



CITY OF BEND

BEND MUNICIPAL AIRPORT

## AIRPORT MASTER PLAN



# ACKNOWLEDGMENTS

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# Table of Contents

## Develop Understanding

### *Chapter 1: Introduction*

Study Purpose .....	1
Project Need.....	2
Project Funding .....	2
Goals of the Master Plan .....	3
Planning Process .....	4
Framework of the Airport Plan .....	5
Project Schedule .....	5
Public Involvement Process.....	6
Known Issues & Opportunities .....	12

### *Chapter 2: Existing Conditions Analysis*

Regional Setting.....	15
<i>Location &amp; Vicinity</i>	
<i>Community Socio-Economic Data</i>	
<i>Airport Role</i>	
<i>Airport History</i>	
<i>Area Airports Contextual Analysis</i>	
<i>Airport Operational Data</i>	
<i>Relevant Studies</i>	
<i>Environmental Data</i>	
<i>Local Surface Transportation System Analysis</i>	
<i>Land Use/Zoning Analysis</i>	
Landside Elements.....	36
<i>General Aviation (GA) Development Areas</i>	
<i>Airport Perimeter Fencing</i>	
<i>Airport Surface Road Access</i>	
<i>Vehicle Parking</i>	
<i>Hangars</i>	
<i>Utilities</i>	
Airside Elements .....	47
<i>Runway/Helipad</i>	
<i>Taxiways &amp; Taxilanes</i>	
<i>Aprons/Tiedowns</i>	
<i>Pavement Condition</i>	
<i>Support Facilities</i>	

<i>Traffic Patterns</i>	
<i>Airspace Classifications</i>	
<i>Local Area Airspace Structure</i>	
<i>Special Use Airspace</i>	
<i>Controlled &amp; Uncontrolled Airspace</i>	
<i>Airspace - FAR Part 77, TERPS, and Runway End Siting Surfaces</i>	
<i>Instrument Flight Procedures</i>	
<i>Air Traffic Control Tower (ATCT)</i>	
<i>Remote ATC Opportunities</i>	
<b>Airport Administration</b> .....	<b>61</b>
<i>Airport Ownership &amp; Management</i>	
<i>Airport Finance</i>	
<i>Airport Rates and Charges</i>	
<i>City of Bend Rules and Regulations</i>	
<i>FAA Compliance Overview</i>	
<b>Existing Conditions Analysis Summary</b> .....	<b>66</b>
<i>Chapter 3: Aviation Activity Forecasts</i>	
<b>Historic Aviation Activity</b> .....	<b>67</b>
<i>Based Aircraft</i>	
<i>Aircraft Operations</i>	
<i>Fuel Sales Data</i>	
<b>Forecast Review and Approval Process</b> .....	<b>75</b>
<i>Bend Aircraft Operations Memo - City of Bend Cover Letter</i>	
<i>Bend Aircraft Operations Memo</i>	
<i>Response to FAA Comments on Bend Aircraft Operations Memo</i>	
<i>Final Bend Aviation Activity Forecasts</i>	
<i>FAA Approval Letter</i>	

## Explore Solutions

### *Chapter 4: Facility Goals and Requirements*

<b>Introduction</b> .....	<b>147</b>
<b>Critical Aircraft and Airport Design Standards</b> .....	<b>148</b>
<i>Critical Aircraft and Airport Reference Code</i>	
<i>Runway Design Code</i>	
<i>Approach and Departure Reference Code</i>	
<i>Taxiway Design Group</i>	
<i>FAA Design Standards</i>	
<b>Airport Capacity and Delay</b> .....	<b>150</b>
<i>Total Operations and Airport Capacity</i>	

<b>Regional Setting Goals and Requirements</b>	153
<i>Location and Vicinity</i>	
<i>Community Socio-Economic Data</i>	
<i>Airport Role</i>	
<i>Airport History</i>	
<i>Area Airports Contextual Analysis</i>	
<i>Airport Operational Data</i>	
<i>Relevant Studies</i>	
<i>Environmental Data</i>	
<i>Local Surface Transportation System Analysis</i>	
<i>Land Use/Zoning Analysis</i>	
<b>Landside Goals and Requirements</b>	157
<i>Airport Perimeter Fencing</i>	
<i>Airport Surface Roads</i>	
<i>Vehicle Parking</i>	
<i>Hangars</i>	
<i>Utilities</i>	
<b>Airside Goals and Requirements</b>	160
<i>Runway/Helipad</i>	
<i>Taxiways &amp; Taxilanes</i>	
<i>Apron/Tiedowns</i>	
<i>Pavement Condition</i>	
<i>Support Facilities</i>	
<i>Traffic Patterns</i>	
<i>Airspace – FAR Part 77, TERPS, and Runway End Siting Surfaces</i>	
<i>Instrument Flight Procedures</i>	
<i>Air Traffic Control Tower (ATCT)</i>	
<b>Airport Management Goals and Requirements</b>	180
<i>Ownership and Management</i>	
<i>Airport Finance</i>	
<i>Airport Rates and Charges</i>	
<i>City of Bend Rules and Regulations</i>	
<i>FAA Compliance Overview</i>	
<b>Summary of Facility Goals and Requirements</b>	181

*Chapter 5: Development Alternatives*

<b>Introduction</b> .....	<b>183</b>
<b>Summary of Development Alternative Analysis Process</b> .....	<b>184</b>
<i>Primary Elements</i>	
<i>Secondary Elements</i>	
<i>Existing, Future, and Ultimate Facilities</i>	
<b>Development Alternatives</b> .....	<b>187</b>
<i>No Build Alternative (No Figure)</i>	
<i>Development Alternative 1</i>	
<i>Development Alternative 2</i>	
<i>Development Alternative 3</i>	
<i>Development Alternative 3A</i>	
<i>Development Alternative 4</i>	
<b>Preferred Development Alternative</b> .....	<b>208</b>

## Implementation

*Chapter 6: Airport Layout Plan*

<b>Introduction</b> .....	<b>215</b>
<b>Airport Layout Plan Drawings</b> .....	<b>216</b>
<i>Airport Data Sheet</i>	
<i>Airport Layout Plan</i>	
<i>Terminal Area Plan Drawings</i>	
<i>FAR Part 77 Airport Airspace Plan</i>	
<i>Runway Inner Approach Plan and Profile Drawings</i>	
<i>Runway Departure Surface Plan and Profile Drawings</i>	
<i>Helicopter Inner Approach Plan and Profile Drawings</i>	
<i>Airport Land Use Plan Drawings</i>	
<i>Exhibit "A" - Airport Property Plan</i>	

*Chapter 7: Strategies & Actions, Capital Improvement Plan, and Financial Plan*

<b>Introduction</b> .....	<b>257</b>
<b>Strategies and Actions</b> .....	<b>257</b>
<i>Airport Master Plan (AMP) Adoption and Implementation</i>	
<i>Airspace Congestion</i>	
<i>Surface Transportation</i>	
<i>Eastside Aviation Development</i>	
<i>Airside Facilities</i>	
<i>Airport Administration</i>	

<b>Capital Improvement Plan . . . . .</b>	<b>262</b>
<i>Short-Term Projects (Years 1-5)</i>	
<i>Intermediate-Term Projects (Years 6-10)</i>	
<i>Long-Term Projects (11-20)</i>	
<i>Capital Funding Sources and Programs</i>	
<b>Financial Plan . . . . .</b>	<b>268</b>
<i>Airport Revenue Projections</i>	
<i>Airport Expense Projections</i>	
<i>Summary of Revenue/Expense Projections</i>	

## Appendices

### Appendices

<i>Appendix A: Cultural Resources Survey . . . . .</i>	<i>271</i>
<i>Appendix B: Environmental Screening . . . . .</i>	<i>292</i>
<i>Appendix C: Noise Contour Data Inputs/Output . . . . .</i>	<i>303</i>
<i>Appendix D: Recycling and Solid Waste Management . . . . .</i>	<i>307</i>
<i>Appendix E: Preliminary ATCT Analysis . . . . .</i>	<i>313</i>
<i>Appendix F: Glossary of Aviation Terms and Abbreviations . . . . .</i>	<i>318</i>

# DEVELOP UNDERSTANDING

WHAT YOU HAVE AND  
WHERE YOU ARE GOING

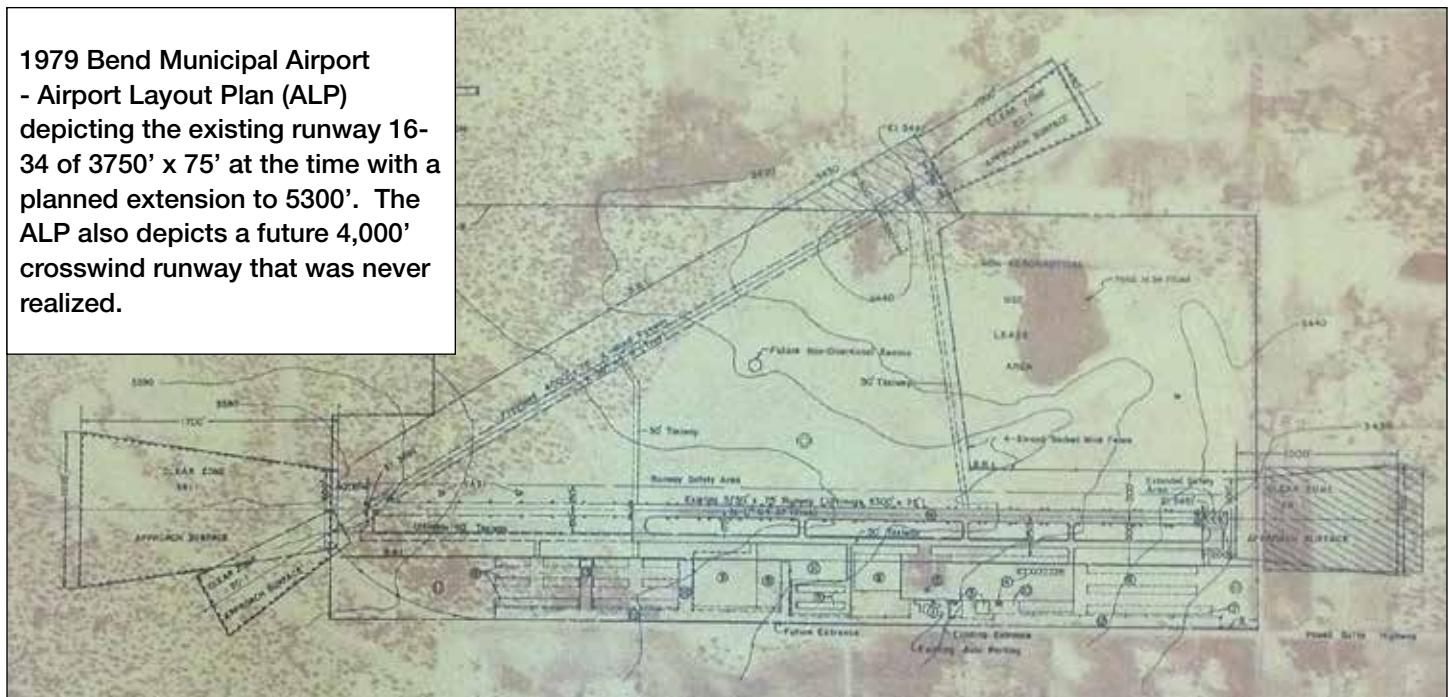


# Chapter 1: Introduction

The City of Bend prepared an Airport Master Plan Update for Bend Municipal Airport (BDN) in cooperation with the Federal Aviation Administration (FAA) to address the airport's needs for the next twenty years. The Airport Master Plan will provide specific guidance in making the improvements necessary to maintain a safe and efficient airport that is economically, environmentally, and socially sustainable.

## Study Purpose

The purpose of the Airport Master Plan is to define the current, short-term and long-term needs of the airport through a comprehensive evaluation of facilities, conditions and FAA airport planning and design standards. The study will also address elements of local planning (land use, transportation, environmental, economic development, etc.) that have the potential of affecting the planning, development and operation of the airport.



Source: 1979 Bend Airport Layout Plan



## Project Need

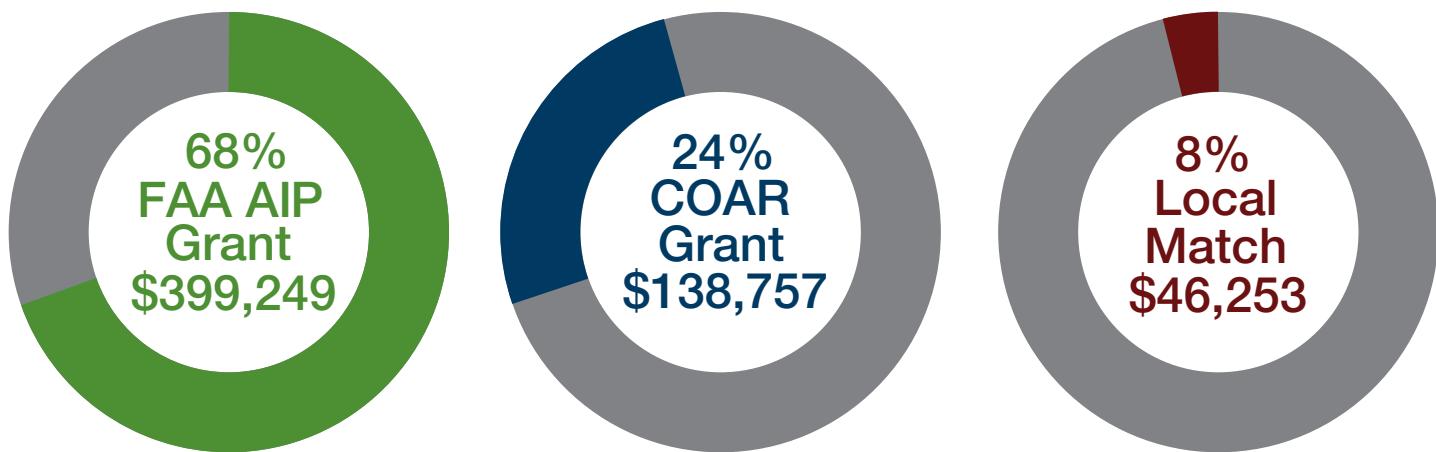
The FAA recommends airports periodically update their master plans as conditions change in order to maintain current planning. Activity at Bend Municipal Airport has increased as the local community and surrounding area have grown. Over the last twenty years, both Bend and Deschutes County have experienced significant growth in population, growing faster than Oregon's statewide rate of growth. At the airport, the number of locally-based aircraft and aircraft operations (takeoffs and landings) has also increased substantially during this period.

As many of the previous airport master plan recommendations have been implemented in response to this demand, the need now exists to update the long-term planning for the airport and reevaluate several concepts presented in the previous master planning effort. In addition to addressing changing local conditions, updated FAA standards and current trends within the aviation industry also need to be reflected in updated airport planning.

This project replaces the 2013 Airport Master Plan, which serves as primary source for inventory data. However, where available, more current or comprehensive data have been included in the report to illustrate current conditions. Existing airfield facilities were examined during on-site inspections to update facility inventory data. The consultants also worked closely with airport staff to review the current facility and operational data maintained by the City.

## Project Funding

Funding for the Airport Master Plan Update is being provided through an FAA Airport Improvement Program (AIP) grant of \$399,249 (68.33%) and an ODA COAR grant of \$138,757 (23.75%) with a local match of \$46,253 (7.92%) provided by the City of Bend. The total project cost of \$584,259 includes City staff administration time to support the planning process. The AIP is a dedicated fund administered by FAA with the specific purpose of maintaining and improving the nation's public use airports. The AIP is funded exclusively through fees paid by users of general aviation and commercial aviation.





# Goals of the Master Plan

The primary goal of the master plan is to provide the framework and vision needed to guide future development at the Bend Municipal Airport. The FAA sets out goals and objectives each master plan should meet to ensure future development will cost-effectively satisfy aviation demand and also consider potential environmental and socioeconomic impacts.

**Goal 1:** Define the vision for the airport to effectively serve the community, airport users, and the region. Assess known issue including air traffic control, runway length, ability to accommodate development, auto parking, fencing, and land use to develop a realistic sustainable plan to improve the airport.

**Goal 2:** Document existing activity, condition of airfield facilities, and policies that impact airport operations and development opportunities.

**Goal 3:** Forecast future activity based on accepted methodology.

**Goal 4:** Evaluate facilities and conformance with applicable local, state, and FAA standards.

**Goal 5:** Identify facility improvements to address conformance issues and accommodate demand.

**Goal 6:** Identify potential environmental and land use requirements that may impact development.

**Goal 7:** Explore alternatives to address facility needs. Work collaboratively with all stakeholders to develop workable solutions to address needs.

**Goal 8:** Develop an Airport Layout Plan to graphically depict proposed improvements consistent with FAA standards as a road map to future development. Prepare a supporting Capital Improvement Plan to summarize costs and priorities.

**Goal 9:** Provide recommendations to improve land use, zoning, and City/County oversight of the airport to remove barriers to appropriate growth at the airport.

**Goal 10:** Summarize the collective vision and plan for the airport in the Airport Master Plan report.

## THE FAA ROLE IN THE AIRPORT MASTER PLAN

FAA Advisory Circular 150/5070-6B Airport Master Plans defines the specific requirements and evaluation methods established by FAA for the study. The guidance in this AC covers planning requirements for all airports, regardless of size, complexity, or role. However, each master plan study must focus on the specific needs of the airport for which a plan is being prepared.

The recommendations contained in an airport master plan represent the views, policies and development plans of the airport sponsor and do not necessarily represent the views of the FAA. Acceptance of the master plan by the FAA does not constitute a commitment on the part of the United States to participate in any development depicted in the plan, nor does it indicate that the proposed development is environmentally acceptable in accordance with appropriate public law. The FAA reviews all elements of the master plan to ensure that sound planning techniques have been applied. However, the FAA only approves the Aviation Activity Forecasts and Airport Layout Plan.

# Planning Process

The three phase planning process is designed to provide multiple feedback loops intended to maintain the flow of information and ideas among the community and project stakeholders and ultimately maximize public involvement.

## DEVELOP UNDERSTANDING

A comprehensive understanding of the issues and opportunities, existing conditions, and an identified level of future aviation activity that would mandate facility improvements required to satisfy future demand.

### Analysis

- Develop Scope of Work
- Public Involvement Strategy
- AGIS Survey
- Existing Conditions Analysis
- Aviation Activity Forecasts

### Project Meetings

- Bi-Weekly Planning Team Meetings
- Project Kick-off Meeting
- Planning Advisory Committee (PAC) Meetings
- Project Stakeholder Meetings
- Regional Stakeholder Meeting

### Work Product

- Working Paper #1
  - » Introduction
  - » Existing Conditions
  - » Aviation Activity Forecasts

## EXPLORE SOLUTIONS

A collaborative exploration of local Airport needs, goals, and facility requirements in sequence with the development of community generated ideas, solutions, and development alternatives.

### Analysis

- Define Updated Airfield Design Standards
- Perform Demand/Capacity Analysis
- Define Facility Goals and Requirements
- Identify & Prepare Development Alternatives
- Evaluate Development Alternatives

### Project Meetings

- Bi-Weekly Planning Team Meetings
- Planning Advisory Committee Meetings (PAC)
- Project Stakeholder Meetings

### Work Product

- Working Paper #2
  - » Facility Goals & Requirements
  - » Airport Development Alternatives

## IMPLEMENTATION

An implementation program with recommended strategies and actions for future land use, transportation, and environmental requirements; a realistic and workable CIP; and current ALP drawings that graphically depict existing conditions at the airport as well as proposed development projects.

### Analysis

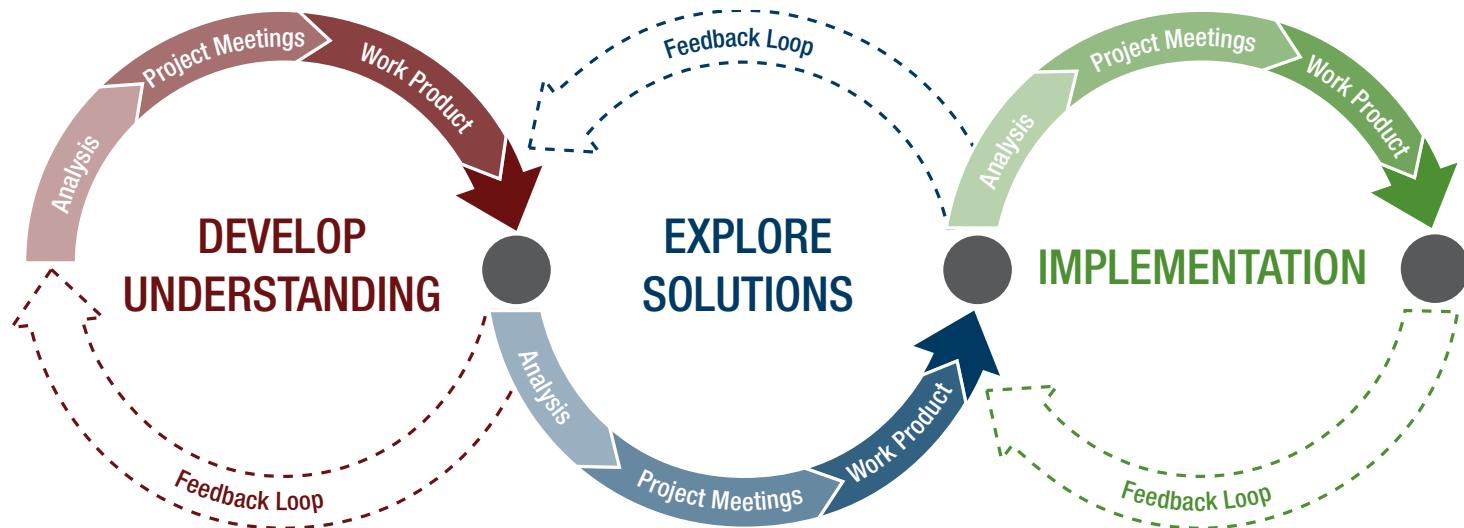
- Conduct Airport Noise Evaluation
- Develop Strategies & Actions
- Develop CIP/Phasing/Financial Plan
- Develop ALP Drawing Set

### Project Meetings

- Bi-Weekly Planning Team Meetings
- Planning Advisory Committee Meetings (PAC)
- Project Stakeholder Meetings
- Regional Stakeholder Meeting

### Work Product

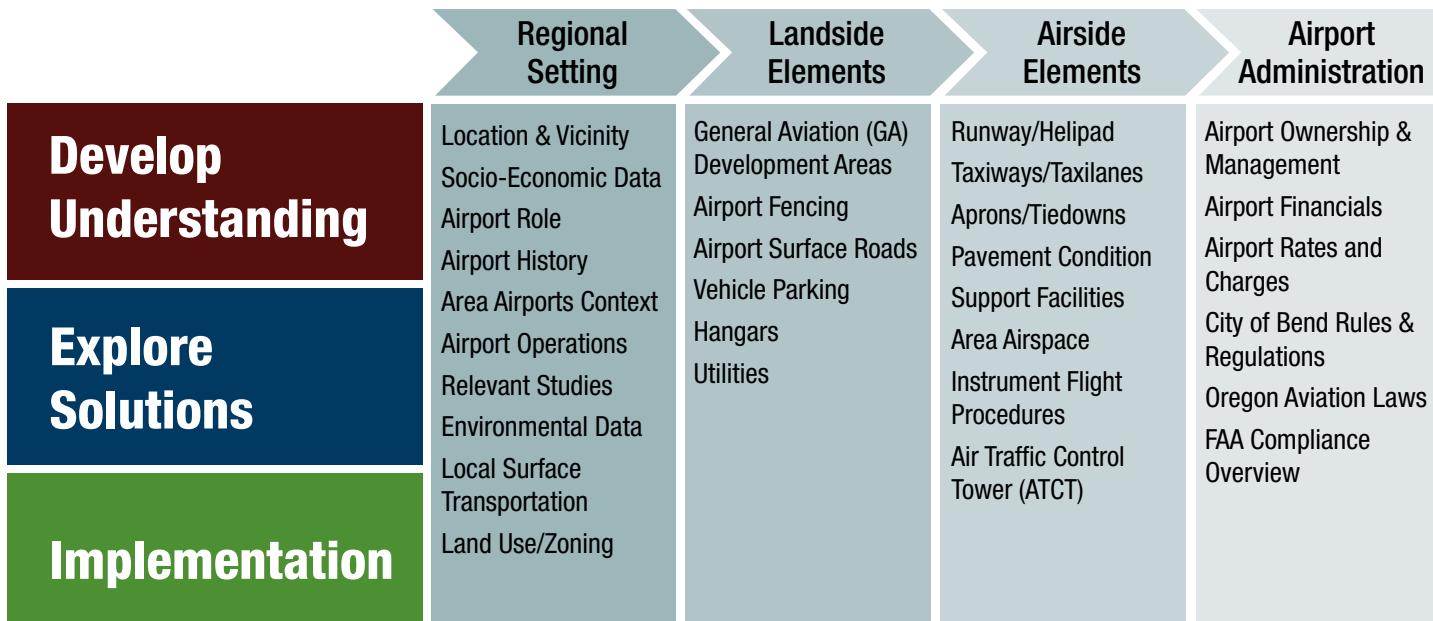
- Working Paper #3
  - » Strategies & Actions
  - » Financial Plan (CIP/Phasing)
  - » ALP Drawing Set
- Final Draft Report
- Final Report





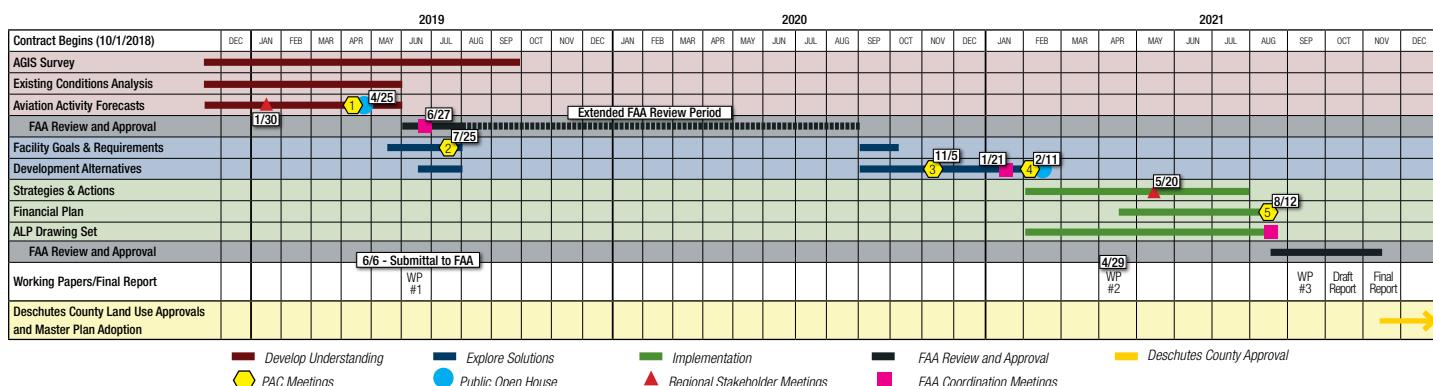
# Framework of the Airport Master Plan

The framework of the airport master plan provides a clear structure to inform and steer future planning decisions and serve as a tool to guide a process that allows the plan to take shape through flexibility, iteration, and adaptation. The framework is based upon an airport-urban interface model intended to analyze the regional setting of the airport, the landside elements and airside elements of the airport, as well as the airport management and administration functions associated with the airport. The framework provides guidance while being flexible enough to adapt to changing conditions to maximize opportunities to develop understanding, explore solutions, and implement the preferred development alternatives for the Airport and adjacent urban and rural environments.



## Project Schedule

The Bend Municipal Airport Master Plan schedule was expected to occur over the course of 24 months but was delayed largely due to an extended forecast review process and the COVID-19 pandemic. A typical planning process is broken into three phases: Phase 1 - Develop Understanding will take approximately 6-7 months excluding the AGIS element, Phase 2 - Explore Solutions will take approximately 8-9 months, and Phase 3 - Implementation will take approximately 8-9 months including 3 months for FAA approvals, which can take anywhere from 3-6 months upon receipt of the final draft narrative reports and drawings. Due to the delays described above the project was completed in approximately 36 months.





