Increase Visibility*: Right angle intersections, both between taxiways and runways, provide the best visibility. Acute angle runway exits provide for greater efficiency in runway usage, but should not be used as runway entrance or crossing points. A right angle turn at the end of a parallel taxiway is a clear indication of approaching a runway.
   - *Avoid "Dual Purpose" Pavements*: Runways used as taxiways and taxiways used as runways can lead to confusion. A runway should always be clearly identified as a runway and only a runway.
   - *Aligned Taxiways Prohibited*: An aligned taxiway is one whose centerline coincides with a runway centerline. Such taxiways have often been established due to the relocation of a runway end without constructing a new entrance taxiway at the new threshold. This places a taxiing aircraft in direct line with aircraft landing or taking off. The resultant inability to use the runway while the taxiway is occupied, along with the possible loss of situational awareness by a pilot, preclude the design of these taxiways. Existing aligned taxiways should be removed as soon as practicable. Any abandoned pavement should preferably be removed, but at a minimum appropriately marked.
   - *Indirect Access*: Do not design taxiways to lead directly from an apron to a runway. Such configurations can lead to confusion when a pilot typically expects to encounter a parallel taxiway.
   - *Hot Spots*: Confusing intersections near runways are more likely to contribute to runway incursions. These intersections must be redesigned when the associated runway is subject to reconstruction or rehabilitation. Other hot spots should be corrected as soon as practicable.

6. **Runway/Taxiway Intersections**:
   - *Right Angle*: Right-angle intersections are the standard for all runway/taxiway intersections, except where there is a need for a high-speed exit. Right-angle taxiways provide the best visual perspective to a pilot approaching an intersection with the runway to observe aircraft in both the left and right directions. They also provide optimal orientation of the runway holding position signs so that they are visible to pilots.
   - *Acute Angle*: Acute angles should not be larger than 45 degrees from the runway centerline. A 30-degree taxiway layout should be reserved for high speed exits. The use of multiple intersecting taxiways with acute angles creates pilot confusion and improper positioning of taxiway signage.
   - *Large Expanses of Pavement*: Taxiways must never coincide with the intersection of two runways. Taxiway configurations with multiple taxiway and runway intersections in a single area create large expanses of pavement, making it difficult to provide proper signage, marking, and lighting.

7. **Taxiway/Runway/Apron Incursion Prevention**: Apron locations that allow direct access into a runway should be avoided. Increase pilot situational awareness by designing taxiways in such a manner that forces pilots to consciously make turns. Taxiways originating from aprons and forming a straight line across runways at mid-span should be avoided.
   - *Wide Throat Taxiways*: Wide throat taxiway entrances should be avoided. Such large expanses of pavement may cause pilot confusion and makes lighting and marking more difficult.
   - *Direct Access from Apron to a Runway*: Avoid taxiway connectors that cross over a parallel taxiway and directly onto a runway. Consider a staggered taxiway layout that forces pilots to make a conscious decision to turn.
   - *Apron to Parallel Taxiway End*: Avoid direct connection from an apron to a parallel taxiway at the end of a runway.

FAA AC 150/5300-13A, Change 1, *Airport Design*, states that "existing taxiway geometry should be improved whenever feasible, with emphasis on designated "hot spots." To the extent practicable, the removal of existing pavement may be necessary to correct confusing layouts. The FAA has not identified any "hot spots" at MHK, and the current airfield layout meets FAA standards with two exceptions as shown on **Exhibit 3D**:

- Aligned taxiway leading to Runway 21
- Taxiway D offers direct access linking Runway 3-21 to the main commercial apron (West Ramp)

In the alternatives chapter, potential solutions to these conditions will be presented. As noted, the FAA indicates that aligned taxiways should be removed as soon as practical. The direct access afforded by Taxiway D can be remedied using several methods. Analysis in the next chapter will also consider improvements which could be implemented on the airfield to minimize runway incursion potential and improve efficiency. Any future taxiways planned will also take into consideration the taxiway design standards.

Taxilane Design Considerations

Taxilanes are distinguished from taxiways in that they do not provide access to or from the runway system directly. Taxilanes typically provide access to hangar areas. As a result, taxilanes can be designed to varying design standards depending on the type of aircraft utilizing the taxilane. For example, a taxilane leading to a T-hangar area only needs to be designed to accommodate those aircraft typically accessing a T-hangar.

The alternatives chapter will consider various designs for improving the safe movement of aircraft via taxilanes if hangar and apron facilities expand over time.

SAFETY AREA DESIGN STANDARDS

The FAA has established several safety surfaces to protect aircraft operational areas and keep them free from obstructions that could affect their safe operation. These include the runway safety area (RSA), runway object free area (ROFA), obstacle free zone (OFZ), and runway protection zone (RPZ). **Table 3E** presents the applicable design standards for each runway.

The entire RSA, OFZ, and OFA should be under the direct control of the airport sponsor to ensure these areas remain free of obstacles and can be readily accessed by maintenance and emergency personnel.

TABLE 3E
Airfield Design Standards
Manhattan Regional Airport

Runway Design Code (RDC)	C-II	C-III	B-II
Applicable Runway	**Existing Runway 3-21**	**Ultimate Runway 3-21**	**Ultimate 13-31**
RUNWAYS			
Runway Length (Existing)	7,000	Up to 8,300	5,000
Runway Width	150	150	75
Runway Shoulder Width	10	20	10
Runway Safety Area			
Width	500	500	150
Length Prior to Threshold	600	600	300
Length Beyond End	1,000	1,000	300
Runway Object Free Area			
Width	800	800	500
Length Beyond End	1,000	1,000	300
Runway Obstacle Free Zone			
Width	400	400	400
Length Beyond End	200	200	200
Separation Standards - Runway Centerline to			
Holding Position	250	250	200
Parallel Taxiway	400	400	240
Aircraft Parking Area	500	500	250

Note: All dimensions in feet.
BOLD: Current condition not meeting design standard
Source: AC 150/5300-13A, Airport Design

It is not required that the RPZ be under airport ownership, but it is strongly recommended. An alternative to fee-simple ownership of the RPZ is the purchase of avigation easements (acquiring control of designated airspace within the RPZ) or to have sufficient land use control measures in place which ensure the RPZ remains free of incompatible development. **Exhibit 3E** depicts the existing and ultimate safety areas at MHK considering all pavements remain in the existing locations (i.e., no runway extensions).

Dimensional standards for the various safety areas associated with the runways are a function of the type of aircraft (ARC) expected to use the runways as well as the approved instrument approach visibility minimums. Each runway can be designed to serve a different type of aircraft based on ARC. At MHK, Runway 3-21 is the designated primary runway and should meet design standards for RDC C-II currently and C-III for future aircraft design. Runway 13-31 should currently meet design standards for RDC B-I and ultimately conform to RDC B-II.

Runway Safety Area (RSA)

The RSA is defined in FAA AC 150/5300-13A, *Airport Design,* as a "surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of undershoot, overshoot, or excursion from the runway." The RSA is centered on the runway and dimensioned in accordance to the approach speed of the critical design aircraft using the runway. The FAA requires the RSA to be cleared and graded, drained by grading or storm sewers, capable of accommodating the design aircraft and fire and rescue vehicles, and free of obstacles not fixed by navigational purpose such as runway edge lights or approach lights.

The FAA has placed a higher significance on maintaining adequate RSA at all airports. Under Order 5200.8, effective October 1, 1999, the FAA established the *Runway Safety Area Program.* The Order states, "The objective of the Runway Safety Area Program is that all RSAs at federally-obligated airports…shall conform to the standards contained in Advisory Circular 150/5300-13, *Airport Design*, to the extent practicable." Each Regional Airports Division of the FAA is obligated to collect and maintain data on the RSA for each runway at the airport and perform airport inspections.

For RDC C-II design, the FAA calls for the RSA to be 500 feet wide and extend 1,000 feet beyond the runway ends. Analysis in the previous section indicated that Runway 3-21 should be planned to accommodate aircraft in RDC C-III. The RSA for RDC C-III is also 500 feet wide and extends 1,000 feet beyond each runway end. It should be noted that only 600 feet of RSA is needed prior to the landing threshold on each runway end under RDC C-II and C-III standards. Runway 3-21 currently meets RSA standards for RDC C-II and C-III.

Runway 13-31 currently meets standards for ARC B-II. The RDC B-II RSA dimensions for Runway 13-31 are 150 feet wide extending 300 feet beyond the end of the runway.

Runway Object Free Area (ROFA)

The ROFA is "a two-dimensional ground area, surrounding runways, taxiways, and taxilanes, which is clear of objects except for objects whose location is fixed by function (i.e., airfield lighting)." The ROFA does not have to be graded and level as does the RSA; instead, the primary requirement for the ROFA is that no object in the ROFA penetrate the lateral elevation of the RSA. The ROFA is centered on the runway, extending out in accordance to the critical aircraft design category utilizing the runway. There are no known obstructions to the ROFA for either runway based on the standards outlined for both in **Table 3E**.

Obstacle Free Zones (OFZ)

The OFZ is an imaginary surface which precludes object penetrations, including taxiing and parked aircraft. The only allowance for OFZ obstructions is navigational aids mounted on frangible bases which are fixed in their location by function, such as airfield signs. The OFZ is established to ensure the safety of aircraft operations. If the OFZ is obstructed, the airport's approaches could be removed or approach minimums could be increased.

For all runways serving aircraft over 12,500 pounds, the OFZ is 400 feet wide, centered on the runway, and extends 200 feet beyond the runway ends. This standard will apply to both runways at MHK. Currently, there are no OFZ obstructions at MHK. Future planning should maintain the OFZ for the appropriate runway type.

Precision Obstacle Free Zone (POFZ)

For runways providing a vertically-guided approach, a precision obstacle free zone (POFZ) is required. The POFZ is defined as "a volume of airspace above an area beginning at the runway threshold, at the threshold elevation, and centered on the extended runway centerline, 200 feet long by 800 feet wide." The POFZ is only in effect when the following operational conditions are met:

I. Vertically-guided approach
II. Reported ceiling below 250 feet and/or visibility less than ¾-statute-mile
III. An aircraft on final approach within two miles of the runway threshold

When these conditions are met, aircraft holding for take-off must hold in such a position so that neither the fuselage nor the tail of the aircraft penetrates the POFZ. The wings of the aircraft are allowed to penetrate the surface. Runway 3 provides a full ILS approach; however, the associated minimums of not lower than ¾-mile do not meet POFZ standards. Historically, the Runway 3 ILS approach did provide for lower than ½-mile visibility minimums and plans consider the return to such in the future. If the minimums are lowered to the historically provided ½-mile, POFZ standards will apply to this runway end when conditions are met. Runway 21 is served by a localizer performance vertically guided (LPV) GPS approach; however, the minimums are not low enough to qualify for POFZ requirements.

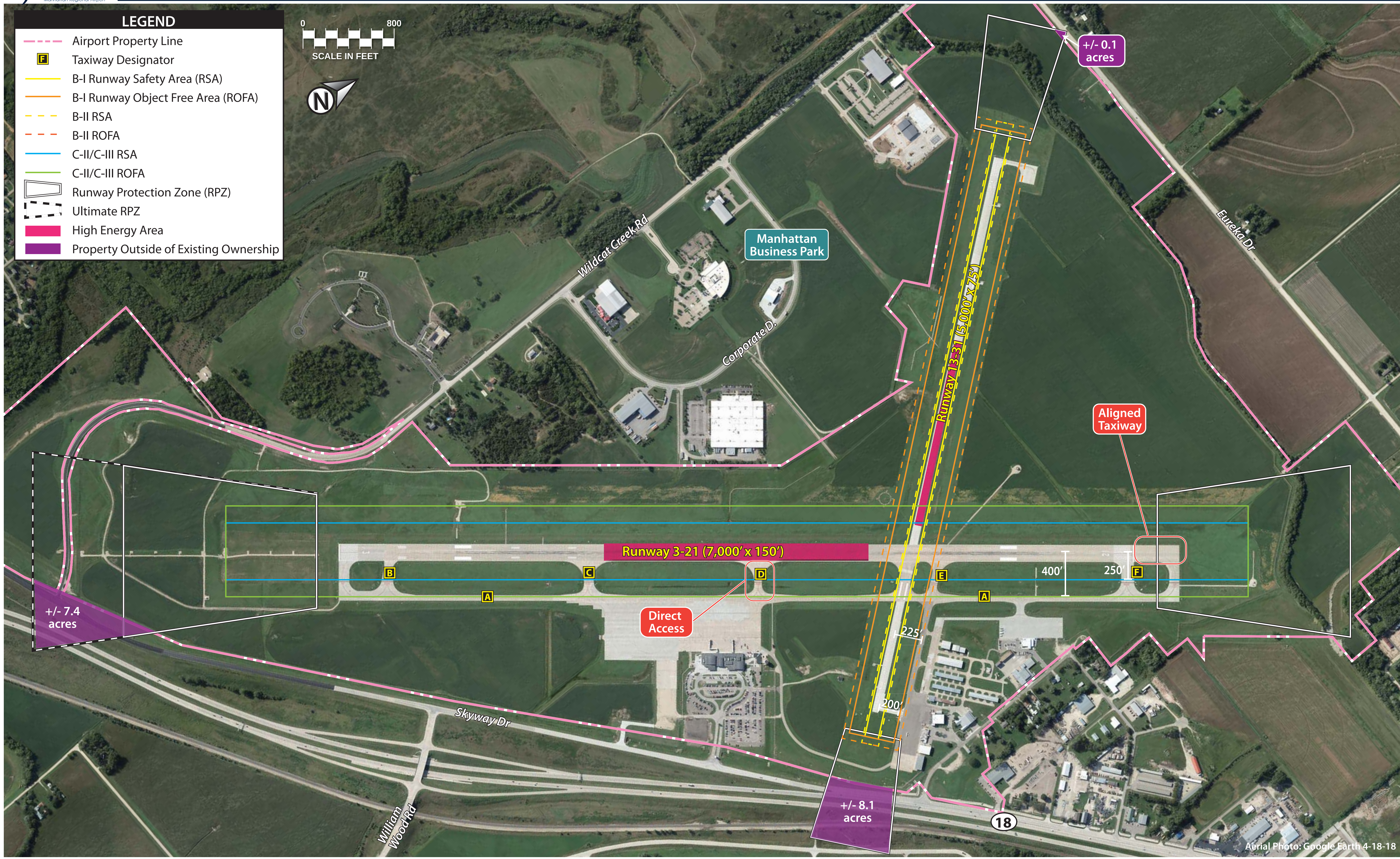


Exhibit 3E
AIRFIELD SAFETY AREAS

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Runway Protection Zones (RPZ)

The RPZ is a trapezoidal area centered on the runway, typically beginning 200 feet beyond the runway end. The RPZ has been established by the FAA to provide an area clear of obstructions and incompatible land uses, in order to enhance the protection of people and property on the ground. The RPZ is comprised of the central portion of the RPZ and the controlled activity area. The central portion of the RPZ extends from the beginning to the end of the RPZ, is centered on the runway, and is the width of the ROFA. The controlled activity area includes any remaining portions of the RPZ. The dimensions of the RPZ vary according to the visibility minimums serving the runway and the type of aircraft (design aircraft) operating on the runway. **Table 3F** provides the applicable RPZ dimensions for the runways at MHK.

TABLE 3F
Runway Protection Zones
Manhattan Regional Airport

	Runway 3 Existing/Ultimate	Runway 21	Runway 13	Runway 31
Approach Runway Protection Zones				
Approach Visibility Minimum	¾-mile /½-mile	¾-mile	Visual/1-mile	Visual/1-mile
Inner Width (ft.)	1,000/1,000	1,000	500	500
Outer Width (ft.)	1,510/1,750	1,510	700	700
Length (ft.)	1,700/2,500	1,700	1,000	1,000
Acres	48.978/78.914	48.978	13.770	13.770
Departure Runway Protection Zones				
Inner Width (ft.)	500	500	500	500
Outer Width (ft.)	1,010	1,010	700	700
Length (ft.)	1,700	1,700	1,000	1,000
Acres	29.465	29.465	13.770	13.770

Source: FAA AC 150/5300-13A, Change 1, Airport Design

While the RPZ is intended to be clear of incompatible objects or land uses, some uses are permitted with conditions and other land uses are prohibited. According to AC 150/5300-13A, Change 1, the following land uses are permissible within the RPZ:

- Farming that meets the minimum buffer requirements,
- Irrigation channels as long as they do not attract birds,
- Airport service roads, as long as they are not public roads and are directly controlled by the airport operator,
- Underground facilities, as long as they meet other design criteria, such as RSA requirements, as applicable, and
- Unstaffed navigational aids (NAVAIDs) and facilities, such as required for airport facilities that are fixed by function in regard to the RPZ.

Any other land uses considered within RPZ land owned by the airport sponsor must be evaluated and approved by the FAA Office of Airports. The FAA has published *Interim Guidance on Land Uses within a Runway Protection Zone* (9.27.2012), which identifies several potential land uses that must be evaluated and approved prior to implementation. The specific land uses requiring FAA evaluation and approval include:

- Buildings and structures (examples include, but are not limited to: residences, schools, churches, hospitals or other medical care facilities, commercial/industrial buildings, etc.)
- Recreational land use (examples include, but are not limited to: golf courses, sports fields, amusement parks, other places of public assembly, etc.)
- Transportation facilities. Examples include, but are not limited to:
  - Rail facilities - light or heavy, passenger or freight
  - Public roads/highways
  - Vehicular parking facilities
- Fuel storage facilities (above and below ground)
- Hazardous material storage (above and below ground)
- Wastewater treatment facilities
- Above-ground utility infrastructure (i.e., electrical substations), including any type of solar panel installations.

The *Interim Guidance on Land within a Runway Protection Zone* states, "RPZ land use compatibility also is often complicated by ownership considerations. Airport owner control over the RPZ land is emphasized to achieve the desired protection of people and property on the ground. Although the FAA recognizes that in certain situations the airport sponsor may not fully control land within the RPZ, the FAA expects airport sponsors to take all possible measures to protect against and remove or mitigate incompatible land uses."

Currently, the RPZ review standards are applicable to any new or modified RPZ. The following actions or events could alter the size of an RPZ, potentially introducing an incompatibility:

- An airfield project (e.g., runway extension, runway shift),
- A change in the critical design aircraft that increases the RPZ dimensions,
- A new or revised instrument approach procedure that increases the size of the RPZ, and/or
- A local development proposal in the RPZ (either new or reconfigured).

Since the interim guidance only addresses a new or modified RPZ, existing incompatibilities are essentially grandfathered under certain circumstances. While it is still necessary for the airport sponsor to take all reasonable actions to meet the RPZ design standard, FAA funding priority for certain actions, such as relocating existing roads in the RPZ, will be determined on a case-by-case basis.

RPZs have been further designated as approach and departure RPZs. The approach RPZ is a function of the aircraft approach category (AAC) and approach visibility minimums associated with the approach runway end. The departure RPZ is a function of the AAC and departure procedures associated with the runway. For a particular runway end, the more stringent RPZ requirements (usually associated with the approach RPZ) will govern the property interests and clearing requirements that the airport sponsor should pursue.

As depicted on **Exhibit 3E**, the southwestern-most corner of the Runway 3 existing RPZ (not lower than ¾-mile visibility minimums) extends beyond current airport property by approximately less than one acre. If the runway were to again be served by lower minimums down to ½-mile, a total of 7.4 acres of the RPZ would be outside of airport ownership. As shown, the RPZ area beyond airport bounds includes State Highway 18 and Skyway Drive. As noted above, the FAA would have to approve the RPZ change prior to implementing a larger or shifted RPZ. The same holds for Runway 31 as 8.1 acres of its current and ultimate RPZ extend south beyond airport property and includes State Highway 18 and Skyway Drive. There are no plans to change this runway end, so the FAA should allow it to continue to exist in a grandfathered state. Further examination of the RPZs associated with each end of both runways will be undertaken later in this study.

RUNWAY/TAXIWAY SEPARATION

The design standard for the required separation between runways and parallel taxiways is a function of the critical design aircraft and the instrument approach visibility minimums. The separation standard for RDC C-II/III with ½- mile visibility minimums is 400 feet from the runway centerline to the parallel taxiway centerline. For RDC B-I, the standard is 225 feet for visual runways and those having approach minimums not lower than one-mile. The same minimums applied to RDC B-II requires the separation standard to be increased to 240 feet.

Parallel Taxiway A is 400 feet from Runway 3-21 (centerline to centerline). As such, Taxiway A is properly separated from Runway 3-21. Runway 13-31 is not served by a full-length parallel taxiway; instead, partial parallel Taxiway E located 250 feet east of runway centerline. Again, this dimension meets and exceeds RDC B-II standards as outlined above.

HOLDING POSITION SEPARATION

Holding position markings are placed on taxiways leading to runways. When instructed, pilots are to stop short of the holding position marking line. For Runway 3-21, holding position marking lines are situated 250 feet from the runway centerline, which meets the RDC C-II design standard. Runway 13-31 holding position marking lines are situated 200 feet from the runway centerline, which meets the RDC B-II design standard.

INSTRUMENT APPROACH CAPABILITY

Instrument approaches are categorized as either precision or non-precision. Precision instrument approach aids provide an exact course alignment and vertical descent path for an aircraft on final approach to a runway, while non-precision instrument approach aids provide only course alignment information. In the past, most existing precision instrument approaches in the United States have been the ILS; however, with advances in global positioning system (GPS) technology, it can now be used to provide both vertical and lateral navigation for pilots under certain conditions.

MHK currently has straight-in instrument approach capability to each end of Runway 3-21, while Runway 13-31 is a visual only runway without a published instrument approach procedure. Runway 3 is served by the airport's only ILS approach. It is also served by an LPV and RNAV GPS approach as well as a very high omnidirectional range (VOR) approach. Runway 21 is also served by an LPV GPS approach. The ILS and LPV GPS approaches provide for the lowest visibility minimums with ¾-mile visibility and 200-foot cloud ceilings.

Runway 3 is served by a medium intensity approach lighting system with runway alignment indicator lights (MALSR). The MALSR, in conjunction with the localizer antenna and glide slope antenna, provides ideal approach minimums to Runway 3 down to 200-foot cloud ceilings and ¾-mile visibility minimums. This approach lighting system enhances safety at the airport, especially during inclement weather or nighttime activity. Typically, the MALSR would aid an ILS to achieve full Category I minimums (½-mile visibility minimums with 200-foot cloud ceilings). Runway 21 is served by a vertically guided LPV GPS approach. Due to terrain and other navigation challenges in the region, consideration should be given to the installation of some variant approach lighting system on Runway 21 in the future.

As noted earlier, the approach had historically offered CAT I minimums, suggesting that some approach obstruction to achieving the CAT I minimums currently exists, necessitating the increase to ¾-mile. A return to lower CAT I minimums for Runway 3 will be considered for the future based on updated obstruction survey data obtained for this study process. There are known elevation, terrain, vegetation, etc. issues in the airport environment. GPS approach technology improvements including required navigation performance (RNP) approaches could allow for lower minimums in such an environment. The FAA will need to develop the approach, but a topical and limited analysis for improved approaches will be completed and presented in later chapters of this report.

VISUAL APPROACH AIDS

In most instances, the landing phase of any flight must be conducted in visual conditions. To provide pilots with visual guidance information during landings to the runway, electronic visual approach aids are commonly provided at airports. Currently, Runways 3 and 21 are served by a four-box precision approach path indicator (PAPI-4) system. Runway 13-31 is served by older visual approach slope indicator (VASI) systems, with a two-box on the 13 end and a four-box on the Runway 31 end. A PAPI-2/4 system should also be considered for Runways 13 and 31 as age requires the replacement of the VASI systems in the future.

Runway end identification lights (REILs) are flashing lights located at the runway threshold end that facilitate rapid identification of the runway end at night and during poor visibility conditions. REILs provide pilots with the ability to identify the runway thresholds and distinguish the runway end lighting from other lighting on the airport and in the approach areas. The FAA indicates that REILs should be considered for all lighted runway ends not planned for a more sophisticated approach lighting system. A REIL system has been installed at the Runway 21 and 31 thresholds. REILs should also be considered for the end of Runway 13.

AIRFIELD LIGHTING, MARKING, AND SIGNAGE

The location of the airport at night is universally indicated by a rotating beacon. For civil airports, a rotating beacon projects two beams of light, one white and one green, 180 degrees apart. The existing beacon at MHK should be maintained through the planning period.

Runway and Taxiway Lighting

Runway lighting provides the pilot with positive identification of the runway and its alignment. Runway 3-21 is equipped with high intensity runway lighting (HIRL), and Runway 13-31 is equipped with medium intensity runway lighting (MIRL). These systems should be maintained through the planning period.

Medium intensity taxiway lighting (MITL) is provided on all parallel and associated entrance/exit taxiways serving both runways. This system is vital for safe and efficient ground movements and should be maintained in the future. Planning should consider MITL on future taxiways that support the runway system at MHK.

It should be noted that many airports are transitioning to light emitting diode (LED) pavement edge lighting technology. LEDs have many advantages, including lower energy consumption, longer lifespan, increased durability, reduced size, greater reliability, and faster switching. While a larger initial investment is required upfront, the energy savings and reduced maintenance costs will outweigh any additional costs in the long run. Consideration should be given to gradually replacing all edge lighting with LED systems.

Pavement Markings

Runway markings are typically designed to the type of instrument approach available on the runway. FAA AC 150/5340-1K, *Standards for Airport Markings*, provides guidance necessary to design airport markings.

Runway 3 is served by precision markings. This aids in accommodating the ILS approach to the runway end. Runways 13, 21, and 31 currently have non-precision markings. All runway markings should be maintained through the long-term planning period.

Airfield Signs

Airfield identification signs assist pilots in identifying their location on the airfield and directing them to their desired location. Lighted signs are installed on the runway and taxiway system on the airfield. The signage system includes runway and taxiway designations, holding positions, routing/directional, distance remaining, and runway exits. All signs should be maintained throughout the planning period, and consideration should be given to gradually replacing any signs not already changed out with LED technology.

WEATHER AND COMMUNICATION INFORMATION

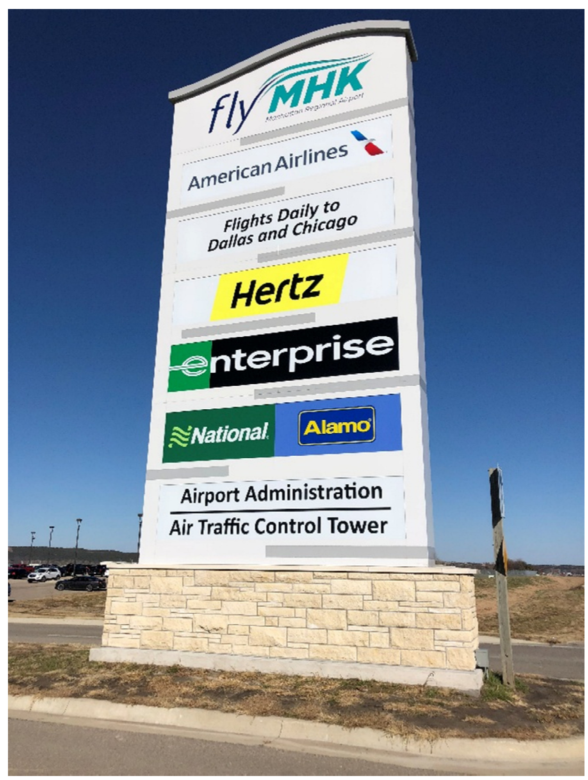
MHK has a lighted wind cone and segmented circle, as well as additional supplemental wind cones in various locations on the airfield. The wind cones provide information to pilots regarding wind speed and direction. The segmented circle consists of a system of visual indicators designed to provide traffic pattern information to pilots. These should be maintained throughout the planning period.

The airport is equipped with an ASOS which provides weather observations 24 hours per day. The system updates weather observations every minute, continuously reporting significant weather changes as they occur. Aircraft in the vicinity can receive this information if they have their radio tuned to the correct frequency (119.075 MHz). In addition, pilots and individuals can call a published telephone number and receive the information via an automated voice recording. This system should be maintained through the planning period.

AIRFIELD FACILITY REQUIREMENTS SUMMARY

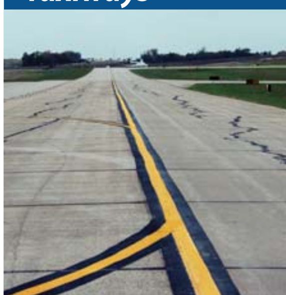
A summary of the airside facilities previously discussed at MHK is presented on **Exhibit 3F**.

PASSENGER TERMINAL COMPLEX REQUIREMENTS



Components of the terminal area complex include the terminal building, gate positions, aircraft apron area, vehicle parking, and surface access roads. As noted in the Chapter One – Inventory, the airport's commercial passenger terminal building was recently renovated and expanded from approximately 12,000 square feet to 45,000 square feet. The project was completed via two phases based upon the *Terminal Area Plan Study (2011)*.

The scoping for this study was to evaluate the findings of the previous terminal study to compare and validate those findings while considering new forecasts presented in this master plan. The *Terminal Area Plan* study projected 2030 enplanement levels to reach 111,031, which was then used as the basis for establishing long-term building sizing requirements. The enplanement projection for this study considers regularly scheduled enplanements to reach 113,300 by 2035. As such, the current terminal building and its supporting facilities should be capable of meeting the long-term passenger enplanements projected in this study effort. Some modifications could be required in the future, such as an additional gates or extra hold room space to meet a changing aircraft fleet size or additional airline entrant. Those changes would be driven by specific demand and will require additional study at the time of need.

CATEGORY	AVAILABLE	SHORT TERM	LONG TERM
Runways			
	<u>Runway 3-21</u> ARC C-II-4000 7,000' x 150' Concrete - grooved 75,000# SWL 110,000# DWL	<u>Runway 3-21</u> ARC C-III-2400 Up to 8,300' x 150' Increased Pavement Strength Up to 150,000# DWL	<u>Runway 3-21</u> Same
	<u>Runway 13-31</u> ARC B-I-VIS 5,000' x 75 Concrete 30,000# SWL 39,000# DWL	<u>Runway 13-31</u> Same	<u>Runway 13-31</u> RDC B-II-5000 Consider: Upgrading Pavement Strength to 75,000 pounds DWL
Taxiways			
	<u>Runway 3-21</u> 50' Wide Full length parallel 7 Entrance/Exits	<u>Runway 3-21</u> Same	<u>Runway 3-21</u> Remove Indirect Taxiway Remove Aligned Taxiway
	<u>Runway 13-31</u> 35' Wide Partial parallel taxiway 2 Exits; One turnaround (Rwy 13)	<u>Runway 13-31</u> Same	<u>Runway 13-31</u> Consider extending partial parallel taxiway Add: one exit
Navigational Aids			
	ATCT, VOR, ASOS	Same	Same
	<u>Runway 3-21</u> ILS; LPV/RNAV (GPS); VOR - (Runway 3) LPV/RNAV (Runway 21)	<u>Runway 3-21</u> Same	<u>Runway 3-21</u> Consider RNP Approaches
	<u>Runway 13-31</u> Visual only	<u>Runway 13-31</u> Same	<u>Runway 13-31</u> Consider: GPS/RNP approaches
Lighting and Markings			
	Rotating beacon Segmented Circle, Lighted windcone MITL	Same	Consider: Supplemental windcone(s)
	<u>Runway 3-21</u> Precision marking MALSR (Runway 3) PAPI-4L (Both ends) REIL (Runway 21) MIRL	<u>Runway 3-21</u> Same	<u>Runway 3-21</u> Consider: MALS/R Runway 21
	<u>Runway 13-31</u> Nonprecision marking REIL (Runway 31) VASI-4L (Runway 31) VASI-2L (Runway 13) MIRL	<u>Runway 13-31</u> Same	<u>Runway 13-31</u> Upgrade: PAPI-2/4 Consider REIL (Runway 13)

ASOS - Automated Surface Observation System
ATCT - Airport Traffic Control Tower
GPS - Global Positioning System
HIRL - Medium - High Intensity Runway Lighting
HITL/MITL - High/Medium Intensity Taxiway Lighting
LPV - Localizer Performance Vertical Guidance
MALSR - Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
PAPI - Precision Approach Path Indicator
REIL - Runway End Identification Lights
RNP - Required Navigation Performance
VASI - Visual Approach Slope Indicator
VOR/DME - Very high frequency Omni-directional Range/Distance Measuring Equipment

Exhibit 3F
AIRSIDE REQUIREMENTS

GENERAL AVIATION FACILITIES

General aviation (GA) facilities are those necessary for handling general aviation aircraft, passengers, and cargo while on the ground. This section is devoted to identifying future GA facility needs during the planning period for the following types of facilities normally associated with general aviation terminal areas:

- Aircraft Storage Hangars
- Aircraft Parking Aprons
- General Aviation Terminal Services
- Auto Parking and Access
- Support Facilities

HANGARS

Utilization of hangar space varies as a function of local climate, security, and owner preferences. The trend in general aviation aircraft, whether single or multi-engine, is toward more sophisticated aircraft (and consequently, more expensive aircraft); therefore, many aircraft owners prefer enclosed hangar space to outside tie-downs.

The demand for aircraft storage hangars is dependent upon the number and type of aircraft expected to be based at the airport in the future. For planning purposes, it is necessary to estimate hangar requirements based upon forecast operational activity***. However, actual hangar construction should be based upon actual demand trends and financial investment conditions.*** Most airport operators have realized that building hangars is a very challenging venture in today's declining general aviation market. Hangar costs have ballooned while ownership trends have declined. Generally, hangar rents have been flat while construction costs far exceed revenue positive opportunities, especially for T-hangars.

There are a variety of aircraft storage options typically available at an airport including shade hangars, T-hangars, executive/box hangars, and bulk storage conventional hangars. Shade hangars are the most basic form of aircraft protection and are common in warmer climates. These structures provide a roof covering, but no walls or doors. There are no shade hangars at MHK, but these could be constructed as less expensive options in the future.

Currently, all available hangar space at the airport is occupied. Forecasts of future based aircraft indicate up to 66 aircraft by 2035. This projection offered by the FAA is highly aggressive when considering historical trends and the lack of readily available space to accommodate growth at MHK. Hangars are expensive to construct and can be cost-prohibitive if additional property needs to be readied (earthworks, utilities, etc.) for their construction. Constraining factors aside, the 24 additional based aircraft would require up to a projected 40,000 square feet of additional hangar storage space including T-hangar (and variants), executive/box hangar, and conventional hangar spaces. Analysis in the next chapter will consider the feasibility of offering the additional aircraft storage hangar space(s) to meet the projected market demand for potential based aircraft.

AIRCRAFT PARKING APRON

FAA Advisory Circular 150/5300-13A, *Airport Design*, suggests a methodology by which transient apron requirements can be determined from knowledge of busy-day operations. The existing general aviation east ramp apron and north ramp meet and exceed existing and long-term apron needs. Additional apron will be considered if hangar development is planned in the future. This analysis will be conducted in the following chapter.

GENERAL AVIATION TERMINAL FACILITIES

General aviation terminal facilities have several functions. Space is required for a pilots' lounge, flight planning, concessions, management, storage, and various other needs. This space is not necessarily limited to a single, separate terminal building, but can include space offered by fixed base operators (FBO) for these functions and services. Currently, GA terminal services are provided by the airport's FBO. The general aviation terminal facilities offered by the FBO appears to be adequately sized through the long-term planning period.

GENERAL AVIATION AUTOMOBILE PARKING

General aviation vehicular parking demands have been determined for MHK. General aviation vehicle parking needs can effectively be characterized as either itinerant or local. Itinerant vehicle parking would include spaces for visitors to the general aviation terminal facilities and passengers utilizing general aviation services. Local vehicle parking is dedicated parking for owners of aircraft based at the airport. Although some based aircraft owners prefer to park their vehicles in their hangars, safety can be compromised when automobile and aircraft movements are intermixed on the apron areas. Therefore, consideration should always be given to providing dedicated vehicle parking for local aircraft owners as well. This is especially true for security driven protocol airports like MHK. The availability of based owner parking will limit the need for vehicles to enter the aircraft apron area. In the future, consideration should be given to constructing a dedicated based owner parking area in close proximity to any new hangar development. This will encourage based aircraft owners to utilize the available parking, thus limiting vehicular movements "inside the fence-line."

SUPPORT FACILITIES

Various facilities that do not logically fall within classifications of airside or landside facilities have also been identified. These other areas provide certain functions related to the overall operation of the airport.

FUEL STORAGE

Fuel services at MHK are provided by Kansas Jet Center and Heartland Aviation. Kansas Jet Center owns its own fuel farm offering both Avgas (100LL) and Jet A fuel service around the clock. The fuel farm consists of one Jet A tank with a capacity of 30,000 gallons and one Avgas tank with a capacity of 12,000 gallons. Fuel is distributed via three fuel trucks including two Jet A trucks and one Avgas truck. The Jet A fuel trucks have capacities of 2,800 and 4,800 gallons, and the Avgas fuel truck has a capacity of 750 gallons. According to the FBO, a Jet A fuel truck with a capacity of 5,000 gallons will be added to their fleet soon. Heartland Aviation offers self-service Avgas and Mogas at a capacity of 3,000 gallons each. In total, including the trucks, the airport currently has the capacity for 37,600 gallons for Jet A, 12,750 gallons for Avgas, and 5,000 gallons of Mogas fuel.

Maintaining a 14-day fuel supply would allow the airport to limit the impact of a disruption of fuel delivery. Currently, the airport has enough static fuel storage to meet the 14-day supply criteria for both Jet A and AvGas fuel.

AIRCRAFT RESCUE AND FIRE FIGHTING (ARFF)

Part 139 airports are required to provide Aircraft Rescue and Fire Fighting (ARFF) services during air carrier operations. Each certificated airport maintains equipment and personnel based on an ARFF index established according to the length of aircraft and scheduled daily flight frequency. There are five indices, A through E, with A applicable to the smallest aircraft and E the largest (based on wingspan).

According to the Airport Certification Manual (ACM), MHK falls within ARFF Index B based upon the fleet mix of the scheduled airline operators. The airport offers Index C with approval via advanced requests. In the future, as the scheduled airline aircraft fleet mix transitions to larger aircraft such as the Embraer 190, which has a length of 118.9 feet, the airport will need to continue to meet ARFF Index B requirements. **Table 3G** presents the vehicle requirements and capacities for each index level.

The MHK ARFF facility is operated by the airport and is located just east of the Old Terminal – Limestone Hangar, fronting South Airport Road to the east. In this location, the facility has both airside and landside access opportunities. Access to the airfield is via an access route to the East Ramp. The facility operates 24 hours per day. All ARFF personnel are trained in basic emergency medical care. Live fire drills are conducted at least once a year. The ARFF personnel receive initial and recurrent training (at least every 12 months) in the following areas:

a. Airport familiarization, including signs, marking, and lighting.
b. Aircraft familiarization.
c. Rescue and firefighting personnel safety
d. Emergency communications systems on the airport, including fire alarms.
e. Use of fire hoses, nozzles, turrets, and other appliances required.
f. Application of the types of extinguishing agents required for Part 139 Certification.
g. Emergency aircraft evacuation assistance.

h. Firefighting operations.
i. Using firefighting equipment for aircraft rescue and firefighting.
j. Aircraft cargo hazards and materials.
k. Familiarization with the Airport Emergency Plan.

TABLE 3G
ARFF Index Requirements

Index	Aircraft Length	Requirements
Index A	<90'	1. One ARFF vehicle with 500 lbs. of sodium-based dry chemical or
		2. One vehicle with 450 lbs. of potassium-based dry chemical and 100 lbs. of water and AFFF for simultaneous water and foam application
Index B	90'-126'	1. One vehicle with 500 lbs. of sodium-based dry chemical and 1,500 gallons of water and AFFF or
		2. Two vehicles, one with the requirements for Index A and the other with enough water and AFFF for a total quantity of 1,500 gallons
Index C	126'-159'	1. Three vehicles, one having Index A, and two with enough water and AFFF for all three vehicles to combine for at least 3,000 gallons of agent or
		2. Two vehicles, one with Index B and one with enough water and ARFF for both vehicles to total 3,000 gallons
Index D	159'-200'	1. One vehicle carrying agents required for Index A and
		2. Two vehicles carrying enough water and AFFF for a total quantity by the three vehicles of at least 4,000 gallons
Index E	>200'	1. One vehicle with Index A and
		2. Two vehicles with enough water and AFFF for a total quantity of the three vehicles of 6,000 gallons

AFFF: Aqueous Film-Forming Foam
ARFF: Aircraft Rescue and Fire Fighting
Source: 14 CFR Part 139

SUMMARY

The intent of this chapter has been to outline the facilities required to meet potential aviation demands projected for MHK for the planning horizon. A summary of the airside requirements is presented on **Exhibit 3F**.

Following the facility requirements determination, the next step is to determine a direction of development which best meets these projected needs through a series of airport development alternatives. The remainder of the master plan will be devoted to outlining this direction, its schedule, and its cost.

Chapter Four

AIRPORT ALTERNATIVES

CHAPTER FOUR

Airport Alternatives

In the previous chapter, airside and landside facilities required to satisfy the demand through the long-term planning period were identified. The next step in the planning process is to evaluate reasonable ways these facilities can be provided. There can be numerous combinations of design alternatives, but the alternatives presented here are those with the perceived greatest potential for implementation.

Any development proposed for a master plan is evolved from an analysis of projected needs for a set period of time. Though the needs were determined by utilizing industry-accepted statistical methodologies, unforeseen future events could impact the timing of the needs identified. The master planning process attempts to develop a viable concept for meeting the needs caused by projected demands for the next 20 years. However, no plan of action should be developed which may be inconsistent with the future goals and objectives of the City of Manhattan (City), which has a vested interest in the development and operation of the Manhattan Regional Airport (MHK).

The development alternatives for the airport can be categorized into two functional areas: the **airside** (runways, navigational aids, taxiways, etc.) and **landside** (passenger terminal, hangars, aprons, and support facilities). Within each of these areas, specific capabilities and facilities are required or desired. In addition, the utilization of airport property to provide revenue support and to benefit the economic development and well-being of the local area must be considered.

Each functional area interrelates and affects the development potential of the others. Therefore, all areas are examined individually, and then coordinated as a whole, to ensure the final plan is functional, efficient, and cost-effective. The total impact of all these factors on the airport must be evaluated to determine if the investment in MHK will meet the needs of the Manhattan metropolitan area, both during and beyond the 20-year planning period.

The alternatives considered later in this chapter will be evaluated by a variety of methods to determine which will best fulfill the local aviation needs. With this information, as well as input from various airport stakeholders, a final airport concept can evolve into a realistic development plan.

NON-DEVELOPMENT ALTERNATIVES

Prior to the presentation of development alternatives for MHK, there are several non-development options that should be considered. Non-development alternatives include a "no-build" or "do-nothing" alternative, development of a new replacement airport at a new location, or closure of the existing airport and the transfer of services to another existing airport. The following presents a discussion of the three primary non-development alternatives and the impact of pursuing each.

NO-BUILD/DO-NOTHING ALTERNATIVE

The no-build alternative essentially considers making no new capital investments in the airport. Limited maintenance and upkeep would continue so that the airport remains safe for aviation activity. No new hangars or apron area would be planned to be built by the airport sponsor; however, this would not, and could not, include the prohibition of hangar construction by a private entity. The obvious result of the no-build alternative is that the airport would be unable to accommodate forecasted demand for aviation services in the area.

The primary reason a community might choose a no-build alternative is to ultimately not be bound by the grant assurances associated with the acceptance of airport development grants. Grant assurances are part of the grant package contract the airport sponsor commits to when accepting a development grant from the Federal Aviation Administration (FAA). As such, airport sponsors are bound to maintain the useful life of the facilities developed or equipment acquired for an airport development project. Useful life is a term not to exceed twenty (20) years from the date of acceptance of a grant offer of federal (FAA) funds for a project. There is no limit on the duration of the terms, conditions, and assurances with respect to real property acquired with federal (FAA) funds.

The unavoidable consequence of the no-build/do-nothing alternative is that the capability of the airport would diminish over time. Its ability to serve as a primary commercial service airport for the Manhattan service area would deteriorate. This would lead to diminished activity levels and would ultimately negatively impact the local and regional economy. Safety concerns would arise, especially if necessary routine maintenance were deferred and the liability for damage to aircraft or accidents would increase. The long-term consequences of the no-build alternative would be to reduce the quality of the existing airport facilities over time, producing undesirable results. This scenario would result in an overall unpleasant experience for regular users and visitors.

MHK has received $33.95 million in FAA development grants since 2005. These grants represent a direct economic stimulus that has lasting positive economic impacts. The City has a vested interest in maintaining and improving airport facilities for commercial service and general aviation users as well as for the military. Without a commitment to ongoing improvement of the airport, users of the airport will be constrained from taking full advantage of the airport's air transportation capabilities.

RELOCATE AIRPORT ALTERNATIVE

This option considers constructing a new airport to replace the existing MHK. The new airport would have to be completed prior to closure of the existing airport. Additional studies beyond the scope of this master plan would be required. These would include a feasibility study, a site selection study, a master plan for the replacement site, and appropriate environmental documentation of the new site (typically an environmental assessment [EA] or environmental impact statement [EIS]).

An important consideration is the potential cost associated with both constructing a new airport and closing the existing airport. A broad estimate for constructing a replacement airport could range upward of $1.0 billion to construct a new airport with similar capabilities as the existing airport. A more detailed analysis would need to be undertaken to identify an acceptable site and to refine the project cost estimates. A large portion of the development costs would be eligible for FAA grant funding. Typically, non-revenue-producing facilities to be located within the airport property line are eligible for FAA funding. New passenger terminal buildings are eligible for FAA grant funding; however, funding eligibility is restricted to public-use areas only. Elements outside the property line, such as utility extension and surface roads, and other privatized facilities are not eligible for funding. Moreover, the City could have other financial costs, such as the cost of retiring existing leases with private or public entities. As an example, a fixed base operator (FBO) could need to be compensated for its facilities and, in some cases, loss of business, potentially resulting in costs extending into millions of dollars.

Often the trigger for pursuing a replacement airport is encroachment upon the existing airport to the point where it can no longer fulfill its role in the national aviation system. While development has extended near the airport, including limited rural residential developments, MHK is still capable of serving its existing and future commercial, general aviation, and military users. If a replacement airport feasibility study were to be undertaken, a detailed analysis would need to identify a site capable of developing equivalent airside, terminal, and landside facilities that exist at MHK today, while providing convenient access to the local and regional service areas.

TRANSFER SERVICE TO ANOTHER AIRPORT ALTERNATIVE

The feasibility of transferring services to an alternate airport relies on answering two primary questions. First, is a capable alternative airport reasonably located to accommodate MHK's primary air service area (Manhattan metropolitan area); and, second, can a nearby airport accommodate MHK's existing and projected aviation demand factors? An analysis of regional airports has been completed to determine if transferring aviation demand is reasonable.

Only two airports in the region could potentially serve to accommodate all the demand currently generated at MHK: Topeka Regional and Salina Regional Airports. These facilities have greater runway capacities and currently serve much larger scale military transport roles; however, their proximity to the City of Manhattan would be problematic in serving commercial airline and/or general aviation operations. MHK currently offers a much higher level of commercial services than both Salina and Topeka. Salina's resurgent airline service is limited to two flights per day sharing seats with Hays, KS with service to Denver and one additional nonstop flight to Chicago. Topeka has historically been served by the airlines; however, the service has always faltered and then ceased. Manhattan has proven to be a solid air service supporting community and market that would not be easily or practically replaced by shifting to a more distant airport in Topeka and/or Salina. Moreover, if Manhattan travelers would be forced to drive to a distant airport, Kansas City or Wichita airports would likely be the more appealing choices, making the shifting of services impractical and imprudent.

Additionally, the City of Manhattan has accepted $33.95 million dollars in federal development grant funding through the Airport Improvement Program (AIP) for projects at MHK since 2005. As was previously discussed, acceptance of development grants obligates the airport sponsor, through grant assurances, to maintain the airport as an airport. Closing the existing airport and transferring services to another existing airport would be considered a violation of these grant assurances, requiring repayment of grants not yet fully depreciated. The investments made, as well as the economic benefits received from the airport, both public and private, could not readily be shifted or regenerated to another airport without significant costs/losses. As such, this alternative is not considered practical, reasonable, and/or financially feasible.

NON-DEVELOPMENT ALTERNATIVES SUMMARY

The purpose of this master plan is to examine aviation needs at MHK over the course of the next 20 years. Therefore, this master plan will examine the needs of the existing airport and will present a program of needed capital improvement projects to cover the scope of the plan. Nonetheless, various non-development alternatives may be considered by the airport sponsor.

Information pertaining to the three most common non-development alternatives has been presented. These are the no-build, relocate/replacement alternatives, and transfer of services. This evaluation is not intended as a recommendation to pursue one of these alternatives; instead, it is for informational purposes only. If the airport sponsor were to pursue one of these alternatives, additional study beyond the scope of this master plan would be required.

Two of the three non-development alternatives would lead to the closure, or a significantly reduced operation, of the existing airport. There is a lengthy process to obtain approval for this course of action. As outlined, the primary hindrance to considering airport closure is the fact that airports have accepted federal development grants that include certain grant assurances, one of which is to maintain the improvement for its useful life (20 years). If an airport is closed in the interim, then the sponsor could be required to refund all or a portion of the past federal investment. Moreover, private investments by any airport operator would also require some form of repayment based on negotiated lease terms. The non-development options are not found to be feasible, practical, or prudent. MHK is a vibrant facility with plenty of remaining growth potential. As such, the non-development alternatives will no longer be considered further in this planning process.

REVIEW OF THE PREVIOUS AIRPORT PLAN

The last master plan was completed in 2009. The following is a summary of major facility recommendations from this study. Project statuses are noted.

1. Extend Runway 3-21 by 3,000 feet, with 2,000 feet added to the southwest and 1,000 feet to the northeast. The 1,000-foot extension to the northeast includes recapturing the existing 400-foot lead-in taxiway and adding 600 feet (depicted on the current Airport Layout Plan [ALP] and illustrated on **Exhibit 4A**).
2. Construct parallel taxiway on the east side of Runway 13-31 (remains on ALP).
3. Taxiway improvements generally widening Taxiway A north of the commercial apron and Taxiway B in the general aviation area (remains on ALP).
4. New general aviation development concepts, including new hangar and apron developments, identified for the northeast quadrant and west of Runway 13 (remains on ALP).
5. Relocate localizer (project completed).
6. Expand commercial airline terminal building, entrance road, and parking lot (mostly completed).
7. Widen the ramp areas for the commercial and cargo aircraft (remains on ALP).
8. Relocate Wildcat Road to intersect with Skyway Drive farther south (completed).
9. Construction of paved perimeter road around airfield (remains on ALP).

AIRSIDE PLANNING CONSIDERATIONS

Generally, airside issues relate to those airport elements that contribute to the safe and efficient transition of aircraft and passengers from air transportation to the landside facilities at the airport. Planning must factor and balance many airside items, including meeting FAA design parameters of the established design aircraft, instrument approach capability, airfield capacity, runway length, taxiway layouts, and pavement strengths. Each of these elements for MHK was analyzed in the previous chapters. This chapter will examine airside improvement opportunities to meet design standards and/or capacity constraints. A summary of the primary airside planning issues to be considered in this alternatives analysis is listed below.

Airside Planning Considerations
• Meet runway design code (RDC) C-III-2400 standards on Runway 3-21 • Extend Runway 3-21 to more safely accommodate larger commercial aircraft in the long term • Rehabilitation options for Runway 3-21 in the near term • Consider corrective measures for non-standard taxiway design

AIRFIELD DESIGN STANDARDS

As a primary commercial service airport in the FAA's *National Plan of Integrated Airport Systems* (NPIAS), MHK should be capable of safely accommodating all commercial service aircraft operating there now and in the future. The critical design aircraft analysis in Chapter Two concluded that Runway 3-21 should meet Runway Design Code (RDC) C-III-24000 design standards both in the existing and future conditions, which coincides with regular use by Bombardier CRJ-900 and Embraer ERJ-175 regional jet aircraft.

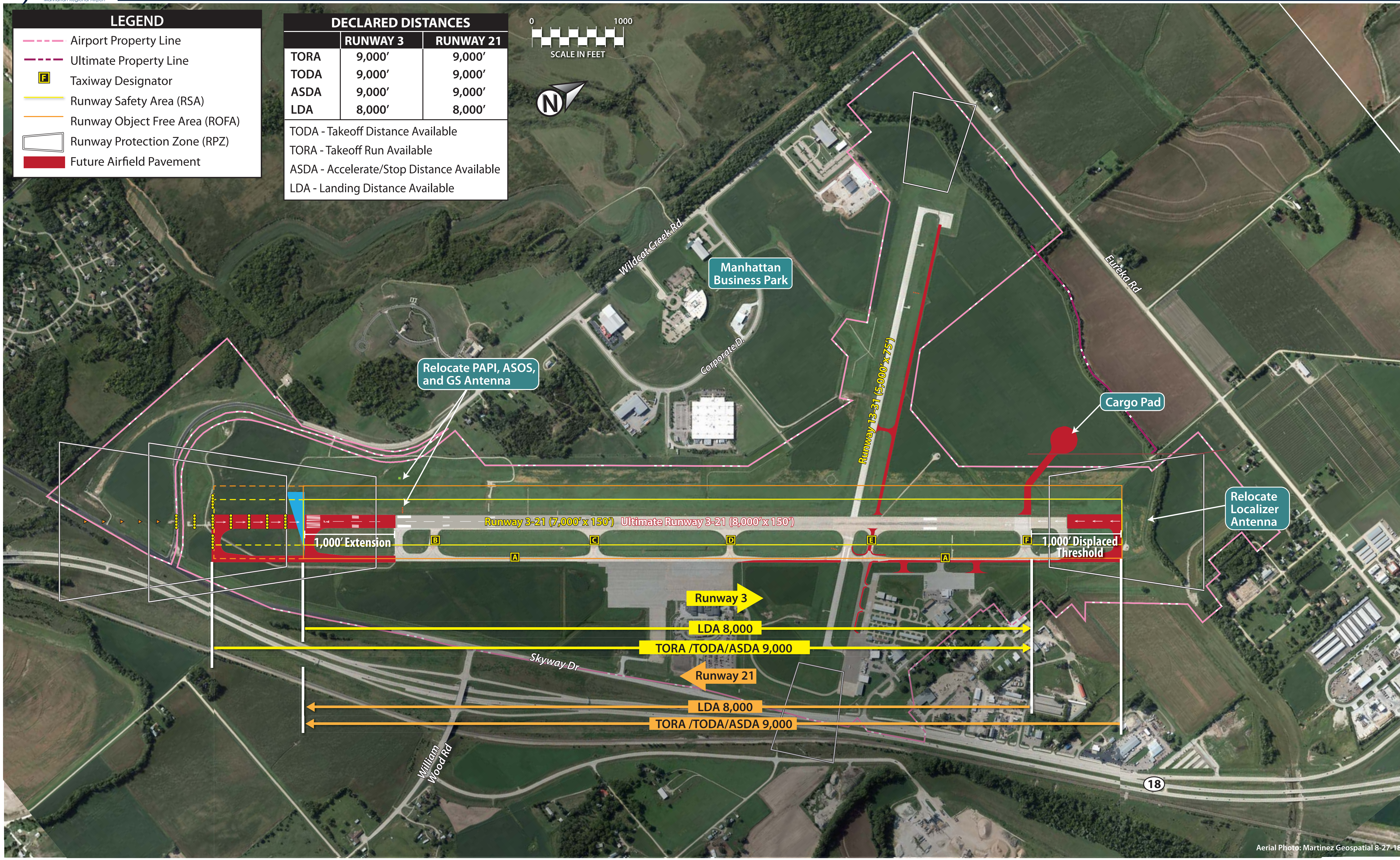
Crosswind Runway 13-31 should meet RDC B-II-5000 design standards, which coincides with regular use by turboprop aircraft, such as the Beechcraft King Air family of turboprops among many others. The runway is currently in excellent condition and will not require additional development with the potential exception of the addition of a parallel taxiway.

RUNWAY LENGTH

The runway length analysis in the previous chapter concluded that the existing length of Runway 3-31 (7,000 feet) is capable of safely accommodating most commercial and business jet aircraft currently operating at MHK. However, during hot summer periods, some larger aircraft must depart from MHK with restricted payloads (less fuel/passengers/freight), which can limit non-stop destination distances. Previous planning has considered extensions to Runway 3-21, with the current ALP showing a 2,000-foot pavement extension to the southwest and 600-foot pavement extension to the northeast. As previously depicted on Exhibit 3A and repeated on **Exhibit 4A**, the total pavement length of 10,000 feet was proposed. The plan included the addition of 2,000 feet of additional pavement south of Runway 3 and fulling incorporating the existing 400-foot lead-in taxiway plus 600 feet of additional pavement north of Runway 21. The exhibit also depicts the operational declared distances associated with the proposed plan, as not all the pavement would be usable for aircraft operations due to safety area limitations.

Declared distances are used to define the effective runway length for landing and takeoff when a standard runway safety area (RSA) cannot be achieved or a runway protection zone (RPZ) needs to be relocated. The four declared distances include:

- Takeoff Run Available (TORA) – the runway length declared available and suitable for the ground run of an aircraft taking off (factors in the positioning of the departure RPZ);



DECLARED DISTANCES

	RUNWAY 3	RUNWAY 21
TORA	9,000'	9,000'
TODA	9,000'	9,000'
ASDA	9,000'	9,000'
LDA	8,000'	8,000'

TODA - Takeoff Distance Available
TORA - Takeoff Run Available
ASDA - Accelerate/Stop Distance Available
LDA - Landing Distance Available

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- Takeoff Distance Available (TODA) – the TORA plus the length of any remaining runway or clearway beyond the far end of the TORA; the full length of the TODA may need to be reduced because of obstacles in the departure area;
- Accelerate-Stop Distance Available (ASDA) – the runway plus stopway length declared available and suitable for the acceleration and deceleration of an aircraft aborting a takeoff (factors in the length of RSA/ROFA beyond the runway end);
- Landing Distance Available (LDA) – the runway length declared available and suitable for landing an aircraft (factors in the length of RSA/ROFA beyond the runway end and the positioning of the approach RPZ).

Generally, declared distances offers a means to achieve greater operational dimensions within a constrained environment where pavement additions are limited upon construction. A common term associated with this type of plan is a reduced or limited pavement utility. The added, or new, pavement does not offer full operational utility in all directions, as in one direction it could serve as operational length (take-off or landing) and in the other direction it serves as RSA.

The existing ALP depicted on **Exhibit 4A** offers an example of declared distance usage and rationale. As shown, a 2,000-foot extension to the southwest allows the pavement to be fully useable for take-off operations to the north (Runway 3); however, only 1,000 feet of the extended pavement would be useable for landings on Runway 3 and for take-off and landing operations on Runway 21 (the arrows on the exhibit demonstrate the length allowances and limitations). As a result, the 2,000-foot extended pavement section's utility is limited to only 1,000 feet of operational length for three of the four possible operational conditions.

As planned, the implementation of declared distances does provide the only option for a fully useable 9,000-foot take-off length on Runway 3. Conversely, the proposed 1,000-foot extension to the northeast would not be useable for landings on either runway end, being useable only for Runway 21 take-off calculations as illustrated on the exhibit. Thus, the proposed northeast pavement extension would have a reduced utility as well. Overall, the proposed ALP development plan presents the only option of providing for a 9,000-foot take-off run without relocating significant hard constraints near the airport, including State Highway 18 and other local roads. Also, it would not require the acquisition of additional nearby properties to achieve compatible land uses within extended RPZs. Runway extension alternatives presented in the following section will utilize similar declared distance approaches.

TAXIWAY CONFIGURATION

The current Runway 3-21 configuration includes a 7,400-foot runway pavement section with the northeastern 400-foot designated as a lead-in taxiway. Lead-in taxiways were historically utilized to offer operational dimensions in constrained airfield configurations. Current design standards, however, do not allow for their use. As a result, the outcome of this planning study must eliminate the lead-in taxiway configuration. The best-case scenario would be to incorporate the taxiway into operational runway length as the existing condition was set based on previous RSA standards. Historically, the FAA required

1,000 feet of RSA prior to a landing threshold, which is why the threshold was relocated from the pavement edge to a position 400 feet south. Current FAA design standards only require 600 feet of RSA prior to a landing threshold; thus, the existing Runway 21 threshold could be shifted back to its original position as the pavement edge. This will be further explored in the next section.

Another taxiway issue needing to be addressed is taxiway nomenclature. Current taxiway designations at MHK do not follow FAA's Engineering Brief 89, *Taxiway Nomenclature Convention* standards. According to the Engineering Brief, stub taxiways associated with a parallel taxiway should be designated with a letter and number. In the case of MHK, the stubs should be A1, A2, A3, etc. beginning with the northernmost stub, or B1, B, B3, etc. beginning with the northernmost stub. As a result, the taxiways should be as follows:

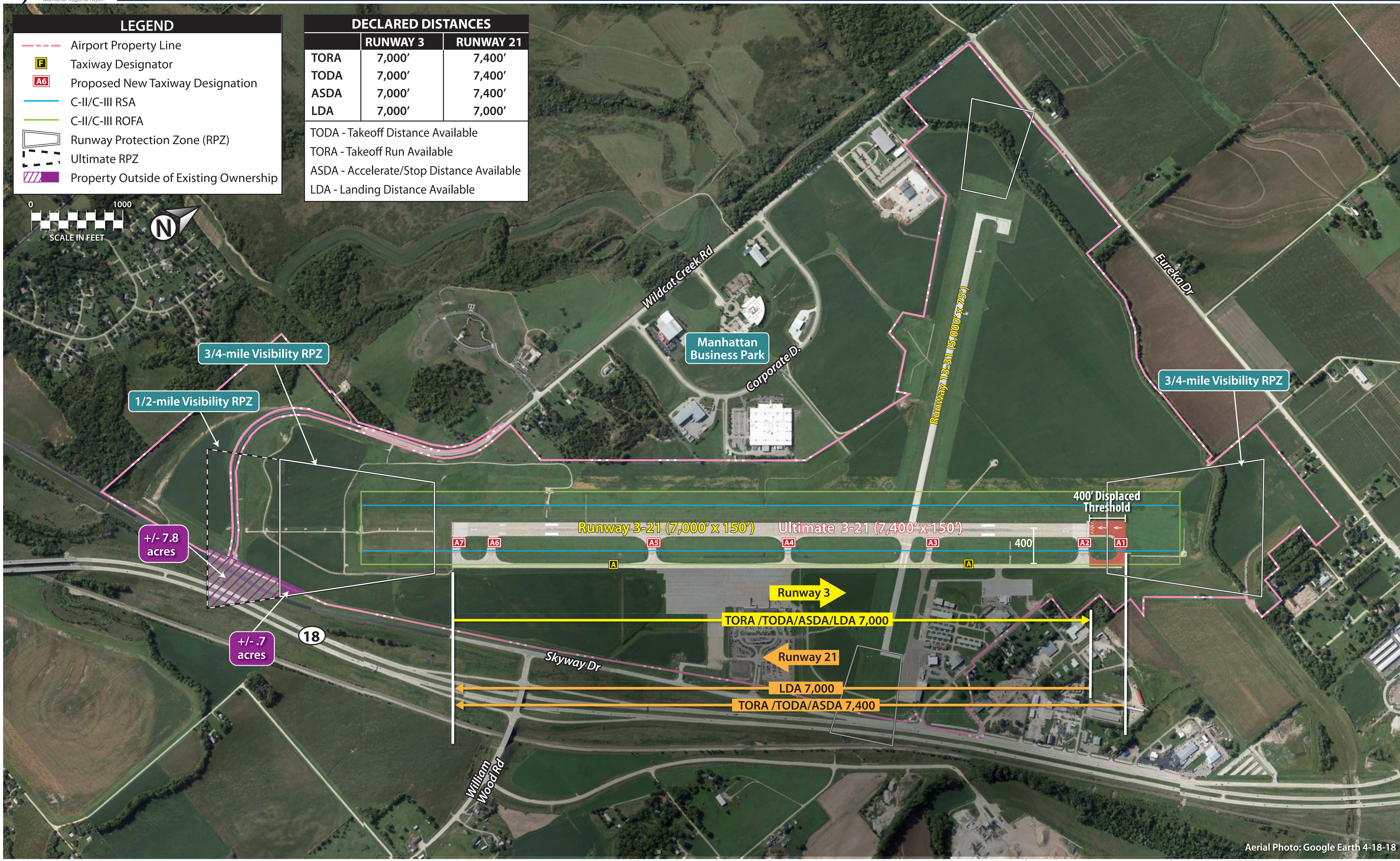
- North End (Runway 21) – A1
- Taxiway F - A2
- Taxiway E – A3
- Taxiway D – A4
- Taxiway C – A5
- Taxiway B – A6
- Runway 3 entrance – A7

RUNWAY 3-21 EXTENSION ALTERNATIVES

Seven alternative extension options for Runway 3-21 have been analyzed for consideration in this planning process. The details of each alternative are described below, along with the alternative's associated advantages and disadvantages. It should be clearly noted that the runway extensions proposed are generally long-term solutions, meaning greater than five years. The recapture of the lead-in taxiway could be justified in the short-term rehabilitation project as the pavement currently exists and could offer an inexpensive improvement for greater operational efficiency during summer months. Runway 3-21 rehabilitation options presented later will also utilize runway extension concepts to promote shorter airfield closures via construction staging. As a result, this chapter is organized to first discuss Runway 3-21 extension options and will be followed by Runway 3-21 rehabilitation options.

RUNWAY 3-21 EXTENSION ALTERNATIVE 1

Depicted on **Exhibit 4B**, Runway 3-21 Alternative 1 considers the most simplistic runway extension option available, reclaiming the existing 400-foot lead-in taxiway as operational runway length. As proposed, the Runway 21 threshold would remain in its current location, thereby being displaced 400 feet. The purpose for the displacement is two-fold. First, the extra 400 feet of pavement would not be useable for any operational calculations on Runway 3 and the displaced threshold would demark the "end of runway." This demarcation can be simpler to implement runway/taxiway lighting and signage. Second,



DECLARED DISTANCES

	RUNWAY 3	RUNWAY 21
TORA	7,000'	7,400'
TODA	7,000'	7,400'
ASDA	7,000'	7,400'
LDA	7,000'	7,000'

TODA - Takeoff Distance Available
TORA - Takeoff Run Available
ASDA - Accelerate/Stop Distance Available
LDA - Landing Distance Available

Exhibit 4B
RUNWAY 3-21 ALTERNATIVE 1

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the displacement would allow the Runway 21 threshold to remain in its current location, falling within the existing airport property bounds.

As shown on the exhibit and outlined in **Table 4A**, Alternative A would have associated declared distances, as LDA is always a factor when a displaced threshold exists. Also, the 400 feet of reclaimed runway pavement would not be useable for Runway 21 operations as 1,000 feet of RSA is required beyond the far end of the runway. Runway 3 TORA and TODA are limited also because the departure RPZ is not extended beyond airport property. As shown on the exhibit, the added 400-foot length will offer 7,400 feet of operational length for Runway 21 departures and 7,000 feet for all other calculations.

Table 4A also presents total construction costs associated with the proposed extension alternative. AS proposed, the alternative would cost approximately $194,000. The cost factors all required improvements, with the exception of pavement costs as all runway extension alternatives (except Alternative 3) are based on the 400-foot lead-in taxiway pavement being rehabilitated in the short term when the entire runway is rehabilitated.

