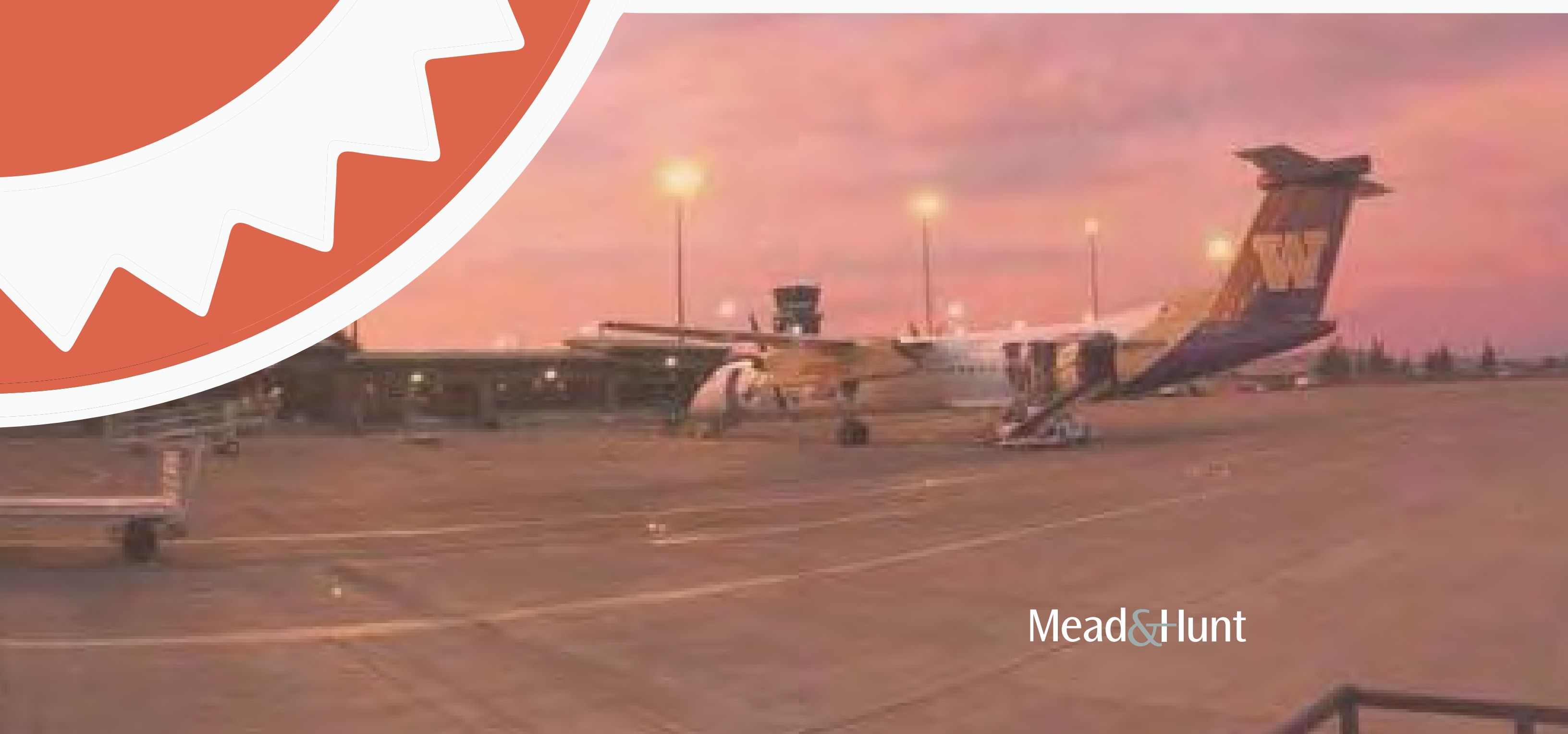
Fly REDMOND

REDMOND MUNICIPAL AIRPORT MASTER PLAN

2018



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REDMOND MUNICIPAL
AIRPORT MASTER PLAN

MARCH 2018

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Chapter Overview

The City of Redmond (City) initiated an update to the Airport Master Plan ("Plan") to assess the facility and service needs of the Redmond Municipal Airport ("the Airport") throughout the next 20 years. The Plan serves as a roadmap for bringing projects, people, and funding together in a coordinated manner, and provides strategic direction regarding the Airport's 20-year capital development plan and investment of resources.

The Plan is conducted in accordance with Federal Aviation Administration (FAA) guidance, as prescribed by grant assurances and mandated by regulatory standards. Conformance with FAA standards enables the City of Redmond to apply for federal and state funding in order to support the maintenance, expansion, and upgrade of airport facilities as demand warrants and funding is available.

Study Introduction

The Airport is owned by the City of Redmond, Oregon. The City of Redmond is a key stakeholder in the Plan. The Aviation Program Manager, Nettice Honn, is the daily project manager for the City. The City's planning and engineering departments are represented on the Planning Advisory Committee (PAC).

The Plan evaluates the Airport's needs over a 20-year planning period for airfield, airspace, terminal area, and landside facilities. The goal is to document the orderly development of Airport facilities essential to meeting City needs, in accordance with FAA standards, and in a manner complementary with community interests. The Plan results in a 20-year development strategy envisioned by the City, reflective of the updated Airport Capital Improvement Program (CIP), and graphically depicted by the Airport Layout Plan (ALP) drawings. The approved Plan allows the City to satisfy FAA assurances, and seek project funding eligible under the respective federal and state airport aid program.

The Master Plan will have the following core components, in accordance with FAA Advisory Circular (AC) 150/5070-6B, *Airport Master Plans:*
1: Study Design
2: Project Management
3: Stakeholder Coordination and Outreach
4: Airports Geographic Information Systems
5: Airport Inventory
6: Demand Forecasts
7: Facility Requirements
8: Improvement Alternatives
9: Financial Feasibility
10: Implementation Plan
11: Airport Layout Plan
12: Documentation

Why is it Time for a Master Plan?

The Airport Master Plan was last updated in 2005, with the ALP drawings last revised in November 2013. Since the 2005 Master Plan, the FAA has updated airfield design standards and aviation activity trends have changed. The 2005 Master Plan does not include important developments as envisioned by the City. This Plan is funded by the City with a grant from the FAA Airport Improvement Program (AIP).

Airport master plans are generally updated every 10 years, depending on the planning outlook and complexity of the airport. The aviation market has seen major changes since 2005, with fuel prices increasing, Next Generation navigation technologies becoming commonplace, the demand for pilots growing worldwide, the accelerated development of unmanned aerial systems, and new FAA policies on airport development. The assumptions and facts that formed the basis for recommendations in the 2005 Master Plan are in need of an update to reflect an evolving marketplace.

The changes in the community around Redmond reinforce the need for a new master plan to reexamine growth projections and future facility needs. The Airport is centrally-located in Central Oregon, an area that has been experiencing unprecedented growth in population and business interests. The region's physical location on the east side of the Cascade Mountains contributes to the favorable weather experienced year round. This is a major factor in the attractiveness to both young families and those looking to retire. These growth patterns will be evaluated in the Plan and included in all facility design and analysis for the Airport's 20-year plan.

Study Goals and Process

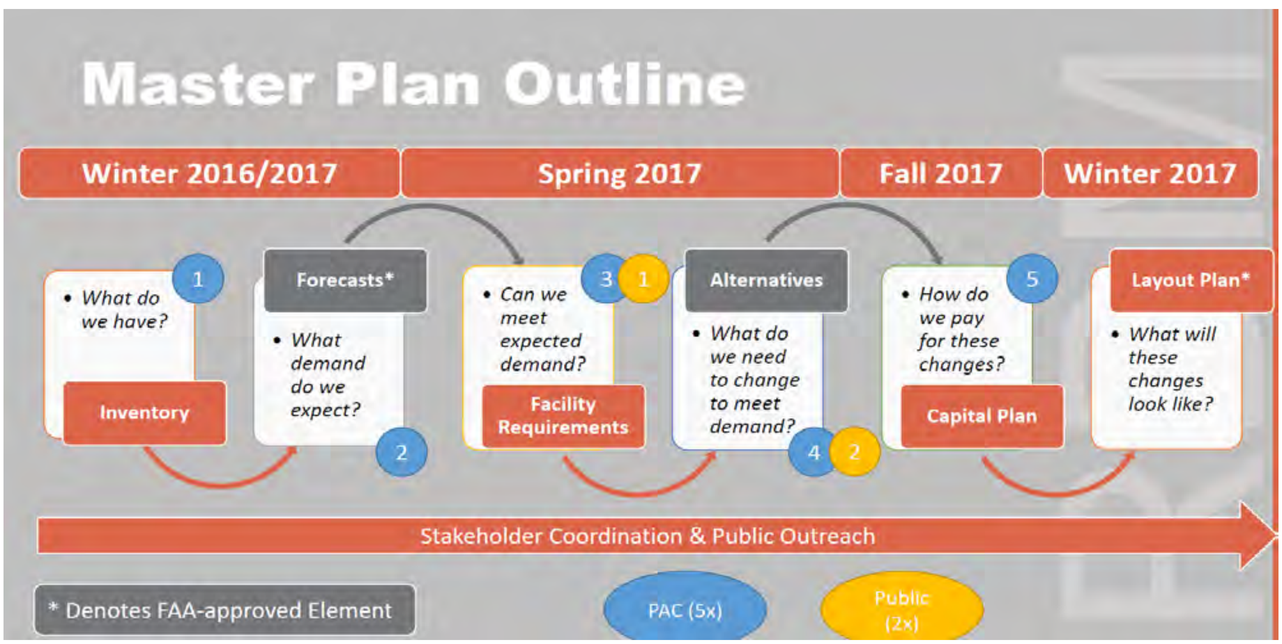
Master Plan Goals / Central Questions of the Master Plan

The core questions for this Plan include the following:

- ✓ How will Central Oregon's growth continue in the future, and what will the impact be on aviation activity?
- ✓ What role will General Aviation (GA) and United States Forest Service (USFS) activities play in the future?
- ✓ Is a runway extension justified, and if so, how long should it be, and in what direction?
- ✓ What is the viability of runway and terminal improvements previously depicted on the ALP?
- ✓ How can the passenger terminal and associated facilities accommodate continued passenger growth and additional carriers?
- ✓ What are the opportunities for increased airport revenue generation?
- ✓ How much property will be needed to satisfy the demand for future aviation use?
- ✓ What future changes in critical aircraft should the Airport plan for?
- ✓ Are aviation facilities adequate to meet the needs of the growing community?

The Planning Process and Timeline

FIGURE I-1: PROJECT TIMELINE & ROADMAP



Plan Participation

As a strategic visioning process, the Plan is structured to be responsive to Airport needs while being inclusive of broader community considerations. This approach builds stakeholder support for Plan recommendations and facilitates acceptance. The Plan's public involvement program is targeted to engage key Airport stakeholders (City and County elected officials, community leaders, on- and off-Airport stakeholders), address comments, and actively encourage public participation.

Agency Coordination

The FAA Seattle Airport District Office (ADO) is the primary external reviewing agency for this Plan. A representative from the Seattle ADO will be provided Plan deliverables and invited to attend PAC and public meetings. A visit will be made to the Seattle ADO two times during the Plan development to review key deliverables since the FAA is not always able to travel to Airport events.

The Oregon Department of Aviation (ODA) is a key stakeholder in the Plan. The Consultant and the Airport will keep ODA updated on Plan progress through routine communication, including scheduled teleconferences, and transmittal of Plan chapters.

Airport Committee

The purpose of the Airport Committee is to advise the City Council regarding issues that concern the development of the Airport. The Airport Committee supported Plan visioning, provided feedback on the Plan elements at key milestones, and will be essential to the Airport's ability to move forward with Plan recommendations.

Planning Advisory Committee

The PAC consists of aviation and non-aviation constituents selected to provide well-rounded Plan perspectives. The PAC serves in an advisory capacity to collectively review Plan recommendations and provide feedback to the Airport and Consultant. PAC input will be used to guide Plan developments. The PAC consists of members representing the following interests:

- ✓ USFS
- ✓ Redmond Economic Development, Inc.
- ✓ Redmond Chamber of Commerce
- ✓ Airport Tenant (GA Representative)
- ✓ Deschutes County
- ✓ City of Redmond Engineering Dept.
- ✓ City of Redmond Planning Division

- City of Bend
- Prineville (S39) Airport Management

The Airport project manager serves as an ex-officio member of the PAC. The FAA and ODA are informed of PAC meetings and invited to attend in an observer role.

Key Technical Stakeholders

While the PAC will provide a continuous sounding board throughout the Plan, there are some stakeholders that are expected to be interested in specific Plan elements and disinterested in others. The Consultant will meet with these stakeholders to collect their feedback on Plan elements that are of interest to them. These include:

Plan Element	Key Technical Stakeholders
Airport Inventory	Control Tower Law enforcement Passenger and Cargo Airlines Transportation Security Administration (TSA) Aircraft rescue and firefighting (ARFF) Businesses on airport property Airport hangar tenants
Demand Forecasts	Passenger and cargo airlines Control tower
Improvement Alternatives	Control tower TSA ARFF Deschutes County

Also, the City of Redmond is completing a Comprehensive Plan update and roadway engineering projects in the vicinity of the Airport concurrent with the Airport Master Plan. Close coordination between the Airport and community planning and development projects were pursued to help efforts of both organizations support common goals.

Public Outreach

This public involvement process is used to inform, educate, and solicit feedback from the public regarding the Plan process, major findings, and conclusions. Conducting public outreach meetings in an "open house" format provides the general public the opportunity to interact with the Airport and Consultant, ask questions, communicate concerns, and provide feedback.

The two (2) public meetings occur at the following Plan milestones.

- ✓ Facility Requirements and Initial Improvement Alternatives
- ✓ Refined Alternatives and Preliminary Capital Improvement Plan

A summary of public involvement is included as a Plan appendix.

SWOT Analysis

As part of the strategic planning process, a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis was conducted with the PAC to determine the appropriate strategic visions for the Airport, and specific goals and objectives to be addressed throughout the Plan. SWOT is a process for synchronizing strategic decision-making factors, and helps categorize the Airport's internal and external characteristics, qualities, and merits. When compiled, the SWOT factors help formulate Plan goals, provide the basis to pragmatically assess recommendations, and guide the Plan’s overall developmental policy. The following SWOT factors were identified by the Planning Advisory Committee during the project kick-off meeting held November 5, 2016.

SWOT TABLE

		Helpful	Harmful
		To Achieving the Objective	To Achieving the Objective
Internal Origin	Attributes Within Airport Influence	Strengths	Weaknesses
External Origin	Attributes Outside of Airport Influence	Opportunities	Threats

Strengths:	characteristics that provide an advantage over others.
Weaknesses:	characteristics that create a disadvantage compared to others.
Opportunities	outside potential that the Airport could capitalize on.
Threats:	outside risks that could be detrimental to the Airport.

Strengths:

- Runway wind coverage and physical access
- Runway length
- Central location
- ARFF presence
- New terminal
- Security
- Business and tourist economy
- Size of Airport-owned property
- Frequency of flights
- Air Traffic Control Tower presence
- FAA grant assurances in place to keep the Airport intact

Weakness:

- TSA and security requirements to adhere to
- Limited infrastructure availability
- USFS airside expansion potential limited by lack of available land adjacent to current taxiways

Opportunities:

- Business and industry diversity in the area
- Hotel availability
- Transportation network companies (Uber)
- Transportation systems/multi-use path
- Terminal – Jet Bridges
- East bound flights
- Additional connections
- Time of flights (more at night)
- Emergency preparedness
- Airport land owned north of airfield (golf course area)
- Airport name/branding
- Improving access to the airfield particularly on the north side

Threats:

- Not isolated from national/international threats
- Availability of skilled workforce or higher education opportunities
- Lack of FBO maintenance technicians and training
- BLM and other open lands where transient population tends to gravitate
- GA competition in the region – users could go elsewhere
- Cascadia earthquake
- Could overshoot growth estimates and overbuild

1.0 AIRPORT INVENTORY

This Inventory Chapter documents 2016 conditions at the Redmond Municipal Airport (the Airport) and provides a foundation for the overall planning analysis in the subsequent chapters of the RDM Master Plan. The Inventory Chapter includes an overview of environmental conditions and land uses at and surrounding the Airport to provide a basis for evaluating planned improvements.

1.1 INTRODUCTION TO THE INVENTORY

This section summarizes the purpose and organization of this chapter, and defines the key elements that are included in the investigation.

1.1.1 CHAPTER PURPOSE AND ORGANIZATION

The Inventory Chapter looks at the physical layout of the Airport and documents 2016 conditions in terms of airfield design standards and aviation activity. The Master Plan does not address management policies and procedures, staffing or operational rules and regulations. These topics are addressed in other airport documents.

The chapter begins with an overview of the Airport that covers location, history, role in the community, property interests, and the components of airport operation. The Airport is a complex operation with three major facility areas: airside, landside, and the terminal building. The Inventory Chapter documents each of these three areas in terms of use, design, and condition.

- ✓ Airside facilities are those areas that are restricted from general public access – sometimes called "inside the fence." This includes runways and taxiways, facilities for general aviation parking and maintenance, air cargo and other private business facilities with direct access to the runway, airport safety and maintenance facilities and the area used by the United States Forest Service (USFS).
- ✓ Landside facilities are those that support airport activities without direct access to the airfield. They include internal roadways, parking areas, and non-aeronautical development areas.
- ✓ The terminal building provides a transition between the airside and landside areas for commercial airline passengers and provides spaces for the traveling public, airline and airport administration, and the Transportation Security Administration (TSA).

The chapter will cover airport activity and design standards, which will be used in later plan chapters to address the need for improvements, improvements that may be recommended, and as a basis for design alternatives.

The chapter looks beyond the boundaries of the Airport to consider surrounding land uses that are subject to aircraft overflight, and the catchment area from where the Airport draws its passengers and users. The Airport serves the businesses and residents of the City of Redmond, the nearby City of Bend, and Deschutes, Crook, and Jefferson counties. The community around the Airport drives the demand for commercial air service, general aviation, and air cargo. Other airports serving the region are documented as they impact demand at the Airport.

Environmental factors are inventoried as they influence aircraft flight. Weather factors, such as temperature and wind direction, impact aircraft performance and drive facility design considerations. Environmental conditions such as wetlands, air quality, and aircraft noise are documented so future development can be evaluated in terms of potential environmental impacts.

Information was collected in several ways, including a site visit to the Airport in October 2016; review of documents and records provided by the Airport, the City of Redmond, the FAA, and other public agencies; and interviews with the Airport tenants. Results are presented in the following sections:

- ✓ Airport Overview
- ✓ Airside Facilities
- ✓ Landside Facilities
- ✓ Terminal Building
- ✓ Aeronautical Setting
- ✓ Community Setting
- ✓ Aviation Activity
- ✓ Airport Economic & Financial Conditions
- ✓ Environmental Conditions

1.2 AIRPORT OVERVIEW

This section gives an overview of the Airport that covers location, history, role in the community, property interests, and the components of airport operation.

1.2.1 AIRPORT LOCATION

The Airport is in central Oregon's high desert just east of the Cascade mountain range. The Airport is the only commercial service airport in the region, located 150 miles from Eugene to the west, 150 miles from Portland to the northwest, and 220 miles from Pendleton to the northeast. The Airport is located in Deschutes County, in the City of Redmond. Redmond's location has been important to its growth and prosperity in terms of the area's population and economy. Redmond has been the hub of the local transportation network since the railroad arrived in 1911. Today, Redmond's location at the intersection of Oregon's Highways 126 and 97 provides driving connections in four directions including to Interstate 5 to the west and Interstate 84 to the north, as shown in **Figure 1-1**.

1.2.2 AIRPORT AND COMMUNITY HISTORY

The first runways were constructed in 1929 with the support of Redmond Ray Johnson American Legion Post and Redmond Commercial Club, which has since evolved into the Redmond Chamber of Commerce. The Works Progress Administration improved the Airport during the 1930s, and during World War II, the US Army Air Corps used the Airport for training B-17 and P-38 pilots. The first commercial flight at the Airport was in 1946. After its service during the war, the Airport was sold to the City of Redmond.

1.2.3 AIRPORT PROPERTY

Airport property includes 2,518 acres surrounding two runways oriented in an "X" configuration. The passenger terminal area is southwest of the runway intersection. Aviation uses have been developed on the west and north side of the Airport along the major access routes of SE Airport Way, SE Veterans Way, and Highway 126. Property uses and development areas are shown on **Figure 1-2,** and key airport facilities are shown in **Figure 1-3**.

Figure 1-1
REDMOND LOCATION MAP

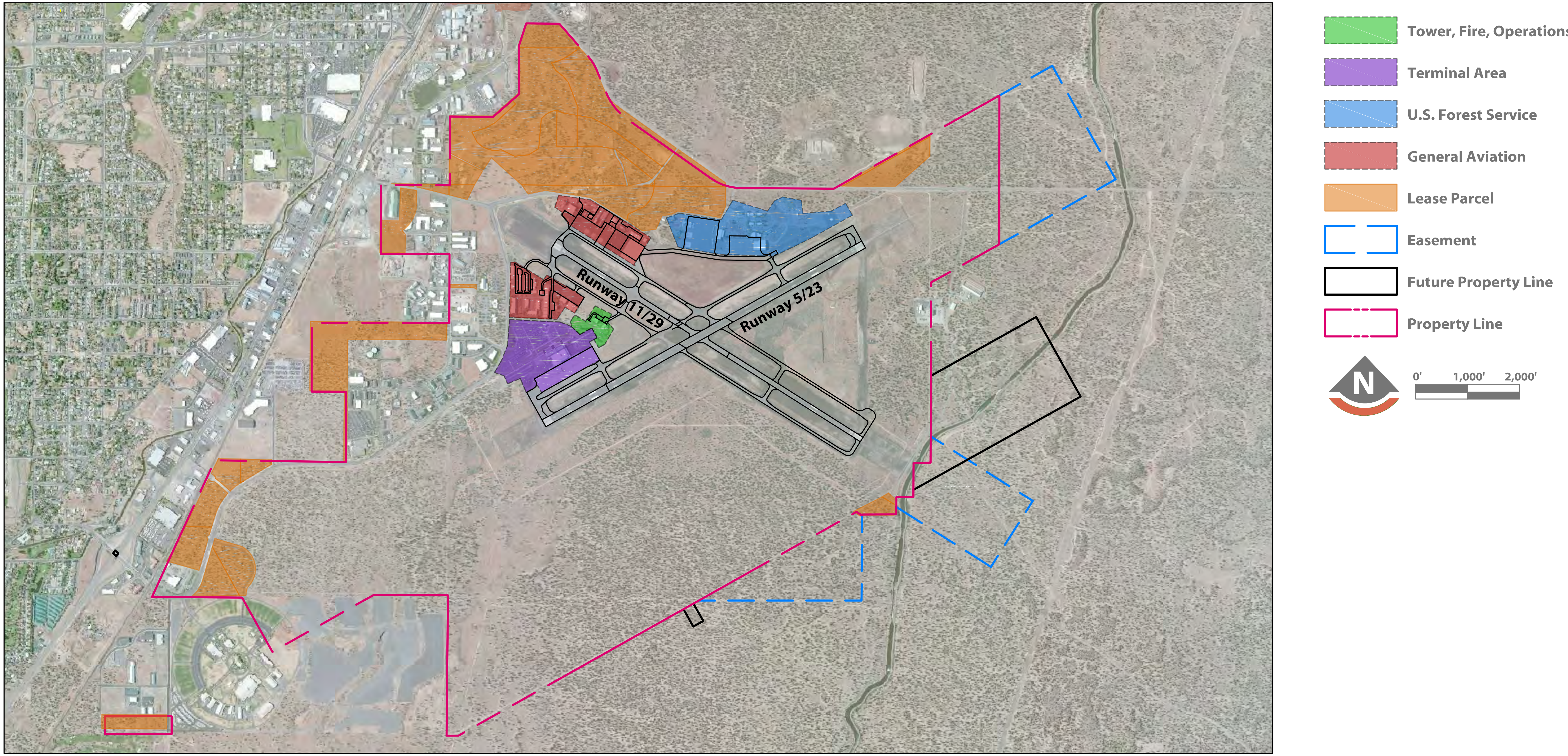


Figure 1-2
Property Map

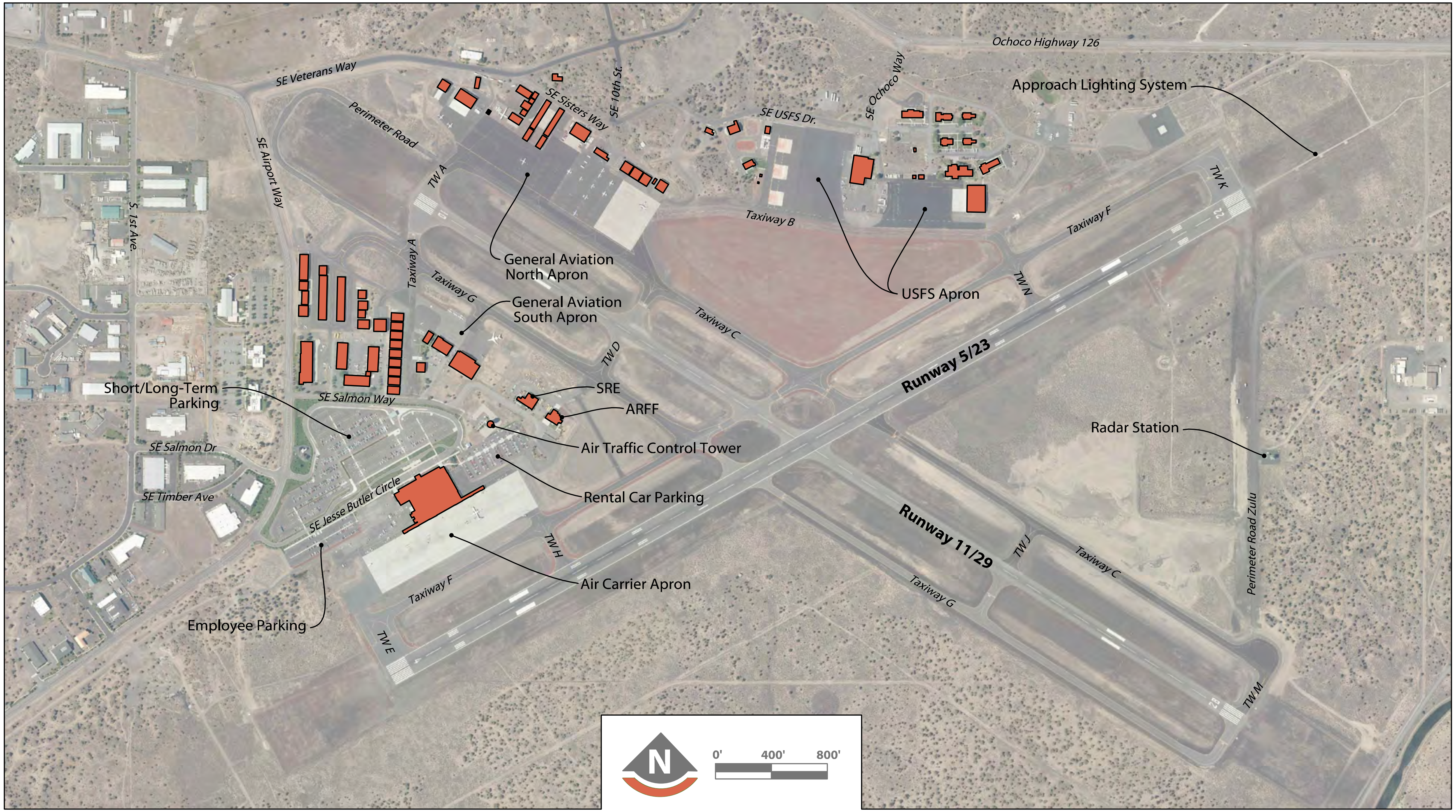


Figure 1-3
AIRPORT FACILITIES

1.2.4 OPERATIONAL OVERVIEW

MANAGEMENT

The Airport is owned by the City of Redmond. The Airport Director reports to the City Manager, and City employees are responsible for daily operations, programs, and services. City Council members, elected by the citizens of Redmond, are the City's policy makers. The City established an Airport Committee in 1991 to act in an advisory role to the City Council on airport-related matters. The Committee is composed of nine members: five appointed by Redmond; one appointed by the City of Bend; one appointed by Deschutes County; one appointed by Jefferson County; and one appointed by Crook County. Redmond recently instituted an Ex-Officio Youth member to help foster interest in aviation for young adults.

FUNCTIONAL CLASSIFICATIONS

The Airport is a public-use facility supporting commercial, general aviation, military, and USFS users. The Federal Aviation Administration (FAA) National Plan of Integrated Airport Systems (NPIAS) classifies the Airport as a non-hub primary commercial service airport. The NPIAS is updated every two years and uses predetermined evaluation criteria including commercial service enplanements, proximity to other airports, and number of based aircraft to identify airports that are of importance to the national air transportation system. Airports that are included in the NPIAS are eligible for FAA Airport Improvement Program (AIP) funding. Classification as a non-hub airport is based on the Airport having more than 10,000 annual passenger enplanements, but less than 0.05 percent of total national commercial passenger enplanements.

Under the Code of Federal Regulations (CFR), the Airport is certified as a Class I FAA Part 139 facility, which means that the Airport maintains facilities intended to serve scheduled passenger aircraft with 30 or more passenger seats.

The Oregon Department of Aviation classifies the Airport as a Category I - Commercial Service Airport. Airports in this category have scheduled commercial air carrier service. The Airport Reference Code (ARC), described in greater detail in **Section 1.3.3**, is C-III, which means that facilities are designed for medium-sized commercial aircraft like the Boeing 737 and Airbus A320. **Table 1-1** describes key facility attributes.

Table 1-1. Airport Data	
Airport Owner	City of Redmond
NPIAS Airport Category	Non-Hub
Airport Reference Code	C-III
Airport Acreage	2,518 acres
Airport Reference Point Coordinates	N 44° 15.24' W 121° 08.99'
Airport Elevation	3080 feet Above Mean Sea Level (AMSL)
Airport Traffic Control Tower	Open 14 hours daily (0500-1900 local time)
Sources: FAA Airport Master Record (Form 5010), Airport Website, Airport Directory, NPIAS.	

1.3 AIRSIDE FACILITIES

"Airside" is a collective term for those areas of the Airport that are accessible to aircraft including runways, taxiways, aprons, and hangar areas. Facilities that directly support aviation activity include:

- ✓ Pavement: runways, taxiways and aprons
- ✓ Structures: aircraft storage and maintenance hangars, fixed base operators (FBOs), fuel storage, snow removal equipment (SRE) storage, and an aircraft rescue and firefighting facility (ARFF)
- ✓ Navigation aids: airfield and approach lighting, weather monitoring systems, radio beacons
- ✓ Airfield signage and markings: (indicators for precision and non-precision instrument runways)
- ✓ Airport traffic control tower (ATCT)
- ✓ Terminal building: Passenger support and services and administrative areas
- ✓ Safety areas: Property set aside to comply with FAA-mandated setbacks and clear zones

1.3.1 RUNWAY SYSTEM

Runways are numbered using a system that assigns a number to each runway end based on its magnetic alignment. The Airport's primary runway, Runway 5-23, is aligned in a northeast/southwest fashion and the crosswind runway, Runway 11-29, is aligned in a northwest/southeast fashion.

Precision instrument runway:
A runway end having an instrument approach procedure that provides course and vertical path guidance conforming to Instrument Landing System (ILS) or Microwave Landing System (MLS) precision approach standards.
Non-precision instrument runway:
A runway end having an instrument approach procedure that provides course guidance without vertical path guidance.

RUNWAY 5-23

Runway 5-23 is 7,038 feet long and 150 feet wide. The runway has an asphalt surface that is transverse-grooved to improve aircraft braking action, reduce hydroplaning, and improve directional control for aircraft when the pavement is wet and icy. The runway was reconstructed in 2016 and is in excellent condition. Runway 5-23 is served by a full-length parallel taxiway on the west side. The runway to parallel taxiway separation is 400 feet, which meets C-III design standards.

Runway 5-23 is a precision instrument runway with high-intensity runway lights (HIRL) and medium-intensity approach lighting system with runway alignment indicator lights (MALSR). These lights provide pilots with visual guidance for landings at night and during poor weather conditions.

RUNWAY 11-29

Runway 11-29 is 7,006 feet long and 100 feet wide. The runway has an asphalt surface and is transverse-grooved. Runway 11-29 is served by two full-length parallel taxiways on the north and south sides. The runway to parallel taxiway separation is 400 feet, which meets B-III design standards.

Runway 11-29 is a non-precision instrument runway with medium-intensity runway lights (MIRL).

Table 1-2 presents data for Runway 5-23 and **Table 1-3** presents data for Runway 11-29. NAVAIDs are defined in **Sections 1.3.6 and 1.3.7**.

Table 1-2. Runway 5-23 Data

Dimensions	Length: 7,038 feet, Width: 150 feet
Bearing	060/240 (True)
Effective Gradient	0.3%
Weight Bearing Capacity	Single-wheel: 68,000 lbs., Double-wheel: 110,000 lbs.
Surface	Asphalt-grooved. Good condition.
Markings	Precision instrument approach. Good condition
Lighting	High-Intensity Runway Edge Lights Runway End Identifier Lights (REIL) – Runway End 05 Visual Approach Slope Indicator (VASI) – Runway End 05 Precision Approach Path Indicator (PAPI) – Runway End 23 1,400 foot MALSR – Runway End 23
Signage	Distance To Go Signs
Sources: FAA Airport Master Record (Form 5010), Airport website.	

Table 1-3. Runway 11-29 Data

Dimensions	Length: 7,006 feet, Width: 100 feet
Bearing	122/302 (True)
Effective Gradient	0.5%
Weight Bearing Capacity	Single-wheel: 28,000 lbs., Double-wheel: 40,000 lbs.
Surface	Asphalt-grooved. Good condition.
Markings	Non-precision instrument approach. Good condition
Lighting	Medium Intensity Runway Edge Lights REIL VASI – Runway End 11 PAPI – Runway End 29
Signage	Distance to Go Signs
Sources: FAA Airport Master Record (Form 5010), Airport website.	

HELIPAD

The Airport has one helipad, which is used by the USFS and not available for public use. The helipad is 48 feet x 48 feet and has a concrete surface. Military and GA helicopters land on the runways and hover taxi to the FBO aprons to park.

1.3.2 TAXIWAY SYSTEM

Parallel taxiways:
Taxiways that run alongside runways.

Connector taxiways:
All other taxiways that connect the aircraft to all facilities.

Hot spots:
Areas where incidents are more likely to occur because of airfield geometry.

The Airport has an extensive system of 12 asphalt taxiways that provides access between the runways and aircraft parking and storage facilities. Taxiways C, F, and G are parallel to the runways and the rest are connector taxiways. The parallel taxiways are 50 feet wide and the connector taxiways are 75 feet wide. Taxiway C and Taxiway G west of Runway 5-23 were reconstructed in 2011 and are in excellent condition. Taxiway C east of Runway 5-23 was constructed in 2013.

There are two areas on the airfield that the FAA has labeled as potential “hot spots,” which is defined in FAA Advisory Circular 150/5300-13A, Change 1, *Airport Design* (AC-13A) as “a location on an airport movement area with a history of potential risk of collision or runway incursion, and where heightened attention by pilots and drivers is necessary.” These two areas are the intersection of Taxiways F and G, and the intersection of Taxiways C and F.

The airfield’s original design was in compliance with FAA standards of the time; however, FAA standards have since changed. Some existing taxiway connectors do not meet FAA guidance defined in AC-13A. These standards seek to promote safer operations by simplifying airfield geometry, and reducing the risk that a pilot will accidentally taxi onto a runway. Examples of non-standard conditions are Taxiway A’s direct access from the North General Aviation Apron to Runway 11-29, and Taxiway H and E’s direct access from the Air Carrier Apron to Runway 5-23. As these taxiways are reconstructed, they will need to be built to the latest design standards.

1.3.3 AIRFIELD DESIGN STANDARDS

The Airport is required to maintain facilities in line with FAA standards as part of an agreement for accepting FAA grant money. FAA design standards for runways are determined by the FAA coding system called the Runway Design Code (RDC), shown in **Table 1-4**. The RDC is made up of the aircraft approach category (AAC), the airplane design group (ADG), and the runway approach visibility minimums. The most demanding AAC and ADG at an airport sets the ARC. The FAA codes taxiways using a standard called the Taxiway Design group (TDG).

RUNWAY CLASSIFICATION AND DESIGN

The design aircraft is an aircraft that uses an airport on a regular basis, which the FAA defines as more than 500 operations per year. The Bombardier Q400 (operated by Alaska Airlines) is the most demanding aircraft that exceeds 500 annual operations. The Q400 has an approach speed of 120 knots, a wingspan of 93.3 feet, and tail height 27.4 feet. Per AAC and ADG standards, the Q400 is classified as a B-III aircraft. **Table 1-4** depicts the Airport's RDC, as indicated in bold font.

Runway Design Code (RDC):
The FAA coding system comprised of three standards that determine the ARC: the Aircraft Approach Category, Airplane Design Group, and Approach Visibility Minimums.

Aircraft Approach Category (AAC):
This first standard is based on the approach speed (in knots) of the design aircraft.

Airplane Design Group (ADG):
This second standard is based on the wingspan and the tail height (in feet) of the design aircraft.

Approach Visibility Minimums:
These are based on runway visual range (RVR), the approximate visibility (in feet) as measured by the RVR light transmission/reception equipment or equivalent weather observer report measurements. The depicted numerical value for RVR relates to runway visibility minimums represented in feet or forward visibility that have statute mile equivalents (4000 RVR = ¾ mile).

Table 1-4. Runway Design Code System		
Aircraft Approach Category (AAC)		
AAC	Approach Speed	
A	Approach Speed less than 91 knots	
B	Approach speed 91 knots or more but less than 121 knots	
C	**Approach speed 121 knots or more but less than 141 knots**	
D	Approach speed 141 knots or more but less than 166 knots	
E	Approach speed 166 knots or more	
Airplane Design Group (ADG)		
Group Number	Wingspan (in feet)	Tail Height (in feet)
I	< 49'	< 20'
II	49' - < 79'	20' - < 30'
III	**79' - < 118'**	**30' - < 45'**
IV	118' - < 171'	45' - < 60'
V	171' - < 214'	60' - < 66'
VI	214' - < 262'	66' - < 80'
Approach Visibility Minimums		
RVR (ft.)	Flight Visibility Category (statue miles)	
VIS	Runways designed for visual approach use only	
5000	Not lower than 1 mile	
4000	Lower than 1 mile but not lower than ¾ mile	
2400	**Lower than ¾ mile but not lower than ½ mile**	
1600	Lower than ½ mile but not lower than ¼ mile	
1200	Lower than ¼ mile	

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

RUNWAY SAFETY AREAS

The FAA defines the Runway Safety Area (RSA) as a defined surface surrounding the runway prepared or suitable for reducing the risk of damage to aircraft in the event of an aircraft undershoot, overshoot, or excursion from the runway. The runways at the Airport each have different RSA design standards. Runway 5-23 is designed to C-III standards, which is the Airport Reference Code as of 2016 and the standard needed for commercial aircraft such as the Boeing 737. Runway 11-29 is designed to B-III standards, suitable for handling aircraft with slower approach speeds. **Table 1-5** depicts runway RSA dimensions.

Table 1-5. Runway Safety Areas

	5-23	11-29
Runway Design Standard	C-III	B-III
Width	500’	400’
Length	9,038’	8,206
Length Beyond Runway Ends	1,000’	600’

RUNWAY PROTECTION ZONES

Runway Protection Zone (RPZ):
A trapezoid-shaped area off the end of each runway defined by the FAA as a zone to enhance the protection of people and property on the ground.

The Runway Protection Zone (RPZ) is a trapezoidal area off the end of the runway. This area is designated to enhance safety for aircraft operations and for people and objects on the ground. The FAA recommends that incompatible land uses, objects, and activities be located outside of the RPZ. The FAA has issued a Memo titled *Interim Guidance on Land Uses Within a Runway Protection Zone* to help airport sponsors understand what land uses are and are not compatible within the RPZ. The FAA recommends that an airport operator maintain full control of an RPZ, ideally through fee simple property acquisition. If this is not feasible, land use control may be achieved through the use easements. Highway 126 goes through the RPZ at the approach end of Runway 23. Veterans Way and Airport Way pass through the RPZ at the Runway 11 approach end. Since these roads are existing features, current FAA guidance does not require the roads to be moved. Actions that would introduce new incompatible land uses to the RPZ, either by airport or neighboring jurisdiction action, require coordination with FAA Headquarters. **Table 1-6** depicts RPZ standards for the Airport.

Table 1-6. Runway Protection Zone Dimensions for Runway Ends

	Length (ft.)	Inner Width (ft.)	Outer Width (ft.)	Acreage
5	1,700	500	1,010	29.465
23	2,500	1,000	1,750	78.914
11	1,700	500	1,010	29.465
29	1,700	500	1,010	29.465

Source: Airport ALP, AC-13A

TAXIWAY DESIGN AND STANDARDS

The TDG determines taxiway design standards. The TDG relates to the undercarriage dimensions of aircraft, based on the overall Main Gear Width and the Cockpit to Main Gear Distance. TDG also determines the taxiway edge safety margin and shoulder width of taxiways. Taxiway protection is determined by the ADG of the design aircraft. The ADG of an aircraft determines the taxiway protection areas, taxiway separation, and required wingtip clearance for aircraft using the taxiways. The TDG and ADG are determined by critical aircraft, the Q400. The Q400 has a TDG of three and ADG of III. **Table 1-7** depicts TDG three and ADG III standards.

Table 1-7. TDG 3 And ADG III Taxiway Standards	
Taxiway Width	50’
Taxiway Edge Safety Margin	10’
Taxiway Shoulder Width	20’
ADG III Standards	
Taxiway Protection	
Taxiway Safety Area (TSA)	118’
Taxiway Object Free Area (OFA)	186’
Taxilane OFA	162’
Taxiway Separation	
Taxiway Centerline to Parallel Taxiway/Taxilane Centerline	152’
Taxiway Centerline to Fixed or Movable Object	93’
Taxilane Centerline to Parallel Taxilane Centerline	140’
Taxilane Centerline to Fixed or Movable Object	81’
Wingtip Clearance	
Taxiway Wingtip Clearance	34’
Taxilane Wingtip Clearance	27’
Source: AC-13A	

1.3.4 AIRCRAFT APRONS

The Airport has four apron areas: the Air Carrier Apron, General Aviation North Apron, General Aviation South Apron, and the USFS Apron. The aprons serve the landside facilities including the passenger terminal building, the general aviation hangar facilities and FBOs, cargo facilities, and the USFS.

The Airport's aprons locations, sizes, and surface pavements are listed below:

- ✓ Air Carrier Apron, west of the runway intersection (378,675 square feet; concrete)
- ✓ General Aviation North Apron, northwest of the runway intersection (672,003 square feet; asphalt and concrete)
- ✓ General Aviation South Apron, north of the Air Carrier Apron and west of the runway intersection (110,475 square feet; asphalt)
- ✓ USFS, north of the runway intersection (473,175 square feet; asphalt and concrete)

1.3.5 FIXED BASE OPERATORS

FBOs support a wide range of GA aeronautical activities, providing services to aircraft and to pilots, the traveling public, and the airlines. There is one FBO at the Airport. The FBO is located on the North GA Apron, and on the South GA Apron. The FBO offers full service operations which include the following services:

- ✓ Aircraft ground handling
- ✓ Aircraft parking (ramp or tiedown)
- ✓ Fuel (100LL and Jet A)
- ✓ Hangars
- ✓ Nitrogen
- ✓ GPU/Power cart
- ✓ Passenger terminal and lounge
- ✓ Aerial tours/aerial sightseeing
- ✓ Aircraft charters
- ✓ Aircraft maintenance
- ✓ Aircraft cleaning/washing/detailing
- ✓ Aircraft parts
- ✓ Catering
- ✓ Rental cars
- ✓ Courtesy cars (free for pilots to use in the local area
- ✓ Public telephone
- ✓ Computerized weather
- ✓ Flight planning facilities
- ✓ Internet access
- ✓ Restrooms
- ✓ De-ice truck and De-ice Cart (type 1)

1.3.6 AIRCRAFT STORAGE

HANGARS

The Airport has box hangars and T-hangars on the north and south aprons. T-hangars store one aircraft while box hangars can accommodate multiple aircraft. Aircraft have direct access to Taxiway G for the south apron and Taxiway C for the north apron. Both taxiways are parallel to Runway 11-29 and have access to Runway 05-23. **Figures 1-4 and 1-5** show examples of hangars at the Airport. **Figure 1-6** shows the airport building layout.

Figure 1-4. Box Hangars

Figure 1-5. T-Hangars

1.3.7 SUPPORT FACILITIES

MAINTENANCE AND SNOW REMOVAL

The Airport has one support facility that houses airport maintenance and Snow Removal Equipment (SRE). The facility is located next to the ARFF and its bays face Taxiway G for quick access. The three storage bays contain plows and other SRE. The storage bay section of the building is approximately 85 feet by 45 feet. The Airport owns and operates the following SRE equipment:

- One 1995 Oshkosh model "HB" all wheel drive
- One 1976 Huber Grader, with a 12' reversible blade
- One 1985 Case Front End Loader
- One 2006 Cat Front End Loader
- Two 20' Pro-Tec snow pushers to attach to a front end loader
- One 12" Pro-Tec snow pusher to attach to a front end loader
- One 22' reversible ramp plow
- One 2000 Oshkosh model "P" series six wheel, all steer, all wheel drive truck
- Two Bowmonk AFM2 Airfield Friction Meter Mark 3.
- One 1984 Oshkosh model WT-2206 all wheel drive with a 2009 slide in power plant and 20" rotary broom.
- One 2007 Ford F-550 deicing unit.
- One 2014 Wausau SnoDozer 3131

BUILDINGS

1	TERMINAL BUILDING	26	LEADING EDGE JET CENTER
2	LANCAIR	28	HANGARS
3	INDUSTRIAL BUILDING	29	AIRFIELD LIGHTING BUILDING
4	INDUSTRIAL BUILDING	30	FOREST SERVICE
5	INDUSTRIAL BUILDING	31	AIR TANKER BASE
6	BUTLER AIRCRAFT SERVICES	32	FOREST SERVICE
7	BUTLER AIRCRAFT SERVICES	33	FOREST SERVICE CASHE BLDG.
8	BUTLER AIRCRAFT SERVICES	36	BUILDING
9	HANGAR	37	WELL PUMP HOUSE
10	HANGAR	38	STORAGE BUILDING
11	HANGAR	39	U.S. FOREST SERVICE AIR CENTER
12	T-HANGARS	40	U.S. FOREST SERVICE AIR CENTER
13	T-HANGARS	41	U.S. FOREST SERVICE AIR CENTER
14	HANGAR	42	U.S. FOREST SERVICE AIR CENTER
15	PUBLIC WORKS DEPARTMENT	43	FOREST SERVICE
16	HANGAR	44	FOREST SERVICE
17	HANGAR	46	AIR TRAFFIC CONTROL TOWER
18	HANGAR	47	AIRPORT RESCUE & FIRE FIGHTING
19	HANGAR	51	SNOW EQUIP. & MAINT. STORAGE
20	LEADING EDGE JET CENTER	52	WAREHOUSE
21	T-HANGARS	53	USFS HANGAR
22	HANGAR	54	SMOKEY HALL
23	T-HANGARS	55	FOREST SERVICE OFFICE BUILDING
24	HANGAR	56	LES SCHWAB HANGAR
25	LEADING EDGE JET CENTER	57	BPA HELICOPTER HANGAR
		58	HANGAR

Figure 1-6
HANGAR BUILDING PLAN

Airport personnel maintain the airfield and Airport-owned buildings. **Figure 1-7** shows the support facility used for maintenance and SRE. The support facility is in good condition. There is space between the support facility and the ARFF for future expansion of either facility should it be necessary.

Figure 1-7. SRE and Maintenance Support Facility

AIRCRAFT RESCUE AND FIRE FIGHTING

The Airport is required to maintain ARFF under Federal Aviation Regulation (FAR) Part 139, which governs the operation of airports with scheduled or unscheduled passenger service by aircraft of more than 30 seats. The Airport is classified with an ARFF Index B designation which applies to airports serving only aircraft that are shorter than 126 feet. The Index B designation specifies equipment types that must be on hand to respond to an aircraft accident. The Airport's ARFF facility is centered between the passenger terminal and the south GA apron with access to Taxiway G. ARFF vehicles include two crash trucks, one ambulance, and a mass casualty incident vehicle. The City of Redmond staffs the ARFF station with one active duty fire fighter at all times.

FUEL FACILITIES

Fuel is offered by the FBO to GA, airlines, military, and USFS. Both 100 low-lead (LL) and Jet A fuel are available from the FBO via full service fuel trucks as shown in **Figure 1-8**, and self-service 100LL is available on the South GA Apron. A list of fuel tanks, their ownership, and fuel type are listed below.

- ✓ At SRE building, diesel fuel tank used for SRE and maintenance
- ✓ South GA Apron, four tanks. Two are 20,000 gallons with Jet A fuel. One 500-gallon 100 LL fuel.
- ✓ North GA Apron, seven tanks. One private use 20,000 gallon Jet A. Two are out of commission and will eventually be removed. Two are out of commission and can be brought back if needed. One is a 20,000-gallon Jet A tank and one 12,000-gallon 100LL tank.

Figure 1-8. Fuel Trucks

UNITED STATES FOREST SERVICE (USFS) REDMOND AIR CENTER

The USFS Redmond Air Center plays a major role in supporting firefighting efforts in Oregon, Alaska, and Washington. Operations depend on the severity of the fire season, which generally lasts from May to October, so the number of operations varies annually. The base typically experiences approximately 780-800 operations per season.

Aircraft operating in and out of the base include C130s, RJ 85s, King Airs, and Sherpas (A and B versions). The USFS has also acquired 16 C130s (H/Q models) that are expected to arrive once reconstruction of Taxiway B is complete in 2017. The base has two aprons capable of accommodating the C130s. The station has an air tanker base on their leased property; hosts training for firefighting and prevention; and processes firefighters and sends them to incidents throughout the service region.

The FBO services the USFS base. The base has and will continue to be visited by traffic from other governmental organizations. Previous visitors include politicians, the Federal Bureau of Investigation, and Air Force One. The base is classified as a hub of operations, incident support base and critical asset for the Federal Emergency Management Agency (FEMA) and related emergency efforts in the event of a large scale natural disaster in the Pacific Northwest, such as an earthquake in the Cascadia subduction zone.

The USFS is planning for an expansion of its facilities to include a visitor center and fire cache on the leased property. The major improvements the base facility needs are improvements to the old roads that lead to the station and the utilities.

1.3.8 PAVEMENT

Pavement management reports are periodically updated to assist airports in the ongoing maintenance of airfield pavements. An airport Pavement Management Program (PMP) assesses the relative condition of the pavement sections and identifies pavement repair and rehabilitation needs and guides capital planning.

Airfield pavements are assessed using a scale known as the Pavement Condition Index (PCI). The PCI inspection assesses the types, severities, and amounts of distress observed in the pavements through a visual inspection. The evaluation is quantified using a scale from 0 (failed) to 100 (new) with ratings applied to individual pavement sections, providing an overall condition report for the Airport. The condition is an indication of the needs for maintenance and/or repair that will be required over a seven-year period. The most recent PCI values at the Airport were calculated in August 2010, and have been updated to reflect construction that has occurred since.

PAVEMENT STRENGTH

An airfield's required pavement strength is determined by aircraft fleet mix. There are two pavement strength classifications, "Utility" and "Other than Utility." Utility pavements are capable of handling aircraft up to 12,500 pounds maximum gross weight (MGW), while Other than Utility pavements can handle aircraft over 12,500 pounds MGW. When the design aircraft exceeds 12,500 pounds as the case at the Airport, the Aircraft Classification Number (ACN)-Pavement Classification Number (PCN) method is used to calculate what the pavement is capable of accommodating.

The ACN-PCN method of determining pavement strength is intended to be used to report relative pavement strength, and not to be used for pavement design.

ACN:
The number that expresses the relative effect of an aircraft at a given configuration on a pavement structure for a specified standard of subgrade strength.

PCN:
A number that expresses the load-carrying capacity of a pavement for unrestricted operations.

Table 1-8 illustrates the standard ACN-PCN reporting format, as described in AC 150/5335-5, *Standardized Method of Reporting Airport Pavement Strength - PCN*.

Table 1-8. Standard ACN-PCN Reporting Format

	Pavement Type	Subgrade Strength (CBR)	Tire Pressure (psi)	Method of Determination
Numerical Value	R - Rigid	A - High (≥ 13 CBR)	W – no limit	T – Technical Study
		B – Medium (>8 but < 13 CBR)	X – 182-254	
	F - Flexible	C – Low (>4 but ≤ 8 CBR)	Y – 74-181	U – Using Aircraft
		D – Ultralow (≤ 4 CBR)	Z – 0-73	
### / R or F / A, B, C, or D / W, X, Y, or Z / T or U				

Source: Airport Records

Table 1-9 includes the 2016 published weight bearing capacities for Runway 5-23 and Runway 11-29.

Table 1-9. Published Weight Bearing Capacity

Runway	Published Weight Bearing Capacity		
	Single Wheel (SW)	Dual Wheel (DW)	Dual Tandem Wheel (DTW)
Runway 05-23	68,000 lbs.	110,000 lbs.	200,000 lbs.
Runway 11-29	28,000 lbs.	40,000 lbs.	N/A

Source: Airport Records

Table 1-10 includes the recommended weight bearing capacity for Runway 05-23 and Runway 11-29 after using the ACN-PCN method for evaluating pavements.

Table 1-10. Recommended Weight Bearing Capacity – ACN-PCN Method

Runway	Recommended Weight Bearing Capacity		
	SW	DW	DTW
Runway 05-23	120,000 lbs.	250,000 lbs.	-
Runway 11-29	94,000 lbs.	150,000 lbs.	-

Source: Airport Records

Other airfield pavements' weight bearing and PCNs are included in **Table 1-11**.

Table 1-11. Other Pavements' Weight Bearing Capacity

Pavement	Weight Bearing Capacity		PCN
	SW	DW	
Taxiway A	68,000 lbs.	91,000 lbs.	26/F/C/X/T
Taxiway B	68,000 lbs.	91,000 lbs.	26/F/C/X/T
Taxiway C	74,000 lbs.	109,000 lbs.	28/F/A/X/U
Taxiway D	74,000 lbs.	109,000 lbs.	28/F/A/X/U
Taxiway E	120,000 lbs.	191,000 lbs.	54/F/C/X/T
Taxiway F	120,000 lbs.	191,000 lbs.	54/F/C/X/T
Taxiway G (East)	81,000 lbs.	121,000 lbs.	29/F/A/X/T
Taxiway G (West)	74,000 lbs.	109,000 lbs.	28/F/B/X/U
Taxiway H	120,000 lbs.	191,000 lbs.	54/F/C/X/T
Taxiway J (South)	81,000 lbs.	121,000 lbs.	29/F/A/X/T
Taxiway J (North)	74,000 lbs.	109,000 lbs.	28/F/B/X/U
Taxiway K	120,000 lbs.	191,000 lbs.	54/F/C/X/T
Taxiway M (South)	81,000 lbs.	121,000 lbs.	29/F/A/X/T
Taxiway M (North)	74,000 lbs.	109,000 lbs.	28/F/B/X/U
Taxiway N	120,000 lbs.	191,000 lbs.	54/F/C/X/T
Air Carrier Apron	76,000 lbs.	100,000 lbs.	29/F/C/X/U
GA North Apron	74,000 lbs.	109,000 lbs.	28/F/B/X/U
GA South Apron	23,000 lbs.	-	8/F/C/X/T

Source: Airport Records

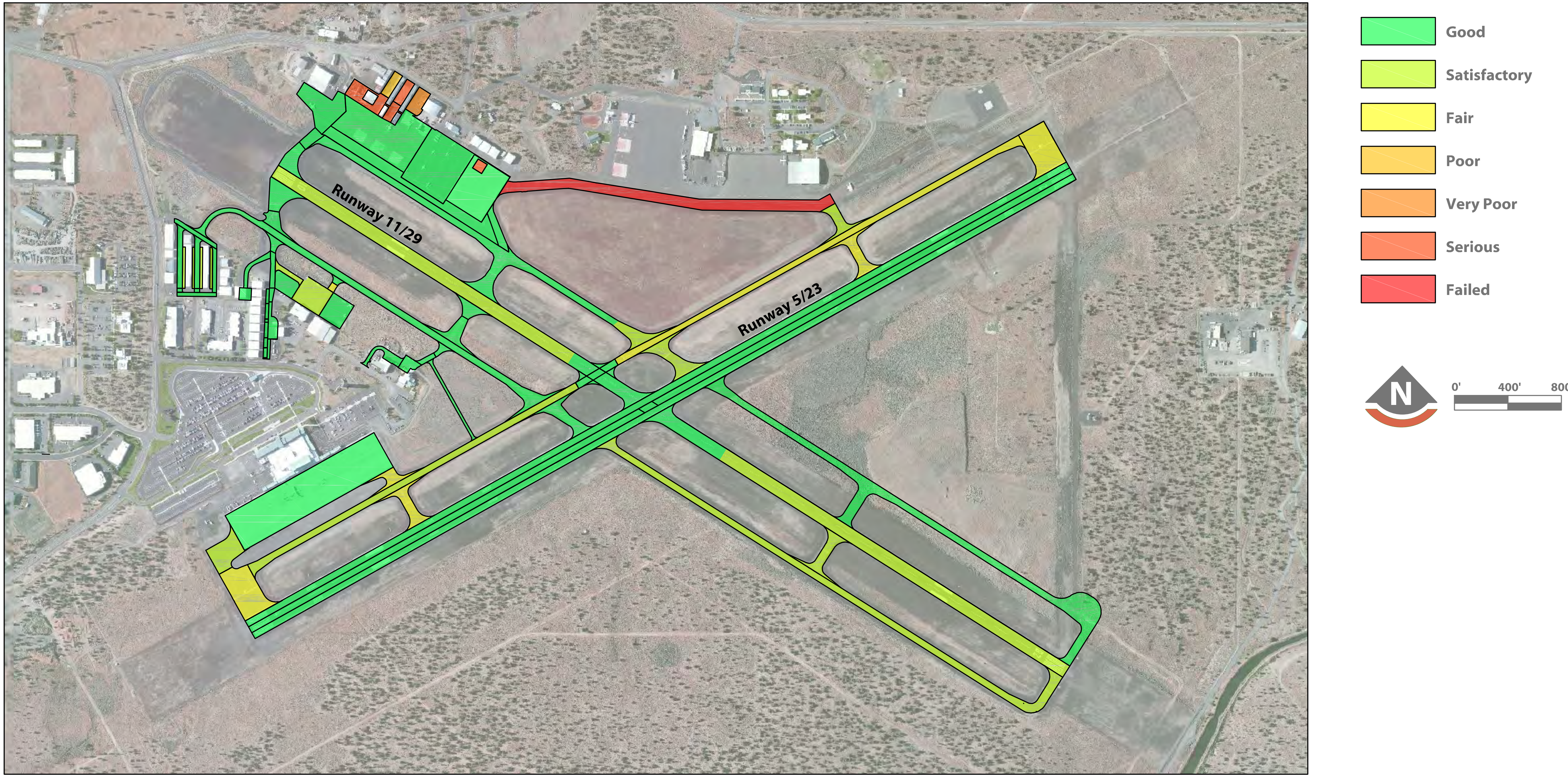


Figure 1-9
PCI Map

1.3.9 NAVIGATIONAL AIDS AND INSTRUMENT PROCEDURES

Aircraft taking off and landing at the Airport rely on instrument procedures, flight patterns, instrument and visual approach aids, and weather observation and communication for safe operations. This section describes these factors in greater detail.

> **Instrument Meteorological Conditions (IMC):**
> When visibility is poor and cloud ceilings are below a defined threshold, those are considered instrument meteorological conditions (IMC).
>
> FAA regulations refer to flight relying on instruments as instrument flight rules (IFR), and IMC is occasionally referred to as "IFR conditions."
>
> When visibility and cloud ceiling are above IMC, pilots may elect to fly using IFR or visual flight rules (VFR), which is where the pilot uses visual cues to safely operate the aircraft.

INSTRUMENT PROCEDURES

Aircraft that use the Airport operate under both visual flight rules (VFR) and instrument flight rules (IFR). The Airport has established instrument approach (landing) and departure (take off) procedures that are provided by the ATCT to pilots as they arrive or depart the Airport. Instrument approach procedures are a series of predetermined maneuvers established by the FAA using electronic NAVAIDS. The procedures assist pilots in locating and landing at an airport during low visibility and cloud ceiling conditions. The eleven instrument approach procedures and one instrument departure procedure in effect at the Airport are summarized in **Table 1-12.**

Table 1-12. Instrument Approach & Departure Procedures

Approach Procedures	Visibility (Nautical Miles, NM)	Descent Minimums (Feet)
ILS OR LOC RWY 23	½	200
RNAV (RNP) Z RWY 05	7/8	276
RNAV (RNP) Z RWY 23	½	250
RNAV (GPS) RWY 11	7/8	250
RNAV (GPS) Y RWY 05	¾	250
RNAV (GPS) Y RWY 23	½	200
RNAV (GPS) Y RWY 29	1	480
RNAV (GPS) Z RWY 29	1	286
VOR/DME RWY 23	1 ¼	935
VOR-A	1	580
JUNIPER VISUAL RWY 23	Visual	Visual
Departure Procedure	**Takeoff Minimums**	
REDMOND THREE		
✓ RWY 5	Minimum climb of 390 feet per nautical mile (NM) to 13000	
✓ RWY 11	Minimum climb of 406 feet per NM to 13000	
✓ RWY 23	Minimum climb of 356 feet per NM to 13000	
✓ RWY 29	Minimum climb of 358 feet per NM to 13000	

In addition to the published instrument procedures, airlines generally have their own instrument procedures that are tailored to their operations specifications, aircraft types, and levels of crew certification. Airline-specific instrument procedures are proprietary and not used by the public, therefore, they are not included in the Inventory Chapter.

FLIGHT PATTERNS

Flight patterns at the Airport are depicted in **Figure 1-10** (Arrival), **Figure 1-11** (Departure), and **Figure 1-12** (Local). Arrival and departure routes show the typical flight patterns aircraft use when approaching or departing the Airport. Local patterns represent operations that occur around the Airport such as touch and go operations. The tracks shown in the figures represent the majority of flight patterns at the Airport. Weather, wind, ATCT direction, and pilot preference determine flight tracks and which runway end aircraft can use for arrivals and departures. .

Touch and Go

An aircraft maneuver where an aircraft lands, slows, then accelerates and takes off without leaving the runway. It is counted as two operations.

INSTRUMENT AND VISUAL APPROACH AIDS

NAVAIDs are visual and electronic guides that assist pilot navigation. Visual NAVAIDs include lights and wind indicators that can be seen through aircraft windows. Reliance on sight limits the utility of visual NAVAIDs when visibility is poor and at great distances. Electronic NAVAIDs are acquired by instruments onboard aircraft and help pilots navigate and land when it is not possible to do so through visual cues alone. Electronic NAVAIDs include terrestrial antennae that use radio frequencies and satellites that use the global positioning system (GPS). NAVAIDs can be used during all flight conditions and must be used when visibility and cloud ceilings are low enough to be considered instrument meteorological conditions (IMC). NAVAIDs for the Airport are listed in **Table 1-13**, and described in more detail in the section that follows.

- ✓ GPS: A satellite based navigational system
- ✓ MALSR: Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
- ✓ ILS: Instrument Landing System – ground based landing system
- ✓ REIL: Runway End Identifier Lights
- ✓ NDB: Non-Directional Beacon
- ✓ PAPI: Precision Approach Path Indicator
- ✓ VOR/DME: a VHF omnidirectional range (VOR) and distance measuring equipment (DME)

Table 1-13. Navigational Aids Summary by Runway

5-23	11-29
high intensity runway edge lights	medium intensity runway edge lights
Runway End 5	**Runway End 11**
REIL	REIL
VASI	VASI
Runway End 23	VOR A (Category A)
PAPI	GPS overlay
1,400 foot MALSR	**Runway End 29**
ILS	REIL
NDB	PAPI
VOR/DME	GPS

Source: FAA Airport Facility Directory

The Airport is equipped with two wind cones, which provide pilots with an indication of wind direction and speed. One wind cone is located next to the intersection of Taxiways F and G and is lighted. The second wind cone is located between the GA north apron and Runway 11-29 and is not lighted.

AIR TRAFFIC CONTROL AND COMMUNICATIONS

FAA's Air Traffic Services division manages the National Airspace System (NAS) using a series of control centers that have control or authority over different segments of aircraft travel:

- ✓ Airport Traffic Control Tower (ATCT)
  - May be run by FAA, or Contractor (The RDM ATCT is run by SERCO)
  - The vicinity of the airport
- ✓ Terminal Radar Approach Control facilities (TRACON)
  - Multiple airports (The Airport approach/departure control is operated by Seattle Center)
- ✓ Air Route Traffic Control Centers (ARTCC)
  - Regional area (The Airport controlled by Seattle Center)
  - Controls aircraft en-route

Airspace administered by the FAA is classified as either "controlled" or "uncontrolled," and defined as one of six classifications. Airspace designated as Class A, B, C, D, and E is controlled airspace, and Class G airspace is uncontrolled airspace. Class F airspace is not used in the United States. **Figure 1-13** depicts the airspace and aeronautical setting surrounding the Airport.

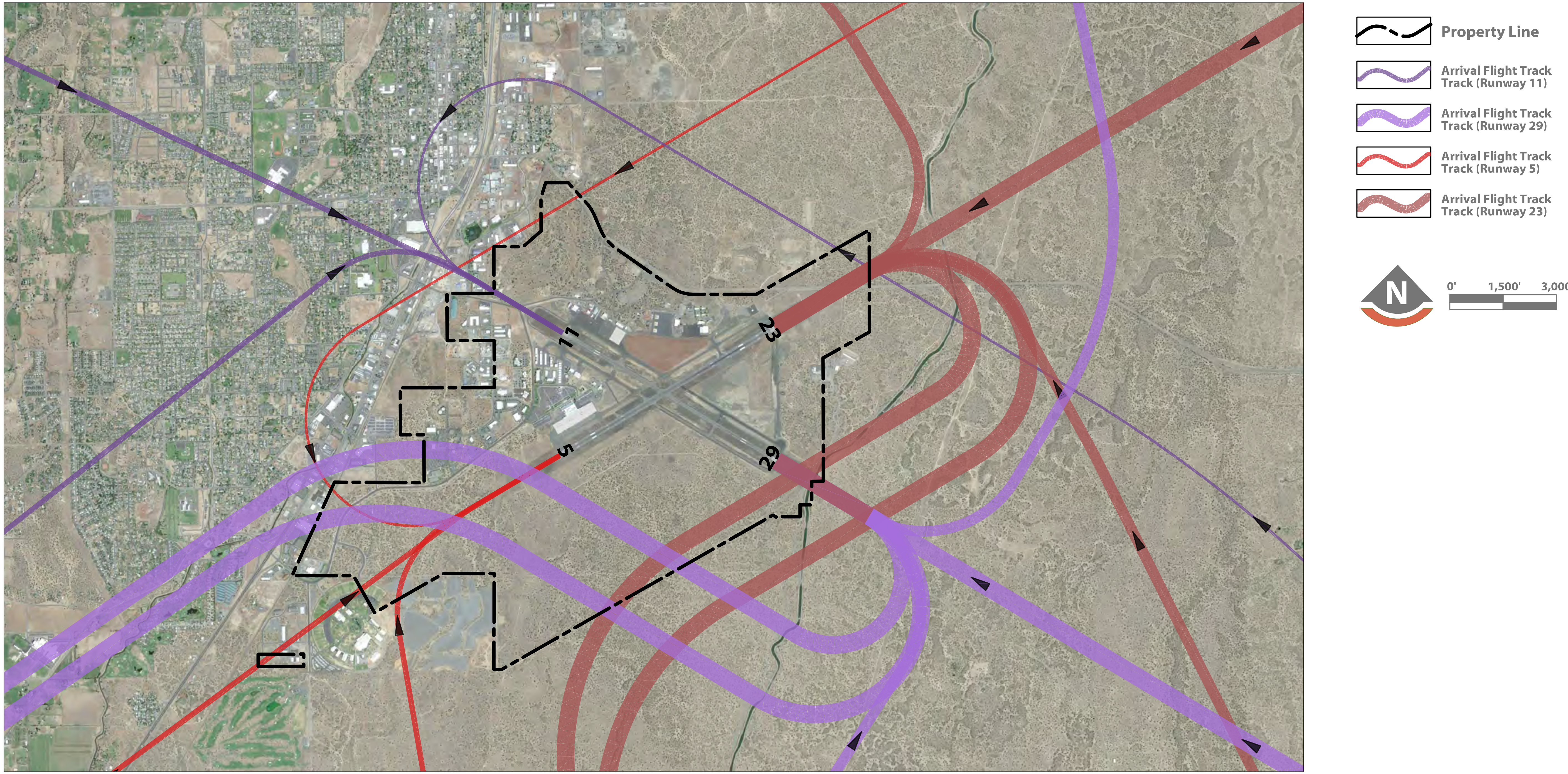


Figure 1-10
ARRIVAL FLIGHT PATTERNS

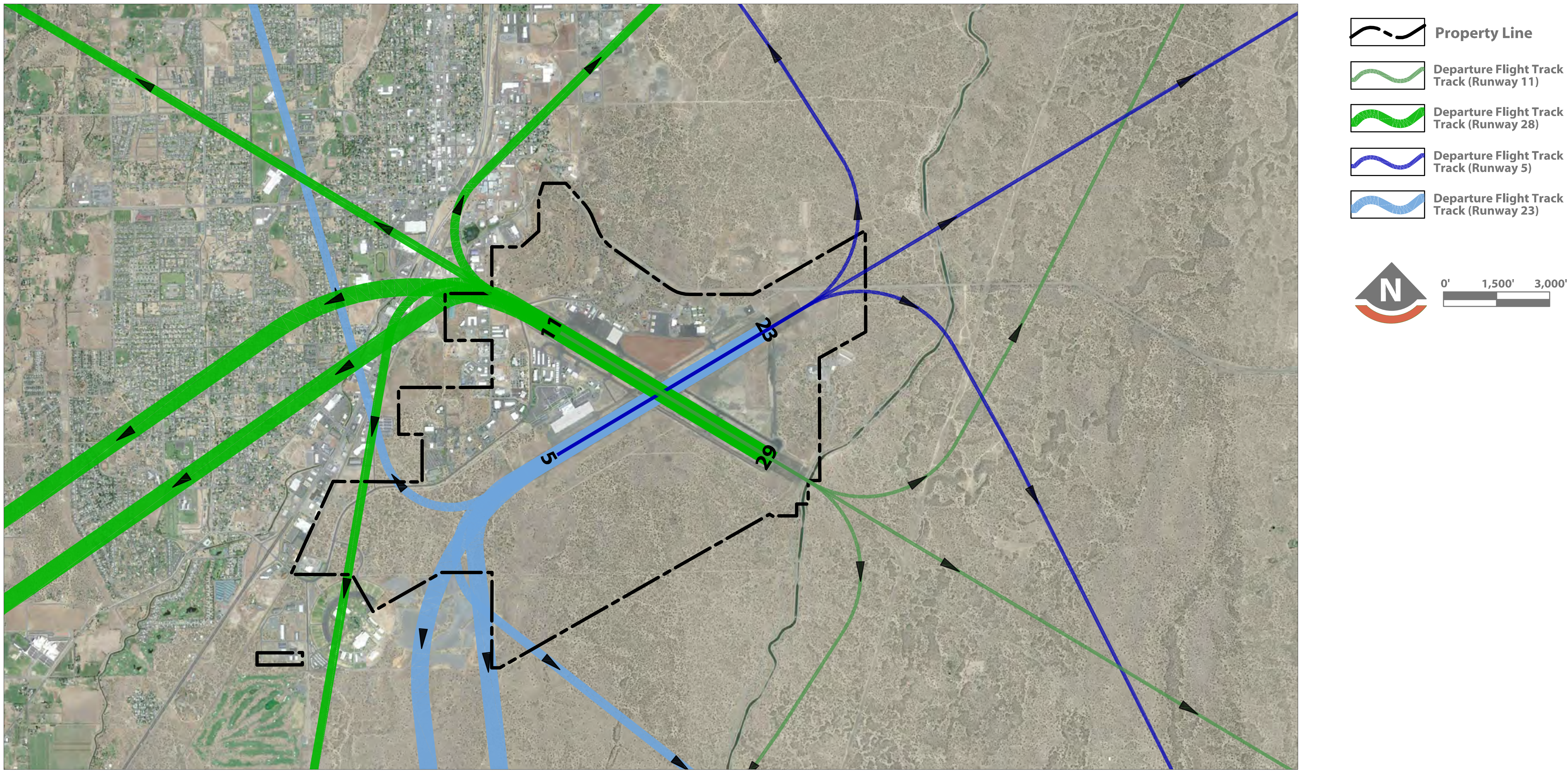


Figure 1-11
DEPARTURE FLIGHT PATTERNS

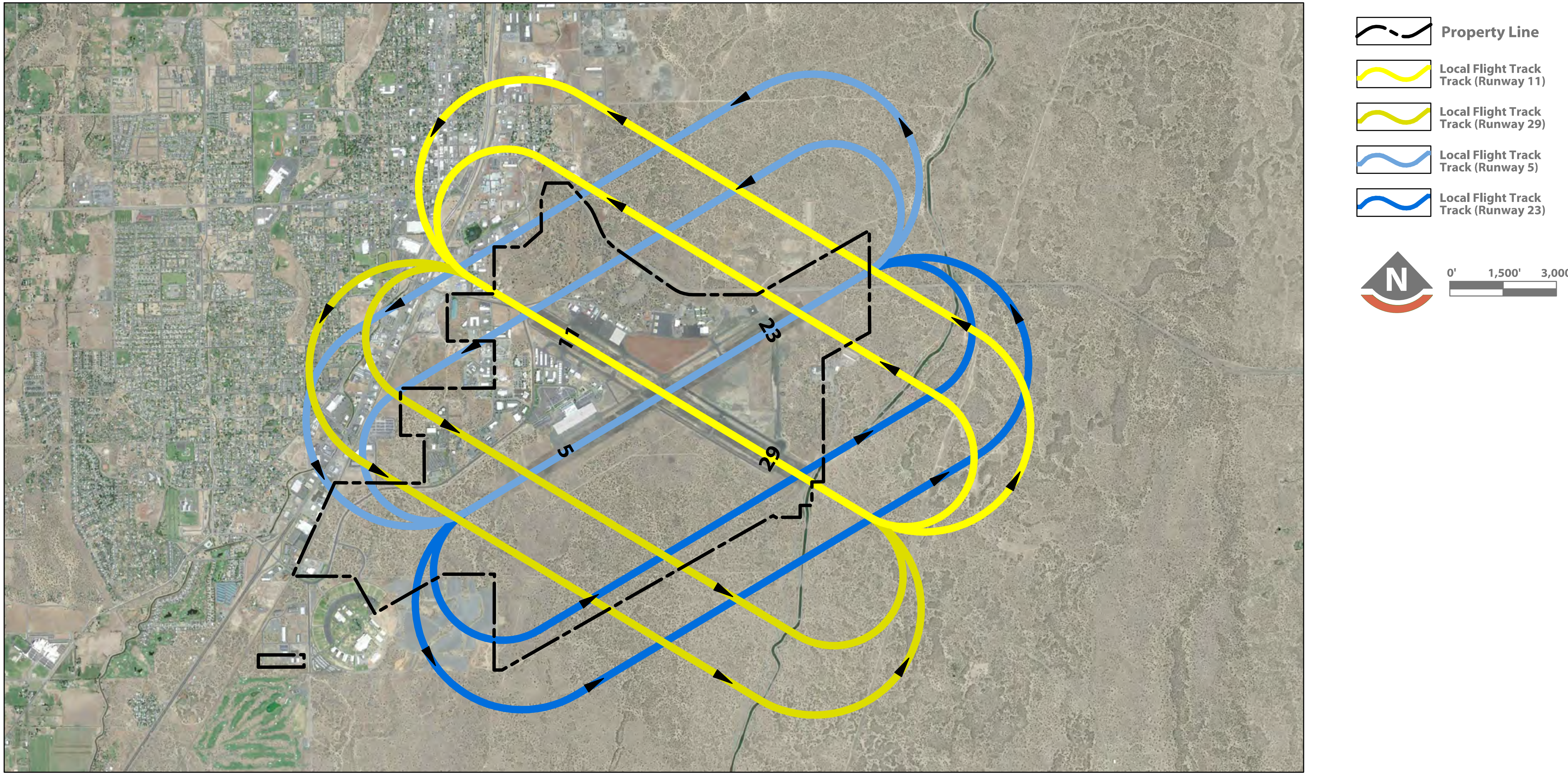
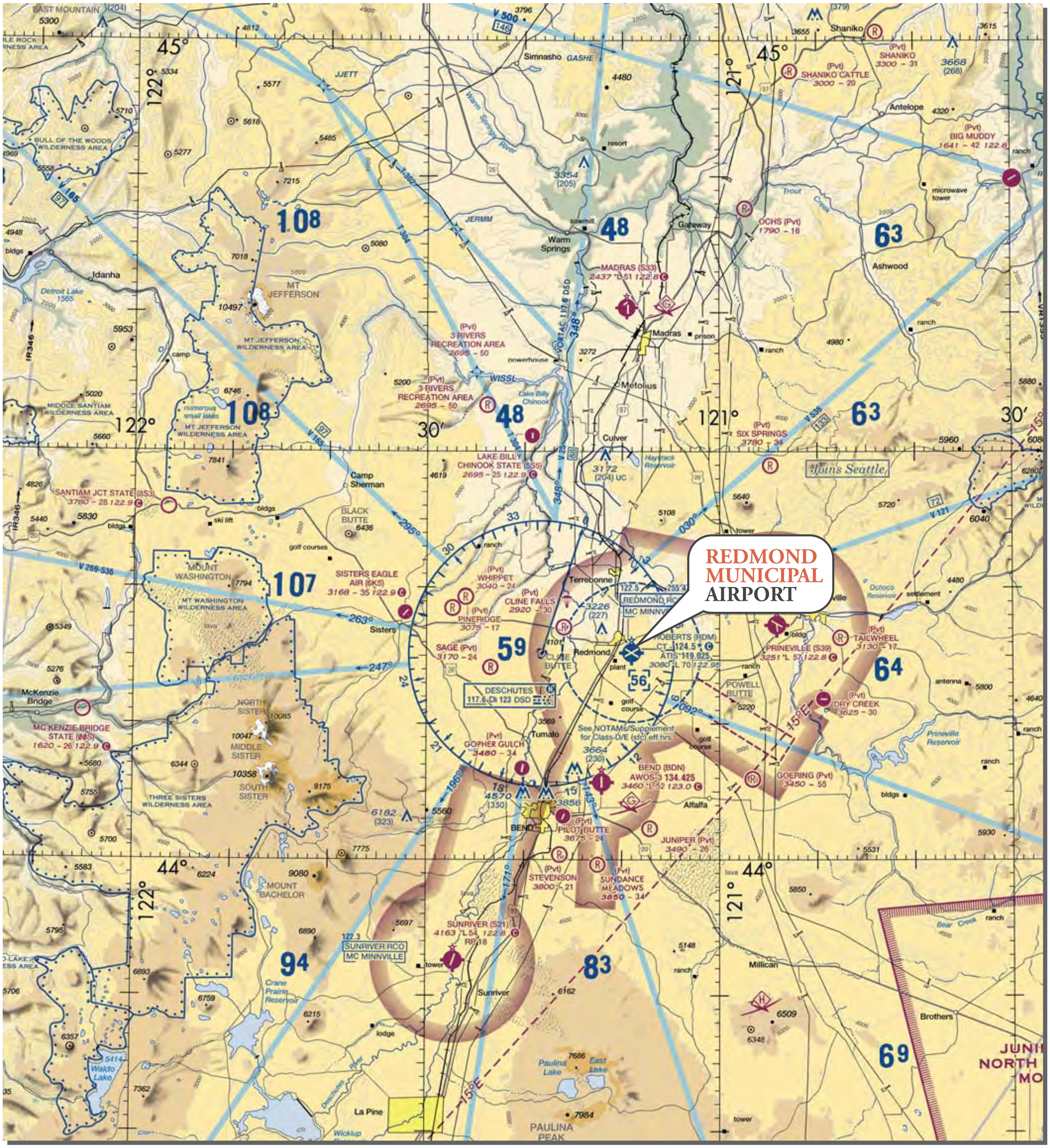


Figure 1-12
LOCAL FLIGHT PATTERNS



Scale 1" = 10 Nautical Miles

Source: *Sectional Aeronautical Chart: Seattle (December 2016, Klamath Falls (March 2017)*

Figure 1-13
AIRSPACE/NAVAIDS SUMMARY

The ATCT, located just to the northeast of the terminal, is a contract tower run by a private company. It is not owned by the FAA and the staff are not FAA employees. The airspace around The Airport is Class D airspace when the ATCT is in service. When the ATCT is not in service, the Airport operates under a Class E airspace designation. IFR operations in vicinity of the Airport are in contact with the Seattle ARTCC, which provides pilots with altitude, aircraft separation, and route guidance.

Pilots flying to the Airport are able to gather information about the Airport from a variety of information sources. The McMinnville Flight Service Station (FSS), another part of FAA's Air Traffic system, provides pilots with pre-flight briefings, assistance with opening and closing flight plans, pilot reports, weather reports, and notices to airmen. Weather information at RDM is broadcast by the automated surface observation system (ASOS).

1.3.10 CLIMATE – WIND AND WEATHER CONDITIONS

WIND

Wind observation data comes from the ASOS. The wind rose shows that prevailing winds come from the northwest and the south-south east. **Figure 1-14** illustrates the all-weather wind rose for the Airport. Inner circle increments that expand outwards represent the total number of observations. Numbers on the outside of the circle from 0 to 36 represent the direction from which the wind is prevailing. Colors represent the speed of the wind in knots. Colors will stretch out towards the edge of the circle for directions from which the wind is prevailing during observations. The observations occurred between 2006 and 2015.

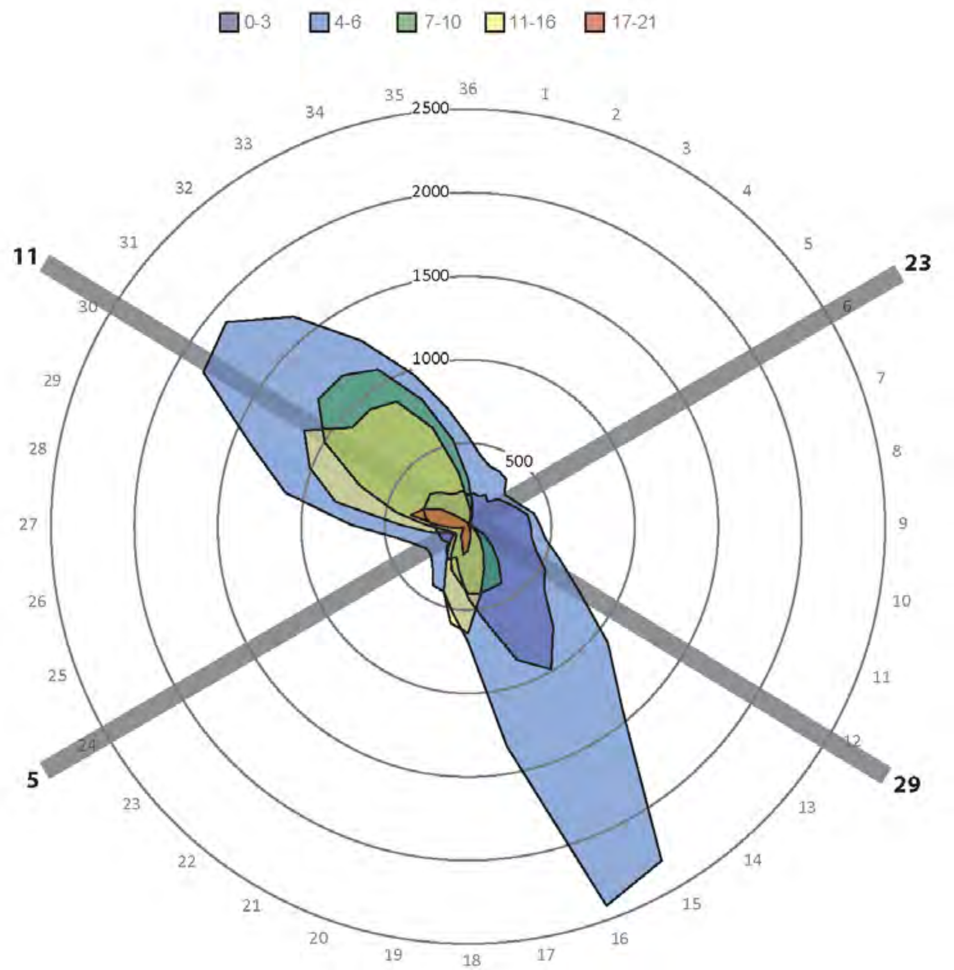
Wind data is vital for aircraft operations. Aircraft performance is enhanced when taking off and landing into the wind, and there are limits to how much crosswind and tailwind aircraft can handle. Wind direction and speed information helps pilots and air traffic control select the most appropriate runway for operation.

FAA standards for crosswind coverage are one of several factors that go into determining how many runways are needed, and what direction they should face. FAA standards state that runways should provide at least 95-percent coverage for aircraft that are expected to use the airport at least 500 times per year. Crosswind runways may be employed to improve wind coverage throughout the year and meet FAA criteria. The allowable crosswind component for each Runway Design Code is included in the **Table 1-14** below:

Table 1-14. Crosswind Component	
Runway Design Code	**Allowable Crosswind Component**
A-I and B-I*	10.5 knots
A-II and B-II	13 knots
A-III, B-III, C-I through C-III, D-I through D-III	16 knots
A-IV and B-IV, C-IV through C-VI, D-IB through D-VI	20 knots
E-I through E-VI	20 knots

*Includes A-I and B-I small aircraft

Figure 1-14. All Weather Wind Rose



Source: FAA Airports Wind Rose Generator.

WEATHER

In addition to wind, temperature and precipitation affect aircraft operation. For example, high temperatures can increase required takeoff distance, which could alter takeoff power settings and require payload reduction. Precipitation can negatively impact braking during landing. The frequency and amount of snow influences the type and number of SRE necessary, which has equipment and material storage implications. Weather data comes from the ASOS at the Airport to provide an idea of the local climate in the area. Key weather conditions are listed in **Table 1-15** below.

Table 1-15. Weather Conditions

Average Annual Temperature	Maximum	62.1° F
	Minimum	32.7° F
	Average Hottest Month	July: 85.5° F
	Average Coldest Month	January: 22.2° F
Precipitation	Average Annual Total	8.64 Inches
	Average Monthly Maximum	January/December: 1.60 Inches
Snowfall	Average Annual Total	19.7 Inches

Source: Western Regional Climate Center, Redmond ASOS Station Data 1948 – 2016.

WEATHER OBSERVATION AND COMMUNICATION

Information about weather conditions is important to pilots as they make navigation decisions. The weather system in place at The Airport is an Automated Surface Observing System (ASOS). The monitoring units in this system are operated jointly by the National Weather Service, the FAA, and the Department of Defense.

When the ATCT is closed, there are communication systems in place to help pilots communicate with each other and gather information about the conditions at the airport and in the surrounding area. These include:

- ✓ Common Traffic Advisory Frequency (CTAF): A radio frequency, specific to each airport, used for communication between pilots operating at, and in the vicinity of, an Airport. The frequency for The Airport is 124.5. The CTAF is used during hours that the ATCT is closed.

- Universal Communication (UNICOM) station: An air-to-ground communication facility. The frequency for The Airport is 122.95. A pilot might use a UNICOM to communicate fuel needs or other requests to a FBO.
- Automatic terminal information service (ATIS): A continuous broadcast of recorded information, such as weather, active runways, available approaches and NOTAMs information, on a frequency specific to each airport. The frequency for The Airport is 119.025.

1.3.11 AIRFIELD MARKING AND LIGHTING

Airfield marking and lighting enhance pilot situational awareness and wayfinding. FAA guidance for airfield markings is defined in AC 150/5340-1, *Standards for Airport Markings* and AC 150/3540-30H *Design and Installation Details for Airport Visual Aids.* This section describes these elements.

RUNWAY MARKINGS

Runway markings are white in color and schematics depend on the approach category of the runway. The markings include the runway end designator, centerline, a threshold bar, aiming point, touchdown zone, and runway edge markings. Runway 05-23 is marked with precision instrument runway (PIR) markings and Runway 11-29 is marked with non-precision instrument runway (NPI) markings.

Table 1-16 lists the runway markings for Runway 05-23 and 11-29.

Runway end designator:
Numbers that identify the magnetic heading of a runway.

Centerline:
Dashed markings that denote the center of the runway.

Threshold bar:
Denotes the beginning of the runway available for landing.

Aiming point:
Provides a visual aiming point for landing operations.

Touchdown zone:
For landing operations, identifies the touchdown zone along a precision runway in 500-foot increments.

Runway edge markings:
Provide enhanced visual contrast between the runway edge and the surrounding terrain or runway shoulders and delineates the width of the suitable paved area for runway operations.

Table 1-16. Runway Markings

Marking	Runway 05-23 (PIR)	Runway 11-29 (NPI)
Runway end designator	X	X
Centerline	X	X

Threshold bar	X	X
Aiming point	X	X
Touchdown zone	X	
Runway edge markings	X	
Source: Airport Pavement and Marking Plan		

TAXIWAY MARKINGS

Taxiway markings consist of yellow centerline and enhanced centerline markings, and hold position signs painted with white inscriptions on red backgrounds.

Centerline:
Continuous markings that denote the center of the taxiway.

Enhanced centerline:
Additional dashed markings on both sides of the centerline to provide visual cues of an upcoming runway hold position.

RUNWAY LIGHTING

Runway 05-23 has high-intensity runway edge lighting (HIRL), consistent with the runway's precision instrument approach capability. Runway 05 is equipped with a four-box visual approach slope indicator (VASI). Runway 23 is equipped with a four-box precision approach path indicator (PAPI).

Runway 11-29 has MIRL. Runway 11 is equipped with a four-box VASI and Runway 29 is equipped with a four-box PAPI. Both runway ends are equipped with REIL, where the pilot sees all red lights when the approach is too low, all white lights when the approach is too high, and both red and white lights when on the appropriate glide path.

HIRL/MIRL:
High/Medium Intensity Runway Lights include white edge lights (with amber lights near the runway ends to indicate runway remaining) and runway threshold lights. The threshold fixtures have split lenses (green/red) indicating the beginning (green) and end (red) of the runway.

REIL:
Runway End Identifier Lights are two synchronized unidirectional flashing lights that help to identify the runway when it is less distinct from its surroundings or during periods of low visibility.

VASI:
VASI project a beam of light having a white segment in the upper part of the beam and red segment in the lower part of the beam. VASIs perform a function similar to the PAPI.

PAPI:
PAPI project light along a standard glide path to a runway end, with red and white colored lights indicating the aircraft's vertical position (above, below, or on glide path) relative to the defined glide path.

TAXIWAY LIGHTING

The taxiways at the Airport are equipped with blue medium-intensity taxiway edge lighting.

OTHER LIGHTING

The Airport has a rotating beacon mounted on a tower support on the north side of the airfield. Rotating beacons are used to indicate the location of an airport to pilots flying at night or during reduced visibility. The beacon provides sequenced white and green flashing lights that rotate 360 degrees.

The Airport has a lighted wind cone located on the west corner of the Taxiway G and Taxiway F intersection.

Additional overhead lighting is located in the terminal area, aircraft parking aprons, and in the hangar areas. There are red obstructions lights mounted on the top of several airport structures and on near-airport obstructions including street lights.

1.3.12 OTHER AIRSIDE FACILITIES

Fencing and gates and service roads are airside facilities that fall outside of these previous categories are briefly discussed in this section.

FENCING AND GATES

The Airport has perimeter chain-link fencing with barbwire around the airfield perimeter to help prevent unauthorized access. Security gates provide access to the FBO, GA hangars, USFS, and controlled movement areas of the airfield.

SERVICE ROADS

The Airport has a system of service roads that extend around the property perimeter to provide access to the various NAVAIDs and weather system and to transition between landside facilities.

The air carrier apron has a white painted two-lane vehicle service road along the northwest side of the apron that provides access the terminal building. A paved vehicle service road extends from the south side of Taxiway A around the Runway 11 end to the north side of Taxiway A. An additional paved service road connects the ARFF station to Taxiway F.

The Airport has a gravel perimeter road that follows the perimeter fence around the Airport operations area. Additional gravel vehicle service roads provide access to the runway approach lighting systems, NAVAIDs, weather observation system, and the airport surveillance radar.

1.4 LANDSIDE FACILITIES

1.4.1 AIRPORT ACCESS AND VEHICLE PARKING

LOCAL ROAD NETWORK

The Airport is served by local two-lane, paved roads referred to as the local road network. Airport Way, which is the main road serving the Airport, intersects Highway 97 south of the Airport at the Deschutes County Fairgrounds. Airport Way connects with Veterans Way near the northwest corner of the Airport. Veterans Way connects to Highway 97 approximately one-half mile west of the Airport and is the Airport's main access point.

VEHICLE CIRCULATION FOR NON-AVIATION FACILITIES

The primary roads serving the Airport include Airport Way and Veterans Way runs along the west side of the Airport. Additionally, a network of paved local streets serves the nearby non-aviation uses. **Table 1-17** summarizes the Airport roadways, organized by classification.

Table 1-17. Airport Roadways By Classification

Roadway Classification	Roadway Name	Airport Development Area
Major Arterial	OR Highway 126 (Ochoco Highway)	North Development Parcel North Business Park USFS Campus
Minor Arterial	19th Street	Fairgrounds Industrial Subarea
Minor Arterial	Airport Way	Airport Way Subarea Fairgrounds Industrial Subarea South Apron Side GA Subarea West Business Park
Minor Arterial	Veterans Way	North Business Park North Development Parcel West Business Park
Major Collector	Salmon Drive	West Business Park
Major Collector	Veterans Way	North Business Park
Local Street	1st Street	West Business Park
Local Street	2nd Court	West Business Park
Local Street	4th Street	West Business Park
Local Street	6th Street	South Apron Side GA Subarea West Business Park
Local Street	10th Street	North Business Park
Local Street	21st Street	Fairgrounds Industrial Subarea
Local Street	23rd Street	Fairgrounds Industrial Subarea
Local Street	Badger Avenue	Fairgrounds Industrial Subarea
Local Street	College Way	West Business Park
Local Street	Deerhound Avenue	Fairgrounds Industrial Subarea
Local Street	Mt. Hood Drive	Airport Way Subarea
Local Street	Lake Road	North Development Parcel
Local Street	Ochoco Way	USFS Campus
Local Street	Pumice Avenue	West Business Park
Local Street	Reindeer Avenue	West Business Park
Local Street	Salmon Avenue	South Apron Side GA Subarea West Business Park
Local Street	Sisters Way	North Business Park USFS Campus
Local Street	Tamarack Court	West Business Park
Local Street	Timber Avenue	West Business Park
Local Street	Umatilla Avenue	West Business Park
Local Street	USFS Drive	USFS Campus
Local Street	Wickiup Avenue	Airport Way Subarea

The intersection at Veterans Way and Airport Way is planned to be realigned as part of a separate project. Preliminary designs by the City of Redmond propose a new roundabout near the intersection of 1st Street and Veterans Way to provide expanded access and service to the North Development Parcel.

AUTOMOBILE PARKING FOR NON-AVIATION FACILITIES

Parking requirements for non-aviation uses at the Airport are defined by the City of Redmond Development Code, Section 8.0500. The City requires developments to provide a minimum number of parking spaces based on land use and specifies the dimensions of the standard parking and compact parking spaces as well as the width of the aisles.

TERMINAL AREA AUTO PARKING AND GROUND TRANSPORTATION

The passengers departing from the Airport have multiple options to access the terminal building. They may use the public parking lot for their private vehicles, can be dropped off at the curb by personal vehicles, or be delivered by taxis or shuttles. The employees have a separate parking area near the terminal separate from the passenger lot and the Airport vendors also have assigned parking separate from employee parking.

The long and short term parking lot (combined facility) accommodates 1,083 vehicles at a rate of $1.00 for each half hour, up to a daily maximum of $10.00. The seventh day is free.

The employee parking lot accommodates 189 vehicles and the vendor lot can accommodate 6 vehicles in marked parking stalls. The vendor lot can accommodate more vehicles besides the marked parking stalls.

GENERAL AVIATION AND OTHER FACILITIES AUTO PARKING

Table 1-18 lists the various aviation related parking areas at the Airport and provides a breakdown of the vehicle parking spaces by standard and the Americans with Disabilities Act (ADA) compliant spaces.

Table 1-18. Vehicle Parking

Location Identifier	Facility	Parking Spaces	
		Standard	ADA
1	FAA Airport Traffic Control Tower	8	1
2	South Apron Private Hangar – RDD Enterprises	21	2
3	Aircraft Rescue and Firefighting (ARFF)	10	2
4	Snow Removal Equipment (SRE)	3	1
5	South GA Apron FBO Building #1	35	1
6	South GA Apron FBO Building #2	6	0
7	Public Works Department	15	1
8	North GA Apron FBO	15	0
9	North Apron Private Hangars – BPA and Les Schwab	28	3
10	USFS	228	6

1.4.2 UTILITIES

Utilities are significant elements in the immediate and long-range planning for the Airport. The Airport's location on the eastern edge of the City of Redmond city limits is in a generally commercial and light industrial region. The Airport currently holds several property interests both adjoining the Airport facility and in the surrounding vicinity. To consider these properties for future expansions would require analysis of the existing utilities and the potential of utility enhancements. This section of the report addresses the location, size, and general feasibility of using existing Airport property utilities for new airport development alternatives.

Figure 1-15 identifies development areas the Airport is considering for future development alternatives:

- ✓ USFS Campus: The northern area servicing the Redmond Air Center and Forest Service operations adjacent to Taxiway B.
- ✓ North Side GA: The apron, FBO, and hangars along the north side of the Airport, accessed by and south of SW Sisters Avenue.
- ✓ North Business Park: The area south of Hwy 126 and north of SW Sisters Avenue characterized by rocky juniper and sage terrain with sparse existing development.
- ✓ North Development Parcel: The old Redmond golf course land bound on the northwest by SE Lake Road, on the northeast, by Hwy 126, and to the south, by Veterans Way.
- ✓ South Side GA: The hangars, FBO, and businesses bound to the west by Airport Way, to the south, by Salmon Avenue, and accessing the Airport by Taxiways A and G.
- ✓ Terminal: The terminal area.
- ✓ West Business Park: The commercial/light industrial area to the west of Airport Way in which the Airport holds several property interests.
- ✓ Airport Way Subarea: The area of land west of Airport Way and immediately north of the Deschutes County Fairgrounds.
- ✓ Fairgrounds Industrial Subarea: The area of land west of 19th Street and south of Airport Way.

The sub-areas identified for this report and designated for potential future expansion appear to have sufficient existing utilities in close proximity. The USFS Campus and potentially parts of the North Side GA are the exception. Most of the utilities in this area appear to be insufficient for future expansion because they were sized to serve only the area of the USFS Campus.

The following sections discuss each utility providing service on or in the vicinity of the Airport as depicted in **Figure 1-16 through 1-19.**

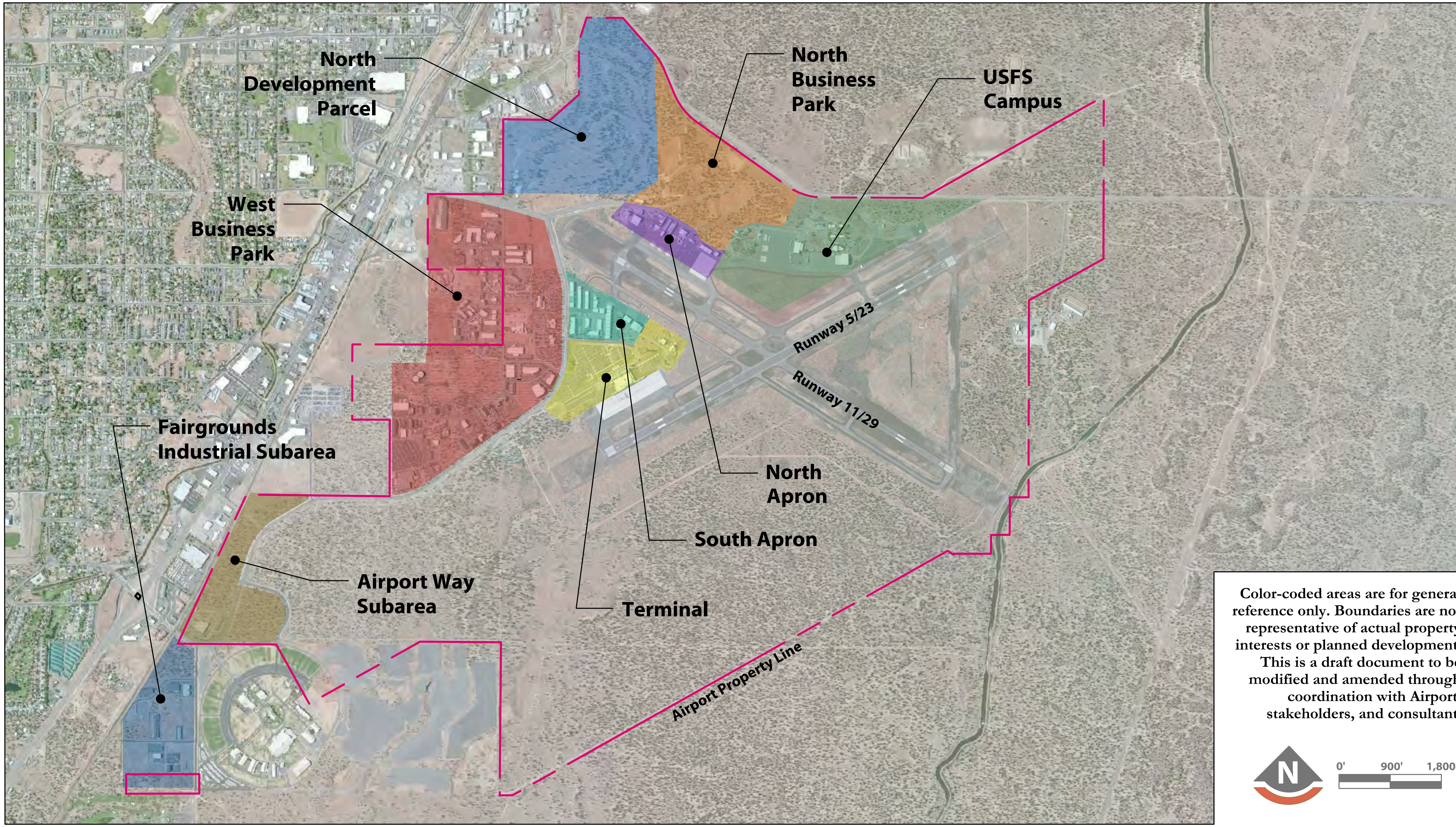


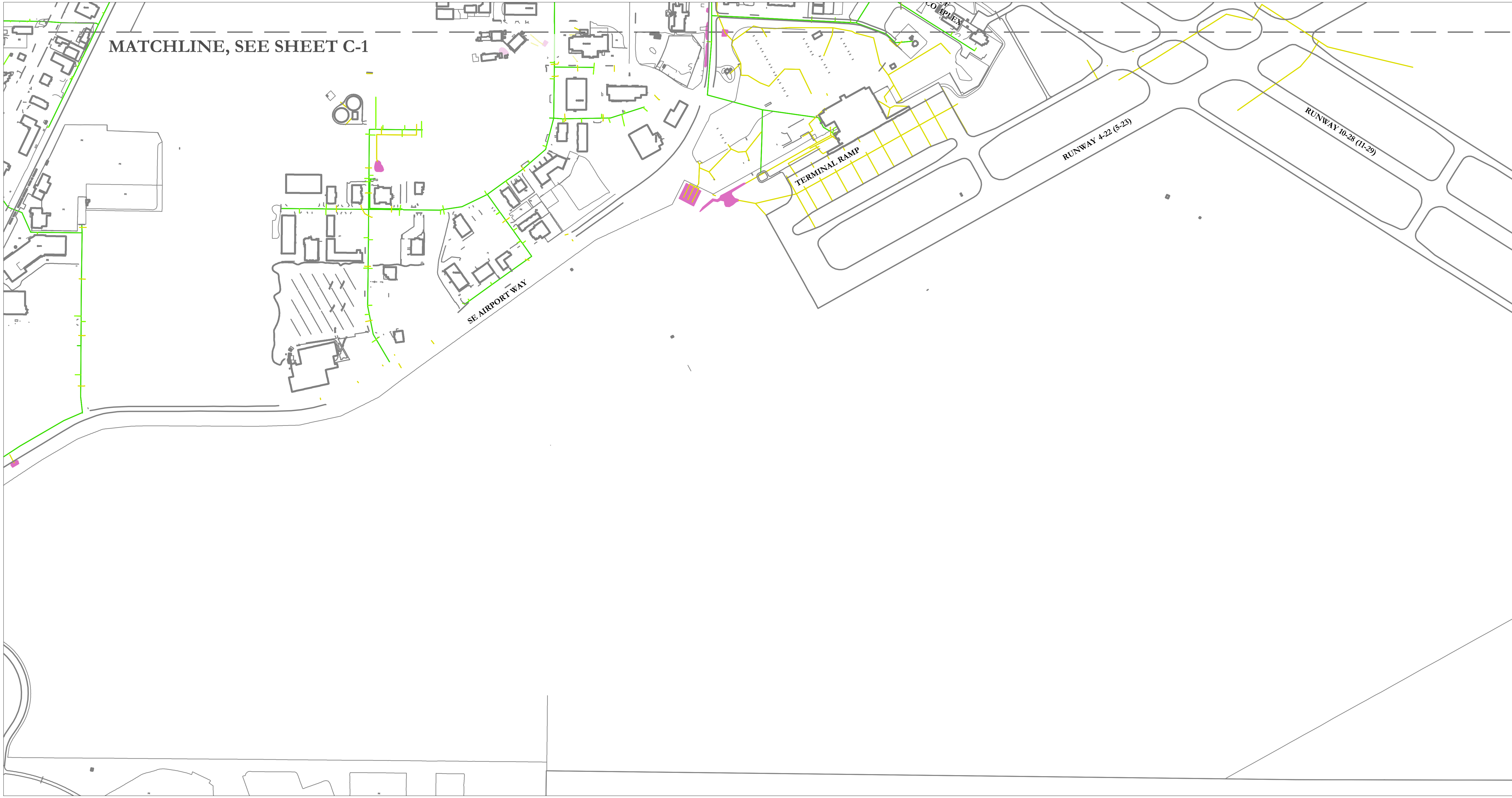
Figure 1-15
Development Areas

LEGEND:

- STORM PIPE
- SEWER MAIN
- SEWER LATERAL
- STORM DETENTION BASIN

Figure 1-16
EXISTING STORM AND SEWER MAINS AND LATERALS

REDMOND MUNCIPAL
AIRPORT MASTER PLAN



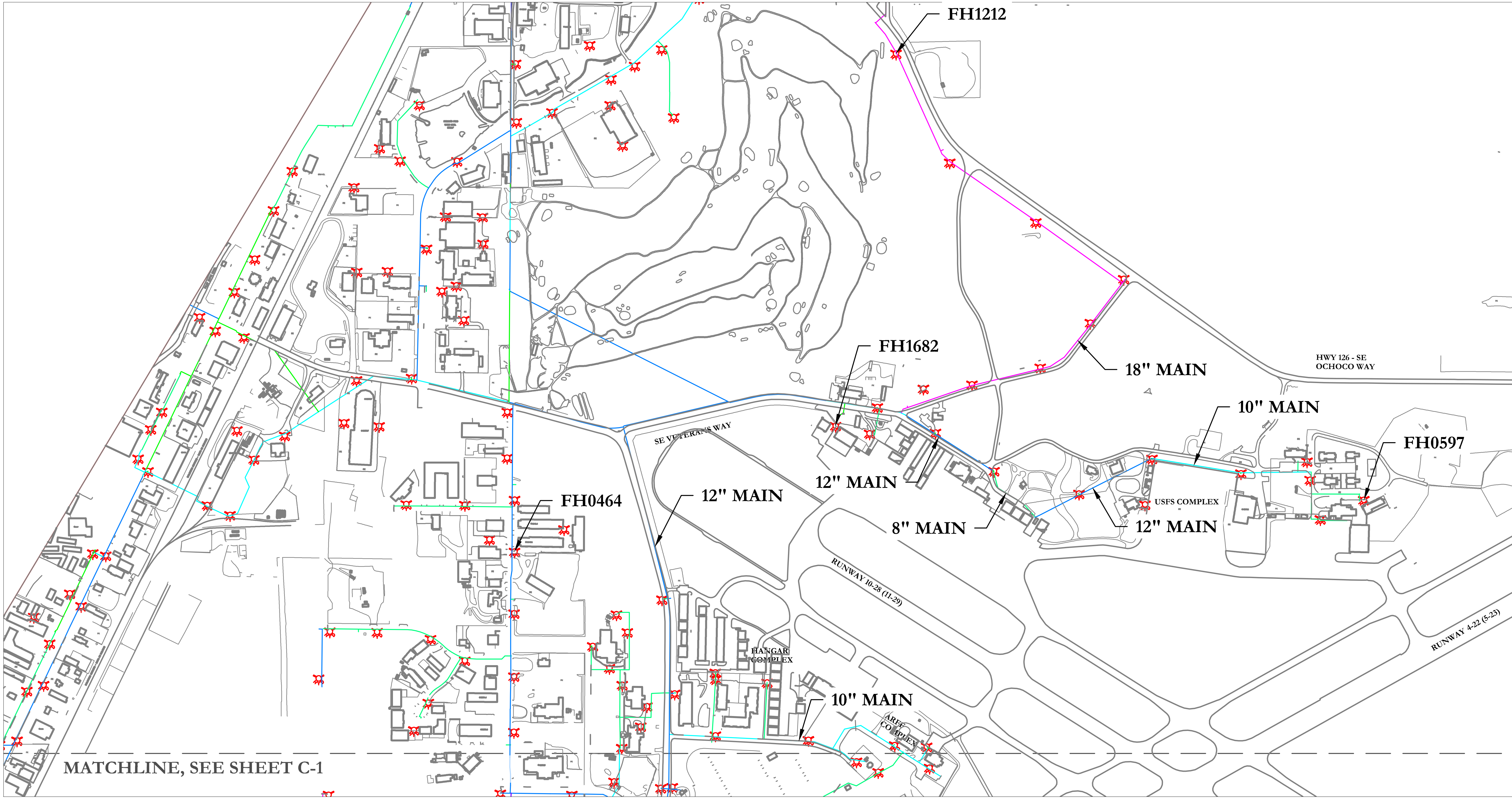
LEGEND:

- STORM PIPE
- SEWER MAIN
- SEWER LATERAL
- STORM DETENTION BASIN

Figure 1-17

EXISTING STORM AND SEWER MAINS AND LATERALS

REDMOND MUNCIPAL
AIRPORT MASTER PLAN

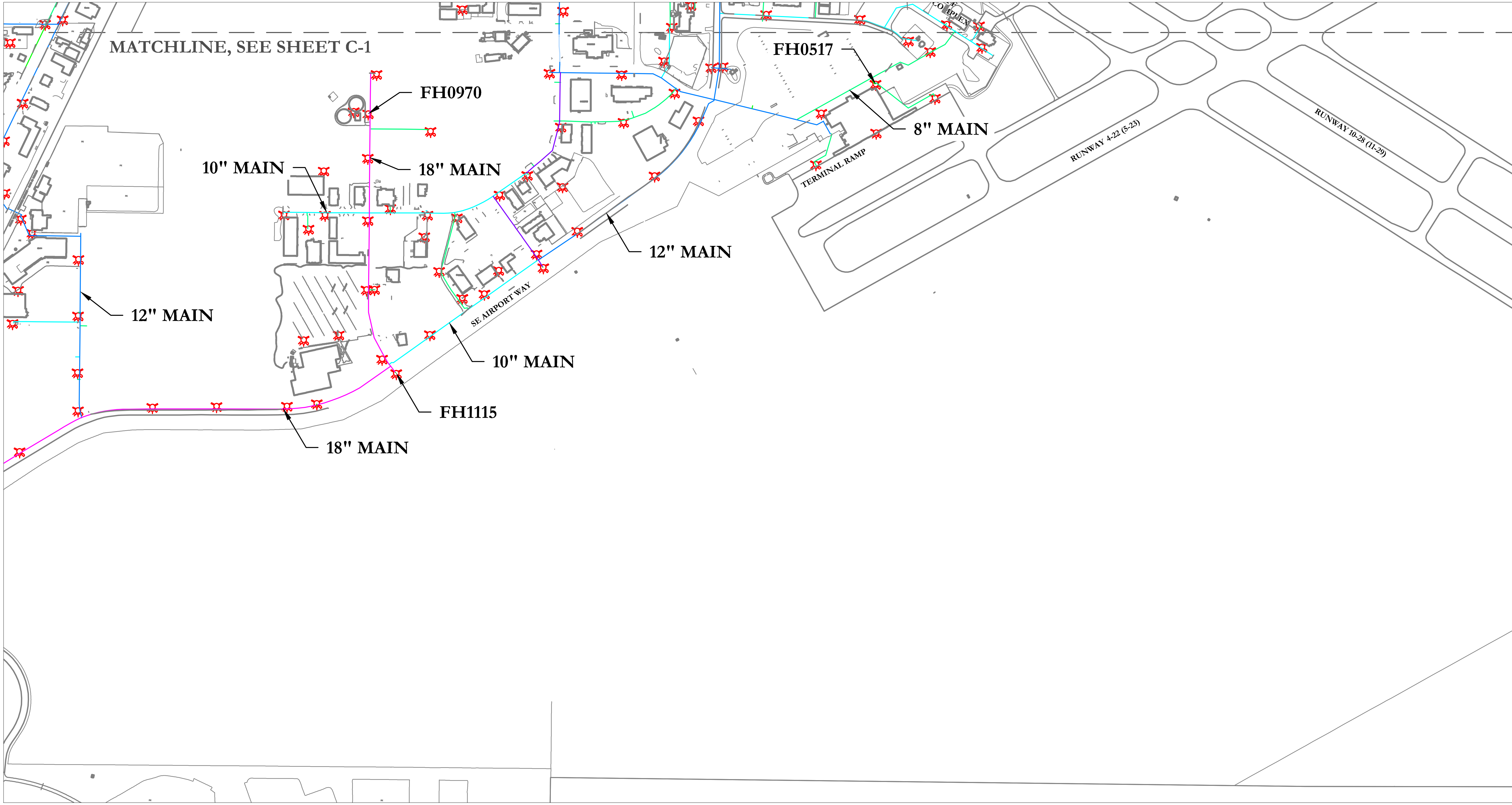


LEGEND:

(green line)	6" MAIN	(blue line)	14" MAIN
(green line)	8" MAIN	(purple line)	16" MAIN
(cyan line)	10" MAIN	(magenta line)	18" MAIN
(blue line)	12" MAIN	(hydrant symbol)	EXISTING HYDRANT

REDMOND MUNCIPAL
AIRPORT MASTER PLAN

Figure 1-18
EXISTING WATER
MAINS AND LATERALS



LEGEND:

6" MAIN	14" MAIN
8" MAIN	16" MAIN
10" MAIN	18" MAIN
12" MAIN	EXISTING HYDRANT

REDMOND OREGON Est 1946

REDMOND MUNCIPAL
AIRPORT MASTER PLAN

Figure 1-19
EXISTING WATER MAINS AND LATERALS

ELECTRIC

Pacific Power (PPL) provides electrical service to the Airport. Discussions with representatives of PPL for this report did not reveal imminent plans for expansion of services beyond the existing overhead and buried circuits servicing the Airport and its surrounding area. As of 2016, one circuit feeds the airport area. A second circuit around the fairground area may be able to be extended to airport, if needed. PPL's position is Airport load growth would drive any expansion. The suggestion is the 2016 level of electrical service in the vicinity of the Airport should suffice for some expansion alternatives, though development beyond the current reach of PPL's circuits would require extension. In the event of development plans proceeding, early coordination with PPL would be required to discuss load growth in a specific location. At that time, PPL would determine whether or not a system impact study is needed, along with a re-evaluation the system.

SEWER

The City of Redmond provides sanitary sewer service to the Airport and its surrounding areas. Redmond's Water Pollution Control Facility is located in the northwest corner of the City. **Figures 1-16 and 1-17** show the gravity mains that serve the areas considered for this report. Mains that follow Airport Way to Veterans Way heading northwest serve the West Business Park, Terminal, and South Side GA areas. A main that runs along Veterans Way and Sisters Avenue serves the North Side GA and abuts the southern edge of both the North Business Park and the North Development Parcel. Another main that originates at the USFS Campus before heading north to intersect Hwy 126 then runs northwest in parallel serves the northern edges of these two development areas. As with the water service at the USFS Campus, additional development adjacent to or requiring use of that area's sewer system would benefit from further analysis.

WATER

The City of Redmond provides water service to the Airport and its surroundings. All of Redmond's water is produced from subsurface wells, stored in reservoirs, and distributed throughout the city through its system of booster pump stations and pipes. The City's Public Works Department monitors, tests, and maintains this water system and stores utility inventory data on the department's Esri-based GIS mapping database. The development areas considered for this report except for the Fairgrounds Industrial Subarea are served by the City's Pressure Zone 2.

Discussion with the Public Works Department indicates that the areas on and around the Airport are adequately served with water for the needs. As depicted in **Figures 1-18** and **1-19**, a water system consisting of pipes ranging in diameter from 12-inches to 18-inches serves the majority of the development areas under consideration. An 18-inch main extends north along Airport Way until SW 6th Street where it extends to the street's terminus. This large-diameter main serves the Airport Way Subarea and the West Business Park.

A 12-inch main follows Airport Way from the intersection of Airport Way and 6th Street through the intersection with Veteran's Way. This 12-inch main and several 10-inch branches along their entire route effectively serve the Terminal area and the South Side GA area, and borders the southern edge of the North Development Parcel and the western edge of the North Side GA. An 18-inch main running parallel to Hwy 126 and angling south along Veterans Way serves the remainder of the North Development Parcel and the North Business Park. All of these areas are anticipated to accommodate development of future water demand.

The USFS Campus and potentially parts of the North Side GA are the exception to sufficiency of the 2016 service capacity for future expansion. An inconsistent series of pipes ranging between eight and 12 inches in diameter serves the USFS Campus. Fire hydrant flow testing performed by the City of Redmond Public Works Department in December 2016 confirmed that flows are approximately 1,100 gallons per minutes (gpm) for hydrants throughout the development areas under consideration. The USFS Campus, however, sees flows of approximately 850 gpm, which is insufficient for expansion of water demand without upgrades to the water infrastructure in this area as of 2016. The Public Works Department recognizes this area as one that most likely would require water infrastructure upgrades prior to any future expansion.

Table 1-19 summarizes the fire flows determined through hydrant testing for this report.