# Public Involvement Process

A comprehensive and engaging public involvement process is a key element to a successful Master Plan update. Therefore, numerous opportunities for public input were built in to the planning process. In addition to two focused Regional Stakeholder meetings, there were five Planning Advisory Committee (PAC) meetings, two Public Open House meetings, numerous FAA coordination meetings, a project website, and ongoing communication and coordination between City of Bend staff and the project planning team over the course of the project.

## REGIONAL STAKEHOLDER MEETINGS

As part of the Bend Airport Master Plan Update the planning team conducted two Regional Stakeholder Meetings with a select group of regional stakeholders to help build a better understanding of the role of the Bend Municipal Airport and to discuss strategies and actions the Airport and community may pursue to implement the plan when completed.

### Summary of Regional Stakeholder Meeting #1

#### January 30, 2019

Regional Stakeholder Meeting #1 served as the kick-off meeting and provided the planning team and local stakeholders with an opportunity to better understand the Community vision/role of the Airport now and in the future. The meeting also helped the planning team develop further understanding of any existing Airport issues and opportunities as identified by meeting participants. There were approximately 35 people in attendance representing a wide cross section of regional stakeholders. Attendees included local and regional government and quasi-governmental officials, Airport based business representatives, Airport users, and Airport neighbors.



The stakeholder input session identified several major themes and specific topics that were discussed during the conversation when stakeholders were presented with the following questions:

- What are the long-term goals you want to see achieved at the Airport?
- What does the Airport need to do to prepare for the future?

The identified themes and stakeholder input included:

#### Economic Development

- Address zoning issues
- Flexible zoning requirements – get rid of the multiple zones within airport boundary
- Expand commercial use to County land – West of Powell Butte Highway.
- Long-term – create usable industrial land – balance between aviation and non-aviation development
- Market KBDN as a desirable employment location
- Review allowable uses for commercial and industrial uses

#### Social/Governance

- Protect Airport from residential conflict
- Public outreach – KBDN Public Awareness
- Airport Fees & Tax Base
- Simplify regulatory process for development – Annex KBDN in to City?

#### Environment

- Remain sensitive to airport noise issues
- Support (Future) Bend Community Action Plan – KBDN accounts for 2% of Bend greenhouse gas emissions
- Electric vehicle charging

#### Infrastructure

- Aircraft Storage – hangars & tiedowns
- Runway extension
- Interior loop roads
- Accommodate growth – land acquisition, runway extension, etc...
- Vehicle access & parking
- Upgrade facilities sustainably





## Airspace

- Improve FAA Air Traffic Control regional visibility – for traffic radar coverage below 7,000;
- Air Traffic Control of neighboring community and safety
- Develop helicopter specific instrument approach
- Preserve flying freedoms
- Need control tower – airspace issues
- Tower (control airspace/safety)
- Air traffic/airspace control
- Volume of traffic

## Safety/Security

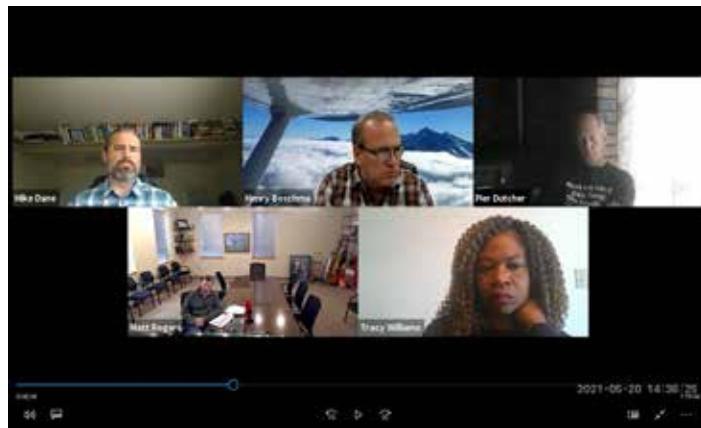
- Airport ops – contaminated runway clearing and NOTAMS
- Building & fire code compliance
- Physical security
- EMS/fire response
- Ramp security/access control

To close out the meeting there was a summary presentation and discussion of the FAA Air Traffic Control Tower (ATCT) program and a previous ATCT Study completed at the Airport. Consultants presented background information related to the status of the FAA ATCT program and the new Remote Tower Program being introduced as a modern alternative to traditional brick and mortar air traffic control towers.

## Regional Stakeholder Meeting #2

**May 20, 2021**

Regional Stakeholder Meeting #2 was conducted remotely via Zoom. The meeting offered the planning team and local stakeholders an opportunity to discuss strategies and actions the Airport and community may pursue to implement the preferred alternative identified throughout the planning process. This meeting helped to clarify and understand the needs from a local and regional perspective and to prioritize improvements as they may relate to other projects within the region.



The meeting included a brief recap of Regional Stakeholder Meeting #1, Facility Goals and Requirements, Development Alternatives, and Implementation Planning steps to come. The focus of the meeting was to confirm the proposed “Key Focus Areas” and “Strategies” intended to guide the development of the Capital Improvement Plan (CIP) and future airport development phasing. The Key Focus Areas and Strategies discussed include:

## Airport Master Plan Adoption and Implementation

- Work with City staff and Deschutes County to assist with AMP Adoption process
- Work with Deschutes County to expedite on-airport development approvals
- Work with Deschutes County to further explore the future “Airport Employment District” concept

## Airspace Congestion

- Design/Construct (ATCT)
- Fly Friendly update
- Monitor and analyze aircraft operational metrics

## Surface Transportation

- Improve airport access
- RPZ analysis and assessment
- Relocate Nelson Road for additional runway length
- Improve eastside airport access roads

## Eastside Aviation Development

- Development of new facilities
- Identify local projects
- Reduce barriers to long-range development planning

## Airfield Facilities (Priorities)

- ATCT
- Perimeter fencing improvements
- Westside taxilane reconstruction/stormwater improvements
- Eastside parking apron
- Southwest apron reconstruction
- Ongoing pavement maintenance
- HOA improvements
- Primary runway extension

## Airport Administration

- Identify new revenue sources
- Address noise concerns with neighbors
- Policies and standards for development at the Airport



## PLANNING ADVISORY COMMITTEE (PAC) MEETINGS

The PAC was assembled to provide input and allow for public dissemination of data. Airport tenants, pilots, local & regional economic development interests, neighbors of the airport, and staff/representatives of the City and/or County served as members of the PAC. In addition to the membership composition noted above, representatives from the FAA Seattle Airports District Office (ADO) and ODA served as ex officio members of the PAC.

### PAC Meeting #1 / Public Open House

#### April 25, 2019

PAC Meeting #1 was an interactive discussion with the PAC that summarized the existing conditions of the Airport and aviation industry, identified and discussed potential issues and opportunities, and established the framework for finalizing the aviation forecasts that were ultimately submitted to the FAA for review and approval.

There were approximately 30 people in attendance at the meeting that included local Airport neighbors, City Council members, Airport users, Oregon Department of Aviation staff, and City staff and consultants. After the summary of the existing conditions analysis and aviation activity forecasts, consultants facilitated an informal Q&A discussion amongst the planning team and PAC members as well as members of the public present at the meeting that revolved around several key issues including:

- Considerable growth in projected aviation activity
- Preserving glider operations area/activity at the Bend Municipal Airport
- Corporate aircraft make up a significant amount of airport operations and will likely continue
- Shortage of T-hangars for Single-engine piston aircraft that make up the vast majority of based aircraft
- Prineville Airport Manager estimated 1/3 of based aircraft are people that may prefer to be based in Bend but cannot find a reasonably priced hangar
- Concerns were discussed regarding coordination between Deschutes County and City of Bend and the notable impacts on development potential at the Airport



### PAC Meeting #2

#### July 25, 2019

PAC #2 was designed to serve as a crucial point in multi-step public review process intended to identify and verify the facility goals and requirements necessary to satisfy future demands on the Airport. PAC #2 presented the proposed Facility Goals and Facility Requirements developed by planning consultants based on input received during Regional Stakeholder Meeting #1, PAC Meeting #1, Airport User Surveys, public comments, airport user comments, and focused discussions with City/Airport staff and other regional stakeholders

The proposed facility goals and requirements were discussed within the context of the regional setting of the Airport, landside elements, airside elements, and the airport administrative elements.

#### Regional Setting

The regional setting discussion was focused primarily on sustaining the long-term economic viability of the Airport through future compatible land use planning for the areas on and around the Airport. The conversation veered more towards a discussion of identifying the appropriate long-term planning and land use designations and/or mechanism for protecting the future Airport property from encroachment of incompatible land uses. Several potential alternatives discussed by PAC members that are worth future consideration amongst the PAC include:

- Maintain existing EFU zoning and low-density residential around Airport (status quo) and impose new restrictions that limits future development/subdivision around the Airport.
- Rezone land with no agricultural production value around the Airport to "County Rural Commercial/Industrial."
- Annex (UGB expansion) and rezone land around the Airport to Urban Commercial/Industrial.
- Identify a new County Comprehensive Plan Designation of "Airport Employment District" within the County's defined "Sphere of Influence" for the Airport.
  - » Is the "sphere of influence" a ½ mile buffer around the property line of the Airport?
  - » What are the type of land uses that can occur within the "Sphere of Influence?"
  - » Land use risk analysis? -- If annexation passes, what is the land use process?

#### Landside Elements

The landside elements discussion revolved around the discussion of apparent hangar shortage that is largely due to underutilized hangar space more so than not enough hangar space available.

A discussion on the legality of the Sponsor providing lease rate rebates and surcharges for underutilized hangar space aviation related uses in hangars was discussed.



The landside elements discussion also included a conversation on the existing non-standard condition of hangars encroaching on Taxilane Object Free Areas observed in the SW development area. The most apparent alternatives were discussed which included:

- limiting the wingspan of aircraft in designated areas by placing appropriate signage
- planning for the redevelopment of the hangar area at the end of useful life of hangars

After a discussion between the PAC and planning consultants on the type of aircraft (typically smaller single-engine Cessna type aircraft with < 40' wingspans) utilizing the SW hangar development area, the PAC consensus appeared to lean towards maintaining the existing hangars and limiting the wingspan of aircraft that can use the area.

### Airside Elements

The airside elements discussion focused on the runway lengths proposed, which seemed adequate to a local corporate pilot. It was discussed that the proposed length is longer than the current runways at Redmond by 700' but that there are also plans for an extension at Redmond. It was clarified that the runway lengths identified for planning analysis will likely be refined when it comes time to fund, design, and construct the proposed improvements. However, it was discussed that the lengths presented are appropriate for the planning level analysis.

### Airport Administrative Elements

The airport Administrative elements Goals and Facility Requirements were presented.

Following the Facility Goals and Requirements discussion, several Conceptual Development Alternatives depicting primary runway extensions and the proposed secondary runway concepts were presented and discussed among the PAC. It was clear that there is much more analysis that has yet to be done, but conceptually the areas depicted for construction of the extension and secondary runway were the most probable locations identified for future consideration of a second runway with the exception of

one comment directed at the SE Development concept. It was recommended by a member of the PAC that the SE Development concept be replaced with a true Eastside Parallel Runway concept.

Another concept that was introduced, but not depicted in the presentation materials, was the idea of the construction of a secondary runway/taxiway facility at an offsite location designed to serve the frequent flight training touch-and-go operations that are known to saturate the airspace at BDN. There are numerous challenges to construction of an offsite runway that were discussed and they include: funding and FAA eligibility, proximity to Redmond and Bend, access, land acquisition, does it just become another airport, and more. It seemed there was consensus among the group that this concept should be included for future consideration.

### PAC Meeting #3

#### November 5, 2020

The facility goals and requirements discussed in PAC #2 served as the building blocks for the development of three preliminary development alternative concepts capable of satisfying future demand. The preliminary development alternatives concepts were presented in PAC #3 for public review and comment.

The meeting included a summary of the Aviation Activity Forecast process and why the FAA requested a more robust aircraft operations analysis. The following was covered in this section of the meeting:

- Recap of Aviation Activity Forecast – Accepted by FAA in August 2020
- Aircraft Operations Analysis – ADS-B Data Analysis
- COVID 19 Impacts & FAA Guidance

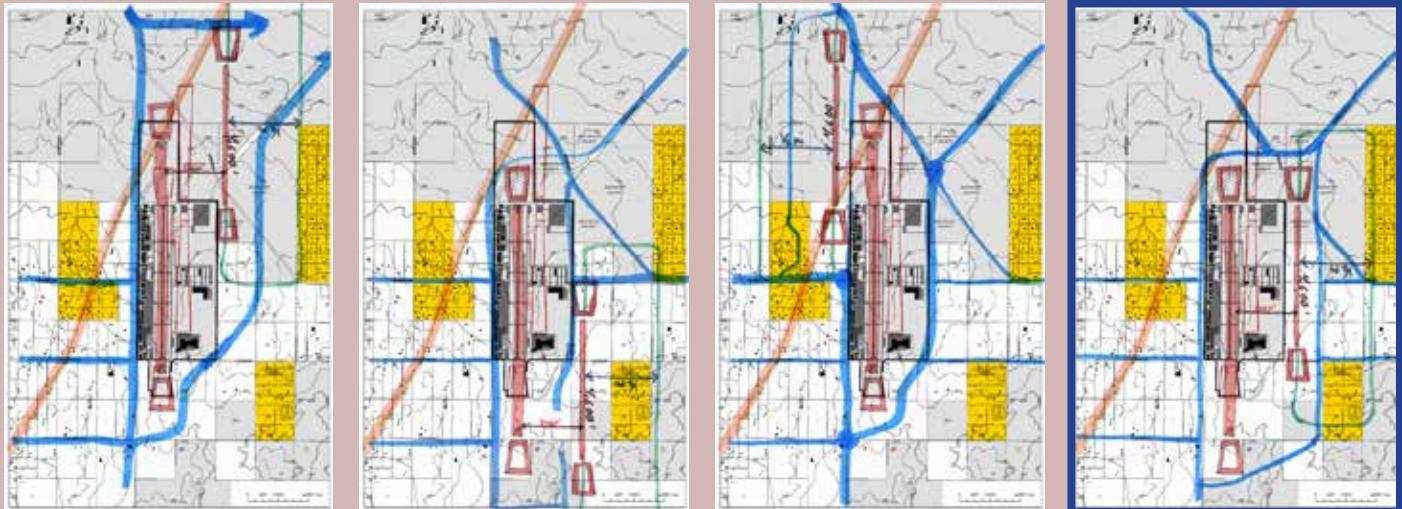
The meeting concluded with a summary of the Facility Goals and Requirements discussed in PAC #2 before COVID-19 and before the extended FAA forecast approval process. Due to the delays the planning team was directed by City staff to revisit some of the larger facility goals and requirements identified and reaffirm community priorities. To do this, the planning team presented the meeting participants with a poll to gauge priorities. The polls conducted live in the meeting identified that:

- Less than half of participants agreed that the runway extension should occur in the next 5 years
- An air traffic control tower (ATCT) was the most important facility improvement the City could pursue. The City should begin to plan for an ultimate runway length of 7,700'
- The City should wait until the next master planning process to begin planning for a second parallel runway
- The majority of attendees preferred that any additional runway length should extend to the south
- Alternative One as the preferred preliminary option for future consideration

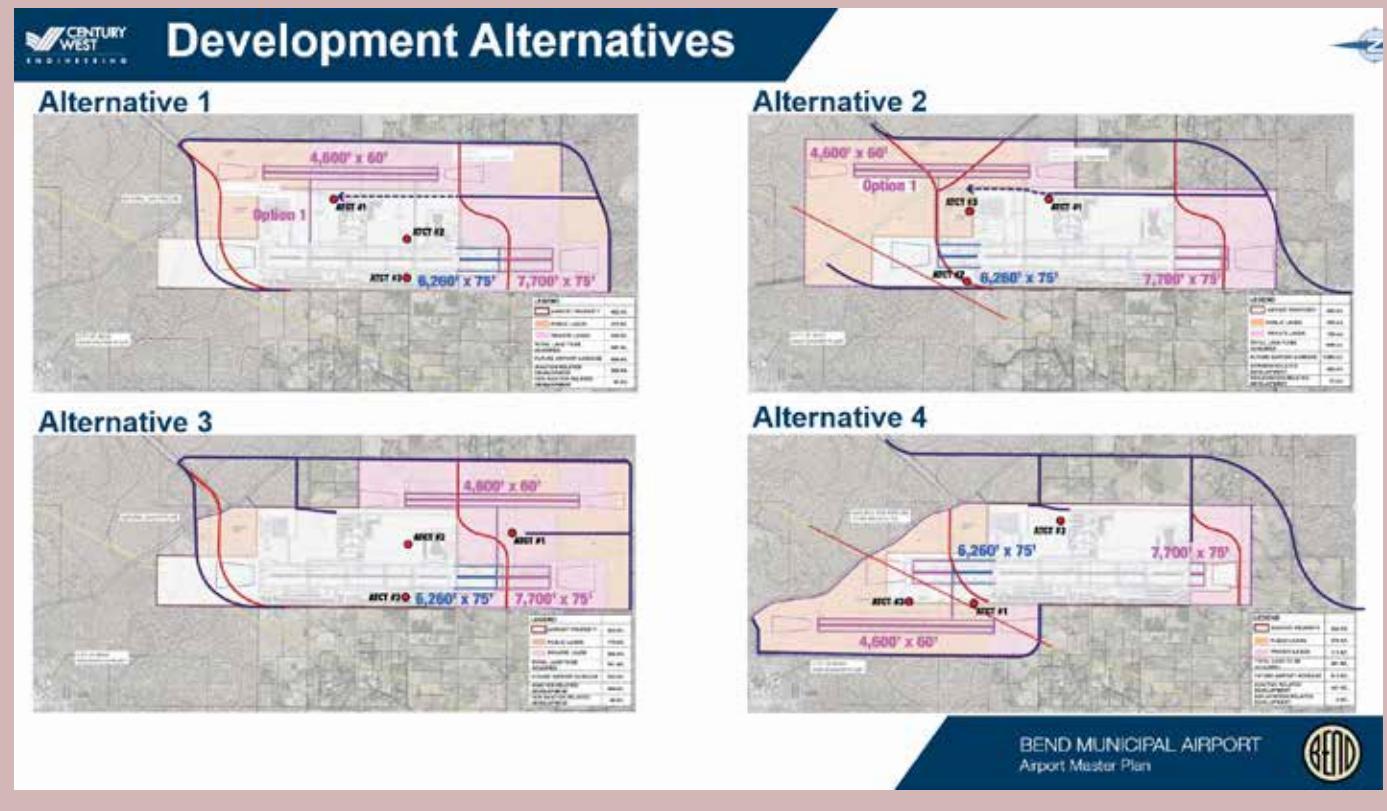


## CONCEPTUAL ALTERNATIVES - PAC MEETING #2 AND PAC MEETING #3

During the development of the aviation activity forecasts, it became apparent that the number of operations experienced at the Airport could guide the planning process to consider a second parallel runway to address fixed-wing aircraft capacity constraints. As a result, planners sketched out several conceptual alternatives to depict what the addition of a second runway could look like for future discussions with PAC members. Three options were presented in PAC Meeting #2 and a fourth option (highlighted with blue border) was developed in coordination with PAC members at PAC #2 for further consideration.



The planning team further refined the alternatives with the information gleaned from PAC members in PAC #2 and developed the following alternatives for presentation in PAC #3. The four alternatives depicting different runway configurations were analyzed internally by consultants, City staff, and PAC members. Much of the information provided in PAC #2 and PAC #3 served as the foundation for the development of the alternatives presented in this summary of the development alternatives.





## PAC Meeting #4 / Public Open House

February 11, 2021

The public input provided in PAC #3 was used to refine the preliminary concepts presented in to five development alternatives which served as the focus of discussion during a second round of public review and comment in PAC #4 and the following Virtual Open House held online due to COVID-19 social distancing requirements.

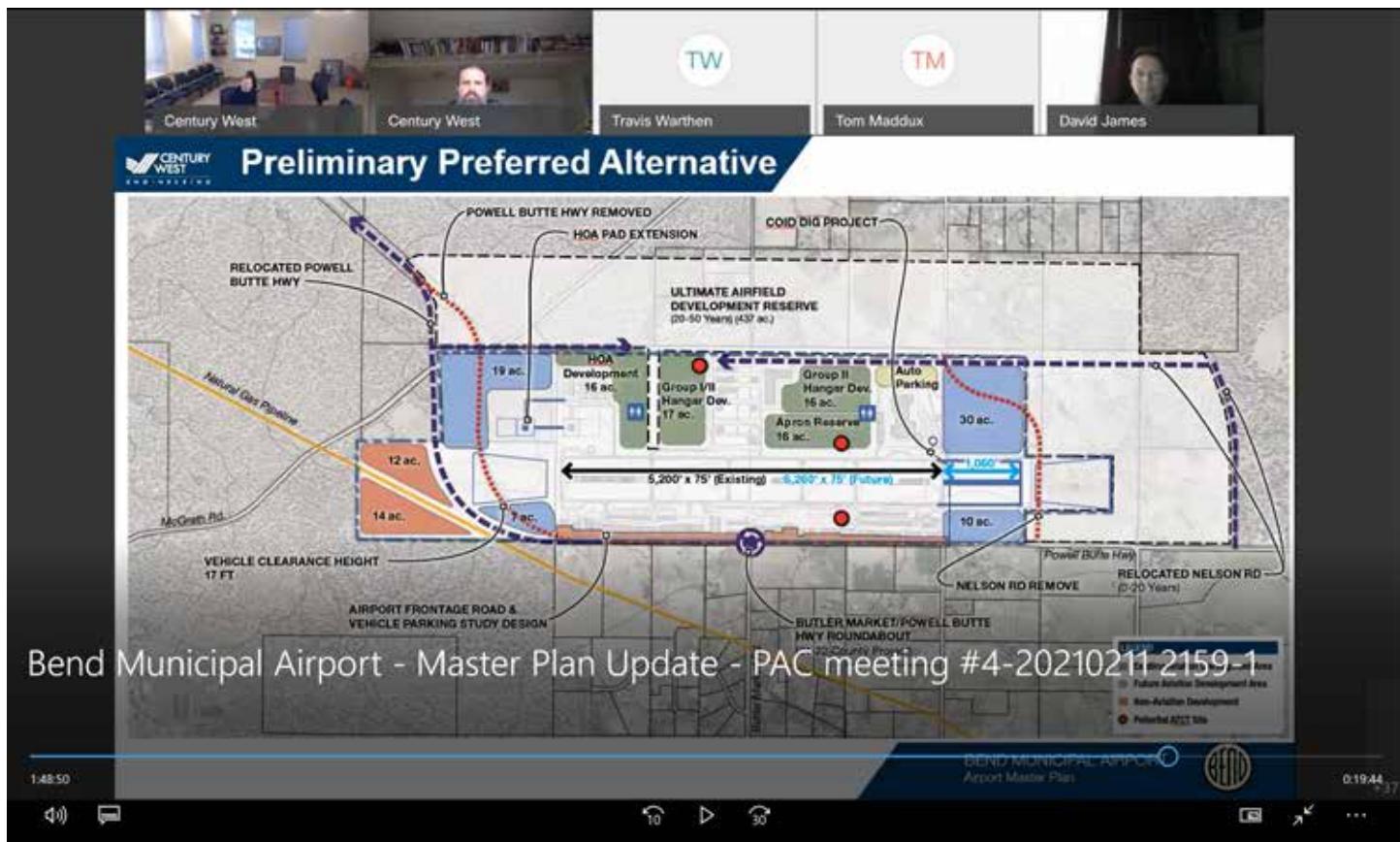
The meeting began with an update and overview of the project schedule, and provided a brief recap of the Facility Goals and Requirements and Conceptual Alternatives presented finalized in PAC #3, a presentation of the five development alternatives and the major elements analyzed, a focused discussion of two potential perimeter fencing alternatives, and the identification of a PAC preferred alternative.

Based on technical evaluations, public input and coordination with local officials, the process lead to the selection of a preferred alternative by the City that was presented for additional public review and comment in WP#2 and Regional Stakeholder Meeting #2.

## PAC Meeting #5

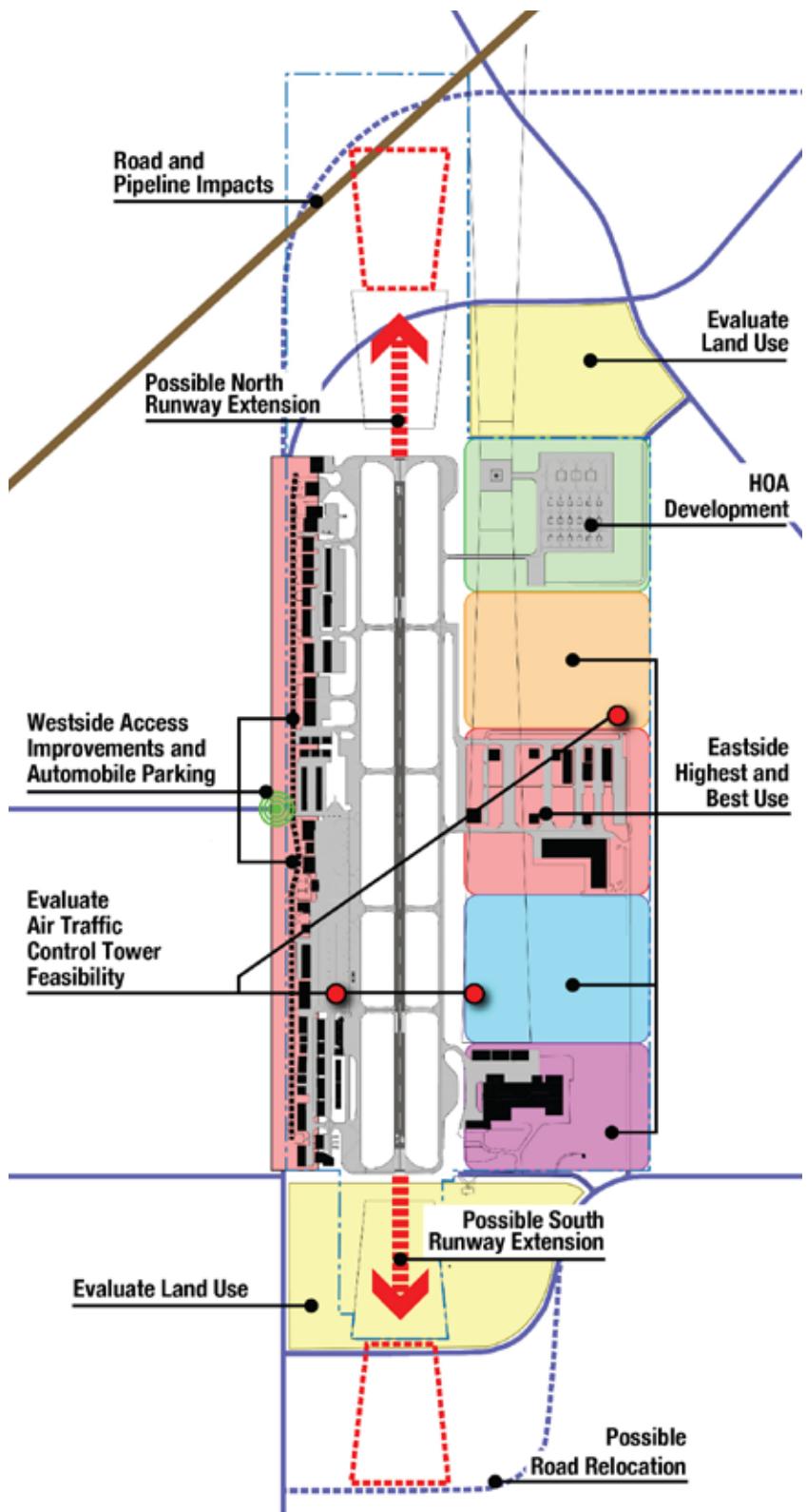
August 12, 2021

PAC Meeting #5 was the final meeting in the planning process and was held online due to COVID-19 social distancing requirements. The meeting included an interactive discussion and presentation with the PAC of the proposed implementation program with recommended strategies and actions based on key focus areas centered around the future land use, transportation, and environmental requirements first presented in Regional Stakeholder Meeting #2. The meeting also included a presentation and discussion of the draft Capital Improvement Plan (CIP) and draft Airport Layout Plan (ALP) drawings that graphically depict existing conditions at the airport as well as proposed development projects. Attendance at the final meeting was much lower than any of the previous meetings. Public comments were minimal.