The final consideration is environmental factors. Alternative 1 would present minimal environmental impacts as no new pavement would be added. The current Runway 3 RPZ has 0.7 acres of land not currently within airport bounds. If the Runway 3 Category I minimums (200-foot cloud height and ½-mile visibility) return, an additional 7.8 acres of land would need to be controlled for the RPZ increase.

TABLE 4A
Runway 3-21 Extension Alternative Summary
Manhattan Regional Airport

	RUNWAY 3-21 ALTERNATIVES													
	1		2		3		4		5		6		7	
Pavement Length	7,400		7,400		8,000		8,400		8,400		9,000		8,900	
Runway End	3	21	3	21	3	21	3	21	3	21	3	21	3	21
Displacement	0	400	0	0	0	0	0	400	1,000	400	0	400	0	900
Declared Distances														
TORA	7,000	7,400	7,400	7,400	8,000	8,000	8,000	8,400	8,000	8,400	9,000	9,000	8,000	8,900
TODA	7,000	7,400	7,400	7,400	8,000	8,000	8,000	8,400	8,000	8,400	9,000	9,000	8,000	8,900
ASDA	7,000	7,400	7,000	7,400	8,000	8,000	8,000	8,400	8,000	8,400	9,000	9,000	8,000	8,900
LDA	7,000	7,000	7,000	7,400	8,000	8,000	8,000	8,400	7,000	8,000	9,000	9,000	8,000	8,000
Total Cost	**$194,000**		**$1,573,720**		**$15,803,764**		**$15,803,764**		**$13,798,139**		**$28,865,758**		**$21,325,669**	
Environmental Factors														
Property Acquisition	~0.7 - 8.5 ac		~5.1 - 12.9 ac		~5.0 – 18.0 ac		~5.0 – 18.0 ac		~1.0 – 5.0 ac		~5.0 – 38.0 ac		~5.0 – 18.0 ac	
Residential Properties	0		~4		0		0		0		Up to 11		0	
Impact Potential(s)	Minimal		Moderate		Moderate		Moderate		Minimal/ Moderate		Moderate+		Moderate	

RUNWAY 3-21 ALTERNATIVE 2

Depicted on **Exhibit 4C**, Alternative 2 physically mirrors the previous alternative. The only difference between the alternatives is Alternative 2 would reclaim the 400-foot lead-in taxiway pavement as full runway without a displacement. An extension of the runway would involve several connected projects, including:

- An extension of Taxiway A.
- Relocation of the Runway 21 precision approach path indicator (PAPI-4) visual approach aid system.
- Relocation of the Runway 21 runway end identification lights (REILS).
- Acquisition (fee-simple/easement) of 4.4 acres of property within the RPZ.

The declared distances for this alternative allow for the full 7,400 feet of pavement to be useable for Runway 3 TORA and TODA but not the ASDA or LDA due to RSA limitations. The shifted RPZ allows for the TORA increase. For Runway 21, all declared distances would match the 7,400-foot pavement length.

This alternative is estimated to cost $1.574 million. Environmental factors are considered moderate as the eastward RPZ shift would require the acquisition (positive control) of 4.4 acres that currently includes four residences.

RUNWAY 3-21 ALTERNATIVE 3

Depicted on **Exhibit 4D**, Alternative 3 considers an extension of the primary runway 1,000 to the southwest, while keeping Runway 21 as it currently exists without the lead-in pavement. As depicted, the extension would also shift the Runway 3 RSA and RPZ 1,000 feet south. This shift would require the relocation of Wildcat Creek Road as drawn to be outside of the shifted RPZ. State Highway 18 would, however, be within the southeastern corner of the shifted RPZ. The Category (CAT) I RPZ would include an additional 13 acres of land and more of State Highway 18. The FAA would be required to approve the location of a roadway in the shifted RPZ. The extension of the runway in this alternative involves several connected projects, including:

- An extension of Taxiway A.
- Relocation of the instrument landing system (ILS) glide slope antenna and localizer.
- Relocation of the medium intensity approach lighting system with runway alignment indicator lights (MALSR).
- Relocation of the PAPI-4 visual approach aid system.
- Acquisition (fee-simple/easement) of five to 18 acres of property within the shifted RPZ(s).
- Rerouting Wildcat Creek Road.

The projected costs of Alternative 3 are estimated at $15.8 million. A large portion of the costs is associated with navigational aid relocations and property acquisition. The environmental impact is considered moderate due to property acquisition and land disturbances to accommodate new paved areas and stabilized RSA.

LEGEND

- Airport Property Line
- Taxiway Designator
- Proposed New Taxiway Designation
- C-II/C-III RSA
- C-II/C-III ROFA
- Runway Protection Zone (RPZ)
- Ultimate RPZ
- Property Outside of Existing Ownership
- Building in RPZ

DECLARED DISTANCES

	RUNWAY 3	RUNWAY 21
TORA	7,400′	7,400′
TODA	7,400′	7,400′
ASDA	7,000′	7,400′
LDA	7,000′	7,400′

TODA - Takeoff Distance Available
TORA - Takeoff Run Available
ASDA - Accelerate/Stop Distance Available
LDA - Landing Distance Available

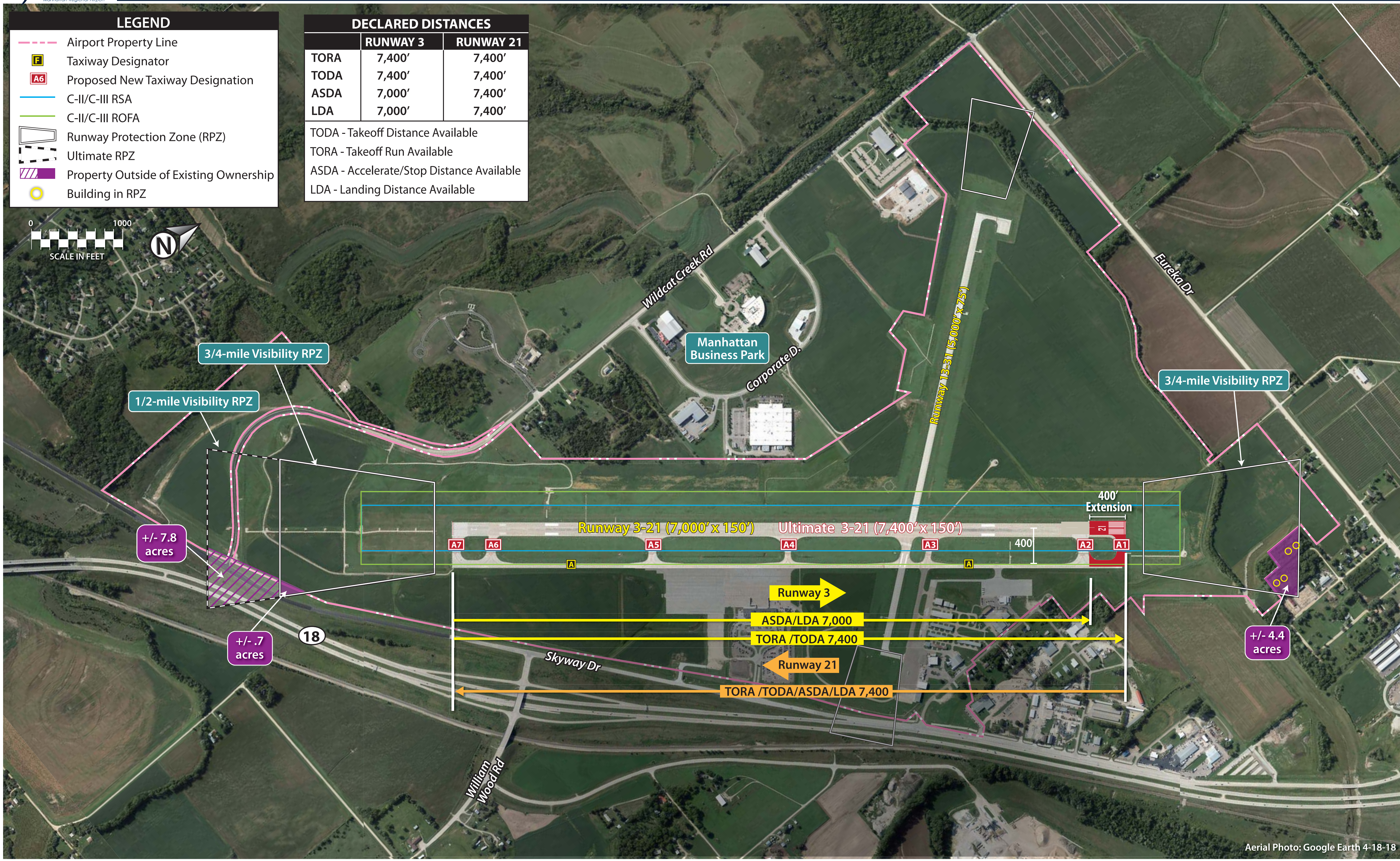

Exhibit 4C
RUNWAY 3-21 ALTERNATIVE 2

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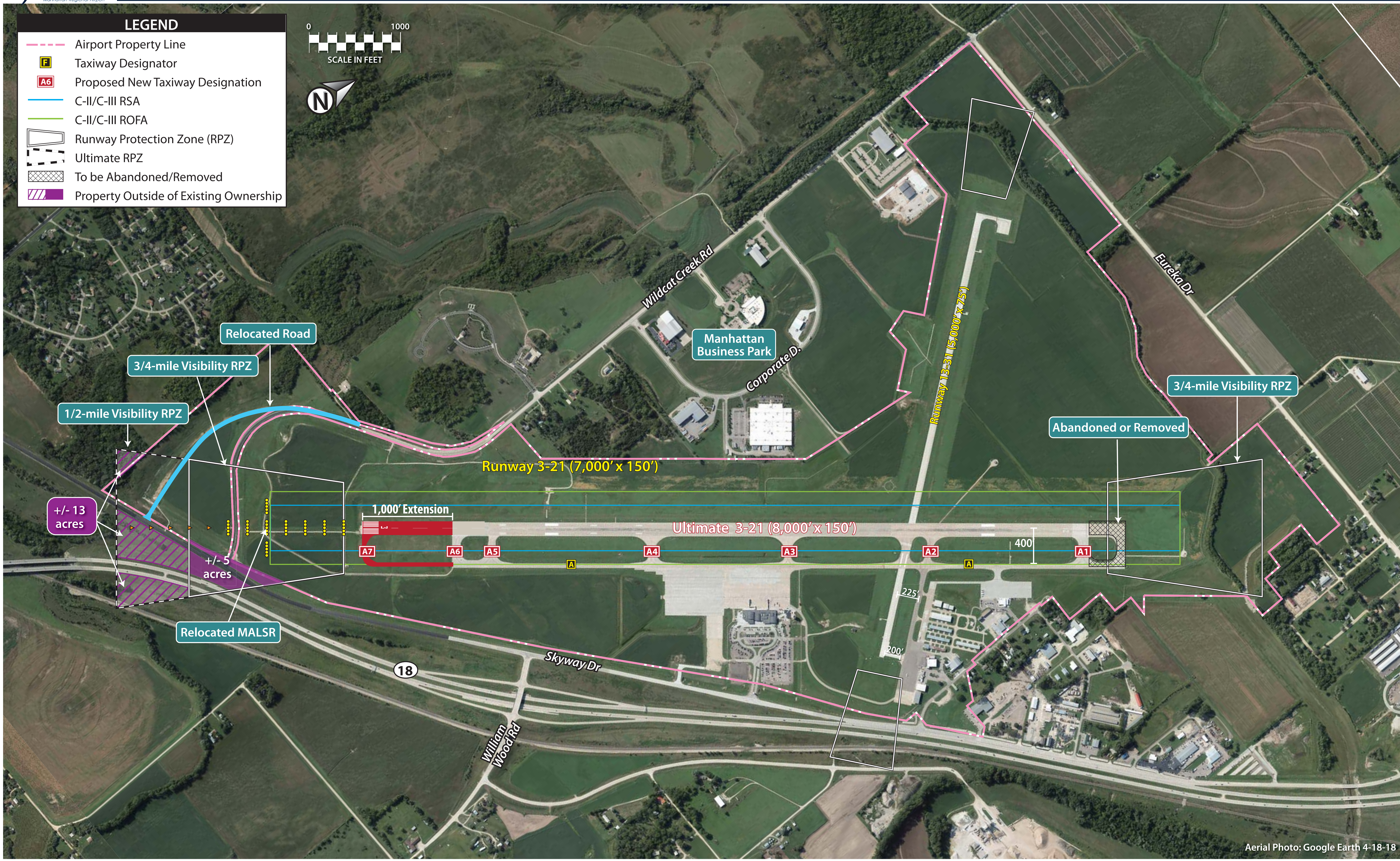

Exhibit 4D
RUNWAY 3-21 ALTERNATIVE 3

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RUNWAY 3-21 ALTERNATIVE 4

Depicted on **Exhibit 4E**, Alternative 4 combines the general premises of Alternatives 1 and 3. As such, the plan would include utilizing the 400-foot lead-in taxiway as runway and a southerly 1,000-foot extension. The resultant pavement length would be 8,400 feet with a Runway 21 landing threshold displacement of 400 feet. Declared distances would be 8,000 feet for all Runway 3 operations and Runway 21 landings. Runway 21 take-off calculations would increase to the full pavement length of 8,400 feet.

The extensions of the runway in this alternative involve several connected projects, including:

- An extension of Taxiway A.
- Relocation of the ILS glide slope antenna and localizer (Runway 3).
- Relocation of the MALSR (Runway 3).
- Relocation of the PAPI-4 visual approach aid system (Runway 3).
- Acquisition (fee-simple/easement) of up to 18 acres.
- Rerouting of Wildcat Creek Drive.

Alternative 4 is estimated to cost $15.8 million as it physically mirrors the previous alternative. Similarly, the environmental factors are considered moderately impacted.

RUNWAY 3-21 ALTERNATIVE 5

Depicted on **Exhibit 4F**, Alternative 5 considers an extension of the primary runway 1,000 feet to the southwest while recapturing the lead-in pavement on Runway 21. This alternative differs from the previous alternative in only one way: it maintains the Runway 3 landing threshold displaced in its current location. As a result, the ILS would not need to be relocated as with Alternative 4; however, a portion of the MALSR would need to be placed in-pavement to lead properly to the Runway 3 displacement. The two RPZs shown for Runway 3 would mirror the existing condition, requiring minimal land controls of up to five acres of land. The extension of the runway in this alternative involves several connected projects, including:

- An extension of Taxiway A.
- Changing the MALSR to include at least four to five in-pavement light stations.
- Acquisition (fee-simple/easement) of five to 18 acres of property within the shifted RPZ(s).
- Rerouting Wildcat Creek Road is shown but not required as with the previous alternative.

The projected costs of Alternative 5 are estimated at $13.8 million. The environmental impact is considered minimal to moderate having land disturbances but minimal land acquisition needs.

RUNWAY 3-21 ALTERNATIVE 6

Depicted on **Exhibit 4G**, Alternative 6 offers the goal of trying to provide a 9,000-foot fully functional pavement surface. Concepts were considered such as a 2,000-foot southerly extension, but these were ultimately rejected due to hard constraints to the south. Alternative 6 includes a 1,000-foot extension in both directions. The southerly extension for Alternative 6 has already been presented on Alternatives 3 and 4. This alternative also includes a 1,000-foot extension to the north. This extension plus the extended 1,000-foot RSA would require significant modifications to the north, including rerouting or modifying the Eureka Valley Tributary Creek immediately north of the localizer antenna. The shifted Runway 21 threshold would include up to 11 residences and approximately 20 acres of land to be acquired.

The extensions of the runway in this alternative involve several connected projects, including:

- An extension of Taxiway A.
- Relocation of the ILS glide slope antenna and localizer (Runway 3).
- Relocation of the MALSR (Runway 3).
- Relocation of the PAPI-4s (both Runways 3 and 21) and REILS (Runway 21).
- Relocation of the localizer (Runway 21).
- Modification of Eureka Valley Tributary Creek due to extended RSA.
- Acquisition (fee-simple/easement) of up to 38 acres and up to 11 residences.
- Rerouting of Wildcat Creek Drive.

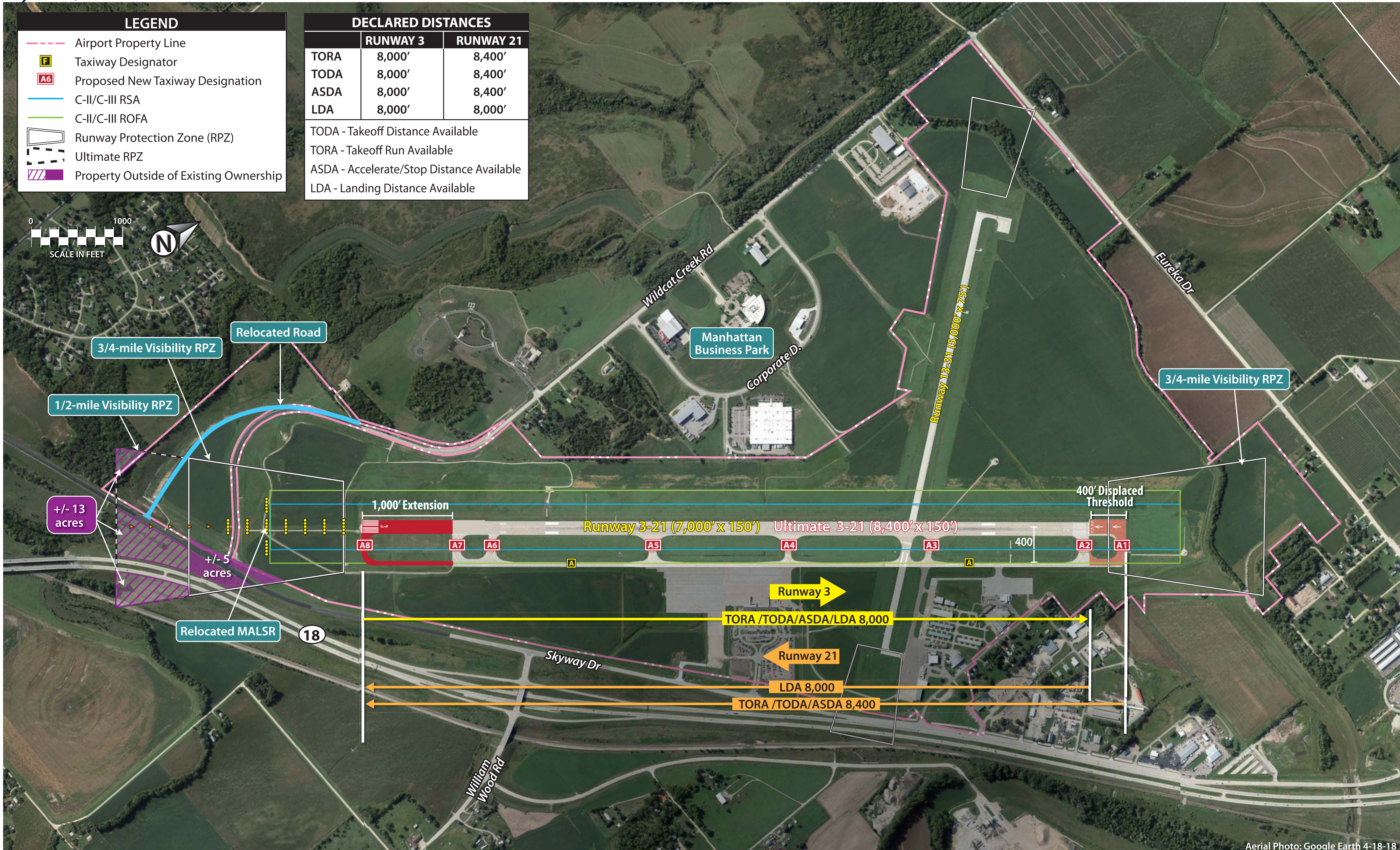
In total, this alternative is projected to cost approximately $28.9 million. It is considered a moderate plus environmental impact due to land disturbances both north and south, including a waterway as well as property and residential acquisitions.

RUNWAY 3-21 ALTERNATIVE 7

Depicted on **Exhibit 4H**, Alternative 7 offers the goal of trying to provide a 9,000-foot of operational length on Runway 21 without the challenging demands north of the runway, as presented in Alternative 6. The plan would include only a 500-foot pavement extension to the north of the existing pavement edge. The extension would allow for 900 feet of additional TORA, TODA, and ASDA on Runway 21 plus the added 1,000 feet to the south, totaling 8,900 feet of operational take-off to the south. Landing distance on Runway 21 would be 8,000 feet. For Runway 3 operations, the extended pavement north would be useable for RSA only, so it would not increase declared distance calculations. As such, Runway 3 declared distances would be 8,000 feet.

The extensions of the runway in this alternative involve several connected projects, including:

- An extension of Taxiway A.
- Relocation of the ILS glide slope antenna and localizer (Runway 3).
- Relocation of the MALSR (Runway 3).



DECLARED DISTANCES

	RUNWAY 3	RUNWAY 21
TORA	8,000'	8,400'
TODA	8,000'	8,400'
ASDA	8,000'	8,400'
LDA	8,000'	8,000'

TODA - Takeoff Distance Available
TORA - Takeoff Run Available
ASDA - Accelerate/Stop Distance Available
LDA - Landing Distance Available

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DECLARED DISTANCES

	RUNWAY 3	RUNWAY 21
TORA	8,000′	8,400′
TODA	8,000′	8,400′
ASDA	8,000′	8,400′
LDA	7,000′	8,000′

TODA - Takeoff Distance Available
TORA - Takeoff Run Available
ASDA - Accelerate/Stop Distance Available
LDA - Landing Distance Available

LEGEND

- Airport Property Line
- Taxiway Designator
- Proposed New Taxiway Designation
- C-II/C-III RSA
- C-II/C-III ROFA
- Runway Protection Zone (RPZ)
- Ultimate RPZ
- Property Outside of Existing Ownership

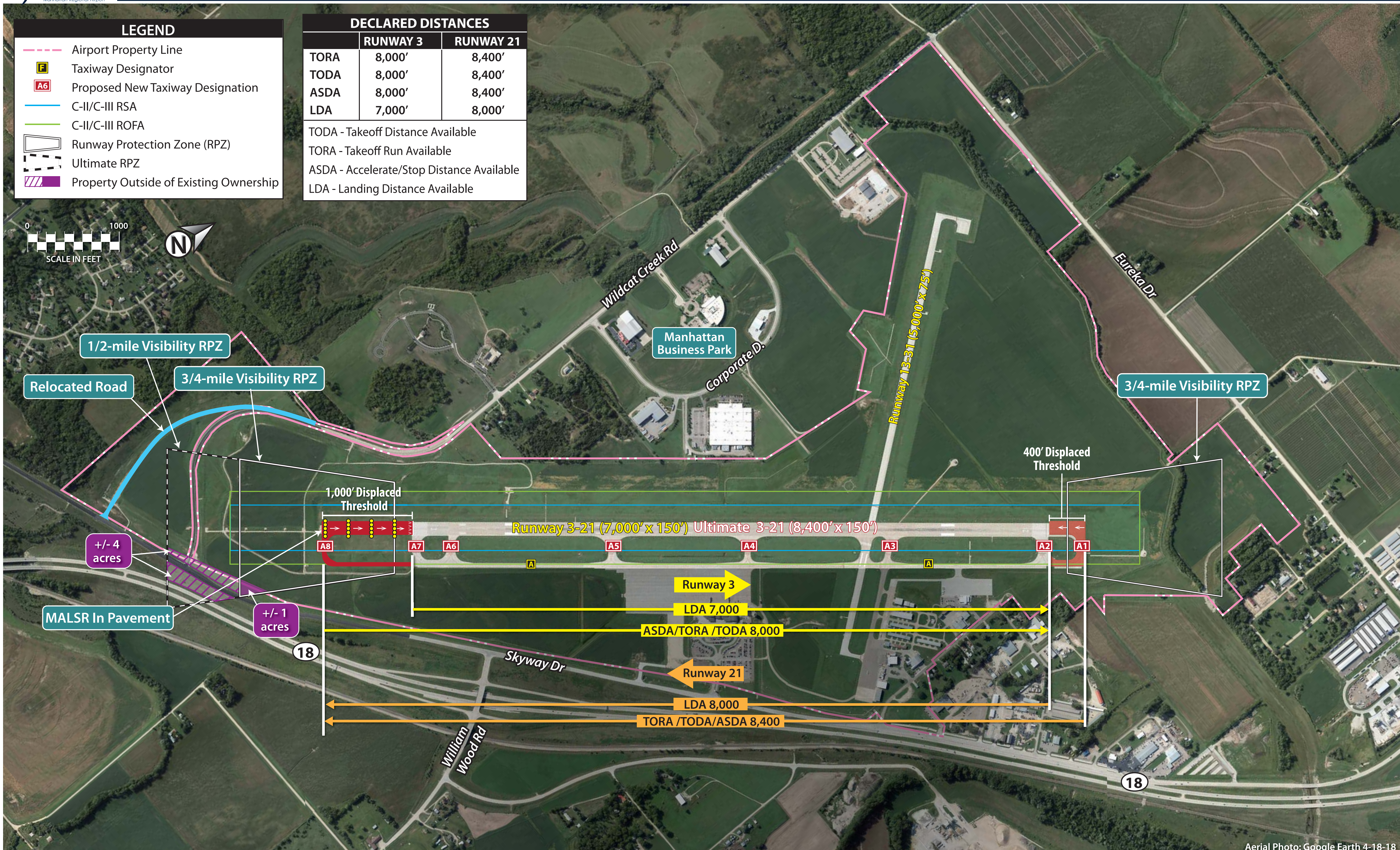

Exhibit 4F
RUNWAY 3-21 ALTERNATIVE 5

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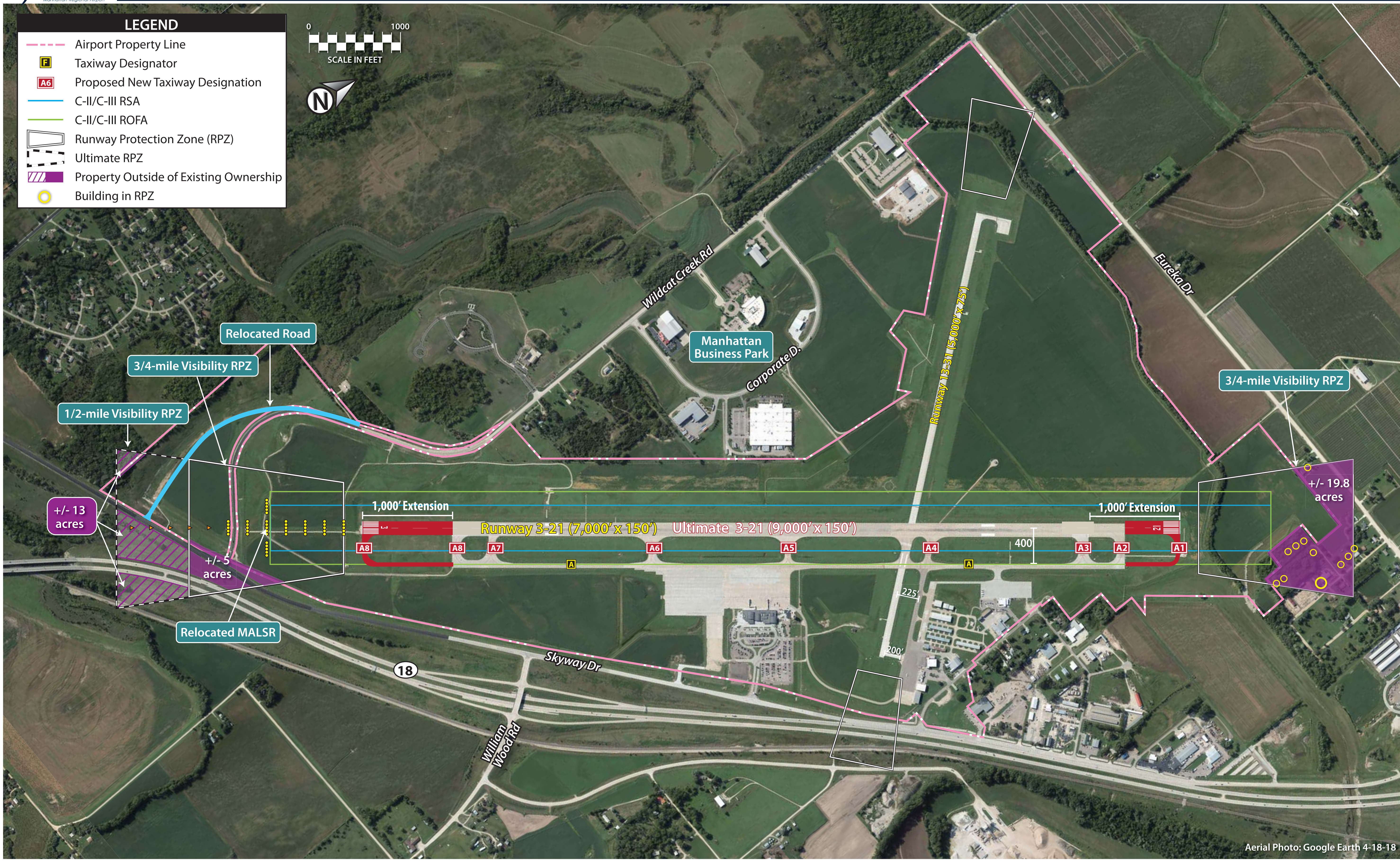
LEGEND
Airport Property Line
Taxiway Designator
Proposed New Taxiway Designation
C-II/C-III RSA
C-II/C-III ROFA
Runway Protection Zone (RPZ)
Ultimate RPZ
Property Outside of Existing Ownership
Building in RPZ
0 1000
SCALE IN FEET
N
Wildcat Creek Rd
Manhattan Business Park
Corporate D.
Eureka Dr
Runway 13-31 (5,000' x 75')
Relocated Road
3/4-mile Visibility RPZ
1/2-mile Visibility RPZ
+/- 13 acres
+/- 5 acres
Relocated MALSR
1,000' Extension
Runway 3-21 (7,000' x 150')
Ultimate 3-21 (9,000' x 150')
A8 A8 A7 A6 A5 A4 A3 A2 A1
A
400
225'
200'
3/4-mile Visibility RPZ
+/- 19.8 acres
Skyway Dr
18
William Wood Rd
Aerial Photo: Google Earth 4-18-18

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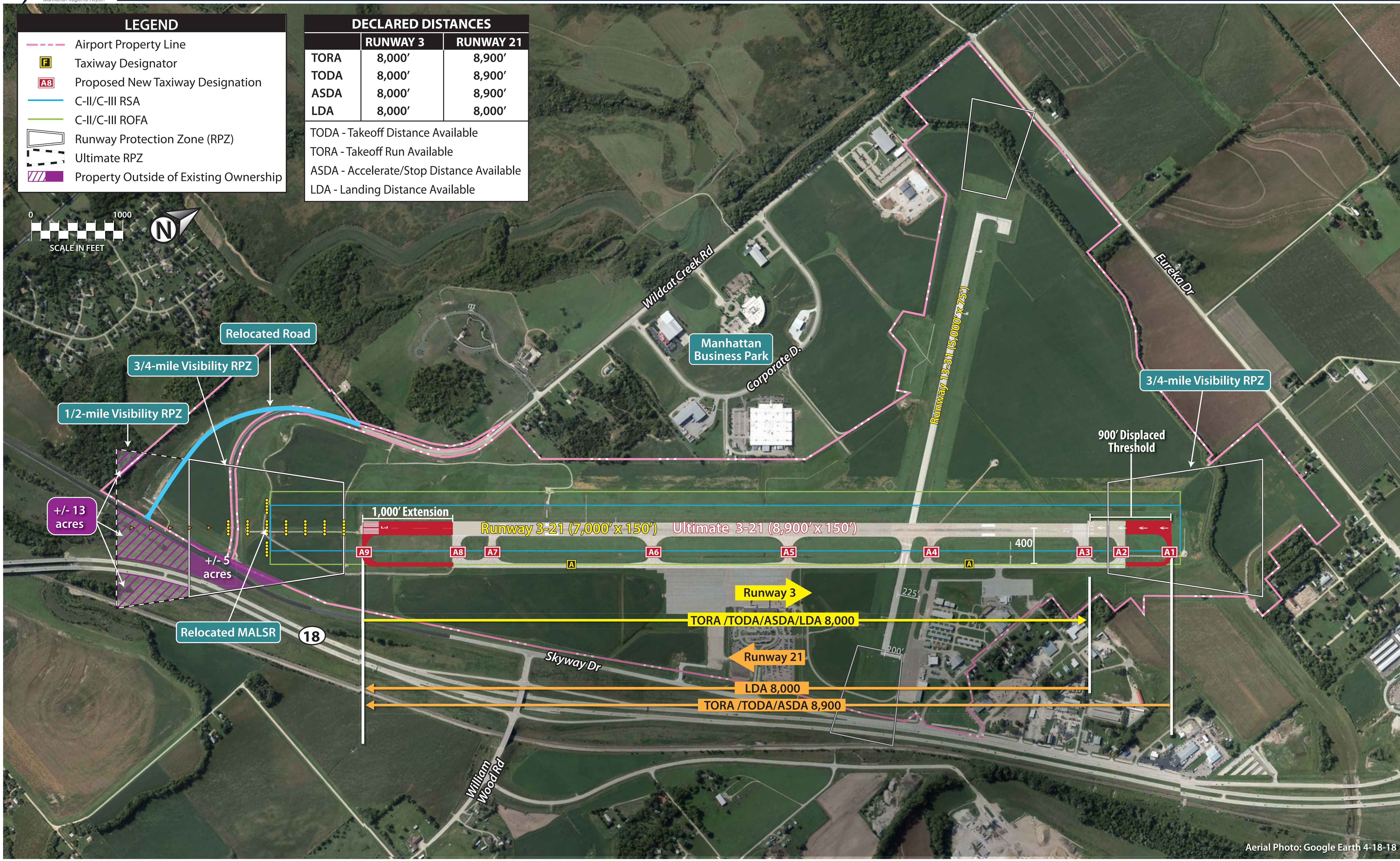

DECLARED DISTANCES

	RUNWAY 3	RUNWAY 21
TORA	8,000'	8,900'
TODA	8,000'	8,900'
ASDA	8,000'	8,900'
LDA	8,000'	8,000'

TODA - Takeoff Distance Available
TORA - Takeoff Run Available
ASDA - Accelerate/Stop Distance Available
LDA - Landing Distance Available

Exhibit 4H
RUNWAY 3-21 ALTERNATIVE 7

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- Relocation of the PAPI-4 (Runway 3).
- Acquisition (fee-simple/easement) of up to 18 acres.
- Rerouting of Wildcat Creek Drive.

Alternative 7 is estimated to cost $21.3 million and would have moderate environmental impacts.

RUNWAY REHABILITATION OPTIONS

Existing Runway 3-21 includes a portland cement concrete (PCC) surface constructed on three different types of materials that are placed on natural soils. The first 400 feet on Runway 3 (southwest end) is cement stabilized base. Between Taxiways B and D, the base course is crushed stone. There is 360 feet of runway at Taxiway D that is asphalt on concrete on sand, which is the same section as the last 1,900 feet. The runway intersection is the same construction as the runway between Taxiways B and D. Runway shoulders are constructed directly on frost-susceptible soils, which is the cause of the longitudinal cracking.

Based upon load testing, Runway 3-21 has structural capacity to support the existing and future design aircraft. The surface of the concrete is deteriorating and is a risk to turbine powered aircraft. Five runway renovation options to provide a durable runway surface have been analyzed and are detailed below. The FAA recommends two pavement elements that are not incorporated in the existing structure: stabilized base course and subsurface drainage. Except for Option 5, Resurface Existing with Asphalt, both elements are incorporated into runway renovations. The proposed Typical Section drawing plan for each renovation option is included in **Appendix C** of this report. **Table 4B** presents the estimated probable cost data for each renovation option.

TABLE 4B
Initial Paving Option Cost
Manhattan Regional Airport

	Option 1 Reconstruct with Concrete	Option 2 Reconstruct with Asphalt	Option 3 Concrete on Rubblized Concrete	Option 4 Asphalt on Rubblized Concrete	Option 5 Asphalt Overlay
Initial Construction Cost (Tigerbrain)	$36,173,078	$26,933,312	$40,975,599	$28,416,942	$18,894,929
Engineering Design & Construction Admin (25%)	$9,043,270	$6,733,328	$10,243,900	$7,104,235	$4,723,735
Total Cost	**$45,216,348**	**$33,666,640**	**$51,219,499**	**$35,521,177**	**$23,618,644**
Initial Construction Cost per SY*	**$291.63**	**$210.30**	**$318.47**	**$219.76**	**$172.05**
Life Cycle Cost per SY*	**$293.69**	**$290.19**	**$320.53**	**$299.66**	**$272.60**

RUNWAY 3-21 RENOVATION OPTIONS 1 AND 2

Options 1 and 2 provide either a concrete or asphalt surface constructed at the existing line and grades. The construction incorporates the FAA recommended provisions for under pavement stabilized drainage and the cement or asphalt stabilized base course. Existing pavement and subgrade would be excavated to the necessary grade, with lime used to stabilize existing cohesive materials for frost protection, and the new pavement constructed. Grade adjustments at the interface with existing taxiways or the crosswind runway would not be necessary. Shoulders will be asphalt pavement with crushed aggregate base material for frost protection and drainage.

RUNWAY 3-21 RENOVATION OPTIONS 3 AND 4

Options 3 and 4 are intended to incorporate the existing concrete pavement as a structural element of the new structure. The existing runway is crushed to rubble using industry standard construction techniques. This method of construction eliminates the requirement to excavate the existing pavement structure and would substantially reduce the quantity of high quality graded crushed stone. The pavement structure would incorporate the FAA recommended subsurface drainage but will not include the stabilized base course. There must be adjustments to existing taxiways and the crosswind runway to match new runway elevations. Shoulders will be asphalt pavement.

RUNWAY 3-21 RENOVATION OPTION 5

Option 5 takes advantage of the existing structural strength of the existing concrete pavement by building a new asphalt operating surface. The asphalt pavement is placed in three lifts for the purpose of correcting surface smoothness, sealing the existing concrete to reduce environmental damage, and removing the risk of debris damage to aircraft. The new pavement surface will be saw cut to match existing joints for the purpose of reducing the risk of reflection cracking of concrete joints. Joint seal will be used to seal saw cuts and preclude the formation of uncontrolled cracking. Shoulders will be asphalt pavement.

RUNWAY 3-21 RENOVATION CONSTRUCTION PHASING AND ESTIMATE COMPLETION TIME OPTIONS

Construction phasing options were established for each of the five Runway 3-21 renovation options to ensure that a minimum of 5,500 feet of active pavement would be available during periods when the runway was open to traffic. In some cases, the declared distances are shorter than 5,500 feet for a few of the operations but never less than 5,000 feet. Those situations are noted on the individual drawings. The lengths of the temporary relocations vary with each option and are also noted on the individual drawings. The minimum lengths were determined to ensure that American Eagle Airlines could operate during open periods. The required design aircraft C-III RSA of 1,000 feet beyond the available runway ends is always provided while the runway is open to traffic.

In all options, a full parallel taxiway to Runway 13 is recommended to eliminate back-taxiing during Phase 4 when Runway 13-31 is the only runway available. This taxiway can be constructed in Phases 1 and 2 without increasing construction time.

The temporary relocated thresholds require marking of the new threshold and installation of threshold lights. In addition, some existing markings that are temporarily invalid will be removed, such as aiming point markings on Runway 21 when that threshold is relocated. It is assumed that runway edge lights will not be re-spaced and that navigational aids will not be temporarily relocated. It is important to note that each temporary displaced threshold requires **up to 3 days of additional runway closure** for this temporary work.

The phasing options also assume 10-12 hour workdays, seven days per week, with only one crew per subcontractor (e.g., one milling machine, one paving machine, etc.). While construction time can be reduced with longer days, overnight work, and more crews, this increases costs and must be discussed with funding agencies. Due to the number of options, alternatives, and combinations, this analysis is not intended to provide a definitive construction time, but to provide a comparison between options. Further refinement will be conducted during the preliminary design phase.

Phase 1 includes work on the Runway 21 end with a temporary relocated threshold. Taxiways F and G are closed, but access to all aprons and hangars will be open.

Phase 2 involves work on the Runway 3 end with a temporary relocated threshold. When Phase 1 is completed, Phase 2 begins. Taxiways A and B are closed but access to all aprons and hangars will be open. Note that the last 400 feet of Runway 3 was constructed in 2010. For this analysis, it is assumed that all runway pavement will receive the same type of remediation.

Phase 3 includes work within the runway/runway intersection, resulting in airport closure. When Phase 2 pavement work is complete, Phase 3 work will begin. Phase 2 electrical, seeding, marking, and other similar work items will be completed during Phase 3, thus shortening the overall construction time. Phase 3 also includes the completion of the parallel taxiway to Runway 13-31.

Phase 4 includes work on the remainder of Runway 3-21, resulting in closure of only that runway. This phase will begin shortly after the start of Phase 3. This overlap will shorten the overall construction time and not increase runway closure time. When a subcontractor completes Phase 3 (e.g., milling), they will move to Phase 4 and complete that section. Runway 3-21 and all associated taxiways will be closed. However, Runway 13-31, its parallel taxiway, all aprons, and building access will be open.

Construction Phasing Option A – No Change in Runway 3-21 Dimensions

For Construction Phasing Option A, depicted on **Exhibit 4J**, it is assumed that the Runway 21 threshold is replaced at its current relocated location. If that threshold is moved or altered to a displaced threshold, then additional declared distances may be available. Construction time under Phasing Option A for each of the Runway 3-21 renovation options is presented in **Table 4C**. As depicted, timing ranges from a low of 62 days for Runway 3-21 Renovation Option 5 to a high of 123 days for Renovation Option 1. A very important consideration for planning purposes is the proposed closure times for each option. Closure would impact all aircraft generally, but specifically this is the time in which the airline operations would be halted. Under this phasing plan, closure times would range between 30 days (Option 5) to 83 days (Option 1).

Table 4C
Estimated Completion Timing for Construction Phasing Option A
Manhattan Regional Airport

	Renovation Option 1 Reconstruct with Concrete	Renovation Option 2 Reconstruct with Asphalt	Renovation Option 3 Concrete on Rubblized Concrete	Renovation Option 4 Asphalt on Rubblized Concrete	Renovation Option 5 Asphalt Overlay
Phase 1 Displace Runway 21	27 days	25 days	19 days	19 days	16 days
Phase 2 Displace Runway 3	13 days	10 days	16 days	18 days	16 days
Phase 3 Airport Closed	44 days	31 days	43 days	42 days	30 days
Phases 3 & 4 Runway 3-21 Closed*	83 days	74 days	63 days	48 days	30 days
Total Construction Time	**123 days**	**109 days**	**98 days**	**85 days**	**62 days**

* Phases 3 & 4 have substantial overlap, so Phase 4 construction time is not relevant.

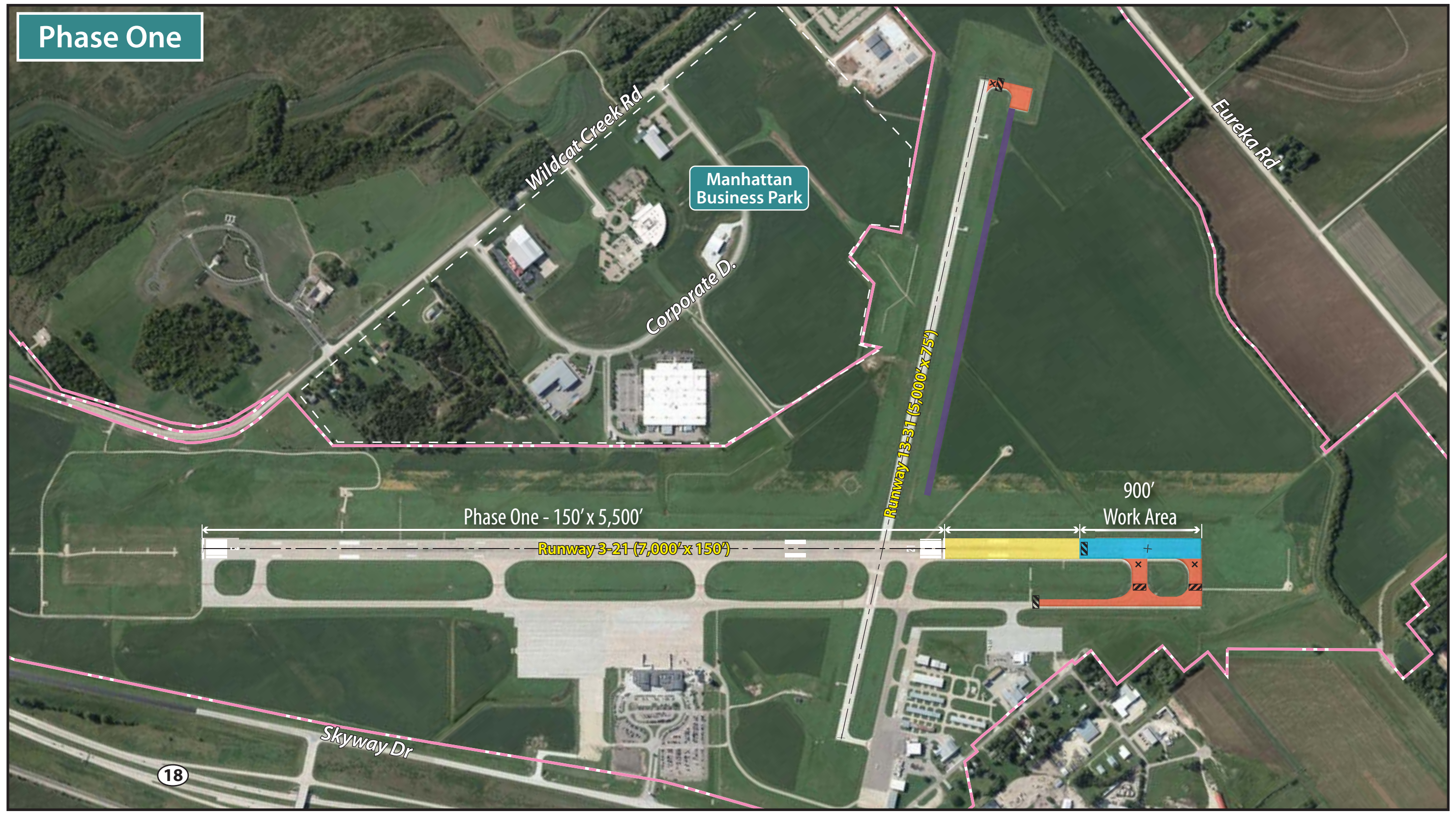
Construction Phasing Option B – Extend Runway by 500 Feet

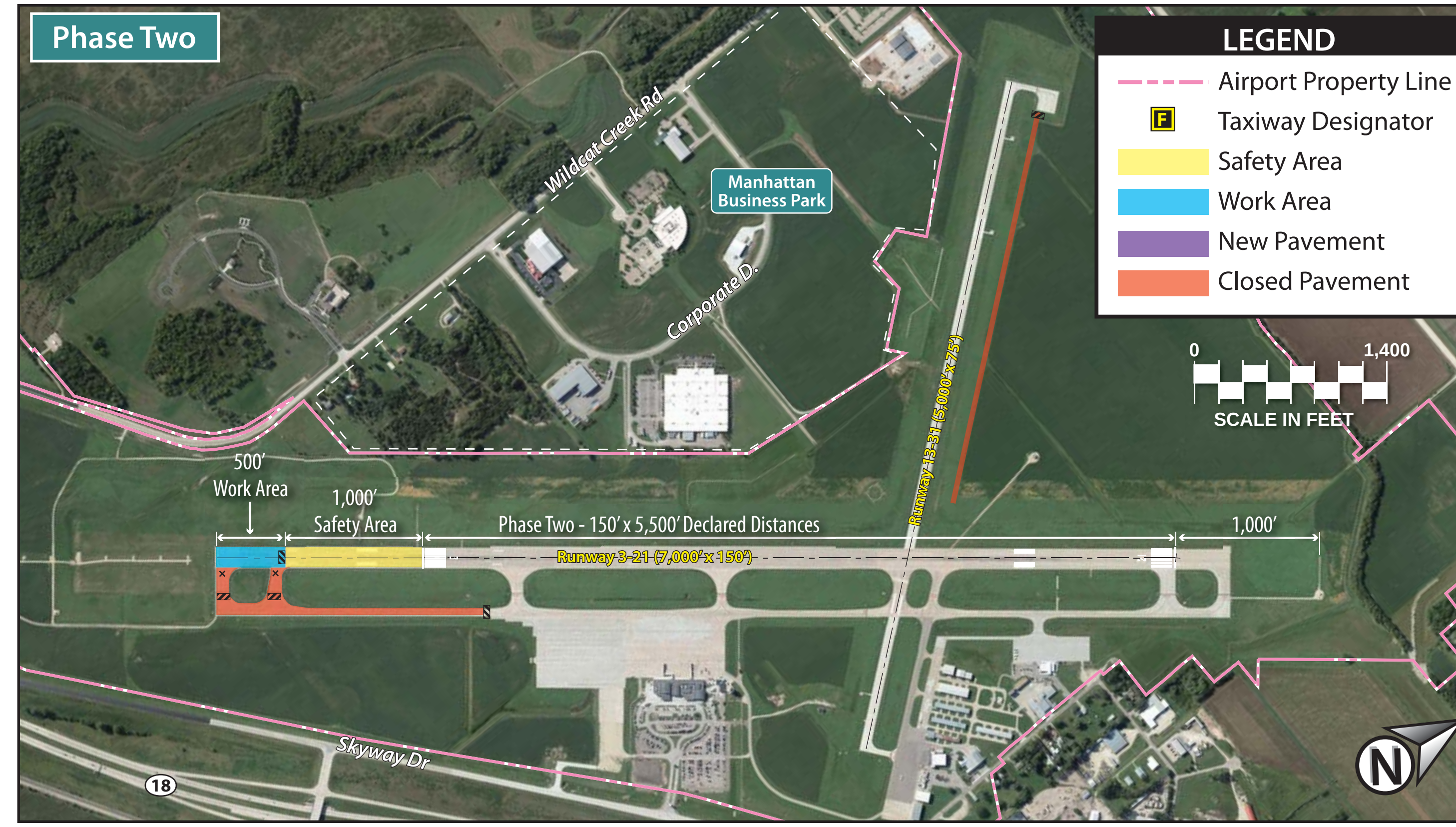
For Construction Phasing Option B, depicted on **Exhibit 4K**, it is assumed that the Runway 21 threshold is moved to the end of the existing pavement. This alters the RPZ and may require additional land acquisition. The estimated construction timing for Phasing Option B under all five Runway 3-21 renovation options is presented in **Table 4D**.

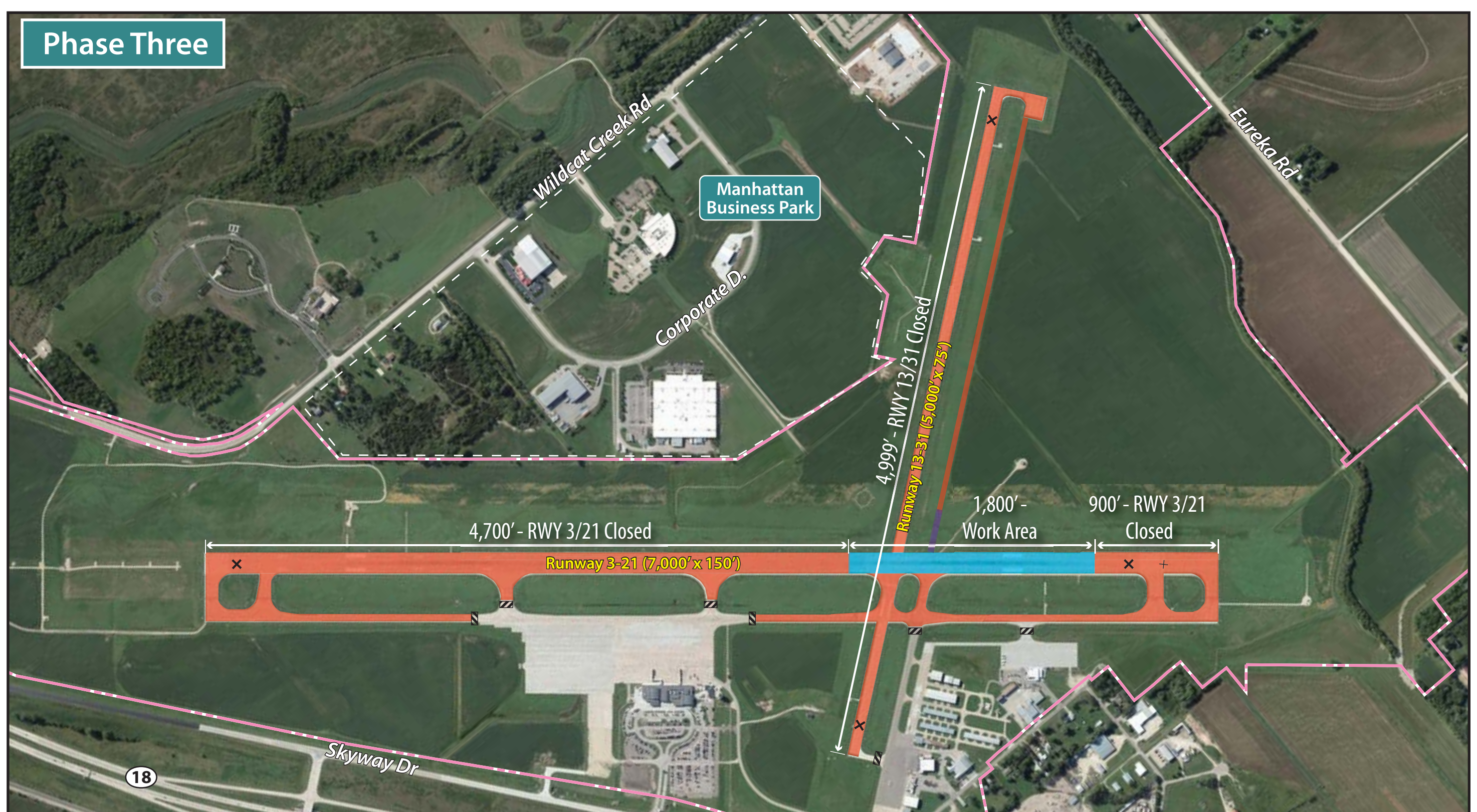
Table 4D
Estimated Completion Timing for Construction Phasing Option B
Manhattan Regional Airport

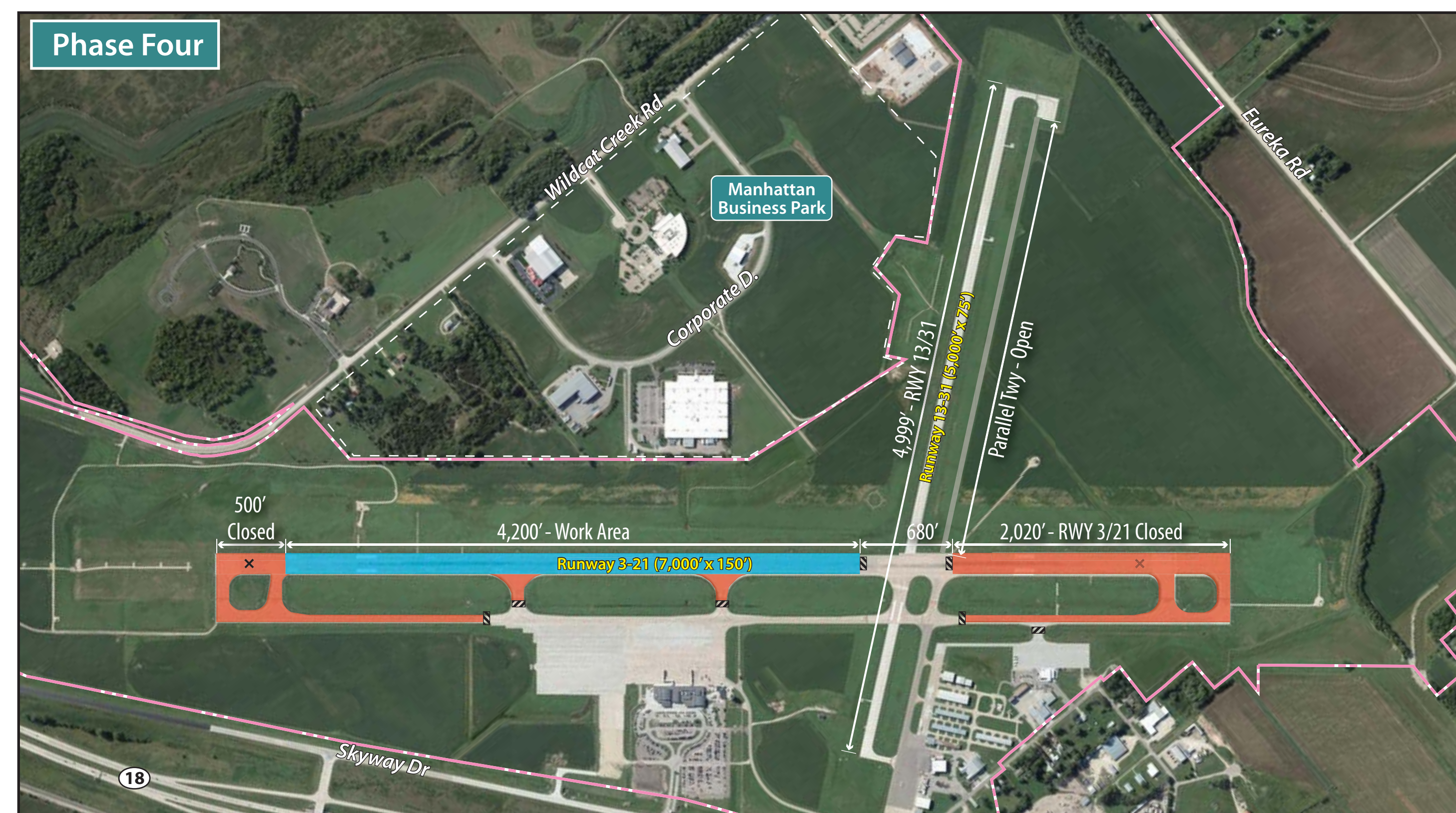
	Renovation Option 1 Reconstruct with Concrete	Renovation Option 2 Reconstruct with Asphalt	Renovation Option 3 Concrete on Rubblized Concrete	Renovation Option 4 Asphalt on Rubblized Concrete	Renovation Option 5 Asphalt Overlay
Phase 1 Displace Runway 21	33 days	30 days	23 days	22 days	19 days
Phase 2 Displace Runway 3	28 days	22 days	20 days	39 days	16 days
Phase 3 Airport Closed	44 days	40 days	43 days	42 days	31 days
Phases 3 & 4 Runway 3-21 Closed*	81 days	68 days	57 days	48 days	42 days
Total Construction Time	**142 days**	**120 days**	**100 days**	**109 days**	**77 days**

* Phases 3 & 4 have substantial overlap, so Phase 4 construction time is not relevant.









Aerial Photo: Martinez Geospatial 8-27-18

Exhibit 4J
CONSTRUCTION PHASING OPTION A

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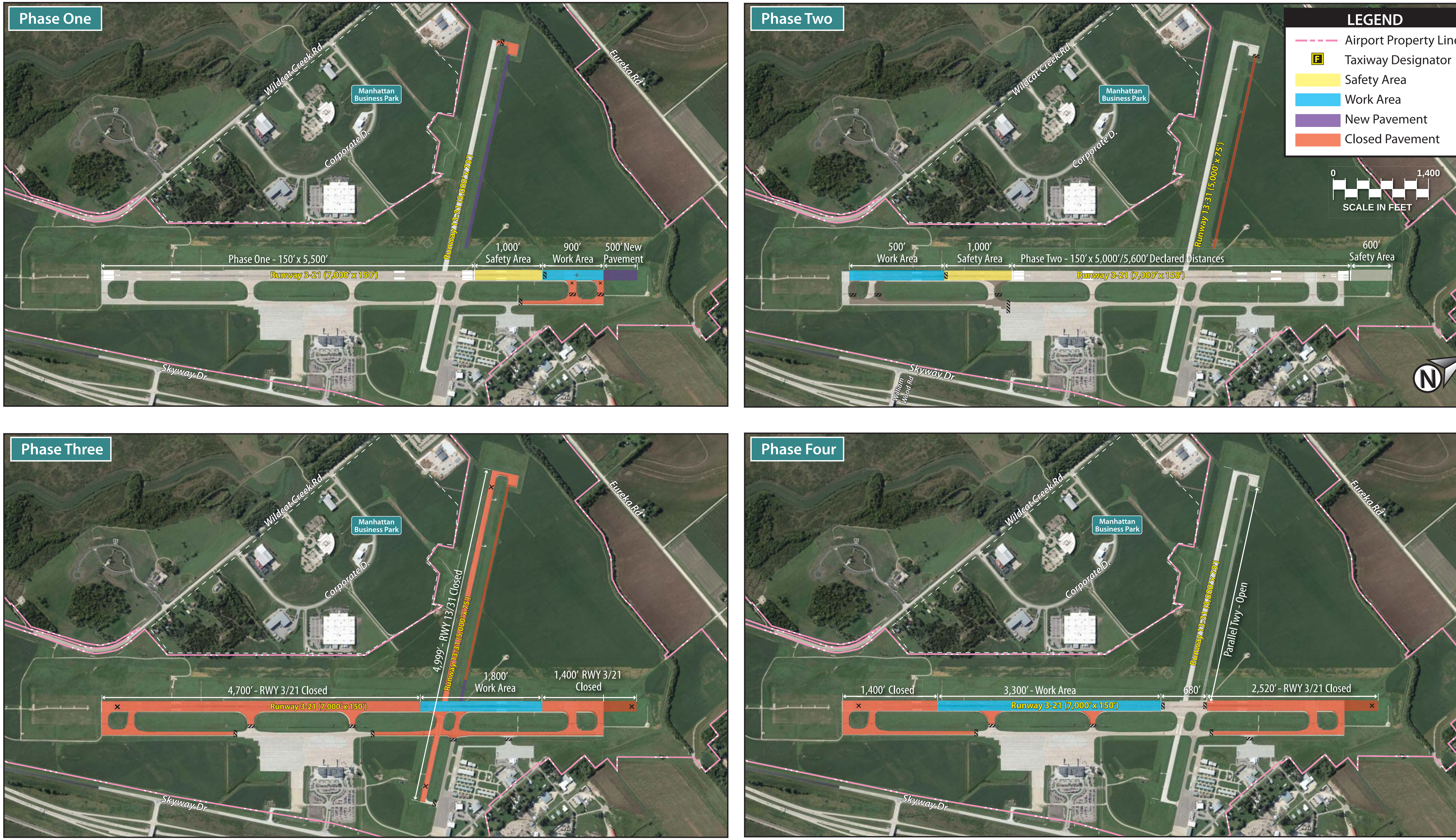


Aerial Photo: Martinez Geospatial 8-27-18

Construction Phasing Option C – Extend Runway 21 by 500 Feet and Extend Runway 3 by 1,000 Feet

Illustrated on **Exhibit 4L**, Construction Phasing Option C uses the same assumptions as previous Phasing Option B. It is assumed that the Runway 21 threshold is moved to the end of the existing pavement. This alters the RPZ and may require additional land acquisition. Estimates of construction timing for each phase of the five Runway 3-21 renovation options is presented in **Table 4E**.

Table 4E
Estimated Completion Timing for Construction Phasing Option C
Manhattan Regional Airport

	Renovation Option 1 Reconstruct with Concrete	Renovation Option 2 Reconstruct with Asphalt	Renovation Option 3 Concrete on Rubblized Concrete	Renovation Option 4 Asphalt on Rubblized Concrete	Renovation Option 5 Asphalt Overlay
Phase 1 Displace Runway 21	33 days	30 days	23 days	22 days	19 days
Phase 2 Displace Runway 3	46 days	26 days	38 days	39 days	16 days
Phase 3 Airport Closed	38 days	40 days	43 days	42 days	31 days
Phases 3 & 4 Runway 3-21 Closed*	78 days	68 days	57 days	48 days	42 days
Total Construction Time	**157 days**	**124 days**	**118 days**	**109 days**	**77 days**

* Phases 3 & 4 have substantial overlap, so Phase 4 construction time is not relevant.

Table 4F summarizes total construction time for all three phasing options under each of the five Runway 3-21 pavement renovation options.

Table 4F
Summary of Construction Timing for Each Phasing Option
Manhattan Regional Airport

	Total Construction Time				
	Renovation Option 1 Reconstruct with Concrete	Renovation Option 2 Reconstruct with Asphalt	Renovation Option 3 Concrete on Rubblized Concrete	Renovation Option 4 Asphalt on Rubblized Concrete	Renovation Option 5 Asphalt Overlay
Phasing Option A	123 days	109 days	98 days	85 days	62 days
Phasing Option B	142 days	120 days	100 days	109 days	77 days
Phasing Option C	157 days	124 days	118 days	109 days	77 days

LANDSIDE PLANNING CONSIDERATIONS

Landside development alternatives generally include consideration of commercial airline and general aviation services as well as additional support areas. The MHK airline terminal complex has been recently upgraded and improved with renovated facilities. As such, the scoping of this study did not include additional study or alternative considerations for commercial terminal facility development. Recent improvements should carry the airport's ability to meet existing and projected demand well into the future. The only remaining items to be considered in this chapter are general aviation improvement alternatives. The scoping of this project included review and presentation of historical general aviation development concepts which are presented in the following alternatives.

Several historical alternatives are no longer valid due to the construction of the north ramp and FBO over the last five years. As such, two alternatives which remain relevant have been reviewed and are presented below.

GENERAL AVIATION ALTERNATIVE 1

Depicted on the left side of **Exhibit 4M**, this first general aviation development alternative considers a simple linear expansion of the GA North ramp to the north and south. This expansion would allow for hangar development along the apron adjacent to the relatively new FBO hangar. As shown, the apron expansion would allow for four additional conventional hangars. The plan also depicts an expanded paved automobile parking lot north of the largest proposed conventional hangar.