Table 1-19. RDM Fire Hydrant Flow Test Inventory

Hydrant ID	Static Pressure (ft)	Flow (gpm)	Location
FH1212	58	1175	Hwy 126 (300' S of SE 9th St.)
FH0597	50	856	USFS NE of Paraloft (Inside FS fence)
FH1682	55	1162	Les Schwab Hangar (Inside fence)
FH0464	69	1256	1842 SE 1st St.
FH0517*	53	1300	Airport (N end of Terminal)
FH0970	60	1175	2551 SW 6th St. (Innovation Park)
FH1115	56	1138	SW Airport Way & SW 6th St.
FH1122	54	1175	SW Airport Way (400' NE of Mt. Hood Dr.)

*****Test data from 2006, all other locations tested December 2016.

TELECOMMUNICATIONS

The Airport is adjacent to the commercial and light industrial operations of the West Business Park, thus the area is well-served by telecommunications and fiber optic providers. CenturyLink, Bend Broadband, and LSNetworks are the primary providers in the Redmond area, though several smaller providers are also available.

NATURAL GAS

Cascade Natural Gas serves the Redmond area. As of 2016, existing pressure mains run adjacent to each of the potential development areas being considered. The existing infrastructure, with extensions as needed, is considered capable of accommodating most future proposed development.

STORM DRAINAGE

Storm drainage on the Airport is contained within the Airport property. The majority of storm drainage, including that of the infield storm system, daylights to an open swale or regional low point, with two notable exceptions. Two large boulder-filled infiltration galleries accommodate storm drainage from the Terminal area and the South Side GA area. One of these is adjacent the north edge of the South Side GA area, and the other is at the southern tip of the Terminal area. These systems are considered to be fixed in their purpose, and not suited for future expansion.

The remaining development areas would likely be subject to the stormwater development requirements of the City of Redmond. These requirements draw largely from the Central Oregon Stormwater Manual (COSM), which outlines Best Management Practices for stormwater management. Given the basaltic subsurface conditions known to define Central Oregon, surface treatment of stormwater, such as swales and drainage basins, is a common management practice. Refer to **Figures 1-16** and **1-17** for locations of stormwater management facilities.

1.4.3 NON-AVIATION FACILITIES

The existing non-aviation developments owned by the Airport and adjacent to airport property are detailed in A**ppendix A.** The information includes known projects in the planning and design stage that may impact the Airport. Airports often own non-aviation parcels as a way to promote development that is compatible with aircraft operations, and to diversify revenue. The non-aviation facilities are divided into the following subareas based on their location:

- ✓ North Development Parcel Subarea
- ✓ North Business Park Subarea
- ✓ South Side GA Subarea
- ✓ West Business Park Subarea
- ✓ Airport Way Subarea
- ✓ Fairgrounds Industrial Subarea

1.4.4 ON-AIRPORT ZONING AND LEASE RESTRICTIONS

Appendix A includes a detailed listing of City of Redmond Zoning designations which occur in the Airport vicinity. The zoning information includes the "zone description" and a listing of permitted uses.

1.5 TERMINAL BUILDING

The terminal building is a modern, well maintained facility built in 2009. With the passenger enplanement growth and the expansion of services since it was built, the terminal will need expansion and alteration for more efficient use and adaptability for future growth. This section describes the terminal facilities that exist in 2016. **Figures 1-20** through **1-25** show the terminal building floor plan by level.

1.5.1 TERMINAL BUILDING

TERMINAL BUILDING FUNCTIONAL COMPONENTS

PARKING / GROUND TRANSPORT

The passengers departing from the Airport have multiple options to access the terminal. They may use the public parking lot for their private vehicles, can be dropped off at the curb by personal vehicles, or be delivered by taxis or shuttles. The employees have a parking area near the terminal separate from the passenger lot, and the Airport vendors also have assigned parking separate from employee parking.

PRE-SECURE AREA

The pre-secure area of the terminal is that portion of the building that precedes the TSA screening. The pre-secure area is comprised of administration offices, airline ticketing and offices, baggage claim, meeter/greeter lounge, food and retail convenience store, rental car agencies, and restrooms.

ADMINISTRATION SPACE

The airport management space is comprised of a reception area, six offices and a conference room.

LAW ENFORCEMENT OFFICERS (LEO) AREAS

RAMS Specialized Security Service, Inc., who provides security for both pre-secure and secure areas, has an office adjacent to the security checkpoint. The City of Redmond Police Department also has an office in the terminal for officers to perform routine duties. While this police office is not staffed full-time, it allows officers to be nearby if needed for an emergency at the Airport.

TICKETING

There are ten ticketing counters, and each airline has dedicated counter(s) with separate queuing lines and ticketing kiosks. Passengers can check in at either the counter or kiosks; however, only the Alaska kiosks allow passengers to tag their own checked baggage. As of 2016, there are three unoccupied counters available. Airline offices and storage spaces serving the airlines are located directly behind the ticketing counters.

MEETER/GREETER LOUNGE

A meeter/greeter lounge immediately follows the inbound passengers' exit from the secure area. It is adjacent to baggage claim and the rental car counters. The waiting area provides seating and a children's play area.

BAGGAGE CLAIM

The baggage claim consists of two baggage carousels and an oversize baggage claim area. A dedicated inbound baggage drop off area on the exterior of the terminal building serves these carousels.

RENTAL CARS

RDM has five counters for six rental car agencies with an office behind each counter. The agencies keep the rental vehicles in a parking lot adjacent to the terminal. Renters access the rental lot via a marked walkway. The rental car agencies are:

- ✓ Alamo
- ✓ Avis
- ✓ Budget
- ✓ Enterprise
- ✓ Hertz
- ✓ National

CONCESSIONS

A single news and gifts concession space is located in the pre-secure area. The plumbing for this space supports beverage service, but no cooking or food preparation takes place as of 2016.

UNFINISHED SPACE

As of 2016, approximately 3,178 square feet of unfinished space is available for future tenant improvement located along the pre-secure central corridor area.

SECURE AREA

The two-story area beyond the TSA checkpoint is referred to as "secure," meaning passengers and employees have gone through TSA screening, or possess required credentials for access. The basement contains baggage screening, the TSA office suite, a maintenance shop, storage, and breakroom. The first floor houses a convenience store and holdroom for passengers, and the second floor contains a bar, restaurant, and another holdroom. There are restrooms on both the first and second floors. Access to the second floor is provided by two sets of stairs and an elevator.

SECURITY CHECKPOINT

The TSA screening area bridges the pre-secure and secure areas. The TSA operation has two lanes for screening passengers in an area approximately 75 feet long and 40 feet wide. Typically, both lanes are in operation daily during peak screening times – from 7 to 8 a.m. and from 12-1 p.m. As of 2016, TSA does not implement a pre-check lane.

The space for TSA screening may need an expansion due to increasing passenger enplanements. There appears to be sufficient space to accommodate an adding an additional lane by opening the space to the east, but this would require the removal of the existing exit passageway. As modifications of TSA guidelines are updated periodically, any future design will have to be mindful of possible changes to current standards.

TSA ADMINISTRATIVE AREA

The TSA support areas are in need of expansion. The Airport was reclassified to a Category 2 airport by the TSA in March 2016, after surpassing 250,000 annual enplanements for the three previous fiscal years. The enhanced classification increases the budget for staff and equipment. An increase in staff would necessitate improvements in the training areas, locker room space, and offices.

BAGGAGE SCREENING

As of 2016, baggage screening is located in the basement. The baggage handling system takes baggage from behind the airline ticketing counters, through the TSA screening equipment in the basement, and back up to the baggage make-up area, defined in the next paragraph. Alterations or reconfigurations to this area to meet updated TSA guidelines need to be balanced against the available basement area.

BAGGAGE MAKE-UP

Baggage make-up is where the airlines retrieve screened baggage. The baggage make-up system is one, large carousel with tug access to four sides. Some congestion at the baggage make-up has been noted. Adding another belt for outbound baggage screening would reduce congestion, and that addition would necessitate a building expansion.

GATES

The Airport has six gates, Gates A-F, for departing passengers. Gates serviced by the airlines are listed below:

- ✓ A – Alaska
- ✓ B – Alaska
- ✓ C – United
- ✓ D – Delta
- ✓ E – American
- ✓ F – Unassigned

HOLDROOMS

The holdrooms are the areas for passengers waiting to board their flights. The first floor area is a one-story space with a two-story circulation space leading to the second floor. The first floor contains seating with approximately 220 seats. The first floor holdroom area acts as a single space. Gate areas are loosely defined by their proximity to the airline gate kiosk. While this provides efficient use of the overall space, it makes it difficult to consolidate passengers with the airline they are flying.

The second floor holdroom has a high, vaulted ceiling with excellent daylighting and good views. There is ample space with approximately 50 chairs. No gates are directly associated with the second floor area.

PASSENGER BOARDING BRIDGES

All aircraft at the Airport are ground boarded, with no passenger boarding bridges (PBBs). Boarding bridges can facilitate passenger boarding and deplaning especially in conjunction with the anticipated airline fleet expansion. The addition of PBBs could make better use of the underutilized second floor holdroom and should lighten the first floor holdroom congestion. The second floor has the space to accommodate additional gates served by PBBs. Installing the PBBs at this location would require extensive modifications to the building. An exiting path likely containing escalators or additional elevators for deplaning passengers would need to be added to direct traffic to the secure exit.

INTERIOR PASSAGEWAY TO AIRCRAFT RAMP

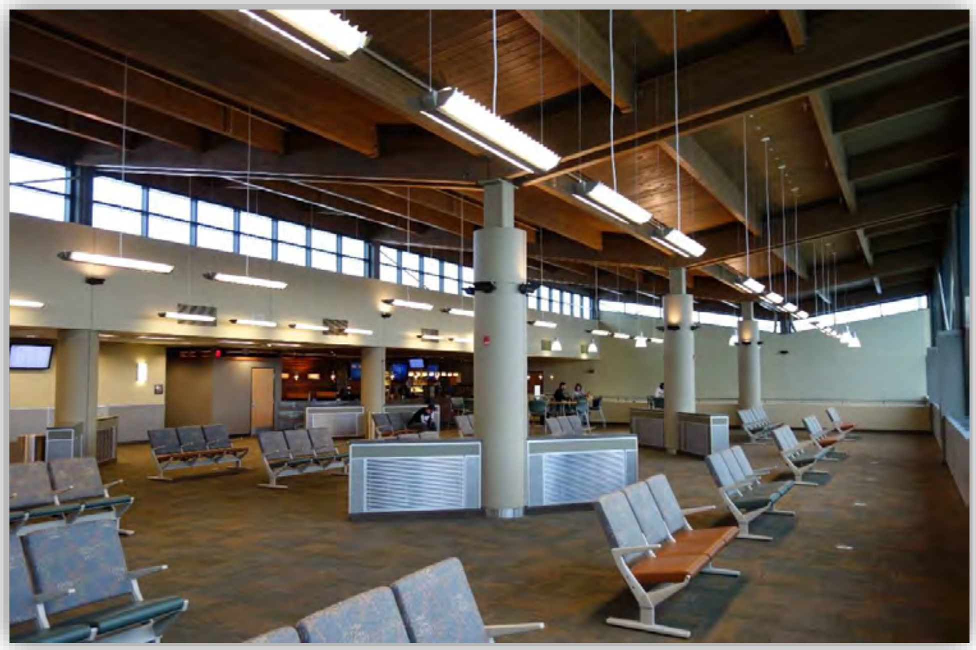
Boarding passengers move through the holdroom gates to an enclosed passageway. The passageway contains access to eight ramp doors that open to the aircraft ramp. The passengers board the aircraft using movable stairs or ramps. Deplaning passengers enter the passageway from the exterior and proceed to a secure exit that leads to baggage claim, rental car counters and the meeter/greeter lounge.

CONCESSIONS

The first floor contains a small convenience store. There is inadequate storage/support space for this area, and the concessionaire has difficulty maintaining stock throughout the day. The second floor has a bar, restaurant and kitchen, with high chair seating at the bar, and table and chair seating near the serving area. As there are no gates on the second floor, the restaurant/bar area is removed from primary holdroom activity.

Existing retail areas could be expanded to provide a broader range of merchandise and facilitate customer movement within the stores, especially when customers enter with luggage. Concessions storage is limited, which leads to shortages and stock shortages during peak periods. There is a lack of cold storage for the food, and getting supplies through TSA screening is time-consuming. There is an opportunity for improved concession revenue with the addition of food service in the pre-secure area of the terminal. A coffee/sandwich shop would serve those waiting for passengers, as well as employees. Electrical and mechanical systems need improvement to address issues related to the circuit breaker for the restaurant refrigerator, and the availability of hot water in the restaurant.

Figure 1-20. Second Level of Passenger Terminal



AIRLINE TICKETING OFFICES (ATO)

As of 2016, the space for offices and storage behind the ticket counters is at capacity. Some of the ATO space is used for storage. An expansion of this area is needed to ease current constrictions and provide for future growth.

GENERAL TERMINAL SYSTEMS/AREAS

BUILDING STORAGE

The terminal building lacks sufficient space for on-site storage. Maintenance equipment, supplies and other materials used at the terminal have to be held in mechanical rooms or remote locations, which is an inconvenience to terminal personnel.

DEDICATED DELIVERY ENTRY

As of 2016, when deliveries are made to the terminal items must be transported from curbside through the public space of the building to their destination. A dedicated delivery entry and unloading area would be more efficient, with distribution through a back-of-house passageway. This could eliminate congestion in the public spaces and provide a more secure entry for goods.

IMPROVED SIGNAGE

The secure passageway leading to the gates could use clearer gate markings in conjunction with destinations indicated at each ramp exit door. The use of video monitors would aid in providing clear direction and information that could change with each flight. The expanded use of informational display units at the holdroom gates and other strategic locations could provide weather information, flight information, and advertisement space.

PUBLIC ADDRESS SYSTEM

The PA system provides an inconsistent level of performance in the holdroom. It has been reported that announcements are difficult to hear.

POWER ISSUES AT GATE AREA

As of 2016, the gates have no back-up power. The gates doors stay in whatever position they are in when the power fails creating a security issue as well as access disruption. There is a desire to expand electrical power to the seating in the terminal.

REVOLVING DOORS

The revolving doors at secure exiting creates a queue as passengers must wait for the slowdown of traffic created by these doors. It was also noted that finding replacement parts for these doors is difficult.

ELECTRIC GROUND SUPPORT EQUIPMENT

The airlines are moving to the implementation of an all-electric fleet for their Ground Support Equipment. Provisions to locate charging stations and provide power to these units need to be developed.

GROUND SETTLEMENT

Some settlement has been noted at gates 1 and 2. These areas should be monitored to see if the settlement has subsided or presents an ongoing issue..

ENERGY EFFICIENCY

The community has expressed an interest in energy efficiency. Where systems need to be update or replaced, energy efficiency should be a priority. There are currently photovoltaic panels on the terminal roof. There is further interest increasing solar generated power.

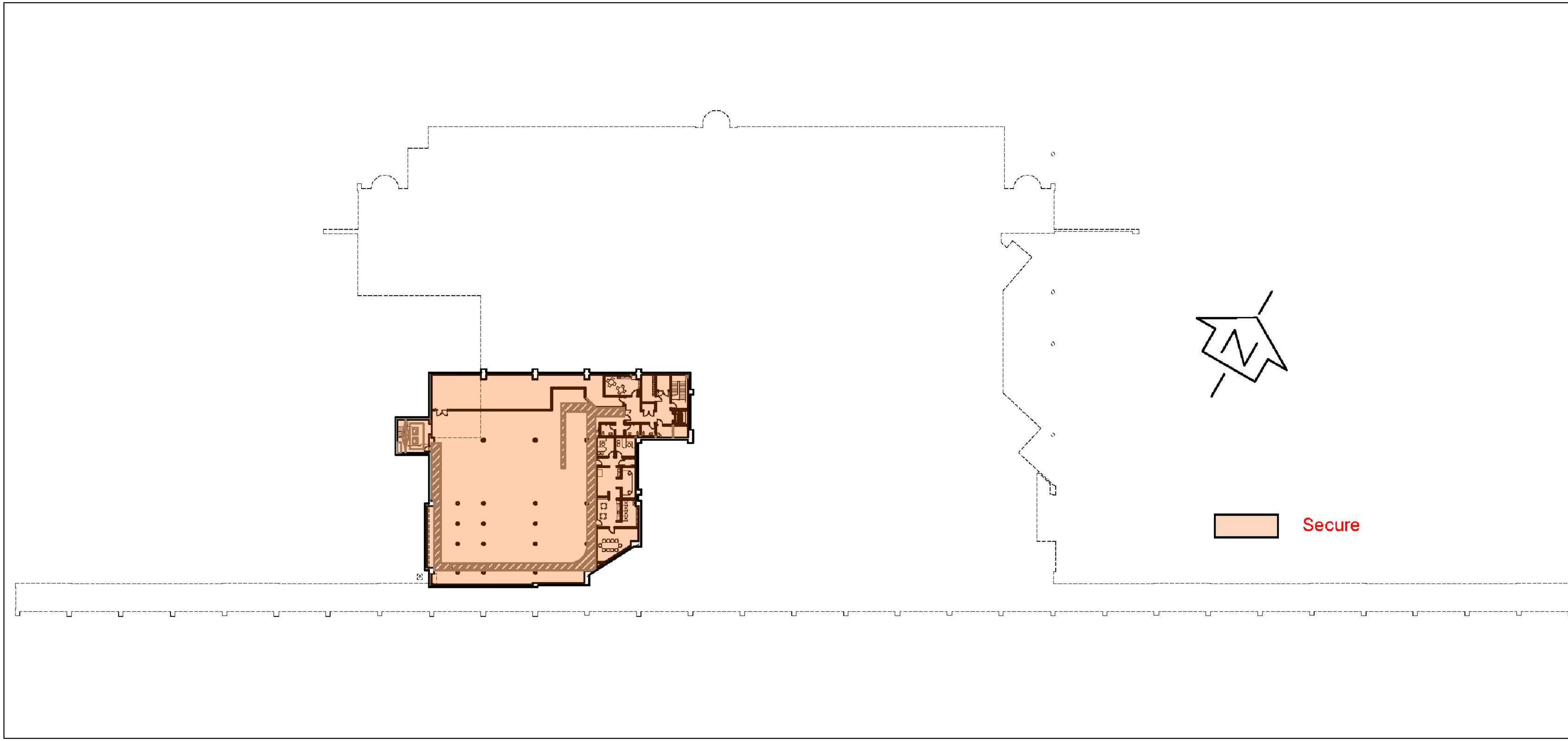


Figure 1-21
BASEMENT FLOOR PLAN

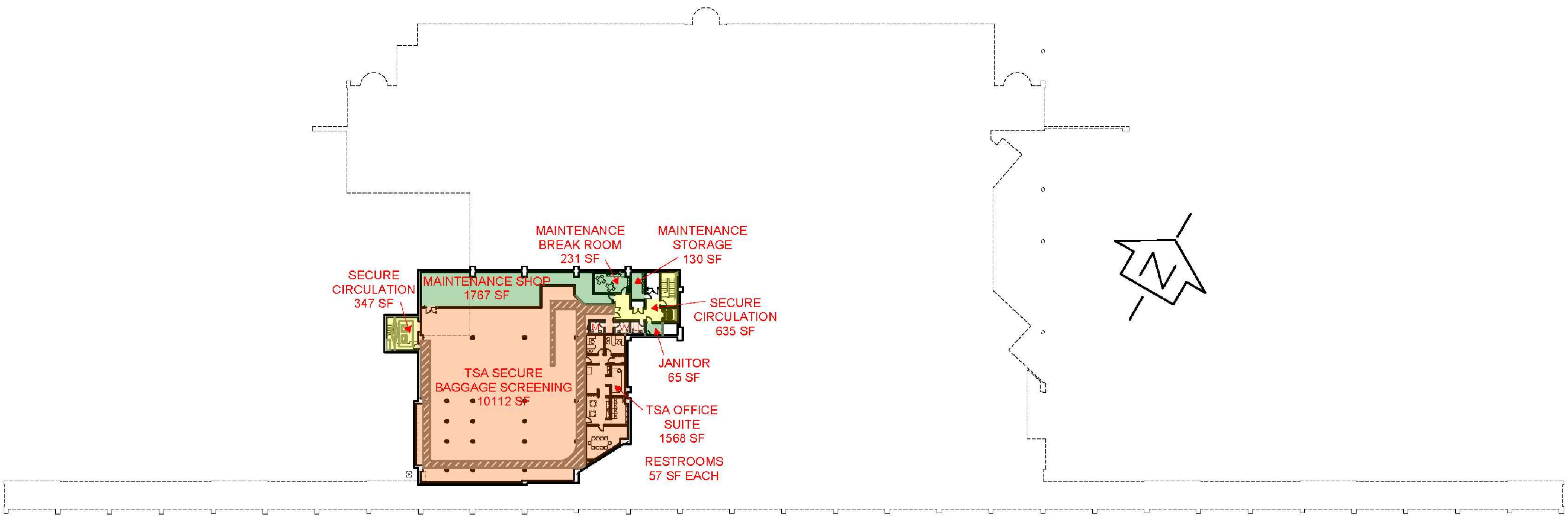


Figure 1-22
BASEMENT FLOOR PLAN

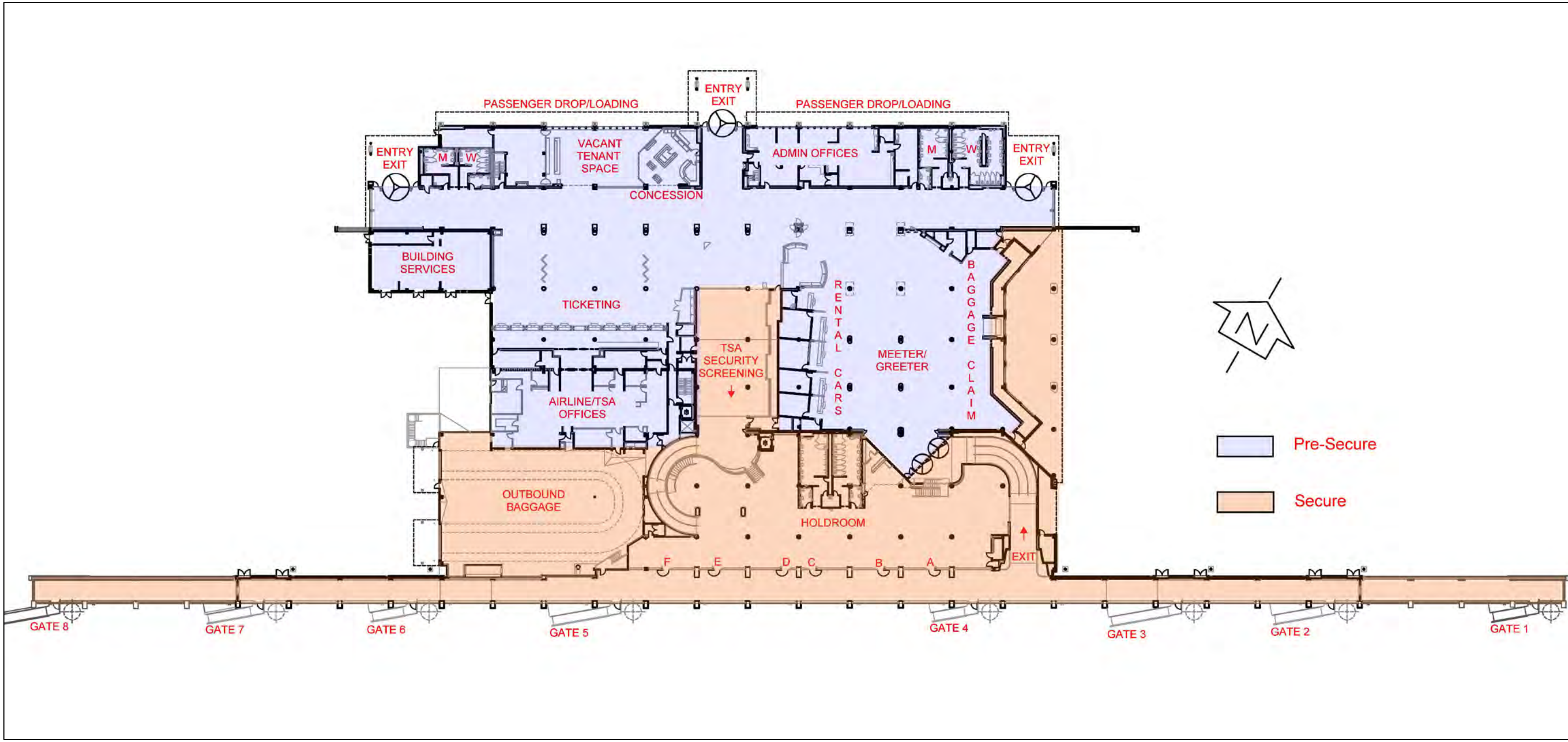


Figure 1-23
GROUND FLOOR PLAN

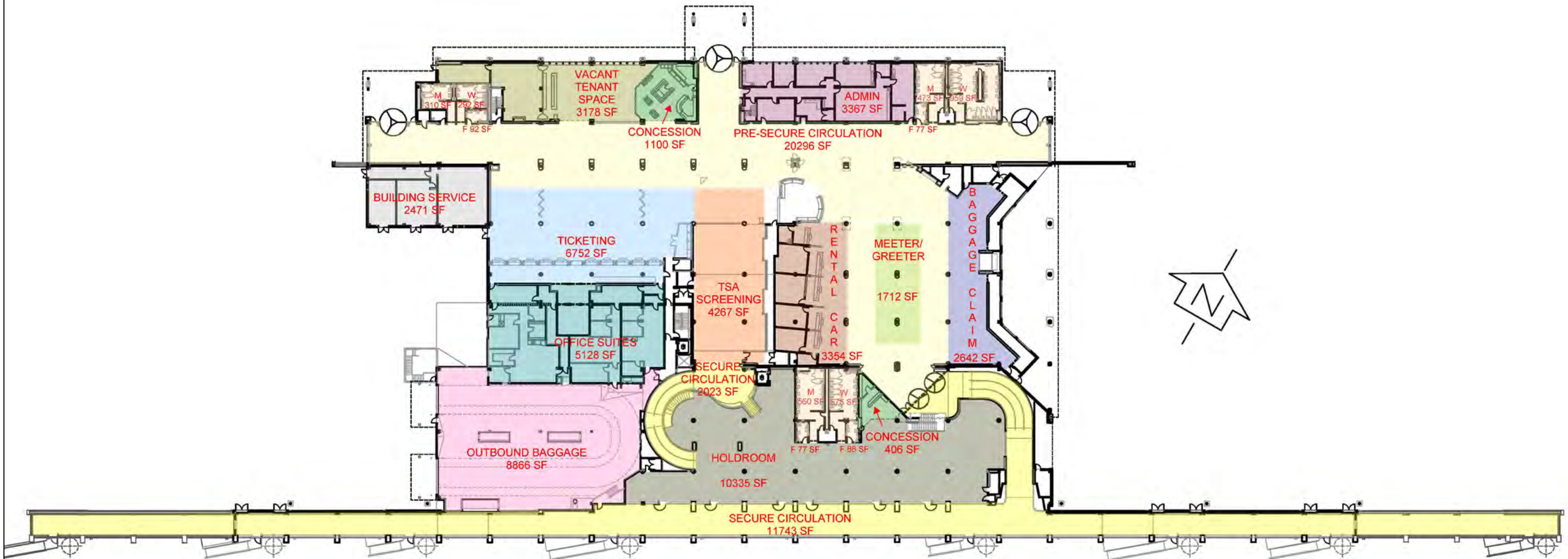


Figure 1-24
GROUND FLOOR PLAN

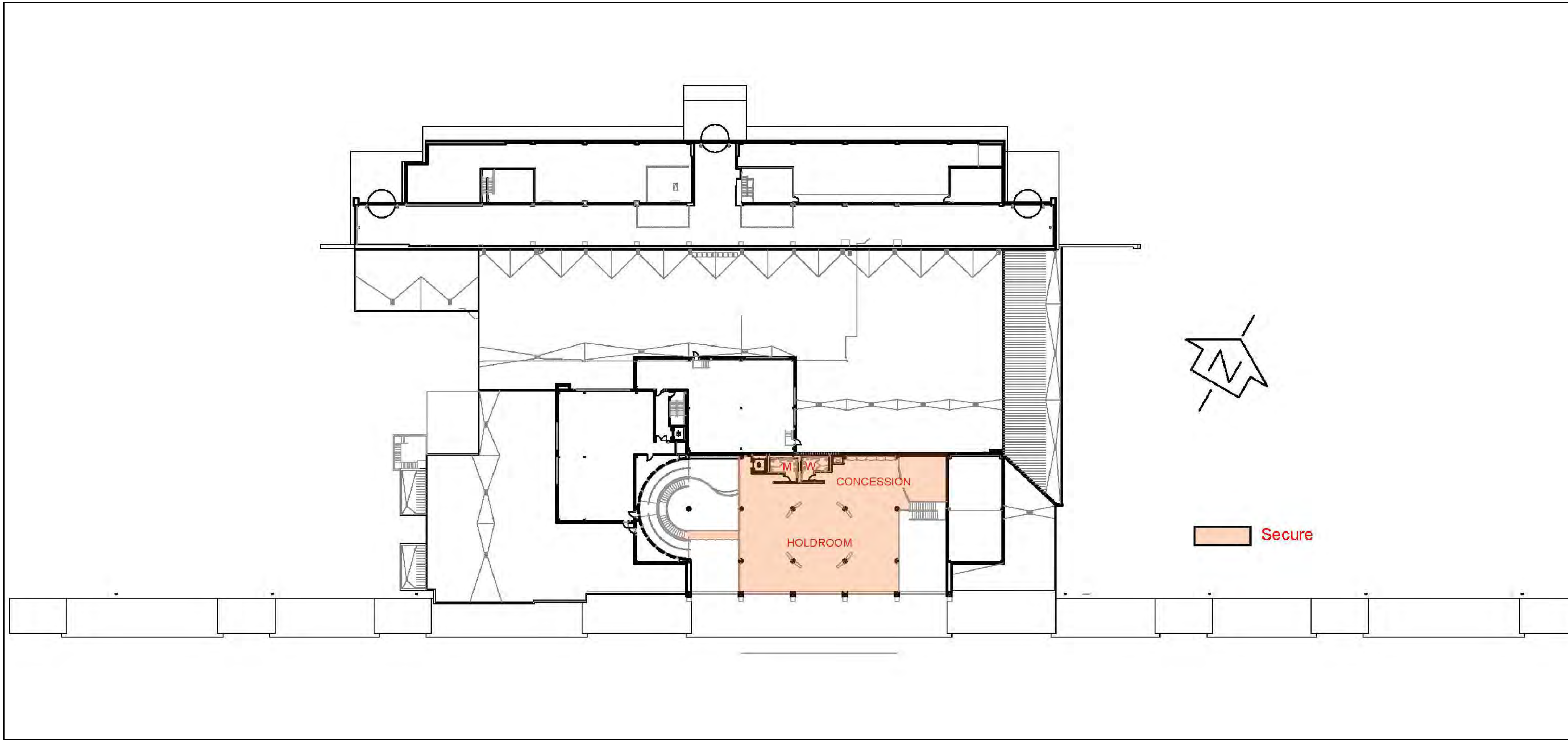


Figure 1-25
SECOND FLOOR PLAN

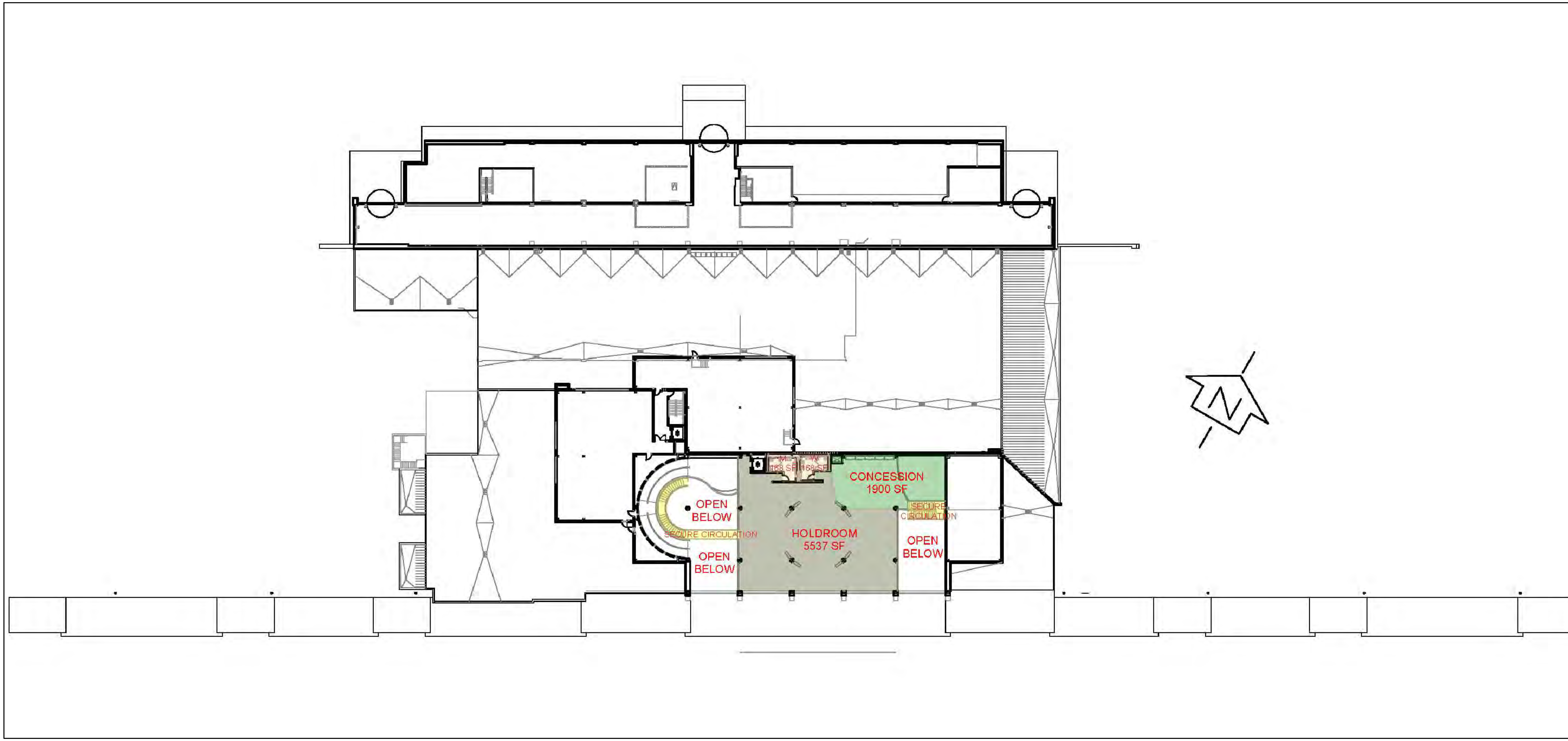


Figure 1-26
SECOND FLOOR PLAN

1.6 AVIATION ACTIVITY

Aviation activity for the Airport is shown below for based aircraft, annual operations (itinerant and local), passenger enplanements, cargo volume (cargo in and cargo out), and flight patterns. This information serves as the baseline for aviation activity forecasts that will help determine the proper facilities needed to serve future aviation activity and demand. Aviation activity is described in detail in **Chapter 2**, **Aviation Activity Forecasts.** A summary of 2016 activity levels is presented in Table **1-20**.

Table 1-20. Aviation Activity for Fiscal Year 2016*

Activity Measure	Totals
Aircraft Operations*	40,162
Air Carrier (Itinerant)	5,127
Air Taxi (Itinerant)	6,340
General Aviation (Itinerant)	10,985
General Aviation (Local)	16,829
Military (Itinerant and Local)	881
Passenger Enplanements**	322,176
Cargo Volume (Tons)**	970.1
Number of Airlines	4
Non-stop Destinations	7
Based Aircraft***	
Aircraft Type	**Totals**
Single-Engine	64
Multi-Engine	4
Jet	6
Helicopters	6
Other	0
Total Based Aircraft	**80**

The airport was closed for one month in 2016 for runway construction.
*Sources: *Terminal Area Forecast 2016, **RDM Monthly Report, RDM Performance Metrics, ***RDM Based Aircraft Survey 2016*

Annual totals are reported by FAA Fiscal Year, which runs from October 1 to September 30. Aviation activity measures reflect one month of airport closure during the reconstruction of Runway 5-23. The aviation activity forecasts will provide additional historical data and investigate changes in aviation activity over the most recent ten year period.

1.7 AERONAUTICAL SETTING

This section details the aeronautical setting surrounding the Airport, including details about neighboring airports and their facilities.

1.7.1 COMMERCIAL SERVICE AIRPORTS

PORTLAND INTERNATIONAL AIRPORT

Portland International Airport (PDX) is the largest airport in the state, located 150 miles from RDM. PDX offers domestic and international flights, and there are four non-stop flights a day from the Airport to PDX.

OTHERS

Four other airports in the greater region are air carrier airports: Eugene Airport (EUG), Rouge Valley International-Medford Airport (MFR), Eastern Oregon Regional Airport (PDT), and Crater Lake Klamath Regional Airport (LMT). EUG is 135 miles west of the Airport, MFR is 189 miles southwest of the Airport, PDT is 221 miles northeast of the Airport, and LMT is 160 south of the Airport. RDM does not have direct flights to these other Oregon airports.

1.7.2 GENERAL AVIATION AIRPORTS

Five general aviation airports are located within 30 nautical miles of the Airport: Bend Municipal (BDN), Madras Municipal (S33), Prineville (S39), Sunriver Airport (S21), and Sisters Eagle Air Airport (6K5). None of these have commercial service as of 2016 and have no future plans for commercial service. BDN has 203 fixed wing based aircraft and S39 has 122 fixed wing based aircraft. These two airports represent the greatest concentration of based aircraft in Crook, Deschutes, and Jefferson Counties.

BEND MUNICIPAL AIRPORT

BDN is 10 nautical miles south of the Airport, and has one 5,200-foot by 75-foot north-south lighted runway with non-precision instrument approach capability. The airport accommodates the highest volume of general aviation activity among all airports in Central Oregon, including flight training and an active glider community. BDN also has 19 helicopters based at the airport due to an extremely large volume of helicopter training activity. A number of small aviation businesses are located at the airport, including the Epic Aircraft manufacturing facility, which manufactures the Epic E1000 single engine turboprop aircraft. Aviation businesses located at BDN total approximately 300 employees. A future extension of Runway 16-34 to an ultimate length of 6,260 feet is proposed based on the approved Airport Layout Plan for BDN.

MADRAS MUNICIPAL AIRPORT

S33 is 25 nautical miles north of the Airport, and has two runways. Runway 16-34, the primary runway, is 5,089 feet long by 75 feet wide with medium intensity lights and existing visual approach capabilities. Runway 4-22, the crosswind runway, is 2,701 feet long by 50 feet wide. Runway 4-22 is primarily used by small, single-engine general aviation aircraft.

Erickson Aero Tankers, who contracts with the USFS and other entities for aerial firefighting aircraft, uses the S33 as a maintenance base for their fleet. The fleet consists of three DC-7 and seven MD-87 air tankers. In addition, Daimler Corporation is constructing a new truck model testing site at S33. As of 2016, this facility is under construction and will include two new test tracks that simulate road conditions for heavy duty trucks.

PRINEVILLE AIRPORT

S39 is 11 nautical miles east of the Airport with two runways. Runway 10-28, the primary runway, is 5,751 feet long by 75 feet wide with MIRL and non-precision instrument approach capability. Runway 15-33, the crosswind runway is 4,054 feet long with a non-standard, 40-foot width, and is limited to aircraft with a maximum takeoff weight of 5,000 pounds or less. This secondary runway has low intensity runway lighting (LIRL) with only visual approach capability.

S39 accommodates a fairly substantial on-site commercial pilot fixed wing training operation and a joint use Bureau of Land Management (BLM) helibase that is home to the Central Oregon Interagency Helitack Crew. Corporate traffic at S39 has increased as a result of the development of data centers for Facebook and Apple in Prineville. Hillsboro Aviation is a Fixed Base Operation at S39 that supports a growing pilot training operation.

SUNRIVER AIRPORT

S21 is approximately 26 nautical miles south/southwest of the Airport and has a single runway. Runway 16-34 is 5,461 feet long by 75 feet wide with LIRL and non-precision instrument approach capability. This airport is privately-owned by Sunriver Resort, LLC, and is for public use. The airport primarily serves residents and visitors to the 3,300-acre Sunriver Resort, which is a planned, fully-contained private residential and resort community. The resort itself is bordered on the north, east, and west by the Deschutes National Forest and the unincorporated community of Three Rivers on the south.

SISTERS EAGLE AIR AIRPORT

6K5 is approximately 20 nautical miles west of the Airport and has a single runway, 2-20. Runway 2-20 is 3,460 feet long and 60 feet wide with visual approach capability only. The airport is privately-owned by Sisters Eagle Air, Inc., and is for public use. The airport primarily serves residents and general aviation pilots who fly in the vicinity of the airport. The runway surface is made of asphalt and the airport has 100LL fuel.

Table 1-21 lists the nearby airports with a summary of available facilities and activity information. Airport locations are shown in **Figure 1-27**.

Table 1-21. Nearby Airports, Primary Runways, and Activity

Element	Bend Municipal Airport (BDN)	Madras Municipal Airport (S33)	Prineville Airport (S39)	Sunriver Airport (S21)	Sisters Airport (6K5)
Runway Designation	16-34	16-34	10-28	18-36	2-20
Runway Length	5,200’	5,089’	5,751’	5,461’	3,460’
Runway Width	75’	75’	75’	75’	60’
Pavement Strength (000)	30 S	75 S, 120 D, 180 2D	30 S	30 S	4 S
Runway Composition	Asphalt	Asphalt	Asphalt	Asphalt	Asphalt
Runway Lighting	MIRL	MIRL	MIRL	LIRL	N.A
Taxiway Lighting	Reflectors	N.A.	N.A.	Reflectors	N.A
Approach Aids	REIL, PAPI-4L	REIL, VASI-4L	PAPI-4L	VASI-2L	N.A
Weather	AWOS	AWOS	AWOS	N.A.	AWOS
Airport Beacon	Clear/Green	Clear/Green	Clear/Green	Clear/ Green	N.A
Approach Capability					
Existing	Non-Precision	Visual	Non-Precision	Non-Precision	Non-Standard
Future	Non-Precision	Non-Precision	Non-Precision	Non-Precision	Non-Standard
2015 Annual Operations*					
Local	70,030	9,192	29,437	2,518	400
Itinerant	70,044	6,128	17,613	3,671	1000
Total Operations	**140,074**	**15,320**	**47,050**	**6,189**	**1,400**
2015 Based Aircraft**					
Single engine	177	40	115	26	15
Multi-Engine	16	0	5	11	2
Jet	10	0	2	4	0
Fixed Wing	**203**	**40**	**122**	**41**	**17**
Rotor	19	1	1	0	0
Gliders	8	0	0	2	0
Ultra-Light	3	2	2	0	0
Total Based	**233**	**43**	**125**	**43**	**17**

*: Bend = 2015 EA; Madras = 2010 Madras Master Plan Interpolated; Prineville = 2016 Prineville Master Plan Interpolated; Sisters = FAA 5010 Airport Master Record; Sunriver = 2015 FAA Terminal Area Forecast (TAF).

**: BDN, S33, S21, 6K5 = FAA 5010 Airport Master Record, Prineville based aircraft = 2016 Airport Master Plan interpolated.

Scale 1″ = 8 Miles

Figure 1-27
SURROUNDING AIRPORTS

1.8 COMMUNITY SETTING

This section presents socioeconomic data to provide a profile of the airport users and the community served by the Airport. Socioeconomic data is used to guide aviation activity forecasts in **Chapter 2**.

1.8.1 SOCIOECONOMIC DATA

In order to define an area of analysis, socioeconomic data was gathered by using data compiled by Woods & Poole Economics, Inc. Woods & Poole categorizes Deschutes County and the cities located in the county, including Redmond, as the Bend-Redmond Metropolitan Statistical Area (MSA). The Bend-Redmond MSA is the area of analysis because it includes data for all of Deschutes County where the Airport is located. The study comprised these socioeconomic indicators to help determine trends in the Bend-Redmond MSA:

The data range was from 2006 to 2015. A longer period of time, rather than one or two years, is helpful for indicating trends more accurately, which is why a ten-year period was used. The accuracy of trends is critical, since trends are used to help determine future forecasts for airports. The selection of this ten-year period incorporates periods of growth and decline, such as the 2008 recession and the strong growth the Airport has seen since 2012. **Table 1-22** shows the socioeconomic data for the Bend-Redmond MSA during 2006 to 2015.

Table 1-22: Socioeconomic Data for Bend-Redmond MSA

Indicator	Population	Employment	Earnings	Income/Capita	GRP	Retail Sales
2006	143,860	91,910	$4,045	$40,619	$6,876	$3,262
2007	147,240	91,670	$4,004	$40,368	$7,052	$3,282
2008	150,690	91,420	$3,964	$40,118	$7,232	$3,301
2009	154,220	91,180	$3,924	$39,869	$7,417	$3,321
2010	157,840	90,930	$3,885	$39,622	$7,607	$3,341
2011	159,800	92,310	$3,868	$40,532	$7,620	$3,518
2012	161,890	93,940	$3,978	$41,377	$7,847	$3,650
2013	165,950	97,710	$4,195	$41,539	$8,202	$3,816
2014	169,160	99,890	$4,373	$42,257	$8,411	$3,958
2015	172,500	102,090	$4,515	$42,975	$8,622	$4,071

Source: Woods & Poole (2016)
Note: Total Earnings (in millions, adjusted to 2016 dollars), Total Personal Income Per Capita (adjusted to 2016 dollars), GRP (in millions, adjusted to 2016 dollars), Total Retail Sales (in millions, adjusted to 2016 dollars).

1.9 AIRPORT FINANCIAL OVERVIEW & ECONOMIC CONTRIBUTION

Commercial service airports are economic engines in the communities that they serve, facilitating the movement of goods and people to and from the community. Airports serve as employment centers, and as municipal entity that leases property and enters into contracts with private enterprise, their financial structure differs from other municipal departments. This section describes the revenues and expenses associated with airport operation, and the economic contribution that the Airport makes to the community it serves through jobs and wages, and business sales.

1.9.1 HISTORICAL FINANCIAL INFORMATION

The Airport generates revenue to cover its expenses and operates as an airport enterprise fund (AEP), which means that it maintains separate accounting from the City of Redmond general fund. The AEP is primarily funded through revenue from passengers and airlines. Grants from the FAA Airport Improvement Program help offset much of the cost of eligible capital improvements. The AEP is organized into three cost-centers: the Terminal Program, the Airfield Program, and the General Operations program. There are three additional sub-funds for debt service, passenger facility charges, and capital projects that are separated out to keep these capital improvement and financing funds from comingling with operating funds.

The Terminal Program uses a cost-recovery rates and charges basis, where the Airport looks to recover investment in facilities from users and tenants. The scope of this program includes the passenger terminal building. The Airfield Program covers operations and maintenance of the airfield, and rates and charges are set on a cost recovery basis. The General Operations Program includes hangars, parking lots, roadways, and non-aviation development, and uses a market rate basis to set rates and charges. The General Operations program helps the Airport diversify revenue streams to guard against slowdown in the aviation industry. A summary of the AEP is presented in **Table 1-23**.

Table 1-23: Airport Financial Overview				
Year	FY2013/14	FY2014/15	FY2015/16	FY2016/17
Type	Actual	Actual	Budget	Budget
Total Resources	**$15,105,114**	**$18,742,348**	**$37,122,840**	**$24,355,420**
General Operations	$7,757,230	$8,754,158	$9,713,972	$8,570,154
Terminal Operations	$1,565,455	$1,624,505	$1,547,364	$1,853,345
Airfield Operations	$1,282,264	$1,174,730	$1,237,932	$1,349,270
Debt Service Reserve	$2,247,694	$2,350,098	$2,539,651	$2,539,651
Passenger Facility Charge	$1,082,796	$1,138,806	$933,921	$1,100,000
Capital Projects	$1,169,675	$3,700,051	$21,150,000	$8,943,000
Total Expenditures	**$9,542,577**	**$13,124,756**	**$37,122,840**	**$24,355,420**
General Operations	$4,952,535	$5,923,221	$9,665,236	$8,848,222
Terminal Operations	$1,226,044	$1,079,200	$1,536,043	$1,575,277
Airfield Operations	$1,138,805	$1,233,063	$1,297,989	$1,349,270
Debt Service Reserve	$-	$-	$2,539,651	$2,539,651
Passenger Facility Charge	$988,743	$1,036,438	$933,921	$1,100,000
Capital Projects	$1,236,450	$3,852,834	$21,150,000	$8,943,000
Net Program	**$5,562,537**	**$5,617,592**	**$-**	**$-**
General Operations	$2,804,695	$2,830,937	$48,736	$(278,068)
Terminal Operations	$339,411	$545,305	$11,321	$278,068
Airfield Operations	$143,459	$(58,333)	$(60,057)	$-
Debt Service Reserve	$2,247,694	$2,350,098	$-	$-
Passenger Facility Charge	$94,053	$102,368	$-	$-
Capital Projects	$(66,775)	$(152,783)	$-	$-

Source: City of Redmond FY2016/17 Budget

1.9.2 AIRPORT ECONOMIC IMPACTS

The Airport is included in the 2014 Oregon Department of Aviation (ODA) Economic Impact Statement for NPIAS Airports. This report identifies the economic contributions of airports to the Oregon economy through on and off airport activities, the jobs created due to the airports, and the total payroll of the jobs created. **Table 1-24** represents the economic impact of the Airport on the Oregon economy is 2012 dollars.

Table 1-24. RDM 2014 Economic Impact		
Jobs	**Payroll**	**Business Sales**
810	$24,735,000	$81,561,000

Source: 2014 ODA Economic Impact Statement for NPIAS Airports

1.10 ENVIRONMENTAL CONDITIONS

The following sections are included to provide a baseline of the existing environmental conditions on and around the Airport. The information presented is a high level overview provided for planning purposes and is not intended to satisfy the requirements of the National Environmental Policy Act (NEPA).

1.10.1 AIR QUALITY

The Airport and surrounding areas are located within a National Ambient Air Quality Standards (NAAQS) Attainment area for the State of Oregon (Oregon Department of Environmental Quality [DEQ], 2016). The EPA established NAAQS for a limited number of pollutants in response to enactment of the Clean Air Act of 1970 and the Amendments of 1975 and 1977. The pollutants of most concern in an arid environment such as Redmond are particulates. The primary impacts to local air quality created by aircraft occur when planes are at or close to ground level during takeoff, landing, and taxiing. Airports have numerous other sources of pollutants including automobile traffic, service trucks, fuel trucks, and auxiliary equipment such as emergency generators. Aircraft engines emit carbon monoxide, carbon dioxide, particulate matter, volatile organic compounds, and oxides of nitrogen and sulfur. Fossil-fuel engines that combust diesel, aviation fuel, and gasoline fuels emit a variety of toxic compounds, which are primarily formaldehyde, benzene, and heavy metals.

Changes in aircraft operations or development at the Airport would require air quality modeling to evaluate the emission of priority pollutants to see if they will approach or exceed the NAAQS. Air quality impacts will be modeled in conjunction with aircraft noise. The FAA Aviation Environmental Design Tool (AEDT) is the required model for aviation noise and air quality modeling and will be used to quantify those impacts for the Airport.

1.10.2 COMPATIBLE LAND USE

Several factors can go into the analyses of whether or not a proposed land use is compatible with an airport. For Redmond Airport, the factors the City has to measure against are provided through the following three avenues:

Noise contours will be created for the Airport in a subsequent chapter of this Master Plan in conjunction with the forthcoming forecasted aviation activity. Once created, the noise contours will provide one factor for reviewing proposed land uses against. The FAA considers the DNL 65 dB an acceptable level at which residential land uses are compatible. Oregon Administrative Rule 340-035-0045 contains State of Oregon criteria for airport noise. The State of Oregon uses the 55 DNL contour to represent the “airport noise criterion.” The airport noise criterion does not indicate liability or legal obligation on the part of the airport; instead it defines the “airport noise impact boundary,” which is used to identify noise sensitive properties near the airport that may experience regular aircraft noise exposure. Local jurisdictions may also implement tighter restrictions.

Airport airspace surfaces as defined in FAR Part 77 *Safe, Efficient Use, and Preservation of the Navigable Airspace* will be depicted in the Airspace Plan, a component of the Airport Layout Plan set. These airspace surfaces should be used by the City of Redmond as a basis for protecting the Airport against incompatible development on the basis of height.

The FAA's Memorandum *Interim Guidance on Land Uses Within a Runway Protection Zone* should serve as a guidance document for allowable land uses within a RPZ.

1.10.3 HISTORICAL, ARCHITECTURAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

APPLICABLE REGULATIONS

The following state laws protect archaeological sites and cultural resources in Oregon: Indian Graves and Protected Objects (ORS 97.740-97.760) and Archaeological Objects and Sites (ORS 358.905-358.961). In order to conduct a survey for archaeological sites, the Oregon State Historic Preservation Office (SHPO) requires an archaeological permit (ORS 390.235). If an archaeological site is recorded on public land, an archaeological permit is required to conduct ground disturbing activities within site boundaries.

Under ORS 358.653 the City is required to consult with the SHPO to avoid inadvertent impacts to historic properties for which they are responsible; this relates primarily to buildings and structures which are listed on the National Register of Historic Places or eligible for listing. Generally, eligible historic properties are at least 50 years old, retain their historic appearance, and meet one of four National Register significance criteria. Airport buildings and structures may also be subject to the City of Redmond Historic Preservation Ordinance.

BACKGROUND RESEARCH METHODS

This effort consisted of a literature review of all areas within one mile of the Airport to identify cultural resources within the study area. The purpose of the review was to identify any cultural resources including Traditional Cultural Properties within the Study Area. The study area has already experienced 36 previous cultural resources studies in support of infrastructure and utility improvements (highway, road, trail, gas, and fiber optic and transmission lines), land exchanges, testing at training centers, and the Redmond Caves. One archaeological survey previously conducted within the Airport boundaries used pedestrian survey methods and did not identify any archaeological resources, as documented in *Redmond Municipal Airport Taxiway "B" Rehabilitation Project - Phase I Field Survey and Section 106*, prepared by Scott E. in 2016 for Morrison Maierle. Reviewed information included recorded cultural resources, historic register-listed properties, ethnographic studies, historical maps, government landowner records, aerial photographs, regional histories, geological maps, soils surveys, and environmental reports. Relevant documents were examined at the Oregon SHPO via the GIS System for Archaeological Records Data and online research library. This literature review did not include fieldwork.

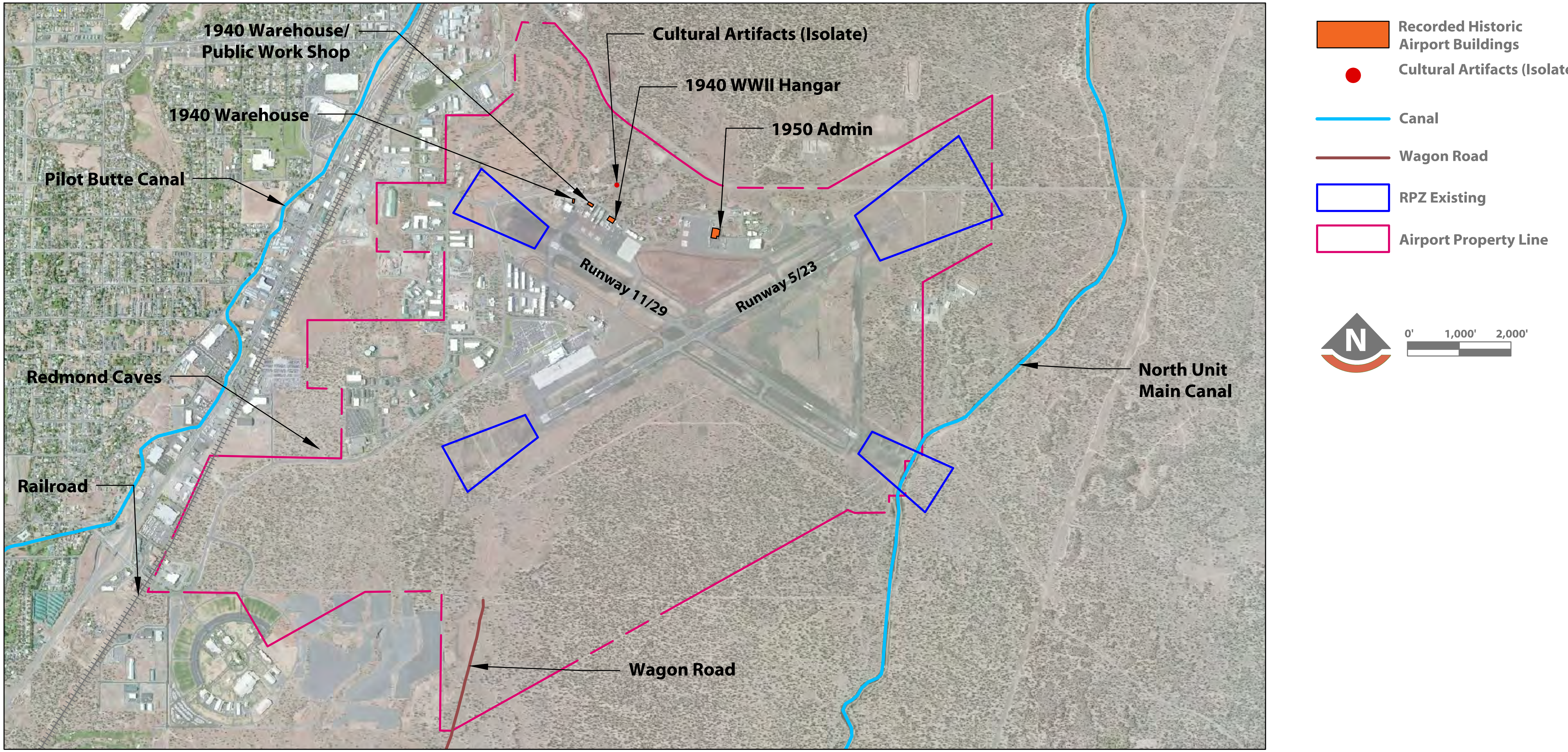


Figure 1-28
Environmental Conditions

CULTURAL SETTING

The type of soils at the Airport have the potential to contain buried cultural remains that were present prior to the eruption of Mount Mazama over 7,500 years ago leaving what is now Crater Lake.

Non-Native explorers arrived in central Oregon in the 1820s under contract with the Hudson's Bay Company. Migration to Oregon began in the 1840s and followed the Oregon Trail. Frank and Josephine Redmond, who arrived in the area in 1904, founded the City of Redmond. Settlers constructed irrigation canals soon after and the town incorporated in 1910. Records of the Greater Redmond Historical Society accessed in 2013 state that, the following year, the Oregon Trunk Railroad was completed and provided improved economic and passenger transportation opportunities for city residents.

Efforts to build an airport began in 1928 and the first runways were constructed in 1929. The Works Progress Administration carried out improvements to the Airport during the 1930s, and during World War II, the US Army Air Corps used the Airport for training activities. The first commercial flight at the Airport was in 1946, as shown in **Figure 1-29**.

Figure 1-29 First Commercial Flight at the Redmond Airport 1946

Source City of Redmond 2016.

United States Geological Survey data from 1962a, 1962b, and 1975 indicates development in the vicinity of the Airport after 1950 has been minor, with some new construction on the northern boundary of the Airport.

PREVIOUS INVESTIGATIONS

A 2016 records search of SHPO's online GIS System for Archaeological Records Data was performed to identify any previously recorded historic or cultural resources surveys within the study area. A review of the Oregon Historic Sites Database was conducted to identify any recorded historic buildings within or directly adjacent to the study area.

RECORDED CULTURAL RESOURCES IN THE STUDY AREA

There are 48 recorded archaeological sites within the study area. They include isolated archeological artifacts, rockshelters (caves), rock alignments; and a historic-era homestead, wagon road, canals, and railway. In addition to these recorded sites, more than 20 isolated precontact-era and historic-era sites are mapped in the SHPO database that do not have Smithsonian site numbers. One, a single obsidian flake, was identified within the Airport boundaries near the intersection of SE Veterans Way and SE Sisters Ave. Sixteen other isolated finds are adjacent to the Airport boundaries. There is the potential for additional precontact archaeological sites to be discovered through an archeological survey of the Airport. An archaeological survey was not part of this study.

The sites listed below are protected under the National Historic Preservation Act. These sites could be affected by changes in airport operations or development. Projects that could affect these sites will require consultation with the SHPO to determine the potential project effects.

REDMOND CAVES SITE (35DS173)

The Redmond Caves Site is immediately adjacent to the Airport's western boundary, along SE Airport Way between SW 13th St and SW 6th St. During investigations in 1941, a sage bark sandal and projectile points were collected. Radiocarbon dating placed the sandal from approximately 1700 to 1900 years old, as noted on the US Bureau of Land Management website, accessed in December 2016. The site integrity has been impacted by looting and recreational use, as recorded by Lee R. Lyman on the form entitled, *Oregon Archaeological Survey, Site 35DS173 – Redmond Caves,* filed in 1983.

REDMOND MUNICIPAL AIRPORT

The Airport itself has been determined eligible for listing in the NRHP. Inventory and recording of buildings on the Airport property in 1997 led to five structures on the property being recommended as contributing to the Airport's historical significance: the Administration Building (1950), Warehouse #1 (1940), Warehouse #2/City of Redmond Public Works Shop (1940), the World War II Hangar (1940), and a storage shed (no construction date provided).

HUNTINGTON WAGON ROAD

East of the County Fairgrounds and south of the Airport boundary is an intact segment of the Huntington Wagon Road (c.1845), which is recorded as archaeological site 35DS2579. This resource extends northward through the airport property in a gentle southwest-northeast trajectory, extending between in sections 33, 27, 22, 15, and 10, recorded on the 1872 map accessed through the US Surveyor General website. The Huntington Wagon Road was part of the section of Oregon Trail (c.1845) between Bend and The Dalles (Cunninghame 1976). In 1864 J.P. Huntington, Oregon Superintendent of Indian Affairs, used the route to travel between Fort Dalles and Fort Klamath.

IRRIGATION CANALS

The North Unit Main Canal (1938), which has been determined eligible for listing in the NRHP, is immediately east of the Airport's eastern boundary. This resource is within a future RPZ.

HISTORIC PROPERTIES ON AIRPORT

Based on a review of an Airport property schedule and a 1997 historic inventory, there are at least five historic buildings within the Project Area as of 2016. **Table 1-25** summarizes the information on the Airport property schedule.

Table 1-25. Airport Buildings 50 years or older	
Description	**Construction Year**
Old Administration	1950
World War II Hangar	1940
Warehouse #1	1940
Warehouse #2	1940
Storage Shed	Unlisted

1.10.4 SECTION 4(f) PROPERTY

Section 4(f) of the U.S. Department of Transportation Act of 1966 protects significant publicly-owned parks, recreational areas, wildlife and waterfowl refuges, and public and private historic sites. Under Section 4(f), the Secretary of Transportation may approve a transportation program or project requiring the use of such sites only if there is no feasible and prudent alternative to using that land, and the program or project includes all possible planning to minimize harm resulting from the use.

Section 4(f) properties include:

- ✓ Parks and recreational areas of national, state, or local significance that are both publicly-owned and open to the public;
- ✓ Publicly-owned wildlife and waterfowl refuges of national, state, or local significance that are open to the public; and
- ✓ Historic sites of national, state, or local significance in public or private ownership regardless of whether they are open to the public.

PARKS AND RECREATIONAL AREAS

The Redmond Caves are a group of five caves formed by volcanic flows of molten lava from the Newberry Caldera. They are immediately adjacent to the western boundary of the Airport, along SE Airport Way between SW 13th St and SW 6th St, and the caves are located inside the Redmond city limits. The Bureau of Land Management (BLM) in partnership with the City of Redmond manages the caves, which are open to the public.

The collapse of a single lava tube created these five caves. The largest opening, Cave 1, enters a fairly deep and expansive cave, while Cave 3 has two openings joined by a narrow but easily passable connection. Caves 1, 3, and 4 are accessible and have deep, sandy soils, with scattered boulders and ceiling blocks.

Native Americans used the caves, at least periodically, over the past 6,000 years. Today, the Redmond Caves are managed as a unique site where visitors can learn about geology, wildlife, and past human use. A Section 4(f) analysis may be needed to assess the potential effects to users of the caves as a result from changes to airport operations.

WILDLIFE AND WATERFOWL REFUGES

There are no publicly-owned wildlife or waterfowl refuges within the study area.

HISTORIC SITES

A literature review of all areas within one mile of the Airport indicates significant historic resources in the study area, as listed below, that would be considered Section 4(f) properties in or near the study area:

- ✓ Five structures on airport property may contribute to the Airport's historical significance: the Administration Building (1950); Warehouse #1 (1940); Warehouse #2/City of Redmond Public Works Shop (1940); the World War II Hangar (1940); and a storage shed (no construction date provided).
- ✓ Huntington Wagon Road
- ✓ Two irrigation Canals: the North Unit Main Canal, which has been determined eligible for listing in the NRHP and is on airport property, and the Pilot Butte Canal, which has also been determined eligible for listing in the NRHP but is not on airport property.
- ✓ Redmond Caves, which are near, but not on, airport property.
- ✓ Oregon Trunk Railroad

A Section 4(f) analysis may be needed to assess the potential effects to these resources as a result from changes to airport operations or development.

1.10.5 THREATENED AND ENDANGERED SPECIES

An official species list was obtained from the U.S. Fish and Wildlife Service (USFWS) website (2016). The only species listed under the Endangered Species Act with the potential to occur in the study area is the gray wolf. The Oregon Biodiversity Information Center (ORBIC) database also was queried to obtain records of known sensitive, threatened and endangered plant and animal species within a two-mile radius of the Airport (ORBIC 2016). There are no documented records of species listed as endangered or threatened, proposed for listing, or candidate for listing as occurring within a two-mile radius of the Airport. There is no designated Critical Habitat for any species within the study area.

According to the USFWS website accessed in 2016, the Airport is in the East Wolf Management Zone where wolves are listed as Endangered. As of USFWS data in 2015, there are no recorded areas of wolf activity in the Redmond area, but given the 2016 population according to the USFWS website and the dispersal capabilities of wolves, at this point it is possible for a wolf to show up in almost any part of the state.

Contact with the USFWS again prior to future development at the Airport is recommended to ensure no species listed under the Endangered Species Act are in the development area.

1.10.6 WATER QUALITY

The City of Redmond has an Underground Injection Control (UIC) Management Plan that documents the City's stormwater management program. The plan also explains how the City protects groundwater quality from stormwater impacts of UIC facilities in compliance with their UIC Water Pollution Control Facility (WPCF) Permit (No. 103050). The City has no naturally occurring surface water within the Urban Growth Boundary, where the highest density development is, so the City's stormwater outfall systems uses drywells, drill holes, injection galleries, and outfalls to vegetated swales and infiltration basins.

WETLANDS AND OTHER WATERS

The following sections provide an overview of known wetlands and other waters on and surrounding the Airport property.

APPLICABLE LAWS AND REGULATIONS

Wetlands are protected under the State of Oregon Removal Fill Law and Section 404 of the Clean Water Act. Wetlands are under the jurisdiction of both Oregon Department of State Lands (DSL) and the US Army Corps of Engineers (Corps). Both agencies use the 1987 *Corps of Engineers Wetlands Delineation Manual* and the 2008 *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* to determine what a wetland is and its extent. An area is determined to be a wetland if it has a dominance of plants that grow in wet conditions (called hydrophytic vegetation), hydric soils, and positive wetland hydrology.

BACKGROUND RESEARCH

A literature review covered areas extending one mile in every direction from the study area. Reviewed information included the US Department of Agriculture Natural Resources Conservation Service (NRCS) Soil Survey, the USFWS National Wetlands Inventory, the Department of State Lands Local Wetlands Inventory, and Deschutes County online property database. A site reconnaissance was performed on October 24, 2016.

The National Wetlands Inventory shows the following wetlands within the study area:

- ✓ Two wetlands on the former Juniper Golf Course;
- ✓ Lateral E Canal and North Unit Main Canal; and
- ✓ Two wetlands on the Forest Service Rappel Base Helipad.

The two wetlands indicated on the former golf course are man-made water features and are not drained. These areas no longer meet the criteria of a wetland because the hydrology is no longer met. Both irrigation canals are not waterbodies under the jurisdiction of either DSL or the Corps because the canals are used for irrigation water conveyance and are turned on and off seasonally. The two wetlands indicated at the Forest Service Rappel Base are paved areas.

The Project Area is situated within the semi-arid shrub-steppe province (Franklin and Dyrness 1988). Vegetation is dominantly western juniper (*Juniperus occidentalis*) and big sagebrush (*Artemisia tridentata*), but also includes rabbitbrush (*Chrysothamus* and *Ericameria* spp.), bitterbrush (*Purshia tridentata*), low sagebrushes (*Artemisia* spp.), and grasses, such as Idaho fescue (*Festuca idahoensis*), needlegrass (*Achnatherum* spp.), squirreltail (*Sitanion hystrix*), and Sandberg bluegrass (*Poa secunda*).

The NRCS maps soils as Deschutes-Stukel complex, dry and Stukel-Rock outcrop-Deschutes complex, dry. Neither of these soils series are classified as nor considered hydric soils. This further indicates that wetlands are unlikely to occur in the study area.

A site reconnaissance performed on October 24, 2016, identified no wetlands or waters of the State/US within the study area. The undeveloped areas of the Airport support an upland plant community of western juniper/gray rabbitbrush/cheatgrass. During this same site reconnaissance, neither primary nor secondary indicators of wetland hydrology were observed.

1.10.7 FARMLAND

Review of the 2016 NRCS Soil Survey of Deschutes County helped evaluate the presence of prime, unique, state or locally important farmland in the project area. The survey indicated the Airport property and study area do not contain soil types classified as "prime farmland." As of 2016, no property within the study area is being used or was recently used or zoned for farming purposes.

1.10.8 CRITICAL AREAS

Local jurisdictions may have critical areas that relate to Oregon's State-wide Land Use Goals. There are no Critical Areas in the City of Redmond's Comprehensive Plan or Development Code.

1.10.9 FLOODPLAINS

FEMA maps floodplains all across the U.S. Specifically, the FEMA Flood Map Service Center collects data from Flood Insurance Rate Maps (FIRMs) and incorporates all the data into a national flood hazard layer to map where floodplains are. There are no floodplains on airport property.

1.10.10 RECYCLING PLAN

The FAA Modernization and Reform Act of 2012 (FRMA) expanded the definition of airport planning to include "developing a plan for recycling and minimizing the generation of airport solid waste" and added a provision requiring airports that prepare a master plan to address issues related to solid waste recycling.

A site visit and staff interviews took place on December 15, 2016, to collect information about recycling at the Airport. The study team toured the passenger terminal, airport offices, airline and other tenant spaces, SRE and ARFF facilities, and other airport buildings. Interviews of the staff from airport management and the facilities department clarified details about the recycling program in place in 2016.

The Airport has an active recycling program; the Airport does not have a written recycling plan. Under this master plan project, a recycling plan document will be developed that describes the existing program and recommends strategies to improve recycling and waste management at the facility. The recycling plan will be an appendix to this master plan report.

1.11 CONCLUSION AND SUMMARY

The facilities and conditions described in this chapter form the baseline of the Airport Master Plan. The research put into preparing this document will support further analysis and recommendations that will occur in subsequent chapters. A summary of key facilities is presented in **Table 1-26**.

Table 1-26. Inventory Chapter Summary

Runways
• Runway 5-23: 7,038 ft. x 150 ft.
• Runway 11-29: 7,006 ft. x 100 ft
 	
Runways and Navigational Aids
• Runway 5-23
  o Good Pavement Condition
  o High Intensity Runway Lights (HIRL)
  o Precision Runway Markings
• Runway End 5
  o Runway End Identifier Lights (REIL)
  o Visual Approach Slope Indicator (VASI)
• Runway End 23
  o Precision Approach Path Indicator (PAPI)
• Runway 11-29
  o Good Pavement Condition
  o Medium Intensity Runway Lights (MIRL)
  o Non-precision Runway Markings
• Runway End 11
  o VASI
• Runway End 29
  o PAPI
 	
Airport Navigational Aids
• VHF Omni-directional Range with Distance Measuring Equipment (VOR/DME)
• Non-Directional Beacon (NDB)
• Automated Surface Observing System (ASOS)
• Two Wind Socks
 	
Emergency
• ARFF Index B
FAA Certification
• Part 139
	Instrument Procedures
	• Runway 5
	  o RNAV (RNP)
	  o RNAV (GPS)
	  o REDMOND THREE
	• Runway 23
	  o ILS
	  o VOR/DME
	  o VOR-A
	  o NDB
	  o RNAV (RNP)
	  o RNAV (GPS)
	  o REDMOND THREE
	  o Visual
	• Runway 11
	  o VOR A (Category A)
	  o GPS
	  o REDMOND THREE
	• Runway 29
	  o GPS
	  o RNAV (GPS)
	  o REDMOND THREE
	
	Building Area
	• Passenger Terminal and TSA
	• Airport Traffic Control Tower
	• Aircraft Maintenance
	• Aircraft Fuel (Full Service & Self Service FBOs)
	• Hangars and Tie-downs
	• Snow Removal Equipment and Maintenance
	• Aircraft Rescue and fire Fighting (ARFF)
	• United States Forest Service (USFS)
	• Business Park

2.0 FORECAST SUMMARY

Central Oregon is growing across all indicators. In the ten years between 2006 and 2016, the population of Deschutes County has grown by 23 percent, gross regional product has grown by 20 percent, and employment has recovered to pre-recession levels. Permanent migrants are drawn by the quality of life and comparatively lower cost of living when compared to Western Oregon and California, and tourists come throughout the year to partake in the tax-free shopping and outdoor activities.

This regional growth has been reflected in the strong uptick in aviation activity. Passenger enplanements have grown at an annual average of 2.1 percent per year, and 2016 enplanements are 66 percent above 2006 levels. Deschutes County has some of the fastest growing communities in the country, and RDM is one of the nation's fastest growing Airports. Historical and FAA-projected growth exceed the levels for Oregon and the U.S.

Air cargo volume has declined by 40 percent over the last ten years. This decline is largely because of a global movement towards electronic substitutes for mail, and high fuel prices, and increased air cargo screening pushing cargo on to trucks. General aviation has spread to other airports in the region, and much flight training relocated from Redmond to Bend. Redmond, with its airport traffic control tower (ATCT), instrument landing system, and two fixed base operators, remains the primary regional airport for jet traffic. A summary of the demand forecasts is presented in **Table 2-1**.

Table 2-1: Forecast Summary

Category	2006	2016	2036	CAGR 2016-2036
Enplanements	**197,223**	**298,322**	**680,750**	**4.2%**
Air Cargo (Tons)	**1,612.8**	**970.1**	**1,000**	**0.2%**
Aircraft Operations	**68,388**	**40,162**	**47,740**	**0.9%**
Itinerant Operations				
Air Carrier	1,433	5,127	13,140	4.8%
Commuter / Air Taxi	16,803	6,340	2,100	-5.4%
General Aviation	22,170	10,985	14,000	1.2%
Military	366	341	300	-0.6%
Local Operations				
General Aviation	27,376	16,829	18,900	0.6%
Military	240	540	500	-0.4%
Based Aircraft	**129**	**80**	**127**	**2.3%**
Single-Engine Piston	92	64	78	1.0%
Multi-Engine Piston	31	6	2	-5.3%
Jet & Turbo-Prop	3	4	30	10.6%
Helicopter	3	6	12	3.5%
Other	0	0	5	N/A

Year corresponds to FAA Fiscal Year, October to September. Airport was closed for three weeks in 2016 for construction. 2016: Enplanements and Air Cargo – RDM Monthly Report and RDM Performance Metrics, Aircraft Operations – Terminal Area Forecast 2016, Based Aircraft – Airport Management Records 2016, CAGR: Compound Annual Growth Rate

2.1 INTRODUCTION TO FORECASTS

Aviation activity forecasts evaluate the future demand at the Airport. This chapter forecasts the following:

- ✓ Passenger Enplanements
- ✓ Cargo Volume
- ✓ Based Aircraft
- ✓ Aircraft Operations (Itinerant and Local)

Forecasts have a base year of 2016, and use the Federal Aviation Administration (FAA) fiscal year (October to September). The forecast period is 20 years with reporting intervals of every five years. Multiple forecasting methodologies are used with each activity, and are compared with the FAA Terminal Area Forecast (TAF).

Forecasts help determine if existing airport facilities are sufficient to handle future demand (passengers, cargo, operations, and based aircraft), or if facilities need to be modified to meet future demand. The FAA Seattle Airports District Office will review forecasts for rationality and comparison to the FAA TAF.

The chapter is organized in the following sections:

- ✓ Community Profile
- ✓ Aviation Activity Profile
- ✓ Scheduled Service Forecasts
- ✓ General Aviation Forecasts
- ✓ Peaking and Critical Aircraft
- ✓ Forecast Summary

TERMINOLOGY

Aircraft Operation: A count of a takeoff, landing, or touch-and-go. Each time an aircraft touches the runway to takeoff or land, it counts as an operation.

Aircraft Approach Category (AAC): Classification of an aircraft by approach speed, with "A" being the slowest and "E" being the fastest.

Airplane Design Group (ADG): Classification of an aircraft by its size (wingspan and tail height) with "I" being the smallest and "VI" being the largest.

Airport Reference Code (ARC): Used to determine facility size and setback requirements. The airport reference code is a composite of the approach category and design group of the critical aircraft.

Based Aircraft: Aircraft that are stored at RDM. These aircraft may be stored full-time or seasonally.

Critical Aircraft: The most demanding aircraft (in terms of size and/or speed) to use an airport more than 500 times a year or to have scheduled operations at an airport.

Enplanement: The act of a passenger boarding a scheduled or charter aircraft operated by a passenger airline.

General Aviation (general aviation): Aviation activities conducted by recreational, business, and charter users not operating as airlines under FAR Part 121, Part 135, or military regulations.

Itinerant Operation: An operation that originates and terminates at different airports. An example is an aircraft flying from RDM to another airport.

Local Operation: An operation that originates and terminates at the same airport. An example is an aircraft taking off from RDM, remaining near the airport to practice flight maneuvers, and then landing at RDM.

Touch-and-Go: A maneuver where an aircraft lands and takes off without leaving the runway. A touch-and-go counts as two aircraft operations.

Table 2-2 describes the data sources used in this chapter.

Table 2-2: Description of Data Sources

Source	Description
FAA TAF	The FAA TAF, published in January 2017, provides historical records and forecasts for passenger enplanements, aircraft operations and based aircraft at RDM. These forecasts serve as a comparison for forecasts prepared as part of this planning effort, and provide historical information on aircraft activity. The TAF is included in **Appendix B** as **Attachment 1**.
FAA Aerospace Forecast	The Aerospace Forecast 2016-2036 is a national-level forecast of aviation activity. The Aerospace Forecast helps guide local forecasts by serving as a point of comparison between local trends and national trends.
FAA Traffic Flow Management System Counts Data (TFMSC)	The TFMSC includes data collected from flight plans. These operations are categorized by aircraft type, and used to identify trends in the RDM fleet mix. The advantage of the TFMSC data is its degree of detail and its insights into the itinerant users of RDM. A disadvantage of TFMSC data is it does not include local operations or operations that did not file a flight plan. As such, the utility of TFMSC data is limited to larger aircraft, including scheduled commercial passenger, cargo, and charter operators, and private business jets.
U.S. Department of Transportation (USDOT) T-100 Database	Scheduled, charter passenger, and air cargo airlines fill out the T-100 form monthly. The T-100 database is an online repository of the data recorded on the forms, such as number of seats sold, number of seats available, freight transported, aircraft used, and departures performed. The T-100 provides a detailed look at the operations of passenger and cargo airlines.
U.S. Census Bureau	U.S. Census Bureau data was used to compare growth in Deschutes County to other communities across the country. Highlights from the Census Bureau are included in **Appendix B** as **Attachment 2**.
Airline Ticket Data	Airline ticket data was used to identify the catchment area and fare trends at RDM. Two sources were used: The Airline Reporting Corporation (ARC) and Market Information Data Tapes. These sources provide insight on the zip codes (based on billing information) that RDM travelers came from, which defines the catchment area. This information was then used to see where else travelers in the catchment area fly from, and determine how many potential RDM passengers chose to fly from other airports.

---- Continued on Next Page ----

Table 2-2: Description of Data Sources – Continued

Source	Description
Socioeconomic Data	Socioeconomic data is provided by data vendor Woods & Poole, Inc. (W&P), and the Portland State University College of Urban & Public Affairs: Population Research Center (PRC). The local municipalities use PRC data for population projections. The City of Redmond Comprehensive Plan was consulted; however, it is dated and does not reflect the best available information. The City of Redmond's Comprehensive Plan was last completed in 2001 (with updates through 2015), and will be fully updated in 2017/2018. The Deschutes County Comprehensive Plan was adopted in 2012. W&P provides data for gap years in the U.S. Census. The W&P dataset considers the Bend-Redmond Metropolitan Statistical Area (MSA), and provides 124 data categories with records from 1970 to 2016, and forecast through 2040. Data categories considered include population, employment, earnings and income, and gross regional product.
Local Economic Development Data	Economic development data helps tell the story behind the community's recent growth and shows where the community is focusing its efforts in terms of business recruitment. Data was provided by the Central Oregon Visitors Association (COVA), Redmond Economic Development, Inc. (REDI), and the Central Oregon Association of Realtors (COAR). Presentations prepared by these groups are included in **Appendix B** as **Attachment 3.**
State Plans	The Oregon Aviation System Plan (OASP) was last prepared in 2007, and projects aviation activity through 2025. The forecast base year was 2005. The OASP projected that RDM would grow from 174,008 enplanements to 537,400 enplanements, based aircraft were expected to grow from 117 to 197, and total operations were going to grow from 62,708 to 95,330. In 2015, OASP enplanement projections were 19 percent higher than actual enplanements, operations projections were 21 percent higher, and based aircraft projections were 14 percent higher .
Stakeholder Interviews	The aviation forecasting team collected data firsthand from airport stakeholders and community members during a series of interviews conducted October 24 and 25, 2016. Interviews were performed with representatives from the following groups • Airport Management • Airport Security • United States Forest Service • American Airlines • Delta Air Lines • Alaska Airlines • Redmond Police • SERCO (Air Traffic Control) • Leading Edge Jet Center • Butler Aircraft Services • Transportation Security • Administration

Part of the master planning process includes getting the best available data for development of forecasts, and evaluating the quality of this data to address anomalies. Common forecast methods, such as regression analysis and time-series evaluation can be thrown off by anomalies in historical data. One such anomaly is the three-week airport closure that occurred in May for runway construction. The closure interrupted normal operations and reduced enplanement totals and operations counts. Extended closures are not part of normal operations for the Airport; therefore, it is important to understand how many operations might have occurred had the Airport not been closed for three weeks. The calculation for the effect of this closure is shown in **Table 2-3**.

Table 2-3: Data Adjustment for Three Week Airport Closure

Category	May Count	Adjust Method	May Adjust
Enplanements	**7,113**	**Load Factor**	**20,274**
Operations	**1,910**	**Sum**	**3,826**
Air Carrier	166	Same as April	520
Air Taxi	154	Same as April	352
Itinerant GA	440	% of Year	881
Local GA	1,107	% of Year	1,874
Military	43	N/A	43

Passenger Enplanements: Alaska: 157 additional departures at 78 percent load factor. American: 20 additional departures at 75 percent load factor, Delta: 38 additional departures at an 84 percent load factor. United: 84 additional departures at an 87 percent load factor.
May operations: Averaged 8.84 percent of annual operations from 2006-2015.
Air Taxi Operations: Include passenger and air cargo.
Military operations: Not adjusted.
Sources: Airport management records from airlines and ATCT, FAA OPSNET database, FAA Terminal Area Forecast.

Passenger enplanements were calculated based on the number of scheduled operations that were canceled during the closure, using the average annual load factor to estimate number of passengers that would have been on the flights. Air carrier and air taxi operations were based on the prior month's schedule. Air taxi operations include both scheduled passenger and air cargo operations.

General aviation operations were estimated through a multi-step process.

1. May 2016 operations were calculated by based on the percent of operations that occurred in May from 2006 to 2015. Records from the ATCT show that an average of 8.8 percent of annual operations occur in May. This means that 3,826 operations were likely to occur in May 2016.
2. Subtracting the air carrier, air taxi, and military operations leaves 2,755 general aviation operations.
3. The FAA Operations Network (OPSNET) database shows that there were 440 itinerant operations and 1,107 local operations classified as general aviation in May 2016. This ratio was applied to the 2,755 expected general aviation operations, producing 881 itinerant operations and 1,874 local operations.

The adjusted enplanement and operations totals were used in forecast models to project future activity. Data reported in the chapter for 2016 matches FAA TAF values. Airport management did not report that based aircraft totals were impacted by the closure. Some tenants relocated their aircraft temporarily; however, overall based aircraft did not change before and after the closure.

2.2 COMMUNITY PROFILE

Community profile describes the location of the Airport, and the community it serves. The Airport is located within Bend-Redmond Metropolitan Statistical Area (MSA) and serves the Central Oregon region. There are five other general aviation (general aviation) airports within 30 nautical miles of the Airport: Bend Municipal Airport (BDN), Madras Municipal Airport (S33), Prineville Airport (S39), Sunriver Airport (S21), and Sisters Eagle Air Airport (6K5). RDM is the only commercial service airport in Central Oregon. This section describes the community population, employment and economic development, gross regional product (GRP), the activities of the US Forest Service (USFS), tourism, the regional airports already mentioned, and the catchment areas and competition. These characteristics comprehensively form RDM's community profile.

2.2.1 POPULATION

Table 2-4 shows the population records from 2006 to 2016 and the Portland State University Population Research Center (PRC) forecast through 2036. The PRC gathers population data on and collaborates with the state of Oregon, the counties, and cities within the state to create the forecast. The MSA grew at a compound annual growth rate (CAGR) of two percent from 2006 and 2015, increasing the total population by more than 33,000. The MSA population is forecasted to grow at a CAGR of 1.8 percent, reaching more than 252,000 by 2036.

Table 2-4: Bend-Redmond MSA Population

Calendar Year	Population	Percent Change
2006	143,316	-
2011	158,875	10.9%
2016	**176,635**	**11.2%**
2021	194,593	10.2%
2026	214,606	10.3%
2031	234,022	9.0%
2036	252,681	8.0%
CAGR (2006-2016)	2.0%	N/A
CAGR (2016-2036)	1.8%	N/A

CAGR = Compound Annual Growth Rate
Source: Portland State University Population Research Center

The U.S. Census Bureau ranked the Bend-Redmond MSA as the seventh fastest growing metro area in the U.S. in 2014, and the 3rd fastest growing metro area in the U.S. in 2016 (**Appendix B, Attachment 2 – Census Data**). Population growth is driven by two primary factors: job availability attracting workers and their families, and quality-of-life factors attracting retirees. **Figure 2-1** shows the population distribution of the MSA from 1970 through to the forecast for 2020. From 1970 to 2020, the median age increases from 31 to 45, and the percent of population over the age of 60 grows from 16 percent to 30 percent. Working age population, particularly the more experienced workers between the ages of 40 and 59, have grown by a total of 40,301 during the same period.

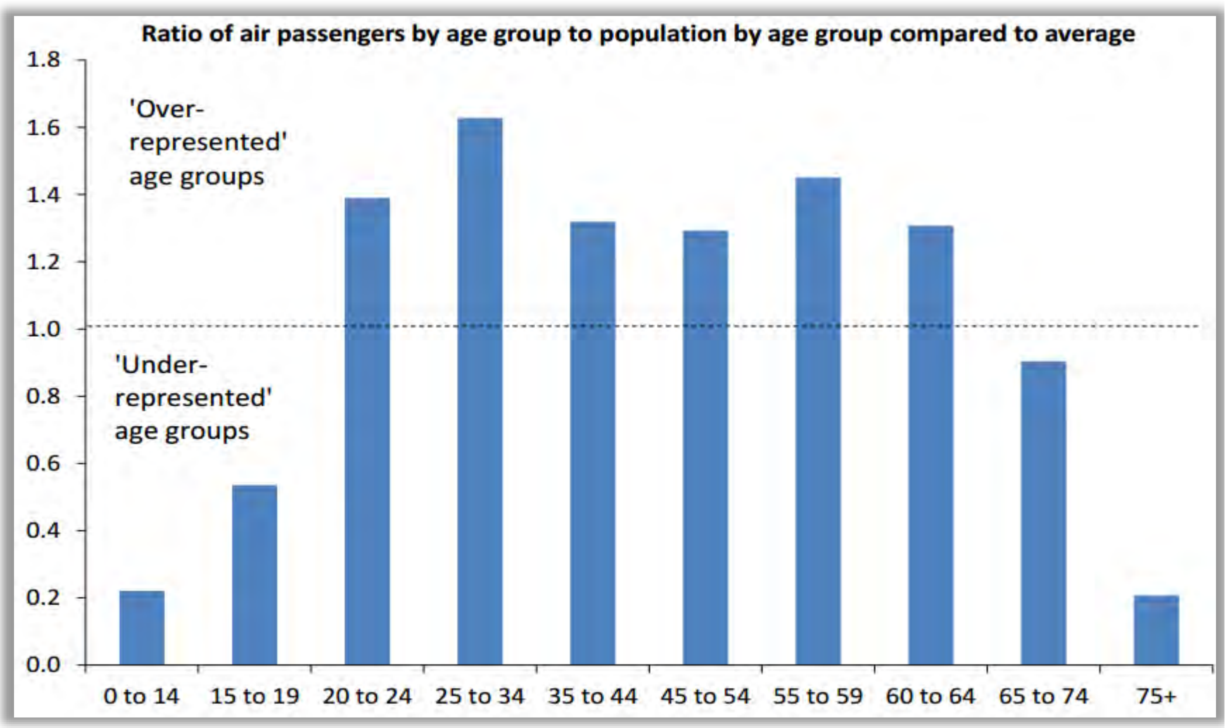
Figure 2-1: RDM Age Distribution

Source: Woods & Poole, 2014

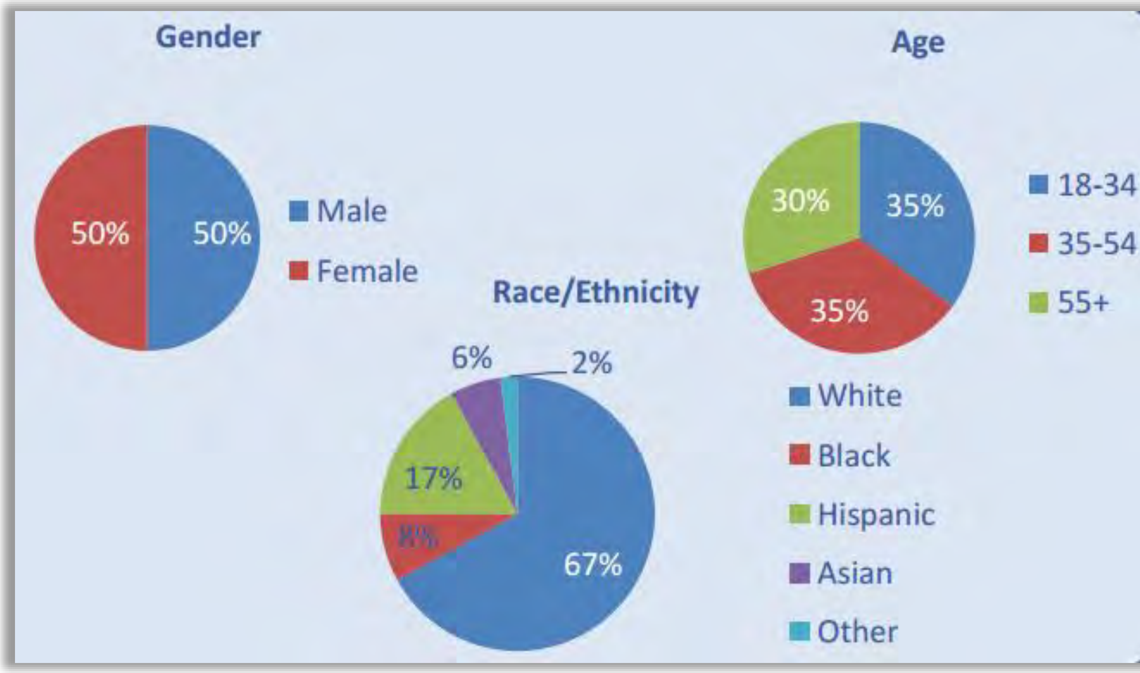
The changing demographics have significance for the incidence of air travel within the community. The 2014 *Shape of Air Travel Markets Over the Next 20 Years* report by the International Air Transportation Association (IATA) shows that working age travelers tend to fly more frequently than the population under the age of 19 and over the age of 65. Population growth, partially spurred by job growth and economic diversification discussed in **Section 3.2**, helps drive up the number of average trips per capita in RDM.

A 2015 survey by Airlines for America (A4A), presented in the 2016 report *Status of Air Travel in the USA*, conforms that working-age U.S. travelers (age 18-54) make up 70 percent of adult travelers. A point of distinction between the IATA and A4A reports is that the A4A report does not address trip frequency amongst the population directly, and does not include children. Travel by age group from the IATA and A4A reports are presented in **Figure 2-2**

Figure 2-2: Air Passenger Trips per Capita by Age



U.S. Air Traveler Composition



Source: IATA, 2014, Airlines for America, 2016

2.2.2 EMPLOYMENT AND ECONOMIC DEVELOPMENT

Per Woods and Poole data, the economy of the Redmond MSA has exhibited recovery since the end of 2007-2009 recession with total employment growing at an annual average rate of one percent from 2009 to 2016. Because of the recession, the MSA employment dropped by a total of 41 percent between 2006 and 2011. Industries that saw the greatest decline in employment were construction with a 14 percent decline, manufacturing with a 7.5 percent decline, and mining with a four percent decline. Professional services, such as finance, insurance, real estate, and professional and technical services were more resilient and posted employment growth between 2006 and 2011.

Economic recovery and diversification have been occurring since the end of the recession. Top industries by total employment in 2006 were construction (13 percent of jobs), retail (12 percent of jobs), and healthcare (10 percent of jobs). By 2016, top industries were healthcare (12 percent of jobs) and retail (12 percent of jobs), while construction dropped to sixth place with seven percent of jobs. MSA employment fluctuates by 6,000 jobs over the course of the year due to the seasonal nature of the ski season. Employment has kept pace with population growth, and the employment per capita ratio was 0.59 in 2016. The decline from 2006 to 2011 is indicative of population growth, coupled by a decline in labor intensive industries (construction and mining) and growth in more automated industries like healthcare and professional services. Total employment and employment per capita are presented in **Table 2-5**. Top industries by employment and sales are presented in **Table 2-6**.

Table 2-5: Bend-Redmond MSA Employment			
Calendar Year	Total Employment	Percent Change	Employment/Capita
2006	98,159		0.68
2011	92,312	-6.0%	0.58
2016	**104,289**	**13.0%**	**0.59**
2021	115,293	10.6%	0.59
2026	126,746	9.9%	0.59
2031	138,395	9.2%	0.59
2036	151,019	9.1%	0.60
Compound Annual Growth Rates			
’06 - ‘16	0.6%	N/A	-1.5%
’16 - ‘36	1.9%	N/A	0.1%

Jobs Per Capita = Total Employment / Total Population.
MSA Population included in **Table 2-3**.
Sources: Employment: Woods & Poole, Population: Portland State University

Job diversity has seen growth as the population and number of people employed has increased. Growing job sectors include aviation, engineering, health, technology, and social media. Below are examples of companies in the MSA that have shown recent growth:

- ✓ RDD – Provider of major systems and components for experimental aircraft.
- ✓ Stratos Aircraft – Located on Airport, Stratos designs, manufactures, and maintains the Stratos 714,
  a very light jet.
- ✓ Bend Research – Medical and pharmaceutical research company.
- ✓ Patheon – A supply-chain oriented pharmaceutical and biopharmaceutical company.
- ✓ Facebook – A social network that houses a server hub in nearby Prineville.
- ✓ Les Schwab Tires – A tire retail chain with a hangar on the Airport and headquarters in Redmond.
- ✓ PCC Structurals, Inc. – Global manufacturer of components are used in aircraft engines, airframes, power generation equipment, armaments, and commercial and medical needs.
- ✓ Nanometrics – Provider of advanced, high performance process control metrology and inspection systems used in the fabrication of products like semiconductors and solid-state devices.

Table 2-6: Bend-Redmond MSA Top 5 Industries by Employment and Sales 2006 – 2016

Top Industries by Employment								
Rank	2006		2011			2016		
	Industry	Jobs	Industry	Jobs	Δ	Industry	Jobs	Δ
1	Construction	12,492	Retail Trade	11,382	(6.3%)	Health Care	13,035	18.0%
2	Retail Trade	12,145	Health Care	11,043	16.5%	Retail Trade	12,939	13.7%
3	Health Care	9,476	Accom. + Food Serv.	8,369	0.2%	Accom. + Food Serv.	9,476	13.2%
4	Accom. + Food Serv.	8,352	State and Local Gov.	7,355	11.1%	State and Local Gov.	7,935	7.9%
5	Manufacturing	6,940	Real Estate	7,212	15.2%	Real Estate	7,924	9.9%
Top Industries by Retail Sales								
Rank	2006		2011			2016		
	Industry	Sales ($M)	Industry	Sales ($M)	Δ	Industry	Sales($M)	Δ
1	Motor Vehicles	$786.5	Gen. Merchandise	$703.9	7.6%	Motor Vehicles	$950.4	35.1%
2	Gen. Merchandise	$654.1	Motor Vehicles	$703.5	(10.6%)	Gen. Merchandise	$772.9	9.8%
3	F&B Retail	$419.1	F&B Retail	$474.9	13.3%	F&B Retail	$533.7	12.4%
4	Building Materials	$353.6	Restaurants	$339.2	12.9%	Restaurants	$407.0	20.0%
5	Restaurants	$300.5	Gasoline Stations	$271.1	34.1%	Building Materials	$327.1	35.9%

Bend-Redmond MSA Top 5 Industries by Employment and Sales 2016 – 2036

Top Industries by Employment								
Rank	2016		2026			2036		
	Industry	Jobs	Industry	Jobs	Δ	Industry	Jobs	Δ
1	Health Care	13,035	Health Care	17,981	37.9%	Health Care	23,629	31.4%
2	Retail Trade	12,939	Retail Trade	15,289	18.2%	Retail Trade	17,475	14.3%
3	Accom. + Food Serv.	9,476	Accom. + Food Serv.	11,375	20.0%	Accom. + Food Serv.	12,883	13.3%
4	State and Local Gov.	7,935	Real Estate	9,561	20.7%	Real Estate	11,310	18.3%
5	Real Estate	7,924	State and Local Gov.	9,344	17.8%	Prof. and Tech Serv.	10,994	22.0%
Top Industries by Retail Sales								
Rank	2016		2026			2036		
	Industry	Sales ($M)	Industry	Sales ($M)	Δ	Industry	Sales($M)	Δ
1	Motor Vehicles	$950.4	Motor Vehicles	$1,222.4	28.6%	Motor Vehicles	$1,462.2	19.6%
2	Gen. Merchandise	$772.9	Gen. Merchandise	$1,025.4	32.7%	Gen. Merchandise	$1,338.4	30.5%
3	F&B Retail	$533.7	F&B Retail	$634.7	18.9%	Restaurants	$745.3	35.1%
4	Restaurants	$407.0	Restaurants	$551.9	35.6%	F&B Retail	$744.3	17.3%
5	Building Materials	$327.1	Building Materials	$412.5	26.1%	Building Materials	$522.3	26.6%

Δ = Total percent change from period before (10 years). Retail sales presented in millions of inflation-adjusted 2016 dollars. Accom. + Food Serv. = Accommodation and Food Services (e.g. hotels). Prof. and Tech Serv. = Professional and Tech Services F&B Retail = Food and Beverage Retail (e.g. grocery stores). Gen. Merchandise: = General Merchandise is a wide array of retail with the exception of food and beverage (e.g. clothing, hardware, etc.). Source: Woods & Poole

2.2.3 GROSS REGIONAL PRODUCT

Gross regional product (GRP) is the value of goods and services produced in the MSA. GRP serves as an index for the health of the overall economy. As the economy increases production– both by producing more goods and producing more valuable goods, GRP increases. GRP per Capita shows the impact of the recession on 2011 GRP, which was down compared to 2006 GRP per Capita despite overall GRP being higher. Woods and Poole projections for GRP show that it will increase slightly faster than the MSA population. This is due to increases in efficiency and growth in the healthcare, professional service, and technical manufacturing industries, which produce higher value goods per person than traditional MSA industries that focus on raw material extraction (agriculture, mining, and forestry). **Table 2-7** shows the GRP of the MSA from 2006 to 2036.

Table 2-7: Bend-Redmond Gross Regional Product

Calendar Year	GRP ($M)	Percent Change	GRP ($M) per Capita
2006	$7,356		$0.051
2011	$7,552	2.7%	$0.048
2016	$8,755	**15.9%**	$0.050
2021	$9,812	12.1%	$0.050
2026	$10,924	11.3%	$0.051
2031	$12,103	10.8%	$0.052
2036	$13,302	9.9%	$0.053
Compound Annual Growth Rates			
’06 - ‘16	6.1%	N/A	0.3%
‘’16 - ‘36	2.1%	N/A	0.3%

GRP per Capita = GRP / Total Population.
GRP is inflation-adjusted 2016 dollars
Sources: GRP: Woods & Poole, Population: Portland State University

2.2.4 UNITED STATES FOREST SERVICE

The United States Forest Service (USFS) Redmond Air Center (RAC) plays a major role in supporting firefighting efforts in the region. USFS aviation activities contribute an average of 500 annual operations, which includes flights by helicopters, tankers, and single-engine spotter aircraft., USFS operations are concentrated during the fire season from May to October. Total operations depend on the severity of the fire season, and the Airport has seen as many as 1,000 tanker flights and as few as 300. The RAC expects to see Lockheed C-130 air tankers following the reconstruction of former Taxiway B (now Taxiway D) in 2017.

In addition to aerial response, the RAC hosts firefighting and emergency response training, and acts as a depot for firefighters headed out to events across the northwest. USFS and contract employees generally fly on scheduled commercial flights; however, charter flights have occurred when demand is sufficient.

Governmental organizations, such as national law enforcement and elected officials, use the RAC when in town.

The USFS classifies the RAC as a hub of operations, incident support base, and critical asset for the Federal Emergency Management Agency (FEMA) and related emergency efforts. FEMA and other disaster response agencies will use the RAC for large scale natural disasters in the Pacific Northwest, such as an earthquake in the Cascadia subduction zone.

2.2.5 TOURISM

The Airport receives tourists throughout the year due to the multitude of activities and attractions in the Central Oregon area. The Central Oregon Visitors Association lists golf courses, ski resorts, hiking trails, and the natural beauty of Oregon as tourist attractions. The Central Oregon Golf Trail features more than two dozen golf courses, three of which are ranked by *Golf Digest* and *GOLF Magazine* in the top 100 public courses in the nation. These top golf courses are a strong attraction for visitors to fly to Central Oregon.

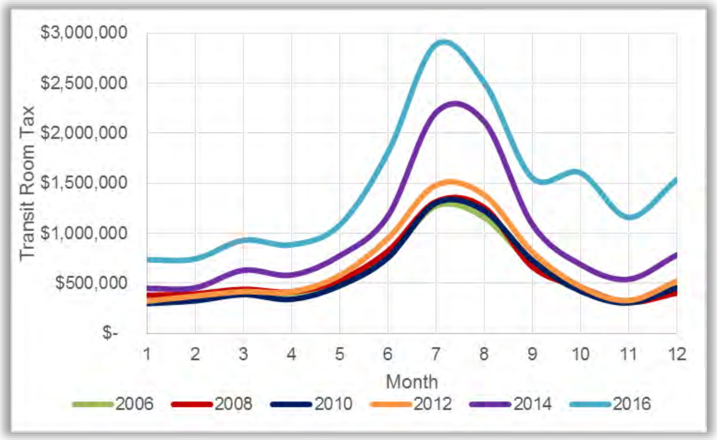
Central Oregon is home to two ski resorts, Mt. Bachelor and Hoodoo where visitors can participate in winter outdoor activities between November and May. Both resorts are also open from June to October for hiking and biking, and complement the trails elsewhere in the community.

Tourism activity is gauged by transit room tax (TRT) collection, which is provided by the Central Oregon Visitors Association (COVA). TRT is a percentage tax charged on hotel rooms. Growth in TRT shows two changes: an increase in average room price, an increase in hotel occupancy, and an increase in the number of rooms available. **Table 2-8** shows that TRT declined during the recession in 2008 and 2009 due to decreased travel, and has grown since. Strong growth from 2013 to 2016 is indicative of new lodging that has been built in response to the demand. Tourism peaks in the summer.

Table 2-8: MSA Transit Room Tax

Fiscal Year	TRT	% Change
2006	$7,159,430	
2007	$7,634,226	6.6%
2008	$7,535,010	-1.3%
2009	$6,560,361	-12.9%
2010	$6,952,963	6.0%
2011	$7,414,547	6.6%
2012	$7,930,881	7.0%
2013	$9,008,940	13.6%
2014	$11,061,570	22.8%
2015	$13,789,892	24.7%
2016	$15,513,984	12.5%
Compound Annual Growth Rate		
'06-'16	8.0%	N/A

TRT Collection by Month



TRT =- Transit Room Tax. TRT adjusted to match FAA fiscal year.
TRT is sum of amount collected by City of Bend, City of Redmond, City of Sisters, and Deschutes County
Months: 1= January, 12 = December
Source: Central Oregon Visitors Association

TRT growth exhibits strong correlation (0.91) with passenger enplanement growth from 2006 to 2016. This is to be expected as both indicators have common drivers. Growth in business and leisure visitors to the community help drive up TRT and passenger enplanement numbers. This, combined with population and employment growth (**Section 3.1** and **3.2**), explain the overall increase in passenger enplanements at RDM.

2.2.6 REGIONAL AIRPORTS

RDM is the only commercial service airport within 100 miles of the main population centers in Central Oregon; however, there are five general aviation airports nearby (Bend (BDN), Madras (S33), Prineville (S39), Sunriver (S21), and Sisters (6K5)). These airports are within 30 miles of RDM and provide general aviation users with choices for aircraft storage and services. A detailed description of the facilities offered at these airports are described in **Chapter 1**. Markets served by each airport are described in **Table 2-9**.

Table 2-9: Regional General Aviation Airports

	Characteristics			Markets Served			
Airport	Runway Length	Instrument Procedure	Jet A & FBO	Large Jets	Small Jets	Turbo-Props	Piston
Redmond	7,038 feet	Precision	Yes	Yes	Yes	Yes	Yes
Bend	5,200 feet	Non-Precision	Yes	No	Yes	Yes	Yes
Madras	5,089 feet	Non-Precision	Yes	No	Yes	Yes	Yes
Prineville	5,751 feet	Non-Precision	Yes	Yes	Yes	Yes	Yes
Sunriver	5,461feet	Non-Precision	Yes	No	Yes	Yes	Yes
Sisters	5,460 feet	Visual	No	No	No	No	Yes

Sources: Airport Facilities: FAA Airport Facilities Directory; Primary Market: Consultant assessment derived from based aircraft records and available facilities (runway length, fuel, instrument procedure)

Determination of market does not indicate the most common aircraft type at an airport, or suggest that a market that is not served will never use an airport. Rather, it reflects the presence of facilities at an airport that cater to the needs of a certain market. For example, piston aircraft are versatile in that they do not need Jet A fuel or a long runway, and due to their susceptibility to strong winds and turbulence, they tend not to be operated when visibility is particularly low due to stormy weather. For this reason, piston aircraft owners have fewer requirements for the airport where they based their aircraft than the owner of a business jet.

Large jets need a long runway to operate at their full potential, and owners generally need the aircraft available to fly regardless of the weather so airport instrumentation is more important. While large jets can use any of the regional airports under the right conditions, owners requiring year-round availability would be unlikely to base their large jet at an airport without the necessary facilities.

2.2.7 CATCHMENT AREAS AND COMPETITION

An airport's "catchment area" is the geographic boundary from which it draws its users, and airport activity is primarily influenced by the movement of people and products to and from the catchment area. Catchment areas are defined by the types of services offered at an airport, proximity of competitor airports, and the tendency of the local population to use the airport. The catchment area for RDM was split up into three different areas: air carrier, business jet, and general aviation. A map of the catchment areas is shown in **Figure 2-3.**

The air carrier catchment area is the largest of the three areas for RDM. The air carrier catchment area includes Central Oregon due to the Airport's location and the distance from other airports. The catchment area boundary is defined by assessing ticket purchases in the area surrounding the Airport, and looking at the zip codes of the passengers that traveled from RDM. The catchment area shows where RDM passengers are likely to come from; however, it should not be misinterpreted to mean that all air travelers in this area use RDM. Some fly from other airport, shown in the next section.

TERMINOLOGY

Air Carrier Catchment Area: Defined by the zip codes passengers live in when they purchase a ticket for an originating flight from the Airport.

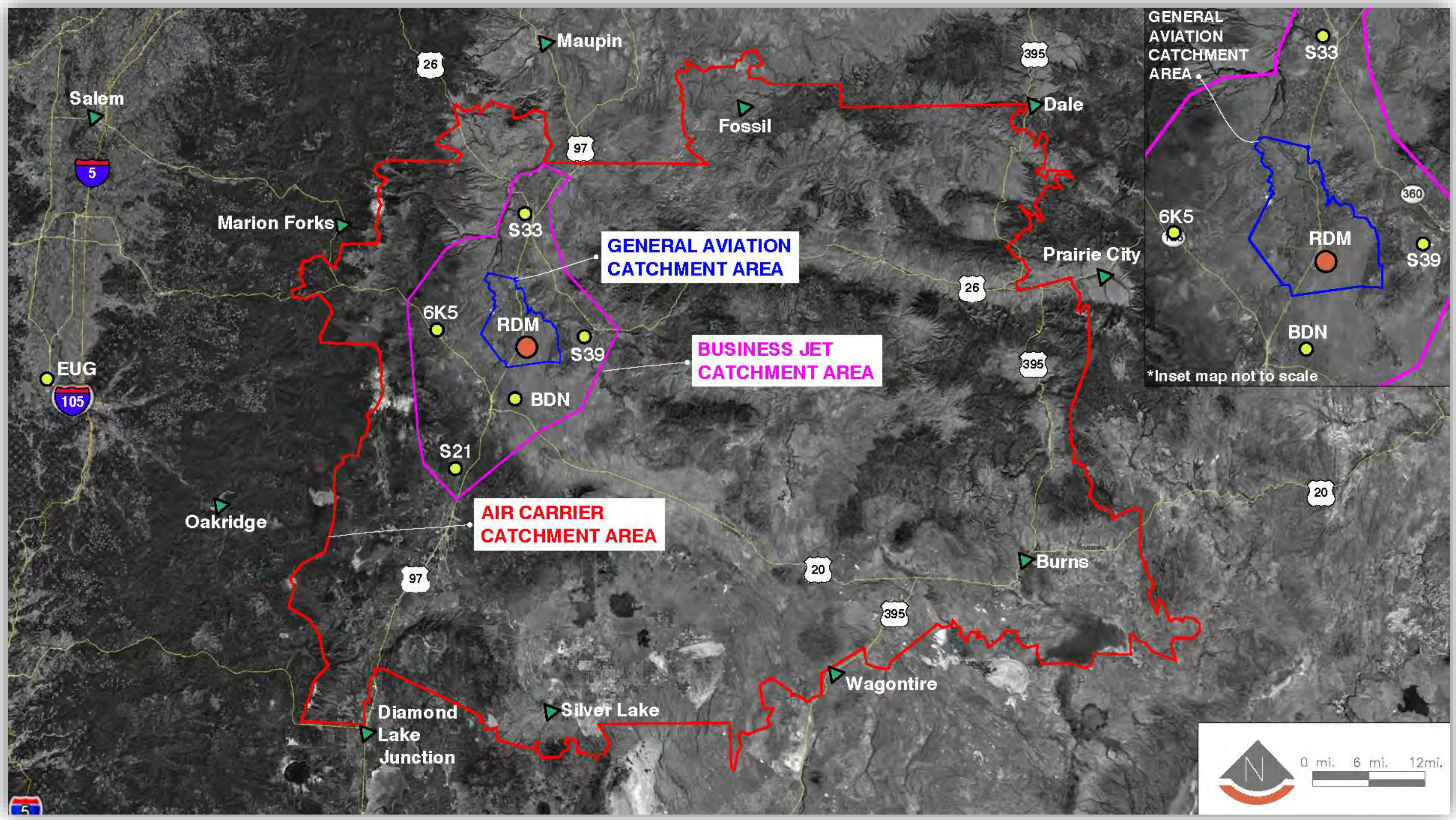
Business Jet Catchment Area: Defined by proximity to other airports capable of handling business jets.

General Aviation Catchment Area: Defined by the towns near the Airport who base general aviation aircraft at RDM.

The business jet catchment area is the second largest of the three areas and extends just past the city limits of Bend, Prineville, Madras, Sisters and Sunriver. This catchment area is based on the primary markets defined in **Table 2-9**. Surrounding airports do not have adequate facilities to serve large business jets throughout the year, which drives the size of the business jet catchment area.

The general aviation catchment area, which is the smallest, includes the City of Redmond and the areas halfway between the airports in Madras, Bend, Sisters, and Prineville. As shown in **Table 2-9**, the nearby airports in these communities have facilities that cater to small jets, turbo props, and piston aircraft. It is expected that aircraft operators will use the facility closest to their home or business provided space is available.

Figure 2-3: Catchment Areas



AIR CARRIER CATCHMENT AREA

The air carrier catchment area was determined based on a sample of passenger tickets issued between June 30th 2015 and June 30th 2016. This sample includes 24,457 tickets out of an estimated 747,325 tickets issued to travelers in the area over this period, meaning that the results are statistically valid at the 95 percent confidence level. *True market* for RDM is 747,325 tickets, which is the total number of tickets sold to the population of the catchment area. The true market includes travelers that used RDM, and travelers that live near RDM and used other airports.

Ticket sales data indicate that 75 percent of the true market used RDM for air travel, 24 percent used Portland (PDX), and the remaining one percent diverted to Eugene (EUG). When assessed based on international and domestic trips, RDM captured 76 percent (527,747) of domestic travelers and 59 percent (32,881) of international travelers. **Table 2-10** shows airport use by communities near the Airport.

Table 2-10: Airport Use by Community[1]

Community	Distance from RDM (Miles)	Year Ending June 30th, 2016 % Airport Use			True Market
		RDM	PDX	EUG	
Bend	17	80	19	1	524,628
Redmond	2	73	26	1	84,581
Sisters	21	69	31	0	33,032
Prineville	20	77	23	1	29,396
Terrebonne	8	72	28	0	17,876
Madras	28	50	49	0	17,448
La Pine	46	74	24	3	11,245
Powell Butte	9	82	17	1	7,486
Culver	21	73	27	0	5,684
Burns	144	56	44	0	2,170
Hines	142	59	41	0	1,711
Silver Lake	95	84	16	0	1,344
Christmas Valley	111	55	45	0	1,283
John Day	135	37	63	0	1,253
Crescent	64	67	28	5	1,192
Mount Vernon	127	48	52	0	947
Camp Sherman	36	75	21	4	856
Warm Springs	52	26	74	0	825
Kimberly	116	57	43	0	703
Canyon City	137	43	52	5	642
Total	**N/A**	**75**	**24**	**1**	**747,325**

1: Does not include markets with fewer than 100 passengers.
Sources: Airline Reporting Corporation, Market Information Data Tapes, and U.S. Department of Transportation

Travelers typically divert to other airports for non-stop flights, lower airfares, and more convenient flight times. Distance from RDM is another factor. **Table 2-10** shows that the Airport retains 72 percent of the true market within 30 miles of the Airport, 58 percent of the true market between 31 and 60 miles, 67 percent of the true market between 61 and 90 miles, and 55 percent of the true market over 91 miles away.

Table 2-10 shows the top 25 destinations true market estimates for passengers daily each way (PDEW) from RDM. PDEW numbers do not justify route existence on their own as many passengers flying from RDM connect in the airline hubs to other destinations. A passenger flying from RDM to Anchorage via Portland is part of the RDM-Anchorage PDEW total, and not part of the RDM-Portland PDEW total. RDM has non-stop service to each of the top five markets, and six of the top ten markets. The Airport uses the information contained in **Table 2-11** to advocate for new routes when meeting with the airlines.

Table 2-11: Top 25 Destinations True Market Estimate And PDEW

Rank	Destination	RDM Reported PAX	Diverted PAX	True Market	PDEW
1	Seattle, WA[1]	61,199	4,442	65,641	89.9
2	Los Angeles, CA[1]	39,780	15,751	55,531	76.1
3	San Francisco, CA[1]	39,417	4,626	44,042	60.3
4	Portland, OR[1]	33,032	0	33,032	45.2
5	Phoenix, AZ (PHX)[1]	25,316	7,136	32,452	44.5
6	Las Vegas, NV	19,226	7,076	26,302	36.0
7	San Diego, CA	19,117	6,765	25,883	35.5
8	Denver, CO[1]	20,496	3,219	23,715	32.5
9	Orange County, CA	16,165	4,163	20,328	27.8
10	Chicago, IL (ORD)	10,465	3,357	13,822	18.9
11	Dallas, TX (DFW)	8,887	4,860	13,748	18.8
12	Anchorage, AK	8,642	4,723	13,364	18.3
13	Salt Lake City, UT[1]	10,010	2,624	12,633	17.3
14	San Jose, CA	6,801	5,096	11,896	16.3
15	Kahului, HI	5,947	5,947	11,893	16.3
16	Boston, MA	8,199	3,160	11,358	15.6
17	Minneapolis, MN	7,729	2,540	10,268	14.1
18	Oakland, CA	5,092	3,907	8,999	12.3
19	Sacramento, CA	5,320	3,587	8,907	12.2
20	Ontario, CA	6,293	1,981	8,274	11.3
21	Newark, NJ	6,778	1,450	8,228	11.3
22	Honolulu, HI	4,483	3,665	8,148	11.2
23	Orlando, FL (MCO)	5,169	2,613	7,783	10.7
24	Spokane, WA	5,710	1,404	7,114	9.7
25	Atlanta, general aviation	4,948	1,693	6,640	9.1
Top 25 destinations		**384,217**	**105,784**	**490,002**	**671.2**
Total domestic		**527,747**	**164,405**	**692,152**	**948.2**
Total international		**32,881**	**22,292**	**55,173**	**75.6**
All markets		**560,628**	**186,697**	**747,325**	**1,023.7**

1: Indicates routes with non-stop service.
PDEW: Passengers Daily Each Way
Airport codes used to identify specific airport used in cities with multiple commercial airports.
Sources: Airline Reporting Corporation, Market Information Data Tapes, and U.S. Department of Transportation

2.3 AVIATION ACTIVITY PROFILE

The aviation activity profile is the baseline of the forecasts. The profile shows trends in activity at the Airport and provides context that explains what, how, and why changes in aviation activity have occurred. Sources that have provided information include the FAA, Airport Management, ATCT staff; and airport tenants. This section is organized in the following order:

- ✓ Airline Service (Passenger and Cargo)
- ✓ General Aviation
- ✓ Military
- ✓ Terminal Area Forecast

The ATCT operates and tracks flights from 5 a.m. to 7 p.m. Arrivals and departures that occur outside of these hours are not included in operations records submitted to the FAA. Commercial airline operations are also reported to the U.S. Department of Transportation (USDOT) and operations that occur when the ATCT is closed are captured using USDOT records.