# Known Issues & Opportunities

At the outset of the Airport Master Plan there were several known issues and opportunities identified by the FAA, airport management, and users of the Airport. These issues and opportunities identified below served as focus areas during the completion of the master plan to ensure a comprehensive and thorough assessment that addressed and documented the proposed solutions and methods of implementation.



## AIR TRAFFIC CONTROL TOWER (ATCT)

An ATCT has been contemplated for the Bend Airport for more than 10 years. Given the high volume and diversity of traffic at the airport, an ATCT would considerably enhance safety. In 2009 an ATCT siting study and Cost Benefit Analysis was completed for the Airport. At the time of the study the Airport did not meet the FAA criteria for acceptance into the FAA Contract Tower Program, however, an ATCT was included in initial ALP drafts of the 2013 AMP, based on three sites that were analyzed in the planning process. Based on direction from the FAA Seattle ADO at that time, the ATCT was removed from the final ALP.

In the subsequent years, the increase in traffic at Bend Airport has revived the desire to pursue an ATCT. Unfortunately, due to changes in FAA funding, the FAA is not currently accepting new towers into the Contract Tower Program.

## EASTSIDE HIGHEST AND BEST USE ANALYSIS

The planning and layout of eastside facilities was analyzed in the 2013 AMP, but it did not consider the two large undeveloped parcels that were tied up through lease options at the time. Recent changes have made these two areas available for consideration in this planning process. It is anticipated an evaluation of the potential uses of these parcels along with the development area adjacent to the recently constructed HOA will be evaluated during the planning process.

The extension of utilities with the HOA project provides considerable new development opportunity that may not have been financially feasible at the time of the last planning process. There is considerable cost associated with preparing the irrigation pond area for development and it is expected the planning process will identify a conceptual design and cost estimates to outline the requirements for future development in this area.

## RUNWAY EXTENSION

A runway extension was identified in the Bend Airport 2013 AMP to accommodate the increased demands of business aircraft. Many current users of the airport are constrained in the hot summer months and have to carry less fuel to operate safely. An extension of 1,060



feet was recommended in the 2013 AMP at the north end of Runway 16/34 to accommodate larger business aircraft that currently operate at the Bend Airport or operate at Roberts Field due to runway length limitations.

The proposed extension would increase the length from 5,200 feet to 6,260 feet and allow the airport to accommodate the current mix of business jets under a broader range of weather conditions. The master plan process will provide the opportunity to reassess airport activity and identify the most demanding aircraft currently using the airport to validate or refine the recommendations of the last plan to establish the required runway length.

The 2013 AMP recommended a runway extension to the north based on a variety of factors and input from stakeholders. The master plan process will revisit extension options including a north extension, south extension, or a combination of extensions on both ends.

## ROAD RELOCATION ALTERNATIVES

An extension of the Runway either to the north or south will significantly impact Deschutes County roads, and require early coordination with County administrators, Planning, and Roads Departments. In recent years, the FAA has identified removal of roads from within Runway Protection Zones (RPZs) as a priority for runway-related projects. The existing length of Runway 16/34 is currently constrained by County roads at both ends. To the north, Powell Butte Highway would need to be significantly realigned as depicted in the 2013 AMP, which would affect both the TransCanada natural gas pipelines and the intersection with McGrath Road. To the south, Nelson Road- which was relocated over 15 years ago to improve safety within the Runway 34 RPZ- would either require relocation or closure to accommodate an extension. Either of these major roadway changes will necessitate an analysis of the effects on the County's transportation system.

## AUTOMOBILE PARKING

Airport parking is an ongoing concern for the airport and tenants. The number of airport businesses with considerable parking needs exceed the capacity within the designated parking locations. The master plan process will include a review of parking for existing uses and potential development. This will also include reviewing Deschutes County land use requirements and Powell Butte Highway setbacks to identify opportunities to improve parking on the airport.

## WESTSIDE ACCESS IMPROVEMENTS

The Deschutes County Capital Improvement Plan includes a potential roundabout at the intersection of Butler Market and Powell Butte Highway. The roundabout will have similar geometry to the recently completed project at Powell Butte Highway and Neff Road/Alpha Market. This project presents a potential for significant impacts to airport property that is tightly constrained by the proximity to the highway.

The project will create an opportunity to evaluate access improvements to the west side of the Airport and also explore other relocation options for Powell Butte Highway.

## AIRPORT PERIMETER FENCING

It is unusual for an airport with the traffic volume of the Bend Airport not to have perimeter fencing for security and wildlife hazard prevention. Due to considerable development needs at the Airport, this issue has not yet been addressed. Since the 2013 AMP project where access requirements and a preferred location for a perimeter fence were analyzed additional questions have remained. The planning process will work to incorporate previous ideas and solutions from the 2013 AMP and refine the location of the fencing and access gates into the plan based on the configuration of the preferred alternative.

## LAND USE

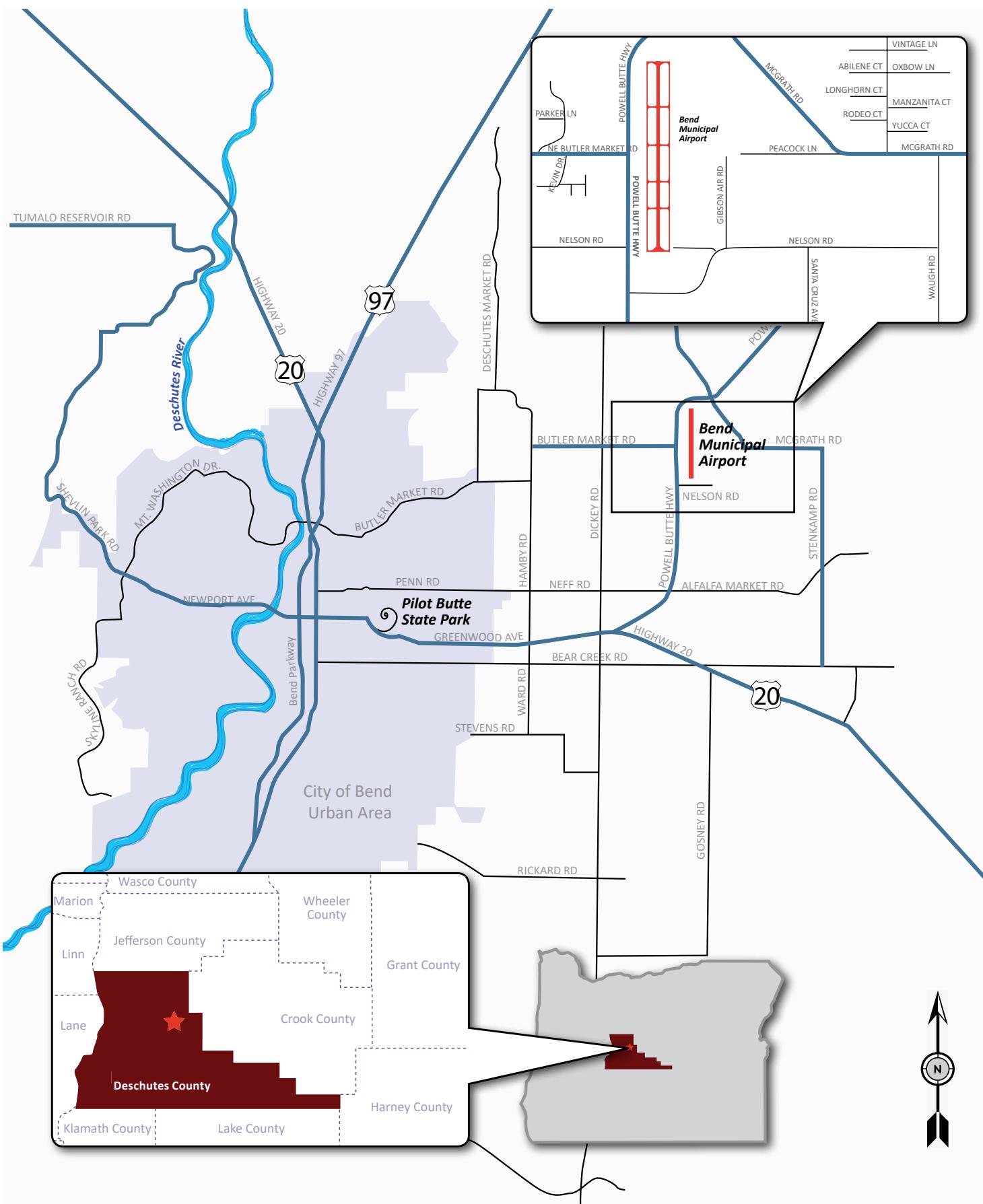
Land use on and off the airport as it relates to potential airport development and runway extension alternatives has been an ongoing discussion since the 2013 AMP. Existing Deschutes County zoning designations within the airport property boundary need to be revised to reflect current conditions, land use and zoning. Code recommendations will be developed during the planning process. Following the completion of the master plan, zoning code updates will need to be coordinated through the adoption of the AMP by the County.

## COUNTY ADOPTION OF AIRPORT MASTER PLAN

The completion and adoption of the 2013 AMP by the FAA and City of Bend was met with challenges of the local adoption process within Deschutes County. As of 2018, the 2013 AMP still has not been adopted by Deschutes County. It is likely that ongoing discussions between City and County planning staff to develop a framework for the plan adoption process from the outset of the master planning process will be necessary to ensure County adoption at the completion of the master plan update.



## LOCATION & VICINITY MAP





# Chapter 2: Existing Conditions Analysis

The existing conditions analysis documents existing airfield facilities and conditions that affect the operation and development of the airport within the context of the regional setting, landside, airside, and administrative functions of the Airport. The existing conditions analysis utilized the 2013 Airport Master Plan and other subsequent work product in addition to numerous meetings with tenants, stakeholders, and City staff, to support the effort. The findings documented in the Existing Conditions Analysis chapter will be used to support subsequent studies and recommendations throughout the development of the master plan.

## Regional Setting

The Regional Setting section is comprised primarily of the those features that provide the “big-picture” context of the Airport to ensure a better understanding of the social, economic, and environmental impacts airports can have in a region, county, and city. This section of the existing conditions analysis includes a discussion of the location & vicinity of the Bend Municipal Airport as well as the socio-economic conditions, airport history, airport role, area airports context, historic airport operations, relevant studies, environmental data, local surface transportation, and land use on and around the Airport.

### LOCATION & VICINITY

Bend is located in Deschutes County in the Central Oregon region at the junction of U.S. Highways 97 and 20. The highways intersect and converge for approximately 2.5 miles within Bend, then extend in four directions across Oregon. Highway 97 is the major north-south travel route through central Oregon that extends north into Washington and south into California. In Oregon, Highway 97 connects Bend to Redmond, Madras, Klamath Falls and numerous smaller communities in addition to providing connecting routes to several state and federal highways located in western and eastern Oregon and the interstate highway system (Interstate 5 and 84). Highway 20 is a major east-west route that extends from Highway 101 in Newport to Vale, before continuing into Idaho. Highway 20 connects Bend to Lebanon, Albany, Corvallis, Newport, Burns, and numerous smaller communities. Driving distances from Bend to major cities include: 17 miles to Redmond; 43 miles to Madras; 167 miles to Portland; 130 miles to Burns; 137 miles to Klamath Falls; 117 miles to Eugene; and 314 miles to Boise.

Deschutes County has a land area of approximately 3,055 square miles, extending from eastward slopes of the Cascade Range. Incorporated cities in Deschutes County include Bend, Redmond, La Pine and Sisters. Sunriver, an unincorporated resort community, is located 15 miles south of Bend. Bend is the county seat.

Bend Municipal Airport is located approximately five miles northeast of Bend, outside the Bend city limits in unincorporated Deschutes County. Surface access to the airport is provided by the Powell Butte Highway, which connects to U.S. Highway 20 and State Highway 126.



## COMMUNITY SOCIO-ECONOMIC DATA

The 2017 Bend Profile and 2018 Central Oregon Profile developed by EDCO (Economic Development for Central Oregon) identify the Bend-Redmond Metropolitan Statistical Area (MSA) as one of the fastest growing regions anywhere in the U.S. due to considerable growth in key family-wage paying industries and abundant outdoor recreational activities. Population forecasts project strong continued growth for the City of Bend and the Central Oregon region well into 2035 and beyond. The desirable outdoor lifestyle, strong demand for tourism, continued growth in industries, and a growing education market with the expansion of the OSU-Cascades campus all contribute to the optimistic outlook for the City of Bend and Central Oregon.

In addition to a growing population, the Central Oregon economy has also shown significant signs of growth since the recession. The average annual growth rate of the Bend-Redmond MSA Per Capital Real GDP has averaged .97% since 2007. In the last five years (2013-2017) the average annual growth rate has been substantially higher on average at 4.16%.

More detailed socio-economic data and analysis is presented in Chapter 3: Aviation Activity Forecasts to supplement the regression analysis methodologies developed in the projections of future aviation activity. The information presented in Tables 2-1 and 2-2 is intended to provide a summary of the local and regional context of the Bend Municipal Airport that depicts significant growth since the recession that is expected to continue well in the future.

**“While extraction industries and much of the general manufacturing base have declined in Central Oregon, there has been considerable growth in key family-wage paying industries such as aviation/aerospace, bioscience, brewing/distilling, high tech, outdoor gear and apparel, and value-added food products. Other more traditional industries such as building materials are still strong.”**

**TABLE 2-1: CENTRAL OREGON POPULATION TABLES**

	2000	2010	2015	2016	2017
Oregon	3,421,399	3,837,300	4,013,845	4,076,350	4,141,100
Crook County	19,184	21,020	21,085	21,580	22,105
Deschutes County	115,367	157,905	170,740	176,635	182,930
Bend	52,029	76,740	81,310	83,500	86,765
La Pine	NA	1,660	1,670	1,675	1,730
Redmond	13,481	26,225	27,050	27,595	28,265
Sisters	959	2,040	2,280	2,390	2,540
Unincorporated	48,898	51,240	53,151	61,475	63,630
Jefferson County	19,009	21,750	22,445	22,790	23,190
Tri-County Total	153,560	200,675	214,270	221,005	228,225

Source: Central Oregon 2018 Economic Profile

*Damon Runberg,  
Central Oregon Regional  
Economist, 2017 from  
COIC's CEDS 2017-  
2021 report.*

**TABLE 2-2: PER CAPITA REAL GDP BEND-REDMOND MSA**

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Bend -Red	\$43,180	\$40,226	\$36,674	\$36,303	\$37,368	\$38,366	\$39,354	\$41,296	\$43,494	\$46,604	\$46,982
Percent Change		-6.84%	-8.83%	-1.01%	2.93%	2.67%	2.58%	4.93%	5.32%	7.15%	0.81%
AAGR (2007-2017)											0.97%

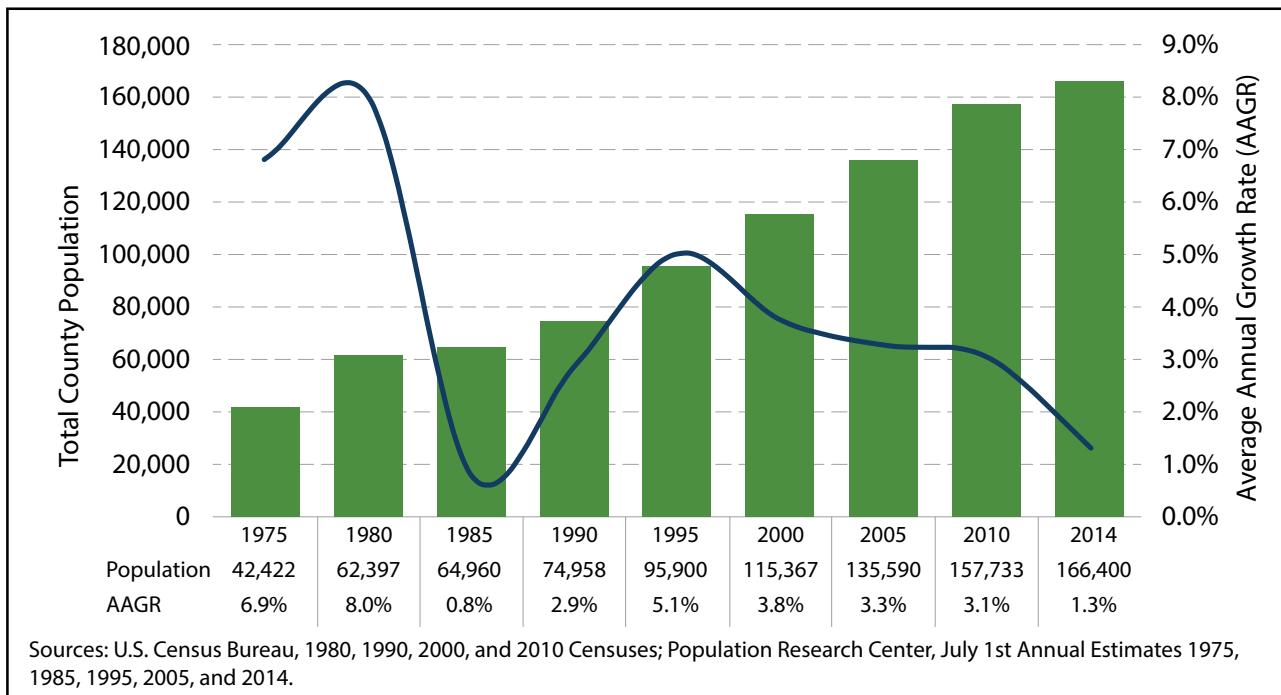
Source: Bureau of Economic Analysis



## Deschutes County Coordinated Population Forecast, 2015-2065

PSU Population Research Center

Deschutes County - Total Population by Five-year Intervals (1975-2010 and 2010-2014)



Source: Deschutes County Coordinated Population Forecast, 2015-2065

The Bend UGB is forecast to increase by more than 46,000 persons from 2015 to 2035, growing from a total population of 85,737 in 2015 to 132,209 in 2035. The Redmond UGB is expected to increase by a slightly slower rate, growing from 27,715 persons in 2015 to a population of 39,812 in 2035. Growth is forecast to occur more slowly for both Bend and Redmond during the second part of the forecast period, with total population increasing to 194,793 and 64,785 respectively by 2065. Both Bend and Redmond UGBs are expected to grow as a share of total county population.

Deschutes County and Sub-Areas—Historical and Forecast Populations, and Average Annual Growth Rates (AAGR)

	Historical			Forecast				AAGR (2015-2035)	AAGR (2035-2065)		
	2000	2010	AAGR (2000-2010)	2015	2035	2065					
Deschutes County	115,367	157,733	3.2%	170,606	249,037	357,345	1.9%	1.2%			
Bend <sup>1</sup>	52,041	76,858	4.0%	85,737	132,209	194,793	2.2%	1.3%			
La Pine	899	1,653	6.3%	1,687	3,014	5,836	2.9%	2.2%			
Redmond	15,524	26,508	5.5%	27,715	39,812	64,785	1.8%	1.6%			
Sisters	961	2,038	7.8%	2,315	4,375	7,212	3.2%	1.7%			
Outside UGBs	45,942	50,676	1.0%	53,151	69,627	84,719	1.4%	0.7%			

Sources: U.S. Census Bureau, 2000 and 2010 Censuses; Forecast by Population Research Center (PRC).

<sup>1</sup> For simplicity each UGB is referred to by its primary city's name.

Source: Deschutes County Coordinated Population Forecast, 2015-2065



## AIRPORT ROLE (NATIONAL, STATE, AND LOCAL)

The role of an airport may vary slightly within the context of the National, State, or Local perspective. Understanding the existing roles of the Airport is key to establishing the long-term vision and development of the facility.

### National Role

The FAA maintains an inventory of U.S. aviation facilities through the National Plan of Integrated Airport Systems (NPIAS). The NPIAS lists existing and proposed airports significant to the air transportation in the United States, and thus are eligible for federal funding through the Airports Improvement Program (AIP) which cover 90% of eligible costs of planning and development projects. According to the 2018 National Plan of Integrated Airport Systems (2019-2023), Report to Congress, Bend Municipal Airport is classified as a Regional General Aviation Airport and as such, supports regional economies by connecting communities to statewide and interstate markets.

### State Role

The Oregon Department of Aviation has developed and regularly updates the Oregon Aviation Plan (OAP) to provide guidance on preserving the State's system of airports. The OAP presents a framework for improving the system for continued support of communities and economic development. The most recent update to the OAP classifies Bend Municipal Airport as a Category II – Urban General Aviation Airport. Category II airports support all general aviation aircraft and accommodate corporate aviation activity, including piston and turbine engine aircraft, business jets, helicopters, gliders, and other general aviation operations. These airports service a multi-state geographic region and/or experience robust levels of general aviation activity.

### Local Role

The Airport serves many roles in the local community. It accommodates an estimated 244 based aircraft and facilitates an estimated 387 operations per day. The Airport provides flight training services for both fixed wing aircraft and helicopters, and it provides users with access to air taxi and corporate/business jet services. The airport also accommodates several businesses that provide jobs to the region and contribute to the local economy.

As part of the airport master planning process, users were asked to respond to a survey with the intent of evaluating how the airport is being utilized, what the perception of the airport is, and to identify issues and opportunities as seen by the users. As part of the survey, respondents were asked to provide their perception of the role of Bend Municipal Airport within the Central Oregon region. Specifically, they were asked to provide input on which of the following roles they would consider as the primary role of the Airport:

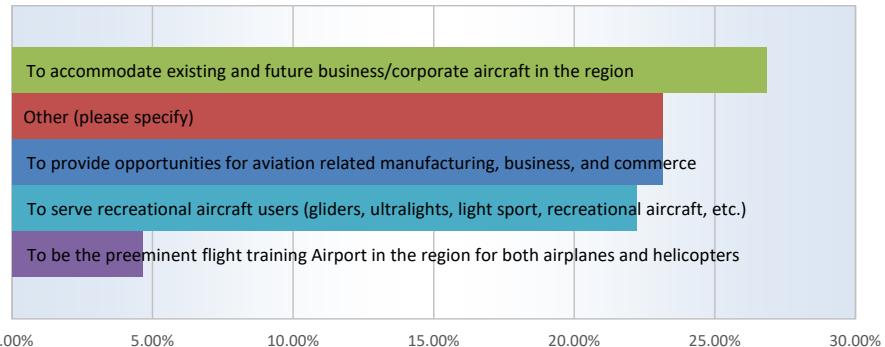
- to accommodate existing and future business/corporate aircraft in the region;
- to provide opportunities for aviation related manufacturing, business, and commerce;
- to be the preeminent flight training Airport in the region for both airplanes and helicopters;
- to serve recreational aircraft users (gliders, ultralights, light sport, recreational aircraft, etc.); and
- other

The even distribution of responses to this question (with the exception of the flight training option), as well as the number of respondents choosing "all of the above" suggest that the Airport likely does not have a single primary role, but instead fills many important roles in the local community, each of which should be considered as the master planning process progresses.

## TENANT SURVEY RESPONSE/DATA

Of the 108 users that responded to the survey, 27% see that the primary role of the Airport is to accommodate regional corporate and business operations; 23% felt that it is to support aviation related business, commerce, and manufacturing; 22% view the Airport as a facility meant to support recreational aircraft operations; and 5% see it as a flight training center for fixed-wing and rotor-wing aircraft. Interestingly, 23% of respondents felt that not one of the listed options were appropriate and instead chose "Other." More than half of respondents that chose "Other" commented that the Airport did not have a single role in the community, and felt that all of the roles listed equally pertain to BDN.

What is the primary role of the Bend Municipal Airport within Central Oregon?



Source: 2019 Bend AMP Tenant Survey Data



## AIRPORT HISTORY

Bend Municipal Airport has been in continuous public use since 1942, when the City of Bend purchased 120 acres of land from the Fitzgerald and Shanno families to establish a public airport. Local officials indicate that the original private airport site dates back to the 1930s. The airport was used for flight training during World War II and continued operations after the war by serving general aviation users. The City acquired an additional 200 acres of property from the U.S. government in 1951, which allowed modernization of facilities to occur. This early period of airport operation coincided with the introduction of numerous new models of small single-engine and multi-engine piston general aviation aircraft.

Over time the current airfield configuration began to take form with several airport improvements including a paved runway, taxiways, aircraft parking and hangars. An additional 100 acres of property, including approximately 80 acres from Deschutes County, was acquired between 1977 and 2003, increasing the airport acreage to its current 420 acres. As depicted in Table 2-3 below federal funding provided over the last 20 years for a variety of improvements and standards upgrades has totaled more than \$27 million.

TABLE 2-3: 20-YEAR FAA GRANT HISTORY

	FISCAL YEAR	NONPRIMARY	STATE APPORTIONMENT	ENTITLEMENT	DISCRETIONARY	TOTAL FEDERAL
Conduct Environmental Study	1999	\$0	\$63,000	\$63,000	\$0	\$63,000
Rehabilitate Apron	1999	\$61,956	\$413,044	\$475,000	\$0	\$475,000
Construct Taxiway	1999	\$13,044	\$86,956	\$100,000	\$0	\$100,000
Improve RSA	2002	\$72,000	\$0	\$72,000	\$0	\$72,000
Construct RSA	2003	\$134,340	\$0	\$134,340	\$0	\$134,340
Install Weather Reporting Equipment	2004	\$44,485	\$80,515	\$125,000	\$0	\$125,000
Improve Runway Safety Area	2004	\$265,845	\$481,155	\$747,000	\$0	\$747,000
Construct Runway	2005	\$150,000	\$0	\$150,000	\$0	\$150,000
Construct Runway	2006	\$150,000	\$3,384,605	\$3,534,605	\$0	\$3,534,605
Construct Runway	2007	\$150,000	\$4,019,965	\$4,169,965	\$0	\$4,169,965
Construct Taxiway	2008	\$100,000	\$0	\$100,000	\$0	\$100,000
Construct Runway	2008	\$11,240	\$1,220,857	\$1,232,097	\$0	\$1,232,097
Construct Runway	2008	\$38,760	\$293,396	\$332,156	\$0	\$332,156
Install Runway Vertical/Visual Guidance System	2008	\$0	\$233,512	\$233,512	\$0	\$233,512
Construct Taxiway	2009	\$48,693	\$0	\$48,693	\$0	\$48,693
Construct Taxiway	2009	\$101,307	\$0	\$101,307	\$0	\$101,307
Construct Taxiway	2009	\$24,600	\$105,922	\$130,522	\$2,800,000	\$2,930,522
Update Airport Master Plan	2010	\$275,400	\$0	\$275,400	\$0	\$275,400
Rehabilitate Taxiway	2011	\$150,000	\$405,321	\$555,321	\$2,873,221	\$3,428,542
Conduct Environmental Study	2013	\$150,000	\$47,625	\$197,625	\$0	\$197,625
Wildlife Hazard Assessments	2015	\$22,741	\$0	\$22,741	\$0	\$22,741
Expand Heliport/Helipad	2015	\$427,259	\$304,497	\$731,756	\$234,914	\$966,670
Expand Heliport/Helipad	2016	\$150,000	\$0	\$150,000	\$5,524,997	\$5,674,997
Reconstruct Apron	2017	\$150,000	\$260,000	\$410,000	\$1,209,937	\$1,619,937
Update Airport Master Plan	2018	\$399,249	\$0	\$399,249	\$0	\$399,249
<b>Total</b>		<b>\$3,090,919</b>	<b>\$11,400,370</b>	<b>\$14,491,289</b>	<b>\$12,643,069</b>	<b>\$27,134,358</b>

Source: FAA - Seattle ADO, December 2018



## AREA AIRPORTS CONTEXTUAL ANALYSIS

The contextual analysis of the airport service area refers to the geographic area surrounding an airport that is directly affected by the activities at that airport. Normally a 30 or 60-minute surface travel time is used to approximate the boundaries of a service area. Airports located beyond a 30-minute travel time have less impact on local airport activity due largely to the redundancy provided by closer facilities. With numerous airports nearby, service areas often overlap, creating competition between airports. Having several airports located within a relatively short distance affects user demand for items such as hangar space, fuel and aviation services. These items are sensitive to cost, convenience and the quality of facilities or services.

The majority of local users of Bend Municipal Airport will live or work within 30 minutes of the airport. Some specialized activities may draw users from greater distances. It is also recognized that Bend Municipal Airport attracts a wide variety of general aviation and business aviation aircraft from outside the local area.

The Bend Municipal Airport service area extends north and south along Highway 97, overlapping with service areas for several other central Oregon airports including Roberts Field, Prineville, Sisters, Sunriver, and Madras, which offer many comparable facilities and services.