GENERAL AVIATION ALTERNATIVE 2

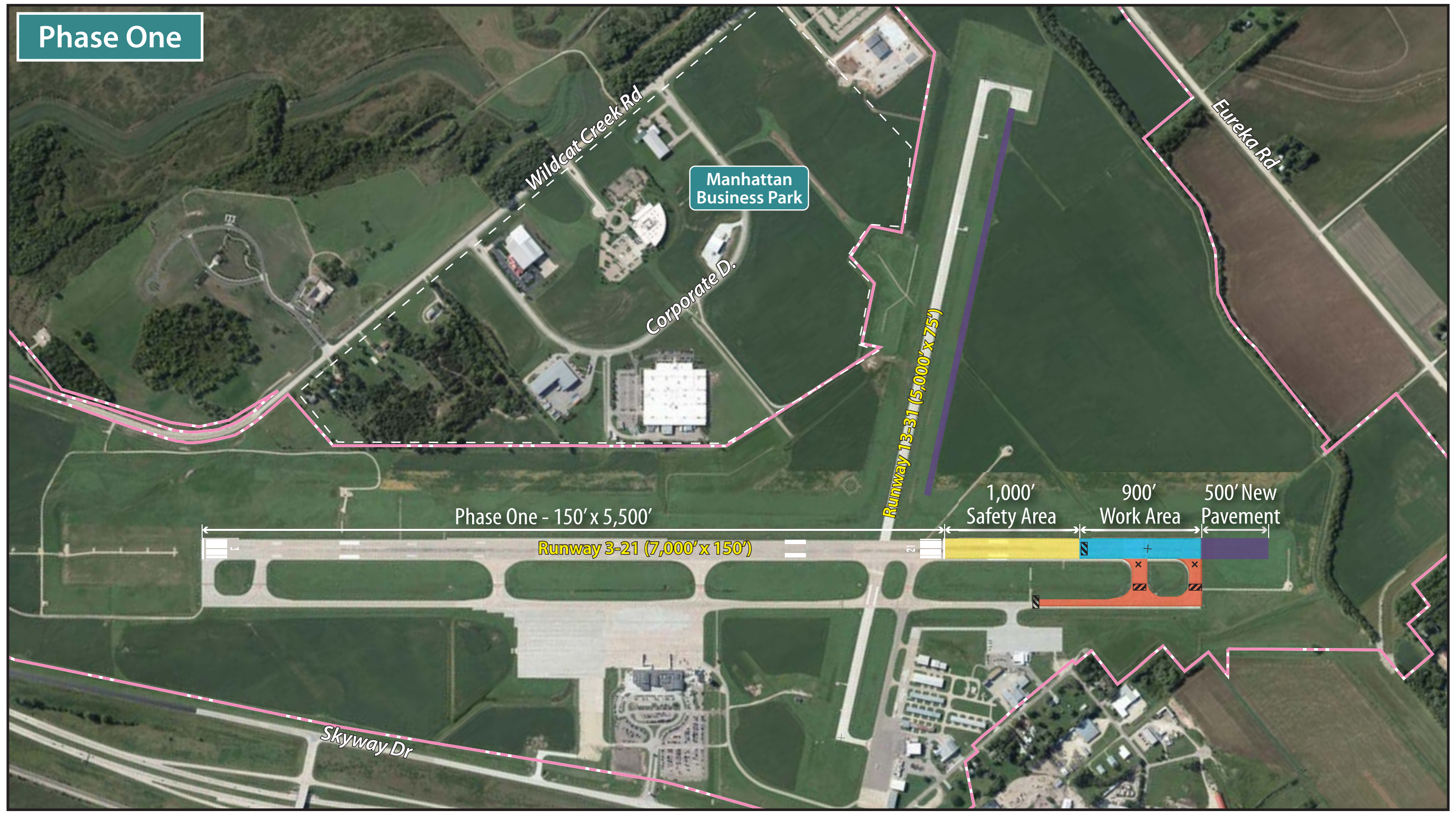
Depicted on right side of **Exhibit 4M**, the second general aviation development alternative includes the simple linear expansion of the GA North ramp to the north and south; however, it proposes the construction of a taxilane to the east allow for additional hangars. Additional hangars are shown to the east including T-hangars and a conventional hangar on the east ramp. As presented, general aviation alternative 2 is on the currently approved ALP.

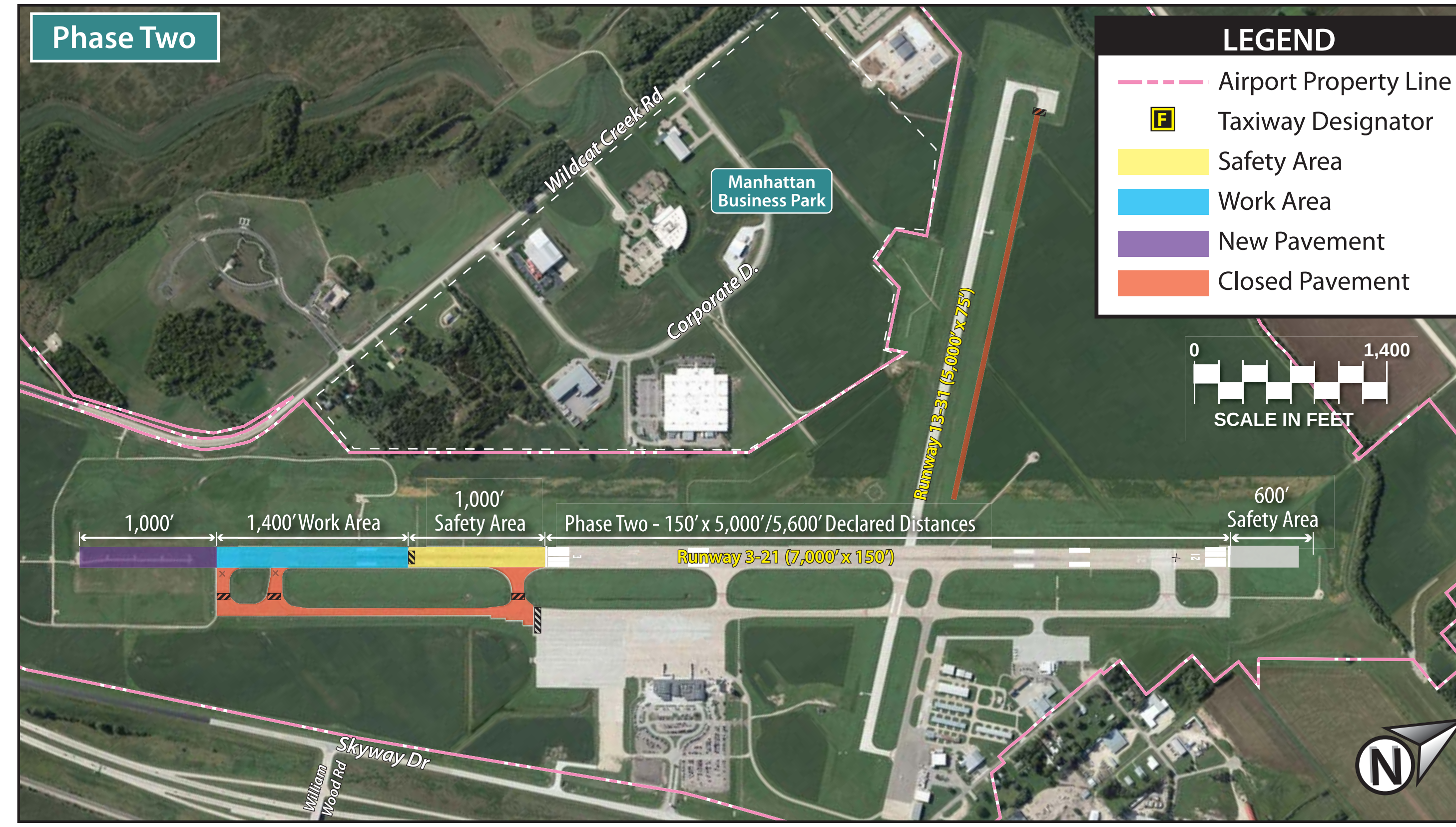
ALTERNATIVES SUMMARY

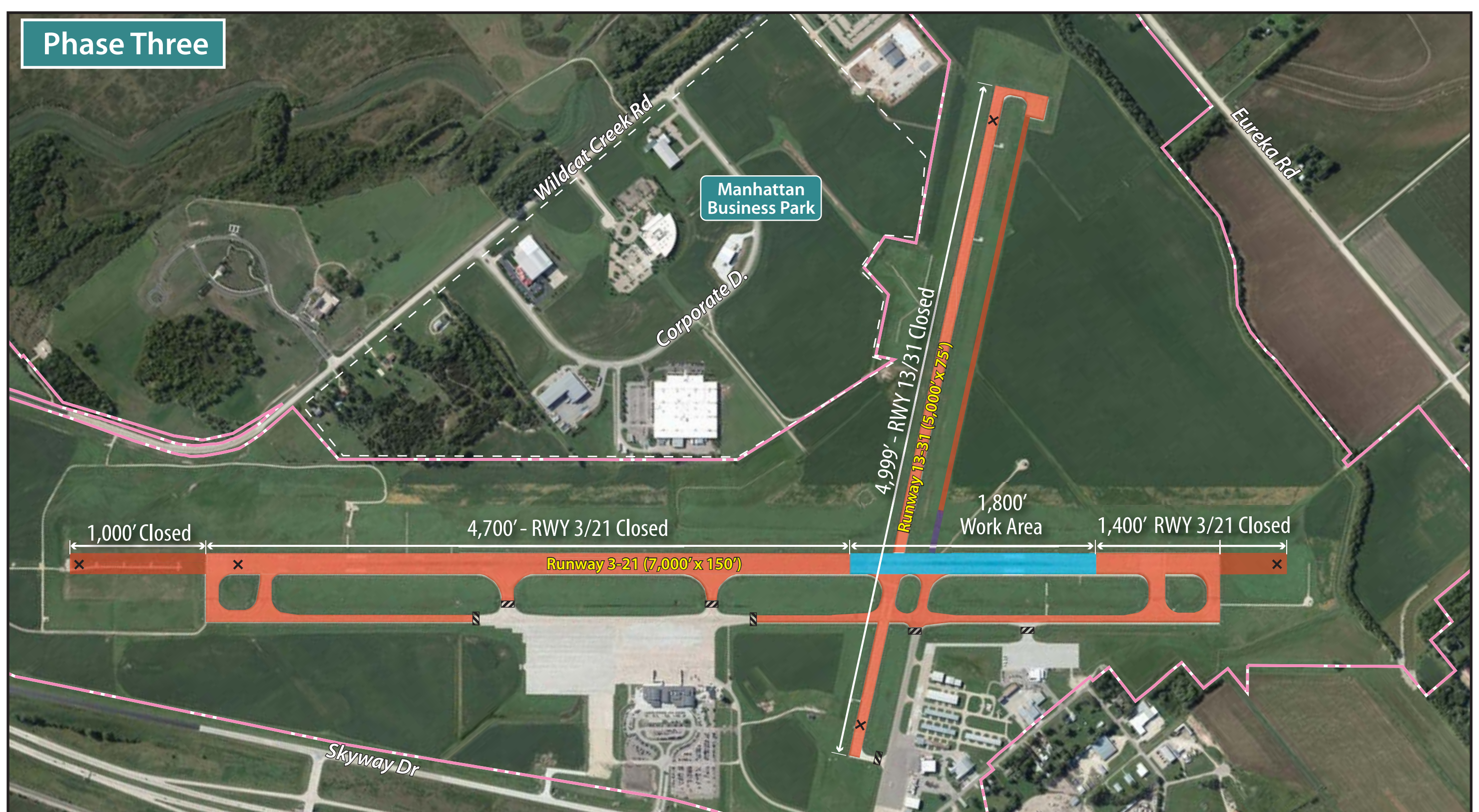
The process utilized in assessing airside and landside development alternatives involved a detailed analysis of short- and long-term requirements, as well as future growth potential. Current airport design standards were considered at each stage of development.

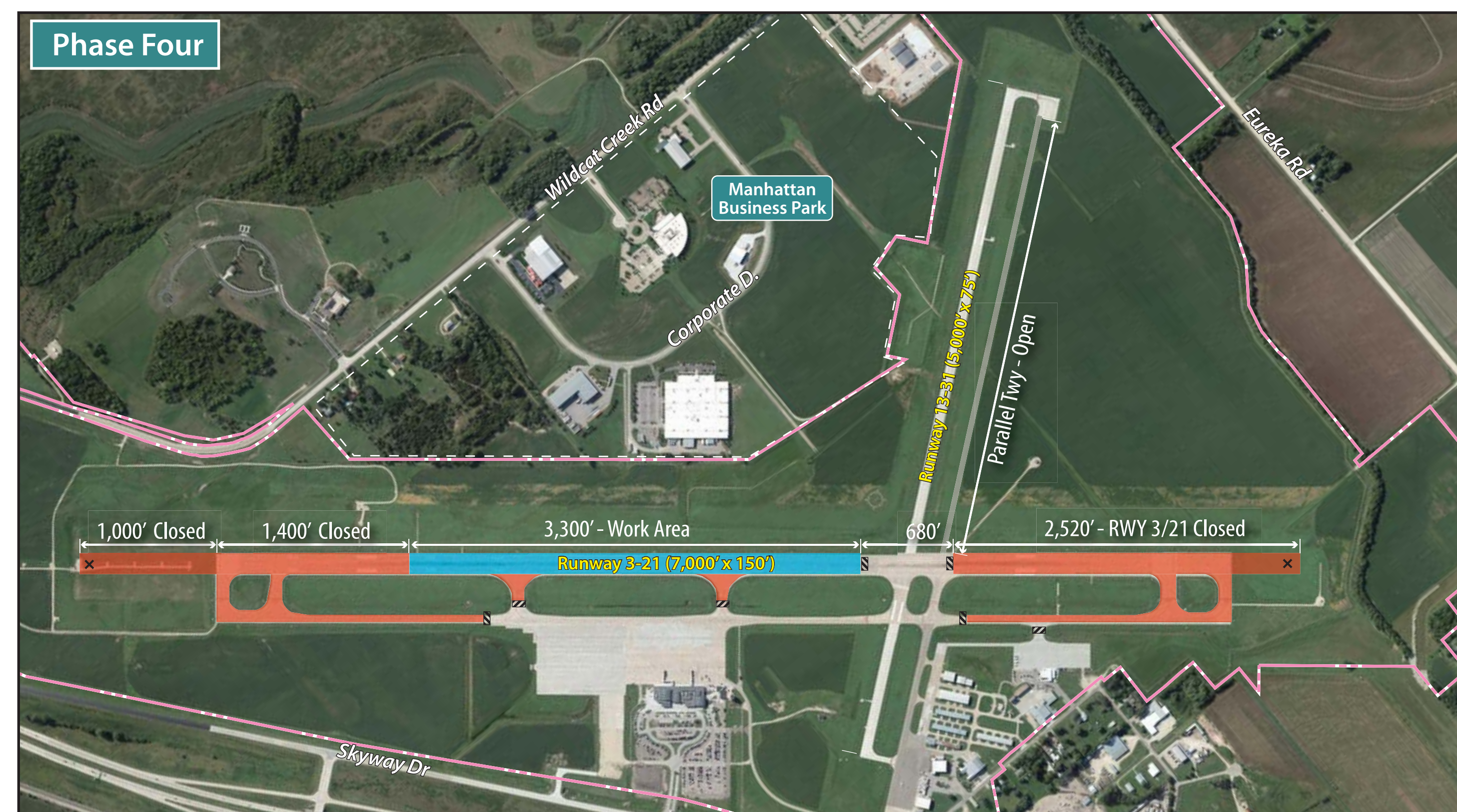
The primary purpose of this planning effort is to guide the short-term rehabilitation of Runway 3-21. This chapter presents several rehabilitation options which could also be supported with runway extensions opportunities allowing for short construction staging and airfield closures.

After review by the Technical Advisory Committee (TAC) and the public, a recommended concept will be analyzed in a safety management systems (SMS) process. The SMS process will include presentation of the concepts to a panel of experts to determine safety and practicality of each development option. Once the SMS process is complete, a recommended development plan, capital improvement program (CIP), and detailed financial plan will follow. The resulting plan will represent an airside facility that fulfills safety and design standards and a landside complex that can be developed as demand dictates.









Aerial Photo: Martinez Geospatial 8-27-18

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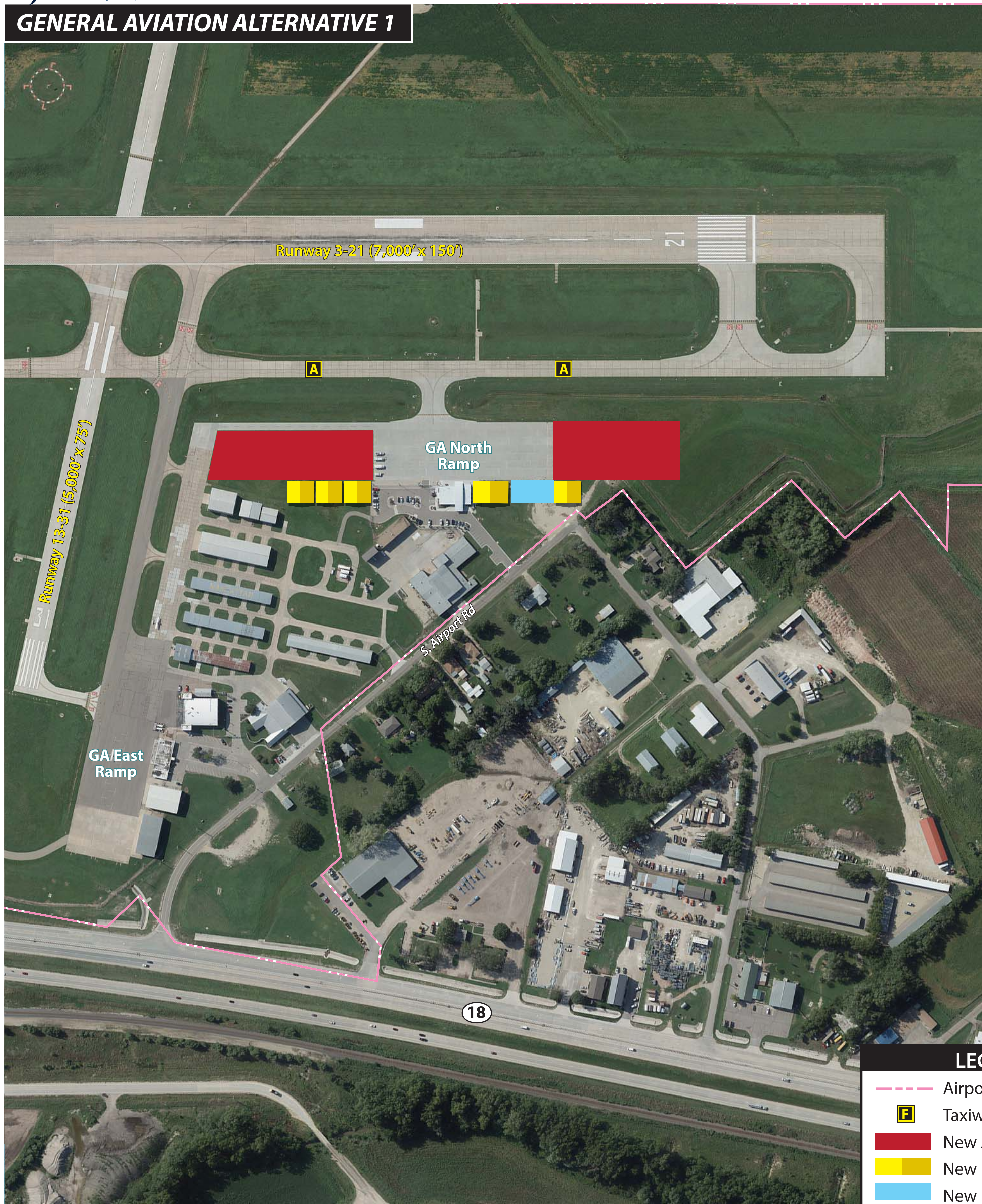
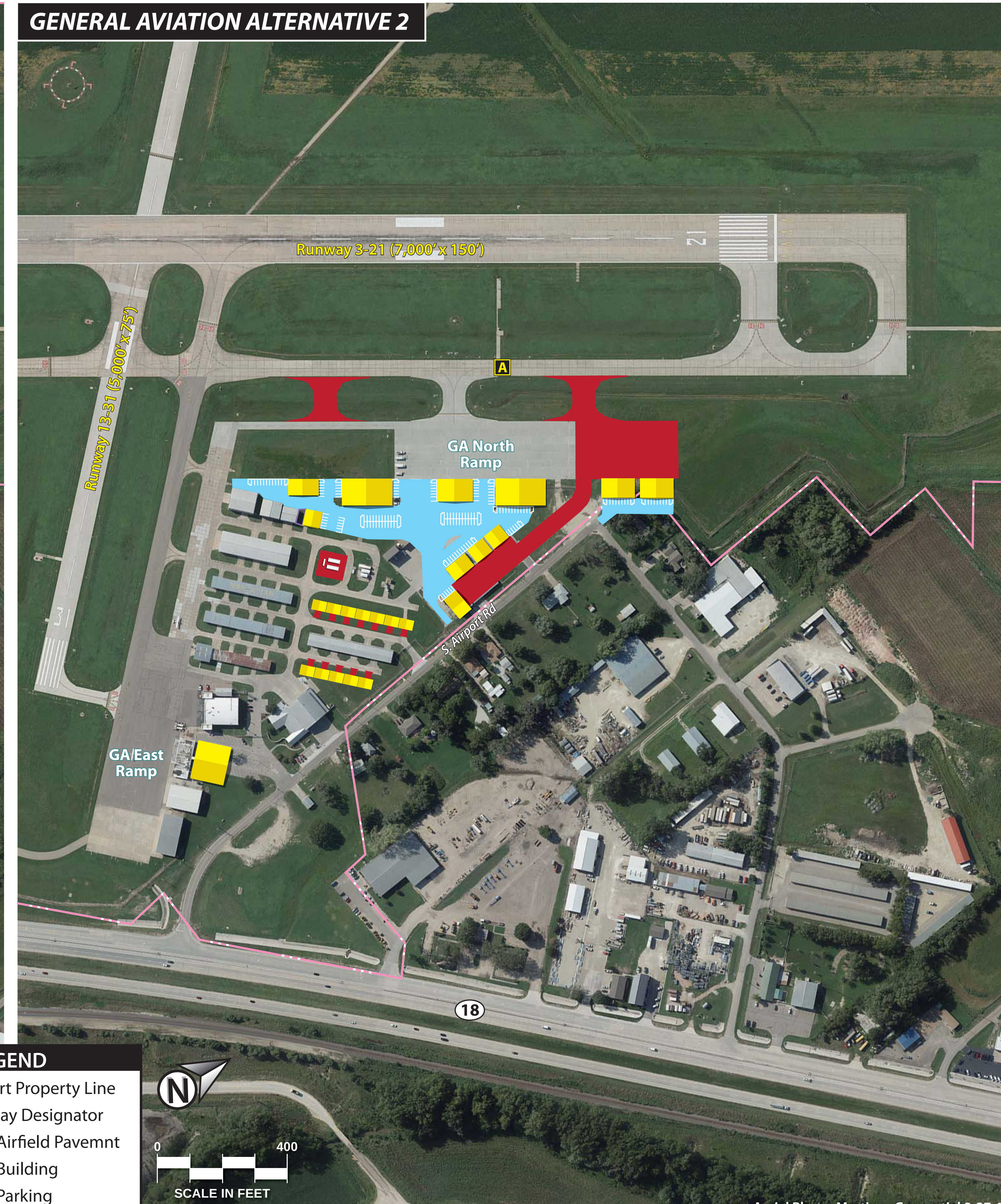
GENERAL AVIATION ALTERNATIVE 1



GENERAL AVIATION ALTERNATIVE 2



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Chapter Five

RECOMMENDED CONCEPT

CHAPTER FIVE

Recommended Concept

The airport master plan for Manhattan Regional Airport (MHK) has progressed through a systematic and logical process with a goal of formulating a recommended 20-year development plan. The process began with an evaluation of existing and future operational demand, which aided in creating an assessment of future facility needs. Those needs were then used to develop alternative facility plans to meet projected needs. Each of those steps in the planning process has included the development of draft working papers, which were presented and discussed at previous Planning Advisory Committee (PAC) meetings and public information workshops and made available on the project website (www.mhk.airportstudy.com).

In the previous chapter, several development alternatives were analyzed to explore options for the future growth and development of MHK. The development alternatives have been refined into a single recommended concept for the master plan. This chapter describes, in narrative and graphic form, the recommended direction for the future use and development of MHK.

The recommended concept provides the ability to meet the disparate needs of the array of airport operators. The goal of this plan is to ensure the airport can continue, and even improve, in its role of serving commercial passenger airlines, general aviation operators, and military aviation in and around the Manhattan metropolitan area. The plan has been specifically tailored to support existing and future growth in all forms of potential aviation activity as the demand materializes.

The recommended master plan concept, as shown on **Exhibit 5A**, presents a long-term configuration for the airport, which preserves and enhances the role of the airport, while meeting Federal Aviation Administration (FAA) design standards. The phased implementation of the recommended development concept will be presented in Chapter Six. The following sections describe the key details of the recommended master plan concept.

AIRSIDE CONCEPT

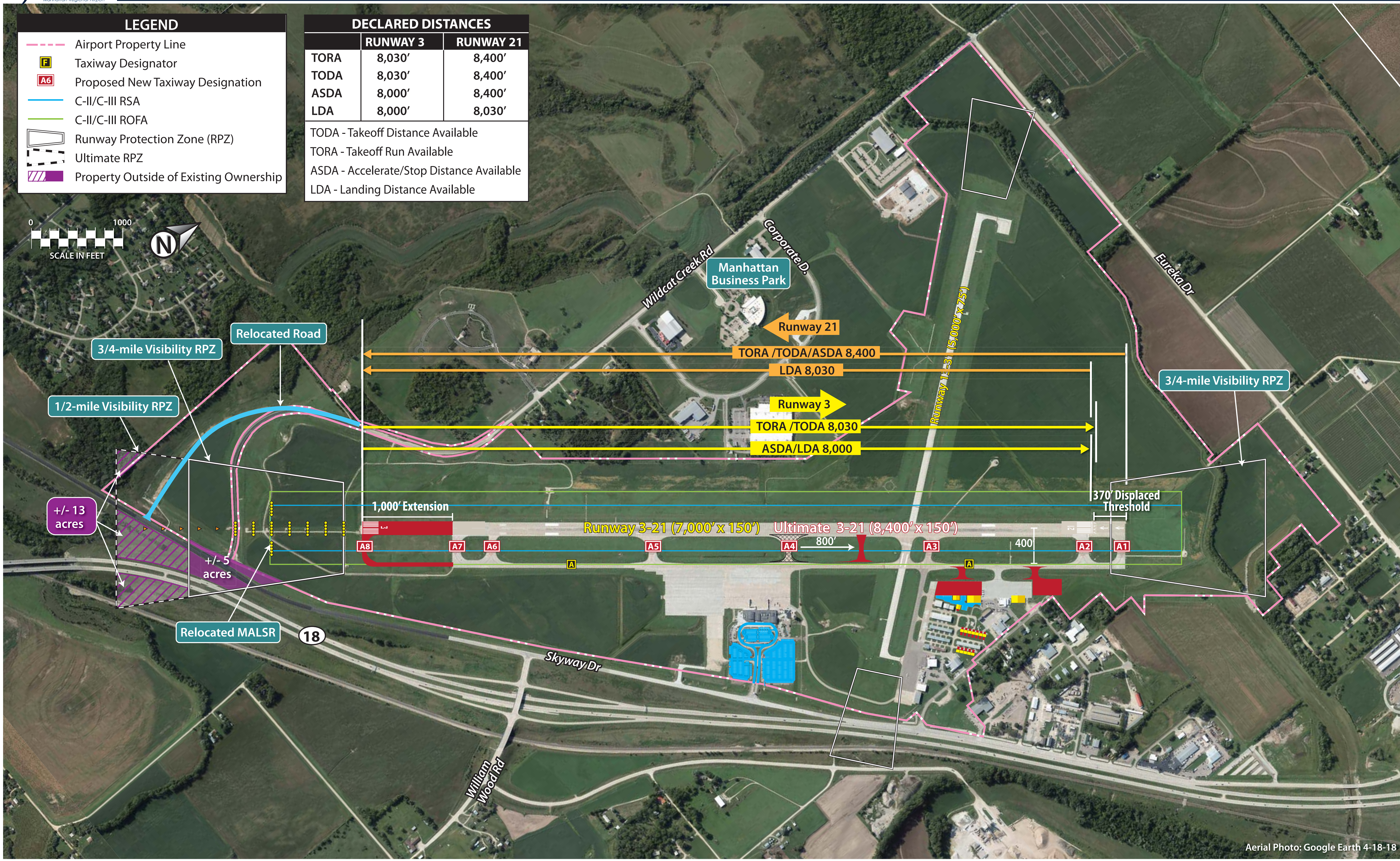
The airside plan generally considers those improvements related to the runway and taxiway system and navigational aids which successfully transition aircraft and passengers between the air and ground movement spaces. Most efforts for this master planning process are centralized around airside concepts.

The inception of this master plan was the result of additional planning required by the FAA to improve and/or replace Runway 3-21 pavement. Ultimately, the goal was to determine the most practical and safe method to repair the runway while minimizing runway closure and the associated impacts to airport users, especially commercial passenger service. Several alternatives were examined as detailed in the previous chapter. These alternatives were vetted through the safety management system (SMS) process as well to help refine alternatives so that the best option would result. That option is presented on **Exhibit 5A** with associated costs and staging factors further outlined in the next chapter.

DESIGN STANDARDS

The FAA has established design criteria to define the physical dimensions of runways and taxiways, as well as the imaginary surfaces surrounding them, to enhance the safe operation of aircraft at airports. These design standards also define the separation criteria for the placement of landside facilities.

As discussed previously, the design criteria primarily center on the airport's critical design aircraft. The critical aircraft is the most demanding aircraft, or family of aircraft, which currently, or are projected to, conduct 500 or more operations (takeoffs and landings) per year at the airport. Factors included in airport design are an aircraft's wingspan, approach speed, tail height and, in some cases, the instrument approach visibility minimums for each runway. The FAA has established the Runway Design Code (RDC) to relate these design aircraft factors to airfield design standards. The most restrictive RDC is also considered the overall Airport Reference Code (ARC).



DECLARED DISTANCES

	RUNWAY 3	RUNWAY 21
TORA	8,030'	8,400'
TODA	8,030'	8,400'
ASDA	8,000'	8,400'
LDA	8,000'	8,030'

TODA - Takeoff Distance Available
TORA - Takeoff Run Available
ASDA - Accelerate/Stop Distance Available
LDA - Landing Distance Available

Exhibit 5A
RECOMMENDED CONCEPT

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While airfield elements, such as safety areas, must meet design standards associated with the applicable RDC, landside elements can be designed to accommodate specific categories of aircraft. For example, an airside taxiway must meet taxiway object free area (TOFA) for all aircraft types using the taxiway, while the taxilane to a T-hangar area only needs to meet width standards for smaller single and multi-engine piston aircraft expected to utilize the taxilane.

The applicable RDC and critical design aircraft for each runway at MHK in the existing and ultimate conditions, as established in Chapter Two, are summarized in **Table 5A**.

TABLE 5A
Airfield Design Parameters
Manhattan Regional Airport

Runway	Critical Design Aircraft	RDC	APRC	DPRC	TDG
Existing					
3-21	ERJ-175	C-III-2400*	D/VI/2400 D/V/2400	D/VI D/V	2
13-31	King Air	B-II-5000	B/III/5000 D/II/5000	B/II	2
Ultimate					
3-21	CRJ-900/EMB-175	C-III-2400*	D/VI/2400 D/V/2400	D/VI D/V	3
13-31	King Air	B-II-5000	B/II/5000	B/II	2

*Critical design aircraft maximum certified takeoff weight of less than 150,000 pounds.
RDC – Runway Design Code
APRC – Approach Reference Code
DPRC – Departure Reference Code
TDG – Taxiway Design Group
Source: FAA AC 150/5300-13A, Change 1, Airport Design

PRIMARY RUNWAY 3-21

Runway Dimensions: The primary runway is currently 7,000 feet long and 150 feet wide, meeting RDC C-III-2400 design standards. At these current dimensions, the runway is capable of safely accommodating all small general aviation aircraft, as well as the fleet of business jets and commercial service aircraft that routinely utilize the airport.

Runway 3-21 entire pavement section is currently 7,400 feet long, with the northernmost 400 feet utilized not as runway but as a “lead-in taxiway”. FAA has changed runway design standards post implementation of the lead-in taxiway. As a result, the analysis in this study was required to offer a disposition of the “nonstandard lead-in taxiway.” The resultant plan shown on **Exhibit 5A** includes recapturing the 400 feet as runway, thereby offering the full 7,400 feet of pavement for operational use; however, due to limitations and constraints to safety areas north of Runway 21, the plan also reduces operational conditions. To maintain a clear runway protection zone (RPZ) on Runway 21, the plan includes displacing the threshold by 370 feet. The displacement allows for the RPZ to remain fully on existing property.

As a result, the landing distance available (LDA) for Runway 21 will be 7,030 while the takeoff dimension for Runway 21 is increased to 7,400 feet. The take-off distance available and landing distance available for Runway 3 would be the full pavement length of 7,400 feet.

In the ultimate condition, the plan recommends extensions of 1,000 feet to the south for a full length of 8,400 feet. These ultimate extensions are included for planning purposes only to accommodate larger/heavier aircraft that have the potential to operate at the airport in the future. Planning for these extensions allow the airport sponsor to formulate a land use plan for the surrounding area that would protect the viability of future airfield development along with airport airspace.

The primary runway width of 150 feet exceeds the C-III-2400 design standard of 100 feet (for design aircraft that have maximum takeoff weights of less than 150,000 pounds). The width does meet RDC D-IV-2400 design standards for the military aircraft that operate at MHK. Therefore, the width should be maintained at 150 feet with the understanding that the FAA may only participate in funding the continued maintenance of the AIP-eligible width of 100 feet. Costs associated with maintaining the remaining 50 feet are likely to be borne by the airport sponsor and, potentially, the Department of Defense (DOD) to ensure the military activities continue. If an ultimate critical design aircraft with a maximum certified takeoff weight of 150,000 pounds or more is used for justification in the future, maintaining a 150-foot wide runway would be AIP-eligible.

Instrument Approach Procedures: Runway 3 is equipped with an instrument landing system (ILS) approach with minimums down to 200-foot cloud ceilings and visibility down to ¾-mile. A precision RNAV Localizer Performance with a Vertical Guidance (LPV) approach is published for Runway 21, and an LPV approach with minimums down to ¾-mile is published. While these approaches are adequate, the plan includes a reduction of minimums on Runway 3 to ½-mile visibility, which had historically been the case.

Runway Protection Zones (RPZs): The approach RPZ for both ends of the runway encompass 78.914 acres. The existing RPZs for the primary runway are located on property owned by the airport sponsor or controlled via avigation easements. The RPZ dimensions are not planned to change in the ultimate condition; however, they will shift to the south because of the planned runway extension. As a result, the airport will need to acquire avigation easements for approximately 18 acres of property within the ultimate Runway 3 RPZ.

CROSSWIND RUNWAY 13-31

Runway Dimensions: The crosswind runway is currently 5,000 feet long and 75 feet wide. These dimensions and design standards are adequate for the type of aircraft that the crosswind runway is meant to serve on a regular basis, including small general aviation aircraft up to mid-sized business jets and turboprop aircraft. Therefore, no modifications to the runway dimensions are currently justified or planned in the short-term period.

TAXIWAY IMPROVEMENTS

Taxiway Nomenclature: Current taxiway designations do not meet FAA Engineering Brief (EB) 89, Taxiway Nomenclature Convention standards. According to the EB, stub taxiways associated with a parallel taxiway should be designated with a letter and number, such as A1, A2, A3, etc., beginning with the northernmost stub for north/south taxiways and starting with the westernmost stub for east/west taxiways. Ultimate taxiway designations that meet the EB standards, along with the additional taxiway extensions/improvements, are identified on **Exhibit 5A**.

The taxiway system is planning to remain relatively similar in layout, but with one exception: the existing location of Taxiway D is problematic, as it offers direct access from the commercial apron to Runway 3-21. Unimpeded, direct access between an apron and a runway is no longer an acceptable airfield geometrical condition. As such, the plan includes the relocation of Taxiway D (to become A3) further north as shown on the exhibit.

LANDSIDE CONCEPT

The primary goal of landside facility planning is to provide adequate space to meet reasonably anticipated commercial airline passenger needs and general aviation needs, while also optimizing operational efficiency and land use. Achieving these goals yields a development scheme that segregates functional uses while maximizing the airport's revenue potential. The plan generally follows the concept proposed within the previous planning efforts.

ENVIRONMENTAL OVERVIEW

An analysis of potential environmental impacts associated with proposed airport projects is an essential consideration in the master plan process. The primary purpose of this discussion is to review the recommended concept plan and associated capital program at the airport to determine whether projects identified in the master plan could, individually or collectively, significantly impact existing environmental resources. The information contained in this section was obtained from previous studies, official websites, and analysis by the consultant.

Construction of any, or all, of the improvements depicted on the recommended concept plan will require compliance with the *National Environmental Policy Act* (NEPA) *of 1969*, as amended. This includes privately funded projects and those projects receiving federal funding. For projects not categorically excluded under FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, compliance with NEPA is generally satisfied through the preparation of an Environmental Assessment (EA). In instances where significant environmental impacts are expected, as determined by the FAA, an Environmental Impact Statement (EIS) may be required. While this portion of the master plan is not designed to satisfy the NEPA requirements, it provides a preliminary review of environmental issues that may need to be considered in more detail within the environmental review processes. It is important to note that the

FAA is ultimately responsible for determining the level of environmental documentation required for airport actions.

The environmental inventory included in Chapter One provides baseline information about the airport environs. This section provides an overview of potential impacts to existing resources that could result from implementation of the planned improvements outlined in the recommended concept plan.

POTENTIAL ENVIRONMENTAL CONCERNS

Table 5A summarizes potential environmental concerns associated with implementation of the recommended master plan development concept for Manhattan Regional Airport. Analysis under NEPA includes direct, indirect, and cumulative impacts. Direct impacts are caused by the action and occur at the same time and place (see 40 Code of Federal Regulations [CFR] § 1508.8(a)). Examples of direct impacts include:

- Construction of a facility or runway in a wetland which results in the loss of a portion of the wetland; or
- Noise generated by the proposed action or alternative(s) which adversely affects noise-sensitive land uses.

Indirect impacts are caused by an action, although are later in time or farther removed in distance and are reasonably foreseeable (see 40 CFR § 1508.8(b)). Indirect impacts may include growth-inducing impacts and other effects related to induced changes in the pattern of land use, population density or growth rate, and related impacts on air and water and other natural systems, including ecosystems (see 40 CFR § 1508.8(b)).

Cumulative impacts are those that take into consideration the environmental impact of past, present, and future actions. Cumulative impacts vary based on the project type, geographic location, potential to impact resources, and other factors, such as the current condition of potentially affected impact categories.

TABLE 5A
Summary of Potential Environmental Concerns
Manhattan Regional Airport – Riley County, KS

Environmental Impact Category	FAA Order 1050.1F, Significance Threshold/Factors to Consider	Potential Environmental Concerns
Air Quality	**Threshold: The action would cause pollutant concentrations to exceed one or more of the National Ambient Air Quality Standards (NAAQS), as established by the United States (U.S.) Environmental Protection Agency (EPA) under the *Clean Air Act*, for any of the time periods analyzed, or to increase the frequency or severity of any such existing violations.**	**Potential Impact.** Although the projected increase in operations over the 20-year planning horizon of the recommended concept plan (**Exhibit 5A**) will likely result in additional emissions, Riley County currently meets federal NAAQS standards. Therefore, general conformity review per the *Clean Air Act* is not required. According to the most recent FAA *Aviation Emissions and Air Quality Handbook* (2015), an emissions inventory under NEPA may be necessary for any proposed action that will result in a reasonably foreseeable increase in emissions due to plan implementation. For construction emissions, a qualitative or quantitative emissions inventory under NEPA may be required, depending on the type of environmental review needed for projects outlined in the recommended concept plan.
Biological Resources	**Threshold: The U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS) determines that the action would be likely to jeopardize the continued existence of a federally listed threatened or endangered species or would result in the destruction or adverse modification of federally designated critical habitat.** FAA has not established a significance threshold for non-listed species. However, factors to consider are if an action would have the potential for: • Long term or permanent loss of unlisted plant or wildlife species; • Adverse impacts to special status species or their habitats; • Substantial loss, reduction, degradation, disturbance, or fragmentation of native species' habitats or their populations; or • Adverse impacts on a species' reproductive rates, non-natural mortality, or ability to sustain the minimum population levels required for population maintenance.	<u>For federally listed species</u> **Potential Impact.** The USFWS Information for Planning and Consulting (IPaC) report identified four threatened or endangered species within the vicinity of the airport: the northern long-eared bat, the least tern, the piping plover, and the Topeka shiner. Impacts to these species should be assessed prior to action and may require consultation with the USFWS. Northern long-eared bats generally roost singly or in colonies underneath bark, cavities, or within crevices of both live and dead trees in the summer. During the winter, they hibernate in caves. Airport activities which involve tree-maintenance or removal activities could affect this bat, and additional surveys may be required to determine the presence of bat roosts in trees. <u>For designated critical habitat</u> **No Impact.** Critical habitat has not been identified within the vicinity of the airport. <u>For non-listed species</u> **Potential Impact.** Non-listed species of concern include those protected by the *Migratory Bird Treaty Act* and the *Bald and Golden Eagle Protection Act*. The potential for impacts to migratory birds and eagles should be evaluated on a project-specific basis. This may include pre-

		construction surveys or scheduling construction outside of nesting seasons for these species. The IPaC report identifies the bald eagle (*Haliaeetus leucocephalus*), a federally protected bird, of particular concern because of known occurrences in the vicinity of the airport. Although not a Bird of Conservation Concern, the bald eagle does warrant attention because of the *Bald and Golden Eagle Protection Act* for potential susceptibilities in offshore areas from certain types of development or activities.
Climate	FAA has not established a significance threshold for Climate; refer to FAA Order 1050.1F, *Desk Reference*, for the most up-to-date methodology for examining impacts associated with climate change.	**Potential Impact.** An increase in greenhouse gas (GHG) emissions could occur over the 20-year planning horizon of the recommended concept plan. A project-specific analysis may be required per the FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, based on the parameters of the individual projects.
***Department of Transportation* (DOT) *Act*: Section 4(f)**	**Threshold: The action involves more than a minimal physical use of a Section 4(f) resource or constitutes a "constructive use" based on an FAA determination that the aviation project would substantially impair the Section 4(f) resource. Resources that are protected by Section 4(f) are publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance; and publicly or privately owned land from an historic site of national, state, or local significance. Substantial impairment occurs when the activities, features, or attributes of the resource that contribute to its significance or enjoyment are substantially diminished.**	**No Impact.** The Section 4(f) resources outlined in Chapter One are located more than two miles from the airport. Those resources closest to the airport are Warner Memorial Park (approximately 2.5 miles) and the Samuel D. Houston House (approximately 3.2 miles). Due to the significant distance these resources are located from the airport, airport activities delineated in the recommended concept plan will not result in physical use of Section 4(f) properties. Additionally, it is unlikely constructive use of these resources will result from airport activities, and the significance or enjoyment of Section 4(f) properties will not be substantially diminished However, the FAA is responsible for determining which federal, state, or local entities need to be consulted to determine whether impacts will substantially impair the resource. If necessary, the Section 4(f) compliance process can involve the preparation of a Section 4(f) statement, which evaluates other feasible alternatives.
Farmlands	**Threshold: The total combined score on Form AD-1006, *Farmland Conversion Impact Rating*, ranges between 200 and 260.** (Form AD-1006 is used by the U.S. Department of Agriculture, Natural Resources Conservation Service [NRCS] to assess impacts under the *Farmland Protection Policy Act* [FPPA].) FPPA applies when airport activities meet the following conditions: • Federal funds are involved; • The action involves the potential for the irreversible conversion of important	**Potential Impact.** Approximately 88 percent of the airport is considered either "prime farmland" or "farmland of statewide importance." Farmland designation for the airport is identified on Exhibit 1P. According to the U.S. Census Bureau, a significant portion of the airport is within an urbanized area and, therefore, may be exempt from FPPA requirements. However, airport property north of Runway 13-31 and Runway 3-21, as well as airport property

	farmlands to non-agricultural uses. Important farmlands include pastureland, cropland, and forest considered to be prime, unique, or statewide or locally important land; or • None of the exemptions to FPPA apply. These exemptions include: ○ When land is not considered "farmland" under FPPA, such as land already developed or already irreversibly converted. These instances include when land is designated as an urban area by the U.S. Census Bureau or the existing footprint includes rights-of-way. ○ When land is already committed to urban development. ○ When land is committed to water storage. ○ The construction of non-farm structures necessary to support farming operations. ○ The construction/land development for national defense purposes.	west of Wildcat Creek Road, is classified as a non-urbanized area. This includes recommended property acquisition depicted on the concept plan relating to the ultimate runway length project and adjusted Runway Protection Zone (RPZ) south of Runway 3-21. If federal funds are involved in projects outlined on the recommended concept plan, and those projects and land acquisition will impact lands that contain prime farmland soils in unurbanized areas, FPPA may apply. As part of the NEPA process for acquisition of property south of Runway 3-21, coordination with the NRCS on the completion of Form AD-1006 may be required
Hazardous Materials, Solid Waste, and Pollution Prevention	FAA has not established a significance threshold for Hazardous Materials, Solid Waste, and Pollution Prevention. However, factors to consider are if an action would have the potential to: • Violate applicable federal, state, tribal, or local laws or regulations regarding hazardous materials and/or solid waste management; • Involve a contaminated site; • Produce an appreciably different quantity or type of hazardous waste; • Generate an appreciably different quantity or type of solid waste or use a different method of collection or disposal and/or would exceed local capacity; or • Adversely affect human health and the environment.	**Potential Impact.** The airport has a fuel farm and provides the opportunity for aircraft maintenance activities that could involve fossil fuels or other types of hazardous materials or wastes. These operations are regulated and monitored by the appropriate regulatory agencies, such as the U.S. Environmental Protection Agency (EPA) and the Kansas Department of Health and Environment. The recommended concept plan does not anticipate land uses that will produce an appreciably different quantity or type of hazardous waste. However, should this type of land use be proposed, further NEPA review and/or a permit will be required. According to the U.S. EPA *EJSCREEN*, there are no known hazardous materials or waste contamination sites currently on airport property. The recommended concept plan delineates land acquisition of approximately 18 acres south of the airport to accommodate the proposed expansion of Runway 3-21 and required RPZ. Since property acquisition is proposed, an Environmental Due Diligence Audit (EDDA) is required as part of the land transaction process. Per Order 1050.19B, *Environmental Due Diligence Audits in the Conduct of FAA Real Property Transactions*, the airport is responsible to execute a Phase I EDDA prior to the acquisition of real property.

Historical, Architectural, Archaeological, and Cultural Resources	FAA has not established a significance threshold for Historical, Architectural, Archaeological, and Cultural Resources. Factors to consider are if an action would result in a finding of "adverse effect" through the Section 106 process. However, an adverse effect finding does not automatically trigger preparation of an EIS (i.e., a significant impact).	**No Impact.** As identified in Chapter One, one historic property, the Samuel D. Houston House, is located more than three miles from the airport. It is unlikely airport activities will impact this historic resource.
Land Use	FAA has not established a significance threshold for Land Use. There are also no specific independent factors to consider. The determination that significant impacts exist is normally dependent on the significance of other impacts.	**Potential Impact.** No historical, architectural, archaeological, or culturally significant resources are located within the immediate vicinity of the airport. The closest historic resource is the Samuel D. Houston House, which is located more than three miles northeast of the airport and is unlikely to be impacted by airport activities. The recommended concept plan includes the acquisition of approximately 18 acres of land south of the airport to accommodate the lengthening of Runway 3-21 and RPZ to prevent incompatible land use development. No structures are presently located within with the area proposed for airport acquisition.
Noise and Noise-Compatible Land Use	**Threshold: The action would increase noise by Day-Night Average Sound Level (DNL) 1.5 decibel (dB) or more for a noise-sensitive area that is exposed to noise at or above the DNL 65 dB noise exposure level, or that will be exposed at or above the DNL 65 dB level due to a DNL 1.5 dB or greater increase, when compared to the no action alternative for the same timeframe.** Another factor to consider is that special consideration needs to be given to the evaluation of the significance of noise impacts on noise-sensitive areas within Section 4(f) properties where the land use compatibility guidelines in Title 14 Code of Federal Regulations (CFR) Part 150 are not relevant to the value, significance, and enjoyment of the area in question.	**Potential Impact.** Noise contours were generated for a 2009 *Airport Noise and Land Use Compatibility Planning Study for Manhattan Regional Airport*[1] for the airport, generating a baseline and 2027 future contours based on anticipated development and airport growth. **Exhibit 5B** depicts both 2009 and 2027 noise contours. In the 2009 contours, the 65 DNL contour remains entirely on airport property. However, the ultimate noise contours highlighted on **Exhibit 5C** show the 65 DNL contour expands well off airport property. To the south, the 65 DNL contour is anticipated to encompass commercial and industrial land uses. To the north, land uses impacted by the 65 DNL contour are industrial, institutional, agricultural, and open space. Single-family residential land uses are present north of the airport within Riley County, although these parcels zoned as Agriculture (AG). Single-family residential is a permitted use in the AG district under the county's zoning code.
Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks		
Socioeconomics	FAA has not established a significance threshold for Socioeconomics. However, factors to consider are if an action would have the potential to: • Induce substantial economic growth in an area, either directly or indirectly (e.g.,	**Potential Impact.** The proposed development plan for the airport could potentially encourage economic growth for the City of Manhattan, City of Ogden, and Riley County. Results include new construction jobs, new jobs for the airport and

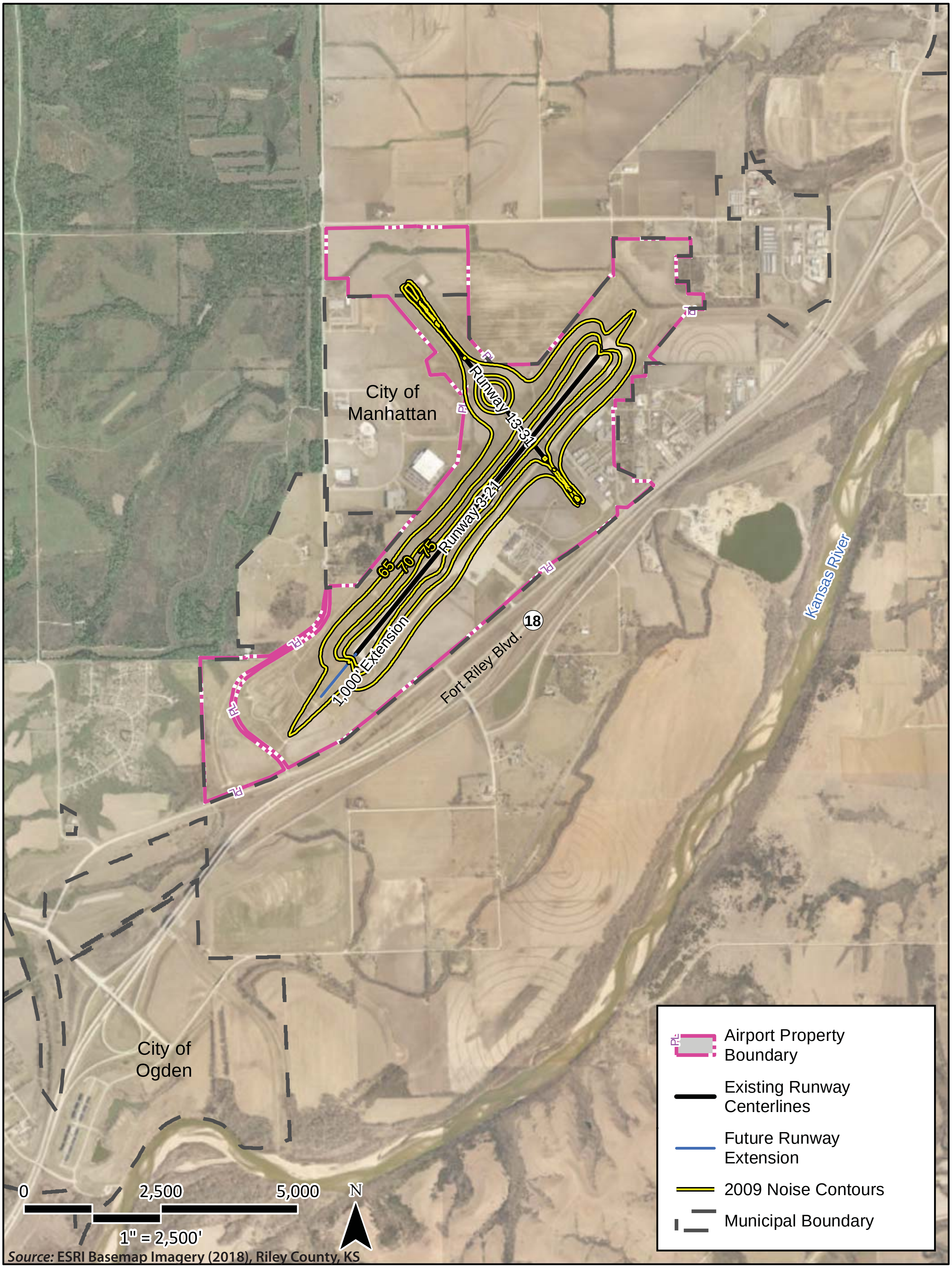
[1] HNTB Corporation *Airport Noise and Land Use Compatibility Planning Study for Manhattan Regional Airport* (July 2010)

	through establishing projects in an undeveloped area); • Disrupt or divide the physical arrangement of an established community; • Cause extensive relocation when sufficient replacement housing is unavailable; • Cause extensive relocation of community businesses that would cause severe economic hardship for affected communities; • Disrupt local traffic patterns and substantially reduce the levels of service of roads serving the airport and its surrounding communities; or • Produce a substantial change in the community tax base.	other commercial uses, new housing, and increase the local tax base.
Environmental Justice	FAA has not established a significance threshold for Environmental Justice. However, factors to consider are if an action would have the potential to lead to a disproportionately high and adverse impact to an environmental justice population (i.e., a low-income or minority population), due to: • Significant impacts in other environmental impact categories; or • Impacts on the physical or natural environment that affect an environmental justice population in a way that FAA determines is unique to the environmental justice population and significant to that population.	**Potential Impact.** Both low-income and minority populations have been identified in the vicinity of the airport. Executive Order (E.O.) 12898, *Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations*, and the accompanying Presidential Memorandum, and Order DOT 5610.2, *Environmental Justice*, require the FAA to provide for meaningful public involvement for minority and low-income populations, as well as analysis that identifies and addresses potential impacts on these populations that may be disproportionately high and adverse. Environmental justice impacts may be avoided or minimized through early and consistent communication with the public and allowing ample time for public consideration. If disproportionately high or adverse impacts are noted, mitigation and enhancement measures and offsetting benefits can be taken into consideration.
Children's Environmental Health and Safety Risks	FAA has not established a significance threshold for Children's Environmental Health and Safety Risks. However, factors to consider are if an action would have the potential to lead to a disproportionate health or safety risk to children.	**Potential Impact.** Per E.O. 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, federal agencies are directed to identify and assess environmental health and safety risks that may disproportionately affect children. These risks include those that are attributable to products or substances that a child is likely to encounter or ingest, such as air, food, drinking water, recreational waters, soil, or products to which they may be exposed. An elementary school has been identified east of the airport, as well as both single- and multi-family residential uses near the airport, which could include small children. Best management practices (BMPs) should be implemented to decrease environmental health risks to children.

		During the construction of the projects outlined on the master plan concept, appropriate measures should be taken to prevent access by unauthorized persons and children to construction project areas.
Water Resources (including Wetlands, Floodplains, Surface Waters, and Groundwater)		
Wetlands	**Threshold: The action would:** **1. Adversely affect a wetland's function to protect the quality or quantity of municipal water supplies, including surface waters and sole source and other aquifers;** **2. Substantially alter the hydrology needed to sustain the affected wetland system's values and functions or those of a wetland to which it is connected;** **3. Substantially reduce the affected wetland's ability to retain floodwaters or storm runoff, thereby threatening public health, safety or welfare (the term welfare includes cultural, recreational, and scientific resources or property important to the public);** **4. Adversely affect the maintenance of natural systems supporting wildlife and fish habitat or economically important timber, food, or fiber resources of the affected or surrounding wetlands.** **5. Promote development of secondary activities or services that would cause the circumstances listed above to occur; or** **6. Be inconsistent with applicable state wetland strategies.**	**Potential Impact.** A linear man-made drainage way identified as a wetland is located in the airfield between Runway 3-21 and Taxiway A, although this information is based on aerial photography interpretation from 1985. Field surveys and wetland delineations may be required to determine the presence or absence of wetlands in project areas. Project areas that may require field surveys prior to project implementation include the new hangars, fuel islands, new aprons, and lands for non-aeronautical land uses. If removal or relocation of wetlands are necessary for airport activities, the airport may be required to obtain a Section 404 Nationwide Permit from the U.S. Army Corps of Engineers (USACE) under the *Clean Water Act.* The Section 404 permit regulates the discharge of dredged or fill material into waters of the United States, including wetlands.
Floodplains	**Threshold: The action would cause notable adverse impacts on natural and beneficial floodplain values. Natural and beneficial floodplain values are defined in Paragraph 4.k of DOT Order 5650.2, *Floodplain Management and Protection.***	**Potential Impact.** A 100-year floodplain was identified by FEMA on airport property (depicted in Chapter One on Exhibit 1R). E.O. 11988, *Floodplain Management*, requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of 100-year floodplains and to avoid direct or indirect support of floodplain development where there is a practicable alternative. The proposed recommended concept proposed new taxiways and apron within the 100-year floodplain at the Runway 21 end. According to the City of Manhattan, a Floodplain Development Permit may be required for any development or site improvements in a floodplain identified on the Official Floodplain Map. The Floodplain Manager shall review and approve this permit, if the development complies with the regulations set forth by the city.

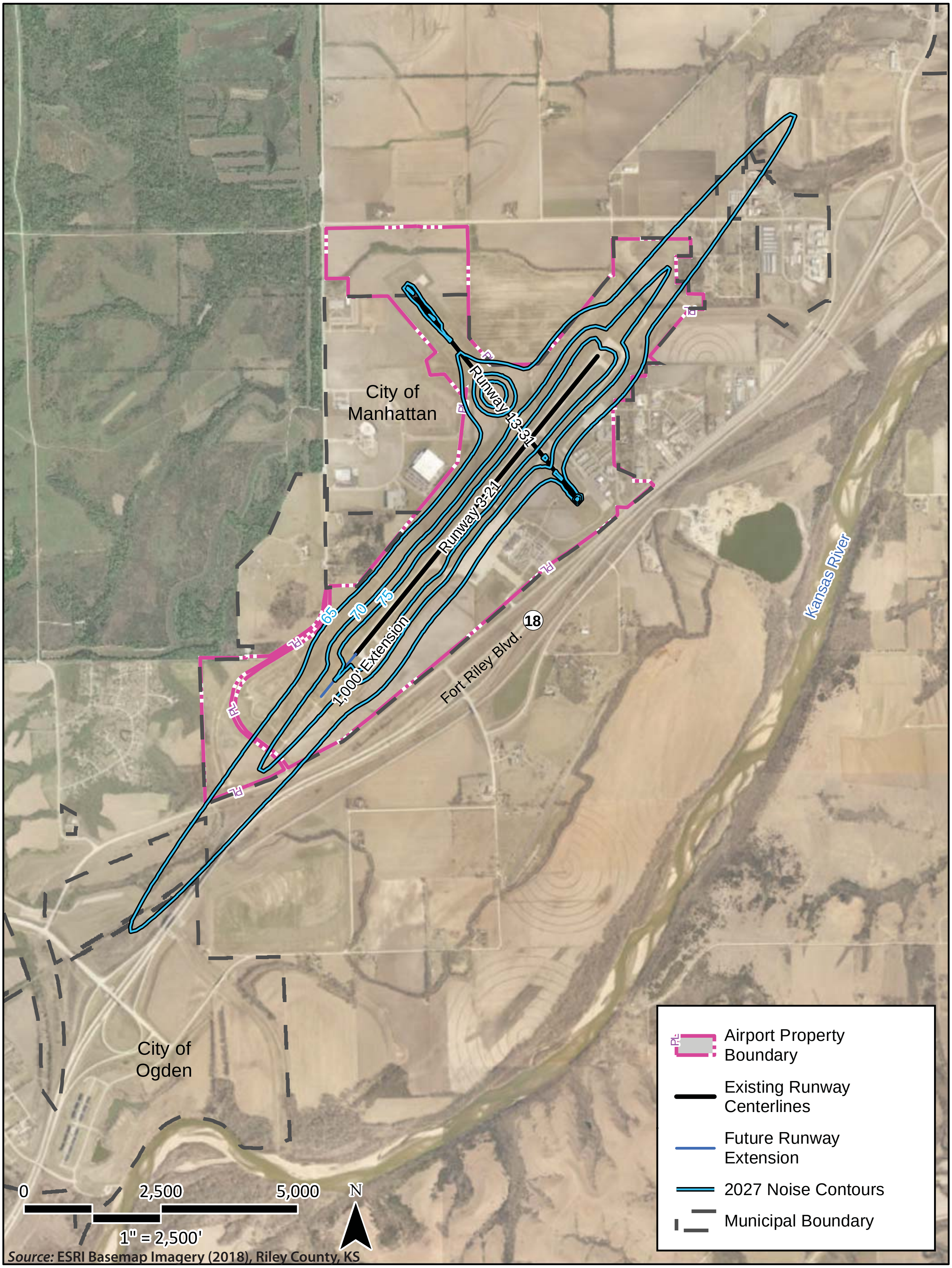
		Per Executive Order (E.O.) 11988, *Floodplain Management*, and Department of Transportation Order (DOT) 5650.2, *Floodplain Management and Protection*, agencies are required to provide the public an opportunity for early public review of any plan or proposal encroaching into a floodplain.
Surface Waters	**Threshold: The action would:** **1. Exceed water quality standards established by federal, state, local, and tribal regulatory agencies; or** **2. Contaminate public drinking water supply such that public health may be adversely affected.**	**Potential Impact.** The City of Manhattan manages both a Municipal Separate Storm Sewer (MS4) Permit and a National Pollutant Discharge Elimination System (NPDES) permit, which is regulated by the State of Kansas Department of Health and Environment (KDHE). Improvements to the airport will require a revised permit to be issued addressing operational and structural source controls, treatment BMPs, and sediment and erosion control. FAA's Advisory Circular (AC) 150/5370-10G, *Standards for Specifying Construction of Airports, Item P-156, Temporary Air and Water Pollution, Soil Erosion and Siltation Control* should also be implemented during construction projects at the airport.
Groundwater	**Threshold: The action would:** **1. Exceed groundwater quality standards established by federal, state, local, and tribal regulatory agencies: or** **2. Contaminate an aquifer used for public water supply such that public health may be adversely affected.** Factors to consider are when a project would have the potential to: • Adversely affect natural and beneficial groundwater values to a degree that substantially diminishes or destroys such values; • Adversely affect groundwater quantities such that the beneficial uses and values of such groundwater are appreciably diminished or can no longer be maintained and such impairment cannot be avoided or satisfactorily mitigated; or • Present difficulties based on water quality impacts when obtaining a permit or authorization.	**No Impact.** Projects proposed and outlined on the recommended concept plan, depicted on **Exhibit 5A**, will not substantially change the amount of water used by the airport. Additionally, the airport property does not serve as a significant source of groundwater recharge and is not located near a sole source aquifer.

Source: Coffman Associates, Inc. analysis



Source: ESRI Basemap Imagery (2018), Riley County, KS

2009 NOISE CONTOURS



Source: ESRI Basemap Imagery (2018), Riley County, KS

Exhibit 5C
2027 NOISE CONTOURS

LAND USE COMPATIBILITY

Land use planning surrounding Manhattan Regional Airport occurs through regulatory and non-regulatory means. The primary regulatory tool for directing land use is the zoning ordinance, which limits the type, size, and density of land uses in various locations. Examples of land use types include residential, commercial, industrial, and agricultural. Non-regulatory means of land use controls include the comprehensive or strategic land use plan and are generally adopted for the greater municipality or specific areas.

It is important to note the distinction between primary land use concepts used in evaluating development with the airport environs and existing land use, comprehensive plan, and zoning land use. Existing land use refers to property improvements as they *exist today* according to county records.

The comprehensive plan land use map identifies the *projected or future* land use according to the locally adopted comprehensive plan. This document guides future development within the community planning area and provides the basis for zoning designations.

Zoning identifies the type of land use *permitted* on a given piece of property according to the local zoning ordinances and maps. Local governments are required to regulate the subdivision of all lands within their corporate limits. Zoning ordinances should be consistent with the general plan, where one has been prepared. In some cases, the land use prescribed in the zoning ordinance or depicted in the general plan may differ from the existing land use.

The following sections describe the applicable land use policies for the area within the vicinity of Manhattan Regional Airport. Specifically, these sections pertain to the lands within the 65 DNL noise contours and the FAA Title 14 FAR Part 77 Approach Surface out to one mile from the end of the runways. For the purposes of this analysis, a study area consisting of a one-mile buffer from each runway end was established, incorporating land from both the cities of Manhattan and Ogden, and Riley County. The study area is approximately 7,149.9 acres, including the airport.

EXISTING LAND USE

Manhattan Regional Airport borders both the City of Manhattan and unincorporated Riley County. As discussed in Chapter One, the airport is primarily adjacent to light industrial (Manhattan Corporate Technology Park), agriculture, and rural residential uses. The central business district for the City of Manhattan is located approximately five miles northeast of the airport, and the City of Ogden is located approximately one mile southwest.

COMPREHENSIVE PLAN

The comprehensive plan is a general policy document used by government agencies to identify and describe communities' characteristics, articulate goals and policies, and explore alternative plans for future growth that, in turn, forms subdivision regulations and zoning ordinances to carry out the plan's goals. Often, municipalities will include goals and policies for their airports that are typically contained in a separate policy document from an Airport Master Plan. Comprehensive plans aid local decision makers regarding complicated issues during the development process, or a maintenance issue. The most current comprehensive plans within the study area include:

- City of Manhattan - *Manhattan Urban Area Comprehensive Plan* (2015)[2]
- Riley County, Kansas - *Plan for Riley County, Kansas* (Vision 2025)[3]
- City of Ogden, Kansas – *Ogden Comprehensive Plan Update 2020*.[4]

For the purposes of this study, specific land use classifications for each jurisdiction within the study area around Manhattan Regional Airport have been recategorized into generalized future land use designations. **Table 5B** represents the future land use classifications for each jurisdiction and how the land use classifications fit into a generalized future land use category.

TABLE 5B
Generalized Classification of Future Land Use Districts
Manhattan Regional Airport

Generalized Zoning Category	City of Manhattan	Riley County	City of Ogden
Agricultural	Agriculture	Agriculture	
Low/Medium Density Residential		Residential Low/ Medium Density	
High-Density Residential			General Residential
Commercial	Office/Research Park	Community Commercial, Office/ Research Park	General Commercia
Industrial	Industrial	Industrial	Manufacturing
Public/Quasi-Public/ Military	Public/Semi-Public	Military, Public/ Semi-Public	Public Use
Open Space	Environmentally Sensitive Areas	Environmentally Sensitive Areas	
Floodplain			Floodplain
Open Space		Preserved Open Space	
Right-of-Way	Right-of-Way	Right-of-Way	Right-of-Way

Sources: City of Manhattan, KS Department of Community Development; City of Ogden Department of Zoning and Planning; Riley County Department of Planning and Development; Coffman Associates analysis.

As shown on **Exhibit 5D** and summarized in **Table 5C**, land use classifications within the study area include agriculture, low- and medium-density residential, commercial, industrial, and public/quasi-public/military uses.