General aviation operations do not have such records; however, flight records captured by FlightAware.com show only 327 general aviation operations occurring outside of ATCT hours. FlightAware records do not capture all operations, only those that file flight plans. However, given the low number of recorded operations, it is expected that total GA operations that occur when ATCT is closed make up a small percentage of overall operations. The absence of a more definite count is not expected to materially impact the forecast. GA operations when the ATCT is closed are shown in **Table 2-12.**

Table 2-12: GA Operations During ATCT Closure

Category	Arrivals	Departures	Total	% of Total Operations
Single Engine Piston	17	8	**25**	**0.06%**
Multi Engine Piston	7	3	**10**	**0.02%**
Jet	110	70	**180**	**0.45%**
Single Engine Turboprop	51	23	**74**	**0.18%**
Multi Engine Turboprop	18	20	**38**	**0.09%**
Total	**203**	**124**	**327**	**0.81%**

Source: FlightAware Fiscal Year 2016 data. ATCT records show **40,162 operations in 2016**

2.3.1 AIRLINE SERVICE

Airline service includes scheduled passenger and cargo flights, and non-scheduled charter flights that operate charters for casinos and the U.S. Forest Service. The sections that follow describe the airline profile, opportunities for new airlines to come to RDM, passenger enplanements, commercial operations, and air cargo service at the Airport.

AIRLINE PROFILE

The Airport has four scheduled passenger airlines: Alaska, United, Delta, and American. In 2017, all flights were operated by regional airlines on behalf of the mainline carriers. Each provides service to their hubs with Alaska flying to Portland and Seattle; America flying to Phoenix and Los Angeles; Delta flying to Salt Lake City and Seattle; and United flying to Denver and San Francisco. Non-stop service to the seven hub airports puts RDM within one stop of many major cities in the world. The 2016 market share for airlines in terms of passengers carried was not evenly divided amongst the airlines: 57 percent of passenger traveled on Alaska, 24 percent on United, 12 percent on Delta, and seven percent on American.

Scheduled cargo service is operated by Ameriflight on behalf of United Postal Service (UPS), and Empire on behalf of Federal Express (FedEx). Alaska Airlines carries cargo on their scheduled passenger flights. The 2016 market share for scheduled cargo carriers in terms of pounds of cargo carried was 51 percent for Ameriflight, 45 percent for Empire, and four percent for Alaska.

The growth in passenger activity at RDM has corresponded with increasing seat capacity on the scheduled carriers. Average seats per departure was 39 in 2006, 70 in 2011 (when Allegiant was operating with 166 seat aircraft), and 64 in 2016 (after Allegiant left the market). Nationally, the FAA Aerospace Forecast 2017-2037 reports that the average seats per departure for regional airlines has grown from 50 in 2006 to 61 in 2016, and is projected to grow to 73 by 2037. The trend of larger aircraft is expected to continue at RDM based on the following fleet decisions made by the major airlines.

Major changes in seat capacity for aircraft operating at RDM are described below.

- ✓ Alaska Airlines replaced the 37-seat Q200 with the 76-seat Q400 in 2008. As a result, flight frequencies in RDM and other markets served by Alaska declined. Passenger numbers also declined at this time; however, this was primarily due to the recession that occurred in 2008-2009.Alaska Airline’s passenger numbers returned to growth in 2010 and exceeded 2008 levels in 2014.
- ✓ SkyWest (operating for United and Delta) has been replacing the 50-seat CRJ-200 with the 65 to 70-seat CRJ-700 and the 76 seat CRJ-900 during peak months. In conversations with airport management, United has indicated that the CRJ-200 will leave the RDM market and be replaced by the CRJ-700 and CRJ-900 in 2017, and Delta has indicated that they intend to phase out the CRJ-200 from the RDM market as soon as the CRJ-700 and CRJ-900 become available throughout the year. Delta did not specify a date when this would occur.

Regional airlines are capped at a maximum of 76 seats per the terms of labor agreements between mainline pilot's unions and the airlines. Aircraft operated by regional airlines typically have fewer seats than they are capable of accommodating because of these agreements. For example, the Bombardier CRJ-900 can accommodate 90 seats in an all economy configuration. Airline purchases known as of April 2017 show that interest is focused on aircraft with greater seating capacity. Alaska, American, Delta, and United have indicated in the fiscal year investor filings with the U.S. Securities and Exchange Commission that they are updating their fleets with more fuel efficient narrow body aircraft as described below. This list does not include conventional narrow body aircraft (e.g. A321ceo), and wide body aircraft (e.g. 787-10) that the airlines have on order.

- ✓ Alaska: 30 Embraer 175 aircraft (up to 88 seats), 30 A320neo aircraft (up to 186 seats), and 32 Boeing 737 MAX aircraft (up to 200 seats);
- ✓ American: 12 Embraer 175 aircraft, 100 Airbus A321neo aircraft (up to 240 seats) and 100 Boeing 737 MAX aircraft;
- ✓ Delta: 75 Bombardier CS100 aircraft (up to 135 seats),
- ✓ Skywest: 18 Embraer 175 aircraft, 200 Mitsubishi MRJ-90 aircraft (up to 90 seats),
- ✓ United: 24 Embraer 175 aircraft, 99 Boeing 737 MAX aircraft

While it is not known how the airlines will deploy these aircraft in their system, it is evident that there are no orders placed for aircraft with fewer than 60 seats. This means that as these smaller aircraft are retired, they will be replaced by larger aircraft. As seen through the retirement of the 37-seat Bombardier Q200 in 2008, communities that cannot fill the larger aircraft will face a reduction in frequency, and potentially lose service all together. The effect that this may have on RDM is discussed in **Section 4.1.3**.

NEW AIR SERVICE OPPORTUNITIES

The most likely new candidate to service the Airport is Allegiant Airlines. As shown in **Table 2-11**, Las Vegas is the market without non-stop service from the Airport. Passengers either connect on flights from RDM, or drive to another airport to fly direct. Allegiant provided service between RDM and Las Vegas between 2007 and 2012, with load factors (number of passengers divided by the number of seats) ranging from 63 percent in 2007 to 81 percent in 2011. Allegiant used the MD-80 aircraft with 166 seats on the Las Vegas route. Allegiant ceased service in 2012 citing rising airport costs as the reason for leaving; however, the Airport and Allegiant are investigating reinstating the service as demand has remained strong.

Allegiant is transitioning from their Boeing MD-80 fleet to a more modern Airbus narrow body fleet. The Airbus aircraft have comparable seating capacity to the MD-80; however, the Airbus are more fuel efficient and can operate on shorter runways at a given takeoff weight than the MD-80. The new aircraft would allow Allegiant to serve RDM throughout the year with a lower weight restriction on hot days, enabling the airline to carry more passengers.

Allegiant is a niche market low-cost carrier that caters to leisure travelers and typically does not offer flights every day of the week, helping keep load factors high. Mainline carriers like Alaska, America, Delta, and United cater to business and leisure travelers and tend to offer multiple daily flight frequencies that coincide with connecting flights at their hubs. The Airport has non-stop service to every mainline airline hub within 1,000 miles. Regional jets that serve the Airport begin to become uneconomical beyond 1,000 miles because they need to remove passengers to take on more fuel. It is not expected that the Airport will see non-stop service to Midwest hubs until airlines begin serving the Airport with larger aircraft such as the Boeing 737 and Airbus A320 series. Entry of these aircraft into the RDM market will depend on the local demand proving that they can fill these larger aircraft reliably.

PASSENGER ENPLANEMENTS AND AIRLINE OPERATIONS

A passenger enplanement is any passenger who boards any aircraft that is considered scheduled commercial and charter aircraft with more than nine seats for turboprops (or any number of seats for jet aircraft). The aircraft must be operating under Title 14 Code of Federal Regulations (CFR) Part 121, which pertains to passenger airlines. Passengers are not counted toward enplanements if they board aircraft that operate under 14 CFR 91, which pertains to general aviation, and 14 CFR 135, which pertains to on-demand air taxis (not airlines). Passenger enplanements include both revenue and non-revenue passengers who paid taxes and passenger facility charges (PFC) for their carriage. Passenger enplanements do not include the flight crew, flight attendants, and any other members of the airline crew.

Passenger enplanements are classified by either *air carrier* or *air taxi/commuter*. Air carrier enplanements are any enplanements that occur on a mainline carrier, such as Delta, United, and American. Air taxi/commuter enplanements are those that occur on a feeder carrier, such as SkyWest Airlines, Mesa Airlines, and Horizon Airlines.

RDM passenger enplanements have increased by 100,000 between 2006 and 2016, which is a CAGR of 4.2 percent. This includes years of decline in 2009, 2012, and 2013. The 2009 decline was caused by the economic recession, and the decline in 2011 and 2012 was caused by Allegiant exiting the market, shown by the drop of air carrier enplanements while Air Taxi/Commuter enplanements grew. RDM enplanements from 2006 to 2016 are shown in **Table 2-13**.

Table 2-13: Passenger Enplanements

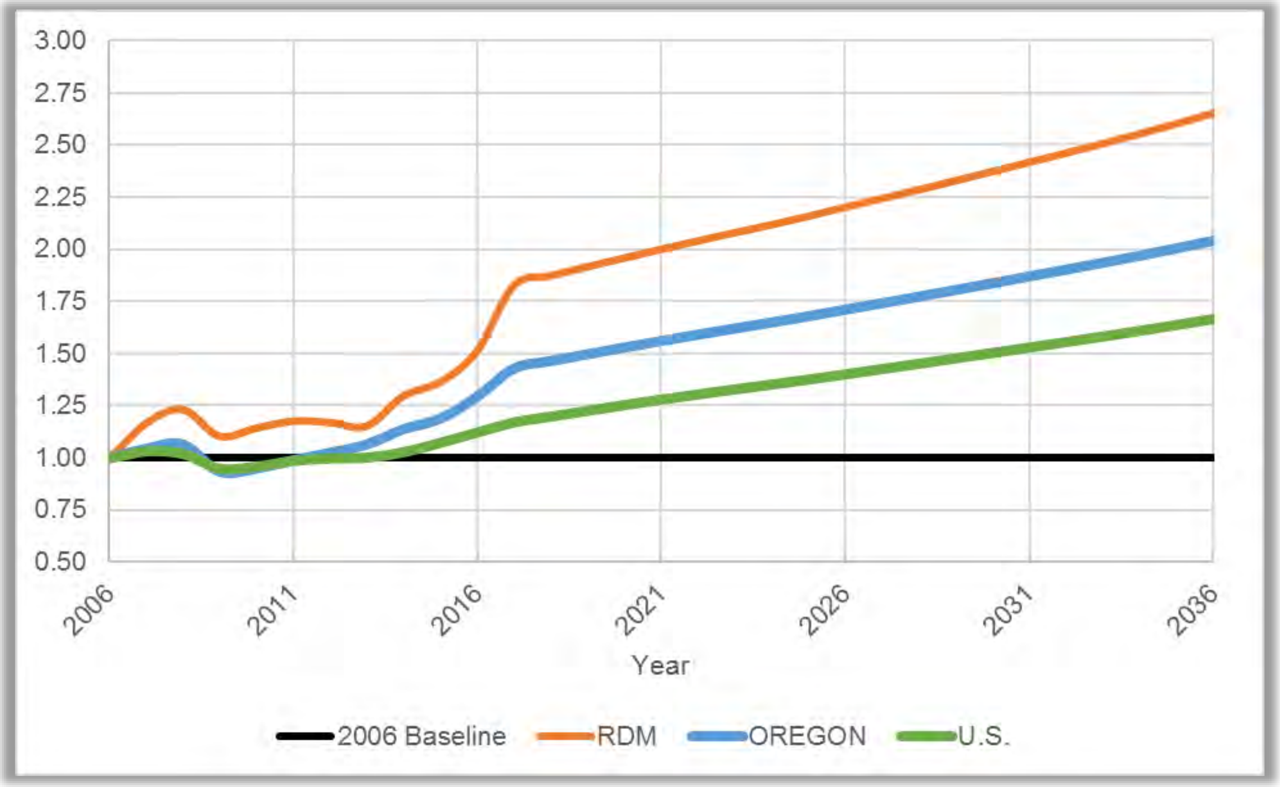
Fiscal Year	Air Carrier	Air Taxi/Commuter	Total	Percent Change
2006	1,427	195,796	197,223	
2007	9,262	220,711	230,033	16.6%
2008	13,886	229,311	243,197	5.7%
2009	26,618	191,208	217,826	-10.4%
2010	28,031	197,530	225,561	3.6%
2011	26,259	205,719	231,978	2.8%
2012	16,660	214,173	230,833	-0.5%
2013	430	226,980	227,410	-1.5%
2014	305	255,560	255,865	12.5%
2015	303	268,829	269,132	5.2%
2016	536	297,786	298,322	19.7%
CAGR	-9.3%	4.2%	4.2%	N/A

CAGR = Compound Annual Growth Rate.
Source: 2016 TAF. 2016 total is impacted by Airport closure in May.

As shown in **Figure 2-4**, growth at RDM exceeded growth experienced by the State of Oregon and the U.S. from 2006 to 2016. The State and the U.S. saw steeper declined during the recession than RDM. Growth at RDM since 2013 has been more pronounced. One reason for the periods of slower decline and more rapid growth over the past ten years is that the local economy has been adding jobs faster than the State and the nation, and the population of the MSA has been growing more quickly.

Forecasts, which come from the FAA TAF published January 2017, project that RDM will grow more quickly than the State and the U.S. through 2036. A key reason behind the higher growth rate is that RDM is an emerging market, whereas the State and the U.S. are mature markets, driven by the medium and large hub airports. PDX made up 88 percent of Oregon passenger enplanements, and medium and large hub airports made up 89 percent of U.S. enplanements in 2016. Hub airports tend to remain more stable than non-hubs, hence the lower historical and projected volatility. The RDM TAF is discussed in **Section 4.4**.

Figure 2-4: Passenger Enplanement Growth



Source: 2017 TAF

Airline operations are categorized as either *air carrier* or *air taxi*. Categorization is based on the seating capacity of an aircraft, regardless of which carrier is operating the aircraft. A seating capacity of 60 seats is the determining factor on how an aircraft is categorized. Aircraft such as 50-seat CRJ-200 with are considered air taxi, and aircraft such as the 76-seat Q400 are considered air carrier.

Total passenger airline operations at RDM have declined by an annual average of 2.2 percent from 2006 to 2016. The largest drop in operations was during the recession; however, total operations numbers have declined every year since except 2010, 2014 and 2016. The primary reason behind the decline in operations is the airline's transition of from *air taxi* aircraft to air carrier aircraft. The greater seating capacity offered by the air carrier aircraft has allowed the airlines to reduce flight frequencies while maintaining or increasing the number of available seats in the market. For example, Alaska cut their operations by a little less than half when they retired the 37-seat Bombardier Q200 in 2008; but they replaced these aircraft with 76-seat Bombardier Q400s, thereby offsetting the decline in operations and maintaining the number of seats available in the market.

Other airlines – American, Delta, and United, have been phasing out the 50-seat CRJ-200, an *air taxi* aircraft, in favor of larger regional jets, which are considered *air carrier* aircraft. These lager jets increase the number of seats available in the market, which has accommodated the growth in passenger enplanements. Passenger airline operations and average seats per departure are shown in **Table 2-14**.

Table 2-14: Passenger Airline Operations

Fiscal Year	Air Carrier	Air Taxi	Total	% Change	Avg. Seats per Departure
2006	360	14,368	14,728		39
2007	2,484	13,792	16,276	10.5%	46
2008	4,782	10,414	15,196	-6.6%	54
2009	5,204	6,360	11,564	-23.9%	67
2010	5,568	6,234	11,802	2.1%	70
2011	4,484	6,248	10,732	-9.1%	70
2012	4,376	6,344	10,720	-0.1%	79
2013	4,276	6,106	10,382	-3.2%	56
2014	5,138	6,440	11,578	11.5%	57
2015	5,292	4,428	9,720	-16.0%	64
2016	6,946	4,796	11,742	20.8%	64
CAGR	34.4%	-10.4%	-2.2%	N/A	N/A

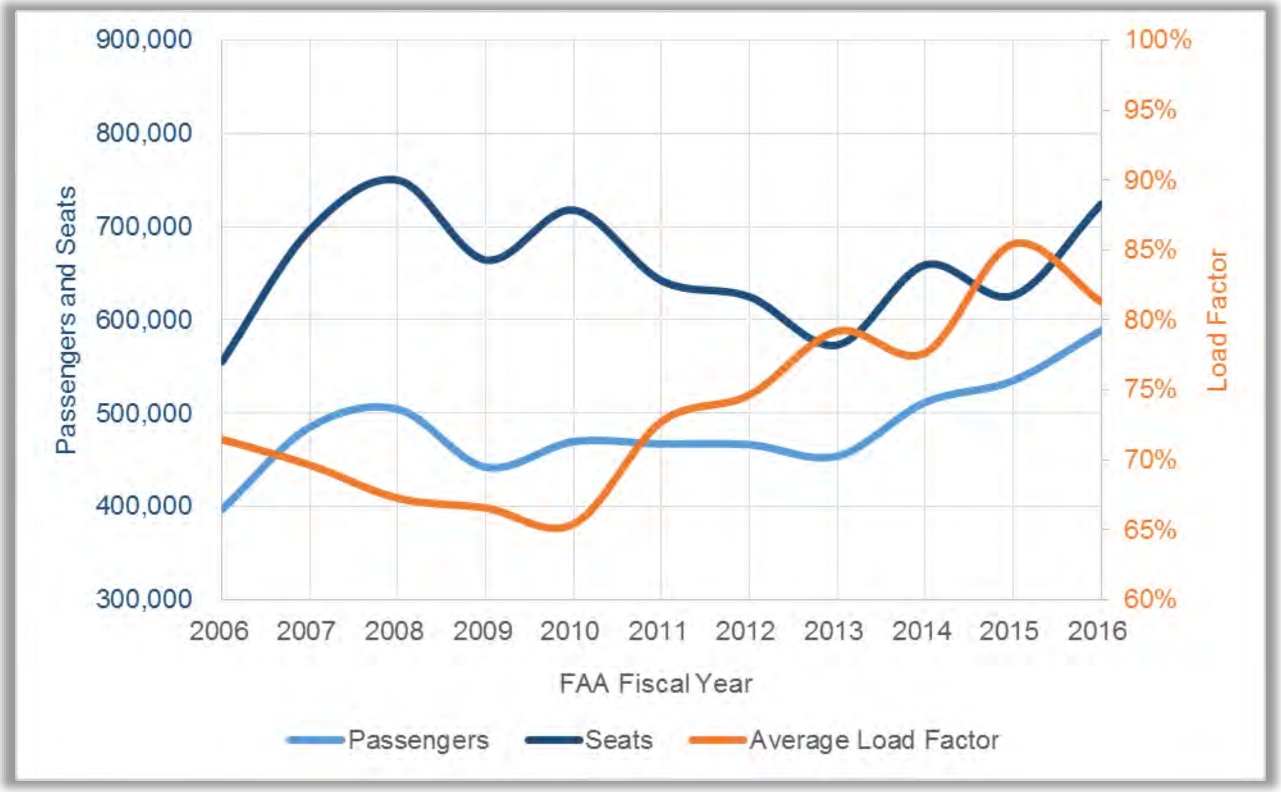
CAGR = Compound Annual Growth Rate.
Sources: 2006-2016 USDOT T-100 Database
Note: TAF and FAA OPSNET counts include Charter, Air Cargo and Forest Service Tanker. Numbers above are for scheduled passenger flights only.

SCHEDULED PASSENGER AIRLINE LOAD FACTOR

Load factor is one metric used by the airlines to assess route performance, and is calculated by dividing the number of passengers by the number of seats available. Available seats represent the supply, and passengers represent the demand. Load factor grows as demand and supply move closer together, and load factor declines when supply grows faster than demand. Airline capacity discipline, which is where airlines reduce seats to a market to increase load factor is evident at RDM from 2010 to 2013, as shown in **Figure 2-5**. The airlines reduced supply by 150,000 seats between 2010 and 2013. Passenger numbers declined by a tenth of this amount during the same period, and average load factor grew from 65 percent to 79 percent. The airlines have added capacity since 2013 and average load factor has remained high. A reason for this is that there is strong demand for air travel in the community, and available seats are being purchased.

The 2017 FAA Aerospace Forecast reports that the average domestic load factor for U.S. regional carriers was 80.1 percent in 2016 and RDM had a load factor of 80.1 percent. Performing at or above industry average helps the Airport market itself to the airlines. As shown in **Table 2-9**, the Airport retains 75 percent of local passengers, and the population and economy of the Redmond MSA are expected to grow. These factors suggest that if RDM is successful in attracting additional air service in the future, the demand will exist to sustain the routes at industry-average load factors.

Figure 2-5: RDM Passengers, Seats, and Average Load



Source: USDOT T-100. Data presented included passengers, seats, and load factors for both inbound and outbound travel.

SCHEDULED PASSENGER AIRLINE AVERAGE FARE AND AVERAGE YIELD

Airfares play an important role in traveler airport selection. Airfares affect an airport's ability to retain passengers, and an airline's desire to increase service to a market. One-way airfares (excluding taxes and PFC) paid by travelers are used to measure the relative fare competitiveness between the Airport and competing airports. **Table 2-15** shows the average airfares of RDM and competing airports for the top 25 destination from RDM.

Multiple factors dictate the price of average airfares: availability of seats, stage length, number of flights, and airline competition. The average one-way airfare for the Airport was $197, which is $32 higher than Portland ($165), and $19 higher than Eugene ($178). Part of Eugene's lower average airfare is due to the presence of Allegiant Airlines, which flies to Los Angeles, Las Vegas, Oakland, and Phoenix. Excluding Allegiant's impact in a few select markets at Eugene, the average one-way fare at RDM was lower than Eugene by $5. The Airport's fare was higher than Portland in every market compared in the analysis. The largest difference was to and from Denver, Chicago-O'Hare and Orlando at more than $70 one-way. When compared to Eugene, the Airport had lower airfares in six markets, including Seattle, San Francisco, Denver, Anchorage, Honolulu, and Atlanta.

Table 2-15 Average Domestic One-Way Fares

Rank	Destination	Average one-way fare			RDM Max ∆
		RDM	PDX	EUG	
1	Seattle, WA	$123	$109	$127	$14
2	Los Angeles, CA	$149	$109	$115	$40
3	San Francisco, CA	$178	$126	$200	$52
4	Portland, OR	$93	-	$81	$12
5	Phoenix, AZ (PHX)	$143	$141	$141	$2
6	Las Vegas, NV	$141	$104	$89	$52
7	San Diego, CA	$158	$122	$152	$36
8	Denver, CO	$208	$128	$211	$80
9	Orange County, CA	$143	$111	$133	$32
10	Chicago, IL (ORD)	$257	$180	$250	$77
11	Dallas, TX (DFW)	$226	$161	$212	$65
12	Anchorage, AK	$206	$167	$212	$39
13	Salt Lake City, UT	$195	$129	$176	$66
14	San Jose, CA	$144	$118	$119	$26
15	Kahului, HI	$272	$259	$270	$13
16	Boston, MA	$262	$228	$239	$34
17	Minneapolis, MN	$235	$202	$234	$33
18	Oakland, CA	$148	$117	$63	$85
19	Sacramento, CA	$168	$111	$161	$57
20	Ontario, CA	$157	$129	$145	$28
21	Newark, NJ	$310	$252	$271	$58
22	Honolulu, HI	$289	$232	$305	$57
23	Orlando, FL (MCO)	$274	$201	$259	$73
24	Spokane, WA	$134	$106	$131	$28
25	Atlanta, general aviation	$294	$253	$296	$41
Average domestic fare		**$197**	**$165**	**$178**	**$32**

Note: YE 2Q 2016; Fares do not include taxes or PFC.
Source: Diio Mi

The average yield, which is measured as revenue per mile flown, is 18.2 cents for RDM. This is 26 percent higher than the national average of 14.5 cents. When comparing the Airport to others in the FAA Northwest Mountain region, the Airport was 31 percent higher than the average of 13.9 cents. Airlines are for-profit businesses and look to add service to markets that produce high yields. Average yields for the airlines that service the Airport are below:

- ✓ Alaska Airlines: 19.2 cents, 44 percent higher than their U.S. average of 13.3 cents.
- ✓ American Airlines: 17.3 cents, 11 percent higher than their U.S. average of 15.6 cents.
- ✓ Delta Airlines: 18.1 cents, 9 percent higher than their U.S. average of 16.6 cents.
- ✓ United Airlines: 17.9 cents, 19 percent higher than their U.S. average of 15.0 cents.

SCHEDULED AIR CARGO

RDM scheduled air cargo volume (expressed in tons) has been highly volatile over the past ten years, with a five percent average annual decline from 2006 to 2016. Operations by dedicated cargo aircraft have declined proportionally, showing a general decline of 4.7 percent per year since 2006. The U.S. domestic cargo market has experienced an average decline of 0.5 percent per year during the same period. The 2017 FAA Aerospace Forecast states that U.S. air cargo has been in decline due to economic uncertainty, high fuel prices, additional security screening requirements, and "a shift from air to other modes (especially truck) […]." Looking forward, the FAA projects that national cargo decline has bottomed out, and will grow slowly into the future. The 2017 Aerospace Forecast states that "the shift from air to ground transportation has occurred."

The FAA Aerospace Forecast indicates that air cargo is strongly linked to grow of gross regional and domestic product. As shown in **Table 2-7**, The MSA GRP has grown by an average of 2.1 percent over the past ten years. The mismatch between local GRP growth and air cargo decline is likely explained by the proximity of RDM to Oregon's cargo hub in Portland. While 75 percent of passengers avoid the three-hour drive to Portland, packages can easily be trucked over the Cascade Mountains. USDOT T-100 data shows that air cargo volumes at PDX have grown by an average of 1.6 percent per year from 2011 to 2016, while RDM air cargo volumes fell by 0.1 percent per year over the same period. Air cargo operations and volumes are shown in **Table 2-16**.

Table 2-16 Cargo Airline Operations and Activity

Fiscal Year	Redmond			U.S. Domestic Market	
	Operations	Total Cargo (Tons)	% Change	Revenue Ton Miles (Millions)	% Change
2006	3,259	1,612.8		12,481	
2007	3,440	1,633.9	1.3%	12,940	3.7%
2008	3,026	1,269.9	-22.3%	12,261	-5.3%
2009	3,340	1,145.1	-9.8%	10,275	-16.2%
2010	3,633	1,087.8	-5.0%	11,243	9.4%
2011	3,252	976.4	-10.2%	10,601	-5.7%
2012	2,815	918.7	-5.9%	10,886	2.7%
2013	3,057	1,003.4	9.2%	10,996	1.0%
2014	1,949	1,035.2	3.2%	11,226	2.1%
2015	1,896	924.5	-10.7%	11,636	3.7%
2016	2,014	970.1	4.9%	11,851	1.8%
CAGR	-4.7%	-5.0%	N/A	-0.5%	N/A

CAGR = Compound Annual Growth Rate.
Sources: RDM: Airport Management and 2006-2016 USDOT T-100 Database; U.S.: FAA Aerospace Forecast 2017-2037

2.3.2 GENERAL AVIATION

General aviation describes flight activities that are not performed by passenger and cargo airlines, and the military. General aviation is broad in scope – activities include, but are not limited to, flight training, recreational flying, private and corporate air transportation, emergency response, and flight testing of new aircraft. This section describes general aviation businesses and activities at RDM.

GENERAL AVIATION BUSINESSES

General aviation businesses include those that offer services to the flying public (e.g. fixed base operators), those that design and construct aircraft, and companies that use aircraft as part of their business (e.g. aerial photography, sightseeing, and employee transport). Key general aviation businesses at RDM are described below.

- ✓ There are two fixed base operators at RDM. These businesses sell 100 Low-Lead (LL) and Jet A fuel, and offer aircraft maintenance, de-icing, aircraft detailing and cleaning, an avionics shop, covered aircraft storage, and a pilot's lounge.
- ✓ There are two aircraft manufacturers based at RDM: Evolution and Stratos. The Evolution facility specializes in final assembly and maintenance of single engine piston aircraft. Stratos is in the process of building and certifying a very light jet. Evolution is a spin-off company of aircraft manufacturer Lancair.
- ✓ There are corporate tenants, such as Les Schwab, that base their business jets at RDM. The aircraft are an integral part of business operations, allowing the companies to move employees around the country
- ✓ Flight training occurs at RDM, but the flight school formerly located at the Airport moved to the Bend Airport in 2008. Features of the Airport, such as the airport traffic control tower and the instrument landing system, are attractive to student pilots preparing to become professional pilots. Students from nearby airports fly to RDM to practice from time to time.

ITINERANT GENERAL AVIATION OPERATIONS

Itinerant operations originate and terminate at different airports. Operators include business travelers to the community, student pilots performing cross country training flights, and recreational pilots. Itinerant operations made up 39 percent of overall general aviation operations in 2016, and have been declining at an annual average rate of 6.8 percent since 2006. This decline is more pronounced at RDM than the national decline of two percent per year. Itinerant general aviation operations are shown in **Table 2-17**.

Table 2-17: Itinerant General Aviation Operations

Year	RDM Operations	% Change	National Operations	% Change
2006	22,170		18,707,000	-0.7%
2007	26,174	18.1%	18,575,000	-5.8%
2008	20,221	-22.7%	17,493,000	-11.0%
2009	16,014	-20.8%	15,571,000	-4.5%
2010	14,767	-7.8%	14,864,000	-2.3%
2011	13,610	-7.8%	14,528,000	0.0%
2012	14,709	8.1%	14,522,000	-2.8%
2013	13,414	-8.8%	14,117,000	-1.0%
2014	12,372	-7.8%	13,979,000	-0.7%
2015	11,551	-6.6%	13,887,000	0.1%
2016	10,985	-1.1%	13,903,000	-0.7%
CAGR	-6.8%	N/A	-2.9%	N/A

CAGR = Compound Annual Growth Rate. Source: FAA Terminal Area Forecast

The decline in itinerant operations is indicative of an industry that is adjusting to modern realities, rather than one that is declining across the board. The 2017 FAA Aerospace Forecast shows that in 2016, aircraft with piston engines made up 72 percent of the national general aviation fleet, and turbine aircraft made up the remaining 18 percent. Hours flown by piston aircraft have declined by an annual average of 1.4 percent since 2010, while hours flown by turbine (jet and turboprop) aircraft have grown by 1.9 percent per year. Similarly, the overall number of active piston aircraft has declined by an annual average of 1.7 percent while total turbine aircraft have grown by an annual average of 1.9 percent.

The general aviation market is readjusting to one with a more even distribution of piston and turbine aircraft, albeit slowly. With the dominant piston market in decline, overall operations will continue to drop; however, there is a growing segment within the itinerant general aviation market.

LOCAL GENERAL AVIATION OPERATIONS

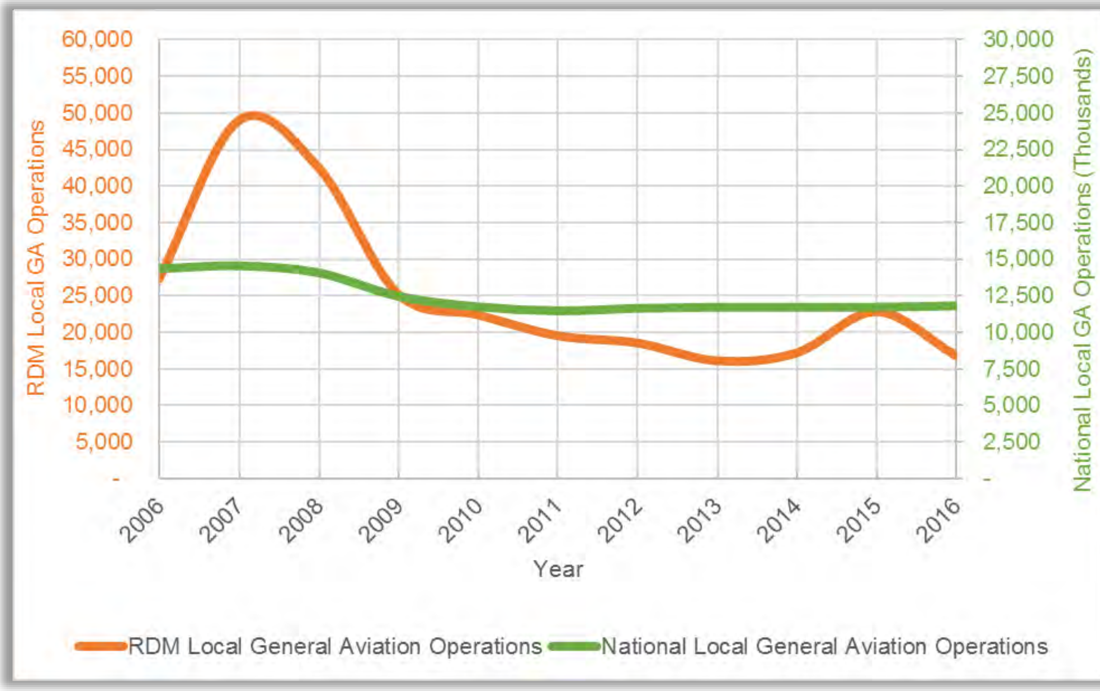
Local general aviation operations originate and terminate at the Airport, and are generally performed by pilots (both student and licensed) that are practicing landings. Local operations are highly sensitive to the level of flight training at an Airport. Touch-and-go landings, which is where the aircraft lands, slows, then accelerates and takes off without leaving the runway, count as two operations. An aircraft practicing touch and goes can perform upwards of six operations in an hour, depending on how busy the traffic pattern is. The flight school, located at RDM from 2007 to 2009 increased local aircraft operations by 79 percent in the first year. Local general aviation operations at RDM and nationally are shown in **Table 2-18**.

The largest decline in local general aviation operations was caused by the departure of the flight school in 2009. Despite the relocation of the school, the Airport still sees student pilots who come from flight schools in Prineville and Bend to practice touch-and-goes in controlled airspace, and to practice using the instrument landing system. The region is attractive for student pilots in the Pacific Northwest because it has more sunshine than areas to the west of the Cascades mountain range.

Nationally, local general aviation operations declined after the recession and have remained essentially flat since 2010. A 2016 Current Market Outlook, produced by aircraft manufacturer Boeing, projects that North America will need 112,000 new pilots between 2016 and 2035. The 2017 FAA Aerospace Forecast projects that student pilots will grow steadily at 0.4 percent per year through 2037, and those entering flight training will primarily do so to earn a sport pilot license (for recreational purposes), or an airline transport pilot (ATP) license (for professional purposes). FAA projections through 2037 have sport pilot license holders growing at 4.1 percent per year and ATP license holders growing at 0.5 percent per year.

Table 2-18: Local General Aviation Operations

Year	RDM Operations	% Change	National Operations	% Change
2006	27,376		14,365,000	
2007	48,990	79.0%	14,557,000	1.3%
2008	42,519	-13.2%	14,081,000	-3.3%
2009	25,261	-40.6%	12,448,000	-11.6%
2010	22,416	-11.3%	11,716,000	-5.9%
2011	19,554	-12.8%	11,437,000	-2.4%
2012	18,565	-5.1%	11,608,000	1.5%
2013	16,124	-13.1%	11,688,000	0.7%
2014	17,213	6.8%	11,675,000	-0.1%
2015	22,854	32.8%	11,691,000	0.1%
2016	16,829	-23.0%	11,776,000	0.7%
CAGR	-4.7%	N/A	-2.0%	N/A



CAGR = Compound Annual Growth Rate. *Source: FAA Terminal Area Forecast, FAA Aerospace Forecast*

BASED AIRCRAFT

TERMINOLOGY

Single-Engine Piston (SEP): SEP have one piston-powered engine. These aircraft are generally smaller and are often used for flight training and recreational flying. SEP may be used for regional business trips. Depending on weight and operator certification, these aircraft generally require only one pilot.

Multi-Engine Piston (MEP): MEP have two or more engines and are typically larger than SEP. Multiple engines make the aircraft more capable, and require additional flight instruction beyond what is needed to operate an SEP. MEP are primarily used for flight training and business aviation. MEP may require two pilots, but many variants can be operated with one.

Jet: Jet aircraft are characterized for having a turbine engine instead of a piston engine. These aircraft may have turbojets, or a turboprop. Jet aircraft range in size from small four-passenger business jets to the largest airliners. They can generally fly faster and at higher altitudes than SEP and MEP, making them better suited for business travel and emergency response. It is less common, but not unheard of, to see a jet used for recreational flying and flight instruction. Some smaller civilian jets can operate with a single pilot; however, most civilian jet aircraft require two.

Helicopter: Helicopters are characterized by having a rotor mounted above the cabin for lift and propulsion. Helicopters are commonly used for flight training, by law enforcement and emergency response, and by aerial businesses such as pipeline inspection, forestry, and aerial agriculture. Helicopters can be piston or turbine powered, and depending on the complexity of the model, can be operated by one pilot or two.

Other: The category of "Other" includes experimental, sport, glider, and ultralight aircraft. These aircraft are used for recreational flying.

- ✓ Experimental aircraft refer to kit airplanes that are built by users, or third-parties besides the original manufacturer. Experimental aircraft share many characteristics with SEP – the key differentiator is how and where the aircraft is assembled.
- ✓ Sport aircraft are airplanes that have a specific weight and maximum speed in level flight. Sport aircraft require less training and a less strict medical certificate to pilot the aircraft.
- ✓ Gliders are unpowered aircraft that are towed into flight, and use thermal uplift to sustain altitude.
- ✓ Ultralight aircraft weigh less than 155 and do not require the pilot operating the aircraft to have a private pilot's license or medical certificate.

Based aircraft are those that use a hangar and are stored at the Airport. Based aircraft do not include visiting, or itinerant aircraft. The FAA breaks down based aircraft into different categories based on an aircraft's propulsion system, engine configuration, and weight. As of 2016, there are 64 SEP aircraft at the Airport, making up 80 percent of the total based fleet. There are six jets, four MEP aircraft, and six helicopters. There were no "Other" aircraft are based at the Airport from 2006 to 2016. **Table 2-19** shows based aircraft records from 2006 to 2026. The airport's counts for 2016 differ than TAF records for the same year. It is expected that the TAF will be updated with the most recent available information following FAA approval of the forecasts.

Table 2-19: Based Aircraft Fleet

Year	SEP	MEP	Jet	Helicopter	Other	Total	% Change
2006	92	31	3	3	0	129	
2007	92	31	3	3	0	129	0.0%
2008	93	44	4	5	0	146	13.2%
2009	96	23	3	3	0	125	-14.4%
2010	93	14	5	6	0	118	-5.6%
2011	61	5	4	5	0	75	-36.4%
2012	61	5	4	5	0	75	0.0%
2013	64	14	5	8	0	91	21.3%
2014	62	9	3	9	0	83	-8.8%
2015	63	9	3	9	0	83	1.2%
2016	64	4	6	6	0	80	-4.8%
CAGR	-3.6%	-18.5%	7.2%	7.2%	N/A	-4.7%	

CAGR = Compound Annual Growth Rate. *Source: FAA Terminal Area Forecast, FAA Aerospace Forecast*

Based aircraft at RDM have been decreasing since 2006. Factors contributing to declining numbers include the 2009 Recession, rising oil prices, the departure of the flight school, competition from area general aviation airports, growing costs associated with earning a private pilot's license, and growing cost of aircraft ownership. The 2008-2009 recession saw the largest drop in based aircraft, and there was a brief recovery in 2013. RDM hangars are currently at capacity and the Airport has a waiting list for aircraft storage. Uncovered apron space is available, but not desirable due to winter snow and ice.

The 2017 FAA Aerospace Forecast shows SEP and MEP aircraft have been retired and have not been replaced, with the combined fleet declining by 1.7 percent a year from 2010 to 2016. The national turbine fleet has grown by 1.3 percent per year, and the helicopter fleet has grown by one percent per year during this time.

2.3.3 MILITARY

There are no based military aircraft at RDM; however, military units occasionally visit to train and refuel. These operations are typically itinerant; however, some military aircraft perform touch-and-goes while in the area. Military aircraft are generally serviced by the FBO, although they occasionally park on the USFS apron. Unlike other aspects of aviation, military activity is driven by the needs of the U.S. Department of Defense, and does not fluctuate in line with market forces. The Department of Defense does not provide projections of future activity or airport use; therefore, military activity is forecasted to grow or decline like other variables in the forecast. For planning purposes, military activity is considered to remain constant throughout the forecast period. Historic military operations are shown in **Table 2-20**.

Figure 2-20: Military Operations

Fiscal Year	Itinerant	Local	Total	% Change
2006	366	240	606	
2007	306	336	642	5.9%
2008	312	303	615	-4.2%
2009	173	134	307	-50.1%
2010	221	300	521	69.7%
2011	224	96	320	-38.6%
2012	212	371	583	82.2%
2013	323	812	1,135	94.7%
2014	383	406	789	-30.5%
2015	241	214	455	-42.3%
2016	341	540	881	93.6%
CAGR	-0.7%	8.4%	3.8%	

Source: 2017 TAF

2.3.4 FAA TAF

The FAA TAF is the official FAA forecast for airports, and is prepared annually by FAA Headquarters for each airport in the FAA National Plan of Integrated Airport Systems. The TAF uses the FAA fiscal year (October to September). TAF data comes from the USDOT T-100 database, airport traffic control tower records, and FAA Form 5010, which airports submit annually to the FAA.

In *Forecast Process for the 2016 TAF*, the FAA states that passenger enplanement forecasts at airports like RDM are developed by looking at a 10 percent sample of passenger activity per quarter, and performing a “regression analysis using fares, regional demographics, and regional economic factors.” Commercial operations are based on USDOT T-100 data for city-pairs (e.g. routes airlines serve from RDM). General aviation activity is based on time-series analysis of past trends.

The FAA reviews forecasts prepared for the Master Plan by comparing them to the TAF. Forecasts that are within 10 percent of the TAF over the five-year period, and 15 percent within the ten-year period can be approved by the Airports District offices. Forecasts outside of these tolerances go to FAA Headquarters for review.

The TAF forecasts passenger enplanements, operations, and based aircraft. The TAF does not forecast operations by aircraft type, peak activity levels, critical aircraft, or air cargo. The TAF used for this forecast was published in January 2017. **Table 2-21** summarizes the TAF for the Airport.

Table 2-21: FAA TAF

Fiscal Year	2016	2021	2026	2031	2036	CAGR
Enplanements	**298,322**	**394,570**	**434,335**	**476,868**	**523,125**	2.8%
Operations	**40,162**	**41,531**	**43,004**	**44,644**	**46,398**	0.7%
Air Carrier	5,127	10,139	11,691	12,835	14,080	5.2%
Air Taxi	6,340	3,699	3,333	3,539	3,758	-2.6%
Itinerant GA	10,985	10,807	10,932	11,057	11,182	0.1%
Itinerant Military	341	341	341	341	341	0.0%
Local GA	16,829	16,005	16,167	16,332	16,497	-0.1%
Local Military	540	540	540	540	540	0.0%
Based Aircraft	**86**	**96**	**109**	**124**	**139**	2.4%
Single Engine Piston	65	75	88	103	118	3.0%
Jet	3	3	3	3	3	0.0%
Multi Engine Piston	9	9	9	9	9	0.0%
Helicopter	9	9	9	9	9	0.0%
Other	0	0	0	0	0	N/A

Other. – Light sport aircraft, gliders, experimental aircraft, ultralights
Source: 2017 TAF

While the TAF is generally a reliable source of information, most recent data tends to lag a year behind airport records. FAA fiscal year 2016 data is marked with an asterisk, meaning that it has not been finalized yet. The 2016 TAF data does not match airport management records in certain areas, shown in **Table 2-22**. Given that Airport Management has the best available data, this information is used to model future scenarios and not the TAF. TAF discrepancies for the main categories (Enplanements, Operations, and Based Aircraft) are within the 10 percent FAA tolerances.

Table 2-22: 2016 Airport Management Records and TAF Differences

Category	Airport Records	TAF	Difference	% Difference
Enplanements	**304,588**	**298,322**	**24,390**	**2.1%**
Operations	**44,015**	**40,162**	**3,853**	**9.6%**
Air Carrier	7,302	5,127	2,175	42.4%
Air Taxi	6,810	6,340	470	7.4%
Itinerant GA	11,426	10,985	440	4.0%
Local GA	17,596	16,829	767	4.6%
Based Aircraft	**80**	**86**	**-6**	**-7.0%**
SEP	64	65	-1	-1.5%
MEP	4	9	-5	-55.6%
Jet	6	3	3	100.0%
Helicopter	6	9	-3	-33.3%

Military operations and "other" based aircraft match TAF records. Sources: Airport records, TAF issued January 2017.

The TAF has exhibited a consistent underreporting of passenger enplanements when compared to Airport records.

Airport records for passengers and commercial operations are presented and compared to the TAF in **Appendix B, Attachment 4**.

2.4 SCHEDULED SERVICE FORECASTS

This section discusses the passenger enplanement forecasts, air cargo volume, and commercial operations. Each sub-section explains the methods used during analysis. Risk and uncertainty are addressed, and comparisons made with the FAA TAF.

2.4.1 PASSENGER ENPLANEMENTS

Use of passenger enplanement forecasts determines the facility requirements for the passenger terminal building and airport parking and street access. The TAF classifies passenger enplanements as Air Carrier and Air Taxi, depending on the role of the airline transporting them. This distinction is more important for keeping records rather than planning facilities; therefore, passenger enplanements are presented in aggregate. The types of aircraft used to transport the passengers are presented in **Section 7**.

METHODS

The passenger demand forecasts employed trend analysis, single-variable regression, and multi-variable regression methods to project passenger enplanements. Regression models used variables that displayed a high level of correlation (greater than 0.8) with passenger enplanements over the past ten years: MSA Population U.S. Gross Domestic Product (GDP), and MSA GRP.

The three variables were checked against passenger enplanements from 2006 to 2016 using regression analysis. The validity of each equation was measured using the R-squared technique, which describes how well the regression equation explains variability in the model. The closer the R-square value is to 1.00, the more confidence can be placed in the equation explaining the historical variability, and it not occurring by chance. **Table 2-23** shows the results of the correlation and regression analyses.

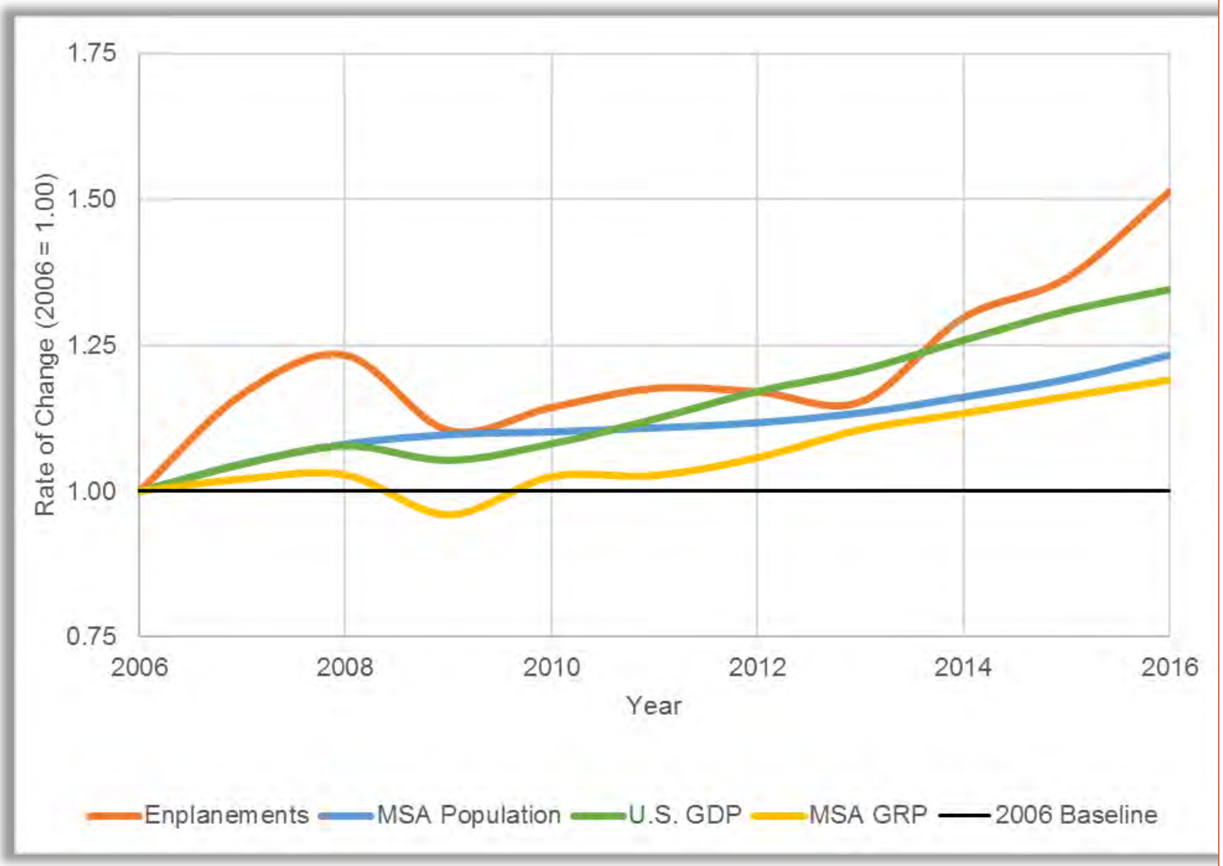
Table 2-23: Enplanement Correlation and Regression Analyses

Variable	Correlation Coefficient	Regression R-Square
MSA Population[1]	0.87	0.75
U.S. Gross Domestic Product[2]	0.84	0.71
MSA Gross Regional Product[3]	0.83	0.69
Sources: 1) Portland State University, 2) U.S. Bureau of Economic Analysis, 3) Woods & Poole		

The three variables were also arranged into multi-variable equations and run through a regression analysis. This time, the adjusted R-square statistic was used to assess the models as the adjusted R-square considers how many variables are being used. Unadjusted R-squared does not consider multiple variables and can produce misleading results. The results of the multi-variable regression analyses are shown in **Table 2-24.**

Table 2-24: Multi-Variable Regression Analyses

Variables	Adjusted R-Square
Population[1], GRP[3], GDP[2]	0.78
Population[1], GRP[3]	0.72
Population[1], GDP[2]	0.69
GRP[3], GDP[2]	0.65



GRP: MSA Gross Regional Product, GDP: U.S. Gross Domestic Product
Sources: 1) Portland State University, 2) U.S. Bureau of Economic Analysis, 3) Woods & Poole

Based on the results of the regression analyses, the equation accounting for population, GRP, and GDP was selected to prepare passenger enplanement forecasts. The equation is displayed below.

Passenger Enplanement Regression Equation: $y=m_1(x_1)+m_2(x_2)+m_3(x_3)+b$

y = Passenger Enplanements, b = Intercept from Regression Analysis

(4.52 x MSA Population) + (94.49 x MSA Gross Regional Product) + (-46.58 x U.S. Gross Domestic Product) - 730,835.51

Forecasts exist for the three variables considered throughout the forecast period. The MSA Population forecast comes from Portland State University, and is used by the City of Redmond for their long-range planning. The MSA Gross Regional Product Forecast comes from Woods & Poole, and the U.S. Gross Domestic Product Forecast comes from the Organization for Economic Cooperation and Development (OECD). The forecasts for each variable are plugged into the regression equation to produce a passenger enplanement forecast for the next 20 years.

The regression-based method of forecasting incorporates a statistical analysis to give confidence that the variables chosen for forecasting have exhibited a degree of correlation with passenger enplanements in the past. The risk to this method is that future forecasts are ultimately based on one set of external projections. Forecasting, particularly over 20 years, will undoubtedly miss future events that will impact aviation activity at RDM. For this reason, the passenger enplanement regression equation goes through one more level of processing to account for future uncertainty.

ADDRESSING RISK AND UNCERTAINTY

The forecasts developed in **Section 5.1.2** rely on a fixed set of future variables. There is only one projected value for U.S. GDP in 2021 that is considered. The risk to this approach is that if the GDP is different than the forecast in the coming years, then the regression equation developed based on the old forecast is likely no longer useful.

One way to mitigate for this uncertainty about the future value of variables that the passenger enplanement forecast is based on is to incorporate a range of uncertainty into the forecast for each variable. This is accomplished by reviewing the historical volatility of the three variables, and then assuming the future values may deviate from the forecast accordingly.

As an example, the U.S. GDP in 2021 will be $21 trillion dollars based on the OECD forecasts. Historical volatility shows that U.S. GDP could sway by plus or minus $3 trillion dollars, which means that the actual value for 2021 could be as low as $18 trillion (in an economic recession), or as high as $24 trillion (in a period of strong growth). Since the value of U.S. GDP is one of the drivers of the enplanement forecasts, it makes sense to account for this volatility in the future and not assume that the U.S. GDP is guaranteed to grow as it has exhibited contraction in the past. The method chosen to account for this volatility is known as Monte Carlo simulation.

Monte Carlo considers the range of future values for each of the three variables in each forecast year using the process described above for GDP. Historical volatility is applied to the forecast value, which produces a range that the forecast value is likely to be within. Once this range has been established for each variable, thousands of trials are run for each of the forecast years. The three variables are permitted to independently and randomly fluctuate within the defined range for each trial. In some trials the variables all grow, in some they all decline, and in some there’s a mix between growth and decline.

Monte Carlo partially mitigates subjectivity when it comes to setting up forecast scenarios. The range that the variables can fluctuate within must be defined, but after this range is established, the model will randomly pick the value of the variables. The Monte Carlo simulation can be run as many times as desired to reduce the impact of outliers (e.g. scenarios where all variables are at their maximums or minimums), and the results are interpreted using percentiles. Percentiles indicate what probability a value has of being higher or lower than the given value. For example, if the 50th percentile value for passenger enplanements in 2021 is 400,000, then this means that, of the thousands of trials run for 2021, 50 percent of the results were below 400,000, and 50 percent were above. Another way of expressing this is that there's a 50 percent probability that 2021 passenger enplanements will be 400,000 or below.

PASSENGER AND TAF COMPARISON

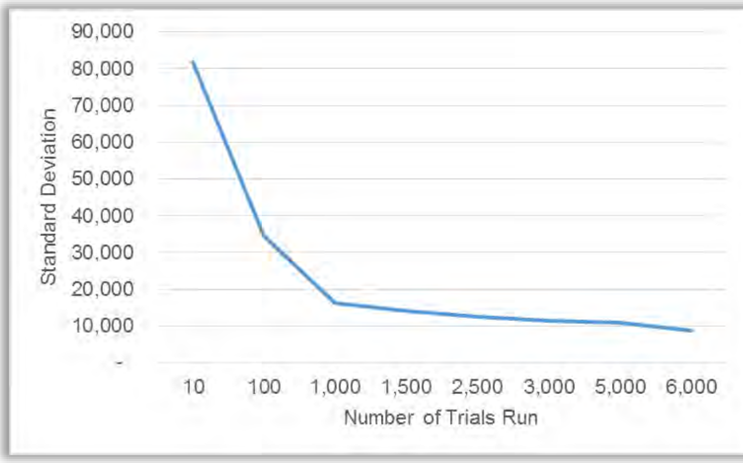
The passenger demand forecasts use the Monte Carlo simulation and the multi-variable regression model based on MSA population, MSA GRP, and U.S. GDP. The three variables are given a range based on historical volatility over the past ten years, which means they consider periods of economic recession and economic growth. The inclusion of local and national variables means that the model includes demand drivers, such as the population and economy driving the need for travel at RDM, and supply drivers, such as the national economy causing people to travel across the country and world.

The Monte Carlo simulation was run 5,000 times to reduce the effect of outliers. Multiple trial runs produce a smoothing effect as the results coalesce around the mean. The law of diminishing returns applies in this situation, and the results differ less and less beyond 1,000 trials. An example of this effect is shown in **Table 2-25**.

The average range of the Monte Carlo trial runs remains near 600,000 after 1,000 trials, and incremental growth slows as more trials are performed. Using this example, it is expected that fewer than 5,000 trials could be run and similar results would be produced; however, running 5,000 trials does not skew the results.

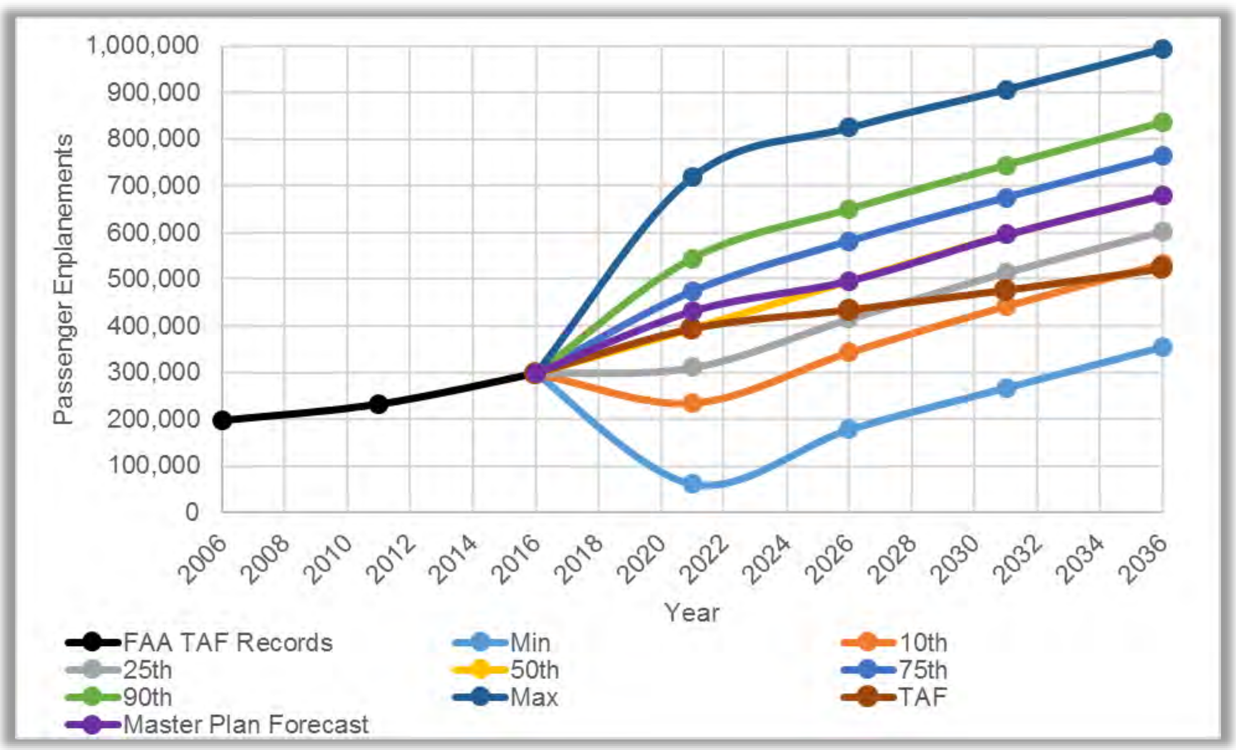
Table 2-25: Effect of Multiple Trials on Monte Carlo Range

Trials	Average Range	Standard Deviation
10	322,000	81,898
100	495,000	34,558
1,000	576,000	16,163
1,500	582,000	14,248
2,500	590,000	12,636
3,000	593,000	11,366
5,000	600,000	11,012
6,000	602,000	8,718



The 5,000 trials are presented using percentiles, minimums, and maximums. A percentile can be any number greater than zero and less than 100; however, presentation becomes less useful if too many percentiles are used. The RDM Enplanement Forecasts are presented for the minimum, 10th, 25th, 50th, 75th, 90th, and maximum percentiles. The results are plotted along with the 2017 TAF for purposes of comparison, and shown in **Figure 2-5**.

Figure 2-5: Passenger Enplanement Forecasts



As stated in **Section 5.1.2**, a key element in addressing risk and uncertainty in demand forecasting is acknowledging that the variable being forecast may decline. Traditional forecasting methods, such as trend analysis and time-series extrapolation, will not decline unless they are building on a model that has been in historical decline. Airport master plan forecasts tend to be more optimistic and project growth. The Monte Carlo analysis provides planners with a “decline” scenario, shown by the minimum, 10th, and 25th percentile results. There are also high-growth scenarios, represented by the maximum, 75th, and 90th percentile results.

The TAF for RDM has a CAGR of 2.8 percent and projects 523,125 enplanements by 2036. This growth rate exceeds the TAF for Oregon, which has a 2.3 percent CAGR, and the 2017 FAA Aerospace Forecast, which has a 1.7 percent CAGR. The higher than average growth rate for RDM reflects strong growth that has occurred over the past ten years, and shows that FAA expects this growth to continue. The passenger enplanement forecast growth rates range between 0.9 percent for the minimum forecast to 6.2 percent for the maximum forecast.

While Monte Carlo helps remove some elements of subjectivity from preparation of forecast scenarios, a decision must still be made on which percentile outputs to use for planning purposes. This decision is made by assembling relevant data that support picking one percentile over the others. TAF and FAA Aerospace Forecast growth rates are in line with the 2.9 percent CAGR of the 25th percentile forecast, while historical growth rates at RDM are between the 50th and 75th percentile forecasts.

Airlines have indicated that they will continue to add seats to the RDM market. Calendar year 2017 schedules from Alaska, American, Delta, and United show that larger aircraft will serve RDM, such as United’s transition from the 50-seat CRJ-200 to the 76-seat Embraer 175. Flight frequencies and destinations are planned to increase in 2017, such as Delta’s new Seattle service on the 50-seat CRJ-200 and 65-seat CRJ-700.

The True Market assessment, described in **Section 3.7**, shows that RDM retains 75 percent of its true market due to the distance between it and other airports in Oregon. Leakage is primarily to PDX, at 24 percent, and primarily on routes where RDM has limited or non-existent direct air service. These include Los Angeles (28 percent leakage) where RDM has one daily flight, Las Vegas (26 percent leakage) where RDM has no daily flights, and San Diego (27 percent) where RDM has no daily flights. As air service develops and airlines add frequencies and new service, it is expected that market retention will improve. Socioeconomic indicators for the MSA suggest that population and industry (measured by GRP) are expected to grow; therefore, the demand for air travel will continue to increase as these variables have been highly correlated in the past. The Airport actively markets to the airlines to attract additional air service, and has a track record of success with this marketing (new service on American Airlines to LAX and PHX and United adding larger aircraft and more frequencies to DEN and SFO).

Based on available information, historical performance, and known changes for the airlines operating at RDM, the 50th percentile forecast is preferred for long-range (5-20 years) passenger enplanement planning purposes. Due to recent passenger growth at the Airport, the short-range (1-5 year) forecast is expected to be between the 50th and 75th percentiles. The 4.2 percent CAGR is lower than the Airport has historically seen over the past ten years, which hints towards market maturation, but is higher than the national Aerospace Forecast and TAF for the state, which are driven by mature markets. The preferred enplanement forecast is compared to the 2017 TAF in **Table 2-26**.

Table 2-26: Passenger Enplanement Forecasts

Year	TAF	Forecast	Difference	
2016	298,322	298,322	0	0.0%
2021	394,570	431,978	37,408	9.5%
2026	434,335	496,750	62,415	14.4%
2031	476,868	595,800	118,932	24.9%
2036	523,125	680,750	157,625	30.1%
CAGR (16-36)	2.5%	3.7%		

CAGR = Compound Average Growth Rate
1) 2016 value for 2017 TAF updated to reflect airport records.

The passenger enplanement forecasts are reasonable and justified because they are based on variables (MSA population, MSA GRP, and U.S. GDP) that have exhibited a high degree of historical correlation with passenger enplanements. The population forecasts are the same as those used in local planning, meaning that stakeholders making municipal investment decisions at the cities in Deschutes County find them to be reasonable. While airlines are generally reluctant to share much of their long-range plans, what is known about future routes and fleet decisions support the growth in these forecasts. The use of Monte Carlo simulation in the forecasts allows for a sensitivity analysis of the forecasts should the MSA grow more quickly or less quickly than expected. The preferred passenger enplanement forecast is used to derive the scheduled commercial operations in **Section 5.3** and the peak enplanement numbers in **Section 7**.

2.4.2 AIR CARGO

Air cargo volume has declined at a CAGR five percent since 2006, which is a steeper decline than the national CAGR of -0.5 percent over the same period. The FAA Aerospace Forecast suggests that the decline in air cargo volume can be attributed to changing security requirements, use of truck carriers, and the advent of digital substitutes to documents and media that used to be shipped. Air cargo will remain critical for certain items and particularly important for communities like those in the MSA that are separated from other urban areas by great distances.

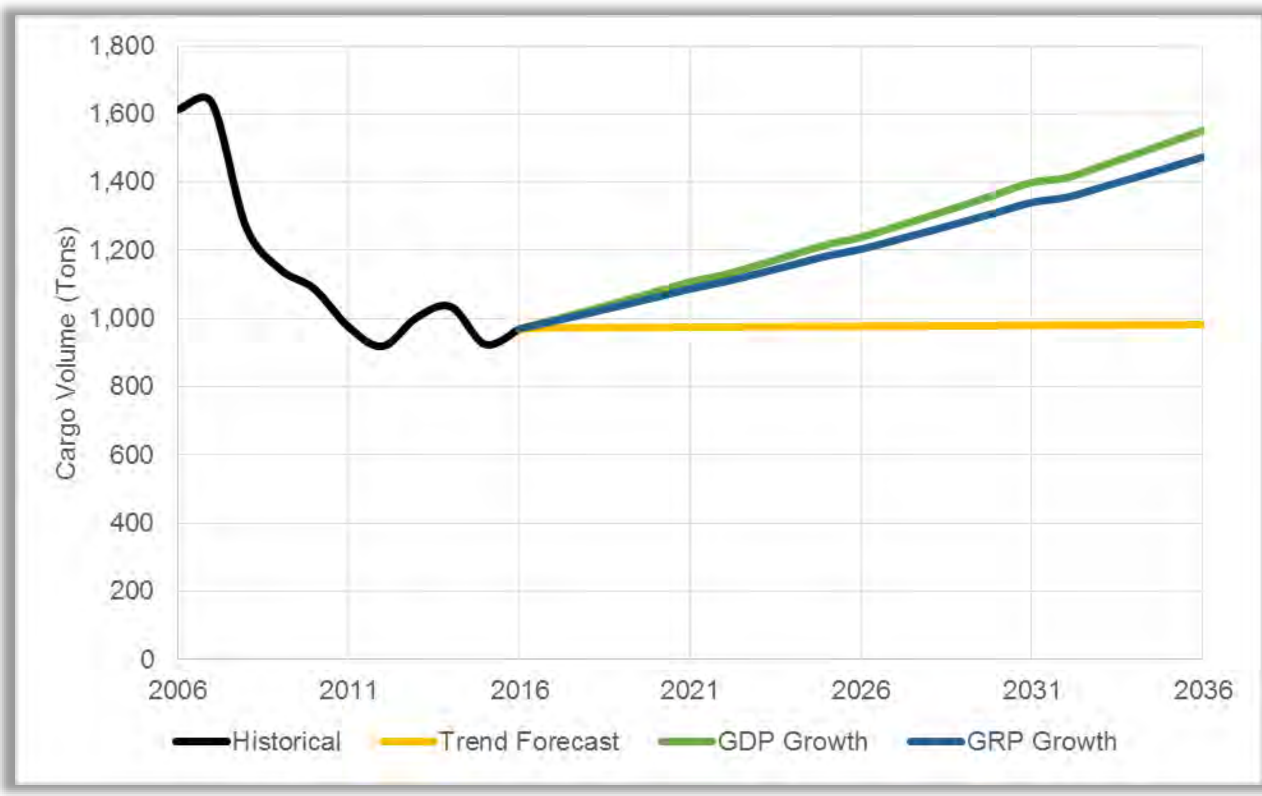
METHODS, FORECAST, AND PREFERRED METHOD

Air cargo at RDM did not exhibit strong historical correlation with any of the variables considered. In the absence of correlated data, the analysis considers variables typically used to forecast cargo volume. The FAA Aerospace Forecast is based on a model that links air cargo to U.S. GDP; therefore, GDP growth is included. MSA GRP is considered as it better reflects the local economy.

Regression analysis for both variables produces forecasts that continue the downward trend experienced since 2006. The FAA Aerospace Forecast suggests that "the shift from air to ground transportation has occurred;" therefore, the decline due to substitution of other methods has likely bottomed out. The decline in cargo volume at RDM was more pronounced from 2006 to 2011 at a CAGR of -9.5 percent than from 2011 to 2016, when the CAGR was -0.1 percent. It is expected that decline in air cargo at RDM has also stabilized.

The three methods considered for air cargo forecast are a trend analysis using 2011 to 2016 data, a time-series analysis using U.S. GDP growth, and a time-series analysis using MSA GRP growth. These methods are presented in **Exhibit 2-6.**

Figure 2-6: Air Cargo Forecasts



The trend methodology has a CAGR of 0.3 percent and projects that air cargo volumes will remain flat, growing from 970 tons to 1,000 tons annually. The GRP growth methodology has a CAGR of 2.1 percent and projects that air cargo volumes will grow from 970 tons to 1,474 tons annually. The GDP growth methodology has a CAGR of 2.4 percent and projects that air cargo volumes will grow from 970 tons to 1,552 tons annually.

As stated in **Section 3.2**, the economy of the MSA is changing and manufacturing is not as prevalent as it once was; however, there are several specialized manufacturers in town, including RDD, Stratos Aircraft, and PCC Structurals. It is expected that these businesses, and those like them, will continue to rely on air cargo for part of their supply chain in addition to rail and truck transport. The growing professional services industry will further support air cargo; however, many items traditionally shipped by lawyers, accountants, and engineers can now be transmitted digitally. It is expected that the volume of air cargo at RDM will remain flat unless the area attracts new manufacturers that are more reliant on just-in-time supply chains, and industries that specialize in logistics and storage outside of those that use truck and rail.

The trend methodology is the preferred air cargo forecast. It is expected that cargo volumes have bottomed out and will remain stable at around 1,000 tons per year into the future. Air cargo operations are expected to remain consistent throughout the forecast period, and will primarily be performed by single- and twin-engine piston and turbo-prop aircraft.

2.4.3 COMMERCIAL OPERATIONS

Commercial operations are those performed by scheduled and charter passenger airlines and cargo aircraft. Operations by business jets that use the FBO and private hangars are not counted towards the commercial operations total, and are instead part of general aviation discussed in **Section 6**.

METHODS

Scheduled passenger and air cargo operations made up 97 percent of the 13,248 commercial operations in 2016, and the remaining three percent were performed by on-demand charter airlines and tankers working for the U.S. Forest Service. Scheduled operations are based on passenger enplanement forecasts in **Section 5.1** and cargo forecasts in **Section 5.2**. Tanker and on-demand operations are expected to remain at their existing levels and growth is expected to be flat into the future. The USFS Redmond Air Center manager indicated that the level of operations will depend on the severity of the fire season, and airport landing records show that there were an average of 550 operations per year from 2006 to 2016.

Scheduled operations are organized based on TAF classifications. The two categories are air carrier, where the aircraft has 60 or more seats, and air taxi/commuter, where the aircraft has less than 60 seats. Forecasts are based on the following assumptions:

- ✓ Scheduled airlines will add service to meet the level of demand expected in the passenger enplanement forecasts.
- ✓ The 50-seat regional jets will be retired by 2026, in line with the FAA Aerospace Forecast projection that "Carriers remove 50 seat regional jets [...] while adding 70-90 seat jets, especially the E-2 family after 2020."
- ✓ As smaller jets are replaced with larger aircraft, average seats per departure will grow. Airlines will adjust flight frequencies and routes to keep load factors at levels similar to what has been experienced in the last five years, more than 80 percent.

The scheduled commercial operations forecasts are presented in **Section 5.3.2**.

SUMMARY AND TAF COMPARISON

Commercial operations are presented in three tables. **Table 2-27** presents scheduled passenger operations only, and does not include air cargo, non-scheduled passenger, and air tanker operations. **Table 2-28** presents total commercial operations, and the **Table 2-29** compares commercial operations to the TAF.

Table 2-27: Scheduled Passenger Operations

Year	Enplanements	Air Carrier			Air Taxi / Commuter			Total Scheduled
			Average			Average		
		Operations	Load Factor	Seats	Operations	Load Factor	Seats	Operations
2006	197,223	360	58%	82	14,368	70%	38	14,728
2011	231,978	4,464	56%	104	6,248	72%	45	10,732
2016	298,322	6,946	84%	74	4,796	90%	50	11,742
2021	391,450	10,000	85%	80	2,000	90%	50	12,000
2026	484,300	11,600	88%	90	1,000	91%	50	12,600
2031	575,350	12,400	86%	108	0	N/A	N/A	12,400
2036	661,600	12,600	84%	125	0	N/A	N/A	12,600
CAGR[1]	4.2%	3.3%	N/A	N/A	-100%	N/A	N/A	0.7%

NOTE – Numbers presented in this table will not match TAF as they contain scheduled passenger operations only, and not charter or air cargo.
1) CAGR from 2016 to 2036 CAGR = Compound Average Growth Rate
Source: USDOT T-100 Database and Airport Records

Table 2-28: Commercial Operations Forecasts

Year	Air Carrier				Air Taxi / Commuter			
	Scheduled Passenger	Non-Scheduled Passenger	Tanker	Sub-Total	Scheduled Passenger	Air Cargo	Sub-Total	Total
2006	209	52	626	887	14,455	3,313	17,768	18,655
2011	4,542	8	514	5,064	6,283	3,333	9,616	14,680
2016	6,254	21	422	6,697	4,522	1,929	6,451	13,148
2021	10,000	40	500	10,540	2,000	2,100	4,100	14,640
2026	11,600	40	500	12,140	1,000	2,100	3,100	15,240
2031	12,400	40	500	12,940	0	2,100	2,100	15,040
2036	12,600	40	500	13,140	0	2,100	2,100	15,240
CAGR[1]	3.6%	3.3%	0.9%	3.4%	-100%	0.4%	-5.5%	0.7%

1) CAGR from 2016 to 2036
CAGR = Compound Average Growth Rate
Source: Historical data comes from airport records, included in **Appendix B** as **Attachment 4**.

Table 2-29: Commercial Operations Forecasts – TAF Comparison

Year	2017 TAF	Forecast	Difference	
2021	13,838	14,640	802	5.8%
2026	15,024	15,240	216	1.4%
2031	16,374	15,040	-1,334	-8.1%
2036	17,838	15,240	-2,598	-14.6%
CAGR[1]	2.2%	0.4%	N/A	N/A

CAGR = Compound Average Growth Rate 1) CAGR for 2016 to 2036
Source: TAF issued January 2017

As with passenger enplanements, the TAF underreports commercial operations. One reason for this is that the ATCT is closed for the earliest and latest operations; therefore, they are not added to FAA OPSNET. Airport records and T-100 data are a more accurate count of operations than the TAF.

2.5 GENERAL AVIATION FORECASTS

General aviation forecasts consider itinerant and local operations, and based aircraft. General aviation covers the aspects of terrestrial flight that are not commercial or military, such as recreational flying, business aviation, flight instruction, and emergency services. General aviation forecasts address itinerant and local aircraft operations, and the number of based aircraft at RDM.

2.5.1 ITINERANT GENERAL AVIATION OPERATION

Itinerant operations are those that begin and end flights at different airports. Itinerant operations are conducted by a wide array of aircraft, from single engine pistons to large private jets.

METHODS

Trends in itinerant general aviation are described in **Section 4.2.2**. Itinerant general aviation operations have exhibited a strong historical correlation with national itinerant general aviation operations (0.97), national local general aviation operations (0.94), and the national single engine fleet (0.86). Strong positive correlation is likely the result of the decline that these indicators have experienced over the past ten years.

RDM and national itinerant general aviation operations have been in decline over the past ten years; however, much of the decline occurred immediately following the 2008-2009 recession. The average annual decline for RDM was -6.4 percent from 2006 to 2016 and -3.4 percent from 2011 to 2016. That national decline slowed from -2.9 percent from 2006 to 2016 to -0.9 percent from 2011 to 2016. The 2017 FAA Aerospace Forecast projects that national itinerant general aviation operations will grow at an average annual rate of 0.3 percent over the next 20 years.

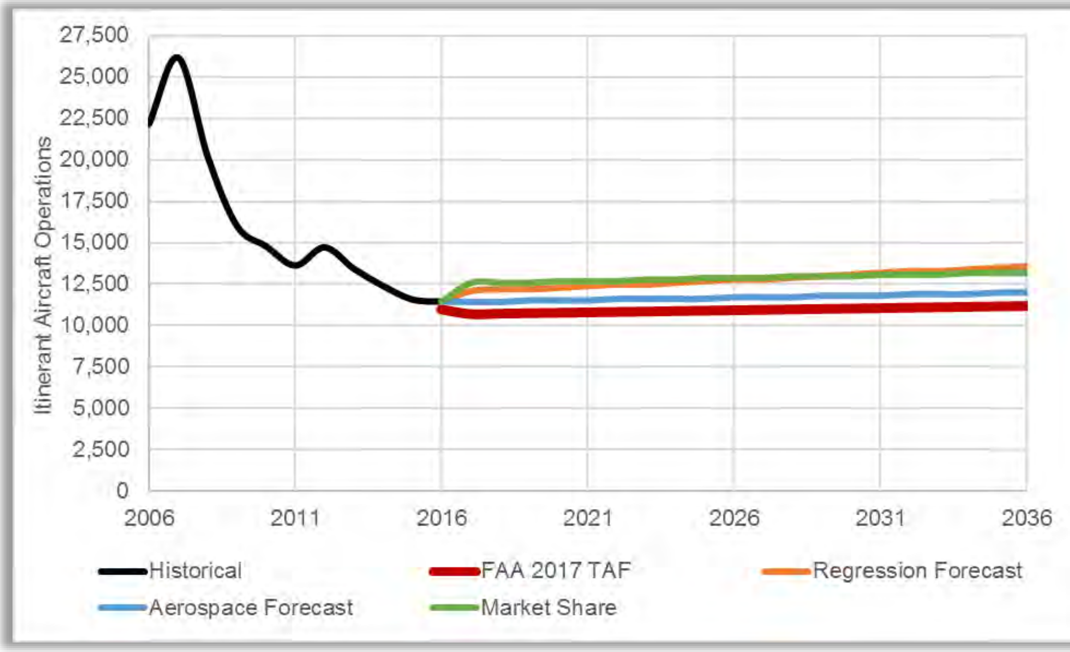
Statistical analysis is only part of the considerations taken into account when establishing a forecast. Local demand drivers, such as those listed below, influence itinerant general aviation traffic at RDM.

- ✓ General aviation businesses, such as those described in **Section 4.2.1**, perform itinerant operations as they move employees and products on their aircraft.
- ✓ Local aircraft manufacturers Stratos and Evolution Aircraft drive itinerant operations through testing and delivery of their aircraft.
- ✓ RDM is a destination market for outdoor recreation, such as golf, winter sports, and hiking. FBO staff indicate that some travelers fly general aviation when visitng the area. The FBO does not keep records on their passengers purposes for visiting the community.
- ✓ The Central Oregon Visitors Association reports that local ski resports have invested $800 million in development over past 10 years to compete with popular areas in other western states. FBO staff indicate that some winter visitors use GA to access the community; however, they do not keep records of who or how many.

Forecasts for itinerant general aviation operations use the following methods: applying the national growth rate from the 2017 Aerospace Forecast and a regression analysis using the top three correlated variables (national itinerant operations, national local operations, and national single engine fleet), using a market share analysis, ansd applying the FAA Aerospace Forecast growth rate. These forecasts are presented along side the 2017 TAF for purposes of comparison in **Table 2-30**.

Table 2-30: Itinerant General Aviation Operations Forecast

Year	Regression	Market Share	Aerospace	TAF
2016	11,426	11,426	11,426	10,985
2021	12,400	12,700	11,600	10,807
2026	12,800	12,900	11,700	10,932
2031	13,200	13,100	11,900	11,057
2036	13,600	13,200	12,100	11,182
CAGR	0.9%	0.7%	0.3%	0.1%



CAGR = Compound Annual Growth Rate. Source for Historical Data: FAA Terminal Area Forecast

PREFERRED AND TAF COMPARISON

There are two reasons that support itinerant operations retuning to growth at RDM: restructuring of the general aviation segments, and regional growth. Itinerant general aviation operations have experienced a period of restructuring following the 2008-2009 recession. As discussed in **Section 4.2.2**, the largest market within general aviation, single engine piston, is in a state of decline. Smaller markets, including turbine, experimental, and light sport are growing. RDM has the longest runway length in the region, which is necessary to accommodate larger jet aircraft, particularly on hot days. The FBO provides the services and facilities needed by these growing markets.

Despite the decline in itinerant operations at RDM over the past ten years, itinerant operations are growing in the Central Oregon region. Data from the TAF for the other airports in the region (Bend (BDN), Sunriver (S21), Madras (S33), and Prineville (S39)), show that the region experienced a six percent annual average growth in itinerant general aviation operations over the past ten years. Itinerant operations declined at RDM, S21, and S39 were offset by growth at BDN and S33. Total itinerant operations within the region more than doubled over the last ten years, as shown in **Table 2-31**.

Table 2-31: Regional Itinerant Operations

Fiscal Year	Bend (BDN)	Redmond (RDM)	Sunriver (S21)	Madras (S33)	Prineville (S39)	Total
2006	27,026	22,170	10,089	2,436	8,450	43,145
2011	49,041	13,610	3,000	4,669	7,000	77,320
2016	71,447	10,985	3,022	4,138	7,142	96,734
2021	80,626	10,807	3,132	4,693	7,847	107,105
2026	90,918	10,932	3,247	5,325	8,555	118,977
2031	102,526	11,057	3,363	6,034	9,314	132,294
2036	115,615	11,182	3,481	6,839	10,133	147,250
CAGR 06-16	6.1%	-4.8%	-11.4%	6.7%	-1.9%	6.0%
CAGR 16-36	2.4%	-0.1%	0.7%	2.5%	1.8%	2.1%

NOTE: Sisters (6K5) is part of RDM's catchment area, but is not part of the TAF. Operations numbers for 6K5 are unknown.
2016 numbers for RDM are adjusted to compensate for the Airport closure in May.
Source: FAA TAF.

Airport location and tenants are key drivers behind the regional growth. U.S. Census records for the City of Bend, where BDN is located, show that the population has grown by six percent from 2010 to 2015. The City is closer to the ski resorts than RDM is, and has facilities capable of serving piston and jet itinerant aircraft in all but the worst weather. The other key factor is tenants – both BDN and S39 have flight schools and the other airports do not. Student pilots perform itinerant operations as part of their training, which is helping drive the overall operations numbers.

Forecasts shown BDN operations continuing to grow, and total airport operations (including local) could reach 230,000 in the next 20 years. BDN has one runway which means that it will be near capacity in 20 years, based on guidance in FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*. As BDN approaches capacity, delays will increase, and the mix of quicker business jets and turbo props with slower fixed wing and helicopter flight training traffic will compound the congestion and delays. This can make BDN a less desirable for some users, and with RDM is 16 miles away, some traffic may choose to avoid the congestion.

The forecast methods considered produce similar results. The range between the lowest and the highest forecast in 2036 is 1,900. Key factors that influence selecting the higher forecast as preferred are described below.

- ✓ The MSA continues to grow, and development pressure in the City of Bend is pushing development in Deschutes County to other communities, such as RDM. As stated in Section 3.6, general aviation users tend to use facilities near their home or business when possible.
- ✓ The City of Redmond has more vacant industrial land with readily available infrastructure than other communities in the region. It is expected that there will be an increase in general aviation traffic from developers and prospective clients inspecting sites, and future tenants as this land develops.
- ✓ Aircraft manufacturer Stratos completed the first flight of its very light jet in November 2016. As the flight testing continues, additional traffic is expected.
- ✓ The FBO is planning to add additional hangars to grow their business, and to be able to accommodate more aircraft. RDM is attractive during the winter because of the instrument landing system; however, more covered aircraft storage is needed. If the FBO can develop more covered storage online, then itinerant operations will grow.

The preferred itinerant operations forecast is the one variable regression forecast, which is based on RDM performing in line with national itinerant general aviation operations. These two variables have exhibited strong historical correlation, and local demand inducing factors, described above, are expected to drive future itinerant general aviation operations. As shown in **Table 2-32**, the preferred itinerant general aviation operations forecast is within seven percent of the TAF in the five- and ten-year reporting periods.

Table 2-32: Itinerant General Aviation Operations Forecasts – TAF Comparison

Year	TAF	Forecast	Difference	
2016	10,985	10,985	0	0.0%
2021	10,807	12,600	1,793	7.3%
2026	10,932	13,000	2,068	7.0%
2031	11,057	13,500	2,443	7.6%
2036	11,182	14,000	2,818	8.2%
CAGR	0.1%	1.2%	N/A	N/A

CAGR = Compound Average Growth Rate
Source: TAF issued January 2017

2.5.2 LOCAL OPERATIONS

Local operations are those that remain in an airport's traffic pattern. These operations are generally by smaller aircraft such as single engine pistons, light sport, and experimental. Local operations are commonly performed by student pilots, recreational pilots, and pilots maintaining proficiency. Pilots flying in the traffic pattern generally land multiple times per hour, which causes high local operations numbers compared to itinerant operations.

METHODS

Local general aviation operations saw their peak in 2007 when there was a flight school at RDM. Operations declined substantially in the years that followed due to the recession, airline hiring freezes, and the relocation of the flight school to BDN. Historical factors that have influenced local general aviation operations are described in **Section 4.2.3**.

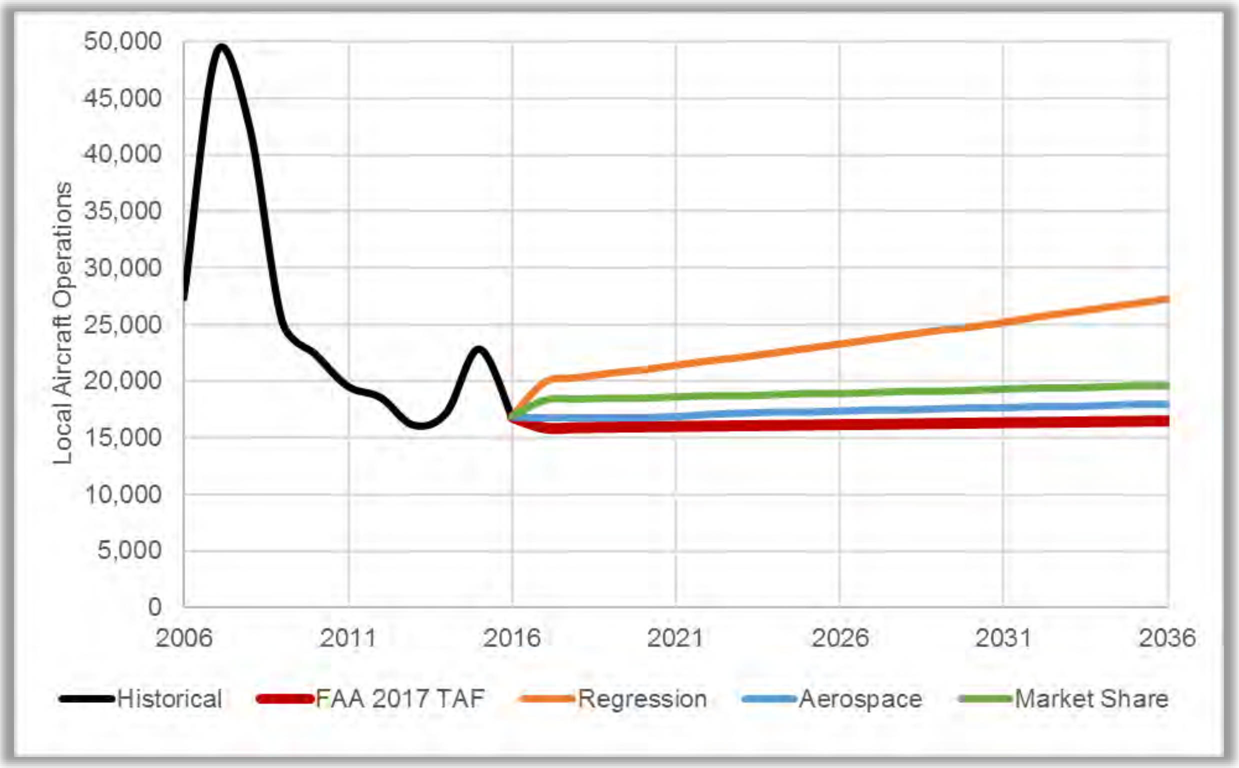
Local general aviation forecasts employ market share analysis, growth rate analysis, and regression analysis methods. The market share analysis takes the percent of national local operations that have occurred at RDM over the past five years (0.16 percent), and forecasts that future local operations will maintain this ratio to national operations based on the 2017 FAA Aerospace Forecast projections. The growth rate analysis takes the variable that showed the highest degree of historical correlation (national local general aviation operations), and used the growth rates in the 2017 FAA Aerospace forecasts to project future activity. Despite the similar independent variables in the market share and growth rate methods, the outcomes are different.

The regression analysis began with a correlation assessment, which found that local general aviation operations exhibited strong correlation with national local general aviation operations (0.87), national itinerant general aviation operations (0.83), and the national single-engine fleet (0.79). Other indicators did not have a strong enough correlation to be considered for analysis.

Local general aviation operations forecasts are shown in **Table 2-33**.

Table 2-33: Local General Aviation Operations Forecast

Year	Regression	Market Share	Aerospace	TAF
2016	16,829	16,829	16,829	16,829
2021	21,400	18,600	17,600	16,005
2026	23,300	18,900	18,200	16,167
2031	25,200	19,300	18,500	16,332
2036	27,300	19,600	18,900	16,497
CAGR	2.4%	0.9%	0.3%	-0.1%



CAGR = Compound Annual Growth Rate. *Source: FAA Terminal Area Forecast*

PREFERRED AND TAF COMPARISON

The TAF is forecasting a slight decline in local operations with a CAGR of -0.1 percent over the next 20 years. Given the historically higher levels of local operations activity and the demand for flight training over the next 20 years, it is unlikely that local general aviation operations will remain flat at RDM. The presence of flight schools in Prineville and Bend attract student pilots to the region, and the instrument landing system and airport traffic control tower at RDM are parts of the student's curriculum that are not found at other area airports. As noted in **Section 6.2.1**, the TAF for BDN suggests that the airport's single runway will near capacity over the next 20 years, which will displace some operations to other area airports. Regional local operations and expected growth at two percent per year, and are shown in **Table 2-34**.

Table 2-34: Regional Local General Aviation Operations						
Fiscal Year	Bend (BDN)	Redmond (RDM)	Sunriver (S21)	Madras (S33)	Prineville (S39)	Total
2006	40,000	27,376	6,799	7,754	2,112	84,041
2011	50,144	19,554	2,500	8,189	3,000	83,387
2016	72,040	16,829	2,518	6,144	3,062	100,593
2021	81,172	16,005	2,613	6,910	3,371	110,071
2026	91,396	16,167	2,712	7,777	3,681	121,733
2031	102,908	16,332	2,813	8,749	4,013	134,815
2036	115,868	16,497	2,916	9,846	4,371	149,498
CAGR 06-16	2.3%	-4.7%	-9.5%	0.5%	3.6%	-0.1%
CAGR 16-36	2.4%	-0.2%	0.7%	2.4%	1.8%	2.0%

NOTE: Sisters (6K5) is part of RDM's catchment area, but is not part of the TAF. Operations numbers for 6K5 are unknown.
Source: FAA TAF.

Regional local operations growth will be led by BDN and S33 at 2.4 percent per year, then S39 and S21. As stated in the FAA document *Forecast Process for the 2016 TAF,* GA operations are assessed based on past trends. The TAF for RDM is likely so low because of the -3.3 percent average annual drop in local operations that the Airport has seen over the past ten years. Given that the regional market is projecting a two percent average annual growth and BDN is nearing capacity, it is expected that RDM local general aviation operations will grow faster than TAF projections.

The preferred local operations forecast is the one based on the 2017 FAA Aerospace Forecast growth rate. This methodology projects that RDM will see growth in line with national demand. As flight training increases across the country, RDM will see local operations grow in kind. One point for consideration when projecting future local general aviation operations is the location of regional flight schools. Schools have expressed interest in moving to RDM; however, the Airport does not have space to accommodate them. Should the Airport attract a flight school by developing a site for aircraft storage and classrooms, then growth could occur in line with the regression forecast. As shown in **Table 2-35**, the preferred local general aviation operations forecast is within ten percent of the TAF at the five-year reporting period, and within fifteen percent of the TAF at the ten-year reporting period.

Table 2-35: Local General Aviation Operations Forecasts – TAF Comparison				
Year	2017 TAF	Forecast	Difference	
2016	16,829	16,829	0	0.0%
2021	16,005	17,600	1,595	10.0%
2026	16,167	18,200	2,033	12.6%
2031	16,332	18,500	2,168	13.3%
2036	16,497	18,900	2,403	14.6%
CAGR	-0.1%	0.4%	N/A	N/A

CAGR = Compound Average Growth Rate
Source: TAF issued January 2017

2.5.3 BASED AIRCRAFT

Based aircraft are those that are stored at the Airport, either in hangars or tie-downs. Scheduled commercial aircraft that visit the Airport routinely and U.S. Forest Service aircraft that are temporarily stored at the Airport during fire season do not count as based. Based aircraft forecasts are primarily used to define aircraft parking and storage needs.

METHODS

Historical trends and the composition of the based aircraft fleet at RDM are discussed in **Section 4.2.4**. Three methods are used to project the size and composition of the based aircraft fleet. The first is a growth rate analysis based on the change by aircraft category (e.g. SEP, MEP, and Jet) from 2011 to 2016. The second is a market share forecast that compares the number of based aircraft at RDM, by category, with the national fleet from 2011 to 2016. The third uses the growth rates for each category of aircraft in the 2017 FAA Aerospace Forecast to project future growth.

PREFERRED AND TAF COMPARISON

Based aircraft forecasts are done at the aircraft category level of detail – SEP growth rates are applied to SEP based aircraft, and jet growth rates are applied to jet aircraft. The 2017 FAA Aerospace Forecast shows that piston aircraft, the most common type at RDM, is expected to decline at -0.8 percent per year into the future. Growth markets include turbine, which are expected to grow at 1.9 percent per year, and helicopters, which are expected to grow at 1.6 percent per year, and Other, which are expected to grow at 1.2 percent per year. Each of the three forecast methods considers the impending change in general aviation fleet composition, and future projections expect that turbine, helicopter, and other aircraft will grow while piston aircraft decline.

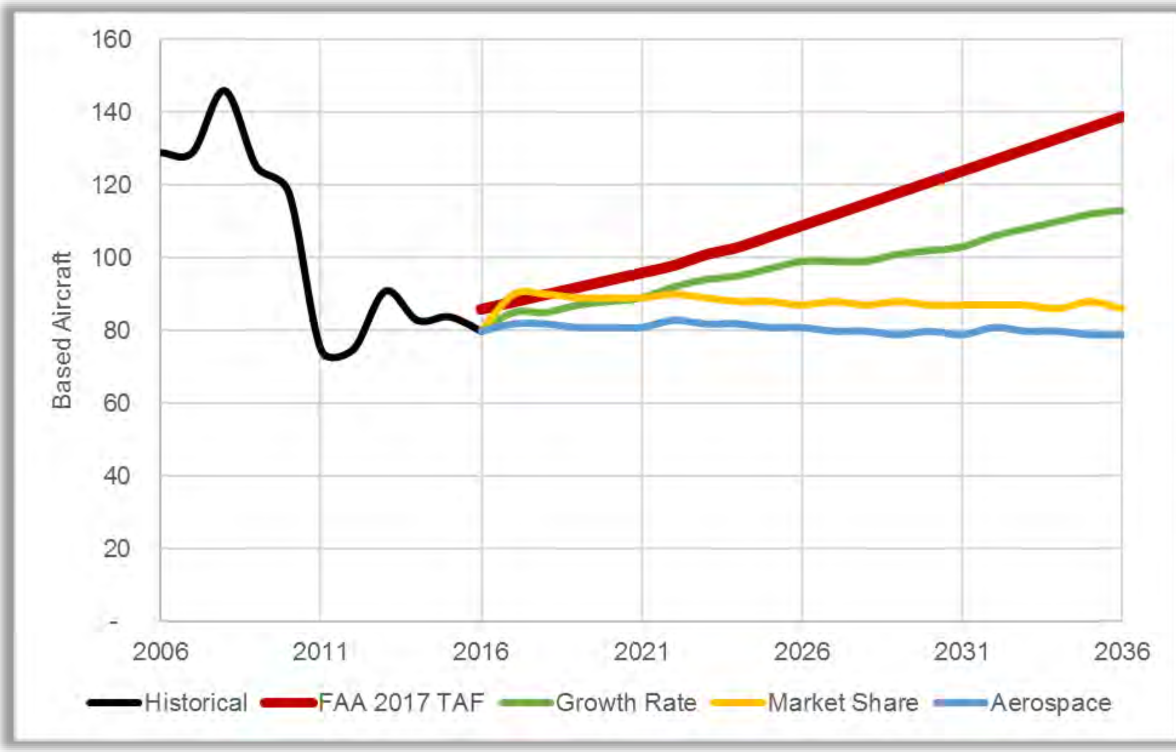
The Growth Rate forecast methodology projects 2.3 percent growth per year. In this methodology, MEP continue to decline, SEP remain stable, and other categories grow. The high growth markets of light sport and experimental aircraft, which were not based at RDM in 2016, are expected to arrive over the next 20 years as the types become more common and replace some of the retired SEP aircraft.

The market share forecast expects that SEP will decline, jet will remain level, and MEP, helicopter, and Other categories will grow. The MEP projection is likely thrown off because RDM had as many as 14 based MEP over the past five years. Since the market share forecast is based on an average market share over the last five years, it may be projecting higher MEP than appropriate.

The 2017 TAF for based aircraft at RDM is uncharacteristically high when compared to the TAF for local and itinerant general aviation operations. While the TAF expects that operations will largely remain flat, the number of aircraft is expected to grow by 2.4 percent per year. As stated in **Section 2**, the TAF based aircraft counts do not match airport management records. The TAF has 86 based aircraft at RDM in 2016 while airport management reports 80. Based aircraft forecasts are shown in **Table 2-36**.

Table 2-36: Based Aircraft Forecasts

Year	Growth Rate	Market Share	Aerospace	TAF
2016	80	80	80	86
2021	89	89	81	96
2026	99	87	81	109
2031	103	87	79	124
2036	113	86	79	139
CAGR	1.7%	0.4%	-0.1%	2.4%



CAGR = Compound Annual Growth Rate. *Source: FAA Terminal Area Forecast*

Based aircraft forecasts are ultimately determined by the amount of space available to park and store new planes. RDM hangars were full in 2016 and the Airport has a waiting list for new space. Although the Airport has held over 140 based aircraft in the past, many of these were parked outside and exposed to the elements. New aircraft have sensitive avionics and are more expensive than their older counterparts were. Aircraft owners prefer covered storage, particularly in climates like RDM where the summer sun and winter rain and snow can damage aircraft.

Airport management and tenants have expressed interest in expanding property for general aviation parking and storage. Location and scale of these improvements will be discussed in **Chapter 4**, Improvement Alternatives. Given that future aircraft storage will not always be constrained by a lack of hangars, that the Airport is in a growing community, and that there are growth markets within general aviation the local growth rate forecast is preferred. A breakdown of the local growth rate forecast by aircraft type is shown in **Table 2-37**.

Table 2-37: Preferred Based Aircraft Forecast

Year	SEP	MEP	Jet	Helicopter	Other	Total
2016	64	4	6	6	-	80
2021	67	3	9	7	3	89
2026	69	3	14	9	4	99
2031	67	2	20	10	4	103
2036	64	2	30	12	5	113
CAGR	0.0%	-3.4%	8.4%	3.5%	N/A	1.7%

SEP: Single Engine Piston
MEP: Multi Engine Piston

The preferred forecast projects strong growth in the number of jets, helicopters, and Other aircraft. The jet category includes both jet and turbo-prop aircraft. The market assessment in **Section 3.6** shows that RDM is the only airport in the region capable of handling large jets on a routine basis. It has the longest runway and only precision approach with a light land in the region, meaning that it offers year-round reliability. **Table 2-38** shows that the preferred forecast is within ten percent of the TAF in five years, and 15 percent of the TAF within ten years.

Table 2-38: Based Aircraft Forecasts – TAF Comparison

Year	2017 TAF	Forecast	Difference	
2016	86	80	-6	-7.0%
2021	96	89	-7	-7.3%
2026	109	99	-10	-9.2%
2031	124	103	-21	-16.9%
2036	139	113	-26	-18.7%
CAGR	2.4%	1.7%	N/A	N/A

CAGR = Compound Average Growth Rate
Source: TAF issued January 2017

2.6 PEAK FORECASTS AND CRITICAL AIRCRAFT

2.6.1 PEAK PERIOD FORECASTS

Peak forecasts estimate when certain airport facilities will be at their busiest. Peak forecasts are used to assess level of service of airfield and terminal facilities and to right-size improvement projects. Improvement projects are not typically designed for the busiest hour of the busiest day of the year because such a design would lead to over-building. Instead, peak forecasts look at a typical busy period throughout the year. Forecasts use historical records to project future peaking; therefore, it is essential that peak forecasts be reevaluated if a change in user or aircraft type occurs. **Table 2-39** presents the peak forecasts.

Table 2-39: Peak Period Forecasts

Category	Period	Factor	2016	2021	2026	2031	2036
Enplanements and Deplanements	Annual	100.0%	298,322	394,500	496,750	595,800	680,750
	Peak Month	10.1%	30,131	39,667	49,948	59,908	68,450
	Peak Day	3.6%	1,085	1,423	1,791	2,148	2,455
	Peak Hour – Enpl.[1]	17.9%	194	219	275	326	388
	Peak Hour – Depl.[1]	15.0%	163	175	252	345	472
Passengers	Annual	100.0%	596,644	789,000	993,500	1,191,600	1,361,500
	Peak Month	10.1%	60,261	79,334	99,897	119,816	136,899
	Peak Day	3.6%	2,169	2,845	3,583	4,297	4,910
	Peak Hour[1]	12.8%	278	393	525	703	940
Aircraft Operations	Annual	100%	40,162	45,540	47,240	47,840	48,940
	Peak Month	10.9%	4,378	4,982	5,168	5,234	5,354
	Peak Day	4.7%	206	233	242	245	251
	Peak Hour	10.0%	21	23	24	25	25

1) Peak hour forecasts adjusted to reflect average load factor, depicted in **Table 2-26**.
Peak Enplanements / Deplanements / Passengers: Month: FAA T-100 Database. Day and Hour: Airline Schedules
Peak Aircraft Operations: Peak Month and Day: FAA OPSNET, Peak Hour: ATCT Staff

2.6.2 CRITICAL AIRCRAFT

The critical aircraft is the most demanding type, or group of aircraft with similar characteristics, to operate more than 500 times per year at an airport. Operations by aircraft type come from Traffic Flow Management System Counts (TFMSC), and the data shows that scheduled commercial and freight aircraft are the critical aircraft at RDM. TFMSC only captures aircraft that file flight plans; therefore, flight training aircraft that operate more frequently than those listed below are not represented. Because flight training aircraft are smaller and slower than the critical aircraft shown, their absence from the TFMSC rankings has no bearing on the critical aircraft selection.

Critical aircraft are categorized by airport reference code (ARC), which is made up of the aircraft approach category (AAC) and airplane design group (ADG), as defined in **Chapter 1** and in the **Terminology** defined in **Section 2.0** of this chapter. The critical aircraft will be used to design and scale improvement projects and setbacks in **Chapter 3**, **Facility Requirements** and **Chapter 4, Improvement Alternatives. Table 2-40** identifies the critical aircraft.

Table 2-40: Existing Critical Aircraft

Rank	Aircraft	Role	Operations	Reference Code
1	Bombardier Q400	Passenger Airline	5,688	B-III
2	Bombardier CRJ-200	Passenger Airline	4,556	C-II
3	Beech Airliner 99	Cargo Airline	914	TBD
4	Cessna 208 Caravan	Cargo Airline	858	B-II
5	Bombardier CRJ-700	Passenger Airline	506	C-II

The existing critical aircraft is the Bombardier Q400, operated by Alaska Airlines. Alaska has announced that it will supplement its fleet of Q400 aircraft with the Embraer 175 regional jet (E175) (reference code C-III), which operates in the same 76-seat configuration as the Q400. Alaska route planning staff and the airport station manager expect that the Q400 will remain in the fleet for at least the next decade and will continue to connect RDM to Alaska hubs in Seattle and Portland. The California market is expected to transition to the E175 in the next five years, and if RDM sees new Alaska routes to California, they may be served by the E175.

As shown in **Table 2-26** in **Section 5.3**, the average seat capacity for air carrier aircraft at RDM is expected to grow from 74 seats in 2016 to 125 seats in 2036. The average will grow if larger narrow-body aircraft, such as the Boeing 737 and Airbus A320 lines, begin service at RDM. These aircraft are typically C-III aircraft apart from the Boeing 737-900, which is a D-III. Exact composition of the future fleet is unknown. What is known is that new Boeing 737 Max and Airbus A320-NEO aircraft will eventually replace existing narrow-bodies. These new aircraft are designed to be more fuel efficient and technologically advanced than their existing counterparts, and have similar physical characteristics. In terms of regional jets, SkyWest (which flies for Alaska, American, Delta, and United) has placed an order for the Mitsubishi Regional Jet (reference code C-III), which can have up to 90 seats. The Bombardier C-Series and second generation of Embraer E-Jets (reference code C-III) are also in early stages of production.

The future air carrier fleet mix will drive the critical aircraft for RDM in the future. Estimates are developed based on enplanement and commercial operations forecasts, aircraft seating capacity, and expected load factor. This estimate does not use aircraft classified as air taxi (less than 60 seats) as these aircraft are expected to be phased out by 2026. The future critical aircraft for Runway 5-23 will be the 737 and A319 (ARC of C-III), and the future critical aircraft for Runway 11-29 will be the Q400 (ARC of B-III). **Table 2-41** shows the projections for the future fleet mix.

Table 2-41: Future Air Carrier Operations by Aircraft Type						
Typical Aircraft	**Seats**	**ARC**	**2021**	**2026**	**2031**	**2036**
CRJ-200	<70	C-II	2,260	0	0	0
Q400/E175/CRJ-900	70-90	B-III/C-II/C-III	8,430	8,200	6,000	3,000
MRJ-90	90-110	C-II	56	1,600	2,000	2,400
737-700	110-130	C-III	286	500	2,000	1,800
A319 (Mainline)	130-150	C-III	204	600	1,000	3,600
A319 (Low Cost), 737-800	150-170	C-III	204	500	1,000	1,500
737-900	>170	D-III	40	200	400	300
Parameters: Based on airline order books and aircraft manufacturer production plans current as of April 2017. Operations growth provides sufficient seats to meet passenger enplanement forecasts at load factors >80%.						

2.7 FORECAST SUMMARY

The forecast summary is presented in **Figure 2-7** and **Figure 2-8**. Highlights of the forecast are below.

- ✓ RDM has experienced strong growth in scheduled airline service because of the migration to Central Oregon and growing tourism demand.
- ✓ RDM is the only commercial service airport in central Oregon and retains 75 percent of passengers in its catchment area. The Airport is equipped with an airport traffic control tower, an instrument landing system, two fixed base operators, and two runways that are both over 7,000 feet long. It is the best equipped airport in Central Oregon to handle commercial and business aviation.
- ✓ Population is expected to grow at 1.8 percent annually. Median age will increase as retirees and job seekers move the community. Working age population is more likely to travel by air than other population segments.
- ✓ The local economy is diversifying, adding jobs in healthcare, technical manufacturing and professional service industries. Tourism and hospitality will remain large employers.
- ✓ Passenger enplanement growth is expected to remain strong, driven by population growth and economic development in Deschutes County. Airlines achieve load factors near and above industry averages at RDM, which helps the Airport market the airlines to attract additional routes and frequencies.
- ✓ Airlines will continue to increase the average number of seats per departure. This will hold commercial operations steady, which the total number of seats offered increases. Air taxi aircraft (less than 60 seats) will exit the market within 10 years.
- ✓ Air cargo will remain level at 1,000 tons a year. Trucks, security screening requirements, and electronic mail substitutes hamper the need for more air cargo.
- ✓ Local and itinerant general aviation operations will remain flat; however, if nearby Bend Airport continues to approach capacity on its single runway, RDM may see an increase in general aviation operations.

- ✓ Flight schools have expressed interest in locating at RDM as they did in the past. If the Airport develops property to accommodate a flight school, general aviation activity will increase.
- ✓ Single-engine and multi-engine piston aircraft will be retired faster than they are replaced. Jet, turbo-prop, helicopter, light sport, and experimental aircraft are growing segments. Growth in based aircraft is largely dependent on the Airport or a private developer preparing a site for new hangars. Existing hangars are at capacity.
- ✓ The future ARCs for Runways 5-23 and 11-29 will remain the same. The critical aircraft for Runway 5-23 will be the Boeing 737 and Airbus A319 with ARCs of C-III. The critical aircraft for Runway 11-29 will be the Bombardier Q400 with an ARC of B-III.

Figure 2-7: Forecast / TAF Comparison

AIRPORT NAME: REDMOND MUNICIPAL AIRPORT

	Year	Airport Forecast	TAF	AF/TAF (% Difference)
Passenger Enplanements				
Base yr.	2016	298,322	298,322	0.0%
Base yr. + 5yrs.	2021	431,978	394,570	9.5%
Base yr. + 10yrs.	2026	496,750	434,335	14.4%
Base yr. + 15yrs.	2031	595,800	476,868	24.9%
Commercial Operations				
Base yr.	2016	11,467	11,467	0.0%
Base yr. + 5yrs.	2021	14,640	13,838	5.8%
Base yr. + 10yrs.	2026	14,240	15,024	-5.2%
Base yr. + 15yrs.	2031	15,040	16,374	-8.1%
Total Operations				
Base yr.	2016	40,162	40,162	0.0%
Base yr. + 5yrs.	2021	44,840	41,531	8.0%
Base yr. + 10yrs.	2026	45,440	43,004	5.7%
Base yr. + 15yrs.	2031	47,040	44,644	5.4%

NOTES: TAF data is on a U.S. Government fiscal year basis (October through September).

Figure 2-7: TAF Forecast Worksheet

AIRPORT NAME: REDMOND MUNICIPAL AIRPORT **Specify base year:** 2016

	Base Yr. Level	Base Yr. + 1yr.	Base Yr. + 5yrs.	Base Yr. + 10yrs.	Base Yr. + 15yrs.	Average Annual Compound Growth Rates: Base yr. to +1	Base yr. to +5	Base yr. to +10	Base yr. to +15
Passenger Enplanements									
Air Carrier	536	22,200	27,600	77,100	211,400	4041.8%	120.0%	64.4%	49.0%
Commuter	297,786	324,200	404,378	419,650	384,400	8.9%	6.3%	3.5%	1.7%
TOTAL	298,322	346,400	431,978	496,750	595,800	16.1%	7.7%	5.2%	4.7%
Operations									
Itinerant									
Air carrier	5,127	8,940	10,540	12,140	12,940	74.4%	15.5%	9.0%	6.4%
Commuter/air taxi	6,340	5,700	4,100	2,100	2,100	-10.1%	-8.3%	-10.5%	-7.1%
Total Commercial Operations	11,467	14,640	14,640	14,240	15,040	27.7%	5.0%	2.2%	1.8%
General aviation	10,985	12,100	12,500	13,000	13,500	10.2%	2.6%	1.7%	1.4%
Military	341	300	300	300	300	-12.0%	-2.5%	-1.3%	-0.9%
Local									
General aviation	16,829	16,800	16,900	17,400	17,700	-0.2%	0.1%	0.3%	0.3%
Military	540	500	500	500	500	-7.4%	-1.5%	-0.8%	-0.5%
TOTAL OPERATIONS	40,162	44,340	44,840	45,440	47,040	10.4%	2.2%	1.2%	1.1%
Instrument Operations	14,197	17,621	17,741	17,491	18,410	24.1%	4.6%	2.1%	1.7%
Peak Hour Operations	21	21	23	23	24	0.0%	1.8%	1.0%	0.9%
Cargo/mail (enplaned+deplaned tons)	970	1,000	1,000	1,000	1,000	3.1%	0.6%	0.3%	0.2%
Based Aircraft									
Single Engine (Nonjet)	64	65	67	69	67	1.6%	0.9%	0.8%	0.3%
Multi Engine (Nonjet)	4	4	3	3	2	0.0%	-5.6%	-2.8%	-4.5%
Jet Engine	6	7	9	14	20	16.7%	8.4%	8.8%	8.4%
Helicopter	6	6	7	9	10	0.0%	3.1%	4.1%	3.5%
Other	0	3	3	4	4	0.0%	0.0%	0.0%	0.0%
TOTAL	80	85	89	99	103	6.3%	2.2%	2.2%	1.7%

B. Operational Factors

	Base Yr. Level	Base Yr. + 1yr.	Base Yr. + 5yrs.	Base Yr. + 10yrs.	Base Yr. + 15yrs.
Average aircraft size (seats)					
Air carrier	74	76	85	102	110
Commuter	50	50	50	N/A	N/A
Average enplaning load factor					
Air carrier	80.5%	85.0%	91.0%	84.0%	87.5%
Commuter	86.3%	83.0%	90.0%	N/A	N/A
GA operations per based aircraft	348	340	330	307	303

3.0 FACILITY REQUIREMENTS

This Facility Requirements Chapter considers the availability and capability of facilities at the Redmond Municipal Airport (RDM or the Airport) to accommodate existing and projected aviation demand over the next 20 years.

3.1 INTRODUCTION TO FACILITY REQUIREMENTS

This chapter compares current and forecasted activity levels (presented in **Chapter 2 Aviation Forecasts**) to the Airport's operational capacity, design requirements, and facility needs. Options for meeting the identified facility needs will be analyzed in **Chapter 4 Alternatives Analysis**.

Facility requirements are presented in the following organizational structure:

- Airside Facility Requirements
  - Airfield Capacity
  - Airfield Design
  - Runway System
  - Taxiway System
  - General Aviation Facilities
- Landside Facility Requirements
  - Passenger Terminal Roadway
  - Passenger Terminal Parking Area
  - Rental Car Facilities
  - Non-aviation Revenue Development
- Terminal Area Facilities
  - Airport Activity
  - Passenger Terminal Building
  - Gate Capacity Requirements
  - Terminal Building Development
  - Conclusions and Recommendations
- Support Facilities
  - Fixed Base Operators
  - United States Forest Service

Airside Facilities:
Facilities that are accessible to aircraft, such as runways and taxiways.
Landside Facilities:
Facilities that support airside facilities, but are not part of the aircraft movement area, such as terminal buildings, hangars, aprons, access roads, and parking facilities.
Support Facilities:
Facilities that can be either airside or landside facilities that aid in the operation of the airport.

- Cargo Facilities
- Airport Support and Maintenance Facilities
- Conclusions and Recommendations

3.2 AIRSIDE FACILITY REQUIREMENTS

An early step in reviewing an airport's long-term needs is to assess capacity and delay issues because these concerns will influence the direction of airfield planning. An airport's annual capacity, known as the Annual Service Volume (ASV), is the number of flight operations an airfield can accommodate during a year. Existing and forecast annual demand is compared with the ASV to determine the percentage capacity at which the airport is operating and to gauge the timing of future airfield capacity improvements. As annual demand approaches ASV, average delays increase. A typical goal is to construct a new runway prior to time delays averaging 10 to 15 minutes per operation, and this requires the completion of planning, environmental, and design work before delays reach this threshold.

Airfield Capacity:
The maximum number of aircraft operations that a specific airfield configuration can accommodate within a specific time interval of continuous demand.

Annual Service Volume (ASV):
Used by the FAA as an indicator of relative operating capacity, ASV is an estimate of an airport's annual capacity that accounts for differences in runway use, aircraft mix, weather conditions, etc. encountered over a year's time. ASV assumes an acceptable level of aircraft delay as described in FAA Advisory Circular (AC) 150/5060-5, Airport Capacity and Delay.

3.2.1 AIRFIELD CAPACITY

The Airport's ASV and hourly capacity are calculated using the methodology the Federal Aviation Administration (FAA) documented in AC 150/5060-5 *Airport Capacity and Delay*. Calculation in this method requires the mix index and runway-use configuration. The mix index is an equation (C+3D) that determines the percentage of aircraft operations that have a Maximum Takeoff Weight (MTOW) over 12,500 pounds. C represents the percent of aircraft over 12,500 but under 300,000 pounds. D represents the percent of aircraft over 300,000 pounds. Finally, the runway-use configuration for RDM is number 9 for crossing runways, shown in **Figure 3-1**. **Table 3-1** shows the mix index for RDM.

Table 3-1: Mix Index	
Landings*	6,079
Operations (> 12.5k lbs.)**	13,148
General Aviation Operations (>12.5k lbs.)***	975
Total RDM 2016 Operations	40,162
C	35.2
D	0.00
Mix Index	35.2

Source: AC 150/5060-5
**Includes air carrier/air taxi/commuter/air tanker/air cargo for aircraft over 12,500 pounds*
***Operations = Landings x 2*
****GA Ops includes Flight Aware data for aircraft over 12,500 pounds.*

Figure 3-1 RUNWAY CONFIGURATION – CAPACITY AND DELAY AC 150/5060-5

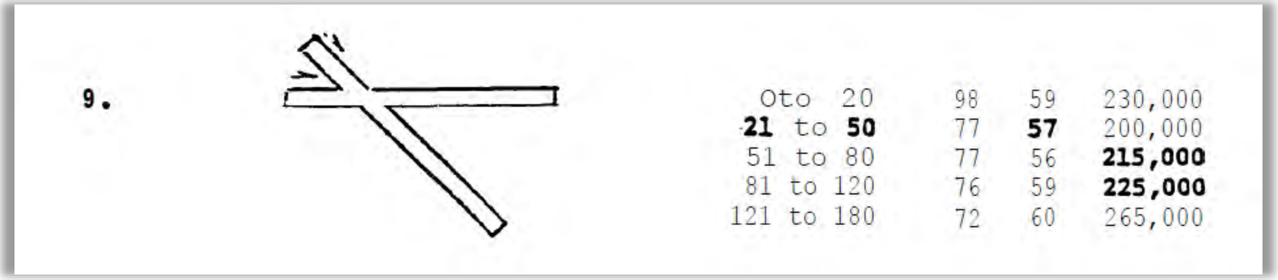


Table 3-2: ASV and Hourly Capacity				
Runway Use Configuration	Mix Index (C+3D)	Capacity (Operations/Hour)		Annual Service Volume (Operations/Year)
		VFR	IFR	
#9	0 to 20	98	59	230,000
	21 to 50	**77**	**57**	**200,000**
	51 to 80	77	56	215,000
	81 to 120	76	59	225,000
	121 to 180	72	60	265,000
Source: AC 150/5060-5				

Hourly capacity is split into visual flight rules (VFR) and instrument flight rules (IFR) capacity. **Table 3-2** above shows the hourly capacity and ASV for RDM.