### Roberts Field - Redmond Municipal Airport (RDM)

Demand for major or regional airline service often involves greater travel distances due to the limited number of airports providing that service. Redmond Municipal Airport (RDM) is the only commercial service airport in Central Oregon and is currently served by four air carriers; Alaska Air, American Airlines, Delta Airlines, and United/United Express with daily direct flights to Denver, Los Angeles, Phoenix, Portland, Salt Lake City, San Francisco, Seattle, and beginning in Summer 2019, direct service to Chicago.

RDM has two asphalt runways (05/23 - 7040'x150 and 11/29 - 7006'x100') and many of the facilities and infrastructure consistent with commercial service airports including an Air Traffic Control Tower (ATCT). Leading Edge Aviation is the primary provider of air charter, FBO, and aircraft maintenance services. Hillsboro Aero Academy recently began providing flight training out of RDM and is expected to grow significantly.

According to recent FAA 5010 data, RDM experiences approximately 41,922 annual operations and has 85 based aircraft. 20% of the operations at RDM are from commercial operators and over half of the based aircraft are single-engine aircraft.

### Madras Municipal Airport (S33)

Madras Municipal Airport serves predominantly small single-engine and twin-engine aircraft associated with transient and locally-based general aviation aircraft activity. The airport also accommodates turbine aircraft activity associated with business aviation aircraft (turboprop or business jet), aerial applicators, occasional military or government-related activity, and limited helicopter operations. The Airport currently also accommodates a growing maintenance/retrofit operation for large firefighting aircraft (DC-7, C130, etc.).

S33 has two asphalt runways (16/34 - 5089'x75' and 04/22 - 2701'x50') and many of the facilities and infrastructure consistent with general aviation airports. The primary provider of air charter, FBO, flight instruction, and aircraft maintenance services at the Airport is Berg Air.

Based on recent FAA 5010 data, S33 experiences approximately 10,700 annual operations and has 67 based aircraft.

### Prineville-Crook County Airport (S39)

Historically, Prineville-Crook County Airport has served a variety of general aviation users, including business, commercial, and government aviation. The United States Forest Service (USFS) and the Bureau of Land Management (BLM) utilize the airport to support their helicopter operations.

S39 has two asphalt runways (10/28 - 5751'x75' and 15/33 - 4054'x40') and many of the facilities and infrastructure consistent with general aviation airports.

Based on recent FAA 5010 data, S39 experiences approximately 10,400 annual operations and has 125 based aircraft.

### Sunriver Airport (S21)

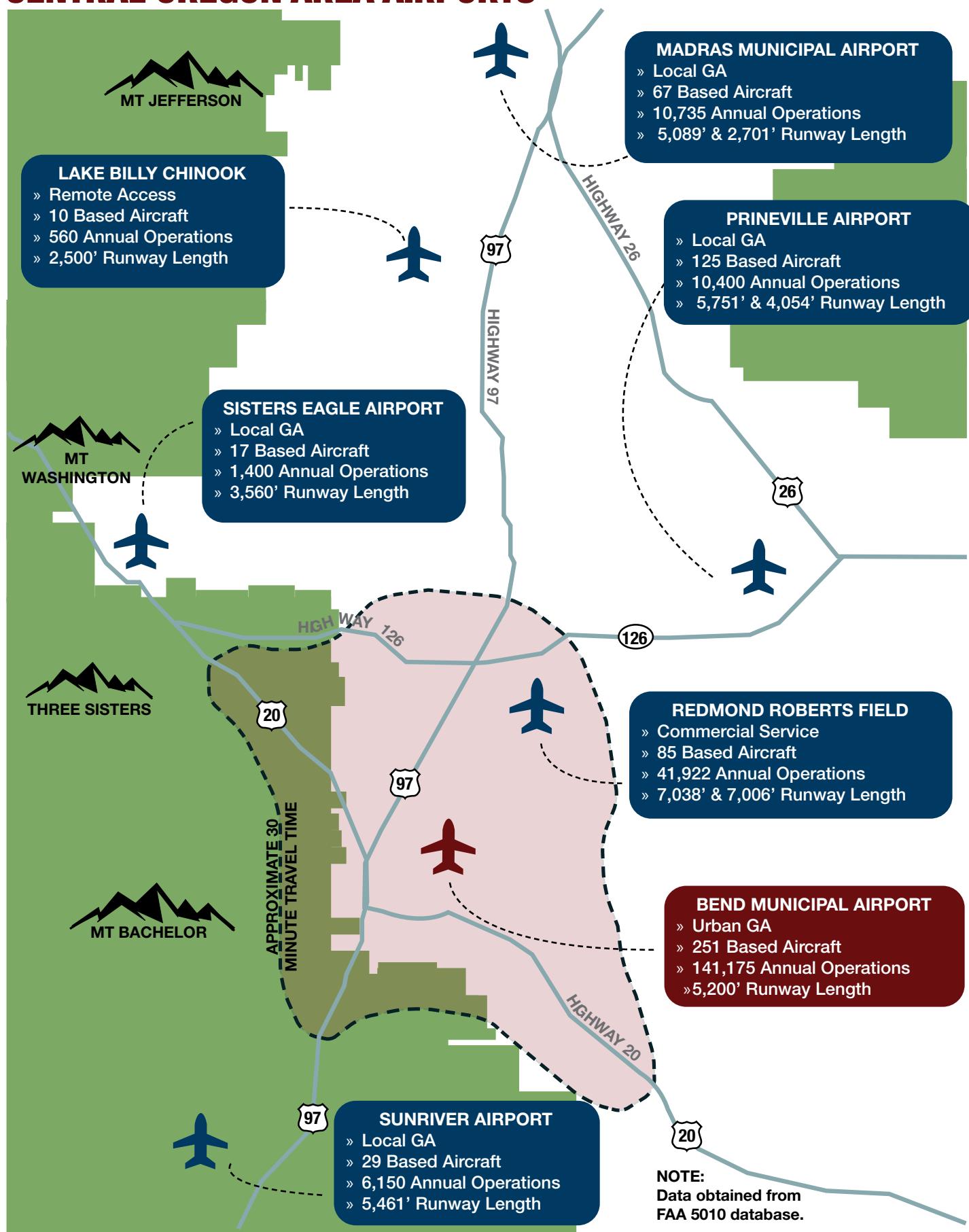
The Sunriver Airport is a privately-owned public-use airport able to accommodate aircraft ranging from small single-engine piston aircraft to larger more demanding turbine aircraft activity associated with business aviation aircraft (turboprop or business jet).

S21 has one asphalt runway (18/36 - 5461'x75') and many of the facilities and infrastructure consistent with general aviation airports.

Based on recent FAA 5010 data, S21 experiences approximately 6,150 annual operations and has 29 based aircraft.



# CENTRAL OREGON AREA AIRPORTS





## Sisters Eagle Air Airport (6K5)

Sisters Eagle Air Airport is a privately-owned public-use airport able to accommodate aircraft ranging from small single-engine piston aircraft to larger more demanding turbine aircraft activity associated with business aviation aircraft (turboprop or business jet).

6K5 has one asphalt runway (02/20 - 3560'x60') and many of the facilities and infrastructure consistent with general aviation airports.

Based on recent FAA 5010 data, 6K5 experiences approximately 1,400 annual operations and has 17 based aircraft.

## Lake Billy Chinook State Airport (5S5)

Lake Billy Chinook State Airport is a privately-owned public-use airport designed to accommodate aircraft ranging from small single-engine piston aircraft to slightly larger twin-engine aircraft. The Airport is used primarily to access the residential airpark homes located adjacent to airfield facilities.

5S5 has one asphalt runway (16/34 - 2500'x32') and limited facilities and infrastructure.

Based on recent FAA 5010 data, 5S5 experiences approximately 560 annual operations and has 10 based aircraft.

TABLE 2-4: FAA 5010 DATA

	BEND	LAKE BILLY CHINOOK	MADRAS	PRINEVILLE	REDMOND	SISTERS EAGLE	SUNRIVER	CENTRAL OREGON AIRPORTS TOTALS
Air Carrier					8,534			8,534
Air Taxi	1,000		600	300	7,149	100	600	9,749
GA Local	70,338	500	6,000	3,000	15,361	400	2,500	98,099
GA Itinerant	69,737	60	4,035	7,000	10,522	900	3,000	95,254
Military	100		100	100	356		50	706
<b>TOTAL OPERATIONS</b>	<b>141,175</b>	<b>560</b>	<b>10,735</b>	<b>10,400</b>	<b>41,922</b>	<b>1,400</b>	<b>6,150</b>	<b>212,342</b>
<hr/>								
<b>TOTAL BASED AIRCRAFT</b>	<b>251</b>	<b>10</b>	<b>67</b>	<b>125</b>	<b>85</b>	<b>17</b>	<b>29</b>	<b>584</b>
Single Engine	190	9	49	107	55	15	15	440
Multi Engine	19	1	7	1	15	2	10	55
Jet	10		8	1	9		2	30
Helicopters	21		1	5	6			33
Glider	8						2	10
Military								
Ultra-Light	3		2	11				16
<hr/>								
OPBA	562	56	160	83	493	82	212	364

Source: <https://www.gcr1.com/5010WEB/>

According to FAA 5010 data estimates depicted in Table 2-4, Bend Municipal Airport accounts for 66% of the total aircraft operations and 43% of the based aircraft within Central Oregon. Local socio-economic conditions and continued expected growth within the Bend area suggests the Bend Municipal Airport will maintain its status as a busy aviation facility of significant economic value for Central Oregon well in to the future. However, as the region grows and new businesses and residents move in to the area, additional pressures will be placed on all of these aviation facilities and airspace in the Central Oregon. As such, regional issues require regional solutions and continuous coordination and cooperation between local municipalities and governing bodies in the area will be critical to aviation facilities within Central Oregon.



## SUMMARY OF AIRPORT OPERATIONS DATA

Bend Municipal Airport accommodates a wide variety of aeronautical activity, including small single- and multi-engine aircraft, business class turbine aircraft (business jets and turboprops), helicopters, and gliders.

Bend Airport Management has kept an accurate count of based aircraft since at least 2010 when an updated count of 213 based aircraft was observed. Recent updated counts identify a net increase of 31 aircraft since 2010 which equates to a 1.82% average annual percentage growth in based aircraft that has been realized at Bend Municipal Airport. Updated based aircraft counts are presented in Table 2-5.

As presented in Table 2-6, calendar year 2018 operations are estimated to be 168,913 for Bend Municipal Airport. The 2018 estimate is approximately 72.3 percent above the 2010 levels documented in the previous airport master plan, and 22.3 percent above 2014 levels documented in the HOA EA.

Bend Municipal Airport is the third busiest airport in the State behind Portland International Airport (PDX) and Hillsboro (HIO) which both have estimated operations exceeding 200,000 operations per year. Bend is also the third largest airport in the State when it comes to based aircraft following behind Aurora State Airport (UAO) and Hillsboro (HIO).

Based aircraft and operations data will be examined further in Chapter 3: Aviation Activity Forecasts.

## FUEL SALES DATA

Fuel sales at the Bend Municipal Airport have increased 4.55% on average annually since 2009. 2018 was the first year that there has been only one fuel provider on the Airport which may explain the noticeable decline (-8.49%) in fuel sales between 2017 and 2018. Looking back beyond 2009 at fuel sales data there is a more tempered growth in fuel sales. Pre-recession fuel sales data indicates total gallons sold in 2006 was 607,000 gallons which was followed by a steep decline to an almost 20-year low in fuel sales in 2012 of 388,000 gallons.

TABLE 2-5: BASED AIRCRAFT

	IN 5010 12/06/18	IN INVENTORY	CURRENTLY VALIDATED
Single Engine	190	207	191
Multi Engine	19	22	19
Jet	10	15	11
Helicopter	21	25	23
Glider	8	8	*
Ultra Light	3	3	*
<b>TOTAL</b>	<b>251</b>	<b>280**</b>	<b>244</b>

Source: Bend Airport Management, 12-18-2018

\* Glider and ultralight aircraft are not considered in the validated aircraft count.

\*\*The increased count in the inventory column includes aircraft that may have N-numbers reported at other airports or aircraft that are not in FAA registry.

TABLE 2-6: ESTIMATED AIRCRAFT OPERATIONS

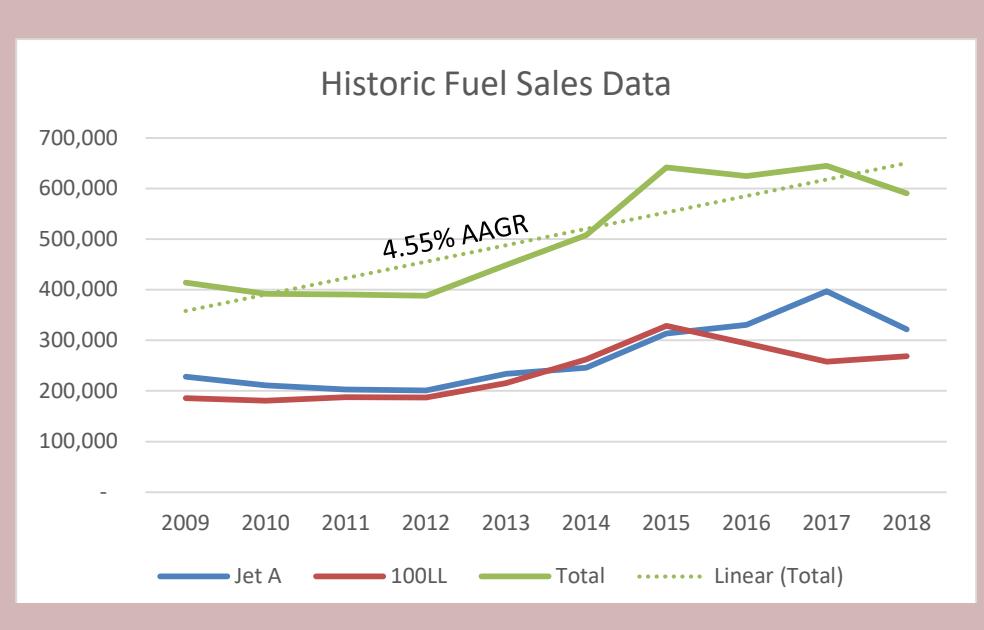
	2010	2014	2018
Single Engine Piston	52,038	59,584	116,236
Multi Engine Piston	3,100	3,565	3,080
Turboprop	2,150	2,400	5,560
Jet	500	1,560	2,084
Glider	300	300	300
Helicopter	39,840	70,104	41,653
<b>TOTAL OPERATIONS</b>	<b>97,928</b>	<b>137,513</b>	<b>168,913</b>

Source:

2010 Estimates obtained from 2013 Airport Master Plan.

2014 Estimates obtained from 2015 Helicopter Operations Area (HOA) Environmental Assessment.

2018 Estimates derived from Airport users/tenant interviews and updated data.





## RELEVANT STUDIES

There are numerous local and regional studies available for reference that contain a significant amount of information as it relates to the Airport or the greater community. Generally speaking, the relevant studies summarized below have been incorporated in to the planning process to provide context when developing understanding, exploring solutions, or implementing the plan.

### **City of Bend Comprehensive Plan & Transportation System Plan (TSP)**

The Bend Municipal Airport is owned by the City of Bend, but it is located outside of the Bend UGB and within unincorporated Deschutes County. Due to the location outside of the UGB area of Bend, Deschutes County regulations and County TSP policy govern land use issues that are associated with the use and operation of Bend Municipal Airport.

### **Rural Enterprise Zone Study**

The Deschutes County Rural Enterprise Zone (E-zone) was approved in April 2008 and encompasses the Bend Municipal Airport and the City of La Pine. The Rural E-zone offers traded-sector employers (companies that sell goods or services outside the local area and expand its economic base) and other eligible companies three (3) to five (5) year property tax exemptions on certain new capital investments that create jobs in the designated areas. The zone is sponsored by Deschutes County and the City of La Pine and is managed by Economic Development for Central region (EDCO). Only new facilities or improvements not yet on the tax roll are eligible for this tax incentive.

### **Deschutes County Comprehensive Plan**

The Deschutes County Comprehensive Plan is a statement of issues, goals and policies meant to guide the future of land use in the County. Several of the sections and policies most relevant to this planning process are summarized:

#### **Rural Economy Policies**

Goal 1: Maintain a stable and sustainable rural economy, compatible with rural lifestyles and a healthy environment.

Policy 3.4.6: Support and participate in master planning for airports in Deschutes County.

#### **Coordination on Facility and Service Planning**

The County role in planning for facilities and services involves coordination, to assure that as new growth is approved, facilities and services are available. Some specific areas for coordination are listed below.

Other Jurisdictions: There are instances where other jurisdictions facilities are located in unincorporated lands. For example, the City of Bend wastewater treatment plant and

Airport are sited on lands regulated by the County. Close coordination with cities goes a long way in ensuring adequate operation and maintenance for those facilities.

#### **Airport District Policies**

The Airport plan designation includes areas which in 1997 were developed with airport related amenities, such as runways, hangars, fueling stations and maintenance facilities. This district also includes areas surrounding the actual airport development which are considered to be in the sphere of influence of the airport and in which airport-related impacts and risks are associated. Development in the airport district shall be limited with respect to heights of structures, public gathering places and other potential risks to persons or property related to those uses.

#### **Goal Exception Statements**

Bend Municipal Airport – Ordinances 80-203, 1980 and 80-222, 1980 provide the Bend Municipal Airport with an exception to Goal 3 to allow for the necessary and expected use of airport property.

For additional information download the Comprehensive Plan at: <https://www.deschutes.org/cd/webform/land-use-planning>

## **ADOPTING THE AIRPORT MASTER PLAN IN TO THE DESCHUTES COUNTY COMPREHENSIVE PLAN**

While the County Comprehensive Plan recognizes the Bend Municipal Airport, the previous 2013 AMP was not formally adopted by the County to include the updates depicted in the Airport Master Plan. This critical step involves several objectives required to fully implement the Airport Master Plan:

- Secure Land Conservation and Development Commission (DLCD) and Deschutes County approval of amendments to the County's comprehensive plan, transportation system plan, and zoning ordinance to implement the updated Airport Master Plan.
- Required Deschutes County Board of Commissioners adoption of two ordinances to:
  - » Amend the comprehensive plan
  - » Amend the zoning ordinance to implement the 2013 Bend Airport Master Plan
  - » Applications to the County will include an exception to Statewide Planning Goals 3 and 12 (if needed) to allow airport uses of property currently owned by the Airport and lying beneath the Airport Overlay Zone but zoned EFU.



## Deschutes Transportation System Plan (TSP)

The Deschutes County TSP provides a road map to meet the needs of air, automobile bicycle, freight, pedestrian rail, transit and other modes within Deschutes County.

In order to guide airport land uses, the County adopted and utilizes the 1994 Bend Municipal Airport Master Plan, as amended in 2002 the “Supplement to 1994 Airport Master Plan,” which is incorporated by reference in to the TSP. Since the completion of the 2013 AMP, which was never formally adopted by the County, this document has remained as the guiding document for airport planning and development within Deschutes County.

### Relevant Goals of the TSP - Goal 16

Protect the function and economic viability of the existing public-use airports, while ensuring public safety and compatibility between the airport uses and surrounding land uses for public use airports and for private airports with three or more based aircraft.

### Relevant TSP Policies

Deschutes County shall protect public-use airports through the development of airport land use regulations. Efforts shall be made to regulate the land uses in designated areas surrounding the Redmond, Bend, Sunriver and Sisters (Eagle Air) airports based upon adopted airport master plans or evidence of each airports specific level of risk and usage. The purpose of these regulations shall be to prevent the installation of airspace obstructions, additional airport hazards, and ensure the safety of the public and guide compatible land use. For the safety of those on the ground, only limited uses shall be allowed in specific noise impacted and crash hazard areas that have been identified for each specific airport.

For additional information download the TSP at:

<https://www.deschutes.org/cd/page/transportation-planning>

## 2013 Bend Airport Master Plan (AMP)

The 2013 AMP findings and conclusions will be used as a primary information source for preparing this updated master planning study and Airport Layout Plan. The 2013 AMP identified a variety of necessary improvements. Several of the recommended improvements & priorities from the 2013 AMP include:

- Eastside Helicopter Landing Area (2014)
- Traffic Pattern Modifications (2014)
- West Terminal Apron Reconfiguration (2015 – 2016)
- East Landside Development (2017-2021, various projects)
- Runway Extension (long term priority 2022 – 2031)
- Air Traffic Control Tower (long term priority 2022-2031)

A copy of the 2013 AMP can be obtained from: <https://www.bendoregon.gov/government/departments/economic-development/bend-airport/airport-development/airport-master-plan>

## 2015 Bend Helicopter Operations Area (HOA) Environmental Assessment (EA)

The 2015 HOA EA project provided the necessary environmental due diligence to construct a dedicated helicopter landing area capable of simultaneous operations with the existing runway and a landing area traffic pattern that did not intersect with the traffic patterns associated with the runway.

A copy of the 2015 HOA EA can be obtained from: <https://www.bendoregon.gov/government/departments/economic-development/bend-airport/airport-development/airport-projects>

## Oregon Aviation Plan (OAP)

In 2018, the Oregon Department of Aviation (ODA) updated the Oregon Aviation Plan (OAP) for the state airport system which includes 95 airports, one heliport and one seaplane base. The study area was statewide and considered both commercial service and general aviation airports.

Each airport's level generally reflects the type of aircraft and customers the airport serves as well as the characteristics of the airport's service area. In the OAP update, Bend Municipal Airport will remain a Category II – Urban General Aviation Airport.

As a Category II airport, the OAP has identified certain facilities and services that should ideally be in place. These objectives are considered the “minimums” to which the airport should be developed. Bend Municipal Airport's specific needs to meet identified statewide airport objectives, as they pertain to the airport's Category II role in the state airport system are:

- Upgrade ARC from B-II to C-II
- Replace Taxiway Reflectors with Taxiway Lighting
- Install Perimeter Security Fencing/Access Control
- Provide Designated Cargo Aircraft Operations Apron

As part of the OAP update, annual economic impacts for 97 statewide airports was also estimated. General aviation operations at Bend Municipal Airport accounted for approximately 24,013 visitors who arrived in the area via aircraft. The total output stemming from all on-airport aviation related tenants, capital improvements and visitor related expenditures was estimated at \$174.5 million. Total full-time employment related to all tenants and visitors accounted for nearly 963 jobs with an estimated payroll of \$36.8 million.



## ENVIRONMENTAL DATA

Bend is located at the convergence of the Eastern Cascade Slopes and Foothills and the Northern Basin and Range eco-regions. Deschutes County is comprised of forest lands, rugged canyons, cinder cones, plateaus and limited areas of agricultural land. The Deschutes River is a major drainage that runs through the county.

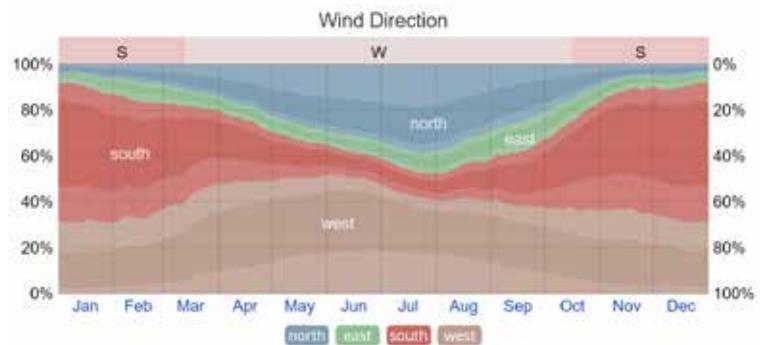
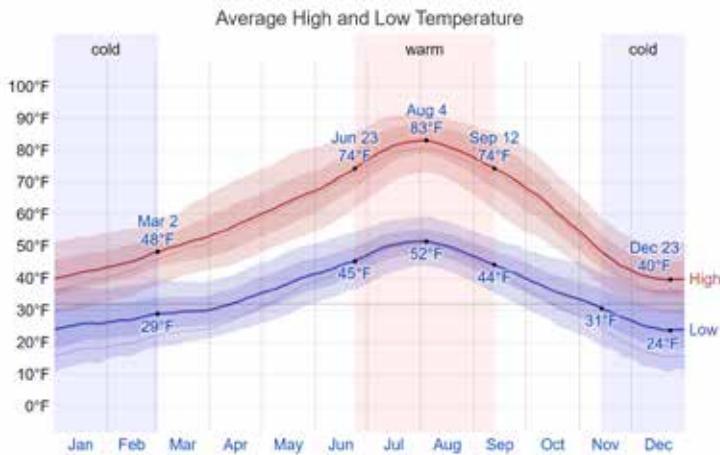
Mountainous terrain surrounds the airport, which sits at 3,460 feet above mean sea level (MSL). Maximum elevation figures (MEF) depicted on aeronautical charts indicates the highest terrain elevations within defined areas ranging from 5,900 feet (north) to 10,700 feet (west, northwest).

### Local Climate/Wind Analysis

Deschutes County has a relatively dry, high desert climate with moderate winter and summer temperature ranges. Temperature and precipitation varies with elevation and proximity to the Cascade Range. The region produces moderate amounts of winter snow.

Historic climatic data for Bend maintained by the Western Regional Climatic Center includes two observation sites. The site nearest Bend Municipal Airport is Station: 350699 Bend 7 NE, which is located approximately 7 miles northeast of Bend. This site has data for the 19-year period between 1991 and 2010. The data indicate that July and August are typically the warmest months; December and January are the coldest. On a monthly basis, the average maximum temperature is 83.7 degrees Fahrenheit (July) and the average minimum temperature is 23.2 degrees (December). Bend 7 NE averages 9.46 inches of precipitation and 5.2 inches of snowfall annually.

The following graphics retrieved from [weatherspark.com](http://weatherspark.com) illustrate the typical weather in Bend, based on a statistical analysis of historical hourly weather reports and model reconstructions from January 1, 1980 to December 31, 2016.



FAA wind data for BDN indicates prevailing winds are generally north-south, with occasional southwesterly and southeasterly flows. As depicted in Table 2-7, the FAA wind analysis tool confirms runway crosswind coverage of the existing runway orientation satisfies FAA minimum 95% coverage requirements for all categories of aircraft.

TABLE 2-7: RUNWAY 16-34 WIND ANALYSIS

	10.5 KNOTS	13 KNOTS	16 KNOTS
IFR	98.56%	99.23%	99.66%
VFR	96.87%	98.82%	99.74%
All-Weather	96.93%	98.83%	99.74%

Source: <https://airports-gis.faa.gov/windRose/>

### Airport Solid Waste and Recycling

The following section provides a summary of the solid waste generated at Bend Municipal Airport and recycling practices in anticipation of identifying any opportunities for reducing waste at the Airport.

On September 30, 2014, the FAA established guidance on preparing airport recycling and solid waste management plans as an element of an airport master plan update. This guidance was in response to Section 133 of the FAA Modernization and Reform Act (FMRA) of 2012 that established the requirement for all airport master plan updates to include a recycling plan that addresses the following:

- Local Recycling Management and Programs;
- Waste Audit;
- Recycling Feasibility;
- Plan to Minimize Solid Waste Generation;
- Operational and Maintenance Requirements;
- Waste Management Contracts;
- Potential for Cost Savings or Revenue Generation; and
- Future Development and Recommendations.



The types of waste typically generated at general aviation airports include:

- Construction and Demolition Waste – Solid waste produced during the excavation, clearing, demolition, construction, and or renovation of airport pavements, buildings, roads, or utilities.
- Yard Waste – Yard waste includes grass clippings, weeds, trees, shrubs, and other debris generated during landscape maintenance.
- Hazardous Wastes – Hazardous wastes are identified in regulation 40 CFR 261.31-33, which are typically corrosive, ignitable, toxic, or reactive. This type of waste requires specific handling, treatment, and disposal.
- Universal Hazardous Waste – The Environmental Protection Agency (EPA) provide less stringent regulations for universal wastes as defined in 40 CFR Part 273, Universal Waste Rule.

To assist airports in developing their recycling program, the FAA has created the Recycling, Reuse, and Waste Reduction at Airports: A Synthesis Document. The FAA provides guidance to airports in two key focus areas:

- Programs to encourage recycling, reduction and reuse of materials; and
- Programs to encourage airports to reduce their energy consumption.

As noted in the Synthesis Document, the guidance may be scaled accordingly for the size and type of airport that is utilizing it.