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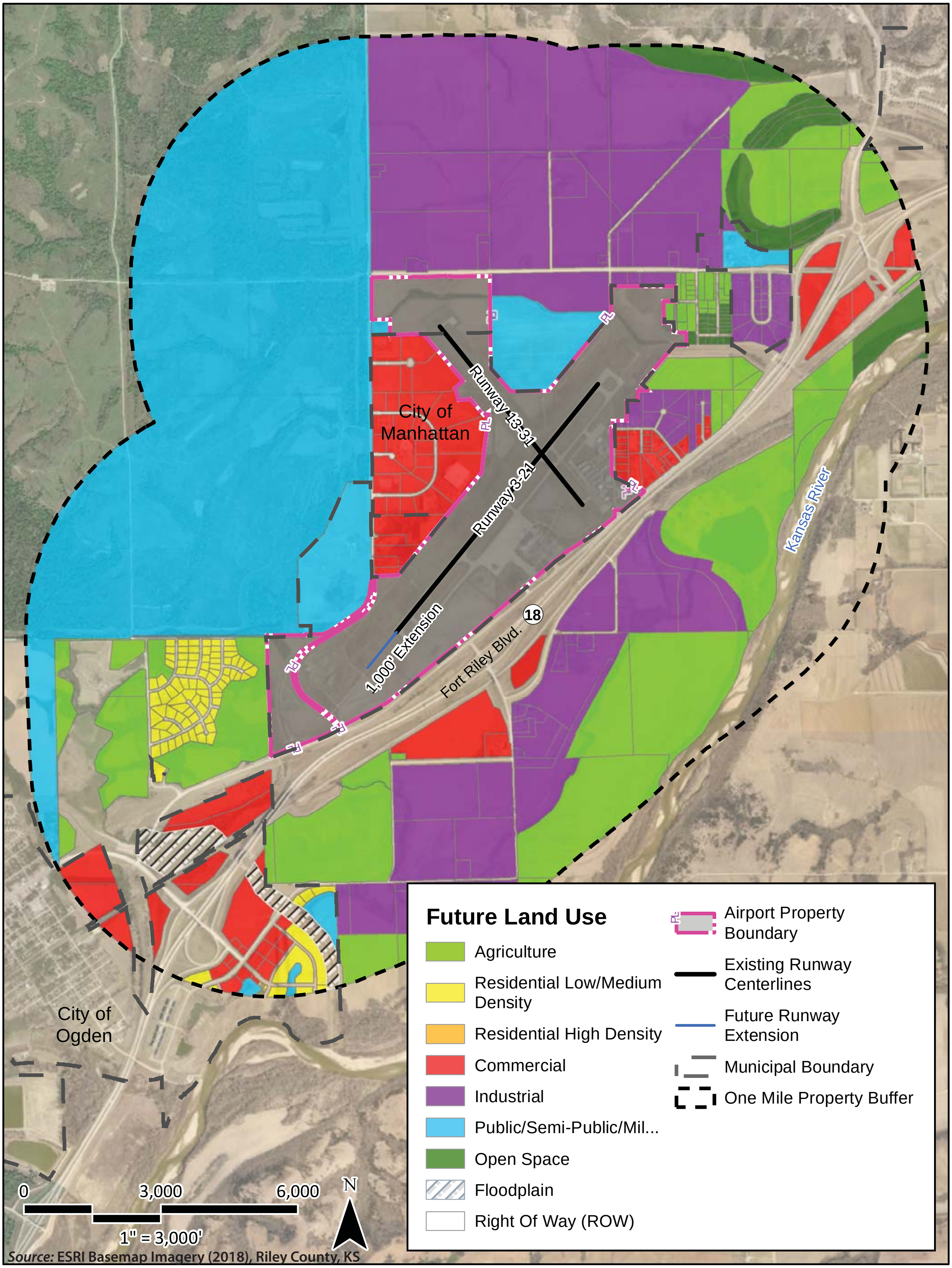
[2] City of Manhattan Community Development Department: *Manhattan Urban Area Comprehensive Plan* (https://www.cityofmhk.com/493/Manhattan-Urban-Area-Comprehensive-Plan); March 24, 2015, Ordinance 7131.
[3] Riley County, KS Planning and Development: *Vision 2025 – A Comprehensive Plan for Riley County, Kansas* (http://www.rileycountyks.gov/1050/Vision-2025-A-Comprehensive-Plan); October 22, 2009, Resolution No. 102209-31.
[4] Schnee, Angela, City of Ogden Zoning Administrator. Phone call with Kriks, Michelle of Coffman Associates on March 16, 2020.



Source: ESRI Basemap Imagery (2018), Riley County, KS

TABLE 5C
Future Land Use Districts
Study Area Summary

General Land Use Designation	Acreage	Percent of Study Area
Manhattan Regional Airport	739.3	10.3%
Agricultural	984.0	13.8%
Low-Density/Medium-Density Residential	75.7	1.1%
High-Density Residential	35.0	0.5%
Commercial	455.7	6.4%
Industrial	1,544.1	21.6%
Public/Quasi-Public/Military	1,789.7	25.0%
Open Space	116.4	1.6%
Floodplain	57.3	0.8%
Right-of-Way	1,352.7	18.9%
Study Area Total	**7,149.9**	**100.00%**

Sources: City of Manhattan, KS Department of Community Development; City of Ogden Department of Zoning and Planning; Riley County Department of Planning and Development; Coffman Associates analysis.

Table 5C identifies the primary future land use as public/quasi-public/military uses, accounting for approximately 25 percent of the planned land use within the study area. Industrial future land use accounts for an additional 21.6 percent of planned land use. Public/quasi-public/military and industrial combined account for approximately 46 percent of the planned land use in the study area. Other significant general plan land uses include agriculture (13.8 percent), right-of-way (18.9 percent), commercial (6.4 percent), open space (1.6 percent), low- and medium-density residential (1.1 percent), planned floodplain (0.8 percent) and high-density residential (0.5 percent).

ZONING

Used in conjunction with subdivision regulations and an essential tool to achieve goals and policies outlined in the comprehensive plan, zoning regulations are used to divide land into districts, or zones, and regulate land use activities in those districts, specify permitted uses, intensity and density of each use, and the bulk sizes of each building. Traditional zoning ordinances separate land into four basic uses: residential, commercial (including office), industrial, and agricultural. The City of Manhattan, Riley County, and the City of Ogden created sub-categories under these basic land uses based on intensity, density, and community impact.

City of Manhattan Zoning Regulations

The *Zoning Regulations*[5] for the City of Manhattan outline the zoning classifications used to regulate the general growth of the city. The following zoning districts are found within the study area around Manhattan Regional Airport under the City of Manhattan jurisdiction:

- **Restricted Business District (C-1).** The C-1 district is designed to provide non-retail commercial and business/professional activities along arterial and collector streets, intended to be compatible with adjacent residential districts.

- **Heavy Commercial District (C-6).** The Heavy Commercial district is intended to allow commercial uses allowing the sale and/or service of heavy equipment or products.

[5] City of Manhattan, KS *Zoning Regulations* (December 17, 2019; Ordinance No 7470); City of Manhattan Community Development Department (https://www.cityofmhk.com/203/Community-Development)

- **Planned Unit Development (PUD).** The PUD district is intended to promote aggressive land development, which takes into account the specific and unique needs of a site that may require changes to the standard bulk regulations, lot layout, or density; or results in a project that provides a greater public benefit than that afforded under conventional zoning.

- **Industrial Park District (I-2).** The Industrial Park district is intended to provide a broad range of manufacturing and research activities in an industrial park setting.

- **Light Industrial District (I-3).** The I-3 district is designed to allow for manufacturing, processing, assembly, and other non-retail activities.

- **Business Park District (I-5).** The Business Park district is to encourage administrative, research, and assembly activities compatible with surrounding uses/districts or adjacent residential districts.

- **University District (U).** The University district permits uses associated with Kansas State University or other educational institutions.

City of Ogden, Chapter XVI: Zoning and Planning

Chapter XVI: *Zoning and Planning* of the *Code of the City of Ogden*[6], addresses the zoning and land division requirements for the city. The following districts are within the study area around Manhattan Regional Airport:

- **Single-Family Residential (R-1).** The R-1 district permits the placement of single-family dwelling units on a single lot where city services are available. This district will also permit, with approval of a Special Use Permit, places of worship, day care centers (caring for no more than 12 children), hospitals, sanitariums, nursing homes, schools, funeral homes, and golf courses/tennis clubs.

- **General Residential (R-3).** The General Residential district is intended to permit single-family residential, two-family residential, and multi-family residential in a higher density form of development. The General Residential district also allows, with the approval of a Special Use Permit, places of worship, daycare centers (caring for no more than 12 children), hospitals, sanitariums, nursing homes, schools, funeral homes, professional services, boarding houses, and bed and breakfasts.

- **Central Commercial (C-1).** Intended to provide an area where a variety of retail and office uses are typically permitted in a central business area of a city.

- **General Commercial (C-3).** The General Commercial district is to allow general retail, business services, and office use suitable for these uses, adjacent to a downtown business district.

- **Light Industrial (I-1).** The I-1 district is intended to permit uses, such as the manufacturing, processing, or assembling of goods; warehousing, wholesales, and storage of goods; freight; transportation terminals; and office and laboratories.

[6] *Code of the City of Ogden, Kansas* (July 5, 2017); Chapter XVI Zoning and Planning, Ordinance No. 448 (July 6, 1994) (https://www.ogden-ks.gov/city-ordinances)

Zoning Regulations of Riley County, Kansas

The Zoning Regulations of Riley County, Kansas[7] outline the zoning classifications on unincorporated county land. The following zoning districts are located within the study area:

- **Agriculture District (AG).** The intent of the AG district is to promote and protect present and future agricultural land uses and is designed to allow development compatible with the existing rural character and agricultural uses.

- **Single-Family Residential (SF-1, SF-2, SF-3, SF-4, and SF-5).** Riley County's code further categorizes the single-family residential district into subdistricts, with each subdistrict classified by lot size and permitted use. However, what each subdistrict has in common is the district's primary intent to provide for a one single dwelling unit per lot. This district also permits other noise-sensitive land uses, such as schools, places of worship, and family care homes.

- **Two-Family Residential (B-1).** The intent of the B-1 district is to permit both single-family and two-family dwellings.

- **Commercial Districts (C-3, C-4).** The intent of the commercial district is to permit the activity of the sale of goods and services for profit.

- **Industrial Districts (D-1, D-2, D-3).** The industrial districts are intended to permit high intensity uses, such as warehousing and storage, manufacturing and processing, and outdoor storage and sales.

- **Planned Development Districts (CPUD, IPUD).** The Planned Unit Development (PUD) district is intended to promote flexible land development, which is typically approved by the planning board and Board of County Commissioners and may differ from other districts outlined in the Riley County zoning regulations. The PUD is intended to consider local environs, open space and natural topography, and account for density, character, transportation, community facilities, and economic development in the development process.

- **Airport Noise Hazard District (N-1).** The N-1 district is intended to protect both the airport and surrounding environs from incompatible land uses, which would perceive aircraft noise as a nuisance. Permitted uses in the N-1 district include agricultural uses, commercial, and industrial. Noise-sensitive uses, such as residential and educational facilities, are prohibited.

- **University District (U).** The U district permits those uses relating to education, research, housing, parking, maintenance, athletics, and recreation in connection with Kansas State University.

- **Fort District (FORT).** Land within Fort Riley, west of the airport.

[7] *Zoning Regulations of Riley County, Kansas* (approved May 3, 1974, updated July 2019): Riley County Planning and Development (https://www.rileycountyks.gov/367/Planning-Development)

Airport Overlay District (City of Manhattan)
Initially discussed in Chapter One, the Airport Overlay District (AO) is an overlay land use designation within the City of Manhattan intended to reduce risk, increase safety, and promote land use compatibility between the airport and surrounding land uses. The primary goal of the AO is to reduce the consequences of accidents related to aviation and to ensure compatibility issues related to noise, pollution, height, and land use compatibility. The AO is depicted in Exhibit 1J.

Airport Noise Hazard District (Riley County)
In order to protect the airport environs, the N-1 district is intended to safeguard the airport and surrounding environs from encroaching noise-sensitive development that could perceive aircraft noise as a nuisance, or against uses which could impact aircraft. Prohibited land uses in the N-1 district include residential and other uses that emit air, noise, odor, or vibration detectable beyond the property line.

Structure height in the N-1 district is not to exceed 50 ft and is not permitted to violate height restrictions specified by Part 77 regulations.

SUBDIVISION REGULATIONS

Subdivision regulations are legal devices employed to administer the division of land into two or more lots, parcels, or sites for the building and location, design, and installation of supporting infrastructure. The subdivision regulations are one of two instruments commonly employed to carry out the goals and policies outlined in the comprehensive plan.

Subdivision regulations can be used to specify requirements for airport-compatible land development by requiring developers to plat and develop land to minimize noise impacts or reduce noise exposure to new development. Subdivision regulations can also be used to protect the airport proprietor from litigation for noise impacts at a later date. The most common requirement is the dedication of a noise or avigation easement to the airport sponsor by the land developer as a condition of the development approval. Easements typically notify property owners of noise related to aircraft overflight.

Subdivision Regulations for City of Manhattan, KS

Article VII: *Contents and Submission Requirements for Plats and Plans*[8], in the City of Manhattan's subdivision regulations requires the identification of both the city's AO district and the county's N-1 district to be identified on a final plat for development.

[8] *Manhattan Urban Area Subdivision Regulations* (September 2, 2003; Ordinance 6357): City of Manhattan Community Development Department (https://cityofmhk.com/203/Community-Development)

Subdivision Regulations of Riley County, KS

The subdivision regulations for Riley County were last updated in October 2015.[9] According to those regulations, there are no specific procedures relating to airport land use compatibility through the subdivision process. Airport land use compatibility is addressed as part of the overall zoning code.

STUDY AREA LAND USE SUMMARY

Using zoning maps available from the City of Manhattan, City of Ogden, and Riley County, the zoning districts within the study area are summarized in **Table 5D**. For the purposes of this study, specific zoning districts in the three jurisdictions around the airport have been recategorized into generalized zoning designations. **Table 5D** represents the zoning districts for each jurisdiction and how those zoning districts fit into a generalized zoning land use category.

TABLE 5D
Generalized Classification of Zoning Districts
Manhattan Regional Airport

Generalized Zoning Category	City of Manhattan	Riley County	City of Ogden
Agricultural		AG	
Single-Family Residential		SF-1, SF-2, SF-3, SF-4, SF-5	R-1
Multi-Family Residential		B-1	R-3
Commercial	C-1, C-6	C-3, C-4	C-1, C-2
Planned Development	PUD	CPUD, IPUD	
Industrial	I-2, I-3, I-5	D-1, D-2, D-3	I-1
Public/Quasi-Public	U	N-1, U	
Fort		Fort	
Right-of-Way		Right-of-Way	
Water Feature			P

Sources: City of Manhattan, KS Department of Community Development; City of Ogden Department of Zoning and Planning; Riley County Department of Planning and Development; Coffman Associates analysis.

Table 5E and **Exhibit 5E** present the generalized zoning districts in the study area.

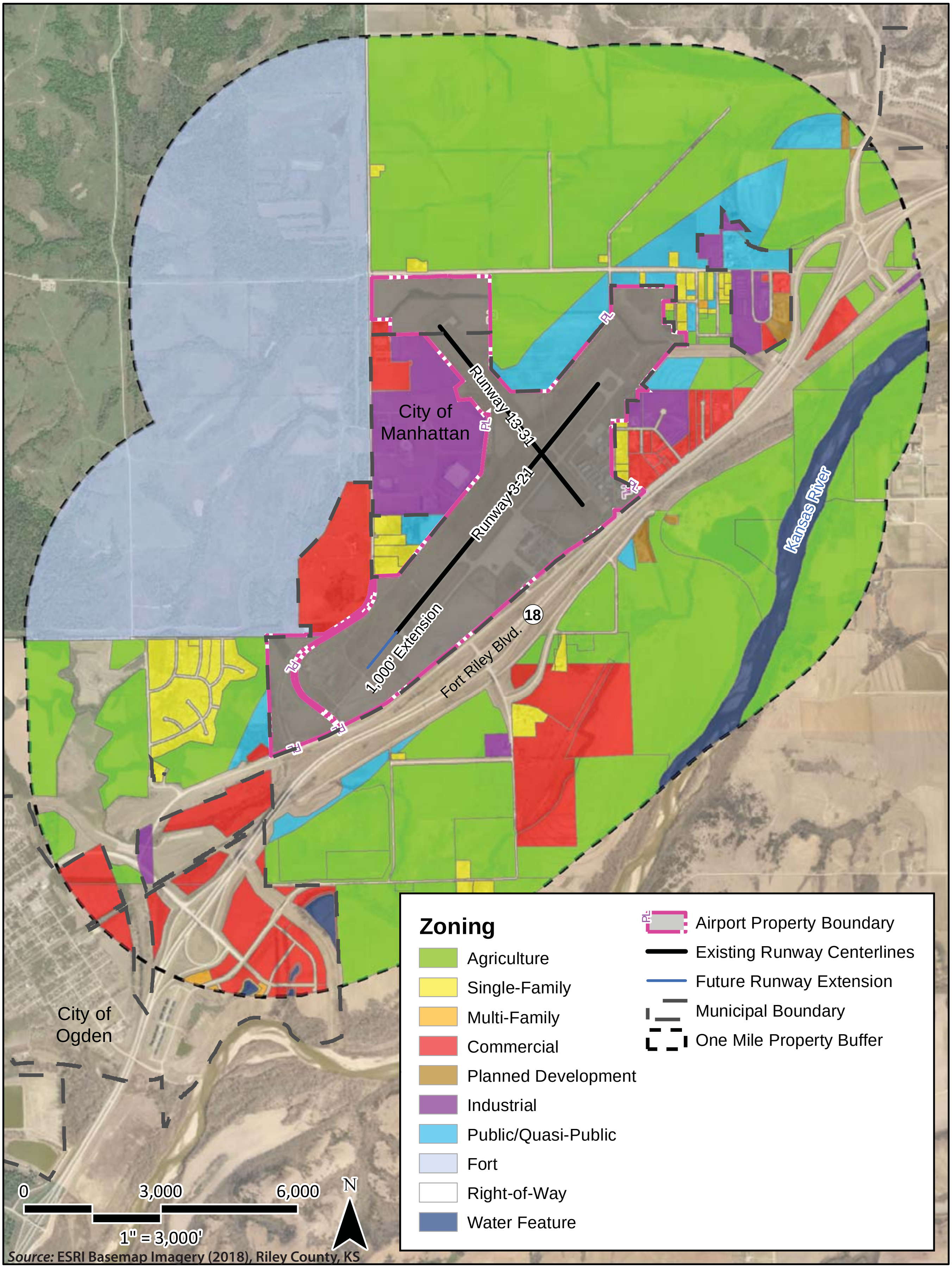
TABLE 5E
General Zoning
Study Area Summary

General Land Use Designation	Acreage	Percent of Study Area[1]
Manhattan Regional Airport	739.3	10.3%
Agricultural	2,598.4	36.3%
Single-Family Residential	170.2	2.4%
Multi-Family Residential	6.1	0.1%
Commercial	527.6	7.4%
Planned Development	21.8	0.3%
Industrial	253.2	3.5%
Public/Quasi-Public	245.4	3.4%
Fort	1,494.2	20.9%
Right-of-Way	942.3	13.2%
Water Feature	151.3	2.1%
Study Area Total	**7,149.9**	**100.00%**

Sources: City of Manhattan, KS Department of Community Development; City of Ogden Department of Zoning and Planning; Riley County Department of Planning and Development; Coffman Associates analysis.
[1] Percentage totals may differ slightly due to rounding of numbers.

Agriculture accounts for more than 36 percent of the study area (36.3 percent). Another 20.9 percent of the study area is Fort Riley, which consists of approximately 1,494.2 acres in the study area.

[9] *Subdivision Regulations of Riley County, Kansas* (approved 1974, updated October 2015): Riley County Planning and Development (http://www.rileycountyks.gov/678/Regulations-and-Zoning)



Source: ESRI Basemap Imagery (2018), Riley County, KS

Approximately 13 percent of the study area is right-of-way (13.2 percent), which includes Fort Riley Boulevard and other arterial, collector, and local road networks. Other predominant zoning districts include single- and multi-family residential (2.5 percent combined), commercial (7.4 percent), and industrial zoning districts (3.5 percent).

Table 5F summarizes the minimum lot areas, maximum density in floor area ratio unless otherwise noted, and maximum height, known as bulk standards, for each zoning district within the study area.

TABLE 5F
Zoning Ordinance Summary
Bulk Standards

Zoning District	Minimum Lot Area	Maximum Density in Floor Area Ratio	Maximum Height (feet)
City of Manhattan			
Restricted Business District (C-1)	15,000 sf[1]	0.30	30 ft[2]
Heavy Commercial District (C-6)	10,000 sf	0.50	50 ft
Planned Unit Development (PUD)	• 0.5 acres for residential or commercial • One acre for industrial • Five acres for manufactured housing	• Residential: 0.40 • Commercial: 0.50 • Industrial: 0.60	Height of structures are generally consistent with the existing zoning district on the lot, and adjacent property. Height may be site specific if requested by applicant.
Industrial Park District (I-2)	One acre	0.50	50 ft
Light Industrial District (I-3)	5,000 sf	0.75	50 ft
Business Park District (I-5)	Two acres	• 0.30 for principle building • 0.60 total for impervious and accessory structures	75 ft
University District (U)	Five acres (for district)	None	None
Riley County			
Agricultural District (AG)	Minimum lot size is contingent on use	Maximum density is contingent on use	Maximum height is contingent on use
Single-Family Residential District (SF-1)[3]	10,000 sf	22 ft[4]	35 ft or 2 ½ stories
Single-Family Residential District (SF-2)	6,500 sf	16 ft	35 ft or 2 ½ stories
Single-Family Residential District (SF-3)	6,500 sf	No minimum	35 ft or 2 ½ stories
Single-Family Residential District (SF-4)	Two acres	No minimum	35 ft or 2 ½ stories
Single-Family Residential District (SF-5)	Two acres	22 ft	35 ft
Two-Family Residential District (B-1)	6,500 sf for single-family dwellings 7,500 for two-family dwellings	None	40 ft
General Business District (C-3)	None	NA[5]	40 ft
Highway Business District (C-4)	10,000 sf	NA	40 ft
Restricted Business District	NA	NA	NA
Business Park District	Two acres	0.30 for principle buildings	78 ft
Heavy Commercial	NA	NA	NA
CPUD	0.5 acre	0.50	NA

TABLE 5F (continued) Zoning Ordinance Summary Bulk Standards			
IPUD	0.5 acre	0.50	NA
Planned Unit Development (PUD)	0.5 acre	0.50	NA
Industrial Park (D-1)	One acre	NA	50 ft
Light Industrial District (D-2)	5,000 sf	NA	50 ft
Heavy Industrial District (D-3)	5,000 sf	NA	No limit
Airport Noise Hazard (N-1)	One acre	NA	50 ft
University (U)	Unrestricted	NA	Unrestricted
Fort	Land use dedicated to Fort Riley		
City of Ogden			
Single-Family Residential District (R-1)	7,200 sf	850 sf minimum dwelling size	35 ft
Multi-Family Residential District (R-3)	• 7,200 sf for single family • 8,400 sf for two family • An additional 1,200 sf per additional dwelling	• 850 sf minimum dwelling size for single family • 600 sf minimum dwelling size for two families • 550 sf minimum dwelling size for multi-family	35 ft
Central Business District (C-1)	No minimum	No maximum	No maximum
General Commercial District (C-2)	7,200 sf	0.60	45 ft
Light Industrial District (I-1)	7,200 sf	0.75	65 ft

Sources: City of Manhattan *Zoning Regulations*, KS; City of Ogden *Code of the City of Ogden, Kansas*, KS; Riley County, KS *Zoning Regulations of Riley County*

[1] sf – square feet

[2] ft – feet

[3] Minimal lot areas reported are based on single-family lots served by a central sewer system. Minimum lot sizes increase if lot is served by a septic tank or waste stabilization pond.

[4] Rather than report a maximum lot density, the *Riley County Zoning Code* details minimum structure width. This figure applies to the primary structure, and does not include attached garages, porches, extensions, etc.

[5] NA – not available

BUILDING CODE

Building codes were established to provided minimum standards to safeguard life, limb, health, and public welfare by regulating and controlling the design, construction, quality of materials, use and occupancy, location, and maintenance of all buildings and structures. Building codes may be required to provide sound insulation in new residential, office, and institutional buildings when warranted by existing or potential high aircraft noise levels. However, the City of Manhattan adopted the *2018 International Building Code,* which currently does not enforce aircraft attenuation in building design and construction.[10]

[10] City of Manhattan adopted construction codes – *2018 International Building Code* (https://cityofmhk.com/342/Adopted-Construction-Codes); Ordinance 7423, June 19, 2019

Riley County does not currently have adopted building codes and relies on the zoning code for development standards.[11]

NON-COMPATIBLE DEVELOPMENT ANALYSIS

Areas with the potential for non-compatible development, when compared to the noise exposure contours and height restrictions within the Part 77 approach surfaces out to one mile, have been evaluated. Further discussion of these areas can be found in Chapter One. This was accomplished by evaluating city- and county-adopted land use plans and zoning designations for those parcels encompassed by the noise contours to determine if noise-sensitive land uses could be developed in those areas. Both the noise contours and height restrictions within the Part 77 approach surface area are addressed below.

Noise Exposure Contours

The standard methodology for analyzing noise conditions at airports involves the use of a computer simulation model. The purpose of the noise model is to produce noise exposure contours that are overlain on a map of the airport and vicinity to graphically represent aircraft noise conditions. When compared to land use, zoning, and general plan maps, the noise exposure contours may be used to identify areas that are currently, or have the potential to be, exposed to aircraft noise.

To achieve an accurate representation of an airport's noise conditions, the noise model uses a combination of industry-standard information and user-supplied inputs specific to the airport. The software provides noise characteristics, standard flight profiles, and manufacturer-supplied flight procedures for aircraft which commonly operate at Manhattan Regional Airport. As each aircraft has different design and operating characteristics (number and type of engines, weight, and thrust levels), each aircraft emits different noise levels. The most common way to spatially represent the noise levels emitted by an aircraft is a noise exposure contour.

Airport-specific information, including runway configuration, flight paths, aircraft fleet mix, runway use distribution, local terrain and elevation, average temperature, and numbers of daytime and nighttime operations, are also used in modeling inputs.

Based on assumptions provided by the user, the noise model calculates average 24-hour aircraft sound exposure within a grid covering the airport and surrounding areas. The grid values, represented with the day-night noise level metric or DNL, at each intersection point on the grid represent a noise level for that geographic location. To create the noise contours, an isoline, similar to those on a topographic map, is drawn connecting points of the same DNL noise value. In the same way that a topographic contour represents the same elevation, the noise contour identifies areas of equal noise exposure.

[11] Riley County, Kansas (https://www.rileycountyks.gov/Faq.aspx?QID=437)

DNL is the metric currently accepted by the FAA, U.S. EPA, and Department of Housing and Urban Development (HUD) as an appropriate measure of cumulative noise exposure. These three agencies have each identified the 65 DNL noise contour as the threshold of incompatibility.

The guidelines summarized in **Exhibit 5F** indicate that all land uses are acceptable in areas below 65 DNL. At or above the 65 DNL threshold, residential land uses without acoustic treatment, mobile homes, and transient lodging are all incompatible. The exhibit notes that homes of standard construction and transient lodging may be considered compatible where local communities have determined these uses are permissible; however, acoustic treatment of these structures is recommended to meet noise level reduction thresholds when comparing the outdoor noise level to the indoor noise level. Schools and other public use facilities are also generally considered to be incompatible with noise exposure above 65 DNL. As with residential development, communities can make a policy decision that these uses are acceptable with appropriate sound attenuation measures. Hospitals and nursing homes, places of worship, auditoriums, and concert halls are structures which are generally compatible if measures to achieve noise level reduction are incorporated into the design and construction of structures. Outdoor music shells and amphitheaters are not compatible and should be prohibited within the 65 DNL noise contour. Additionally, agricultural uses and livestock farming are generally considered compatible apart from related residential components of these uses, which should incorporate sound attenuation measures.

As discussed in the "Environmental Overview" section, noise exposure contours were prepared for Manhattan Regional Airport for an *Airport Noise and Land Use Compatibility Planning Study* in 2009 with a baseline condition (2009) and a long-range condition (2027) based on the operational forecasts.[12] The resulting contours are shown on **Exhibit 5B** and **Exhibit 5C**. As shown on the exhibits, both the 70 and 75 DNL noise contours for Runway 3-21 remain entirely on airport property in both the baseline and long-range forecast. As depicted on **Exhibit 5B**, the 65 DNL noise exposure contour baseline condition remains entirely on airport property. However, due to the proposed ultimate runway length of Runway 3-21 and future operational forecast outlined in Chapter Two, the 65 DNL contour for long-range conditions is anticipated to extend off airport property (**Exhibit 5C**).

Noise contours for both 2009 and 2027 for Runway 13-31 remain entirely on airport property.

Height Restrictions

Using a similar process to the non-compatible development analysis for noise contours, the zoning and future land use within the Part 77 approach surface area out to one mile from the end of the runways were evaluated. Future land use designations are not included in this analysis, as the comprehensive plan for the City of Manhattan, Riley County, or the City of Ogden does not specify height limitations for future land uses.

As identified in **Exhibit 5G**, areas within the Part 77 approach surface area out to one mile of the runway ends are zoned Agricultural, Single-Family Residential, Multi-Family Residential, Commercial, Planned

[12] HNTB Corporation *Airport Noise and Land Use Compatibility Planning Study for Manhattan Regional Airport* (July 2010)

LAND USE	Yearly Day-Night Average Sound Level (DNL) in Decibels					
	Below 65	65-70	70-75	75-80	80-85	Over 85
Residential						
Residential, other than mobile homes and transient lodgings	Y	N[1]	N[1]	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N[1]	N[1]	N[1]	N	N
Public Use						
Schools	Y	N[1]	N[1]	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Government services	Y	Y	25	30	N	N
Transportation	Y	Y	Y[2]	Y[3]	Y[4]	Y[4]
Parking	Y	Y	Y[2]	Y[3]	Y[4]	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail-building materials, hardware and farm equipment	Y	Y	Y[2]	Y[3]	Y[4]	N
Retail trade-general	Y	Y	25	30	N	N
Utilities	Y	Y	Y[2]	Y[3]	Y[4]	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y[2]	Y[3]	Y[4]	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y[6]	Y[7]	Y[8]	Y[8]	Y[8]
Livestock farming and breeding	Y	Y[6]	Y[7]	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y[5]	Y[5]	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts, and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

The designations contained in this table do not constitute a federal determination that any use of land covered by the program is acceptable under federal, state, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally-determined land uses for those determined to be appropriate by local authorities in response to locally-determined needs and values in achieving noise compatible land uses.

See other side for notes and key to table.

Exhibit 5F
PART 150 NOISE COMPATIBILITY GUIDELINES

KEY

Y (Yes) Land Use and related structures compatible without restrictions.

N (No) Land Use and related structures are not compatible and should be prohibited.

NLR Noise Level Reduction (outdoor-to-indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.

25, 30, 35 Land Use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structure.

NOTES

1. Where the community determines that residential or school uses must be allowed, measures to achieve outdoor-to-indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB, respectively, should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide an NLR of 20 dB; thus, the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.

2. Measures to achieve NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

3. Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

4. Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

5. Land use compatible provided special sound reinforcement systems are installed.

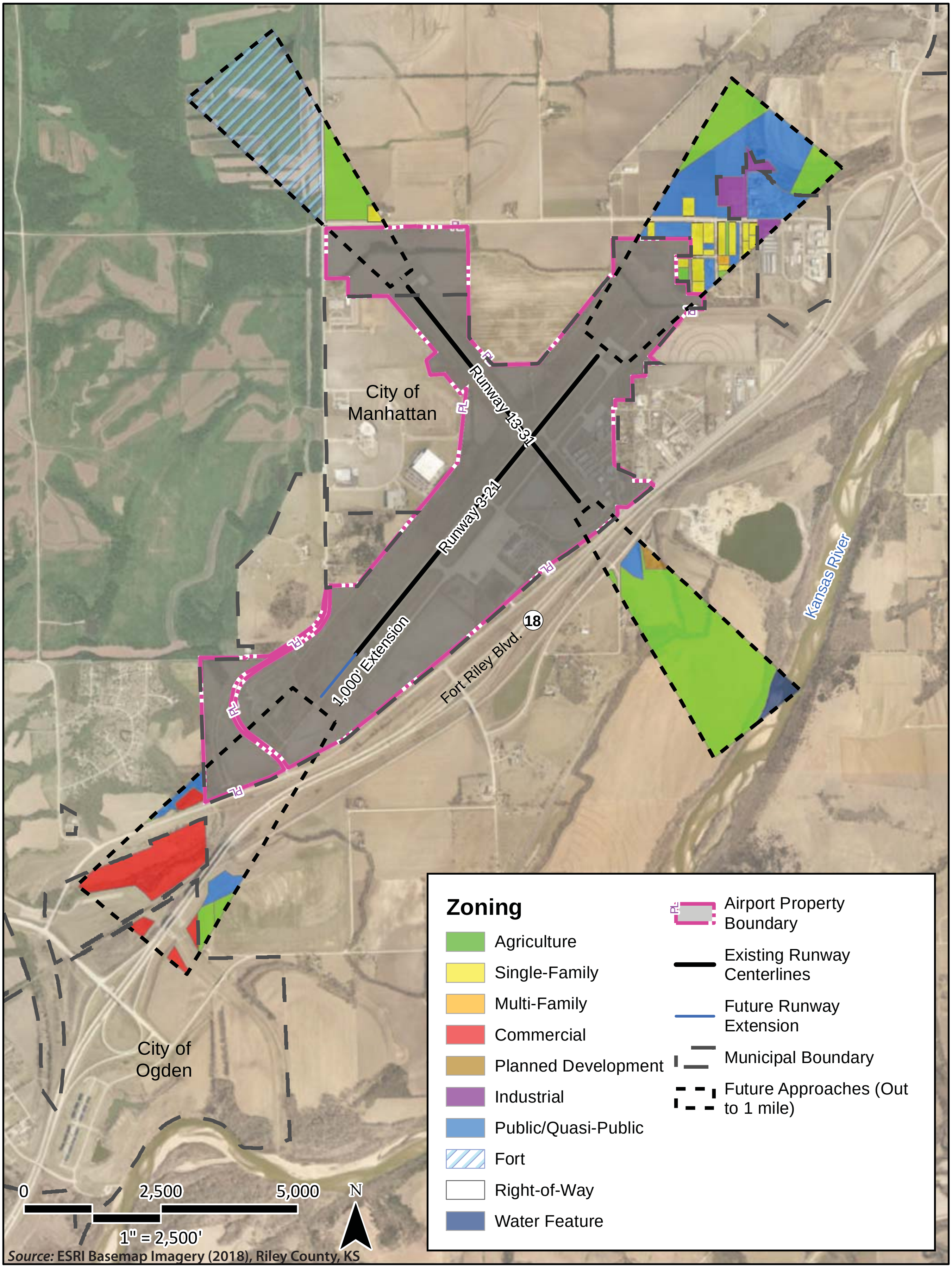
6. Residential buildings require an NLR of 25.

7. Residential buildings require an NLR of 30.

8. Residential buildings not permitted.

Source: ***14 CFR Part 150***, Appendix A, Table 1.

Exhibit 5F (continued)
PART 150 NOISE COMPATIBILITY GUIDELINES



Source: ESRI Basemap Imagery (2018), Riley County, KS

Exhibit 5G
APPROACH SURFACE ZONING

Development, Industrial, Public/Quasi-Public, and Fort. As noted in **Table 5F** above, the maximum height limit for residential districts is 35 feet for lower density residential and 40 feet for higher density residential uses. The maximum height allowed for all zoning designations found in the Part 77 approach surface area is 78 feet, which is applied to the Business Park district within Riley County. **Exhibit 5G** highlights the ultimate land use approach areas. While no height limitation is placed on the Heavy Industrial and University zoning districts in Riley County, the N-1 district is in place to ensure structure height is compatible with the airport.

RECOMMENDATIONS

Based on the information presented above and the non-compatible development analysis, the following recommendations are provided to maintain airport land use compatibility in the vicinity of Manhattan Regional Airport.

Incorporate Airport Land Use Compatibility Goals and Policies into Comprehensive Plans for the City of Ogden and Riley County. A comprehensive plan is the starting point guiding a city's and county's development and is the recommending policy document for development. It is recommended the city and county include, with input from the Manhattan Regional Airport, goals, policies, and objectives for the airport when the respective comprehensive plans are scheduled for updates.

Encourage the City of Ogden to incorporate an Airport Overlay based on the 2027 noise contours. Currently, the City of Ogden does not include an overlay district addressing airport compatibility in the City's Zoning Regulations. Within the overlay, those uses incompatible with the airport can be prohibited, following the guidelines outlined in *Airport Noise and Land Use Compatibility Planning Study for Manhattan Regional Airport*.

Incorporate the Part 77 Map into the Local Zoning Ordinance as an Airport Overlay Zone. Currently, the City of Ogden's Zoning Regulations does not reference protected surface areas within the Part 77 map area. An Airport Overlay Zone is intended for two important purposes:

1. To protect the airport from the encroachment of land uses that are incompatible with airport activities and that may limit airport growth; and

2. To minimize public exposure to excessive noise and other safety hazards commonly associated with aviation land uses.

To ensure the city's codes are most up to date with the needs of the airport, it is recommended the city incorporate the most current Part 77 map to prohibit incompatible uses or structures that could affect the airport.

Incorporate land division guidelines for airport-compatible development into local subdivision regulations. Subdividing land is typically the initial step of the development process. It is important to ensure at this stage land arrangement is compatible with the airport and appropriate avigation easements are dedicated.

Adopt Fair Disclosure Requirements for Real Estate Transactions within the Vicinity of the Airport. Fair disclosure regulations in real estate transactions are intended to ensure that prospective buyers of property are informed that the property is or will be exposed to potentially disruptive aircraft noise or overflights. It is not uncommon, around even the busiest airports, for newcomers to report having bought property without having been informed about airport noise levels. At the most formal level, fair disclosure can be implemented through a city and county ordinance requiring a deed notice for property within the vicinity based on an existing boundary, such as the Part 77 Horizontal Surface. The following is an example of deed notice language that would notify the property owner of the proximity of an airport and expectations for living in the vicinity of the airport:

> *The subject property is within the vicinity of Manhattan Regional Airport, located at 5500 Skyway Drive, Manhattan, KS 66503. Properties within this area are routinely subject to overflights by aircraft using this public-use airport and, as a result, residents may experience inconvenience, annoyance, or discomfort arising from the noise of such operations. Residents also should be aware that the current volume of aircraft activity may increase in response to the population and economic growth within the City of Manhattan, City of Ogden, Fort Riley, and Riley County. Any subsequent deed conveying this parcel or subdivisions thereof shall contain a statement in substantially this form.*

AIRPORT RECYCLING, REUSE, and WASTE REDUCTION

The *FAA Modernization and Reform Act of 2012* (FMRA), which amended Title 49, United States Code (USC), included several changes to the Airport Improvement Program (AIP). Two of these changes are related to recycling, reuse, and waste reduction at airports.

- Section 132(b) of FMRA expanded the definition of airport planning to include "developing a plan for recycling and minimizing the generation of airport solid waste, consistent with applicable State and local recycling laws, including the cost of a waste audit."

- Section 133 of FMRA added a provision requiring airports that have or plan to prepare a master plan, and receive AIP funding for an eligible project, to ensure the new or updated master plan addresses issues relating to solid waste recycling at the airport, including:
  - the feasibility of solid waste recycling at the airport;
  - minimizing the generation of solid waste at the airport;
  - operation and maintenance requirements;
  - a review of waste management contracts; and
  - the potential for cost savings or the generation of revenue.

Typically, airport sponsors have purview over waste handling services in facilities they own and operate (i.e., the passenger terminal building, airport rescue and firefighting (ARFF) station, and maintenance facilities). Tenants of airport-owned buildings/hangars, or tenants that own their own facilities, are typically responsible for coordinating their own waste handling services. While the focus of this plan is on airport-operated facilities, the airport should work to incorporate facility-wide strategies that create consistency in waste disposal mechanisms. This would ultimately reduce the quantity of materials sent to the landfill.

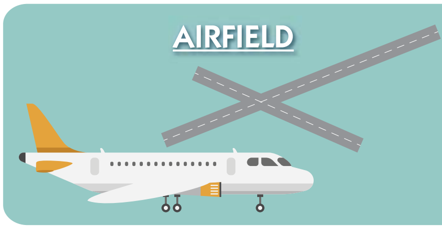
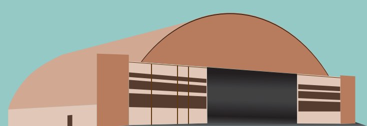
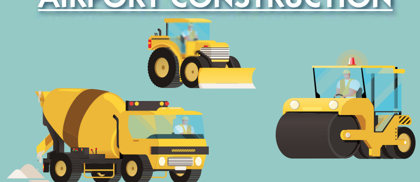
For airports, waste can generally be divided into eight categories:[13]

- **Municipal Solid Waste** (MSW) is more commonly known as trash or garbage consisting of every-day items that are used and then discarded (i.e., single-use packaging).
- **Construction and Demolition Waste** (C&D) is considered non-hazardous trash resulting from land clearing, excavation, demolition, renovation or repair of structures, roads and utilities, including concrete, wood, metal, drywall, carpet, plastic, pipe, cardboard, and salvaged building components. C&D is also generally labeled as MSW.
- **Green Waste** is a form of MSW yard waste consisting of tree, shrub and grass clippings, leaves, weeds, small branches, seeds, and pods.
- **Food Waste** includes unconsumed food products or waste generated and discarded during food preparation and is also considered MSW.
- **Deplaned Waste** is waste removed from passenger aircrafts. Deplaned waste includes bottles, cans, newspapers, mixed paper (i.e., napkins or paper towels), plastic cups, service ware, food waste, and food-soiled paper/packaging. Deplaned waste can represent as much as 20 percent of an airport's total MSW stream.
- **Lavatory Waste** is a special waste that is emptied through a hose and pumped into a lavatory service vehicle. The waste is then transported to a triturator[14] facility for pretreatment prior to discharge in the sanitary sewage system. Due to the chemicals in lavatory waste, it can present environmental and human health risks if mishandled. Caution must be taken to ensure lavatory waste is not released to the public sanitary sewerage system before pretreatment.
- **Spill Clean and Remediation Wastes** are also special wastes which are generated during cleanup of spills and/or the remediation of contamination from several types of sites on an airport.
- **Hazardous Wastes** are governed by the *Resource Conservation and Recovery Act* (RCRA), as well as the regulations in 40 Code of Federal Regulations (CFR) Subtitle C, Parts 260 to 270. The U.S. Environmental Protection Agency (EPA) developed less stringent regulations for certain hazardous waste, known as universal waste, described in 40 CFR Part 237, *The Universal Waste Rule*.

As seen on **Exhibit 5H**, there are multiple areas where Manhattan Regional Airport potentially contribute to the waste stream, including the terminal, airfield, hangars, airport construction projects, aircraft galleys, and administrative offices. To create a comprehensive waste reduction and recycling plan for the airport, all potential inputs must be considered.

[13] Recycling, Reuse and Waste Reduction at Airports, FAA (April 24, 2013)
[14] A triturator facility turns lavatory waste into fine particulates for further processing.

AIRPORT WASTE STREAMS for MANHATTAN REGIONAL AIRPORT

AIRPORT AREA	POTENTIAL INPUTS	POTENTIAL OUTPUTS
TERMINAL 	Café Passengers Employees	Food Waste, Paper Plastic, Trash Aluminum Cans Deplaned Waste
AIRFIELD 	Aircraft Operations	Runway Rubber Green Waste
HANGERS 	Goods Movements	Plastic Wood Vehicle Waste (Tires & Fluids)
AIRCRAFT 	Aircraft Ground Support Equipment (GSE)	Vehicle Waste Plastic Wastewater Hazmat
AIRPORT CONSTRUCTION 	Construction Re-Construction Demolition	Reused Concrete Reused Asphalt Vehicle Waste Soils, Building Materials Wood, General Waste
GALLEY 	Aircraft Food Services	Food Waste Waste Water Plastic Aluminum Cans
ADMINISTRATIVE OFFICES 	Employees	Food Waste Paper, Plastic Aluminum Cans Trash, Cardboard

Source: Recycling, Reuse, and Waste Reduction at Airports, FAA (April 24, 2013)

EXISTING SERVICES

Currently, waste management services for the airport are managed by the City of Manhattan under an agreement to oversee solid waste removal at all city-owned facilities, which is provided by Waste Management. MSW dumpsters are located adjacent to the airport terminal and the general aviation hangars. No information is available regarding the weight of MSW hauled or the cost of service, and dumpsters are emptied twice weekly.

Currently, the airport engages in recycling services, also provided by Waste Management. Recycling dumpsters are in the same locations as the MSW dumpsters. The airport also provides a small recycling container inside the terminal. **Exhibit 5J** depicts items Waste Management allows to be recycled and those that cannot.[15]

There are a few key city staff members directly involved in the airport's waste management and recycling system. It is crucial to encourage tenant participation to assure buy-in of the airport's recycling efforts. The city should review internal procedures to ensure there are no unacceptable items contaminating recycling containers, or recyclables thrown in the trash. Clearly marked signage of what is and is not accepted placed near the solid waste and recycling containers is another significant part of a consistent, effective recycling system.

MHK should make certain that waste and recycling containers are right-sized to the existing operation, as well as on a collection schedule that picks up only when the containers are full. Since recycling services are offered, the airport could track recycling rates and waste quantities to identify cost saving measures that are currently unidentified simply based on the lack of quantitative data.

To ensure recycling is part of the airport's everyday business, airport administration can provide training, education, and support to personnel, tenants, and others who conduct business at the airport. In-person meetings with airport tenants should be held to create mutual understanding of the airport's solid waste and recycling goals and how tenants play a vital role in the airport's overall success.

The continuation of an effective program requires accurate data of current waste and recycling rates. There are several ways an airport can gain insight into their waste stream. The waste audit is the most comprehensive and intensive way to assess waste stream composition, opportunities for waste reduction, and capture of recyclables.

Examination of Records

- Waste hauling and disposal records and contracts
- Supply and equipment invoices
- Other waste management costs (commodity rebates, container costs, etc.)

[15] Waste Management Services (https://www.wm.com/us/en/myhome)

WHAT CAN I RECYCLE?

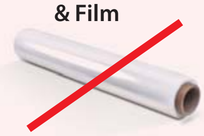
YES, PLEASE

Plastic Bottles & Containers 	Recycle plastics like empty bottles, jars, jugs, and tubs by their shapes. Chasing arrows don't necessarily indicate recyclability. **Expert Tip** Caps are now recyclable, but you must put them back on empty containers before tossing in the bin.
Food & Beverage Cans (Clean and Dry) 	Recycle all empty tin, aluminum, and steel cans. **Expert Tip** Empty aerosol cans can also be recycled. If the can has a plastic lid, you should remove it.
Paper 	Paper, newspaper, and magazines are good to recycle. **Expert Tip** Soiled and wet paper should be placed in the trash.
Flattened Cardboard & Paperboard 	Flatten and recycle all cardboard and paperboard. **Expert Tip** Break down and flatten cardboard boxes to make room for more materials to fit in your recycling.
Food & Beverage Containers 	Recycle empty milk cartons, juice boxes, and food cartons.
Pizza Boxes 	Cardboard pizza delivery boxes without leftovers or liners should be recycled.

NO, THANKS

Bagged Recyclables

Plastic Wraps & Film



Flexible Packaging

Plastic Bags

Garden Hoses, Rope, Leashes, Wire & String

Soiled Paper Towels

Cups with Plastic or Wax Coating

Polystyrene Foam & Plastic Pizza Boxes

Needles

Dirty Diapers

Food Waste

Batteries

Yes, but not curbside

Glass Bottles & Jars

Glass recycling offered through separate service

Source: Waste Management (2019)

Facility Walk-Through

- Qualitative waste information
- Understanding waste pickup and hauling practices

Waste Audit

- Collection and analysis of the types of waste produced

SOLID WASTE MANAGEMENT SYSTEM

There are two different waste management systems airports can deploy when managing solid waste and recycling efforts at their facility. Airports generally utilize either a *centralized* or a *decentralized* waste management system. The differences between these two methods are described below and summarized on **Exhibit 5K**.

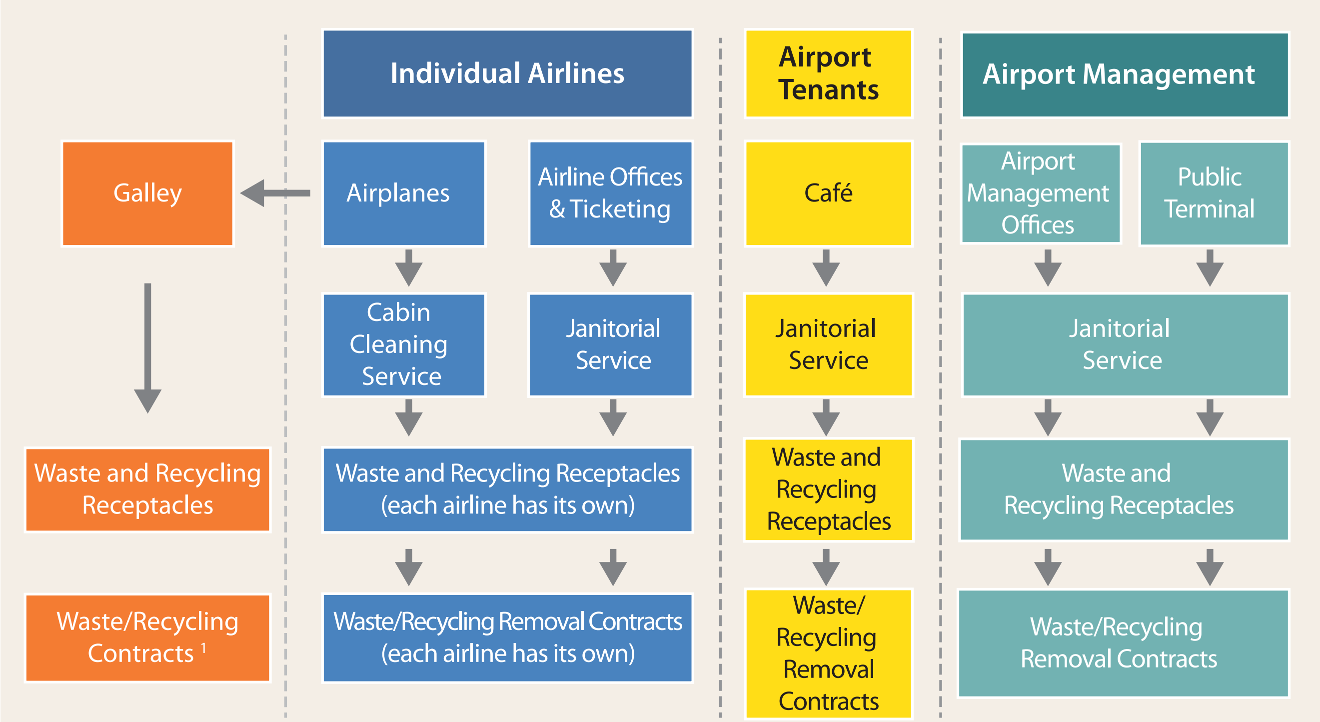
- **Centralized waste management system.** A centralized waste management system happens when the airport provides receptacles for the collection of waste, recyclables, or compostable materials and contracts for the removal by a single local provider.[16] This waste management system allows a greater opportunity for participation from airport tenants who may not be incentivized to recycle on their own. The centralized system is advantageous in that is has less players involved in the overall management of the solid waste and recycling efforts, and allows greater control by the city over the type, placement, and maintenance of dumpsters, thereby saving space and eliminating the need for each tenant to have their own containers. A centralized strategy can be inefficient for some airports as it requires more effort and oversight on the part of airport management. However, this waste management system streamlines MSW and recycling collection, maximizes the opportunity to reduce waste generation, and increases diversion of recyclables.

- **Decentralized waste management system.** A decentralized waste management system happens when an airport provides waste containers and contracts for the hauling of waste materials in airport-operated spaces only. However, airport tenants, such as fixed-base operators, retail shops, and other tenants manage the waste from their leased spaces with separate contracts, billing, and hauling schedules. A decentralized waste management system can increase both the number of receptacles on airport property and the number of trips by a waste collection service provider, should the collection schedule for the tenant differ from the airport.

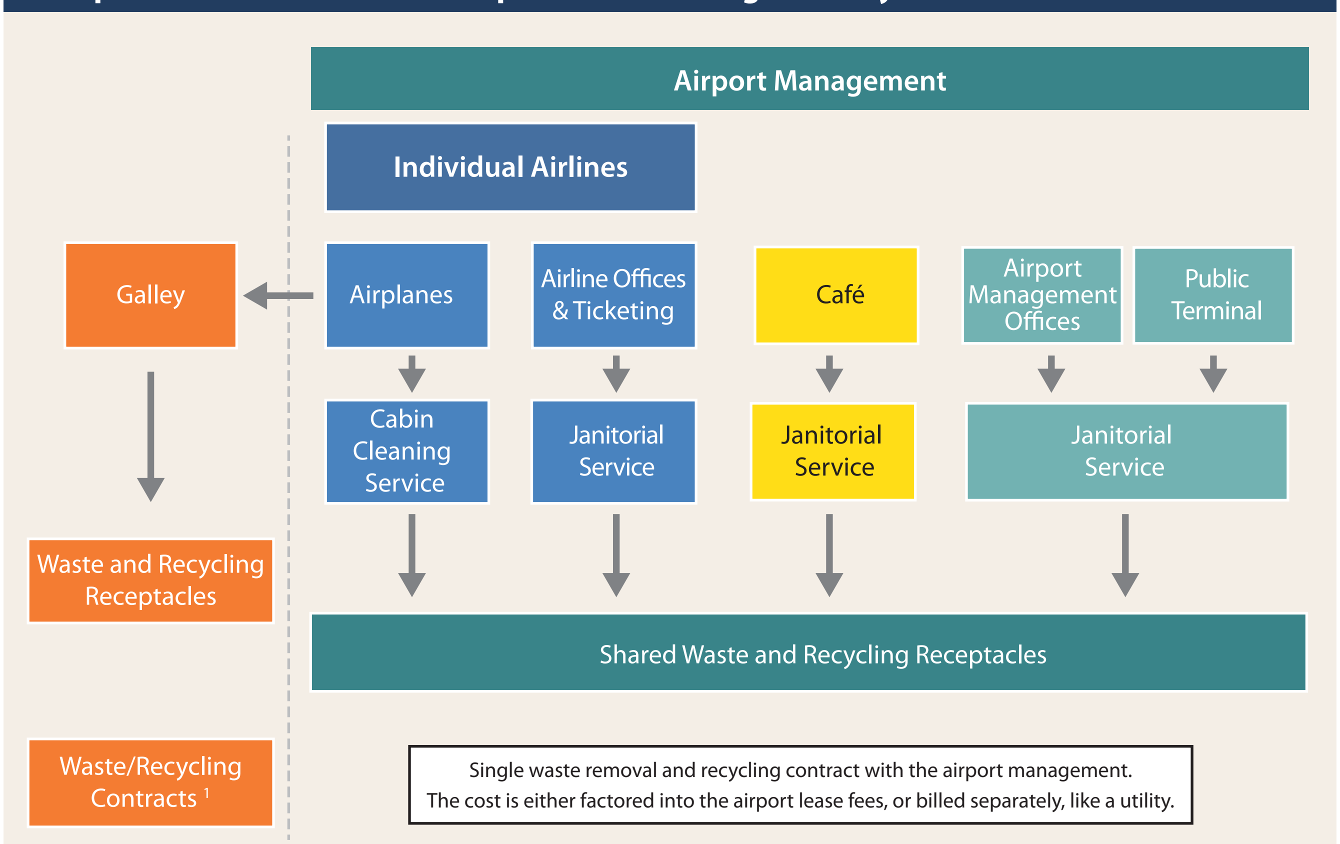
Currently, the airport participates in a centralized waste management system since the city provides waste and recycling dumpsters that are available for use by airport tenants. Manhattan city staff and the airport should continue to actively engage tenants to maximize recycling efforts and reduce MSW.

[16] *Airport Waste Management and Recycling Practices* (2018) The National Academies of Sciences, Engineering, and Medicine Airport Cooperative Research Program, Synthesis 92.

Components of a Decentralized Airport Waste Management System



Components of a Centralized Airport Waste Management System



[1] Galleys usually manage their own waste even if an airport relies on a centralized system

Source: Natural Resources Defense Council, Trash Landings: How Airlines and Airports Can Clean Up Their Recycling Programs, December 2006.

SOLID WASTE AND RECYCLING GOALS

While the airport may or may not expand the existing waste management system with additional landside recycle dumpsters in additional airport locations, there are other opportunities for improvement. **Table 5G** outlines objectives that could help reduce waste generation and increase recycling efforts at MHK. To increase the effectiveness of the recycling program, establishing a baseline of recycled materials and tracking the progress over time will help the airport determine what recycling efforts are successful.

TABLE 5G
Recommended Waste Management and Recycling Goals
Manhattan Regional Airport – Riley County, KS

Goals	Objectives
Reduce the amount of solid waste generated	Switch to an online bill pay system to eliminate monthly paper bills
	Conduct a waste audit to identify the most common types of waste
	Eliminate the purchase of items that are not recyclable (i.e., Styrofoam, plastic bags)
	Make electronic files, not paper files, when possible
	Set copiers and printers to print on both sides of paper by default
	Reduce the amount of "junk mail" received
Reuse of materials or equipment	Use grass clippings as mulch
	Offer reusable dishes to employees
	Cardboard boxes for shipping and storage
Increase the amount of material recycled	Improve waste tracking and data management
	Incorporate recycling requirements and/or recommendations into tenant lease agreements
	Expand recycling marketing and promotion efforts throughout public areas
	Require contractors to implement strategies to reduce, reuse, and recycle construction and demolition waste

Source: *Coffman Associates, Inc.*

Chapter Six

CAPITAL PROGRAM

CHAPTER SIX

Capital Program

This chapter presents the description of the airport capital program and the resulting financial projections for the Manhattan Regional Airport (MHK). The capital program is developed under the assumption that various demand-based indicators, such as annual operations, annual passenger enplanements, and based aircraft grow in-line with the aviation demand forecast presented in the MHK Master Plan Chapter 2.

MHK is operated by the City of Manhattan, Kansas (City). The daily management of MHK is overseen by the Airport Director who also serves as a liaison to the Airport Advisory Board. The City makes appointments to more than twenty advisory boards and committees, including the Airport Advisory Board. The primary purpose of the Airport Advisory Board is to recommend policies regarding MHK to the City Commission. In addition, the Airport Advisory Board prepares an annual written report to the City Commission; aids the City in developing community awareness of airport operations; and aids and advises the City Commission and the Airport Director regarding planning, capital improvements, and negotiation of major contracts. The operations of MHK generate revenues from airport users to fund operating expenses and debt service requirements. Capital projects are funded through the receipt of Airport Improvement Program (AIP) grants, internally generated funds, the collection of Passenger Facility Charges (PFCs), and the periodic issuance of general obligation bonds (GO Bonds).

The City's Fiscal Year ends December 31 (CY). Since the City had not yet completed the CY 2019 audit, the CY 2019 numbers reflect unaudited amounts as of December 31, 2019. The CY 2020 numbers reflect the City's 2020 budget (CY 2020 Budget). All of the tables prepared for the financial analysis are included at the end of this chapter.

ACTIVITY FORECAST

Table 6A presents the activity forecast used to develop the financial plan. The enplanement and operations forecast for CY 2024 through CY 2038 reflect the growth rates included in MHK's Master Plan Chapter 2, **Table 2W**. Since the activity forecast was prepared, the COVID-19 pandemic occurred resulting in the imposition of travel restrictions that have severely impacted the aviation industry, including MHK. As a result, CY 2019 through CY 2023 enplanements have been re-forecasted as follows:

- CY 2019 reflect actual amounts.
- CY 2020 amounts have been decreased by 50% based on the International Air Transport Association's (IATA) prediction as of May 2020.
- Enplanements are forecast to recover to CY 2019 levels by CY 2023, per IATA's prediction as of May 2020.
- CY 2024 through CY 2038 are re-forecast using the annual growth rates included in **Table 2W.**

TABLE 6A
Activity Forecast (in 000s)
Manhattan Regional Airport

Calendar	Enplanements				Operations		Landed Weight	
Year	Per Table 2W	Growth Rates	Reforecast (a)	% Change	Per Table 2W	Growth Rates	Forecast (b)	% Change
2019			77,553	--			101,577	--
2020			38,800	-50.0%			50,800	-50.0%
2021			54,200	39.7%			64,000	26.0%
2022			65,900	21.6%			80,600	25.9%
2023	79,100	1.6%	79,100	20.0%	39,0269	0.6%	101,600	26.1%
2024			81,747	3.3%			102,991	1.4%
2025			84,482	3.3%			104,401	1.4%
2026			87,309	3.3%			105,831	1.4%
2027			90,231	3.3%			107,280	1.4%
2028	93,250	3.3%	93,250	3.3%	41,775	1.4%	108,748	1.7%
2029			95,495	2.4%			109,924	1.1%
2030			97,795	2.4%			111,113	1.1%
2031			100,150	2.4%			112,314	1.1%
2032			102,561	2.4%			113,528	1.1%
2033			105,031	2.4%			114,756	1.1%
2034			107,560	2.4%			115,997	1.1%
2035			110,150	2.4%			117,251	1.1%
2036			112,802	2.4%			118,519	1.1%
2037			115,518	2.4%			119,800	1.1%
2038	118,300	2.4%	118,300	2.4%	46,518	1.1%	121,095	1.1%
CAGR (2018-2038)	2.43%		2.61%		0.72%		1.54%	

(a) 2018 and 2019 reflect actual results. 2020 is estimated to decrease 50 percent with recovery to 2019 levels by 2023 per IATA as of May 2020.
(b) 2018 and 2019 reflect actual results. 2020 is estimated to decrease 50 percent with recovery to 2019 levels by 2023 per IATA. Remaining years are forecast with growth in operations.
Sources: MHK, historical records; Coffman Associates, Table 2W; DKMG Consulting, reforecast

CY 2020 through CY 2023 landed weights are forecast in the same manner as enplanements. Since landed weight is not forecast in **Table 2W** and is necessary to calculate the landing fee for the financial forecast, the CY 2024 through CY 2038 landed weights are assumed to grow with the growth in operations shown in **Table 2W**.

CAPITAL PROGRAM AND FUNDING SOURCES

All airports receiving federal AIP funding are required to maintain a current capital improvement program with the Federal Aviation Administration (FAA), which identifies projects to be undertaken at an airport over a specified period of time. MHK's capital improvement program (CIP) includes the projects recommended in **Chapter 5 - Recommended Development Concepts** from FY 2021 through FY 2038.

Exhibit 6A presents the recommended CIP and its corresponding cost estimates, which are based on a planning level of detail. **Exhibit 6B** depicts the improvement staged by proposed timeline. While accurate for master planning purposes, actual project costs will likely vary from these planning estimates once project design and engineering estimates are developed. The cost estimates, including contingencies, design costs and construction management costs, presented in the table are presented in 2020 dollars and inflated dollars equal to 3 percent annually reflecting the most recent five-year average of Engineering News-Record's Construction Cost Index. As shown in the exhibit, the CIP is estimated to cost approximately $100.5 million in 2020 dollars and $114.5 million in inflated dollars. **Table 6B** presents the CIP's estimated funding sources by year, which are described in the following subsections.