Instrument Flight Rules (IFR) Operations:
Aircraft operations conducted by pilots with reference to instruments in the flight deck, with navigation accomplished by reference to electronic signals.

Visual Flight Rules (VFR) Operations:
Operations conducted by pilots with only visual reference to the ground, obstructions, and other aircraft.

AIRFIELD CAPACITY CONCLUSIONS AND RECOMMENDATIONS

The Airport is currently operating at 20 percent of its annual capacity, 27 percent of its VFR hourly capacity, and 36 percent of its IFR hourly capacity. As shown in **Chapter 2 Aviation Activity Forecasts**, the Airport is forecasted to handle 47,740 annual operations by 2036. The associated increases will not significantly change the capacity percentages. No major airfield changes will be required for airport capacity and delay purposes.

3.2.2 AIRFIELD DESIGN

The FAA's design standards, presented in a series of ACs, heavily influence design and construction of airside facilities. The primary AC that addresses airfield design is AC 150/5300-13A, Change 1, *Airport Design* (AC-13A). This section covers the specific design standards that apply to RDM. Additional information related to design standards can be found in **Chapter 1 Introduction**.

DESIGN STANDARDS CONCEPTS AND TERMINOLOGY

The FAA is responsible for the overall safety of civil aviation in the United States; therefore, FAA design standards are primarily driven by safety, with secondary goals including efficiency and utility also reflected in FAA standards and policy. Changes to improve safety and efficiency are constantly evolving as the aviation industry continues to develop, and the expectation is that design standards will continue to evolve alongside technologies and procedures.

CRITICAL AIRCRAFT

The initial step in airside facility planning is to identify the critical aircraft. According to FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)*, paragraph 3-4, the critical aircraft is the most demanding aircraft that operates at the airport more than 500 times per year or an aircraft used for scheduled passenger service. The characteristics used in facility planning include approach speed, wingspan, tail height, main gear width, cockpit to main gear length, aircraft weight, and takeoff and landing distances.

Critical Aircraft:
This is an aircraft with characteristics that determine the application of airport design standards for a specific runway, taxiway, taxilane, apron, or other facility. This can be a specific aircraft model or a composite of several aircraft currently using, expected to use, or intended to use the airport or part of the airport. This is also called the "design aircraft" or "critical design aircraft."

The existing critical aircraft are based on historical operations records and current airline schedules. The future critical aircraft is determined based on projections from **Chapter 2 Aviation Activity Forecasts**.

CURRENT CRITICAL AIRCRAFT

The most demanding aircraft currently using the airport is the Bombardier Q400 and Bombardier CRJ-900. Together, these two aircraft are the critical aircraft for Runway 5-23. The Q400 is also the critical aircraft for Runway 11-29.

FORECAST CRITICAL AIRCRAFT

At RDM, critical air carrier aircraft are expected to follow the general trend in airline operations nationwide, leading to a likely shift in aircraft types over the next 20 years. Routes into and out of RDM will likely shift toward increased aircraft size and reduced frequency. For RDM, this means the potential for a transition to narrow body aircraft. As addressed in the **Chapter 2 Aviation Activity Forecasts**, future critical air carrier aircraft are expected to be a combination of narrow-body jet and turboprop aircraft as shown in **Table 3-3** below.

Table 3-3: Future RDM Air Carrier Operations by Aircraft Type						
Typical Aircraft	**Seats**	**ARC**	**2021**	**2026**	**2031**	**2036**
CRJ-200	<70	C-II	2,260	0	0	0
Q400/E175/CRJ-900	70-90	B-III/C-III/C-III	8,430	8,200	6,000	3,000
MRJ-90	90-110	C-II	56	1,600	2,000	2,400
B737-700	110-130	C-III	286	500	2,000	1,800
A319 (Mainline)	130-150	C-III	204	600	1,000	3,600
A319 (Low Cost), B737-800	150-170	C-III	204	500	1,000	1,500
B737-900	>170	D-III	40	200	400	300

Parameters: Based on airline order books and aircraft manufacturer production plans current as of April 2017. Operations growth provides sufficient seats to meet passenger enplanement forecasts at load factors >80%.

AIRPORT REFERENCE CODE (ARC)

The FAA AC-13A uses a coding system to determine design standards for an airport. The coding system is shorthand for the physical and operational characteristics of the most demanding aircraft that routinely use the airport.

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. Aircraft in parenthesis are representative of the ARC category.

EXISTING ARC

The existing ARC is designated as C-III (E175).

FUTURE ARC

A change in fleet mix associated with the airlines will occur and the A319 will dictate the future ARC. The future ARC will remain C-III.

RUNWAY DESIGN CODE (RDC)

The RDC is a three-component code that defines the design standards applicable to a specific runway. A letter, A-E, depicts the first component and stands for the Aircraft Approach Category (AAC). The AAC relates to the approach speed of the critical aircraft. A Roman numeral, I-VI, depicts the second component, which is the Airplane Design Group (ADG). The ADG relates to the greatest wingspan or tail height of the critical aircraft. The third component relates to runway approach visibility minimums as expressed in Runway Visual Range (RVR) equipment measurements. **Table 3-4** summarizes the RDC classifications. The critical aircraft and RDC determine the scale and setbacks of airfield facilities.

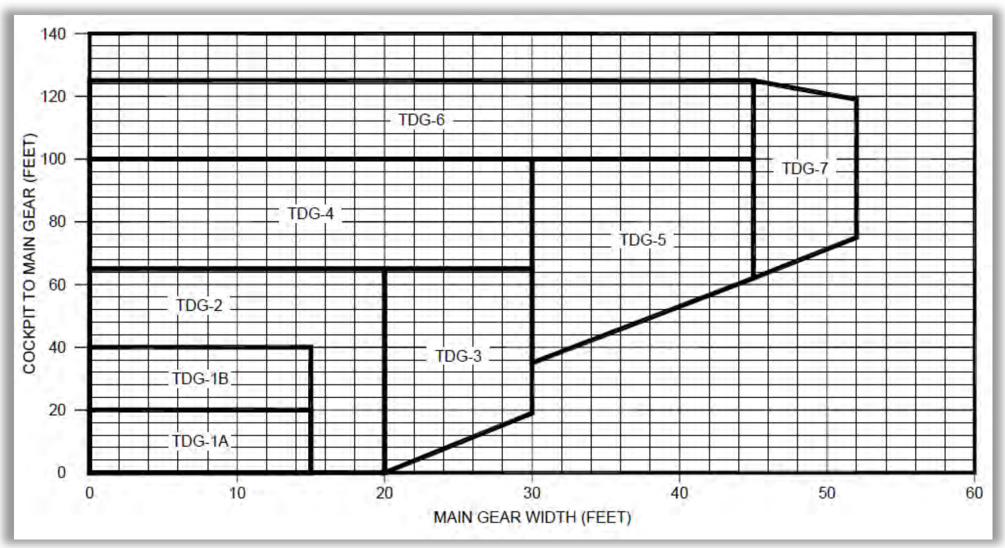
Runway Visual Range (RVR): The range on the centerline of a runway over which the pilot of an aircraft can see the runway surface markings or lights delineating the runway, reported in hundreds of feet. For example, 2400 RVR is equal to one-half mile.

Table 3-4: Runway Design Code					
Runway		AAC	ADG	Approach Visibility Minimums	Design Aircraft
11-29	Existing	B	III	7/8 mile (2,400')	Q400
	Future	No Change	No Change	No Change	No Change
5-23	Existing	C	III	½ mile (2,500')	E175
	Future	No Change	No Change	No Change	A319

TAXIWAY DESIGN GROUP (TDG)

The TDG criteria are a new design standard incorporated into AC-13A. The previous RDM Airport Layout Plan (ALP) and Master Plan did not address this standard. The TDG takes into account the dimensions of the aircraft landing gear to determine taxiway widths and pavement fillets to be provided at taxiway intersections. Fillet pavement accommodates the inner wheel of the airplane as it turns. There are seven (1-7) TDG classifications distinguished by width of the main gear and wheel base (the distance from nose gear to main gear). TDG classifications are presented in **Figure 3-2.**

Figure 3-2 TAXIWAY DESIGN GROUPS



Source: Figure 3-2 from AC 5300-13a, Change1

EXISTING TDG

The Bombardier Q400 is the existing critical aircraft for all taxiways serving the runways. Due to its wide main landing gear, it is a TDG-5 aircraft. No other aircraft now operating at the Airport is above TDG-3.

FUTURE TDG

The aviation activity forecasts indicate the Airbus A319 will become the future critical aircraft if the Q400 is no longer in the fleet. These future aircraft have a narrower main landing gear width, and are both in TDG-3. As of 2017, Alaska has announced it will supplement its fleet of Q400 aircraft with the Embraer 175 regional jet (E175), which operates in the same 76-seat configuration as the Q400. Alaska route planning staff and the airport station manager expect that the Q400 will remain in the fleet for at least the next decade. Alaska Airlines will likely still operate a limited number of Q400s for short haul routes (e.g. RDM-Portland International Airport [PDX]) beyond the next decade. Exactly when the Q400 will be retired from Alaska's fleet is unknown.

There is currently a taxiway construction project for fiscal year 2018 to change the connector taxiways of Runway 11/29 to TDG 4. TDG 4 has the minimum fillet dimensions that will allow the Q400 to taxi at RDM. This allows the Q400 to continue operating at RDM until it retires from service and allows the future critical aircraft (A319) to dictate the future TDG. Therefore, it is recommended that TDG-3 be used for planning, and that standards for TDG-3 should be applied to both runways and all taxiways serving the runways once the Q400 no longer operates at RDM.

WIND COVERAGE

The primary factor influencing runway orientation is wind. The preferred design for runways is to align them so that airplanes take-off and land into a headwind. This minimizes the challenges associated with crosswinds, and provides for more efficient aircraft performance. Small, light aircraft are more affected by crosswinds than larger, heavier ones. FAA runway design criteria state that runway orientation must satisfy 95 percent wind coverage based on annual wind conditions. A crosswind runway may be justified to satisfy the 95 percent wind coverage requirement for the combined runways.

Observations for wind coverage are categorized into all weather, instrument meteorological conditions (IMC), and visual meteorological conditions (VMC). Depending upon the RDC, runways must meet the allowable crosswind component of 10.5, 13, 16, or 20 knots. Runways 5-23 and 11-29 have RDCs of C-III and B-III respectively, and both must meet an allowable crosswind component of 16 knots.

Table 3-5: Wind Coverage				
All Weather				
Runway	**10.5 Knots (12 M.P.H)**	**13 Knots (15 M.P.H.)**	**16 Knots (18.5 M.P.H.)**	**20 Knots (28 M.P.H.)**
11-29	89.63%	94.34%	98.83%	99.87%
5-23	94.85%	97.17%	99.06%	99.79%
Combined	97.65%	99.39%	99.88%	99.99%
Calm Wind Percentage (0-3 knots)			37.40%	
Number of Observations			86,755	
IMC				
Runway	**10.5 Knots (12 M.P.H)**	**13 Knots (15 M.P.H.)**	**16 Knots (18.5 M.P.H.)**	**20 Knots (28 M.P.H.)**
11-29	98.18%	99.12%	99.77%	99.95%
5-23	94.67%	96.94%	99.36%	99.91%
Combined	99.32%	99.83%	99.97%	100.00%
Calm Wind Percentage (0-3 knots)			49.70%	
Number of Observations			7,457	
VMC				
Runway	**10.5 Knots (12 M.P.H)**	**13 Knots (15 M.P.H.)**	**16 Knots (18.5 M.P.H.)**	**20 Knots (28 M.P.H.)**
11-29	94.55%	96.99%	99.00%	99.78%
5-23	89.17%	94.10%	98.78%	99.87%
Combined	97.49%	99.35%	99.88%	99.99%
Calm Wind Percentage (0-3 knots)			36.30%	
Number of Observations			79,413	

Table 3-5 shows annual average wind coverage for each runway direction during three weather conditions: all weather, VMC, and IMC. When calculated individually, neither runway alignment provides 95 percent coverage for operations during 10.5 knots under the three weather conditions. The alignment of Runway 11-29 does not provide the required coverage during 13-knot all weather conditions and Runway 5-23's alignment does not provide the required coverage during 13-knot VMC weather conditions. However, the combined alignment of the two runways provides over 97 percent coverage during each weather condition, justifying the need for continued FAA investment in secondary Runway 11-29 to maintain the required wind coverage.

According to current FAA design standards, the historical wind data reported above does not justify a B-III RDC on the crosswind runway (11-29), however, the Airport has the intention of maintaining the B-III designation throughout the planning period covered under this Master Plan.

OTHER DESIGN CONSIDERATIONS

- ✓ Airspace (approach and departure protection, terrain, and obstructions): Instrument flight procedure minimum descent altitudes, glide paths, and climb gradients are determined by obstacle clearances. Obstacle clearance surfaces extend along the extended runway centerline. Runways are typically aligned to avoid terrain and tall structures that existed at the time of design; however, tall objects and terrain can impose restrictions on aircraft operations if they inhibit the ability for aircraft to safely arrive and depart. Ideally, airports work with nearby communities to adopt land use planning techniques to minimize incompatible development.
- ✓ Independent versus dependent operating streams: Runways that intersect or that have intersecting approach and departure corridors are dependent on each other. During high levels of activity, these dependencies cause delay. As delays increase, establishment of an independent operating stream may be necessary. This can be accomplished by providing a new parallel runway with sufficient lateral separation from existing runways. Airplane wake turbulence and instrument landing capabilities are considerations when determining the amount of space needed between parallel runways.
- ✓ ATCT Line of Sight: Air traffic controllers require an uninterrupted line of sight between the air traffic control tower (ATCT) and approach and departure corridors, runways, taxiways, and aprons. Protection of controller line of sight is considered in airport development.
- ✓ NAVAID critical areas: Electronic equipment used for navigation, communication, security, and surveillance are commonly found throughout airport property. In order to function properly, most of these items require clear and graded areas, setbacks from certain objects and construction materials, and a clear corridor between transmitters and receivers. Development and most activities are restricted in these areas.
- ✓ Visual aids to navigation: Certain visual aids, including the airport beacon, runway approach lighting, and runway glide path indicator lights require unobstructed line of sight from aircraft in flight. This line of sight is considered in the planning and design of airport facilities.

3.2.3 RUNWAY SYSTEM

RUNWAY DESIGN STANDARDS

FAA AC-13A stipulates the design criteria, surfaces, and dimensions for each runway. Dimensions for the design surfaces are based upon the critical aircraft and reference code plus the type of approach instrumentation available. A brief explanation of each design surface is presented below. All runway design surfaces and instrument landing system critical areas are illustrated on **Figure 3-3.** Summary matrices (**Tables 3-7** and **3-8**) are included following the explanations.

RUNWAY SAFETY AREA (RSA)

The RSA provides a graded, clear area for aircraft in case of a runway excursion, and provides greater accessibility for firefighting and rescue equipment during such incidents. The RSA must be clear of all objects and capable of supporting aircraft, maintenance vehicles, and rescue vehicles. The FAA does not grant modifications to RSA standards, meaning that non-standard RSAs must be corrected as soon as possible. RSAs are illustrated with a red line in **Figure 3-3**.

Runway Safety Area (RSA): A rectangular area surrounding a runway suitable for reducing the risk of damage to aircraft in the event of an undershoot, overshoot, or excursion from the runway.

Object Free Area (OFA): A rectangular area centered on a runway, taxiway, or taxilane centerline provided to enhance the safety of aircraft operations by remaining clear of objects.

The RSA for each runway meets FAA design standards for the existing configuration. Impacts to the RSA from a potential runway extension will be explored in the **Chapter 4 Alternatives Analysis**. The Airport is required to continue to maintain a clear and graded area for each RSA lateral to, and beyond the runway end. Response to inspections by the FAA Runway Safety Action Team, who conducts inspections on a regular basis, will help maintain required grading. Runway 5-23 has published declared distances of 7,031 feet for the accelerate stop distance available (ASDA) and landing distance available (LDA). Declared distances that do not equal the full length of a runway mean the RSA has a penetration. The object identified as penetrating the RSA was the localizer on Runway End 5. Survey data collected for this master plan shows no objects penetrating any design surfaces of Runway 5-23. The latitude and longitude for the localizer and Runway End 5 were used in the inverse computation provided by the National Geodetic Survey website to determine the distance between the survey points. The distance between both points was greater than 1,000 feet, meaning the localizer did not penetrate the RSA. It is recommended that the declared distances change to the full length of Runway 5-23, 7,038 feet, due to the RSA being clear of objects.

RUNWAY OBJECT FREE AREA (ROFA)

ROFA standards require clearing of above-ground objects protruding above the nearest point of the RSA. Objects non-essential for air navigation must not be placed in the ROFA. Except where precluded by other standards, objects that need to be located in the ROFA for air navigation or aircraft ground maneuvering purposes are allowed to penetrate the ROFA. The ROFAs at RDM are illustrated with a purple line in **Figure 3-3**. The ROFAs for both runways currently meet standards.

RUNWAY OBSTACLE FREE ZONE (ROFZ)

ROFZs are defined three-dimensional volumes of airspace centered above the runway centerline that must be kept clear during aircraft operations. The shape and size of the ROFZ is dependent on the size of aircraft using the runway and the approach minimums for a specific runway end. The ROFZ extends 200 feet beyond each end of each runway. The width of the ROFZs for both runways at RDM is 400 feet. The ROFZs at RDM are illustrated with a black line in **Figure 3-3**. The ROFZs for both runways at RDM meet FAA standards.

INNER-APPROACH OBSTACLE FREE ZONE (IAOFZ)

The IAOFZ only applies to the ends of runways that have an approach lighting system. Therefore, at RDM an IAOFZ only exists in the area before the threshold for Runway 23. IAOFZs begin 200 feet beyond the runway threshold at the same elevation as the runway threshold and extends 200 feet beyond the last light unit in the approach lighting system. The width is the same as the ROFZ (400 feet) and rises at a slope of 50 (horizontal) to 1 (vertical). The IAOFZ is shown with a black line in **Figure 3-3**. The IAOFZ for Runway 23 at RDM meets FAA standards.

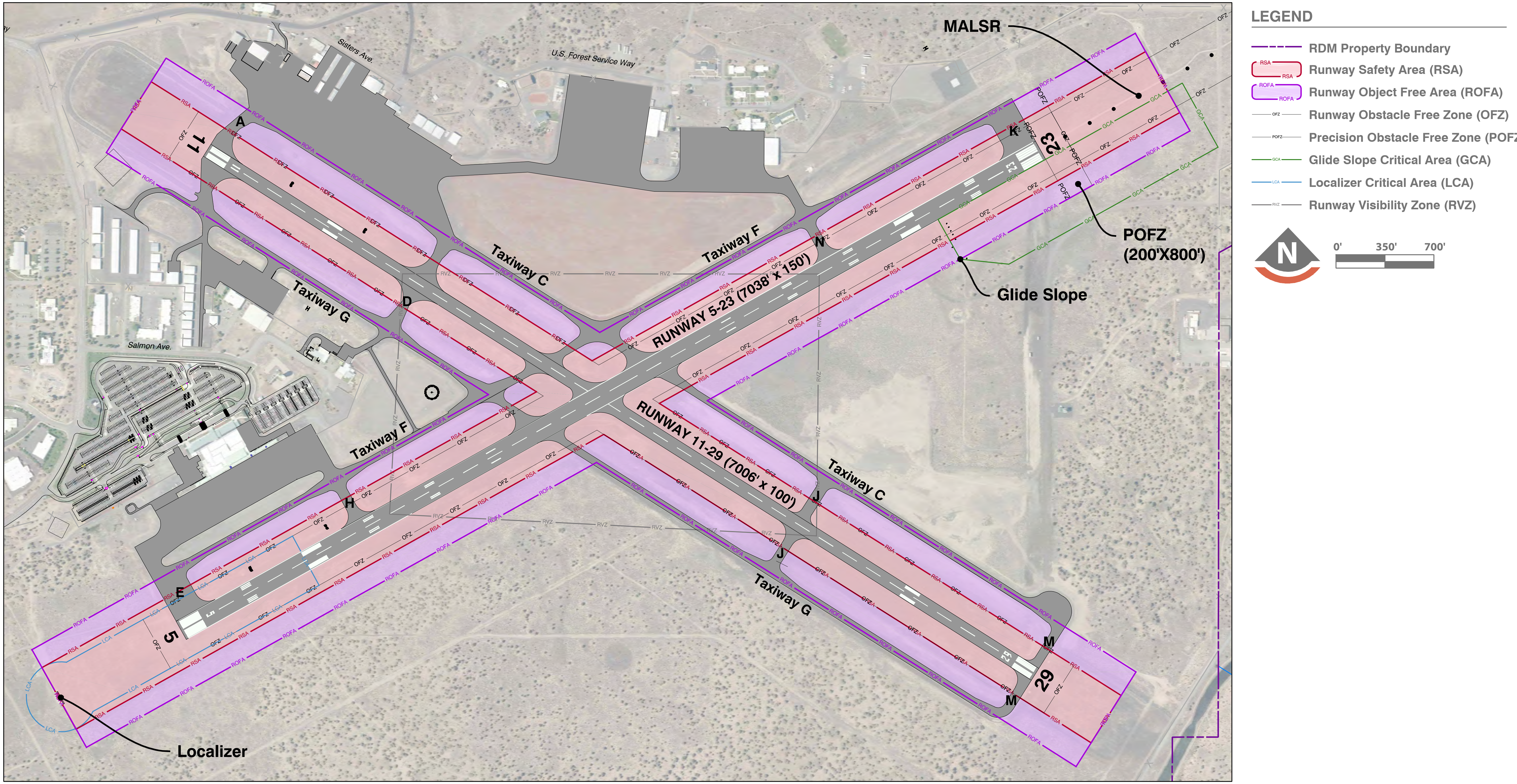
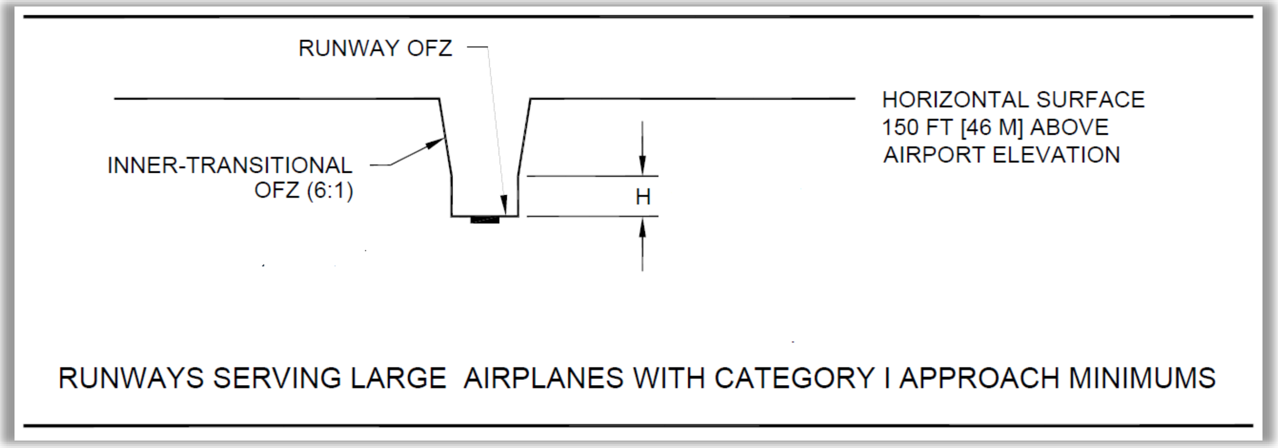


Figure 3-3
RUNWAY DESIGN SURFACES

INNER-TRANSITIONAL OBSTACLE FREE ZONE (ITOFZ)

An ITOFZ exists only for runways with instrument approach visibility minimums of less than ¾ mile. Therefore, at RDM an IAOFZ only applies to Runway 5-23. The ITOFZ is a defined volume of airspace along the sides of the ROFZ and IAOFZ. **Figure 3-4** illustrates the shape of the ITOFZ. The ITOFZ will be shown and analyzed on the Airspace Plan sheets of the ALP, after the alternatives analysis. The ITOFZ meets FAA standards.

Figure 3-4 INNER-TRANSITIONAL OFZ



PRECISION OBSTACLE FREE ZONE (POFZ)

The POFZ is defined as a volume of airspace above an area beginning at the landing threshold, at the elevation of the landing threshold, and centered on the extended runway centerline (200 feet long by 800 feet wide), illustrated on **Figure 3-3** in black. The POFZ is in effect when all three of the following criteria are met:

- ✓ The approach includes vertical guidance;
- ✓ The reported ceiling is below 250 feet or visibility is less than 3/4 statute miles (or RVR is below 4,000 feet); and
- ✓ An aircraft is on final approach within two miles of the runway threshold.

When the POFZ is in effect, the wing of an aircraft on a taxiway waiting for runway clearance may penetrate the POFZ, but the fuselage and tail may not. Runway 23 is the only runway end with a POFZ. It meets FAA standards.

RUNWAY PROTECTION ZONES (RPZ)

Runway Protection Zone (RPZ):
The RPZ is a trapezoidal area with the intention of enhancing the protection of people and property on the ground.

The RPZ is a trapezoidal area at the end of the runway, the purpose of which is to enhance safety for aircraft operations and for people and objects on the ground. The FAA requests that incompatible land uses, objects, and activities be located outside of the RPZ. The FAA also requests that an airport operator maintain full control of an RPZ, ideally through fee simple property acquisition. If this is not feasible, land use control may be achieved through the use easements.

Total acres for the existing RPZs located on and off RDM property are called out in **Figure 3-5**, and documented in summary **Tables 3-7** and **3-8** at the end of this section. The RPZs within the existing airport property and under Airport control are shaded green, and those outside Airport property boundaries are shaded orange.

The FAA provides guidance on RPZ land use compatibility in AC-13A and more extensive guidance in the 2012 memorandum *Interim Guidance on Land Uses within a Runway Protection Zone*. Land uses and structures that are not inherently compatible in the RPZ include: buildings, especially habitable structures or structures of assembly; fuel facilities; hazardous material storage; recreational land uses; and transportation facilities and roads.

The City of Redmond is currently in the design process for a realignment of the intersection of SE Veterans Way and SE Airport Way. This intersection is currently located in the central *controlled access* portion of the Runway 11 approach RPZ (see **Figure 3-6**). FAA standards discourage intersections located in this portion of an RPZ. The design for the proposed realignment shifts the intersection to outside of the controlled access portion of the RPZ and replaces a three-way stop intersection with a roundabout.

The FAA does not have the authority to regulate local land use, so it relies on the airport sponsor to work with local jurisdictions to promote compatible development within the RPZ. Airport actions that introduce incompatible land uses into the RPZ, either by moving a runway end or increasing the size of the RPZ, require coordination with FAA headquarters. This coordination is not needed for existing incompatible land uses if the RPZ does not move or change size. The analysis of runway extension alternatives presented in **Chapter 4** addresses property acquisition that would be required to support each alternative.

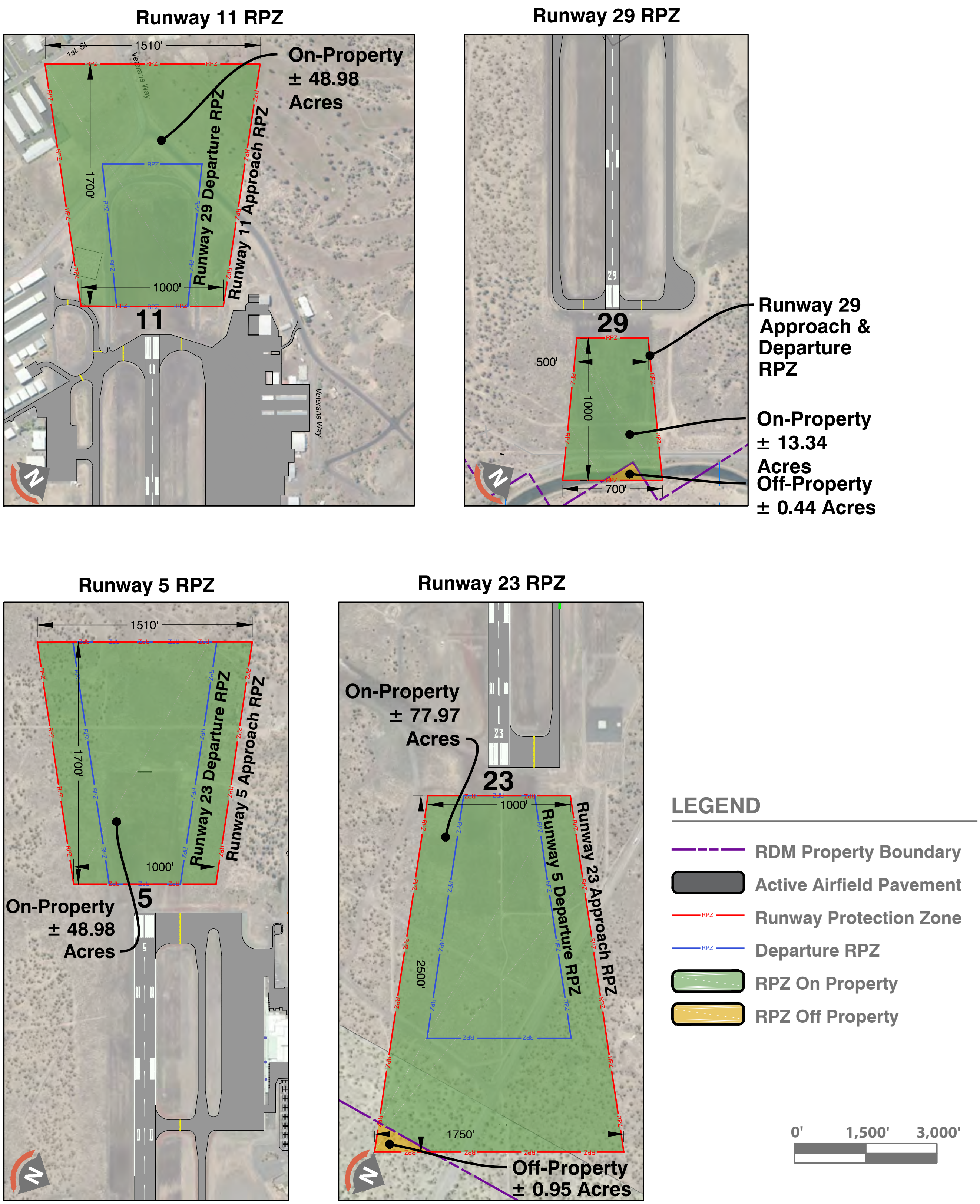
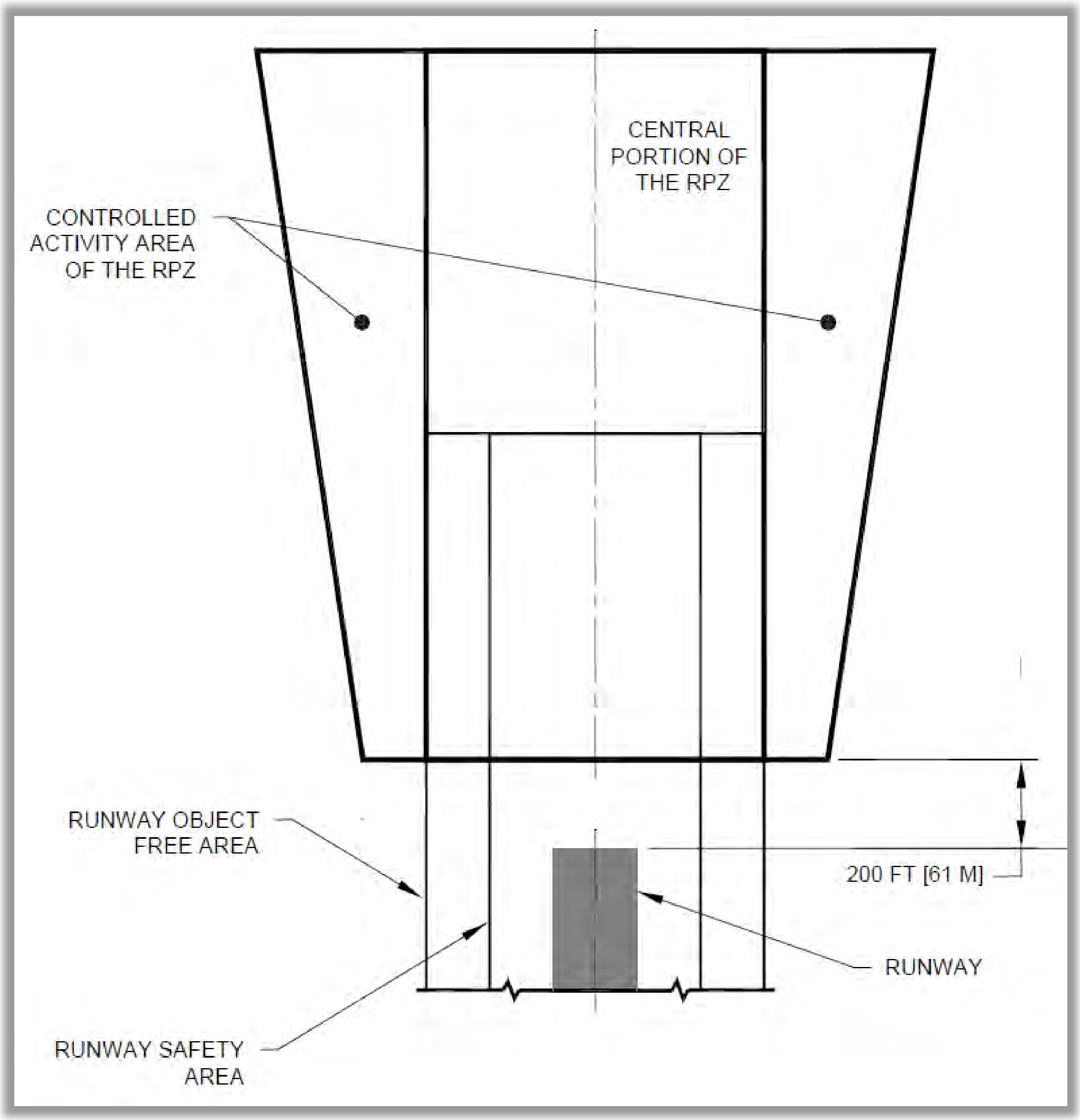


Figure 3-5
RUNWAY PROTECTION ZONES

Figure 3-6 RUNWAY PROTECTION ZONE SUBAREAS



RUNWAY VISIBILITY ZONE (RVZ)

Runway line-of-sight standards indicate intersecting runways must maintain an unobstructed line of sight from any point five feet above the runway centerline to any other point five feet above the intersecting runway centerline within the runway visibility zone (RVZ). The RVZ at RDM is established by points located equidistant from the intersection and the runway ends. The RVZ precludes any fixed or movable objects that may limit line of sight between the runways, and is shown as a blue line in **Figure 3-3**. The RVZ line-of-sight at RDM is unobstructed. It is recommended that RDM continue to limit any permanent structures with the RVZ.

HOLD POSITIONS

RDC determines the holding position distance on each connector taxiway from the runway centerline. AC-13A shows that, for RDC C-III runways such as Runway 5-23, the holding position is 250 feet from the runway centerline. In addition, the distance is increased 1 foot for each 100 feet the airport is above sea level. Using this formula, at 3,080 feet mean sea level (MSL), the required distance for hold positions from the runway centerline is 281 feet on taxiways connecting to Runway 5-23. Currently, the hold lines for Runway 5-23 are located at 200 feet from centerline and do not meet the 281-foot requirement.

As Runway 11-29 is designated as RDC B-III, the elevation factor does not apply and the hold positions should be located 200 feet from the runway centerline. For Runway 11-29, the hold lines are currently located at 206 feet from runway centerline, slightly exceeding the requirement AC-13A.

NAVAID CRITICAL AREAS

Runway 23 is equipped with a glide slope and localizer as part of the instrument landing system (ILS) to the approach end of Runway 23. The FAA requires a critical area at each runway end to remain clear of objects to ensure aircraft using the equipment receive undistorted signals. The critical areas for Runway 23 are the localizer critical area (LCA) and the glide slope critical area (GCA). Dimensions of the GCA are for the "null reference" facility type glide slope. **Table 3-6** shows the dimensions for the LCA and GCA for an ILS category I defined by FAA Order 6750.16D, *Siting Criteria for ILS*. There are no known penetrations to the GCA and LCA (additional information will be provided in the AGIS survey). The FAA requires vegetation not exceed twelve inches in height in the ILS critical areas.

BLAST PADS

Paved runway blast pads provide blast erosion protection beyond runway ends during jet aircraft operations. AC-13A recommends runways serving ADG-III have full-length paved shoulders. In effect, blast pads are an extension of the full-length paved shoulders beyond the runway end.

Table 3-6. Critical Area Dimensions

Area	Length	Width
Localizer Critical Area	2,000 feet	400 feet
Glideslope Critical Area	2,000 feet	200 feet

Source: Order 6750.16D, Siting Criteria for ILS

RDM does not currently have blast pads. Should the Airport determine blast pads to be beneficial in the future, for runways supporting ADG C-III aircraft, blast pads should be 200 feet by 200 feet. For runways supporting ADG B-III aircraft, blast pads should be 140 feet wide and 200 feet long.

The tables below summarize design standards, existing conditions, and any proposed disposition.

Table 3-7. Runway 11-29 Design Standards Matrix

Runway 11-29 RDC:		B-III		
Item	**Existing Conditions**	**FAA Design Standards[1]**	**Meets Standards?**	**Disposition**
Runway Design				
Width	100 ft.	100 ft.	Yes	No Action
Shoulder Width	20 ft.	20 ft.	Yes	No Action
Blast Pad Width	N/A	140 ft.	No	Add to ALP
Blast Pad Length	N/A	200 ft.	No	Add to ALP
Crosswind Component (all weather)	99.13% @ 16 knots	95% @ 16 knots	Yes	No Action
Gradient (maximum)	0.51%	1.5%	Yes	No Action
Runway Protection				
Runway Safety Area (RSA)				
Length beyond departure end	600 ft.	600 ft.	Yes	No Action
Length prior to threshold	600 ft.	600 ft.	Yes	No Action
Width	300 ft.	300 ft.	Yes	No Action
Runway Object Free Area (ROFA)				
Length beyond departure end	600 ft.	600 ft.	Yes	No Action
Length prior to threshold	600 ft.	600 ft.	Yes	No Action
Width	800 ft.	800 ft.	Yes	No Action
Runway Obstacle Free Zone (OFZ)				
Length prior to threshold	200 ft.	200 ft.	Yes	No Action
Width	400 ft.	400 ft.	Yes	No Action
Inner Approach OFZ	N/A	N/A	N/A	N/A
Inner Transitional OFZ	N/A	N/A	N/A	N/A
Precision Obstacle Free Zone (POFZ)	N/A	N/A	N/A	N/A
Approach Runway Protection Zone (RPZ)				
Length	11: 1700 ft.; 29: 1000	11: 1700 ft.; 29: 1000	Yes	N/A
Inner Width	11: 1000 ft.; 29: 500	11 :1000 ft.; 29: 500		
Outer Width	11: 1510 ft.; 29: 700	11: 1510 ft.; 29: 700		
Departure Runway Protection Zone (RPZ)				
Length	1000 ft.	1000 ft.	Yes	No Action
Inner Width	500 ft.	500 ft.	Yes	No Action
Outer Width	700 ft.	700 ft.	Yes	No Action
Runway Separation				
From Runway Centerline to:				
Parallel Runway Centerline	N/A	700 ft.	Yes	No Parallel RWY
Hold Line[2]	200 ft.	200 ft.	Yes	No Action
Parallel Taxiway Centerline	400 ft.	300 ft.	Yes	No Action
Aircraft Parking Area	425 ft.	400 ft.	Yes	No Action

Source: FAA Advisory Circular 150/5300-13A, Change 1 Airport Design (February 2014)

Table 3-8. Runway 5-23 Design Standards Matrix

Runway 5-23 RDC:		C-III		
Item	**Existing Conditions**	**FAA Design Standards[1]**	**Meets Standards?**	**Disposition**
Runway Design				
Width	150 ft.	150 ft.	Yes	No Action
Shoulder Width	25 ft.	25 ft.	Yes	No Action
Blast Pad Width	N/A	200 ft.	No	Add to ALP
Blast Pad Length	N/A	200 ft.	No	Add to ALP
Crosswind Component (all weather)	99.07% @ 16 knots	95% @ 16 knots	Yes	No Action
Gradient (maximum)	0.29%	1.5%	Yes	No Action
Runway Protection				
Runway Safety Area (RSA)				
Length beyond departure end	1000 ft.	1000 ft.	Yes	No Action
Length prior to threshold	600 ft.	600 ft.	Yes	No Action
Width	500 ft.	500 ft.	Yes	No Action
Runway Object Free Area (ROFA)				
Length beyond departure end	1000 ft.	1000 ft.	Yes	No Action
Length prior to threshold	600 ft.	600 ft.	Yes	No Action
Width	800 ft.	800 ft.	Yes	No Action
Runway Obstacle Free Zone (OFZ)				
Length prior to threshold	200 ft.	200 ft.	Yes	No Action
Width	400 ft.	400 ft.	Yes	No Action
Inner Approach OFZ	23: 2500 ft. x 400 ft.	N/A	N/A	N/A
Inner Transitional OFZ	23: 1991 ft	N/A	N/A	N/A
Precision Obstacle Free Zone (POFZ) (Runway 23 only)				
Length	200 ft.	200 ft.	Yes	No Action
Width	800 ft.	800 ft.	Yes	No Action
Approach Runway Protection Zone (RPZ)				
Length	5: 1700 ft. 23: 2500	5: 1700 ft. 23: 2500 ft.	Yes	N/A
Inner Width	5: 1000 ft. 23: 1000	5 :1000 ft. 23: 1000 ft.		
Outer Width	5: 1510 ft. 23: 1750	5: 1510 ft. 23: 1750 ft.		
Departure Runway Protection Zone (RPZ)				
Length	1,700 ft.	1700 ft.	Yes	No Action
Inner Width	500 ft.	500 ft.	Yes	No Action
Outer Width	1,010 ft.	1010 ft.	Yes	No Action
Runway Separation				
From Runway Centerline to:				
Parallel Runway Centerline	N/A	700 ft.	No	No Parallel RWY
Hold Line[2]	250 ft.	250 ft.	Yes	No Action
Parallel Taxiway Centerline	400 ft.	400 ft.	Yes	No Action
Aircraft Parking Area	540 ft.	500 ft.	Yes	No Action

Source: FAA Advisory Circular 150/5300-13A, Change 1 Airport Design (February 2014)

RUNWAY LENGTH

The performance requirements of the critical aircraft designated for a runway determine an airport's recommended runway length. Performance capabilities of individual aircraft are, in turn, affected by factors including the aircraft payload and fuel load, the runway elevation, wind conditions, and air temperature.

Currently, Runway 5-23 is 7,038 feet long and Runway 11-29 is 7,006 feet long. At these lengths, the runways adequately serve the range of piston and jet aircraft now operating at the Airport. RDM has direct flights to seven airline hubs, all under 1,000 nautical miles (nm) from the Airport. With a few aircraft and time of year exceptions, the runway length is generally sufficient[1] for current aircraft and current destinations. However, as new airlines begin serving RDM, and existing airlines change fleets and add new destinations, a wide range of aircraft could serve the Airport in the future. As noted in the discussion of critical aircraft earlier in this chapter, specific fleet mix changes anticipated at the Airport include:

- ✓ Replacement of Q4002 with ERJ-175
- ✓ Regional jet (CRJ-200, 700 and 900) replacement with narrow body aircraft (A319 and B737)

This section examines whether the available runway length meets the needs not only of existing users, but also those of future critical aircraft serving future destinations. To analyze the runway requirements for these new aircraft types, an understanding of the factors that impact aircraft performance is necessary. The following paragraphs explain the terminology and variables used in the runway length assessment.

ELEVATION

RDM has four runway ends from which aircraft can operate, ranging from 3,044 feet above mean sea level (AMSL) to 3,080 feet AMSL, which is the official airport elevation.

INTERNATIONAL STANDARD ATMOSPHERE (ISA)

This mathematical model describes how the earth's atmosphere, or air pressure and density, change depending on altitude. The atmosphere is less dense at higher elevations. ISA is frequently used in aircraft performance calculations because deviation from ISA will change how an aircraft performs. ISA at sea level occurs when the temperature is 59°F. ISA at RDM's 3,080 feet AMSL occurs when the temperature is 48°F.

[1] CRJ-200 operations to certain destinations during summer months are occasionally weight restricted on departure from RDM.

[2] Some Q400 operations associated with short haul routes such as RDM-PDX will remain into the future.

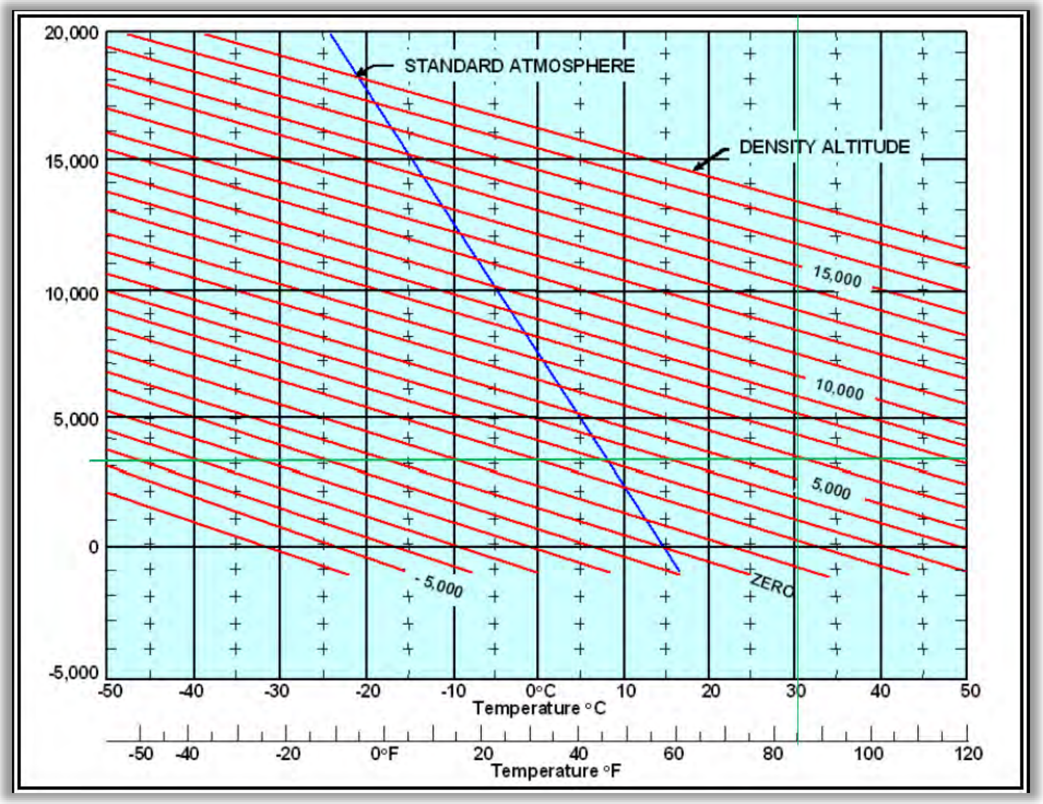
DENSITY ALTITUDE (DA)

This measurement comparing air density at a point in time and specific location to ISA is a critical component of aircraft performance calculations. DA is used to understand how aircraft performance differs than the performance that would be expected under ISA. DA is primarily influenced by elevation and air temperature. To examine the effect of changes to either variable, this calculation holds the other variable constant.

- ✓ When elevation is constant: When air temperature increases, DA increases. When air temperature decreases, DA decreases. This comparison is often used when analyzing aircraft performance at an airport during different times of the day and different days of the year.
- ✓ When temperature is constant: When elevation increases, DA increases. When elevation decreases, DA decreases. This comparison, which is not often used, can be employed to compare aircraft performance at different airports under identical climate conditions.

Figure 3-7 illustrates how DA is impacted when factoring in the average maximum temperature (85.5°F) for Redmond. The result is a density altitude increased to approximately 5,800 feet MSL.

Figure 3-7 DENSITY ALTITUDE FOR RDM AVERAGE MAXIMUM TEMPERATURE



For year-round planning purposes, density altitude of 5,800 feet MSL is assumed for the aircraft performance-based runway length analysis here.

FUTURE FLEET AND DESTINATIONS

DA, aircraft takeoff weight, and aircraft performance are the three primary factors to be considered when determining runway length requirements. Aircraft takeoff weight is directly related to the distance of the flight. For shorter distances, aircraft may be able to depart with a full passenger cabin and less than full fuel tanks. In those instances, the aircraft will typically be departing below MTOW and experience better takeoff performance. Aircraft will typically require a full load of fuel for longer trips. A full passenger cabin and full load of fuel will be close to the aircraft's MTOW.

This runway length analysis looks at the future fleet changes as discussed in **Chapter 2** in conjunction with destinations likely to be served from RDM in the future. Destination distance is a critical factor in this analysis. RDM currently sees non-stop service to the airline hubs within 1,000 nm distance (Seattle-Tacoma International Airport, Portland International Airport, Salt Lake City International Airport, San Francisco International Airport, Los Angeles International Airport, Phoenix Sky Harbor International Airport). The next step beyond those hubs would be direct flights to Midwest or midcontinent hubs such as Minneapolis-Saint Paul, Minnesota; Denver, Colorado; and Houston and Dallas/Fort Worth, Texas. Those cities are all within 1,500 nm, which is a reasonable range for the forecast airline fleet, and likely destinations within the 20-year planning window.

The following analysis documents calculated takeoff weights for each of the air carrier aircraft types to reach a 1,500 nm destination. Those takeoff weights are then used with the aircraft manufacturer's performance tables contained in their respective airport planning manuals to determine a runway length requirement for the future.

RUNWAY LENGTH RECOMMENDATION

Using the 1,500 nm destination, as mentioned above, results in varying takeoff length requirements for the different aircraft types, as shown in **Table 3-9**. The CRJ-200 is not capable of flying for 1,500 nm. For the CRJ-700, 1,500 nm is near the range limits of the aircraft, and it must be weight restricted in order to carry enough fuel for the trip.

The B737-700 and A319 can make the trip with a full passenger load, but not with the current RDM runway length. The CRJ-900, B737-800, and EMB-175 would require some weight adjustments (e.g., blocked seats) in order to make the 1,500 nm trip.

The 1,500 nm destination is near the range limit of the EMB-175. No additional runway length would improve the passenger carrying capacity for the EMB-175 at RDM when adjusted for DA.

Table 3-9. Runway Length Requirements	
Aircraft Type	**Takeoff Length Required for 1,500 NM Trip**
Existing Fleet[1]	
CRJ-200	Out of Range
CRJ-700	9,100 feet[2]
Future Fleet	
CRJ-900	11,000 feet
EMB-175	10,000 feet[3]
B737-700	8,500 feet
B737-800	12,000 feet
A319	9,800 feet

[1] The Q400 has been excluded from this analysis since they will be eliminated from service except for very short haul flights (RDM-PDX).
[2] Weight restricted with a reduction of 10 passengers.
[3] Weight restricted with a reduction of 13 passengers.

Figures 3-8, 3-9, and **3-10** show three options to be considered in preliminary discussions for locating a runway extension: a split extension, northeast extension, and southwest extension. Variations of a 10,000-foot runway are explored in further detail in the **Chapter 4 Alternatives Analysis**.

RUNWAY WIDTH

Table 3-10 summarizes the runway width requirements according to RDC compared with the current runway widths.

Table 3-10. Runway Width Requirements					
Runway 11-29			**Runway 5-23**		
B-III Design Width	Existing Width	Meets Standards?	C-III Design Width	Existing Width	Meets Standards?
100’	100’	Yes	150’	150’	Yes

As no changes in RDC code are anticipated within the 20-year planning period, no changes in runway width are required.

RUNWAY PAVEMENT STRENGTH

The FAA provides guidance for classifying and reporting pavement strength in AC 150/5335-5C, *Standardized Method of Reporting Airport Pavement Strength – PCN*. The pavement strength is represented by a value called the Pavement Classification Number (PCN). The PCN is calculated based upon the pavement section, total aircraft operations, and operations by the most demanding aircraft anticipated to utilize the pavement.

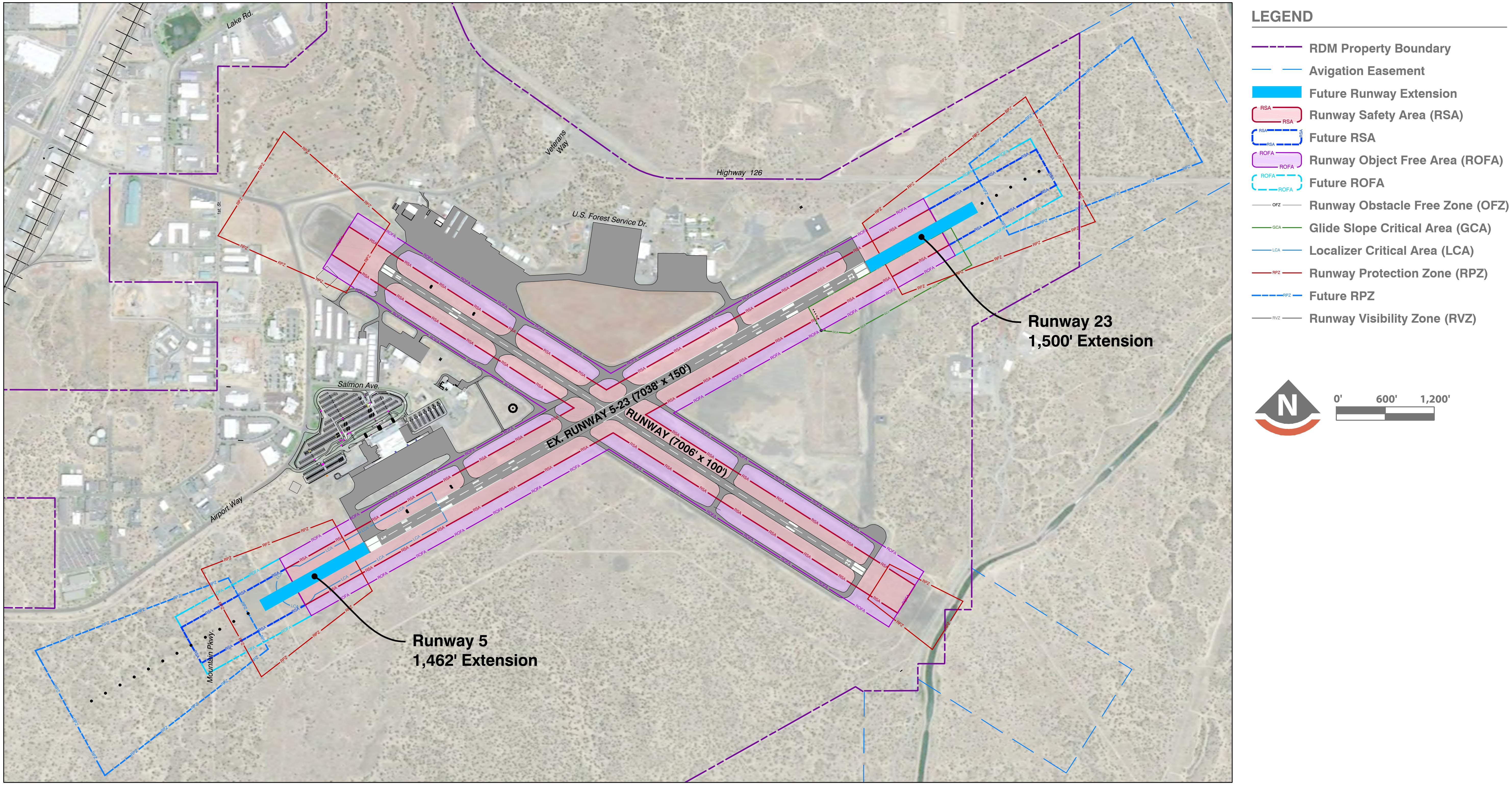
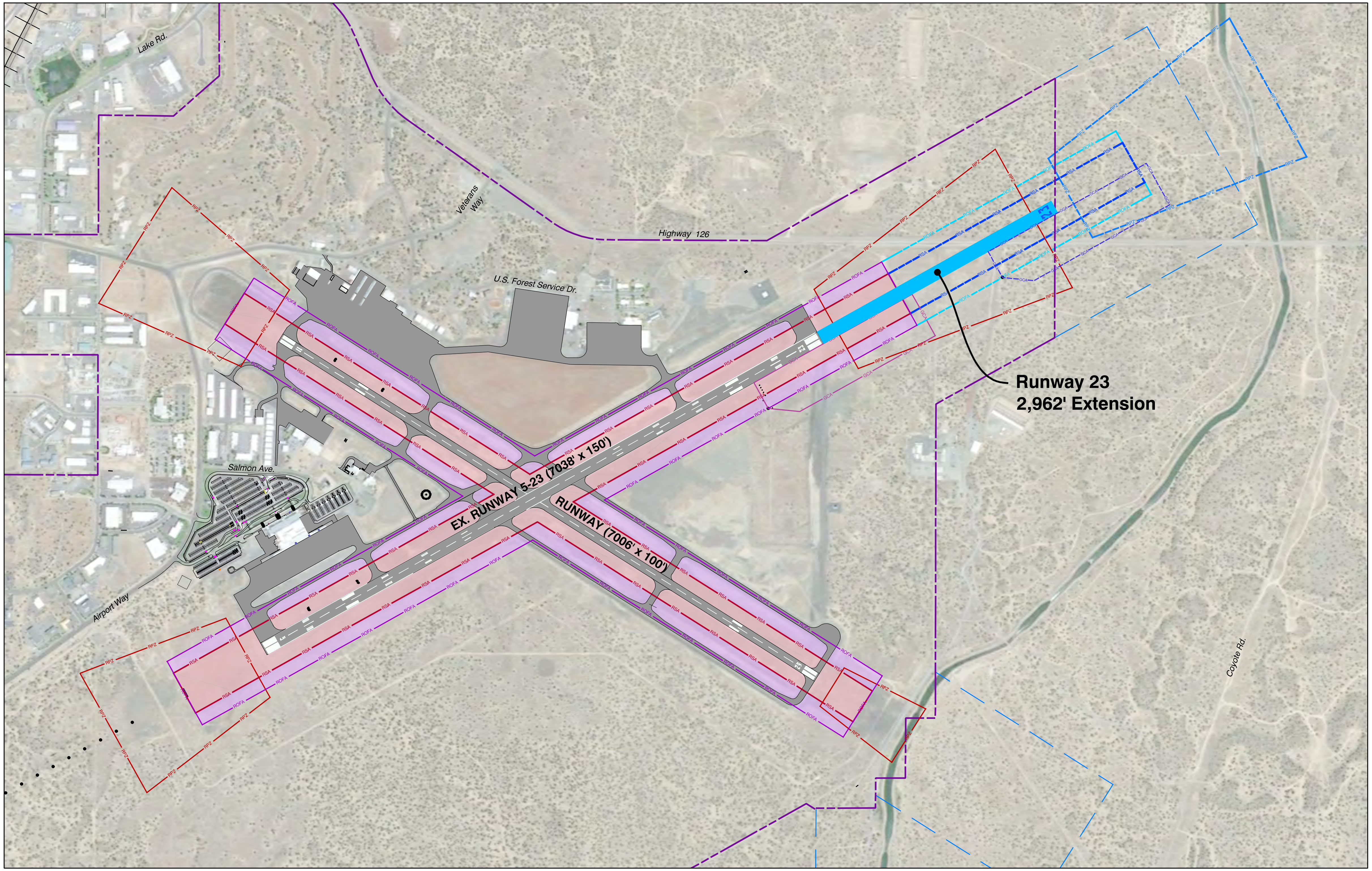


Figure 3-8
RUNWAY EXTENSION - SPLIT



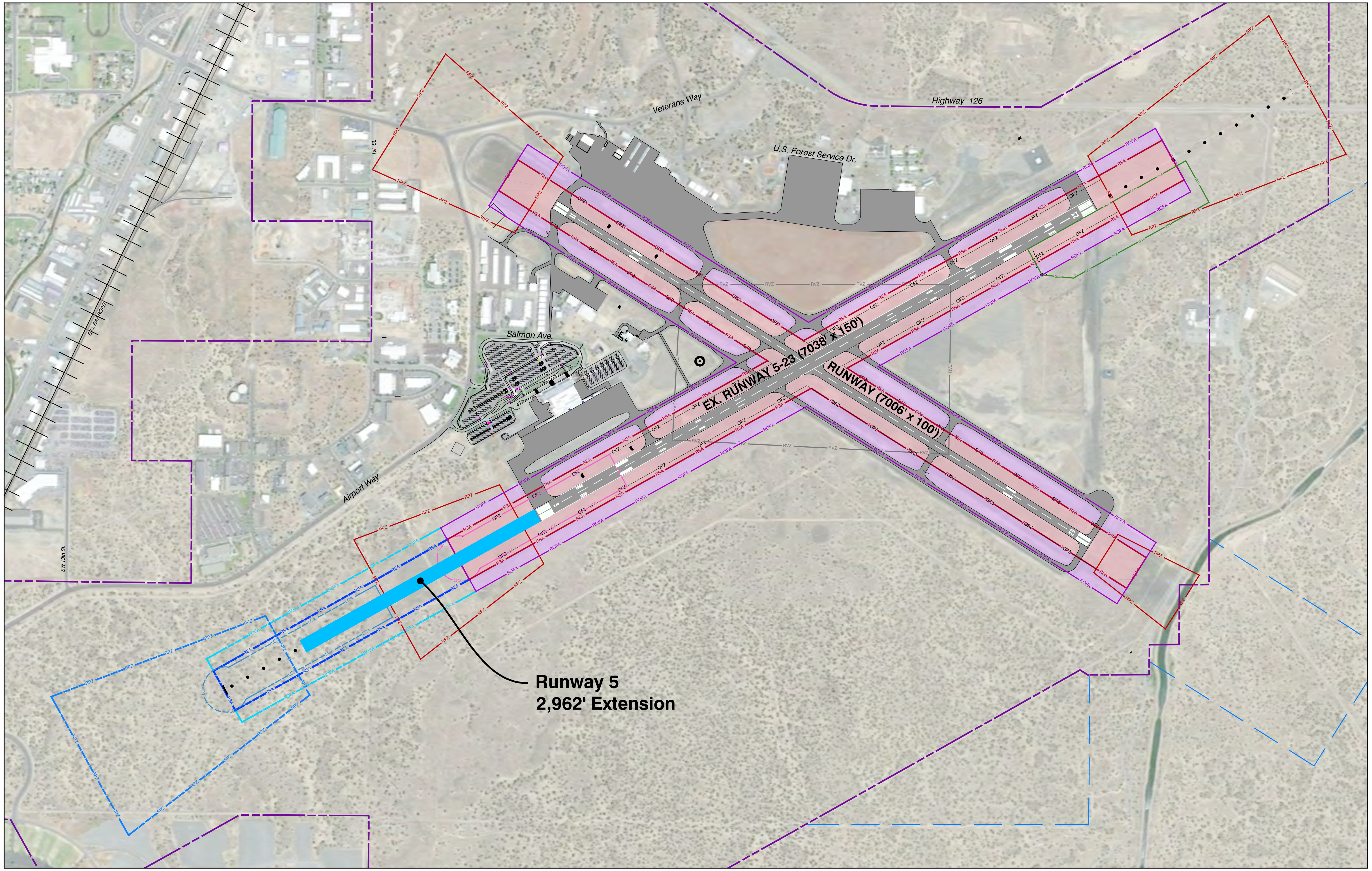
LEGEND

- RDM Property Boundary
- Avigation Easement
- Future Runway Extension
- Runway Safety Area (RSA)
- Future RSA
- Runway Object Free Area (ROFA)
- Future ROFA
- Glide Slope Critical Area (GCA)
- Future GCA
- Localizer Critical Area (LCA)
- Runway Protection Zone (RPZ)
- Future RPZ

N

0' 600' 1,200'

Figure 3-9
RUNWAY EXTENSION - EAST



LEGEND

- RDM Property Boundary
- Avigation Easement
- Future Runway Extension
- Runway Safety Area (RSA)
- Future RSA
- Runway Object Free Area (ROFA)
- Future ROFA
- Glide Slope Critical Area (GCA)
- Localizer Critical Area (LCA)
- Future LCA
- Runway Protection Zone (RPZ)
- Future RPZ

N

0' 600' 1,200'

Figure 3-10
RUNWAY EXTENSION - WEST

Airfield pavements strengths are detailed in **Chapter 1 Airport Inventory**. The aircraft types that currently operate at the airport are under the pavement strength limits for their respective areas on the airfield. However, as the airline fleet transitions away from regional jets to narrow body aircraft (B737 and A319), the pavement ratings will be exceeded. Pavement strength ratings are not necessarily a limit, but rather a design rating. That means aircraft weighing over the design rating will not cause the pavement to immediately fail, but with continued use, the life cycle of the pavement will be reduced. When the Airport does see these larger narrow body airline aircraft increasing in frequency at the airport, pavement strengthening projects should be studied.

INSTRUMENT APPROACHES AND DESIGN SURFACES

Instrument approaches in effect at RDM are described in the **Chapter 1 Airport Inventory**. A summary of the lowest minimum approach procedures are included in **Table 3-11**. The glide slope antenna, localizer antenna and medium intensity approach lighting systems (MALSRs) facilities make up the ILS. This system supports precision instrument approaches to Runway 23. More discussion on these facilities is provided in the Airside Facilities Section of **Chapter 1**.

Table 3-11. Lowest Minimums – Instrument Approach Procedures

Approach Procedures	Visibility (NM)	Descent Minimums (Feet)
ILS OR LOC RWY 23	½	200
RNAV (GPS) RWY 11	7/8	250
RNAV (GPS) Y RWY 05	¾	250
RNAV (GPS) Z RWY 29	1	286

There are three principal standards used to protect the flight corridors to and from runways:

- ✓ Title 14 of the Code of Federal Regulation, Part 77, *Safe, Efficient Use, and Preservation of Navigable Airspace* (Part 77)
- ✓ FAA Order 8260.3C, United States Standard for Terminal Instrument Procedures (TERPS)
- ✓ Threshold siting surfaces (TSS) described in AC-13A

Part 77 and TSS deal with runway threshold location and compatible land use and are used in airport planning. TERPS surfaces deal with instrument procedure development and are not commonly used in airport planning. The TERPS instrument departure surface is cross-referenced as a TSS in AC-13A.

Part 77 imaginary airspace surfaces are determined by the runway type and the type of instrument approach procedure (e.g. visual, non-precision, and precision). Part 77 surfaces are notification surfaces designed to identify and determine obstructions to air navigation. They are advisory, not regulatory; however, Oregon State Code (ORS) 836.530 provides regulatory authority for the State to enforce the standards. Penetrations to Part 77 surfaces can make it difficult for airports to extend or relocate runways, or to add new instrument procedures.

TERPS surfaces are determined by the type of instrument approach procedure (e.g. ILS, global positioning system [GPS], VHF Omnidirectional Range [VOR]). TERPS surfaces are regulatory, and penetrations to TERPS surfaces will result in the modification or cancelation of an instrument approach procedure.

TSS, also known as obstacle clearance surfaces, are determined by the type of instrument procedure and critical aircraft on each runway, and the visibility minimums of the lowest instrument approach. TSS apply to both approach and departure ends of the runway, and determine the location of the runway thresholds. Penetration of TSS will require modification of departure climb gradient for penetrations to departure TSS, and/or relocation of landing thresholds or reduction in approach procedure capability for penetrations to approach TSS. Airspace surfaces are drawn and analyzed as part of the ALP set development.

At this time, an upgraded approach to runway end 5 that supports LPV approach capabilities, similar to the localizer and glideslope of an instrument landing system (ILS) approach into runway end 23, is under consideration.

RUNWAY LIGHTING AND MARKING

Runway 5-23 is equipped with high-intensity runway edge lighting, runway end identifier lights, and a MALSR to the approach end of Runway 23.

Runway 11-29 is equipped with medium-intensity runway edge lighting and runway end identifier lights. No approach lighting system serves either end of Runway 11-29.

Runway 11-29 is marked with non-precision markings and Runway 5-23 is marked with precision markings in accordance with FAA AC 150/5340-1L, *Standards for Airport Markings*.

No major changes, other than periodic maintenance and updates, to the runway markings or lighting systems are recommended within the 20-year planning period.

RUNWAY SYSTEM CONCLUSION AND RECOMMENDATIONS

Runway 5-23 will need an extension to a length of about 10,000 feet to accommodate the future airlines passenger fleet. Alternative means of serving this fleet are explored in the next chapter.

3.2.4 TAXIWAY SYSTEM

Taxiways enable circulation of aircraft from the runways to terminal area facilities and between facilities within the terminal area. FAA design standards and guidelines intended to enhance safety and pilot situational awareness serve as the basis for this review of the adequacy of the RDM taxiway system.

RDM already has full-length parallel taxiways and regularly spaced exit taxiways serving both runways. Therefore, the focus in this master plan has been on refining the layout to meet current FAA design standards and address hot spots (defined below).

TAXIWAY DESIGN STANDARDS

As with runways, taxiways standards are based upon the critical aircraft expected to use each taxiway. The existing critical aircraft are the E175 for Runway 5-23 and the Q400 for Runway 11-29. The E175 is in TDG 3 and the Q400 in TDG 5. Due to the higher TDG of the Q400 and the Q400 operating on both runways, TDG 5 is the existing design standard. As mentioned in section **3.2.2 Airfield Design,** a taxiway construction project for Fiscal Year 2018 will change the connector taxiways of Runway 11-29 to TDG 4 to allow the Q400 to continue operating at RDM until the Q400 is no longer in service and while the future critical aircraft changes to the A319. The A319 is in TDG 3 and will dictate future taxiway design standards. Once the Q400 is no longer in service, the parallel taxiways serving both runways (Taxiway F, G, and C) and all connector/exit taxiways should be designed to accommodate TDG 3. Taxiway standards are shown in **Table 3-11**.

Table 3-11. Taxiway Standards

Taxiway Design Group	Width	Taxiway Edge Safety Margin	Shoulder Width
TDG 5	75	15	30
TDG 4*	50	10	20
TDG 3*	50	10	20

****: Please see AC 150/5300-13A for differences in taxiway fillet dimensions.***

TAXIWAY GEOMETRY ANALYSIS

AC-13A includes taxiway design recommendations for reducing the potential for runway incursions. The section that follows provides a review of those design standards relevant to the current airfield configuration.

Runway Incursions:
Runway incursions are events when an aircraft or vehicle inadvertently proceeds onto an active runway without air traffic control clearance.

DIRECT ACCESS TO RUNWAYS

One of the ways to reduce runway incursions is to require pilots taxiing aircraft to make distinct, purposeful turns between leaving an apron area and accessing a runway. That is to say, there should not be direct straight-line taxiways leading from an apron to a runway and taxiway turns should be right-angle connectors An example of the direct access issue and resolution is shown below in **Figure 3-11**. An example of a right-angle connector is shown in Figure 3-12. There are several areas on the Airport where direct access currently occurs. These areas are listed below and identified on **Figure 3-13.**

- ✓ Taxiway A (north side): a taxiway centerline stripe leads directly from a tiedown apron across Taxiway C to the threshold for Runway 11

- ✓ Taxiway A (south side): a taxiway centerline stripe leads directly from a row of box hangars across Taxiway G to the threshold for Runway 11
- ✓ Taxiway E: a taxiway centerline stripe leads directly from the commercial apron to the threshold for Runway 5
- ✓ Taxiway H: a taxiway centerline stripe leads directly from the commercial apron to Runway 5-23

Figure 3-11. Example of Direct Access Issue and Resolution

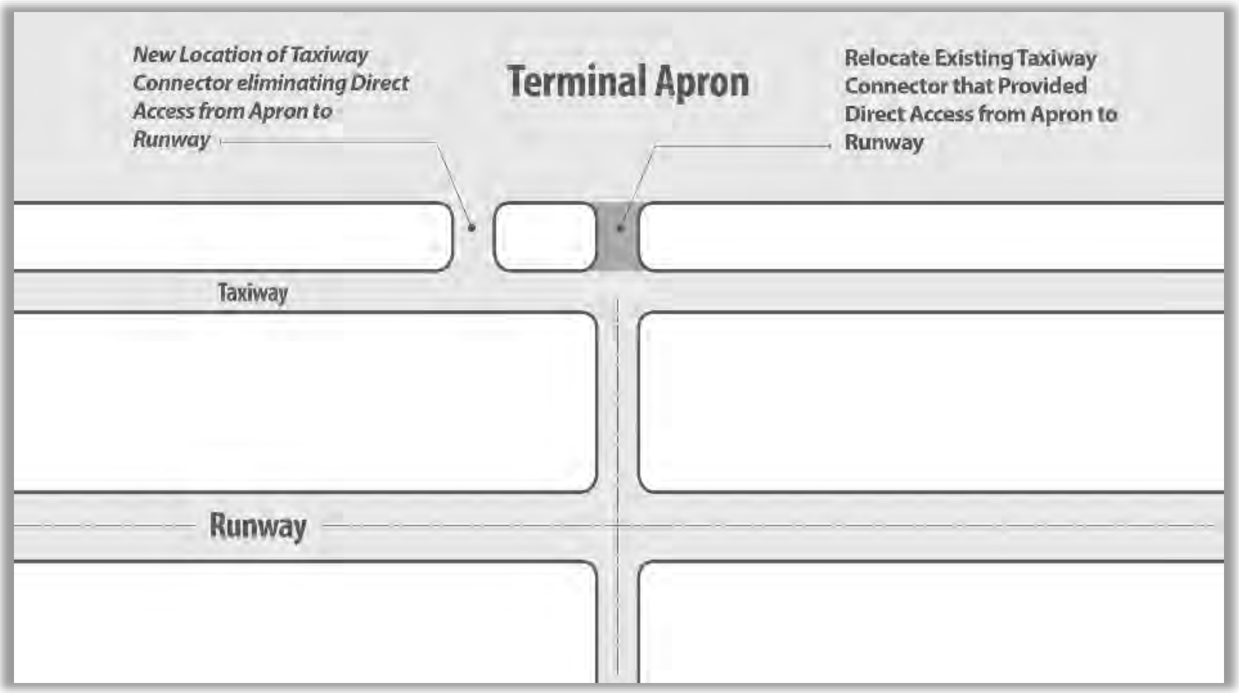
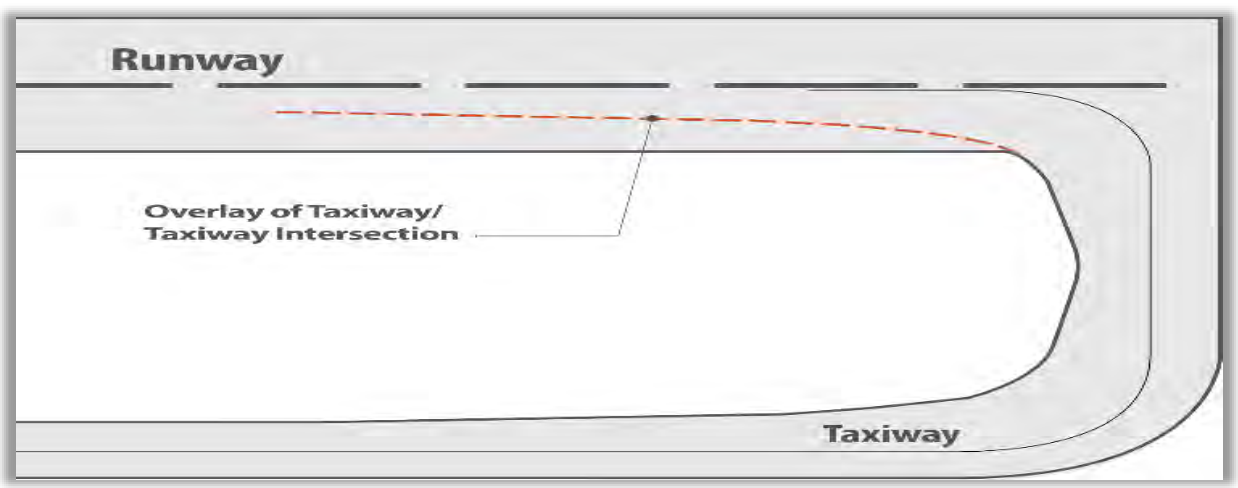


Figure 3-12 Example of Right-Angle Connector



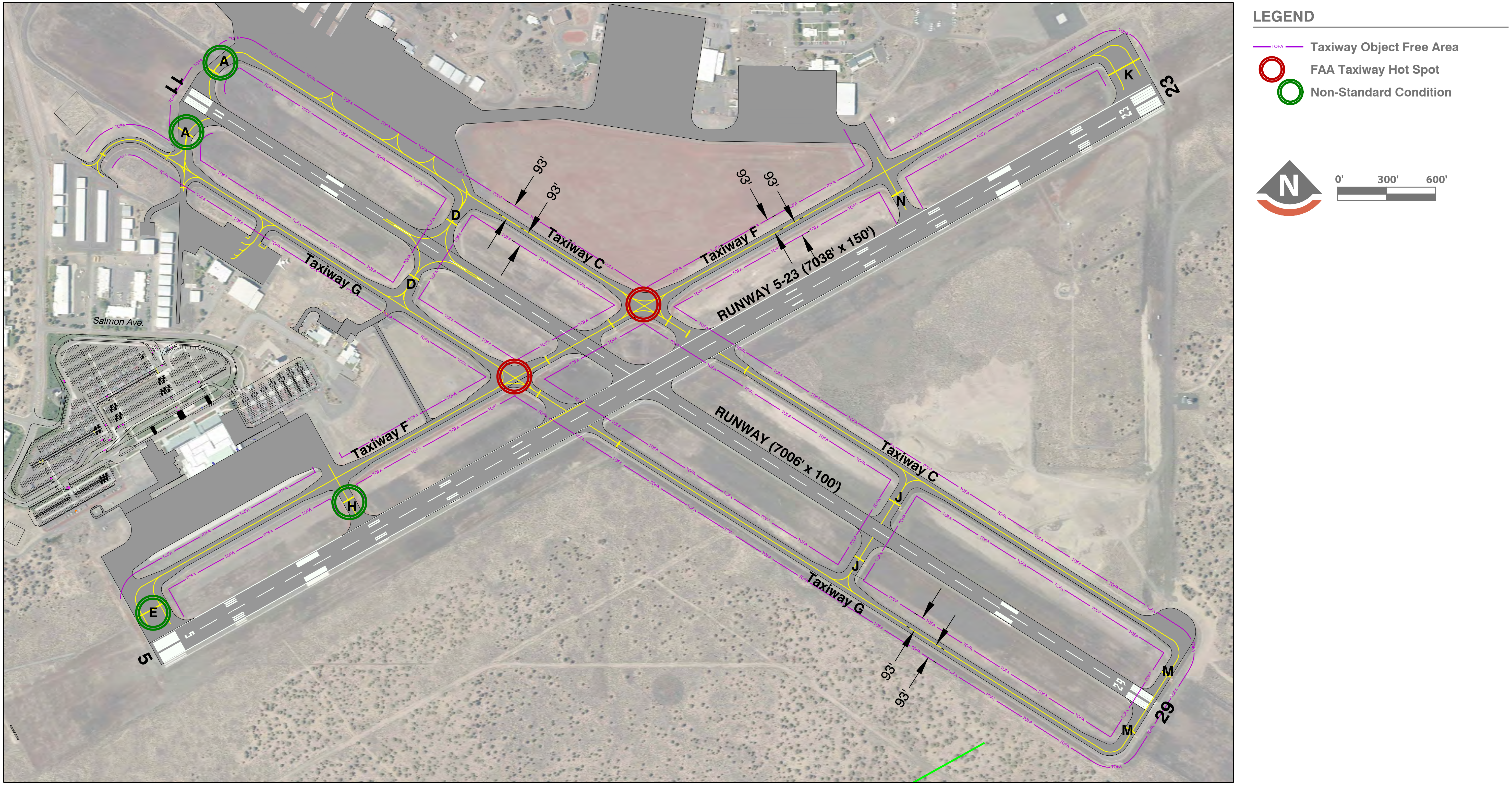


Figure 3-13
TAXIWAY DESIGN

COMPLEX INTERSECTIONS

The AC-13A also recommends simplifying complex taxiway intersections. The AC defines complex taxiway intersections as those with more than three nodes (more than three possible directions of travel). No taxiway junctions on the RDM airfield are complex intersections. No changes are required.

HOT SPOT ANALYSIS

Two areas of the airfield have been designated by the FAA as Hot Spots: the Taxiway C intersection with Taxiway F, and the Taxiway F intersection with Taxiway G. Ultimately the FAA will likely require proposed resolutions to these two areas to reduce the risk of runway incursions. **Chapter 4 Alternatives Analysis** will include analysis of potential designs.

> **Hot Spot:**
> A hot spot is defined as a location on an airport movement area with a history of potential risk of collision or runway incursion, and where heightened attention by pilots and drivers is necessary.

RUNWAY END CONNECTORS

Another design standard introduced in AC-13A was intended to reduce or eliminate wide expanses of pavement, especially at runway crossing locations. Until recently Taxiway E and K had dual entrance taxiways without "no taxi" islands painted on the pavement. This nonstandard condition was corrected in 2017.

RIGHT-ANGLE TAXIWAY CONNECTORS

The AC recommends that all taxiway connections to runways be 90-degree angles, except for high speed exit taxiways and parallel taxiways associated with one runway crossing another runway. The north and south segments of Taxiway A are both oblique-angled taxiways that do not fall into either of the exception categories just discussed. The modifications to these two segments described above under the ***Direct Access to Runways*** section will provide the recommended right-angle taxiways. An example of a right-angle taxiway connector is shown in **Figure 3-12**.

EXIT TAXIWAY ANALYSIS

The location of exit taxiways can impact a runway's capacity. The quicker an aircraft can slow to a safe speed and exit the runway, the sooner another can land or takeoff. AC-13A states that, in general, each 100-foot reduction of the distance from the threshold to the exit taxiway reduces the runway occupancy time by approximately 0.75 second for each aircraft using the exit. Conversely, the opposite is true as well, each every 100-foot increase in the distance from the threshold to the exit taxiway increases the runway occupancy time by approximately 0.75 second for each aircraft using the exit. **Table 3-12** below contains the exit taxiway distance from landing threshold for each of the four runways and the corresponding percentage able to use each exit taxiway. The information below is for dry runways only. When wet, the percent of aircraft able to use each taxiway will be reduced as the landing lengths will be increased. Since RDM does not currently and is not forecast to experience a capacity or delay problem, there is no need to adjust the current locations of these exit taxiways.

3-12. Taxiway Exit Utilization (Dry)					
Runway 23					
		Percent Able			
Taxiway	**Distance**	**Small Single Engine**	**Small Twin Engine**	**Large**	**Heavy**
N	1,660'	40%	0%	0%	0%
C	3,085'	100%	39%	0%	0%
G	4,070'	100%	98%	8%	0%
H	5476'	100%	100%	75%	24%
E	6850'	100%	100%	95%	90%
Runway 5					
		Percent Able			
Taxiway	**Distance**	**Small Single Engine**	**Small Twin Engine**	**Large**	**Heavy**
H	1,450'	39%	0%	0%	0%
G	2,800'	95%	35%	0%	0%
C	3,750'	100%	89%	5%	0%
N	5,275'	100%	100%	40%	5%
K	6,850'	100%	100%	95%	90%
Runway 11					
		Percent Able			
Taxiway	**Distance**	**Small Single Engine**	**Small Twin Engine**	**Large**	**Heavy**
D	1,700'	80%	1%	0%	0%
F	2,750'	100%	35%	0%	0%
J	5,000'	100%	100%	49%	9%
M	6,850'	100%	100%	95%	90%
Runway 11					
		Percent Able			
Taxiway	**Distance**	**Small Single Engine**	**Small Twin Engine**	**Large**	**Heavy**
J	1,950'	84%	1%	0%	0%
F	4,050'	100%	98%	8%	0%
D	5,100'	100%	100%	49%	9%
A	6,850'	100%	100%	95%	90%

**Small Single Engine = 12,000 lbs or less*
Small Twin Engine = 12,500 lbs or less
Large = 12,500 lbs to 300,000 lbs
Heavy = Greater than 300,000 lbs

TAXIWAY PAVEMENT STRENGTH

As discussed under the **Runway Pavement Strength** section above, the forecast airline fleet transitions to narrow body aircraft will exceed the existing pavement strength ratings. When the Airport does see these larger narrow body airline aircraft increasing in frequency at the airport, pavement strengthening projects should be studied.

TAXIWAY SYSTEM CONCLUSION AND RECOMMENDATIONS

The existing taxiway system serves the RDM Airport users well. No major inadequacies exist for the current airfield configuration or activity levels. Some areas are identified below that do not comply with the latest geometry guidance from the FAA. Those areas are analyzed in **Chapter 4** and depicted with solutions on the ALP.

- ✓ Taxiway A (north side): add pavement and restripe to provide a right-angle taxiway

- ✓ Taxiway A (south side): add pavement and restripe to provide a right-angle taxiway
- ✓ Taxiway E: replace existing taxiway segment between the apron and Taxiway F with a new connector taxiway located about 400 feet east of the existing taxiway
- ✓ Taxiway H: replace the existing taxiway segment between the apron and Taxiway F with a new connector taxiway located about 175 feet east of the existing taxiway
- ✓ Taxiway C hot spot: shift segment that crosses Runway 5-23 to the east
- ✓ Taxiway G hot spot: shift segment that crosses Runway 5-23 to the west
- ✓ Runway exit taxiways: retain current locations
- ✓ Pavement strength: evaluate pavement strength requirements when narrow body airline aircraft begin regularly scheduled operations at the Airport

As presented below in the **General Aviation Facilities** section, if the Airport moves forward with developing a new east field GA complex, the airport could ultimately benefit from a full-length parallel taxiway to the east of Runway 5-23. The existing GA facilities at RDM are constrained and a full-length parallel taxiway east of Runway 5-23 will provide access to the airfield for a new GA complex and allow for future airport development on property that is adjacent to the parallel taxiway.

Figure 3-13 (above) highlights non-compliant areas of the airfield.

3.2.5 GENERAL AVIATION FACILITIES

Growth in GA based aircraft at the Airport is contingent upon adequate facilities and easy developable areas. Currently, the general aviation facilities at the airport are somewhat constrained. With a few exceptions, the easily developable areas with access to the airfield are occupied. The remaining areas available can be used for infill hangar development in an effort to accommodate some of the projected 33 new based aircraft at the Airport, which are forecast within the 20-year planning period.

Figure 3-14 depicts conceptual hangar infill sites and one new development area on the north side of the airfield.

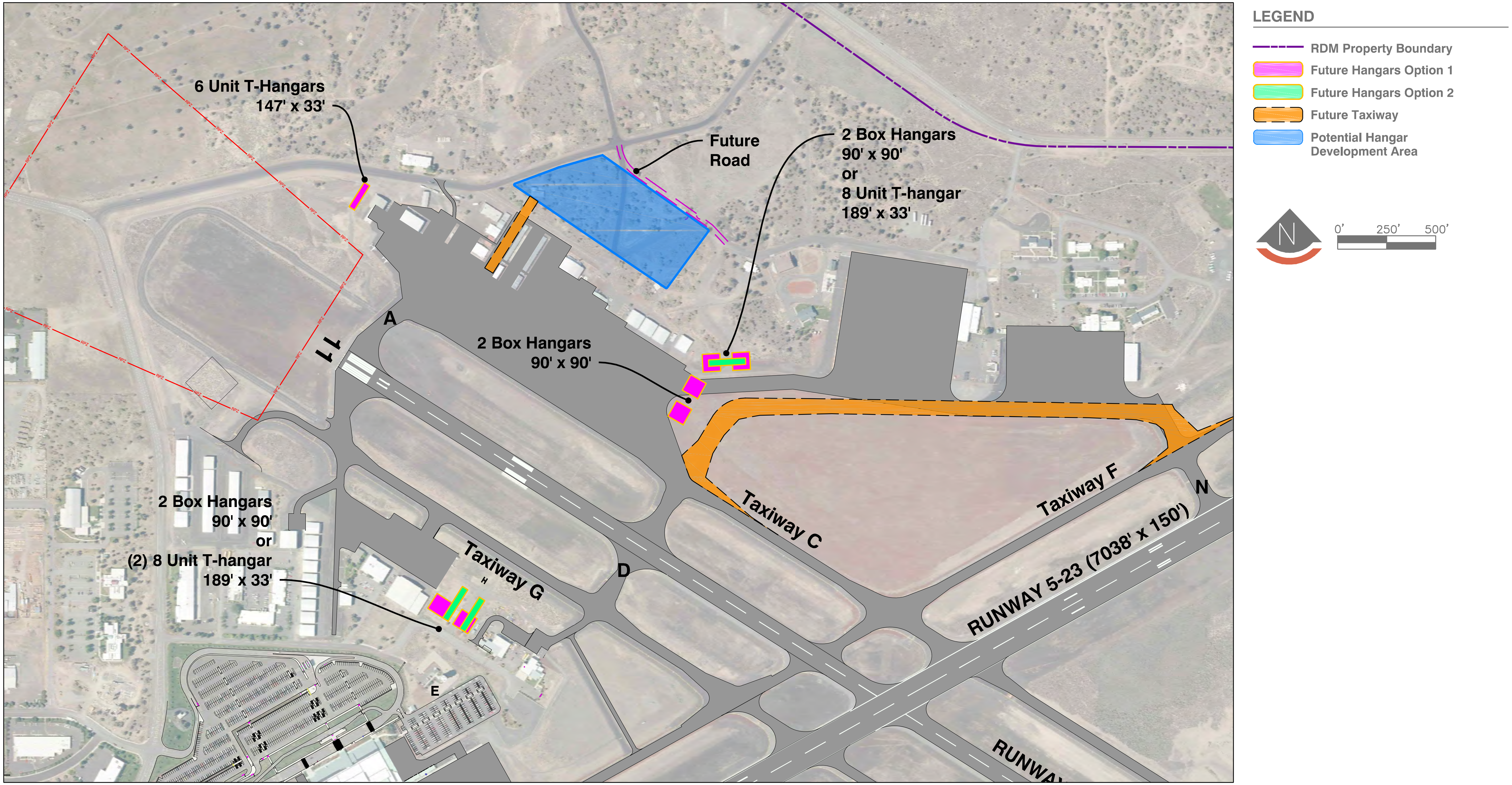


Figure 3-14
HANGARS

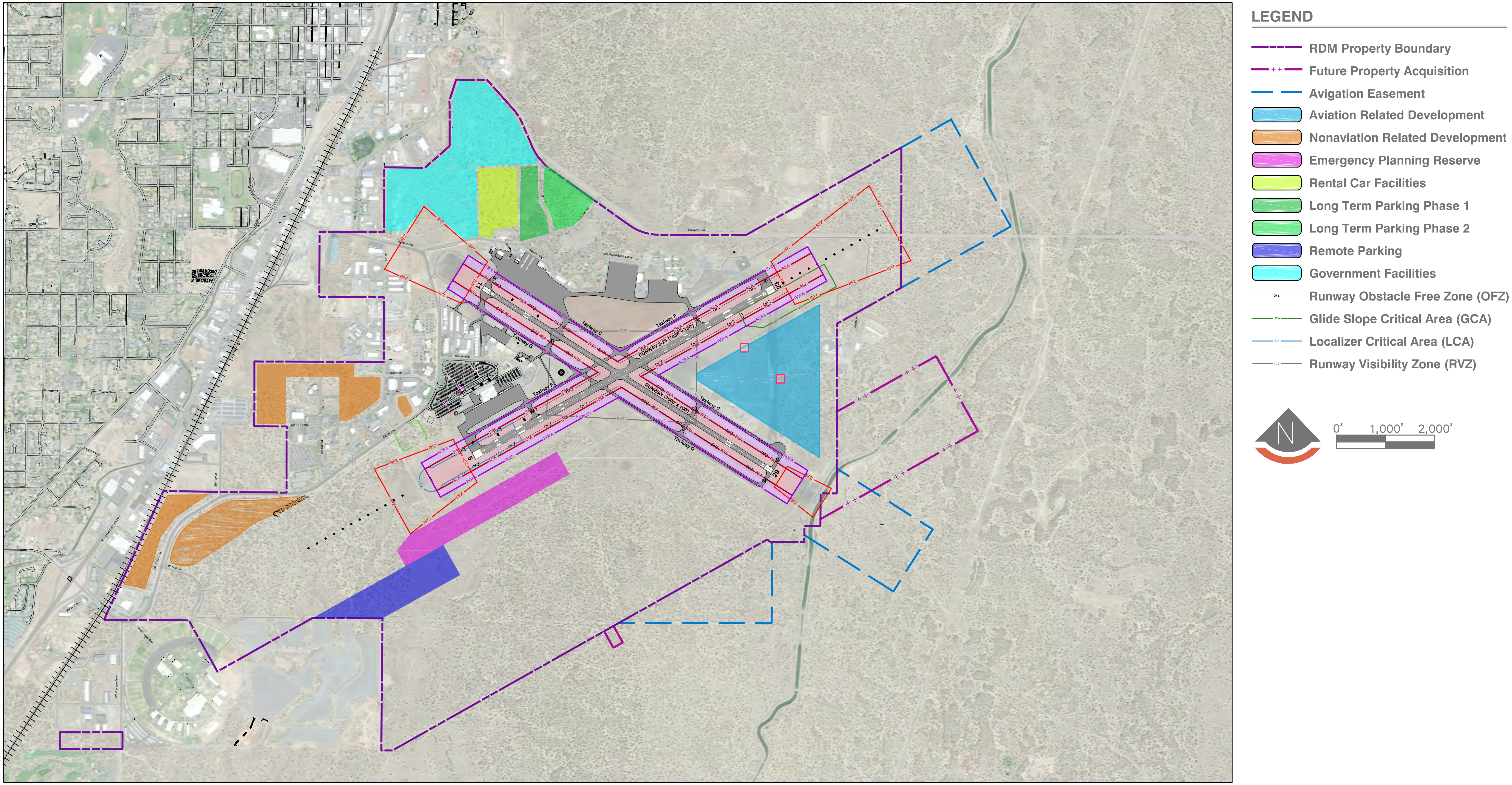


Figure 3-15
DEVELOPMENT AREAS

Chapter 2 Aviation Activity Forecast identifies an increase of 5 single-engine aircraft, 24 jet aircraft, 6 helicopters, and 5 other type aircraft relocating to the Airport within the 20-year planning period. Some of these aircraft could be located in the infill sites as shown in **Figure 3-14**, however, in order to accommodate all 33 aircraft, at least one new GA development area should be planned.

To protect for GA development beyond the 20-year planning period or growth exceeding this plan's forecast, an aviation reserve area is proposed in the east quadrant of the airport between the two runways. **Figure 3-15** shows this location. If another Fixed Base Operator (FBO) is looking to serve the Airport, this would be a suitable location. However, development in this area will be costly due to the lack of infrastructure and the high cost of site preparation.

Variations and alternative configurations of the hangar infill sites and GA development area will be further explored in the **Chapter 4 Alternatives Analysis**.

Itinerant operations are also relevant to this master plan. The Airport is forecast to experience an increase of approximately 3,000 itinerant general aviation operations within the 20-year planning period. The 3,000 annual operations equate to approximately 8 operations per day, or 4 aircraft visiting the airport. The existing FBO can accommodate the increase as currently configured.

Additional support facilities are discussed later in this chapter.

CONCLUSIONS AND RECOMMENDATIONS

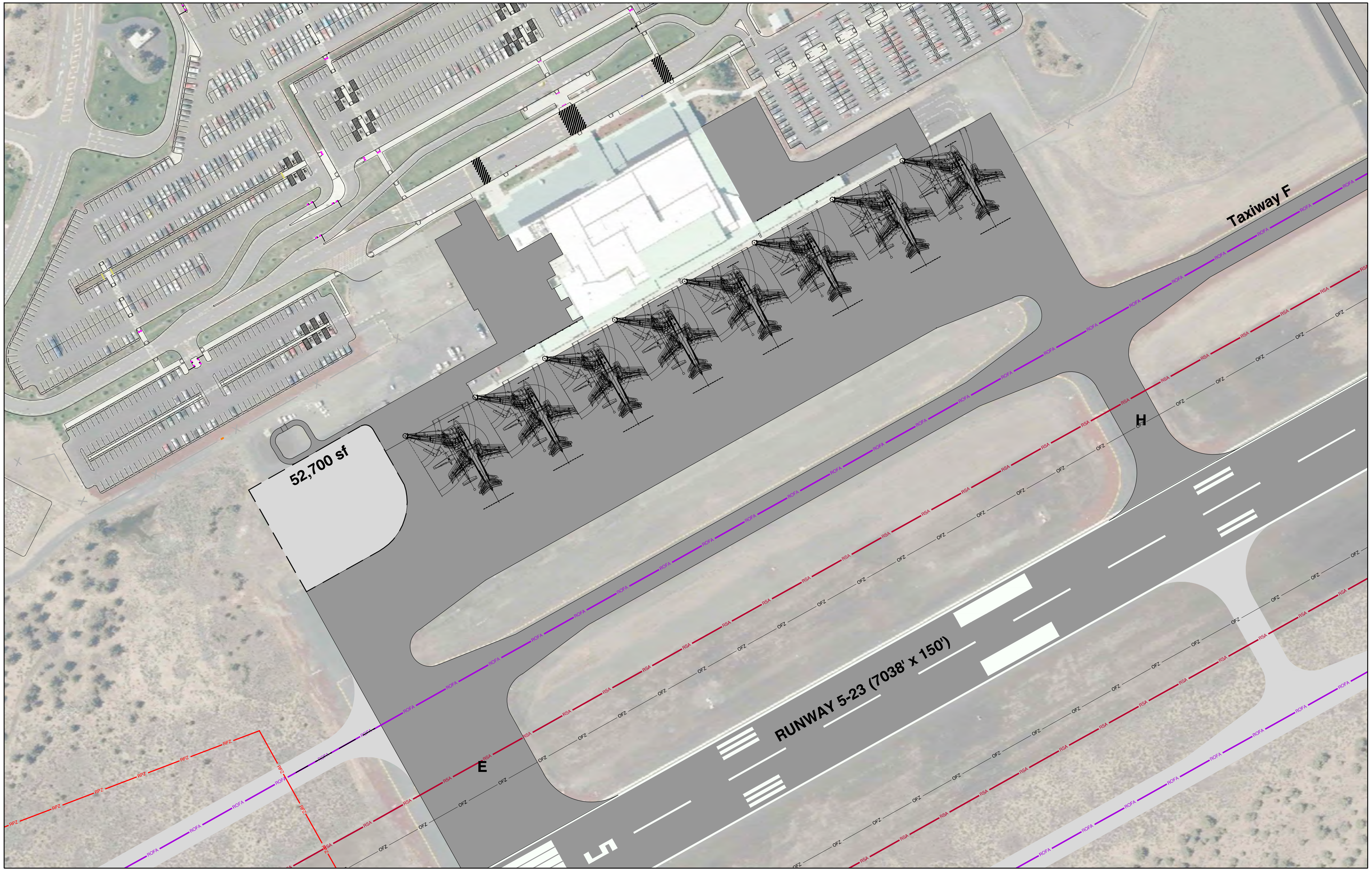
To accommodate the forecast increase in general aviation based aircraft, the following facility improvements should be made:

- ✓ Identification of hangar site alternatives
- ✓ Locate long-term general aviation development area

PASSENGER TERMINAL APRON

The passenger terminal apron is approximately 1,528 feet wide and 297 feet deep (453,816 square feet). Taxiway connectors H and E provide access to parallel taxiway F and Runway 5-23.

The apron accommodates seven aircraft parked at terminal gate positions and one additional parking position. Based on current airline schedules, up to eight aircraft each day are scheduled to remain overnight (RON). As airline operations increase and schedules change this number may increase to 10 RON aircraft. Given that the passenger terminal apron is currently at capacity for RON aircraft, the airport should plan for an apron expansion as soon as practical. **Figure 3-16** illustrates a conceptual apron expansion to accommodate the projected RON demand. Specific locations and alternatives will be explored in the following **Chapter 4 Alternatives Analysis**.



LEGEND

- RDM Property Boundary
- Active Airfield Pavement
- Future Airfield Pavement
- Runway Safety Area (RSA)
- Runway Object Free Area (ROFA)
- Runway Obstacle Free Zone (OFZ)

N

0' 100' 200'

Figure 3-16
TERMINAL AND AIRLINE APRON EXPANSION

3.3 LANDSIDE FACILITY REQUIREMENTS

3.3.1 PASSENGER TERMINAL ROADWAY

With the advent of Transportation Network Companies (TNC) such as Uber and Lyft, the Airport has identified a need for a separate curbside area to consolidate TNC vehicles dropping off and picking up passengers. **Chapter 4 Alternatives Analysis** will include various locations and options for this service.

3.3.2 PASSENGER TERMINAL PARKING AREA – PUBLIC PARKING

At RDM public parking is a single-level uncovered parking lot that accommodates both short- and long-term parking. As of 2017, the terminal parking lot accommodates 1,083 vehicles. This analysis compares parking spaces against enplaned passengers for forecast scenarios to determine whether the parking facilities will require expansion.

ACRP Report No. 25: Airport Passenger Terminal and Design recommends that public parking supply should range from 900 to 1,400 spaces per million enplaned passengers. Based on this guidance, total public parking spaces at RDM exceed the recommended range for current enplanement levels and fall within the recommended range through 2036. However, based on first-hand information supplied by the Airport, the parking lot has exceeded capacity several times in the last year. Given this information, it appears the suggested ratio of 900 to 1,400 spaces per million enplaned passengers is not appropriate for RDM.

Airports Cooperative Research Program (ACRP):
An industry-driven, applied research program managed by the Transportation Research Board (TRB) that develops near-term, practical solutions to problems faced by airport operators.

The Airport has reached parking capacity with current enplaned passenger levels of 322,176. A ratio of 330 parking positions for every 100,000 enplaned passengers is based on capacity being reached in 2016 plus a 10 percent buffer. The Airport's parking lot requires expansion as soon as practical to meet existing demand, as well as projected future growth. Based on the airport-specific ratio of 330:100,000 enplanements, RDM should plan to accommodate an additional 1,100 parking spaces to accommodate demand through the 20-year planning period, shown in **Table 3-13**. The parking expansion can be accomplished with phased development, allowing the Airport to develop smaller portions of the parking expansion as needed. Auto parking areas are shown on **Figure 3-17**. Specific locations and alternatives will be explored in the following **Chapter 4 Alternatives Analysis**.

LEGEND

- RDM Property Boundary
- Area 1 - Hourly & Premium Long-Term Parking
- Area 2 - Original Employee Parking Reduced
- Area 3 - Expanded Vendor Parking as Necessary
- Area 4 - Alternative Employee Parking Expansion

Note: Layout assumes additional off-site long term parking lot. Employee parking would move to off-site parking lot as necessary.

N

0' 100' 200'

Figure 3-17
AUTO PARKING AREAS

Table 3-13. Recommended Parking Improvements	2016	2021	2026	2031	2036
Enplanements	322,176	391,450	484,300	575,350	661,600
Parking Required[3]	1,083	1,292	1,598	1,899	2,183
Capacity (Deficiency)	0	(209)	(515)	(816)	(1,100)

ACRP recommends 1,000 feet as the maximum walking distance from a parking space to the terminal building before shuttle service should be offered. The farthest point at the northwest end of the parking lot is approximately 1,000 feet, while the farthest point at the southwest end is 1,250 feet. The far limits of the existing parking area are within the limits of pedestrian travel; however, the long walk from the southwest end of the parking lot is farther than desirable.

EMPLOYEE/TENANT PARKING

The employee and tenant parking lot is immediately adjacent to the terminal building on the southwest side and accommodates 195 vehicles. Currently the airport has issued 277 employee and tenant parking passes. If conditions dictate all employees must be present on the same day, the parking lot will be over capacity. As the Airport continues to experience record growth in enplaned passengers, employee and tenant numbers will grow. Additional parking for employees and tenants should be identified. For reference, the current ratio of parking passes allocated is 85.9 passes per 100,000 enplanements. Projecting this ratio out with the forecast enplanements results in a requirement of approximately 500 employee and tenant parking spaces in 20 years. Specific locations and alternatives for employee parking will be explored in the following **Chapter 4 Alternatives Analysis**.

3.3.3 RENTAL CAR FACILITIES

Alamo, Avis, Budget, Enterprise, Hertz, and National car rental agencies offer rental vehicles at the Redmond Airport. Vehicles are picked-up and dropped-off in a 224-space parking lot located immediately northwest of the terminal building. The Airport has near-term development plans for an offsite rental car facility that will include cleaning, storage, and a fueling station. The rental car agencies plan to continue using the 224 parking spaces next to the terminal building for the pick-up and return location. Long-term storage and support services will be accomplished at the future offsite location. Specific locations and alternatives will be explored in the following **Chapter 4 Alternatives Analysis**.

[3] Ratio of parking spots to enplanements is 330 parking positions for every 100,000 enplanements and based off of 2016 enplanements and assumption of a full parking lot with a 10% buffer. Ratio was then applied to forecast enplanement numbers.

3.3.4 NON-AVIATION REVENUE DEVELOPMENT

The consultant conducted an analysis to identify the facility requirements for non-aviation businesses that complement the airport operations and are appropriate for the Redmond market, given local economic conditions. The analysis in its entirety is contained in the Appendix J. A summary of recommended infrastructure upgrades to help facilitate the revenue development are described below.

Non-Aviation Development Target Industries:

- ✓ Accommodation and Food Services
- ✓ Speculative Light Industrial Buildings
- ✓ Construction
- ✓ Manufacturing
- ✓ Wholesalers and Warehousing
- ✓ Public Administration

RECOMMENDED UPGRADES

The following recommendations are offered based on a comparison of the existing utility and transportation facilities and the corresponding demands of the target industries. **Figure 3-18** depicts the nine subareas that are the focus of this section. In all subareas, sewer lines would need to be extended from nearby mains and storm water management facilities would need to be constructed in conjunction with site development. Local streets should be constructed to the local industrial street standard (40-foot paved width with sidewalks) to accommodate necessary truck access for most of the target industry sectors. Improved access to Oregon Route 126 will eventually be required to accommodate future growth with any of the target industry sectors and will likely include added turn lanes and traffic signals. Turn lanes at major intersections may also be needed to serve future development. Necessary improvements would be identified with the preparation of traffic impact studies for specific development proposals.

Specific upgrade requirements for each subarea are noted below.

- ✓ North Development Parcel Subarea: The existing water lines between Lake Road and Veterans Way are not well-connected. A loop system is recommended throughout the subarea to maintain necessary flows for high-demand industrial users. This subarea currently has no existing transportation infrastructure and will need to rely on the construction of new streets. Transportation improvements associated with the Airport Runway Extension will eventually provide access through the subarea. Local streets that provide direct site access will need to be constructed to local industrial standard (40-foot paved width with sidewalks).
- ✓ North Business Park Subarea: The existing water lines between Veterans Way and OR 126 are not well-connected. A loop system is recommended to supply necessary flows for high-demand users. The local streets (10th Street, Sisters Avenue, Ochoco Way) need to be upgraded to current local industrial standard (40-foot paved width with sidewalks). Veterans Way needs to be upgraded to meet the major collector standard (36-foot paved width with sidewalks). At the Veterans Way intersection with OR 126, an eastbound right-turn deceleration lane on OR 126 may be necessary as volumes increase, and separate left- and right-turn lanes may be necessary on the Veterans Way approach. Left-turn lanes on Veterans Way at other intersecting roadways may also be needed.

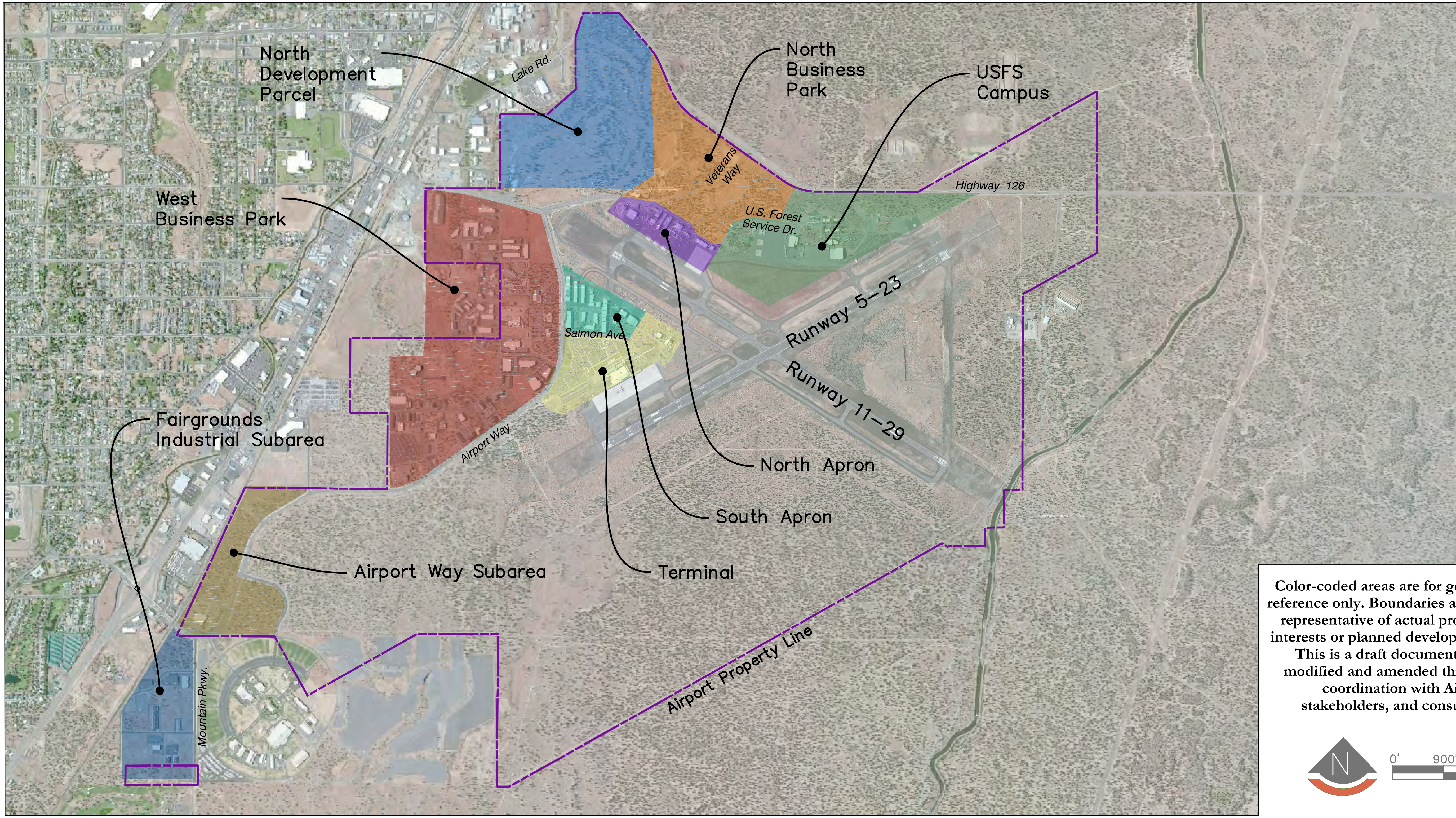


Figure 3-18
Development Areas

- ✓ South Apron Subarea: Salmon Avenue needs sidewalks on the north side of the street.
- ✓ West Business Park Subarea: Airport Way and Veterans Way need sidewalk infill, primarily along undeveloped property.
- ✓ Airport Way Subarea: Airport Way needs sidewalk infill on both sides of the street. Mt. Hood Drive needs sidewalks along both sides of the street. Wickiup Avenue needs to be constructed or upgraded to current local industrial standard (40-foot paved width with sidewalks).
- ✓ Fairgrounds Industrial Subarea: Airport Way needs sidewalks on the south side of the street.

3.4 TERMINAL AREA FACILITIES

The existing terminal is a relatively new facility constructed in 2010 to meet the requirements of the community in support of a modernization program that would both attract travelers from the region, including Redmond, and provide a better operating environment for the airlines.

3.4.1 AIRPORT ACTIVITY

The focus of the terminal area facility master plan is to develop additional capacity to meet current trends in airline operations reflected in the activity forecast. A migration to larger aircraft over the planning period is the primary trend. Airlines have been in the process of retiring smaller aircraft, the 35- to 50-seat jet aircraft that have served commuter operations since the mid-1990s, and replacing them with larger 65- to 90-seat aircraft. This trend has also included larger narrow-body aircraft that serve small hub destination airports on specific high demand and seasonal flights.

This section addresses terminal area facility improvements over the next 20 years. Level of service modifications and upgrades to these facilities areas can be built as a series of projects that meet specific needs during the period. **Table 3-14** provides the basis of design for this development, a summary of major airline peaking activity for 2016 and 2036 derived from the aviation forecasts. These peaking characteristics define the operation and are used to calculate operations-based program requirements.

Table 3-14. Airline Operations Peaking Characteristics – 2016 – 2036 Forecast		
Airline Activity Component	**Existing (2016)**	**Forecast (2036)**
Aircraft		
Aircraft	CRJ-700	B737/A319
Average Aircraft Seat Size	69	119
Load Factor	84%	84%
Passengers		
Total Passengers [Enplaned + Deplaned]	644,352	1,323,200
Peak Month Passengers - Enplaned	32,395	66,524
Peak Month Passengers - Enplaned - Percent	10.10%	10.10%
Peak Month Passengers - Deplaned	32,395	66,524
Peak Month Passengers - Deplaned - Percent	10.10%	10.10%
Total Average Day Passengers [Enplaned + Deplaned]	1,765	3,625
Total Peak Day Passengers [Enplaned + Deplaned]	2,324	7,122
Total Peak Hour Passengers	289	1,060
Peak Hour Enplaned Passengers [PHEP]	208	580
Peak Hour Deplaned Passengers [PHDP]	144	560
Enplanements Per Departure [E/D] - Average Annual Day	58	105
Enplanements Per Departure [E/D] - Average Day of Peak Month	60	115
Aircraft Operations		
Total Annual Airline Operations	11,200	12,600
Peak Week Air Carrier Operations	290	414
Total Daily Operations	42	60
Total Daily Flight Departures	21	30

Source: Mead & Hunt Airline Activity Forecasts

3.4.2 PASSENGER TERMINAL BUILDING

Airlines embarked on a program of consolidation and capacity constraint during and after the 2007–2009 recession. Capacity constraint served to move fuel-inefficient aircraft out of airline fleets, replacing them with aircraft that would provide both fuel savings and increased seating capacity. As the industry recovered and then began to grow, airlines have replaced commuter aircraft with larger narrow-body aircraft. Airport terminal facilities have been straining to meet the demands generated by the new aircraft for landside, terminal building, and ramp apron capacity.

The Redmond terminal building was designed for smaller commuter aircraft, those operating in the 50- to 70-seat range of seat capacity. It was also designed in a more traditional layout, in which a main departures hall serves as a waiting area, similar to a train station, where passengers await a boarding call and then proceed to their designated platform. In the airport terminal, tickets are lifted prior to entering the boarding corridor, which serves as the platform from which passengers are boarded onto the aircraft. These design elements place more limitations on capacity for passenger departures lounges than on other terminal components. One disadvantage to the current layout is that expansion requires moving other components. Expansion of the upper level concourse departures lounge is possible, and would have less impact on functional components, but that expansion is limited to either side, as moving into the ramp apron would reduce space required for larger aircraft.

While this layout has merit in a smaller terminal, it can be counterintuitive to travelers who prefer to be as close to their transport as possible prior to boarding. Proximity provides a sense of calm, as passengers can see their scheduled departure posted at the gate and be readily aware of any airline operations interruption that would require their response. It is more than information, though, as passengers in close physical proximity to their transport often believe they will have some control over responding to any disruption in their schedules.

The present terminal layout might have served the operation longer had the airline industry not evolved so quickly, creating additional demand on terminal buildings throughout the country as well as at Redmond. Terminal expansion in 2010 provided much needed space, which has allowed the facility to absorb an increase in demand at almost all functional components. Future growth forecast for Redmond will require more terminal space to meet passenger demand. Terminal area ramp apron space can be reconfigured to accommodate larger aircraft at more gates than the present six commuter gate hardstands. A summary of the building improvements identified for the planning period are listed by functional component in **Table 3-15**. The recommended areas, when complete, represent a program for the year 2036. Some components will take priority over others in phased development and are listed from higher to lower priority based on passenger demand and available capacity.

Table 3-15. Program Requirements Summary

Second floor concourse and passenger departures lounges	An eight-gate reconfiguration of the second level concourse level including vertical circulation and relocated concessions and toilets. This development will be phased in smaller projects. Vertical circulation for the eight-gate development will be built in the first phase, requiring reconfiguration of the lower level departures lounge and concessions areas.
Ramp apron gate hardstands and passenger boarding bridges	A total of eight ramp apron gate hardstand positions, with corresponding passenger boarding bridges. The ramp apron area contains 243,205 square feet. Each hardstand position will accommodate the largest narrow body aircraft. The boarding bridges will be capable of handling EMB-145/CRJ-200 aircraft, larger commuter jets and up to B737-900Max/A321neo aircraft. These component areas and equipment will be phased in smaller projects over the 20-year period to 2036.
Concessions	Car rental, retail and gifts, food and beverage, goods, stock and cold storage on the non-secure and secure sides of the terminal. Concessions will also include a small, dedicated receiving and security screening area for all concessions stores delivered to the terminal building, plus a small office break room for the concessionaire.

Continued on the next page.

Table 3-15 - continued. Program Requirements Summary	
Departures/Ticket Hall	Ticket hall expansion will involve both ticketing facility and main concourse expansion; the former to meet current and near-term demand in airline ticket office space and greater ticket counter capacity to meet growth in demand, and the latter to meet increases in queueing and gathering of passengers in the main departures hall during seasonal peak travel. Given limits at the terminal curb and roadway, this space could initially be met by relocating some of the functions from the front of the departures hall. Toward the end of the planning period, this requirement can be met through ticket hall expansion and roadway relocation.
Outbound Baggage Make-up	The outbound baggage make-up facility will become constrained as more flights are added to the schedule, requiring more cart staging at the baggage make-up device. Expansion of this area will include an additional make-up device adjacent to the existing device.

Terminal programmatic requirements were identified and calculated for functional components only. **Table 3-16** lists program requirements based on the major components. Administration and ancillary area requirements are included as a percentage of the total programmed space. This includes facilities maintenance and services, workrooms, storage, and janitor closets. Mechanical and electrical support has been programmed as a percentage of the total additional programmed space above the 140,000-square-foot existing building. Other equipment space such as vertical circulation elevators, escalators, and stairs have been identified and included as line items in the program, as their footprints are quantifiable.