### Local Recycling Management and Programs

Bend Garbage and Recycling provides solid waste removal and recycling for Bend Municipal Airport. State, County, and City recycling management and solid waste programs pertinent to the Airport include:

#### State Of Oregon

In 1983, the Recycling Opportunity Act was the first law in the U.S. to require that people statewide be provided with an opportunity to recycle. This statute established solid waste management policies for waste prevention, reuse and recycling.

In order to conserve energy and natural resources the statute uses a solid waste management hierarchy:

- Reduce the amount of waste generated;
- Reuse materials for their original intended use;
- Recycle what can't be reused;
- Compost what can be reused or recycled;
- Recover energy from what cannot be reused, recycled, or composted;
- Dispose of residual materials safely.

The Recycling Opportunity Act also required that:

- Wasteshed counties, except for the City of Milton-Freewater and the greater Portland tri-county area known as the Metro wasteshed, to have recycling depots; and
- Cities with populations over 4,000 to provide monthly curbside recycling collection service to all garbage service customers.

The 1991 Oregon Recycling Act (Senate Bill 66) strengthened the states recycling requirements and created a recovery goal of 50 percent by year 2000. This statute also established a household hazardous waste program; required recycled content in glass containers, directories and newsprint publications; established requirements for recycling rigid plastic containers to promote market development; and required the Department of Environmental Quality to calculate annual recovery rates and develop a solid waste management plan. In 2005, House Bill 3744 established a new wasteshed goal and extended Oregon's statewide recovery goals of 45 percent in 2005 and 50 percent in 2009.

#### City Of Bend

While the City of Bend is the owner of the Bend Municipal Airport, Solid Waste and Recycling standards are set by Deschutes County, which has jurisdiction.

#### Deschutes County

The Department of Solid Waste oversees the management of solid waste and recycling in Deschutes County. Knott Landfill Recycling and Transfer Facility, the only landfill in the County, is estimated to remain open until 2029.

For waste disposal, four Transfer Stations provide servicing for outlying areas of Deschutes County. These include:

- Negus Transfer Station, located in Redmond
- Northwest Transfer Station, between Bend and Sisters
- Southwest Transfer Station, north of La Pine
- Alfalfa Transfer Station, off Walker Road near Alfalfa.

Deschutes Recycling, located at Knott Landfill Recycling and Transfer Facility, and all four of our Transfer Stations provide full recycling opportunities. Recycling is available for commingled recyclables, cardboard, glass, appliances, auto batteries, computer monitors, CPUs, printers, keyboards and mice, TVs, other electronics, motor oil, tires, scrap metal, wood waste and yard debris.

#### Waste Audit

Tenants and users of the Bend Municipal Airport create a limited amount of waste on site. Specific sources of on-site waste include:

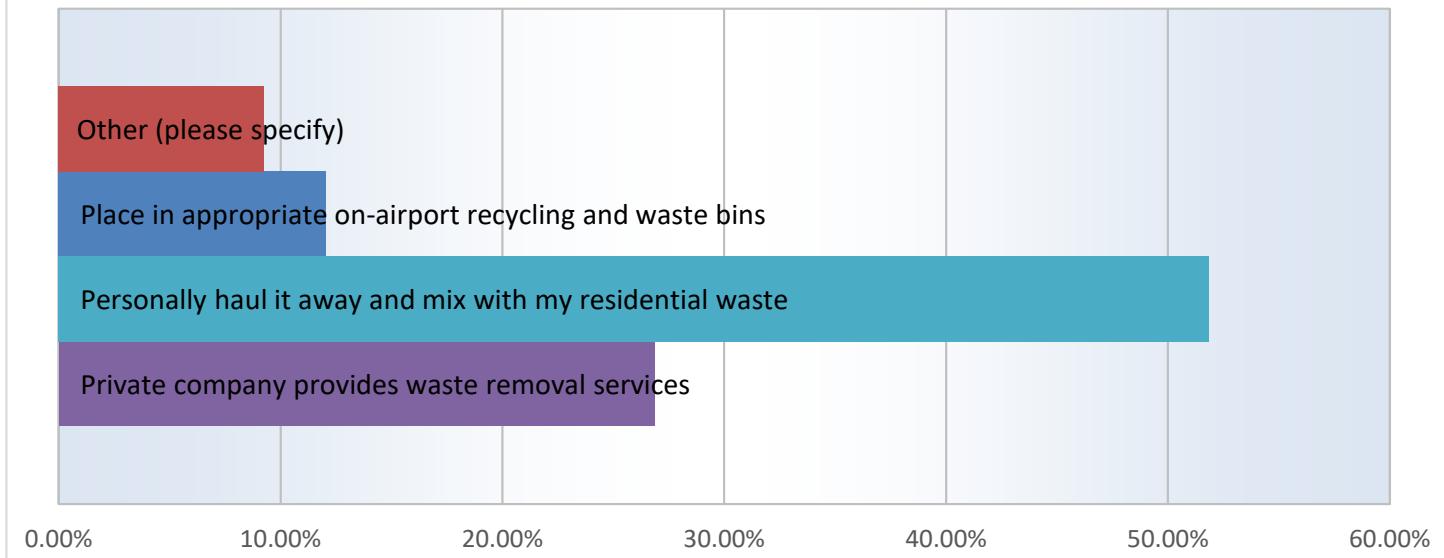
- Fixed base operator (FBO) building generates paper waste, plastic bottles, aluminum cans and other typical office trash. As part of the FBO operations, they can produce used oil and aircraft parts such as tires, filters, etc.
- Private hangars and buildings can create a variety of waste, depending on the function of the building. Hangars typically produce anything from typical household trash to used oil and aircraft parts.
- Manufacturers and on-airport businesses generate similar waste to off-airport businesses such as paper waste and other typical office trash. They can also produce used oil and aircraft parts such as tires, filters, etc. depending on the nature of their business.

## Waste Disposal

No state or federal requirements apply to the waste that is generated on the airport. Each individual tenant is responsible for disposal of their own waste and any hazardous materials.

In a survey submitted to Airport tenants, over half of respondents indicated they personally hauled away any of their waste generated at the Airport. The majority of remaining respondents indicated a private waste removal company provides waste removal services or they place any waste in appropriate on-airport recycling and waste bins.

### What do you do with any solid waste/garbage you produce while on the Airport?

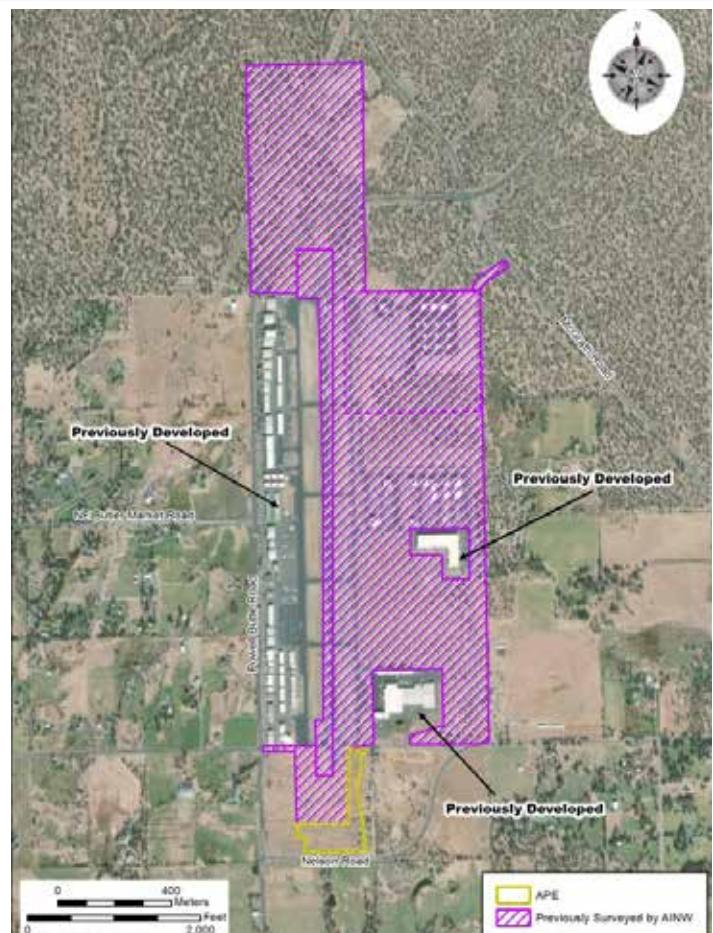


## Cultural Resources Analysis

Consultants have previously conducted six cultural resource studies at the Airport at land that almost covers the entirety of Airport property. The current study area (depicted as APE on graphic) for the project encompasses the remaining 5.4 acres of land owned by the City, south of the existing runway and north of Nelson Road.

The pedestrian survey of the study area resulted in the identification of one historic-period site (temporary site number 18/2763-1) consisting of a linear stone rubble alignment that may have been used as a fence line or as a designated location to place rocks at the edge of an agricultural field. A small historic-period debris scatter was found within a section of the stone alignment. Site 18/2763-1 is recommended to be not eligible for listing in the NRHP. No historic-period buildings or other structures were present within the APE. Based on the results of the cultural resource survey, the consultant recommends a finding of "No Historic Properties Affected" for the Bend Municipal Airport Master Plan project.

**The complete cultural resources survey report is provided in its entirety within the appendices of this report.**





## NEPA Review

An environmental screening for the following environmental impact categories were included as part of the Master Plan and are summarized in the following:

- Section 4(f) of the U.S. Department of Transportation Act
- Biotic Resources
- Federally-listed Endangered and Threatened Species and Critical Habitats
- Wetlands and Waters of the U.S.
- Floodplains
- Stormwater and Water Quality
- Air Quality

### Section 4(F) of the US Department of Transportation Act

There are no parks or other public lands adjacent to the Airport.

#### Biotic Resources

Vegetation in the vicinity of the Airport is characteristic of a typical eastern Oregon western juniper (*Juniperus occidentalis*) plant community. These areas occupy intermediate moisture zones between a Ponderosa pine (*Pinus ponderosa*) and steppe or shrub-steppe habitats. Most annual moisture is received during the winter as snow while summers are hot with little to no moisture. Most areas of the Airport grounds are managed and mowed grassy and herbaceous areas. Other areas of the Airport are dominated by western juniper in the tree layer and rabbitbrush (*Chrysothamnus viscidiflorus*) and big sagebrush (*Artemisia tridentata*) in the shrub layer. The herb layer is characterized by cheat grass (*Bromus tectorum*), various thistles, yarrow (*Achillea millefolium*), and tumbleweed (*Salsola tragus*).

Migratory Bird Treaty Act (MBTA) protected species that may be present and breed within three-miles of the Airport were identified. Other species protected by the MBTA may also be present at that time of year, and therefore be susceptible to disturbance by construction activities.

## TENANT SURVEY RESPONSE/DATA

**48% of all survey respondents agreed that the most important environmental issue affecting BDN is Airport Sustainability.**

**At Regional Stakeholder Meeting #1 one of the sustainability comments received from participants stated:**

**“Support (Future) Bend Community Climate Action Plan – KBDN accounts for 2% of Bend greenhouse gas emissions.”**

## Federally-listed Endangered and Threatened Species and Critical Habitats

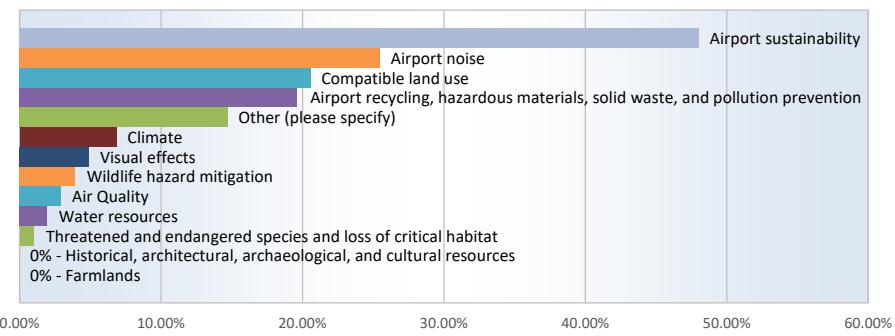
To determine what species and critical habitat protected under the Endangered Species Act could occur in the vicinity of the Airport, the USFWS website was queried and data reviewed from the Oregon Biodiversity Information Center (ORBIC 2018). A table listing the federally-listed species identified for Deschutes County is included within the full memo in the appendices. The species with some potential to occur near or within the project area are discussed below. The other species do not occur in or near the project area due to lack of supporting habitat features.

The nearest known occurrences of gray wolf (*Canis lupus*) (endangered west of Highways 395, 78, and 95) is in the White River Unit in southern Wasco County (ODFW 2018) where at least two pups were observed in 2018 (ODFW 2018). It is highly unlikely that gray wolf will occur at the Airport given they are not found in areas with high human density/activity and a lack of ungulate prey. Additionally, and there are no documented sightings of gray wolves within a one mile radius of the Airport.

#### Wetlands and Waters of the U.S.

Wetlands are under the jurisdiction of both Oregon Department of State Lands (DSL) and the U.S. Army Corps of Engineers (Corps) and are protected under the State of Oregon Removal Fill Law and Section 404 of the Clean Water Act. Both agencies use the Corps of Engineers Wetland Delineation Manual (Experimental Laboratory 1987) and the Arid West Wetland Delineation Supplement Manual (Corps of Engineers 2008) for determining wetland and their extent. An area is determined to be a wetland if it has a dominance of hydrophytic vegetation (plants that grow in wet conditions), hydric soils, and positive wetland hydrology. The Natural Resource Conservation Service (NRCS) maps the majority of the Airport as having Deskamp loamy sand, 0 to 3 percent slopes, and Gosney-rock outcrop-Deskamp complex, 0 to 15 percent slopes to the north and south ends of the study

What do you believe are the most important environmental issues affecting the Bend Municipal Airport?





area. Deskamp loamy sand and Gosneyrock outcrop are both considered somewhat excessively drained soils and found in old lava plains at elevations between 3,000 and 4,000 feet. Neither soil found in the project area meets the definition of "hydric soil" by the NRCS.

A wetland reconnaissance was conducted by Environmental Science Associates (ESA) on November 30, 2018 to examine areas mapped as freshwater pond, freshwater forested/shrub wetland, and riverine by the National Wetlands Inventory (NWI) (Figure 1). Aerial imagery suggests that all of these areas once actively conveyed water. However, based on more recent aerial imagery and the November site visit, the riverine channel (a Central Oregon Irrigation District[(COID] lateral) has been covered with the exception of approximately 85 feet of daylit canal between Powell Butte Rd. and a culvert. In this area, flowing water and hydrophytic (albeit dormant) vegetation (e.g., Carex sp., Rumex sp., and Iris pseudacorus) was observed (Figures 2 and 3). Moving east from the culvert, the channel is piped underground across the remainder of the airport property to the east, then north. The roughly 6-acre NWI mapped freshwater pond-freshwater forested/shrub wetland east of the existing runway no longer receives water from the canal and is completely dry with no remnant hydric features observed (Figure 4). Upland plant species, including rabbitbrush and thistle, were observed. On the east side of the airport property, the remnant canal is open but, again, no longer conveys water.

The COID lateral would be considered a jurisdictional water of the U.S. by the Corps ("A tributary can be a natural, man-altered, or man-made water and includes waters such as rivers, streams, canals, and ditches not excluded under paragraph (b) of this section." 328.3 (c)(3)). However, the canal would not be a jurisdictional waterbody of the State (under OAR 141-085-0515).

#### Floodplains

The Federal Emergency Management Agency's Flood Insurance Rate Map does not identify any floodplains in the area.

#### Stormwater and Water Quality

The Airport is typically flat, with no significant closed drainage depressions or drainage patterns. Stormwater appears to runoff impervious surfaces and infiltrate well before reaching any water body with protected fish or amphibians.

#### Air Quality

The Bend Municipal Airport and surrounding area is not located in a National Ambient Air Quality Standards (NAAQS) Maintenance area for the State of Oregon (Oregon Department of Environmental Quality). The EPA established NAAQS for a limited number of pollutants with the 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 Bend, Oregon, are particulates. The primary impacts to local air quality from 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 at and from terminals, service trucks, fuel trucks, and auxiliary equipment such as emergency generators. Aircraft engine emissions 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.

**The complete environmental screening report is provided in its entirety within the appendices of this report. Noise Contours**

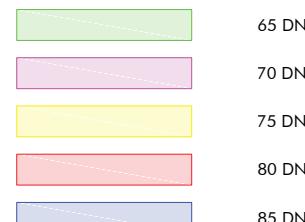
#### Noise Contours

The noise analyses conducted for the HOA EA in 2014 depicts the existing airfield configuration at the time the EA was completed as well as the proposed configuration based on the preferred alternative identified in the EA out to the year 2020. The noise analyses are based on updated estimates of air traffic for the current year (2014) completed at the time of the EA, as well as the revised master plan forecasts which were submitted to FAA for review and approval as part of the EA.

The noise exposure contours document the anticipated impact of the EA preferred alternative, which included the new helipad constructed on the east side of Runway 16-34. Each noise contour includes 100 percent of estimated/forecast helicopter and fixed wing air traffic activity at the Airport.

As part of this master planning effort, once a preferred alternative has been selected, updated noise contours will be developed for existing and future conditions. The noise contours will reflect existing and future aircraft operations as presented in Chapter 3: Aviation Activity Forecasts.

#### Noise Contours Legend



— - — PROPERTY LINE

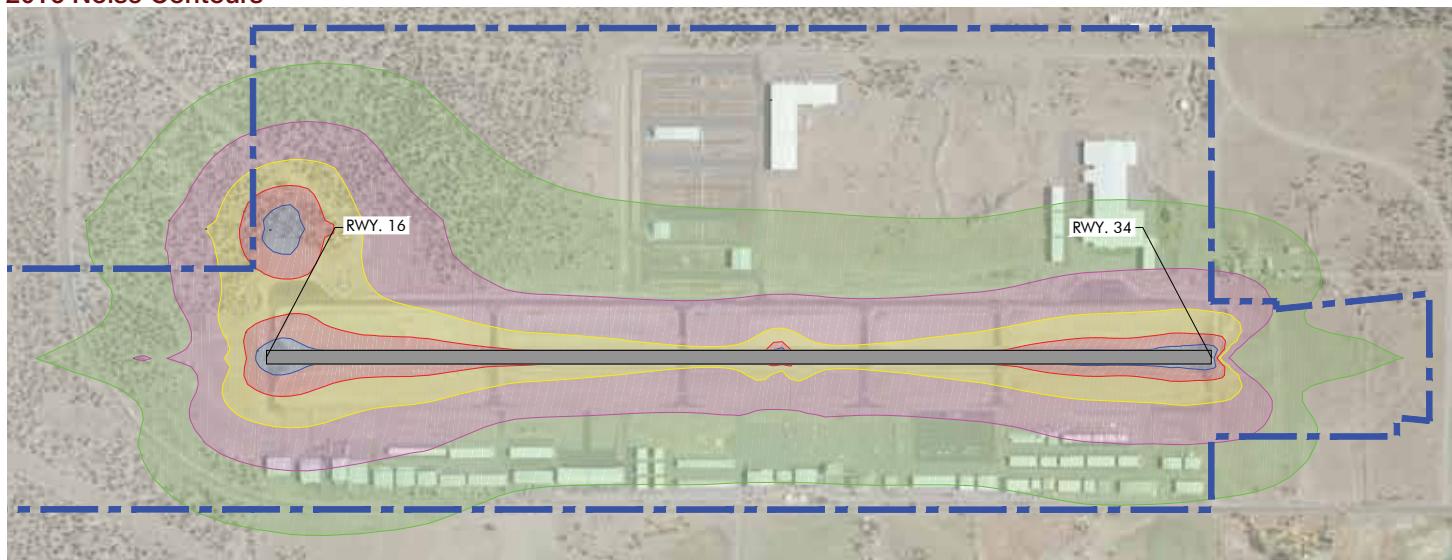


# 2014 HOA ENVIRONMENTAL ASSESSMENT - NOISE CONTOURS

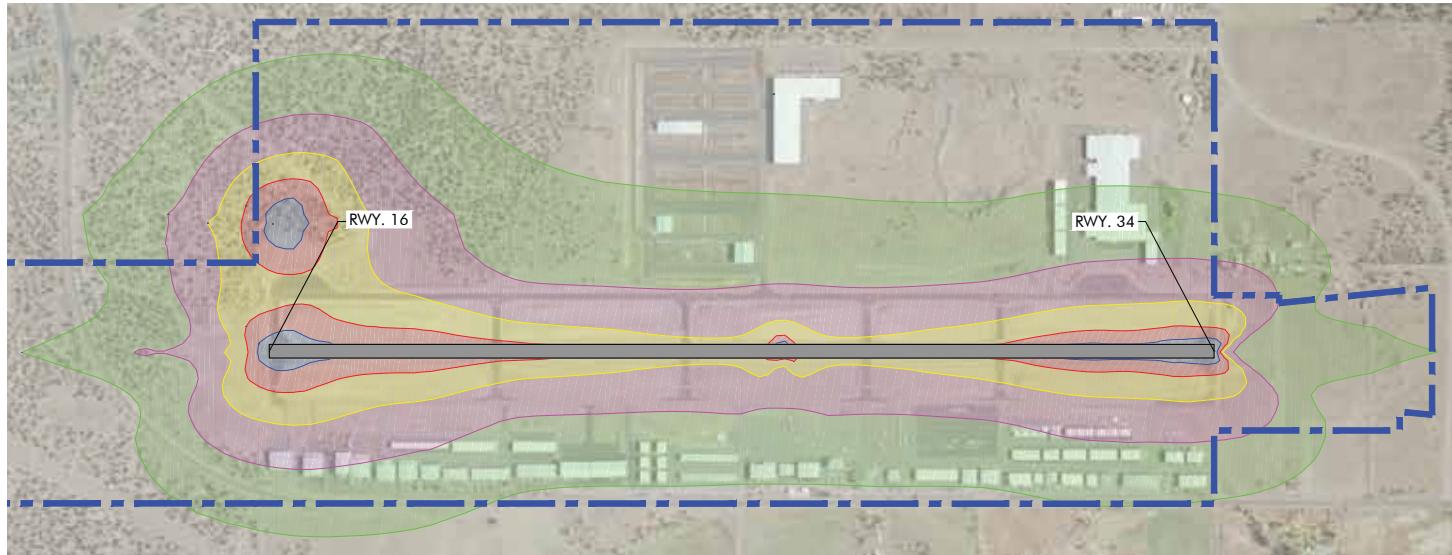
2014 Noise Contours



2016 Noise Contours



2020 Noise Contours

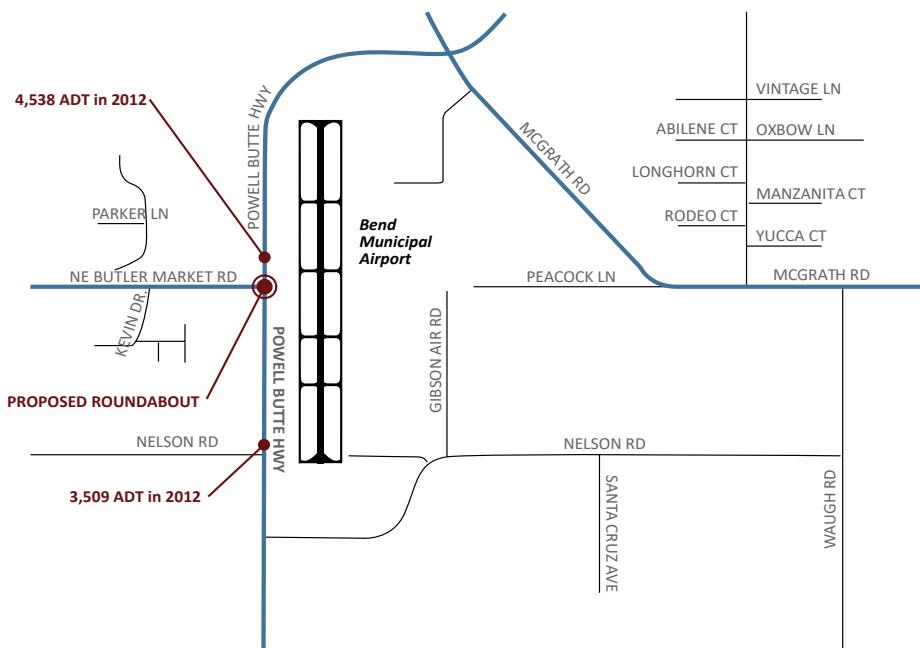


## LOCAL SURFACE TRANSPORTATION SYSTEM ANALYSIS

Surface access to Bend Municipal Airport is provided via Powell Butte Highway, which connects to U.S. Highway 20 and Oregon Highway 126. The Deschutes County Transportation Plan identifies Powell Butte Highway as "a former state highway that is now a rural arterial within Deschutes County." Traffic count data is available for two sections of the highway near the airport including 0.10 miles north of Butler Market Road (4,538 Average Daily Trips in 2012) and 0.02 miles north of Nelson Road (3,509 Average Daily Trips in 2012). The east side of the Airport is accessed by Gibson Air Road via Nelson Road on the South or McGrath Road on the North.

As previously identified, the Deschutes County Capital Improvement Plan includes a potential roundabout at the intersection of Butler Market and Powell Butte Highway. The roundabout will have similar geometry to the project at Powell Butte Highway and Neff Road/Alpha Market. This proposed project presents a potential for significant impacts to airport property that is already tightly constrained by the proximity to the highway.

This major County project presents an opportunity to evaluate access improvements to the west side of the Airport and also explore other relocation options for Powell Butte Highway which have been identified by multiple stakeholders as an important issue to be addressed during this project.



## ROUNDABOUT CONCEPTUAL RENDERING





## LAND USE/ZONING ANALYSIS

Bend Municipal Airport is located outside the Bend city limits and urban growth boundary (UGB). The eastern edge of the City of Bend UGB is approximately 2.25 miles west of the Airport's western boundary. Land use controls and zoning for the airport and in the immediate vicinity of the airport are administered by Deschutes County.

### Base Zoning

The majority of City-owned land comprising the Bend Municipal Airport is depicted as **Airport Development Zone – AD** (Deschutes County Code, Chapter 18.76). As described in the code, "The purpose of the Airport Development (AD) Zone is to allow for development compatible with ongoing airport use consistent with the Deschutes County Year 2000 Comprehensive Plan and the 1994 Bend Airport Master Plan (as amended by a 2002 supplement), while providing for public review of proposed development likely to have significant impact on surrounding lands.

The AD Zone is composed of three separate zoning districts, each with its own set of allowed uses and distinct regulations, as further set forth in DCC 18.76."

The three sub-districts outlined in DCC 18.76 include:

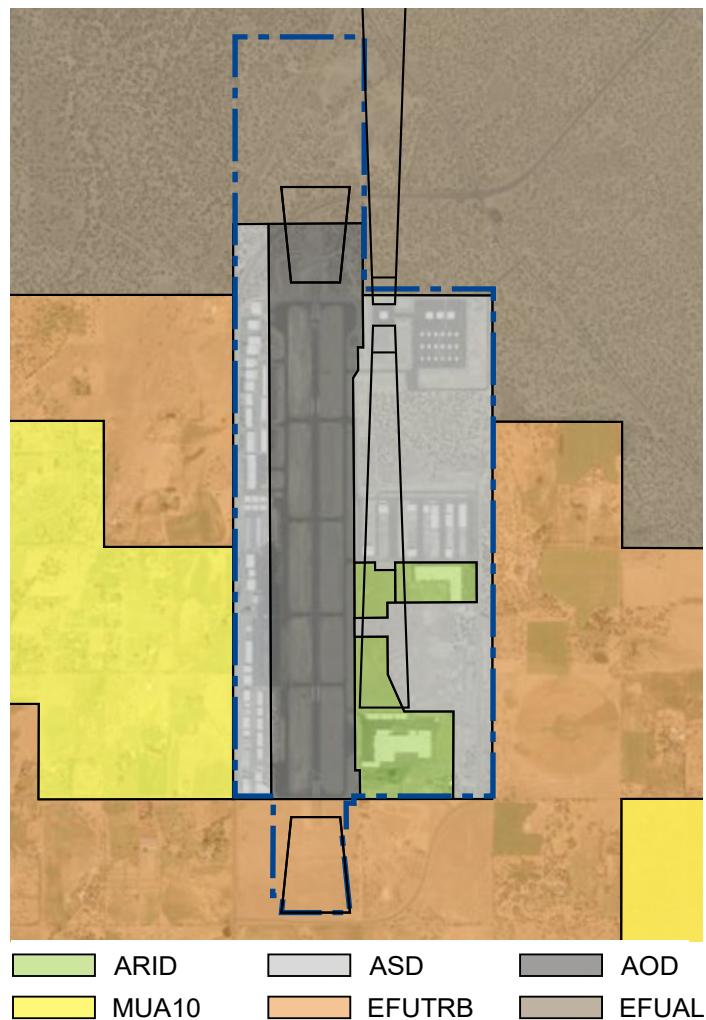
**Airport Operations District (AOD):** which is intended to accommodate and protect airfield facilities such as runways, taxiways, and aircraft fueling;

**Aviation Support District (ASD):** which includes all of the items from the AOD and adds aircraft hangars, aircraft tiedowns, airport or aviation-related businesses that benefit from an airport location, and airport restaurants;

**Aviation-Related Industrial District (ARID):** which expands the uses allowed in the ASD to include industrial businesses that benefit from an airport location.