TABLE 6B
Annual Funding Sources of the CIP (in 000s)
Manhattan Regional Airport

Year	Project Costs		Funding Sources					
			AIP Grants		Third Party	Local		Total Funding Sources
	2020 $	Inflated (a)	Entitlements	Discretionary		Pay-Go PFCs	City General Fund	
2021	$3,400.0	$3,400.00	$3,060.0	$0.0	$0.0	$0.0	$340.0	$3,400.0
2022	18,120.2	18,120.20	1,671.8	13,076.3	0.0	0.0	3,372.0	18,120.2
2023	18,120.2	18,120.20	823.7	13,924.5	0.0	0.0	3,372.0	18,120.2
2024	1,240.1	1,240.10	945.4	170.7	0.0	0.0	124.0	1,240.1
2025	12,401.4	12,401.40	2,192.8	8,968.5	0.0	0.0	1,240.1	12,401.4
2026	1,100.0	1,100.00	990.0	0.0	0.0	0.0	110.0	1,100.0
Total Short Term (2021-2026)	**$54,381.90**	**$54,381.90**	**$9,683.70**	**$36,140.00**	**$0.0**	**$0**	**$8,558.2**	**$54,381.9**
Total Long Term (2027-2038)	**$46,070.0**	**$60,111.0**	**$14,273.0**	**$18,901.0**	**$15,057.1**	**$3,914.3**	**$7,965.6**	**$60,111.0**
Total CIP	**$100,451.9**	**$114,492.9**	**$23,956.7**	**$55,041.0**	**$15,057.1**	**$3,914.3**	**$16,523.8**	**$114,492.9**
	$82,117.70							

(a) Beginning in the intermediate term, project costs were inflated at 3 percent, which reflects the most recent five-year average of Engineering News-Record's Construction Cost Index.
Source: Coffman Associates, project costs

	CAPITAL IMPROVEMENT PROGRAM FOR MHK	FAA ELIGIBLE	LOCAL SHARE	TOTAL COST
SHORT TERM PROJECTS				
2021	Engineering Design/Bidding for Runway 3/21	$3,060,000	$340,000	$3,400,000
2022	Runway 3/21 Reconstruction/Rubblization (150' width) & Taxiway D Removal - Phase 1	14,748,180	3,372,020	18,120,200
2023	Runway 3/21 Reconstruction/Rubblization (150' width) & Taxiway D Removal - Phase 2	14,748,180	3,372,020	18,120,200
2024	Engineering Design/Bidding for Taxiway A	1,116,090	124,010	1,240,100
2025	Taxiway A Reconstruction & Lighting (A1 to A5)	11,161,260	1,240,140	12,401,400
2026	Construct New Taxiway D	990,000	110,000	1,100,000
SHORT TERM PROJECTS TOTAL		**$45,823,710**	**$8,558,190**	**$54,381,900**
LONG TERM PROJECTS				
1	Acquire Snow Removal Equipment	$1,350,000.00	$150,000.00	$1,500,000
2	ARFF Truck	1,080,000	120,000	1,200,000
3	Jet Bridge Replacement	1,170,000	130,000	1,300,000
4	2nd Baggage Carousel / Expansion	450,000	50,000	500,000
5	Construct GA Ramp Expansion Phase 1 (South) with Connector Taxiway from A	1,701,000	189,000	1,890,000
6	Construct GA Ramp Expansion Phase 2 (North) with Connector Taxiway from A	1,647,000	183,000	1,830,000
7	Construct Standard T-Hangar #106	0	1,500,000	1,500,000
8	Rehabilitate 3 T-Hangars #13, #14 & #16 (2-8 Place T-Hangars & 1-7 Place T-Hangar)	0	1,600,000	1,600,000
9	Construct 2 Large Box Hangars #102 & #103 (70' deep x 150' wide)"	0	5,230,000	5,230,000
10	Construct Small Box Hangars #101	0	890,000	890,000
11	Construct Small Box Hangar #104	0	570,000	570,000
12	Construct 5-Bay Box Hangar #107	0	1,750,000	1,750,000
13	ATCT Equipment (Voice Switch, Recorder, etc.)	180,000	20,000	200,000
14	ATCT Building Improvements & Repair	90,000	10,000	100,000
15	Emergency Generator Replacement	360,000	40,000	400,000
16	Security Upgrades	0	700,000	700,000
17	Replace Lights on Runway 13/31	396,000	44,000	440,000
18	Approach Lighting (PAPI, REILs) on Runway 13/31	594,000	66,000	660,000
19	Land & Easement Acquisition and Obstruction Removal for RWY 3 Extension & RWY 13 RPZ, including EA	882,000	98,000	980,000
20	1,000' Extension to Runway 3/21 (South) & Taxiway A, including Lights, Navaids & Wildcat Road Relocation	14,400,000	1,600,000	16,000,000
21	GA Apron & Taxiway E Major Rehabilitation (PCI Report APB, APC-001 & TLE2-001)	3,825,000	425,000	4,250,000
22	Hangar Taxiway E Major Rehabilitation (PCI Report TLD-001 AND TLE-001)	468,000	52,000	520,000
23	Concrete general pavement maintenance	1,665,000	185,000	1,850,000
24	Asphalt general pavement maintenance	189,000	21,000	210,000
LONG TERM PROJECTS TOTAL		**$30,447,000**	**$15,623,000**	**$46,070,000**
TOTAL CIP PROGRAM COSTS		**$76,270,710**	**$24,181,190**	**$100,451,900**

Exhibit 6A
CAPITAL IMPROVEMENT PROGRAM

DECLARED DISTANCES

	RUNWAY 3	RUNWAY 21
TORA	8,030′	8,400′
TODA	8,030′	8,400′
ASDA	8,000′	8,400′
LDA	8,000′	8,030′

TODA - Takeoff Distance Available
TORA - Takeoff Run Available
ASDA - Accelerate/Stop Distance Available
LDA - Landing Distance Available

SHORT TERM PROJECTS

1. Engineering Design/Bidding for Runway 3/21
2. Runway 3/21 Reconstruction/Rubblization (150' width) & Taxiway D Removal - Phase 1
3. Runway 3/21 Reconstruction/Rubblization (150' width) & Taxiway D Removal - Phase 2
4. Engineering Design/Bidding for Taxiway A
5. Taxiway A Reconstruction & Lighting (A1 to A5)
6. Construct New Taxiway D

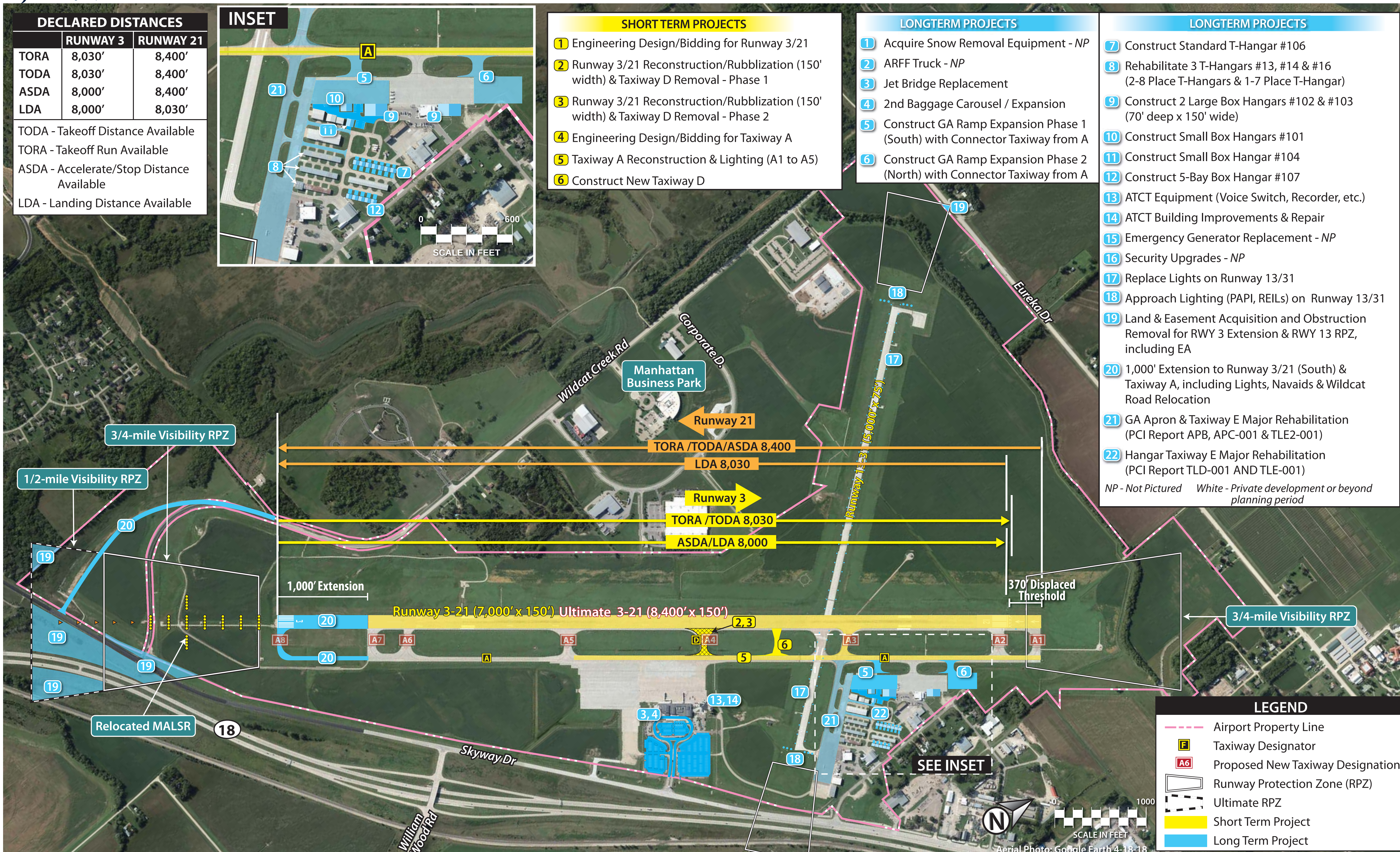
LONGTERM PROJECTS

1. Acquire Snow Removal Equipment - *NP*
2. ARFF Truck - *NP*
3. Jet Bridge Replacement
4. 2nd Baggage Carousel / Expansion
5. Construct GA Ramp Expansion Phase 1 (South) with Connector Taxiway from A
6. Construct GA Ramp Expansion Phase 2 (North) with Connector Taxiway from A

LONGTERM PROJECTS

7. Construct Standard T-Hangar #106
8. Rehabilitate 3 T-Hangars #13, #14 & #16 (2-8 Place T-Hangars & 1-7 Place T-Hangar)
9. Construct 2 Large Box Hangars #102 & #103 (70' deep x 150' wide)
10. Construct Small Box Hangars #101
11. Construct Small Box Hangar #104
12. Construct 5-Bay Box Hangar #107
13. ATCT Equipment (Voice Switch, Recorder, etc.)
14. ATCT Building Improvements & Repair
15. Emergency Generator Replacement - *NP*
16. Security Upgrades - *NP*
17. Replace Lights on Runway 13/31
18. Approach Lighting (PAPI, REILs) on Runway 13/31
19. Land & Easement Acquisition and Obstruction Removal for RWY 3 Extension & RWY 13 RPZ, including EA
20. 1,000' Extension to Runway 3/21 (South) & Taxiway A, including Lights, Navaids & Wildcat Road Relocation
21. GA Apron & Taxiway E Major Rehabilitation (PCI Report APB, APC-001 & TLE2-001)
22. Hangar Taxiway E Major Rehabilitation (PCI Report TLD-001 AND TLE-001)

NP - Not Pictured *White - Private development or beyond planning period*



LEGEND

- Airport Property Line
- Taxiway Designator
- Proposed New Taxiway Designation
- Runway Protection Zone (RPZ)
- Ultimate RPZ
- Short Term Project
- Long Term Project

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AIP GRANTS

Grants administered by the FAA through the AIP are a critical capital funding source to implement the projects recommended in the short-term CIP. Passenger entitlement grants are allocated to airports by a formula based on enplanements, cargo entitlement grants are allocated based on historical landed weight market share, and discretionary grants are allocated in accordance with FAA guidelines. FAA grants are subject to annual Congressional appropriation. The AIP expires periodically, and federal reauthorization is required to continue. In October 2018, Congress passed a five-year reauthorization bill for the FAA — the FAA Reauthorization Act of 2018. In April 2020, Congress passed the Coronavirus Aid, Relief, and Economic Security Act (CARES Act) in response to the COVID-19 pandemic, which provided additional grants to airports. The FAA allocated $2.1 million in CARES Act funds to MHK. At this time, MHK intends on using these funds for operating expenses and, therefore, those funds are not assumed as a funding source of the CIP.

The U.S. DOT classifies MHK as a non-hub airport. Therefore, the AIP formula stipulates that MHK is entitled to receive 90 percent in federal funding for AIP-eligible projects. AIP funds can be used for most improvement needs, but not operating costs. However, AIP funds are typically not available for revenue-generating projects, so for the purpose of this analysis, AIP funds are not assumed for revenue-generating projects.

As shown in **Exhibit 6A**, approximately $79.0 million in AIP grants ($24.0 million in passenger entitlement grants and $55.0 million in discretionary grants) is forecast to be available to fund the CIP projects from CY 2021 through CY 2038. The application of entitlement and discretionary grants by year are presented in **Table 6C** and are described in greater detail in the following subsections.

TABLE 6C
Application of AIP Grants (in 000s)
Manhattan Regional Airport

	Source Table	2021	2022	2023	2024	2025	2026	2027 – 2038	Total
Available Grants									
Entitlement	6D	$1,066.6	$605.3	$823.7	$945.4	$1,082.6	$1,110.2	$15,263.0	$20,896.7
Discretionary		0.0	13,076.3	13,924.5	170.7	8,968.5	0.0	18,901.0	55,041.0
Total available grants		**$1,066.6**	**$13,681.6**	**$14,748.2**	**$1,116.1**	**$10,051.1**	**$1,110.2**	**$34,164.0**	**$75,937.7**
Beginning balance (a)		$3,060.0	$1,066.60	$0.0	$0.0	$0.0	($1,110.2)	($990.0)	$3,060.0
Plus: available grants		$1,066.6	$13,681.6	$14,748.2	$1,116.1	$10,051.1	$1,110.2	$34,164.0	$75,937.7
Less: eligible portion of CIP									
Entitlements	6B	($3,060.0)	($1,671.8)	($823.7)	($945.4)	($2,192.8)	($990.0)	($14,273.0)	($23,956.7)
Discretionary	6B	$0.0	($13,076.3)	($13,924.5)	($170.7)	($8,968.5)	$0.0	($18,901.0)	($55,041.0)
Ending balance		$1,066.6	$0.0	$0.0	$0.0	($1,110.2)	($990.0)	$0.0	$0.0

(a) Beginning balance is equal to the design of Runway 3/21, which is assumed to be funded with 2019 and 2020 entitlements.
(a) In April 2020, the FAA allocated $2.1 million in CARES Act funds to MHK. At this time, MHK intends to use these funds for operating expenses, and therefore, they are not assumed as a funding source for the CIP.

Entitlement Grants

Entitlement funds are distributed through grants by a formula based on the number of enplanements at individual airports and the amount of landed weight of arriving cargo at individual airports for the most recent federal fiscal year. In cases where entitlement funds are not used during the current federal fiscal year, these funds are redistributed to other airport sponsors as discretionary funds in the next federal fiscal year. **Table 6D** presents MHK's AIP passenger entitlement calculation. As shown in the table, it is estimated that MHK will receive approximately $20.9 million in passenger entitlement AIP grants from CY 2021 through CY 2038.

Federal entitlements apportioned to MHK in 2019 and 2020 in the amount of $3.1 million are being used to fund the design of Runway 3/21, which is reflected in the beginning balance on **Table 6C**. As a result, a total of $24.0 million in entitlement funds are assumed to fund the CIP.

TABLE 6D
Calculation of AIP Entitlements (in 000s)
Manhattan Regional Airport

	2019	2020	2021	2022	2023	2024	2025	2026	2027-2038
Enplanements for Entitlement	77.6	38.8	54.2	65.9	79.1	81.7	84.5	87.3	
FAA Formula (a)									
$7.80 for 1st 50,000 Enplanements	$390.0	$302.6	$390.0	$390.0	$390.0	$390.0	$390.0	$390.0	
$5.20 for next 50,000 Enplanements	143.3	0.0	21.8	82.7	151.3	165.1	179.3	194.0	
$2.60 for next 400,000 Enplanements	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
$0.65 for next 500,000 Enplanements	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
$0.50 for the remaining Enplanements	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Calculated Entitlements	**$533.3**	**$302.6**	**$411.8**	**$472.7**	**$541.3**	**$555.1**	**$569.3**	**$584.0**	
Total Calculated Entitlements x 2 (b)	**$1,066.6**	**$605.3**	**$823.7**	**$945.4**	**$1,082.6**	**$1,110.2**	**$1,138.6**	**$1,168.0**	
2 Year Lag in Receipt of Grants (c)			**$1,066.6**	**$605.3**	**$823.7**	**$945.4**	**$1,082.6**	**$1,110.2**	**$15,263.0**
Cumulative AIP Entitlement Grants			**$1,066.6**	**$1,671.8**	**$2,495.5**	**$3,440.9**	**$4,523.5**	**$5,633.7**	**$20,896.7**

(a) The FAA formula is defined in 49 United States Code § 47114.
(b) In any fiscal year in which the total amount available under 49 United States Code § 48103 is $3.2 billion or more, the amount apportioned to a sponsor shall be increased by doubling the amount that would otherwise be apportioned.
(c) A two-year lag is assumed to reflect the time needed to compile annual enplanement data and complete the grant application and approval process.

Discretionary Grants

At the beginning of each federal fiscal year, the FAA sets aside the amount of discretionary funds to cover the Letter of Intent (LOI) payment schedules. The total discretionary funds in all LOIs subject to future obligation are limited to approximately 50 percent of the forecast discretionary funds available for that purpose. The authorizing statute directs the FAA to allocate certain discretionary funding to specific airport types and set aside categories such as noise, reliever airports, military airport program and projects relating to capacity, safety, security, and noise. The FAA has some discretion in funding specific projects within these discretionary funding set-aside categories. The FAA approves discretionary funds for use on specific projects, after consideration of project priority and other selection criteria.

As shown on **Exhibit 6A**, the City estimates it will receive discretionary grants in the amount of $36.1 million to fund the shortfall in entitlement funds for the short-term CIP. An additional $18.9 million in discretionary grants is assumed to fund projects in the long-term CIP for a total of $55.0 million in discretionary funding.

THIRD PARTY FUNDS

Many airports use third party funding when the planned improvements will primarily be used by a private business or other organization. Such projects are not ordinarily eligible for federal funding. Projects of this kind typically include hangars, fixed based operator facilities, fuel storage, exclusive air-craft parking aprons, industrial aviation use facilities, non-aviation office/commercial/industrial developments, and other similar projects. Private development proposals are considered on a case-by-case basis. Often, airport funds for infrastructure, preliminary site work, and site access are required to facilitate privately developed projects on airport property. As shown in **Exhibit 6A**, the CIP anticipates third party funding of approximately $15.1 million for several hangar construction projects, including T-hangars, large box hangars, and small box hangars.

LOCAL FUNDS

As shown in **Exhibit 6A**, the City has approximately $88.1 million in grant eligible projects in the CIP but only approximately $79.0 million available in AIP passenger entitlements and discretionary funds. This $9.1 million shortfall, as well as the local match and non-eligible portions of the CIP, will need to be recovered through other funding sources such as PFCs and City funds. These funding sources are discussed in greater detail in the following subsections.

Passenger Facility Charges

As shown in **Exhibit 6A**, approximately $3.9 million in PFCs are available to fund the CIP from CY 2021 through CY 2038. PFCs are authorized by Title 14 of the Code of Federal Regulations, Part 158 and are administered by the FAA. PFCs collected from qualified enplaned passengers are used to fund eligible projects. An airport operator can impose a PFC of $1, $2, $3, $4 or $4.50 per eligible, enplaned passenger. Once a PFC is imposed, it is included as part of the ticket price paid by passengers enplaning at the airport, collected by the airlines, and remitted to the airport operator, less an allowance for airline processing expenses. The PFC legislation stipulates that if a medium to large hub airport institutes a PFC of $1, $2, or $3, they must forego 50 percent of their AIP entitlement funds. This increases to 75 percent if they charge a $4 or $4.50 PFC. Since MHK is designated by the FAA as a non-hub airport, it does not have to forego any of its annual AIP entitlement funds.

Projects that are eligible for PFC funding include those that preserve or enhance the capacity, safety, or security of the air transportation system; reduce noise or mitigate noise effects; or furnish opportunities for enhanced competition between or among air carriers. PFCs cannot be used for revenue-generating facilities at airports, such as restaurants and other concession space, rental car facilities, public parking facilities, or construction of exclusively leased space or facilities.

MHK currently has one open PFC application, PFC App# 2014-04-C, to collect a $4.50 per enplaned passenger fee for a total approval amount of $2,972,696, expiring on May 1, 2025. PFC App# 2014-04-C is approved to fund the eligible portion of the debt service associated with the Series 2017B GO Bonds issued by the City to fund phase one of the terminal expansion. The City is currently in the process of preparing an additional PFC application to be submitted to the FAA by the end of 2020 to fund the eligible portion of the debt service associated with the Series 2019B GO Bonds issued to fund phase two of the terminal expansion.

Table 6E presents the PFC calculation for MHK, as well as the annual funding plan for these revenues. As shown in the table, approximately $7.4 million in PFCs are estimated to be collected from CY 2020 through CY 2038. Approximately $2.6 million of this PFC revenue is committed to the open PFC application and $815,900 to the 2020 anticipated PFC application. The remaining $3.9 million is applied to eligible projects in the CIP on a pay-go basis.

TABLE 6E
Application of PFCs (in 000s)
Manhattan Regional Airport

	Source Table	2020	2021	2022	2023	2024	2025	2026	2027 - 2038	Total 2020 - 2038
Enplanements		38.8	54.2	65.9	79.1	81.7	84.5	87.3		
% of enpl revenue producing		96.2%	96.2%	96.2%	96.2%	96.2%	96.2%	96.2%		
Enplanements for PFC		37.3	52.1	63.4	76.1	78.7	81.3	84.0		
$4.50 per Enplanement (a)		$4.39	$4.39	$4.39	$4.39	$4.39	$4.39	$4.39		
Total PFC Revenue		**$163.9**	**$228.9**	**$278.4**	**$334.1**	**$345.3**	**$356.8**	**$368.8**	**$5,275.0**	**$7,351.3**
Beginning Balance		$0.0	($33.5)	($2.1)	$77.8	$215.9	$364.4	$523.7	$694.5	$0.0
PFC revenue		$163.9	$228.9	$278.4	$334.1	$345.3	$356.8	$368.8	$5,275.0	$7,351.3
Less: PFC eligible debt service										
Series 2017B Bonds	6F	($142.6)	($143.6)	($144.4)	($141.8)	($142.5)	($143.2)	($143.7)	($1,576.7)	($2,578.6)
Series 2019B Bonds	6F	($54.8)	($53.9)	($54.1)	($54.2)	($54.3)	($54.3)	($54.3)	($436.0)	($815.9)
Less: future PFC application for CIP	6B	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	($3,914.3)	($3,914.3)
Ending Balance		**($33.5)**	**($2.1)**	**$77.8**	**$215.9**	**$364.4**	**$523.7**	**$694.5**	**$42.4**	**$42.4**

The PFC formula is defined in 49 United States § 40117. PFC of $4.50 less airline collection fee of $0.11.

City Funds

MHK generates revenue through airline revenue, fuel flowage fees, rental cars, hangar rentals, land leases, and other revenues. These revenues are used to cover operating expenses and debt service obligations at MHK. As shown on **Exhibit 6A**, approximately $10.7 million in City funds are required to fund the remainder of the CIP.

FINANCIAL FEASIBILITY

This section of the financial analysis presents the projected operating expenses, debt service, and revenues resulting from the daily operation of MHK. In addition, the funding of the CIP is layered into the projections to determine if it is feasible for the City to undertake the described program within the planning period.

GENERAL OBLIGATION DEBT SERVICE

The City issues GO Bonds to help fund certain projects at MHK. **Table 6F** presents the debt service associated with the outstanding GO Bonds issued for MHK. As shown in the table, annual outstanding GO Bond debt service increases from approximately $526,500 in CY 2019 to $605,700 in CY 2026. As previously mentioned, a portion of the Series 2017B Bonds and the Series 2019B Bonds are PFC-eligible. This analysis does not assume the issuance of future GO Bonds to fund the CIP. However, they may be an available financing vehicle if the City cannot fund the CIP on a pay-go basis.

TABLE 6F
Outstanding GO Bond Debt Service (in 000s)
Manhattan Regional Airport

Issuance	2019	2020	2021	2022	2023	2024	2025	2026	2027 - 2038
Series 209	$42.2	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Series 212	40.1	40.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Series 213	27.7	26.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Series 2010	86.4	83.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Series 2016	24.3	23.9	23.5	23.1	22.7	22.1	26.5	25.8	0.0
Series 2017B&C									
Terminal Building Phase 1	209.2	210.8	212.2	213.4	209.5	210.6	211.6	212.4	2,329.7
FBO Facility	59.0	58.4	62.8	62.0	61.3	60.5	59.8	59.0	729.7
Series 2019B									
Terminal Building Phase 2	33.9	279.1	274.7	275.6	276.2	276.6	276.8	276.7	2,221.5
Rental car	3.7	29.7	29.3	28.8	28.4	27.9	32.4	31.8	245.1
Total outstanding debt service	**$526.5**	**$751.7**	**$602.4**	**$602.9**	**$598.0**	**$597.7**	**$607.0**	**$605.7**	**$5,526.0**
PFC Eligible (a)									
Series 2017B Terminal Building Phase 1	$141.6	$142.6	$143.6	$144.4	$141.8	$142.5	$143.2	$143.7	$1,576.7
Series 2019B Terminal Building Phase 2	6.7	54.8	53.9	54.1	54.2	54.3	54.3	54.3	436.0
Total PFC-eligible debt service	**$148.2**	**$197.4**	**$197.5**	**$198.5**	**$196.0**	**$196.8**	**$197.5**	**$198.0**	**$2,012.8**

(a) According to PFC App # 2014-04-C, the Series 2017B Bond debt service is 67.7% PFC eligible. MHK intends on submitting a new application in 2020 to fund the PFC-eligible portion of the Series 2019B Bonds, which is 19.6%.
Source: MHK historical records

OPERATING EXPENSES

Operating expenses at MHK include personnel services, contractual services, commodities, and equipment operating expenses for both the administration and operations divisions. Interest expense and financing costs are reported as non-operating expenses. The CY 2019 operating expenses reflect unaudited amounts as of December 31, 2019 and the CY 2020 operating expenses reflect the CY 2020 Budget. **Table 6G** presents operating expenses by line item for CY 2019 through CY 2038.

TABLE 6G
Operating Expense Projections (in 000s)
Manhattan Regional Airport

			Short Term						Long Term
	Unaudited	Budget	Forecast						2027 -
	2019	2020	2021	2022	2023	2024	2025	2026	2038
Administration Division									
Personnel services	$183.6	$199.3	$202.2	$205.2	$208.3	$211.4	$214.6	$217.8	$2,883.5
Contractual services	95.9	111.3	113.1	114.8	116.5	118.2	120.0	121.8	1,607.0
Commodities	2.9	2.4	2.4	2.4	2.4	2.4	2.4	2.4	28.8
Equipment	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal	**$283.2**	**$312.9**	**$317.7**	**$322.4**	**$327.2**	**$332.0**	**$337.0**	**$342.0**	**$4,519.3**
Operations Division									
Personnel services	$608.2	$619.1	$628.4	$637.8	$647.4	$657.1	$667.0	$677.0	$8,961.9
Contractual services	372.3	395.7	401.6	407.5	413.5	419.5	425.7	432.0	5,708.7
Commodities	140.9	128.7	130.7	132.7	134.7	136.7	138.7	140.7	1,859.4
Lease Purchase	18.3	26.8	27.2	27.6	28.0	28.4	28.8	29.2	387.1
Equipment	34.1	19.5	19.8	20.1	20.4	20.7	21.0	21.3	280.5
Capital Outlay	0.0	17.5	17.8	18.1	18.4	18.7	19.0	19.3	255.0
Other charges	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.2
Subtotal	**$1,173.9**	**$1,207.4**	**$1,225.6**	**$1,243.9**	**$1,262.5**	**$1,281.2**	**$1,300.3**	**$1,319.6**	**$17,453.8**
Total operating expenses	**$1,457.1**	**$1,520.2**	**$1,543.3**	**$1,566.3**	**$1,589.7**	**$1,613.2**	**$1,637.3**	**$1,661.6**	**$21,973.1**
Percent change		**4.3%**	**1.5%**	**1.5%**	**1.5%**	**1.5%**	**1.5%**	**1.5%**	
CAGR (2020 - 2026)								**1.5%**	

Sources: MHK, FY 2019 – FY 2020
DKMG, FY 2021 – FY 2038

As shown in the table, operating expenses are budgeted to be approximately $1.5 million in CY 2020 and are forecast to increase to approximately $1.7 million in CY 2026, reflecting a CAGR of 1.5 percent from CY 2020 through CY 2026. Operating expenses are projected based on a review of historical trends and the anticipated effects of inflation assumed at 1.5 percent annually, reflecting the most recent 10-year average of the Midwest Consumer Price Index (CPI).

OPERATING REVENUES

A major portion of operating revenues at MHK are derived from non-airline and airline sources. Non-airline revenues accounted for 85.9 percent of MHK's revenues in CY 2019 and include parking, rental car revenues, terminal concessions, FBO fees, land rents, facility rentals, cargo rentals, and other operating revenues. **Table 6H** presents the primary non-airline tenants at MHK.

TABLE 6H Primary Non-Airline Tenants Manhattan Regional Airport				
Location	**Description**	**Basic Rental**	**2020 Rates**	**Annual**
Advertising	Terminal Wall Space	Monthly	$200.00	$2,400.00
Advertising	Terminal Monitors – per image	Monthly	$200.00	$2,400.00
Farmland	Inside & outside of fence	Bi-Annual	$17,664.50	$35,329.00
Fuel Farm	Self Serve	Monthly	$18.06	$216.72
Fuel Farm	FBO Tanks	Monthly	$10.67	$128.04
Land	Private Hangar	Annual	$900.00	$900.00
Land	Private Hangar	Annual	$900.00	$900.00
Land	Private Hangar	Annual	$540.00	$540.00
Office	FAA Space	Monthly	$385.00	$4,620.00
Office	Flex Air, Inc (Charles Copeland)	Monthly	$135.00	$1,620.00
Stone Hangar	Heartland Aviation	Monthly	$1,349.46	$16,193.52
Terminal	Enterprise	Monthly	$2,200.00	$26,400.00
Terminal	Hertz	Monthly	$750.00	$9,000.00
Terminal	Five-Star Vending	Monthly	% of rev	
Terminal	Bandit Coffee & Café	Monthly	$700.00	$8,400.00
Storage Space	Heartland Aviation	Monthly	$15.00	$180.00
Office	General Services Administration (TSA)	Monthly	$1,810.26	$21,723.12
Office	Kansas Jet Center - FBO	Monthly	$5,400.00	$64,800.00

Airline revenues accounted for 14.1 percent of MHK's operating revenue in CY 2019 and include revenues generated from American Eagle through airline landing fees, terminal rentals, and deicing fees. In November 2017, the City instituted ordinance landing fee rates through 2038 with a fixed terminal rental rate. MHK also receives landing fees from charter flights which are included in the non-airline revenues. **Table 6J** presents the airline rates and charges at MHK for CY 2021 through CY 2026.

TABLE 6J
Airline Rates & Charges
Manhattan Regional Airport

	Short Term						Long Term
	Forecast						
	2021	2022	2023	2024	2025	2026	2038
Terminal Rentals							
Airline Space							
Inside office space	750.0	750.0	750.0	750.0	750.0	750.0	
Outside storage	660.0	660.0	660.0	660.0	660.0	660.0	
Airline Terminal Rates							
Inside office space	$21.00	$21.00	$21.00	$21.00	$21.00	$21.00	$21.00
Outside storage	$1.73	$1.73	$1.73	$1.73	$1.73	$1.73	$1.73
Terminal Rentals (in 000s)							
Inside office space	$15.8	$15.8	$15.8	$15.8	$15.8	$15.8	
Outside storage	1.1	1.1	1.1	1.1	1.1	1.1	
Total terminal rentals (in 000s)	$16.9	$16.9	$16.9	$16.9	$16.9	$16.9	
Landing Fees							
Landed weight (in 000s)	64.0	80.6	101.6	103.0	104.4	105.8	
Landing Fee	$0.56	$0.58	$0.60	$0.62	$0.64	$0.66	$0.93
Landing fee revenues (in 000s)	$35.8	$46.7	$61.0	$63.9	$66.8	$69.8	
Deicing fees	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Airline cost per enplanement							
Total airline revenue	$52.7	$63.6	$77.9	$80.7	$83.7	$86.7	
Enplanements	54.2	65.9	79.1	81.7	84.5	87.3	
Airline cost per enplanement	$0.97	$0.97	$0.98	$0.99	$0.99	$0.99	$1.09
Maximum	$1.09						
Minimum	$0.97						

Sources: Airline Agreement, terminal rental rate
November 2017 City ordinance, landing fee rate

The airline cost per enplanement (CPE) is also presented in **Table 6J**. As shown, MHK's CPE is below $1.00 per enplanement during the short-term forecast period. **Table 6K** presents a comparison of MHK's CPE to airports of similar enplanement size. This comparison was developed with information included in the FAA Certification Activity Tracking System data base for 2018, the most recent year for which data was available. As shown in the table, the average CPE is $3.29 for airports of similar enplanement size to MHK, compared to MHK's CY 2018 CPE of $1.87. The average CPE was inflated by the CPI of 1.5% to $3.71 in FY 2026 and $4.43 in FY 2038. While this analysis maintains MHK's existing airline rates and charges structure, the data in this table suggests that there is capacity to increase airline rates and charges to help fund the CIP projects that will be utilized by the airlines.

TABLE 6K
Comparable Airport CPEs
Manhattan Regional Airport

	State	Airport Code	Enplaned Passengers	2018 (a) CPE
Lynchburg Regional	VA	LYH	79,469	$4.16
Easterwood	TX	CLL	76,339	$9.06
Sloulin Fld Intl	ND	ISN	73,795	$2.24
Yakima Air Terminal	WA	YKM	71,796	$2.83
Flagstaff Pulliam	AZ	FLG	70,710	$2.51
Manhattan Regional	KS	MHK	70,705	$1.87
Pago Pago Intl	AS	PPG	70,393	$4.88
Pangborn Memorial	WA	EAT	64,689	$1.50
Salisbury-Ocean City	MD	SBY	64,676	$2.99
Central Nebraska Regional	NE	GRI	63,409	$1.37
Waco Regional	TX	ACT	60,540	$2.78
Average CPE				**$3.29**
Increase with CPI to 2026				**$3.71**
Increase with CPI to 2038				**$4.43**

Sources: Airline Agreement, terminal rental rate
November 2017 City ordinance, landing fee rate

Table 6L presents operating revenues for CY 2019 through CY 2026. As shown, operating revenues are budgeted to be $609,900 in CY 2020 and are forecast to increase to approximately $666,100 in CY 2026, reflecting a CAGR of 1.5 percent from CY 2020 to CY 2026. Operating revenues are projected based on a review of historical trends and the anticipated effects of inflation assumed at 1.0 percent annually. Airline revenues are forecast per the terms detailed in **Table 6J**. Lease revenue generated from new, third party-funded hangars included in the CIP is a potential revenue source. This analysis does not assume the generation of any additional lease revenue from those new hangars.

TABLE 6L
Revenue Projections (in 000s)
Manhattan Regional Airport

	Source Table	Unaudited 2019	Budget 2020	Short Term Forecast 2021	2022	2023	2024	2025	2026	Long Term 2027 - 2038
Services and sales										
City sales tax		$8.8	$6.1	$6.2	$6.3	$6.4	$6.5	$6.6	$6.7	$88.2
County sales tax		2.7	2.0	2.0	2.0	2.0	2.0	2.0	2.0	24.0
Airline landing fees	6J	52.8	45.0	35.8	46.7	61.0	63.9	66.8	69.8	1,093.3
Charters landing fees		12.1	10.0	10.1	10.2	10.3	10.4	10.5	10.6	135.0
Fuel flowage		72.4	73.0	73.7	74.4	75.1	75.9	76.7	77.5	992.7
Other fees		7.6	13.9	14.0	14.1	14.2	14.3	14.4	14.5	184.6
Rental car fees		251.1	230.0	232.3	234.6	236.9	239.3	241.7	244.1	3,126.4
Deicing services										
Airline (a)		26.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FBO		34.8	20.0	20.2	20.4	20.6	20.8	21.0	21.2	270.0
Advertising		6.9	4.8	4.8	4.8	4.8	4.8	4.8	4.8	57.6
Subtotal		$475.4	$404.8	$399.1	$413.5	$431.3	$437.9	$444.5	$451.2	$5,971.8
Use of money & property										
Hangar rent		$72.3	$72.2	$72.9	$73.6	$74.3	$75.0	$75.8	$76.6	$981.7
Clearspan hangar rent		16.4	16.7	16.9	17.1	17.3	17.5	17.7	17.9	230.4
Office rent										
Airline	6J	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	202.7
Other		26.7	27.9	27.9	27.9	27.9	27.9	27.9	27.9	334.8
Stone hangar rent		16.4	16.5	16.7	16.9	17.1	17.3	17.5	17.7	228.0
Common area		0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Land leases		2.3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	30.0
Equipment rent		17.4	10.0	10.1	10.2	10.3	10.4	10.5	10.6	135.0
Farm income		32.1	39.5	39.8	40.2	40.6	41.0	41.4	41.8	533.8
Contributions & other		6.2	3.0	3.0	3.0	3.0	3.0	3.0	3.0	36.0
Subtotal		$206.7	$205.1	$206.7	$208.3	$209.9	$211.5	$213.2	$214.9	$2,712.4
Total operating revenue		$682.1	$609.9	$605.8	$621.8	$641.2	$649.3	$657.7	$666.1	$8,684.2
Percent change			-10.6%	-0.7%	2.6%	3.1%	1.3%	1.3%	1.3%	
CAGR (2020 - 2026)									**1.5%**	
Airline revenue	6J	$95.8	$61.9	$52.7	$63.6	$77.9	$80.7	$83.7	$86.7	$1,296.0
Non-airline revenue		586.3	548.0	553.1	558.2	563.3	568.6	574.0	579.4	7,388.2
Total operating revenue		**$682.1**	**$609.9**	**$605.8**	**$621.8**	**$641.2**	**$649.3**	**$657.7**	**$666.1**	**$8,684.2**
Airline revenue		**14.1%**	**10.1%**	**8.7%**	**10.2%**	**12.1%**	**12.4%**	**12.7%**	**13.0%**	**14.9%**
Non-airline revenue		**85.9%**	**89.9%**	**91.3%**	**89.8%**	**87.9%**	**87.6%**	**87.3%**	**87.0%**	**85.1%**

American Eagle has its own a deicing truck and fluid; however, when the truck is out of service, American Eagle leases equipment and purchases flued from MHK. Since these fees are unpredictable, they are not budgeted.
Sources: MHK, FY 2019 – FY 2020
DKMG, FY 2021 – FY 2038

PRO FORMA CASH FLOW

Table 6M presents the pro forma cash flow of MHK for the planning period, based on the projection of operating revenues and operating expenses previously discussed. As shown in the table, the City needs to subsidize MHK in an amount ranging between $915,000 in CY 2019 and a high of $4.6 million in CY 2022. The City subsidy includes shortfalls in CIP funding, which is assumed to be funded by the City as shown in **Exhibit 6A**.

TABLE 6M
Pro Forma Cash Flow (in 000s)
Manhattan Regional Airport

				Short Term						Long Term
	Source Table	Unaudited 2019	Budget 2020	Forecast 2021	2022	2023	2024	2025	2026	2027 - 2038
Revenues										
Operating revenues	6L	$682.1	$609.9	$605.8	$621.8	$641.2	$649.3	$657.7	$666.1	$8,684.2
PFCs	6E	$327.6	$163.9	$228.9	$278.4	$334.1	$345.3	$356.8	$368.8	$5,275.0
FBO reimburse for debt	6F	$59.0	$58.4	$62.8	$62.0	$61.3	$60.5	$59.8	$59.0	$729.7
Less: operating expenses	6G	($1,457.1)	($1,520.2)	($1,543.3)	($1,566.3)	($1,589.7)	($1,613.2)	($1,637.3)	($1,661.6)	($21,973.1)
Net revenues		**($388.4)**	**($688.0)**	**($645.7)**	**($604.1)**	**($553.1)**	**($558.0)**	**($563.0)**	**($567.6)**	**($7,284.2)**
Less: outstanding GO debt service	6H	($526.5)	($751.7)	($602.4)	($602.9)	($598.0)	($597.7)	($607.0)	($605.7)	($5,526.0)
Less: CIP funded projects	6B	$0.0	$0.0	($340.0)	($3,372.0)	($1,812.0)	($124.0)	($1,240.1)	($110.0)	($5,277.8)
Profit/(Loss)		**($915.0)**	**($1,439.8)**	**($1,588.2)**	**($4,579.0)**	**($2,963.2)**	**($1,279.8)**	**($2,410.1)**	**($1,283.3)**	**($18,088.0)**
City General Fund contribution		$915.0	$1,439.8	$1,588.2	$4,579.0	$2,963.2	$1,279.8	$2,410.1	$1,283.3	$18,088.0
Breakeven		**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**

SUMMARY

The financial projections were prepared based on available information and assumptions set forth in this appendix. It is believed that such information and assumptions provide a reasonable basis for the projections to the level of detail appropriate for planning purposes. Some of the assumptions used to develop the projections may not be realized, and unanticipated events or circumstances may occur. Therefore, the actual results will vary from those projected, and such variations could be material.

The actual need for facilities is most appropriately established by airport activity levels rather than a specified date. Actual demand may be slower to develop than expected. On the other hand, high levels of demand may establish the need to accelerate the development. Although every effort has been made in this planning process to conservatively estimate when facility development may be needed, aviation demand will dictate when facility improvements need to be delayed or accelerated.

The financial feasibility of future projects will be determined by existing and future leases, federal and state funding levels, other funding sources, and the ability to generate internal cash flow from operations at MHK. As it has in the past, this analysis assumes that the City will continue to subsidize the operation of MHK.

Appendix A

Glossary of Terms

Glossary of Terms

A

ABOVE GROUND LEVEL: The elevation of a point or surface above the ground.

ACCELERATE-STOP DISTANCE AVAILABLE (ASDA): See declared distances.

ADVISORY CIRCULAR: External publications issued by the FAA consisting of nonregulatory material providing for the recommendations relative to a policy, guidance and information relative to a specific aviation subject.

AIR CARRIER: An operator which: (1) performs at least five round trips per week between two or more points and publishes flight schedules which specify the times, days of the week, and places between which such flights are performed; or (2) transports mail by air pursuant to a current contract with the U.S. Postal Service. Certified in accordance with Federal Aviation Regulation (FAR) Parts 121 and 127.

AIRCRAFT: A transportation vehicle that is used or intended for use for flight.

AIRCRAFT APPROACH CATEGORY: A grouping of aircraft based on 1.3 times the stall speed in their landing configuration at their maximum certificated landing weight. The categories are as follows:

- Category A: Speed less than 91 knots.
- Category B: Speed 91 knots or more, but less than 121 knots.
- Category C: Speed 121 knots or more, but less than 141 knots.
- Category D: Speed 141 knots or more, but less than 166 knots.
- Category E: Speed greater than 166 knots.

AIRCRAFT OPERATION: The landing, takeoff, or touch-and-go procedure by an aircraft on a runway at an airport.

AIRCRAFT OPERATIONS AREA (AOA): A restricted and secure area on the airport property designed to protect all aspects related to aircraft operations.

AIRCRAFT OWNERS AND PILOTS ASSOCIATION: A private organization serving the interests and needs of general aviation pilots and aircraft owners.

AIRCRAFT RESCUE AND FIRE FIGHTING: A facility located at an airport that provides emergency vehicles, extinguishing agents, and personnel responsible for minimizing the impacts of an aircraft accident or incident.

AIRFIELD: The portion of an airport which contains the facilities necessary for the operation of aircraft.

AIRLINE HUB: An airport at which an airline concentrates a significant portion of its activity and which often has a significant amount of connecting traffic.

AIRPLANE DESIGN GROUP (ADG): A grouping of aircraft based upon wingspan. The groups are as follows:

- Group I: Up to but not including 49 feet.
- Group II: 49 feet up to but not including 79 feet.
- Group III: 79 feet up to but not including 118 feet.
- Group IV: 118 feet up to but not including 171 feet.
- Group V: 171 feet up to but not including 214 feet.
- Group VI: 214 feet or greater.

AIRPORT AUTHORITY: A quasi-governmental public organization responsible for setting the policies governing the management and operation of an airport or system of airports under its jurisdiction.

AIRPORT BEACON: A navigational aid located at an airport which displays a rotating light beam to identify whether an airport is lighted.

AIRPORT CAPITAL IMPROVEMENT PLAN: The planning program used by the Federal Aviation Administration to identify, prioritize, and distribute funds for airport development and the needs of the National Airspace System to meet specified national goals and objectives.

AIRPORT ELEVATION: The highest point on the runway system at an airport expressed in feet above mean sea level (MSL).

AIRPORT IMPROVEMENT PROGRAM: A program authorized by the Airport and Airway Improvement Act of 1982 that provides funding for airport planning and development.

AIRPORT LAYOUT DRAWING (ALD): The drawing of the airport showing the layout of existing and proposed airport facilities.

AIRPORT LAYOUT PLAN (ALP): A scaled drawing of the existing and planned land and facilities necessary for the operation and development of the airport.

AIRPORT LAYOUT PLAN DRAWING SET: A set of technical drawings depicting the current and future airport conditions. The individual sheets comprising the set can vary with the complexities of the airport, but the FAA-required drawings include the Airport Layout Plan (sometimes referred to as the Airport Layout Drawing (ALD), the Airport Airspace Drawing, and the Inner Portion of the Approach Surface Drawing, On-Airport Land Use Drawing, and Property Map.

AIRPORT MASTER PLAN: The planner's concept of the long-term development of an airport.

AIRPORT MOVEMENT AREA SAFETY SYSTEM: A system that provides automated alerts and warnings of potential runway incursions or other hazardous aircraft movement events.

AIRPORT OBSTRUCTION CHART: A scaled drawing depicting the Federal Aviation Regulation (FAR) Part 77 surfaces, a representation of objects that penetrate these surfaces, runway, taxiway, and ramp areas, navigational aids, buildings, roads and other detail in the vicinity of an airport.

AIRPORT REFERENCE CODE (ARC): A coding system used to relate airport design criteria to the operational (Aircraft Approach Category) to the physical characteristics (Airplane Design Group) of the airplanes intended to operate at the airport.

AIRPORT REFERENCE POINT (ARP): The latitude and longitude of the approximate center of the airport.

AIRPORT SPONSOR: The entity that is legally responsible for the management and operation of an airport, including the fulfillment of the requirements of laws and regulations related thereto.

AIRPORT SURFACE DETECTION EQUIPMENT: A radar system that provides air traffic controllers with a visual representation of the movement of aircraft and other vehicles on the ground on the airfield at an airport.

AIRPORT SURVEILLANCE RADAR: The primary radar located at an airport or in an air traffic control terminal area that receives a signal at an antenna and transmits the signal to air traffic control display equipment defining the location of aircraft in the air. The signal provides only the azimuth and range of aircraft from the location of the antenna.

AIRPORT TRAFFIC CONTROL TOWER (ATCT): A central operations facility in the terminal air traffic control system, consisting of a tower, including an associated instrument flight rule (IFR) room if radar equipped, using air/ground communications and/or radar, visual signaling and other devices to provide safe and expeditious movement of terminal air traffic.

AIR ROUTE TRAFFIC CONTROL CENTER: A facility which provides en route air traffic control service to aircraft operating on an IFR flight plan within controlled airspace over a large, multi-state region.

AIRSIDE: The portion of an airport that contains the facilities necessary for the operation of aircraft.

AIRSPACE: The volume of space above the surface of the ground that is provided for the operation of aircraft.

AIR TAXI: An air carrier certificated in accordance with FAR Part 121 and FAR Part 135 and authorized to provide, on demand, public transportation of persons and property by aircraft. Generally operates small aircraft "for hire" for specific trips.

AIR TRAFFIC CONTROL: A service operated by an appropriate organization for the purpose of providing for the safe, orderly, and expeditious flow of air traffic.

AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC): A facility established to provide air traffic control service to aircraft operating on an IFR flight plan within controlled airspace and principally during the en route phase of flight.

AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER: A facility operated by the FAA which is responsible for the central flow control, the central altitude reservation system, the airport reservation position system, and the air traffic service contingency command for the air traffic control system.

AIR TRAFFIC HUB: A categorization of commercial service airports or group of commercial service airports in a metropolitan or urban area based upon the proportion of annual national enplanements existing at the airport or airports. The categories are large hub, medium hub, small hub, or non-hub. It forms the basis for the apportionment of entitlement funds.

AIR TRANSPORT ASSOCIATION OF AMERICA: An organization consisting of the principal U.S. airlines that represents the interests of the airline industry on major aviation issues before federal, state, and local government bodies. It promotes air transportation safety by coordinating industry and governmental safety programs and it serves as a focal point for industry efforts to standardize practices and enhance the efficiency of the air transportation system.

ALERT AREA: See special-use airspace.

ALTITUDE: The vertical distance measured in feet above mean sea level.

ANNUAL INSTRUMENT APPROACH (AIA): An approach to an airport with the intent to land by an aircraft in accordance with an IFR flight plan when visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude.

APPROACH LIGHTING SYSTEM (ALS): An airport lighting facility which provides visual guidance to landing aircraft by radiating light beams by which the pilot aligns the aircraft with the extended centerline of the runway on his final approach and landing.

APPROACH MINIMUMS: The altitude below which an aircraft may not descend while on an IFR approach unless the pilot has the runway in sight.

APPROACH SURFACE: An imaginary obstruction limiting surface defined in FAR Part 77 which is longitudinally centered on an extended runway centerline and extends outward and upward from the primary surface at each end of a runway at a designated slope and distance based upon the type of available or planned approach by aircraft to a runway.

APRON: A specified portion of the airfield used for passenger, cargo or freight loading and unloading, aircraft parking, and the refueling, maintenance and servicing of aircraft.

AREA NAVIGATION: The air navigation procedure that provides the capability to establish and maintain a flight path on an arbitrary course that remains within the coverage area of navigational sources being used.

AUTOMATED TERMINAL INFORMATION SERVICE (ATIS): The continuous broadcast of recorded non-control information at towered airports. Information typically includes wind speed, direction, and runway in use.

AUTOMATED SURFACE OBSERVATION SYSTEM (ASOS): A reporting system that provides frequent airport ground surface weather observation data through digitized voice broadcasts and printed reports.

AUTOMATIC WEATHER OBSERVATION STATION (AWOS): Equipment used to automatically record weather conditions (i.e. cloud height, visibility, wind speed and direction, temperature, dew point, etc.)

AUTOMATIC DIRECTION FINDER (ADF): An aircraft radio navigation system which senses and indicates the direction to a non-directional radio beacon (NDB) ground transmitter.

AVIGATION EASEMENT: A contractual right or a property interest in land over which a right of unobstructed flight in the airspace is established.

AZIMUTH: Horizontal direction expressed as the angular distance between true north and the direction of a fixed point (as the observer's heading).

B

BASE LEG: A flight path at right angles to the landing runway off its approach end. The base leg normally extends from the downwind leg to the intersection of the extended runway centerline. See "traffic pattern."

BASED AIRCRAFT: The general aviation aircraft that use a specific airport as a home base.

BEARING: The horizontal direction to or from any point, usually measured clockwise from true north or magnetic north.

BLAST FENCE: A barrier used to divert or dissipate jet blast or propeller wash.

BLAST PAD: A prepared surface adjacent to the end of a runway for the purpose of eliminating the erosion of the ground surface by the wind forces produced by airplanes at the initiation of takeoff operations.

BUILDING RESTRICTION LINE (BRL): A line which identifies suitable building area locations on the airport.

C

CAPITAL IMPROVEMENT PLAN: The planning program used by the Federal Aviation Administration to identify, prioritize, and distribute Airport Improvement Program funds for airport development and the needs of the National Airspace System to meet specified national goals and objectives.

CARGO SERVICE AIRPORT: An airport served by aircraft providing air transportation of property only, including mail, with an annual aggregate landed weight of at least 100,000,000 pounds.

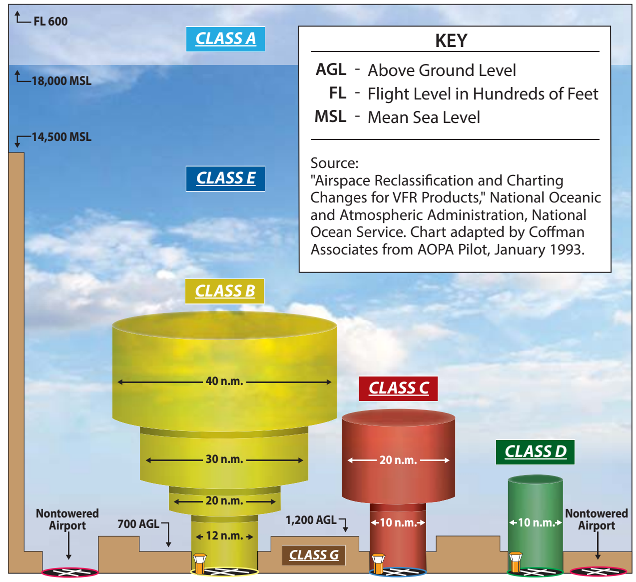
CATEGORY I: An Instrument Landing System (ILS) that provides acceptable guidance information to an aircraft from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a decision height of 200 feet above the horizontal plane containing the runway threshold.

CATEGORY II: An ILS that provides acceptable guidance information to an aircraft from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a decision height of 100 feet above the horizontal plane containing the runway threshold.

CATEGORY III: An ILS that provides acceptable guidance information to a pilot from the coverage limits of the ILS with no decision height specified above the horizontal plane containing the runway threshold.

CEILING: The height above the ground surface to the location of the lowest layer of clouds which is reported as either broken or overcast.

CIRCLING APPROACH: A maneuver initiated by the pilot to align the aircraft with the runway for landing when flying a predetermined circling instrument approach under IFR.



CLASS A AIRSPACE: See Controlled Airspace.

CLASS B AIRSPACE: See Controlled Airspace.

CLASS C AIRSPACE: See Controlled Airspace.

CLASS D AIRSPACE: See Controlled Airspace.

CLASS E AIRSPACE: See Controlled Airspace.

CLASS G AIRSPACE: See Controlled Airspace.

CLEAR ZONE: See Runway Protection Zone.

COMMERCIAL SERVICE AIRPORT: A public airport providing scheduled passenger service that enplanes at least 2,500 annual passengers.

COMMON TRAFFIC ADVISORY FREQUENCY: A radio frequency identified in the appropriate aeronautical chart which is designated for the purpose of transmitting airport advisory information and procedures while operating to or from an uncontrolled airport.

COMPASS LOCATOR (LOM): A low power, low/medium frequency radio-beacon installed in conjunction with the instrument landing system at one or two of the marker sites.

CONICAL SURFACE: An imaginary obstruction-limiting surface defined in FAR Part 77 that extends from the edge of the horizontal surface outward and upward at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

CONTROLLED AIRPORT: An airport that has an operating airport traffic control tower.

CONTROLLED AIRSPACE: Airspace of defined dimensions within which air traffic control services are provided to instrument flight rules (IFR) and visual flight rules (VFR) flights in accordance with the airspace classification. Controlled airspace in the United States is designated as follows:

- **CLASS A**: Generally, the airspace from 18,000 feet mean sea level (MSL) up to but not including flight level FL600. All persons must operate their aircraft under IFR.

- **CLASS B**:
Generally, the airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports. The configuration of Class B airspace is unique to each airport, but typically consists of two or more layers of air space and is designed to contain all published instrument approach procedures to the airport. An air traffic control clearance is required for all aircraft to operate in the area.

- **CLASS C**: Generally, the airspace from the surface to 4,000 feet above the airport elevation (charted as MSL) surrounding those airports that have an operational control tower and radar approach control and are served by a qualifying number of IFR operations or passenger enplanements. Although individually tailored for each airport, Class C airspace typically consists of a surface area with a five nautical mile (nm) radius and an outer area with a 10 nautical mile radius that extends from 1,200 feet to 4,000 feet above the airport elevation. Two-way radio communication is required for all aircraft.

- **CLASS D**: Generally, that airspace from the surface to 2,500 feet above the air port elevation (charted as MSL) surrounding those airports that have an operational control tower. Class D airspace is individually tailored and configured to encompass published instrument approach procedure. Unless otherwise authorized, all persons must establish two-way radio communication.

- **CLASS E**: Generally, controlled airspace that is not classified as Class A, B, C, or D. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface area, the airspace will be configured to contain all instrument procedures. Class E airspace encompasses all Victor Airways. Only aircraft following instrument flight rules are required to establish two-way radio communication with air traffic control.

- **CLASS G**: Generally, that airspace not classified as Class A, B, C, D, or E. Class G airspace is uncontrolled for all aircraft. Class G airspace extends from the surface to the overlying Class E airspace.

CONTROLLED FIRING AREA: See special-use airspace.

CROSSWIND: A wind that is not parallel to a runway centerline or to the intended flight path of an aircraft.

CROSSWIND COMPONENT: The component of wind that is at a right angle to the runway centerline or the intended flight path of an aircraft.

CROSSWIND LEG: A flight path at right angles to the landing runway off its upwind end. See "traffic pattern."

D

DECIBEL: A unit of noise representing a level relative to a reference of a sound pressure 20 micro newtons per square meter.

DECISION HEIGHT/ DECISION ALTITUDE: The height above the end of the runway surface at which a decision must be made by a pilot during the ILS or Precision Approach Radar approach to either continue the approach or to execute a missed approach.

DECLARED DISTANCES: The distances declared available for the airplane's takeoff runway, takeoff distance, accelerate-stop distance, and landing distance requirements. The distances are:

- **TAKEOFF RUNWAY AVAILABLE (TORA):** The runway length declared available and suitable for the ground run of an airplane taking off.

- **TAKEOFF DISTANCE AVAILABLE (TODA):** The TORA plus the length of any remaining runway and/or clear way beyond the far end of the TORA.

- **ACCELERATE-STOP DISTANCE AVAILABLE (ASDA):** The runway plus stopway length declared available for the acceleration and deceleration of an aircraft aborting a takeoff.

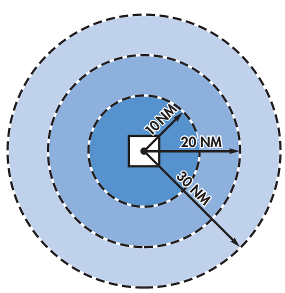
- **LANDING DISTANCE AVAILABLE (LDA):** The runway length declared available and suitable for landing.

DEPARTMENT OF TRANSPORTATION: The cabinet level federal government organization consisting of modal operating agencies, such as the Federal Aviation Administration, which was established to promote the coordination of federal transportation programs and to act as a focal point for research and development efforts in transportation.

DISCRETIONARY FUNDS: Federal grant funds that may be appropriated to an airport based upon designation by the Secretary of Transportation or Congress to meet a specified national priority such as enhancing capacity, safety, and security, or mitigating noise.

DISPLACED THRESHOLD: A threshold that is located at a point on the runway other than the designated beginning of the runway.

DISTANCE MEASURING EQUIPMENT (DME): Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid.



DNL: The 24-hour average sound level, in Aweighted decibels, obtained after the addition of ten decibels to sound levels for the periods between 10 p.m. and 7 a.m. as averaged over a span of one year. It is the FAA standard metric for determining the cumulative exposure of individuals to noise.

DOWNWIND LEG: A flight path parallel to the landing runway in the direction opposite to landing. The downwind leg normally extends between the crosswind leg and the base leg. Also see "traffic pattern."

E

EASEMENT: The legal right of one party to use a portion of the total rights in real estate owned by another party. This may include the right of passage over, on, or below the property; certain air rights above the property, including view rights; and the rights to any specified form of development or activity, as well as any other legal rights in the property that may be specified in the easement document.

ELEVATION: The vertical distance measured in feet above mean sea level.

ENPLANED PASSENGERS: The total number of revenue passengers boarding aircraft, including originating, stop-over, and transfer passengers, in scheduled and nonscheduled services.

ENPLANEMENT: The boarding of a passenger, cargo, freight, or mail on an aircraft at an airport.

ENTITLEMENT: Federal funds for which a commercial service airport may be eligible based upon its annual passenger enplanements.

ENVIRONMENTAL ASSESSMENT (EA): An environmental analysis performed pursuant to the National Environmental Policy Act to determine whether an action would significantly affect the environment and thus require a more detailed environmental impact statement.

ENVIRONMENTAL AUDIT: An assessment of the current status of a party's compliance with applicable environmental requirements of a party's environmental compliance policies, practices, and controls.

ENVIRONMENTAL IMPACT STATEMENT (EIS): A document required of federal agencies by the National Environmental Policy Act for major projects are legislative proposals affecting the environment. It is a tool for decision-making describing the positive and negative effects of a proposed action and citing alternative actions.

ESSENTIAL AIR SERVICE: A federal program which guarantees air carrier service to selected small cities by providing subsidies as needed to prevent these cities from such service.

F

FEDERAL AVIATION REGULATIONS: The general and permanent rules established by the executive departments and agencies of the Federal Government for aviation, which are published in the Federal Register. These are the aviation subset of the Code of Federal Regulations.

FEDERAL INSPECTION SERVICES: The provision of customs and immigration services including passport inspection, inspection of baggage, the collection of duties on certain imported items, and the inspections for agricultural products, illegal drugs, or other restricted items.

FINAL APPROACH: A flight path in the direction of landing along the extended runway centerline. The final approach normally extends from the base leg to the runway. See "traffic pattern."

FINAL APPROACH AND TAKEOFF AREA (FATO). A defined area over which the final phase of the helicopter approach to a hover, or a landing is completed and from which the takeoff is initiated.

FINAL APPROACH FIX: The designated point at which the final approach segment for an aircraft landing on a runway begins for a non-precision approach.

FINDING OF NO SIGNIFICANT IMPACT (FONSI): A public document prepared by a Federal agency that presents the rationale why a proposed action will not have a significant effect on the environment and for which an environmental impact statement will not be prepared.

FIXED BASE OPERATOR (FBO): A provider of services to users of an airport. Such services include, but are not limited to, hangaring, fueling, flight training, repair, and maintenance.

FLIGHT LEVEL: A measure of altitude used by aircraft flying above 18,000 feet. Flight levels are indicated by three digits representing the pressure altitude in hundreds of feet. An airplane flying at flight level 360 is flying at a pressure altitude of 36,000 feet. This is expressed as FL 360.

FLIGHT SERVICE STATION: An operations facility in the national flight advisory system which utilizes data interchange facilities for the collection and dissemination of Notices to Airmen, weather, and administrative data and which provides pre-flight and in-flight advisory services to pilots through air and ground based communication facilities.

FRANGIBLE NAVAID: A navigational aid which retains its structural integrity and stiffness up to a designated maximum load, but on impact from a greater load, breaks, distorts, or yields in such a manner as to present the minimum hazard to aircraft.

G

GENERAL AVIATION: That portion of civil aviation which encompasses all facets of aviation except air carriers holding a certificate of convenience and necessity, and large aircraft commercial operators.

GENERAL AVIATION AIRPORT: An airport that provides air service to only general aviation.

GLIDESLOPE (GS): Provides vertical guidance for aircraft during approach and landing. The glideslope consists of the following:

1. Electronic components emitting signals which provide vertical guidance by reference to airborne instruments during instrument approaches such as ILS; or

2. Visual ground aids, such as VASI, which provide vertical guidance for VFR approach or for the visual portion of an instrument approach and landing.

GLOBAL POSITIONING SYSTEM (GPS): A system of 48 satellites used as reference points to enable navigators equipped with GPS receivers to determine their latitude, longitude, and altitude.

GROUND ACCESS: The transportation system on and around the airport that provides access to and from the airport by ground transportation vehicles for passengers, employees, cargo, freight, and airport services.

H

HELIPAD: A designated area for the takeoff, landing, and parking of helicopters.

HIGH INTENSITY RUNWAY LIGHTS: The highest classification in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

HIGH-SPEED EXIT TAXIWAY: A long radius taxiway designed to expedite aircraft turning off the runway after landing (at speeds to 60 knots), thus reducing runway occupancy time.

HORIZONTAL SURFACE: An imaginary obstruction-limiting surface defined in FAR Part 77 that is specified as a portion of a horizontal plane surrounding a runway located 150 feet above the established airport elevation. The specific horizontal dimensions of this surface are a function of the types of approaches existing or planned for the runway.

I

INITIAL APPROACH FIX: The designated point at which the initial approach segment begins for an instrument approach to a runway.

INSTRUMENT APPROACH PROCEDURE: A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing, or to a point from which a landing may be made visually.

INSTRUMENT FLIGHT RULES (IFR): Procedures for the conduct of flight in weather conditions below Visual Flight Rules weather minimums. The term IFR is often also used to define weather conditions and the type of flight plan under which an aircraft is operating.

INSTRUMENT LANDING SYSTEM (ILS): A precision instrument approach system which normally consists of the following electronic components and visual aids:

1. Localizer.
2. Glide Slope.
3. Outer Marker.
4. Middle Marker.
5. Approach Lights.

INSTRUMENT METEOROLOGICAL CONDITIONS: Meteorological conditions expressed in terms of specific visibility and ceiling conditions that are less than the minimums specified for visual meteorological conditions.

ITINERANT OPERATIONS: Operations by aircraft that are not based at a specified airport.

K

KNOTS: A unit of speed length used in navigation that is equivalent to the number of nautical miles traveled in one hour.

L

LANDSIDE: The portion of an airport that provides the facilities necessary for the processing of passengers, cargo, freight, and ground transportation vehicles.

LANDING DISTANCE AVAILABLE (LDA): See declared distances.

LARGE AIRPLANE: An airplane that has a maximum certified takeoff weight in excess of 12,500 pounds.

LOCAL AREA AUGMENTATION SYSTEM: A differential GPS system that provides localized measurement correction signals to the basic GPS signals to improve navigational accuracy integrity, continuity, and availability.

LOCAL OPERATIONS: Aircraft operations performed by aircraft that are based at the airport and that operate in the local traffic pattern or within sight of the airport, that are known to be departing for or arriving from flights in local practice areas within a prescribed distance from the airport, or that execute simulated instrument approaches at the airport.

LOCAL TRAFFIC: Aircraft operating in the traffic pattern or within sight of the tower, or aircraft known to be departing or arriving from the local practice areas, or aircraft executing practice instrument approach procedures. Typically, this includes touch and-go training operations.

LOCALIZER: The component of an ILS which provides course guidance to the runway.

LOCALIZER TYPE DIRECTIONAL AID (LDA): A facility of comparable utility and accuracy to a localizer, but is not part of a complete ILS and is not aligned with the runway.

LONG RANGE NAVIGATION SYSTEM (LORAN): Long range navigation is an electronic navigational aid which determines aircraft position and speed by measuring the difference in the time of reception of synchronized pulse signals from two fixed transmitters. Loran is used for en route navigation.

LOW INTENSITY RUNWAY LIGHTS: The lowest classification in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

M

MEDIUM INTENSITY RUNWAY LIGHTS: The middle classification in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

MICROWAVE LANDING SYSTEM (MLS): An instrument approach and landing system that provides precision guidance in azimuth, elevation, and distance measurement.

MILITARY OPERATIONS: Aircraft operations that are performed in military aircraft.

MILITARY OPERATIONS AREA (MOA): See special-use airspace

MILITARY TRAINING ROUTE: An air route depicted on aeronautical charts for the conduct of military flight training at speeds above 250 knots.

MISSED APPROACH COURSE (MAC): The flight route to be followed if, after an instrument approach, a landing is not affected, and occurring normally:

1. When the aircraft has descended to the decision height and has not established visual contact; or
2. When directed by air traffic control to pull up or to go around again.

MOVEMENT AREA: The runways, taxiways, and other areas of an airport which are utilized for taxiing/hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At those airports with a tower, air traffic control clearance is required for entry onto the movement area.

N

NATIONAL AIRSPACE SYSTEM: The network of air traffic control facilities, air traffic control areas, and navigational facilities through the U.S.

NATIONAL PLAN OF INTEGRATED AIRPORT SYSTEMS: The national airport system plan developed by the Secretary of Transportation on a biannual basis for the development of public use airports to meet national air transportation needs.

NATIONAL TRANSPORTATION SAFETY BOARD: A federal government organization established to investigate and determine the probable cause of transportation accidents, to recommend equipment and procedures to enhance transportation safety, and to review on appeal the suspension or revocation of any certificates or licenses issued by the Secretary of Transportation.

NAUTICAL MILE: A unit of length used in navigation which is equivalent to the distance spanned by one minute of arc in latitude, that is, 1,852 meters or 6,076 feet. It is equivalent to approximately 1.15 statute mile.

NAVAID: A term used to describe any electrical or visual air navigational aids, lights, signs, and associated supporting equipment (i.e. PAPI, VASI, ILS, etc.)

NAVIGATIONAL AID: A facility used as, available for use as, or designed for use as an aid to air navigation.

NOISE CONTOUR: A continuous line on a map of the airport vicinity connecting all points of the same noise exposure level.

NON-DIRECTIONAL BEACON (NDB): A beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine his or her bearing to and from the radio beacon and home on, or track to, the station. When the radio beacon is installed in conjunction with the Instrument Landing System marker, it is normally called a Compass Locator.

NON-PRECISION APPROACH PROCEDURE: A standard instrument approach procedure in which no electronic glide slope is provided, such as VOR, TACAN, NDB, or LOC.

NOTICE TO AIRMEN: A notice containing information concerning the establishment, condition, or change in any component of or hazard in the National Airspace System, the timely knowledge of which is considered essential to personnel concerned with flight operations.

O

OBJECT FREE AREA (OFA): An area on the ground centered on a runway, taxiway, or taxilane centerline provided to enhance the safety of aircraft operations by having the area free of objects, except for objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes.

OBSTACLE FREE ZONE (OFZ): The airspace below 150 feet above the established airport elevation and along the runway and extended runway centerline that is required to be kept clear of all objects, except for frangible visual NAVAIDs that need to be located in the OFZ because of their function, in order to provide clearance for aircraft landing or taking off from the runway, and for missed approaches.

ONE-ENGINE INOPERABLE SURFACE: A surface emanating from the runway end at a slope ratio of 62.5:1. Air carrier airports are required to maintain a technical drawing of this surface depicting any object penetrations by January 1, 2010.

OPERATION: The take-off, landing, or touch-and-go procedure by an aircraft on a runway at an airport.

OUTER MARKER (OM): An ILS navigation facility in the terminal area navigation system located four to seven miles from the runway edge on the extended centerline, indicating to the pilot that he/she is passing over the facility and can begin final approach.

P

PILOT CONTROLLED LIGHTING: Runway lighting systems at an airport that are controlled by activating the microphone of a pilot on a specified radio frequency.

PRECISION APPROACH: A standard instrument approach procedure which provides runway alignment and glide slope (descent) information. It is categorized as follows:

- **CATEGORY I (CAT I)**: A precision approach which provides for approaches with a decision height of not less than 200 feet and visibility not less than 1/2 mile or Runway Visual Range (RVR) 2400 (RVR 1800) with operative touchdown zone and runway centerline lights.