Table 3-16. Terminal Building Program Functional Components

Functional Component	Basis of Analysis	Capacity	Demand	Additional Requirements	Number of Processors
Entrance Hall	25 SF/Passenger	420	638	6,000 SF	N/A
Ticket Hall	Queue, Counter, ATO	10	15	5	15
Checked Baggage Screening	Screening Capacity	600 BPH	465 BPH	None	N/A
Outbound Baggage Make-Up	NB EQVFlights	3	8	5	2
Passenger Security Screening	150 Passengers/Hour	300	550	2	2
Passenger Departures Lounge	Peak Hour Seats	220	656	436	N/A
Second Level Concourse Corridor	Peak Hour Passengers	N/A	760	19,000	N/A
Second Level Concourse Toilets	Arriving Passengers	3 Fixt/Gate/Gender	48	48	N/A
Concessions	Individual Airport	N/A	12,800 SF	9,300 SF	N/A
Baggage Claim & Inbound Drop	Checked Baggage	2 NB EQA	4 NB EQA	2 NB EQA	2
Vertical Circulation	2 Esc/Elev/Direction	1 Elevator	2 / Direction	2 Esc/Elev/Direction	N/A

3.4.3 GATE CAPACITY REQUIREMENTS

The airport terminal currently has six commuter aircraft gate hardstand positions, of which five are assigned to air carriers. Future gate requirements have been determined through formulas for growth based on historical measures of annual enplanements and operations per gate. For destination airports such as Redmond, a practical gate capacity can be set based on precedent, geography, markets served, and airline hub operations. Geography marks the distance from major hub markets, which affect the number of flights that can reasonably be scheduled into the airport. Airline hubs operate arrivals and departures banks throughout the day, and flights to and from Redmond are coordinated with these operations. Historical precedent represents airlines' preferences for scheduling at Redmond to take best advantage of hub operations. Adding flights into other periods of the day should follow precedent and can be achieved through limited and/or seasonal scheduling to test markets.

Determining a practical gate capacity provides a framework to indicate a need for additional gates so airlines can schedule into preferred periods of the day. Large hub airports will typically schedule eight to ten turns per gate or more, depending upon airlines' minimum objective ground time and aircraft size. With longer periods of no activity at small hub destination airports, an achievable number of operations per gate may be indicated with as few as five or six before additional gates may be required.

Enplanements and operations per gate show there is more than sufficient capacity through the operating day to add flights. Forecast activity builds on the schedule carriers operate today. Using six aircraft as the current gate requirement, enplanements per gate calculations show that six will serve into the future. With the early morning departures bank activity, a higher number of gates would be supported.

Table 3-17. Airline Gate Demand Forecast - Enplanements Per Gate

Year	Annual Enplaned Passengers	Annual Departures	No. of Gates	Enplanements Per Gate	Enplanements Per Departure
2014	255,654	5,789	6	42,600	44
2015	280,823	4,860	6	46,800	58
2016	322,176	5,600	6	53,700	58
Future Years					
2021	391,450	5,740	6	63,700	68
2026	484,300	5,800	6	78,000	84
2031	575,350	6,200	7	86,700	93
2036	661,600	6,300	7	98,100	105

Source: Mead & Hunt Airline Activity Forecasts & Analysis

Table 3-17 shows a requirement of seven gates based on a measure of enplanements per gate. Using forecasts for the four planning horizons within the period, six gates to represent current airline schedule activity, and enplanements per gate yields a total requirement of seven gates, which supports a close range of variance to meet airline schedule preference. Operations per gate yields a smaller total number of gates based on a higher efficiency in gate use. This method does not take into consideration multiple departures within a short window.

The use of historical precedent is a primary factor in forecasting future operations growth. Current airline schedules serve as records of how airlines prefer to operate based on hub schedules. Airlines may change schedules to manage seasonal time changes, adjusting flight departures and arrivals to meet operational requirements, but their core schedules remain relatively steady over time.

From the airline activity schedule for current operations, early morning comprises the largest block of outbound activity, with seven departures over two hours and eight total during the period. Six of these departures occur within one hour. Overnight there are eight aircraft on the ground. This is anticipated to increase to nine aircraft by the end of the planning period. The terminal building has six gates, five of which are used by the carriers to manage eight aircraft operations in the first departures bank. Based on this schedule precedent and an increase in aircraft size, eight gates would be supported through the planning period. The airlines can manage this activity by towing aircraft from hardstand positions to contact gate positions; however, because there would be closely spaced departures within a limited operations area, a safer option would be to provide additional contact gates. **Table 3-18** shows the design day forecast early morning departures bank.

Table 3-18. Future Schedule Forecast - Early Morning Departures – 2036

RDM	Equipment	Destination	Airline	Aircraft Seat Capacity (Average Number of Seats)	Aircraft Seat Configuration
0510	EMBRAER-175	PDX	ALASKA	70-90	76
0530	AIRBUS-319	SFO	UNITED	130-150	138
0550	MITSUBISHI-90	DEN	UNTED	90-110	100
0555	BOEING-737	SEA	ALASKA	110-130	130
0600	BOEING-737	LAX	AMERICAN	150-170	150
0600	AIRBUS-319	SEA	DELTA	130-170	138
0625	AIRBUS-319	SLC	DELTA	130-170	138
0700	AIRBUS-319	SJC	ALASKA	130-150	138
0722	EMBRAER-175	PDX	ALASKA	70-90	76

Source: Mead & Hunt Airline Activity Forecasts & Analysis

In meeting demand for future activity, eight contact gates with building departures lounges and passenger boarding bridges are supported. This development can be built in phases, with the first phase comprised of building expansion and reconfiguration of existing space and layouts to prepare for a transition to second-level departures lounges. A full complement of gates, departures lounges, and passenger boarding bridges would be supported by the end of the planning period.

The airlines may be forced to operate larger aircraft into their major hub airports sooner in the period due to limited gate resources at these airports. This will likely be evident in the early morning and late afternoon arrivals and departures banks, eventually migrating to midday periods. During this transition, there will still be a need for ground boarding commuter aircraft at hardstand positions, particularly with Alaska/Horizon operating the Q400 aircraft well into the future. Balancing the needs of the air carriers through gate resource planning will be key to meeting growth demands on the terminal building over time.

3.4.4 TERMINAL BUILDING DEVELOPMENT

Figures 3-19 and 3-20 show development of first and second level building improvements to meet demand, including eight gate plans with corresponding departures lounge and aircraft hardstands. **Figures 3-21 and 3-22** show potential phase one improvements.

Figure 3-19 FIRST LEVEL TERMINAL BUILDING MASTER PLAN EXPANSION

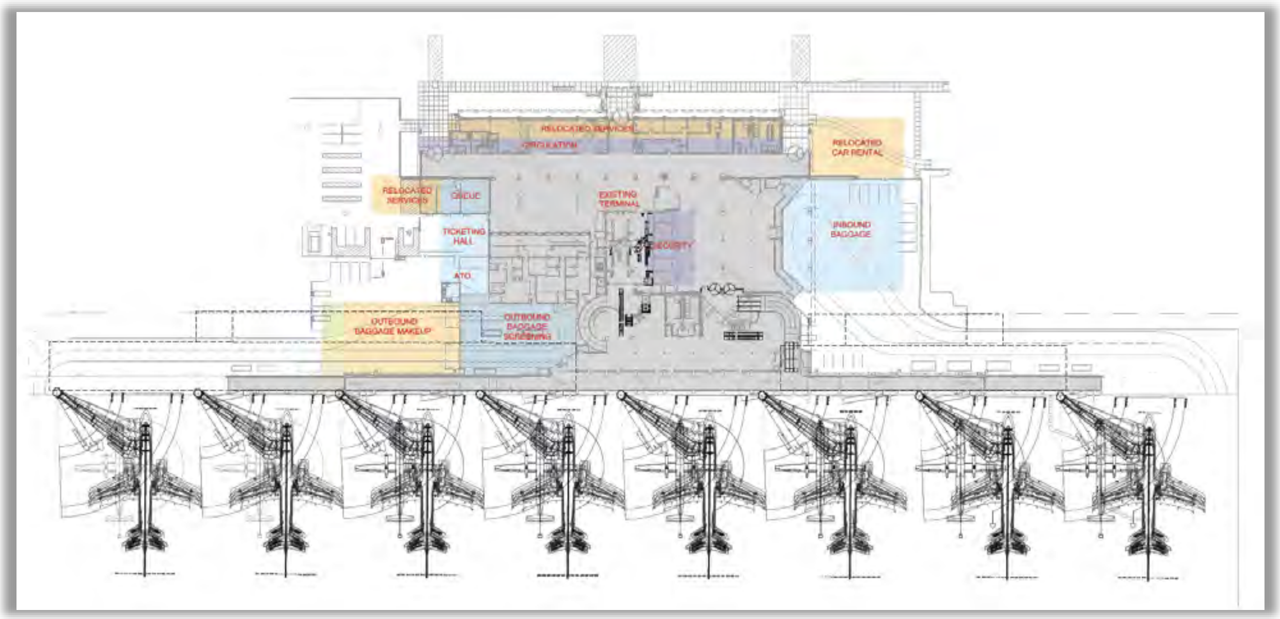


Figure 3-20 SECOND LEVEL TERMINAL BUILDING MASTER PLAN EXPANSION

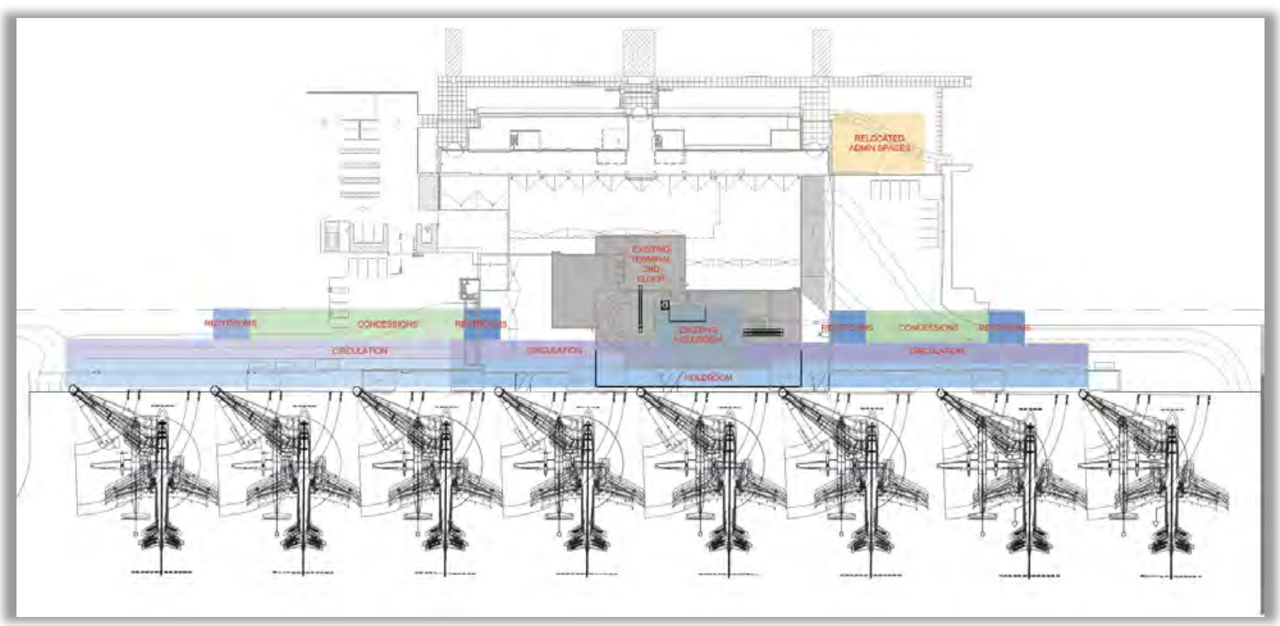


Figure 3-21 FIRST LEVEL TERMINAL BUILDING MASTER PLAN EXPANSION – PHASE ONE

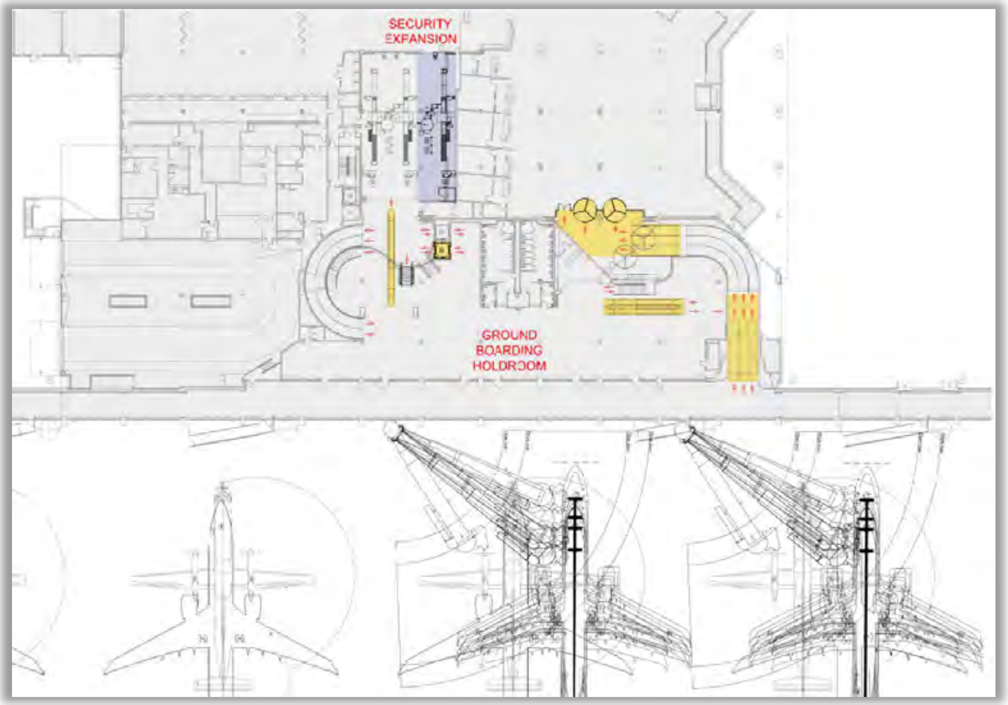
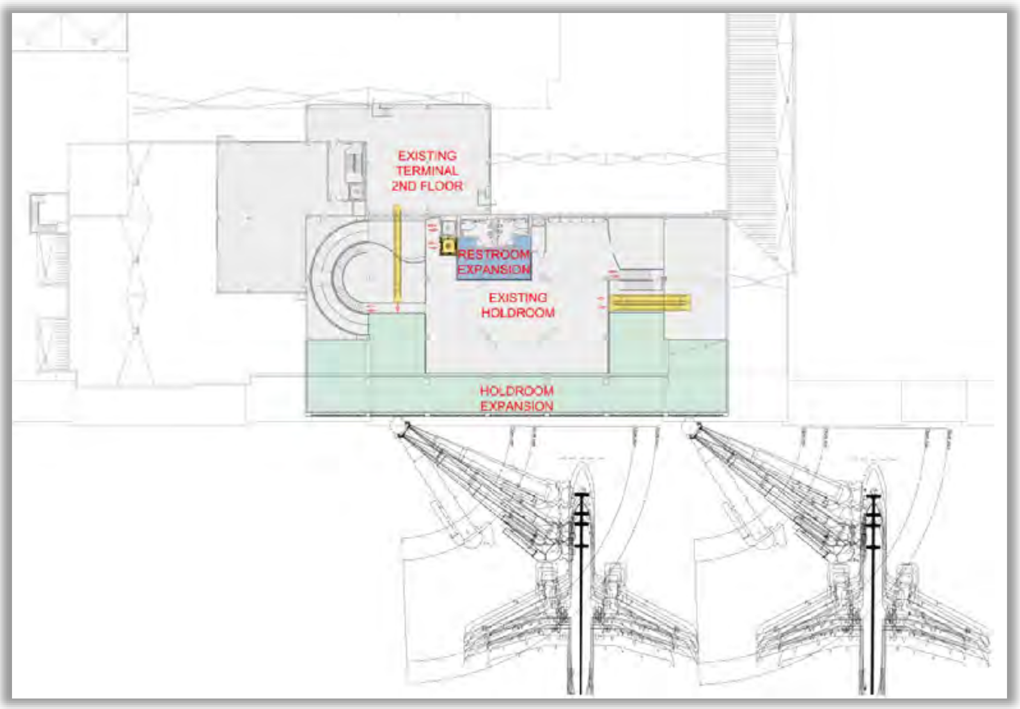


Figure 3-22 SECOND LEVEL TERMINAL BUILDING MASTER PLAN EXPANSION – PHASE ONE



3.4.5 CONCLUSIONS AND RECOMMENDATIONS

- ✓ Reconfigure second floor concourse and passenger departure lounges
- ✓ Construct a total of eight ramp gate hardstand positions with passenger boarding bridges
- ✓ Expansion and reconfiguration of concessions
- ✓ Expansion of ticket hall and main concourse
- ✓ Expansion of the outbound baggage make-up area

3.5 SUPPORT FACILITY REQUIREMENTS

3.5.1 FIXED BASE OPERATOR (FBO)

The Airport is served by one FBO, located on either side of Runway 11-29. The FBO has expressed a desire for expanded facilities, however, the development potential for both areas are limited due to other existing development in the area. The north apron area has the potential for expanded airside development behind the existing building line, but would likely be expensive due to site development costs.

As mentioned previously, the concept of a new separate general aviation development in the east quadrant of the airport could provide multiple new avenues for additional FBOs to be located at the airport.

3.5.2 UNITED STATES FOREST SERVICE (USFS)

The USFS has plans for expansion of their facilities to include additional training facilities, hangars and miscellaneous support facilities. All current plans fall within the USFS leasehold and are not expected to require additional land availability from the Airport.

3.5.3 CARGO FACILITIES

Air cargo operators performed 1,929 operations in 2016 and the forecast shows air cargo remaining flat at 2,100 annual operations through 2036. The proximity to major trucking routes and lack of demand for overnight shipments has not dictated a high amount of air freight. Air cargo operators use the general aviation apron north of Runway 11-29 to load and unload cargo, and handle processing off-site. No need for additional facilities for air cargo purposes are anticipated.

3.5.4 AIR SUPPORT AND MAINTENANCE FACILITIES

SNOW REMOVAL EQUIPMENT (SRE)

The Airport has plans underway to replace and relocate the SRE building to the north side of the airfield. The relocation will allow for an expanded building size and also open up valuable airside land for future aviation related development. The future size and location are being evaluated as of April 2017. The details will be incorporated into the **Chapter 4 Alternatives Analysis**.

AIRPORT RESCUE AND FIRE FIGHTING (ARFF)

The ARFF facility is centrally located northeast of the terminal building. Since RDM is certified under 14 CFR Part 139, it must comply with ARFF equipment, staff, and operational requirements developed by the FAA and the International Civil Aviation Organization Rescue and Fire Fighting Panel. According to Part 139 and FAA AC 150/5220-10E, ARFF equipment and staff requirements are based upon the length of the largest air carrier aircraft that serves an airport with an average of five or more daily departures. **Table 3-20** presents the ARFF Index, aircraft length criteria, and representative air carrier aircraft.

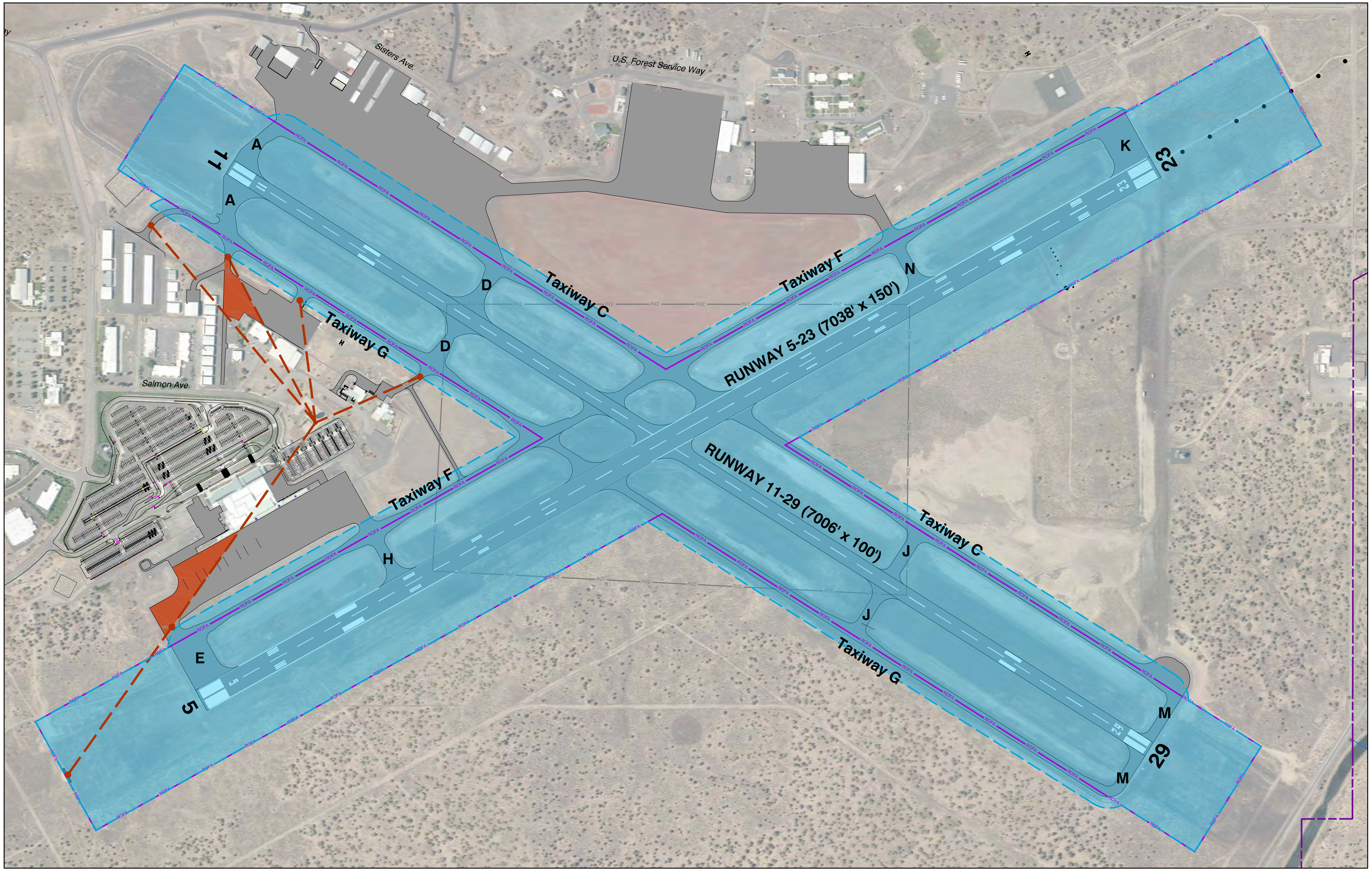
Table 3-20. ARFF Index Requirements

ARFF Index	Aircraft Length Criteria	Representative Aircraft
A	Less than 90 feet	CRJ-200
B	**90 feet but less than 126 feet**	**Q400,B-737, A-319, ERJ-145**
C	126 feet but less than 159 feet	B-757, MD-80, A-310
D	159 feet but less than 200 feet	B-767, DC-10
E	More than 200 feet	B-747, A-380
Source: Code of Federal Regulations, Part 139.315		

RDM currently falls under ARFF Index B based on the longest aircraft operating at the Airport with an average of five or more daily departures. The Airport currently meets the ARFF Index B requirements. No change to the ARFF Index is expected within the 20-year planning window.

AIR TRAFFIC CONTROL TOWER (ATCT)

No changes to the location, size, or function of the existing ATCT are anticipated within the 20-year planning timeframe. The existing ATCT line-of-sight is depicted on **Figure 3-23**. Several known areas of line-of-sight blockage have been depicted. ATC has an operational way of addressing these blocked areas. No new line-of-sight blockages should be created through future on-airport development. The ATCT line-of-sight will be an evaluation factor used in the **Chapter 4 Alternatives Analysis**.



LEGEND

- RDM Property Boundary
- Movement Area
- Runway Object Free Area (ROFA)
- Runway Visability Zone (RVZ)
- ATCT Line of Sight Shadow

0' 350' 700'

Figure 3-23
ATCT Line Of Sight

AIRPORT SERVICE ROADS

The Airport currently has a well-established network of perimeter service roads of varying types. A combination of dirt and paved service roads allow airport personnel to access all areas of the existing airfield. No changes to the airport service roads are anticipated for the existing airfield layout.

Should the **Chapter 4 Alternatives Analysis** recommend a runway extension or the protection for an ultimate third runway, service roads would need to be reevaluated for those planned improvements.

SECURITY GATES

The perimeter fence line contains multiple gates. There a several types of gates used according to their purpose and need. Gates are located primarily near the north and south general aviation areas of the airport providing access to and from hangars, businesses and general aviation users. No areas of improvement have been identified for the existing airport configuration. As alternative airfield layouts are addressed in Chapter 4, so will the requirements for additional airfield access points.

DISASTER PLANNING FACILITY REQUIREMENTS

In the event of a Cascadia Subduction earthquake event or other similar magnitude disaster event, the Airport could very likely be called to serve as a critical transportation link to help supply people, equipment and supplies necessary to manage the event's aftermath. Preliminary discussion with personnel from the Office of Emergency Management and Oregon Air National Guard have indicated that the Airport could be used as a forward operating base where supplies and people would arrive by air and be redistributed where necessary. Inbound supplies would likely arrive via C-17 and C-130 military transport aircraft. Depending on the source, personnel could also arrive on those military transport aircraft or on chartered commercial flights.

Physical space for both supplies and aircraft will likely be at a premium in the immediate days/weeks following an event. Long-term development plans generated in this Master Plan will consider what areas of the Airport could be used to accommodate the mobilization following a disaster event where RDM serves a critical role.

In the days/weeks immediately following a Cascadia event or similar disaster, it is likely that scheduled airline service would be halted.

3.5.5 CONCLUSIONS AND RECOMMENDATIONS

- ✓ Identify location for relocated SRE building
- ✓ Identify on-airport areas for storage of supplies to assist with the response to a Cascadia Subduction event

3.6 FACILITY REQUIREMENTS SUMMARY

The following summarizes the facility requirements necessary for the Airport to accommodate its projected 20-year growth, increase aviation and non-aviation related revenue generating development, and comply with required airfield design standards.

- ✓ Runway 5-23 will need an extension to a length of about 10,000 feet to accommodate the future airlines passenger fleet
- ✓ The parallel taxiways and runway connector taxiways will be designated as TDG3
- ✓ Taxiway system geometry improvements:
  - Taxiway A (north side): add pavement and restripe to provide a right angel taxiway
  - Taxiway A (south side): add pavement and restripe to provide a right angel taxiway
  - Taxiway E: replace existing taxiway segment between the apron and Taxiway F with a new connector taxiway located about 400 feet east of the existing taxiway
  - Taxiway H: replace the existing taxiway segment between the apron and Taxiway F with a new connector taxiway located about 175 feet east of the existing taxiway
  - Taxiway C hot spot: shift segment that crosses Runway 5-23 to the east
  - Taxiway G hot spot: shift segment that crosses Runway 5-23 to the west
  - Runway exit taxiways: retain current locations
  - Pavement strength: evaluate pavement strength requirements when narrow body airline aircraft begin regularly scheduled operations at the Airport
- ✓ General aviation development:
  - Site aircraft storage hangars to accommodate at least 33 aircraft.
  - Locate additional long-term general aviation development area for future hangars and/or future FBOs
- ✓ Expand passenger terminal apron.
- ✓ Identify an area within the terminal loop road for transportation network companies to pick-up and drop-off passengers
- ✓ Locate parking lot expansion for up to 1,100 parking spaces
- ✓ Locate parking lot expansion for up to 500 employee and tenant parking spaces
- ✓ Evaluate alternative sites for off-site rental car service center

- ✓ Non-aviation revenue generating improvements:
  - North Development Parcel Subarea: Install a loop water line system between Lake Road and Veterans Way are not well-connected. Construct new streets.
  - North Business Park Subarea: Install a loop water system between Veterans Way and Oregon Route 126. Upgrade the local streets (10th Street, Sisters Avenue, Ochoco Way) to current local industrial standard (40-foot paved width with sidewalks). Upgrade Veterans Way to meet the major collector standard (36-foot paved width with sidewalks).
  - South Apron Subarea: Construct sidewalks on the north side of Salmon Avenue
  - West Business Park Subarea: Install sidewalk infill as necessary along Airport Way and Veterans Way
  - Airport Way Subarea: Install sidewalk on both sides of Airport Way and Mt. Hood Drive. Upgrade Wickiup Avenue to current local industrial standard (40-foot paved width with sidewalks).
  - Fairgrounds Industrial Subarea: Install sidewalks on south side of Airport Way
- ✓ Terminal Improvements:
  - Reconfigure second floor concourse and passenger departure lounges
  - Construct a total of eight ramp gate hardstand positions with passenger boarding bridges
  - Expansion and reconfiguration of concessions
  - Expansion of ticket hall and main concourse
  - Expansion of the outbound baggage make-up area
- ✓ Identify location for relocated SRE building
- ✓ Identify on-airport areas for storage of supplies to assist with the response to a Cascadia Subduction event

Chapter 4 details alternative evaluations for each of the above facility requirements.

CHAPTER SUMMARY

This chapter evaluates a series of alternative solutions to satisfy the Redmond Municipal Airport's (RDM or "the Airport") facility requirements, which are described in **Chapter 3 – Facility Requirements**. The purpose of this analysis is to enable development of airport facilities that can realistically accommodate forecasted demand. The process of defining and evaluating alternatives is iterative, beginning with a broad range of possibilities that are then refined based on alternative evaluation criteria and Airport development goals. The alternatives evaluation process is structured to systematically evaluate options and provide the technical basis for arriving at a preferred development concept. Criteria utilized to evaluate development alternatives include:

- ✓ Operational performance
- ✓ Environmental considerations
- ✓ Construction feasibility
- ✓ Financial impacts
- ✓ Stakeholder feedback

Various sets of improvement plans were developed for the Airport's airside, landside and terminal areas to accommodate projected needs throughout the planning period. Although they do not exhaust all the variations, the developed alternatives form an appropriate base to produce a "preferred" plan of development for the airport. The preferred alternative serves as a guide for capital improvement planning and is the basis of the Airport Layout Plan (ALP). A summary of the recommended alternatives is included below. The analysis that led to the selection of a preferred alternative is described in this chapter.

- ✓ **Runway Alternative – Alternative 1**
  The recommended alternative extends Runway 5-23 2,962 feet to the southwest for a total runway length of 10,000 feet, as shown in **Figure 4-2**. The runway extension of Runway End 5 would occur on airport-owned property, requires no additional land acquisition or easements, and does not require building demolition or relocation of existing highways and roads. It is assumed that Runway 5-23 would have an upgraded approach that supports area navigation (RNAV) and localizer performance with vertical guidance (LPV) approach capabilities.
- ✓ **Taxiway Alternative – Alternative 1**
  The recommended alternative, as shown in **Figure 4-8** identifies a new full-length parallel taxiway east of Runway 5-23, addresses Federal Aviation Administration (FAA) "Hot Spots" One and Two, and can be constructed in multiple phases as demand dedicates. Improvements to Taxiway A and Taxiway F are identified to comply with FAA Advisory Circular (AC) 150/5300-13A, Change 1, *Airport Design*.

- ✓ **Vehicle Parking Alternative – Alternative 1**
  The recommended alternative, as shown in **Figure 4-10**, adds 4,000 parking stalls and converts the existing hourly terminal parking lot in front of the terminal into a combination of hourly and premium long-term parking. The existing employee vehicle parking lot to the west of the passenger terminal would be reduced to accommodate expanded vendor vehicle parking. A second employee vehicle parking lot would be developed within the central passenger terminal area. Additional long-term vehicle parking would be developed west of SE Airport Way and a remote vehicle parking lot would be developed north of the Deschutes County Fairgrounds Expo Center, along the west side of SE Airport Way. Rental car facilities would be developed just north of the additional long-term vehicle parking lot.
- ✓ **General Aviation Development Alternative – Alternative 2**
  The recommended alternative, as shown in **Figure 4-15,** identifies the expansion of aeronautical and non-aeronautical development north from the existing north development area. The resultant expansion would support a new flight school, hangar expansion for both corporate and general aviation users, and support non-aeronautical development.
- ✓ **Passenger Terminal Alternative – Alternative 3**
  The recommended alternative, as shown in **Figures 4-24, 4-25,** and **4-26,** identifies expansion of the existing terminal to the west and will expand passenger boarding and holdroom areas, outbound and inbound baggage operations, Transportation Security Administration (TSA) security screening, rental car counters and offices, ticket counters, queuing and airline ticketing offices, administration space, and mechanical support spaces. The terminal expansion supports seven new aircraft gates, with the ability to add an eighth gate, that accommodate Aircraft Design Group (ADG)-III aircraft (Airbus A320 or Boeing B737) served through passenger boarding bridges (PBBs). The proposed expansion stays clear of the Airport's Runway Visibility Zone (RVZ).

4.0 INTRODUCTION

This chapter introduces a variety of alternatives related to the Airport's runways, taxiways, vehicle parking, general aviation (GA) development, location of support facilities, passenger terminal and non-aeronautical development. Alternatives are analyzed using evaluation criteria developed for the Master Plan and were agreed upon during the initial scoping of the project. The outcome of the analysis and the public process is the selection of a preferred alternative for the Master Plan. Each alternative was evaluated according to five categories: alignment with operational performance, environmental considerations, constructability, financial impacts/cost to the Airport, and stakeholder feedback. Feedback was collected throughout the planning process from the Master Plan Planning Advisory Committee (PAC) and the public. The PAC is a diverse group made up of elected officials, on- and off-airport businesses, and members of the broader community. The PAC's role is to help shape the Master Plan into a document that is reflective of community goals and interests while satisfying FAA requirements for airport development. The preferred alternative identified in **Section 4.6** is used to prepare the implementation plan described in a subsequent chapter. The implementation plan includes phasing of improvements, expected capital costs, and key decision points where the Airport will reevaluate implementation assumptions prior to further development. The preferred alternatives will be shown on the ALP.

The chapter is organized as follows:

4.1 Airport Development Objectives
4.2 Alternatives Development Process
4.3 Evaluation Categories
4.4 Evaluation Process
4.5 Airport Development Alternatives
4.6 Alternatives Summary

4.1 AIRPORT DEVELOPMENT OBJECTIVES

The Master Plan is intended to produce a cohesive set of alternatives that position the Airport to accommodate the forecasted demand over the next 20 years. Prior to developing and evaluating specific alternatives, the Airport's development objectives must be understood. Development objectives for this Master Plan include:

- ✓ Accommodate future demand over the next 20 years and position the Airport to attract additional tenants and businesses
- ✓ Increase revenue generation through the development of non-aeronautical land
- ✓ Provide development area for GA and United States Forest Service (USFS) activities
- ✓ Develop the passenger terminal and associated facilities to provide high levels of service
- ✓ Develop facilities in an environmentally compatible manner
- ✓ Develop facilities in accordance with all federal, state, and local regulations
- ✓ Develop facilities consistent with Stakeholder needs

Development to meet long-term demand requires consideration of both the airside and landside needs of the Airport. Airside facilities include runways, taxiways, support facilities, and non-terminal building areas, while landside facilities include vehicle parking areas, walkways, public access roads, rental car facilities, taxi and ground transportation, hotels, and any other areas accessible to the public. Those needs are presented in the following airside and landside planning sections.

4.1.1 AIRSIDE PLANNING

Airside needs include:

- ✓ Analyze the ability of the Airport to meet design standards identified in the FAA AC 150/5300-13A, Change 1, *Airport Design*
- ✓ Address FAA identified Hot Spots on the taxiways
- ✓ Analyze existing and future capacity constraints, which include an expanded passenger terminal and apron area, additional supporting taxiways, runway extension, and a future parallel runway
- ✓ Provide a variety of aircraft storage options including t-hangars, box hangars, and corporate hangars
- ✓ Identify location for a new fuel farm to support passenger airline and GA operations, and define fuel truck haul routes to minimize taxiway crossings
- ✓ Incorporate a flight school into proposed development
- ✓ Expand property available for development by GA and corporate aviation tenants
- ✓ Identify a storage location for emergency preparedness in support of the Federal Emergency Management Agency (FEMA) or other emergency responding agencies
- ✓ Identify strategic land acquisition to support airport operation and future development

4.1.2 LANDSIDE PLANNING

Landside needs include:

- ✓ Remove roadways within the existing and future runway protection zones (RPZs) when feasible
- ✓ Maximize buildable property for aeronautical and non-aeronautical development
- ✓ Analyze locations for expanded short- and long-term passenger vehicle parking, rental car operators and associated support facilities, Airport employee and vendor parking, and overflow parking
- ✓ Analyze existing landside access and roadway networks to support future development
- ✓ Identify strategic land acquisition to support proposed improvements

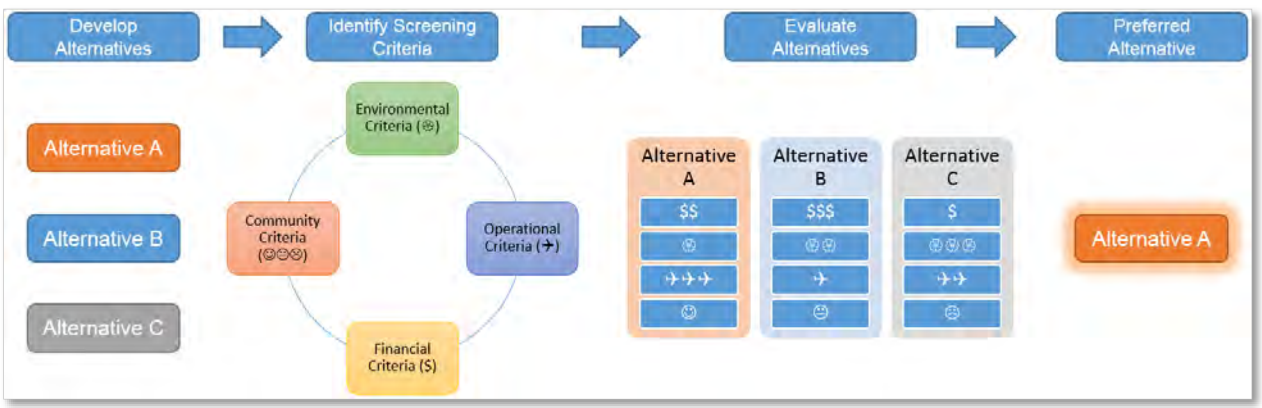
4.2 ALTERNATIVES DEVELOPMENT PROCESS

The framework for the alternatives development was established in **Chapter 1 – Inventory**, **Chapter 2 – Forecast**, and **Chapter 3 – Facilities Requirements**. Information contained in these chapters was used to develop layouts that support the Airport's ability to accommodate forecasted demand and prepare a 20-year facility plan for the Airport moving forward. Developing the alternatives included examining:

- ✓ FAA Airport Design Standards
- ✓ Land Development Strategies
- ✓ Revenue Producing Opportunities
- ✓ Aircraft Operations
- ✓ Passenger Enplanements

These factors provide the framework necessary to formulate feasible development alternatives to meet future demand. The typical alternatives development and evaluation process is illustrated in the following **Figure 4-1**.

Figure 4-1. Typical Alternatives Development Process



4.2.1 AIRPORT MASTER PLAN ADVISORY COMMITTEE INPUT

Throughout this planning process, public involvement and stakeholder outreach has been a continuous process involving educational, listening, and collaborative components. Stakeholder groups include the PAC, Airport Committee, City of Redmond, and members of the public. The feedback received during the process is used to qualitatively compare the alternatives.

4.3 EVALUATION CATEGORIES

The following evaluation categories provide the basis of analysis for each alternative and support a fact-based comparison:

- ✓ Operational Capabilities (Specific to Functional Area)
- ✓ Performance Requirement Benchmarks (Ability to accommodate demand)
- ✓ Land Use Compatibility
- ✓ Environmental Impacts
- ✓ Stakeholder Feedback
- ✓ Constructability
- ✓ Financial Cost/Impacts

These categories were developed to ensure the selected alternative is consistent with the role of the Airport and are described in the following sections.

4.3.1 OPERATIONAL CAPABILITIES

This evaluation category is applied to the alternatives to determine their ability to satisfy the facility requirements identified in **Chapter 3 – Facility Requirements**. An analysis of the demand and capacity requirements, and geometric and other standards that govern the design of airport components, guided development of the facility requirements.

4.3.2 PERFOMANCE REQUIREMENTS BENCHMARKS

This evaluation category is applied to the alternatives to determine their ability to support demand identified in **Chapter 2 – Aviation Activity Forecasts**. Alternatives aligned with the forecasts if they provided the facilities necessary to meet identified demand through 2036.

4.3.3 LAND USE COMPATABILITY

This category evaluates alternatives based on compatible land use and the potential impacts to land or other environmental factors that could influence an alternative. These include noise exposure, wetlands or stream impacts, or other factors that might be unique to developed alternatives.

4.3.4 ENVIRONMENTAL IMPACTS

This category evaluates alternatives based on compatibility with existing environmental assets with the goal of developing in an environmentally sustainable manner. The following impacts to specific environmental elements were considered:

- 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, Archaeological, and Cultural Resources
- Land Use
- Natural Resources and Energy Supply
- Compatible Land Use
- Socioeconomic, 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)

Early identification of these environmental factors may help avoid impeding future development plans. The analysis is not intended to fulfill the environmental clearance requirements as defined in FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, and FAA Order 5050.4B, *National Environmental Policy Act*.

4.3.5 STAKEHOLDER FEEDBACK

Stakeholder input was obtained from the PAC, Airport Advisory Committee, City of Redmond, FAA, various stakeholders, community members, and members of the public to assist in evaluating the alternatives. Public and committee meetings were held on the following dates:

- ✓ Stakeholder Interviews – September 26, 2016
- ✓ Redmond City Council – October 25, 2016
- ✓ PAC Meeting #1 – November 9, 2016
- ✓ Airport Committee – November 10, 2016
- ✓ Redmond City Council – February 7, 2017
- ✓ PAC Meeting #2 – February 8, 2017
- ✓ Redmond City Workshop – April 25, 2017
- ✓ PAC Meeting #3 – June 22, 2017
- ✓ FAA Teleconference – August 4, 2017
- ✓ PAC Meeting #4 and Open House – October 18, 2017
- ✓ Redmond City Council – January 9, 2018
- ✓ PAC Meeting #5 and Open House #2 – Scheduled for Winter 2018

These public meetings were supplemented with presentations, exhibits, and one-on-one interviews. Input was considered and incorporated into the development of the alternatives for RDM.

4.3.6 CONSTRUCTABILITY

This category evaluates alternatives based on implementing the alternative in logical phases. Timing and the sequence of construction can create delays, increase cost, and impact airport operations. Each alternative was examined to determine the degree of its impact on airport operations.

4.3.7 FINANCIAL COSTS/IMPACTS

This category evaluates alternatives based on cost factors to assess feasibility and form a relative basis of comparison. The analysis looks at the following for each alternative:

- ✓ Ability to fund the required capital expenditures
- ✓ Airport operating costs
- ✓ Potential revenues, operating and capital expenses, and potential funding sources for each alternative

Capital expenses include demolition costs, construction and site preparation costs, environmental costs and lease buyouts.

4.4 EVALUATION PROCESS

This section defines the alternatives analysis process utilized in accordance with FAA AC 150/5070-6B, *Airport Master Plans*. Developing multiple alternatives represents the first of a multi-step process that leads to the selection of a preferred alternative. It is important to note that the current FAA-approved ALP identifies future improvements recommended in a prior master planning effort. The master planning process addresses facility needs, but also allows the components of the previous preferred alternative to be retained or modified, if they meet current needs.

Airport development alternatives are created to respond to defined facility needs, with the goal of identifying general preferences for both individual items and the overall concepts being presented. The process will allow the widest range of ideas to be considered and the most effective facility development concept to be defined.

Elements of a preferred alternative will emerge from the evaluation process that can best accommodate all required facility improvements. Parts of the various alternatives will be consolidated into a preferred alternative based on the input of multiple stakeholders. The preferred alternative can be refined further as the City proceeds through the process of finalizing the remaining elements of the airport Master Plan. Public input and coordination with the PAC, FAA, and RDM throughout the evaluation process will also help to shape the preferred alternative.

Once the preferred alternative is selected by RDM, a detailed capital improvement program will be created that identifies and prioritizes specific projects to be implemented. The elements of the preferred alternative will be integrated into the updated ALP drawings that will guide future improvements at the Airport.

4.5 AIRPORT DEVELOPMENT ALTERNATIVES

The initial airport development alternatives are intended to facilitate a discussion and evaluation about the most efficient way to meet the facility needs of the Airport. The facility requirements identified in the previous chapter include a variety of airside, landside, passenger terminal, and other development needs. The airport development alternatives are organized into several groups:

- ✓ Runway Alternatives
- ✓ Taxiway Alternatives
- ✓ GA Development Alternatives
- ✓ Vehicle Parking Alternatives
- ✓ Support Facilities Alternatives
- ✓ Passenger Terminal Alternatives
- ✓ Non-Aeronautical Property Development Alternatives

The airport development alternatives are described below and depicted in **Figures 4-2** through **4-32** to illustrate the key elements of each alternative.

4.5.1 RUNWAY ALTERNATIVES

Runway 5-23 is the Airport's primary runway and is 7,038 feet long and 150 feet wide. The runway has pavement strength of 68,000 pounds for single-wheel gear (SWG) aircraft and 110,000 pounds for dual wheel gear (DWG) aircraft and is designed to C-III Standards. Runway 11-29 is the crosswind runway and is 7,006 feet long and 100 feet wide. The runway has pavement strength of 28,000 pounds for SWG and 40,000 pounds for DWG and is designed to B-III Standards. Additional airfield capacity is not required as the existing primary runway can accommodate future demand through 2036.

Chapter 3 – Facility Requirements explained the potential need for a 2,962-foot-runway extension to Runway 5-23 for a total runway length of 10,000 feet to serve markets in the Midwest. To examine the feasibility of an extension at RDM, six runway extension alternatives have been identified and are evaluated in the following sections. The alternatives assume an upgraded approach to Runway End 5 that supports LPV approach capabilities, similar to the localizer and glideslope of an Instrument Landing System (ILS) approach into Runway End 23. The MALSR (Medium Approach Light System with Runway Alignment Indicator Lights) will remain within the RPZ and on airport property. Earthwork for the runway and supporting taxiway extension alternatives to the southwest requires significant fill due to the uneven terrain and requirements to match existing grades of the runway and taxiway. **Chapter 3** also explained how the existing Runway 5-23 RSA had no penetrations and a recommendation was made to change declared distances to the full length of the runway. To ensure that there are no future RSA penetrations and that declared distances can stay at 10,000 feet, the RSA around any future extension must remain clear of objects.

None of the alternatives would impact night operations.
Runway extension alternatives consider RPZ requirements in FAA AC 150/5300-13A, Change 1, *Airport Design* and the 2012 memorandum *Interim Guidance on Land Uses within a Runway Protection Zone (2012 RPZ Memo).* Modifications to Runway End 23 will require evaluation of the relocation of Highway 126 to meet FAA design guidance. The alternatives comply with AC 150/5300-13A, Change 1, *Airport Design* standards for the runway safety area (RSA), runway object free area(ROFA), and taxiway object free area (TOFA).

ALTERNATIVE 1 – EXTEND RUNWAY 5-23 SOUTHWEST

This alternative provides a 10,000- foot- long runway by extending Runway 5-23 to the southwest, as shown in **Figure 4-2**. The extension of Runway End 5 will occur on airport-owned property, requires no additional land acquisition or easements, and does not require building demolition or relocation of existing highways and roads. The construction of the proposed runway extension and supporting taxiways would require 79,092 cubic yards (CY) of material excavation and the supporting taxiway would require 10,792 CY of material excavation for 89,884 CY of total material excavation. This alternative would add 77,400 square yards (SY) of additional pavement. FAA runway and taxiway design criteria are met with this alternative.

This alternative is straightforward relative to project phasing, contractor mobilization, and staging areas, and would have minimal impact on airport operations. The extension would increase the extent of the RVZ by 1,481 feet to the southwest. The aircraft rescue and firefighting (ARFF) building will obstruct the view of aircraft arriving to or from the intersection of the two runways. The ARFF building will relocate to keep the RVZ clear of obstructions.

Four obstructions (trees) have been identified within the future 50:1 Approach Surface, however, these obstructions are on existing airport property and can be mitigated. The extension does not change any instrument approach capabilities and Navigational Aids (NAVAIDs) would be relocated appropriately.

This alternative is estimated at a total project cost of $48,450,000 and includes engineering, environmental compliance, construction management services, relocation of the ARFF building, and extension of Taxiway F to the new end of Runway 5.

ALTERNATIVE 2A – EXTEND RUNWAY 5-23 NORTHEAST

This alternative involves extending Runway 5-23 2,962 feet to the northeast with a parallel taxiway and separate exit and entrance connectors as shown in **Figure 4-3**. The extension of Runway 23 by 2,962 feet requires the relocation and realignment of Highway 126 by 1.75 miles, and 62 acres of additional property to comply with AC 150/5300-13A and the *2012 RPZ Memo.* The required acquisition off the end of Runway 23 is located outside City Limits and outside the Redmond urban growth boundary (UGB) in unincorporated Deschutes County. The property is zoned Exclusive Farm Use (EFU), for which state law severely restricts non-agricultural uses. As a result, extending the runway outside the UGB or rerouting a portion of Highway 126 outside the UGB would require seeking an Exception to Statewide Planning Goal 3 (Agricultural Lands) and receiving approval from the Board of County Commissioners. To obtain approval, the City would have to demonstrate that it performed an alternatives analysis demonstrating that other options within the UGB were not viable. This could subject the City and the County to potential appeals and project delays.

The North Unit Main Canal, a Section 4(f) historic resource due to its age, would also be located within the RPZ, and FAA may require potential mitigation measures such as the placement of a cap on the canal in the RPZ area. The extension would increase the extent of the RVZ by 1,481 feet to the northeast; however, there would be no additional inclusions of facilities within the RVZ.

The construction of the proposed runway extension and supporting taxiway and connectors would require 1,693 CY of material excavation and the supporting taxiway would require 718 CY of material excavation for 2,411 CY of total material excavation. This alternative would add 77,400 SY of additional pavement. The complexity of constructing this alternative is straightforward relative to project phasing, contractor mobilization, and staging areas, and would have minimal impact to airport operations.

The extension does not change any instrument approach capabilities and all NAVAIDs would be relocated appropriately.

No new obstructions to the 50:1 approach surface were identified with the proposed extension.

This alternative is estimated at a total project cost of $37,550,000 and includes engineering, environmental compliance, and construction management services.

ALTERNATIVE 2B – EXTEND RUNWAY 5-23 NORTHEAST

This alternative is a derivative of Alternative 2A and similarly involves extending Runway 5-23 2,962 feet to the northeast with a parallel taxiway and separate exit and entrance connectors as shown in **Figure 4-4**. Instead of relocating Highway 126 outside of critical runway geometric areas, such as the RPZ, Highway 126 would remain in its current alignment and a tunnel would be constructed underneath the Runway 23 to achieve the 2,962-foot extension. This alternative requires 63 acres of additional property to comply with AC 150/5300-13A and the 2012 memorandum *2012 RPZ Memo.* The required acquisition off the end of Runway 23 is located outside City Limits and outside the Redmond UGB in unincorporated Deschutes County. The property is zoned EFU, for which state law severely restricts non-agricultural uses. As a result, extending the runway outside the UGB or rerouting a portion of Highway 126 outside the UGB would require seeking an Exception to Statewide Planning Goal 3 (Agricultural Lands) and receiving approval from the Board of County Commissioners. To obtain approval, the City would have to demonstrate that it performed an alternatives analysis of other options within the UGB that were not viable. This would be a high bar to meet and could subject the City and the County to potential appeals and project delays.

The North Unit Main Canal will be located within the Runway 23 RPZ for this alternative as discussed in Alternative 2A.

This alternative will require the same amount of material excavation and additional pavement as Alternative 2A. This alternative will also have no effect on instrument approach capabilities, relocates NAVAIDs appropriately, and has no identified obstructions.

This alternative is estimated at a total project cost of $58,440,000 and includes engineering, environmental compliance, and construction management services.

ALTERNATIVE 3A – SPLIT RUNWAY 5-23 EXTENSION

This alternative involves extending Runway 5-23 by 400 feet to the northeast and by 2,562 feet to the southwest for a total runway length of 10,000 feet with a parallel taxiway and separate exit and entrance connectors as shown in **Figure 4-5.** This alternative assumes the FAA would not require RPZ compliance for the existing alignment of Highway 126 through Runway 23's RPZ. Extending Runway End 23 to the northeast utilizes an existing avigation easement for a portion of the land that falls within Runway 23's RPZ. Runway 5-23 extends 400 feet to the northeast in this alternative due to the extent of the OFA stopping prior to Highway 126. Extending Runway End 5 to the southwest would occur on existing airport property and requires no additional land acquisition or easements nor any building demolition or relocation of existing highways or roads.

The construction of the proposed split runway extension and supporting taxiway and connectors would require 72,092 CY of material excavation and the supporting taxiway would require 9,416 CY of material excavation for 81,508 CY of total material excavation. This alternative would add 85,300 SY of additional pavement. This extension would however increase the extent of the RVZ by 1,281 feet and include a portion of the existing passenger terminal aircraft apron and the ARFF building. The complexity of constructing this alternative is straightforward relative to project phasing, contractor mobilization, and staging areas, and would have minimal impact to airport operations.

Four obstructions (trees) have been identified within the future 50:1 Approach Surface for the extended Runway 5; however, these obstructions are on existing airport property and could easily be mitigated. The extension does not change any instrument approach capabilities and all NAVAIDs would be relocated appropriately.

This alternative is estimated at a total project cost of $29,319,000 and includes engineering, environmental compliance, and construction management services.

ALTERNATIVE 3B – SPLIT RUNWAY 5-23 EXTENSION

This alternative involves equally extending Runway 5-23 by 1,500 feet to the northeast and by 1,462 feet to the southwest with a parallel taxiway and separate exit and entrance connectors as shown in **Figure 4-6.** The extension of Runway End 23 to the northeast requires relocating and realigning 0.8 miles of Highway 126 0.34 miles north and utilizes an existing avigation easement for a portion of the land that falls within Runway 23's RPZ. The realignment of Highway 126 is 1.25 miles and is outside of the future RPZ for Runway End 23. Extending Runway End 5 to the southwest would occur on existing airport property and does not require additional land acquisition, easements, building demolition, or relocation of existing highways or roads.

The North Unit Main Canal, a Section 4(f) historic resource due to its age, would be located within the Runway End 23 RPZ, and FAA may require mitigation measures such as the placement of a cap on the canal in the RPZ. The extension would increase the extent of the RVZ to the southwest by 731 feet and to the northeast by 750 feet; however, there would be no additional inclusions of facilities within the RVZ.

The construction of the proposed runway extensions and supporting taxiway and connectors would require 11,893 CY of material excavation, and the supporting taxiway would require 6,416 CY of material excavation for 18,309 CY of total material excavation. This alternative would add 81,600 SY of additional pavement. The complexity of constructing this alternative is straightforward relative to project phasing, contractor mobilization, and staging areas, and would have minimal impact to airport operations.

This alternative has the same obstructions and mitigation identified in Alternative 3A and also relocates NAVAIDs as needed.

This alternative is estimated at a total project cost of $31,555,000 and includes engineering, environmental compliance, and construction management services.

ALTERNATIVE 3C – SPLIT RUNWAY 5-23 EXTENSION

This alternative is a derivative of Alternative 3B and similarly involves extending Runway 5-23 by 1,500 feet to the northeast and by 1,462 feet to the southwest with a parallel taxiway and separate exit and entrance connectors as shown in **Figure 4-7.** The extension of Runway End 23 to the northeast requires relocating and realigning 0.8 miles of Highway 126 0.50 miles north and utilizes an existing avigation easement for a portion of the land that falls within Runway 23's RPZ. The realignment of Highway 126 is 3 miles and is outside of the avigation easement of Runway End 23. Extending Runway End 5 to the southwest would occur on existing airport property and does not require additional land acquisition, easements, building demolition, or relocation of existing highways or roads.

The North Unit Main Canal will be located within the Runway 23 RPZ for this alternative as discussed in Alternative 3B.

The construction of the proposed runway extensions and supporting taxiway and connectors would require 11,893 CY of material excavation, and the supporting taxiway would require 3,416 CY of material excavation for 15,309 CY of total material excavation. This alternative would 81,600 SY of additional pavement. The complexity of constructing this alternative is straightforward relative to project phasing, contractor mobilization, and staging areas, and would have minimal impact to airport operations.

This alternative has the same obstructions and mitigation identified in Alternative 3A and also relocates NAVAIDs as needed.

This alternative is estimated at a total project cost of $36,850,000 and includes engineering, environmental compliance, and construction management services.

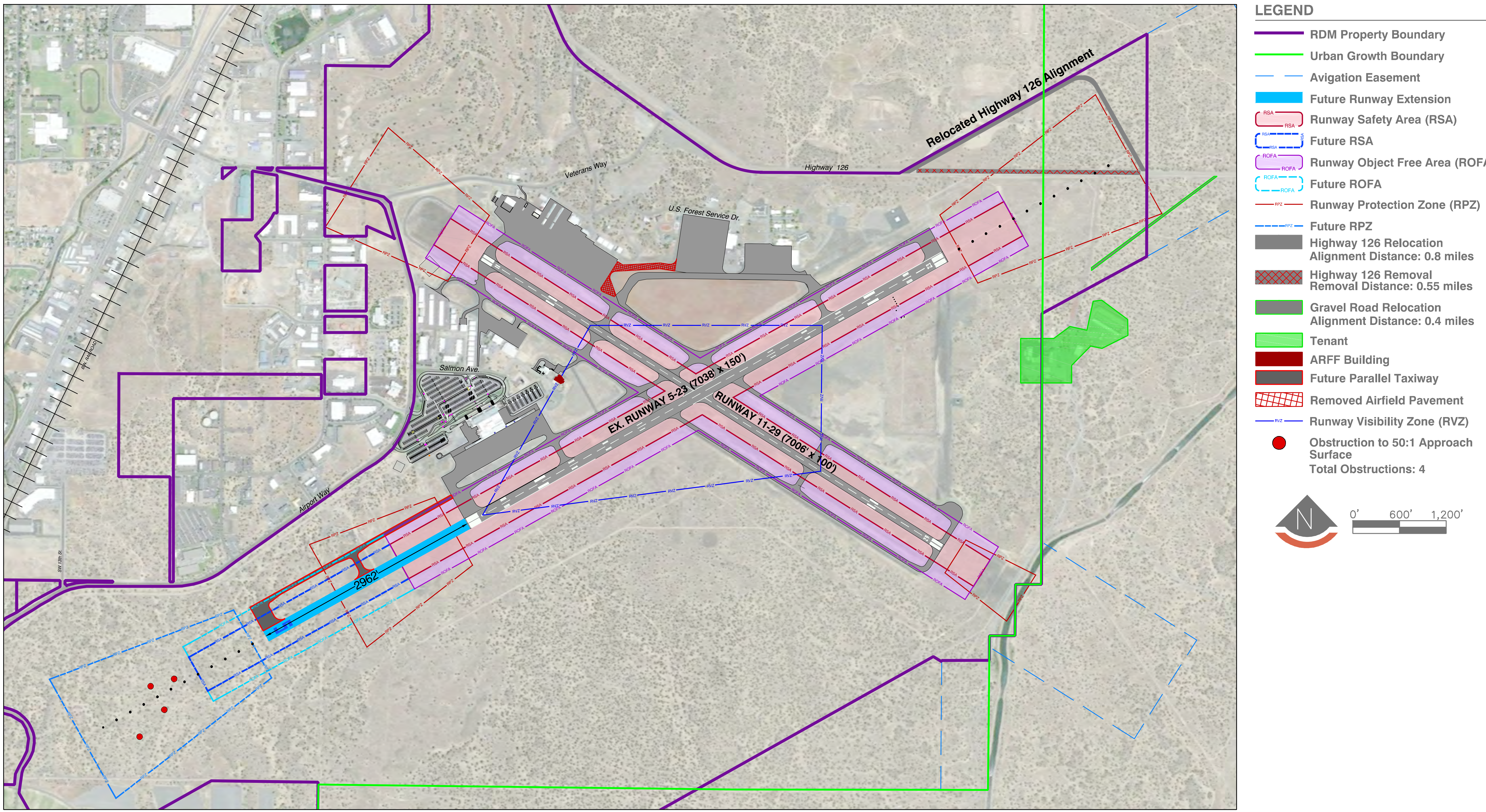
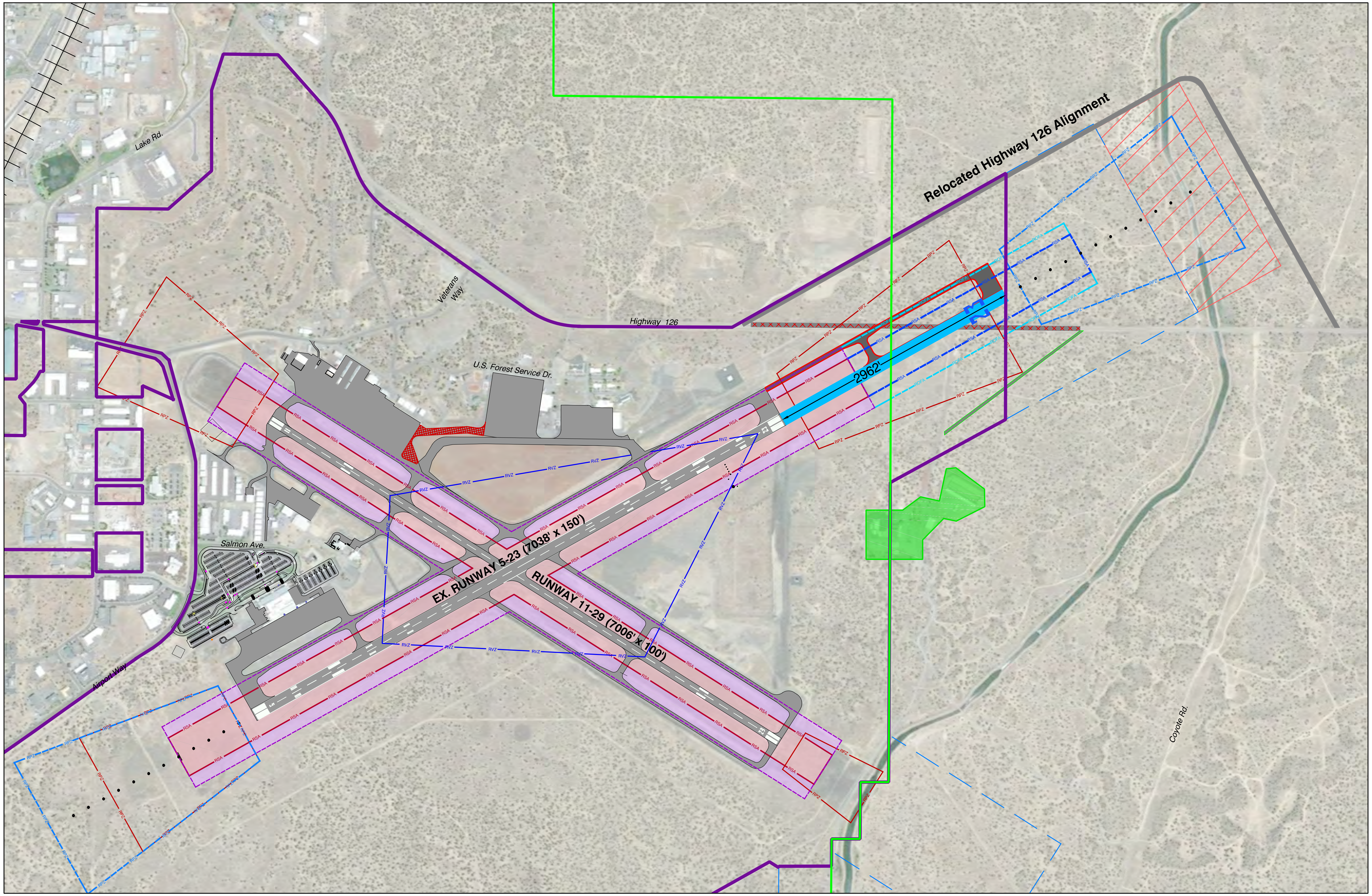


Figure 4-2
Alternative 1 - Extend Runway Southwest

Mead&Hunt



LEGEND

- RDM Property Boundary
- Urban Growth Boundary
- Avigation Easement
- Future Runway Extension
- Runway Safety Area (RSA)
- Future RSA
- Runway Object Free Area (ROFA)
- Future ROFA
- Runway Protection Zone (RPZ)
- Future RPZ
- Highway 126 Relocation Alignment Distance: 1.75 miles
- Highway 126 Removal Removal Distance: 0.75 miles
- Gravel Road Relocation Alignment Distance: 0.4 miles
- Tenant
- Future Land Acquisition (62 acres)
- Future Parallel Taxiway
- Removed Airfield Pavement
- Runway Visibility Zone (RVZ)
- Obstruction to 50:1 Approach Surface Total Obstructions: 0

N

0' 600' 1,200'

Figure 4-3

Alternative 2A - Extend Runway Northeast

REDMOND MUNICIPAL AIRPORT MASTER PLAN

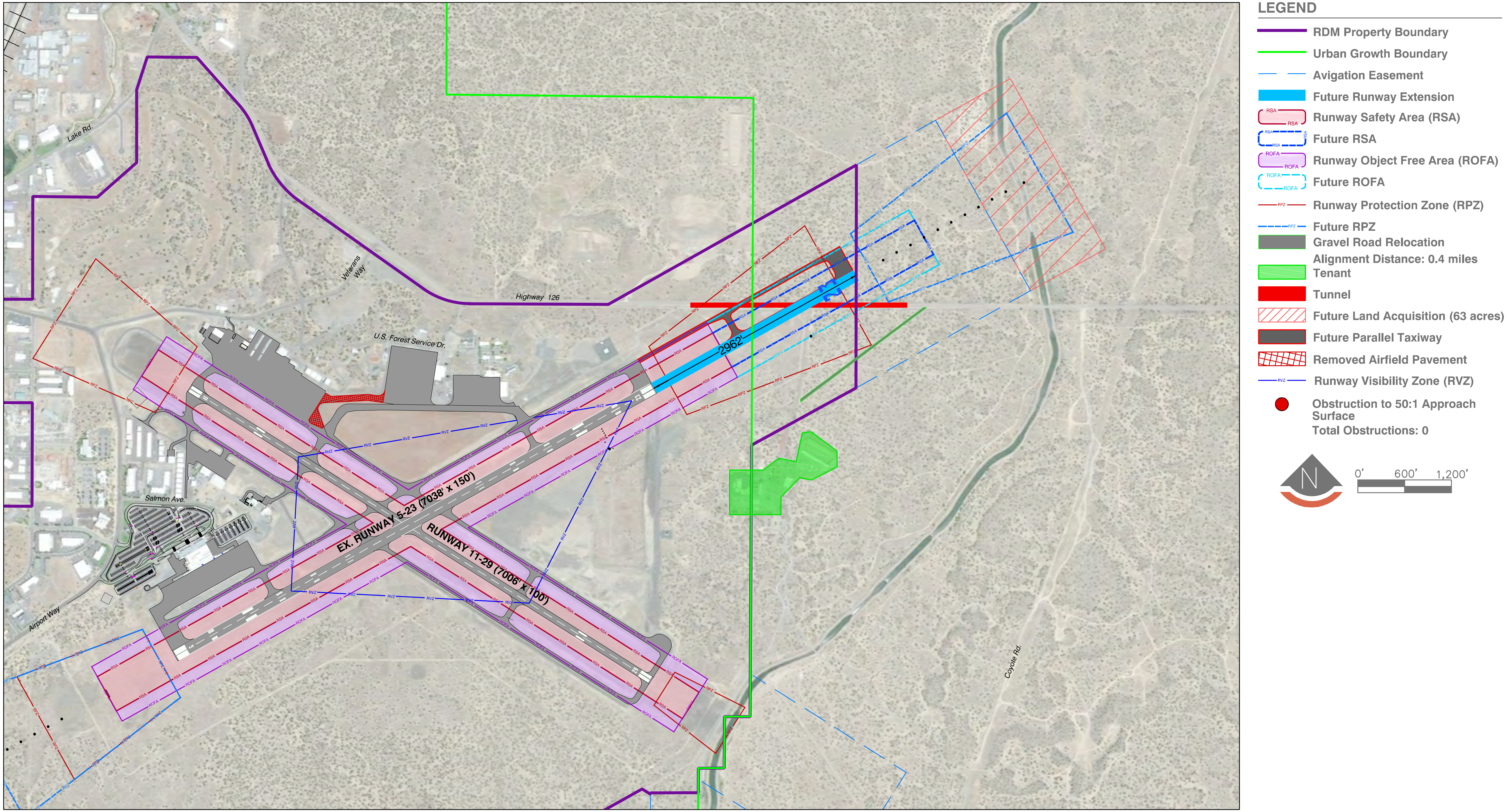


Figure 4-4

Alternative 2B - Extend Runway Northeast

REDMOND MUNICIPAL AIRPORT MASTER PLAN

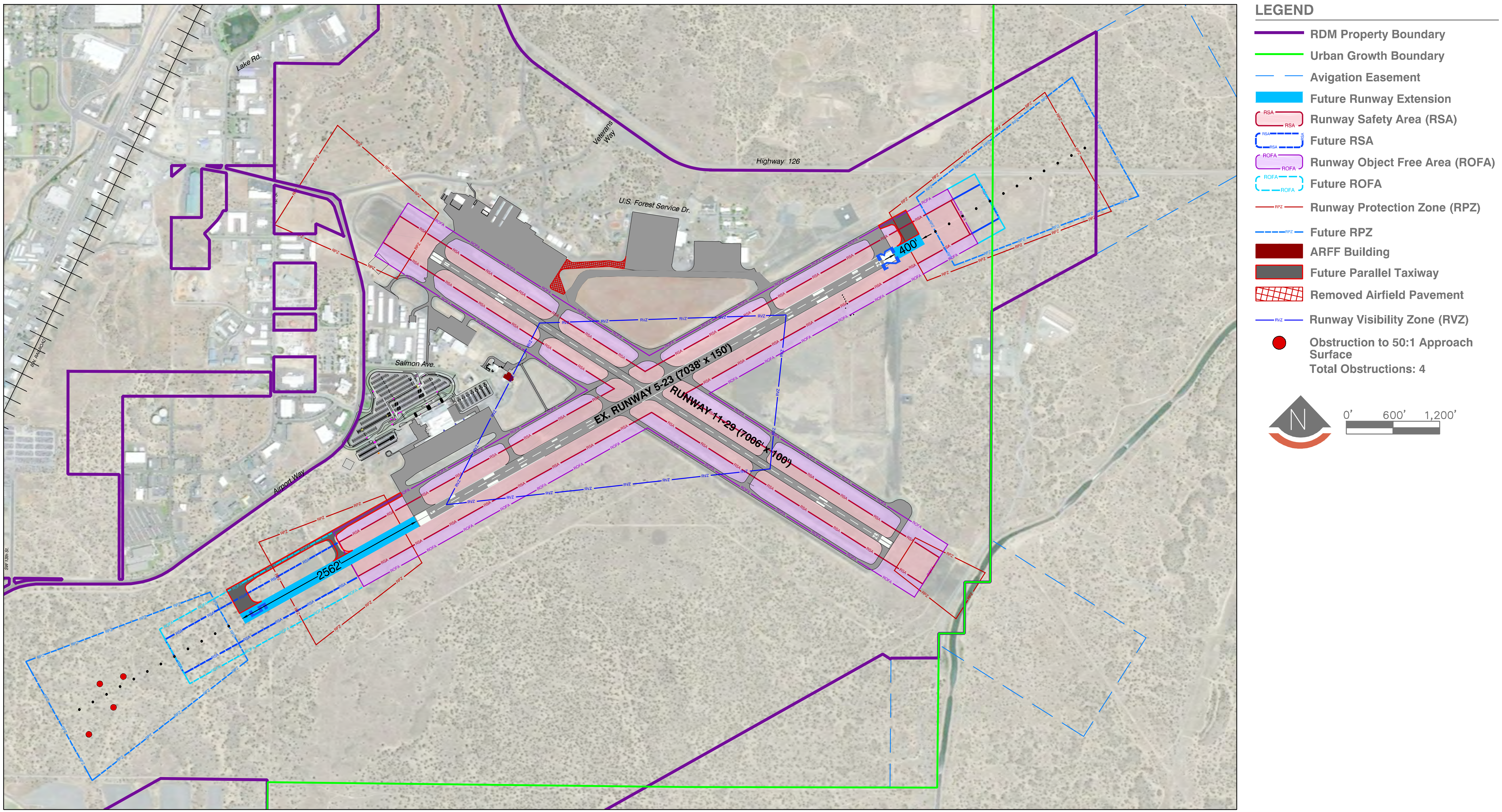
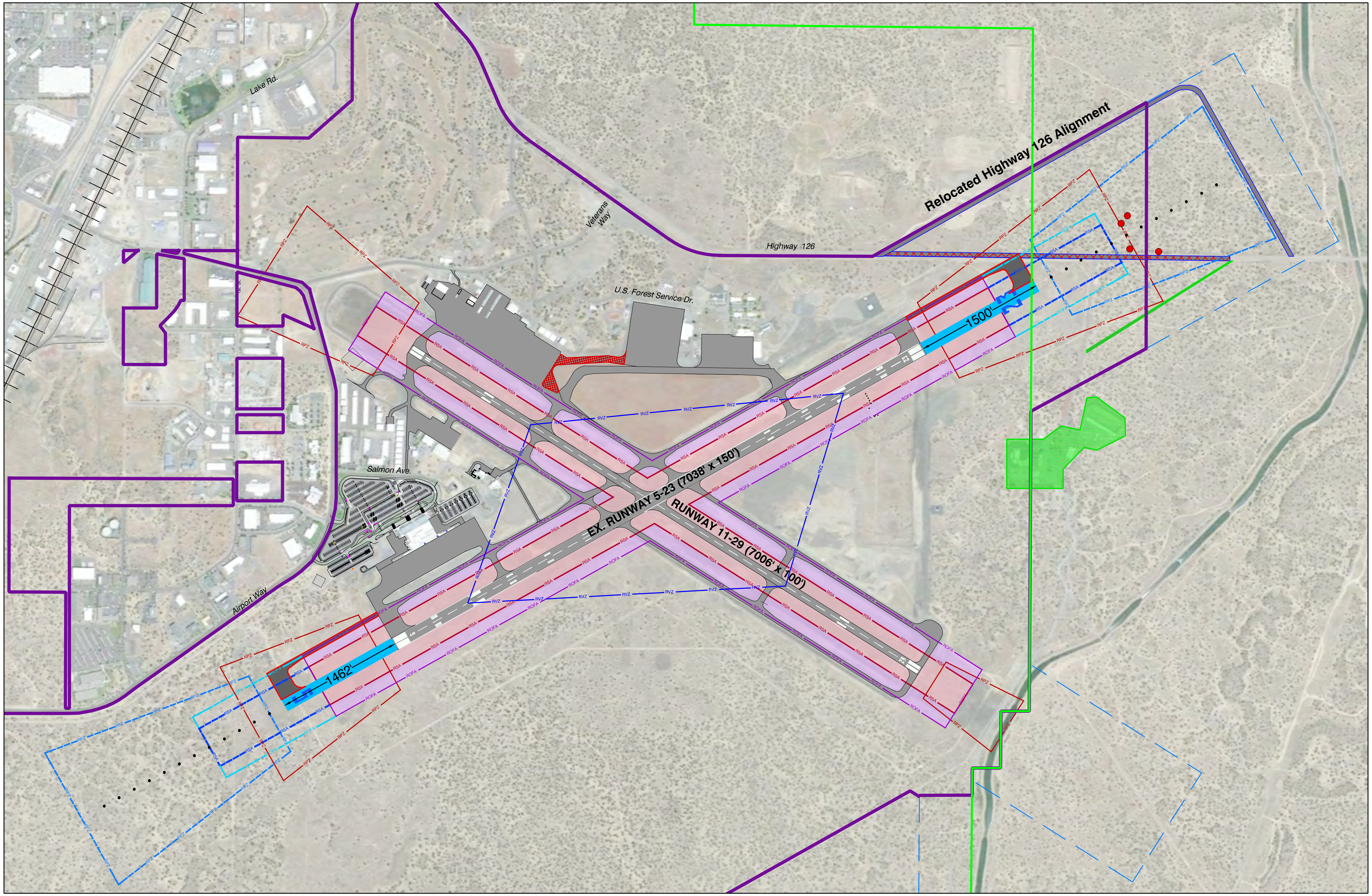


Figure 4-5

Alternative 3A - Split Runway Extension



LEGEND

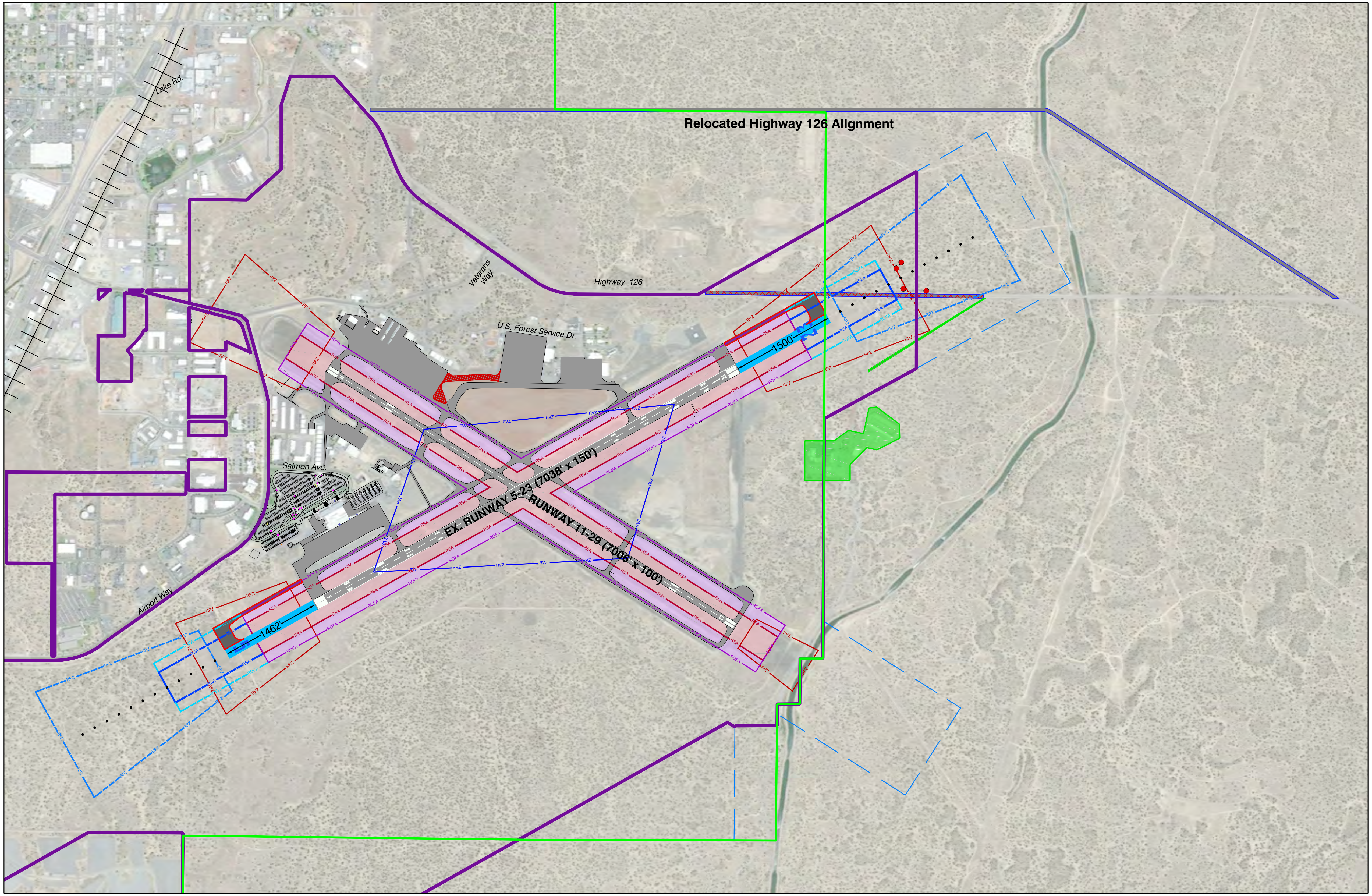
- RDM Property Boundary
- Urban Growth Boundary
- Avigation Easement
- Future Runway Extension
- Runway Safety Area (RSA)
- Future RSA
- Runway Object Free Area (ROFA)
- Future ROFA
- Runway Protection Zone (RPZ)
- Future RPZ
- Highway 126 Relocation Alignment Distance: 1.25 miles
- Highway 126 Removal Removal Distance: 0.8 miles
- Gravel Road Relocation Alignment Distance: 0.4 miles
- Tenant
- Future Parallel Taxiway
- Removed Airfield Pavement
- Runway Visibility Zone (RVZ)
- Obstruction to 50:1 Approach Surface Total Obstructions: 4

N

0' 600' 1,200'

Figure 4-6

Alternative 3B - Split Runway Extension



LEGEND

- RDM Property Boundary
- Urban Growth Boundary
- Avigation Easement
- Future Runway Extension
- Runway Safety Area (RSA)
- Future RSA
- Runway Object Free Area (ROFA)
- Future ROFA
- Runway Protection Zone (RPZ)
- Future RPZ
- Highway 126 Relocation
  Alignment Distance: 3 miles
- Highway 126 Removal
  Removal Distance: 0.8 miles
- Gravel Road Relocation
  Alignment Distance: 0.4 miles
- Tenant
- Future Parallel Taxiway
- Removed Airfield Pavement
- Runway Visibility Zone (RVZ)
- Obstruction to 50:1 Approach Surface
  Total Obstructions: 4

N

0' 750' 1,500'

Figure 4-7
Alternative 3C - Split Runway Extension

SUMMARY EVALUATION OF RUNWAY ALTERNATIVES

Table 4-1 presents a summary and an evaluation of the various alternatives for a runway extension at RDM. Alternative 1 is the preferred alternative because the Airport owns the land on which the runway extension will be built.

Table 4-1. Summary Evaluation Matrix of Runway Alternatives

Impact Category	Alternative 1	Alternative 2A	Alternative 2B	Alternative 3A	Alternative 3B	Alternative 3C
Description of Improvement	Extend Runway 5 2,962' to the southwest	Extend Runway 23 2,962' to the northeast	Extend Runway 23 2,962' to the northeast and Highway 126 tunnel under runway and taxiway	Extend Runway 5 2,562' to the southwest and extend Runway 23 400' to the northeast	Extend Runway 5 1,462' to the southwest and extend Runway 23 1,500' to the northeast	Extend Runway 5 1,462' to the southwest and extend Runway 23 1,500' to the northeast
Operational Capabilities						
Attract Larger Airplanes and Operating Weights and Range	Potential with longer published runway length for 5-23	Potential with longer published runway length for 5-23		Potential with longer published runway length for 5-23		
Critical Airspace Approach and Departure Surface Considerations	Instrument approach capabilities added to Runway 5	Instrument approach capabilities added to Runway 5		Instrument approach capabilities added to Runway 5		
Effect on All-Weather Capabilities	No Change	No Change		No Change		
NAVAIDS	Relocate with extension	Relocate with extension		Relocate with extension		
Runway Protection Zone Conflicts	Highway 126 in Runway End 23 RPZ	None	None due to Highway 126 tunnel.	Highway 126 in Runway End 23 RPZ	None	
Surface Transportation	Airport perimeter road in Runway 5 RPZ; Highway 126 in Runway 23 RPZ	None		Airport perimeter road in Runway 5 RPZ; Highway 126 in Runway 23 RPZ	None	
Effect on Night Operations	Instrument lighting proposed for Runway 5	Instrument lighting proposed for Runway 5		Instrument lighting proposed for Runway 5		
Performance Requirements						
Supporting Taxiways	Extend Taxiway F southwest 2,962' to new end of Runway 5	Extend Taxiway F northeast 2,962' to new end of Runway 23		Extend Taxiway F northeast 400' to new end of Runway 23 and 2,562' southwest to new end of Runway 5	Extend Taxiway F northeast 1,500' to new end of Runway 23 and 1,462' southwest to new end of Runway 5	
Obstructions	0 obstructions to NE 4 obstructions to SW	No obstructions		0 obstructions to NE 4 obstructions to SW	4 obstructions to NE 0 obstructions to SW	
Runway Visual Zone	Extends southwest by 1,481'; air carrier apron and ARFF bldg penetrate RVZ	Extends northeast by 1,481', no additional inclusions		Extends southwest by 1,281' and northeast by 200', air carrier apron and ARFF bldg penetrate RVZ	Extends southwest by 731' and northeast by 750', no additional inclusions	
Land Use Compatibility						
Impacts to Off- Airport Land Use	Potential decreased compatibility to the southwest	Potential decreased compatibility to the northeast and relocation of business required	Potential decreased compatibility to the southwest and northeast	Potential decreased compatibility to the southwest and northeast		
Impacts to Airport Property Use	Reduction in available building area southwest of relocated approach end of Runway 5 due to RPZ and approach surface shift	No Change		Reduction in available building area southwest of relocated approach end of Runway 5 due to RPZ and approach surface shift		

Table 4-1. Summary Evaluation Matrix of Runway Alternatives

Impact Category	Alternative 1	Alternative 2A	Alternative 2B	Alternative 3A	Alternative 3B	Alternative 3C
Description of Improvement	Extend Runway 5 2,962' to the southwest	Extend Runway 23 2,962' to the northeast	Extend Runway 23 2,962' to the northeast and Highway 126 tunnel under runway and taxiway	Extend Runway 5 2,562' to the southwest and extend Runway 23 400' to the northeast	Extend Runway 5 1,462' to the southwest and extend Runway 23 1,500' to the northeast	Extend Runway 5 1,462' to the southwest and extend Runway 23 1,500' to the northeast
Environmental Impact Potential						
Property Acquisitions / Easements	None	62 acres (Runway 23 RPZ and property around RPZ)		None		
Historic, Architectural, and Archaeological and Cultural Resources	None	The North Unit Main Canal (Historic Resource) would be located in the RPZ		None	The North Unit Main Canal (Historic Resource) would be located in the RPZ	
Section 4(F) of the Department of Transportation Act	None	The North Unit Main Canal (Section 4(f) Resource) would be located in the RPZ		None	The North Unit Main Canal (Section 4(f) Resource) would be located in the RPZ	
Material Excavation Quantities	Runway: 79,092 CY Taxiway: 10,792 CY Total: 89,884 CY	Runway: 1,693 CY Taxiway: 718 CY Total: 2,411 CY		Runway: 72,092 CY Taxiway: 9,416 CY Total: 81,508 CY	Runway: 11,893 CY Taxiway: 6,416 CY Total: 18,309 CY	Runway: 11,893 CY Taxiway: 3,416 CY Total: 15,309 CY
Impervious Surfaces (Runways and Associated Taxiways)	77,400 SY of additional pavement. (includes extension of Twy F)	77,400 SY of additional pavement. (includes extension of Twy F); 1.75 miles of relocated Highway 126	77,400 SY of additional pavement. (includes extension of Twy F)	85,300 SY of additional pavement. (includes extension of Twy F)	81,600 SY of additional pavement. (includes extension of Twy F); 1.25 miles of relocated Highway 126	
Stakeholder Feedback						
On/Off Airport Related Impacts	Low	Medium	High	Low	Medium	High
Project Risk	Low	High		Low	High	
Implementation Complexity	Low	High		Low	High	
Constructability						
Impact to Airport Operations	Low	Low		Low		
Phasing Complexity	Low	Low	High	Low	Medium	
Financial Costs/Impacts						
Project Cost	$48,450,000	$37,550,000	$58,440,000	$29,319,000	$31,555,000	$36,850,000
ALTERNATIVE EVALUATION						
DETERMINATION	Favorable	Favorable	Not Favorable	Neutral	Not Favorable	Not Favorable

AIRFIELD CAPACITY AND THIRD RUNWAY

As discussed in **Chapter 3 – Facility Requirements**, RDM is currently operating at 20 percent of its annual capacity, 27 percent of its Visual Flight Rules (VFR) hourly capacity and 36 percent of its Instrument Flight Rules (IFR) capacity with the existing runway configuration. Flight school operations are expected to double total operations at RDM but will not change the percentage of the mix index because of the weights of aircraft in the flight school fleet. All aircraft in the flight school fleet weigh below 12,500 pounds, and only aircraft that weigh greater than 12,500 pounds can be used in the mix index equation to determine maximum annual service volume (ASV). Total operations at RDM will approximate to 80,000, only 40 percent of its ASV of 200,000 operations. It is anticipated that the aviation activity forecasted through 2036 will not significantly change airfield capacity thus not justifying the need for additional runway capacity. However, a third parallel runway was identified in the previous April 2005 Airport Master Plan and is included on the FAA-approved current ALP (February 2005). The runway is parallel to Runway 5-23 with 3,700 feet centerline to centerline separation and is to initially be constructed 6,200 feet long and 100 feet wide with supporting taxiways and connectors. The ultimate runway was identified as 8,000 feet long and 100 feet wide.

Though it is not anticipated RDM will need a new third runway through 2036, this improvement will be preserved and carried forward into the preferred alternative. Land use controls are in place to protect the third runway from encroachment by incompatible development. Keeping the runway on the ALP preserves long-range flexibility for the Airport should operations require additional capacity, or airport development moves farther west.

4.5.2 TAXIWAY ALTERNATIVES

Airports should provide a safe and efficient taxiway system to expedite aircraft movements to and from the runways and apron areas. The purpose of taxiway improvements is to develop layouts that are operationally efficient, enhance safety, improve circulation, increase capacity and address needs identified in **Chapter 3 – Facility Requirements**. Alternatives are evaluated in this section and recommended improvements to the taxiway system are identified below.

- ✓ Taxiway A (north side): additional pavement will be added to shift the point at which Taxiway C curves and becomes Taxiway A. Taxiway centerline striping on the apron will be modified to connect to Taxiway C and require an additional turn to access Taxiway A.
- ✓ Taxiway A (south side): pavement will be added to shift the point at which Taxiway A connects to Taxiway G. This will require aircraft using the apron taxilane to taxi on Taxiway G before turning to access Taxiway A.
- ✓ Taxiway E: the existing taxiway segment between the apron and Taxiway F will be removed. It will be replaced with a new connector taxiway located about 400 feet east of the existing taxiway (measured centerline to centerline).

Taxiway H: the existing taxiway segment between the apron and Taxiway F will be removed. It will be replaced with a new connector taxiway located about 175 feet east of the existing taxiway (measured centerline to centerline).

ALTERNATIVE 1 – FULL-LENGTH PARALLEL TAXIWAY

This alternative involves addressing FAA-identified Hot Spots 1 and 2 and refines the Airport's taxiway system to resolve issues related to direct access to the runway from an aircraft apron area and non-standards pavement conditions, as shown in **Figure 4-8**, and as discussed in FAA AC 150/5300-13A, Change 1, *Airport Design*. A new parallel taxiway would be constructed in three phases on the eastside of Runway 5-23 with new taxiway connectors to the runway and Taxiway F. The first phase of construction would add 34,379 SY of additional pavement. The second phase would add 24,765 SY of additional pavement, and the third phase would add 26,067 SY of additional pavement. Pavement from Taxiways C and G between the new parallel taxiway and Taxiway F would be removed to address FAA Hot Spots 1 and 2 and mitigate the potential of a runway incursion. The existing Taxiway H and E intersections that facilitate direct access from the passenger apron to Runway 5-23 would be moved to a location that mitigates the potential for aircraft to accidentally cross Taxiway F and unintentionally enter the runway environment. An additional Taxiway connection to Taxiway F would be constructed to facilitate aircraft movement to and from the apron area. To resolve the non-standard pavement conditions, pavement would be added to both sides of the Taxiway A intersections to form a 90-degree turn and eliminate the wide-pavement areas.

Separately, in-fill pavement would be added to the existing aircraft apron area to increase the size of the apron and provide additional uses to include aircraft parking, ground service equipment staging, and storage or other as-needed storage or staging.

The phased approach to project construction allows the Airport to add additional taxiway pavement as needed and minimizes impact on airport operations during construction. The runways will need to be closed temporarily when connector taxiways are added, and when Phase 2 crosses Runway 11-29. Construction can be scheduled to minimize overall disruption.

This alternative is estimated at a total project cost of $20,400,00 and includes engineering, environmental compliance, and construction management services.

ALTERNATIVE 2 – PARALLEL TAXIWAY WITH OFFSET

This alternative, as shown in **Figure 4-9**, is a derivative of Alternative 1 and similarly addresses FAA identified Hot Spots 1 and 2 and resolves all pavement conditions identified in FAA AC 150/5300-13A, Change 1, *Airport Design*. The only difference between Alternatives 1 and 2 relate to designing the new parallel taxiway on the eastside of Runway 5-23 and eliminating the taxiway connectors between Taxiway C and G. New taxiway connectors would be constructed to prevent the creation of hot spots similar to the existing FAA identified Hot Spots 1 and 2 on the opposite side of the airfield. Other conditions remain the same.

This alternative is estimated at a total project cost of $10,913,000 and includes engineering, environmental compliance, and construction management services.

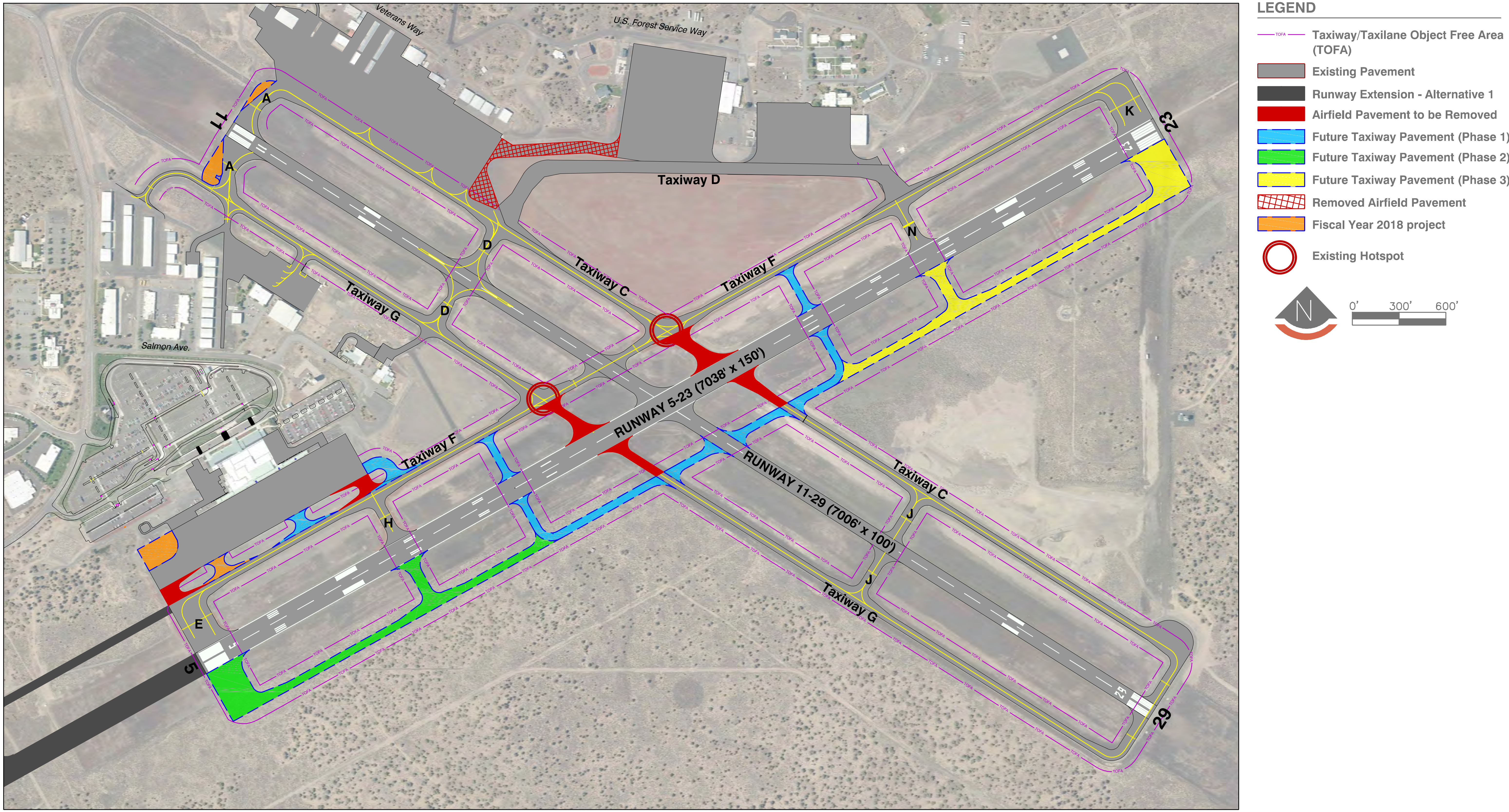


Figure 4-8
Alternative 1 - Full Length Parallel Taxiway

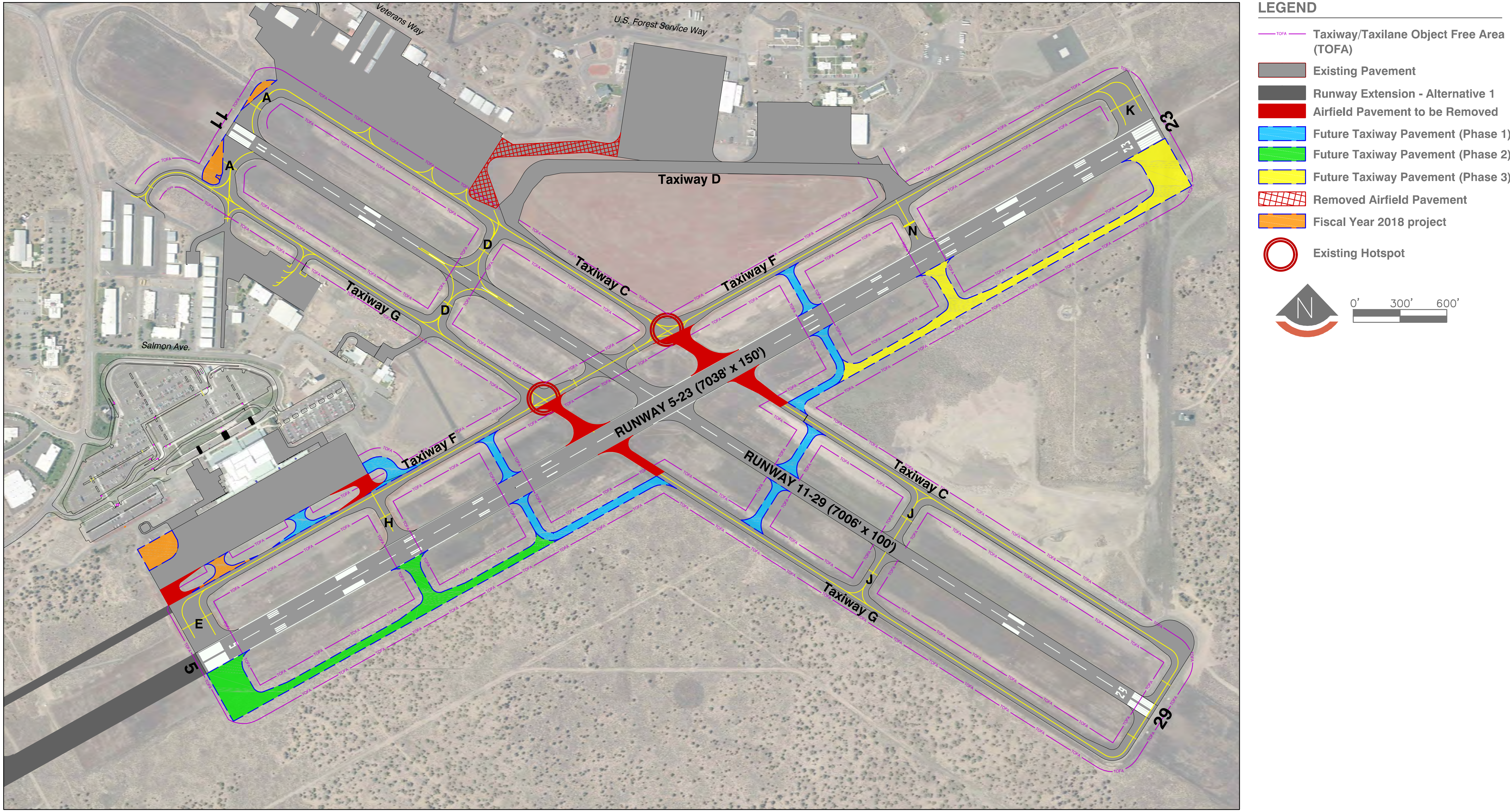


Figure 4-9

Alternative 2 - Parallel Taxiway with Offset

SUMMARY EVALUATION OF TAXIWAY ALTERNATIVES

Table 4-2 presents a summary and an evaluation of the various alternatives for taxiway improvements at RDM. Alternative 1 is the preferred alternative due to the taxiway connectors not being offset, resulting in a full length parallel taxiway.

Table 4-2.Summary Evaluation Matrix of Taxiway Alternatives

Impact Category	Alternative 1	Alternative 2
Description of Improvement	Parallel taxiway on east side of RWY 5-23.	Parallel taxiway on east side of RWY 5-23.
Operational Capabilities		
Airfield Operability & Access	New east and west access to RWY 5-23	New east and west access to RWY 5-23
Presents Solution for FAA Identified Hot Spots 1 & 2	Yes	Yes
Airline and GA Aircraft Separation	Yes	Yes
Performance Requirements		
Reduces Aircraft Taxi Times	TBD	TBD
Increases Potential for Development	Yes	Yes
Expansion Capabilities	Project can be completed in multiple phases	Project can be completed in multiple phases
AC 150/5300-13A Deficiencies	Resolved	Resolved
Complies with Current Design Criteria	Yes	Yes
Land Use Compatibility		
Impacts to Airport Property Use	New airside or landside development area east of RWY 5-23	New airside or landside development area east of RWY 5-23
Aviation Compatible Use	Yes	Yes
Environmental Impact Potential		
Property Acquisitions / Easements	None	None
Impervious Surfaces	Additional Pavement: Phase 1: +/- 34,379 SY Phase 2: +/- 24,765 SY Phase 3: +/- 26,067 SY	Additional Pavement: Phase 1: +/- 34,379 SY Phase 2: +/- 24,765 SY Phase 3: +/- 26,067 SY
Constructability		
Impact to Airport Operations	Low	Low
Phasing Complexity	Low	Low
Financial Costs/Impacts		
Project Cost	$20,400,000	$10,913,000
ALTERNATIVE EVALUATION		
DETERMINATION	Favorable	Favorable

4.5.3 AIRPORT VEHICLE PARKING ALTERNATIVES

Chapter 3 – Facilities Requirements identified the need for additional vehicle parking. The airport reached the terminal parking lot capacity of 1,083 vehicles multiple times in 2016 and had to utilize overflow parking lots. An additional 1,100 parking stalls will be needed to meet demand through 2036. This section analyzes landside alternatives through options focused on adding hourly and premium vehicle parking, long-term vehicle parking, remote vehicle employee vehicle parking, vendor vehicle parking, and rental car facilities.

It is noted that the Airport has begun to see service by transportation network companies (TNCs) like Lyft and Uber. Service by TNCs could theoretically reduce future parking demand if passengers opt to take TNCs to and from the Airport rather than using their own vehicles. It is recommended that the Airport monitor how TNCs impact parking demand and adjust planning assumptions accordingly. Since each community is different and TNCs are a relatively new entrant to the RDM market, it is unknown how much impact they will have on parking demand.

A passenger vehicle parking garage was not considered as part of the alternatives analysis due to the abundance of available vacant land, operational impacts during construction, costs associated with long-term operations and maintenance, and impacts to the scenic views to and from the passenger terminal building.

ALTERNATIVE 1 – SOUTHWEST DEVELOPMENT

This alternative adds an estimated 4,000 parking stalls, as shown in **Figure 4-10**, and involves converting the existing hourly terminal parking lot into a combination of hourly and premium long-term parking. The estimate for the number of parking stalls is based on the average space for stalls and circulation.

Additional hourly and premium long-term parking would be developed directly adjacent to the existing hourly terminal parking. This vehicle parking lot would require the relocation of existing tenants and building demolition. The existing employee vehicle parking lot to the west of the passenger terminal would be converted to hourly or premium long-term parking. A new employee vehicle parking lot would be developed off Salmon Avenue, between the south GA apron and snow removal equipment building. Additional long-term vehicle parking would be developed west of SE Airport Way, and a remote vehicle parking lot would be developed north of the Deschutes County Fair Grounds Expo Center, along the west side of SE Airport Way. Rental car facilities would be developed just north of the additional long-term vehicle parking lot.

For the Airport to provide service to these new areas, the Airport would need to implement a bus operation as the distance to the new passenger parking lot from the passenger terminal ranges from 1.2 to 1.5 miles. This would increase costs due to the need for procurement of a bus fleet, and the on-going costs for fuel, maintenance, and drivers.

The complexity of constructing this alternative is straightforward relative to project phasing, contractor mobilization, and staging areas and would have minimal impact to airport operations. Potential exists for the discovery of archaeological resources in the project area, and it is recommended that a field survey be conducted prior to any construction.

This alternative is estimated at a total project cost of $21,400,000 and includes engineering, environmental compliance, and construction management services.

ALTERNATIVE 2A – SE AIRPORT WAY DEVELOPMENT

This alternative adds an estimated 3,100 parking stalls, as shown in **Figure 4-11**, and involves converting the existing hourly terminal parking lot into a combination of hourly and premium long-term parking. The estimate for the number of parking stalls is based on the average space for stalls and circulation.

The existing employee vehicle parking lot to the west of the passenger terminal would be converted to hourly or premium long-term parking. A new employee vehicle parking lot would be developed off Salmon Avenue, between the south GA apron and snow removal equipment building. Additional remote and long-term vehicle parking would be developed closer to the central passenger terminal area east of SE Airport Way and outside of critical Runway 5-23 design surfaces. Rental car facilities would be developed just north of the additional long-term vehicle parking lot adjacent to the central passenger terminal area.

For the Airport to provide service to these new areas, the Airport would need to implement a bus operation as the distance to the new passenger parking lot ranges from half a mile to one mile. This would increase costs due to the procurement of a bus fleet, fuel, maintenance, and drivers.

The complexity of constructing this alternative is straightforward relative to project phasing, contractor mobilization, and staging areas, and would have minimal impact to airport operations. A potential exists, however, for the discovery of archaeological resources in the area of this alternative, and it is recommended a survey be conducted prior to any construction.

This alternative is estimated at a total project cost of $13,692,000 and includes engineering, environmental compliance, and construction management services. It does not include increased operational costs or vehicle costs associated with bus service.

ALTERNATIVE 2B – SE AIRPORT WAY DEVELOPMENT

This alternative adds an estimated 1,600 parking stalls, as shown in **Figure 4-12**, and is derived from Alternative 2A. Alternative 2B involves converting the existing hourly terminal parking lot into a combination of hourly and premium long-term parking. The estimate for the number of parking stalls is based on the average space for stalls and circulation.

The existing employee vehicle parking lot to the west of the passenger terminal would be converted to hourly or premium long-term parking. A new employee vehicle parking lot would be developed off Salmon Avenue, between the south GA apron and snow removal equipment building.

Additional long-term vehicle parking would be developed in multiple phases, with the first phase on property west of SE Airport Way on a vacant parcel within an industrial complex. The second phase would be on property east of SE Airport Way close to the terminal area. Additional remote vehicle parking and rental car facilities would be developed closer to the central passenger terminal area west of SE Airport Way and outside of critical Runway 5-23 design surfaces. These facilities would be adjacent to the second phase for long-term vehicle parking.

For the Airport to provide service to these new areas, a similar type of bus operation as Alternative 2A would need to be implemented by the Airport as the distance to the new passenger parking lot from the passenger terminal ranges from half a mile to one mile.

The complexity of constructing this alternative is straightforward relative to project phasing, contractor mobilization, and staging areas, and would have minimal impact to airport operations. A potential exists, however, for the discovery of archaeological resources in the area of this alternative, and it is recommended a survey be conducted prior to any construction.

This alternative is estimated at a total project cost of $10,678,000 and includes engineering, environmental compliance, and construction management services. It does not include increased operational costs or vehicle costs associated with bus service.

ALTERNATIVE 2C – SE AIRPORT WAY DEVELOPMENT

This alternative adds an estimated 1,700 parking stalls, as shown in **Figure 4-13,** and is derived from Alternatives 2A and 2B. Alternative 2C involves converting the existing hourly terminal parking lot into a combination of hourly and premium long-term parking. The estimate for the number of parking stalls is based on the average space for stalls and circulation.

The existing employee vehicle parking lot to the west of the passenger terminal would be converted to hourly or premium long-term parking. A new employee vehicle parking lot would be developed off Salmon Avenue, between the south GA apron and snow removal equipment building. Additional long-term vehicle parking would be developed in multiple phases with the first phase on property east of SE Airport Way. The second phase would require the relocation of existing tenants and building demolition; however, this parcel of land is close to the terminal area. Tenants would be relocated to a vacant parcel within an industrial complex. Additional remote vehicle parking and rental car facilities would be developed closer to the central passenger terminal area west of SE Airport Way and outside of critical Runway 5-23 design surfaces. These facilities would be adjacent to the initial phase for long-term vehicle parking.

For the Airport to provide service to these new areas, the Airport would need to implement a bus operation as the distance to the new passenger parking lot from the terminal building ranges from one half to one mile. This would increase costs due to the need for procurement of a bus fleet, and the on-going costs for fuel, maintenance, and drivers.

The complexity of constructing this alternative is straightforward relative to project phasing, contractor mobilization, and staging areas, and would have minimal impact to airport operations. A potential exists, however, for the discovery of archaeological resources in the area of this alternative, and it is recommended a survey be conducted prior to any construction.

This alternative is estimated at a total project cost of $16,222,000 and includes engineering, environmental compliance, and construction management services. It does not include increased operational costs or vehicle costs associated with bus service.

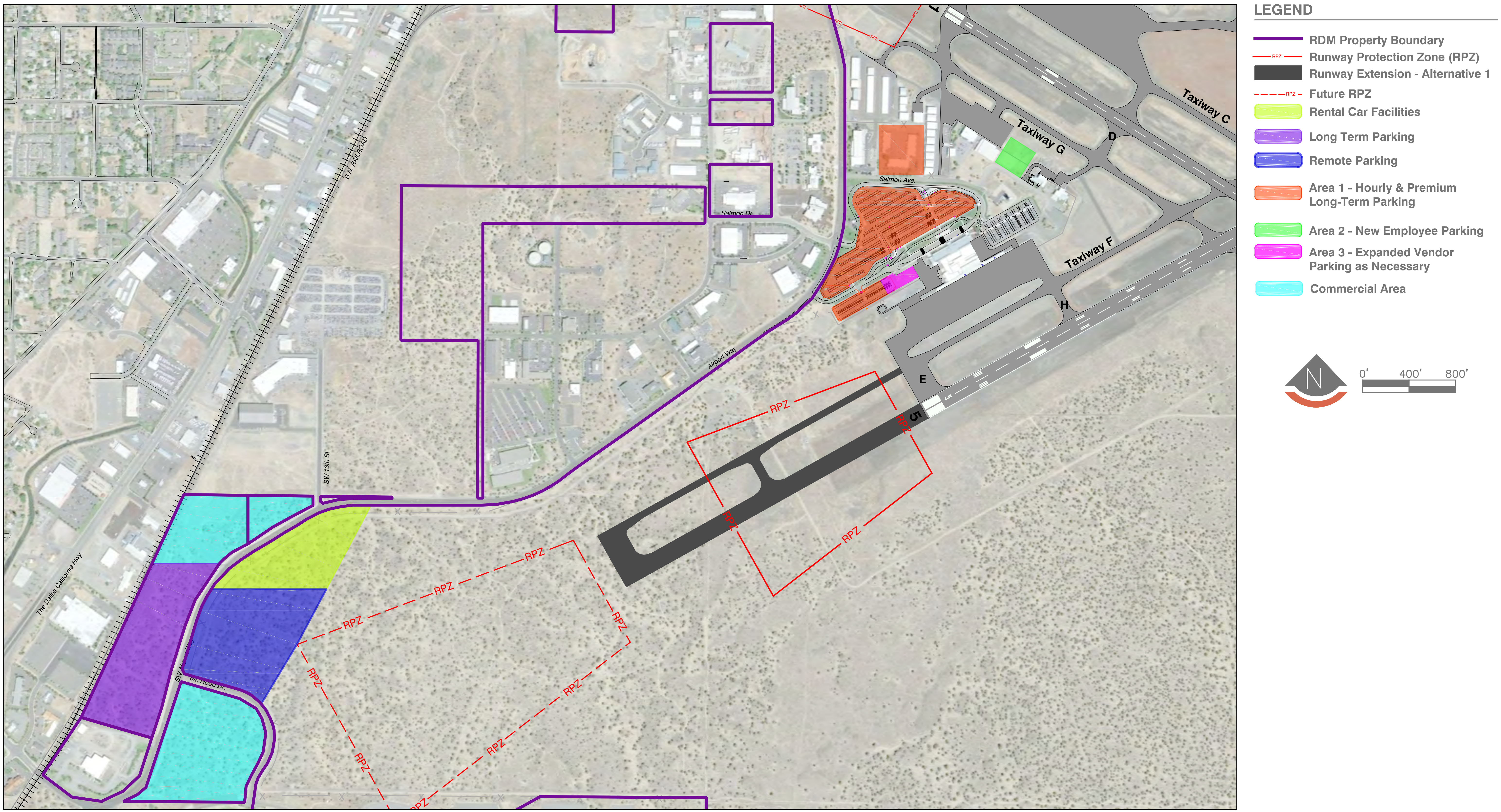


Figure 4-10
Alternative 1 - Southwest Development

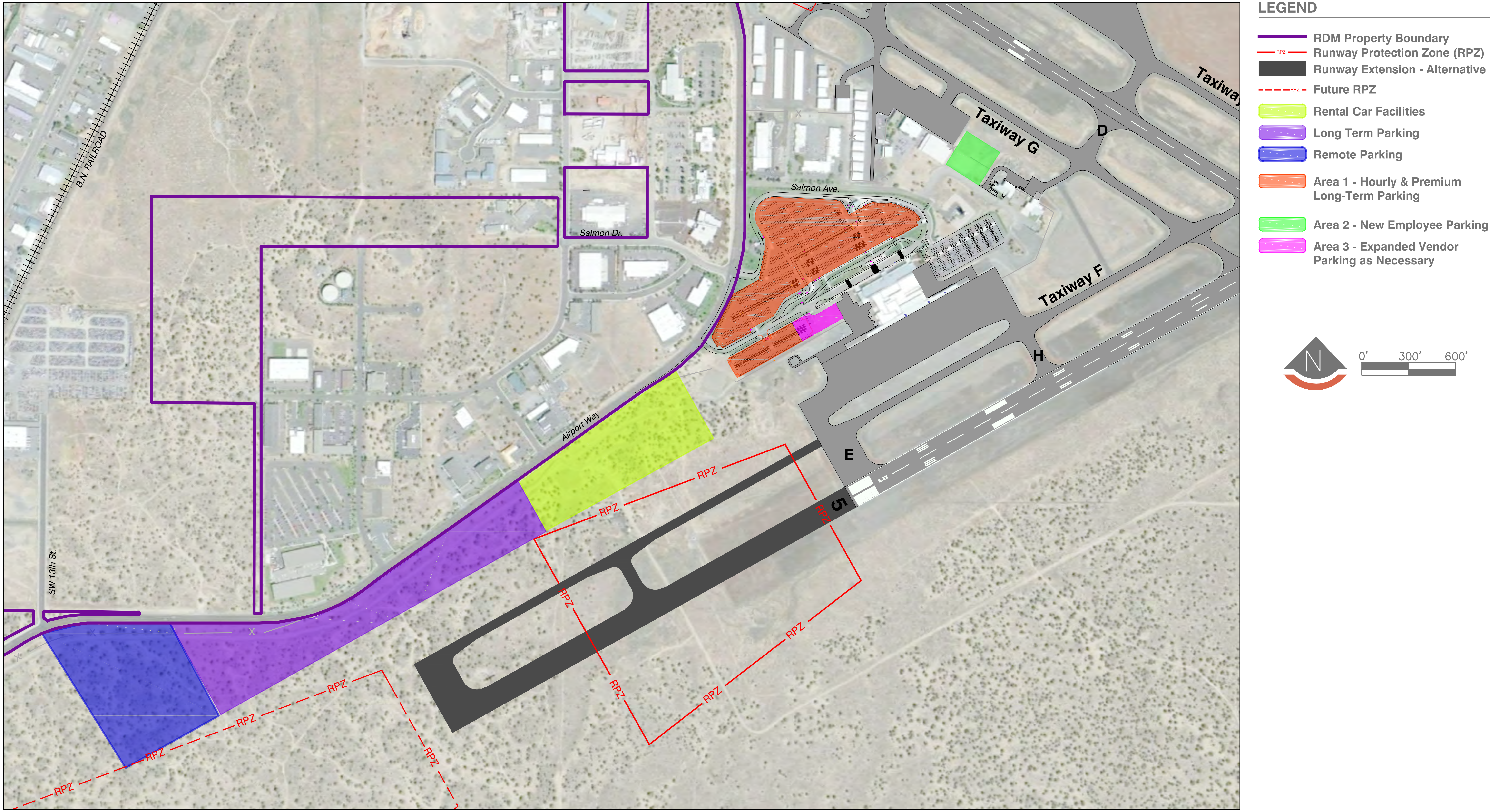


Figure 4-11
Alternative 2A - SE Airport Way Development

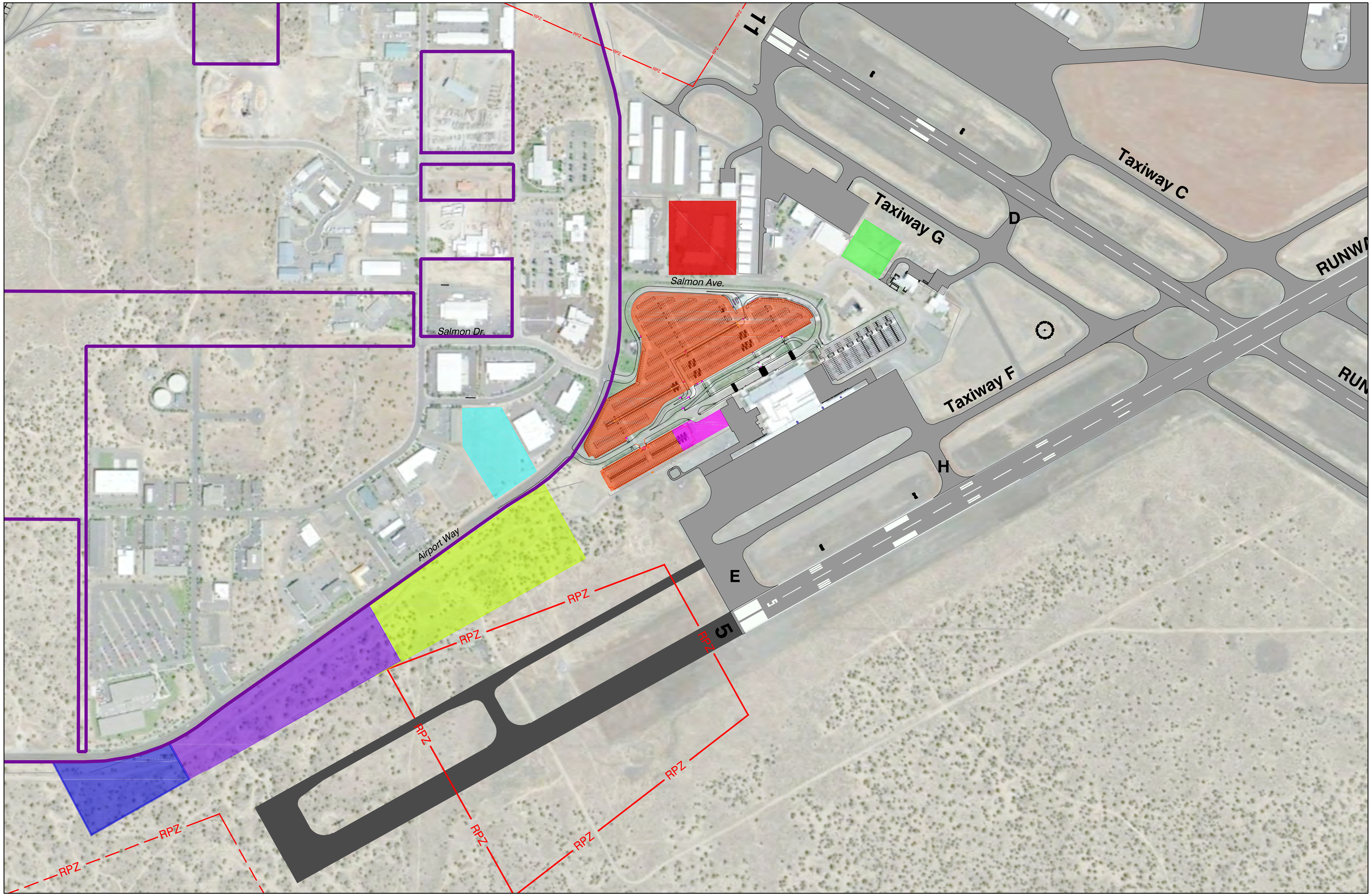
LEGEND

- RDM Property Boundary
- Runway Protection Zone (RPZ)
- Runway Extension - Alternative 1
- Future RPZ
- Rental Car Facilities
- Long Term Parking Phase 1
- Long Term Parking Phase 2
- Remote Parking
- Area 1 - Hourly & Premium Long-Term Parking
- Area 2 - New Employee Parking
- Area 3 - Expanded Vendor Parking as Necessary

0' 300' 600'

Figure 4-12
Alternative 2B - SE Airport Way Development

Mead&Hunt



LEGEND

- RDM Property Boundary
- Runway Protection Zone (RPZ)
- Runway Extension - Alternative 1
- Future RPZ
- Rental Car Facilities
- Long Term Parking Phase 1
- Long Term Parking Phase 2
- Remote Parking
- Area 1 - Hourly & Premium Long-Term Parking
- Area 2 - New Employee Parking
- Area 3 - Expanded Vendor Parking as Necessary
- Relocated Tenants

N

0' 300' 600'

Figure 4-13
Alternative 2C - SW Airport Way Development

SUMMARY EVALUATION OF VEHICLE PARKING ALTERNATIVES

Table 4-3 presents a summary and an evaluation of the various alternatives for vehicle parking at RDM. Alternative 1 is the preferred alternative because of the increase in the amount of parking stalls (estimated increase of 4,000) and the minimal impact to airport operations.