Portions of City-owned airport property are zoned Exclusive Farm Use – Alfalfa Subzone (EFUAL) on the north and Exclusive Farm Use - Tumalo/Redmond/Bend Subzone (EFUTRB).

**Airport Vicinity Zoning -** The zoning in the vicinity of the airport accommodates rural agricultural and low density residential uses. The zones include EFUTRB – Tumalo/Redmond/Bend Subzone; MUA10 – Multi-Use Agricultural; and EFUAL-Alfalfa Subzone.



### FUTURE AIRPORT DEVELOPMENT ZONING DISTRICT

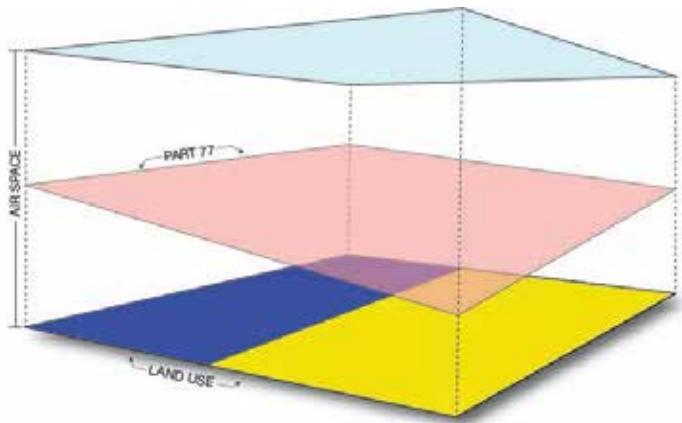
As a separate project, concurrent with the final adoption of the Airport Master Plan and update of the County Comprehensive Plan, the City of Bend and Deschutes County will work together to update the Deschutes County zoning code designations for the Bend Municipal Airport.

The zoning code update project may include updating the zoning code to consolidate the AD, AOD, ASD, and ARID districts into one AD zone that encompasses all airport related uses. The AD zone would need to clearly identify aviation related uses and accessory uses that can be permitted outright, which generally includes the facilities typically associated with an airport such as runways, taxiways, hangars, aviation businesses, flight training, etc. The AD zone will also need to provide guidance for conditional land use approval of light industrial, commercial, and other non-aviation land uses where it may be mutually beneficial to be located on the Airport.

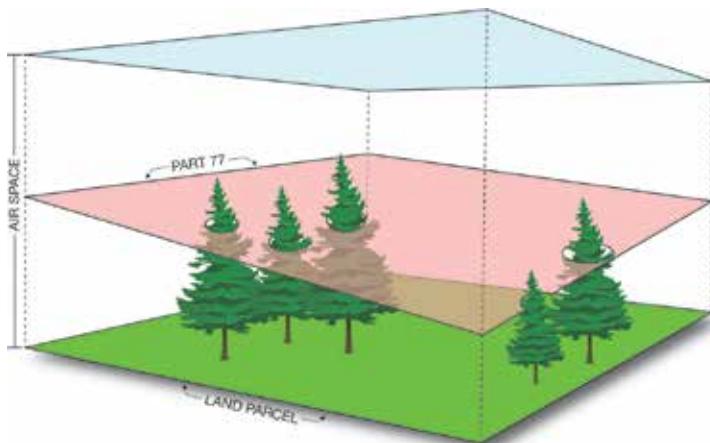


## Airport Overlay Zones

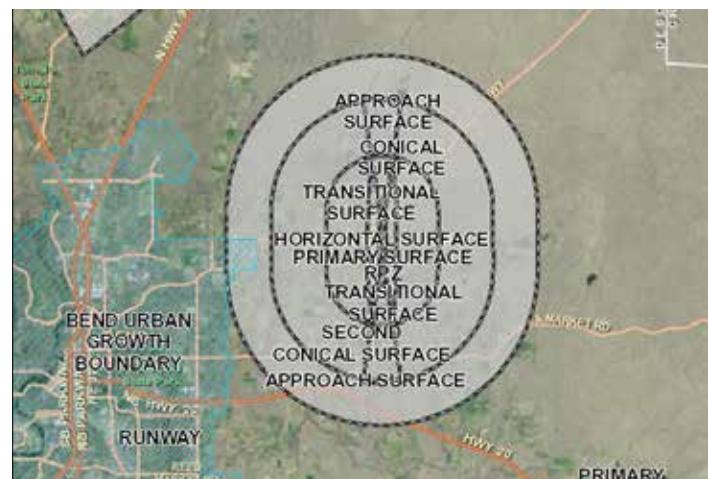
Deschutes County has adopted the Airport Safety Combining Zone (AS) for all airports located in the county. As described in the DCC 18.90 "The purpose of the AS zone is to restrict incompatible land uses and airspace obstructions around airports in an effort to maintain an airport's maximum benefit. Incompatible uses may include height of trees, buildings, structures, or other items and uses that would be subject to frequent aircraft over-flight and might intrude into areas used by aircraft."



The AS zone applies to all unincorporated areas located under airport FAR Part 77 airspace and runway protection zones (defined by FAA in Advisory Circular 150/5300-13, as amended). The airport overlay zones do not affect the zoning or permitted uses for the underlying property. However, State guidance does identify typical compatible land uses per FAR Part 77 surfaces and FAA safety areas. For the Deschutes County AS zone, the more restrictive height limit from either the surface zoning or overlay zoning will apply. Variances are permitted in cases where rising terrain penetrates the airport's airspace surfaces. Additional requirements include the use of glare-resistant materials in construction and limitations on signage and lighting.



## DESCHUTES COUNTY AS ZONES



Source: <https://dial.deschutes.org/Real/InteractiveMap>

## COMPATIBLE LAND USE PLANNING

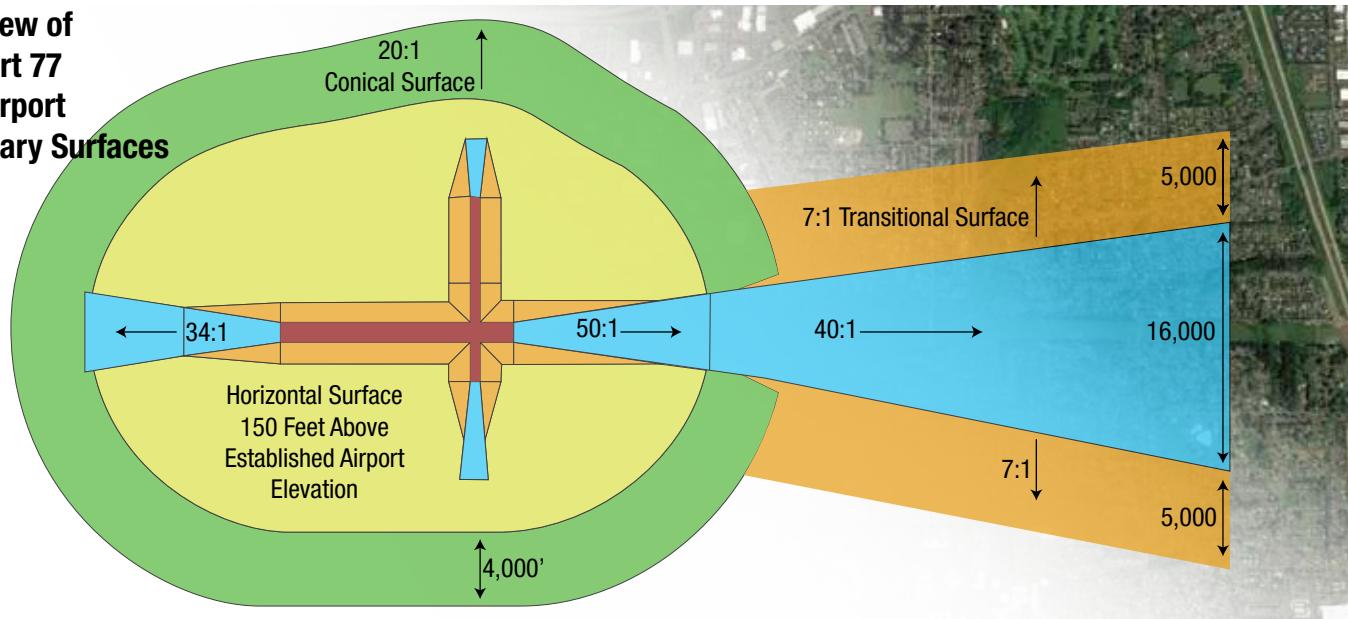
The table below retrieved from the Oregon Department of Aviation's Airport Land Use Compatibility Guidebook identifies land uses that are generally compatible or incompatible within airport safety areas and Part 77 surfaces like those depicted above for the Bend Municipal Airport.

Land Uses	Primary Surface	Transitional Surface	Horizontal Surface	Conical Surface	Approach Surface	Runway Protection Zone
<b>Residential</b>						
Residential, other than those listed below	NC	NC	•	C	•	NC
Mobile home parks	NC	NC	•	C	•	NC
Transient lodgings	NC	NC	•	C	•	NC
<b>Public Use</b>						
Places of public assembly (schools, hospitals, churches, auditoriums)	NC	NC	•	C	NC	NC
Government services	NC	•	C	C	•	NC
Transportation (parking, highways, terminals)	NC	•	C	C	•	•
<b>Commercial Use</b>						
Offices, business and professional	NC	•	C	C	•	NC
Wholesale & retail - building materials, hardware and farm equipment	•	•	C	C	•	NC
Retail trade - general	NC	•	C	C	•	NC
Utilities	NC	•	•	•	•	•
Communication	NC	•	•	•	•	NC
<b>Manufacturing &amp; Production</b>						
Manufacturing - general	NC	•	•	•	•	NC
Agricultural (except livestock) and forestry	•	•	C	C	•	•
Livestock farming and breeding	NC	•	•	C	•	NC
Mining and fishing, resource production and extraction	NC	NC	•	•	•	NC
<b>Recreational</b>						
Outdoor sports arenas and spectator sports	NC	NC	•	C	NC	NC
Nature exhibits and zoos	NC	NC	•	C	NC	NC
Amusement park, resorts and camps	NC	NC	C	C	NC	NC
Golf courses	NC	NC	C	C	NC	NC
Parks	NC	•	•	•	•	•



# FAR PART 77 AIRSPACE

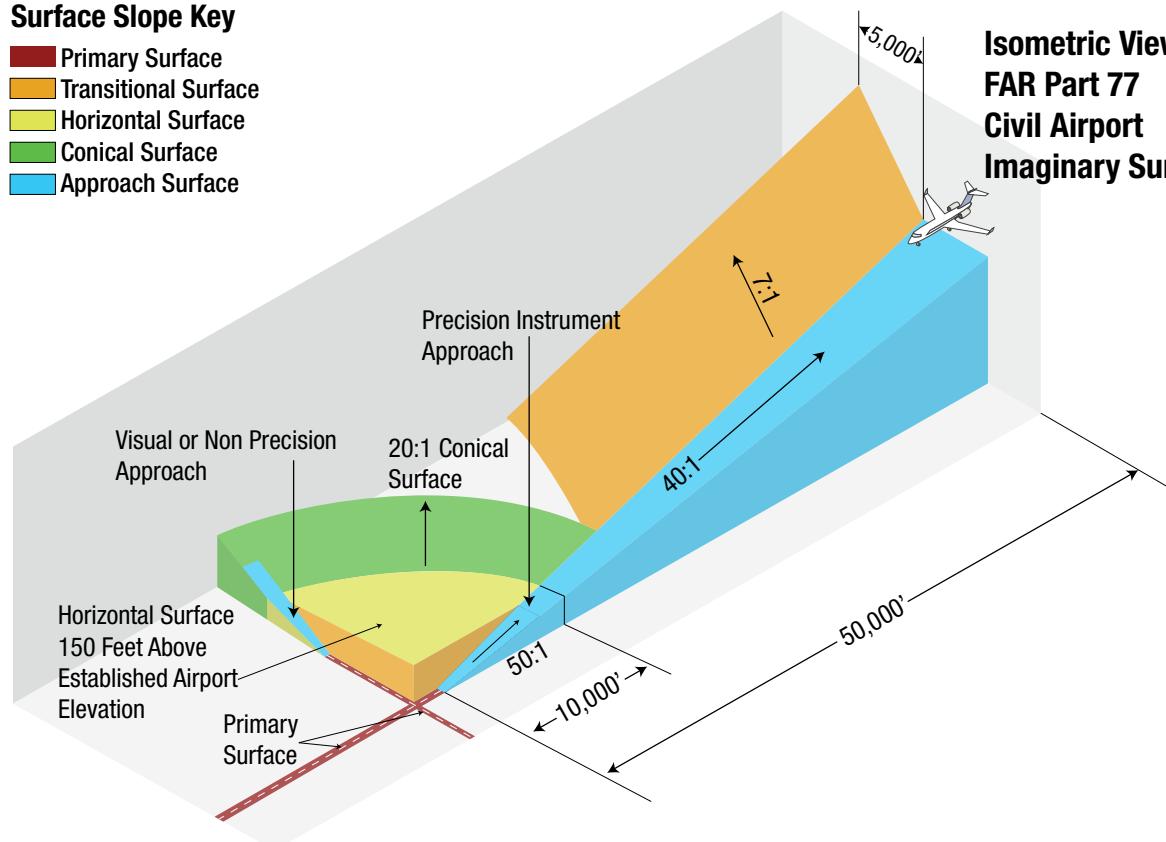
## Plan View of FAR Part 77 Civil Airport Imaginary Surfaces



## Surface Slope Key

- Primary Surface (Maroon)
- Transitional Surface (Orange)
- Horizontal Surface (Yellow)
- Conical Surface (Green)
- Approach Surface (Blue)

## Isometric View of FAR Part 77 Civil Airport Imaginary Surfaces



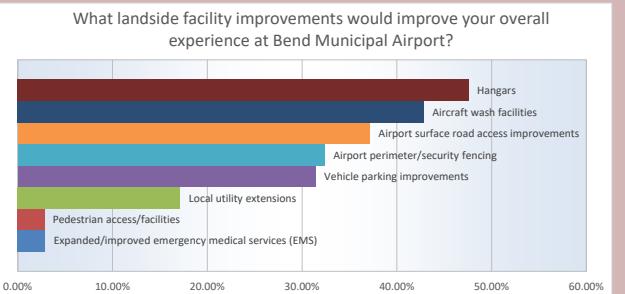
For Bend Municipal Airport, the approach surfaces for Runway 16/34 extend 10,000 feet beyond each runway (beginning 200 beyond the runway end). Other surfaces extend approximately 14,000 feet from each runway end.

# Landside Elements

The landside elements section includes the facilities designed to support airport operations but not those dedicated to aircraft operations. This section of the existing conditions analysis includes a discussion of Utilities, Airport Fencing, Airport Surface Roads, Vehicle Parking, GA Terminal Areas, and Hangars.

## TENENT SURVEY RESPONSE/DATA

Over 30% of all survey respondents agreed that the 5 most important landside facility improvements that would improve the overall experience at BDN are additional/cheaper hangars, aircraft wash facilities, airport surface road access improvements, airport perimeter/security fencing, and vehicle parking improvements.



## GENERAL AVIATION (GA) DEVELOPMENT AREAS

The Bend Municipal Airport can be divided into four distinguishable GA Development Areas. The four quadrants and their common names are the original airport development areas along Powell Butte Highway in the Northwest and Southwest portion of the Airport as well as the areas east of the runway identified as Northeast HOA area and Southeast Epic/Aerofacilities development areas.

### Northwest Development Area

The northwest area includes primarily corporate and GA aircraft hangars. The area houses a mix of businesses and aircraft storage hangars. It is largely built out, however, additional vehicle parking for aviation businesses would be beneficial according to airport users.

### Southwest Development Area

The southwest area includes the main FBO and parking/fuel apron. The area is mostly built out and serves a mix of large corporate hangars used for aircraft storage and aviation related businesses with a large number of aircraft storage hangars closer to the flight line. The two-floor general aviation terminal building has approximately 9,000 square foot of interior space. The terminal building houses airport management and FBO office space, passenger waiting areas, pilot facilities, a restaurant and public restrooms. The building has a small vehicle parking area for customers and staff.

### Northeast Development Area HOA

The HOA area was developed with FAA funding and is limited to helicopter

### Northwest Area

- 176,000 SF of existing aviation related development.
- Area is mostly built out.
- Airport access road dead ends.
- Faces Powell Butte Highway.
- Vehicle parking can be challenging.

### Southwest Area

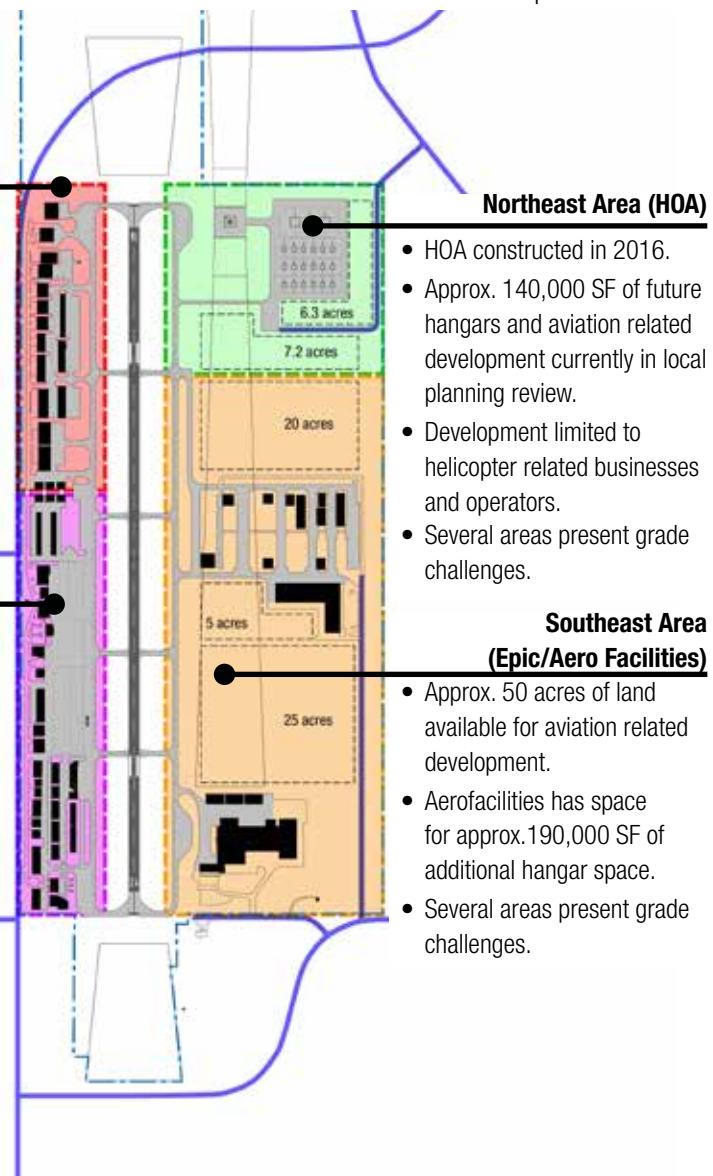
- 232,000 SF of existing aviation related development.
- Area is mostly built out.
- FBO - Leading Edge Aviation
- Face of the Airport as primary terminal area.
- Faces Powell Butte Highway.
- Airport access road dead ends.
- Vehicle parking can be challenging.

### Northeast Area (HOA)

- HOA constructed in 2016.
- Approx. 140,000 SF of future hangars and aviation related development currently in local planning review.
- Development limited to helicopter related businesses and operators.
- Several areas present grade challenges.

### Southeast Area (Epic/Aero Facilities)

- Approx. 50 acres of land available for aviation related development.
- Aerofacilities has space for approx. 190,000 SF of additional hangar space.
- Several areas present grade challenges.





related businesses and operators. Roadway access off of McGrath Road cannot be internally connected to Gibson Air Road due to FAA funding constraints. A gated maintenance access for airport staff could be constructed.

### Southeast Development Area

This area includes the two Epic Aircraft manufacturing buildings and Aero Facilities. Aero Facilities has a large number of construction ready corporate hangar sites available to meet near term demand. It also has several large undeveloped areas to the north of Aero Facilities and to the south of the Epic building that are available for development. The area to the south of the Epic building will require significant fill place in order for development to occur. Between the Epic building and Taxiway B there is additional developable area that was depicted for a future/additional FBO building or airport administration building and corporate aircraft parking and hangars in the previous master plan.

### AIRPORT PERIMETER FENCING

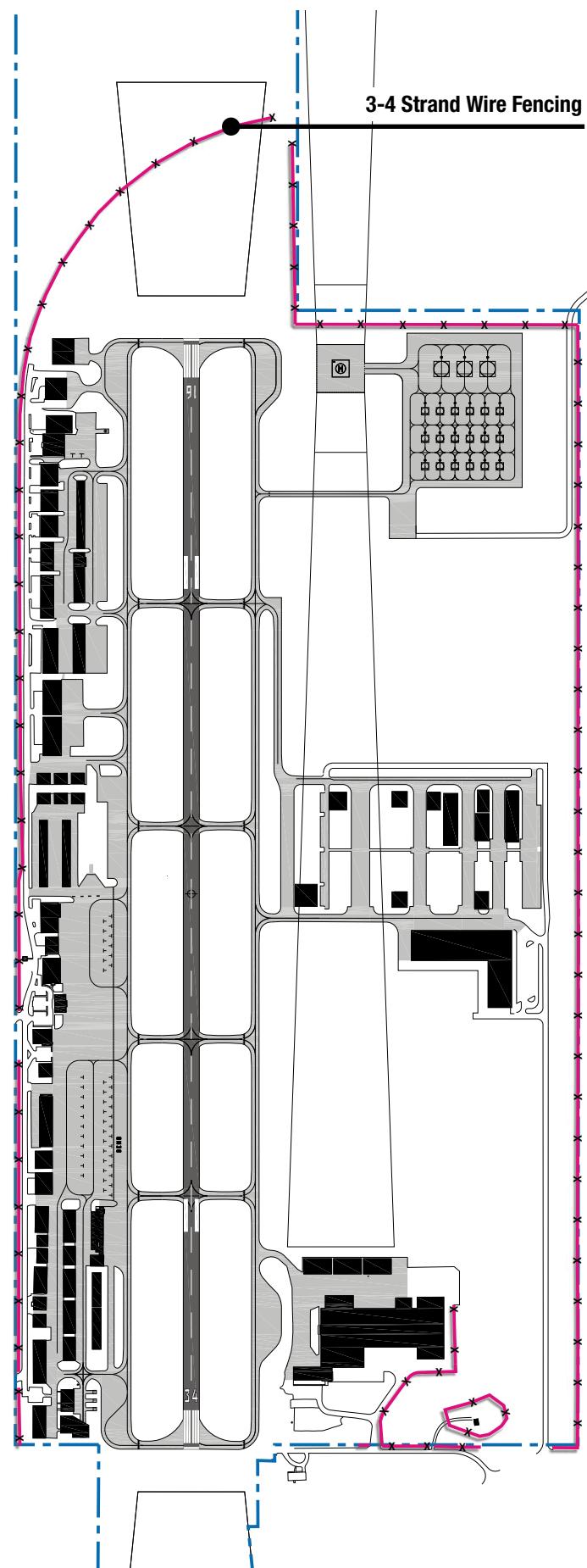
The airport has limited areas of fencing, which consists primarily of three or four strand wire fencing along the airport property line. The west landside area, which is directly adjacent to the airport frontage road and the Powell Butte Highway, is not fenced and numerous locations for direct access to the airside operation areas exists.



Typical 3 to 4 strand wire fencing generally encompassing Bend Municipal Airport perimeter.



Potential option for airport perimeter/security fencing and vehicle access gates.





## AIRPORT SURFACE ROAD ACCESS

A frontage road serving the west landside area of the Airport has two direct connections to Powell Butte Highway. Nelson Road and Gibson Air Road provides vehicle access to landside facilities located on the east side of the Airport. An unprotected left turn lane (southbound lane) is located at the intersection of Powell Butte Highway and Nelson Road. A new airport roadway has been extended from McGrath Road to serve the new HOA development area on the northeast side of the airport.

### TENANT SURVEY RESPONSE/DATA

**38% of survey respondents agree that improvements to Airport surface roads and access would improve the overall experience at Bend Municipal Airport.**

One respondent stated: "With the current road into the airport it can be a little nerve wracking turning off of the powell butte highway when traffic is heavy. People are traveling at 60 mph and not very inclined to slow down."

Another respondent stated: "1) An access road within the airport boundary connecting the west side with the east side development and new helicopter area would make the airport more efficient. 2) A safer and more attractive entrance/exit to Powell Butte Hwy is needed."



## VEHICLE PARKING

Designated automobile parking areas on the Airport are typically located in front of each individual hangar. Main airport parking is located adjacent to the general aviation terminal building with 36 paved spaces. Additional vehicle parking is available adjacent to individual large hangars. However, the limited availability of vehicle parking in the west landside terminal area has been identified as a significant improvement need. On the west side of the Airport there are approximately 578 parking spots, which equates to approximately 1.4 parking stalls per 1,000 sq. feet of total westside building area.

Vehicle parking on the east side of the Airport operates independently of the west side as they share no vehicle access points. There are approximately 465 parking stalls on the east side associated with the private development areas Aerofacilities and Epic Aircraft. Parking on the east side of the Airport is generally considered to be adequate but additional parking may be required upon further analysis.

Deschutes County code requirements create additional challenges for auto parking on the Airport in the future. County Code 18-116.030 (E)5 front yard parking requirements limits locating parking in the "front yard" area for commercial and industrial uses. Exceptions to this rule may be available and County staff have previously recommended the City pursue this exception with County staff to continue to allow parking in the "front yard" of the Airport and airport businesses to continue.