- **CATEGORY II (CAT II)**: A precision approach which provides for approaches with a decision height of not less than 100 feet and visibility not less than 1200 feet RVR.

- **CATEGORY III (CAT III)**: A precision approach which provides for approaches with minima less than Category II.

PRECISION APPROACH PATH INDICATOR (PAPI): A lighting system providing visual approach slope guidance to aircraft during a landing approach. It is similar to a VASI but provides a sharper transition between the colored indicator lights.

PRECISION APPROACH RADAR: A radar facility in the terminal air traffic control system used to detect and display with a high degree of accuracy the direction, range, and elevation of an aircraft on the final approach to a runway.

PRECISION OBJECT FREE AREA (POFA): An area centered on the extended runway centerline, beginning at the runway threshold and extending behind the runway threshold that is 200 feet long by 800 feet wide. The POFA is a clearing standard which requires the POFA to be kept clear of above ground objects protruding above the runway safety area edge elevation (except for frangible NAVAIDS). The POFA applies to all new authorized instrument approach procedures with less than 3/4 mile visibility.

PRIMARY AIRPORT: A commercial service airport that enplanes at least 10,000 annual passengers.

PRIMARY SURFACE: An imaginary obstruction limiting surface defined in FAR Part 77 that is specified as a rectangular surface longitudinally centered about a runway. The specific dimensions of this surface are a function of the types of approaches existing or planned for the runway.

PROHIBITED AREA: See special-use airspace.

PVC: Poor visibility and ceiling. Used in determining Annual Service Volume. PVC conditions exist when the cloud ceiling is less than 500 feet and visibility is less than one mile.

R

RADIAL: A navigational signal generated by a Very High Frequency Omni-directional Range or VORTAC station that is measured as an azimuth from the station.

REGRESSION ANALYSIS: A statistical technique that seeks to identify and quantify the relationships between factors associated with a forecast.

REMOTE COMMUNICATIONS OUTLET (RCO): An unstaffed transmitter receiver/facility remotely controlled by air traffic personnel. RCOs serve flight service stations (FSSs). RCOs were established to provide ground-to-ground communications between air traffic control specialists and pilots at satellite airports for delivering en route clearances, issuing departure authorizations, and acknowledging instrument flight rules cancellations or departure/landing times.

REMOTE TRANSMITTER/RECEIVER (RTR): See remote communications outlet. RTRs serve ARTCCs.

RELIEVER AIRPORT: An airport to serve general aviation aircraft which might otherwise use a congested air-carrier served airport.

RESTRICTED AREA: See special-use airspace.

RNAV: Area navigation - airborne equipment which permits flights over determined tracks within prescribed accuracy tolerances without the need to overfly ground-based navigation facilities. Used en route and for approaches to an airport.

RUNWAY: A defined rectangular area on an airport prepared for aircraft landing and takeoff. Runways are normally numbered in relation to their magnetic direction, rounded off to the nearest 10 degrees. For example, a runway with a magnetic heading of 180 would be designated Runway 18. The runway heading on the opposite end of the runway is 180 degrees from that runway end. For example, the opposite runway heading for Runway 18 would be Runway 36 (magnetic heading of 360). Aircraft can takeoff or land from either end of a runway, depending upon wind direction.

RUNWAY ALIGNMENT INDICATOR LIGHT: A series of high intensity sequentially flashing lights installed on the extended centerline of the runway usually in conjunction with an approach lighting system.

RUNWAY DESIGN CODE: A code signifiying the design standards to which the runway is to be built.

RUNWAY END IDENTIFICATION LIGHTING (REIL): Two synchronized flashing lights, one on each side of the runway threshold, which provide rapid and positive identification of the approach end of a particular runway.

RUNWAY GRADIENT: The average slope, measured in percent, between the two ends of a runway.

RUNWAY PROTECTION ZONE (RPZ): An area off the runway end to enhance the protection of people and property on the ground. The RPZ is trapezoidal in shape. Its dimensions are determined by the aircraft approach speed and runway approach type and minima.

RUNWAY REFERENCE CODE: A code signifying the current operational capabilities of a runway and associated taxiway.

RUNWAY SAFETY AREA (RSA): A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway.

RUNWAY VISIBILITY ZONE (RVZ): An area on the airport to be kept clear of permanent objects so that there is an unobstructed line of- site from any point five feet above the runway centerline to any point five feet above an intersecting runway centerline.

RUNWAY VISUAL RANGE (RVR): An instrumentally derived value, in feet, representing the horizontal distance a pilot can see down the runway from the runway end.

S

SCOPE: The document that identifies and defines the tasks, emphasis, and level of effort associated with a project or study.

SEGMENTED CIRCLE: A system of visual indicators designed to provide traffic pattern information at airports without operating control towers.

SHOULDER: An area adjacent to the edge of paved runways, taxiways, or aprons providing a transition between the pavement and the adjacent surface; support for aircraft running off the pavement; enhanced drainage; and blast protection. The shoulder does not necessarily need to be paved.

SLANT-RANGE DISTANCE: The straight line distance between an aircraft and a point on the ground.

SMALL AIRCRAFT: An aircraft that has a maximum certified takeoff weight of up to 12,500 pounds.

SPECIAL-USE AIRSPACE: Airspace of defined dimensions identified by a surface area wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities. Special-use airspace classifications include:

- **ALERT AREA**: Airspace which may contain a high volume of pilot training activities or an unusual type of aerial activity, neither of which is hazardous to aircraft.

- **CONTROLLED FIRING AREA**: Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to nonparticipating aircraft and to ensure the safety of persons or property on the ground.

- **MILITARY OPERATIONS AREA (MOA)**: Designated airspace with defined vertical and lateral dimensions established outside Class A airspace to separate/segregate certain military activities from instrument flight rule (IFR) traffic and to identify for visual flight rule (VFR) traffic where these activities are conducted.

- **PROHIBITED AREA**: Designated airspace within which the flight of aircraft is prohibited.

- **RESTRICTED AREA**: Airspace designated under Federal Aviation Regulation (FAR) 73, within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated joint use. When not in use by the using agency, IFR/VFR operations can be authorized by the controlling air traffic control facility.

- **WARNING AREA:** Airspace which may contain hazards to nonparticipating aircraft.

STANDARD INSTRUMENT DEPARTURE (SID): A preplanned coded air traffic control IFR departure routing, preprinted for pilot use in graphic and textual form only.

STANDARD INSTRUMENT DEPARTURE PROCEDURES: A published standard flight procedure to be utilized following takeoff to provide a transition between the airport and the terminal area or en route airspace.

STANDARD TERMINAL ARRIVAL ROUTE (STAR): A preplanned coded air traffic control IFR arrival routing, preprinted for pilot use in graphic and textual or textual form only.

STOP-AND-GO: A procedure wherein an aircraft will land, make a complete stop on the runway, and then commence a takeoff from that point. A stop-and-go is recorded as two operations: one operation for the landing and one operation for the takeoff.

STOPWAY: An area beyond the end of a takeoff runway that is designed to support an aircraft during an aborted takeoff without causing structural damage to the aircraft. It is not to be used for takeoff, landing, or taxiing by aircraft.

STRAIGHT-IN LANDING/APPROACH: A landing made on a runway aligned within 30 degrees of the final approach course following completion of an instrument approach.

T

TACTICAL AIR NAVIGATION (TACAN): An ultrahigh frequency electronic air navigation system which provides suitably-equipped aircraft a continuous indication of bearing and distance to the TACAN station.

TAKEOFF RUNWAY AVAILABLE (TORA): See declared distances.

TAKEOFF DISTANCE AVAILABLE (TODA): See declared distances.

TAXILANE: The portion of the aircraft parking area used for access between taxiways and aircraft parking positions.

TAXIWAY: A defined path established for the taxiing of aircraft from one part of an airport to another.

TAXIWAY DESIGN GROUP: A classification of airplanes based on outer to outer Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance.

TAXIWAY SAFETY AREA (TSA): A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway.

TERMINAL INSTRUMENT PROCEDURES: Published flight procedures for conducting instrument approaches to runways under instrument meteorological conditions.

TERMINAL RADAR APPROACH CONTROL: An element of the air traffic control system responsible for monitoring the en-route and terminal segment of air traffic in the airspace surrounding airports with moderate to high levels of air traffic.

TETRAHEDRON: A device used as a landing direction indicator. The small end of the tetrahedron points in the direction of landing.

THRESHOLD: The beginning of that portion of the runway available for landing. In some instances the landing threshold may be displaced.

TOUCH-AND-GO: An operation by an aircraft that lands and departs on a runway without stopping or exiting the runway. A touch-and go is recorded as two operations: one operation for the landing and one operation for the takeoff.

TOUCHDOWN: The point at which a landing aircraft makes contact with the runway surface.

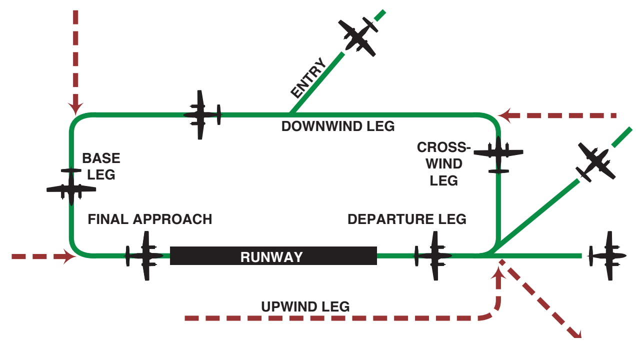
TOUCHDOWN AND LIFT-OFF AREA (TLOF): A load bearing, generally paved area, normally centered in the FATO, on which the helicopter lands or takes off.

TOUCHDOWN ZONE (TDZ): The first 3,000 feet of the runway beginning at the threshold.

TOUCHDOWN ZONE ELEVATION (TDZE): The highest elevation in the touchdown zone.

TOUCHDOWN ZONE (TDZ) LIGHTING: Two rows of transverse light bars located symmetrically about the runway centerline normally at 100- foot intervals. The basic system extends 3,000 feet along the runway.

TRAFFIC PATTERN: The traffic flow that is prescribed for aircraft landing at or taking off from an airport. The components of a typical traffic pattern are the upwind leg, crosswind leg, downwind leg, base leg, and final approach.



U

UNCONTROLLED AIRPORT: An airport without an air traffic control tower at which the control of Visual Flight Rules traffic is not exercised.

UNCONTROLLED AIRSPACE: Airspace within which aircraft are not subject to air traffic control.

UNIVERSAL COMMUNICATION (UNICOM): A nongovernment communication facility which may provide airport information at certain airports. Locations and frequencies of UNICOM's are shown on aeronautical charts and publications.

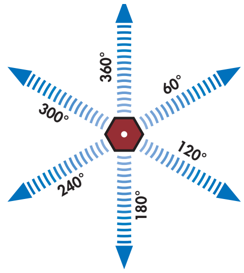
UPWIND LEG: A flight path parallel to the landing runway in the direction of landing. See "traffic pattern."

V

VECTOR: A heading issued to an aircraft to provide navigational guidance by radar.

VERY HIGH FREQUENCY/ OMNIDIRECTIONAL RANGE (VOR): A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north. Used as the basis for navigation in the national airspace system. The VOR periodically identifies itself by Morse Code and may have an additional voice identification feature.

VERY HIGH FREQUENCY OMNI-DIRECTIONAL RANGE/ TACTICAL AIR NAVIGATION (VORTAC): A navigation aid providing VOR azimuth, TACAN azimuth, and TACAN distance-measuring equipment (DME) at one site.



VICTOR AIRWAY: A control area or portion thereof established in the form of a corridor, the centerline of which is defined by radio navigational aids.

VISUAL APPROACH: An approach wherein an aircraft on an IFR flight plan, operating in VFR conditions under the control of an air traffic control facility and having an air traffic control authorization, may proceed to the airport of destination in VFR conditions.

VISUAL APPROACH SLOPE INDICATOR (VASI): An airport lighting facility providing vertical visual approach slope guidance to aircraft during approach to landing by radiating a directional pattern of high intensity red and white focused light beams which indicate to the pilot that he is on path if he sees red/white, above path if white/white, and below path if red/red. Some airports serving large aircraft have three-bar VASI's which provide two visual guide paths to the same runway.

VISUAL FLIGHT RULES (VFR): Rules that govern the procedures for conducting flight under visual conditions. The term VFR is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan.

VISUAL METEOROLOGICAL CONDITIONS: Meteorological conditions expressed in terms of specific visibility and ceiling conditions which are equal to or greater than the threshold values for instrument meteorological conditions.

VOR: See "Very High Frequency Omnidirectional Range Station."

VORTAC: See "Very High Frequency Omnidirectional Range Station/Tactical Air Navigation."

W

WARNING AREA: See special-use airspace.

WIDE AREA AUGMENTATION SYSTEM: An enhancement of the Global Positioning System that includes integrity broadcasts, differential corrections, and additional ranging signals for the purpose of providing the accuracy, integrity, availability, and continuity required to support all phases of flight.

Abbreviations

AC: advisory circular

ADF: automatic direction finder

ADG: airplane design group

AFSS: automated flight service station

AGL: above ground level

AIA: annual instrument approach

AIP: Airport Improvement Program

AIR-21: Wendell H. Ford Aviation Investment and Reform Act for the 21st Century

ALS: approach lighting system

ALSF-1: standard 2,400-foot high intensity approach lighting system with sequenced flashers (CAT I configuration)

ALSF-2: standard 2,400-foot high intensity approach lighting system with sequenced flashers (CAT II configuration)

AOA: Aircraft Operation Area

APV: instrument approach procedure with vertical guidance

ARC: airport reference code

ARFF: aircraft rescue and fire fighting

ARP: airport reference point

ARTCC: air route traffic control center

ASDA: accelerate-stop distance available

ASR: airport surveillance radar

ASOS: automated surface observation station

ATCT: airport traffic control tower

ATIS: automated terminal information service

AVGAS: aviation gasoline - typically 100 low lead (100LL)

AWOS: automatic weather observation station

BRL: building restriction line

CFR: Code of Federal Regulation

CIP: capital improvement program

DME: distance measuring equipment

DNL: day-night noise level

DWL: runway weight bearing capacity of aircraft with dual-wheel type landing gear

DTWL: runway weight bearing capacity of aircraft with dual-tandem type landing gear

FAA: Federal Aviation Administration

FAR: Federal Aviation Regulation

FBO: fixed base operator

FY: fiscal year

GPS: global positioning system

GS: glide slope

HIRL: high intensity runway edge lighting

IFR: instrument flight rules (FAR Part 91)

ILS: instrument landing system

IM: inner marker

LDA: localizer type directional aid

LDA: landing distance available

LIRL: low intensity runway edge lighting

LMM: compass locator at middle marker

LOM: compass locator at outer marker

LORAN: long range navigation

MALS: medium intensity approach lighting system with indicator lights

MIRL: medium intensity runway edge lighting

MITL: medium intensity taxiway edge lighting

MLS: microwave landing system

MM: middle marker

MOA: military operations area

MSL: mean sea level

NAVAID: navigational aid

NDB: nondirectional radio beacon

NM: nautical mile (6,076.1 feet)

NPES: National Pollutant Discharge Elimination System

NPIAS: National Plan of Integrated Airport Systems

NPRM: notice of proposed rule making

ODALS: omnidirectional approach lighting system

OFA: object free area

OFZ: obstacle free zone

OM: outer marker

PAC: planning advisory committee

PAPI: precision approach path indicator

PFC: porous friction course

PFC: passenger facility charge

PCL: pilot-controlled lighting

PIW public information workshop

PLASI: pulsating visual approach slope indicator

POFA: precision object free area

PVASI: pulsating/steady visual approach slope indicator

PVC: poor visibility and ceiling

RCO: remote communications outlet

RRC: Runway Reference Code

RDC: Runway Design Code

REIL: runway end identification lighting

RNAV: area navigation

RPZ: runway protection zone

RSA: runway safety area

RTR: remote transmitter/receiver

RVR: runway visibility range

RVZ: runway visibility zone

SALS: short approach lighting system

SASP: state aviation system plan

SEL: sound exposure level

SID: standard instrument departure

SM: statute mile (5,280 feet)

SRE: snow removal equipment

SSALF: simplified short approach lighting system with runway alignment indicator lights

STAR: standard terminal arrival route

SWL: runway weight bearing capacity for aircraft with single-wheel tandem type landing gear

TACAN: tactical air navigational aid

TAF: Federal Aviation Administration (FAA) Terminal Area Forecast

TDG: Taxiway Design Group

TLOF: Touchdown and lift-off

TDZ: touchdown zone

TDZE: touchdown zone elevation

TODA: takeoff distance available

TORA: takeoff runway available

TRACON: terminal radar approach control

VASI: visual approach slope indicator

VFR: visual flight rules (FAR Part 91)

VHF: very high frequency

VOR: very high frequency omni-directional range

VORTAC: VOR and TACAN collocated

fly MHK
Manhattan Regional Airport

Appendix B

Forecast and Critical Aircraft Approval

U.S. Department
of Transportation

**Federal Aviation
Administration**

Central Region
Iowa, Kansas
Missouri, Nebraska

901 Locust
Kansas City, Missouri 64106
(816) 329-2600

March 08, 2019

Mr. Jesse Romo
Airport Director
Manhattan Regional Airport
5500 Skyway Drive, Suite.120
Manhattan, KS 66502

Dear Mr. Romo:

Forecast/Critical Design Aircraft Approval
Manhattan Regional (MHK), Manhattan, KS
AIP No. 3-20-0052-049-2018

The submitted Aviation Demand Forecast is Approved.

The proposed existing Critical Design Aircraft, **C-II**, is **Approved**. The proposed ultimate Critical Design Aircraft, **C-III**, is **Approved**.

You may proceed with developing the remainder of the report and the Airport Layout Plan drawings. If you have any questions regarding this project, please call me at (816) 329-2646 or via email at jason.knipp@faa.gov.

Sincerely,

Jason Knipp
Kansas Planner

CC: Mike Dmyterko, Coffman Associates, Inc.

flyMHK
Manhattan Regional Airport

Appendix C

Runway 3-21 Pavement Analyses

Exhibit C1
APPROXIMATE LIMITS OF THE DISTURBANCE - OPTIONS 1 & 2

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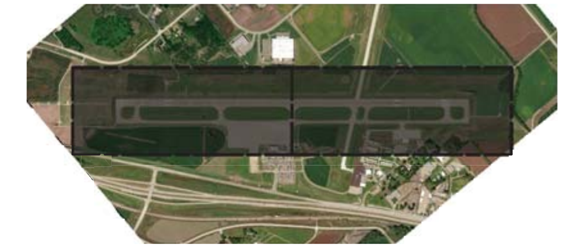
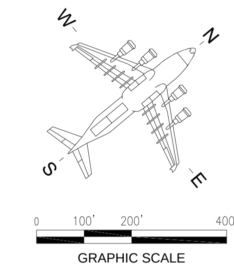


KEYMAP



LEGEND:

— · — · — APPROXIMATE LIMITS OF CONSTRUCTION

NOTE:

LIMITS SHOWN ARE APPROXIMATE. CONNECTOR TAXIWAYS ARE RECONSTRUCTED BACK TO THE PARALLEL TAXIWAY. RUNWAY 13-31 IS RECONSTRUCTED 1,000 FEET EITHER SIDE OF RUNWAY 03-21.

Exhibit C2
APPROXIMATE LIMITS OF THE DISTURBANCE - OPTIONS 3 THRU 5

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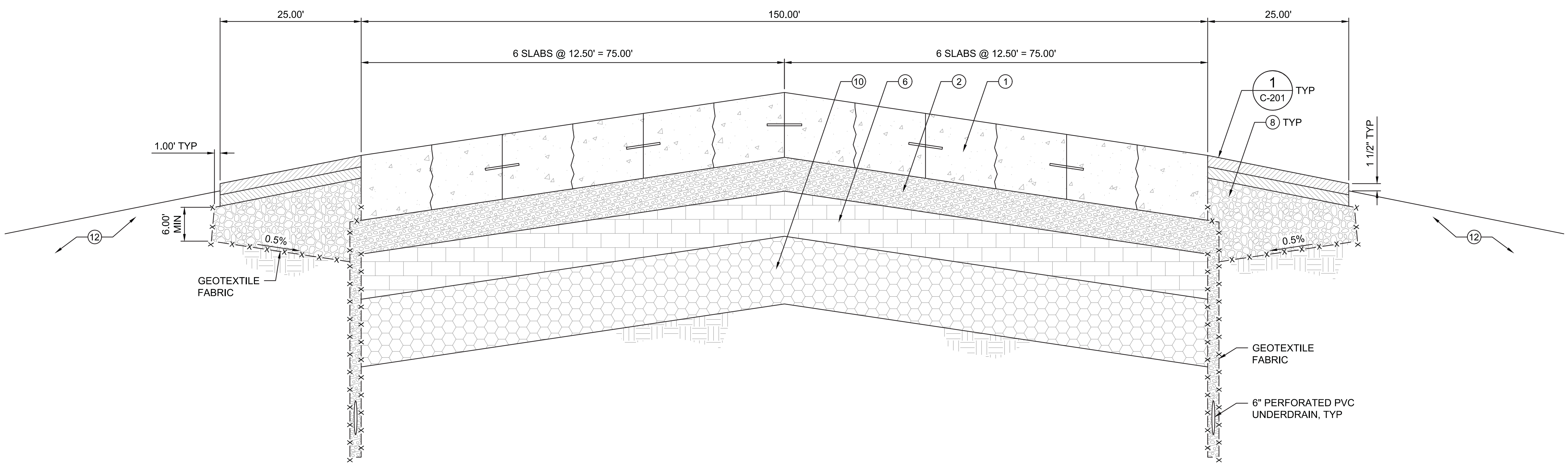
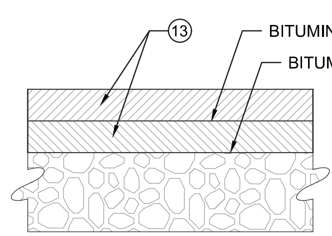
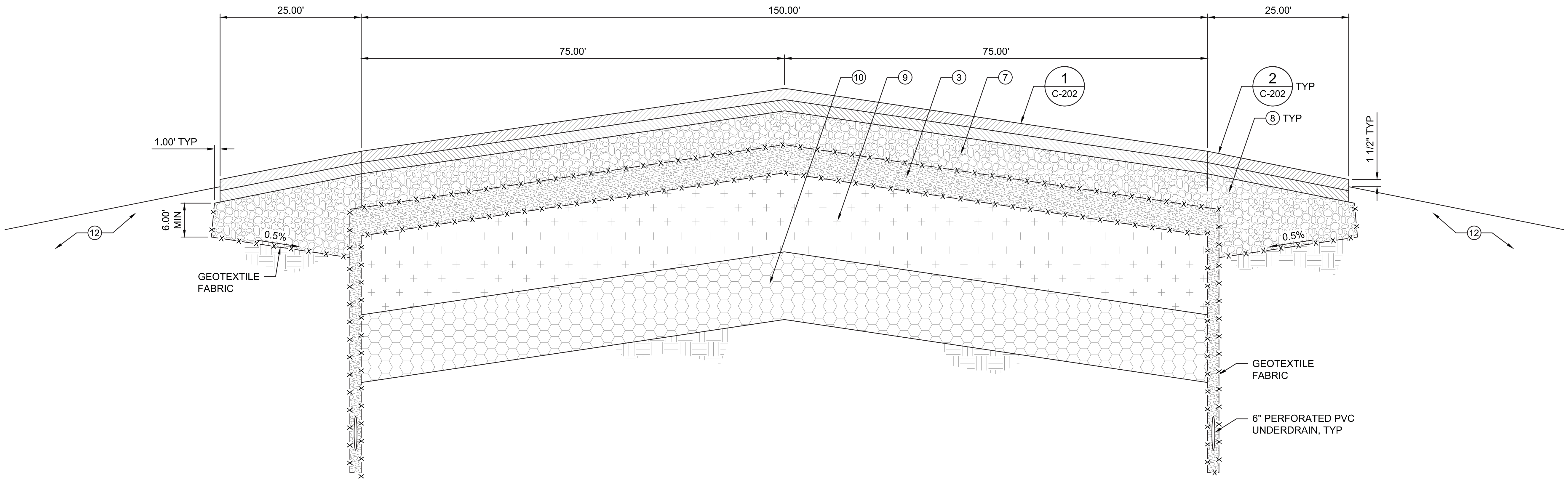


A
C-201
OPTION 1: PCC RECONSTRUCTION AT GRADE
SCALE: HORIZONTAL: 1"=10' VERTICAL: 1"=1'

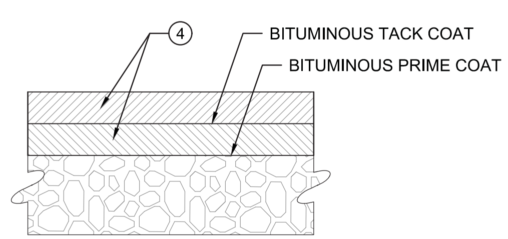


1
C-201
SHOULDER HMA DETAIL
SCALE: NONE

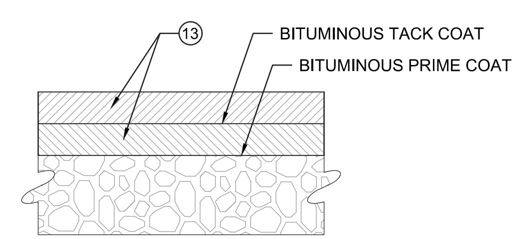
PAVEMENT MATERIAL SPECIFICATIONS		
CALLOUT	ITEM	DESCRIPTION
1	P-501	11.5" CONCRETE PAVEMENT
2	P-307	CEMENT TREATED PERMEABLE BASE COURSE
3	P-403	5" ASPHALT STABILIZED DRAINAGE LAYER
4	P-401	2" HOT MIX ASPHALT SURFACE
5	P-401	2.5" HOT MIX ASPHALT BASE
6	P-304	8" CEMENT-TREATED AGGREGATE BASE COURSE
7	P-209	6" CRUSHED AGGREGATE BASE COURSE
8	P-209	VARIABLE THICKNESS CRUSHED AGGREGATE BASE COURSE
9	P-154	14" SUBBASE COURSE
10	P-155	12" LIME-TREATED SUBGRADE
11	P-215	13" RUBBLIZED CONCRETE
12	P-152	EMBANKMENT
13	P-401	2" HOT MIX ASPHALT SURFACE - SHOULDER MIX



B C-202 OPTION 2: HMA RECONSTRUCTION AT GRADE
SCALE: HORIZONTAL: 1"=10' VERTICAL: 1"=1'



1 C-202 RUNWAY HMA DETAIL
SCALE: NONE



2 C-202 SHOULDER HMA DETAIL
SCALE: NONE

PAVEMENT MATERIAL SPECIFICATIONS		
CALLOUT	ITEM	DESCRIPTION
1	P-501	11.5" CONCRETE PAVEMENT
2	P-307	CEMENT TREATED PERMEABLE BASE COURSE
3	P-403	5" ASPHALT STABILIZED DRAINAGE LAYER
4	P-401	2" HOT MIX ASPHALT SURFACE
5	P-401	2.5" HOT MIX ASPHALT BASE
6	P-304	8" CEMENT-TREATED AGGREGATE BASE COURSE
7	P-209	6" CRUSHED AGGREGATE BASE COURSE
8	P-209	VARIABLE THICKNESS CRUSHED AGGREGATE BASE COURSE
9	P-154	14" SUBBASE COURSE
10	P-155	12" LIME-TREATED SUBGRADE
11	P-215	13" RUBBLIZED CONCRETE
12	P-152	EMBANKMENT
13	P-401	2" HOT MIX ASPHALT SURFACE - SHOULDER MIX

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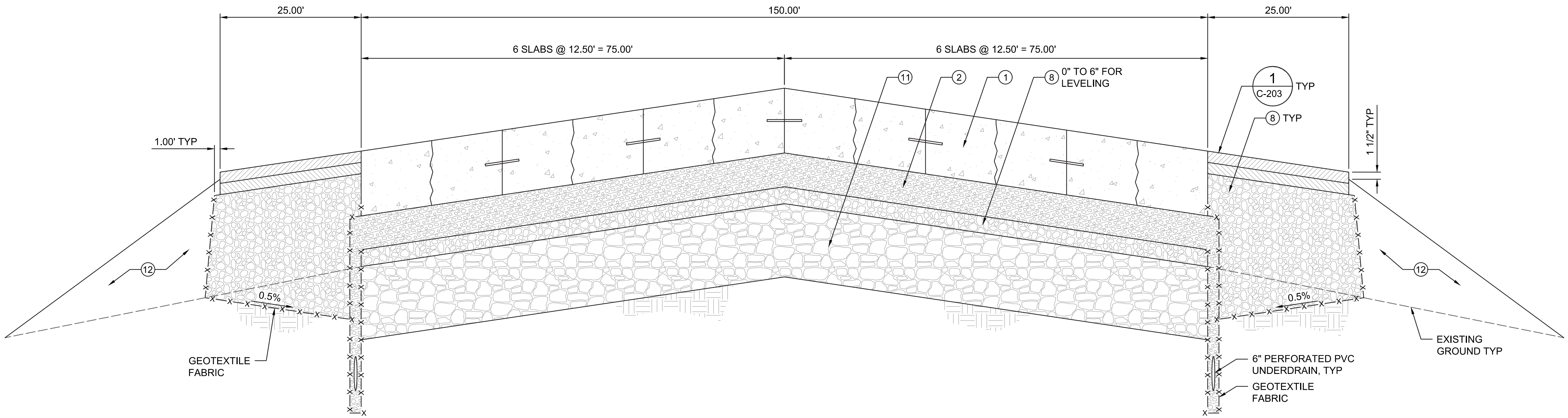
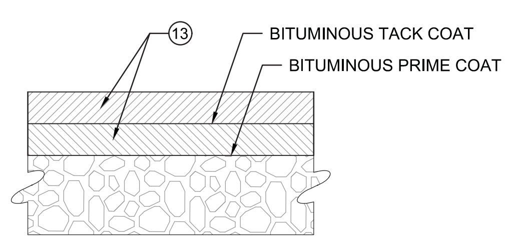


C C-203 OPTION 3: PCC ON RUBBLIZED CONCRETE

SCALE: HORIZONTAL: 1"=10' VERTICAL: 1"=1'



1 C-203 SHOULDER HMA DETAIL

SCALE: NONE

PAVEMENT MATERIAL SPECIFICATIONS		
CALLOUT	ITEM	DESCRIPTION
1	P-501	11.5" CONCRETE PAVEMENT
2	P-307	CEMENT TREATED PERMEABLE BASE COURSE
3	P-403	5" ASPHALT STABILIZED DRAINAGE LAYER
4	P-401	2" HOT MIX ASPHALT SURFACE
5	P-401	2.5" HOT MIX ASPHALT BASE
6	P-304	8" CEMENT-TREATED AGGREGATE BASE COURSE
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9	P-154	14" SUBBASE COURSE
10	P-155	12" LIME-TREATED SUBGRADE
11	P-215	13" RUBBLIZED CONCRETE
12	P-152	EMBANKMENT
13	P-401	2" HOT MIX ASPHALT SURFACE - SHOULDER MIX

Exhibit C5
TYPICAL SECTION - OPTION 3: PCC ON RUBBERIZED CONCRETE

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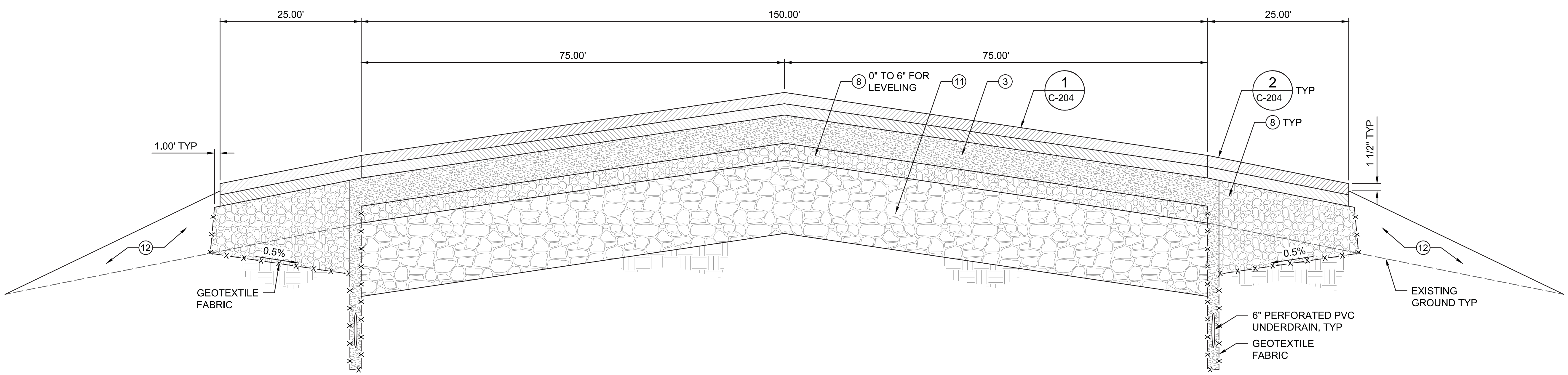
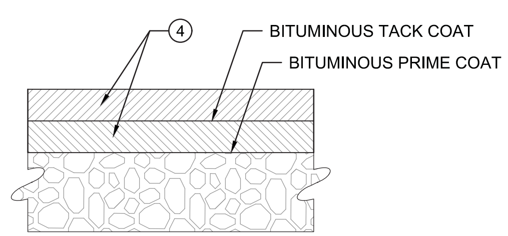
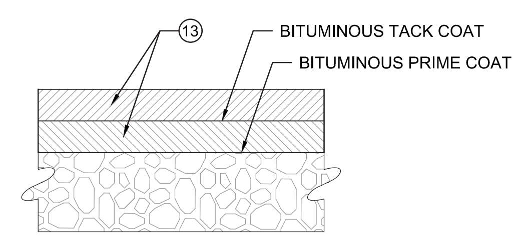


D C-204 OPTION 4: HMA ON RUBBLIZED CONCRETE
SCALE: HORIZONTAL: 1"=10' VERTICAL: 1"=1'



1 C-204 RUNWAY HMA DETAIL
SCALE: NONE



2 C-204 SHOULDER HMA DETAIL
SCALE: NONE

PAVEMENT MATERIAL SPECIFICATIONS		
CALLOUT	ITEM	DESCRIPTION
1	P-501	11.5" CONCRETE PAVEMENT
2	P-307	CEMENT TREATED PERMEABLE BASE COURSE
3	P-403	5" ASPHALT STABILIZED DRAINAGE LAYER
4	P-401	2" HOT MIX ASPHALT SURFACE
5	P-401	2.5" HOT MIX ASPHALT BASE
6	P-304	8" CEMENT-TREATED AGGREGATE BASE COURSE
7	P-209	6" CRUSHED AGGREGATE BASE COURSE
8	P-209	VARIABLE THICKNESS CRUSHED AGGREGATE BASE COURSE
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11	P-215	13" RUBBLIZED CONCRETE
12	P-152	EMBANKMENT
13	P-401	2" HOT MIX ASPHALT SURFACE - SHOULDER MIX

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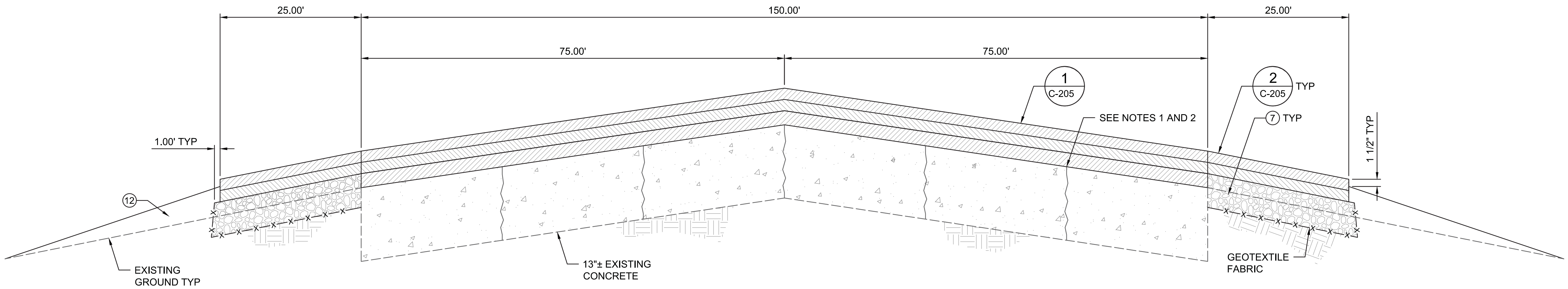


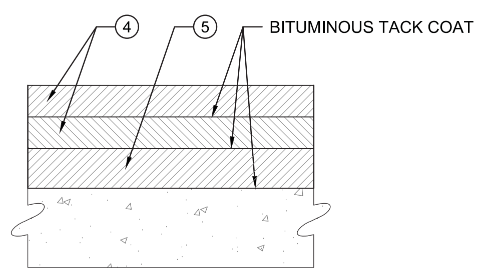
E C-205 OPTION 5: HMA OVERLAY

SCALE: HORIZONTAL: 1"=10' VERTICAL: 1"=1'

NOTES:

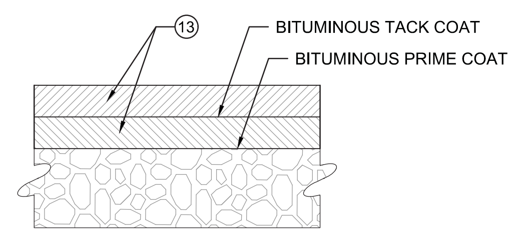
1. VARIABLE DEPTH PROFILE MILLING OF EXISTING CONCRETE TO ESTABLISH CROSS SLOPE.

2. AFTER MILLING, SURVEY ALL EXISTING CONCRETE JOINTS AND CRACKS. AFTER PLACING THE HMA OVERLAY, SAWCUT AND SEAL THE HMA AT THE LOCATION OF EACH UNDERLYING JOINT AND CRACK.



1 C-205 RUNWAY HMA DETAIL

SCALE: NONE



2 C-205 SHOULDER HMA DETAIL

SCALE: NONE

PAVEMENT MATERIAL SPECIFICATIONS

CALLOUT	ITEM	DESCRIPTION
1	P-501	11.5" CONCRETE PAVEMENT
2	P-307	CEMENT TREATED PERMEABLE BASE COURSE
3	P-403	5" ASPHALT STABILIZED DRAINAGE LAYER
4	P-401	2" HOT MIX ASPHALT SURFACE
5	P-401	2.5" HOT MIX ASPHALT BASE
6	P-304	8" CEMENT-TREATED AGGREGATE BASE COURSE
7	P-209	6" CRUSHED AGGREGATE BASE COURSE
8	P-209	VARIABLE THICKNESS CRUSHED AGGREGATE BASE COURSE
9	P-154	14" SUBBASE COURSE
10	P-155	12" LIME-TREATED SUBGRADE
11	P-215	13" RUBBLIZED CONCRETE
12	P-152	EMBANKMENT
13	P-401	2" HOT MIX ASPHALT SURFACE - SHOULDER MIX

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Appendix D

Comparative Safety Analysis Panel Report

Comparative Safety Analysis Panel Report:

Runway Rehabilitation

Manhattan Regional Airport

Meeting Date: November 12, 2019

Table of Contents

Table of Figures

Table of Tables

Section 1 Introduction

The Manhattan Regional Airport (MHK) which is owned and operated by the City of Manhattan, KS is currently conducting a master plan project which is led by Coffman and Associates (planning team). This process is taking into consideration major and much needed runway improvements on MHK's primary and only commercial service runway, Runway 3-21. The Runway also needs rehabilitation, so the planning team is addressing current geometry issues with taxiway alignments, lineup taxiway, and a displaced threshold condition. Further, there are major gradient change issues that need to be taken care of when this project is executed. The FAA Airports' Division (ARP), Airport District Office (ADO) has requested a Comparative Safety Assessment (CSA) in order to understand the potential safety and operational impacts of the alternatives to executing this project as part of the capital plan as part of the master planning effort. The results of the CSA are contained herein. Table 1 provides the participants list from the CSA which was held at the airport on November 12, 2019. See **Appendix A** for the sign-in sheets.

Table 1 Participants List

Participate	Organization	Panel Member, Observer, SME	On the phone, in person, or did not participate
Diane Hoffer	Olsson	Panel Member	In person
JJ Kuntz	Airport Advisory Board	Panel Member	In person
Jason Knipp	FAA ARP	Panel Member	In person
Nardos Wills	FAA	Panel Member	In person
Jerry Hayes	FAA	Panel Member	In person
Mike Dmyterko	Coffman & Associates	Panel Member	In person
Patti Roblyer	KJC	Panel Member	In person
Timothy McClaran	FAA	Panel Member	In person
Phillip C. Adams II	Midwest ATC	Panel Member	In person
Brennen Walter	Envoy	Panel Member	In person
Jesse Romo	MHK	Panel Member	In person
Mark Cozad	FAA	Panel Member	In person
Rich Jankovich	Airport Advisory Board	Panel Member	In person
Josh McCowan	Kansas State University/Airport Advisory Board	Panel Member	In person
Brandon Keazer	MHK	Panel Member	In person
Dave Fleet	Faith Group	Facilitator	In person

Section 2 Describe the System

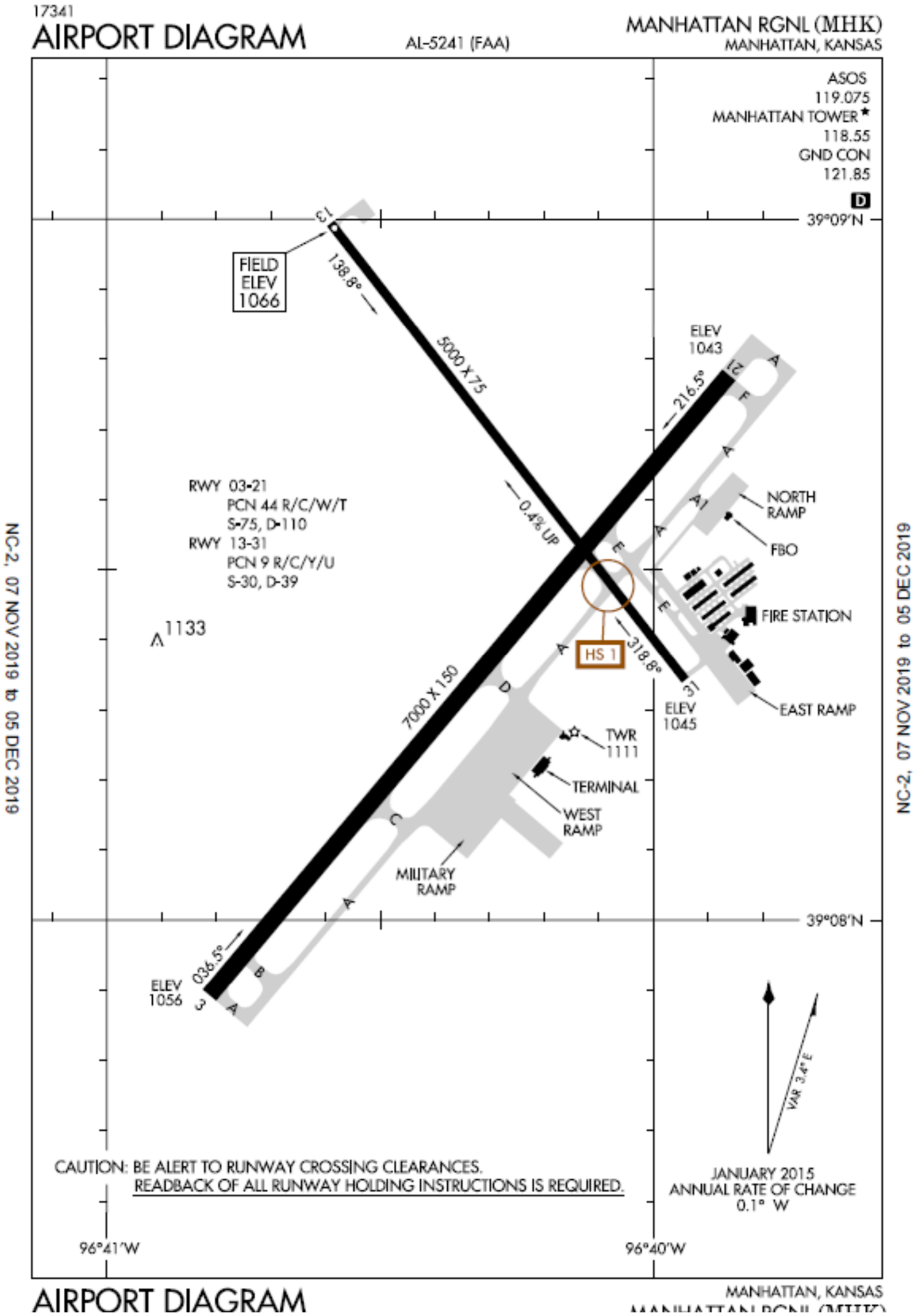
MHK has two runways. 3-21 is 7,000' X 150' with CAT I ILS on the Runway 3 end. Runway 13-31 is 5,000' X 75'. Runway 3-21 has a parallel taxiway. The turnoffs from the runway to primary taxiway (A) will be renamed as part of this project as well. The renaming will provide for an alphanumeric convention. MHK is served by one commercial air carrier, American Eagle. Passenger traffic as grown significantly over the past five years with American Eagle adding services and considering transitioning to larger commuter E-175 aircraft. MHK is also the primary airport for Kansas State University and provides services for sporting teams and events. Kansas State utilizes larger aircraft, such as Boeing 757/767 for their sports charters.

The Aircraft Design Group (ADG) for MHK is C-III and weighs less than 150,000 pounds. This represents the E-175. Kansas State as well as the military operate larger aircraft which represents C-III, weighing over 150,000 pounds. The annual operating numbers for the larger C-III are less than the 500 operations required by the FAA before an aircraft can be deemed as the designated ADG. See **Figure 1** for the current Airport Layout Plan.

Additional pertinent information that was discussed during the project briefing included:

a. Runway 3-21 aircraft operations breaks down with 60% on Runway 21 and 40% on Runway 3. Runway 21 is the prevailing wind coverage runway. NOTE: this was pertinent when discussing the need to move and subsequently rebuilt the current Taxiway D (noted in the next section).
b. MHK has approximately 632 annual commercial operations and are projected to double with 1,264 annual commercial operations within the next five years.

Figure 1 Airport Layout Plan



Section 3 Proposed System Change

The proposed system change, runway rehabilitation (the project), was broken down into the following four options to be compared to one another:

1. Runway Rehab construction technique
   a. Rubblization existing pavement and pave over it
   b. Full depth removal and replacement
2. Phasing options
   a. Phased approach regardless of type of technique
   b. Close it all at once and get it done as quickly as possible
3. ADG C-III over or under 150,000 lbs.
   a. Rebuild runway at 100’ wide for under 150,000 lbs.
   b. Rebuild runway at existing 150’ wide
4. D Taxiway will be removed to meet current design standards
   a. Consider replacing approximately 800’ down Runway 3 as part of the initial project
   b. Not replaced at all

Schedule differences

a. Full depth reconstruction would be 145 days with four phases
b. Rubblization reconstruction would be 95 days with the same four phases
c. A 24/7 construction operation would reduce overall project time by approximately 33%. Therefore, a rubblization approach could be reduce to 60 days with a 24/7 operation.

.

Section 4 Identify the Hazards

The CSA process is not approached as a strict Safety Risk Management (SRM) five step effort. However, as the planning team presented the alternatives and the panel members discussed and looked at potential impacts, some important hazardous distinctions came to light. Negative impacts to the operation and the airport's ability to provide service were also considered.

- A phased approach with the full depth reconstruction option will leave deep excavation areas along the closed runway and adjacent open pavements. While this condition is not new to airfield construction projects it is more hazardous than the Rubblization option.
- The phased approach in either reconstruction scenario leaves declared distances as the only option to keep Runway 3-21 open, and in multiple phases there would be marginal runway length available for commercial operations.
- The full depth reconstruction option will leave large excavation areas that will fill with water when rain occurs. This situation will slow the project and only serve to further restrict commercial operations. Rubblization will reduce this possibility significantly.
- United Airlines will not operate Kansas State sports team charters on a 100' wide runway. While there was not direct knowledge presented, it was believed the military charters with ADG C-III and larger cannot operate on a 100' wide runway as well. NOTE: strictly an operational impact.
- Should Runway 3-21 be reconstructed to meet current design standards for ADG C-III under 150,000 lbs. it would be narrowed to 100' in width. As explained in the previous bullet this will significantly impact users of MHK and provide a runway that is more constrained than what currently exists. NOTE: strictly an operational impact.

Table 2 – Hazards and Potential Mitigations

<table>
<tr><th></th><th>Hazards</th><th>Potential Mitigations</th></tr>
<tr><td>1.</td><td>Full depth reconstruction leaves open areas next to AOA surfaces.</td><td rowspan="5">Runway Rehab construction technique
Rubblization existing pavement and pave over the top was chosen.
Phasing options
Close Runway 3-21 all at once and get it done as quickly as possible
NOTE: the option of reducing the project to just two phases is still a possibility in order to keep Runway 13-31 open for as long as possible, given the intersection work with Runway 3-21. This will minimize the complete closure of the airport.
ii. Determine the added costs of a 24/7 operation compared to a month of operational impact to the airport.
ADG C-III over or under 150,000 lbs.
Rebuild runway at existing 150' wide is what will be shown on the ALP and how the planning team will approach overall project management.
NOTE: given that FAA ARP may only fund work for a 100' wide runway, because there are 500 ADG operations requirements not currently being met that would justify 150', the planning team will look to understand the budget short fall and assist the airport with addressing it.
D Taxiway will be removed to meet current design standards</td></tr>
<tr><td>2.</td><td>Phased approach provides marginal runway length for commercial operations.</td></tr>
<tr><td>3.</td><td>Large open areas filling with water during rain events.</td></tr>
<tr><td>4.</td><td>United Airlines providing Kansas State U. charters will not operate on a 100' wide runway. NOTE: strictly an operational impact.</td></tr>
<tr><td>5.</td><td>Should Runway 3-21 be reconstructed to meet current design standards for ADG C-III under 150,000lbs. It would be narrowed to 100'</td></tr>
</table>

	Hazards	Potential Mitigations
	in width. NOTE: strictly an operational impact.	• D Taxiway will be removed and relocated in the new proposed location on the ALP (800' to the Northeast), to be funded later.

Section 5 Decisions

Given the identified hazards, operational impacts, and financial implications (not normally considered in the CSA process given that they are not safety hazards), the following decisions were made:

1. Runway Rehab construction technique
    a. Rubblization existing pavement and pave over the top was chosen.
2. Phasing options
    a. Close Runway 3-21 all at once and get it done as quickly as possible
        i. NOTE: the option of reducing the project to just two phases is still a possibility in order to keep Runway 13-31 open for as long as possible, given the intersection work with Runway 3-21. This will minimize the complete closure of the airport.
        ii. Determine the added costs of a 24/7 operation compared to a month of operational impact to the airport.
3. ADG C-III over or under 150,000 lbs.
    a. Rebuild runway at existing 150’ wide is what will be shown on the ALP and how the planning team will approach overall project management.
        i. NOTE: given that FAA ARP may only fund work for a 100’ wide runway, because there are 500 ADG operations requirements not currently being met that would justify 150’, the planning team will look to understand the budget short fall and assist the airport with addressing it.
4. D Taxiway will be removed to meet current design standards
    a. D Taxiway will be removed and relocated in the new proposed location on the ALP (800’ to the Northeast), to be funded later.

The results from this CSA are documented in the FAA ARP SAS-1 form, CSA tab. See attached in **Appendix B** for reference.

Section 6 Conclusion

While the airport, tenants, operators, planning team, and FAA attended and came to decisions about the overall approach for this project, there are still several outstanding issues. The planning team will be addressing the funding and phasing as the ALP is finalized and the capital plan and budget are finalized.

Appendix A Sign In Sheets

City of Manhattan Kansas
Manhattan Regional Airport

DATE: November 12, 2019		
SMS Meeting		
NAME	**ORGANIZATION**	**PHONE NUMBER**
14 Mark Cozad	FAA - Part 139	(816) 329-2621
15 [illegible]	MHK	785-587-4592
16 RICH JANKOVICH	MHK	219-730-9378
17 Josh McCowan	MHK	785-410-6266
18		
19		
20		
21		
22		
23		
24		
25		
26		

City of Manhattan Kansas
Manhattan Regional Airport

0

DATE: November 12, 2019		
SMS Meeting		
NAME	ORGANIZATION	PHONE NUMBER
1 DAVE FLEET	FAITH GROUP	317-490-0050
2 Diane Hofer	Olsson	402-641-4468
3 JJ KUNTZ	Bluemont Hotel	785-473-7091
4 JASON KNIPP	FAA AIRPORTS	816-329-2646
5 Nardos Wills	FAA	816 329 2636
6 Jerry Hayes	FAA	816-329-2632
7 Mike Dmyterko	Coffman Associates	816 524 3500
8 Patti Roblyer	KJC	785-776-1991
9 Timothy McClaren	FAA	816 329 2623
10 Phillip C Adams II	MHK Tower ATM	785-341-7597
11 Brennen Walter	Envoy	785-564-2882
12 Jesse Romo	MHK	785-587-4565
13		

Appendix B FAA ARP SAS-1 Form

FAA Office of Airports Safety Assessment Tools

Region: ACE | **Locid** MHK

Office: ACE-620 | **Airport:** Manhattan Regional

State: KS | **City:** Manhattan | **State:** KS

Project Manager: #NAME? | **SMS ID:**

SAS

PHA

NfdcFacilities

Matrix

CSA Alternatives

EmployeeDirectoryResults

HAW Table

Not

CSA

SME Pool

SAS Table

OSA

Alt Table

Attachments:

Proposal Summary

OE/AAA Comments

SRM Report

Other Document Narratives CSA

Airports Safety Risk Management (SRM) **Compile data and existing conditions**

Safety Assessment Screening for Projects (SAS-1) **Page 1**

1. Project Location

a. Locid	MHK	**SMS ID:**	0
b. Airport	Manhattan Regional Airport		
c. City	Manhattan		
d. State	KS		
e. Sponsor	City of Manhattan		
f. Service Level	P C		
g. CFR 139 Date	03/2005		
h. CFR 139 Type	I A S		

2. Describe the Proposed Action (Include any identifying number or date of submission (e.g., date of ALP))

The Manhattan Regional Airport (MHK) which is owned and operated by the City of Manhattan, KS is currently conducting a master plan project which is led by Coffman and Associates (planning team). This process is taking into consideration major and much needed runway improvements on MHK's primary and only commercial service runway, Runway 3-21. The Runway also needs rehabilitation, so the planning team is addressing current geometry issues with taxiway alignments, lineup taxiway, and a displaced threshold condition. Further, there are major gradient change issues that need to be taken care of when this project is executed. The FAA Airports' Division (ARP), Airport District Office (ADO) has requested a Comparative Safety Assessment (CSA) in order to understand the potential safety and operational impacts of the alternatives to executing this project as part of the capital plan as part of the master planning effort. The CSA which was held at the airport on November 12, 2019.

3. Approval Action Type/Triggering Event (Select all that apply)

a. ☑ *Airport Layout Plan (ALP) (new or update)*
b. ☐ Airport construction review, coordination, and approval
c. ☐ *Other airport changes not involving construction*
d. ☐ Part 150 Noise Compatibility Program (measures that may affect aviation safety)

4. Project Screening

a. ○ A preliminary analysis indicates that an SRM review is required (Complete pages 2 & 3)
b. ○ The proposal does not require further SRM review (Discard pages 2 & 3)

Prepared by: David M. Fleet

Office: Faith Group LLC (Facilitator) Signature: ______________

Title: Director of Consulting (Facilitator) Date: 2/11/2020

Safety Assessment Screening for Projects (SAS-1) **Page 2**

SMS ID: 0

5. Was the proposal reviewed by OE/AAA?

a. ○ Yes ◉ No (Skip to block number 6)

b. Case Number:

c. Determination Date:

d. ☐ OE/AAA review comments attached.

e. ☐ OE/AAA review indicates an objection to the proposal.

6. A review of the proposal indicates the following: (Select all that apply)

ARP System Safety Impact Checklist

a. ☐ The Proposed Action may deviate from applicable FAA standards

b. ☐ The Proposed Action may increase aviation safety risks, with existing controls in-place

c. ☑ The Proposed Action may adversely affect aviation operations with existing controls in-place

d. ☐ The Proposed Action my affect navigational aids

e. ☐ The Proposed Action may impact TERPS surfaces

f. ☐ Other Safety Impact:

SRM Panel

g. __ The OE/AAA review indicates that an SRM panel is required.

h. √ The Safety Impact Checklist indicates that an SRM panel is required

7. SRM Finding of No Increased Risk

The proposed action was reviewed with respect to known hazards and existing controls. Potential risks were evaluated with appropriate FAA personnel, airport operations, and other aviation officials with safety responsibilities. Based on this review, existing controls (including standard NOTAMS) will eliminate the probability of new risks being introduced into the aviation system. An SRM panel is not required.

Name and Title	**Date**	**Signature**
N/A		

8. SRM Panel and Findings

a. Report date: **b.** ☐ Report attached

9. Initial Risk Determination

a. ◉ Low initial Risk. Attach supporting documentation.

b. ○ Medium Initial Risk. Attach detailed explanation of hazards.

c. ○ High Initial Risk. Attach detailed explanation of hazards. (Requires review by ARP Safety Review Board)

10. Final Risk Determination

a. ◉ Low Risk. Attach detailed explanation of mitigating measures, including NOTAM requirements.

b. ○ Medium Risk. Attach detailed explanation of mitigating measures, including NOTAM requirements.

c. ○ High Risk. The project proposal with risk mitigation in place is unacceptable.

Safety Assessment Screening for Projects (SAS-1)

SMS ID: 0

11. SRM Panel Members and Certification

We certify that we have reviewed the project documentation and have fully considered the potential hazards (and any proposed mitigation measures) before reaching this determination. Dissenting opinions concerning the determination are included in the report.

Name	hours and team needed for overs	Title	Date	Signature
Phillip Adams II		Midwest ATC	Feb 12, 2020	Phillip C Adams II
Brennen Walter		Envoy	2/12/20	Brennen Walter

12. Airport Certification and Acceptance

As a duly authorized representative of the sponsor of the airport identified above, I hereby certify that I have reviewed and understand the hazards and mitigation measures identified in the attached documentation. I further certify that I understand it is our legal duty, as sponsor, to ensure that any and all airport-related mitigation measures are fulfilled and documented in a timely manner. Any such commitments on our part represent an obligation under our Federal grant assurances, regardless of whether the FAA participates in the funding of any part of the Proposed Action. Nothing in the FAA's review may be deemed as relieving the sponsor of its legal obligations as owner and operator of the airport.

Name and Title	Date	Signature
Jesse R. Romo, A.A.E Airport Director	2/19/20	[signature]

13. FAA SRM Approval

Hazards were identified and analyzed using standard procedures and processes in accordance with FAA Order 5200.11. Mitigation measures, including draft NOTAM requirements, if necessary, are attached and are included with the formal FAA project approval action. These measures will help ensure safety levels are maintained at acceptable levels both during and after the proposed construction and non-construction airport changes.

Name and Title	Date	Signature

Comparative Safety Assessment

SMS ID:

Airport: MANHATTAN RGNL

Locid: MHK

City: MANHATTAN

Project Manager: David M. Flee

Description: Comparing

1 Hazard ID	2 Hazard Description	3 Causes	4 System States	5 Effects	6 Severity	7 Severity Rationale	8 Existing Controls	9 Alt1	10 Alt2	11 Alt3	12 Alt4
MHK-0-1	Full Depth Reconstruction leaves open areas next to AOA surfaces.	Full depth excavation of the runway and phases.	During a full depth reconstruction project, with a phased approach.	Aircraft operations over and toward significant changes in surfaces.				NOTE: the severity of these issues could not be quantified in the context of the meeting. See Narrative report.			
MHK-0-2	Phased approach provides marginal runway length for commercial operations.	5,500' displaced threshold runway for three phases of the project.	If the project is phased with the intent of keep a usable runway this will be the best result.	Impact to commercial and charter operators.				NOTE: the severity of these issues could not be quantified in the context of the meeting. See Narrative report.			
MHK-0-3	Large open areas filling with water during rain events.	Full depth excavation of the runway and phases.	During a full depth reconstruction project.	Extends the time for the project resulting in a negative operational impact.				NOTE: the severity of these issues could not be quantified in the context of the meeting. See Narrative report.			
MHK-0-4	United Airlines providing Kansas State U. charters will not operate on a 100' wide runway.	ADG C-III less than 150,000 lbs. requires only a 100' wide runway. (Design AC requirements)	Only if the project is completed to meet the minimum standards.	Airport not providing necessary services to their major, local employer.				NOTE: the severity of these issues could not be quantified in the context of the meeting. See Narrative report.			
MHK-0-5	Should Runway 3-21 be reconstructed to meet current design standards for ADG C-III under 150,000 lbs. it would be narrowed to 100' in width. As explained in the previous bullet this will significantly impact users of MHK and provide a runway that is more constrained than what currently exists.	ADG C-III less than 150,000 lbs. requires only a 100' wide runway. (Design AC requirements)	Only if the project is completed to meet the minimum standards.	Airport not providing necessary services to their major, local employer.				NOTE: the severity of these issues could not be quantified in the context of the meeting. See Narrative report.			
MHK-0-6											
MHK-0-7											
MHK-0-8											
MHK-0-9											
MHK-0-10											
MHK-0-11											
MHK-0-12											
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MHK-0-28											
MHK-0-29											
MHK-0-30											

Last Name	First Name	Organization	Title	Email	Telephone	Name	Date Signed
Hoffer	Diane	Olsson					
Kuntz	JJ	Airport Advisory Board					
Knipp	Jason	FAA ARP					
Wills	Nardos	FAA					
Hayes	Jerry	FAA					
Dmyterko	Mike	Coffman & Assoc.					
Roblyer	Patti	KJC					
McClaran	Tim	FAA					
Adams II	Phillip	Midwest ATC					
Walter	Brennen	Envoy					
Romo	Jesse	MHK					
Cozad	Mark	FAA					
Jankovich	Rich	Airport Advisory Board					
McCowan	Josh	Kansas State University/Airport Advisory Board					
Keazer	Brandon	MHK					
Fleet	Dave	Faith Group LLC					

Appendix E

ALP Set

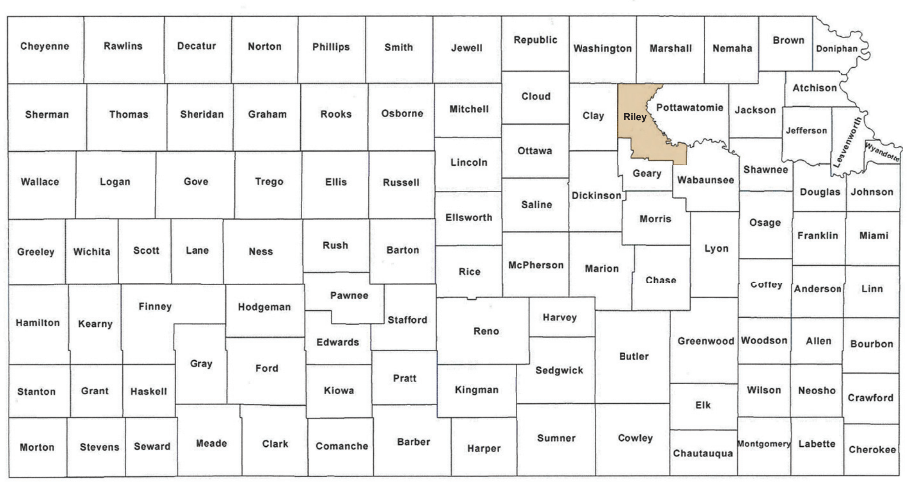
AIRPORT LAYOUT PLANS

for the

MANHATTAN REGIONAL AIRPORT

Manhattan, Kansas

Prepared for
the City of Manhattan, Kansas



DRAWING INDEX

1. TITLE SHEET
2. AIRPORT DATA SHEET
3. AIRPORT LAYOUT DRAWING
4. AIRPORT AIRSPACE DRAWING I
5. AIRPORT AIRSPACE DRAWING II
6. AIRPORT AIRSPACE PROFILE DRAWING I RUNWAY 3-21
7. AIRPORT AIRSPACE PROFILE DRAWING II RUNWAY 3
8. AIRPORT AIRSPACE PROFILE DRAWING III RUNWAY 13-31
9. INNER PORTION OF THE APPROACH SURFACE DRAWING RUNWAY 3
10. INNER PORTION OF THE APPROACH SURFACE DRAWING RUNWAY 21
11. INNER PORTION OF THE APPROACH SURFACE DRAWING RUNWAY 13
12. INNER PORTION OF THE APPROACH SURFACE DRAWING RUNWAY 31
13. RUNWAY 3-21 DEPARTURE SURFACE DRAWING
14. TERMINAL AREA DRAWING
15. LAND USE DRAWING

LOCATION MAP

VICINITY MAP

FOR APPROVAL BY

Jesse R. Romo, A.A.E. Digitally signed by Jesse R. Romo, A.A.E. Date: 2020.05.07 12:36:15 -05'00'

Jesse R. Romo
Airport Director
DATE:

NO.	REVISIONS	DATE	BY	APP'D.

"THE PREPARATION OF THESE DOCUMENTS WAS FINANCED IN PART THROUGH A GRANT FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER SECTION 505 OF THE AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1982, AS AMENDED. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THESE DOCUMENTS BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT ON THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED HEREIN NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH APPROPRIATE PUBLIC LAWS."