Table 4-3. Vehicle Parking Alternatives Summary Evaluation Matrix

Impact Category	Alternative 1	Alternative 2A	Alternative 2B	Alternative 2C
Description of Improvement	Reorganization of existing vehicle parking and additional long term/remote vehicle parking lots	Reorganization of existing vehicle parking and additional long term/remote vehicle parking lots		
Operational Capabilities				
Operability & Access to Terminal	Increases existing parking stalls by 314%.	Increases existing parking stalls by 287%.	Increases existing parking stalls by 153%.	Increases existing parking stalls by 161%.
Surface Transportation	Passengers are transported via bus to/from the terminal.	Passengers are transported via bus to/from the terminal.		
Transportation Cost	Increased cost for procurement of bus fleet, fuel and continued maintenance	Increased cost for procurement of bus fleet, fuel and continued maintenance		
Performance Requirements				
Addition or Subtraction of Vehicle Parking Stalls	Estimated 4,052 additional stalls	Estimated 3,109 additional stalls	Estimated 1,667 additional stalls	Estimated 1,744 additional stalls
Estimated Distance from Terminal to Vehicle Parking Lot	6,500' to 8,000'	2,000' to 5,000'	1,500' to 4,000'	1,000' to 4,000'
Conforms to FAA Standards	No Parking in RPZ.	Future parking in RPZ and no height conflicts with critical surfaces.		
Land Use Compatibility				
Impacts to Airport Property Use	Undeveloped property repurposed into vehicle parking.	None		Business relocation to repurpose land into vehicle parking.
Property Acquisition	None	None	Yes	
Business Relocation	Yes	None		Yes
Impacts to Off- Airport Land Use	None	None	Vacant property repurposed into vehicle parking.	Vacant property repurposed for Commercial/Industrial use.
Environmental Impact Potential				
Property Acquisitions / Easements	None	None	Yes	
Historic, Architectural, and Archaeological and Cultural Resources	Potential exists for discovery of archaeological resources	Potential exists for discovery of archaeological resources		
Threatened and Endangered Species	Requires Contact of USFWS - East Wolf Mgmt. Zone.	Requires Contact of USFWS - East Wolf Mgmt. Zone.		
Stakeholder Feedback				
Supporting Services	Required	Required		
Compatible w/Existing Development	Above Average	Excellent	Above Average	Above Average
Protection of Scenic View (Terminal)	No Impact	No Impact		
Constructability				
Impact to Airport Operations	Minimal	Construction near SE Airport Way and Central Terminal Area		
Building Demolition	Yes	No		Yes
Phasing Complexity	Low	Medium		
Financial Costs/Impacts				
Project Cost	$21,400,000	$13,692,000	$10,678,000	$16,222,000
OVERALL EVALUATION				
DETERMINATION	**Favorable**	**Favorable**	**Not Favorable**	**Not Favorable**

4.5.4 GENERAL AVIATION DEVELOPMENT ALTERNATIVES

As discussed in **Chapter 4 – Facility Requirements**, the existing GA facilities are constrained and lack easily developable areas with airfield access. Demand forecasts project additional based aircraft, corporate aviation related activities, and a potential flight school. This section analyzes GA development alternatives focused on accommodating anticipated demand with a maximum build potential.

ALTERNATIVE 1 – CENTRAL DEVELOPMENT AREA

This alternative, as shown in **Figure 4-14**, focuses on the development of a vacant 37.6-acre parcel of land southeast of the proposed taxiway parallel to Runway 5-23. This parcel has been identified for future aviation use and can be developed to accommodate many GA activities. This site does penetrate the existing RVZ and has direct access to Runway 5-23.

The complexity of constructing this alternative is straightforward relative to project phasing, contractor mobilization, and staging areas, and would have minimal impact to airport operations. Earthwork is a significant factor due to the significant grades and known presence of rock in the area that requires excavation and embankment quantities of 9,200 CY and 151,000 CY, respectively.

This alternative is estimated at a total project cost of $19,491,000 and includes engineering, environmental compliance, and construction management services.

ALTERNATIVE 2 – NORTH DEVELOPMENT AREA

This alternative, as shown in **Figure 4-15,** focuses on the redevelopment of existing GA facilities on the northwest side of the Airport while maximizing the development of vacant land north and south of SE Veterans Way for a total of 60 acres.

Future aviation development would occur north of existing GA facilities and south of Highway 126. The development would require relocating segments of SE Airport Way, SW Sisters Avenue, and SE Sisters Avenue and provide new access to existing buildings, leasehold areas, and new facilities. The future aviation development would be the potential site for a new flight school, or fixed-base operator (FBO). A new single engine air tanker (SEAT) Base would be located adjacent to existing USFS buildings. New commercial development would surround proposed aviation development and border, but not impact, Highway 126. It is recommended that all Airport property on the north side of the Airport, that is outside of the RPZ for Runway End 11, the USFS lease and GA development areas, be rezoned for airport compatible general commercial zoning.

This alternative is estimated at a total project cost of $72,000,000 and includes engineering, environmental compliance, and construction management services. Total project cost reflects the full buildout of this alternative.

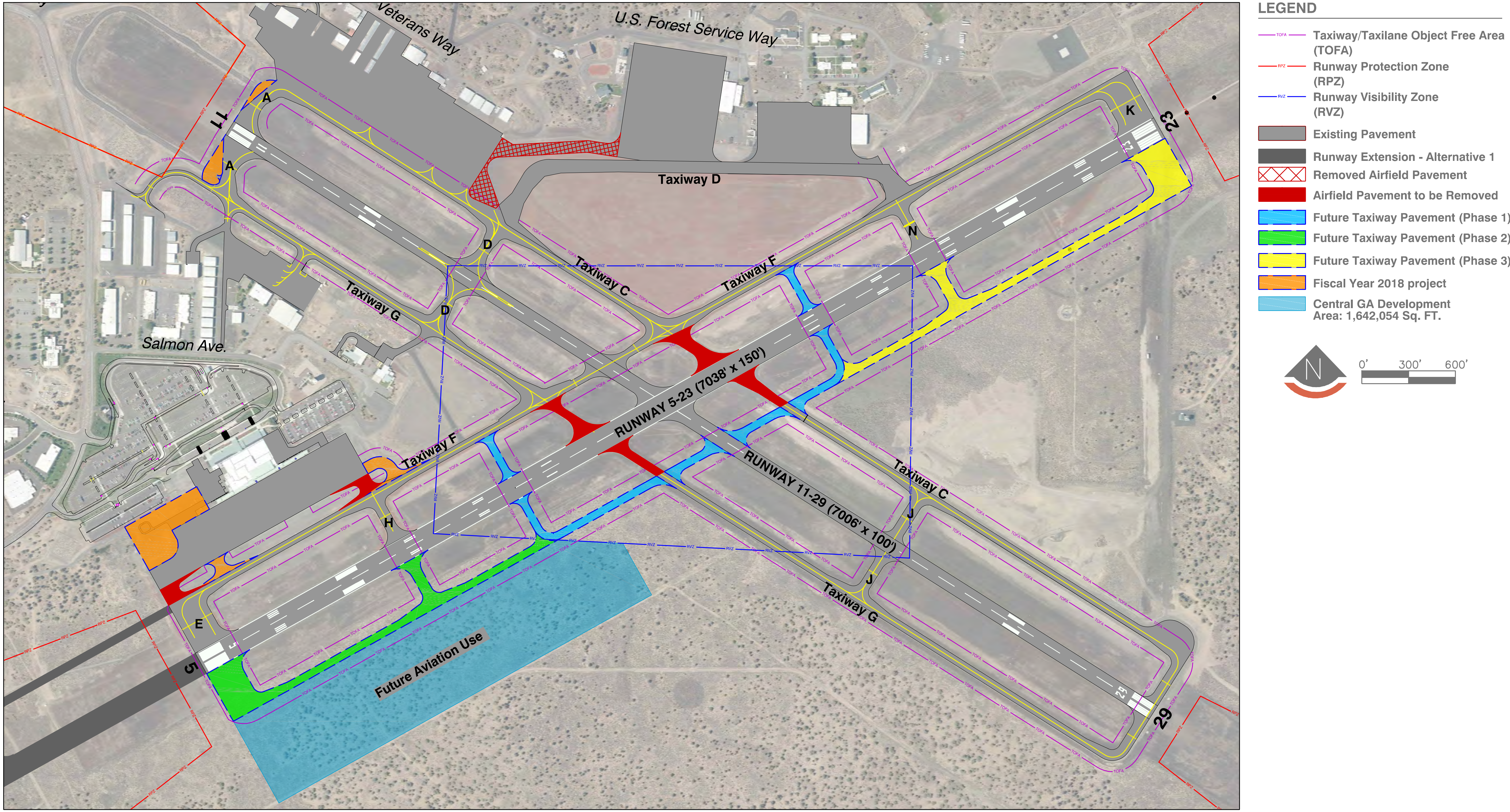


Figure 4-14
Alternative 1 - Centralized Development Area

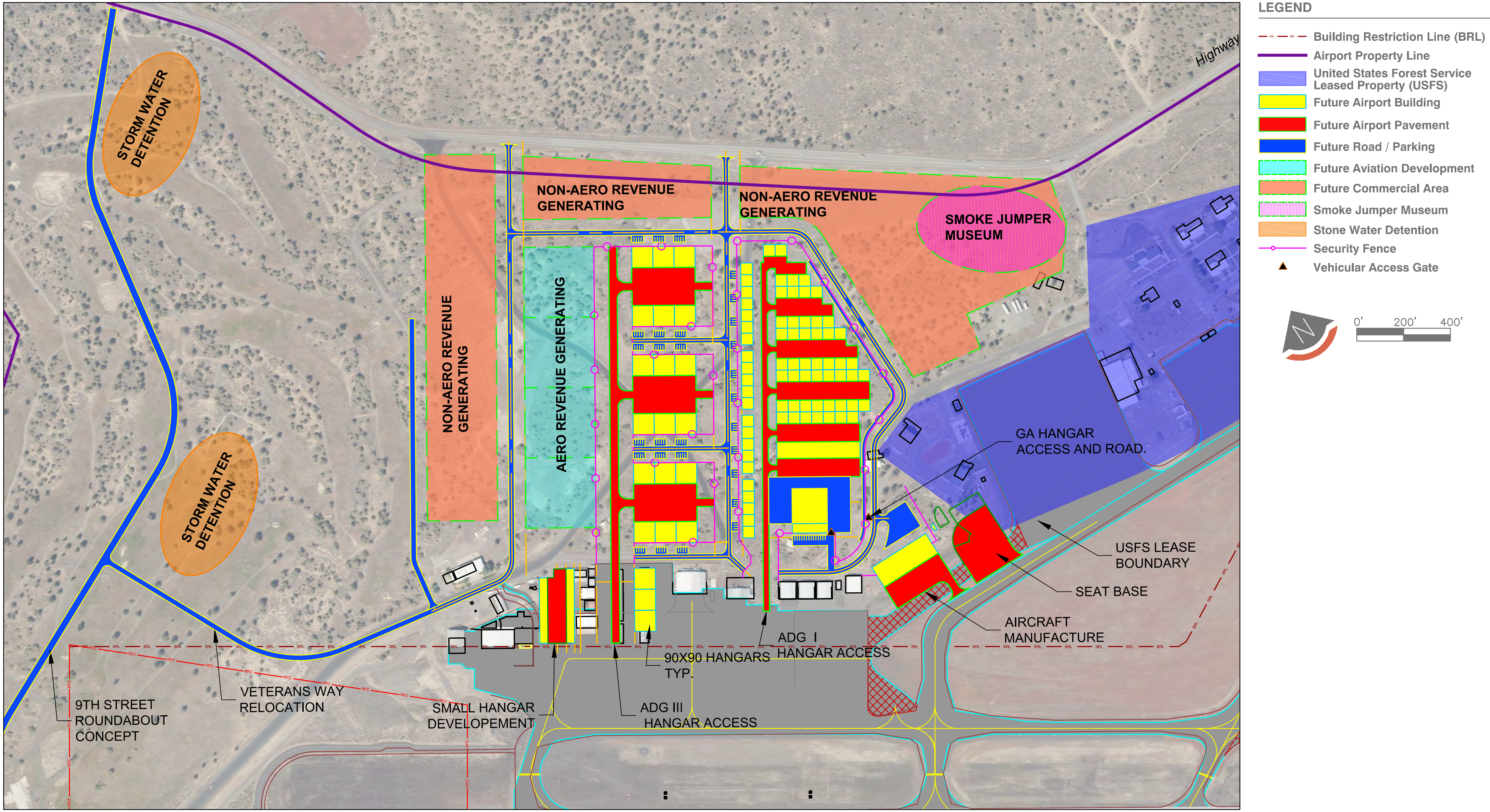


Figure 4-15
Alternative 2 - North Development Area

SUMMARY EVALUATION OF GA DEVELOPMENT ALTERNATIVES

Table 4-4 presents a summary and an evaluation of the various alternatives for GA development at RDM. Alternative 2 is the preferred alternative because development of the north area will have minimal impacts to airport operations and the airfield and will help meet demand for future based aircraft.

Table 4-4. General Aviation Development Alternatives Summary Evaluation

Impact Category	Alternative 1	Alternative 2
Description of Improvement	Expand GA development east of RWY 5-23.	Expand north GA area for future based aircraft.
Operational Capabilities		
Operability & Access	Accommodates anticipated demand. New roadways required.	Accommodates anticipated demand. Roadway relocations required.
Airfield Impacts	Low	Low
Airline and GA Aircraft Separation	Yes	Yes
Hangar and Building Facility Additions	Greenfield site - potential multiple uses.	New flight school, FBO and hangar facilities for corporate and general aviation users
Performance Requirements		
Expansion Capabilities	Estimated 1,642,054 Sq. FT. of new development	Estimated 2,574,000 Sq. FT. of new development
Increases Potential for Development	Yes	Yes
Land Use Compatibility		
Impacts to Airport Property Use	Undeveloped land repurposed into aviation use.	Undeveloped land repurposed into aviation use.
Impact to Other Facilities	None	Demolition of older hangar facilities
Environmental Impact Potential		
Impervious Surfaces	Unknown	Estimated 46,350 SY of additional airfield pavement and 34,350 SY of additional roadway pavement
Property Acquisitions / Easements	None	Relocation of Veterans Way and 10th Street
Historic, Architectural, and Archaeological and Cultural Resources	None	Removal of two of four historic structures on airport property (Warehouse #1 and #2, circa 1940)
Section 4(F) of the Department of Transportation Act	None	Potential removal of an identified Section 4(f) resource
Tenant Relocation Required	No	Yes
Threatened and Endangered Species	Requires Contact of USFWS - East Wolf Mgmt. Zone.	Requires Contact of USFWS - East Wolf Mgmt. Zone.
Constructability		
Impact to Airport Operations	Low	Low
Grading/Soil Conditions	Complex	Complex
Facilities Demolition	None	Yes
Phasing Complexity	Low	Medium
Financial Costs/Impacts		
Project Cost	$19,491,000	$72,000,000
OVERALL EVALUATION		
DETERMINATION	**Favorable**	**Favorable**

4.5.5 AVIATION SUPPORT FACILITIES ALTERNATIVES

This section develops and evaluates alternatives for fuel farm expansion and the identification of fuel truck routes that minimize taxiway crossings. Aviation support facilities such as fuel farms are necessary to serve existing users but also encourage growth in aviation-related activities. Another important factor is the identification of a dedicated on-airport fuel truck haul route to expedite the delivery of fuel and provide for the highest level of safety by minimizing airfield crossings.

FUEL FARM

During the busiest times of the year, the Airport requires multiple Jet A fuel deliveries per day to keep up with demand. The lack of storage capacity is operationally inefficient and puts the Airport at risk of not being able to meet demand should the supply chain be disrupted by a fuel shortage or natural disaster. Analysis considers an expanded fuel farm location that would increase Jet A fuel storage capacity. For planning purposes, all fuel farm alternatives include five 20,000-gallon Jet A tanks. This order of magnitude increase in fuel storage would allow the Airport to have approximately fifteen days of fuel capacity during the very busiest times of year, which meets the needs projected in the demand forecasts, and is similar to the storage capacity of other airports with a similar amount of jet and turbo-prop operations. There is potential for the development of two fuel farm locations to expedite delivery and minimize the crossing of Runway 11-29, with one site to potentially serve the north GA users, and a second to support airline operations. All fuel farm alternatives can be expanded as demand dictates.

All alternatives are estimated at a total project cost of $5,200,000 that includes site work, concrete pad, containment, five 20,000 United States Gallon (USG) tanks, permitting, paved vehicle access, and other associated costs.

Each of the alternatives involve the construction of a fuel farm. The proposed fuel farm can accommodate five 20,000 USG Jet A fuel tanks to increase Jet A fuel capacity by 100,000 USG over the Airport's existing capacity of 44,000 USG. The existing airfield perimeter fence will need to be reconfigured to account for two new access gates that allow the ingress and egress of fuel trucks to access the secure airside of the Airport, but with access limited to only the fuel farm. The fuel farm can be expanded to accommodate additional Jet A tanks or other types of fuel.

ALTERNATIVE 1 – SE AIRPORT WAY

This alternative, as shown in **Figure 4-16**, involves the construction of a fuel farm off Airport Way, south of the existing parking lots. This proposed location of a new fuel farm does not penetrate the existing or any future RVZ for Runway 5-23.

The complexity of constructing this alternative is straightforward relative to project phasing, contractor mobilization, and staging areas and would have minimal impact to airport operations.

ALTERNATIVE 2 – NORTH DEVELOPMENT AREA: VETERANS AVENUE

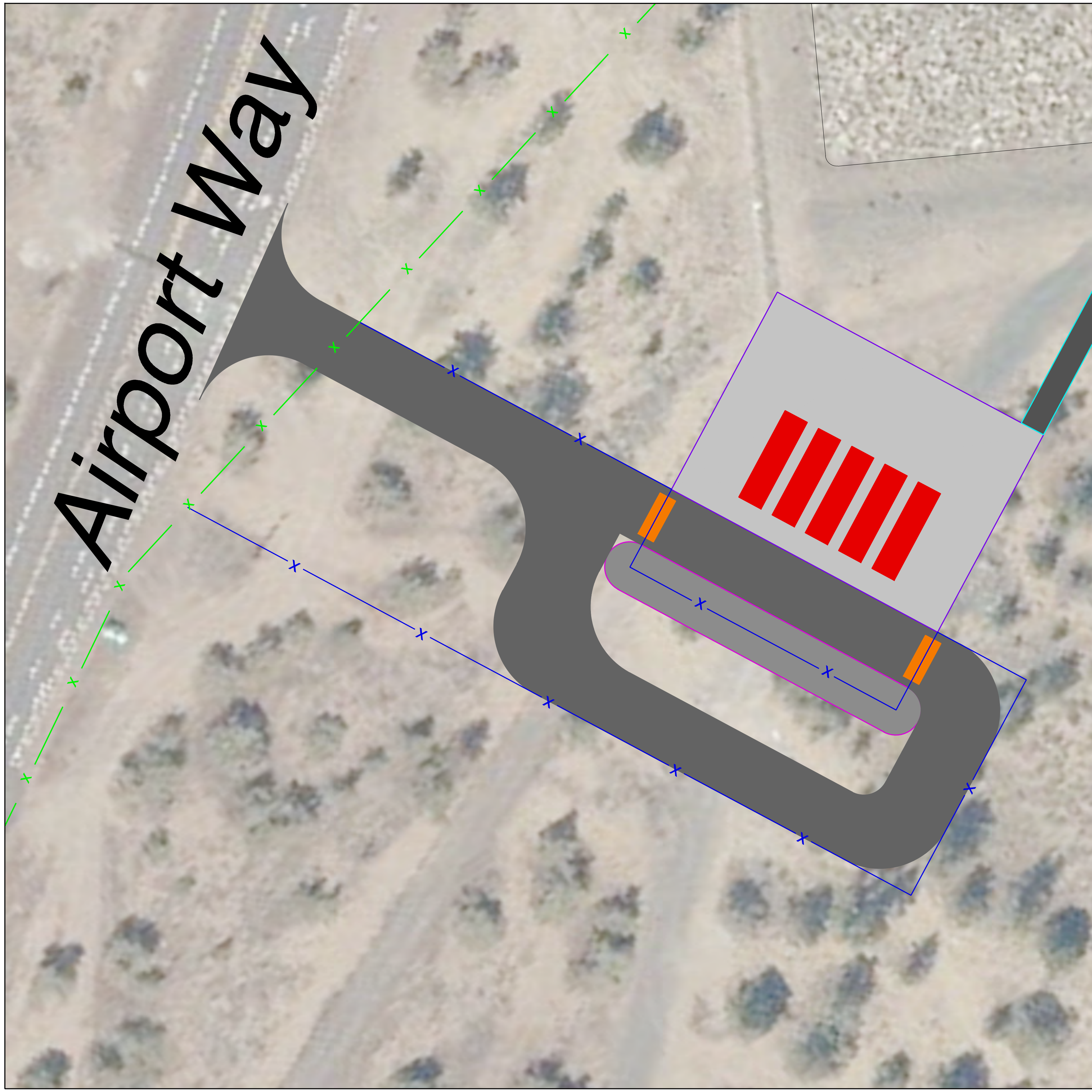
This alternative, as shown in **Figure 4-17**, involves the construction of a fuel farm off Veterans Avenue, on the north GA apron. This proposed location of a new fuel farm does not penetrate the existing or any future RVZ for Runway 5-23.

Construction of this alternative requires the demolition of an existing building that has been identified as a Section 4(f) historic resource (Warehouse #2, circa 1940). The method of construction is straightforward relative to project phasing, contractor mobilization, and staging areas, and would have minimal impact to airport operations. A potential exists, however, for the discovery of archaeological resources in the area of this alternative, and it is recommended a survey be conducted prior to any construction.

ALTERNATIVE 3 – NORTH DEVELOPMENT AREA: SISTERS AVENUE

This alternative, as shown in **Figure 4-18**, involves the construction of a fuel farm off Sisters Avenue, on the north GA apron. This proposed location of a new fuel farm does not penetrate the existing or any future RVZ for Runway 5-23.

The complexity of constructing this alternative is straightforward relative to project phasing, contractor mobilization, and staging areas, and would have minimal impact to airport operations. A potential exists, however, for the discovery of archaeological resources in the area of this alternative, and it is recommended a survey be conducted prior to any construction.



LEGEND

- Existing Fence Line
- Adjusted Fence Line
- Fuel Farm Gate
- Paved Area around Fuel Farm
- Curb
- Road/Loop to Fuel Farm
- Fuel Truck Road
- Fuel Tanks (Jet A) Five 20,000 Gallon Tanks Total: 100,000 Gallons

N

0' 25' 50'

Location

Figure 4-16

Alternative 1 - SE Airport Way

LEGEND

- Existing Fence Line
- Adjusted Fence Line
- Fuel Farm Gate
- Paved Area around Fuel Farm
- Curb
- Road/Loop to Fuel Farm
- Fuel Truck Road
- Fuel Tanks (Jet A) Five 20,000 Gallon Tanks Total: 100,000 Gallons

N

0' 25' 50'

Location

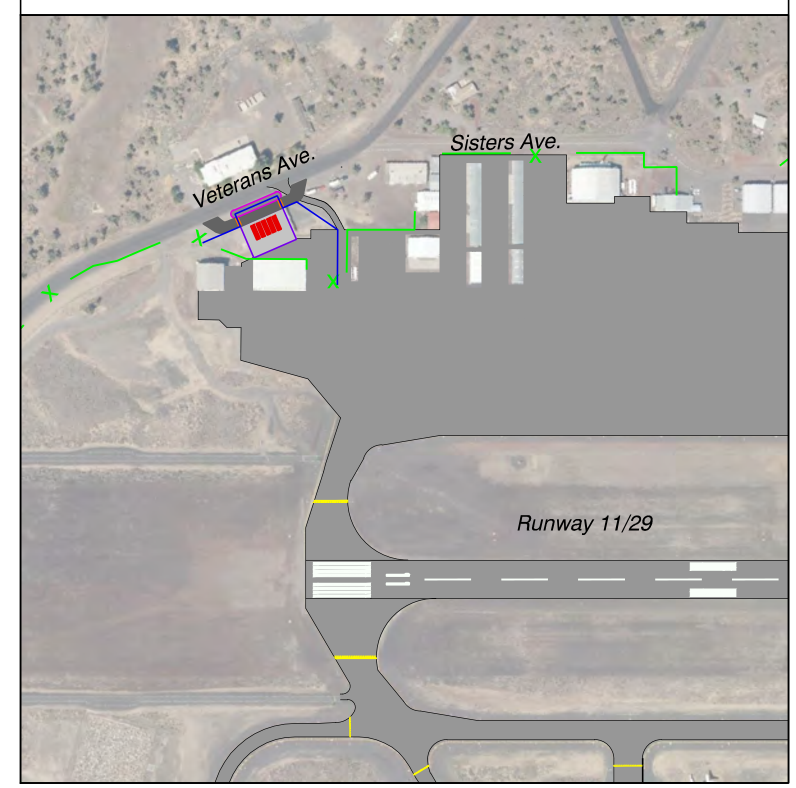


Figure 4-17

Alternative 2 - North Development Area: Veterans Ave.

LEGEND

- Existing Fence Line
- Adjusted Fence Line
- Fuel Farm Gate
- Paved Area around Fuel Farm
- Curb
- Road/Loop to Fuel Farm
- Fuel Truck Road
- Fuel Tanks (Jet A)
  Five 20,000 Gallon Tanks
  Total: 100,000 Gallons

N

0' 25' 50'

Location

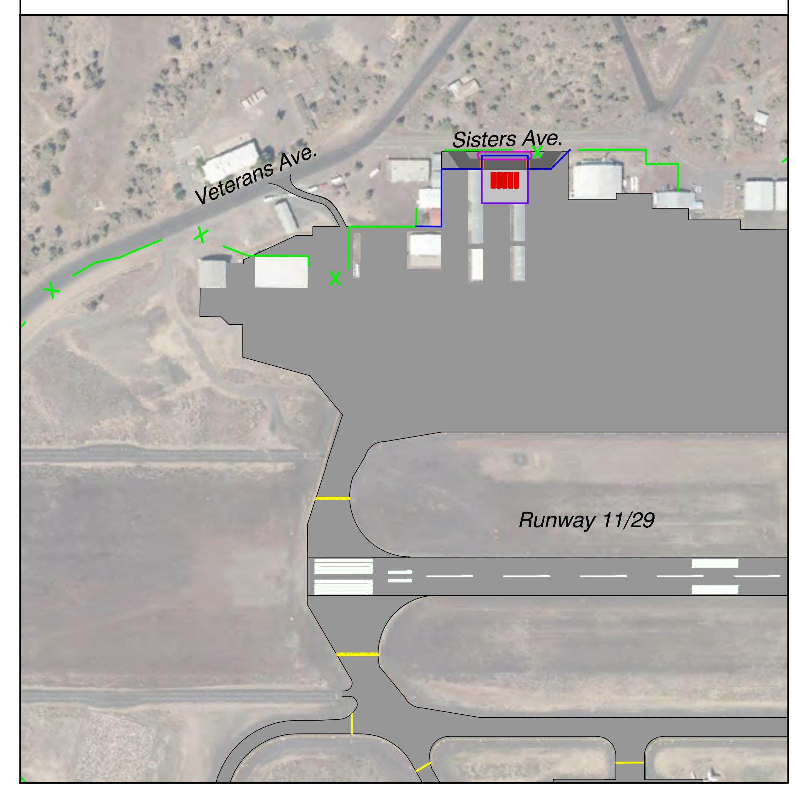


Figure 4-18
Alternative 3 - North Development Area: Sisters Ave.

SUMMARY EVALUATION OF FUEL FARM EXPANSION ALTERNATIVES

Table 4-5 presents a summary and an evaluation of the various alternatives for the expansion of the fuel farm at RDM. Alternative 1 is the preferred alternative because of the low impact to the airfield and airport operations. The location of the fuel farm is beneficial for commercial operations because fuel trucks will have a short commute time between the fuel farm and commercial apron, and the addition of Jet A fuel tanks near the commercial apron will negate the need for a fuel truck haul route.

Constructability Impact Category	Alternative 1	Alternative 2	Alternative 3
Description of Improvement	Construction of five 20,000 USG Jet A fuel tanks (100,000 USG)	Construction of five 20,000 USG Jet A fuel tanks (100,000 USG)	Construction of five 20,000 USG Jet A fuel tanks (100,000 USG)
Operational Capabilities			
Airfield Operability & Access	Serves Jet A users only. No 100 LL or mogas tanks. Tanker entrance off of Airport Way.	Serves Jet A users only. No 100 LL or mogas tanks. Tanker entrance off of Veterans Ave.	Serves Jet A users only. No 100 LL or mogas tanks. Tanker entrance off of Sisters Ave.
Airfield Impacts	None	None	None
Performance Requirements			
Level of Service	15 day fuel reserve	15 day fuel reserve	15 day fuel reserve
Expansion Capabilities	Additional tanks can be added in the future.	Additional tanks can be added in the future.	Additional tanks can be added in the future.
Land Use Compatibility			
Impact to Other Facilities	None	Demolition of existing building	Demolition of older hangar buildings.
Impacts to Airport Property Use	None	None	None
Environmental Impact Potential			
Permits/Code Requirements	Federal, State, City permits and Code Requirements	Federal, State, City permits and Code Requirements	Federal, State, City permits and Code Requirements
Historic, Architectural, and Archaeological and Cultural Resources	None	Removal of one of four historic structures on airport property (Warehouse #2, circa 1940). Potential exists for discovery of archaeological resources.	Potential exists for discovery of archaeological resources.
Section 4(F) of the Department of Transportation Act	None	Potential removal of an identified Section 4(f) resource	None
Tenant Relocation	No	Yes	Yes
Property Acquisitions / Easements	No	No	No
Constructability			
Impact to Airport Operations	Low	Low	Low
Facilities Demolition	No	Yes	Yes
Phasing Complexity	Low	Low	Low
Financial Costs/Impacts			
Project Cost	$5,200,000	$5,200,000	$5,200,000
OVERALL EVALUATION			
DETERMINATION	**Favorable**	**Favorable**	**Favorable**

ON-AIRPORT FUEL TRUCK HAUL ROUTES

Fuel trucks currently travel from the north GA apron to the commercial terminal apron to refuel aircraft because Jet A fuel is only stored at the north GA apron. Travel between both aprons requires fuel trucks to travel on taxiways that are in the movement area. Fuel truck haul route alternatives are designed to allow fuel trucks to deliver fuel from the north GA apron to the commercial apron and to stop fuel trucks from traveling on taxiways or runways.

Fuel truck haul route alternatives can be ignored if Jet A fuel tanks are built on both sides of Runway 11-29. If Jet A tanks are built south of Runway 11-29, in proximity to the commercial apron, fuel trucks will be able to deliver fuel to the commercial apron without having to travel on taxiways or runways.

ALTERNATIVE 1 – INNER ROUTE

This alternative, as shown in **Figure 4-19**, involves the construction of a road for fuel trucks to deliver fuel to aircraft on the commercial apron without crossing or traveling on a taxiway or runway. The proposed road starts at the north GA apron and connects with the service road that exists around Runway 11 to avoid the TOFA. It then continues off the service road outside of the RPZ and crosses three taxiway connectors as the road avoids the TOFA. The road stays parallel with Runway 11-29 until it crosses in front of the segmented circle at the intersection of Runways 11-29 and 5-23, and then it turns running parallel with Runway 5-23, continuing straight to the commercial apron, and staying outside of the TOFA.

This alternative is estimated at a total project cost of $514,200 and includes engineering, environmental compliance, and construction management services.

ALTERNATIVE 2 – CENTRAL ROUTE

This alternative, as shown in **Figure 4-20,** involves the construction of a road for fuel trucks to deliver fuel to aircraft on the commercial apron without crossing or traveling on a taxiway or runway. The road begins at the north GA apron and connects with the existing service road around Runway End 11 to avoid the TOFA. It then continues off the service road while in the RPZ and continues along the Airport's perimeter to the south GA apron and parallels Runway 11-29 to the area of the segmented circle and follows the same route to the commercial apron that is shown for Alternative 1.

This alternative is estimated at a total project cost of $162,000 and includes engineering, environmental compliance, and construction management services.

ALTERNATIVE 3 – OUTER ROUTE

This alternative, as shown in **Figure 4-21,** involves the construction of a road for fuel trucks to deliver fuel to aircraft on the commercial apron without crossing or traveling on a taxiway or runway. The proposed road follows the same route as Alternative 2 until it reaches the ARFF. It then follows the existing perimeter fence to the commercial apron.

This alternative is estimated at a total project cost of $183,000 and includes engineering, environmental compliance, and construction management services.

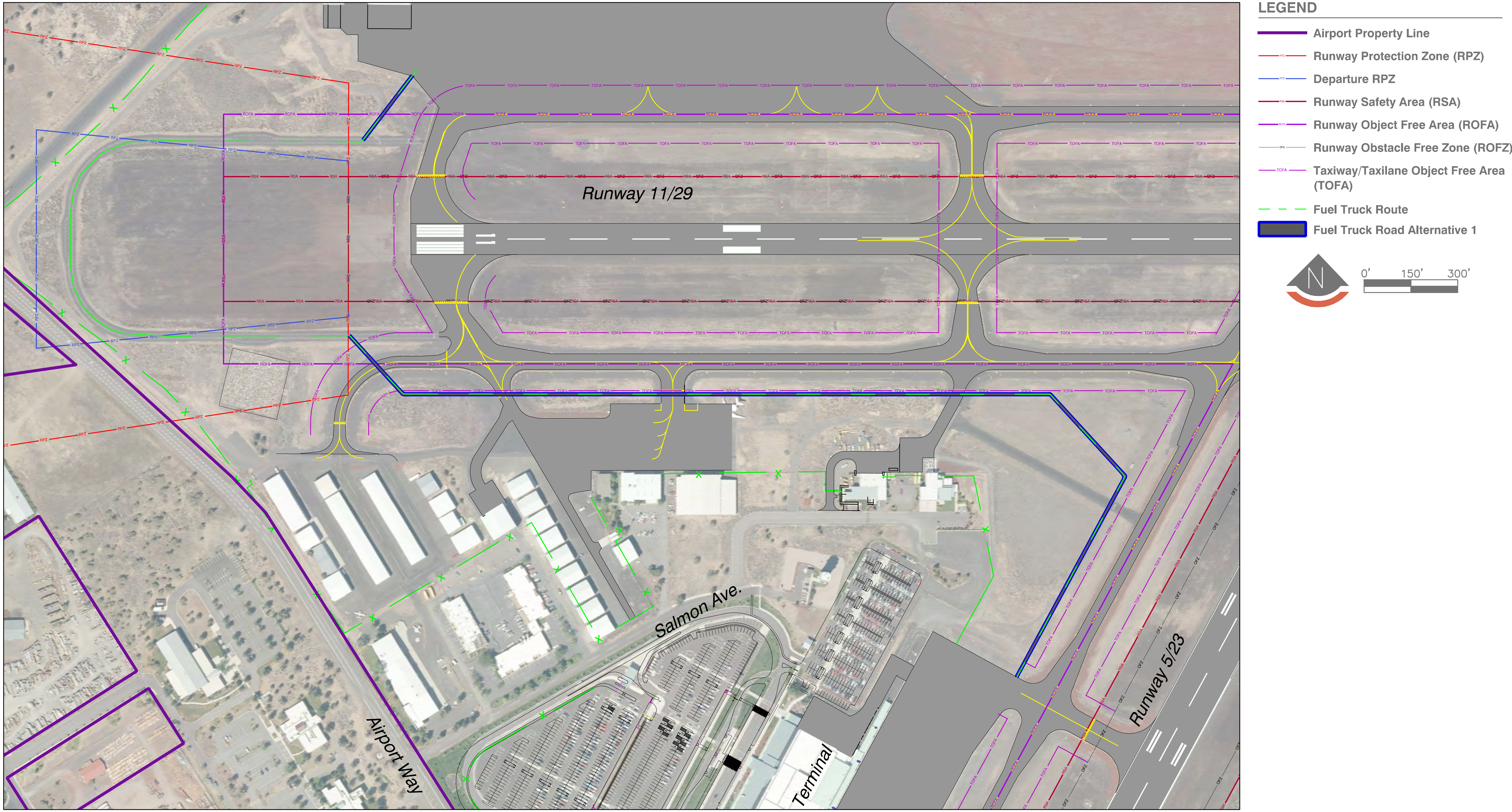


Figure 4-19
Alternative 1 - Inner Route

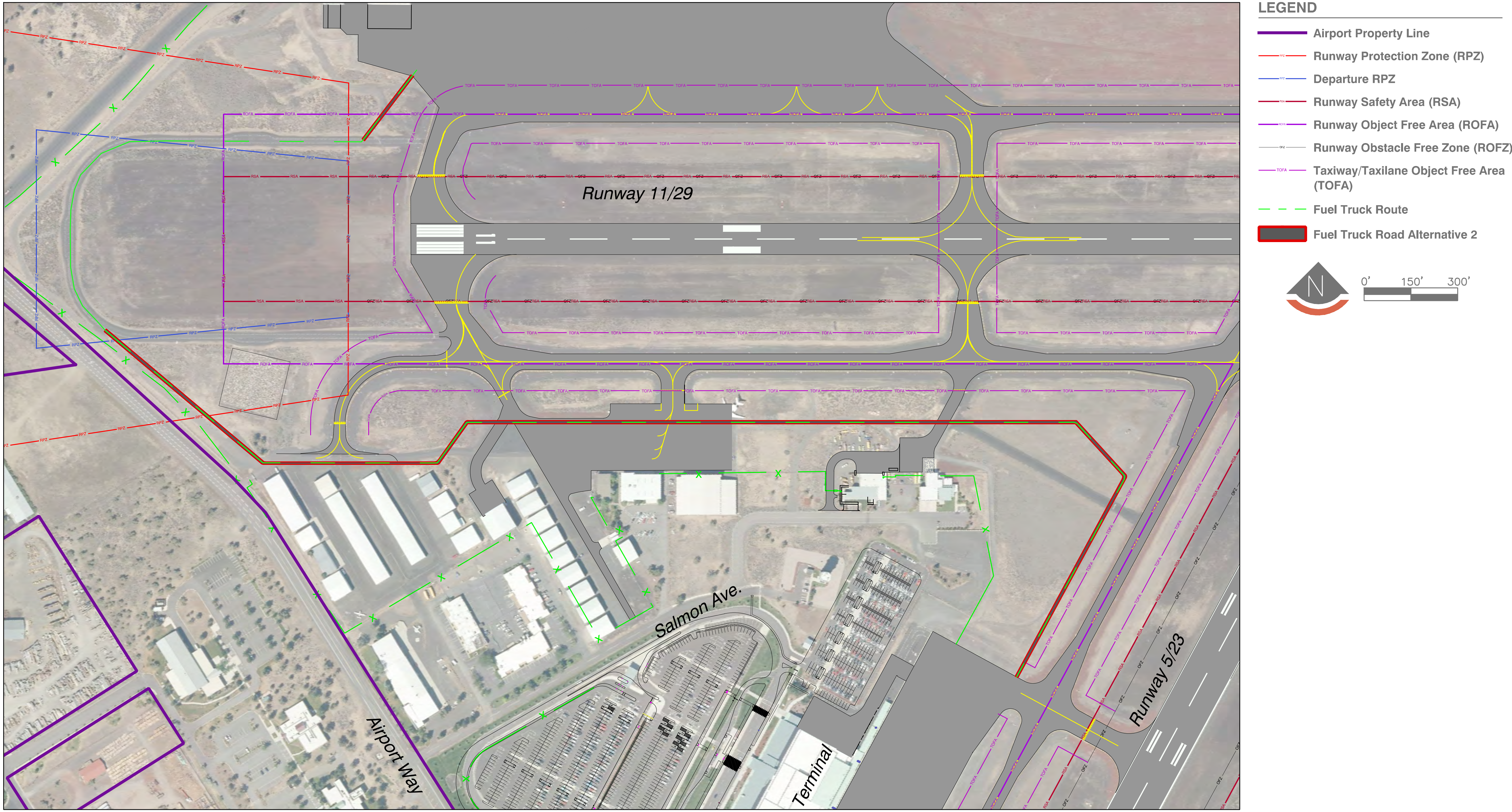


Figure 4-20
Alternative 2 - Central Route

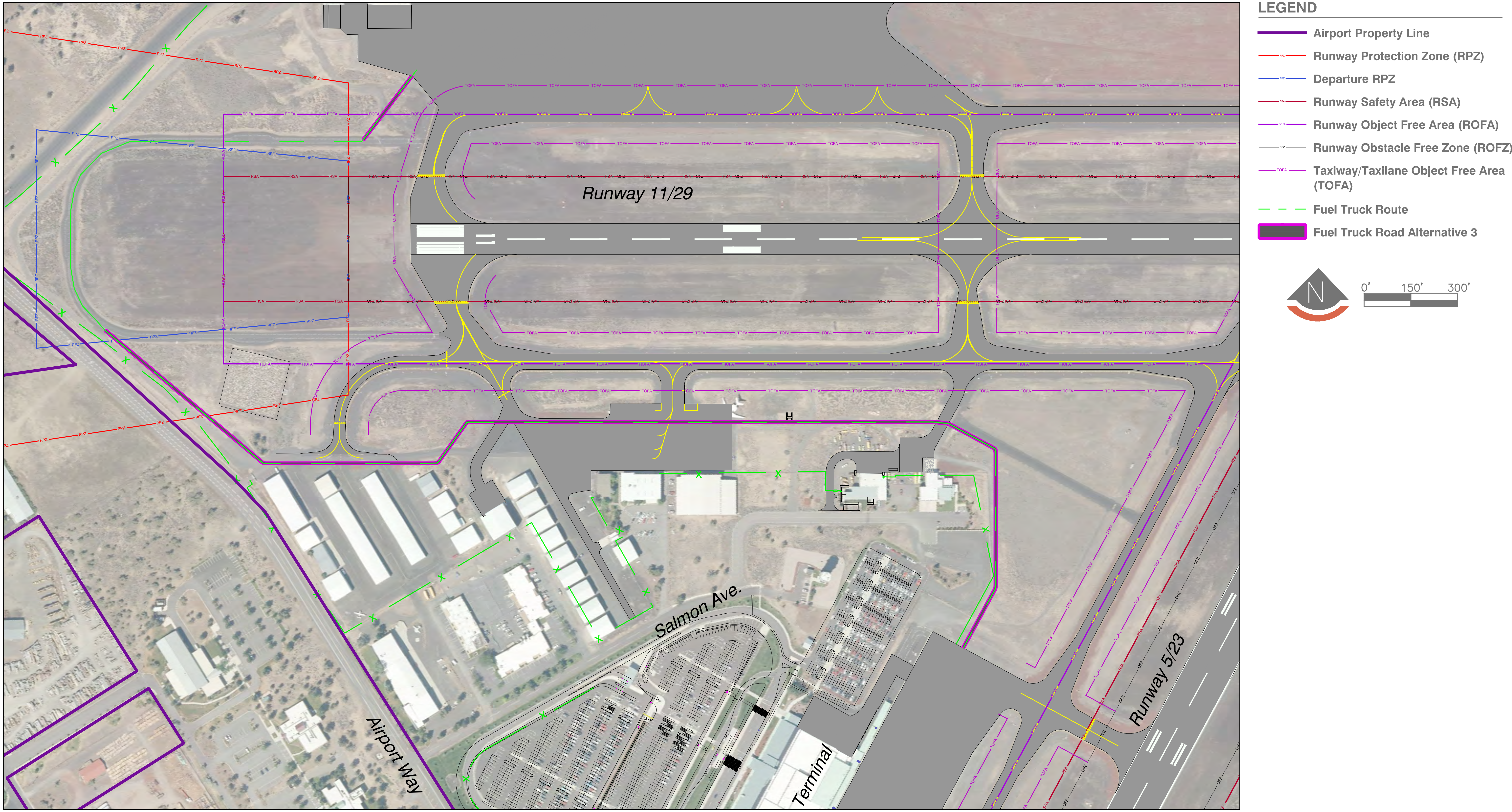


Figure 4-21
Alternative 3 - Outer Route

SUMMARY EVALUATION OF FUEL TRUCK HAUL ROUTE ALTERNATIVES

Table 4-6 presents a summary and an evaluation of the various alternatives for the construction of a fuel truck haul route at RDM. Alternative 1 is the preferred alternative because of the minimal impact to airport operations and facilities.

Table 4-6. Fuel Truck Haul Routes Alternatives Summary Evaluation Matrix

Impact Category	Alternative 1	Alternative 2	Alternative 3
Description of Improvement	Construction of a two way on-airport fuel truck haul route to eliminate the crossing of active runways/taxiways.	Construction of a two way on-airport fuel truck haul route to eliminate the crossing of active runways/taxiways.	Construction of a two way on-airport fuel truck haul route to eliminate the crossing of active runways/taxiways.
Operational Capabilities			
Airfield Operability & Access	Connects North GA, Central GA and Airline Operations.	Connects North GA, Central GA and Airline Operations.	Connects North GA, Central GA and Airline Operations.
Airfield Operational Impacts	Minimal	Minimal	Minimal
Performance Requirements			
Route Alignment	Eliminates taxiway and runway crossings. Penetrations to the TOFA and ROFA. Crosses four taxilane connectors.	Eliminates taxiway and runway crossings. Penetrations to the TOFA and ROFA. Crosses four taxilane connectors.	Eliminates taxiway and runway crossings. Penetrations to the TOFA and ROFA. Crosses four taxilane connectors.
Land Use Compatibility			
Impacts to Airport Property Use	None	None	None
Impact to Other Facilities	None	Crosses South GA Apron	Crosses South GA Apron
Environmental Impact Potential			
Property Acquisitions / Easements	None	None	None
Tenant Relocation Required	None	None	None
Constructability			
Impact to Airport Operations	Minimal	Minimal	Minimal
Facilities Demolition	None	None	None
Phasing Complexity	Low	Low	Low
Financial Costs/Impacts			
Project Cost	$514,200	$162,000	$183,000
OVERALL EVALUATION			
DETERMINATION	**Favorable**	**Neutral**	**Neutral**

4.5.6 PASSENGER TERMINAL ALTERNATIVES

As discussed in **Chapter 3 – Facility Requirements**, the existing passenger terminal was originally designed for smaller commuter aircraft with 35 to 50 seats. As airlines retired these aircraft to focus on more fuel-efficient aircraft with 65 to 90 seats, existing facilities have struggled to meet the existing passenger demand. The forecasted growth in passengers requires additional space in almost every functional terminal component. The following areas are specifically addressed in this chapter:

- ✓ Passenger boarding and holdrooms
- ✓ Outbound and inbound baggage operations
- ✓ TSA security screening
- ✓ Rental car counters and offices
- ✓ Ticket counters, queuing, and airline ticketing offices
- ✓ Administration space
- ✓ Mechanical support spaces

It is anticipated that airlines will operate even larger aircraft at the Airport within the 20-year forecast horizon to include variants of the Airbus A320 or Boeing 737, ADG-III aircraft. This section develops and evaluates alternatives for the expansion of the current passenger terminal to serve the anticipated demand in passengers and larger aircraft.

ALTERNATIVES 1 & 2 – WEST & EAST EXPANSIONS

PASSENGER BOARD BRIDGES AND HOLDROOMS

With the projected increase in passengers, and the airlines' planned transition from regional aircraft to larger and more efficient jets, the terminal will need physical improvements to accommodate these changes. The use of passenger boarding bridges (PBBs) provides a more efficient and comfortable way to board the larger aircraft. Smaller regional jets, like the CRJ 200, can be accessed from the current boarding floor with bridges, but larger jets can only be served from the second floor waiting area. The holdrooms and associated support spaces (e.g., restrooms, concession, etc.) will need expansion to meet the larger passenger capacity of the aircraft.

By 2026 it is anticipated that five passenger boarding bridges will be needed, and by 2036, an additional three bridges will be needed. To handle this expansion, the first and second floor holdrooms will need to increase in size.

There is only one recommended boarding bridge layout for 2026. The second floor will be slightly expanded over the existing ground floor concourse to accommodate two boarding bridges. These PBBs will service larger ADG-III aircraft such as the A320 or a 737. The lower level gates 3, 5, and 6 will be reconfigured to house PBBs that will service small regional aircraft. Gates 2, 4, and 7 will remain as ground floor boarding.

Two alternatives exist for the 2036 expansion. The first, identified in **Figure 4-22**, is to expand the terminal's second floor towards the west over an expanded baggage make-up area and the existing first floor passenger holdroom. In this alternative, five additional PBBs will be installed for aircraft boarding from the second floor. Gate 3 will remain as a first level accessed PPB.

A second alternative, identified in **Figure 4-23**, is to expand the terminal's second floor towards the east over an expanded first floor holdroom and incoming baggage. Four additional PBBs will be added to provide aircraft boarding from the second floor. Gates 5 and 6 will remain as first floor accessed PPBs.

The expansion of the gate and holdroom areas for both options is projected to be approximately 35,000 square feet (sf).

OUTBOUND AND INBOUND BAGGAGE OPERATIONS

By 2019, it is expected that the outbound baggage system will be at capacity due to the increased passenger enplanements. In addition to the increase in enplanements, the first floor holdroom expansion to the west will occupy a portion of the existing outbound baggage system. The outbound baggage system will require an expansion of approximately 3,500sf.

Inbound baggage operations will also need expansion. The existing baggage claim has two baggage carousels. It is anticipated that two additional carousels will be needed to meet the increased passenger load. This expansion will move towards the east. The expansion of the inbound baggage area is projected to be an additional 7,800sf.

TRANSPORTATION SECURITY ADMINISTRATION SECURITY SCREENING

The current Transportation Security Administration (TSA) screening area at the Airport consists of two screening lanes and will be at maximum capacity in five to six years. The expected need, by 2036, is for four lanes to provide uncongested screening. The increased area needed for this expansion will be accomplished by appropriating the area currently occupied by the rental car counters and offices. Future screening options may also provide a separate screening lane for security badged personnel.

The additional space required for the expanded TSA screening area will be 4,500sf.

RENTAL CAR COUNTERS AND OFFICES

To accommodate the expansion of TSA screening, the rental car counters and offices will require relocation. Rental car operations will expand to the northeast corner of the terminal. This area will be directly connected to baggage claim and sized to meet the future needs of the Rent-A-Car (RAC) operations.

TICKET AGENT POSITIONS, QUEUING, AND AIRLINE TICKET OFFICES

There are currently 20 agent positions at the ticketing counters with an anticipated need to add an additional four positions by 2026 and an additional nine positions by 2036, for a total of 33 positions. Additional queuing space will also be required for the 13 new positions. A westward expansion will allow for these future needs. To support the expanded ticketing operation, additional Airline Ticket Offices (ATOs) will be necessary.

The additional space required for the expanding ticketing operations and ATO offices is projected to be 10,800sf.

ADMINISTRATION SPACE

As the terminal expands, additional administrative space will be required to accommodate the growing staff. It is anticipated that a future administrative space would be provided on the second floor above the planned RAC expansion.

MECHANICAL, ELECTRICAL, IT, AND OTHER SUPPORT SPACE

To support the expansion of the terminal, additional space will be needed for mechanical, electrical, IT, and support space.

ALTERNATIVE 3 – NEW CONCOURSE EXPANSION

Development of Alternative 3 is based on comments about Alternative 1 from airport management and the general public from the open house meeting on October 18, 2017. Alternative 3 provides details on each phase of the terminal expansion.

To facilitate future passenger capacity and the ability to handle large jet aircraft, renovations to the existing terminal would proceed in three phases: 1) renovating the existing ground floor holdroom (identified in **Figure 4-24)**; 2) expanding the terminal west and adding a new concourse adjacent to the existing second floor holdroom (identified in **Figure 4-25)**; and 3) expanding the remaining areas of the terminal (identified in **Figure 4-26)**.

PASSENGER BOARD BRIDGES AND HOLDROOMS

Phase one will include reconfiguring the boarding corridor into extra passenger holdroom space to increase seating capacity. An expansion of the passenger holdroom will extend east past the exit lane. The ground floor of the passenger holdroom expansion will be 5 feet higher than the existing holdroom to facilitate PBBs. The extra 5 feet allows PBBs to reach the larger aircraft on the apron. Three PBBs are anticipated in the holdroom expansion. The exit lane will receive renovations to handle an increase in passengers. No renovations will occur on the second floor.

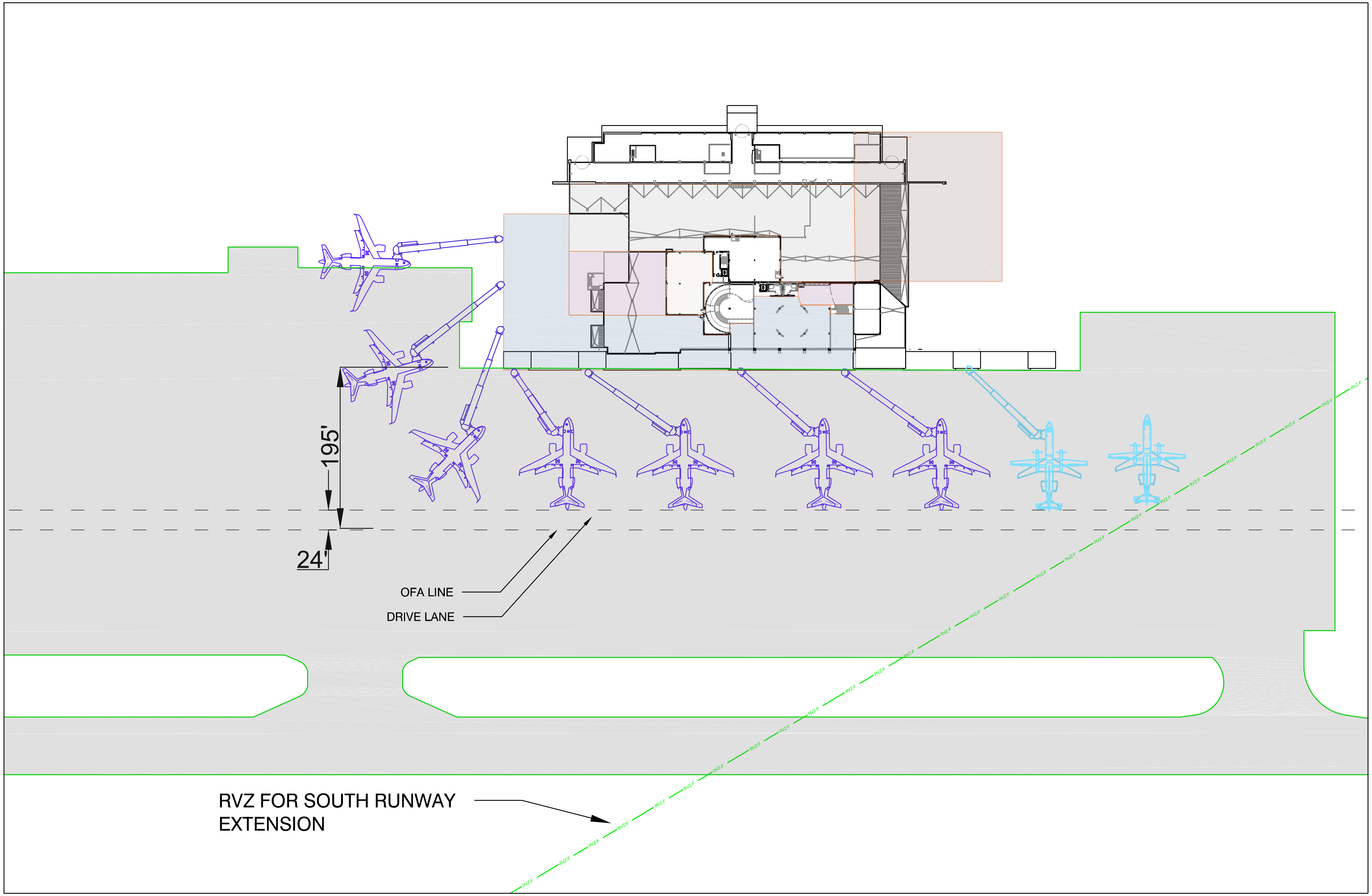
TERMINAL EXPANSION AND NEW CONCOURSE

Phase two will expand the terminal west and add a new concourse adjacent to the existing second floor holdroom. In the interest of fiscal responsibility, avoiding construction-related congestion, and alleviating space needs in the terminal, a new building will be built adjacent to and connected to the west side of the terminal. The new building will house the ticket hall and larger baggage handling area on the ground floor. The second floor of the new building will contain a new concourse that is adjacent to the existing second floor holdroom. Access to the concourse will be possible with escalators and elevators that will be in the ground floor holdroom. The new concourse will have four PBBs. Once the new ticket hall is operational, a portion of the existing ticket hall and ticket offices will be repurposed as the new security checkpoint to accommodate passenger capacity needs. Mechanical facilities will be relocated to the new building. Renovations will occur to the existing second floor holdroom to connect to the new concourse.

TERMINAL EXPANSION OF REMAINING AREAS

In Phase three, RAC operations will relocate to the existing airport administration area, baggage claim will expand into the area previously occupied by RAC operations, and the existing TSA security checkpoint will be reconfigured into a new exit lane. Completion of phase three of Alternative 3 will provide space for the expansion of program areas in order of emerging need in the future. There will be two possible configurations for aircraft boarding, the first being seven PBBs and three ground boarding positions, and the second being eight PBBs and one ground boarding position. **Figure 4-26** shows the first configuration for boarding. This configuration, when upgrading to an eighth PBB, will remove two of the three ground boarding positions and allow for the additional PBB to facilitate boarding from the ground floor holdroom or from the second floor holdroom.

This alternative is estimated at a total project cost of 110,698,900 and includes engineering, environmental compliance, and construction management services. Total project cost includes the cost of the northeast terminal apron reconstruction alternative.



LEGEND

- Runway Visibility Zone (RVZ)
- Existing Pavement
- Boarding Bridge / Aircraft Associated with 1st Floor Level
- Boarding Bridge / Aircraft Associated with 2nd Floor Level

Figure 4-22

Alternative 1 - Forecast 2036 West Aircraft Boarding Expansion

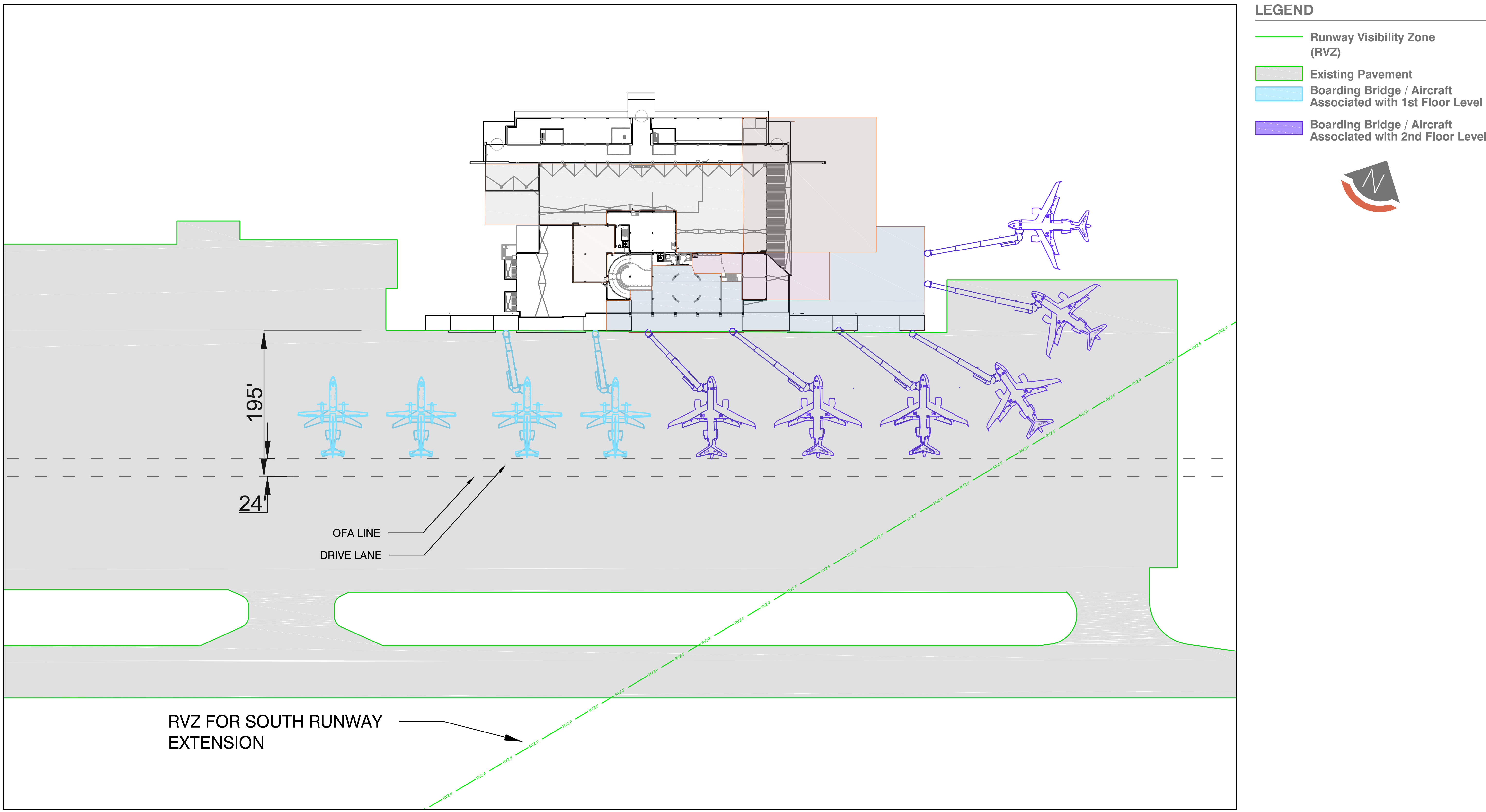
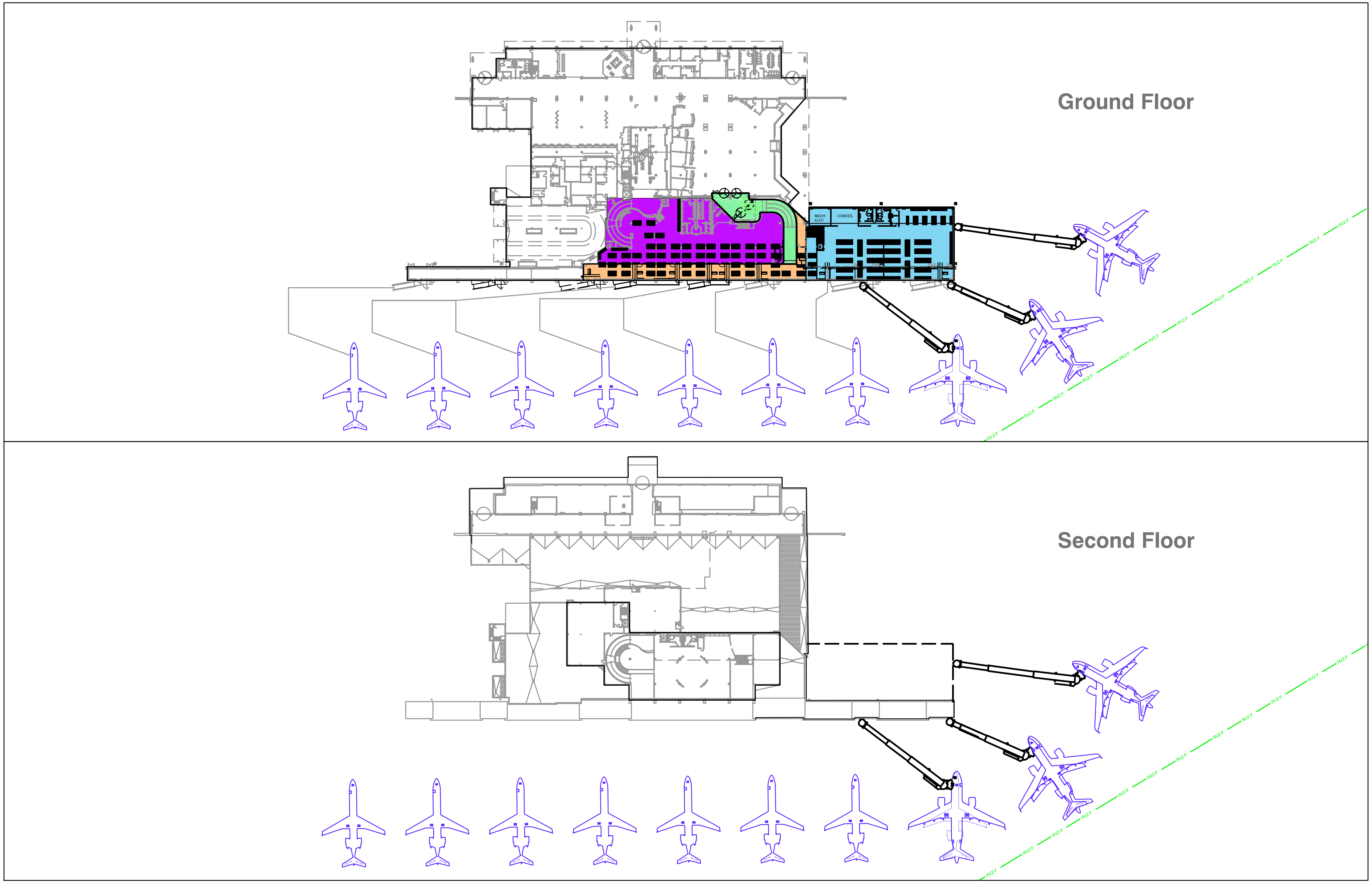


Figure 4-23
Alternative 2 - Forecast 2036 East Aircraft Boarding Expansion



LEGEND

- Runway Visibility Zone (RVZ)
- Renovate Existing Holdroom Space (15,470 Square Feet)
- Renovate Boarding Corridor into Holdroom (5,990 Square Feet)
- Renovate Exit Lane / Ramp (3,040 Square Feet)
- Elevated Holdroom Expansion (15,770 Square Feet)

Figure 4-24

Alternative 3 - Forecast 2036 New Concourse Expansion - Phase 1

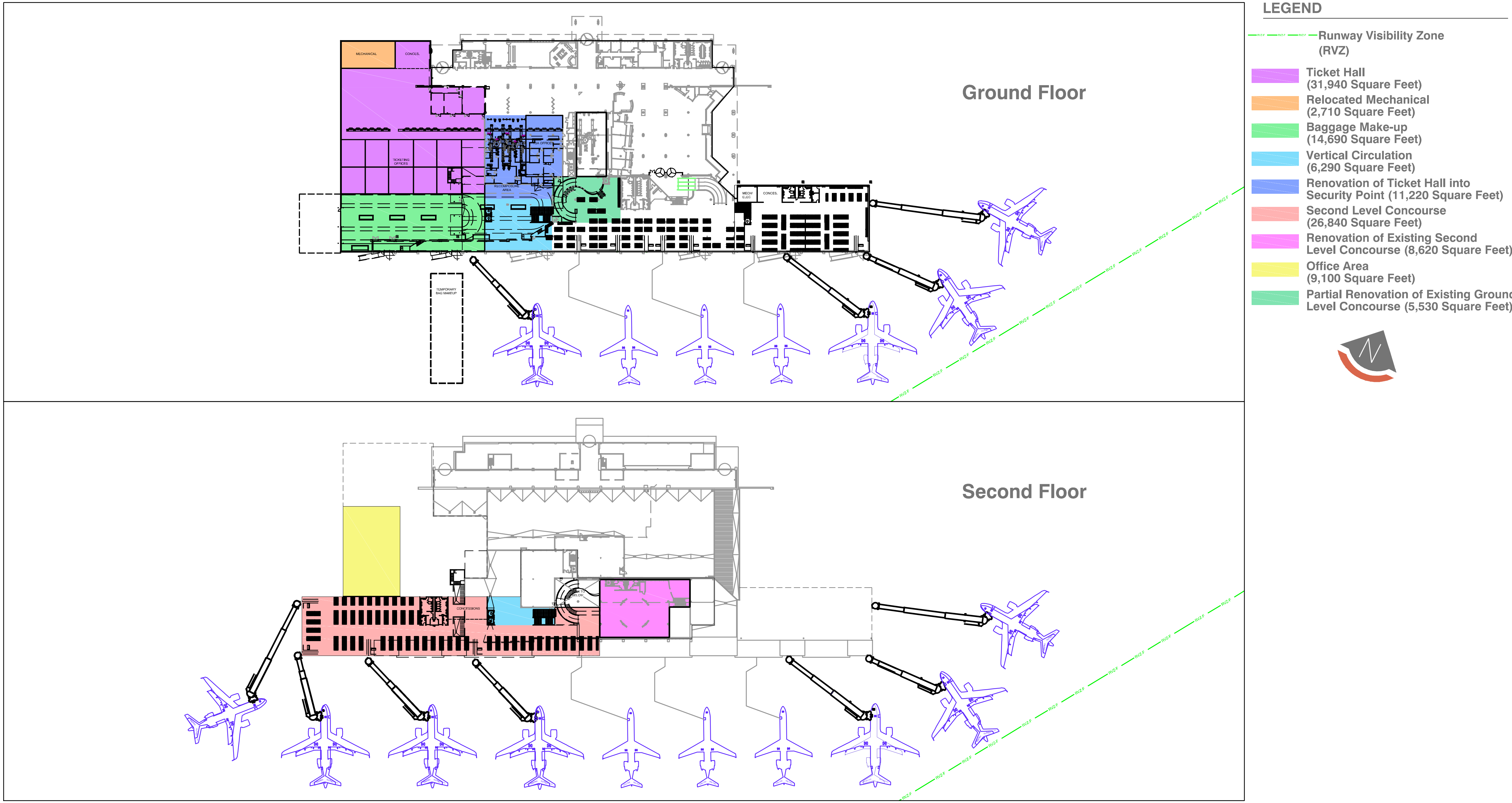


Figure 4-25

Alternative 3 - Forecast 2036 New Concourse Expansion - Phase 2

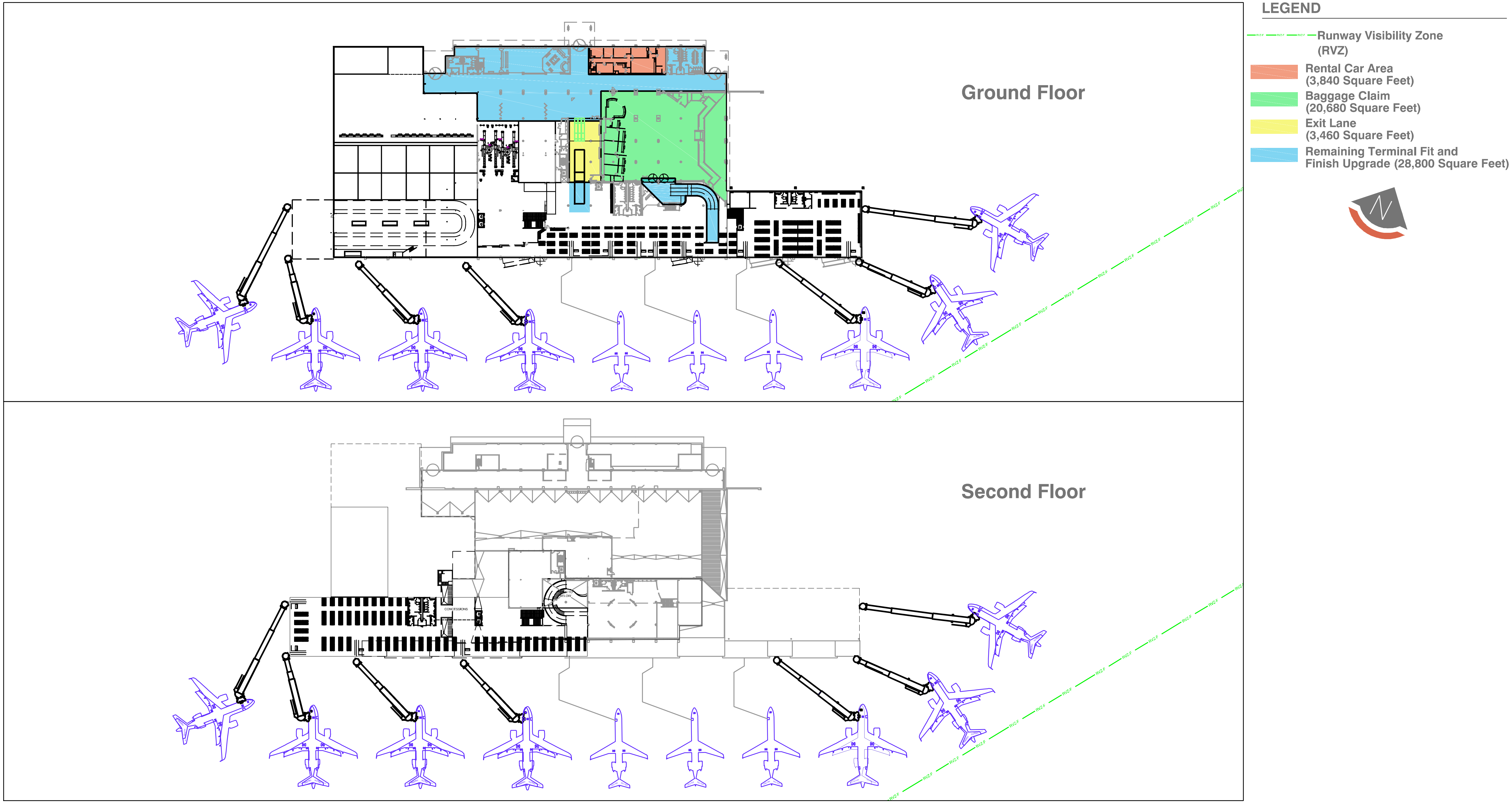


Figure 4-26
Alternative 3 - Forecast 2036 New Concourse Expansion - Phase 3

SUMMARY EVALUATION OF PASSENGER TERMINAL ALTERNATIVES

Table 4-7 presents a summary and an evaluation of the various alternatives for improvements to the passenger terminal at RDM. Alternative 3 is the preferred alternative because expanding the existing terminal to the west provides greater flexibility for future growth.

Table 4-7. Passenger Terminal Alternatives Summary Evaluation Matrix Impact Category	Alternative 1	Alternative 2	Alternative 3
Description of Improvement	Expansion of existing terminal facilities to the west	Expansion of existing terminal facilities to the east	Expansion of existing terminal facilities and new concourse
Operational Capabilities			
Operability & Access	Reconfiguration of internal building space and temporary placement of facilities	Reconfiguration of internal building space and temporary placement of facilities	Reconfiguration of internal building space and temporary placement of facilities
Operational Impacts	Runway 5 expansion to the SE increases extent of the RVZ but does not include aircraft parking positions	Runway 5 expansion to the SE increases extent of the RVZ to include aircraft parking	Runway 5 expansion to the SE increases extent of the RVZ to include aircraft parking
Performance Requirements			
Accommodates Anticipated Passenger Demand	Yes	Yes	Yes
Accommodates Anticipated ADG-III Aircraft (A320 / B737)	Yes	Yes	Yes
Land Use Compatibility			
Impacts to Airport Property Use	Yes	Yes	Yes
Impact to Other Facilities	Yes	Yes	Yes
Environmental Impact Potential			
Property Acquisitions / Easements	None	None	None
Tenant Relocation Required	Yes	Yes	Yes
Constructability			
Impact to Airport Operations	Minimal	Minimal	Minimal
Facilities Demolition	Yes	Yes	Yes
Phasing Complexity	Low	Low	Low
Financial Costs/Impacts			
Project Cost	In Progress	In Progress	$110,698,900
OVERALL EVALUATION			
DETERMINATION	**Favorable**	**Not Favorable**	**Favorable**

4.5.7 NON-AERONAUTICAL DEVELOPMENT ALTERNATIVES

The economic benefits generated from an airport's commercial, industrial, and aviation-related tenants provide substantial tax revenues and employment opportunities for the surrounding communities. Thus, it is in the Airport's best interest to develop future commercial/industrial uses, in addition to aviation-related activities, where feasible. Development around the Airport will diversify revenue streams and promote compatible development. Multiple subareas on and around the Airport were analyzed to examine their development potential to include the:

- ✓ Fairgrounds Industrial Subarea
- ✓ Airport Way Subarea
- ✓ West Business Park
- ✓ North Business Park
- ✓ North Apron
- ✓ South Apron
- ✓ North Development Parcel
- ✓ USFS Campus
- ✓ Terminal

Non-aeronautical alternatives were developed for the Fairgrounds Industrial and Airport Way Subareas in addition to the West and North Business Parks. The remaining potential development areas were excluded from non-aeronautical concept planning due to their planned aviation use or other exclusive uses (e.g., USFS use of its campus and potential emergency response training facility in the North Development Parcel).

Non-aeronautical landside alternatives were developed to illustrate the following potential uses:

- ✓ Accommodation and food services
- ✓ Industrial (which includes speculative light industrial buildings, construction firms, manufacturing, and wholesalers and warehousing)
- ✓ Gas station/ convenience store
- ✓ Office/flex (only in the North Business Park)

Conceptual building footprints were developed for the City-owned parcels within the Fairgrounds Industrial Subarea, Airport Way Subarea, West Business Park, and North Business Park. Additional buildings are likely to be constructed on privately held land as well, though those have not been illustrated within the development alternatives prepared for this Master Plan.

Table 4-8 summarizes the approximate size of the resulting non-aviation building floor areas that could be accommodated on City-owned land within each of the four subareas and further described in the subsequent alternatives.

Table 4-8. Summary of Non-Aviation Building Areas by Subarea (Square Feet)

Use	Subarea			
	Fairgrounds Industrial	Airport Way	West Business Park	North Business Park
Accommodations	0	130,000	0	0
Food/restaurant	0	11,000	0	0
Gas station/ convenience store[1]	0	4,500	0	0
Industrial buildings[2]	70,000	299,500	123,000	0
Office/flex[3]	0	0	0	289,000

Notes:

[1] Gas station/convenience store is not a permitted use in the M-1 Light Industrial zone so a zone change or code amendment would be necessary to accommodate this use.

[2] Industrial buildings include light industrial buildings, construction firms, manufacturing uses, wholesalers, and warehouse use.

[3] The illustrated portion of the North Business Park is zoned C-5 Tourist Commercial, which does not permit industrial uses. Office uses have been illustrated in this area as they are permitted in the zone.

As a subsequent effort to the Master Plan update, the City may wish to consider amending the zoning near the Airport to accommodate a wider range of airport-compatible uses, including commercial, industrial, and institutional uses. Currently, nearby zones include Airport, Light Industrial (M-1), Tourist Commercial (C-5), Open Space Park Reserve (OSPR), Park, and Public Facility (PF), each of which has its own set of permitted uses and development standards. Some communities have been able to capitalize on their public airports by applying zoning designations that allow for a wide range of uses so long as they do not affect aviation operations. Permitting a variety of uses and imposing regulations to limit impacts on aviation may be a way for the City to stimulate economic development while maintaining and enhancing the viability of the Airport. To implement this option, the City may need to amend the Comprehensive Plan and Comprehensive Plan Map, Development Code, and Zone Map.

FAIRGROUNDS INDUSTRIAL SUBAREA

The Fairgrounds Industrial Subarea is zoned Light Industrial (M1) and the majority is privately owned. The southernmost lot in this subarea is an 8-acre City-owned lot. The concept plan illustrates the potential for 70,000sf of industrial buildings on the City parcel. While not pictured on the diagrams, the privately owned land has the potential for up to 200,000sf of additional industrial buildings and 15,000-20,000sf of supporting commercial uses (e.g., restaurants).

AIRPORT WAY SUBAREA

The Airport Way Subarea is zoned Light Industrial (M1) and the land is owned by the City. The southern 9 acres are currently developed with Peterson Caterpillar's facility. The concept plan illustrates nearly

300,000sf of industrial buildings, plus 15,500sf of supporting commercial (gas station and restaurants) and a five-story, 130,000sf hotel (hotels may require additional soundproofing measures due to proximity to the railroad and runway). Of this, a hotel, 4,000sf of restaurant, and 195,000sf of industrial buildings are depicted west of Airport Way. If the land west of Airport Way is needed for rental car facilities and airport parking as envisioned in some aviation alternatives, then some or all these non-aviation uses would not be possible at this location. East of Airport Way, the concept plan illustrates 7,000sf of restaurant, 4,500sf of gas station/convenience store, and 104,500sf of industrial buildings. Due to the large parcel size east of Airport Way, an internal circulation network with private roadways has also been illustrated.

WEST BUSINESS PARK

The West Business Park area contains multiple zoning designations, including Light Industrial (M1), Public Facility, and Park. The concept plan illustrates 123,000sf of industrial buildings on City-owned land within the M1 zone. Potential building locations were selected to avoid the future westward extension of Salmon Drive and the future realignment of the Airport Way-Veterans Way intersection. While not pictured on the diagrams, the privately owned land has the potential for up to 375,000sf of additional industrial buildings.

NORTH BUSINESS PARK

The North Business Park area contains multiple zoning designations, including Light Industrial (M1), Tourist Commercial (C5), and Open Space Park Reserve (OSPR). As the southern portion of this subarea is anticipated to be used for aviation purposes, only the northern portion by Highway 126 is available for non-aeronautical development. This northern portion is zoned C5 and industrial uses are not allowed, so the concept plan illustrates 289,000sf of office buildings. The C5 zone would also permit food services and accommodations, which have not been illustrated but may be considered if such uses are not developed along Airport Way south of the Airport.

SITE, TRANSPORTATION, AND UTILITY CONSTRUCTION COST ESTIMATES

Based on the illustrated non-aeronautical development, this section describes order-of-magnitude site preparation costs as well as transportation and utility costs that can be anticipated to serve the developments.

In general, the site preparation costs include site clearing and grading, stormwater management, installation of utilities, and construction of new roadways. Site development costs have been estimated on a square-foot basis and assume typical construction methods and design for commercial and industrial developments.

The overall public utility systems within the non-aeronautical development areas appear to have capacity to accommodate the proposed uses, so a need for upgrades to existing utilities are not expected to be necessary. Some of the study areas require public utility extensions to serve new development.

FAIRGROUNDS INDUSTRIAL SUBAREA

Site preparation for the Fairgrounds Industrial Subarea is expected to include extension of SW Elkhorn Avenue to connect to the southern terminus of SW Badger Way, which will include 8" sewer and 12" water public utility extensions within the new roadway.

Site preparation construction costs are expected to total over $4 million, as outlined below:

- ✓ On-site earthwork, parking, and private roadways - $1,232,900
- ✓ On-site private utilities - $818,900
- ✓ Public roadways - $960,000
- ✓ Public utilities - $1,160,000
- ✓ Total site development costs: $4,171,800

AIRPORT WAY SUBAREA

Site preparation for the Airport Way Subarea is expected to include extension of 12" public water lines along Mt Hood Drive and within the southern on-site private roadway, as well as extension of 8" public sewer lines within the southern private roadway.

Site preparation construction costs are expected to total nearly $13 million, as outlined below:

- ✓ On-site earthwork, parking, and private roadways - $6,536,800
- ✓ On-site private utilities - $5,528,200
- ✓ Public roadways - $0
- ✓ Public utilities - $855,000
- ✓ Total site development costs: $12,920,000

WEST BUSINESS PARK

Site preparation for the West Business Park Subarea is expected to include extension of SE Salmon Drive to the western edge of the subarea, which will include 12" water and 8" sewer public utility extensions within the new roadway. The proposed realignment of the intersection of SE Airport Way and SE Veterans Way is not included in the non-aeronautical site development roadway costs listed below.

Site preparation construction costs are expected to total over $8 million, as outlined below:

- ✓ On-site earthwork, parking, and private roadways - $3,277,700
- ✓ On-site private utilities - $2,651,600
- ✓ Public roadways - $850,000
- ✓ Public utilities - $1,232,500
- ✓ Total site development costs: $8,011,800

NORTH BUSINESS PARK

Site preparation for the North Business Park Subarea is expected to include upgrades of the existing SE 10th Street and SE Veterans Way to meet city standard road sections, which will include 12" water and 8" sewer public utility extensions within 10th Street. SE Veterans Way includes public utilities that do not need upgrades or extensions. The proposed realignment of the intersection of SE Airport Way and SE Veterans Way is not included in the non-aeronautical site development roadway costs listed below.

Site preparation construction costs are expected to total over $8 million, as outlined below:

- ✓ On-site earthwork, parking, and private roadways - $3,045,400
- ✓ On-site private utilities - $2,396,200
- ✓ Public roadways - $470,000
- ✓ Public utilities - $451,300
- ✓ Total site development costs: $6,392,900

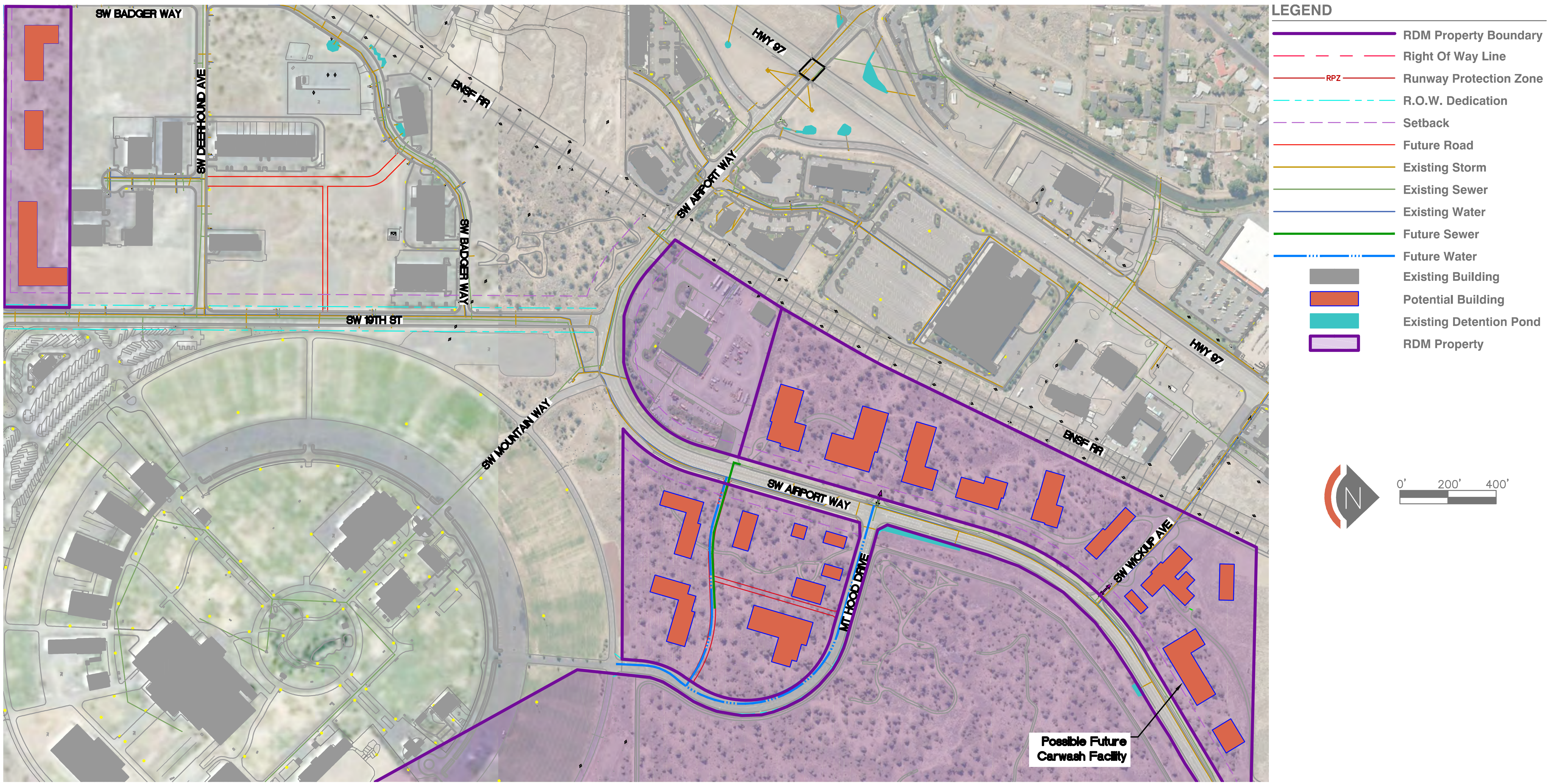
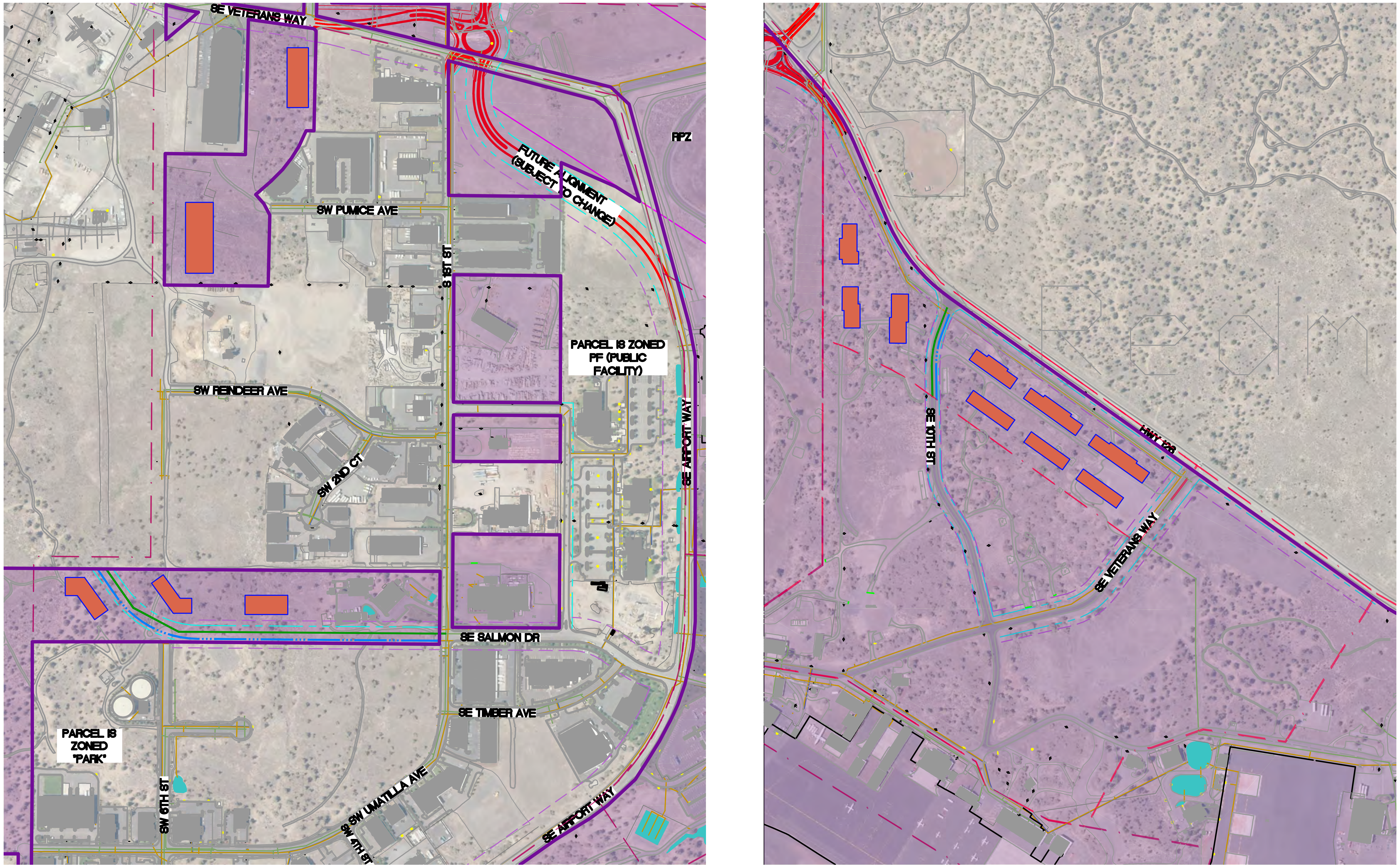


Figure 4-27
Alternatives - Fairgrounds Industrial & Airport Way Subareas

REDMOND MUNICIPAL
AIRPORT MASTER PLAN



LEGEND

- RDM Property Boundary
- Right Of Way Line
- RPZ Runway Protection Zone
- R.O.W. Dedication
- Setback
- Future Road
- Existing Storm
- Existing Sewer
- Existing Water
- Future Sewer
- Future Water
- Existing Building
- Potential Building
- Existing Detention Pond
- RDM Property

Figure 4-28

Alternatives - West & North Business Park Subareas

4.5.8 AIRCRAFT RESCUE & FIRE FIGHTING BUILDING ALTERNATIVES

The FAR Part 139 establishes certification requirements for airports serving scheduled air carrier operations. As an FAR Part 139 certified airport, RDM must provide Aircraft Rescue and Firefighting (ARFF) services in support of scheduled air carrier service. Part 139 requires that ARFF services must be able to meet a three-minute response time where an ARFF vehicle must reach the midpoint of the farthest runway serving air carrier aircraft from its assigned post or reach any other specified point of comparable distance on the movement area that is available to air carriers and begin application of an extinguishing agent. The existing ARFF building will lie within the future RVZ if Runway 5-23 extends to the southwest; in this scenario, the ARFF site would need to be relocated. The relocated site must remain clear of all FAR Part 77 surfaces, existing, and future RVZ and not impact FAA Air Traffic Control Tower (ATCT) line of site. Three possible locations were identified for the ARFF building, as described below.

ARFF RELOCATION SITE 1

This alternative, as shown in **Figure 4-29**, involves demolishing the existing ARFF facility and the construction of a new ARFF facility on a portion of the former footprint of the existing site, while shifting the future building a sufficient distance to remain clear of FAR Part 77 and the RVZ. The new ARFF location remains clear of all FAR Part 77 surfaces, does not impact the existing or future RVZ, and does not impact the existing ATCT line of site.

This alternative is estimated at a total project cost of $3,250,000 and does not include demolition, engineering, environmental compliance, or construction management services.

ARFF RELOCATION SITE 2

This alternative, as shown in **Figure 4-30,** involves the construction of a relocated ARFF building on a vacant parcel of land, northeast of the ATCT, adjacent to the existing Snow Removal Equipment (SRE) building. The new ARFF location remains clear of all FAR Part 77 surfaces, does not impact the existing or future RVZ, and does not impact the existing ATCT line of site.

This alternative is estimated at a total project cost of $2,877,280 and does not include engineering, environmental compliance, or construction management services.

ARFF RELOCATION SITE 3

This alternative, as shown in **Figure 4-31,** involves converting the existing SRE building into the ARFF building. The new ARFF location remains clear of all FAR Part 77 surfaces, does not impact the existing or future RVZ, and does not impact the existing ATCT line of site.

This alternative is estimated at a total project cost of $2,877,280 and does not include engineering, environmental compliance, or construction management services.

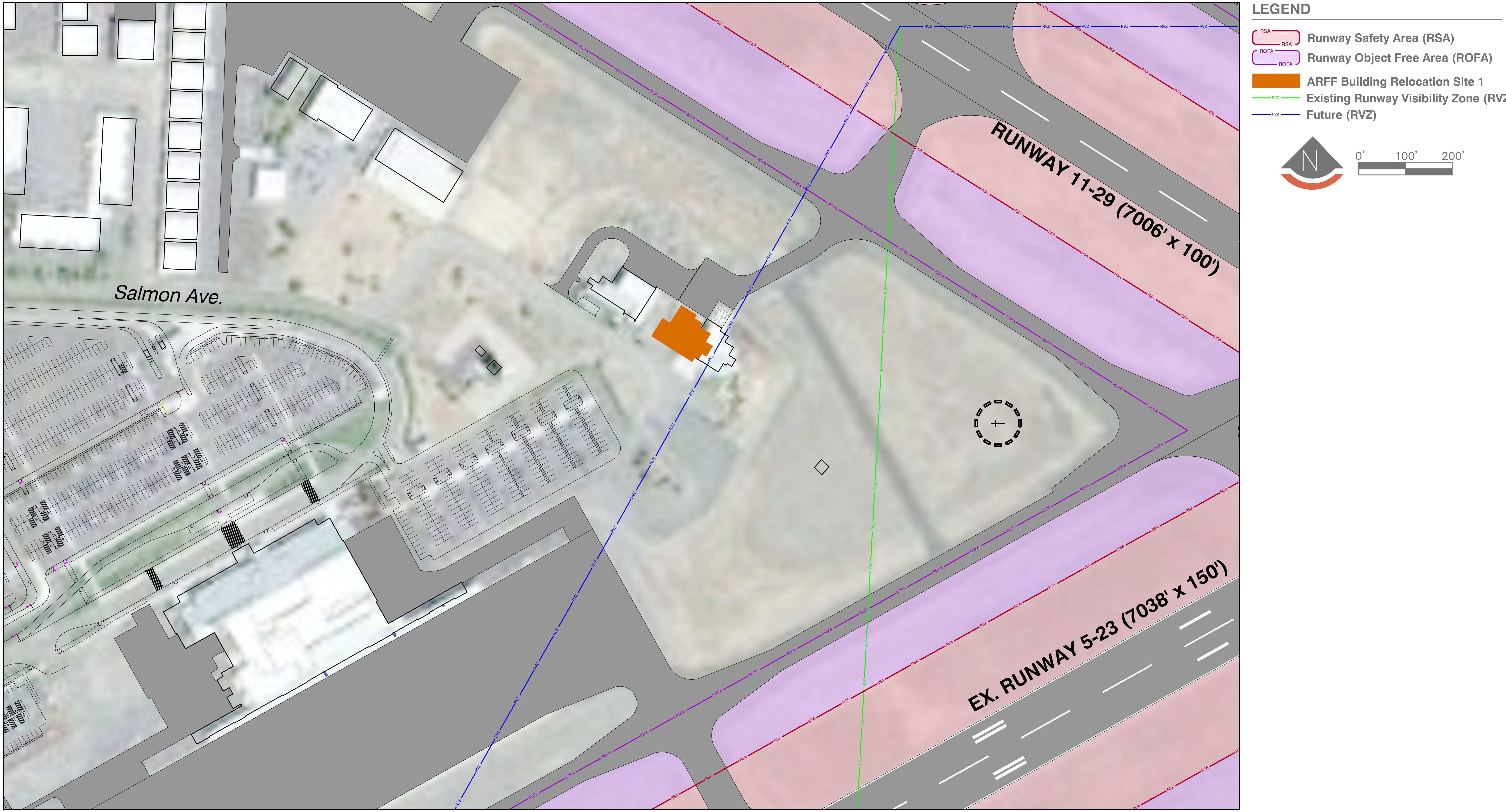


Figure 4-29
Alternative 1A - ARFF Relocation Site 1

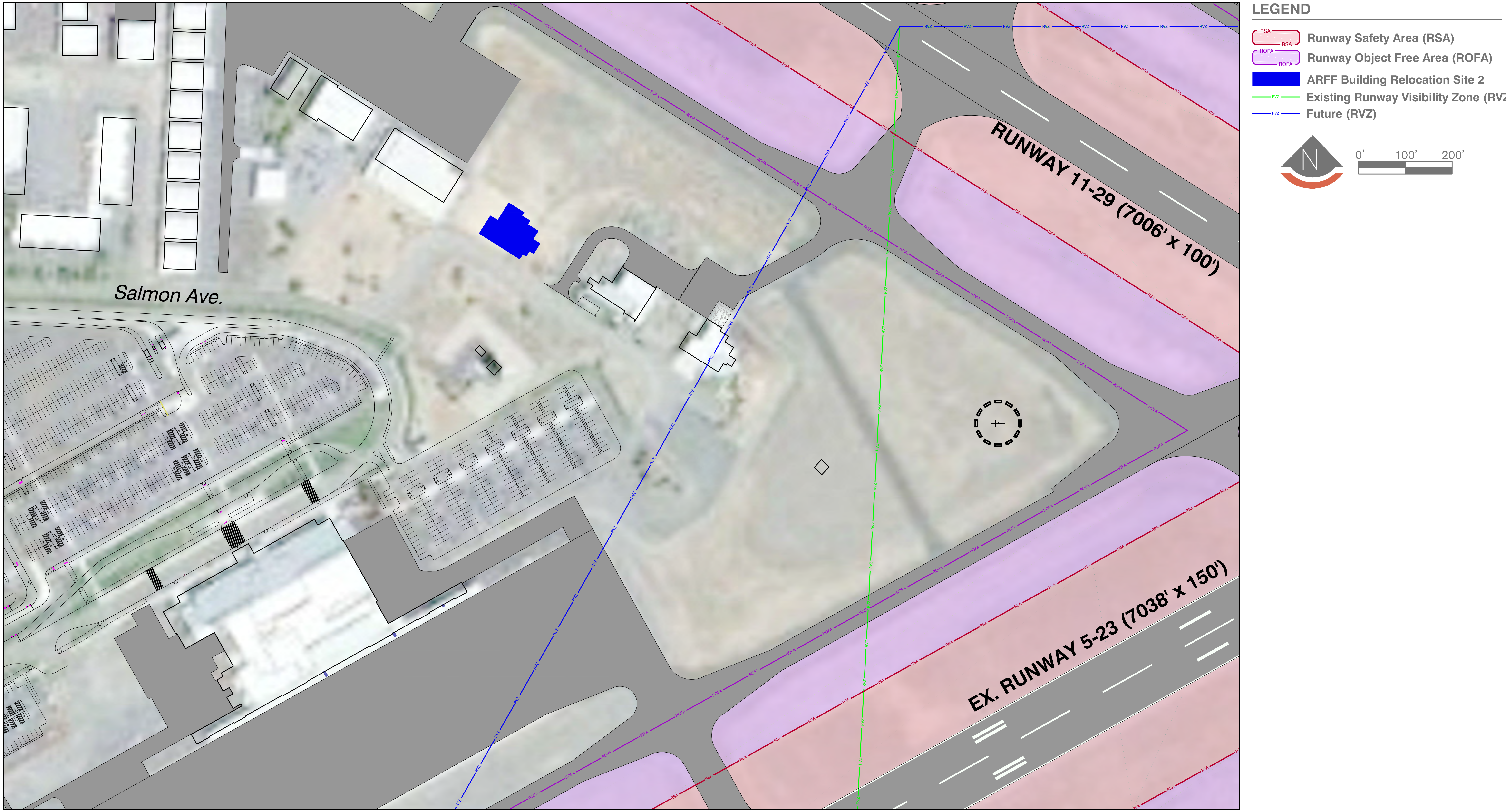


Figure 4-30
Alternative 1B - ARFF Relocation Site 2

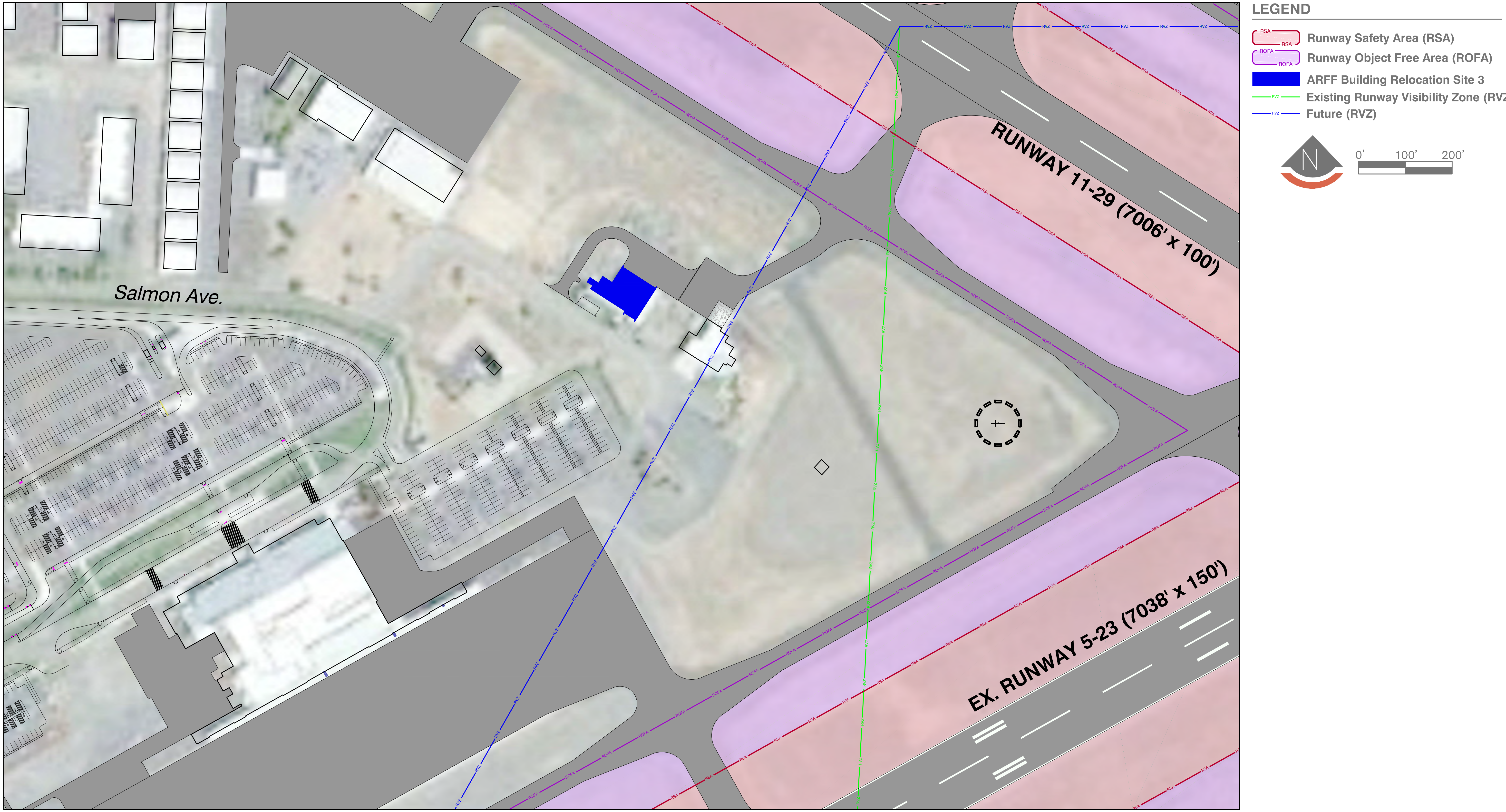


Figure 4-31
Alternative 1C - ARFF Relocation Site 3

SUMMARY EVALUATION OF ARFF BUILDING ALTERNATIVES

Table 4-9 presents a summary and an evaluation of the various alternatives for the relocation of the ARFF building. Alternative 1 is the preferred alternative because the ARFF building will continue to be in range to meet required response times for emergencies and the alternative uses a portion of the existing ARFF building footprint for the relocation.

Table 4-9. ARFF Relocation Alternatives Summary Evaluation Matrix

Impact Category	Alternative 1	Alternative 2	Alternative 3
Description of Improvement	Relocate ARFF to portion of existing ARFF footprint.	Relocate ARFF next to SRE building.	Relocate ARFF to existing SRE building.
Operational Capabilities			
Operability & Access	ARFF will remain in response time distance for emergencies	ARFF will remain in response time distance for emergencies	ARFF will remain in response time distance for emergencies
Airfield Impacts	Low	Low	Low
Performance Requirements			
Expansion Capabilities	Yes	Yes	Yes
Land Use Compatibility			
Impacts to Airport Property Use	ARFF wll be out of RVZ	ARFF wll be out of RVZ	ARFF wll be out of RVZ
Impact to Other Facilities	None	None	SRE building converted into ARFF
Environmental Impact Potential			
Property Acquisitions / Easements	None	None	None
Historic, Architectural, and Archaeological and Cultural Resources	None	None	None
Section 4(F) of the Department of Transportation Act	None	None	None
Tenant Relocation Required	Yes	Yes	Yes
Threatened and Endangered Species	Requires Contact of USFWS - East Wolf Mgmt. Zone.	Requires Contact of USFWS - East Wolf Mgmt. Zone.	Requires Contact of USFWS - East Wolf Mgmt. Zone.
Constructability			
Impact to Airport Operations	Low	Low	Low
Grading/Soil Conditions	Complex	Complex	Complex
Facilities Demolition	Yes	Yes	Yes
Phasing Complexity	Low	Low	Low
Financial Costs/Impacts			
Project Cost	$3,250,000	$2,877,280	$2,877,280
OVERALL EVALUATION			
DETERMINATION	**Favorable**	**Favorable**	**Favorable**

4.5.9 NORTHEAST PASSENGER TERMINAL APRON RECONSTRUCTION ALTERNATIVE

As part of the terminal expansion project, the northeast passenger terminal apron needs to be reconstructed with concrete to accommodate a parked regional jet Embraer ERJ-175 to have adequate support for the weight of the aircraft and tail height clearance of the FAR Part 77 transitional surface, and to remain clear of the future RVZ. The section of apron that would be reconstructed is located on the northeast side of the existing apron. The concrete area would be 135’ in width and 30’ in length for a total area of 4,126sf of Portland Cement Concrete Pavement (PCCP). The apron reconstruction would potentially require the relocation of two light poles, relocation of the vehicle service road, and relocation of ground support equipment storage on the apron.

ALTERNATIVE 1 – NORTHEAST APRON RECONSTRUCTION

This alternative, as shown in **Figure 4-32,** involves the reconstruction of 4,126sf of pavement to PCCP to accommodate the weight of an ERJ-175. This alternative is estimated at a total project cost of $1,998,900 and does not include any relocation of light poles, service roads, demolition of existing facilities, engineering, environmental compliance, or construction management services.

Figure 4-32
Alternative 1 - Northeast Apron Reconstruction

4.6 ALTERNATIVES SUMMARY

The preferred Airport development alternative outlines the necessary development and facility improvements that will not only meet the forecasted demand presented in **Chapter 2 – Forecast**, but also ultimately supports competitiveness and financial viability for the Airport. It is recommended that the Airport acquire available property north of Highway 126 for future aeronautical and non-aeronautical uses, in addition to ensuring compatible uses. The following improvement alternatives are recommended.

AIRSIDE FACILITIES

- ✓ Extend Runway End 5 to the southwest by 2,962 feet for a total length of 10,000 feet for Runway 5-23
- ✓ Upgrade the approach to Runway 5to support LPV approach capabilities
- ✓ Demolish existing taxiway connectors E and H that provide direct access to Runway 5-23 from the passenger terminal apron and reconstruct taxiway connectors E and H in a position that conforms to current FAA AC 150/5300-13A, Change 1, *Airport Design* standards
- ✓ Construct a new taxiway connector from Taxiway F to the passenger terminal apron on the northeast side
- ✓ Construct the first phase of a new parallel taxiway on the east side of Runway 5-23, and eliminate two segments of Taxiways F and C, to address FAA identified Hot Spots 1 and 2
- ✓ Construct the second phase of a new parallel taxiway on the east side of Runway 5-23 to facilitate aircraft movements and support a future central GA development area
- ✓ Construct the third phase of a new parallel taxiway on the east side of Runway 5-23 to facilitate aircraft movements
- ✓ Construct improvements to the north and south ends of taxiway connector A to conform to current FAA AC 150/5300-13A, Change 1, *Airport Design* standards
- ✓ Reconstruct the passenger terminal apron to allow the tail of a parked ERJ-175 to remain under the FAR Part 77 surfaces and have the weight of the aircraft properly supported
- ✓ Coordinate with the FAA, Oregon Department of Transportation – Highway Division, County of Deschutes, and the local Irrigation District for the relocation of a segment of Highway 126 outside of Runway 23's RPZ to comply with requirements in FAA AC 150/5300-13A, Change 1, *Airport Design* and the *2012 RPZ Memo*

GENERAL AVIATION DEVELOPMENT

- ✓ Expand existing GA facilities on the north side
- ✓ Develop new GA facilities east of the Runway 5 End that would support future aviation uses upon buildout of the north side GA facilities

VEHICLE PARKING

- ✓ Develop property near the Deschutes County Fair Grounds Expo Center for the expansion of rental car facilities, new long-term parking, and remote parking
- ✓ Expand employee parking to include the vacant parcel within the central terminal area
- ✓ Expand existing vendor parking to consume a portion of the existing employee parking lot

SUPPORT FACILITIES

- ✓ Relocate the SRE building to the northside GA development area
- ✓ Construct a new fuel farm south of the existing passenger terminal
- ✓ Relocate the ARFF building outside of the future RVZ

PASSENGER TERMINAL BUILDING

- ✓ Expand the passenger terminal building to the west to accommodate future passenger demand and larger ADG-III aircraft

NON-AERONAUTICAL PROPERTY DEVELOPMENT

- ✓ Develop non-aeronautical property in the Fairgrounds Industrial, Airport Way, West Business Park, and North Business Park Subareas
- ✓ Explore amending the zoning near the Airport to accommodate a wider range of airport-compatible uses, including commercial, industrial, and institutional uses

4.6.1 PREFERRED DEVELOPMENT CONCEPT

Capital costs will be calculated and added to the improvement projects identified in the implementation plan. The preparation of an updated ALP will begin to show how the Airport will look at the end of the implementation plan.

The preferred airport layout is shown **in Figure 4-33**.

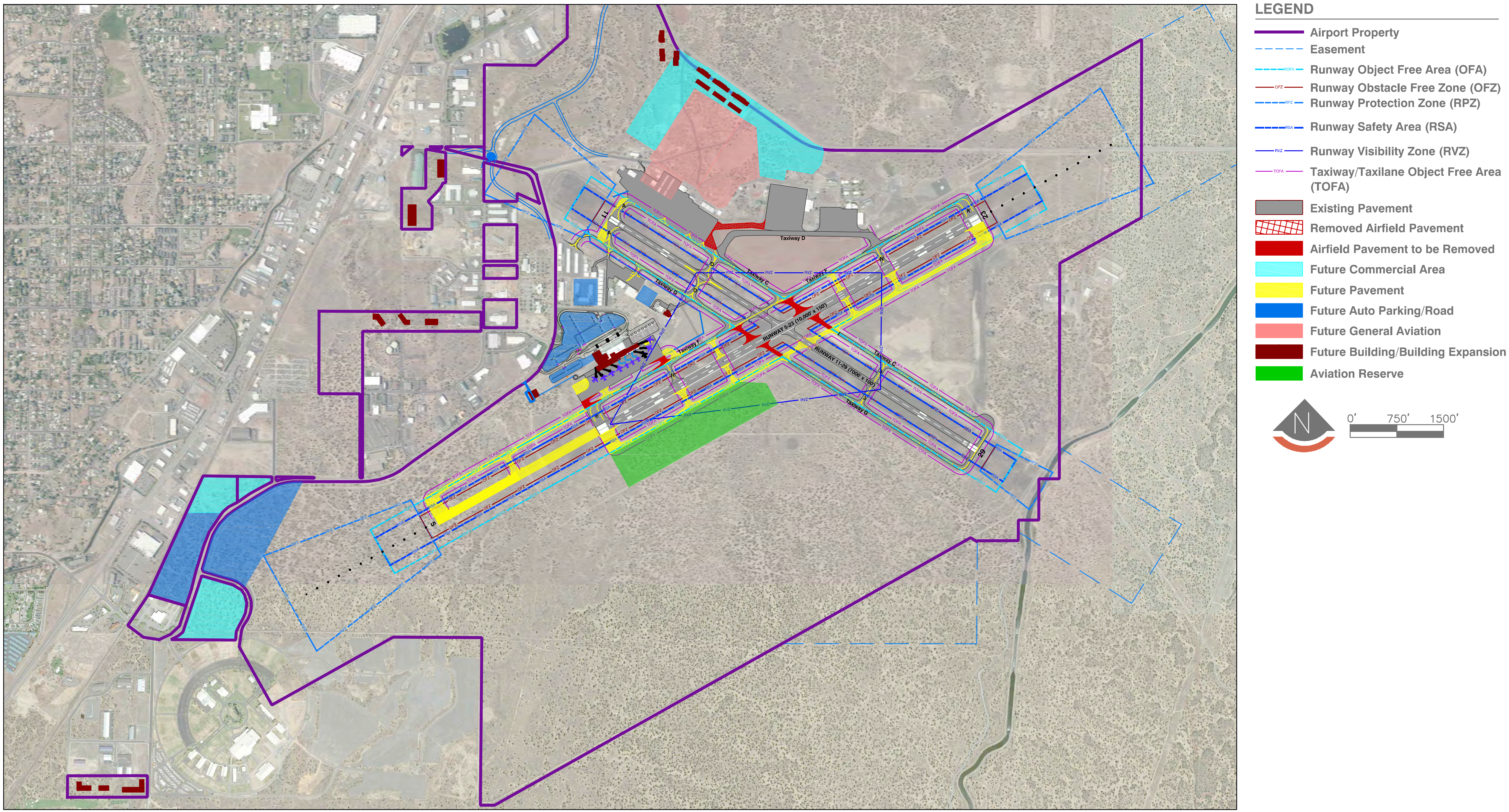


Figure 4-33
Preferred Alternatives

5.0 FINANCIAL FEASIBILITY

This chapter describes the 20-year Capital Improvement Plan (CIP) for Redmond Municipal Airport (RDM or the Airport). The CIP is a strategic year-by-year project development schedule for the continued development, upgrade, and expansion of facilities and equipment. The CIP is developed in accordance with federal and state aviation grant programs and is structured to fit the Airport's financial capabilities. The Federal Aviation Administration (FAA) and the Oregon Department of Aviation (ODA) reviewed and accepted the Airport's current five-year CIP, which RDM updates annually. Annual updates include improvement projects identified in this Master Plan through the 20-year planning horizon.