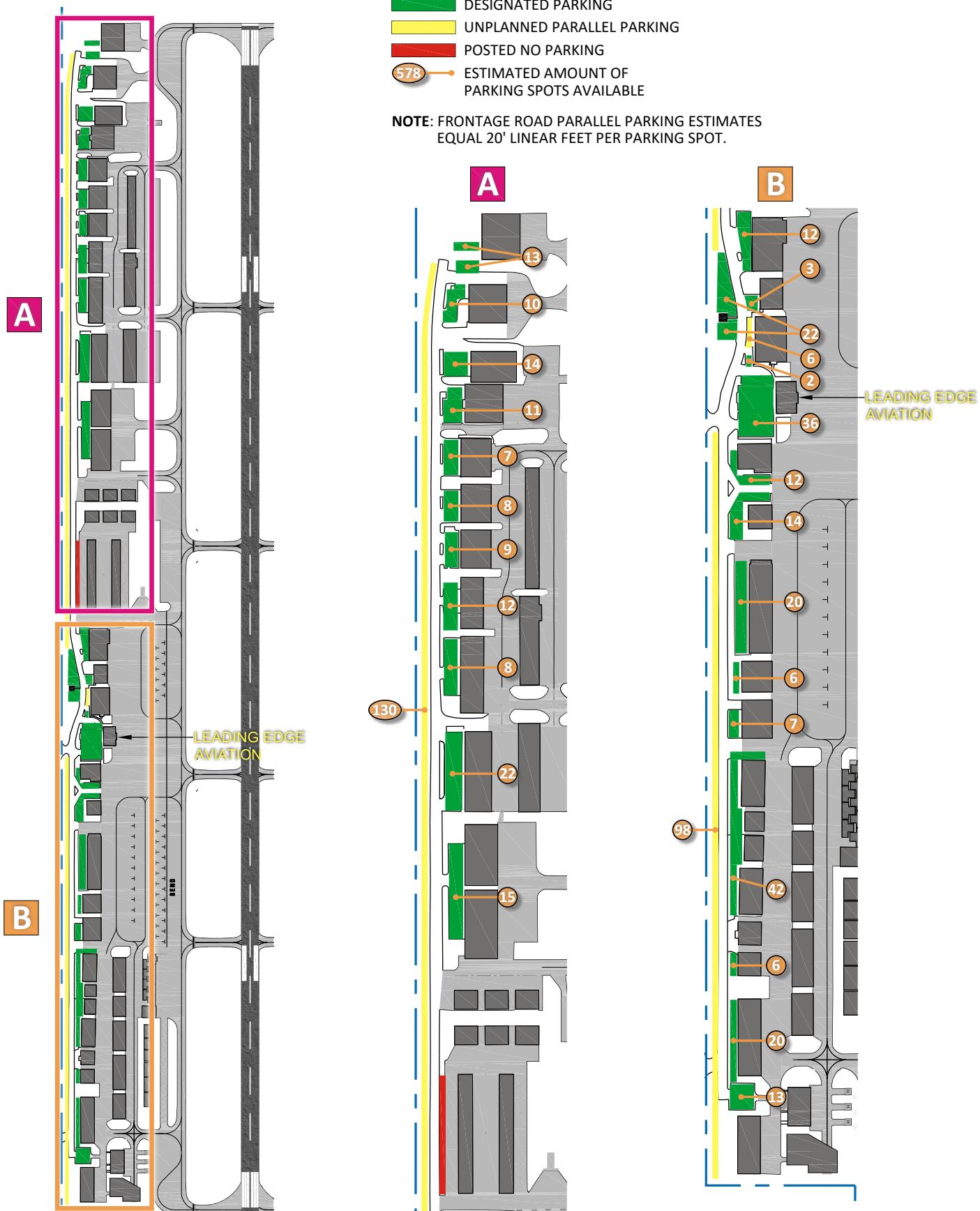
### TENANT SURVEY RESPONSE/DATA

**31% of survey respondents agree that vehicle parking improvements would improve the overall experience at Bend Municipal Airport.**

General comments from survey respondents described vehicle parking on the Airport as in short supply, adhoc, haphazard, or not enough parking to accommodate demand.



# EXISTING WESTSIDE VEHICLE PARKING



## HANGARS

Bend Municipal Airport accommodates a variety of aviation-related buildings including aircraft storage hangars, commercial and mixed-use hangar, and a general aviation terminal. The airport also accommodates a large commercial/industrial complex near its southeast corner that has previously used for aircraft manufacturing by Lancair and Cessna and is currently leased to Epic Aircraft for manufacturing. Currently, the airport has over 1,000,000 square feet of total building area and it is estimated that approximately 700,000 square feet is hangar floor space.

Existing building ownership/occupancy for the Airport varies. The west side of the airport currently accommodates the majority of landside facilities and based aircraft in a variety of apron and hangar facilities. The airport's west side is approaching its landside development capacity with only a handful of vacant areas remaining.

There are currently 12 City-owned hangars with approximately 71 leased spaces including T-hangars and 2- and 3-unit executive hangars. The east side of the airport is now the primary development area for any new landside facilities. Currently the east side of the airport accommodates two large hangar developments (Epic Air and Aero Facilities) and the area adjacent to the HOA that is limited to facilities designed to accommodate helicopters.

It is common for larger hangars at the Airport to accommodate only one aircraft and often times it is only a smaller single-engine piston aircraft. This common practice at the Airport has resulted in a significant hangar shortage. As of March 2019, there are over 30 interested parties identified on the City's official hangar wait list.

### TENANT SURVEY RESPONSE/DATA

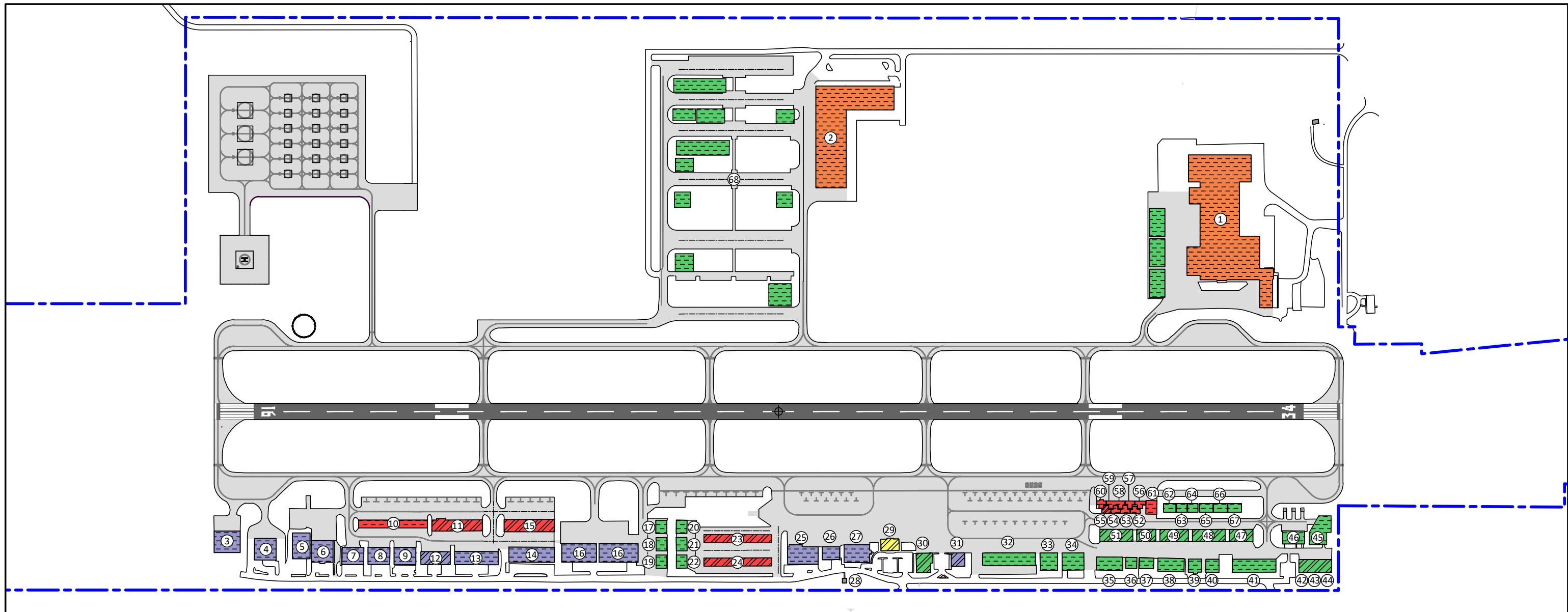
**48% of survey respondents agree that hangar improvements would improve the overall experience at Bend Municipal Airport.**

**General comments from survey respondents typically described the hangar situation on the Airport as though hangars were in short supply and too expensive for what you get.**

**Comments from survey respondents include:**

- **“Hangar access (quantity) and affordability is a negative when it comes to utilizing Bend Municipal as a non-commercial operator of the airport.”**
- **“Considering the cost of hangar rental, the hangars are in sad shape.”**
- **“There is a lack of modern hangars or quality hangars at a reasonable price.”**





①	OWNER	AREA (SQFT)	PARKING	PARKING/1K SQFT
①	EPIC	215,022	280	1.30
②	EPIC	90,000	87	0.97
③	PALADIN DATA	12,000	13	1.08
④	CURRY INV. LLC	9,995	10	1.00
⑤	BRONSON (SNOWLINE)	9,671	14	1.45
⑥	BRONSON (PRECISE FLIGHT)	10,210	11	1.08
⑦	EVENS	7,999	7	0.88
⑧	GARCIA	7,961	8	1.00
⑨	HENSLEY	7,946	9	1.13
⑩	JUNIPER INVESTMENTS	11,382	0	0.00
⑪	CITY HANGAR - J	12,040	0	0.00
⑫	CITY HANGAR	8,065	12	1.49
⑬	#1: DIESTEL, #2: SHAKER, #3: NOVOTEL	12,231	8	0.65
⑭	ELECTRONICS INTERNATIONAL	14,645	22	1.50
⑮	CITY HANGAR - I	13,077	0	0.00
⑯	MAVERICK AIR, LLC	13,760	15	1.09
⑰	HARTLEY	3,048	0	0.00

⑯	OWNER	AREA (SQFT)	PARKING	PARKING/1K SQFT
⑯	BENNETT	3,016	0	0.00
⑯	LEE	3,041	0	0.00
⑯	VOLO	3,043	0	0.00
⑯	HARTNACK	3,021	0	0.00
⑯	OLDENBURG	3,000	0	0.00
⑯	CITY HANGAR - B	11,760	0	0.00
⑯	CITY HANGAR - A	11,737	0	0.00
⑯	JUNIPER INV.	11,827	22*	1.86
⑯	JUNIPER INV.	4,768	7*	1.47
⑯	STEWART PRO-AIR MAINT.	9,866	27*	2.74
⑯	CITY	424	0	0.00
⑯	PRO-AIR FBO	4,557	8*	1.76
⑯	PRO-AIR PUMICE BLOCK	6,345	23*	3.62
⑯	GIBSON	3,887	14	3.60
⑯	BEND MUNI. CONDO HANGARS - MC	14,686	20	1.36
⑯	AVIATION PROPERTIES	6,466	6	0.93
⑯	RANGER CORP.	8,005	7	0.87

⑯	OWNER	AREA (SQFT)	PARKING	PARKING/1K SQFT
⑯	60 AVIATION, LLC	7,383	17*	2.30
⑯	SIERRA	2,597	6*	2.31
⑯	BELL	3,293	7*	2.13
⑯	A-HOGUE / B-STORCH	7,350	12*	1.63
⑯	ALLEN	3,850	0	0.00
⑯	HOLT	3,664	6	1.64
⑯	METCALFE	12,120	27*	2.23
⑯	WINDWARD PERFORMANCE	2,982	2*	0.67
⑯	ADVANCED AVIATION	3,055	2*	0.65
⑯	SUMMIT AIRMIKE CUSTARD	2,982	2*	0.67
⑯	PEVERIERI	10,561	0	0.00
⑯	PEVERIERI	6,101	0	0.00
⑯	CITY HANGAR - H	6,194	0	0.00
⑯	CITY HANGAR - G	8,510	0	0.00
⑯	CITY HANGAR - F	7,355	0	0.00
⑯	CITY HANGAR - E	4,925	0	0.00
⑯	CITY HANGAR - D	8,479	0	0.00

⑯	OWNER	AREA (SQFT)	PARKING	PARKING/1K SQFT
⑯	TB4 - DRESSLER	1,048	0	0.00
⑯	TB3 - FOSTER REVOCABLE TRUST	1,131	0	0.00
⑯	TB2 - BRONSON	1,086	0	0.00
⑯	TB1 - KIMSON MUNICH	1,092	0	0.00
⑯	TA5 - BOND	1,271	0	0.00
⑯	TA4 - REYNOLDS	1,107	0	0.00
⑯	TA3 - DANIELS	2,200	0	0.00
⑯	TA2 - JAQUES	2,200	0	0.00
⑯	TA1 - JAQUES	1,182	0	0.00
⑯	WAHLBERG	3,181	0	0.00
⑯	A - SIMCHUK	2,306	0	0.00
⑯	B - JAQUES	1,917	0	0.00
⑯	C - DILLARD	1,917	0	0.00
⑯	D - SEA-AIR	2,524	0	0.00
⑯	E - DILLARD	2,514	0	0.00
⑯	F - SIERRA	2,488	0	0.00
⑯	AERO FACILITIES	89,457	98	1.10

LEGEND				
<span style="background-color: orange; display: inline-block; width: 10px; height: 10px;"></span>	AVIATION BUSINESS [249,288 SQFT]			
<span style="background-color: yellow; display: inline-block; width: 10px; height: 10px;"></span>	FIXED BASED OPERATION (FBO) [4,557 SQFT]			
<span style="background-color: purple; display: inline-block; width: 10px; height: 10px;"></span>	AVIATION/BUSINESS HANGAR [161,334 SQFT]			
<span style="background-color: green; display: inline-block; width: 10px; height: 10px;"></span>	BOX HANGAR [308,780 SQFT]			
<span style="background-color: red; display: inline-block; width: 10px; height: 10px;"></span>	T-HANGAR [73,293 SQFT]			
<span style="background-color: black; display: inline-block; width: 10px; height: 10px;"></span>	CITY-OWNED STRUCTURE [102,253 SQFT]			
<span style="background-color: grey; display: inline-block; width: 10px; height: 10px;"></span>	PRIVATELY OWNED STRUCTURE [694,999 SQFT]			

\*PARKING FOR FACILITIES WITH SHARED LOTS WAS ESTIMATED BY SPLITTING AVAILABLE STALLS EVENLY AMONG BUILDINGS WEIGHTED BY STRUCTURE AREA.

## BUILDING FACILITIES OWNERSHIP AND USE

## BEND MUNICIPAL AIRPORT AIRPORT MASTER PLAN

 CENTURY  
WEST  
ENGINEERING







## UTILITIES

The developed areas of Bend Municipal Airport have water, natural gas, sanitary sewer, electrical, storm water drainage and telephone service. The following text describes and depicts the locations of the major utilities serving BDN.

### Water

The airport property is served by two water sources; a City of Bend well at the southeast corner of the airport property, and an Avion water main entering in the northwest corner of the airport property on Powell Butte Highway. The water system on the west side of Runway 16/34 is generally separated from the water system on the east side of Runway 16/34, except for two 12" connections that cross the runway to serve the HOA, Epic, and Aero facilities. A COID line runs along the south property boundary.

The water system on the west side of Runway 16/34 is served by a water main which generally runs north and south, parallel to Powell Butte Highway. The west side water main:

- Serves 33 water service connections
- Serves 26 fire hydrants
- Has two connections to the east side water main

Water service to Epic and Aero facilities on the southeast side is provided by the City of Bend's well and the south water main crossing, which forms a loop around the southeast portion of the airport property. The southeast loop:

- Serves 39 water service connections
- Serves 28 fire hydrants
- Has one connection to the west side water main at the south end of runway 16/34

The HOA is served by a 12" water main that runs along the south and east sides of the HOA adjacent to the access road. The HOA water system:

- Provides 9 1" services lines with meter stops. Currently there are no active service connections at these meter stops.
- Serves 7 fire hydrants
- Has one connection to the west side water main at Taxiway A5/B5.

### Sanitary Sewer

Airport property is served by a City-owned gravity sewer system through sanitary sewer mains on both sides of Runway 16/34. There is a pump station at the northern end of the airport property, and sanitary exits the site northward through a force main.

On the west side of Runway 16/34, a gravity sanitary sewer main begins near the southern end of the airport property. The west side sewer main:

- Generally runs south to north
- Intercepts one sanitary line from the west
- Serves a total of 11 sanitary service connections
- Intercepts the east side sewer main
- Continues north to a pump station at the northern end of the airport property

On the east side of Runway 16/34, a gravity sanitary sewer main begins near the southern end of the airport property in the vicinity of the commercial building formerly operated by Cessna. The east side sewer main:

- Generally runs south to north
- Intercepts three sanitary sewer lines from the east
- Serves a total of 34 sanitary sewer service connections
- Turns west and crosses runway 16/34
- Is intercepted by the west side sewer main after crossing runway 16/34

At the HOA, the gravity main begins near the northeast side of the facility, under the asphalt access drive. The HOA sewer main:

- Runs clockwise around the east, south, and west sides of the HOA. The high point is at the northeast corner of the HOA and the low point is at the pump station North of Runway 16
- Is intercepted by the west side sewer main north of Taxiway B
- Has 5 stub-outs available for service connections, at this time there are no active connections on this main.

### Stormwater

The Airport's stormwater system is primarily made up of a network of edge drain, culverts and surface drainage which generally carries runoff from south to north and off of the property. Runway 16/34 and Taxiway B are drained by edge drains. Culvert crossings are present at all connector taxiways and there are 10 runway crossings. The HOA development project included the construction of stormwater collection mains for anticipated buildout along the east side of the apron. All of the HOA stormwater lines feed to a rock-lined detention area adjacent the west side of the apron.



## Communications

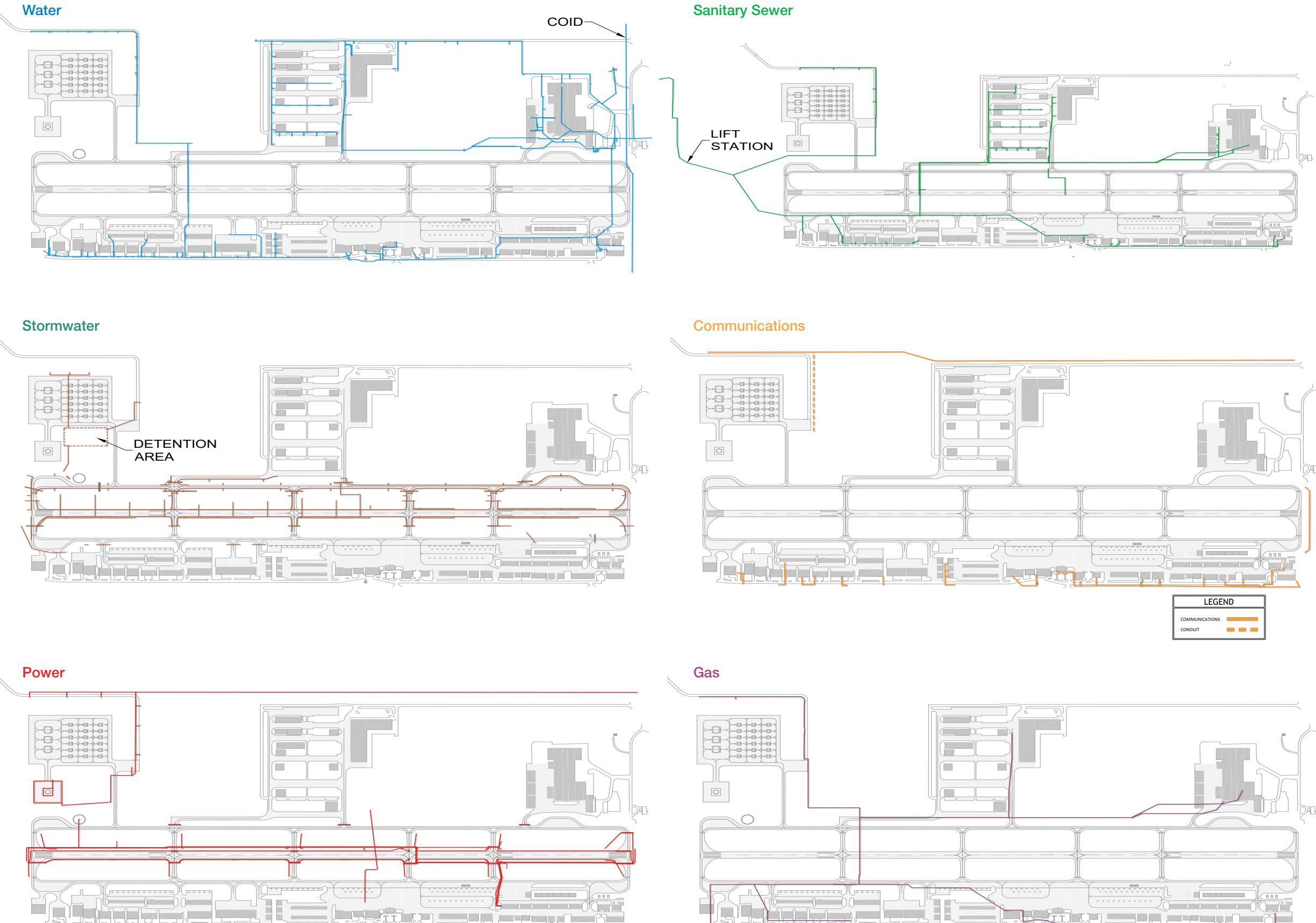
Communications services are provided by Qwest and enter the airport property at multiple points along the Powell Butte Highway. A telephone line crosses from the west to east side of Runway 16/34 at the southern end of the runway. Fiber-optic service is provided by from Bend-Tel. Currently there is no telecommunications service in place at the HOA, as it is the policy of the utility not to install lines until service is requested to that area. However, a spare conduit was installed along the south edge of the south HOA access road as part of the HOA construction to facilitate a connection to the existing telecommunication lines located east of the east access road.

## Power

Electrical service is provided by Central Electric Cooperative and PPL and enters the airport property at points along Powell Butte Highway. Underground electrical lines encircle Runway 16/34 and there are crossings at the north, south, and middle of the runway. Service to the HOA is fed from overhead lines entering the property on the south side from Nelson Road.

## Gas

Natural gas service is provided by Northwest Natural Gas and enters the airport property in the northwest corner from a point on Powell Butte Highway. Gas mains follow the sanitary sewer system very closely. Gas mains on the east and west side of Runway 16/34 run north and south. A connection between the west side main and the east side main occurs at a runway crossing south of Taxiway A5/B5. Service to the HOA is fed from a 4" main which connects at the connection of the east side main and the runway crossing.







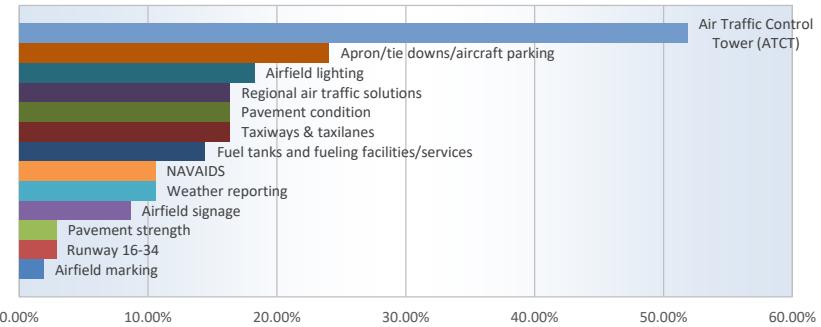
# Airside Elements

The Airside Elements section is comprised of the those facilities that facilitate the movement and operation of aircraft on the ground and in the air around the Bend Municipal Airport. This section of the existing conditions analysis includes a discussion of the aprons/tiedowns/aircraft parking, taxiways/taxilanes, runway/helipad, airfield pavements condition/strength/markings, support facilities, FAA design standards, air traffic control, area airspace, and instrument approach procedures.

## TENANT SURVEY RESPONSE/DATA

Over 50% of all survey respondents agreed that the single most important airside facility improvement that would improve the overall experience at BDN was an Air Traffic Control Tower (ATCT). Additional apron/tiedown/aircraft parking spaces was also identified as an important airside facility improvement that should be considered at BDN.

What airside facility improvements would improve your overall experience at Bend Municipal Airport?



## RUNWAY/HELIPAD

Runway 16/34 is oriented in a north-south direction (180-360 degree bearing relative to true north). The runway is paved and lighted with full-length parallel taxiways on both sides (west and east). Runway 16/34 is 5,200 feet long and 75 feet wide. The runway has an effective gradient of 1.085 percent, with the high point (3,459.5 feet MSL) located at its south end (Runway 34 threshold). The runway was constructed in 2007 to replace the former Runway 16/34 which was removed during construction. Runway 16/34 has six 90-degree exit taxiways on both sides that connect to the east and west parallel taxiways.

Both ends of Runway 16/34 have nonprecision instrument markings that include threshold bars, threshold markings, runway designation numbers, centerline stripe, aiming point markings, and side stripes. The markings were observed to be in excellent condition during a recent site visit. All runway markings are consistent with FAA standards for configuration, color (white paint), and approach type (non-precision instrument).

Runway 16/34 has published weight bearing capacity of 30,000 pounds for aircraft equipped with single wheel landing gear. A pavement rating for dual wheel aircraft is not published. However, based on the runway design, a dual wheel rating of approximately 50,000 to 60,000 pounds would be expected. During a 2017 pavement inspection, runway pavement was observed to be in satisfactory condition, consistent with its age.

TABLE 2-8: RUNWAY 16/34 DATA

Dimensions	5,200 x 75'
Bearing	N 0d 4' 27" W (True)
Effective Gradient	1.085%
Surface/Condition	Asphalt/Satisfactor (new in 2007)
Weight Bearing Capacity (WBC)	30,000 pounds - Single Wheel Gear as published
Marking	Non-precision Instrument (NPI) Runway numbers, threshold end bars, threshold markings, centerline stripe, aiming point markings, side stripes (white)
Lighting	Medium Intensity Runway Edge Lighting (MIRL) Precision Approach Path Indicators (PAPI) 4 Light - Runway 16 and 34 (3.0 degree glide path) Runway End Identifier Lights (REIL) (Runway 16 and 34)
Signage	Mandatory, Location, Directional, Destination Signs



Runway 16/34 has medium intensity runway lighting (MIRL) with precision approach path indicators (PAPI) and runway end identifier lights (REIL) on both ends. All of the lighting components for Runway 16/34 were installed in 2007 when the new runway was constructed and reportedly function normally.

- MIRL: The MIRL system includes white edge lights (with amber lights located near the runway ends to indicate runway remaining) and split lens (green/red) threshold lights. The threshold lights consist of two sets of four fixtures near each corner of the runway ends. The fixtures have split lenses (green/red) indicating the beginning and end of the runway. The MIRL is pilot-activated using the common traffic advisory frequency (CTAF) 123.0 MHz.
- REIL: Runways 16 and 34 are equipped with runway end identifier lights (REIL), which consist of two high-intensity sequenced strobe lights that mark the end of the runway. For instrument runways without an approach lighting system, REILS assist pilots in establishing visual contact with the runway environment during periods of darkness or reduced visibility. The REIL is pilot-activated using the common traffic advisory frequency (CTAF) 123.0 MHz.
- Visual Guidance Indicators: Runways 16 and 34 are equipped with a 4-light Precision Approach Path Indicators (PAPI). The PAPI projects 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 glide path. The PAPIs operate continuously and have a standard 3-degree glide path. The system was installed in 2007 and reportedly functions normally. The PAPI is the standard visual guidance indicator (VGI) for general aviation runways.
- Taxiway Lighting: The taxiways at Bend Municipal Airport are not equipped with edge lighting. Blue reflective markers are installed on the major taxiways at the airport. The reflectors are stake-mounted along the outer edges of the taxiways.
- Other Lighting: Limited overhead lighting is available in the terminal area, fueling area, and in various hangar areas. Some hangars also have exterior wall-mounted flood lights.

The helicopter landing pad was constructed in 2016 on the northeast area of the Airport. The development of the helicopter landing area was completed to provide several obvious benefits to Airport users:

- It provides a dedicated helicopter landing area capable of simultaneous operation with the runway;
- a dedicated helicopter landing area traffic pattern that does not intersect with the traffic patterns associated with the runway;
- increased separation of helicopter and fixed-wing air traffic in flight and on the ground;
- and reduced interaction between the different aircraft types and improved airfield efficiency.





## TAXIWAYS & TAXILINES

Bend Municipal Airport has an extensive taxiway system, including dual parallel taxiways (Taxiways A and B) for Runway 16/34 that provide access to both runway ends and landside facilities on both sides of the runway. A system of taxilanes provides access to aircraft parking aprons and hangar development areas.

The runway and both parallel taxiways are configured with six 90-degree exit taxiways. The exit taxiways on each side of the runway are directly aligned. The number and location of the exit taxiways allow efficient aircraft movement in the runway-taxiway system.

The parallel taxiways and the exit taxiways are equipped with blue stake-mounted edge reflectors and centerline stripes. Aircraft hold lines are located on all taxiway connections to the runway 200 feet from runway centerline, which corresponds to the edge of the runway obstacle free zone (OFZ). All taxiway markings are yellow.

### Taxiway A

Taxiway A is the west parallel taxiway for Runway 16/34. Taxiway A is 35 feet wide and has a runway-parallel taxiway separation of 300 feet. The taxiway was shifted and reconstructed in 2012 to meet FAA standards and is in excellent condition. The aircraft hold line, centerline and lead-in line striping on Taxiways A1-A6, and the centerline on Taxiway A are in excellent condition.

Five existing exit taxiways (A2-A6) were reconstructed and extended as part of the new runway construction. Taxiway A1 and approximately 300 feet at the south end of Taxiway A were newly constructed in the runway project. The original Taxiway A1 was removed in construction. The two end exit taxiways (A1 and A6) are 40 feet wide and the interior exit taxiways (A2-A5) are 35 feet wide. Taxiway A directly abuts the main apron and has several taxilane connections to adjacent hangar areas.