MANHATTAN REGIONAL AIRPORT (MHK)

TITLE SHEET

MANHATTAN, KS

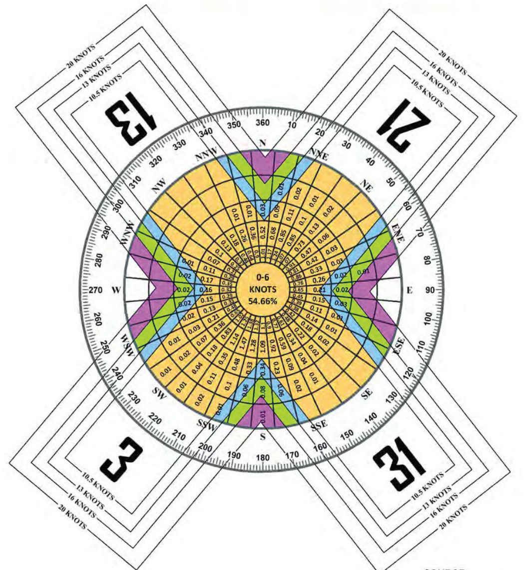
PLANNED BY: M. Dmyterko
DETAILED BY: D. Przybycien
APPROVED BY: T.Kahmann

April 2020 SHEET 1 OF 15

Coffman Associates
Airport Consultants
www.coffmanassociates.com

ALL WEATHER WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 3-21	95.25%	97.88%	99.53%	99.91%
Runway 13-31	88.56%	93.68%	98.00%	99.47%
All Runways	98.95%	99.77%	99.95%	99.99%



SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Manhattan Regional Airport
Manhattan, KS

OBSERVATIONS:
102,834 All Weather Observations
Jan. 1, 2008 - Dec. 31 2017

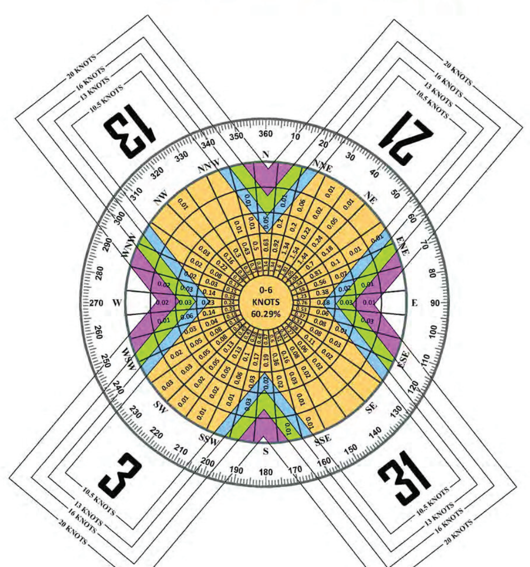
Magnetic Declination
00° 00' East
Annual Rate of Change
00° 00' West
(Source: NOAA, NCEI, Monty Year)

RUNWAY DATA TABLE	RUNWAY 3 - 21 EXISITING 3	EXISITING 21	INTERIM (0-5 Years)[1] 3	INTERIM 21	ULTIMATE 3	ULTIMATE 21	RUNWAY 13-31 EXISITING 13	EXISITING 31	ULTIMATE 13	ULTIMATE 31
RUNWAY IDENTIFICATION	3	21	3	21	3	21	13	31	13	31
RUNWAY DESIGN CODE (RDC)	C-II-4000		C-II-4000		C-III-2400		B-II-5000		B-II-5000	
APPROACH REFERENCE CODE (APRC)	D/IV/4000		D/IV/4000		D/IV/4000		B/II/VIS		B/II/VIS	
DEPARTURE REFERENCE CODE (DPRC)	D/IV		D/IV		D/IV		B/II		B/II	
RUNWAY SURFACE MATERIAL	CONCRETE		CONCRETE		CONCRETE		CONCRETE		CONCRETE	
RUNWAY PAVEMENT STRENGTH WHEEL LOADING (IN THOUSAND LBS. #1)	75 (S), 110 (D)		75 (S), 110 (D)		75 (S), 110 (D)		30 (S), 39 (D)		30 (S), 75 (D)	
RUNWAY PAVEMENT STRENGTH PCN	44 /R/C/W/T		44 /R/C/W/T		44 /R/C/W/T		9 /R/C/Y/U		9 /R/C/Y/U	
RUNWAY PAVEMENT SURFACE TREATMENT	GROOVED		SAME		GROOVED		N/A		SAME	
RUNWAY EFFECTIVE GRADIENT	0.18%		SAME		0.28%		0.43%		SAME	
RUNWAY WIND COVERAGE	99.53% @ 16 KNOTS (AW)		SAME		SAME		88.56% @10.5 KNOTS (AW)		SAME	
	99.64% @ 16 KNOTS (IFR)		SAME		SAME		90.33% @ 10.5 KNOTS (IFR)		SAME	
RUNWAY DIMENSIONS (L X W)	7000' X 150'		7400' X 150'		8400' X 150'		5001' X 75'		SAME	
RUNWAY DISPLACED THRESHOLD ELEVATION (NAVD88)	N/A	N/A	N/A	1043.4'	N/A	SAME	N/A	N/A	SAME	SAME
RUNWAY SAFETY AREA DIMENSION DESIGN STANDARD (W x LENGTH BEYOND END)	500' X 1000'	500' X 1000'	SAME	500' X 1000'	500' X 1000'	SAME	120' X 240'	120' X 240'	150' X 300'	150' X 300'
RUNWAY SAFETY AREA DIMENSION ACTUAL (W x LENGTH BEYOND END)	500' X 1000'	500' X 1000'	SAME	500' X 1000'	500' X 1000'	SAME	120' X 240'	120' X 240'	150' X 300'	150' X 300'
RUNWAY END COORDINATES LAT	39°07'53.58"	39°08'46.65"	SAME	39°08'49.67"	39°07'46.00"	SAME	39°08'59.63"	39°08'20.57"	SAME	SAME
RUNWAY END COORDINATES LONG	96°40'48.74"	96°39'51.75"	SAME	96°39'48.50"	96°40'56.88"	SAME	96°40'35.43"	96°39'56.54"	SAME	SAME
RUNWAY DISPLACED THRESHOLD COORDINATES LAT	N/A	N/A	SAME	39°08'46.88"	N/A	SAME	N/A	N/A	SAME	SAME
RUNWAY DISPLACED THRESHOLD COORDINATES LONG	N/A	N/A	SAME	96°39'51.50"	N/A	SAME	N/A	N/A	SAME	SAME
RUNWAY LIGHTING TYPE	HIRL		SAME		HIRL		MIRL		MIRL	
RUNWAY PROTECTION ZONE DIMENSIONS	1700' X 1000' X 1510'	1700' X 1000' X 1510'	SAME	1700' X 1000' X 1510'	2500' X 1000' X 1750'	SAME	1000' X 500' X 700'	1000' X 500' X 700'	SAME	SAME
RUNWAY MARKING TYPE	PRECISION	NONPRECISION	SAME	NONPRECISION	PRECISION	SAME	NONPRECISION	NONPRECISION	SAME	SAME
14 CFR PART 77 APPROACH CATEGORY	34:1	34:1	SAME	34:1	50:1/40:1	SAME	20:1	20:1	SAME	SAME
APPROACH TYPE	NONPRECISION	NONPRECISION	SAME	NONPRECISION	PRECISION	SAME	VISUAL	VISUAL	SAME	SAME
VISIBILITY MINIMUMS	3/4 Mile	3/4 Mile	SAME	3/4 Mile	1/2 Mile	SAME	≥ 1 MILE	≥ 1 MILE	SAME	SAME
TYPE OF AERONAUTICAL SURVEY REQUIRED FOR APPROACH	VGS	VGS	SAME	VGS	VGS	SAME	NVG	NVG	SAME	SAME
DEPARTURE SURFACE (YES/NO)	YES	YES	SAME	YES	YES	SAME	NO	NO	SAME	SAME
RUNWAY OBJECT FREE AREA DIMENSION DESIGN STANDARD (W x LENGTH BEYOND END)	800' x 1000'	800' x 1000'	SAME	800' x 1000'	800' x 1000'	SAME	400' X 240'	400' X 240'	500' X 300'	500' X 300'
RUNWAY OBJECT FREE AREA DIMENSION ACTUAL (W x LENGTH BEYOND END)	800' x 1000'	800' x 1000'	SAME	800' x 1000'	800' x 1000'	SAME	400' X 240'	400' X 240'	500' X 300'	500' X 300'
RUNWAY OBSTACLE FREE ZONE DIMENSION DESIGN STANDARD (W x LENGTH BEYOND END)	400' X 200'	400' X 200'	SAME	400' X 200'	400' X 200'	SAME	400' X 200'	400' X 200'	SAME	SAME
RUNWAY OBSTACLE FREE ZONE DIMENSION ACTUAL (W x LENGTH BEYOND END)	400' X 200'	400' X 200'	SAME	400' X 200'	400' X 200'	SAME	400' X 200'	400' X 200'	SAME	SAME
OBSTACLE CLEARANCE SURFACE (OCS)/SITING SURFACE	4, 6, 7	4, 6, 7	SAME	4, 6, 7	5, 6, 7	SAME	3	3	SAME	SAME
RUNWAY VISUAL AND INSTRUMENT NAVAIDS	ILS, LPV/RNAV GPS, VOR, MALSR, PAPI-4, HIRL	LPV/RNAV, PAPI-4, REIL, HIRL	SAME	LPV/RNAV, PAPI-4, REIL, HIRL	ILS, LPV/RNAV GPS, VOR, MALSR, PAPI-4, HIRL	SAME	VASI-2, MIRL	VASI-4, MIRL, REIL	PAPI-2, MIRL	PAPI-4, MIRL, REIL
TOUCHDOWN ZONE ELEVATION (TDZE)	1056.0'	1048.2'	SAME	1048.1'	1066.0'	1048.1'	1066.0'	1051.1'	1066.0'	1051.1'
TAXIWAY WIDTH	35'-50'	35'-50'	SAME	35'-50'	35'-50'	35'-50'	35'-50'	35'-50'	35'-50'	35'-50'
TAXIWAY SAFETY AREA DIMENSIONS	79'	79'	SAME	79'	118'	118'	79'	79'	79'	79'
TAXIWAY OBJECT FREE AREA DIMENSIONS	131'	131'	SAME	131'	186'	186'	131'	131'	131'	131'
TAXIWAY CENTERLINE TO FIXED OR MOVABLE OBJECT	65.5'		SAME		81.0'		39.5'		57.5'	
TAXIWAY LIGHTING	MITL	MITL	SAME	MITL	MITL	MITL	MITL	MITL	MITL	MITL
HORIZONTAL DATUM	NAD83		NAD83		NAD83		NAD83		NAD83	
VERTICAL DATUM	NAVD88		NAVD88		NAVD88		NAVD88		NAVD88	

[1] INTERIM CONDITION CONSIDERS RUNWAY RECONSTRUCTION WITHIN THE NEXT 5 YEARS

IFR WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 3-21	96.79%	98.59%	99.64%	99.90%
Runway 13-31	90.33%	94.35%	98.18%	99.48%
All Runways	99.28%	99.80%	99.94%	100.00%



SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Manhattan Regional Airport
Manhattan, KS

OBSERVATIONS:
11,983 IFR Observations
Jan. 1, 2008 - Dec. 31 2017

TAXIWAY DATA TABLE

EXISTING TAXIWAY DESIGNATION	ULTIMATE TAXIWAY DESIGNATION	EXISTING/ ULTIMATE TAXIWAY WIDTH	EXISTING/ ULTIMATE TAXILANE WIDTH	EXISTING/ ULTIMATE TAXIWAY SAFETY AREA DIMENSION	EXISTING/ULTIMATE TAXIWAY OBJECT FREE AREA DIMENSION	EXISTING/ ULTIMATE TAXILANE SAFETY AREA DIMENSION	EXISTING/ ULTIMATE TAXILANE OBJECT FREE AREA DIMENSION	EXISTING/ ULTIMATE TAXIWAY & TAXILANE SEPARATION	EXISTING/ ULTIMATE TAXIWAY LIGHTING
A	A	50'	N/A	79'/118'	131'/186'	N/A	115'/162'	NA	MITL
B	A6	80'	N/A	79'/118'	131'/186'	N/A	115'/162'	NA	MITL
C	A5	85'	N/A	79'/118'	131'/186'	N/A	115'/162'	NA	MITL
D	A4	50'	N/A	79'/118'	131'/186'	N/A	115'/162'	NA	MITL
E	A3	65'	N/A	79'/118'	131'/186'	N/A	115'/162'	NA	MITL
F	A2	113'	N/A	79'/118'	131'/186'	N/A	115'/162'	NA	MITL
-	A1	90'	N/A	79'/118'	131'/186'	N/A	115'/162'	NA	MITL

RUNWAY DECLARED DISTANCE	EXISTING 3	EXISTING 21	INTERIM 3	INTERIM 21	ULTIMATE 3	ULTIMATE 21	EXISTING 13	EXISTING 31	ULTIMATE 13	ULTIMATE 31
TAKE OFF RUN AVAILABLE (TORA)	7000	7000	7030'	7400'	8030'	8400'	5001'	5001'	5001'	5001'
TAKEOFF DISTANCE AVAILABLE (TODA)	7000	7000	7030'	7400'	8030'	8400'	5001'	5001'	5001'	5001'
ACCELERATE-STOP DISTANCE AVAILABLE (ASDA)	7000	7000	7030'	7400'	8030'	8400'	5001'	5001'	5001'	5001'
LANDING DISTANCE AVAILABLE (LDA)	7000	7000	7030'	7030'	8030'	8030'	5001'	5001'	5001'	5001'

ELECTRONIC AIRPORT NAVAID OWNERSHIP

NAVAID	OWNER
ILS	FAA
GS	FAA
MALSR	FAA
ASOS-3	NOAA
BEACON	CITY OF MANHATTAN, KS
VOR	FAA
PAPI-4	FAA
VASI-2	FAA
MIRL	CITY OF MANHATTAN, KS
MITL	CITY OF MANHATTAN, KS
REIL	FAA

AIRPORT DATA

MANHATTAN REGIONAL AIRPORT			
CITY: MANHATTAN	COUNTY: RILEY	OWNER: CITY OF MANHATTAN, KS	
	EXISITNG	INTERIM	ULTIMATE
AIRPORT REFERENCE CODE (ARC)	ARC C-II	ARC C-II	ARC C-III
MEAN MAXIMUM TEMPERATURE OF HOTTEST MONTH	91.1° JULY		
AIRPORT ELEVATION (NAVD 88)	1066.0'	SAME	SAME
AIRPORT NAVIGATION AIDS	ROTATING BEACON, MALSR (3)	SAME	SAME
	GLIDESLOPE	SAME	SAME
	PAPI-4L (3-21), VASI-2L (13-31)		
	HIRL (3-21), MIRL (13-31)	SAME	SAME
	REIL (31)	SAME	SAME
AIRPORT REFERENCE POINT (ARP) COORDINATES (NAD 83)	39°08'28.44"	39°08'29.07"	39°08'26.15"
	96°40'18.47"	96°40'17.56"	96°40'20.19"
MISCELLANEOUS FACILITIES	ASOS-3, LIGHTED WINDCONE/SEGMENTED CIRCLE, MIRL, MITL	SAME	SAME
DESIGN CRITICAL AIRCRAFT	CRJ 700	SAME	ERJ 175
WINGSPAN OF DESIGN AIRCRAFT (FEET)	76.27'	SAME	93.92
APPROACH SPEED OF DESIGN AIRCRAFT (KNOTS)	135	SAME	124
UNDERCARRIAGE WIDTH OF DESIGN AIRCRAFT (FEET)	18.85'	SAME	23.58
MAGNETIC DECLINATION (DEGREES)	3°1'E	3°1'E	3°1'E
DECLINATION DATE	10/21/2019	10/21/2019	10/21/2019
DECLINATION SOURCE	NOAA.GOV	NOAA.GOV	NOAA.GOV
NPIAS CODE	P	P	P
STATE SYSTEM PLAN ROLE	CS	CS	CS

MODIFICATIONS TO STANDARDS APPROVAL TABLE

APPROVAL DATE	AIRSPACE CASE NUMBER	STANDARD MODIFIED	DESCRIPTION
NONE REQUIRED			

NO.	REVISIONS	DATE	BY	APP'D.

"THE PREPARATION OF THESE DOCUMENTS WAS FINANCED IN PART THROUGH A GRANT FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER SECTION 505 OF THE AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1982, AS AMENDED. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THESE DOCUMENTS BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT ON THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED HEREIN NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH APPROPRIATE PUBLIC LAWS."

MANHATTAN REGIONAL AIRPORT (MHK)

AIRPORT DATA SHEET

MANHATTAN, KS

PLANNED BY: M. Dmyterko
DETAILED BY: D. Przybycien
APPROVED BY: T.Kahmann

April 2020

SHEET 2 OF 15

Coffman Associates
Airport Consultants
www.coffmanassociates.com

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
ESMT	ESMT(U)	AVIGATION EASEMENT
N/A		AIRPORT PROPERTY- ACQUISITION METHOD AT THE DISCRETION OF AIRPORT
32 33 / 5 4		SECTION CORNERS
		AIRPORT REFERENCE POINT (ARP)
	N/A	AIRPORT BEACON
		AWOS-3
BRL		BUILDING RESTRICTION LINE (25')
		NAVAID CRITICAL AREA
		STRUCTURES ON AIRPORT
		STRUCTURE OFF AIRPORT
N/A		ABANDON/REMOVE
		FENCE LINE
		HOLD MARKING
		RUNWAY PAVEMENT
		TAXIWAY PAVEMENT
		APRON PAVEMENT
		OBSTRUCTION AREA WITH OBSTACLE ID
DESIGNATION		SURVEY MONUMENT WITH IDENTIFIER
OFA	OFA(U)	OBJECT FREE AREA
RSA	RSA(U)	RUNWAY SAFETY AREA
OFZ	OFZ(U)	OBSTACLE FREE ZONE
A	N/A	OBSTACLE FREE ZONE PENETRATION
N/A	POFZ(U)	PRECISION OBSTACLE FREE ZONE
		ROADS PAVED
		ROADS UNPAVED
RPZ		RUNWAY PROTECTION ZONE
RVZ	RVZ(U)	RUNWAY VISIBILITY ZONE
TOFA	TOFA(U)	TAXIWAY OBJECT FREE AREA
TSA	TSA(U)	TAXIWAY/TAXILANE SAFETY AREA
		TIE-DOWNS
		PAPI-4
	N/A	VASI-4
		RUNWAY END IDENTIFIER LIGHTS (REIL)
		TREELINE
400	400	TOPOGRAPHIC CONTOURS

EXISTING AIRPORT FACILITIES

NO.	DESCRIPTION	ELEV. (MSL)
1	Terminal Building	1075.2'
2	Administration Office	1061.9'
3	ATCT	1111.2'
4	Electrical Vault	1053.4'
5	KS Jet Center (FBO)	1065.7'
6	Storage/Tenant	1068.0'
7	Airport Maintenance	1064.0'
8	Dry Material Storage	1071.8'
9	Hangar E-2	1063.9'
10	Hangar E-1	1064.4'
11	Corporate Hangar	1067.1'
12	Hangar D	1063.8'
13	Hangar C	1057.3"
14	Hangar B	1057.4'
15	Office/Storage	1065.1'
16	Hangar A	1065.1'
17	Hangar H	1059.6'
18	ARFF Facility	1079.1'
19	Storage/Tenant	1064.2'
20	Old Terminal Hangar	1085.6'
21	AIRPORT BEACON	1111.2'
22	Clearspan Hangar	1067.9'
23	Corporate Hangar	1067.8'
24	Corporate Hangar	1067.8'
25	Fuel Farm	1055.5'
26	Fuel Farm	1060.3'

PACS SACS STATIONS

DESIGNATION	PERMANENT IDENTIFIER	LATITUDE	LONGITUDE
MHK A	AJ8083	39° 08' 05.843" N	096° 40' 41.637" W
MHK B	AJ8084	39° 08' 18.405" N	096° 39' 55.179" W
MHK C	AJ8085	39° 08' 38.818" N	096° 40' 07.178" W

MHK A SETTING: SET IN STAINLESS STEEL ROD IN SLEEVE FLUSH WITH GROUND
MHK B SETTING: SET IN TOP OF CONCRETE MONUMENT
CNM A SETTING: SET IN TOP OF CONCRETE MONUMENT

OFZ PENETRATION TABLE

ID	DESCRIPTION	REMEDIATION
A	GROUND PENETRATES BY 0.34'	GRADE TERRAIN
B	GROUND PENETRATES BY 0.12'	GRADE TERRAIN

ULTIMATE AIRPORT FACILITIES

NO.	DESCRIPTION	ELEV. (EST)*
101	Corporate Hangar	1064.1'
102	Corporate Hangar	1065.3'
103	Corporate Hangar	1067.3'
104	Corporate Hangar	1063.1'
105	Fuel Farm Expansion	1055.5'
106	Box Hangar (8-Unit)	1064.4'
107	Box Hangar (5-Unit)	1064.4'

* Structure heights are estimates based on typical heights for proposed building type.

FOR APPROVAL BY CITY OF .....

Jesse R. Romo, A.A.E. Digitally signed by Jesse R. Romo, A.A.E. Date: 2020.05.07 12:37:56 -05'00'

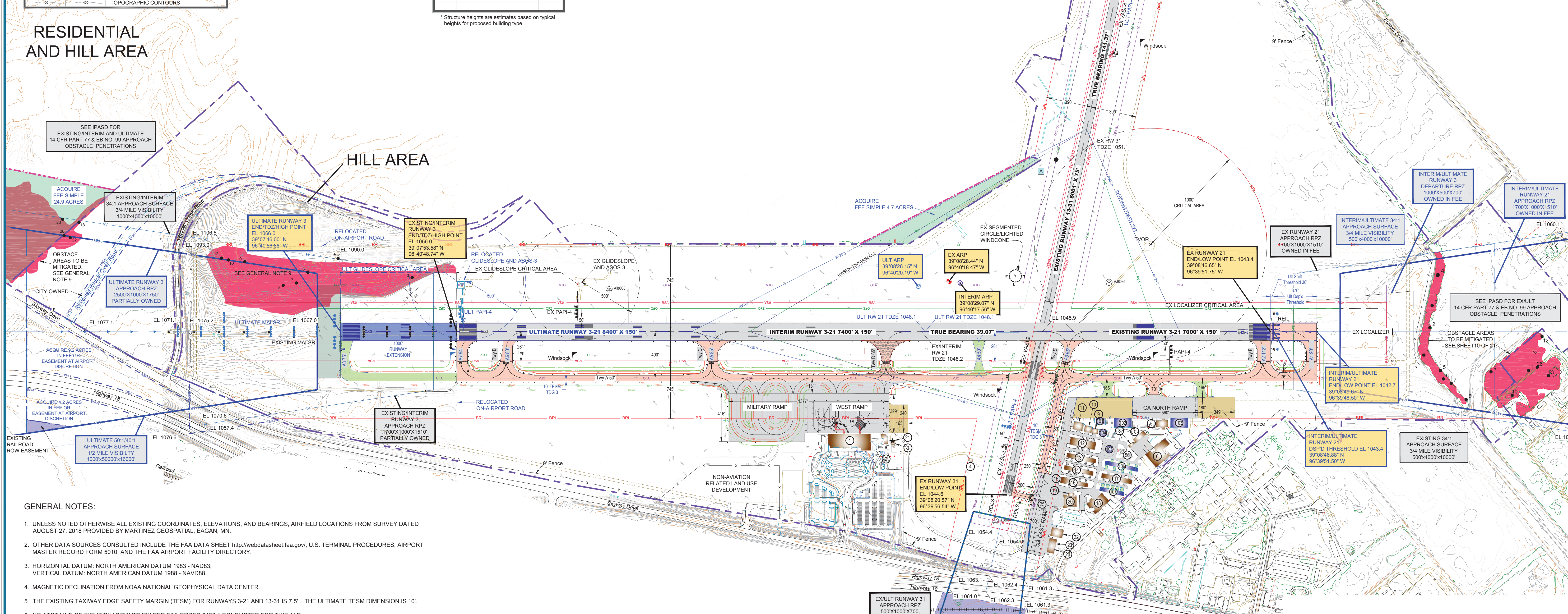
Jesse R. Romo
Airport Director
Date

FAA APPROVAL STAMP

CONDITIONAL APPROVAL

The approval indicated by my signature is given subject to the condition that the items identified in our approval letter dated May 11, 2020 may not be undertaken without prior written environmental approval by the Federal Aviation Administration. This approval action does not imply any commitment for Federal funding, or approval of future structures requiring notice under FAR Part 77.

Digitally signed by JASON W KNIPP Date: 2020.05.11 08:31:29 -05'00'



GENERAL NOTES:

1. UNLESS NOTED OTHERWISE ALL EXISTING COORDINATES, ELEVATIONS, AND BEARINGS, AIRFIELD LOCATIONS FROM SURVEY DATED AUGUST 27, 2018 PROVIDED BY MARTINEZ GEOSPATIAL, EAGAN, MN.
2. OTHER DATA SOURCES CONSULTED INCLUDE THE FAA DATA SHEET http://webdatasheet.faa.gov/, U.S. TERMINAL PROCEDURES, AIRPORT MASTER RECORD FORM 5010, AND THE FAA AIRPORT FACILITY DIRECTORY.
3. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 - NAD83;
VERTICAL DATUM: NORTH AMERICAN DATUM 1988 - NAVD88.
4. MAGNETIC DECLINATION FROM NOAA NATIONAL GEOPHYSICAL DATA CENTER.
5. THE EXISTING TAXIWAY EDGE SAFETY MARGIN (TESM) FOR RUNWAYS 3-21 AND 13-31 IS 7.5' . THE ULTIMATE TESM DIMENSION IS 10'.
6. NO ATCT LINE OF SIGHT/SHADOW STUDY PER FAA ORDER 6480.4 CONDUCTED FOR THIS ALP.
7. INTERIM CONDITION CONSIDERS RUNWAY RECONSTRUCTION WITHIN THE NEXT 5 YEARS.
8. THE CITY OF MANHATTAN'S AIRPORT OVERLAY ZONE RESTRICTS THE HEIGHT OF STRUCTURES, WHETHER FOR MAINTENANCE PURPOSES OR NEW, AND THE GROWTH OF ANY TREE TO A HEIGHT OF FIFTY FEET ABOVE THE "SURFACE OF THE LAND". CITY OF MANHATTAN ORDINANCE NUMBER 7405, EFFECTIVE AS OF MARCH 19, 2019.
9. TREES AND GROUND THAT PENETRATE EXISTING 14 CFR PART 77 APPROACH AND EB-99 SURFACES TO BE REMOVED AND GROUND TO BE GRADED DURING CONSTRUCTION OF THE RUNWAY 3 EXTENSION. THE RUNWAY 3 EXTENSION WILL REQUIRE AN RPZ STUDY IS REQUIRED.
10. SEE INNER PORTION OF THE APPROACH SURFACE DRAWINGS FOR THRESHOLD SITING SURFACE PENETRATIONS.
11. SEE TERMINAL AREA DRAWING FOR CLOSE-IN AND DIMENSIONAL DETAILS.
12. EXISTING VASI-2 AND VASI-4 ON RUNWAY 13-31 TO BE REPLACED WITH PAPI-4's.

NO.	REVISIONS	DATE	BY	APP'D.

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MANHATTAN REGIONAL AIRPORT (MHK)

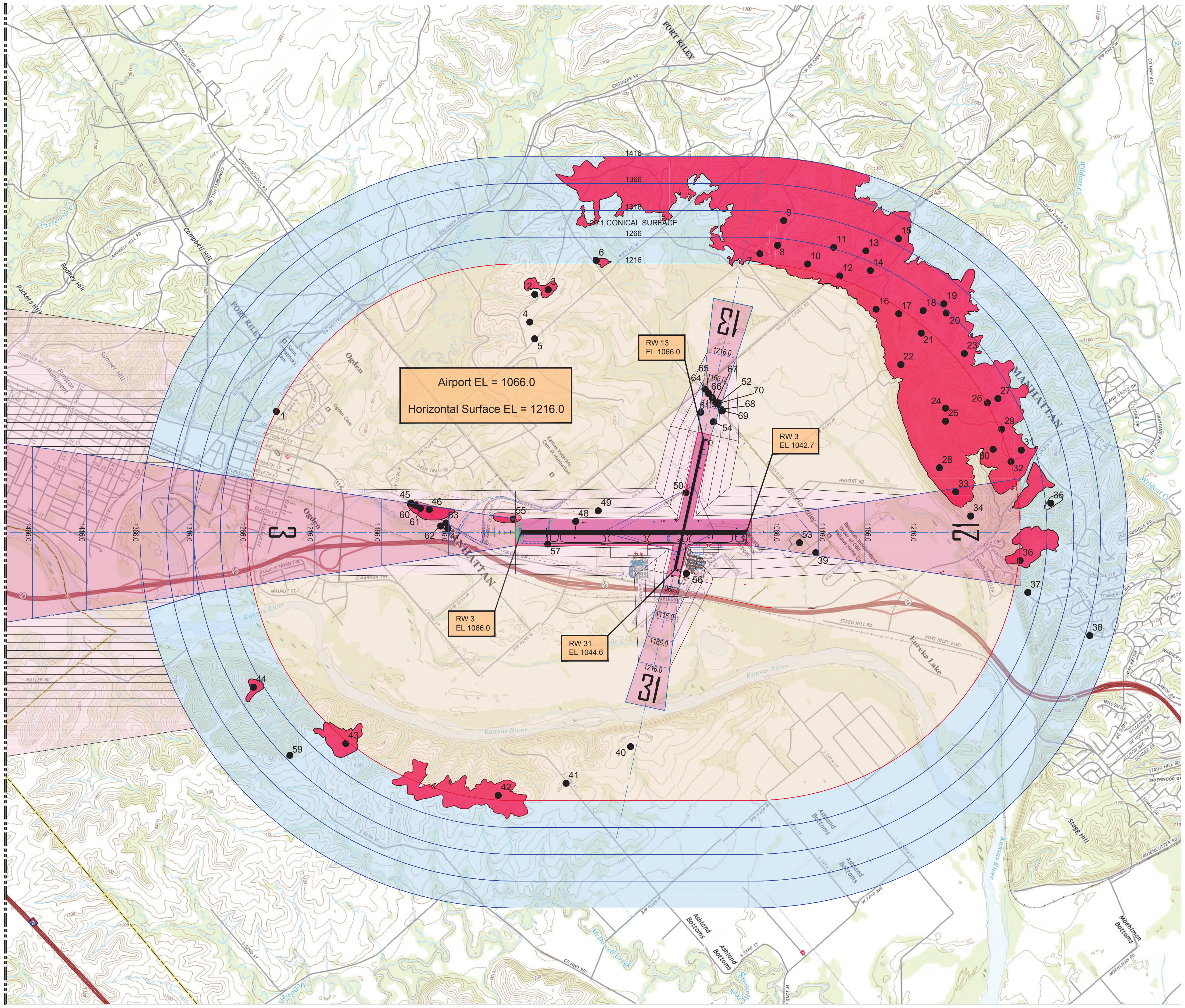
AIRPORT LAYOUT DRAWING

MANHATTAN, KS

PLANNED BY: M. Dmyterko
DETAILED BY: D. Przybycien
APPROVED BY: T.Kahmann

April 2020 SHEET 3 OF 15

Coffman Associates Airport Consultants www.coffmanassociates.com

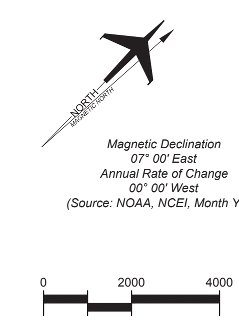


OBSTRUCTION TABLE

No.	Description	Top Elevation (msl)	Obstructed Surface	Penetration	Proposed Dispostion	ASN
1	ANTENNA	1261.0	HORIZONTAL	45.0	MAINTAIN OR ADD OBSTRUCTION LIGHT	TBD
2	TREES	1250.9	HORIZONTAL	34.9	TRIM/REMOVE	TBD
3	GROUND	1223.0	HORIZONTAL	7.6	LOWER	TBD
4	TREES	1240.1	HORIZONTAL	24.1	TRIM/REMOVE	TBD
5	ROAD	1230.7	HORIZONTAL	14.7	LOWER ROAD GRADE	TBD
6	TREES	1235.7	CONICAL	13.1	TRIM/REMOVE	TBD
7	GROUND	1307.1	CONICAL	71.6	LOWER	TBD
8	TREES	1335.3	CONICAL	82.4	TRIM/REMOVE	TBD
9	TREES	1336.6	CONICAL	36.5	TRIM/REMOVE	TBD
10	GROUND	1316.9	HORIZONTAL	90.2	LOWER	TBD
11	GROUND	1328.1	HORIZONTAL	59.6	LOWER	TBD
12	BLDG PEAK	1349.2	HORIZONTAL	133.2	MAINTAIN OR ADD OBSTRUCTION LIGHT	TBD
13	SILO	1382.8	HORIZONTAL	100.8	MAINTAIN OR ADD OBSTRUCTION LIGHT	TBD
14	UTILITY POLE	1349.9	HORIZONTAL	98.2	MAINTAIN OR ADD OBSTRUCTION LIGHT	TBD
15	UTILITY POLE	1343.0	CONICAL	15.1	MAINTAIN OR ADD OBSTRUCTION LIGHT	TBD
16	ANTENNA	1280.5	HORIZONTAL	64.5	MAINTAIN OR ADD OBSTRUCTION LIGHT	TBD
17	TREES	1356.6	HORIZONTAL	140.6	REMOVE ALL TREES AND LOWER GRADE	TBD
18	GROUND	1338.3	HORIZONTAL	100.1	LOWER	TBD
19	GROUND	1340.0	CONICAL	67.5	LOWER	TBD
20	TREES	1375.1	CONICAL	112.9	TRIM/REMOVE	TBD
21	TREES	1379.0	HORIZONTAL	163.0	TRIM/REMOVE	TBD
22	GROUND	1342.1	HORIZONTAL	126.1	LOWER	TBD
23	TREES	1305.3	CONICAL	71.6	TRIM/REMOVE	TBD
24	TREES	1392.8	HORIZONTAL	176.8	TRIM/REMOVE	TBD
25	BLDG PEAK	1304.1	HORIZONTAL	88.1	MAINTAIN OR ADD OBSTRUCTION LIGHT	TBD
26	TREES	1386.1	CONICAL	169.0	TRIM/REMOVE	TBD
27	GROUND	1352.7	CONICAL	114.6	LOWER	TBD
28	GROUND	1276.7	HORIZONTAL	60.7	LOWER	TBD
29	ROAD	1284.5	CONICAL	64.6	LOWER	TBD
30	TREES	1303.8	HORIZONTAL	87.8	LOWER	TBD
31	BLDG PEAK	1305.2	CONICAL	64.1	MAINTAIN OR ADD OBSTRUCTION LIGHT	TBD
35	FENCE	1271.6	CONICAL	54.9	REMOVE	TBD
33	TREES	1300.7	HORIZONTAL	84.8	TRIM/REMOVE	TBD
34	TREES	1231.4	HORIZONTAL	15.4	TRIM/REMOVE	TBD
35	TREES	1305.3	CONICAL	29.5	TRIM/REMOVE	TBD
36	TREES	1281.6	CONICAL	62.8	TRIM/REMOVE	TBD
37	BLDG PEAK	1252.7	CONICAL	10.2	MAINTAIN OR ADD OBSTRUCTION LIGHT	TBD
38	ANTENNA	1420.5	CONICAL	46.2	MAINTAIN OR ADD OBSTRUCTION LIGHT	TBD
39	TREES	1105.7	APPROACH	6.5	TRIM/REMOVE	TBD
40	TREES	1226.0	HORIZONTAL	10.0	TRIM/REMOVE	TBD
41	TOWER	1259.1	HORIZONTAL	43.2	MAINTAIN OR ADD OBSTRUCTION LIGHT	TBD
42	GROUND	1263.3	HORIZONTAL	47.3	LOWER	TBD
43	GROUND	1318.6	CONICAL	97.7	LOWER	TBD
44	TREES	1328.8	CONICAL	45.7	TRIM/REMOVE	TBD
45	ROAD	1066.0	APPROACH	13.4	LOWER	TBD
46	TREES	1198.1	APPROACH	67.9	TRIM/REMOVE	TBD
47	TREES	1132.9	APPROACH	16.4	TRIM/REMOVE	TBD
48	GLIDESLOPE ANTENNA	1084.4	PRIMARY	33.9	TO REMAIN LIGHTED	TBD
49	TREES	1112.2	TRANSITIONAL	21.7	TRIM/REMOVE	TBD
50	GROUND	1053.1	PRIMARY	2.9	LOWER	TBD
51	TREES	1116.0	APPROACH	12.6	TRIM/REMOVE	TBD
52	TREES	1144.7	APPROACH	17.3	TRIM/REMOVE	TBD
53	TREES	1135.8	APPROACH	40.8	TRIM/REMOVE	TBD
54	TREES	1111.0	APPROACH	20.0	TRIM/REMOVE	TBD
55	GROUND	1085.2	APPROACH	7.3	LOWER	TBD
56	LIGHT POLE	1085.7	TRANSITIONAL	14.0	MAINTAIN OR ADD OBSTRUCTION LIGHT	TBD
57	AIRPORT SERVICE ROAD	1061.2	PRIMARY	5.3	CLOSE ROAD	TBD
58	TREES	1146.2	TRANSITIONAL	35.8	TRIM/REMOVE	TBD
59	GROUND	1314.5	CONCICAL	7.4	CASE TO BE FILED WITH OEAAA	TBD
60	POLE	1187.0	APPROACH	49.0	TO BE MITIGATED WITH RUNWAY EXTENSION	20-023160
61	POLE	1168.0	APPROACH	34.0	TO BE MITIGATED WITH RUNWAY EXTENSION	20-023159
62	POWER LINE	1136.0	APPROACH	15.0	TO BE MITIGATED WITH RUNWAY EXTENSION	2006-ACE-2570-OE
63	POLE	1141.0	APPROACH	16.0	TO BE MITIGATED WITH RUNWAY EXTENSION	20-023158
64	POWER LINE	1118.0	APPROACH	5.0	TO BE MITIGATED WITH RUNWAY EXTENSION	2008-ACE-3359-OE
65	POWER LINE	1114.0	APPROACH	4.0	TO BE MITIGATED WITH RUNWAY EXTENSION	2008-ACE-3358-OE
66	POWER LINE	1114.0	APPROACH	8.0	TO BE MITIGATED WITH RUNWAY EXTENSION	2008-ACE-3357-OE
67	POWER LINE	1115.0	APPROACH	13.0	TO BE MITIGATED WITH RUNWAY EXTENSION	2008-ACE-3356-OE
68	POWER LINE	1114.0	TRANSITIONAL	17.0	TO BE MITIGATED WITH RUNWAY EXTENSION	2008-ACE-3354-OE
69	POWER LINE	1114.0	TRANSITIONAL	10.0	TO BE MITIGATED WITH RUNWAY EXTENSION	2008-ACE-3353-OE
70	POWER LINE	1114.0	APPROACH	14.0	TO BE MITIGATED WITH RUNWAY EXTENSION	2008-ACE-3355-OE

Triggering Event: ALP Update

Nonpenetrating objects have been excluded from table.



GENERAL NOTES:

1. OBSTRUCTION SURVEY DATED AUGUST 27, 2018 BY MARTINEZ GEOSPATIAL, EAGAN, MN.
2. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 - NAD83;
   VERTICAL DATUM: NORTH AMERICAN DATUM 1988 - NAVD88
3. THE CITY OF MANHATTAN'S AIRPORT OVERLAY ZONE RESTRICTS THE HEIGHT OF STRUCTURES, WHETHER FOR MAINTENANCE PURPOSES OR NEW, AND THE GROWTH OF ANY TREE TO A HEIGHT OF FIFTY FEE ABOVE THE "SURFACE OF THE LAND". CITY OF MANHATTAN ORDINANCE NUMBER 7405, EFFECTIVE AS OF MARCH 19, 2019.
4. THE FOLLOWING USGS 7.5 QUAD MAPS OF THE STATE OF KANSAS WERE APPLIED AS BACKGROUND: FORT RILEY NE, JUNCTION CITY, KEATS, MANHATTAN, OGDEN, OLSBURG, RILEY, SWEDE CREEK, TUTTLE CREEK DAM, WREFORD, AND WHITE CITY NW.
5. OBSTRUCTION AND CLEARANCE ELEVATIONS ARE CALCULATED FROM ULTIMATE RUNWAY END ELEVATIONS AND ULTIMATE SURFACES.
6. OBSTRUCTION GROUPINGS REFLECT THE TALLEST NATURAL AND MANMADE PENETRATION WITHIN A REPRESENTATIVE SELECTION OF OBSTRUCTIONS THROUGHOUT THE LARGER GROUPINGS.
7. SEE INNER PORTION OF THE APPROACH SURFACE DRAWINGS FOR CLOSE-IN APPROACH DETAILS.
8. ALL ELEVATIONS IN MSL FEET.

LEGEND

HIGH DENSITY VEGETATION AND OBSTRUCTION AREA - SAMPLED POINTS REPRESENT THE HIGHEST POINTS WITHIN THE VICINTIY OF OBJECTS.

25 OBSTRUCTION IDENTIFIER

NO.	REVISIONS	DATE	BY	APP'D.

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MANHATTAN REGIONAL AIRPORT (MHK)

AIRPORT AIRSPACE DRAWING I

MANHATTAN, KS

PLANNED BY: M. Dmyterko
DETAILED BY: D. Przybycien
APPROVED BY: T.Kahmann

April 2020 SHEET 4 OF 15

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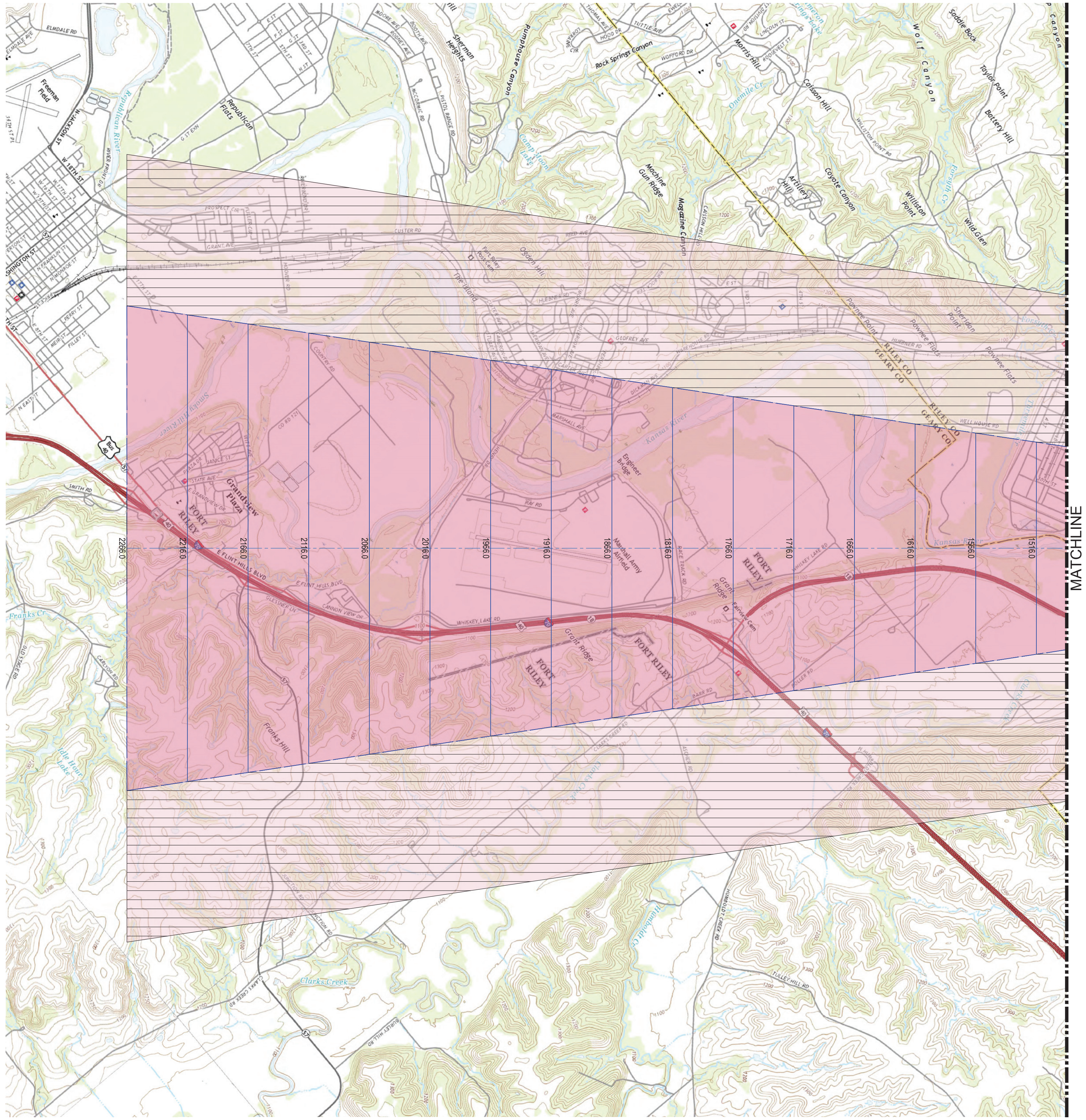
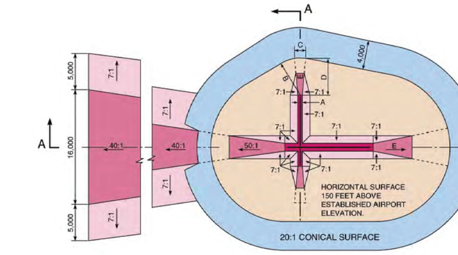
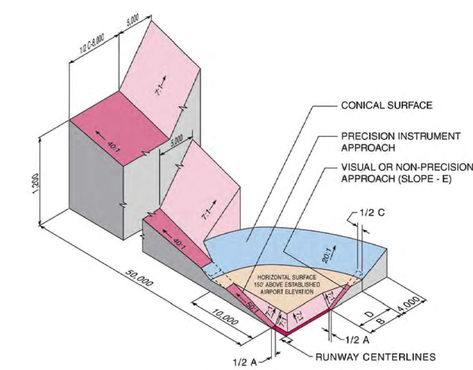




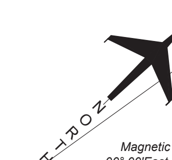
DIM	ITEM	DIMENSIONAL STANDARDS (FEET)					
		VISUAL RUNWAY		NON-PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY
		A	B	A	B		
					C	D	
A	WIDTH OF PRIMARY SURFACE AND APPROACH SURFACE WIDTH AT INNER END	250	500	500	500	1,000	1,000
B	RADIUS OF HORIZONTAL SURFACE	5,000	5,000	5,000	10,000	10,000	10,000
		VISUAL APPROACH		NON-PRECISION INSTRUMENT APPROACH			PRECISION INSTRUMENT APPROACH
		A	B	A	B		
					C	D	
C	APPROACH SURFACE WIDTH AT END	1,250	1,500	2,000	3,500	4,000	16,000
D	APPROACH SURFACE LENGTH	5,000	5,000	5,000	10,000	10,000	*
E	APPROACH SLOPE	20:1	20:1	20:1	34:1	34:1	*

A - UTILITY RUNWAYS
B - RUNWAYS LARGER THAN UTILITY
C - VISIBILITY MINIMUMS GREATER THAN 3/4 MILE
D - VISIBILITY MINIMUMS AS LOW AS 3/4 MILE
* - PRECISION INSTRUMENT APPROACH SLOPE IS 50:1 FOR INNER 10,000 FEET AND 40:1 FOR AN ADDITIONAL 40,000 FEET



ISOMETRIC VIEW OF SECTION A-A

SOURCE: FAA Order JO 7400.2J, Figure 6-3-3



Magnetic Declination
00° 00'East (Month YYYY)
Annual Rate of Change
00° 00' West (Month YYYY)

0 2000 4000
SCALE IN FEET

NO.	REVISIONS	DATE	BY	APP'D.

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MANHATTAN REGIONAL AIRPORT (MHK)

AIRPORT AIRSPACE DRAWING II

MANHATTAN, KS

PLANNED BY: M. Dmyterko
DETAILED BY: D. Przybycien
APPROVED BY: T.Kahmann

April 2020 SHEET 5 OF 15

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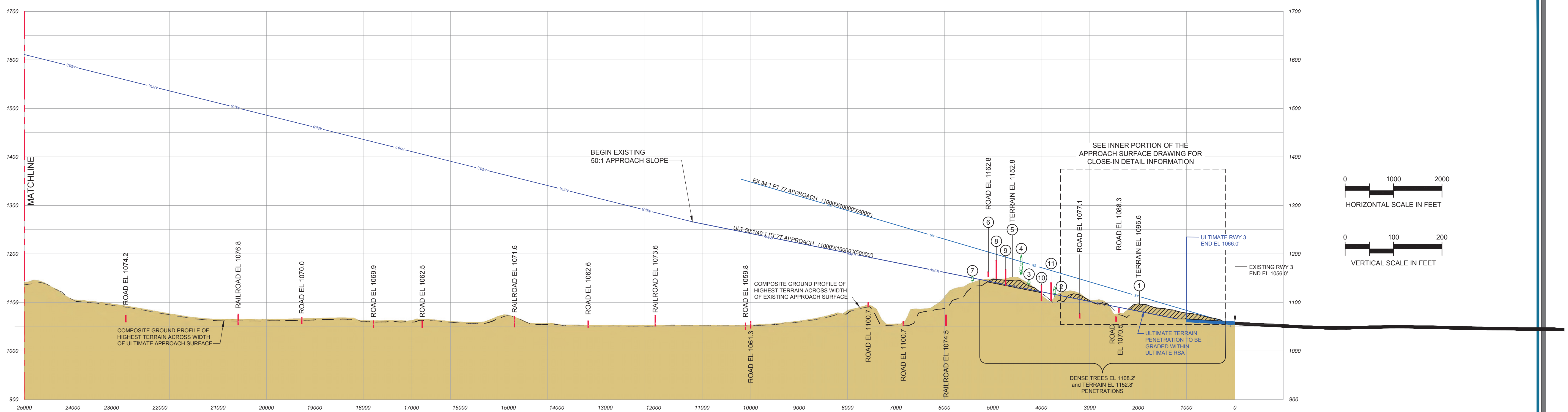
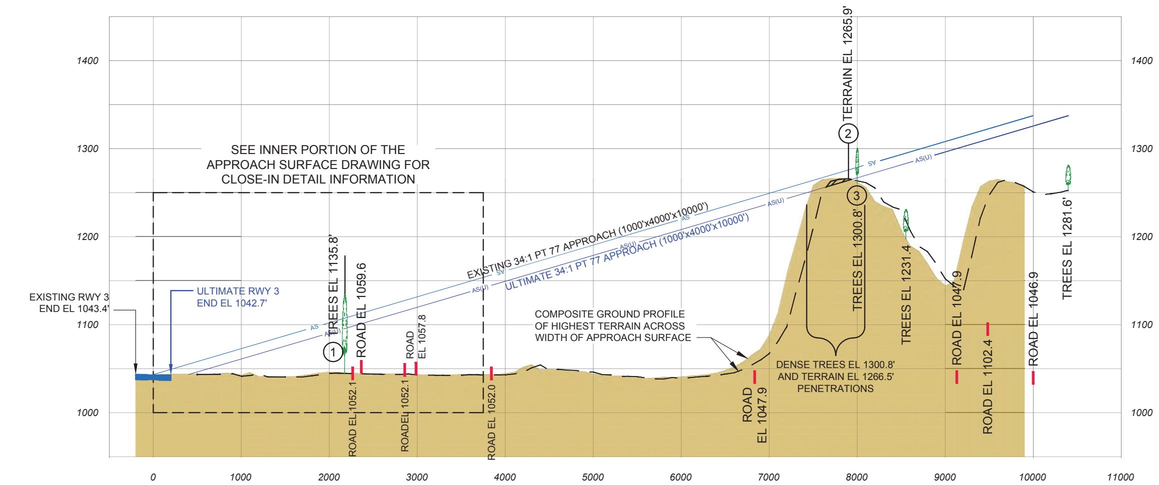
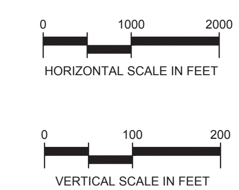


RWY 3 PT 77 APPROACH OBSTRUCTION TABLE				
No.	Description	Top Elevation (msl)	PT77 50:1 Approach Penetration	Proposed Disposition
1	GROUND	1092.3	12.8	LOWER
2	TREES	1132.9	38.4	TRIM/REMOVE
3	TREES	1147.2	42.2	TRIM/REMOVE
4	TREES	1198.1	89.9	TRIM/REMOVE
5	GROUND	1152.8	20.8	LOWER
6	EXISTING PUBLIC ROAD	1162.8	20.9	LOWER
7	TREES	1154.3	5.9	TRIM/REMOVE
8	POLE	1187.0	49.0	#20-023160 TO BE MITIGATED WITH RUNWAY EXTENSION
9	POLE	1168.0	34.0	#20-023159 TO BE MITIGATED WITH RUNWAY EXTENSION
10	POWER LINE	1136.0	15.0	#20-023158 TO BE MITIGATED WITH RUNWAY EXTENSION
11	POLE	1141.0	16.0	#2008-ACE-3359-OE TO BE MITIGATED WITH RUNWAY EXTENSION

Close-in and Nonpenetrating Objects Have Been Excluded from Table.





RWY 21 PT 77 APPROACH OBSTRUCTION TABLE				
No.	Description	Top Elevation (msl)	PT77 34:1 Approach Penetration	Proposed Disposition
1	TREES	1135.8	40.8	TRIM/REMOVE
2	TERRAIN	1265.9	2.6	CASE TO BE FILED WITH OEAAA
3	TREES	1089.0	25.4	CASE TO BE FILED WITH OEAAA

Close-in and nonpenetrating objects have been excluded from table.

GENERAL NOTES:

1. SAMPLED POINTS IDENTIFIED FROM SURVEY PROVIDED BY MARTINEZ GEOSPATIAL, EAGAN, MN. DATED AUGUST 27, 2018.
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VERTICAL DATUM: NORTH AMERICAN DATUM 1988 - NAVD88
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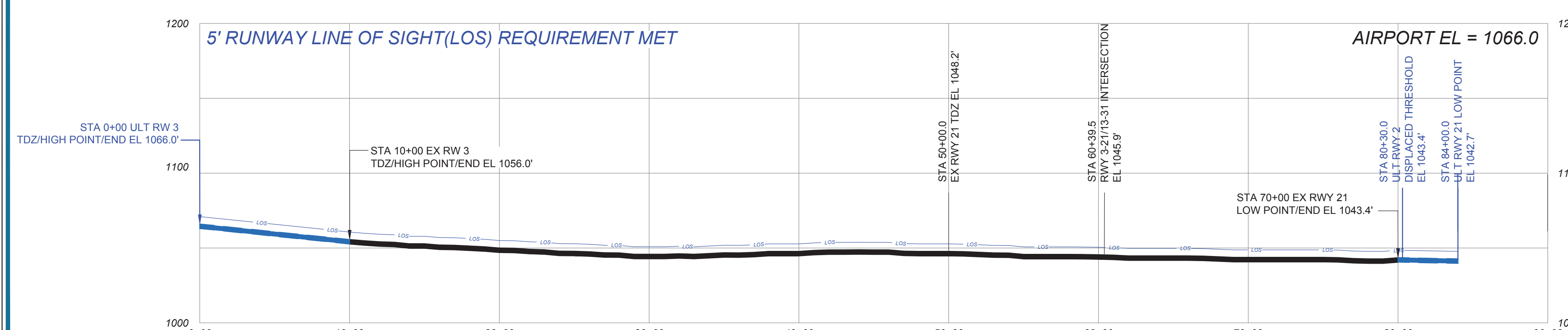
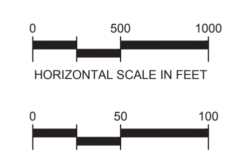
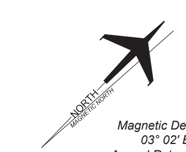
4. SEE INNER PORTION OF THE APPROACH SURFACE DRAWINGS FOR CLOSE-IN APPROACH DETAILS.
5. ALL ELEVATIONS IN MSL FEET.



RUNWAY 3-21 PROFILE





Magnetic Declination
03° 02' East
Annual Rate of Change
00° 06' West
(Source: NOAA, NCEI, January 2019)

NO.	REVISIONS	DATE	BY	APP'D.

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MANHATTAN REGIONAL AIRPORT (MHK)

AIRPORT AIRSPACE PROFILE DRAWING I RUNWAY 3-21

MANHATTAN, KS

PLANNED BY: M. Dmyterko
DETAILED BY: D. Przybycien
APPROVED BY: T.Kahmann

February 2020 SHEET 6 OF 16

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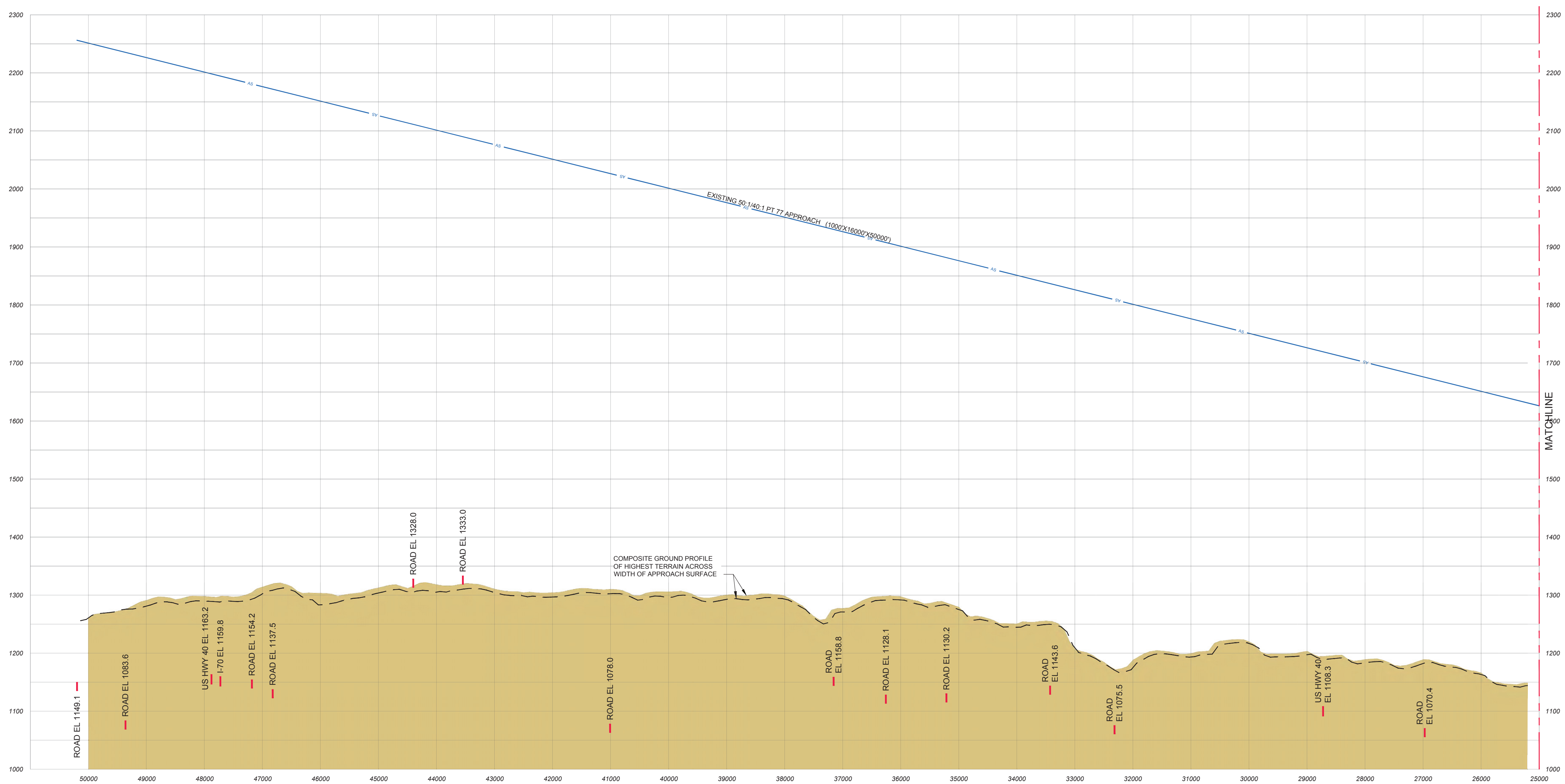

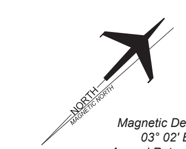

Magnetic Declination
03° 02' East
Annual Rate of Change
00° 06' West
(Source: NOAA, NCEI, January 2019)

0 1000 2000
HORIZONTAL SCALE IN FEET

0 100 200
VERTICAL SCALE IN FEET

NO.	REVISIONS	DATE	BY	APP'D.

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MANHATTAN REGIONAL AIRPORT (MHK)

AIRPORT AIRSPACE PROFILE DRAWING II
RUNWAY 3

MANHATTAN, KS

PLANNED BY: M. Dmyterko
DETAILED BY: D. Przybycien
APPROVED BY: T.Kahmann

February 2020 SHEET 7 OF 16

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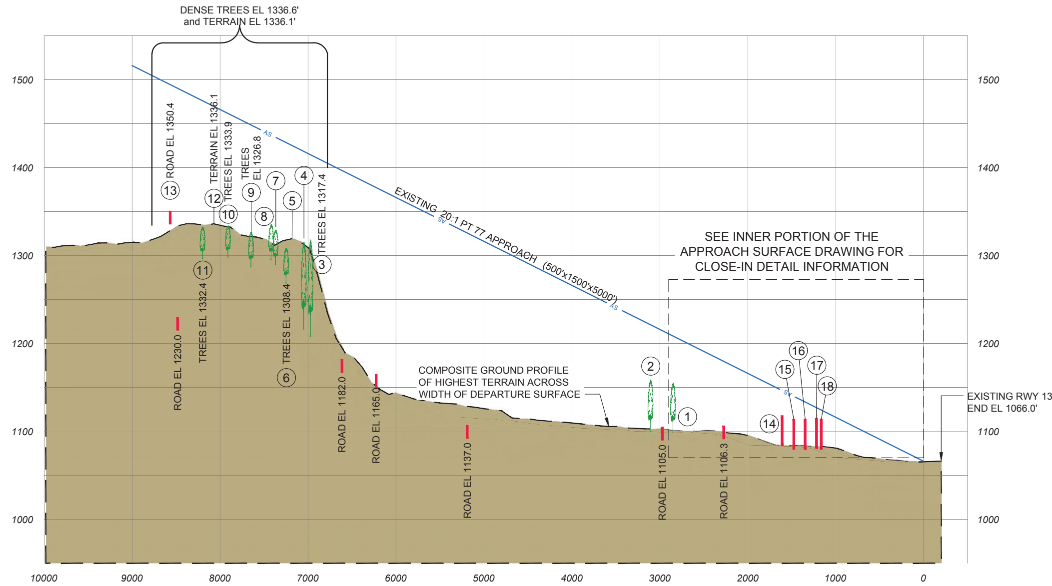
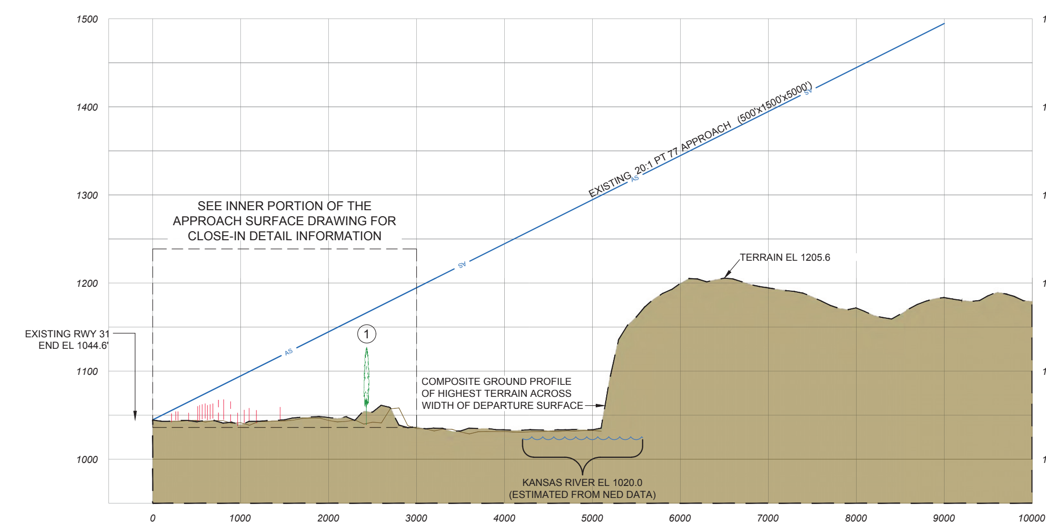


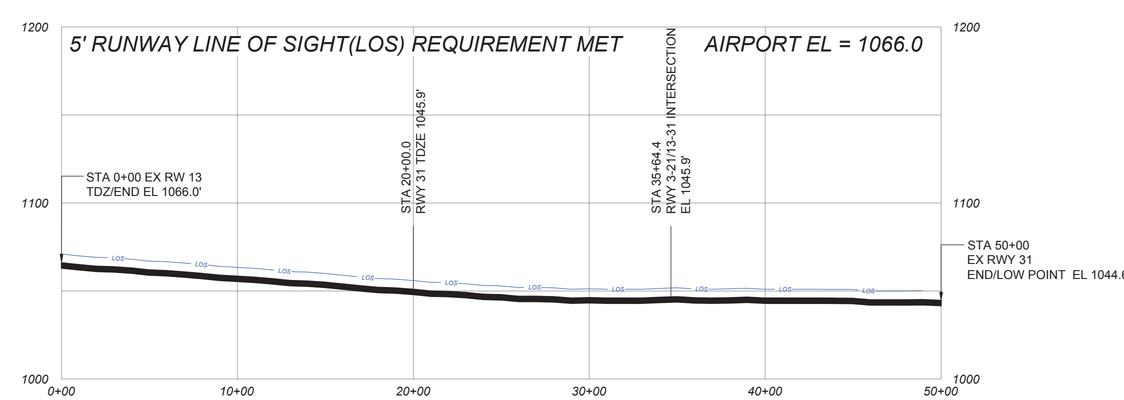
RWY 13 PT 77 APPROACH OBSTRUCTION TABLE				
No.	Description	Top Elevation (msl)	PT77 20:1 Approach Penetration	Proposed Disposition
	SEE INNER PORTION OF THE APPROACH SURFACE DRAWING FOR CLOSE-IN OBSTRUCTIONS			

Close-in and Nonpenetrating Objects Have Been Excluded from Table.



RWY 31 PT 77 APPROACH OBSTRUCTION TABLE					
No.	Description	Top Elevation (msl)	PT77 20:1 Approach Penetration	PT77 34:1 Approach Penetration	Proposed Disposition
	SEE INNER PORTION OF THE APPROACH SURFACE DRAWING FOR CLOSE-IN OBSTRUCTIONS				

Close-in and/or nonpenetrating objects have been excluded from table.



RUNWAY 13-31 PROFILE

0 500 1000
HORIZONTAL SCALE IN FEET

0 50 100
VERTICAL SCALE IN FEET

GENERAL NOTES:

1. SAMPLED POINTS IDENTIFIED FROM SURVEY PROVIDED BY MARTINEZ GEOSPATIAL, EAGAN, MN. DATED AUGUST 27, 2018.
2. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 - NAD83;
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4. SEE INNER PORTION OF THE APPROACH SURFACE DRAWINGS FOR CLOSE-IN APPROACH DETAILS.
5. ALL ELEVATIONS IN MSL FEET.

Magnetic Declination
03° 02' East
Annual Rate of Change
00° 06' West
(Source: NOAA, NCEI, January 2019)

0 1000 2000
HORIZONTAL SCALE IN FEET

0 100 200
VERTICAL SCALE IN FEET

NO.	REVISIONS	DATE	BY	APP'D.