The CIP is not intended to be rigid or inflexible. It does not require the Airport to build anything and does not require the FAA or ODA to fund identified projects. Projects that receive FAA funding will need to show that they meet FAA design standards, are justified based on FAA criteria described in this chapter, and undergo an environmental review pursuant to the requirements of the National Environmental Policy Act (NEPA), as amended.

5.1 APPROACH TO CAPITAL PLANNING

5.1.1 Project Phasing

The CIP identifies individual projects, costs, and funding participation phased within the short term (1-5 years), mid-term (6-10 years), and long-term (11-20 years) planning periods. The CIP projects are prioritized based on need identified in **Chapter 2, Aviation Activity Forecasts**, and **Chapter 3, Facility Requirements**. These considerations influenced project priority:

- ✓ Ability to enhance efficiency and meet FAA design standards.
- ✓ Ability to repair and upgrade facilities reaching the end of useful life.
- ✓ Ability to meet user demand and desired level of service.
- ✓ Ability to support long-term airport strategic goals related to scheduled commercial air service, general aviation, the U.S. Forest Service, and emergency response.

Several projects identified in this CIP can be phased over years. This approach helps distribute capital costs more evenly and allows the Airport to implement improvements as demand materializes. Project phasing supports accelerating or delaying project implementation in response to economic conditions and changing airport user needs.

5.1.2 Project Costs

Professional engineers and architects have developed cost estimates for each project contained in the CIP. All project costs use 2018 dollars. For projects not occurring in 2018, the estimators adjusted for inflation at a rate of three percent. Except where explicitly noted, project costs have fifteen percent contingency added to the construction cost to account for unknowns. Costs for environmental assessment, design, and construction management are included as appropriate.

5.1.3 Funding Participation and Commitment

The CIP identifies funding classified into one of three categories for each project:

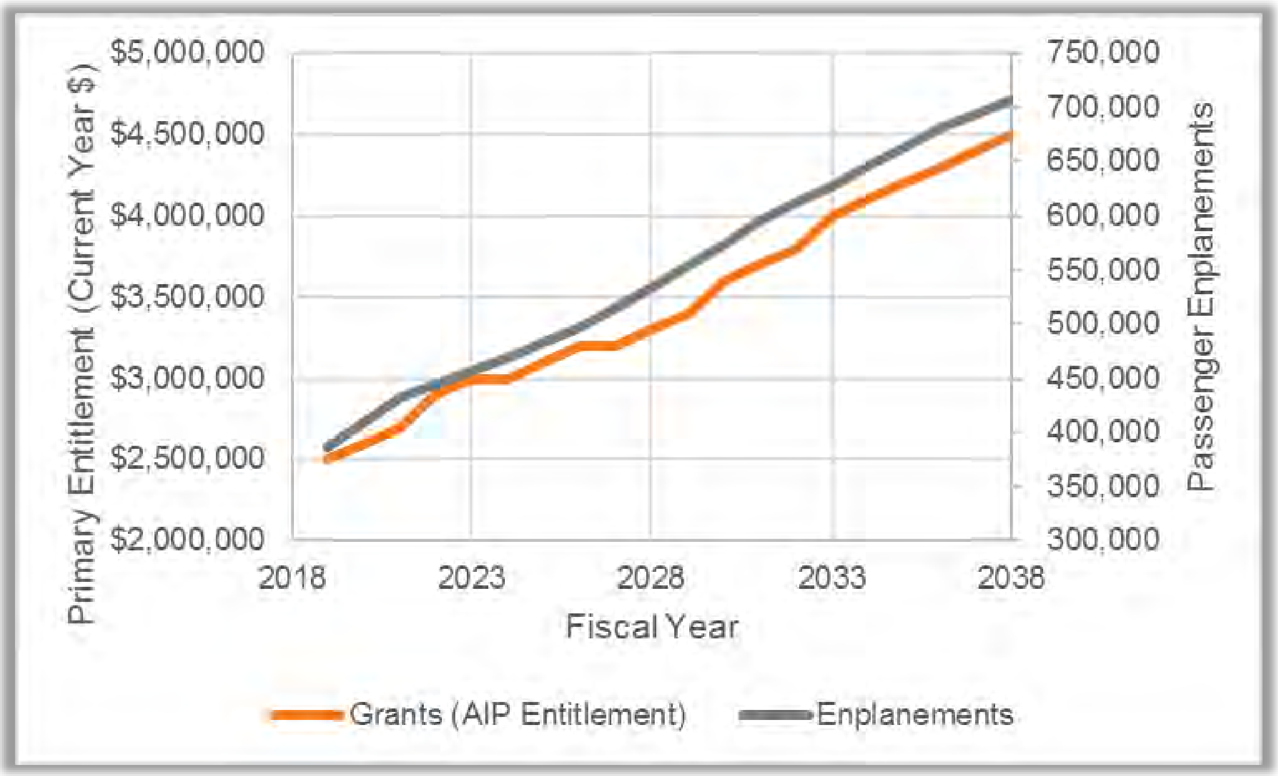
- ✓ FAA Airport Improvement Program (AIP)
- ✓ Passenger Facility Charges (PFCs)
- ✓ Local funds (Airport revenues, bonds, customer facility charge [CFC], and ODA grants)

FAA AIP funds are classified as entitlement and discretionary. The FAA grants funding to airport improvements through the Aviation Trust Fund (ATF), which is financed by aviation system user fees and taxes (e.g., airline passenger tax, aircraft parts taxes, fuel taxes, and aircraft registration fees). The AIP provides the mechanism to reinvest the ATF at FAA-eligible airports. FAA Order 5100.38D *Airport Improvement Program Handbook* (AIP Handbook) describes AIP funding eligibility. The AIP program requires the Airport to contribute a local match of 6.67 percent for AIP grants received, which is lower than the typical 10 percent requirement. This is due to the fact that the Airport receives a high federal share based the large amount of federal lands located in Deschutes County. More information can be found in FAA Order 5100.38D Appendix AA. The FAA distributes AIP entitlement funding annually, and the Airport can save the entitlement funds for up to three years, which helps pay for more expensive projects.

The FAA National Plan of Integrated Airport Systems (NPIAS) defines RDM as a primary airport, meaning it is a commercial service airport with more than 10,000 annual passenger enplanements. The NPIAS identifies airports eligible for AIP funding and estimates the amount of AIP funds needed to fund projects that will update airports to current FAA standards and increase capacity as needed. Primary airports are eligible for annual primary entitlement funding under the AIP. The total amount of primary entitlement funding depends on the number of enplaning passengers (passenger entitlements), and the volume of landed cargo (cargo entitlement). The AIP Handbook defines how the FAA calculates primary entitlement.

In fiscal year (FY) 2018, the primary entitlements (PE) for RDM totaled $2,240,000. The FAA calculates entitlement based on the last calendar year of data prior to the FAA fiscal year that starts in October. FY2018 started in October 2017, and FY2018 entitlement is based on enplanement levels in calendar year 2016. The FAA projects future entitlement funds using the passenger enplanement forecast for two years prior and rounded to the nearest hundred thousand. RDM sees less than 1/10 of a percent of national cargo volume, so cargo entitlements are not included in future entitlement projections. **Figure 5-1** shows the entitlement and passenger enplanement projections.

Figure 5-1: AIP Entitlement Funding Projection



Entitlement funds equal to current year dollars, not adjusted for inflation to 2018 values. Entitlement calculated using formula in AIP Handbook, Table 4-1, for when more than $3.2 billion is available in national AIP funding.
Enplanement forecast described in ***Chapter 3***

Projects eligible for AIP funding may receive discretionary funding if the total cost exceeds what can be covered by entitlement funds. Discretionary funds are not guaranteed and the project in question competes with others from across the NPIAS for funding.

The demand for FAA AIP funds exceeds the availability. The FAA uses a national priority rating system to allocate AIP grant funds for specific airport projects. This formula system, which is occasionally adjusted to reflect national priorities, considers the airport type and project role. The following are the FAA AIP funding categories and point system:

- ✓ Safety/Security = 10 points
- ✓ Statutory Emphasis Programs = 9 points
- ✓ Planning / Reconstruction / Environment = 8 points
- ✓ Capacity = 7 points
- ✓ Standards = 6 points
- ✓ Other = 4 points

PFCs are a fee attached to airline tickets to pay for facilities that passengers on commercial airlines use. This fee can be used for airport improvement projects; however, the Airport is required to consult with the airlines on which projects the fee will be used for. As of February 2018, the Airport collects $4.50 per enplaning passenger, and the proceeds are used for the debt service on the bonds that paid for the existing passenger terminal building. PFCs are allocated to the existing terminal debt service through the City of Redmond (the City) Fiscal Year 2038/2039.

Local funds include, but are not limited to, Airport revenues from leases, fuel surcharges, landing fees, and automobile parking. Local funds may include bonds issued on the full faith and credit of the City, grants from ODA, and CFCs from rental cars. The Airport does not receive funding from the City general fund for capital or operating expenses. The Airport uses local funds to provide the 6.67 percent match on AIP-eligible projects, and to pay for projects that are not eligible for AIP funding. FAA policy states that CFC funds can only be used for projects related to the rental cars.

The CIP identifies expected funding sources for each project based on cost and eligibility. The Airport updates it's five-year CIP with the State and the Airport annually and will update funding sources appropriately as the time nears to implement projects. Before projects included on the CIP can be implemented, they may require environmental assessment and property acquisition. The CIP allocates time and money for the Airport to complete these actions. The cost estimates include contingency for unknown expenses such as legal fees, design challenges, and changing regulation.

5.1.4 Airport Funds

The City reviewed the Airport's financial data to ascertain the availability of local funds to support the CIP. The City performed a financial analysis during the development of the CIP to identify if the expected local capital requirements could be met. The City's model considered revenue growth based on additional landings and passengers and the ability of the Airport to take on debt to finance more expensive capital projects.

Airport revenue consists of grants and fees collected from users of the air carrier terminal. Such fees include: PFCs, landing fees, rental car commissions, and parking fees. Federal and state grants for approved capital improvement projects make up a sizable portion of airport funding. The airport also receives revenue from non-aviation related land leases.

The source of funds for operational and capital improvement projects at the Airport is the Airport Fund. The Airport Fund is divided into two sub-funds: Capital Projects and Operational Projects. The Capital Projects sub-fund is used to construct major capital projects. Operational projects are further divided into three programs: the Terminal program, the Airfield program, and the General Operations program:

- ✓ The Terminal program funds Airport Terminal operations and is collected through Airline tenants paying rent, maintenance, and overhead fees.
- ✓ The Airfield program funds Airport Airfield operations and maintenance. Costs for the Airfield program are recovered through landing and fuel flowage fees.
- ✓ The General Operations program funds maintenance, improvement, and leasing of industrial properties, private hangars, and vehicle parking lots for passengers and rental car agencies.

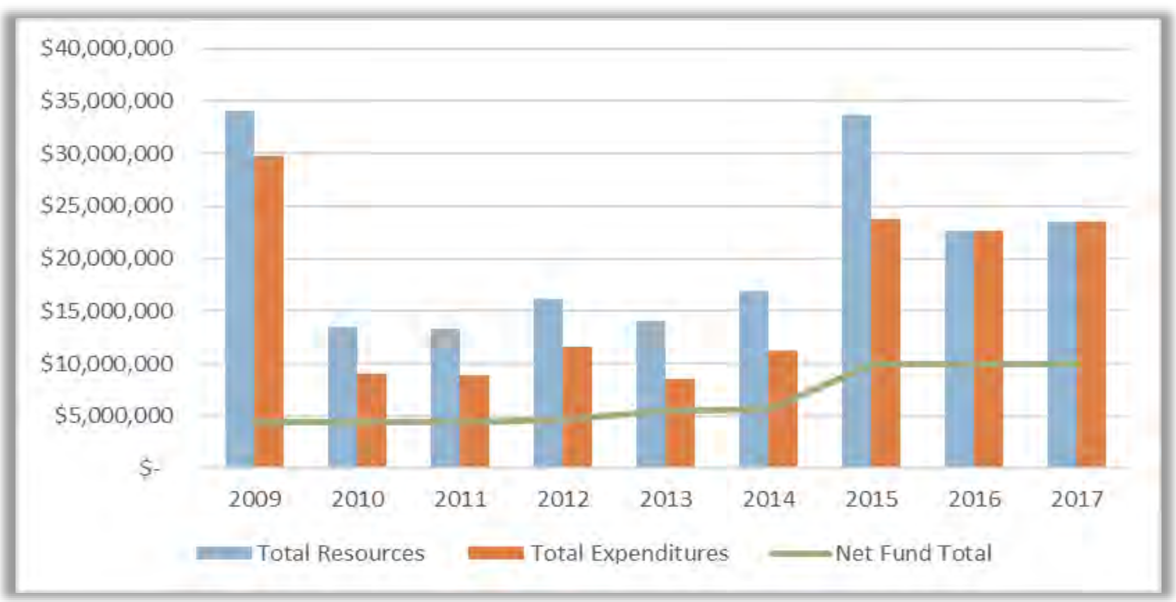
Airport funds vary from year to year depending on how busy the Airport is. Large capital projects, typically paid for by AIP grants, are the primary cause of large variations of the past five years. For example, the Airport received $3 million in grants during FY2014, and more than $12 million in grants for FY2015. **Table 5-1** shows the resource and expenditure by sub-fund.

Table 5-1. Total Resources and Expenditures by Sub-Fund					
	2013	2014	2015	2016	2017
Total Resources	$14,106,302	$16,846,264	$33,649,483	$22,616,499	$23,477,443
Total Beginning Fund Balances	$4,620,801	$ 5,562,536	$ 5,617,592	$ 8,039,651	$ 6,755,917
Total Current Resources	$9,485,501	$11,283,728	$28,031,891	$14,576,848	$16,721,526
Total Expenditures	$8,543,766	$11,228,672	$23,739,026	$22,616,499	$23,477,443
Operations	$7,307,316	$ 7,375,838	$ 9,929,537	$11,157,582	$13,308,184
Debt Service Reserve	$0	$0	$0	$ 2,515,917	$2,715,259
Customer Facility Charge	$0	$0	$0	$0	$739,000
Capital Projects	$1,236,450	$ 3,852,834	$13,809,489	$ 8,943,000	$6,715,000
Net Fund Total	$5,562,536	$5,617,592	$9,910,457	$9,910,456	$9,910,456

Total Resources is the sum of Total Beginning Fund Balances and Total Current Resources.
Total Expenditure is the sum of Operations, Debt Service Reserve, Customer Facility Charge, and Capital Projects.
Net Fund Total is the difference between Total Resources and Total Expenditure.
Source: City of Redmond: The Airport Fund

Figure 5-2 provides information on expenditures by sub-funds and total resources from FY2009 to 2017. FY2009 to FY2015 are income statements, and FY2016 and FY2017 are budgets. The budgets are balanced: expenses equal projected revenues. The Total Resources category is the sum of current resources and the fund balance from the beginning of the previous year. The Airport has had surplus net funds with enough resources to cover expenditures. Additional details of the annual revenue and expenditure can be found in the City's annual budget.

Figure 5-2: Airport Fund Resources and Expenditures



5.2 CAPITAL IMPROVEMENT PLAN

The Airport completed its latest CIP in January 2018, which covers projects for FY2019 to FY2023, and reviewed it with the FAA Seattle Airports District Office (ADO). The FAA prefers that the next three years of capital projects remain consistent to assist in the allocation of funds across the NPIAS. Thus, near-term projects have a relatively firm timeline compared to mid- and long-term projects which have more flexible timelines. The Master Plan CIP focuses on projects that occur beyond FY2023; however, there are some recommendations for reordering projects in FY2022 and FY2023 based on conversations that occurred during Master Plan CIP development. **Table 5-2** includes a summary of the costs and funding sources.

Table 5-2. Summary of Capital Improvement Plan

Period (Years)	Years	Project Costs	Entitlement	Discretionary	Local
Near-term (1-5)	2019-2023	$39,558,000	$13,633,403	$8,653,020	$17,271,577
Mid-term (6-10)	2024-2028	$28,148,001	$11,861,480	$2,143,327	$14,143,194
Long-term (11-20)	2029-2038	$203,001,667	$42,705,187	$64,244,174	$96,052,306
CIP	2019-2038	$270,707,668	$68,200,070	$75,040,521	$127,467,077

PFC funds are not shown as a source of up-front capital improvement funds. PFCs are expected to be used for terminal building debt service throughout the 20-year CIP.
This list includes only projects that are considered candidates for AIP funding.

The CIP summary shown above does not include projects not eligible for AIP funding and does not include PFCs or CFCs as funding sources. Funding from the Airport and the State are part of the local funding category, and availability of State funding should be assessed closer to the time to implement the project. AIP discretionary funding can be variable, and the project may need to be advanced or delayed depending on funding availability. The components of each period of the CIP are described in the following sections.

5.2.1 Near-term CIP (FY2019-FY2023)

The near-term CIP includes construction of a new snow removal equipment (SRE) storage facility, acquisition of SRE and aircraft rescue and firefighting (ARFF) equipment, pavement rehabilitation, airfield lighting, and the first phase of the passenger terminal building expansion. **Table 5-3** shows the near-term CIP, and the projects are described in the following sections. **Figure 5-3** shows project locations.

Table 5-3. Near-term CIP

Year	Project	Entitlement	Discretionary	Local	Total
2019	SRE Building	$2,500,000	$0	$8,613,000	$11,113,000
2020	SRE Vehicles	$1,493,333	$0	$106,667	$1,600,000
	SRE Building (Reimbursement)	$490,000	$0	$0	$490,000
2021	Rehabilitate Taxiways F, E, H, N, K	$2,316,737	$1,873,930	$299,333	$4,490,000
	Widen Taxiway F	$0	$4,648,000	$332,000	$4,980,000
	Rehabilitate Electrical Vault	$933,330	$0	$66,667	$1,000,000
2022	Pavement Management Plan	$56,000	$0	$4,000	$60,000
	Terminal Phase 1, Part 1	$1,574,720	$0	$645,280	$2,220,000
2023	Terminal Phase 1, Part 2	$4,269,280	$2,131,090	$7,204,630	$13,605,000
Near-Term CIP Total		$13,633,403	$8,653,020	$17,271,577	$39,558,000

2019 Projects

The Airport plans to build an SRE building on the north side of the Airport. This building will provide crews with a centralized storage location for their supplies and vehicles that are presently dispersed around the airfield. The project is expected to cost $11 million dollars and will be funded by $3 million in AIP entitlement funding, and $8 million in local funds. The Airport will be reimbursing itself $490,000 via entitlement funding in FY2020.

2020 Projects

The 2020 projects include the second phase of the SRE building and the purchase of two SRE vehicles. The Airport will carry the remaining $250,000 of AIP entitlement funding over to the next year, which will help cover the costs of the planned pavement and electrical projects. No environmental, design, or construction projects are planned for 2020.

2021 Projects

The 2021 projects include rehabilitation of Taxiways F, E, H, N, and K, widening of Taxiway F, and rehabilitation of the lighting electrical vault. Taxiway F is the parallel taxiway to Runway 5-23, and Taxiways E, H, N, and K and the connector taxiways. Taxiway F is going to be widened near the passenger terminal apron to accommodate the wheelbase of the Bombardier Q400 aircraft used by Alaska Airlines.

The equipment in the electrical vault, located on the north side of the Airport in the general aviation area, is aging and in need of replacement.

These projects include a mix of AIP entitlement, discretionary, and local funds. The Airport has coordinated with the Seattle ADO on the needs for discretionary funds in 2021.

2022 Projects

The 2022 projects include an update of the pavement management plan and the start of the passenger terminal program. The pavement management plan will assess the condition of the airfield pavements and be used to plan future capital investment. The passenger terminal program is a multi-year project that includes terminal rehabilitation and expansion needed to meet the expected level of passenger demand.

The terminal program begins with environmental permitting and design for Phase 1A, reconfiguration of the existing holdroom and Phase 1B, expansion of the holdroom and additional terminal apron to accommodate parked aircraft. Phase 1A, 1B, and the terminal apron will occur over three years, starting with environmental permitting and design. It is expected that both phases of the project will be Categorically Excluded under FAA Order 5050.4B *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions* as it involves the rehabilitation of an existing building and expanding the building into a paved area.

The completion of the terminal program's design and environmental review is expected to be completed within one year. The project could experience a delay into early 2023; however, it is not expected the delay will impact the 2023 terminal construction project.

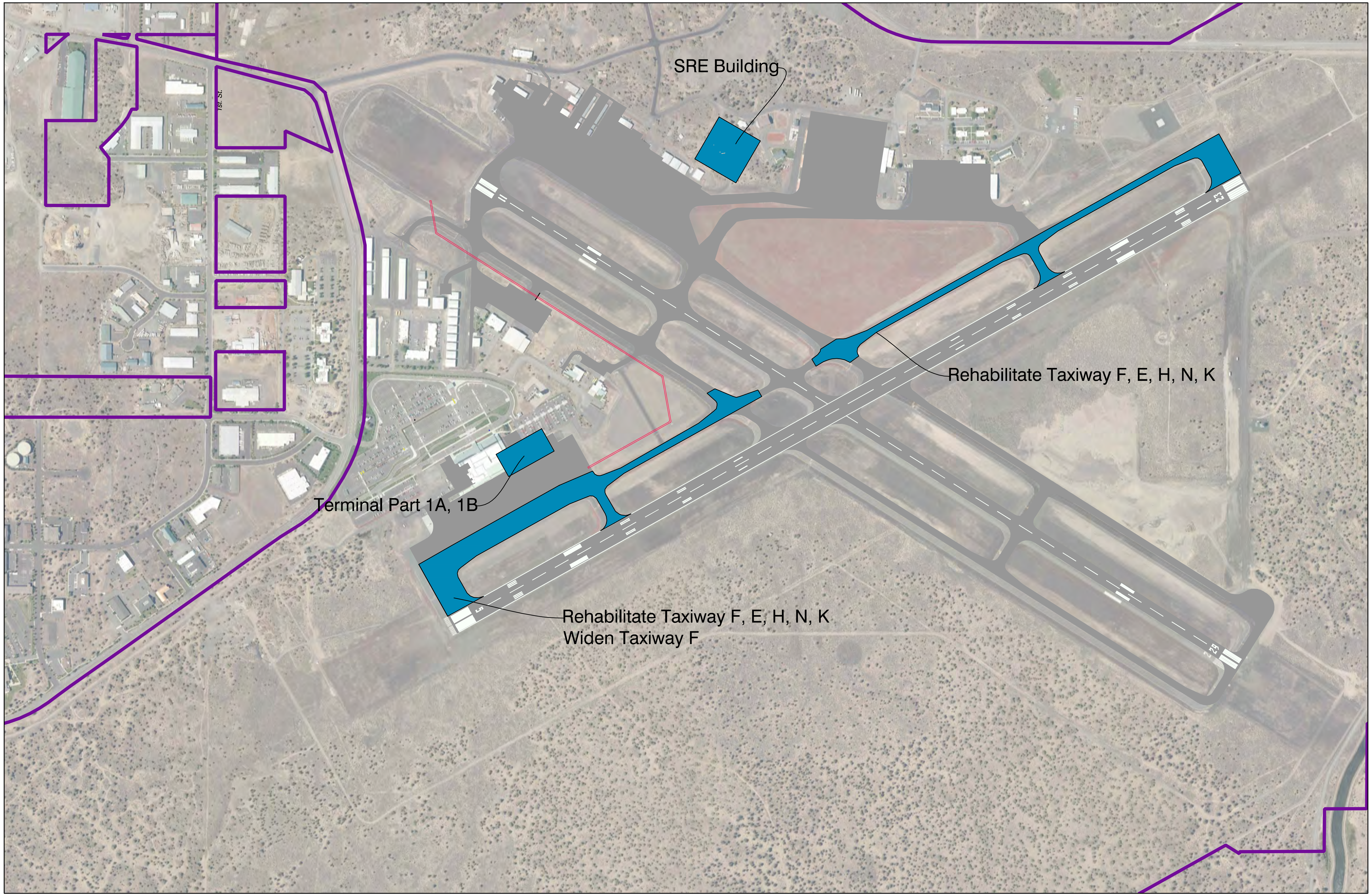
The availability of funds necessary to design and build the terminal improvements is a key consideration in implementing the project. Phase 1A and Phase 1B are expected to require more than $2.6 million in discretionary funds and $11 million in local funds. These shares were calculated assuming 93 percent of terminal square footage for Phase 1A and 91 percent for Phase 1B would be eligible for any type of AIP funding (entitlement or discretionary), and of that square footage, only 20 percent would be competitive for discretionary funds due to the nature of the project to enhance capacity. If discretionary funding is not available, or the terminal project does not compete as well for the funding as expected, then the local share will be higher. Airport operating revenues cannot cover the level of investment required and PFCs are needed for debt service on the existing terminal.

The Airport can issue a bond to cover construction costs and expects passenger growth will increase the operating revenues required for the debt service. The risk with this approach is that if passenger volumes decline, then the Airport may face a budget shortfall and need to reallocate funds to cover the debt. Demand projections and growth demonstrated by the Airport, the airlines that serve the airport, and the travelers coming to and from Deschutes County suggest that a severe decline is unlikely; however, it is recommended that the City perform a sensitivity analysis on this project prior to implementation.

2023 Project

The 2023 project is the construction of Phase 1A, 1B, and the apron. Phase 1A and the apron will be built in one year. The 2023 project will be finished in 2024 when Phase 1B is completed. The project should be designed to minimize disruption for the traveling public; however, there is a risk that construction-related disruptions may negatively impact passenger numbers during construction. The Airport dealt with construction impacts on passenger volumes and landing fees during May 2016 when the intersection of the runways was re-constructed. The loss of PFCs, concessions and parking revenues, landing fees and fuel flowage fees should be accounted for when reviewing project financials.

The terminal project is expected to be completed in 2024. Completing the entire project in 2023 may be possible. This would increase capital expenditure, but reduce operational impacts associated with construction. Construction phasing will be explored in more detail when the project is designed, and an implementation plan is developed.



LEGEND

- RDM Property Boundary
- Fuel Truck Road
- CIP Projects

N

0' 400 800

REDMOND MUNICIPAL
AIRPORT MASTER PLAN

Near-Term (2019-2023) CIP Projects

5.2.2 Mid-term CIP (FY2024-FY2028)

The mid-term CIP includes the completion of Terminal Phase 1B, acquisition of an ARFF truck, rehabilitation of the Taxiway G pavement and lighting, the environmental assessment for the general aviation expansion, a new Master Plan, a fuel truck haul road, and pavement maintenance. The mid-term CIP includes 500 additional stalls of automobile parking. **Table 5-4** shows the mid-term CIP, and the projects are described in the following sections. **Figure 5-4** shows the planned locations for these projects.

Table 5-4. Mid-term CIP

Year	Project	Entitlement	Discretionary	Local	Total
2024	Terminal Phase 1, Part 3	$2,066,667	$1,024,660	$2,538,673	$5,630,000
	ARFF Truck	$933,333	$0	$66,667	$1,000,000
	Mid-term Auto Parking (300 stalls)	Ineligible	Ineligible	$6,420,000	$6,420,000
2025	Rehabilitate Taxiway G Pavement	$2,596,000	$1,118,667	$265,333	$3,980,000
	Rehabilitate Taxiway G Lighting	$504,000	$0	$36,000	$540,000
	Mid-term Auto Parking (200 stalls)	Ineligible	Ineligible	$4,410,000	$4,410,000
2026	Northside GA Expansion (Enviro)	$289,333	$0	$20,667	$310,000
2027	Northside GA Expansion	$2,594,667	$0	$185,333	$2,780,000
	Master Plan Update	$592,667	$0	$42,333	$635,000
2028	Master Plan Update, continued	$606,667	$0	$43,333	$650,000
	Fuel Truck Road	$625,333	$0	$44,667	$670,000
	Pavement Rehabilitation	$1,052,813	$0	$70,188	$1,123,001
Mid-Term CIP Total		$12,798,980	$11,861,480	$2,143,327	$14,143,194

2024 Project

Among the 2024 projects is the completion of construction for Phase 1B. This project will increase the height of the passenger holdroom floor to allow passenger boarding bridges to reach larger aircraft on the apron. Additional projects in 2024 include ARFF truck acquisition and construction of mid-term auto parking. Acquisition of an ARFF truck to replace the existing, older vehicle will require local funds. Construction of auto parking will create 300 additional parking stalls. This new lot requires removal of the United States Department of Agriculture building and is not eligible for AIP funding. The project will help the Airport meet parking demand. Transportation network companies Uber and Lyft began operating at the Airport in 2017. It is recommended that the Airport monitor the effect of these companies on parking demand and adjust capital programming as demand warrants.

2025 Projects

Taxiway G pavement and lighting rehabilitation projects will both occur in 2025. Both project timelines are flexible; however, while maintenance of existing pavement and lighting can keep them in working order, costs will increase over time as pavement and equipment deteriorate. The lighting equipment can be upgraded to use LEDs for long term cost savings through lower power consumption, as the types of LEDs planned for use are functional in the winter months when snow piles around the base of the lights. Traditional incandescent lights melt snow with the heat they release where LEDs may not without being equipped with thermostatically-controlled heating units.

The third project to occur in 2025 is the construction of 200 parking stalls. As with the parking project in 2024, the additional parking stalls will help the Airport meet parking demands.

2026 Projects

The 2026 projects include the environmental permitting phase of the Northside GA Expansion project and the reimbursement of ARFF truck costs. Design and construction of the Northside GA Expansion will take place in 2027. The project expands the available GA area with additional hangars and facilities and will also involve rerouting an existing road. This project will require an environmental assessment. The reimbursement of the ARFF truck costs is a financial transaction with which the airport is reimbursed through the entitlement funds for the ARFF truck acquisition in 2024.

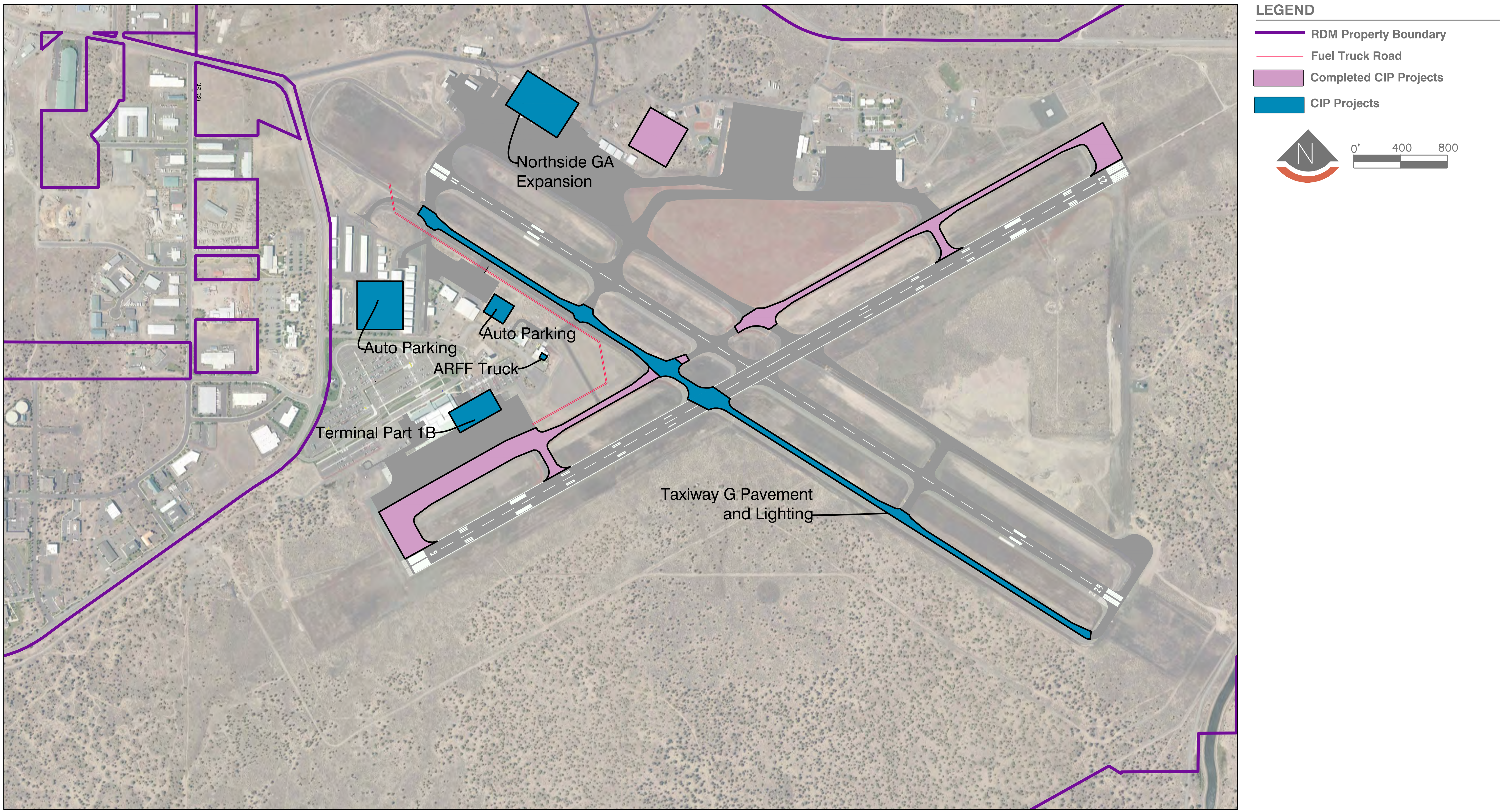
2027 Projects

The design and construction phase of the Northside GA Expansion will take place in 2027. Due to the geology, there will be significant work required to bring the terrain to airport grade before construction of the facilities can occur. The Airport will prepare sites for private investment and construct automobile and aircraft access. Tenants will develop these sites and the speed at which this occurs can impact the Airport’s return on investment. The project is a low priority compared to other CIP projects and not very competitive for discretionary funding due to it not being a necessity for Airport operations.

The second 2027 project is the beginning of an Airport Master Plan. The Master Plan will likely revisit the need for the runway extension, assess long-term passenger terminal needs, and determine if additional automobile parking is needed. The implementation details of the Long-term Projects will be planned during the master plan project.

2028 Projects

Projects in 2028 include completing the Master Plan, the fuel truck road, and a placeholder for pavement rehabilitation if needed. The road is intended to minimize the amount of time trucks spend on aircraft movement areas when transferring fuel from the northside to the southside. The Airport is considering building Jet A fuel tanks near the terminal building, which may negate the need for a fuel truck road.



Mid-Term (2024-2028) CIP Projects

5.2.3 Long-term CIP (FY2029-FY2038)

The long-term CIP encompasses the runway and taxiway extension projects as well as the ARFF building relocation needed to accommodate the extensions. Phase 2 of the terminal project is scheduled to take place between 2035 and 2037. Three pavement rehabilitation projects are planned within that period but are considered “as-needed.” **Table 5-5** shows the long-term CIP, and the projects are described in the following sections. **Figure 5-5** shows the planned locations for these projects.

Table 5-5. Long-term CIP

Year	Project	Entitlement	Discretionary	Local	Total
2029	Runway Extension Environmental	$1,754,667	$0	$125,333	$1,880,000
	Taxiway Extension Environmental	$373,333	$0	$26,667	$400,000
2030	Runway Extension Design	$2,846,667	$0	$203,333	$3,050,000
	Taxiway Extension Design	$513,333	$0	$36,667	$550,000
	ARFF Building Design	$392,000	$0	$28,000	$420,000
2031	Runway Extension 1 of 2	$372,520	$22,382,147	$1,625,333	$24,380,000
	Taxiway Extension 1 of 2	$4,456,667	$0	$318,333	$4,775,000
	ARFF Building Relocation	$3,929,333	$0	$280,667	$4,210,000
2032	Runway Extension 2 of 2	$3,800,000	$19,636,000	$1,674,000	$25,110,000
	Taxiway Extension 2 of 2	$0	$4,592,000	$328,000	$4,920,000
2033	Pavement Rehab	$2,818,667	$0	$201,333	$3,020,000
2034	Terminal Phase 2 Environmental	$1,332,533	$0	$420,800	$1,753,333
2035	Terminal Phase 2 Design	$6,855,200	$0	$2,164,800	$9,020,000
2036	Terminal Phase 2 (1 of 2)	$5,593,600	$8,686,800	$42,869,600	$57,150,000
2037	Terminal Phase 2 (2 of 2)	$4,400,000	$8,947,227	$45,516,107	$58,863,334
2038	Pavement Rehab	$3,266,667	$0	$233,333	$3,500,000
Long-Term CIP Total		$39,351,587	$42,705,187	$64,244,174	$96,052,306

2029 Projects

The two 2029 projects are the environmental phases of the southwest runway extension and the associated parallel taxiway extension. The runway extension NEPA process may take 18 months or more. Justification for the runway extension is expected to occur as part of the 2027 Master Plan, and much of the environmental baseline work will occur at this time. The 2017 Master Planning process included the concept of runway extension in stakeholder meetings and the response was generally positive. The underlying goal of the extension is to open the Airport to additional markets in the Midwest that are out of range or payload-limited with the existing runway configuration. The runway length assessment is included in **Chapter 3**.

2030 Projects

Both design phases of the southwest runway extension and the associated full-length parallel taxiway will occur in 2030. The design phase of the ARFF building will also occur in 2030. The existing ARFF building lies within the runway visibility zone of extended Runway 5-23 and will need to be relocated. This project is considered part of the runway extension project as the building would not need to be moved if the runway was not extended.

2031 Projects

Construction of the runway and taxiway extensions will begin in 2031 and is expected to take two years. The ARFF building relocation will also take place in 2031 and is expected to be completed within a year. The first year of work is expected to include earthwork and grading. There is an elevation change between the existing location of Runway End 5 and where future Runway End 5 will be located. Cost estimates include approximately 950,000 cubic yards of fill for the embankment required to meet runway and taxiway grading and safety area requirements.

2032 Projects

Construction on the runway and taxiway extensions is scheduled for completion in 2032. Work completed in 2032 will include paving of the runway and taxiways and relocation of navigational aids. Runway 5-23 will need to be temporarily shortened during construction to keep aircraft clear of the construction equipment. Project phasing and implementation will be structured to minimize runway closure and downtime.

2033 Project

There are no definitive capital projects for 2033; however, the Airport can use that year to catch up on pavement rehabilitation, if needed. It is recommended that the Airport begin to save its primary entitlement funds this year to help offset the cost of Phase 2 of the passenger terminal building. The need for Phase 2 is expected to be validated by the 2037 Master Plan. The Master Plan will include new enplanement forecasts and an assessment of the performance of the passenger terminal building since Phase 1 was constructed.

2034 Project

The 2034 project is the environmental permitting of Passenger Terminal Phase 2. This improvement extends the overall building footprint to the southwest, over what is now the vendor parking lot. Passenger Terminal Phase 2 is expected to be eligible for a categorical exclusion under NEPA because impacts are limited to previously disturbed parcels. Should an environmental assessment be required, it is expected that one can be completed within a year and not delay the start of construction.

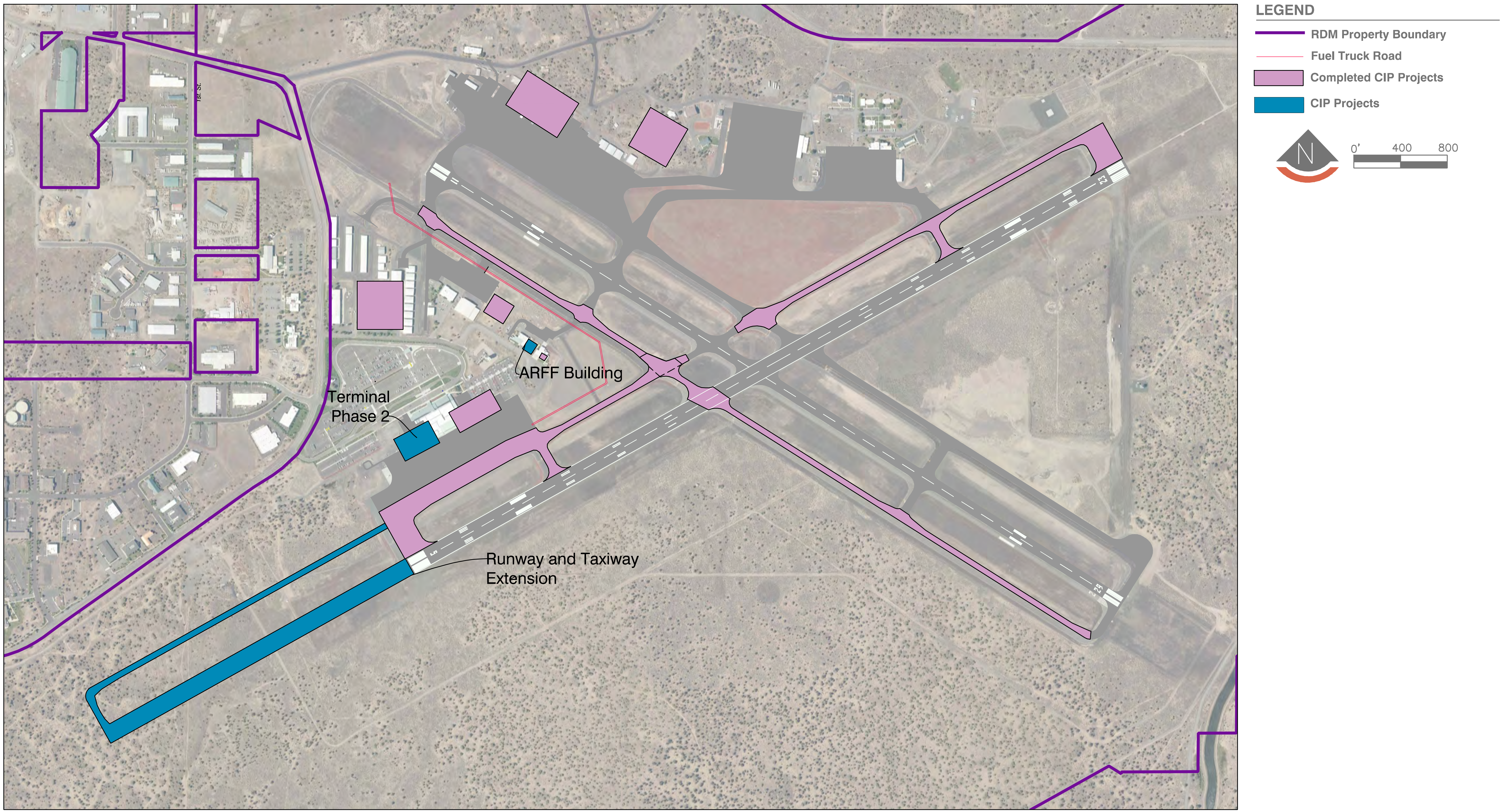
2035 Project

The 2035 project is the design of Passenger Terminal Phase 2. Phase 2 will expand the terminal and add a new concourse adjacent to the second floor holdroom. The new building will have the ticket hall and larger baggage handling area on the ground floor and a new concourse on the second floor adjacent to the existing second floor holdroom. The existing ticket hall and offices will be repurposed as the new security checkpoint after the new ticket hall is completed.

2036-2037 Projects

Passenger Terminal Phase 2 will be built over two years and construction will be structured to minimize impact on existing terminal operations. It is possible that closure and relocation of terminal facilities during construction may temporarily decrease airline activities; however, this impact is not expected to extend past construction.

Passenger Terminal Phase 2 is expected to cost more than $126 million when it is constructed (assuming 3 percent inflation), or roughly $72 million in 2018 dollars. Passenger Terminal Phase 2 will be funded by a combination of entitlement, discretionary, and local funds. PFCs are expected to be obligated for debt service on previously completed capital projects like Passenger Terminal Phase 1. Preliminary estimates suggest that 76 percent of square footage will be eligible for AIP funding, and of that, 20 percent will compete well for discretionary funding. The high-level funding split is 14 percent for entitlement ($18 million), 14 percent for discretionary ($18 million), and 72 percent for local funds ($91 million). This funding split is expected to be revised as part of the 2027-2028 Master Plan.



REDMOND MUNICIPAL
AIRPORT MASTER PLAN

Figure 5-5
Long-Term (2029-2038) CIP Projects

5.3 CHAPTER SUMMARY

The 20-year CIP provides a flexible guideline for the Airport to plan for near-, mid-, and long-term project goals. Project phasing allows the Airport to account for economic changes and adjust project priorities to meet the Airport's financial capabilities. The projects have been distributed across 20 years to reflect the airport needs and to distribute capital costs evenly.

The near-term, five-year (FY2019-2023) CIP will help the Airport grow and meet demand by organizing resources to rehabilitate taxiways and runways as well as begin the large-scale terminal remodeling and expansion project. Including taxiway and runway rehabilitation in the near-term will help lower overall costs by mitigating the need for ongoing maintenance, which will increase in cost over time.

The mid-term (FY2024-2028) CIP projects include the continuation of the terminal phase and Taxiway G pavement and lighting rehabilitation. Additionally, the planned Northside general aviation expansion and additional parking is aimed at meeting the forecasted increase in activity at the Airport. The long-term (FY2029-2032) CIP projects consist of large-scale projects including runway extension, taxiway extension, and the second phase of terminal expansion. Many of these projects are multi-year and will require a large amount of funding. The long-term projects will increase the Airport's capabilities and contribute to helping the Airport meet increased demand.

APPENDIX A:

ALP CHECKLIST (in development)

APPENDIX B:

SUPPLEMENTAL FORECAST INFORMATION

APO TERMINAL AREA FORECAST DETAIL REPORT
Forecast Issued January 2017

RDM

	Enplanements			AIRCRAFT OPERATIONS: Itinerant Operations					Local Operations					
Fiscal Year	Air Carrier	Commuter	Total	Air Carrier	Air Taxi & Commuter	GA	Military	Total	Civil	Military	Total	Total Ops	Total Tracon Ops	Based Aircraft
REGION: ANM STATE: OR LOCID: RDM														
CITY:REDMOND AIRPORT:ROBERTS FIELD														
2006	1,427	195,796	197,223	1,433	16,803	22,170	366	40,772	27,376	240	27,616	68,388	0	129
2007	9,262	220,771	230,033	2,781	16,349	26,174	306	45,610	48,990	336	49,326	94,936	0	129
2008	13,886	229,311	243,197	4,413	13,795	20,221	312	38,741	42,519	303	42,822	81,563	0	146
2009	26,618	191,208	217,826	4,444	9,680	16,014	173	30,311	25,261	134	25,395	55,706	0	125
2010	28,031	197,530	225,561	4,858	9,396	14,767	221	29,242	22,416	300	22,716	51,958	0	118
2011	26,259	205,719	231,978	4,140	8,886	13,610	224	26,860	19,554	96	19,650	46,510	0	75
2012	16,660	214,173	230,833	3,931	8,649	14,709	212	27,501	18,565	371	18,936	46,437	0	75
2013	430	226,980	227,410	4,201	8,232	13,414	323	26,170	16,124	812	16,936	43,106	0	91
2014	305	255,560	255,865	4,738	8,573	12,372	383	26,066	17,213	406	17,619	43,685	0	83
2015	303	268,829	269,132	4,335	6,578	11,551	241	22,705	22,854	214	23,068	45,773	0	83
2016*	536	297,786	298,322	5,127	6,340	10,985	341	22,793	16,829	540	17,369	40,162	0	85
2017*	536	359,803	360,339	6,897	6,245	10,711	341	24,194	15,877	540	16,417	40,611	0	87
2018*	536	369,043	369,579	7,682	5,659	10,735	341	24,417	15,909	540	16,449	40,866	0	89
2019*	536	377,594	378,130	8,528	4,981	10,759	341	24,609	15,941	540	16,481	41,090	0	91
2020*	536	385,844	386,380	9,356	4,315	10,783	341	24,795	15,973	540	16,513	41,308	0	93
2021*	536	394,034	394,570	10,139	3,699	10,807	341	24,986	16,005	540	16,545	41,531	0	95
2022*	536	402,010	402,546	10,733	3,297	10,832	341	25,203	16,037	540	16,577	41,780	0	97
2023*	536	409,726	410,262	11,038	3,222	10,857	341	25,458	16,069	540	16,609	42,067	0	100
2024*	536	417,274	417,810	11,246	3,254	10,882	341	25,723	16,101	540	16,641	42,364	0	102
2025*	536	425,305	425,841	11,462	3,293	10,907	341	26,003	16,134	540	16,674	42,677	0	105
2026*	536	433,799	434,335	11,691	3,333	10,932	341	26,297	16,167	540	16,707	43,004	0	108
2027*	536	442,039	442,575	11,913	3,373	10,957	341	26,584	16,200	540	16,740	43,324	0	111

2028*	536	450,341	450,877	12,136	3,414	10,982	341	26,873	16,233	540	16,773	43,646	0	114
2029*	536	458,968	459,504	12,368	3,455	11,007	341	27,171	16,266	540	16,806	43,977	0	117
2030*	536	467,560	468,096	12,599	3,497	11,032	341	27,469	16,299	540	16,839	44,308	0	120
2031*	536	476,332	476,868	12,835	3,539	11,057	341	27,772	16,332	540	16,872	44,644	0	123
2032*	536	485,049	485,585	13,070	3,582	11,082	341	28,075	16,365	540	16,905	44,980	0	126
2033*	536	493,906	494,442	13,308	3,625	11,107	341	28,381	16,398	540	16,938	45,319	0	129
2034*	536	503,097	503,633	13,555	3,669	11,132	341	28,697	16,431	540	16,971	45,668	0	132
2035*	536	512,709	513,245	13,814	3,713	11,157	341	29,025	16,464	540	17,004	46,029	0	135

APO TERMINAL AREA FORECAST DETAIL REPORT

Forecast Issued January 2017

RDM

	Enplanements			AIRCRAFT OPERATIONS: Itinerant Operations					Local Operations					
Fiscal Year	Air Carrier	Commuter	Total	Air Carrier	Air Taxi & Commuter	GA	Military	Total	Civil	Military	Total	Total Ops	Total Tracon Ops	Based Aircraft
2036*	536	522,589	523,125	14,080	3,758	11,182	341	29,361	16,497	540	17,037	46,398	0	138

Source: https://www.census.gov/content/dam/Census/newsroom/releases/2015/cb15-56_table3.pdf

The 20 Fastest-Growing Metro Areas from July 1, 2013, to July 1, 2014

Rank	Metro Area	Percent Change
1.	The Villages, Fla.	5.4
2.	Myrtle Beach-Conway-North Myrtle Beach, S.C.-N.C.	3.2
3.	Austin-Round Rock, Texas	3.0
4.	Odessa, Texas	2.9
5.	St. George, Utah	2.9
6.	Cape Coral-Fort Myers, Fla.	2.7
7.	Bend-Redmond, Ore.	2.7
8.	Greeley, Colo.	2.6
9.	Midland, Texas	2.6
10.	Naples-Immokalee-Marco Island, Fla.	2.5
11.	Houston-The Woodlands-Sugar Land, Texas	2.5
12.	Fort Collins, Colo.	2.4
13.	Hilton Head Island-Bluffton-Beaufort, S.C.	2.4
14.	Daphne-Fairhope-Foley, Ala.	2.4
15.	Raleigh, N.C.	2.3
16.	Orlando-Kissimmee-Sanford, Fla.	2.2
17.	Charleston-North Charleston, S.C.	2.2
18.	North Port-Sarasota-Bradenton, Fla.	2.2
19.	Panama City, Fla.	2.2
20.	Boise City, Idaho	2.1

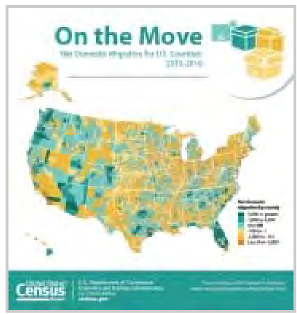
Source: https://www.census.gov/newsroom/press-releases/2017/cb17-44.html

Newsroom

FOR IMMEDIATE RELEASE: THURSDAY, MARCH 23, 2017

Maricopa County Added Over 222 People Per Day in 2016, More Than Any Other County

March 23, 2017
Release Number: CB17-44



MARCH 23, 2017 — Maricopa County, Ariz., replaced Harris County, Texas, as the county with the nation's highest annual population growth, according to U.S. Census Bureau population estimates released today. Harris County was the largest numeric gainer for eight years in a row. Maricopa County gained 81,360 people between July 1, 2015 and July 1, 2016, or about 222 people per day, while the nation's second-largest population gainer, Harris County, gained 56,587 people, or about 155 people per day on average.

Maricopa County, home to Phoenix, primarily grew through the addition of 43,189 residents from net domestic migration, a measure of how many people move to or from an area versus other parts of the United States. The county also added 25,428 people from natural increase (more births than deaths) and 10,188 people from net international migration.

Harris County, Texas, home to Houston, saw changes in net domestic migration, going from a net gain of more than 17,000 to a net loss of more than 16,000. Despite this, Harris County had the second largest gain in population due to high natural increase (46,412) and net international migration (27,922).

"In the early 2000s, Maricopa County was in the top one or two counties by numeric growth. From 2009-2011, Maricopa County saw much lower net migration than in the years before or after, which caused the county to drop out of the top population-gaining counties," explained

Peter Borsella, a demographer in the Census Bureau's population division. "While net international migration has not reached prior levels, net domestic migration and natural increase have continued to rise, making Maricopa County this year's largest numeric gainer."

In addition, Maricopa grew the fastest among the top 10 largest counties at 1.95 percent, an increase from 1.90 percent from the previous year. Harris County remained the third-largest county with 4.6 million people, and Maricopa County remained the fourth-largest county with 4.2 million people. Los Angeles County and Cook County, Ill., remained the largest and second-largest counties, respectively.

The statistics released today provide population estimates and components of change for our nation's 382 metropolitan statistical areas, 551 micropolitan statistical areas, and 3,142 counties, as well as Puerto Rico's metropolitan statistical areas, micropolitan statistical areas and municipios.

Find more highlights from this year's release below and local-level statistics on census.gov.

In the coming months, the Census Bureau will release 2016 population estimates for cities and towns, as well as national, state and county population estimates by age, sex, race and Hispanic origin.

Some High-Population Counties or County-Equivalents Continued to Experience Population Loss

These notable high-population counties continued to see population loss:

- Cook County, Ill. (Chicago): -21,324.
- Wayne County, Mich. (Detroit): -7,696.
- Baltimore city, Md.: -6,738.

Baltimore city saw an increase in population loss this year primarily due to a doubling of its net domestic out-migration.

Fastest-Growing Areas in Utah

Three of the 20 fastest-growing metro areas between 2015 and 2016 were located either partially or completely in Utah (St. George, Utah; Provo-Orem, Utah; and Logan, Utah-Idaho).

- Provo-Orem, Utah, and Logan, Utah-Idaho, saw natural increase as a larger component of growth than either net international migration or net domestic migration, while St. George, Utah, saw net domestic migration as a larger component of growth than either net international migration or natural increase.
- Also, San Juan County, Utah, was the fastest-growing county in the United States among counties with populations of 10,000 or more in 2015. It grew by 7.6 percent.

Second-Fastest-Growing U.S. County in 2015 Fell to 2,858th in 2016

North Dakota counties no longer top the list of fastest-growing counties by percentage change.

- McKenzie County fell from second-fastest growing by percentage change to 2,858th.
- Williams County fell from third to 3,105th.
- Mountrail County fell from sixth to 2,375th.
- Stark County fell from eighth to 3,103rd.

All of these counties lost population due to people moving away to other parts of the United States (negative net domestic migration). Formerly fast-growing North Dakota counties have been replaced in the top 10 by counties in Iowa, Oregon and Washington. Other top 10 counties once again are in Utah, Texas and Florida.

County Highlights

- Eight of the 10 counties with the most natural decrease (more deaths than births) were in Florida. Four of the top 10 counties with the most natural increase were in California, and 3 of the 10 were in Texas.
- St. Louis County, Mo., dropped below 1 million for the first time since 2011, largely due to a rise in net domestic out-migration.
- Three counties reached a population milestone of 100,000 or higher: Fairbanks North Star Borough, Alaska; Highlands County, Fla., and Carver County, Minn.
- Pasco County, Fla., reached a population of 500,000, and Tarrant County, Texas, reached 2 million.

Metropolitan Statistical Area Highlights

- The nation's 382 metro areas contained approximately 277.1 million people in 2016, representing approximately 86 percent of the nation's population. This was an increase of approximately 2.3 million people from 2015.
- For the fourth year in a row, The Villages, Fla., a metro area west of the Orlando-Kissimmee-Sanford, Fla., metro area, was the nation's fastest-growing metro area, with a 4.3 percent population increase between 2015 and 2016.
- The Dallas-Fort Worth-Arlington, Texas, and Houston-The Woodlands-Sugar Land, Texas, metro areas were the two largest numeric-gaining metro areas between 2015 and 2016, increasing by more than 100,000 each.
- Four metro areas were among both the 25 fastest growing and the 25 largest numeric gaining between 2015 and 2016: Austin-Round Rock, Texas; Raleigh, N.C.; Orlando-Kissimmee-Sanford, Fla.; and Las Vegas-Henderson-Paradise, Nev. For all four areas, net domestic migration was a larger component of change than either net international migration or natural increase
- Among the 10 largest metro areas, the Chicago-Naperville-Elgin, Ill.-Ind.-Wis., metro area was the only metro area that did not grow in population between 2015 and 2016.

Micropolitan Statistical Area Highlights

- The nation’s 551 micro areas contained approximately 27.7 million people in 2016, representing approximately nine percent of the nation’s population. This is an increase of approximately 16,000 people from 2015.
- Micro areas in the West grew the most.
  - Heber, Utah, was the fastest-growing micro area, with an increase of 4.7 percent between 2015 and 2016. The five fastest-growing micro areas were in the West: Heber, Utah; Prineville, Ore.; Ellensburg, Wash.; Bozeman, Mont.; and Cedar City, Utah. Among these five areas, net domestic migration was a larger component of change than either net international migration or natural increase.
  - Bozeman, Mont., had the largest numeric gain among micro areas between 2015 and 2016, increasing by approximately 3,800 people. Four of the five largest numeric-gaining micro areas between 2015 and 2016 were in the West: Bozeman, Mont.; Hilo, Hawaii; Kalispell, Mont.; and Oak Harbor, Wash.

Puerto Rico

- Overall, Puerto Rico's population has been decreasing since 2010. The Commonwealth total resident population decreased by 314,850 (or 8.4 percent) since 2010 to 3,411,307 on July 1, 2016.
- San Juan experienced the largest numeric decrease in population of any municipio, losing 8,497 residents between July 1, 2015 and July 1, 2016, followed by Bayamón (-4,448 residents) and Ponce (-3,748 residents).
- Of Puerto Rico's 78 municipios, only Gurabo experienced growth between July 1, 2015, and July 1, 2016, gaining 56 residents (an increase of 0.1 percent).
- All other municipios experienced a decline in population. The fastest-declining municipios were Peñuelas, Lares and Guánica, featuring a decline of 2.7 percent each.

To find where people are leaving from and moving to, visit Census Flows Mapper.

-X-

The Census Bureau develops county, metro area and micro area population estimates by measuring population change since the most recent census. The Census Bureau uses births, deaths, administrative records and survey data to develop estimates of population. For more detail regarding the methodology, see <www.census.gov/programs-surveys/popest/technical-documentation/methodology.html>.

The Office of Management and Budget's statistical area delineations (for metro and micro areas) are those issued by that agency in July 2015. Metro areas contain at least one urbanized area of 50,000 or more population, and micro areas contain at least one urban cluster of at least 10,000 (but less than 50,000) population. Both metro and micro areas consist of one or more whole counties or county equivalents. Some metro and micro area titles may be abbreviated in the text of the news release. Full titles are shown in the tables.

Top 10 Largest-Gaining Counties (Numeric Change): July 1, 2015 to July 1, 2016

County	Population	Numeric Change	Percent Change	Births	Deaths	Domestic Migration	International Migration
Maricopa County, Arizona	4,242,997	81,360	1.95	56,073	30,645	43,189	10,188
Harris County, Texas	4,589,928	56,587	1.25	73,072	26,660	-16,225	27,922
Clark County, Nevada	2,155,664	46,375	2.20	27,352	16,501	27,735	6,566
King County, Washington	2,149,970	35,714	1.69	25,905	13,580	8,511	15,500
Tarrant County, Texas	2,016,872	35,462	1.79	28,682	12,903	13,411	6,348
Riverside County, California	2,387,741	34,849	1.48	30,845	17,092	16,961	3,099
Bexar County, Texas	1,928,680	33,198	1.75	28,283	13,458	13,077	5,361
Orange County, Florida	1,314,367	29,503	2.30	16,721	8,198	10,083	11,078
Dallas County, Texas	2,574,984	29,209	1.15	40,063	16,407	-6,193	12,133
Hillsborough County, Florida	1,376,238	29,161	2.16	17,345	11,179	14,806	7,774

Top 10 Fastest-Growing Counties (Percent Change, Counties With a Population of 10,000 or More): July 1, 2015 to July 1, 2016

County	Population	Numeric Change	Percent Change	Births	Deaths	Domestic Migration	International Migration
San Juan County, Utah	16,895	1,188	7.56	240	112	1,038	13
Kendall County, Texas	42,540	2,088	5.16	391	389	1,844	77
Hays County, Texas	204,470	9,896	5.09	2,553	1,011	7,932	171
Wasatch County, Utah	30,528	1,363	4.67	475	126	891	77
Dallas County, Iowa	84,516	3,739	4.63	1,268	433	2,500	296
Comal County, Texas	134,788	5,675	4.40	1,597	1,085	4,760	109
Sumter County, Florida	123,996	5,114	4.30	501	1,742	4,873	55
Crook County, Oregon	22,570	923	4.26	240	236	886	7
Juab County, Utah	11,010	444	4.20	185	74	319	-1
Kittitas County, Washington	44,866	1,809	4.20	391	286	1,563	72

Top 10 Largest-Declining Counties or County Equivalents (Numeric Change): July 1, 2015 to July 1, 2016

County	Population	Numeric Change	Percent Change	Births	Deaths	Domestic Migration	International Migration

Cook County, Illinois	5,203,499	-21,324	-0.41	68,049	42,297	-66,244	18,434
Wayne County, Michigan	1,749,366	-7,696	-0.44	23,209	18,231	-17,346	4,279
Baltimore city, Maryland	614,664	-6,738	-1.08	8,654	6,871	-11,008	2,195
Cuyahoga County, Ohio	1,249,352	-5,673	-0.45	14,941	13,563	-10,122	3,402
Suffolk County, New York	1,492,583	-5,320	-0.36	15,446	12,793	-11,278	4,327
Milwaukee County, Wisconsin	951,448	-4,866	-0.51	13,675	8,176	-13,186	2,505
Allegheny County, Pennsylvania	1,225,365	-3,933	-0.32	13,193	13,995	-5,821	3,479
San Juan County, New Mexico	115,079	-3,622	-3.05	1,703	1,026	-4,341	42
St. Louis City, Missouri	311,404	-3,471	-1.10	4,547	3,070	-6,189	981
Jefferson County, New York	114,006	-3,254	-2.78	2,000	945	-4,674	345

Top 25 Fastest-Growing Metro Areas (Percent Change): July 1, 2015 to July 1, 2016

Rank by Percent Change	Metro Area	2015 Population	2016 Population	Numeric Change	Percent Change	Natural Increase	Births	Deaths	Net Migration	Domestic Migration	International Migration
1	The Villages, FL	118,882	123,996	5,114	4.3	-1,241	501	1,742	4,928	4,873	55
2	Myrtle Beach-Conway-North Myrtle Beach, SC-NC	432,493	449,295	16,802	3.9	-488	4,214	4,702	15,308	14,881	427
3	Bend-Redmond, OR	174,942	181,307	6,365	3.6	398	1,853	1,455	5,698	5,695	3
4	Greeley, CO	285,053	294,932	9,879	3.5	2,381	4,106	1,725	7,300	6,991	309
5	Cape Coral-Fort Myers, FL	700,285	722,336	22,051	3.1	-658	6,666	7,324	20,780	17,769	3,011
6	St. George, UT	155,450	160,245	4,795	3.1	1,026	2,232	1,206	3,285	3,267	18
7	Provo-Orem, UT	585,362	603,309	17,947	3.1	10,004	12,347	2,343	7,765	6,893	872
8	Punta Gorda, FL	173,194	178,465	5,271	3.0	-1,614	1,044	2,658	6,154	5,800	354
9	Austin-Round Rock, TX	1,998,104	2,056,405	58,301	2.9	17,071	27,375	10,304	40,273	33,395	6,878
10	North Port-Sarasota-Bradenton, FL	768,013	788,457	20,444	2.7	-3,227	6,545	9,772	21,138	18,913	2,225
11	Coeur d'Alene, ID	150,364	154,311	3,947	2.6	480	1,834	1,354	3,169	3,123	46
12	Lakeland-Winter Haven, FL	649,425	666,149	16,724	2.6	892	7,678	6,786	15,061	12,152	2,909
13	Sebastian-Vero Beach, FL	147,792	151,563	3,771	2.6	-766	1,284	2,050	3,828	3,530	298
14	Raleigh, NC	1,271,381	1,302,946	31,565	2.5	8,414	15,893	7,479	22,607	18,510	4,097
15	Orlando-Kissimmee-Sanford, FL	2,382,132	2,441,257	59,125	2.5	10,798	28,849	18,051	46,922	29,441	17,481
16	Port St. Lucie, FL	454,111	465,208	11,097	2.4	-890	4,357	5,247	10,724	9,759	965

Rank by Percent Change	Metro Area	2015 Population	2016 Population	Numeric Change	Percent Change	Natural Increase	Births	Deaths	Net Migration	Domestic Migration	International Migration
17	Naples-Immokalee-Marco Island, FL	356,570	365,136	8,566	2.4	-220	3,270	3,490	7,434	5,292	2,142
18	Daphne-Fairhope-Foley, AL	203,690	208,563	4,873	2.4	161	2,274	2,113	4,289	4,046	243
19	Boise City, ID	675,777	691,423	15,646	2.3	4,157	8,753	4,596	10,757	9,950	807
20	Logan, UT-ID	133,093	136,159	3,066	2.3	1,991	2,578	587	1,052	728	324
21	Deltona-Daytona Beach-Ormond Beach, FL	623,378	637,674	14,296	2.3	-2,437	5,714	8,151	15,419	13,981	1,438
22	Fayetteville-Springdale-Rogers, AR-MO	513,449	525,032	11,583	2.3	3,660	7,266	3,606	7,845	6,564	1,281
23	Olympia-Tumwater, WA	269,183	275,222	6,039	2.2	1,000	3,172	2,172	4,725	4,060	665
24	Charleston-North Charleston, SC	744,603	761,155	16,552	2.2	3,710	9,662	5,952	12,377	11,471	906
25	Las Vegas-Henderson-Paradise, NV	2,109,289	2,155,664	46,375	2.2	10,851	27,352	16,501	34,301	27,735	6,566

Contact

Public Information Office

301-763-3030

pio@census.gov

Related Information

- Press kit
- Detailed tables
- Graphic: Embed, Download or Print
- Spanish Version

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Central Oregon Association of REALTORS®

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Presentation - November 4th, 2016

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VISION: Redmond - A great place to live and prosper

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Help local businesses & pursue outside leads

Retention

Expansion

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Policy

Advocate, collaborate, & track

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Space

Sustainable Operations

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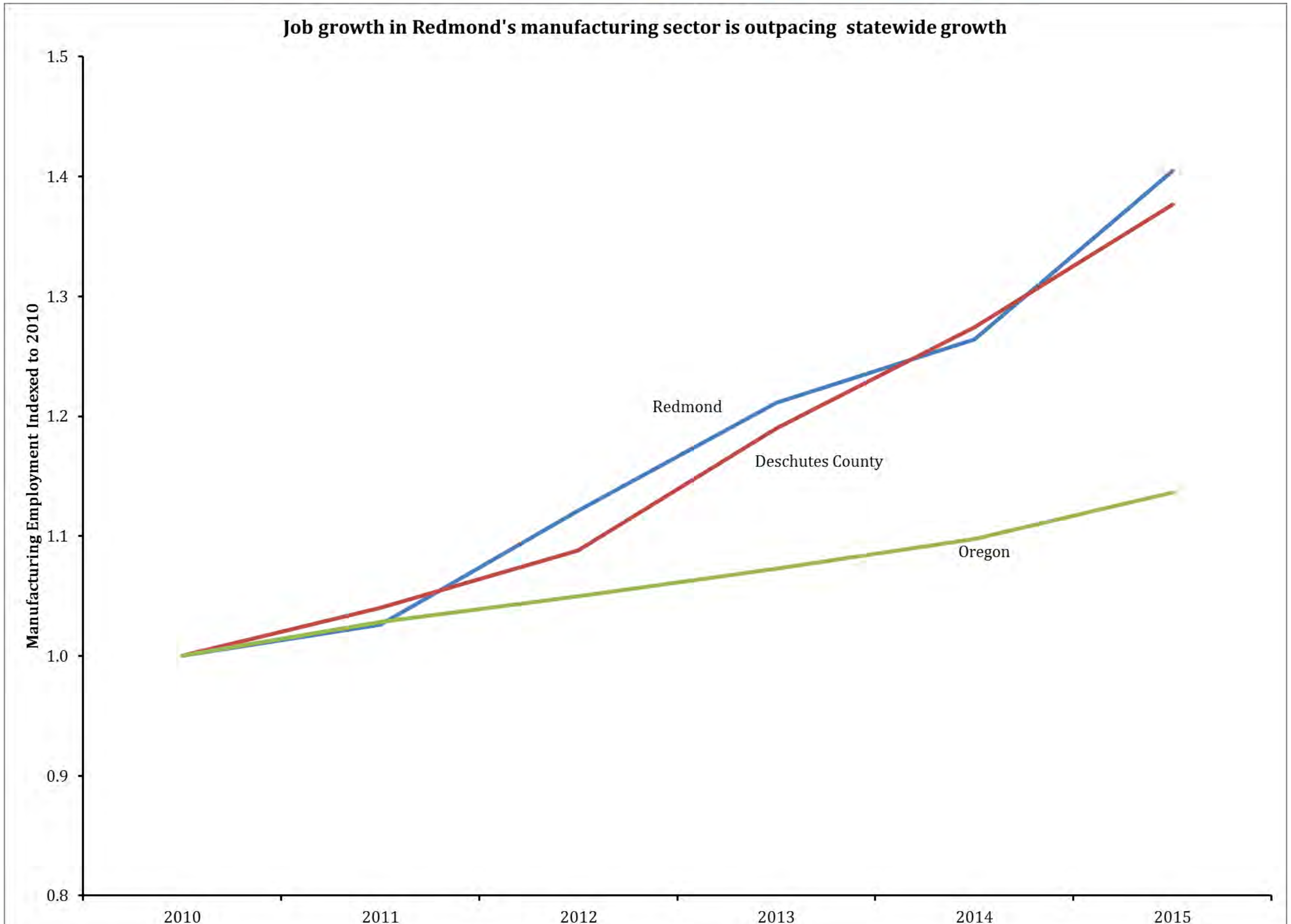

Manufacturing Growth in Redmond

-6.9% Increase '14-'15

-8th of all 382 Metro's

-41% 2010-2015

-Bend/Redmond MSA: 6th Fastest Year/Year Job Growth in US – all occupations

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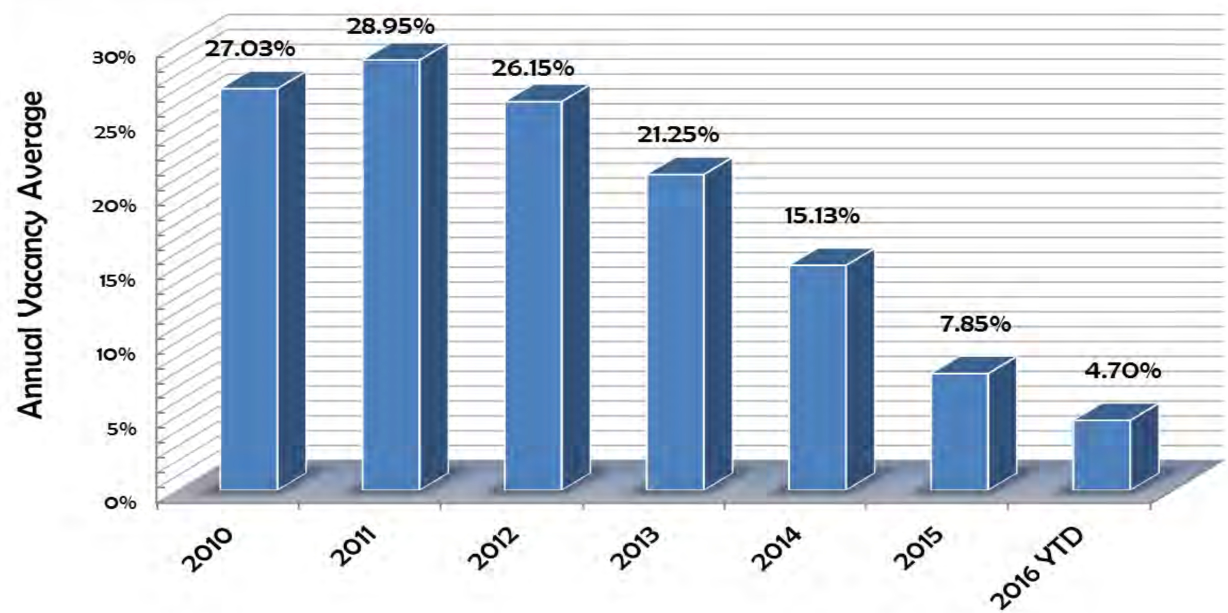
Redmond Industrial Vacancy Rate Trend



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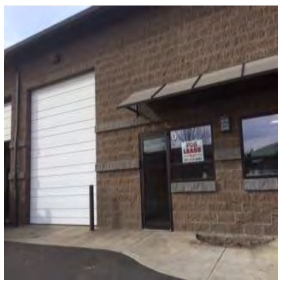
Available Space



Flex Space 1,500-3,000 sf – **4** options exist

Flex Space 3,000-8,000 sf – **6** options available

Stand Alone buildings over 15,000 sf – **2** options exist

2 heavy industrial flex spaces at 13,000 and 28,000

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Industrial Land and Lease Rates

Industrial Land (M1 and M2)	$2.50-$4.50 sf
Industrial Warehouse Lease Rate (avg)	$.50/sf+ NNN
Upper Edge of Lease Market	$.70/sf + NNN

Industrial Space - Market Demand
(REDI Pending Projects)

PROJECT NEED	DEMAND
1,500-3000 sf	3 Projects
3,000-8,000 sf	7 Projects
10,000-25,000 sf	8 Projects
25,000 sf and up	4 Projects

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REDI 2016 Developer Tour

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Lead Generation Activity

- Team Oregon Advanced Manufacturing

SHOT SHOW GEAR UP

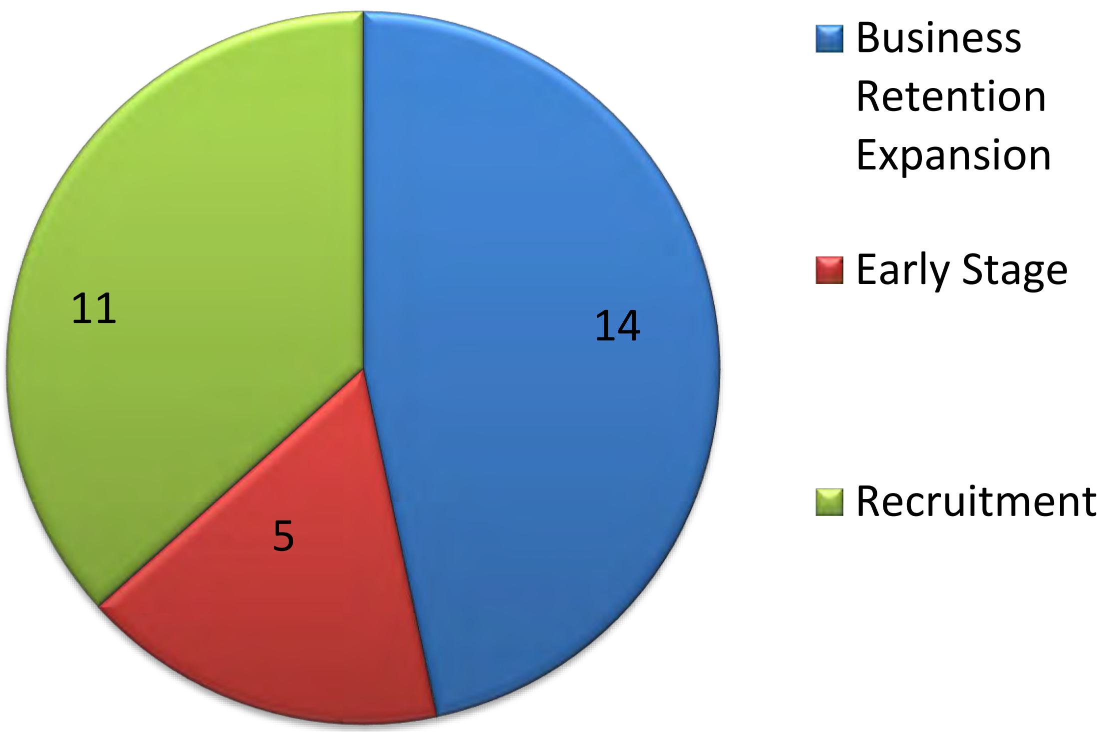
- Lead Generation Pilot

McMinnville ECONOMIC DEVELOPMENT PARTNERSHIP all here

SEDCOR Strategic Economic Development Corporation

GREATER PORTLAND

Project Type



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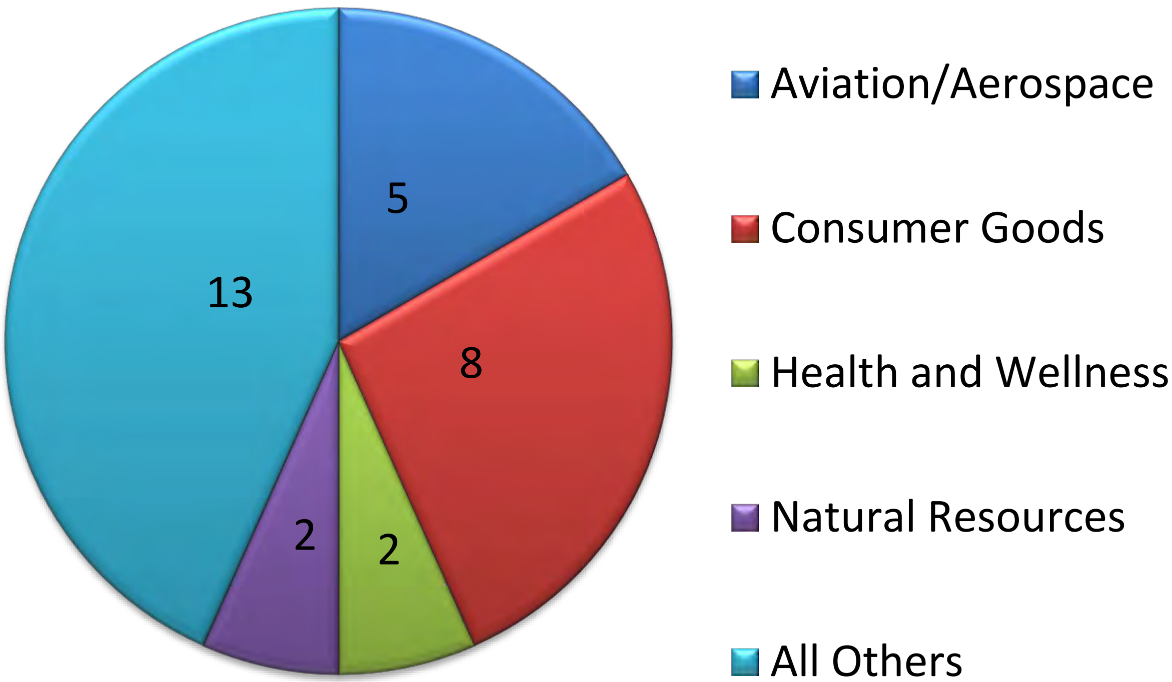
Industry Type



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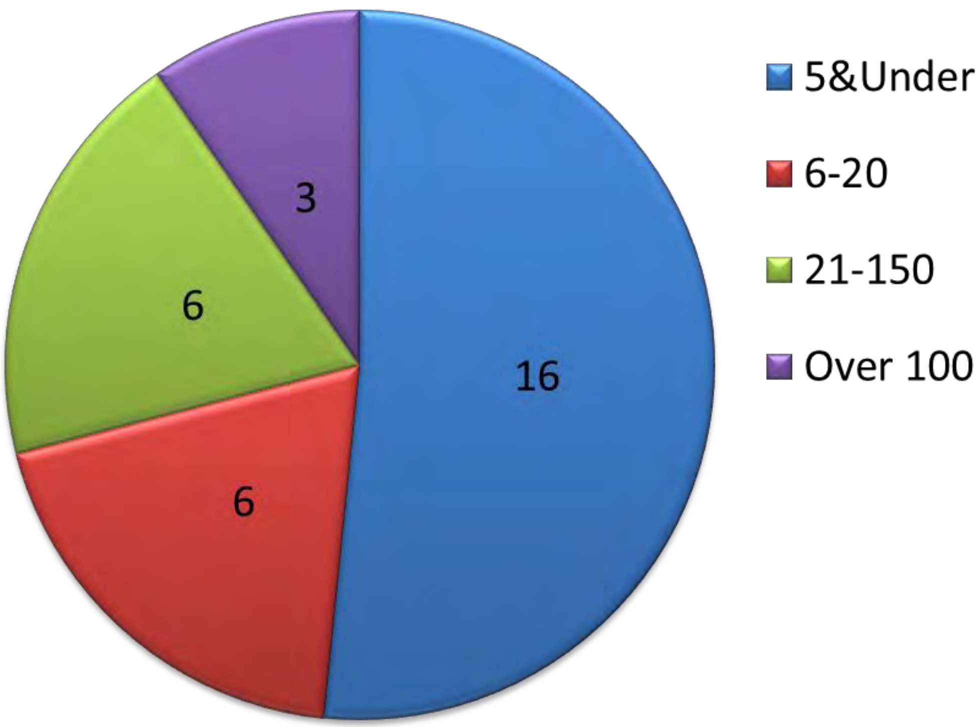
Project Pipeline: Jobs



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Strategic Initiatives: Strengthening Redmond's Business Environment

ACT Work Ready Communities
DESCHUTES COUNTY OREGON
CERTIFIED 2015-17

Certified Work Ready Communities

Airlines Meetings (COAST)

DELTA AIR LINES

Alaska AIRLINES

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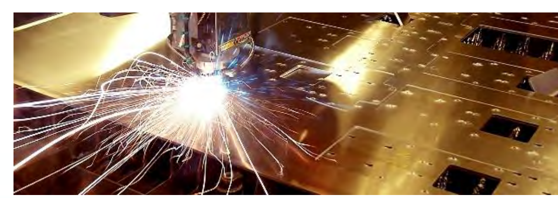
Advanced Mfg. Industry Consortium



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Sustainable Operations:

Social Media Presence

3rd Annual Investor Social

Membership Development

Annual Luncheon

Made in Redmond Tour

blog

Fly REDMOND

Made **In Redmond Tour**

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Questions?

Jon Stark
Sr. Manager
Redmond Economic Development

541-923-5223; Jon@edcoinfo.com; www.rediinfo.com

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Figure A4-1: TAF and Airport Records Comparison

Fiscal	Enplanements				Air Carrier (AC) Operations				Air Taxi (AT) Operations				Commercial Operations (AC + AT)			
Year	TAF	Airport	Δ#	Δ%	TAF	Airport	Δ#	Δ%	TAF	Airport	Δ#	Δ%	TAF	Airport	Δ#	Δ%
2006	197,223	205,061	7,838	4%	1,433	887	-546	-38%	16,803	17,768	965	6%	18,236	18,655	419	2%
2007	230,033	239,096	9,063	4%	2,781	3,043	262	9%	16,349	17,508	1,159	7%	19,130	20,551	1,421	7%
2008	243,197	252,665	9,468	4%	4,413	5,211	798	18%	13,795	14,498	703	5%	18,208	19,709	1,501	8%
2009	217,826	229,987	12,161	6%	4,444	5,615	1,171	26%	9,680	10,119	439	5%	14,124	15,734	1,610	11%
2010	225,561	235,921	10,360	5%	4,858	6,151	1,293	27%	9,396	9,997	601	6%	14,254	16,148	1,894	13%
2011	231,978	242,888	10,910	5%	4,140	5,064	924	22%	8,886	9,616	730	8%	13,026	14,680	1,654	13%
2012	230,833	241,488	10,655	5%	3,931	4,898	967	25%	8,649	9,218	569	7%	12,580	14,116	1,536	12%
2013	227,410	236,586	9,176	4%	4,201	4,785	584	14%	8,232	9,185	953	12%	12,433	13,970	1,537	12%
2014	255,865	265,213	9,348	4%	4,738	5,812	1,074	23%	8,573	8,526	-47	-1%	13,311	14,338	1,027	8%
2015	269,132	277,157	8,025	3%	4,335	5,860	1,525	35%	6,578	6,586	8	0%	10,913	12,446	1,533	14%
2016	298,322	304,588	6,266	2%	5,127	6,697	1,570	31%	6,340	6,451	111	2%	11,467	13,148	1,681	15%
CAGR	2.1%	2.0%			6.6%	10.6%			-4.8%	-4.9%			-2.3%	-1.7%		

TAF records (enplanements and operations) come from TAF issued January 2017.
Airport records come from airlines (enplanements) and payment of landing fees (operations).
CAGR = Compound Annual Growth Rate

Figure A4-2: Airport Commercial Operations Records

		FAA Fiscal Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	RATE	CHART
Subtotal	Air Carrier	Scheduled Commercial Passenger	209	2,184	4,636	5,142	5,742	4,542	4,413	4,207	4,995	5,240	6,254	40.5%	
Subtotal	Air Carrier	Charter	52	136	51	34	41	8	-	22	44	39	21	-8.7%	
Subtotal	Air Carrier	Air Tanker	626	723	524	439	368	514	485	556	773	581	422	-3.9%	
Subtotal	Air Carrier	Sched. Com. Pax + Charter + Tanker	**887**	**3,043**	**5,211**	**5,615**	**6,151**	**5,064**	**4,898**	**4,785**	**5,812**	**5,860**	**6,697**	22.4%	
Subtotal	Air Taxi	Scheduled Commercial Passenger	14,455	14,006	10,961	6,764	6,186	6,283	6,340	5,916	6,602	4,560	4,522	-11.0%	
Subtotal	Air Taxi	Scheduled Commercial Freight	3,313	3,502	3,537	3,355	3,811	3,333	2,878	3,269	1,924	2,026	1,929	-5.3%	
Subtotal	Air Taxi	Sched. Com. Pax + Freight	**17,768**	**17,508**	**14,498**	**10,119**	**9,997**	**9,616**	**9,218**	**9,185**	**8,526**	**6,586**	**6,451**	-9.6%	
Total		Air Carrier + Air Taxi	**18,655**	**20,551**	**19,709**	**15,734**	**16,148**	**14,680**	**14,116**	**13,970**	**14,338**	**12,446**	**13,148**	-3.4%	

Source: Airport records depicting landing fees.

Figure A4-3: Airport Enplanement Records by Month

Enplanement/Deplanement by Airlines																				
Summary																				
FY	96-97	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16
July Enplane	10,019	9,924	11,849	13,948	15,054	16,137	13,410	13,559	14,017	18,349	18,763	23,618	23,354	22,583	22,879	23,819	24,812	24,320	26,448	28,710
July Deplane	10,176	10,177	12,415	14,554	15,235	16,508	13,868	13,788	13,849	18,552	19,059	23,704	23,807	23,405	23,713	24,022	25,560	24,529	27,272	29,650
August Enplane	10,440	10,638	12,796	14,765	15,746	17,598	14,511	13,886	15,646	18,536	22,290	24,251	23,321	23,205	23,728	23,986	24,210	23,877	27,374	29,276
August Deplane	10,750	10,420	12,321	13,783	15,495	17,634	14,175	13,676	14,603	17,789	21,844	24,018	22,954	22,341	22,849	23,452	23,821	23,660	27,414	28,118
September Enplane	9,183	9,879	11,149	12,954	13,792	9,694	12,205	12,255	13,263	16,221	19,002	20,542	18,743	19,374	19,475	20,702	19,686	21,797	23,466	24,896
September Deplane	8,409	9,132	10,789	12,650	13,236	9,126	11,456	11,538	12,924	15,787	18,304	19,601	17,808	18,958	19,125	20,322	19,119	20,544	21,192	24,250
October Enplane	8,896	9,053	10,795	12,336	14,000	11,181	11,567	12,635	13,381	16,115	19,282	21,106	18,728	18,785	19,310	19,456	18,943	21,207	21,796	24,496
October Deplane	8,652	8,856	10,618	12,184	13,578	10,781	11,074	12,178	13,166	15,962	18,617	20,419	18,220	18,446	18,880	19,317	18,328	20,968	21,311	23,962
November Enplane	7,548	7,871	10,311	11,897	13,231	10,903	11,039	11,852	13,239	14,164	18,347	20,292	17,835	18,790	19,016	18,945	18,192	20,075	20,405	23,974
November Deplane	7,614	8,215	10,006	12,052	13,020	10,847	11,372	12,009	13,107	13,513	18,204	20,139	18,117	18,885	19,144	18,855	18,178	20,707	19,985	23,272
December Enplane	8,835	9,840	12,368	12,519	13,708	11,513	12,751	12,718	14,101	17,176	19,081	22,085	19,649	21,159	21,057	20,051	18,885	22,806	19,988	25,286
December Deplane	9,250	10,419	13,029	13,297	14,722	12,171	13,442	13,293	14,930	17,959	20,027	23,514	20,481	22,615	22,421	22,003	19,960	24,281	20,651	26,871
January Enplane	9,151	9,455	10,443	12,218	12,726	11,243	11,485	11,678	14,216	16,126	18,166	21,328	17,633	18,621	19,826	18,578	18,194	20,550	21,225	24,863
January Deplane	8,079	8,337	9,288	10,823	11,276	10,089	9,995	10,088	12,715	14,372	16,646	19,010	15,466	16,413	17,465	16,547	16,644	18,108	18,651	22,364
February Enplane	8,493	8,555	10,579	11,293	12,506	10,422	10,757	11,859	12,275	14,930	16,523	20,509	16,620	16,427	17,158	17,039	16,469	17,502	19,357	22,912
February Deplane	8,182	8,348	10,555	11,207	12,063	10,410	10,707	11,872	12,246	14,753	16,285	20,610	16,575	16,286	16,914	16,812	16,456	18,209	19,118	22,633
March Enplane	8,983	9,449	11,525	13,347	14,627	11,633	11,866	12,601	15,229	17,271	18,969	19,852	19,179	18,887	20,231	19,860	18,926	21,067	22,469	25,313
March Deplane	9,202	9,625	11,620	13,400	14,360	11,876	11,742	12,758	15,320	16,393	18,291	19,706	18,936	19,363	20,512	19,427	18,901	20,692	22,361	25,514
April Enplane	8,577	8,802	11,027	11,853	12,753	10,597	10,276	11,353	14,089	15,243	18,224	19,362	16,970	17,870	17,570	17,533	17,561	19,479	20,986	23,656
April Deplane	8,474	8,833	10,550	11,450	13,230	10,549	10,365	11,149	13,830	15,619	18,769	19,688	17,195	17,241	17,243	17,871	17,477	19,706	20,973	24,180
May Enplane	9,069	9,387	10,975	12,851	13,672	11,064	11,427	11,799	15,535	16,066	20,003	20,391	17,578	18,350	18,916	18,944	18,398	21,165	21,901	7,379
May Deplane	8,732	9,501	11,085	13,921	13,927	11,335	11,526	12,308	15,728	16,797	20,288	20,812	18,256	18,886	19,390	19,840	19,138	22,021	22,305	7,086
June Enplane	9,794	11,277	12,541	14,190	14,755	12,664	12,933	13,686	16,476	17,915	22,090	22,322	20,633	20,950	21,297	22,374	21,024	24,074	26,148	30,397
June Deplane	9,793	11,224	12,310	14,293	15,104	12,788	13,093	13,477	16,697	17,828	22,672	22,603	21,190	21,003	22,131	22,732	21,379	24,623	25,978	30,578
TOTAL Enplane	108,988	114,130	136,358	154,171	166,570	144,649	144,227	149,881	171,467	198,112	230,740	255,658	230,243	235,001	240,463	241,287	235,300	257,919	271,563	291,158
TOTAL Deplane	107,313	113,087	134,586	153,614	165,246	144,114	142,815	148,134	169,115	195,324	229,006	253,824	229,005	233,842	239,787	241,200	234,961	258,048	267,211	288,478
TOTALS	216,301	227,217	270,944	307,785	331,816	288,763	287,042	298,015	340,582	393,436	459,746	509,482	459,248	468,843	480,250	482,487	470,261	515,967	538,774	579,636
FAA FY (Oct-Sep)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Enplanements	109,787	119,483	142,231	157,096	165,407	141,346	143,801	153,107	181,647	205,061	239,096	252,665	229,987	235,921	242,888	241,488	236,586	265,213	277,157	304,588
Deplanements	107,707	118,883	140,048	156,593	164,548	140,345	142,318	150,508	179,867	202,403	237,122	251,070	229,140	234,825	241,896	241,904	235,194	265,193	273,351	301,464
Total	217,494	238,366	282,279	313,689	329,955	281,691	286,119	303,615	361,514	407,464	476,218	503,735	459,127	470,746	484,784	483,392	471,780	530,406	550,508	606,052

Source: Airport records, reported by the airlines.

APPENDIX C:

RECYCLING PLAN

Fly REDMOND

REDMOND MUNICIPAL AIRPORT
RECYCLING, REUSE & WASTE REDUCTION PLAN
2018

Mead&Hunt

REDMOND MUNICIPAL AIRPORT
RECYCLING, REUSE & WASTE REDUCTION PLAN
2018

Mead & Hunt
Morgan Turner
2605 Port Lansing Road
Lansing, MI 48906
Ph. 517-908-3130

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EXECUTIVE SUMMARY

The City of Redmond, Oregon, operator of Redmond Municipal Airport (RDM or the Airport) is committed to environmentally responsible operations. The Airport is updating their master plan and is including planning for solid waste in keeping with the *FAA Modernization and Reform Act of 2012* (FMRA) requirements. The purpose of this task was to evaluate RDM's existing waste and recycling program and provide recommendations to increase landfill diversion through waste reduction, reuse, and recycling.

The consultant conducted a facility walk-through and informal interviews with RDM staff to develop a baseline and identify areas of opportunity to divert waste from the landfill. The consultant developed recommendations appropriate for the Airport's waste stream based on the baseline information and identified opportunities.

Highlights of these recommendations include:

- ✓ Establish goals and objectives
- ✓ Track progress and report regularly
- ✓ Continue to promote emptying of water bottles pre-security and refilling post-security
- ✓ Collect and donate food, beverages, and toiletries
- ✓ Continue paper, plastic, plastic bottle, aluminum can, cardboard, and glass recycling and expand to other areas, including deplaned waste
- ✓ Improve education and outreach for passengers, employees, tenants, and contractors
- ✓ Supplement, right size, collocate, and standardize recycling stations and garbage cans
- ✓ Expand and improve signage, specifically at the security checkpoint
- ✓ Update contracts/leases and establish purchasing policy
- ✓ Maintain and improve recycling program according to Plan Do Check Act cycle

This range of recommendations will allow RDM the flexibility to implement those that are compatible with changing conditions and available resources, while providing the opportunity increase landfill diversion over time through a phased, comprehensive program.

1. INTRODUCTION

A. REGULATORY BACKGROUND AND PROJECT PURPOSE

Section 132(b) of the FMRA expanded the definition of airport planning to include “developing a plan for recycling and minimizing the generation of airport solid waste.” FMRA Section 133 added a requirement that airports that prepare or update a master plan and receive Federal Aviation Administration (FAA) Airport Improvement Program (AIP) funding ensure that new or updated master plans address issues related to solid waste recycling. These issues include:

1) the feasibility of solid waste recycling
2) minimizing the generation of solid waste
3) operation and maintenance requirements
4) review of waste management contracts
5) the potential for cost savings or revenue generation.

In September 2014, the FAA released a memorandum titled “Guidance on Airport Recycling, Reuse, and Waste Reduction Plans.” This memo details the FAA’s expectations and suggestions for an airport’s recycling plan. To comply with FMRA and according to the FAA’s guidance memo, RDM is preparing this recycling, reuse, and waste reduction plan. The purpose of this plan is to document and assess RDM’s existing waste and recycling program based on the factors listed above and to recommend improvements.

An airport’s waste and recycling program and documented plan depend on several factors including:

- ✓ the size, location, and layout of the airport
- ✓ the amount and type of waste generated
- ✓ markets for recyclable commodities
- ✓ costs for recycling
- ✓ available local infrastructure
- ✓ the willingness of an airport and its tenants to implement recycling and other strategies

The extent and accuracy of available information governed the content of this plan.

B. AIRPORT DESCRIPTION

RDM is in the high desert region of central Oregon in the City of Redmond within Deschutes County. The City of Redmond owns RDM. The Airport Manager reports to the City Manager, and City employees are responsible for day to day airport operations. An Airport Committee advises elected City Council members on Airport matters. The Committee includes representation from Redmond, the City of Bend, Deschutes County, Jefferson County, and Crook County.

RDM, a non-hub primary airport, serves as the high desert region's only commercial service airport. The Airport is a public-use facility and is included in the FAA *National Plan of Integrated Airport Systems (NPIAS).* The Airport is an FAA Class I Part 139 facility, with facilities and services to accommodate scheduled passenger aircraft with 30 or more passenger seats. The Oregon Department of Aviation classifies RDM as a Category I – Commercial Service Airport.

The Airport serves commercial, general aviation (GA), military, and US Forest Service (USFS) activity. In fiscal year 2016, RDM saw approximately 546,700 total passengers (273,351 enplanements), saw 39,211 total operations, and had 40 based aircraft. Four airlines serve the Airport (American Airlines, Alaska Air, Delta Air, and United/United Express) and reach seven domestic destinations. Additional background and activity information is available in the Airport Master Plan.

C. WASTE DEFINITIONS AND PLAN FOCUS

Municipal Solid Waste (MSW) consists of everyday items that are used and then discarded. There are six primary types of MSW generated at airports:

a. General MSW consists of common inorganic waste, such as product packaging, disposable utensils, plates and cups, bottles, and newspaper. Less common items, such as furniture and clothing, are also considered general MSW.
b. Food waste is either food that is not consumed or the waste generated and discarded during food preparation. Food waste and green waste make up a waste stream known as "compostable" waste.
c. Green waste consists of tree, shrub and grass clippings, leaves, weeds, small branches, seeds, pods and similar debris generated by landscape maintenance activities. Green waste and food waste together may be referred to as "compostables."
d. Deplaned waste is a specific type of MSW that is removed from passenger aircraft. These materials include bottles and cans, newspaper and mixed paper, plastic cups, service ware, food waste, food soiled paper, and paper towels.
e. Construction and Demolition Waste (C&D) is generally categorized as MSW and is any non-hazardous solid waste from land clearing, excavation, and/or the construction, demolition, renovation or repair of structures, roads, and utilities. C&D waste commonly includes concrete, wood, metals, drywall, carpet, plastic, pipes, land clearing debris, cardboard, and salvaged building components.

This plan focuses on the management of MSW and other materials that can be recycled or disposed of in a landfill. This plan does not address the management of other types of waste, specifically:

- ✓ hazardous waste
- ✓ universal waste
- ✓ industrial waste
- ✓ waste from international flights
- ✓ C&D waste that is subject to special requirements or requires special handling (asbestos, lead, etc.).

The handling, recycling, and disposal of these materials are regulated by federal, state, and local laws.

D. KEY AIRPORT BUILDINGS AND PLAN SCOPE

The Airport's buildings include an airline passenger terminal, airport support facilities, GA facilities and tenant facilities.

AIRLINE PASSENGER TERMINAL

The passenger terminal serves airline passengers and provides space for airline-related services.

Airport administration offices, airline ticketing counters and offices, restrooms, food and retail store, security queuing area, meeter/greeter area, baggage claim, and rental car counters and offices comprise the pre-security or non-sterile portion of the terminal.

The administration offices include a reception area, offices, one conference room, and a breakroom. The firm providing airport security services has an office adjacent to the security checkpoint, and the City of Redmond Police Department also has an office in the terminal.

The ticketing counters, associated queuing lines and kiosks, and adjacent offices are allocated to each airline. A shop offering packaged food and drinks and retail items, including souvenirs, is in the non-sterile area. There are restrooms in the non-sterile area.

The meeter/greeter area connects the secure area exit with baggage claim and the car rental counters. This space also has a children's play area. There are two luggage belts in the baggage claim area, as well as a space for oversized baggage claim. Each rental car company has a counter and adjacent office for their use.

Passengers access the security checkpoint via a queuing area at its entrance. The Transportation Security Administration (TSA) operates the security checkpoint, which offers two lanes for screening of passengers and carry-on items. TSA personnel also have access to training areas, locker room space, and offices.

The post-security or secure portion of the terminal offers services for passengers already screened at the security checkpoint. The secure area includes a second food and retail shop, a bar/restaurant, restrooms, airline gates, and passenger holdrooms.

Secure area food and retail space is occupied by a small convenience store that also offers packaged foods and drinks as well as souvenirs (Figure 1).

Figure 1 : Terminal convenience store

The convenience store has a small coffee condiments area with a built-in trash can (Figure 2).

Figure 2 : Coffee condiments area in convenience store

A bar/restaurant is located on the second floor of the secure area and features bar seating as well as tables and chairs with wait staff service (Figure 3). The restaurant also sells packaged beverages (Figure 4).

Figure 3 : Bar and restaurant in secure area

Figure 4 : Bar area and cooler with packaged beverages

The secure area also has restrooms.

Six gates serve deplaning and enplaning passengers with each gate is dedicated to one airline. Holdrooms, where passengers wait to board departing flights within the departure lobby, are loosely defined at RDM by their proximity to each gate; the first-floor departure lobby is one space with seating available throughout. Additional general departure seating is available on the second-floor atrium.

Additional areas of the terminal are accessible only to credentialed staff and contractors. These areas include baggage screening, a maintenance shop, storage, and a breakroom.

AIRPORT SUPPORT FACILITIES

Airport staff maintain the property and perform snow removal and deicing activities. The Airport's plows, other winter equipment, and grounds maintenance vehicles are stored in the Snow Removal Equipment (SRE) Building.

The City of Redmond provides personnel to meet RDM's aircraft rescue and firefighting (ARFF) requirements. On-duty firefighters, ARFF vehicles, and associated activities are housed in a dedicated facility at RDM.

GENERAL AVIATION FACILITIES

One fixed-base operator (FBO) offers services such as ground handling, aircraft maintenance, hangar rental, fueling, and pilot/passenger facilities to support GA activity at RDM. The Airport has box hangars and T-hangars to store GA aircraft.

CARGO

Cargo facilities are made up of hangars that RDM leases and adjacent areas of the aircraft ramp/apron.

USFS

The USFS leases space to operate the Redmond Air Center, a firefighting facility protecting areas in Oregon, Washington, and Alaska. The Air Center is a hub of USFS firefighting operations, such as training and dispatching, as well as an incident support base for Federal Emergency Management Agency (FEMA) efforts in the event of a natural disaster in the Pacific Northwest.

PLAN SCOPE

The facilities described above include buildings and areas in which RDM has direct control of waste management and others in which RDM has influence but not direct control. According to FAA guidance, areas over which RDM has "direct control" or "influence" should be included in the Recycling, Reuse, and Waste Reduction Plan; areas outside Airport control or influence may be excluded. The Airport has direct control over operations and activities related to waste management in these areas:

- ✓ Passenger Terminal Building
    - public use spaces
    - airport administration offices
    - other staff work areas
- ✓ Airport SRE Building
- ✓ Airport maintenance activities

In addition, RDM can influence the management of waste and recyclables in tenant spaces through lease agreements and contracts, including:

- ✓ Passenger Terminal Building
    - TSA spaces
    - Airline leased areas
      (including ticketing counters, offices, breakrooms, and deplaned waste)
    - Rental car tenant areas
    - Retail areas and bar/restaurant
- ✓ FBO Building (leased by RDM)
- ✓ Aircraft hangars (leased by RDM)
- ✓ USFS facilities (leased by RDM)
- ✓ ARFF building (coordination with City of Redmond)

The Airport does not have control or influence over waste management in the FAA Air Traffic Control Tower (ATCT) nor areas adjacent to Airport property controlled by neighboring businesses and property owners; therefore, they are excluded from this plan.

2. EXISTING PROGRAM

A. DRIVERS

The Airport established its recycling program to reduce the quantity of material disposed of in the landfill and to conserve resources, including financial resources. The Airport staff's commitment and practices drive the program; it is supported by local recycling infrastructure.

B. ALIGNMENT WITH LOCAL PROGRAMS

The City, who owns and operates RDM, contracts with a waste hauling contractor to provide waste and recycling collection services for residents, multifamily units, and commercial businesses. RDM's program aligns with the City's efforts; RDM recycles all the material types collected by the City's contractor.

C. INFRASTRUCTURE

Employees, tenants, and passengers have access to a network of trash cans and recycling stations in the terminal. In general, there are many trash cans throughout the building and a few recycling stations in specific locations. The recycling stations and the garbage cans are lined/fitted with bags.

In the ticketing lobby and airline counter area, there are tall round, metal garbage cans with round openings in the lids (Figure 5). These garbage cans are also available at the entrance to the security screening checkpoint (Figure 6), in the baggage claim and meeter / greeter space (Figures 7 and 8), and throughout the sterile area, including in the holdroom (Figure 9) and atrium (Figures 10 and 11).

Figure 5 : Garbage cans in ticketing lobby

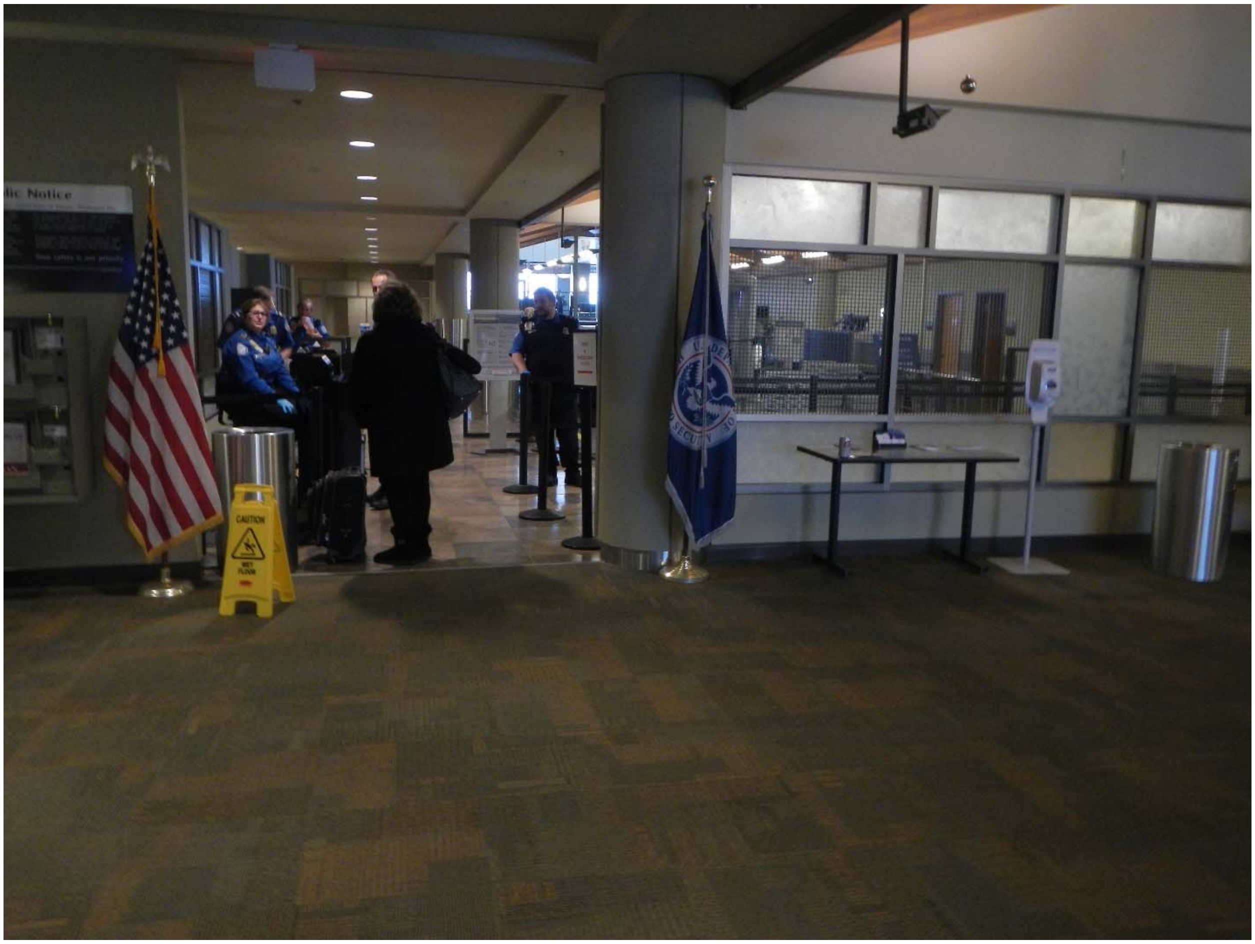


Figure 6 : Garbage cans at entrance to security screening checkpoint

Figure 7 : Garbage cans in baggage claim

Figure 8 : Garbage cans in meeter / greeter area

Figure 9 : Garbage cans in holdroom

Figure 10 : Garbage can in atrium near restaurant

Figure 11 : Garbage can in atrium

Recycling stations, conjoined units with four labeled compartments, are positioned in four locations within the non-sterile and sterile areas: in the security queuing area, at the base of the stairs leading to the atrium (Figure 12), within the atrium seating area near the restaurant (Figure 13), and in the meeter/greeter area near baggage claim (Figure 14).

Figure 12 : Recycling station in holdroom area, near stairs to atrium

Figure 13 : Recycling station in atrium, near restaurant

Figure 14: Recycling station in meeter/greeter area near baggage claim

At the curbside entrances to and exits from the terminal, there are large garbage cans featuring hoods with large openings (Figure 15).

Figure 15 : Curbside garbage can

The terminal restrooms feature paper towel dispensers and air hand dryers (Figure 16), with garbage cans positioned below the paper towel dispensers and small bins located in each toilet stall.

Figure 16 : Terminal restrooms offer both hand dryers and paper towel dispensers

Drinking fountains are available near the restrooms throughout the terminal; RDM has installed one water bottle refill station in the sterile area (Figure 17).

Figure 17 : Water bottle filling station and drinking fountain in holdroom

The restaurant kitchen and back of house area include space for food preparation, dishwashing, storage, and other activities. Space in this area is limited. Garbage is collected in a large container (Figure 18).

Figure 18 : Restaurant back of house area, including garbage can

Glass, plastic bottles, and cans are taken to the recycling station located in the atrium. Restaurant staff break down cardboard boxes and stack them throughout the day (Figure 19); they carry these to the terminal cardboard dumpster as needed to clear the space and at the end of the day.

Figure 19 : Restaurant collection of cardboard for recycling

The restaurant offers paper carryout containers, and restaurant employees use refillable water bottles. The retail areas have small trash cans near the register, and retail employees use the terminal recycling stations for paper, plastic bottles, cans, and glass.

In Alaska Air's ticketing area, each station has space for a small trash can. The cargo desk also has a small trash can (Figure 20). The airline's office/breakroom space has two large trash cans (Figure 21); a low, squat recycling bin for paper (Figure 22); and a container for cans and plastic bottles (Figure 23).

Figure 20 : Garbage can in airline cargo area

Figure 21 : Garbage can in airline breakroom area

Figure 22 : Recycling bin in airline office area

Figure 23 : Garbage and recycling collection in airline office area

The Delta ticket counter also has a space for a “trash box” (Figure 24). In the Delta offices, there are small garbage cans by the desks (Figure 25), and the area also has a low, squat recycling bin for paper (Figure 26).

Figure 24 : Airline ticketing counter with "trash box"

Figure 25 : Garbage can in airline office

Figure 26 : Recycling bin in airline office

In the airline baggage handling area, a space shared by all the airlines, there are small trash cans located by the vending machine (Figure 27).

Figure 27 : Vending machine and garbage cans in baggage handling area

The car rental offices have containers for trash, and some use the terminal recycling stations for paper, plastic bottles, cans, and glass.

In the administration offices, there are in-cabinet waste and recycling bins in the breakroom/kitchenette (Figure 28) and in the conference room (Figure 29).

Figure 28 : In-cabinet garbage and recycling bins in Airport administration breakroom

Figure 29 : In-cabinet garbage and recycling bins in Airport conference room

In the copy room, there is one bin each for garbage and recycling (Figures 30 and 31), as well as a small paper shredder.

Figure 30 : Airport administration copy room

Figure 31 : Garbage can and recycling bin in Airport administration copy room

Each office/desk has a garbage can and some employees use copy paper box lids to collect paper for recycling (Figures 32 and 33).

Figure 32 : Garbage can in Airport administration office

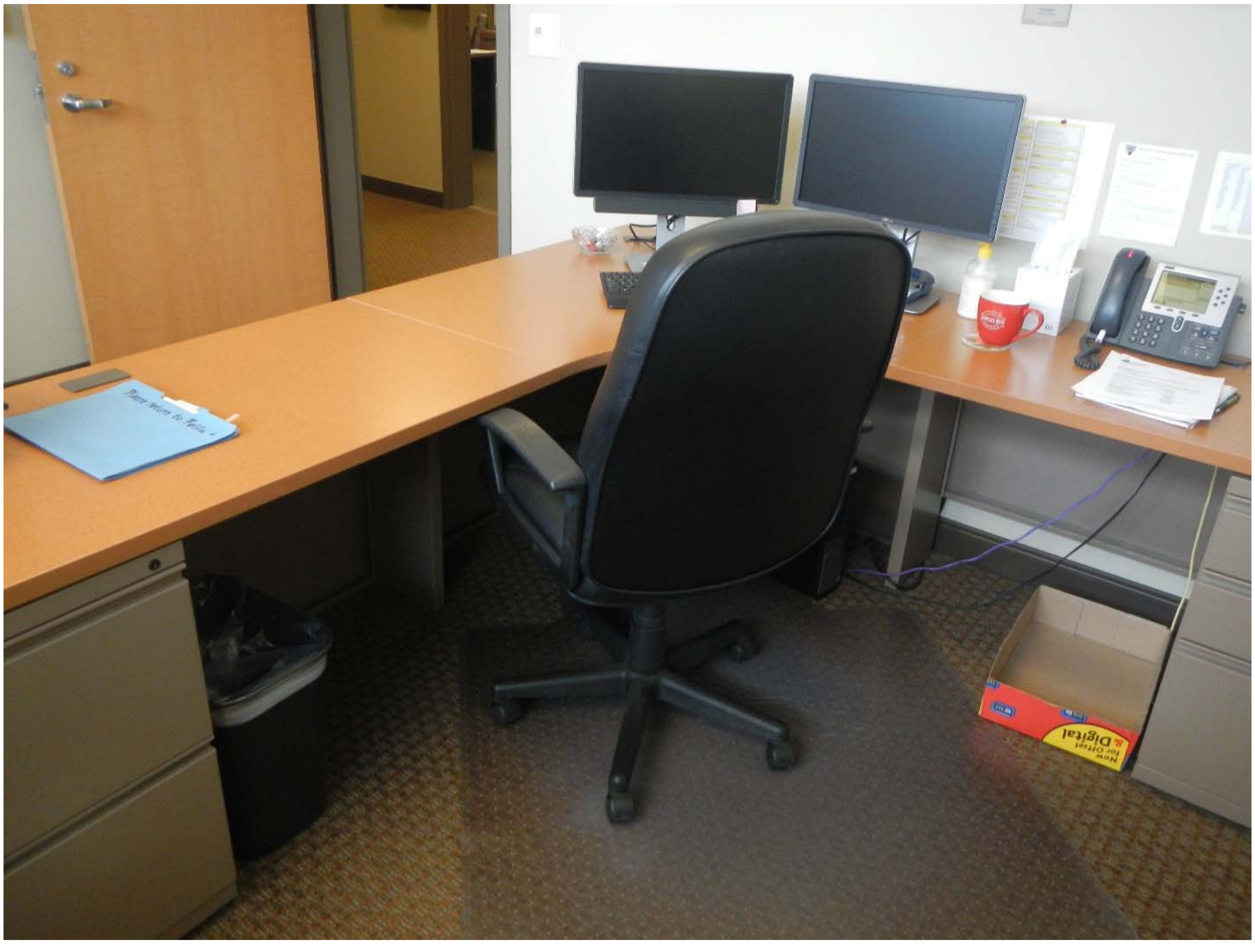


Figure 33 : Garbage can and box lid for recycling in Airport administration office

The labels on recycling stations in the terminal and on the bins in the administration offices are the primary method to convey messaging about and instructions related to recycling. The recycling stations in the terminal are labeled for plastic, glass, paper, and cans with graphics depicting a plastic bottle, glass bottle, stack of paper and envelope, and aluminum can, respectively (Figure 34). Additional signage posted on the recycling bins alerts passengers that there is a “Water bottle refill station in the boarding area” (Figure 35).