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MANHATTAN REGIONAL AIRPORT (MHK)

AIRPORT AIRSPACE PROFILE DRAWING III RUNWAY 13-31

MANHATTAN, KS

PLANNED BY: M. Dmyterko
DETAILED BY: D. Przybycien
APPROVED BY: T.Kahmann

April 2020 SHEET 8 OF 15

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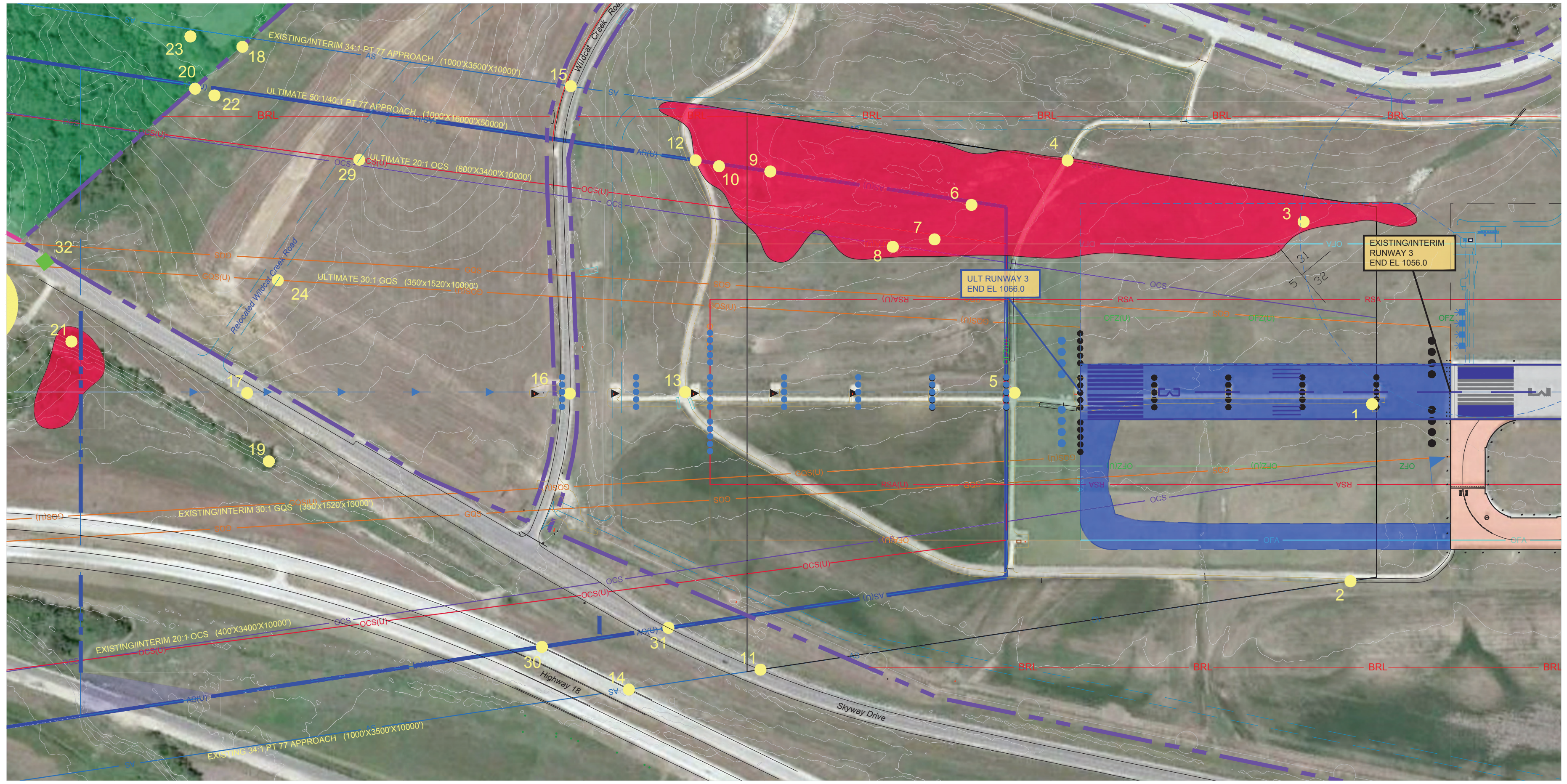
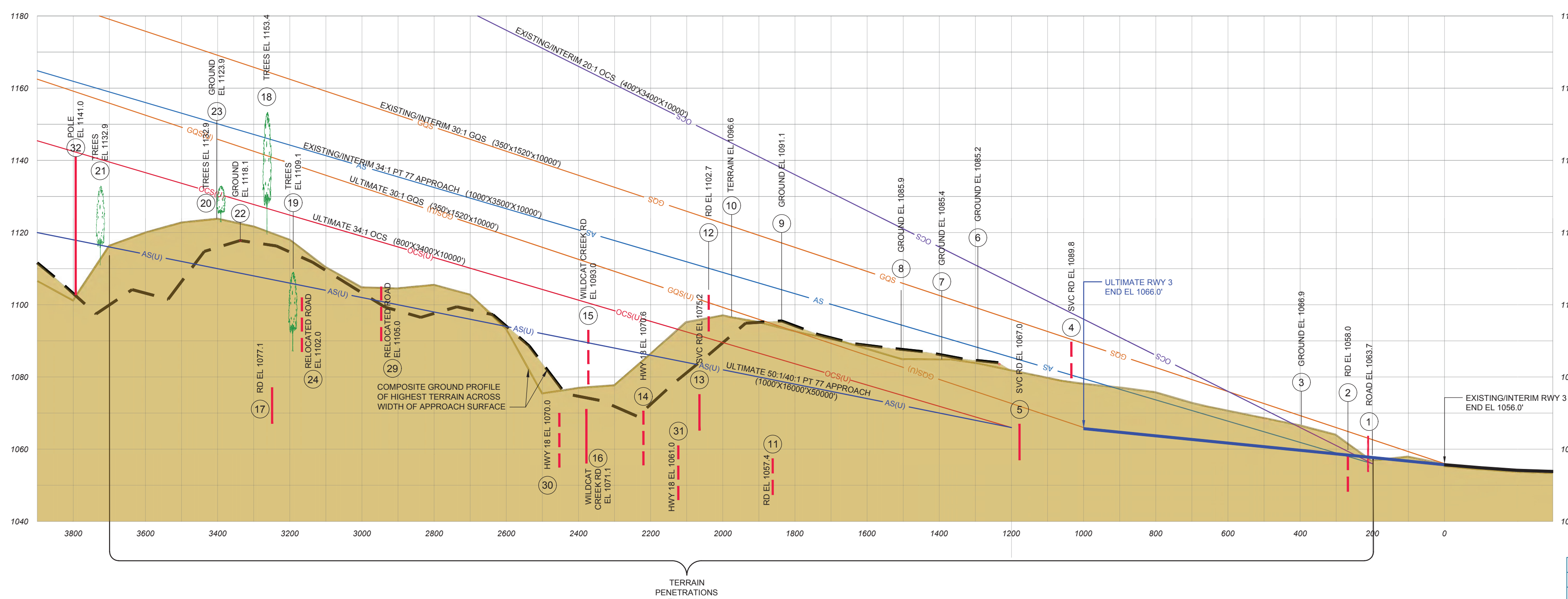


EXISTING RUNWAY 3 APPROACH OBSTRUCTION TABLE						
No.	Description	Top Elevation (msl)	EX 34:1 PT77 Approach Penetration	EX 20:1 OCS Penetration	EX 30:1 OCS Penetration	Proposed Disposition
1	SERVICE ROAD	1063.7	7.4	7.1	0.6	AIRPORT CONTROLLED ROAD; NAR
2	SERVICE ROAD	1058.3	0.3	1.1	6.6	AIRPORT CONTROLLED ROAD; NAR
3	GROUND	1066.9	5.1	1.1	2.3	CASE TO BE FILED WITH OEAAA
4	SERVICE ROAD	1089.8	9.3	7.9	0.7	AIRPORT CONTROLLED ROAD; NAR
18	TREE	1153.4	7.3	55.8	11.4	TRIM/REMOVE
29	POLE	1141.0	16.0	94.8	41.6	#20-023158 TO BE MITIGATED WITH RUNWAY EXTENSION
Triggering Event: ALP Update						
NAR: No Action Required						
Close-in and Nonpenetrating Objects Have Been Excluded from Table.						
Traverseway elevations provided per 14 CFR Part 77.						
Red numerals indicate amount of obstruction in feet.						

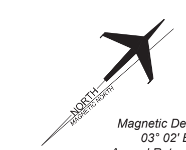
ULTIMATE RUNWAY 3 APPROACH OBSTRUCTION TABLE						
No.	Description	Top Elevation (msl)	ULT 50:1 PT77 Approach Penetration	ULT 34:1 OCS Penetration	EX 30:1 OCS Penetration	Proposed Disposition
1	SERVICE ROAD	1063.7	NA	NA	NA	RELOCATE SERVICE ROAD
2	SERVICE ROAD	1058.3	NA	NA	NA	RELOCATE SERVICE ROAD
3	GROUND	1066.9	NA	NA	NA	LOWER
4	SERVICE ROAD	1089.8	NA	NA	NA	RELOCATE SERVICE ROAD
5	SERVICE ROAD	1067.0	1.4	1.7	4.9	RELOCATE SERVICE ROAD
6	GROUND	1085.2	17.3	16.5	9.4	LOWER
7	GROUND	1085.4	15.5	13.7	6.2	LOWER
8	GROUND	1085.9	13.7	10.9	3.0	LOWER
9	GROUND	1091.1	12.4	6.4	2.8	LOWER
10	GROUND	1096.6	15.1	7.8	1.9	LOWER
12	SERVICE ROAD	1102.7	20.1	12.2	2.3	RELOCATE SERVICE ROAD
15	PUBLIC ROAD	1093.0	3.5	7.5	18.8	RELOCATE ROAD
18	TREE	1153.4	NA	NA	11.9	TRIM/REMOVE
19	TREE	1109.1	3.3	15.5	29.9	TRIM/REMOVE
20	TREE	1132.9	23.1	2.4	12.8	TRIM/REMOVE
21	TREES	1132.9	16.4	7.3	23.9	TRIM/REMOVE
22	GROUND	1118.0	9.3	10.9	25.9	LOWER
29	RELOCATED ROAD	1105.0	4.1	12.4	25.9	LOWER
32	POLE	1141.0	23.1	1.4	18.2	#20-023158 TO BE MITIGATED WITH RUNWAY EXTENSION
Triggering Event: ALP Update						
Close-in and Nonpenetrating Objects Have Been Excluded from Table.						
Traverseway elevations provided per 14 CFR Part 77.						
Red numerals indicate amount of obstruction in feet.						

OBSTRUCTION AREA - SAMPLED POINTS REPRESENT THE HIGHEST POINTS WITHIN THE VICINTIY OF OBJECTS.



GENERAL NOTES:

1. OBSTRUCTION SURVEY DATED AUGUST 27, 2018 BY MARTINEZ GEOSPATIAL, EAGAN, MN.
2. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 - NAD83; VERTICAL DATUM: NORTH AMERICAN DATUM 1988 - NAVD88
3. OBSTRUCTION GROUPINGS REFLECT THE TALLEST NATURAL, MANMADE PENETRATION WITHIN A REPRESENTATIVE SELECTION OF OBSTRUCTIONS THROUGHOUT THE LARGER GROUPINGS.
4. ALL ELEVATIONS IN MSL FEET.



Magnetic Declination
03° 02' East
Annual Rate of Change
00° 06' West
(Source: NOAA, NCEI, January 2019)

0 200 400
HORIZONTAL SCALE IN FEET

0 20 40
VERTICAL SCALE IN FEET

NO.	REVISIONS	DATE	BY	APP'D.

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MANHATTAN REGIONAL AIRPORT (MHK)

INNER PORTION OF THE APPROACH SURFACE DRAWING RUNWAY 3

MANHATTAN, KS

PLANNED BY: M. Dmyterko
DETAILED BY: D. Przybycien
APPROVED BY: T.Kahmann

April 2020 SHEET 9 OF 15

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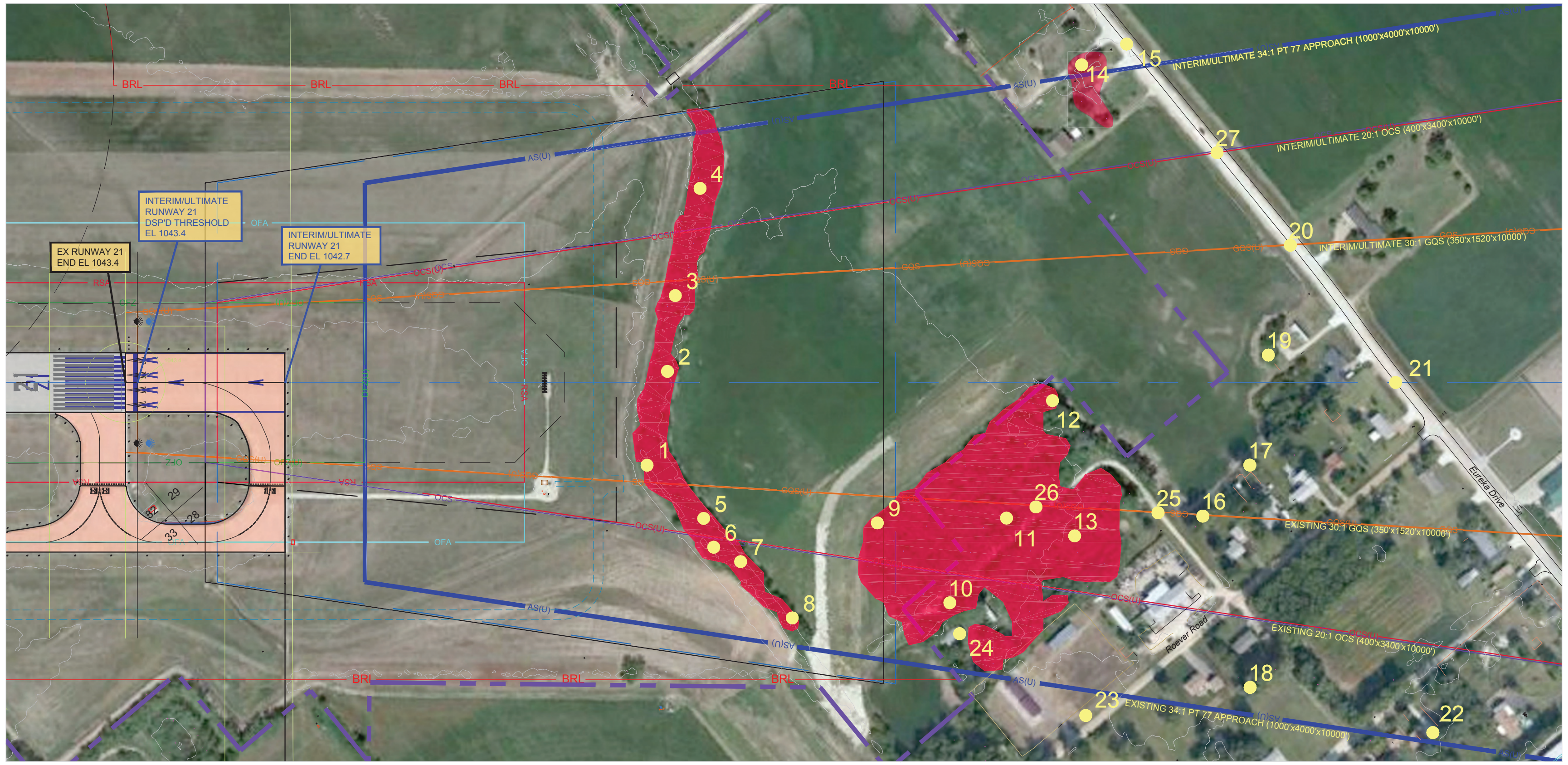

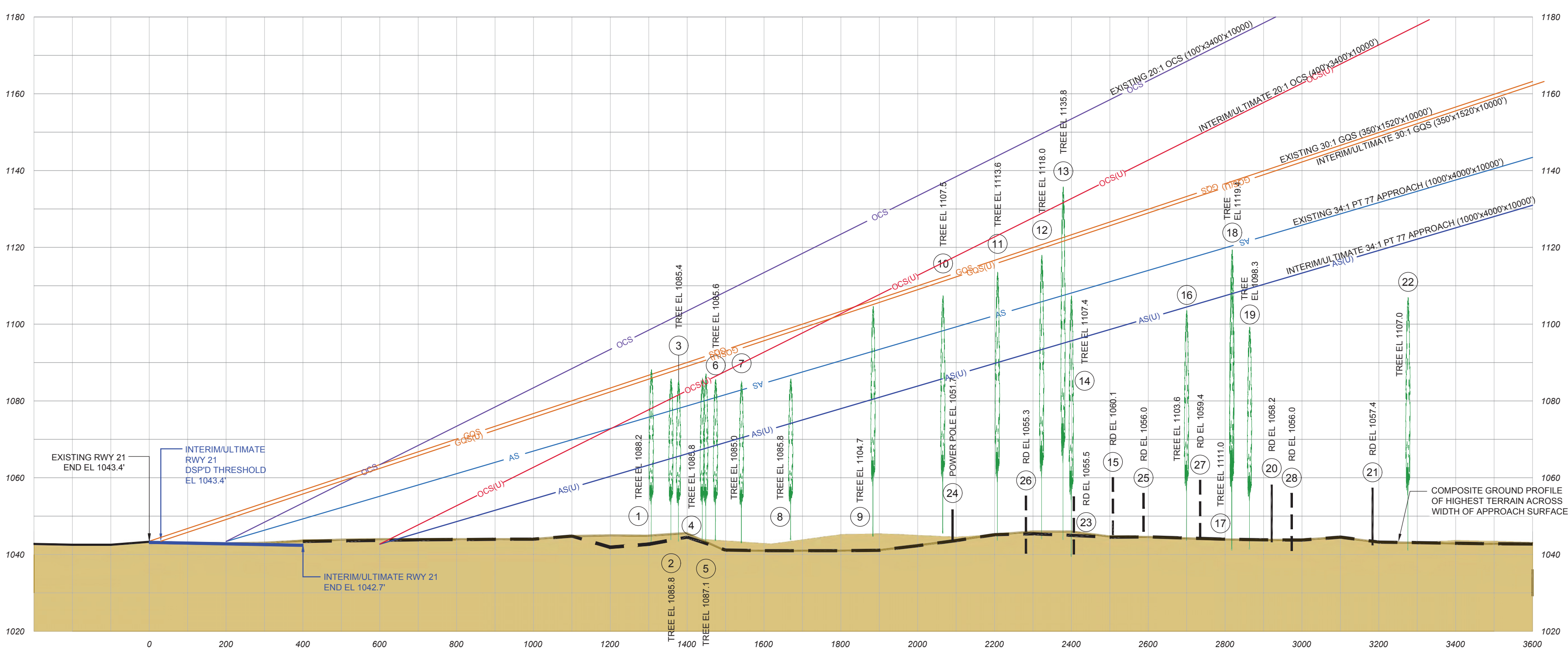

EXISTING RUNWAY 21 APPROACH OBSTRUCTION TABLE						
No.	Description	Top Elevation (msl)	EX PT77 34:1 Approach Penetration	EX 20:1 OCS Penetration	EX 30:1 OCS Penetration	Proposed Disposition
1	TREES	1088.2	12.2	10.6	1.2	TRIM/REMOVE
2	TREES	1085.8	8.3	15.5	2.9	TRIM/REMOVE
3	TREES	1085.4	7.4	16.9	3.9	TRIM/REMOVE
4	TREES	1085.8	6.0	19.6	5.6	TRIM/REMOVE
5	TREES	1087.1	7.0	18.7	NA	TRIM/REMOVE
6	TREES	1085.6	4.7	21.5	NA	TRIM/REMOVE
7	TREES	1085.0	2.2	25.5	NA	TRIM/REMOVE
8	TREES	1085.8	0.9	31.2	NA	TRIM/REMOVE
9	TREES	1104.7	11.8	22.9	NA	TRIM/REMOVE
10	TREES	1107.5	9.2	29.2	NA	2020-ACE-2856-OE
11	TREES	1113.6	11.1	30.2	NA	2020-ACE-2857-OE
12	TREES	1118.0	12.2	31.6	2.8	2020-ACE-2858-OE
13	TREES	1135.8	28.3	16.5	NA	2020-ACE-2859-OE
14	TREES	1107.4	0.6	45.8	NA	2020-ACE-2860-OE
15	ROAD	1060.1	51.2	98.7	NA	2020-ACE-2861-OE
16	TREES	1103.6	13.3	64.8	29.8	2020-ACE-2862-OE
17	TREES	1111.0	9.4	63.2	26.3	2020-ACE-2863-OE
18	TREES	1119.4	1.0	54.9	NA	2020-ACE-2864-OE
19	TREES	1098.3	23.4	78.3	40.5	2020-ACE-2865-OE
20	ROAD	1058.2	65.2	121.3	82.6	2020-ACE-2866-OE
21	ROAD	1057.4	73.7	135.2	92.1	2020-ACE-2867-OE
22	TREES	1043.4	90.5	153.8	109.2	2020-ACE-2868-OE
23	ROAD	1055.5	54.3	100.8	69.8	2020-ACE-2869-OE
24	POWER POLE	1051.7	47.3	86.2	61.4	2020-ACE-2870-OE
25	ROAD	1056.0	57.6	106.8	73.7	2020-ACE-2871-OE
26	ROAD	1055.3	49.3	92.2	64.2	2020-ACE-2872-OE
27	ROAD	1059.4	52.7	100.9	68.6	2020-ACE-2873-OE

Triggering Event: ALP Update

Nonpenetrating objects have been excluded from table.

Traverseway elevations provided per 14 CFR Part 77.

Red numerals indicate amount of obstruction in feet.

ULTIMATE RUNWAY 21 APPROACH OBSTRUCTION TABLE						
No.	Description	Top Elevation (msl)	ULT PT77 34:1 Approach Penetration	ULT 20:1 OCS Penetration	EX 30:1 OCS Penetration	Proposed Disposition
1	TREES	1088.2	24.7	10.2	2.2	TRIM/REMOVE
2	TREES	1085.8	20.8	5.2	1.9	TRIM/REMOVE
3	TREES	1085.4	19.8	3.8	2.9	TRIM/REMOVE
4	TREES	1085.8	18.4	1.1	4.6	TRIM/REMOVE
5	TREES	1087.1	19.5	2.0	NA	TRIM/REMOVE
6	TREES	1085.6	17.2	0.8	NA	TRIM/REMOVE
7	TREES	1085.0	14.6	4.8	NA	TRIM/REMOVE
8	TREES	1085.8	11.6	10.5	NA	TRIM/REMOVE
9	TREES	1104.7	24.2	2.2	NA	TRIM/REMOVE
10	TREES	1107.5	21.7	8.5	NA	2020-ACE-2856-OE
11	TREES	1113.6	23.6	9.5	NA	2020-ACE-2857-OE
12	TREES	1118.0	24.6	10.9	1.8	2020-ACE-2858-OE
13	TREES	1135.8	40.8	4.2	NA	2020-ACE-2859-OE
14	TREES	1107.4	11.9	25.1	NA	2020-ACE-2860-OE
15	ROAD	1060.1	38.7	78.0	NA	2020-ACE-2861-OE
16	TREES	1103.6	0.9	44.1	28.8	2020-ACE-2862-OE
17	TREES	1111.0	3.1	42.5	25.3	2020-ACE-2863-OE
18	TREES	1119.4	11.5	34.2	NA	2020-ACE-2864-OE
19	TREES	1098.3	11.0	57.6	39.5	2020-ACE-2865-OE
20	ROAD	1058.2	52.8	100.6	81.6	2020-ACE-2866-OE
21	ROAD	1057.4	61.3	114.5	91.1	2020-ACE-2867-OE
22	TREES	1107.0	14.4	69.5	44.6	2020-ACE-2868-OE
23	ROAD	1055.5	41.9	80.1	NA	2020-ACE-2869-OE
24	POWER POLE	1051.7	34.8	65.5	NA	2020-ACE-2870-OE
25	ROAD	1056.0	45.2	86.1	72.7	2020-ACE-2871-OE
26	ROAD	1055.3	36.9	71.5	63.2	2020-ACE-2872-OE
27	ROAD	1059.4	40.3	80.2	67.6	2020-ACE-2873-OE

Triggering Event: ALP Update

Nonpenetrating objects have been excluded from table.

Traverseway elevations provided per 14 CFR Part 77.

Red numerals indicate amount of obstruction in feet.

Magnetic Declination
03° 02' East
Annual Rate of Change
00° 06' West
(Source: NOAA, NCEI, January 2019)

0 200 400
HORIZONTAL SCALE IN FEET

0 20 40
VERTICAL SCALE IN FEET

GENERAL NOTES:

1. OBSTRUCTION SURVEY DATED AUGUST 27, 2018 BY MARTINEZ GEOSPATIAL, EAGAN, MN.
2. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 - NAD83;
   VERTICAL DATUM: NORTH AMERICAN DATUM 1988 - NAVD88
3. OBSTRUCTION AND CLEARANCE ELEVATIONS ARE CALCULATED FROM ULTIMATE RUNWAY END ELEVATIONS AND ULTIMATE SURFACES.
4. OBSTRUCTION GROUPINGS REFLECT THE TALLEST NATURAL, MANMADE PENETRATION WITHIN A REPRESENTATIVE SELECTION OF OBSTRUCTIONS THROUGHOUT THE LARGER GROUPINGS.
5. ALL ELEVATIONS IN MSL FEET.

OBSTRUCTION AREA - SAMPLED POINTS REPRESENT THE HIGHEST POINTS WITHIN THE VICINITY OF OBJECTS.

NO.	REVISIONS	DATE	BY	APP'D.

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MANHATTAN REGIONAL AIRPORT (MHK)

INNER PORTION OF THE APPROACH SURFACE DRAWING RUNWAY 21

MANHATTAN, KS

PLANNED BY: M. Dmyterko
DETAILED BY: D. Przybycien
APPROVED BY: T.Kahmann

April 2020 SHEET 10 OF 15

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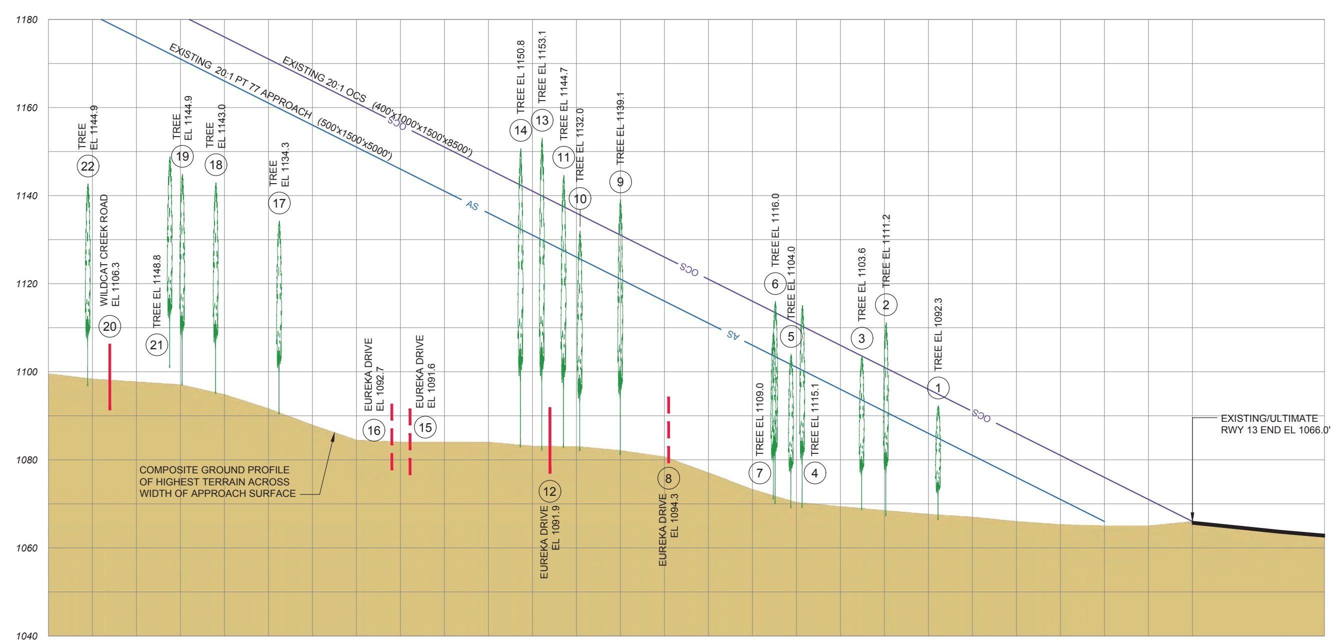
EXISTING/ULTIMATE OBSTRUCTION TABLE					
No.	Description	Top Elevation (msl)	EX/ULT PT77 20:1 Approach Penetration	EX/ULT 20:1 OCS Approach Penetration	Proposed Disposition
1	TREES	1092.3	7.4	NONE	TRIM/REMOVE
2	TREES	1111.2	20.4	10.4	TRIM/REMOVE
3	TREES	1103.6	10.1	0.1	TRIM/REMOVE
4	TREES	1115.1	14.8	4.8	TRIM/REMOVE
5	TREES	1104.0	2.4	NONE	TRIM/REMOVE
6	TREES	1116.0	12.6	2.6	TRIM/REMOVE
7	TREES	1109.0	5.4	NONE	TRIM/REMOVE
9	TREES	1139.1	18.1	8.1	TRIM/REMOVE
10	TREES	1132.0	6.4	NONE	TRIM/REMOVE
11	TREES	1144.7	17.3	7.3	TRIM/REMOVE
13	TREES	1153.1	NA	13.2	TRIM/REMOVE
14	TREES	1150.8	NA	8.5	TRIM/REMOVE
Triggering Event: ALP Update					
Nonpenetrating objects have been excluded from table.					
Traverseway elevations provided per 14 CFR Part 77.					
Red numerals indicate amount of obstruction in feet.					



Magnetic Declination
03° 02' East
Annual Rate of Change
00° 06' West
(Source: NOAA, NCEI, January 2019)

0 200 400
HORIZONTAL SCALE IN FEET

0 20 40
VERTICAL SCALE IN FEET

GENERAL NOTES:

1. OBSTRUCTION SURVEY DATED AUGUST 27, 2018 BY MARTINEZ GEOSPATIAL, EAGAN, MN.
2. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 - NAD83; VERTICAL DATUM: NORTH AMERICAN DATUM 1988 - NAVD88
3. OBSTRUCTION GROUPINGS REFLECT THE TALLEST NATURAL, MANMADE PENETRATION WITHIN A REPRESENTATIVE SELECTION OF OBSTRUCTIONS THROUGHOUT THE LARGER GROUPINGS.
4. ALL ELEVATIONS IN MSL FEET.

OBSTRUCTION AREA - SAMPLED POINTS REPRESENT THE HIGHEST POINTS WITHIN THE VICINTIY OF OBJECTS.

NO.	REVISIONS	DATE	BY	APP'D.

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MANHATTAN REGIONAL AIRPORT (MHK)

INNER PORTION OF THE APPROACH SURFACE DRAWING RUNWAY 13

MANHATTAN, KS

PLANNED BY: M. Dmyterko
DETAILED BY: D. Przybycien
APPROVED BY: T.Kahmann

April 2020 SHEET 11 OF 15

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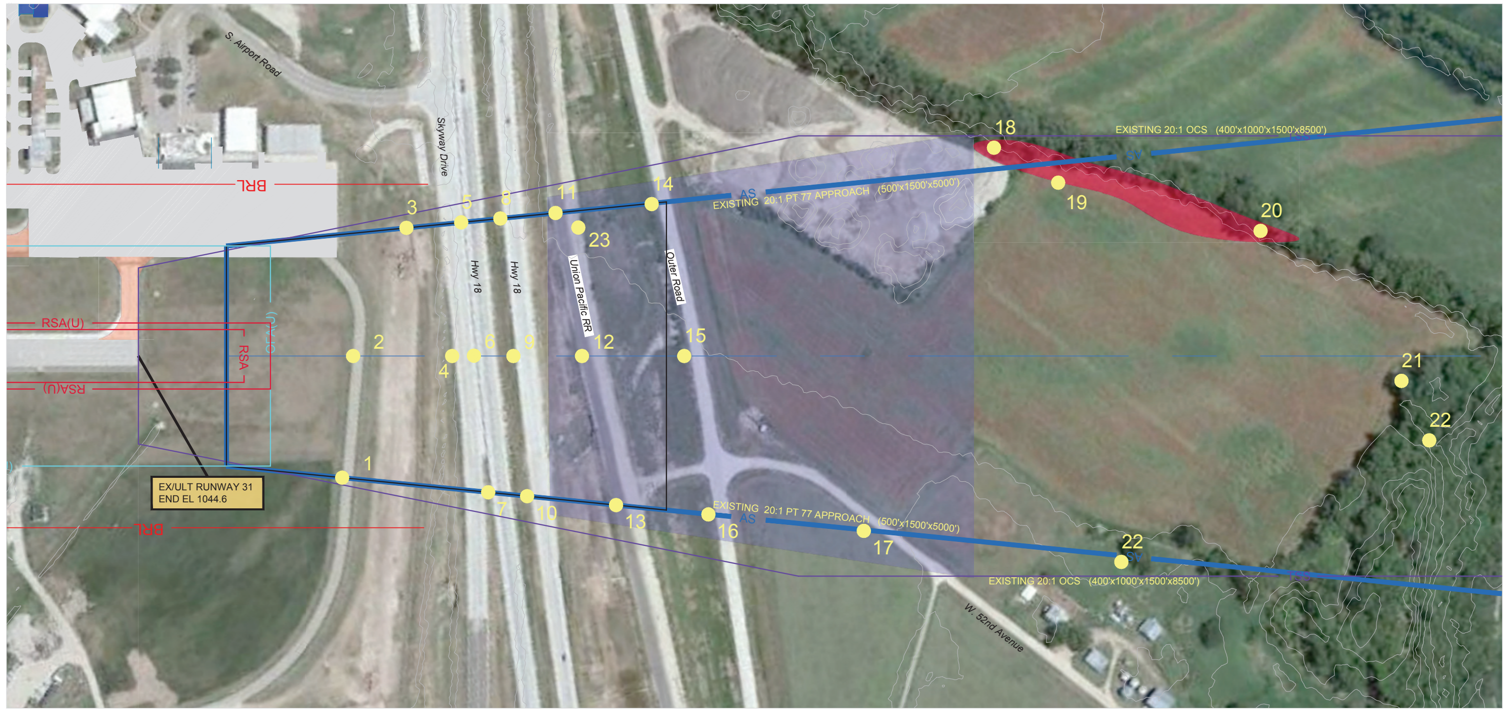
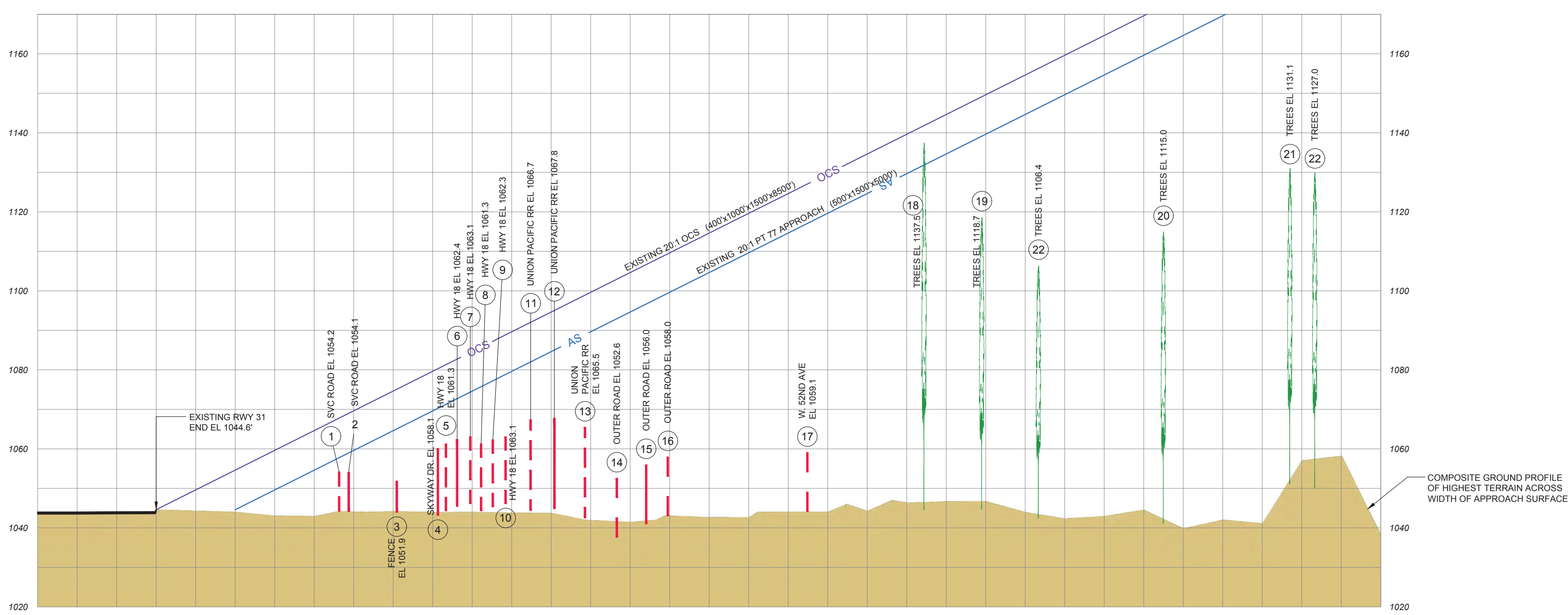


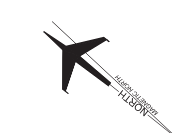
EXISTING RUNWAY 31 APPROACH OBSTRUCTION TABLE					
No.	Description	Top Elevation (msl)	PT77 20:1 Approach Clearance	20:1 OCS Approach Clearance	Proposed Disposition
18	TREES	1137.5	15.8	25.8	CLEAR; NAR
Triggering Event: ALP Update					

OBSTRUCTION AREA - SAMPLED POINTS REPRESENT THE HIGHEST POINTS WITHIN THE VICINTIY OF OBJECTS.

GENERAL NOTES:

1. OBSTRUCTION SURVEY DATED AUGUST 27, 2018 BY MARTINEZ GEOSPATIAL, EAGAN, MN.
2. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 - NAD83;
   VERTICAL DATUM: NORTH AMERICAN DATUM 1988 - NAVD88
3. OBSTRUCTION GROUPINGS REFLECT THE TALLEST NATURAL, MANMADE PENETRATION WITHIN A REPRESENTATIVE SELECTION OF OBSTRUCTIONS THROUGHOUT THE LARGER GROUPINGS.
4. ALL ELEVATIONS IN MSL FEET.





Magnetic Declination
03° 02' East
Annual Rate of Change
00° 06' West
(Source: NOAA, NCEI, January 2019)

0 200 400
HORIZONTAL SCALE IN FEET

0 20 40
VERTICAL SCALE IN FEET

NO.	REVISIONS	DATE	BY	APP'D.

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MANHATTAN REGIONAL AIRPORT (MHK)

INNER PORTION OF THE APPROACH SURFACE DRAWING RUNWAY 31

MANHATTAN, KS

PLANNED BY: M. Dmyterko
DETAILED BY: D. Przybycien
APPROVED BY: T.Kahmann

April 2020 SHEET 12 OF 15

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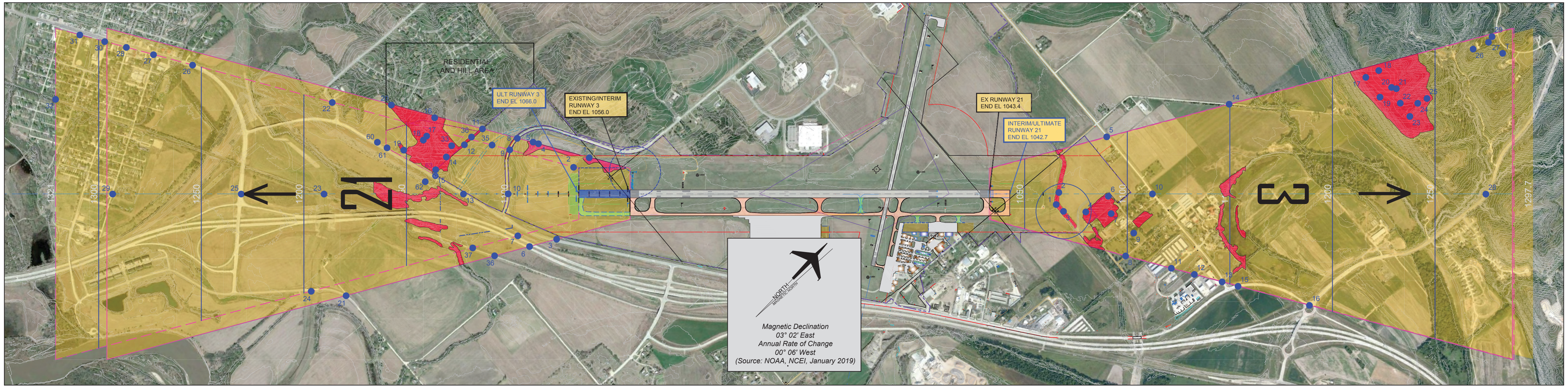
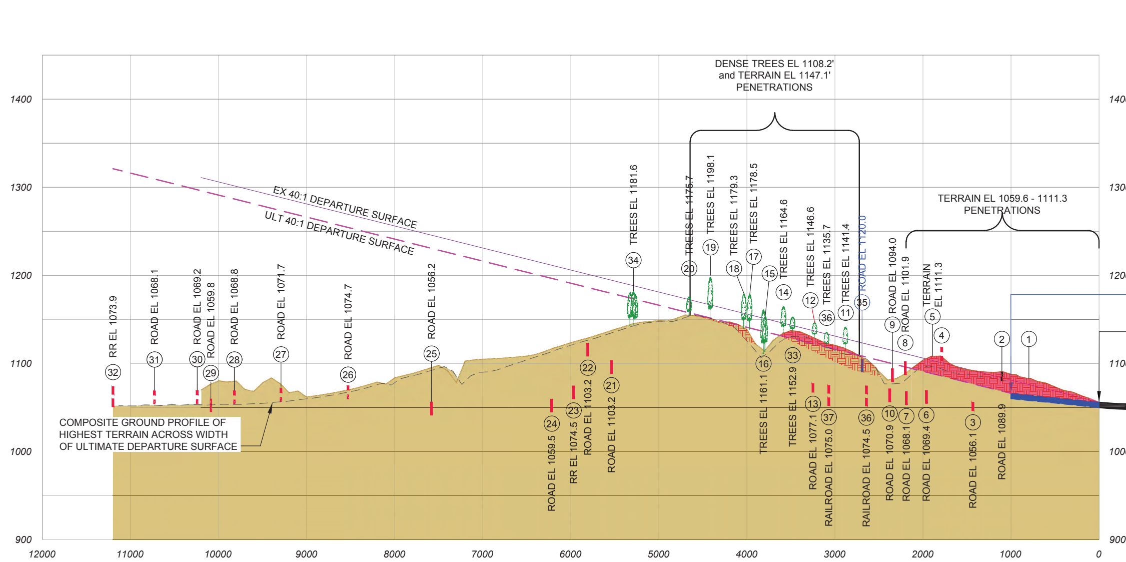


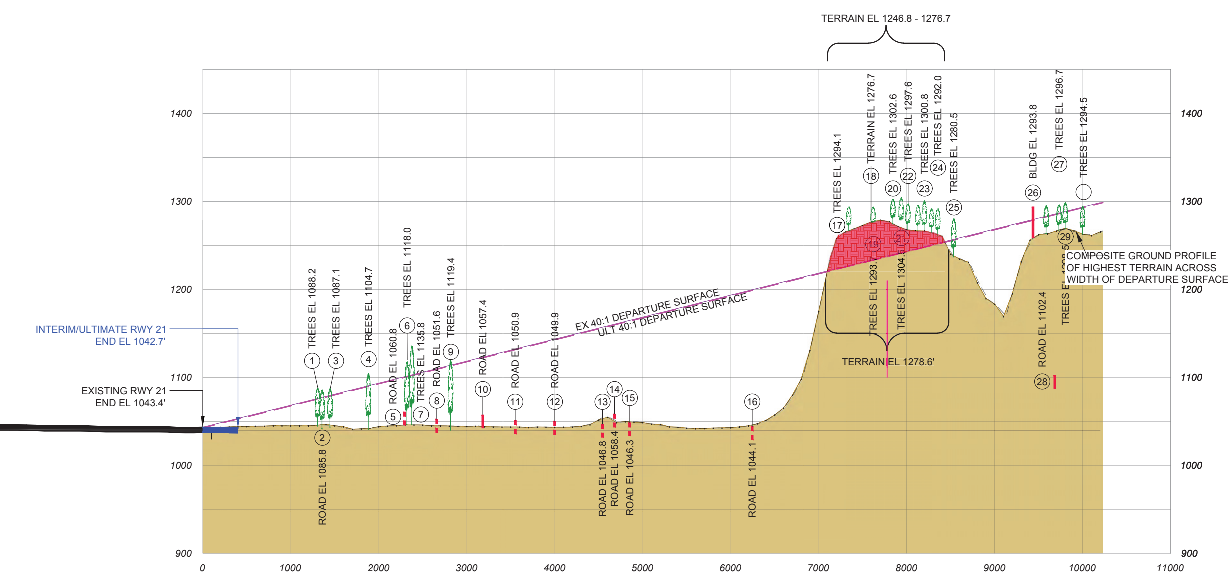


0 1000 2000

HORIZONTAL SCALE IN FEET

0 100 200

VERTICAL SCALE IN FEET



RUNWAY 21 DEPARTURE OBSTRUCTION TABLE

No.	Description	Top Elevation (msl)	Departure Penetrations		Proposed Dispostion
			Existing	Ultimate	
1	TERRAIN	1078.9	(5.6)	(20.6)	CASE TO BE FILLED WITH OEAAA
2	AIRPORT SERVICE ROAD	1089.9	(6.4)	(21.4)	CASE TO BE FILLED WITH OEAAA
4	ROAD	1118.2	(17.6)	(32.6)	CASE TO BE FILLED WITH OEAAA
5	TERRAIN	1111.3	(6.2)	(21.2)	CASE TO BE FILLED WITH OEAAA
8	ROAD	1101.9	9.5	(5.5)	CASE TO BE FILLED WITH OEAAA
11	TREES	1141.4	(15.9)	(30.9)	CASE TO BE FILLED WITH OEAAA
12	TREES	1146.6	(9.8)	(24.8)	CASE TO BE FILLED WITH OEAAA
14	TREES	1164.6	(19.0)	(34.0)	CASE TO BE FILLED WITH OEAAA
15	TREES	1153.5	(2.7)	(17.7)	CASE TO BE FILLED WITH OEAAA
16	TREES	1161.1	(9.9)	(24.9)	CASE TO BE FILLED WITH OEAAA
17	TREES	1178.5	(23.3)	(38.3)	CASE TO BE FILLED WITH OEAAA
18	TREES	1179.3	(22.5)	(37.5)	CASE TO BE FILLED WITH OEAAA
19	TREES	1198.1	(31.8)	(46.8)	CASE TO BE FILLED WITH OEAAA
20	TREES	1175.7	(3.3)	(18.3)	CASE TO BE FILLED WITH OEAAA
33	TREES	1152.9	(9.9)	(24.9)	CASE TO BE FILLED WITH OEAAA
34	TREES	1181.6	6.6	(8.4)	CASE TO BE FILLED WITH OEAAA
35	RELOCATED ROAD	1135.7	N/A	(27.4)	CASE TO BE FILLED WITH OEAAA
38	POLE	1187.0	(7.8)	(22.8)	#20-023160 TO BE MITIGATED WITH RUNWAY EXTENSION
39	POLE	1168.0	6.5	(8.5)	#20-023159 TO BE MITIGATED WITH RUNWAY EXTENSION
40	POWER LINE	1136.0	19.9	4.9	2006-ACE-2570-OE TO BE MITIGATED WITH EXTENSION
41	POLE	1141.0	9.9	(5.1)	#20-023158 TO BE MITIGATED WITH RUNWAY EXTENSION
Triggering Event: ALP Update					

N/A: Not Applicable

Nonpenetrating objects have been excluded from table.

Red numerals indicate amount of obstruction in feet.

RUNWAY 3 DEPARTURE OBSTRUCTION TABLE

No.	Description	Top Elevation (msl)	Departure Penetrations		Proposed Dispostion
			Existing	Ultimate	
1	TREES	1088.2	(12.1)	(13.6)	CASE TO BE FILED WITH OEAAA
2	TREES	1085.8	(8.4)	(9.9)	CASE TO BE FILED WITH OEAAA
3	TREES	1087.1	(7.5)	(8.9)	CASE TO BE FILED WITH OEAAA
4	TREES	1104.7	(14.2)	(15.6)	CASE TO BE FILED WITH OEAAA
6	TREES	1118.0	(16.5)	(18.0)	CASE TO BE FILED WITH OEAAA
7	TREES	1135.8	(32.9)	(34.4)	CASE TO BE FILED WITH OEAAA
9	TREES	1119.4	(5.5)	(7.0)	CASE TO BE FILED WITH OEAAA
17	TREES	1294.1	(67.1)	(68.6)	CASE TO BE FILED WITH OEAAA
18	TERRAIN	1276.7	(43.4)	(44.9)	CASE TO BE FILED WITH OEAAA
19	TREES	1293.7	(59.8)	(61.3)	CASE TO BE FILED WITH OEAAA
20	TREES	1302.6	(63.1)	(64.5)	CASE TO BE FILED WITH OEAAA
21	TREES	1304.5	(62.7)	(64.1)	CASE TO BE FILED WITH OEAAA
22	TREES	1297.6	(53.8)	(55.3)	CASE TO BE FILED WITH OEAAA
23	TREES	1300.8	(52.4)	(53.8)	CASE TO BE FILED WITH OEAAA
24	TREES	1292.0	(39.7)	(41.2)	CASE TO BE FILED WITH OEAAA
25	TREES	1280.5	(23.7)	(25.2)	CASE TO BE FILED WITH OEAAA
26	BUILDING PEAK	1293.8	(14.5)	(16.0)	CASE TO BE FILED WITH OEAAA
27	TREES	1296.7	(10.0)	(11.4)	CASE TO BE FILED WITH OEAAA
29	TREES	1298.5	(10.0)	(11.5)	CASE TO BE FILED WITH OEAAA
30	TREES	1294.5	(0.9)	(2.3)	CASE TO BE FILED WITH OEAAA
Triggering Event: ALP Update					
Survey mapping provided by Martinez Geospatial					

Nonpenetrating objects have been excluded from table.

Red numerals indicate amount of obstruction in feet.

HIGH DENSITY VEGETATION AND OBSTRUCTION AREAS - SAMPLED POINTS REPRESENT THE HIGHTEST POINTS WITHIN THE VICINTIY OF OBJECTS.

OBSTRUCTION IDENTIFIER

ULTIMATE GRADE/TERRAIN PENETRATIONS

GENERAL NOTES:

1. HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 - NAD83; VERTICAL DATUM: NORTH AMERICAN DATUM 1988 - NAVD88.
2. SAMPLED POINTS REPRESENT THOSE CAUSING THE MOST ADVERSE CLIMB GRADIENT, CLIMB-TO-ALTITUDE, AND/OR CEILING AND VISIBILITY.
3. SAMPLED POINTS IDENTIFIED FROM SURVEY PROVIDED BY MARTINEZ GEOSPATIAL, DATED AUGUST 27, 2018.
4. SUPPLEMENTAL ELEVATION DATA BEYOND THE LIMITS OF THE SURVEY, FROM THE USGS GEARY COUNTY, FORT RILEY, AND MANHATTAN CITY NED 1/9 ARC SECOND 2010.
5. 50' CONTOURS ACROSS DEPARTURE SLOPE REPRESENT ULTIMATE CONDITION.
6. ALL ELEVATIONS IN MSL FEET.

NO.	REVISIONS	DATE	BY	APP'D.

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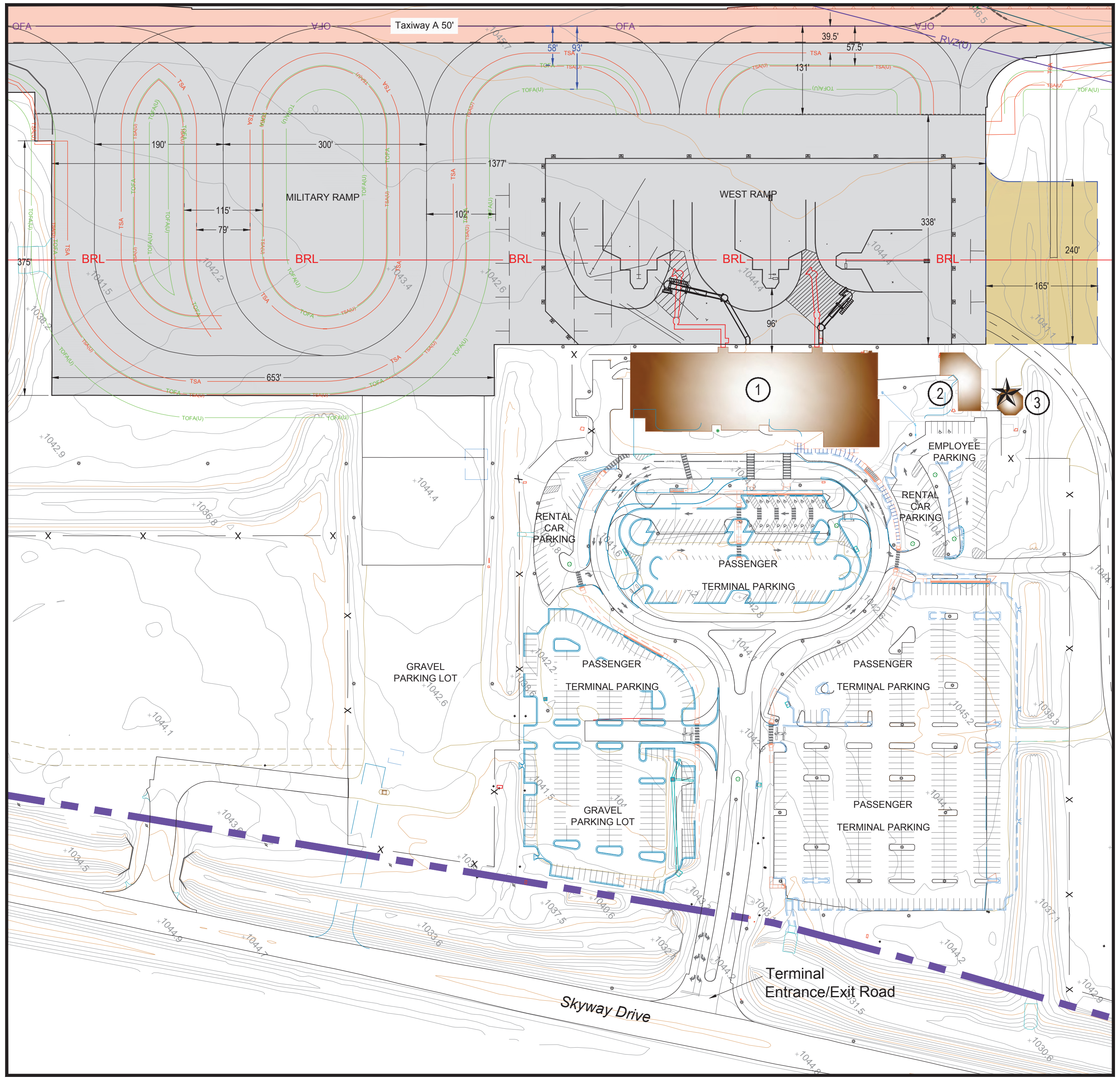
MANHATTAN REGIONAL AIRPORT (MHK)

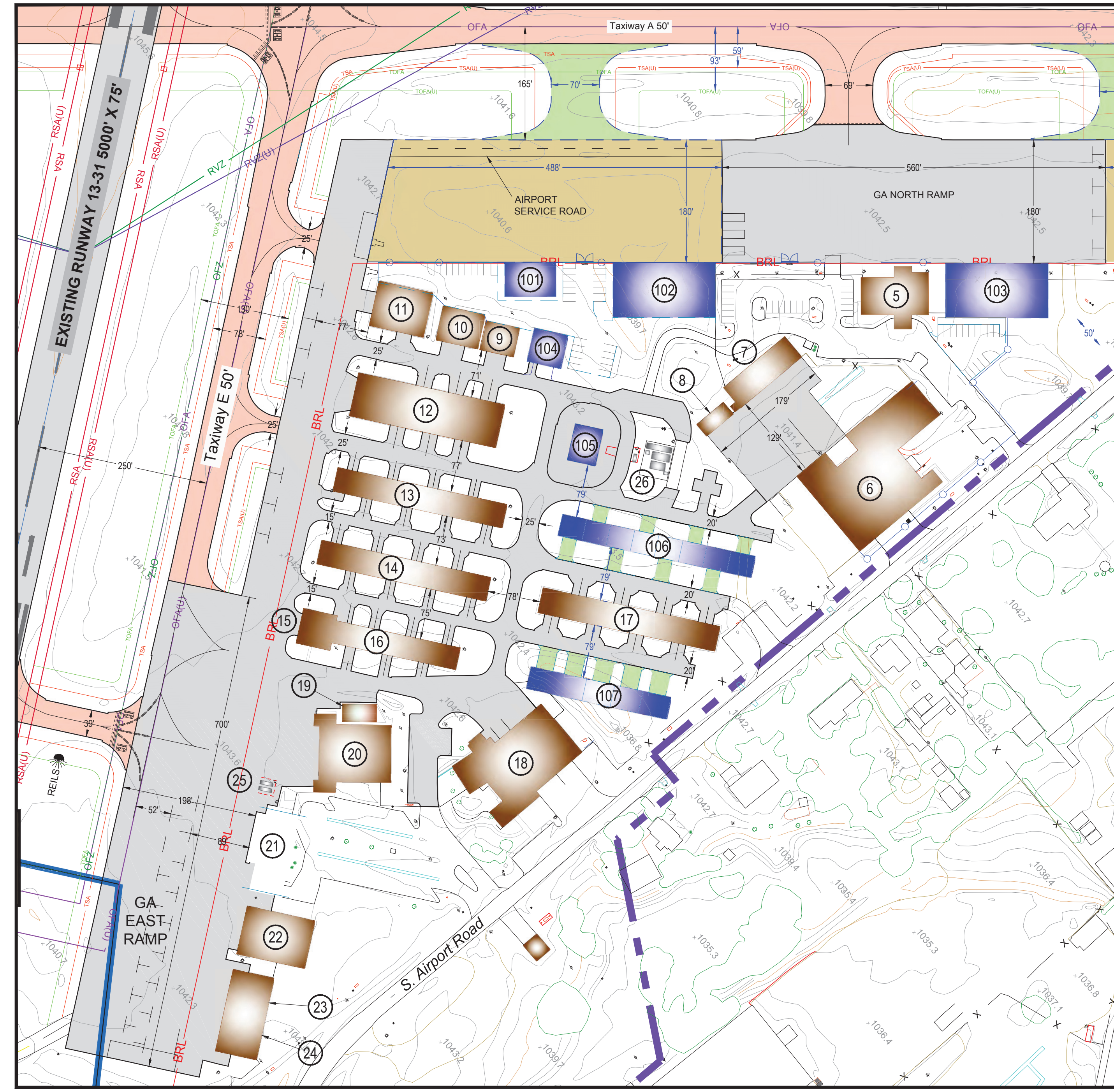
RUNWAY 3-21 DEPARTURE SURFACE DRAWING

MANHATTAN, KS

PLANNED BY: M. Dmyterko
DETAILED BY: D. Przybycien
APPROVED BY: T.Kahmann

April 2020





LEGEND

EXISTING	ULTIMATE	DESCRIPTION
		AIRPORT PROPERTY LINE
ESMT	ESMT(U)	AVIGATION EASEMENT
32 33 / 5 4		SECTION CORNERS
		AIRPORT REFERENCE POINT (ARP)
	N/A	AIRPORT BEACON
		AWOS-3
BRL		BUILDING RESTRICTION LINE (25')
		NAVAID CRITICAL AREA
		STRUCTURES ON AIRPORT
		STRUCTURE OFF AIRPORT
N/A		ABANDON/REMOVE
		FENCE LINE
		HOLD MARKING
		RUNWAY PAVEMENT
		TAXIWAY PAVEMENT
		APRON PAVEMENT
DESIGNATION		SURVEY MONUMENT WITH IDENTIFIER
OFA	OFA(U)	OBJECT FREE AREA
RSA	RSA(U)	RUNWAY SAFETY AREA
OFZ	OFZ(U)	OBSTACLE FREE ZONE
A	N/A	OBSTACLE FREE ZONE PENETRATION
N/A		PRECISION OBSTACLE FREE ZONE
		ROADS PAVED
		ROADS UNPAVED
RPZ		RUNWAY PROTECTION ZONE
RVZ	RVZ(U)	RUNWAY VISIBILITY ZONE
TOFA	TOFA(U)	TAXIWAY OBJECT FREE AREA
TSA	TSA(U)	TAXIWAY/TAXILANE SAFETY AREA
		TIE-DOWNS
		PAPI-4
	N/A	VASI-4
		RUNWAY END IDENTIFIER LIGHTS (REIL)
		TREELINE
400	400	TOPOGRAPHIC CONTOURS

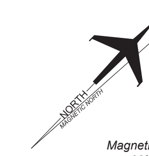
EXISTING AIRPORT FACILITIES

NO.	DESCRIPTION	ELEV. (MSL)
1	TERMINAL BUILDING	1075.2'
2	ADMINISTRATION OFFICE	1061.9'
3	ATCT	1084.4'
4	ELECTRICAL VAULT	1053.4'
5	KS JET CENTER (FBO)	1065.7'
6	STORAGE/TENANT	1068.0'
7	AIRPORT MAINTENANCE	1064.0'
8	DRY MATERIAL STORAGE	1071.8'
9	HANGAR E-2	1063.9'
10	HANGAR E-1	1064.4'
11	CORPORATE HANGAR	1067.1'
12	HANGAR D	1063.8'
13	HANGAR C	1057.3"
14	HANGAR B	1057.4'
15	OFFICE/STORAGE	1065.1'
16	HANGAR A	1065.1'
17	HANGAR H	1059.6'
18	ARFF FACILITY	1079.1'
19	STORAGE/TENANT	1064.2'
20	OLD TERMINAL HANGAR	1085.6'
21	OLD TERMINAL (VACANT)	1059.4'
22	CLEARSPAN HANGAR	1067.9'
23	CORPORATE HANGAR	1067.8'
24	CORPORATE HANGAR	1067.8'
25	FUEL FARM	1055.5'
26	FUEL FARM	1060.3'
27	AIRPORT BEACON	1111.2'

ULTIMATE AIRPORT FACILITIES

NO.	DESCRIPTION	ELEV. (EST)*
101	Corporate Hangar	1064.1'
102	Corporate Hangar	1065.3'
103	Corporate Hangar	1067.3'
104	Corporate Hangar	1063.1'
105	Fuel Farm Expansion	1055.5'
106	Box Hangar (8-Unit)	1064.4'
107	Box Hangar (5-Unit)	1064.4'

* Structure heights are estimates based on typical heights for proposed building type.



Magnetic Declination
03° 02' East
Annual Rate of Change
00° 06' West
(Source: NOAA, NCEI, January 2019)

0 100 200
SCALE IN FEET

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MANHATTAN REGIONAL AIRPORT (MHK)

TERMINAL AREA DRAWING

MANHATTAN, KS

PLANNED BY: M. Dmyterko
DETAILED BY: D. Przybycien
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April 2020 SHEET 14 OF 15

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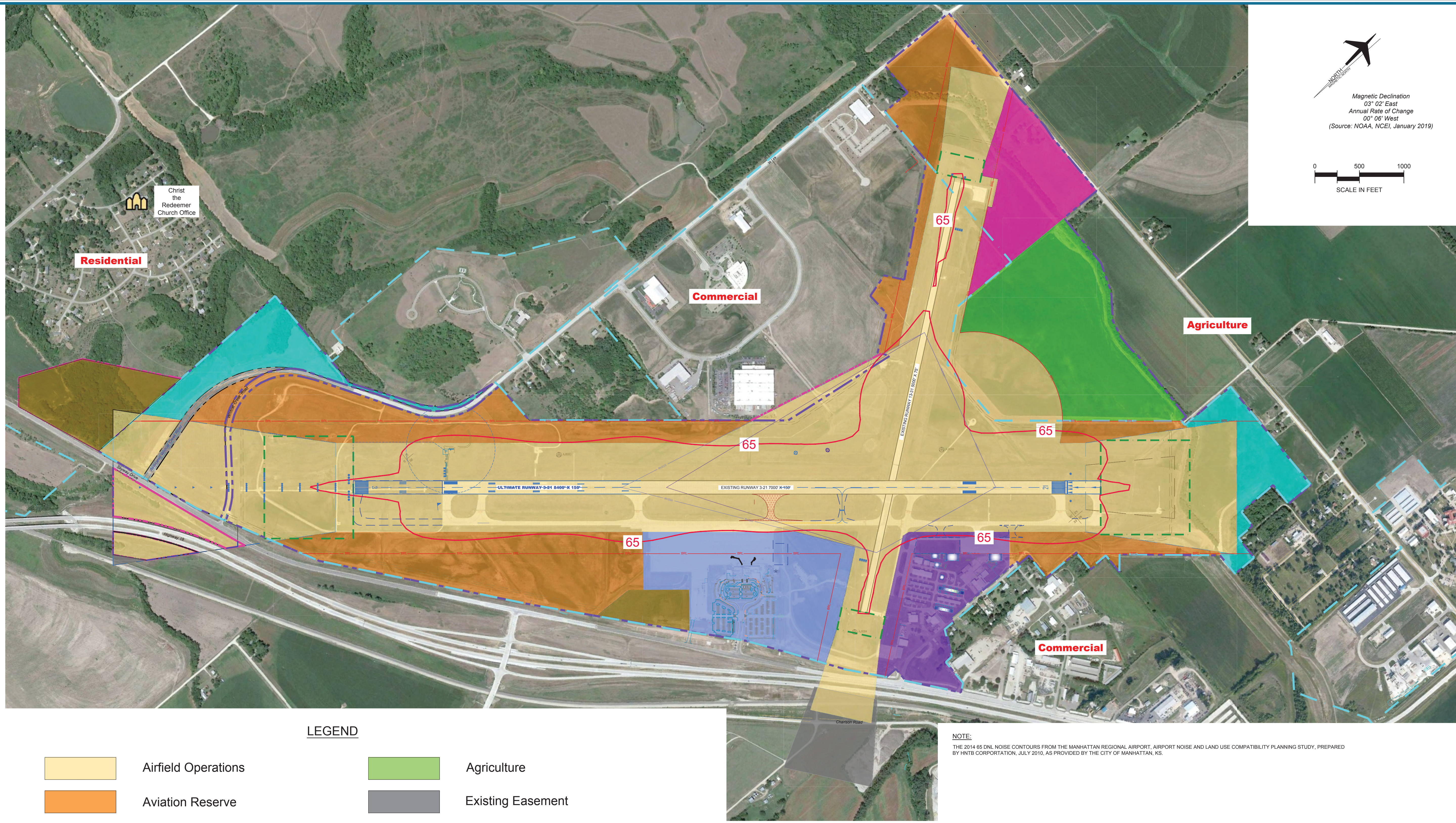

LEGEND

	Airfield Operations		Agriculture
	Aviation Reserve		Existing Easement
	Terminal Area		Ultimate Easement
	General Aviation		Existing Airport Property Line
	Mixed Use - Aviation/Non-Aviation		Ultimate Airport Property Line
	Non-Aviation Related		Crop Restriction Zone
	Open Space	65	2014 DNL Contour
			City of Manhattan Boundary

NOTE:

THE 2014 65 DNL NOISE CONTOURS FROM THE MANHATTAN REGIONAL AIRPORT, AIRPORT NOISE AND LAND USE COMPATIBILITY PLANNING STUDY, PREPARED BY HNTB CORPORTATION, JULY 2010, AS PROVIDED BY THE CITY OF MANHATTAN, KS.

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MANHATTAN REGIONAL AIRPORT (MHK)

LAND USE DRAWING

MANHATTAN, KS

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April 2020 SHEET 15 OF 15

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