Figure 34: Recycling station labeling

Figure 35 : Recycling station sign alerting passengers about water bottle refill station located in the boarding area (holdroom)

RDM has also installed signage in the restrooms in the non-sterile area encouraging passengers to “Reuse your water bottle” (Figures 36 and 37). These signs instruct passengers to empty their bottles pre-security and refill them post-security at the drinking fountain in the boarding area.

Figure 36 : Restroom signage encouraging passengers to reuse water bottles

Figure 37 : Restroom signage encouraging passengers to reuse water bottles (closeup)

At the Maintenance building, there are several garbage cans, including in the supervisor's office and in the breakroom. The ARFF facility has carts for waste and recyclable materials (Figure 38), and there are also several recycling bins and trash cans (Figures 39 and 40).

Figure 38: Carts for garbage and recyclables at ARFF facility

Figure 39 : Garbage cans or recycling bins in ARFF building kitchen

Figure 40 : Container for recycling beverage containers in ARFF building

A trash dumpster, cardboard dumpster, and cart for recyclables are in the GA area (Figure 41).

Figure 41 : Dumpsters and carts located in GA area

The FBO terminal has several garbage cans but no recycling bins.

The carts, dumpster, and compactor used to consolidate waste and recyclables materials generated in the terminal are positioned within a landside fenced enclosure adjacent to the terminal building (Figure 42). The four, 95-gallon carts are used for comingled recyclables, the six-yard dumpster for cardboard, and the 20-yard compactor for waste. Containers for glass recycling are also located in the enclosure. A second 2-yard waste dumpster is in a landside enclosure near the terminal smoking area. The waste and recycling hauler provides these containers. Access to the enclosure is restricted to specific airport staff and the contractors' collection crews. The contractor uses its own vehicles to collect the waste and recyclable materials from RDM and transfer them for processing or disposal.

Figure 42 : Carts and compactor in fenced enclosure

Waste materials (food waste and other MSW) are collected from the dumpster weekly and the compactor biweekly. These materials are transported for disposal at Deschutes County's Knott Landfill. Recyclable materials (comingled paper, plastic, and aluminum, as well as segregated glass and cardboard) are collected weekly and transported to a recycling facility at the landfill where they are sorted, compressed into bales, marketed, and sold.

D. OPERATION AND MAINTENANCE REQUIREMENTS / ROLES AND RESPONSIBILITIES

RDM's recycling program is maintained by facilities staff, with support from Airport management personnel.

The facilities manager is primarily responsible for the recycling program, including directing housekeeping activities, adjusting the program, purchasing custodial supplies, and communicating with RDM's business coordinator about collection services.

Airport facilities staff includes six full time personnel. Facilities staff are responsible for custodial activities in specific buildings and areas, including collecting waste and recyclables from cans and bins and transferring these materials to the appropriate dumpsters. Airport facilities staff are responsible for custodial activities:

- ✓ in public spaces of the terminal
- ✓ in TSA areas
- ✓ in RDM offices
- ✓ in the SRE building
- ✓ in other Airport spaces
- ✓ on the airfield
- ✓ in GA hangars leased through Airport Administration

The Airport's terminal tenants (restaurant and shop, rental car companies, and airlines) and tenants in some of the outlying buildings (FBO and one GA hangar) are responsible for custodial activities in their areas including transferring waste to the appropriate dumpsters. The operators of the FBO, ATCT, and ARFF building are each responsible for securing their own waste and recycling services.

The Airport's business coordinator is responsible for communicating with the collection service providers and tracking program invoices. The aviation program manager is responsible for supporting the program through allocation of resources (financial and other) and for coordinating tenant leases.

High County Disposal (formerly High Desert Disposal) is the primary waste and recycling hauling contractor for RDM. High County Disposal collects garbage from RDM's dumpsters and transports this material to a transfer station for disposal at the Deschutes County's Knott Landfill. The transfer station is located approximately five miles south of the Airport, and the landfill is approximately 20 miles south of the Airport in Bend, Oregon.

High County Disposal also collects recyclable materials from RDM and transports them to one of the county's recycling facilities (located at the transfer station and the landfill) for processing. The Airport is also serviced by the parent company of High County Disposal, Bend Garbage & Recycling, for the collection of shredded paper and waste syringes. Deschutes Recycling, a sister company to High County Disposal, accepts yard waste for composting and sells compost to the public. The area does not appear to have a commercial food waste compost facility.

E. CURRENT WASTE REDUCTION, REUSE, AND RECYCLING EFFORTS

WASTE REDUCTION

Also called "waste minimization," waste reduction refers to reducing the volume of waste produced at its source. This can be accomplished through changing habits and practices, such as printing and purchasing. RDM currently employs the following practices to reduce the total amount of waste generated:

- ✓ Double sided printing in administration offices
- ✓ Email and internal websites for inter-office communication
- ✓ Shared drives for storage of documents
- ✓ Computer software to receive fax messages
- ✓ On-screen print preview and PDF printer or other electronic printing
- ✓ Outsourcing large print jobs

REUSE

In a waste management context, reuse refers to using materials and items more than once and as many times as possible before disposal. Reuse can include using items and materials for the original purpose or repurposing something for a different use. Reuse can require purchasing durable materials and items instead of disposable or single use options.

The Airport currently reuses:

- ✓ Ceramic coffee mugs and durable silverware, plates, bowls, and cups (instead of plastic, paper, or Styrofoam) in Administration breakroom
- ✓ Office supplies, including inter-office envelopes
- ✓ Towels/rags in maintenance areas
- ✓ Office furniture

RECYCLING

Using the infrastructure and resources described above, RDM currently recycles three streams: cardboard; glass; and comingled paper, plastic bottles, and aluminum cans.

Terminal tenants generate most of the cardboard in the form of shipping boxes. The paper stream includes printer paper, mail, envelopes, and other paper from the Airport Administration offices as well as paper items, such as newspapers and magazines, collected in the public areas of the passenger terminal. The plastic, aluminum, and glass streams are primarily made up of beverage containers, collected from the public areas of the passenger terminal as well as the administration offices and restaurant. Some plastic bottles and aluminum cans may be collected by employees and tenants for refund under the State's bottle bill.

CONSTRUCTION AND DEMOLITION DEBRIS, GREEN WASTE, AND OTHER WASTE

The Airport reuses and recycles the waste generated during construction projects where possible. For example, asphalt millings from a runway project were used to improve the perimeter road. Removed lighting fixtures were donated for reuse. The Airport works with the City Department of Public Works and follows the City's surplus goods policy/practices. Green waste generated from the maintenance of the property is managed on-site where possible. The Airport collects hazardous waste; used oil and filters; batteries; paint; used tires; and scrap metal for beneficial reuse, recycling, or return to supplier programs.

TENANT EFFORTS

In addition to the recycling program operated by RDM, tenants at the Airport may be recycling on their own. In some instances, these tenants may be using the Airport's bins, carts, dumpsters, and compactor.

F. TRACKING AND PERFORMANCE

The Airport does not currently track overall waste generation, recycled material volume, or other metrics. At present, RDM does not have specific waste or recycling objectives, targets, or goals.

3. WASTE AUDIT

RDM staff provided information about:

- ✓ airport buildings and facilities
- ✓ areas that generate waste
- ✓ the types of waste generated in each area
- ✓ the materials that can be recycled under the current program.

Facilities staff have informally observed passenger and employee waste and recycling related behaviors and, for this document, described generally how waste flows through the facility. The staff also described waste and recycling collection and hauling practices.

The consultant evaluated Airport information and records as well as aviation industry waste and recycling trends to identify the source, composition, and quantity of waste generated at RDM, including areas under RDM's direct control or influence. The consultant then used this information to identify opportunities to improve and monitor program effectiveness.

A. QUANTITY AND SOURCES

According to invoices provided by Airport staff, Bend Garbage & Recycling collects a 35-gallon roll cart of shredded paper approximately annually. Using conversion factors from the United States Environmental Protection Agency (EPA), this equates to approximately 8.5 pounds of paper.

According to invoices provided by Airport staff, the waste compactor serviced by High County Disposal has a capacity of 20 yards and is collected every other week. Assuming a load factor of 75 percent and based on conversion factors from the EPA, each load is estimated to contain 15 cubic yards or 4 tons of compacted municipal solid waste each collection. This totals approximately 105 tons a year. The Airport also uses a two-yard dumpster for waste; this container is serviced weekly. Based on the same load and conversion factors, this smaller container is estimated to contain 400 pounds of waste each collection for a total of 10 tons a year. Together, these dumpsters represent an annual generation of 115 tons of waste each year.

The invoices do not detail the size or collection frequency for the recycling carts and dumpsters. A representative from High County Disposal provided the following information about RDM's other waste and recycling containers' capacities and service schedules:

- ✓ Cardboard: one 6-yard dumpster; collected weekly
- ✓ Comingled recyclables: four, 95-gallon carts; collected weekly
- ✓ Glass: collected weekly

Based on a 75 percent load factor and conversion factors from the EPA, the consultant estimated that RDM recycles approximately 10 tons of cardboard and 10 tons of commingled recyclables. To estimate the annual quantity of glass recycled, information about the capacity of the glass recycling containers and their collection schedule is needed.

According to the invoices, the Airport also rented two 30-yard dumpsters for airfield waste collection and scrap metal collection in 2017. The quantity of waste generated from these occasional collection events is not included in the Airport's baseline annual generation.

Based on industry averages, the overall contribution of waste and recyclables from various areas and activities at RDM is likely similar to the distribution shown in Table 1.

Table 1: Estimated Generation at RDM by Area/Activity

RDM Area/Activity	Estimated Percent	Estimated Weight
Deplaned	20%	27 tons
Other Airline	24%	32 tons
Administration	3%	4 tons
Public Areas	35%	48 tons
Concessions	18%	24 tons
Total	100%	135 tons

Based on this distribution, programs that focus on the airlines and public areas may represent the best opportunities to reduce waste generation and increase landfill diversion. A physical waste sort could provide more detailed information about the amount and proportion of waste generated in total and by each area, activity, tenant, etc.

Based on the waste and recycling data presented above, the Airport's current recycling rate is about 15 percent.

B. COMPOSITION

Based on the activities taking place at RDM, a varied waste stream can be expected. According to industry case studies and previous waste planning projects, an airport's waste stream is approximately 40 percent recyclable, 35 percent compostable, and 25 percent waste that cannot be recycled or composted due to current technologies and, as a result, must be placed in a landfill.

Table 2 lists each area included in the scope of this plan and the type(s) of waste likely generated there.

Table 2: Redmond Municipal Airport Waste by Area and Material

Area | Material	Office Paper	Newspapers	Magazines	Plastic	Aluminum	Cardboard	Glass	Food Waste	Paper Products	Liquids	Toiletries	Packaging	Styrofoam	Metals	Deplaned Waste	Green / Yard Waste	Construction and Demolition Waste	Other Waste
Airline Terminal Building																		
Public passenger areas Curbs, ticketing lobby, restrooms, security screening queuing area, sterile gate areas, public "meet and greet" spaces, baggage claim area		x	x	x	x			x	x	x	x	x						x
Tenant areas Shops, bar/restaurant, and associated activities	x	x	x	x	x	x	x	x	x	x		x						x
Airline areas Offices, ticketing counters, gate stations, breakrooms, underwing services, and deplaned waste	x	x	x	x	x	x		x	x	x		x			x			x
Rental Car areas Offices, counters, return areas, service areas, breakrooms	x			x	x			x	x	x								x
TSA Spaces	x	x	x	X	X			x	x	x	x	x						x
Airport Administration Offices	x	x	x	x	x	x		x	x			x						x
ARFF Building	x	x	x	x	x	x	x	x	x			x						
SRE Building	x	x	x	x	x	x		x	x						x	x	x	x
Airport Maintenance Activities															x	x	x	x

A physical waste sort could provide more detailed information about the specific composition of waste at RDM. This information may include:

- ✓ the types of items included in each general category
- ✓ the contamination rate of the recycling stream (items that are not recyclable in the recycling bins)
- ✓ the recovery rate for recycling (the proportion of recyclable items that are segregated properly).

The data from a waste audit can also be used to identify opportunities to improve the composition of the waste stream (by item substitution, by improving recycling to reduce the volume of waste, etc.).

The following sections describe in more detail some of the waste and recyclable materials generated at an airport like RDM: toiletries, food and beverages at security screening, and liquids throughout the facility.

TOILETRIES, FOOD, AND BEVERAGES - TSA RESTRICTIONS

The TSA restricts the volume of liquids, gels and aerosols that can be carried onto an aircraft. Passengers are allowed three-ounce containers of toiletries in one one-quart baggie (3-1-1) in their carry-on luggage. Even though these restrictions have been in place for longer than 10 years, toiletries, beverages, and food items that do not meet the requirements are regularly found in passenger luggage during security screening.

When these items are found, the TSA gives passengers three options: pack the item in a checked bag, give the item to a non-traveling family member or friend, or forfeit the item. By law, the TSA cannot retain any items removed from passenger luggage, so items that are not repacked or handed off end up in the trash. In addition, when a restricted item is discovered in a passenger's carry-on or bag, the passenger may be subject to additional screening, which requires extra time and can interrupt the flow at a security screening checkpoint.

Some problematic items that end up in the trash at security checkpoints include: bottled water, other bottled or canned beverages, toothpaste (larger than travel size), shampoo and/or conditioner (larger than three ounces), sunscreen, and aloe gel. Some other, less obvious unallowable items are peanut butter, yogurt, applesauce, and maple syrup.

It is expected that the garbage cans and recycling station located in the security queuing area receive a fair amount of liquids and beverage containers due to TSA restrictions. These items end up in the waste stream where the liquids are difficult to manage and the containers cannot be recycled. Liquids add significant weight to the waste stream, contaminate other materials like paper, and may be rejected by a recycler, which can result in them being landfilled.

LIQUIDS

Liquids contaminate and degrade other materials within the recycling stream and add weight to recycling or waste streams where they are found. In some cases, liquids are thrown away in their containers, which means the recyclable material found in water bottles, aluminum soda cans, and plastic beverage containers is not captured for recycling.

C. PURCHASES

The Airport does not currently track the quantity and type of disposable items and supplies purchased for the facility. This information could provide insight on some of the materials coming into the Airport which will go back out as waste (other materials are brought on-site by passengers, employees, and vendors). The purchase list may include:

- ✓ items that have reusable or recyclable alternatives (foam cups)
- ✓ some items which could be eliminated (by converting paper forms to digital to reduce paper waste generated)
- ✓ some which indicate scale of the activity at the Airport (paper towel and garbage bags).

4. REVIEW OF WASTE MANAGEMENT CONTRACTS

As noted in Section 1, the FMRA lists the review of waste management contracts as an element of addressing solid waste recycling at an airport. The FAA memorandum titled “Guidance on Airport Recycling, Reuse, and Waste Reduction Plans” explains that the purpose of reviewing these contracts is to “identify opportunities for improving (waste) program scope and efficiency, as well as identify constraints.”

In general, the Airport’s contracts and leases address housekeeping requirements and related expectations for managing trash and provide limited information about recycling. These contracts and leases do not necessarily impede recycling or other waste management strategies; however, they do not explicitly require conformance with or support of the Airport’s recycling and related efforts. The following sections describe the content of various Airport contracts related to waste and recycling.

A. CUSTODIAL AND WASTE HAULING CONTRACTS

RDM does not contract for custodial services for the areas under airport control; these areas are maintained by City employees.

The City has an exclusive franchise agreement established by ordinance with High County Disposal for the collection of waste and recyclable materials. The City’s solid waste franchise ordinance outlines the responsibilities of the collection contractor, including:

- ✓ Dispose of waste at site owned and/or operated by Deschutes County
- ✓ Provide opportunity to recycle in accordance with State law and the Department of Environmental Quality (DEQ) rules
- ✓ Provide necessary collection vehicles, containers, facilities, and personnel

The Airport is also serviced by Bend Garbage & Recycling, the parent company of High County Disposal. The Airport does not have contractual agreements with High County Disposal or Bend Garbage & Recycling. The Airport is serviced by these companies under the City’s franchise agreement and ordinance.

B. TENANT LEASES AND SERVICE CONTRACTS

Two of the Airport’s agreements with tenant and service providers reference recycling or recycled products; however, the rest have basic requirements pertaining to trash removal and janitorial activities in leased areas. The Airport’s template T-hangar lease agreement (dated 2016) specifies that the hangar tenant will perform or pay for housekeeping services including trash collection and removal in the leased space. The Airport uses a template titled, “Lease for Aeronautical Use Improvements.” The lease template requires the tenant to perform maintenance including cleaning and trash collection and removal to keep the property clean and orderly.

An example agreement titled, “On-airport Rental Car Concession,” dated October 2016 stipulates that the rental car company will provide janitorial and cleaning services and supplies for the leased spaces. It also requires that the rental car company provide for “handling and disposal of all trash, garbage, recyclable material, and other refuse” generated in the tenant’s areas. This agreement explains that the City (Airport) will provide receptacles for these materials for the tenant’s use. Through the lease agreement, the rental car tenant agrees to bear any reasonable costs “associated with the implementation of any existing or future recycling program.” The tenant can also propose an alternative recycling plan for the City’s approval. The agreement also commits the tenant to undertaking “reasonable steps to minimize the impact of their operation on the environment.” Because this agreement is more recent than the other described in this section, it’s provisions about recycling may serve as an example for future contracts.

The Airport’s lease with one of the FBOs (dated July 2015) requires the operator to “make suitable arrangements for the storage, collection, and removal of all trash, garbage and other refuse resulting from (their) activities…in accordance with any applicable laws, ordinances, and rules and regulations of the Airport.” This lease does not specifically mention recycling. The 2003 agreement between these parties required the tenant to provide “proper containers for trash and garbage” and to “keep the lease premises free and clear of rubbish, debris, and litter at all times.”

An example agreement for commercial passenger air service dated July 2014 requires the airline to provide “arrangement for the adequate, sanitary handling and disposal of all trash, garbage, aircraft sewage, and other refuse.” This agreement explains that the City (Airport) will provide “covered metal receptacles” for these materials. No reference is made to recycling.

A 2014 addendum to the FBO’s 2010 agreement with a tenant stipulates that the tenant will provide containers for trash and garbage. Recycling is not mentioned.

The City has an intergovernmental agreement with one of the County’s fire protection organizations for ARFF services. This agreement does not specifically address waste (or recycling); however, it does detail that the organization is responsible for the maintenance of the Airport Fire Station.

The Airport has two agreements with a food and beverage service provider. The first, for food and beverage concession, specifies that the City (Airport) “will provide a common-use trash compactor or dumpsters with scheduled trash collection for the Airport tenants and concessionaries.” The concessionaire agrees to provide arrangement for the handling and disposal of trash, garbage, and other refuse and to maintain temporary collection areas in a sanitary and presentable condition. The concessionaire is required to handle waste materials to “prevent the presence of rodents” and to keep all garbage materials in durable, pest-proof, covered or lidded containers that are easily cleaned. When waste materials are transported within the Terminal, the concessionaire is required to package them in containers that prevent leaks and use only the routes established by the City (Airport). This agreement also details the concessionaire’s responsibilities as related to cooking oil/liquid grease.

The Airport's second agreement with the food and beverage service provider covers retail, coffee, and snack food concession. This second agreement includes the same language regarding use of the compactors and dumpsters, maintaining leased areas in a sanitary condition, and movement of materials. Neither agreement describes the recycling program.

The Airport's 2001 agreement with the USFS (amended in 2004 and 2011) stipulates that the tenant pays rent based on costs for janitorial services and garbage collection and removal.

The Airport's agreement with a GA tenant/aviation business requires the tenant to maintain the premises "in a neat, clean, safe, and sanitary condition" and to pay charges for utilities such as garbage collection and removal and janitorial work.

The Airport's contract with a parking management company, dated June 2011, prohibits this company from accumulating trash or waste material and requires the company to promptly dispose of materials daily. This agreement does include a clause in conformance to State law that requires the company to use recycled material where applicable, if the recycled product:

- ✓ is available
- ✓ meets standards
- ✓ can substitute for a non-recycled product
- ✓ cost does not exceed the cost of the non-recycled by more than five percent.

This agreement was the only one reviewed under this project that discussed recycled products; it may serve as an example for future contracts.

The parking agreement also includes a mechanism for the City (Airport) to reimburse the company for cost and expenses according to an operating budget; however, the line item for cleaning and janitorial supplies was listed for zero dollars in the copy provided for review under this project.

Two GA hangar leases dated 2008 and 2005, respectively, contain the same language: "Tenant shall provide proper containers for trash and garbage and shall keep the leased premises free and clear of rubbish, debris, and litter at all times." This is likely standard GA hangar tenant lease language, which does not include information about recycling.

A 2002 U.S. Government Lease for Real Property leased space at the Airport for use by the TSA. This agreement describes the services provided by the Airport, including trash removal and janitorial service and supplies. It also outlines other requirements including:

- ✓ cleaning to be completed during Airport hours
- ✓ rent to be adjusted annually based on actual janitorial costs
- ✓ the Airport to maintain the area in a clean condition and provide supplies and equipment

- ✓ daily emptying of trash receptacles, disposal of trash and garbage, and cleaning of cans used for collection of waste

C. EXPIRING LEASES AND CONTRACTS

Specific information regarding the expiration, extension and/or renewal dates of the Airport's numerous leases was not reviewed under this project. As outlined in the FAA guidance memo, "this information can signal the Airport's next opportunity to add recycling, reuse, and waste reduction objectives to existing leases and contracts."

D. FUNDING

Waste and recycling collection are funded in RDM's operating budget. RDM does not currently receive payment or rebates for recycled materials.

5. RECYCLING FEASIBILITY

Many factors impact the feasibility of recycling at RDM; some are universal, and others, specific to the facility. The following sections describe the more influential of these factors.

A. COMMITMENT AND SUPPORT

The willingness of RDM and its contractors and tenants to commit to and support the facility's recycling program are critical to the success of such a program. Without the commitment of resources such as funding, labor and time, space, and access to secure areas, a waste management program could struggle.

AIRPORT POLICY AND CONTRACTOR DEDICATION

RDM's administration has supported the recycling program in the past, and it is expected that this will continue in the foreseeable future. The administration has implemented other sustainability projects, for example, as a solar energy installation. Based on the resources allocated to these programs, the Airport Committee and City of Redmond appear to generally support recycling, practical waste management, and sustainable operations.

The City's waste management contractor is "committed to providing outstanding customer service, being recognized as leaders in our industry, and maintaining a connection (the) community of Central Oregon by supporting charitable endeavors." High Country Disposal's goal is to "continue to be on the forefront offering new programs and ways for our customers to recycle more." These commitments and goals align with continued support of the City and the Airport's recycling programs.

AIRLINE POLICIES

All four airlines that operate at RDM have established sustainability programs that include elements of waste and recycling. At least one of the airlines serving RDM separates and recycles materials deplaned from commercial service flights.

American Airlines has implemented recycling programs on the ground and in the skies. American recycles in back offices and breakrooms at their major hub at Dallas/Fort Worth International Airport, at maintenance centers, and in other offices/employee work areas. According to their website, the airline introduced the industry's first onboard recycling program and recycles aluminum cans, paper, and plastic in-flight.

During information interviews, Alaska Air staff and contractors described the process for separating recyclables in flight and during cabin cleaning activities. Alaska Airlines' environmental strategy includes working to reduce waste from flights and other facilities, including recycling and composting of coffee grounds. Alaska's 2015 goal was to increase recycling capture rate on flights from 79 percent to 85 percent. The airline specifically mentions that their recycling goals are "limited by local infrastructure as many airports and municipalities have different protocols and capabilities for co-mingled recycling." Alaska has worked with a reuse company to salvage leather from old plane seats and reuse the material in consumer goods. The airline is also working with inflight crews to keep unused disposable items such as cups and napkins on aircraft instead of returning them to the catering carts, where they are thrown away in the unstocking process. Alaska's goal is to ensure all inflight service ware items are recyclable, reusable, and/or sustainably sourced. Alaska has also taken steps to reduce dependence on printed paper using iPads, iPhones, and tailored applications ("apps") in their operations.

Per corporate policy, Delta is "committed to minimizing waste streams through diversion and re-use, waste, recycling programs, and (waste reduction)." Delta has been working to increase the number of cities where they recycle and the volume of material collected. In addition, they track employee recycling at the headquarters campus in Atlanta and upcycle life vests, carpet, and leather seat covers. Aboard Delta flights, single stream materials, including plastic, aluminum, and paper, are collected by flight attendants in designated bags. These materials are collected by cabin service and transported to designated recycling containers. Empty cans and bottles left in the beverage carts are recycled by Delta's catering partners.

United Airlines is "committed to operating sustainably and responsibly" and has recycled over 28 million pounds of aluminum cans, paper, and plastic from flights and facilities. In 2014, United began to replace its hot beverage cups with fully recyclable alternatives made from recycled plastic water bottles.

Offering recycling for deplaned waste at RDM aligns the Airport with its airline partners.

B. TECHNICAL AND ECONOMIC FACTORS

LOCAL MARKETS AND INFRASTRUCTURE

Markets for recycled materials fluctuate widely based on many factors and interactions. Local waste haulers typically accept materials that can be recycled cost-effectively in the area. Manufacturers purchasing recycled material want it to be predictable and ready for use; therefore, recycling facilities are particular about what materials they accept and prefer materials that are of high value and clean and easy to separate.

The materials listed in Table 3 are accepted under the City's commercial recycling program. As noted above, inclusion in such programs typically indicates that the market and/or infrastructure for these materials is strong. RDM currently recycles all the materials the City's commercial recycling program accepts.

Table 3: Materials Accepted for Residential Curbside Recycling in the City of Tulsa
Recyclable Materials – City of Redmond Commercial Program
Cardboard
Tin and aluminum
Plastic bottles, tubs, and jugs
Mixed paper, newspaper, magazines
Glass
Source: High Country Disposal Commercial Recycling website https://highcountrydisposal.com/services-2/commercial-services/recycling-collection/

Deschutes County operates one landfill and four transfer stations/recycling centers in the Redmond area.

LOGISTICAL CONSIDERATIONS AND CONSTRAINTS

To maintain a recycling program at RDM, certain elements must be in place. These include:

- ✓ a proactive and engaged custodial staff
- ✓ a willing and affordable hauling contractor
- ✓ space for bins, dumpsters, and compactors
- ✓ access to secure areas of the facility (including airside ramps and sterile terminal areas).

At this time, these elements appear unconstrained; additional resources including custodial labor, waste hauling services, space, and airport access are anticipated to be available to support the continuation and/or expansion of the recycling program at RDM.

CONTRACTUAL ISSUES

A detailed evaluation of the Airport's contracts is included in Section 4. Any major contractual issues with maintaining and improving the recycling program at RDM are not anticipated. RDM and the waste and recycling collection contractor will need to continue to collaborate to support the facility's recycling program.

C. RECYCLING, LANDFILL, AND ENERGY-FROM-WASTE FACILITY REQUIREMENTS

The recycling facility and landfill that accept waste from RDM have specific acceptance criteria and requirements. Adherence to these specifications protects the safety of employees handling these materials; the integrity and operation of the equipment and infrastructure used to transfer, sort, and convert these materials; and the value of the recyclable stream. Information provided by High County Disposal indicates that the glass stream collected from the Airport has included contamination (non-glass materials); this presents challenges to recycling this material.

Components that seem recyclable (plastic, glass, or metal parts) comprise some items generated at RDM; however, the recycling facility has specific material standards, so it is important that non-recyclable items are not included in the facility's recycling stream.

Waste items that may be generated at the Airport, but are prohibited at the recycling facility include:

- ✓ Styrofoam
- ✓ Plastic bags
- ✓ Saran wrap
- ✓ Frozen food packaging
- ✓ Plastic clamshells
- ✓ Bakery containers
- ✓ Paper/plastic plates
- ✓ Paper napkins
- ✓ Paper/plastic cups
- ✓ Waxed cardboard
- ✓ Plastic lids and caps
- ✓ Liquid in container
- ✓ Lightbulbs
- ✓ Batteries
- ✓ Other garbage

Waste material that may be generated at RDM but is prohibited by the Deschutes County's Knott Landfill includes hazardous waste, radioactive waste, large batteries, paint, and C&D waste.

Some waste items cannot be recycled or landfilled, for example hazardous waste and chemicals, paint, batteries, and C&D waste. These items must be managed through hazardous waste or universal waste programs or disposed of at a specialized landfill.

COSTS

RDM strives to be as self-sustaining as feasible; therefore, it is imperative that programs implemented and maintained at the facility, including recycling, are as cost-effective as possible.

D. GUIDELINES AND POLICIES

To evaluate RDM's existing recycling plan in the context of local, state, and national requirements, the consultant reviewed federal, State of Oregon, and local waste and recycling regulations and policies/factors.

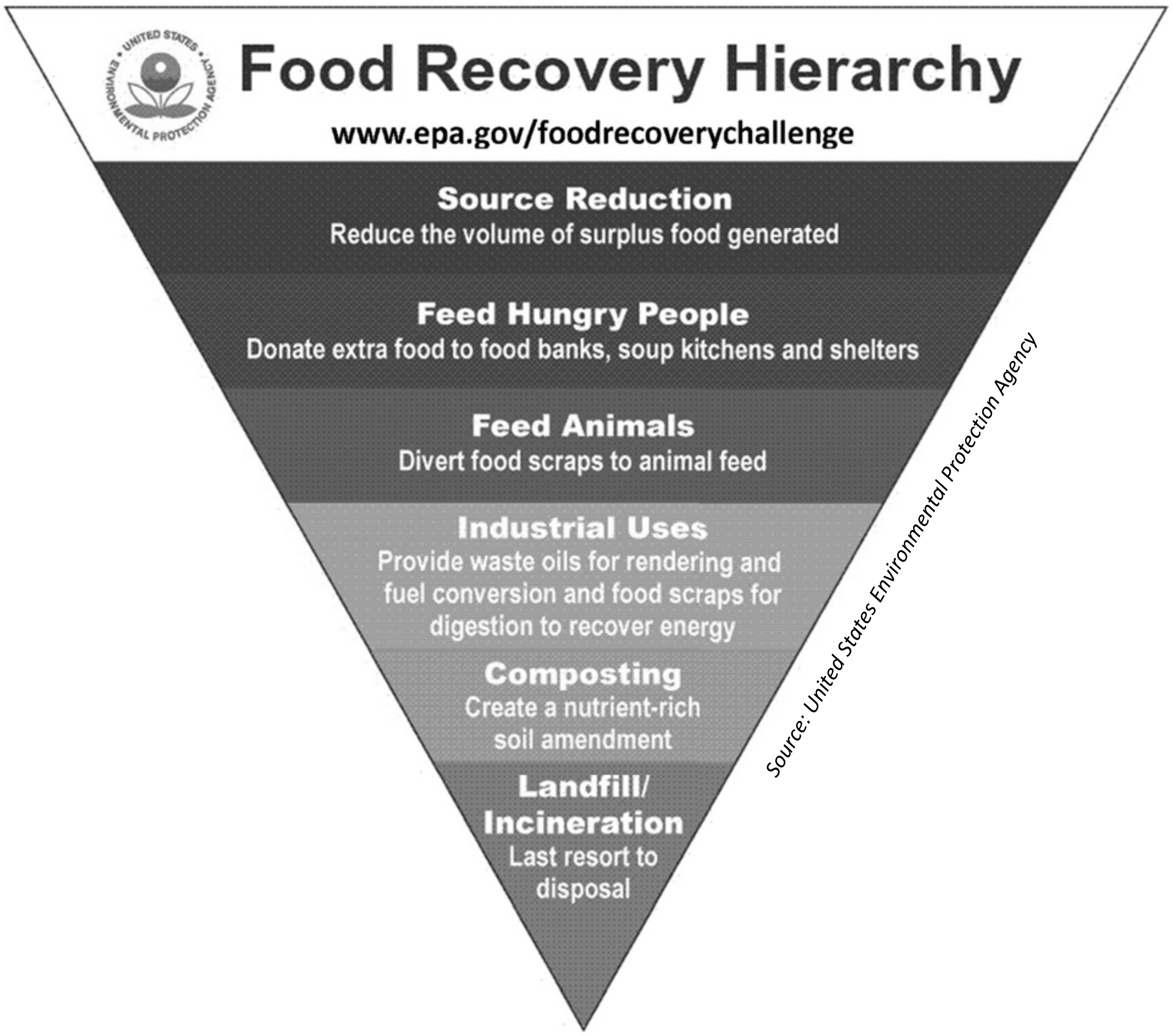
FEDERAL

At the federal level, the United States Environmental Protection Agency (EPA) is responsible for developing a solid waste management program under the Resource Conservation and Recovery Act (RCRA) and related policies and guidance. RCRA provides the framework for management of hazardous and non-hazardous waste. All generators of hazardous waste, including airports, are required to comply with RCRA and all other federal waste laws and regulations.

As described in Section 1, the FAA's definition of "airport planning" was updated in 2012 through FMRA to include planning for recycling and waste minimization. The Airport is required to address solid waste as part of airport master planning. The FAA provides guidance on airport waste and recycling in the September 2014 memo on the topic as well as in a synthesis document prepared in 2013 (both available on the FAA's website).

The EPA has developed a hierarchy of waste management strategies. This hierarchy, shown below, ranks these strategies from most- to least-environmentally preferred and places emphasis on reducing, reusing, and recycling.

In addition to the general waste management hierarchy, the EPA has also developed a preference ranking of management strategies for food waste, as shown below.



STATE

The State of Oregon's bottle bill was the first of its kind in the country and was introduced in 1971 to reduce litter. Under the current form of this law, customers pay a ten-cent deposit when they purchase soft drinks, water, and beer in metal, glass, and plastic bottles and cans. Then, customers return the empty containers to stores and centers to receive a ten-cent refund per container. This bill is administered by the Oregon Liquor Control Commission.

Outside of the bottle bill, the base recycling law is the Opportunity to Recycle Act, first passed in 1983 and last amended in 2015. The DEQ establishes Recycling and Waste Reduction administrative rules to elaborate on the Act and is responsible for regulating cities, counties, and other local governments regarding waste. The DEQ has developed a policy and integrated plan for managing waste materials, *Materials Management in Oregon: 2050 Vision and Framework for Action.*

The Opportunity to Recycle Act prioritizes certain waste management strategies over others in alignment with the hierarchy promoted by the EPA:

- ✓ Reduce
- ✓ Reuse
- ✓ Recycle
- ✓ Compost
- ✓ Energy Recovery
- ✓ Disposal

The state's material recovery rate goal is 52 percent for 2020 and 55 percent for 2025. In addition, the state's recovery rate goals for food waste, plastic waste, and carpet waste are all 25 percent by 2020. Each county (and some metropolitan areas) set their own voluntary recovery goals by statute.

To make progress under the 2050 Vision, cities of a certain size or within a certain region must implement three to five listed reduction and reuse elements. All other cities must implement a minimum number of recycling program elements, based on their size and location, chosen from the thirteen options listed in Senate Bill 263. The state's laws and plans allow the local units to implement programs to meet the statewide mandatory and individual voluntary goals.

LOCAL

Deschutes County operates one landfill, Knott Landfill, Recycling, and Transfer Facility, which is expected to reach capacity in 2029. The County has set a goal to recover 45 percent of waste generated by 2025 to reduce the amount disposed of in the landfill. As of 2018, the County has formed an advisory committee, hired a consultant, and is preparing a comprehensive solid waste management plan. The final plan may provide additional guidance and support for recycling in Redmond and at RDM.

According to the *Code of the City of Redmond*, the City's goal is to make RDM the "best airport of its size in the country." Sections 2.550 through 2.570 of the City's code describe the requirements for FBOs, airlines, charter and taxi flight operators, aircraft and parts dealer, and provider of agricultural services (crop dusting). The code also defines regulations for petroleum products sold and used at the facility, for leasing space, and for prohibiting unauthorized business as well as other aspects of the Airport's operation. The sole mention of waste or recycling appears in the section on commercial vehicle operations: drivers of commercial vehicles (car services, taxis, and courtesy vehicles) are to dispose of trash in the receptacles located on the sidewalk in the taxi parking area. Sections 2.590 through 2.588 outline the roles and responsibilities of the Airport Committee.

The *Code of the City of Redmond* includes information about garbage service in Sections 4.400 through 4.420. As outlined in the code, the City has contracted for the "exclusive right to collect, remove, and dispose of all refuse except recognized industrial by-products." The final section under the garbage heading details the City's conformance with the State's Opportunity to Recycle legislation. The City requires the collection contractor to provide recycling collection service for recyclable materials at the minimum level as required by the State or higher level as permitted by the City Council. The code specifies that the contractor's recycling program must include:

- ✓ One durable recycling container for each residential customer
- ✓ Expanded education and promotion
- ✓ Multifamily recycling
- ✓ Commercial recycling
- ✓ Recycling depots (drop-off locations)

The Code specifies that the promotion of the program is the responsibility of the contractor. However, the Code also recognizes that education on the need for recycling is a joint responsibility of the City, schools, community organizations, the contractor, the County, and other parties.

Based on the availability of residential and commercial recycling, the project team assumes the residents of the communities surrounding the airport, and therefore the employees and passengers, have been exposed to recycling, receive on-going messaging about its importance, and are generally supportive of recycling efforts.

E. OTHER INCENTIVES

As noted earlier in Section 5, most of the airlines serving RDM have recycling programs and targets. Aligning the RDM program with the airlines' practices provides the opportunity for a win-win scenario whereby the facility can reduce its environmental impact and, by helping the airlines reduce their impacts, generate goodwill with the airlines.

6. COST SAVINGS OR REVENUE GENERATION

The costs associated with a recycling program depend on available infrastructure, material markets, and the type of waste generated at a facility. These costs sometimes include capital costs for containers, landfill tipping fees, hauling costs, material rebates, and labor. An evaluation of the potential cost savings and revenue generation opportunities is required for an Airport Recycling, Reuse, and Waste Reduction Plan according to FMRA.

Airport staff provided a garbage collection expenses tracking spreadsheet for review under this project. This spreadsheet included costs for terminal waste collection, airfield waste collection, and general waste collection (specific single collection events), with the fees for collection of recyclable materials included in the waste costs. Based on data from 2015 through 2017, on average, the Airport spends approximately $8,800 each fiscal year (July 1 to June 30) for collection of waste from the terminal. One scrap metal collection from a GA hangar conducted in August 2017 cost two thousand dollars. Calendar year 2017, the Airport spent approximately fifty dollars a month for collection of waste from the airfield. The Airport pays to have waste syringes collected from the restrooms and shredded paper collected from the offices about once a year.

To estimate approximate annual costs for recycling, information about the charges associated with the collection of the recycling dumpster and carts and other services is needed. After supplementing the information compiled and analyzed in this document, RDM can make informed solid waste management decisions over time. Using the information provided in this plan and cost information available to RDM, RDM can begin to analyze the program's financials, evaluate costs, and determine if enhancements should be implemented. If expansion of the program is not technically or economically feasible at this time, this information will help RDM determine when improvements might be feasible.

7. RECOMMENDATIONS

This section documents recommendations for the Airport, including waste reduction, reuse, and recycling strategies, based on the information presented earlier, specifically the waste audit and feasibility discussion.

A. OBJECTIVES AND TARGETS

It is recommended that the Airport set specific, measurable, achievable, realistic, and time-bound (SMART) goals for its waste and recycling program. Having an established set of objectives and targets provides a basis and foundation for subsequent activities and actions. Progress toward such goals does require tracking, but can also provide information on progress and improvements, which can be a valuable marketing and education tool.

The waste source, quantity, and composition information in Section 3 provides baseline data for establishing objectives and targets, and Section 5 describes the goal and target established by the State of Oregon. The objectives and targets derived from this information can be used to calculate target levels for RDM. A physical material sort would further inform goal-setting efforts.

These are potential objectives and targets RDM might adopt or use as inspiration for other goals:

- ✓ Recover 45 percent of waste generated by 2025
  (based on Deschutes County goal, current rate is estimated at 15 percent)
- ✓ Recover 55 percent of waste generated by 2025
  (based on State of Oregon goal, current rate is unknown)
- ✓ 100 percent of tenant leases include recycling provisions
- ✓ 100 percent of RDM employees completed simple training on recycling program
  (more details later in this section)

In the absence of established specific objectives and targets, the following sections present general, universal recommendations for increasing recycling and reducing waste generation at an airport like RDM.

B. TRACKING AND REPORTING

As noted in Section 2, RDM does not currently track metrics associated with the waste management program. It is recommended that RDM begin to regularly estimate and track the volume of waste sent to the landfill and the volume of material collected for recycling as well as the costs associated with these services. Trends associated with waste generation, landfill, recycling, and cost can be assessed for issues or opportunities for improvement.

RDM's waste and recycling performance is not currently reported to stakeholders. It is recommended that RDM proactively provide this information to management, employees, tenants, and interested external stakeholders on a regular basis. The purposes of this reporting are:

- ✓ to remind management employees, tenants, and contractors about the recycling program
- ✓ to communicate the Airport's commitment to its recycling program and its broader commitment to sustainability
- ✓ to solicit feedback and suggestions for improving the recycling program.

The frequency of reporting is up to the Airport, but it is recommended that reporting be completed at least annually. The reporting schedule should also be updated as needed to accommodate changes to the program. The schedule is expected to initially increase in frequency as the program evolves and new strategies are implemented, and then potentially return to a lesser frequency as the program is maintained.

C. REDUCE AND REUSE

To reduce the facility's environmental impacts, RDM should focus on moving materials up the waste management hierarchy. Waste reduction is the most environmentally preferred waste management strategy as determined by the EPA. Waste reduction can be accomplished in many ways, including reusing items.

It is recommended that the Airport evaluate the following reduction and reuse strategies to determine which, if any, are feasible and prudent for implantation at RDM.

- ✓ Substituting disposable items with durable alternatives in the administration office and other staff work areas
- ✓ Reusing items and materials where possible
- ✓ Working with the restaurant tenant to donate edible food to a community food security organization
- ✓ Collecting and donating unopened food, beverage, and toiletry items subject to TSA restrictions
- ✓ Encouraging reuse by passengers, tenants, and contractors

LIQUIDS

It is expected that the garbage can located in the security queuing area receives a fair amount of liquids and beverage containers due to TSA restrictions. Unfortunately, when these materials end up in the waste stream, the liquids are difficult to manage, and the containers cannot be recycled. Liquids add significant weight to the waste stream, contaminate other materials like paper, and may be rejected by a recycler, which will result in them being landfilled.

To minimize the amount of liquid discarded in the security checkpoint area, it is recommended that RDM continue to promote emptying of water bottles in the restroom sinks and refilling post security. Existing colorful, graphic signs in the terminal restrooms encourage passengers to empty water bottles prior security and to refill them after screening. These signs are positioned above eye-level. The message might reach more passengers if the signs were lowered and supplemented, for example, with vinyl cling decals on the mirrors over the sinks and posters or other visuals in the checkpoint queuing area.

In the future, these signs could be revised to also encourage passengers to recycle disposable water bottles if they do not wish to refill them. It is further recommended that RDM make a recycling station available in the immediate proximity of the pre-security restrooms so that passengers who do empty their disposable containers in the sinks have a convenient place to recycle the items they do not wish to refill.

D. DONATION OF FOOD, BEVERAGES, AND TOILETRIES

It is recommended that RDM work with the food and beverage concessionaire to assess the possibility of donating edible food to a local food bank, soup kitchen, or shelter for distribution to the populations they serve. Feeding people is the second preferred strategy for addressing food waste according to the EPA. Federal and state laws protect organizations that donate food in good faith from liability. Some organizations will pick up food at the source which reduces the demand on the Airport and concessionaire.

It is recommended that RDM investigate the feasibility of collecting unopened bottles of water, other beverages, food and toiletries that are restricted from carry-on luggage and donating them to a local charity or other organization. These items can be very heavy and add weight to the waste stream.

In compliance with TSA requirements, these items may need to be collected prior to the security checkpoint queuing area. RDM would collect these items by locating a container at the security checkpoint and managing storage of the items until the receiving organization could collect them. To implement this recommendation, coordination between RDM, the designated receiving organization, and the TSA would be needed. An example of an Airport with such a program is McCarran International Airport in Las Vegas, Nevada.

Example Donation Collection at McCarran International Airport (LAS)

E. RECYCLE AND COMPOST

Recycling is the second preferred waste management strategy, according to the EPA, after waste reduction/reuse. Recycling allows waste items to be processed into raw materials to make new products. The FAA guidance expects an airport's recycling, reuse, and waste reduction plan to document, at a minimum, the facility's existing program to recycle paper, plastic bottles, aluminum cans, and plastic cups. The Airport recycles most of these materials as well as cardboard and glass.

PAPER

The Airport is currently recycling paper (printer paper, mail, envelopes, and other items) collected from the administration offices as well as from the terminal (newspapers and magazines). Paper is also recycled from the other Airport buildings (Maintenance and ARFF.) These paper streams are comingled with other recyclables. Bend Waste & Recycling collects shredded paper from the offices under a separate service.

Managing recyclable paper separately from plastic bottles and aluminum cans protects the value of the paper stream and increases its recycling potential by minimizing contamination from liquids and creating a stream that may not need to be sorted. It is recommended that the Airport ask Bend Waste & Recycling about adding non-shredded office paper, newspapers, or magazines to the shredded paper collection.

It is also recommended that the Airport expand the program to additional areas, including the airline and rental car company offices, and encourage increased recycling of paper by employees, tenants, and passengers. Doing so reduces the environmental impacts associated with landfilling this material and manufacturing virgin paper.

Waste magazines and newspapers are generated aboard commercial flights and when they expire on the newsstand; it is recommended that the Airport collaborate and coordinate with the airlines and concession tenant serving RDM to evaluate adding paper items from deplaned waste and newsstands to this program.

Collaborate concession tenant to evaluate adding paper items from newsstands to this program

PLASTIC BOTTLES AND ALUMINUM CANS

The Airport is currently recycling plastic bottles and aluminum cans collected in the terminal, Maintenance, and ARFF buildings. Some plastic bottles and aluminum cans may be collected by employees and tenants for refund under the State's bottle bill. Recycled plastic bottles and aluminum cans are comingled with paper.

It is recommended that the Airport continue the current program and expand to additional areas. It is also recommended that the Airport support return of containers included in the bottle bill refund program as these programs typically have a higher recovery rate than a comingled stream. Whether through recycling or return for refund, increased recovery of plastic bottles by employees, tenants, and passengers reduces the environmental impacts associated with landfilling this material and manufacturing virgin plastic.

Plastic bottles are also generated aboard commercial flights; it is recommended that the Airport collaborate and coordinate with the airlines serving RDM to evaluate adding plastic bottles from deplaned waste to this program.

PLASTIC CUPS

Plastic cups are typically generated aboard commercial flights. It is recommended that the Airport collaborate and coordinate with the airlines serving RDM to evaluate adding plastic cups from deplaned waste to the recycling program.

CARDBOARD

The Airport currently recycles cardboard collected from the terminal food and beverage tenants and the administration offices. This material is collected and managed separately from the comingled recyclable and glass streams; this protects the value of the cardboard material by creating a single material stream (more desirable because it reduced contamination from liquids and requires less processing after collection). It is recommended that the Airport continue to recycle cardboard. It is also recommended that RDM provide feedback to the tenants on the progress and performance of this program and solicit their feedback regarding improvements that could be made to increase or support their participation. Marketing this program to all the terminal tenants could result in additional participation and remind existing participants of the program's specific requirements.

GLASS

The Airport currently recycles glass collected from the terminal restaurant tenant and passengers. This material is collected and managed separately from the comingled recyclable and cardboard streams; this protects the value of the other material by reducing contamination glass. It is recommended that the Airport continue to recycle glass and work to reduce contamination in this material stream. It is also recommended that RDM provide feedback to the tenants on the progress and performance of this program and solicit their feedback regarding improvements that could be made to increase or support their participation.

OTHER RECYCLABLES

As other recyclable materials are identified in RDM's waste stream, it is recommended that the Airport work with the waste hauling contractor to design and implement strategies to separate, collect, and process these materials.

GREEN WASTE

It is recommended that the Airport evaluate how green waste is managed and explore opportunities to align the facility's practices with the waste hierarchy; for example, by reducing the generation of this material at the source (mulching lawnmowers), reusing material where possible (chipped branches as mulch), composting (via the local facility), and disposing of the material on or off site as a last resort.

FOOD WASTE COMPOSTING

According to industry case studies, food waste is typically a major component of the waste stream at an Airport (on average, 35 percent). As described in Section 5, the EPA's food recovery hierarchy assigns priority to composting of food waste over landfill of this material (after using it to feed people as discussed under **Reduce and Reuse**). Composting is the process of decomposing food and other waste into a nutritious soil additive.

Composting of food waste at RDM is largely dependent on the availability of a local composting facility interested in accepting this material. As noted in Section 2, there does not appear to be a commercial composting facility in the area.

If a composting facility is found or established in the area, RDM should evaluate implementing composting at the Airport. In a terminal, pre-consumer food waste (waste generated by food preparation activities) is generally easier to compost because restaurant employees are at a facility more frequently and on a more regular basis than passengers, so they are easier to train and educate on composting practices and requirements. The specific items accepted by a composting facility are dependent on that facility's design and the process used to break down the waste; some facilities accept all food waste (including meat and bones and breads) while others accept only vegetables and fruit.

One option for easing into composting gradually is to first implement a composting program for coffee grounds generated by restaurants in the terminal. Coffee grounds have a pleasant odor, are easily identifiable (therefore easy to separate), are typically uncontaminated by other materials, and are generated in a predicable manner and quantity. Once tenants are comfortable composting coffee grounds, other materials can be added by name (banana peels, apple cores, etc.) and/or by type (fruits, vegetables, etc.) until all food waste appropriate for composting is included.

PAPER PRODUCTS

Once a commercial composting facility is available in the area, the Airport may wish to collect paper towels and other paper products (napkins and tissues) for composting. Composting is environmentally preferred over landfilling this material.

Because the Airport's restrooms are equipped with paper towel dispensers and nearby garbage cans, the waste stream collected in these cans will primarily consist of paper towel. This stream can be expected to contain low contamination and a steady volume of material, making it an attractive material for composting.

No modifications to the paper towel dispensers or garbage bins would be needed to implement paper towel composting. Alternative bins would need to be conveniently located and clearly labeled to accept other waste generated in the restrooms that is not paper towel, and the bins reserved for paper towel should be labeled "Paper Towel Only – Collected for Composting" (or similar) to instruct use and explain how this material is managed. The Airport would also need a dedicated cart for this material and a procedure to collect and store it separately until it was collected by the waste hauling contractor for delivery to the composting facility.

F. EDUCATION AND OUTREACH

Under the existing program, education of and outreach to Airport employees, tenants, contractors and passengers is primarily accomplished through container signage in the terminal.

To supplement these efforts, it is recommended that RDM improve the in-terminal messaging for passengers and provide brief, clear instructions for recycling. Providing clear, instructional signage at the recycling stations or recycling bins can improve passenger participation and reduce contamination. See Section G below for information about signage.

It is recommended that RDM provide simple, on-going training for employees, tenants, and contractors that explains the recycling program, including its purpose and requirements. Such a training program will promote program participation and compliance, resulting in increased recycling and reduced contamination. In addition, training can designate a contact and a mechanism to receive feedback and ideas for improvement.

The format of employee training could take any number of forms, including emails, meetings, posters, etc. The content of such training should include:

- ✓ reminders about the materials that are accepted for recycling at the Airport and the location of the containers to be used for the program,
- ✓ information about purchasing requirements, and
- ✓ information about the positive effect the program is having on RDM's environmental impact.

Information and participation from the waste collection contractor should also be incorporated into the training program. In addition, different stakeholders and organizations involved in collection, housekeeping, recycling, composting, and other waste activities could also be asked to provide content or to be present during training.

It is recommended that the Airport include a brief overview of the recycling program during employee on-boarding training and recurrent refresher training at regular intervals. To use employee time as effectively as possible, waste training could be combined with other trainings or meetings.

RDM should consider providing introductory level information to new tenants and provide training materials such as postings, postcards, etc. to existing tenants for use with their employees. As some airport tenants may experience significant employee turnover, providing this information on a regular basis (for example, annually) will help keep everyone up to date on the program.

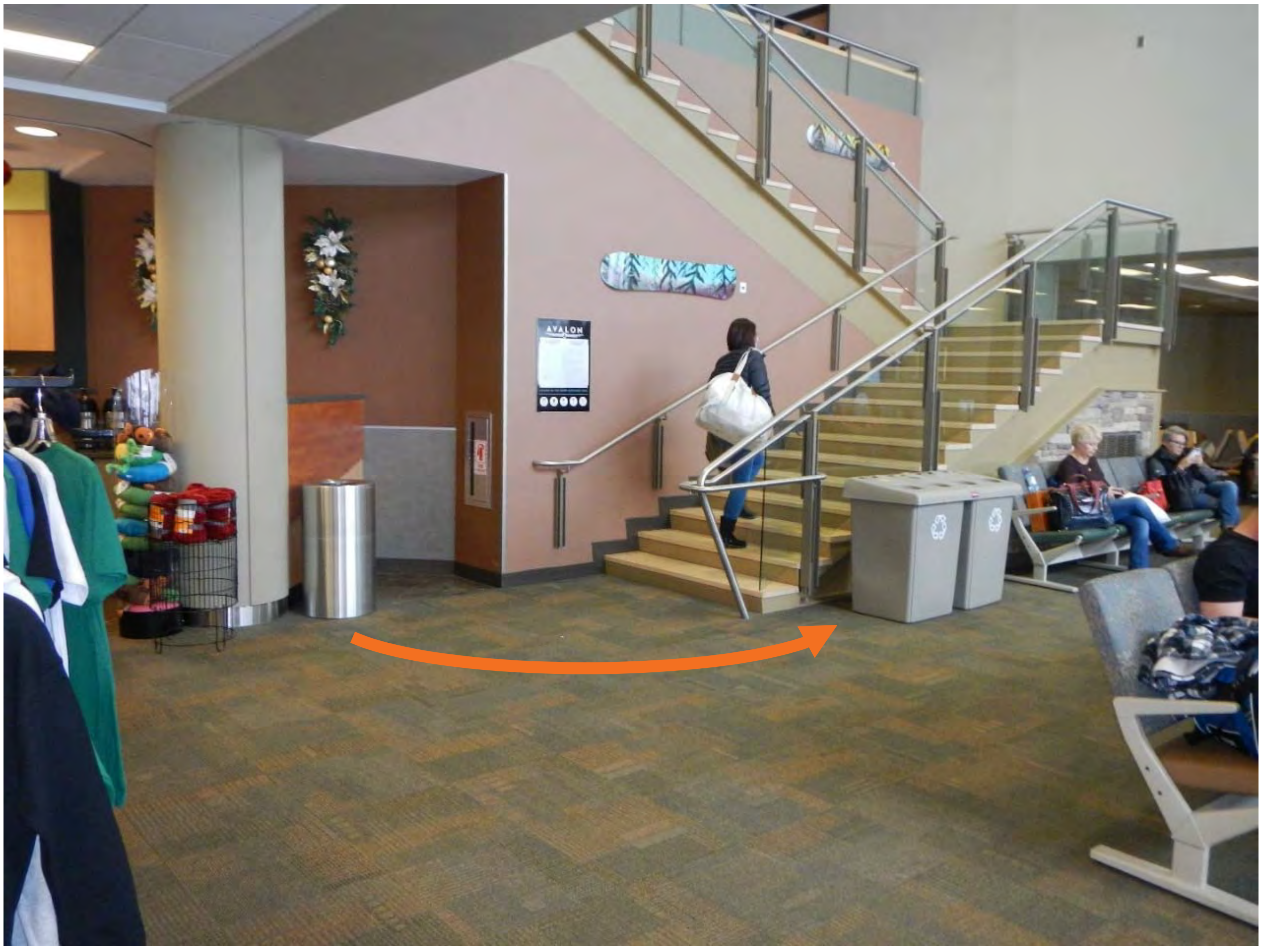
Once a training and education program is implemented, it is recommended that RDM actively maintain such a program to facilitate its continued success. The content of trainings should be updated as the program changes and grows.

G. CONTAINERS AND BINS

The existing recycling stations in the terminal are conjoined units with four compartments, top facing signage, and restrictive lids; no changes to the design of the containers are recommended at this time. Conjoined containers ensure a consistent format at every recycling station location; top facing signage and restrictive lids have also been shown to educate and instruct passengers to separate materials appropriately. It is recommended that RDM install additional recycling stations in high traffic areas of the terminal as resources allow.

The recycling containers in other areas at the Airport are typically blue and have varying sizes and designs. No major changes are recommended to the design of these bins other than to ensure they and their service schedule are rightsized for the existing and future volume of material collected under the program and future improvements.

Collocation of recycling containers with garbage cans has been shown to decrease contamination and increase recycling participation. It is highly recommended that RDM move a garbage can next to any recycling station or container that does not currently have one paired with it (as space allows).



Move garbage cans next to recycling stations and containers

In addition, RDM should consider removing some of the stand-alone garbage cans inside the public areas of the terminal. There are many garbage cans in the terminal, and they are typically closer/more available than a recycling station; therefore, in many cases, it is more convenient for passengers, employees, and tenants to locate and use a garbage can for all materials than to find and use a recycling station. These containers could be repurposed as recycling containers in other spaces for comingled or single stream recyclables (in offices for paper, in breakrooms for bottles and cans, etc.)

The design of the garbage cans varies by location. As these containers are retired or replaced, the Airport may want to consider standardizing the shape and color of the containers to aid in recognition. It is recommended that RDM install additional recycling bins in other areas as the other areas are added to the program and resources allow.

Airport maintenance staff conduct the day to day waste activities, their insight is valuable in improving and maintaining the recycling program at RDM. Their insight on which containers are underused or undersized can help inform changes to the location and size of existing and future recycling stations, recycling containers, and garbage cans.

H. SIGNAGE AND LABELING

The Airport's recycling signage could be expanded and improved. The recycling stations in the terminal are labeled for each accepted material but RDM should consider providing additional signage adjacent to recycling stations that elaborates on the Airport's program and provides direction for passengers.

A key location for additional signage is in the security checkpoint queuing area in the terminal. As described in Section 3, the TSA restrictions compel the generation of waste, and items discovered in passenger luggage must be disposed in accordance with the agency's policies. In addition, restricted items discovered in passenger luggage by TSA can prompt additional security screening that increases congestion and wait times in the security line. Clear signage in this area would help educate passengers on the restrictions as well as their options to comply with the restrictions to reduce wait times and without throwing these items away. Signage pertaining to the emptying of liquids and refill of containers post-security is discussed above.

Signage and labeling for recycling bins in other areas of the Airport is inconsistent or absent and could be improved with color, images, and short, clear, instructive text to improve understanding of which items are recyclable and which should be thrown away.

I. OTHER RECOMMENDATIONS

In addition to the strategies recommended above, the following strategies are recommended for RDM's waste and recycling program.

CONTRACTS AND LEASES

As described in Section 4, contracts are a vehicle through which the Airport can influence tenant behavior, including recycling. As contracts and leases expire, extend, or renew, it is recommended that the Airport consider revising the new contract language to include waste management requirements or preferences, for example, support of the recycling program. This could be a general clause stating a preference that tenants reduce, reuse, and recycle where practicable or specific information about recycling, reuse, or waste reduction objectives and requirements. Two agreements reviewed for this project include language regarding conformance with the State's Opportunity to Recycle law and recycled content purchasing, respectively (see Section 4). Another approach is to update the City's Airport Ordinance to include recycling requirements and preferences and ensure each contract or lease requires adherence to these policies.

PURCHASING POLICIES AND REQUIREMENTS

The Airport's existing purchases may create waste; specific purchase information was not available for this project. It is recommended that the Airport (or City) consider adopting a purchasing policy that prioritizes items that are durable (versus disposable), reusable, recyclable, compostable, and/or made from recycled content. Once established, this policy could be shared with the Airport's tenants to encourage their own adoption of sustainability-minded purchasing practices.

ADDITIONAL FACILITIES AND NEW DEVELOPMENT

The Airport may wish to consider expanding the recycling program to additional areas, for example, in the buildings and activities that were excluded from this plan. Expanding recycling and waste reduction to areas outside the Airport's control or influence will require cooperation and collaboration with the operators of those areas as well as with their housekeeping and waste hauling contractors. Expansion could be as simple as encouraging these areas to recycle and acting as a resource for their questions or as complex as assisting these areas with an evaluation of their facility and/or container selection and signage design.

As the Airport grows and changes, it is recommended that recycling and waste management be considered as a part of designing and constructing new development projects. This could be accomplished by establishing construction specifications that outline waste management requirements or preferences for Airport projects (for example, any landfill diversion rate requirements or recycled-content material preferences) and involving the waste collection contractor in the design and planning of new facilities. The operation and maintenance of new facilities under the control or influence of RDM, once constructed, should be included in the Airport's recycling program (for example a new general aviation hangar development).

Any expansions of the existing program should be designed with care to maintain consistency and compatibility with the program in the terminal, administration offices, and other established areas.

J. CONTINUOUS IMPROVEMENT

It is recommended that RDM maintains and implements improvements to the recycling program by following the Plan Do Check Act cycle.

PLAN

The recommended strategies and supporting references make up the "plan" portion of the process. Defining success (for example, something like 45 percent recycling by 2020), establishing materials and areas of focus, collecting baseline information (waste audit, surveys, etc.), identifying sub-goals, and identifying strategies are all part of planning. In the future, additional areas of focus, baseline measurements, and goals will likely be needed.

DO

Implementation of strategies included in this plan represents the “do” portion of the process. This involves implementing the recommendations in this plan and making progress toward achieving the goals. In “doing,” the Airport will continue developing a culture of awareness for waste management and will begin to shape the practices and processes for improving and optimizing its activities associated with reduction, reuse, recycling, composting, and other waste management elements at the facility.

CHECK

As strategies are implemented, the “check” portion of the process involves reporting that requires regularly tracking and checking the progress toward meeting the goals. The Airport has finite resources (financial, staffing, capital, etc.), therefore, the management and tracking of the plan must not be unnecessarily arduous. If tracking and checking become too difficult or time consuming, the entire plan may suffer. Checking may require the Airport to develop and use tools for measuring success and identifying areas for improvement, including a mechanism for feedback and process for reviewing suggestions.

The following scenarios may trigger re-evaluation of the program and/or the constraints described in this document:

- ✓ New state recycling laws, requirements, or goals
- ✓ New RDM programs or goals
- ✓ New City of Redmond programs or goals
- ✓ New Deschutes County programs or goals
- ✓ New local infrastructure, for example, composting facility
- ✓ Changes within or expiration of franchise agreement with waste hauling contractor(s)

ACT

The “act” portion of the process encompasses taking what has been learned in the previous stages and actively responding. It can be helpful to ask, “What did we learn?” and “How can we do better next time?” By re-evaluating the strategies, activities, goals, and metrics, adjustments can be identified and put into action.

It is recommended that meetings on waste and recycling be held on a regular basis to drive the continuous improvement cycle (review the recycling program and plan and implement improvements/adjustments). It is further recommended that these meetings include a representative from each of the following areas: the waste hauling company, the airlines serving RDM, the restaurant tenant, other terminal tenants, a hangar tenant, the Redmond community, and the traveling public.

K. RECOMMENDATIONS SUMMARY

The recommendations outlined in this document do not require major capital improvements and were designed to be compatible with RDM's in-progress master plan, the existing recycling program, and other airport requirements.

Table 4 summarizes recommendations for the RDM waste and recycling program.

Table 4: Recommendations Summary

RDM Waste and Recycling Program Recommendations

Objectives and Targets
- Set SMART goals (see Section 7).

Tracking and Reporting
- Regularly estimate and track volume of waste to landfill, volume of material collected for recycling, recycling rate, and costs for waste and recycling services.
- Assess waste generation, landfill, recycling, and cost trends for issues or opportunities for improvement.
- Establish a regular reporting schedule; proactively provide information about the program.

Reduce and Reuse
- Substitute disposable items with durable alternatives.
- Reuse items and materials.
- Continue to promote emptying of water bottles in restroom sinks and refilling post security.
  - Lower and supplement water bottle emptying/refilling signs.
  - Revise water bottle emptying/refilling signs to encourage recycling of disposable water bottles.
  - Place a recycling station in immediate proximity of the pre-security restrooms.
- Work with the restaurant tenant to donate edible food.
- Collect and donate unopened food, beverage, and toiletry items.
- Encourage reuse by passengers, tenants, and contractors.

Paper
- Continue the paper recycling program.
- Ask about adding non-shredded office paper, newspapers, and magazines to the shredded paper collection.
- Expand paper recycling program to additional areas, specifically airline deplaned newspapers and magazines and expired items from the newsstand.

Plastic Bottles and Aluminum Cans, Plastic Cups
- Continue the plastic bottle and aluminum can recycling program.
- Expand the program to additional areas, specifically airline deplaned beverage containers.
- Support the return of containers included in the bottle bill refund program.
- Coordinate plastic cup recycling with the airlines serving RDM.

Cardboard
- Continue the cardboard recycling program.
- Provide feedback to tenants on the progress and performance of this program, solicit their feedback, and market the program to all tenants.

Glass
- Continue the glass recycling program.
- Work to address contamination in this material stream.
- Provide feedback to tenants on the progress and performance of this program and solicit their feedback.

Other Recyclables
- Work with the waste hauling contractor to design and implement strategies for other materials as they are identified in the waste stream.

Green Waste
- Evaluate how this material is managed and explore opportunities to align with the EPA hierarchy.

Food Waste
- If a composting facility is established in the area, evaluate composting at RDM.
  - Start with coffee grounds, then expand to other pre-consumer food waste.

Paper Products
- If a composting facility is established in the area, evaluate composting at RDM.

Education and Outreach
- Improve in-terminal messaging for passengers.
  - Provide clear, instructional signage at recycling stations.
- Provide simple, on-going training for employees, tenants, and contractors.

Containers and Bins
- Install additional recycling stations in high traffic areas of the terminal.
- Right-size recycling bins and the service schedule in other areas.
- Collocate recycling bins and garbage cans.
- Remove stand-alone garbage cans in public areas of terminal.
- Standardize recycling bins and garbage cans as they are retired/replaced.
- Install additional recycling bins and garbage cans in other areas, as they are added to program.

Signage and Labeling
- Expand and improve signage to elaborate on the program and provide direction, specifically, in the checkpoint queuing area.

Contracts and Leases
- Revise new contract language or update the City Airport Ordinance to include waste management requirements/preferences.

Purchasing Policies and Requirements
- Adopt a purchasing policy that prioritizes materials that are durable, reusable, recyclable, compostable, and/or made from recycled content.
  - Share with tenants to encourage them to adopt their own similar practices.

Additional Facilities and New Development
- Collaborate with operators of areas excluded from this plan to expand the program.
- Consider recycling and waste management as part of designing and constructing new development.

Continuous Improvement
- Maintain and improve the recycling and waste program according to Plan Do Check Act cycle.

8. CONCLUSION

RDM currently has a simple recycling program in place that includes basic elements and has the potential to be expanded in phases to further reduce the facility's environmental impact. This document has described the existing program and outlined recommended improvements that will allow RDM to potentially increase both landfill diversion and recycling volumes. In addition, this plan documents and supports RDM's compliance with the FMRA of 2012 and FAA guidance for recycling, reuse, and waste reduction.

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APPENDIX D:

IMPLEMENTATION PLAN

Project Title:	Terminal Phase 1A	**Project Number:**	
Project Description:	Environmental, design, and construction of terminal holdroom remodel and reconfiguration.		
Total Cost (2017 Dollars):	$6,160,000	**Funding Sources:**	PE, Discretionary, Local
Year:	2022-2023	**Phased Project**	☒ Yes ☐ No
Project Components	☐	Planning	
	☒	Design	$274,000
	☒	Environmental	$456,000
	☒	Construction	$5,430,000
Enabling Projects:			
Equipment Acquisition	None		
Comments:	Environment and Design phases occur in Year 1 of 2 for Terminal Phase 1B.		
Is project timeline flexible? Are any projects dependent on this project?			

Planning and Zoning

Project Conformity	☒ Conforms to existing zoning ☐ May require rezone/Comprehensive Plan amendment
Project compliance with minimum standards	☒ Yes ☐ No
Any potential controversy based on stakeholder feedback?	Stakeholders generally support the project.
Process description and duration	Phase 1 will renovate existing ground floor holdroom and includes reconfiguring the boarding corridor into extra holdroom space to increase seating capacity.

Environmental

Level of state and federal environmental review required?	The project is AIP funded and will require NEPA process. Expected to be a categorical exclusion (CatEx).
Potential complications?	FAA may potentially ask for an environmental assessment instead of a CatEx.
Cost of mitigation	Mitigation not expected.
Description of mitigation process and uncertainty	Mitigation not expected.
Process description and duration	

Design

Any pre-implementation support facility construction or site prep required?	☐ Yes ☒ No
Potential challenges of site location?	No
Are there financial and operational risks based on project scale?	
Improvement suggestions of design process	
Process description and duration	

Funding

Can the Airport fund the project in its current state?	☐ Yes ☒ No
Fiscal impact of project on immediate and ongoing Airport finances.	Project costs exceed available funds. The Airport will need to issue a bond to cover costs.
How competitive is the improvement for discretionary funding?	
How competitive is the project for FAA priority compared to other Airport CIP projects?	

Operation and Maintenance

Potential impact on airport operating costs?	Project will increase terminal footprint which will impact operating and maintenance costs.
Are additional staff needed?	Project will increase terminal footprint which may require additional maintenance and/or janitorial staff.

Project Title:	Terminal Phase 1B	**Project Number:**		
Project Description:	Environmental, design, and construction phases of the elevated holdroom expansion.			
Total Cost (2017 Dollars):	$11,020,000	**Funding Sources:**	Discretionary, Local	
Year:	2022	**Phased Project**	☒ Yes ☐ No	
Project Components	☐	Planning		
	☒	Design	$816,000	
	☒	Environmental	$490,000	
	☒	Construction	$9,714,000	
Enabling Projects:				
Equipment Acquisition	None			
Comments:				
Is project timeline flexible? Are any projects dependent on this project?				

Planning and Zoning

Project Conformity	☒ Conforms to existing zoning ☐ May require rezone/Comprehensive Plan amendment
Project compliance with minimum standards	☒ Yes ☐ No
Any potential controversy based on stakeholder feedback?	Stakeholders generally support the project.
Process description and duration	Phase 1B will elevate the ground floor of the holdroom by 5 feet to facilitate Passenger Boarding Bridge (PBBs). This will allow PBBs to reach larger aircraft on the apron.

Environmental

Level of state and federal environmental review required?	The project is AIP funded and will require NEPA process. Expected to be a categorical exclusion (CatEx).
Potential complications?	FAA may potentially ask for an environmental assessment instead of a CatEx.
Cost of mitigation	Mitigation not expected.
Description of mitigation process and uncertainty	Mitigation not expected.
Process description and duration	

Design

Any pre-implementation support facility construction or site prep required?	☐ Yes ☒ No
Potential challenges of site location?	No
Are there financial and operational risks based on project scale?	
Improvement suggestions of design process	
Process description and duration	

Funding

Can the Airport fund the project in its current state?	☐ Yes ☒ No
Fiscal impact of project on immediate and ongoing Airport finances.	A Bond will need to be considered for the greater terminal program. The City can issue a bond that contribute to local funds to cover construction costs.
How competitive is the improvement for discretionary funding?	
How competitive is the project for FAA priority compared to other Airport CIP projects?	

Operation and Maintenance

Potential impact on airport operating costs?	Project will increase terminal footprint which will impact operating and maintenance costs.
Are additional staff needed?	Project will increase terminal footprint which may require additional maintenance and/or janitorial staff.

Project Title:	Terminal Apron Expansion	**Project Number:**	
Project Description:	Environmental, design, and construction phases of Terminal Apron Expansion project		
Total Cost (2017 Dollars):	$1,998,900	**Funding Sources:**	PE, Local
Year:	2022-2023	**Phased Project**	☐ Yes ☒ No
Project Components	☐	Planning	
	☒	Design	$118,000
	☒	Environmental	$73,000
	☒	Construction	$1,808,000
Enabling Projects:			
Equipment Acquisition	None		
Comments:			

Planning and Zoning

Project Conformity	☒ Conforms to existing zoning ☐ May require rezone/Comprehensive Plan amendment
Project compliance with minimum standards	☒ Yes ☐ No
Any potential controversy based on stakeholder feedback?	Stakeholders generally support the project.
Process description and duration	As the Terminal Phase 1B project will allow PBBs to reach larger aircraft on the apron, the apron expansion will increase the overall capacity of the apron.

Environmental

Level of state and federal environmental review required?	The project is AIP funded and will require NEPA process. Expected to be a categorical exclusion (CatEx).
Potential complications?	FAA may potentially ask for an environmental assessment instead of a CatEx.
Cost of mitigation	Mitigation not expected.
Description of mitigation process and uncertainty	Mitigation not expected.
Process description and duration	

Design

Any pre-implementation support facility construction or site prep required?	☐ Yes ☒ No
Potential challenges of site location?	No
Are there financial and operational risks based on project scale?	A Bond will need to be considered for the greater terminal program. The City can issue a bond that contribute to local funds to cover construction costs.
Improvement suggestions of design process	
Process description and duration	

Funding

Can the Airport fund the project in its current state?	☐ Yes ☒ No
Fiscal impact of project on immediate and ongoing Airport finances.	A Bond will need to be considered for the greater terminal program. The City can issue a bond that contribute to local funds to cover construction costs.
How competitive is the improvement for discretionary funding?	
How competitive is the project for FAA priority compared to other Airport CIP projects?	

Project Title:	Mid-term Auto Parking Phase 1	Project Number:	
Project Description:	Design and construction of 300 additional parking stalls.		
Total Cost (2017 Dollars):	$5,205,250	**Funding Sources:**	Local
Year:	2024	**Phased Project**	☒ Yes ☐ No
Project Components	☐	Planning	
	☒	Design	
	☐	Environmental	
	☒	Construction	
Enabling Projects:			
Equipment Acquisition	None		
Comments:	This is a Non-AIP project		
Is project timeline flexible? Are there any other projects dependent on this project?			

Planning and Zoning

Project Conformity	☒ Conforms to existing zoning ☐ May require rezone/Comprehensive Plan amendment
Project compliance with minimum standards	☒ Yes ☐ No
Any potential controversy based on stakeholder feedback?	
Process description and duration	Project will require removal of the USDA building.

Environmental

Level of state and federal environmental review required?	
Potential complications?	
Cost of mitigation	
Description of mitigation process and uncertainty	
Process description and duration	

Design

Any pre-implementation support facility construction or site prep required?	☒ Yes ☐ No
Potential challenges of site location?	Project requires removal of USDA building and tenants, potential reconfiguration of traffic circulation, and stormwater considerations.
Are there financial and operational risks based on project scale?	
Improvement suggestions of design process	
Process description and duration	

Scheduled start date	2024
Expected cost	$339,000

Funding

Can the Airport fund the project in its current state?	☐ Yes ☐ No
Fiscal impact of project on immediate and ongoing Airport finances.	
How competitive is the improvement for discretionary funding?	
How competitive is the project for FAA priority compared to other Airport CIP projects?	

Operation and Maintenance

Potential impact on airport operating costs?	
Are additional staff needed?	

Project Title:	Rehab Taxiway G Pavement	Project Number:	
Project Description:			
Total Cost (2017 Dollars):	$3,331,333	Funding Sources:	PE, Discretionary, Local
Year:	2025	Phased Project	☐ Yes ☒ No
Project Components	☐	Planning	
	☒	Design	$203,000
	☐	Environmental	
	☒	Construction	$3,128,000
Enabling Projects:			
Equipment Acquisition	None		
Comments:			
Is project timeline flexible? Are there any other projects dependent on this project?	Project timeline is flexible but needs to happen sooner than later. Ongoing maintenance of existing pavement can keep it in working order, but costs will grow over time as the pavement deteriorates.		

Planning and Zoning

Project Conformity	☒ Conforms to existing zoning ☐ May require rezone/Comprehensive Plan amendment
Project compliance with minimum standards	☒ Yes ☐ No
Any potential controversy based on stakeholder feedback?	Project is not controversial.
Process description and duration	

Environmental

Level of state and federal environmental review required?	The project is AIP funded and will require NEPA process. Expected to be a categorical exclusion (CatEx).
Potential complications?	FAA may potentially ask for an environmental assessment instead of a CatEx.
Cost of mitigation	Mitigation not expected.
Description of mitigation process and uncertainty	Mitigation not expected.
Process description and duration	

Design

Any pre-implementation support facility construction or site prep required?	☐ Yes ☒ No
Potential challenges of site location?	
Are there financial and operational risks based on project scale?	Pavement rehab is a simple project and not considered a risk.
Improvement suggestions of design process	
Process description and duration	
Scheduled start date	2025
Expected cost	$203,000

Funding

Can the Airport fund the project in its current state?	☒ Yes ☐ No
Fiscal impact of project on immediate and ongoing Airport finances.	No major financial impact.
How competitive is the improvement for discretionary funding?	The project's competitiveness depends on what the scale of the project is anticipated to be.
How competitive is the project for FAA priority compared to other Airport CIP projects?	Competitiveness depends on the condition of the pavement and the scale of rehabilitation.

Operation and Maintenance

Potential impact on airport operating costs?	Rehabilitation should reduce maintenance costs in the short term.
Are additional staff needed?	No additional staff needed.

Project Title:	Rehab Taxiway G Lighting	**Project Number:**	
Project Description:			
Total Cost (2017 Dollars):	$453,300	**Funding Sources:**	PE, Local
Year:	2025	**Phased Project**	☐ Yes ☒ No
Project Components	☐	Planning	
	☒	Design	$28,000
	☐	Environmental	
	☒	Construction	$425,000
Enabling Projects:			
Equipment Acquisition			
Comments:			

Planning and Zoning

Project Conformity	☒ Conforms to existing zoning ☐ May require rezone/Comprehensive Plan amendment
Project compliance with minimum standards	☒ Yes ☐ No
Any potential controversy based on stakeholder feedback?	Project is not controversial.
Process description and duration	

Environmental

Level of state and federal environmental review required?	The project is AIP funded and will require NEPA process. Expected to be a categorical exclusion (CatEx).
Potential complications?	FAA may potentially ask for an environmental assessment instead of a CatEx.
Cost of mitigation	Mitigation not expected.
Description of mitigation process and uncertainty	Mitigation not expected.
Process description and duration	

Design

Any pre-implementation support facility construction or site prep required?	☐ Yes ☒ No
Potential challenges of site location?	
Are there financial and operational risks based on project scale?	Light rehabilitation is not considered a risk.
Improvement suggestions of design process	
Process description and duration	
Scheduled start date	2025
Expected cost	$28,000

Funding

Can the Airport fund the project in its current state?	☒ Yes ☐ No
Fiscal impact of project on immediate and ongoing Airport finances.	No major financial impact.
How competitive is the improvement for discretionary funding?	The project's competitiveness depends on what the scale of the project is anticipated to be.
How competitive is the project for FAA priority compared to other Airport CIP projects?	Competitiveness depends on the condition of the lights and the scale of rehabilitation.

Operation and Maintenance

Potential impact on airport operating costs?	Rehabilitation should reduce maintenance costs in the short term.
Are additional staff needed?	No additional staff needed.

Project Title:	Mid-term Auto Parking Phase 2	**Project Number:**	
Project Description:	Design and construction of 200 additional parking stalls.		
Total Cost (2017 Dollars):	$3,695,382	**Funding Sources:**	Local
Year:	2025	**Phased Project**	☐ Yes ☒ No
Project Components	☐	Planning	
	☒	Design	$226,000
	☐	Environmental	
	☒	Construction	$3,469,000
Enabling Projects:	Mid-term Auto Parking Phase 1		
Equipment Acquisition			
Comments:	Non-AIP project		

Planning and Zoning

Project Conformity	☐ Conforms to existing zoning ☐ May require rezone/Comprehensive Plan amendment
Project compliance with minimum standards	☐ Yes ☐ No
Any potential controversy based on stakeholder feedback?	
Process description and duration	
Scheduled start date	
Expected cost	
Is project timeline flexible? Are there any other projects dependent on this project?	

Environmental

Level of state and federal environmental review required?	
Potential complications?	
Cost of mitigation	
Description of mitigation process and uncertainty	
Process description and duration	
Scheduled start date	
Expected cost	
Is project timeline flexible? Are there any other projects dependent on this project?	

Design

Any pre-implementation support facility construction or site prep required?	☐ Yes ☐ No
Potential challenges of site location?	
Are there financial and operational risks based on project scale?	
Improvement suggestions of design process	
Process description and duration	
Scheduled start date	2025
Expected cost	$226,000
Is project timeline flexible? Are there any other projects dependent on this project?	

Funding

Can the Airport fund the project in its current state?	☐ Yes ☐ No
Fiscal impact of project on immediate and ongoing Airport finances.	
How competitive is the improvement for discretionary funding?	
How competitive is the project for FAA priority compared to other Airport CIP projects?	

Operation and Maintenance

Potential impact on airport operating costs?	
Are additional staff needed?	

Project Title:	Northside GA Expansion	**Project Number:**		
Project Description:				
Total Cost (2017 Dollars):	$2,444,692	**Funding Sources:**	PE, Local	
Year:	2026-2027	**Phased Project**	☒ Yes ☐ No	
Project Components	☐	Planning		
	☒	Design	$100,000	
	☒	Environmental	$251,000	
	☒	Construction	$2,093,000	
Enabling Projects:				
Equipment Acquisition	None			
Comments:				
Is project timeline flexible? Are there any other projects dependent on this project?				

Planning and Zoning

Project Conformity	☒ Conforms to existing zoning ☐ May require rezone/Comprehensive Plan amendment
Project compliance with minimum standards	☒ Yes ☐ No
Any potential controversy based on stakeholder feedback?	Have not received controversial feedback.
Process description and duration	

Environmental

Level of state and federal environmental review required?	Environmental Assessment required.
Potential complications?	
Cost of mitigation	
Description of mitigation process and uncertainty	
Process description and duration	Less than 1 year

Design

Any pre-implementation support facility construction or site prep required?	☒ Yes ☐ No
Potential challenges of site location?	Site will need to be brought to Airport grade, requiring significant earthwork and rock excavation.
Are there financial and operational risks based on project scale?	Return on investment – high costs and potentially low rate of return. Individual tenants are needed to fill spots.
Process description and duration	Less than 1 year

Funding

Can the Airport fund the project in its current state?	☒ Yes ☐ No
Fiscal impact of project on immediate and ongoing Airport finances.	There is risk in finding tenants for new facilities.
How competitive is the improvement for discretionary funding?	Very low
How competitive is the project for FAA priority compared to other Airport CIP projects?	Very low

Operation and Maintenance

Potential impact on airport operating costs?	Increase airport surfaces therefore increased workload for administrative staff.
Are additional staff needed?	No additional staff needed.

APPENDIX E:

COORDINATION AND OUTREACH SUMMARY

APPENDIX E: COORDINATION AND PUBLIC OUTREACH SUMMARY

This appendix documents the coordination and outreach efforts utilized throughout the Master Plan process. Organizations involved, dates of meetings and general feedback are noted below.

PLANNING ADVISORY COMMITTEE (PAC)

A Planning Advisory Committee (PAC) was setup to engage the input and review on working papers, materials and alternatives early in the planning process. The PAC consisted of members from the following organizations:

- ✓ Mayor of the City of Redmond
- ✓ United States Forest Service – Redmond Air Center
- ✓ Redmond Municipal Airport - Fixed Base Operators
- ✓ City of Redmond – Engineering Department
- ✓ City of Redmond – Community Development Director
- ✓ City of Bend – Business Advocate
- ✓ City of Bend – Assistant City Manager
- ✓ Prineville Airport
- ✓ Redmond Economic Development, Inc.
- ✓ Deschutes County – Emergency Services
- ✓ Deschutes County – Planning Department
- ✓ Central Oregon Visitors Association

PAC MEETINGS AND DATES

The following PAC meetings were held:

- ✓ **PAC Meeting #1:** Airport Administration Offices – November 9th, 2016
- ✓ **PAC Meeting #2:** Airport Administration Offices – February 8th, 2017
- ✓ **PAC Meeting #3:** Airport Administration Offices – June 22nd, 2017
- ✓ **PAC Meeting #4:** Airport Administration Offices – October 18th, 2017
- ✓ **PAC Meeting #5:** Airport Administration Offices – March 14th, 2018

PUBLIC OPEN HOUSES

Members of the public were invited to contribute to the planning process at two open house opportunities:

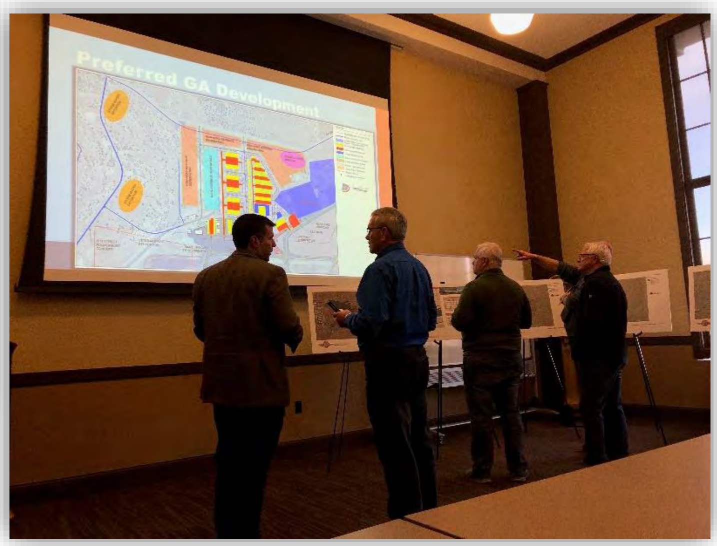
PAC MEETINGS AND DATES

The following public open houses were held:

- ✓ **Public Meeting #1:** Redmond City Hall – October 18th, 2017
- ✓ **Public Meeting #2:** Redmond City Hall – March 14th, 2018

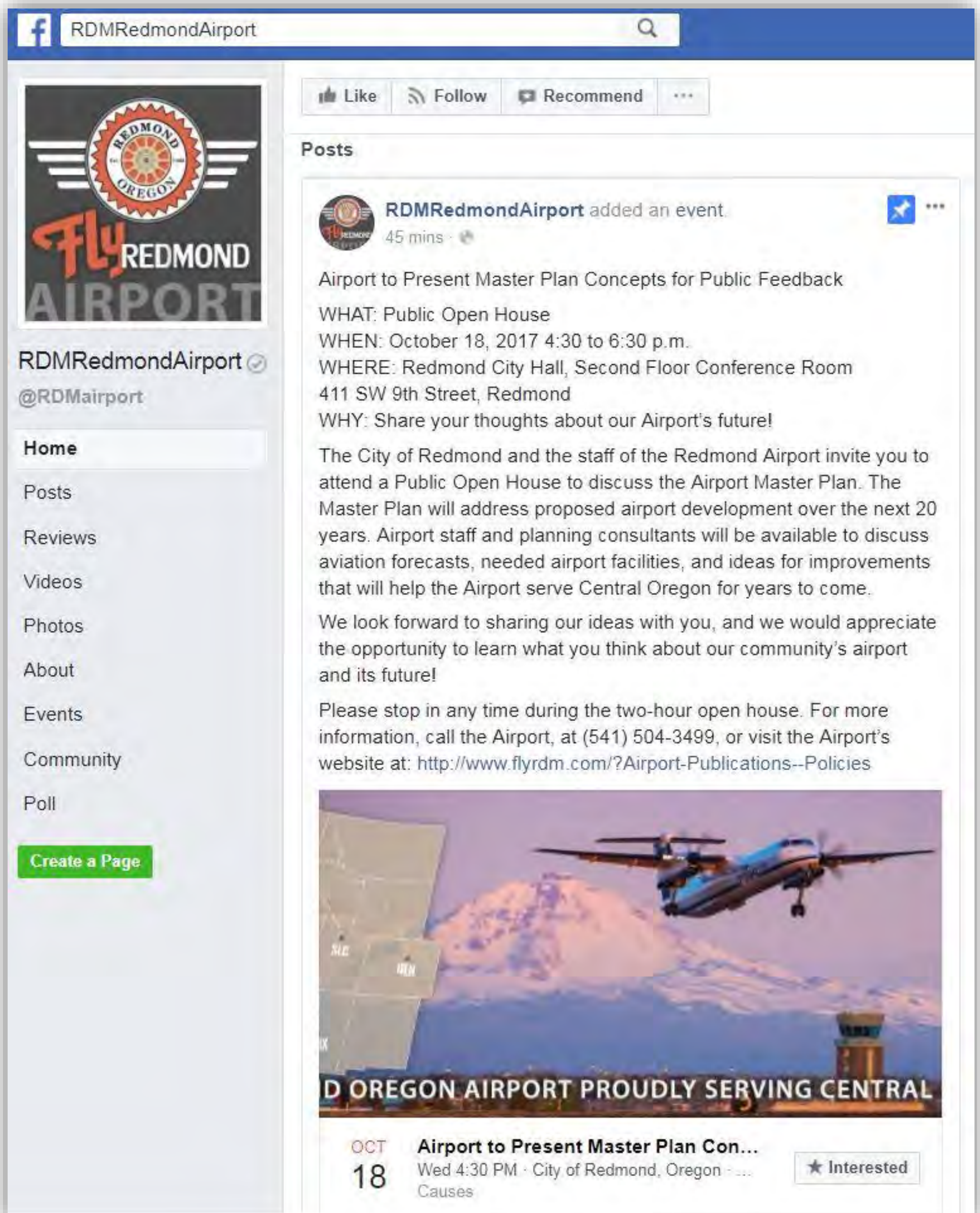
Public Meeting #2 - March 14th, 2018

Public Meeting #2 - March 14th, 2018



ADVERTISEMENTS FOR PUBLIC OPEN HOUSES

The following public postings are examples of the advertisements used to publicize the open houses.




THE REDMOND MUNICIPAL AIRPORT CORDIALLY INVITES YOU TO
AIRPORT MASTER PLAN OPEN HOUSE
OCTOBER 18, 2017
4:30 P.M. TO 6:30 P.M.
REDMOND CITY HALL
The Airport Master Plan guides airport development over the next 20 years. Airport staff and planning consultants will be available to discuss aviation forecasts, needed airport facilities, and ideas for improvements that will help the Airport serve Central Oregon for years to come. We look forward to sharing our ideas with you, and learning what YOUR thoughts are for the future of the Redmond Municipal Airport.
Fly REDMOND
QUESTIONS ABOUT THE MASTER PLAN PROCESS? VISIT WWW.FLYRDM.COM FOR MORE INFORMATION


THE REDMOND MUNICIPAL AIRPORT CORDIALLY INVITES YOU TO
AIRPORT MASTER PLAN OPEN HOUSE
MARCH 14, 2018
5:00 P.M. TO 7:00 P.M.
REDMOND CITY HALL
The Airport Master Plan guides airport development over the next 20 years. Airport staff and planning consultants will be available to discuss aviation forecasts, needed airport facilities, and ideas for improvements that will help the Airport serve Central Oregon for years to come. We look forward to sharing our ideas with you, and learning what YOUR thoughts are for the future of the Redmond Municipal Airport.
Fly REDMOND
QUESTIONS ABOUT THE MASTER PLAN PROCESS? VISIT WWW.FLYRDM.COM FOR MORE INFORMATION

APPENDIX F:

LANDSIDE DEVELOPMENT

APPENDIX F: LANDSIDE DEVELOPMENT AND OTHER SUPPORT FACILITIES

The research and analysis in this appendix identifies the facility requirements for non-aviation businesses that complement the airport operations or are appropriate for the Redmond market, given local economic conditions. Subareas described in this appendix can be viewed on Figure 3-19, contained in Chapter 3 of this Master Plan.

TARGET INDUSTRY SECTORS

Based on an analysis of the Redmond economy, several market sectors were identified as target industries for the area near the airport.

FACTORS INFLUENCING SELECTION OF TARGET INDUSTRIES

The following considerations were used in identifying target industries:

- ✓ **Existing Business Clusters.** Businesses have already agglomerated in Redmond and in the vicinity of the airport based on the collective competitive advantages of the community and sites near the airport. Existing business concentrations were inventoried and evaluated in the socioeconomic analysis in **Chapter 2**.
- ✓ **Growth Outlook.** The socioeconomic analysis further identified industries and subsectors likely to experience strong growth over the next ten years. This information was derived from Oregon Employment Department data, as well as the third-party data service *Moody's Analytics*.
- ✓ **Suitability of Site/Land Inventory.** This assessment considered the suitability of available land among airport area properties to accommodate potential uses.
- ✓ **Anecdotal Input/Stakeholder Feedback.** The proposed land use determination considered the economic development goals and objectives of the City of Redmond and the airport, input from stakeholders, and professional insights from the consultant team.

TARGET INDUSTRY SECTORS

Based on the factors identified above, the following target industries have been identified for the airport area:

- ✓ **Accommodation and Food Services.** Both anecdotal and empirical inputs suggest the "airport district" (loosely defined here as land south of OR 126 and east of US 97) would benefit from expanded support services, specifically full-service restaurants serving daytime employment and potentially an airport-oriented hotel. The district has a daytime population of almost 3,000 people (not including airport passenger throughput) and is served by only a handful of full-service restaurants.
- ✓ **Speculative Light Industrial Buildings.** The City of Redmond is almost devoid of speculative industrial space suitable to accommodate small- to medium-sized emerging businesses. Speculative industrial development would face a positive real estate climate and serve a growing need in the market. However, the extent to which this use type could be achievable with a ground lease option is less certain (many businesses would prefer to own their land).
- ✓ **Construction.** Construction is a predominant industry in Central Oregon and is expected to exhibit considerable growth over the next decade. The airport district has had success attracting construction firms. There are at least 20 construction firms in the airport district. Construction firms are also a potentially compatible use for ground lease options, as their permanent capital needs are less intensive than other industrial uses.
- ✓ **Manufacturing.** The airport district has a competitive advantage in attracting manufacturing uses interested in co-locating near Central Oregon Community College and capitalizing on the steady supply of workers coming out of its Redmond campus programs. Specifically, metals, equipment, and transportation equipment manufacturers may find opportunities. These are also uses with an established presence in the district. Food and beverage manufacturing is also a high-growth sector that has a measurable presence east of US 97.
- ✓ **Wholesalers and Warehousing.** Wholesaling is an attractive use for the airport district, given the transportation advantages in Redmond and the airport district—nearly 40 wholesaling firms are already in the airport district. Wholesalers commonly require limited investment in real property, often a simple steel or concrete tilt structure. Wholesalers also typically operate on low margins. Combined, these are factors that may make a ground lease option more attractive for this sector.
- ✓ **Public Administration.** The airport district has a clear agglomeration of institutional and public administrative uses (e.g., U.S. Forest Service). Public entities are solid targets for ground leases due to their creditworthiness, long-term functions/holding periods, and (sometimes) least-cost location selection.
- ✓ **Gas Station and Convenience Store.** Per the City of Redmond request, a gas station and convenience store is desirable to serve customers utilizing the airport, including rental car returns.

LAND USE CHARACTERISTICS OF TARGET INDUSTRY SECTORS

This section describes the range of typical building and site sizes and outlines the parking requirements for the target industry sectors.

Typical Building and Site Sizes for Target Industry Sectors

Table 1 below shows an approximate range of building and site sizes for the target industry sectors listed above. This information was derived based on the sizes of similar existing uses in the Redmond and Bend areas. Hotels generally require large buildings on lots of 2 or 3 acres to accommodate parking. The size needs of food services vary widely depending on the restaurant and building type; restaurants in strip malls, for instance, generally require less space than what is shown below for stand-alone restaurants. Large lots are typically not required for food services. Speculative light industrial buildings for emerging small- or medium-sized businesses would generally require smaller spaces than the other industrial uses, though some light industrial uses in the area require large buildings and lots of over an acre. Warehouse, wholesale, and manufacturing uses require large buildings, ranging from just over 10,000 square feet to upwards of 100,000 square feet or more in some cases, though the average size for available properties in the Redmond/Bend area falls between 10,000 and 20,000 square feet. These industrial uses require site sizes ranging from several acres to over 100 acres for large regional warehouses, distribution centers, and heavy industrial manufacturing. Public administration size requirements also vary widely depending on the use. Some public administrative uses do not require large buildings or lots, but institutional campuses may require large buildings on multi-acre properties.

Table J-1. Target Industry Typical Building and Site Sizes

Target Industry	Typical Building Size (square feet)	Typical Lot Size (acres)
Accommodation (hotels)	30,000-50,000	2-3
Food Services (stand-alone)	2,000-8,000	0.1-0.25
Speculative Light Industrial Buildings	8,000-16,000	0.5 - 1.5
Construction	4,000-15,000	1-2
Manufacturing	10,000-30,000	3-100+
Wholesalers and Warehousing	10,000-170,000	2-100+
Public Administration	4,000-50,000	0.3-2
Gas Station & Convenience Store	800-2,400	0.5-1.5

Automobile Parking for Target Industry Sectors

Parking requirements are established in the City of Redmond Development Code section 8.0500. The City requires developments to provide minimum parking spaces based on land use. **Table J-2** summarizes parking requirements for land uses that fall within the target industry sectors. Note that some land uses demand more parking than the code minimum to meet operational needs.

Table J-2. City of Redmond Parking Requirements	
Land Use	**Minimum Parking Ratio**
Commercial Service and Repair	1 space per 600 square feet (sf) retail floor area
Contractor's Yard	1 space per employee or 1 space per 200 sf of office area
Eating and Drinking Establishment	1 space per 100 sf of net floor area
Equipment Rental, Sales, and Service	1 space per 600 sf of retail floor area
Espresso Stand or Booth	1 space per employee
Industrial, General, or Service Related	1 space per 800 sf
Manufacturing and Assembly	1 space per 600 sf
Motel, Hotel	1 space per room, plus 1 space for manager
Office	1 space per 300 sf net office floor area
Retail, General	1 space per 200 sf of retail floor area
Utility Facility	1 space (regardless of facility size)
Warehouse	1 space per 1,000 sf

TRANSPORTATION NEEDS FOR TARGET INDUSTRY SECTORS

All of the target industries need to provide adequate transportation access for passenger vehicles and to varying intensities of truck traffic. Efficient routes to the highway system are necessary to support freight movement associated with the target industries. The existing street network within the study area includes several minor arterial and major collector streets that provide access to the highway system. Turn lanes are generally present at major intersections, but additional turn lanes on major streets may be necessary to serve future development, and local streets may need to be widened to accommodate trucks (see Recommended Upgrades section).

UTILITY DEMANDS FOR TARGET INDUSTRY SECTORS

The target industries listed above comprise a wide range of demands on the utility systems. **Tables J-3** through **J-7** summarize minimum recommended available utility service to support industrial development.

Table J-3. Water Service Requirements for Target Industries

Target Industry	Main Line Size[1]	Fire Line Size	High Pressure Dependency	Flow Rate[2]
Accommodation and Food Services	6”	6”	Not Required	1200 GPD / acre
Speculative Light Industrial Buildings	6”	8”	Not Required	1500 GPD / acre
Construction	6”	6”	Not Required	500 GPD / acre
Manufacturing[3]	6”	10”	Not Required	1850 GPD / acre
Wholesalers and Warehousing	6”	8”	Not Required	500 GPD / acre
Public Administration	6”	6”	Not Required	1200 GPD / acre
Gas Station & Convenience Store	6”	8” [4]	Not Required	500 GPD / acre

[1] Minimum recommended main size for domestic or process use. Utility providers typically do not install water mains smaller than 6” diameter.
[2] GPD / acre: Gallons per day per acre, based on gross property area
[3] Excludes high water users such as food processors, etc.
[4] Small-footprint buildings often do not include fire sprinklers. The fire line size listed applies to on-site hydrant service.

Table J-4. Sewer Service Requirements for Target Industries

Target Industry	Main Line Size[1]	Flow Rate[2]
Accommodation and Food Services	8”	1200 GPD / acre
Speculative Light Industrial Buildings	8”	1500 GPD / acre
Construction	8”	500 GPD / acre
Manufacturing[3]	8”	1850 GPD / acre
Wholesalers and Warehousing	8”	500 GPD / acre
Public Administration	8”	1200 GPD / acre
Gas Station & Convenience Store	8”	500 GPD / acre

[1] Minimum recommended main size for sanitary sewer. Utility providers typically do not install sewer mains smaller than 8” diameter, so this is the smallest recommended line size.
[2] GPD / acre: Gallons per day per acre, based on gross property area
[3] Excludes high water users such as food processors, etc.

Table J-5.Telecommunications Service Requirements for Target Industries

Target Industry	Major Communications Dependency	Fiber Optic Dependency
Accommodation and Food Services	Preferred	Preferred
Speculative Light Industrial Buildings	Preferred	Required
Construction	Preferred	Not Required
Manufacturing	Required	Preferred
Wholesalers and Warehousing	Preferred	Preferred
Public Administration	Preferred	Preferred
Gas Station & Convenience Store	Preferred	Preferred

Table J-6. Natural Gas Service Requirements for Target Industries	
Target Industry	Main Line Size
Accommodation and Food Services	2”
Speculative Light Industrial Buildings	4”
Construction	2”
Manufacturing	4”
Wholesalers and Warehousing	2”
Public Administration	2”
Gas Station & Convenience Store	2”

Table J-7. Electrical Service Requirements for Target Industries			
Target Industry	Minimum Service Demand[1]	Close Proximity to Substation	Redundancy Dependency
Accommodation and Food Services	0.5 MW	Preferred	Not Required
Speculative Light Industrial Buildings	0.5 MW	Preferred	Not Required
Construction	0.5 MW	Not Required	Not Required
Manufacturing	0.5 MW	Preferred	Not Required
Wholesalers and Warehousing	1 MW	Not Required	Not Required
Public Administration	0.5 MW	Preferred	Not Required
Gas Station & Convenience Store	0.2 MW	Not Required	Not Required
[1] ***MW: Megawatts***			

Stormwater at the Redmond Airport is generally managed and contained on site. Swales and ditches are generally used to direct runoff to localized low spots or subsurface infiltration galleries to be discharged via infiltration to the soil. Based on nearby existing facilities and development, we do not expect any issues for the proposed developments. All development will need to meet City of Redmond stormwater treatment regulations and Oregon Department of Environmental Quality requirements for underground injection control discharge, as applicable.

EVALUATION OF LAND SUPPLY FOR TARGET INDUSTRIES

This section assesses each landside development subarea to determine whether the existing zoning permits some or all of the target industries; characterizes parcel sizes for developable land; and identifies FAA leasehold restrictions. All subareas are depicted on **Figure 1-15** in **Chapter 1** of this Master Plan.

In all affected subareas, sites with leasehold restrictions may be less attractive to developers who prefer to own their own sites or who require a long-term lease for financing.[1] Those subareas closest to the runway are also subject to FAA Part 77 height and use restrictions that could affect future development.

[1] According to Redmond Planning Division staff, parcels denoted as having leasehold restrictions are those acquired by the City and/or County from the FAA that may not be sold. Therefore, any third-party users would need to lease the property.

North Development Parcel Subarea

The North Development Parcel Subarea consists of 134 developable acres of City-owned land, including 17 acres zoned Light Industrial (M1) land, 60 acres zoned Tourist Commercial (C5) accessible from OR 126, and 57 acres zoned Open Space Park Reserve (OSPR) at the southern end. The entire subarea is subject to leasehold restrictions. As noted above, ground leases may be viable options for wholesalers and warehouse uses, as well as construction firms. The M1 zone allows both of these uses, but light industrial users may be disinclined to develop a property that can only be leased, not purchased. The C5 and M1 areas, especially off OR 126, could be developed as restaurants (sit-down or drive-through), cafes, or diners. Brew pubs are allowed outright in C5 areas, but other bars and taverns would be a conditional use. Hotels and motels are allowed outright in the C5 zone and would be well-suited to these areas due to proximity to the highway and airport. Options are limited for the large area of OSPR land, but public facilities are permitted outright in this zone when approved in the comprehensive plan or other public facilities plans for this zone. The City has had preliminary conversations with emergency response agencies regarding use of this area for a future emergency training facility.

North Business Park Subarea

This subarea consists of 94 developable acres, with 44 acres zoned Light Industrial (M1), 17.2 acres zoned Tourist Commercial (C5), and 57 acres zoned Open Space Park Reserve (OSPR). The same potential uses would apply for the North Business Park Subarea as the North Development Parcel Subarea above. The entire subarea is subject to leasehold restrictions, so some industrial uses such as wholesale and warehouse might be viable options, while light industrial users may be less inclined to develop these properties through a ground lease. Construction firms could be a viable use for the M1 zones. Food services could be developed on M1 and C5 lots, though bars and taverns would be a conditional use in the C5 zone. As with the North Development Parcel Subarea, accommodation would be well-suited for the C5 areas because of convenient access to the highway and airport. Development options are limited in the OSPR zone, but there may be potential for public facilities in these areas. The southern portion of this subarea is being contemplated for future airport-compatible development (possible corporate, executive, and general aviation facilities) with the northern portion by OR 126 targeted for future commercial development due to its Tourist Commercial (C5) zoning designation.

South Apron Subarea

The South Apron Subarea contains 19 acres zoned Airport, and 5.8 acres zoned Light Industrial (M1), with approximately 25 acres of developed land excluding right-of-way. Twenty-three acres of this subarea, including both Airport and M1 zoned land, is part of a much larger lot owned by the City and subject to leasehold restrictions. A two-acre lot at the southwest corner of the subarea, privately owned and zoned M1, could be used for speculative Light Industrial, Warehouse, or Manufacturing that do not require large lot sizes, or food services uses, though the site is currently developed. In the Airport zone, development options are limited to uses that support and complement the airport.

West Business Park Subarea

The West Business Park contains 225 acres of land, including 193 acres zoned Light Industrial (M1), 24 acres zoned Public Facility, and 8 acres zoned Park. There are approximately 93 acres of developable land, including several vacant M1 parcels, and several acres of vacant area in the Park and Public Facility zoned lots. Most of the City-owned property is subject to leasehold restrictions (33 acres), while the remaining 8 acres is the Park-zoned property home to two City water storage tanks. There are several large vacant privately-owned Light Industrial (M1) zoned lots that could be potential sites for speculative light industrial, wholesale, warehouse, or manufacturing. Portions of these sites could also be used for accommodation, food services, or construction-related business. The PF-zoned lot along the eastern edge of the subarea could be suitable for public administration uses.

Airport Way Subarea

The Airport Way Subarea area contains 55 acres zoned Light Industrial (M1), including approximately 9 acres of developed land (City-owned but leased to Peterson Caterpillar) and 46 acres of developable land owned by the City. The City-owned property is subject to leasehold restrictions. Four of the vacant city-owned lots are over 8 acres and could be ideal spaces for wholesale warehouse uses or large construction firms that could operate under a ground lease. With several relatively large vacant lots adjacent or in close proximity to each other, this subarea could also be an opportunity for a regional warehouse distribution facility. Proximity to the railroad and surrounding industrial uses makes this area unappealing for accommodations such as hotels. Food services could be a viable option to serve employment in the area, as the area currently lacks food options, if it could be demonstrated that sufficient demand exists.

Fairgrounds Industrial Subarea

The Fairgrounds Industrial Subarea consists of 56 acres zoned Light Industrial (M1), including 41 developable acres. There are several privately-owned vacant lots of approximately 1-2 acres in size that could be used for small light industrial uses, construction firms, or food services uses to support the surrounding area. At the north end of the site is a larger vacant privately-owned site (8.8 acres) which, due to its size and zoning could be appealing for use as light industrial, wholesale warehouse, or manufacturing. The southernmost lot in this subarea is an 8-acre City-owned lot subject to leasehold restrictions. Wholesale and warehousing could be viable options for this relatively large site with a ground lease option.

DESCRIPTION OF EXISTING UTILITIES AND ROADWAYS SERVING LANDSIDE SUBAREAS

This section evaluates the existing public utilities and transportation network serving each subarea. Illustrations of existing utilities are found in ___.

North Development Parcel Subarea

- ✓ Water: This subarea is currently served by a 10-inch main along the northern boundary in Lake Road, and by a 12-inch main along the southern boundary in Veterans Way. Public mains do not traverse the interior of the subarea.
- ✓ Sewer: This subarea is currently served by an 8-inch main which transitions to a 10-inch main within Lake Road to the north, and an 8-inch main within Veterans Way to the south. Public mains do not traverse the interior of the subarea.
- ✓ Transportation: This subarea currently has no existing transportation infrastructure within its boundaries. Although OR 126 runs along a portion of the subarea, no existing connections are present. No connections to Veterans Way south of the subarea exist. To accommodate the Airport Runway Extension, plans to relocate the Airport Way/Veterans Way intersection and realign several network streets are under development by the City. These plans currently show a realignment of Veterans Way into the subarea and an extension of 9th Street southward from OR 126 through the subarea to connect with Airport Way. The 9th Street extension will be a minor arterial street that should include a three-lane cross section. Veterans Way will remain a major collector and should have a two-lane cross section with possible turn lanes at major intersections.

North Business Park Subarea

- ✓ Water: This subarea is currently served by an 18-inch main within OR 126 to the east, and within Veterans Way to the south. Public mains do not traverse the interior of the subarea.
- ✓ Sewer: This subarea is currently served by an 8-inch main within Veterans Way to the south, and a 12-inch main within OR 126 to the north.
- ✓ Transportation: This subarea is bisected by Veterans Way, which connects to OR 126 on the northern border of the subarea and US 97 to the west. Veterans Way is a major collector between Airport Way and OR 126. It has two travel lanes with a shoulder bike lane west of the intersection with Sisters Avenue, but no paved shoulders northeast of that intersection. No turn lanes are present on any portion of Veterans Way between Airport Way and OR 126. The subarea also includes local street connections to OR 126 with 10th Avenue connecting on the west side, and Sisters Avenue to Ochoco Way connecting on the east side. None of these local streets has been improved beyond a narrow two-lane paved section.

South Apron Subarea

- ✓ Water: This subarea is currently served by a 12-inch main within Airport Way, and a 10-inch main connecting to the terminal loop.
- ✓ Sewer: This subarea is served by 8-inch mains within Airport Way and the on-site access roads.
- ✓ Transportation: This subarea is served by Salmon Avenue, which connects to Airport Way. Salmon Avenue is a two-lane local street with no sidewalks, with the exception of one short segment. This site has direct access to the airport taxiways.

West Business Park Subarea

- ✓ Water: This subarea houses the existing water reservoirs at the north end of 6th Street. These reservoirs supply mains ranging from 10 to 18 inches within the subarea.
- ✓ Sewer: This subarea is served by 8-inch mains within the streets throughout the subarea.
- ✓ Transportation: This subarea has minor arterial streets along its northern boundary (Veterans Way) and eastern boundary (Airport Way). Veterans Way connects to both US 97 and OR 126 and has been constructed with a two-lane cross section that includes bike lanes but almost no sidewalks. It has no left-turn lanes at any of the local street intersections into the subarea. Airport Way connects to US 97 and has been constructed primarily with a two-lane cross section augmented with left-turn and right-turn lanes at intersecting streets. Bike lanes are part of the roadway, but pedestrian facilities only exist along some developed parcels. This subarea also includes Salmon Street, a major collector, and a local street network that serves existing development. To accommodate the Airport Runway Extension, plans to relocate the Airport Way/Veterans Way intersection and realign several network streets are under development by the City. A railroad spur from the BNSF tracks extends to the western boundary of this subarea.

Airport Way Subarea

- Water: This subarea is currently served by an 18-inch main within Airport Way.
- Sewer: This subarea is currently served by a 12-inch main within Airport Way to the east and south. Sewer flows from this subarea appear to be split between two separate main lines running north and west from the site.
- Transportation: This subarea is served by Airport Way, a minor arterial that connects southward to US 97 and northward to Veterans Way and OR 126. Airport Way has been constructed with a three-lane cross section (including bike lanes) with right-turn lanes at some intersections, but sidewalks are present on only some segments. Mt. Hood Drive was constructed as a four-lane local street eastward from Airport Way to the Fairgrounds but does not currently extend to the west, although a street stub has been constructed. The intersection of Wickiup Avenue (a local street) at Airport Way has been constructed, but no existing roadway connects to the intersection. The BNSF railroad tracks run along the western boundary, but has no existing rail spurs in this subarea.

Fairgrounds Industrial Subarea

- Water: This subarea is currently served by a 12-inch main within 19th Street, and 8-inch mains elsewhere throughout the subarea.
- Sewer: This subarea is currently served by a 12-inch main within 19th Street, and 8-inch mains elsewhere within the subarea.
- Transportation: This subarea is currently served by 19th Street, a minor arterial that connects to Airport Way approximately one-quarter mile from US 97. 19th Street has been fully constructed with a three-lane cross section, with sidewalks and bike lanes on both sides from Airport Way to Elkhorn Avenue. A network of new local streets west of 19th Street serve existing development. The BNSF railroad tracks run along the western boundary, but BNSF has no existing rail spurs in this subarea.

RECOMMENDED UPGRADES

The following recommendations are offered based on a comparison of the existing utility and transportation facilities and the corresponding demands of the target industries. In all subareas, sewer lines would need to be extended from nearby mains and stormwater management facilities would need to be constructed in conjunction with site development. Local streets should be constructed to the local industrial street standard (40-foot paved width with sidewalks) to accommodate necessary truck access for most of the target industry sectors. Improved access to OR 126 will eventually be required to accommodate future growth with any of the target industry sectors and will likely include added turn lanes and traffic signals. Turn lanes at major intersections may also be needed to serve future development.

Necessary improvements would be identified with the preparation of traffic impact studies for specific development proposals.

Specific upgrade requirements for each subarea are noted below.

- ✓ North Development Parcel Subarea: The existing water lines between Lake Road and Veterans Way are not well-connected. We recommend installing a loop system throughout the subarea to maintain necessary flows for high-demand industrial users. This subarea currently has no existing transportation infrastructure and will need to rely on the construction of new streets. Transportation improvements associated with the Airport Runway Extension will eventually provide access through the subarea. Local streets that provide direct site access will need to be constructed to the local industrial standard (40-foot paved width with sidewalks).
- ✓ North Business Park Subarea: The existing water lines between Veterans Way and OR 126 are not well-connected. We recommend installing a loop system to supply necessary flows for high-demand users. The local streets (10th Street, Sisters Avenue, Ochoco Way) need to be upgraded to the current local industrial standard (40-foot paved width with sidewalks). Veterans Way needs to be upgraded to meet the major collector standard (36-foot paved width with sidewalks). At the Veterans Way intersection with OR 126, an eastbound right-turn deceleration lane on OR 126 may be necessary as volumes increase, and separate left- and right-turn lanes may be necessary on the Veterans Way approach. Left-turn lanes on Veterans Way at other intersecting roadways may also be needed.
- ✓ South Apron Subarea: Salmon Avenue needs sidewalks on the north side of the street.
- ✓ West Business Park Subarea: Airport Way and Veterans Way need sidewalk infill, primarily along undeveloped property.
- ✓ Airport Way Subarea: Airport Way needs sidewalk infill on both sides of the street. Mt. Hood Drive needs sidewalks along both sides of the street. Wickiup Avenue needs to be constructed/upgraded to the current local industrial standard (40-foot paved width with sidewalks).
- ✓ Fairgrounds Industrial Subarea: Airport Way needs sidewalks on the south side of the street.

APPENDIX G:

NOISE INPUTS

NOISE INPUT APPENDIX

Existing (2016) and Future (2036) noise contours were generated with the FAA's Aviation Environmental Design Tool (AEDT) version 2d. Inputs were obtained from a variety of sources including, Chapter 2 *Aviation Activity Forecasts* of this Master Plan, Airport personnel, Air Traffic Control Tower personnel, published instrument procedures and traffic patterns and institutional knowledge.

The following information formed the basis of the noise contour development.

Table G-1 Activity Table 2016
Itinerant Operations

Category	Modeled Aircraft	Modeled Operations
Air Carrier	Q400	5,688
	CRJ-700	506
Commuter / Air Taxi	CRJ-200	4,556
Air Cargo and Forest Service	Beech 99	965
	Cessna Caravan 208	965
	BAE 146	250
	Ayres T34 Thrush	250
General Aviation	Citation II	330
	Citation V	330
	GLF6	330
	Pilatus PC-12	330
	Cessna Conquest	330
	CJ1	330
	Piaggio Avanti	330
	TBM850	330
	Lancair	2,087
	Lancair Turbine	2,087
	GASEPV	2,087
	GASEPF	2,087
Helicopter	SH-60	500
	R22	0
Military	P-3	114
	King Air 90	114
	C-130	114
TOTAL ITINERANT OPERATIONS		**25,010**

Local (touch-and-go) Operations		
Category	**Modeled Aircraft**	**Modeled Operations**
General Aviation		
	C-172	5,267
	Piper Seminole	5,267
	King Air 90	5,267
	Lancair	2,104
	Lancair Turbine	2,104
	GASEPV	2,104
	GASEPF	2,104
Helicopter		
	R22	4,200
Military		
	P-3	90
	King Air 90	83
	C-230	83
TOTAL TOUCH-AND-GO OPS		28,673
TOTAL AIRPORT OPERATIONS*		**82,356**
*Airport operations include a 2x multiplier for touch-and-go operations as one touch-and-go represents two operations for counting purposes		

Table G-2 Activity Table 2036 Itinerant Operations Category	Modeled Aircraft	Modeled Operations
Air Carrier	Q400	1,000
	E175	1,000
	CRJ-900	1,000
	MRJ-90	2,400
	737-700A319	4,350
	737-700	1,800
	737-800	750
	737-900	300
	CRJ-700	0
Commuter / Air Taxi	CRJ-200	0
Air Cargo and Forest Service	Beech 99	1,050
	Cessna Caravan 208	1,050
	BAE 146	250
	Ayres T34 Thrush	250
General Aviation	Citation II	420
	Citation V	420
	GLF6	420
	Pilatus PC-12	420
	Cessna Conquest	420
	CJ1	420
	Piaggio Avanti	420
	TBM850	420
	Lancair	2,660
	Lancair Turbine	2,660
	GASEPV	2,660
	GASEPF	2,660
Helicopter	SH-60	1,000
	R22	0
Military	P-3	100
	King Air 90	100
	C-130	100
TOTAL ITINERANT OPERATIONS		30,500

Local (touch-and-go) Operations Category	Modeled Aircraft	Modeled Operations
General Aviation	C-172	5,330
	Piper Seminole	5,330
	King Air 90	5,330
	Lancair	2,363
	Lancair Turbine	2,363
	GASEPV	2,363
	GASEPF	2,363
Helicopter	R22	4,250
Military	P-3	83
	King Air 90	83
	C-230	83
TOTAL TOUCH-AND-GO OPS		29,939
TOTAL AIRPORT OPERATIONS*		**90,377**

*Airport operations include a 2x multiplier for touch-and-go operations as one touch-and-go represents two operations for counting purposes

Table G-3 Time of Day	
Air Carrier	
Day	**Night**
82%	18%
Commuter / Air Taxi	
Day	**Night**
82%	18%
Air Cargo	
Day	**Night**
50%	50%
Forest Service	
Day	**Night**
100%	0%
General Aviation - Itinerant	
Day	**Night**
93%	7%
General Aviation - Local	
Day	**Night**
95%	5%
Helicopter	
Day	**Night**
100%	0%
Military	
Day	**Night**
95%	5%

Table G-4 Runway Use Distribution			
Commercial Arrivals			
Runway			
11	29	5	23
5%	5%	30%	60%
Commercial Departures			
Runway			
11	29	5	23
5%	5%	60%	30%
General Aviation Arrivals			
Runway			
11	29	5	23
60%	30%	5%	5%
General Aviation Departures			
Runway			
11	29	5	23
60%	30%	5%	5%