### Taxiway B

Taxiway B is the east parallel taxiway for Runway 16/34. Taxiway B is 35 feet wide and has a runway-parallel taxiway separation of 300 feet. Taxiway B has holding areas at both ends to allow aircraft to remain clear of the taxiway while conducting final preparations for takeoff or awaiting instrument flight plan clearances. Taxiway B was constructed in 2010 and currently has 2 connections to apron/hangar taxilanes (located at B2 and B3). Taxiway markings include centerline, lead-in lines, and aircraft hold lines. Edge reflectors are installed on Taxiway B and the Exit Taxiways B1-B6 .

## Access Taxiways and Taxilanes

The west landside area is served by a system of access taxiways/taxilanes that connect directly or indirectly to Taxiway A. These include taxilanes between hangar rows and individual taxilanes/taxiways that serve a single hangar or small group of hangars. The condition of these taxiways/taxilanes ranged from “poor” to “excellent” in the 2017 pavement inspection. Taxiways/taxilanes centerline stripes vary in condition from poor to good; some surfaces do not have centerline stripes.

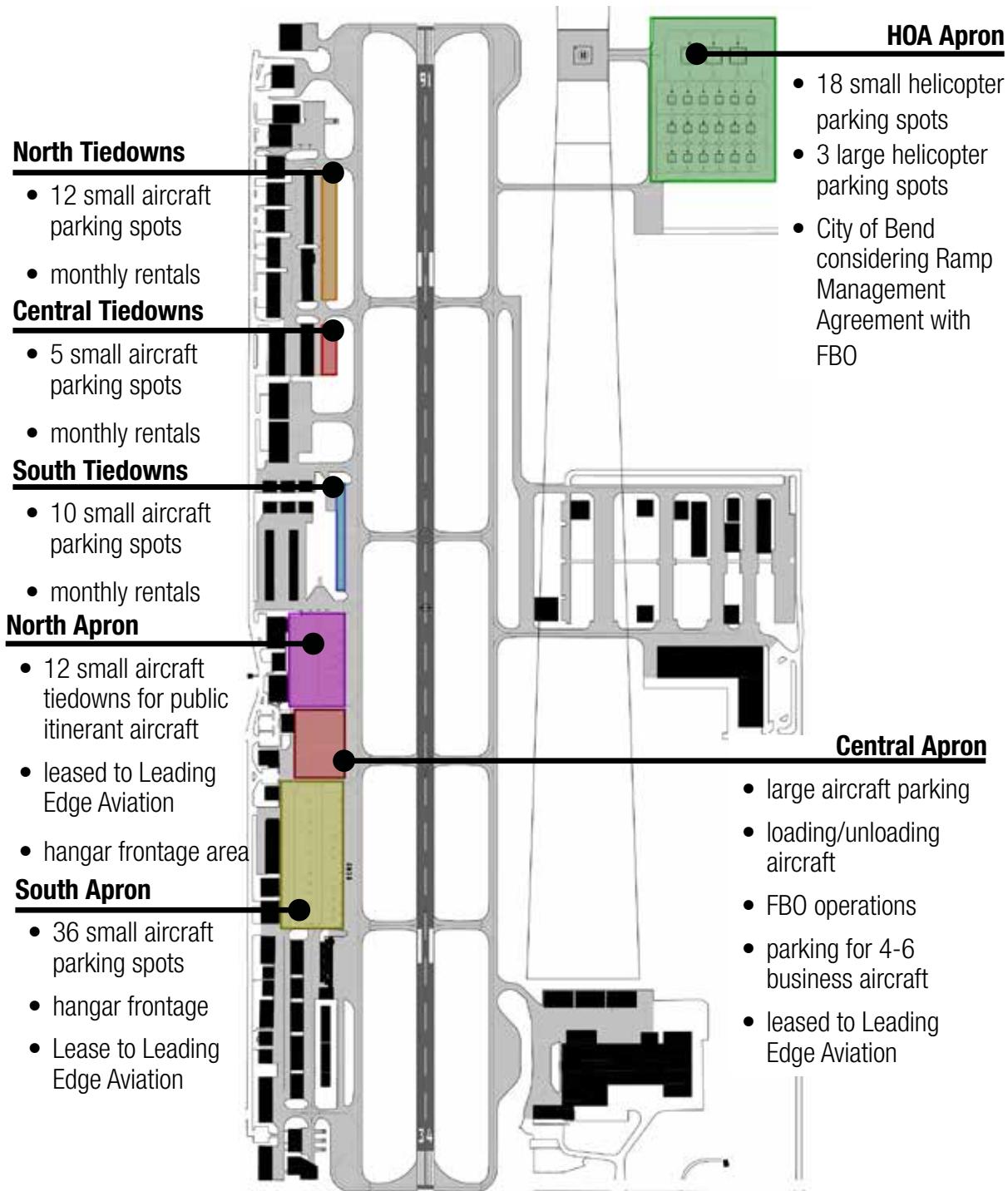
The east landside areas are currently served by two primary access taxiways that extend eastward from Taxiway B at exits B2 and B3. A series of access taxiways/taxilanes extend from these taxiways to serve adjacent hangar sites. Prior to construction of Taxiway B in 2010, there were two eastside access taxiways that connected directly to Runway 16/34. These connections were removed during construction and runway access for all east landside development is provided by six exit taxiways (B1-B6). The east side taxiways/taxilanes are in very good to excellent condition (new); some taxilanes have centerline stripes.



## APRONS/TIEDOWNS

Bend Municipal Airport has four public use aircraft apron areas and three designated monthly tiedown areas. On the west side of Runway 16/34 there are 27 small aircraft tiedowns available for monthly rental, 48 small airplane tiedowns, and 4-6 large airplane parking spaces or more depending on the size of aircraft. Numerous alternatives were considered when the North, Central, and South Apron pavement areas were redesigned and reconstructed in 2017. Five alternatives were developed during the scoping/preliminary design process and then four more alternatives were evaluated during the final design process that ultimately resulted in the existing layout as constructed.

On the east side of Runway 16/34 the HOA apron area has 18 small helicopter parking spots and 3 large helicopter parking spots. The North, Central, and South apron areas have been reconfigured recently to accommodate the western shift of Taxiway A and completion of the HOA apron area. In addition, several airport tenants also have smaller private aircraft aprons with limited parking adjacent to individual hangar developments.





## Central Apron

The center section of the terminal apron is located directly in front of the general aviation terminal/FBO. The apron accommodates aircraft loading/unloading and large aircraft parking. The apron has space for 4-6 large aircraft. However, larger business jet or turboprop aircraft typically “drive through” the apron and park parallel to the terminal building. The apron can typically accommodate two or three large aircraft in this configuration. More aircraft can be accommodated depending on the size of the aircraft.



## North Apron

The northern section of the terminal apron is located immediately north of the terminal building and accommodates small airplane tiedowns. The apron is configured with 12 small aircraft parking space.

A small fueling apron area extends beyond the northern-most taxilane serving the apron. The existing fuel tanks at this site are no longer in service. However, the fueling apron has space to accommodate one to two small aircraft, although clearance to the adjacent taxilane is limited.



## South Apron

The southern section of the terminal apron is located to the south of the terminal building and accommodates small airplane tiedowns. The apron is configured with a total of 36 small aircraft parking spaces.



## HOA Apron

The Helicopter Operations Area (HOA) apron construction in the northeast corner of the Airport was completed in 2017. The new apron area provides separate parking and operations area for the high level of helicopter operations experienced at Bend Municipal Airport. Facilities are designed for a large mix of helicopters equipped with skids or wheeled rotor wing aircraft. There are a total of 21 helicopter parking spots. 18 for small helicopters and 3 for large helicopters. Currently, the site is not utilized as the primary helicopter operations area due to challenges associated with obtaining County development approval for additional hangar facilities, class rooms, and support facilities. The City of Bend is currently working with County staff to obtain approvals to begin development of hangars adjacent to the apron. Additionally, the City of Bend is currently discussing a ramp management agreement with the FBO provider to oversee operations of the area.



## TENANT SURVEY RESPONSE/DATA

**24% of survey respondents agree that apron/tiedown/aircraft parking improvements would improve the overall experience at Bend Municipal Airport.**

**General comments from survey respondents typically described the need for additional aircraft parking and clear signage for designated parking areas.**

**Comments from survey respondents include:**

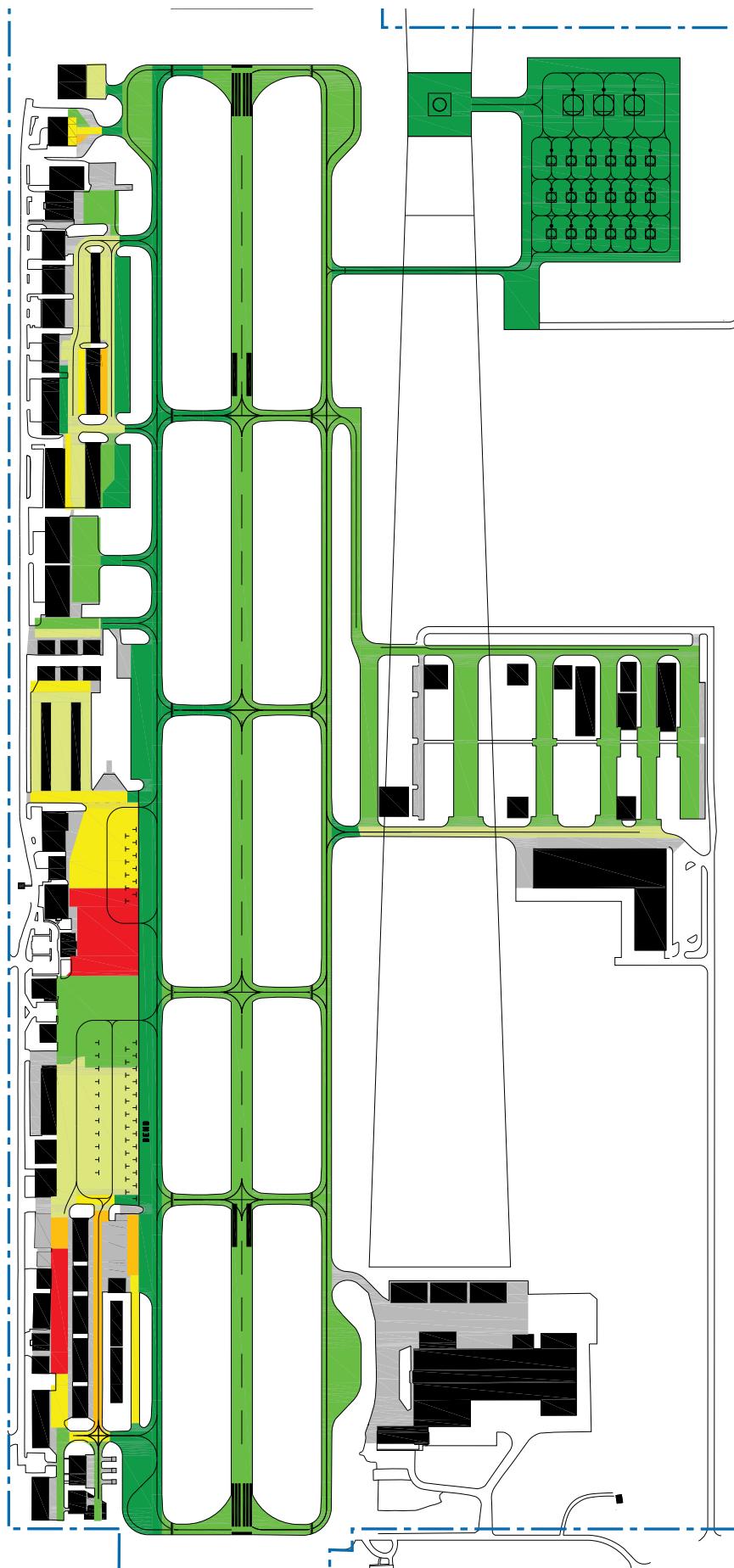
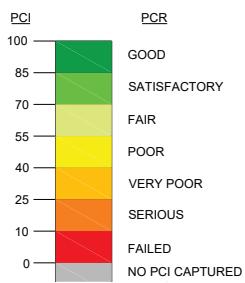
- “Transient parking can become full regularly and the tie downs are too far apart.”
- “Airfield signage that designates “Transient Parking” and “Flight School Parking” would greatly reduce the confusion of incoming traffic on where to park.”
- “Very limited tie down space. More Public tie downs with no charge options.”

## PAVEMENT CONDITION

The Oregon Department of Aviation Pavement Evaluation Program (PEP) systematically identifies maintenance, repair, and rehabilitation projects needed to sustain functional pavements at Oregon airports. The PEP provides a thorough evaluation of current conditions and future projections of condition in terms of pavement condition indices (PCI) for all eligible pavements on all paved airports across the state. For NPIAS airports like Bend that receive federal money, this work assists the Airport in meeting their grant assurances.

Pavement Condition Index (PCI) surveys were performed in June 2017 for Bend Municipal Airport. The survey was performed using the Pavement Condition Index (PCI) methodology developed by the U.S. Army Corps of Engineers, and outlined in the current edition of ASTM D-5340, Standard Test Method for Airport Condition Index Surveys.

Pavement condition for the bulk of the pavement at the Bend Municipal Airport is in Fair to Good condition. However, several areas on the Airport are experiencing Poor to Failed pavement conditions. The evaluation depicted is consistent with airport user feedback and airport management understanding. City staff are working with the FAA Seattle ADO to identify funding and schedule the necessary work to address the areas where pavement is in the worst condition. The pavement condition report for Bend Municipal Airport is available for download at <https://www.oregon.gov/aviation/Pages/Pavement-Evaluation-Program.aspx>





## SUPPORT FACILITIES

Support facilities generally include airside support facilities such as airfield lighting, signage, weather reporting equipment, NAVAIDS, fuel tanks, and fueling facilities.

### Airport Lighting and Signage

Bend Municipal Airport accommodates day and night operations in both visual and instrument meteorological conditions (IMC). The runway is equipped with lighting systems that are consistent with current instrument approach requirements and runway use. The runway-taxiway system has extensive signage that conveys directional, location, and runway clearance information to pilots. All airfield lighting observed during recent site visits appeared to be in good condition and fully operational.



### Airport Lighting

The airport has a rotating beacon mounted on a tower support on the east side of the runway near midfield. Rotating beacons are used to indicate the location of an airport to pilots at night or during reduced visibility. The beacon provides sequenced white and green flashing lights (representing a lighted land airport) that rotate 360 degrees to allow pilots to identify the airport from all directions from several miles. The beacon operates on a dusk-dawn automatic switch and reportedly functions normally.

Two lighted wind cones are located on the east side of the runway; one wind cone is located near mid-field and the second is located in the segmented circle, near the north end of the runway.

### Airfield Signage

The runway-taxiway system has mandatory instruction signs (red background with white letters/numbers) marking the aircraft holding positions at each of the taxiway connections with the runway [16-34, 16, 34, etc.]; the signs also include taxiway direction/designations [A1, A2, etc.] with yellow background and black numbers/letters. The signs are located to coincide with the painted aircraft hold lines on

each taxiway that connects to the runway. The signs are internally illuminated and were installed new in 2007 and 2010 (Taxiway B).

### Weather Reporting

Bend Municipal Airport has an automated weather observation system (AWOS-3) that provides 24-hour weather information. The AWOS is located on east side of Runway 16/34, near its north end. The AWOS-3 provides altimeter setting, wind data, temperature, dewpoint, density altitude, visibility, and cloud/ceiling data.

### Navigation Aids (NAVAIDS)

The Deschutes VORTAC, located 10.1 miles north of the airport supports nearby enroute air navigational routes and instrument approach procedures to several area airports. Ten separate enroute airways converge in this area. Local airport operations and flight activity is not directly affected by the enroute airspace due to the minimum enroute altitudes that are well above the local airport traffic pattern altitude. The Bodey nondirectional beacon is located 15 miles northeast of the airport supports instrument approaches at Redmond and is also used by pilots for VFR navigation.

### Aircraft Fuel

Bend Municipal Airport has 100-octane low lead (100LL) aviation gasoline (AVGAS) and jet fuel (Jet-A) available for sale through the local fixed base operator (FBO), Leading Edge Aviation. Leading Edge owns and maintains the fuel storage and dispensing system that includes two above ground double-wall tanks and a 24-hour credit card payment system for self fueling in the "north fuel farm area." The fixed point fueling system is located north of the terminal apron adjacent to monthly tie-down parking and consists of two 12,000 tanks. One tank is 100LL and the other is Jet A. Leading Edge also owns the existing south fuel farm tanks - two 10,000 gallon tanks one of each Jet-A and 100LL - which are currently used for bulk fuel storage only. Leading Edge also has seven mobile fuel trucks available for aircraft fueling.







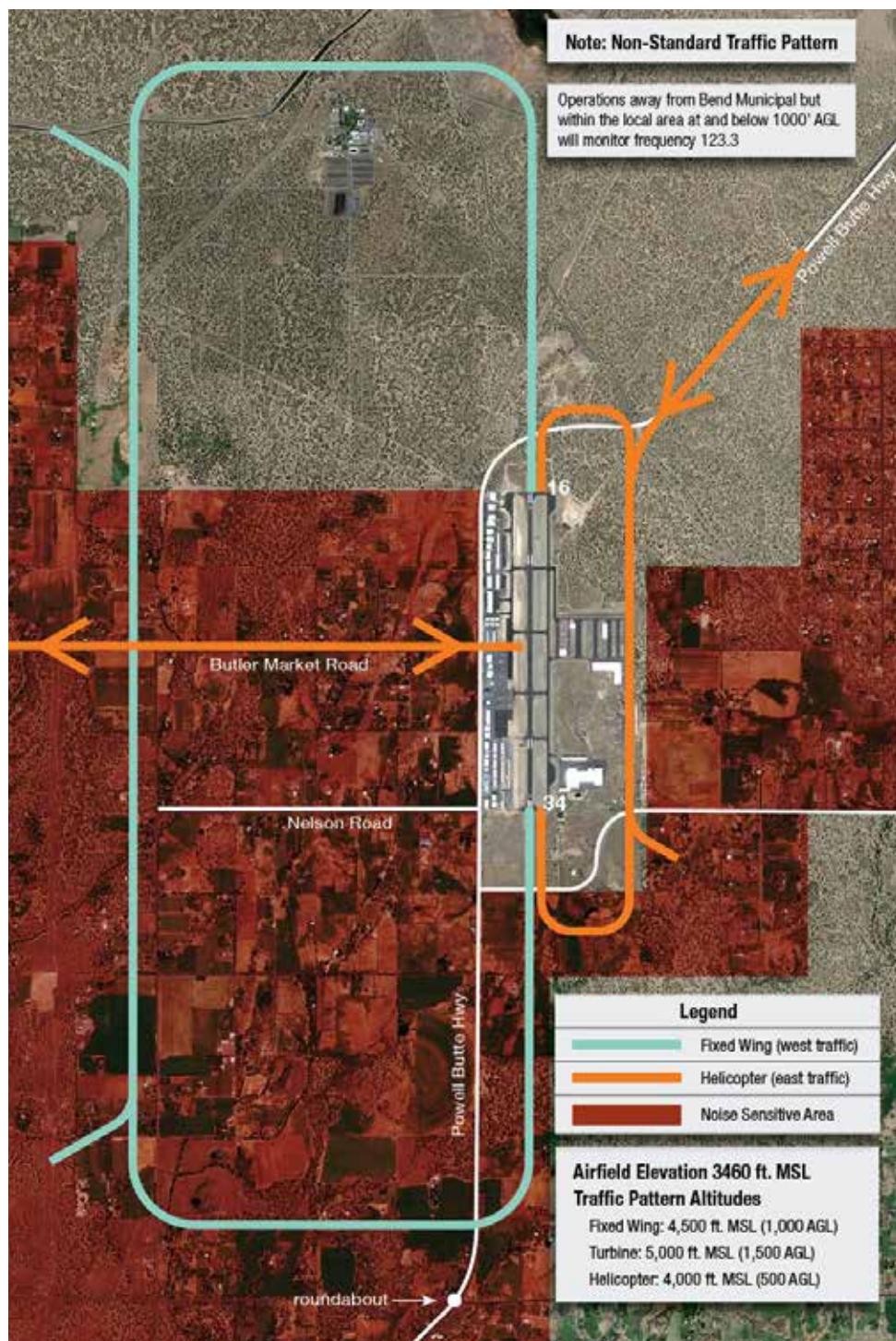
## TRAFFIC PATTERNS

The City of Bend has developed an Airport Fly-Friendly program with the goal of increasing pilot awareness and reducing aircraft noise impacts for airport neighbors. The airport traffic pattern developed during the fly-friendly program identified a pattern altitude of 1,000 feet above ground level for fixed wing traffic and 1,500 feet above ground level for larger turbine aircraft. The airport utilizes non-standard traffic patterns with fixed wing traffic operating primarily on the west side of the runway and local helicopter traffic at a lower altitude (500 feet above ground level) pattern on the east side of the runway.

BDN is bordered by noise sensitive areas to the west, south, and east and pilots are asked to avoid flying over noise-sensitive areas (highlighted red on the map below) whenever possible. When overflight of noise-sensitive areas is unavoidable, pilots are asked to maintain as much altitude as possible.

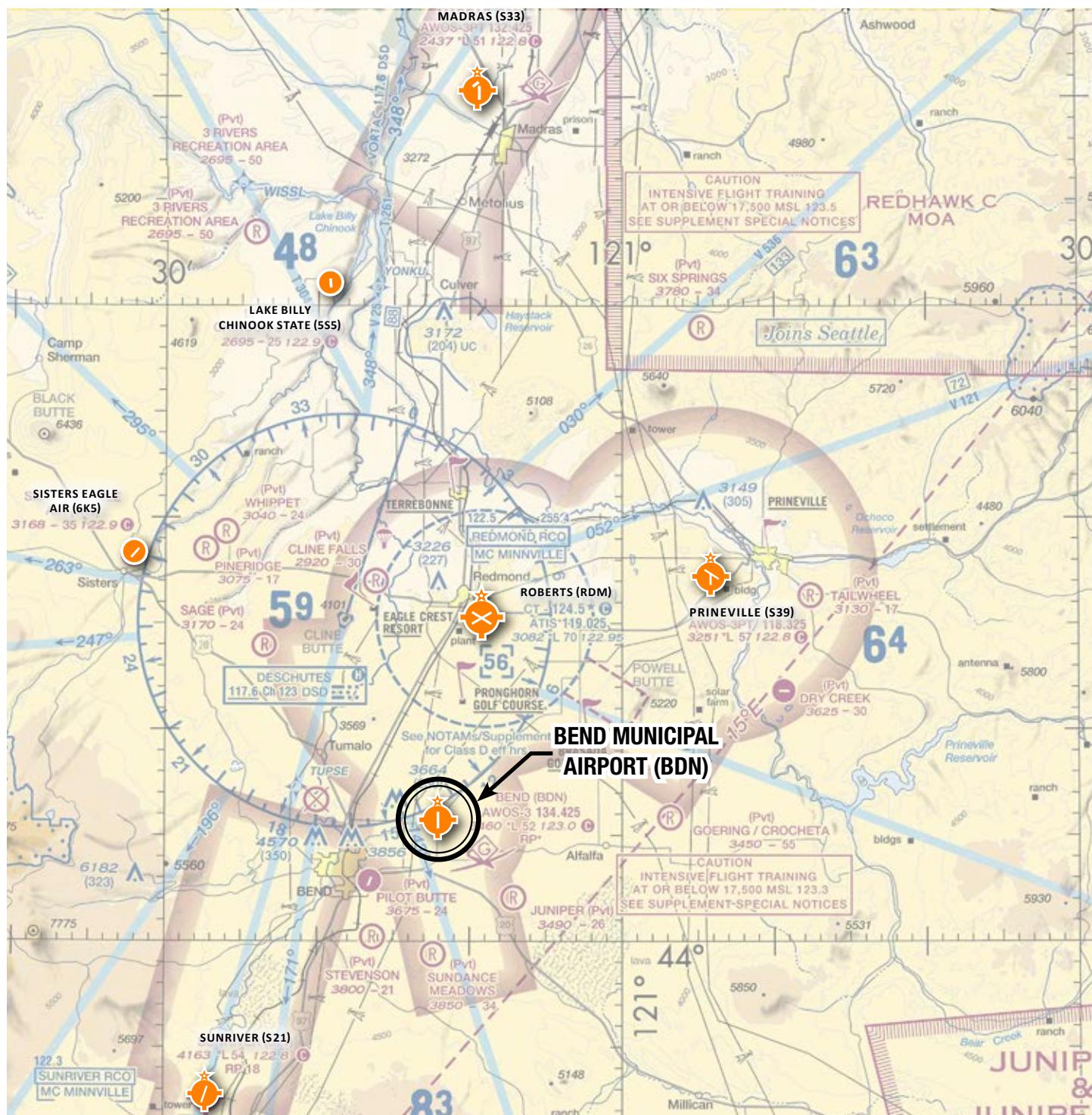
Recommended noise reduction procedures in place at the Bend Municipal Airport include:

- Fixed wing to remain west of runway using right hand pattern Runway 16 and left hand pattern Runway 34
- Rotor wing to remain east of runway and use right hand pattern Runway 34 and left hand pattern Runway 16
- Runway 16 is preferred when calm wind, weather, and traffic permit
- Fixed wing aircraft - no turns before end of runway
- For departures, use best rate of climb whenever possible
- Overfly major roadways and non-residential areas whenever possible
- Nighttime flight training operations between 10pm and 6am are discouraged
- Avoid noise sensitive areas depicted on vicinity map and area within 2-mile radius of Alfalfa, 7 miles south east of airport whenever possible
- Request propeller-driven aircraft use AOPA "Noise Awareness Steps"
- Departing aircraft are asked to use the "Close-In" noise abatement procedures - [www.nba.org/ops/environment/quiet-flying](http://www.nba.org/ops/environment/quiet-flying)
- Helicopters are asked to follow noise abatement best practices whenever possible - [www.rotor.com/resources/noiseabatementprocedures.aspx](http://www.rotor.com/resources/noiseabatementprocedures.aspx)





# AREA AIRSPACE - SEATTLE/KLAMATH FALLS SECTIONAL CHART

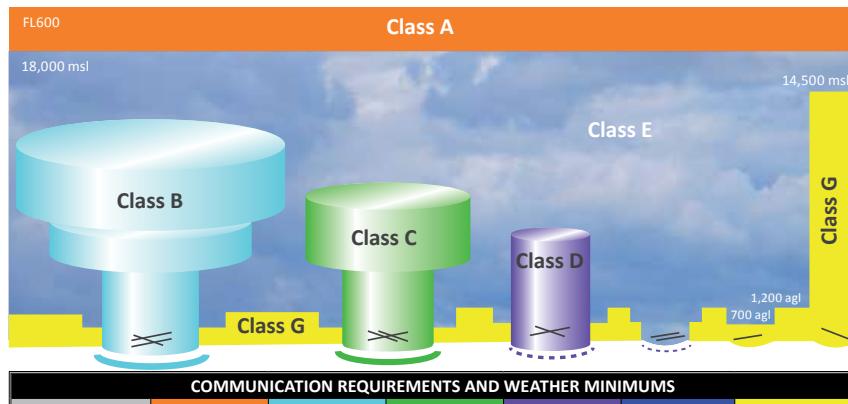




## AIRSPACE CLASSIFICATIONS

Airspace within the United States is classified by the FAA as “controlled” or “uncontrolled” with altitudes extending from the surface upward to 60,000 feet above mean sea level (MSL). Controlled airspace classifications include Class A, B, C, D, and E. Class G airspace is uncontrolled.

Aircraft operating within controlled airspace are subject to varying levels of positive air traffic control that are unique to each airspace classification. Requirements to operate within controlled airspace vary, with the most stringent requirements associated with very large commercial airports in high traffic areas. Uncontrolled airspace is typically found in remote areas or is limited to a 700 or 1,200-foot AGL layer above the surface and below controlled airspace.



COMMUNICATION REQUIREMENTS AND WEATHER MINIMUMS						
Airspace Class Definition	Class A	Class B	Class C	Class D	Class E	Class G
Generally airspace above 18,000 feet MSL up to and including FL 600.	Generally airspace from the surface up to 10,000 feet MSL surrounding the nation's busiest airports	Generally multi-layered airspace from the surface up to 10,000 feet MSL surrounding towered airports with service by radar approach control	Generally airspace from the surface to 4,000 feet AGL surrounding towered airports with service by radar approach control	Generally airspace from the surface to 2,500 feet AGL surrounding towered airports	Generally controlled airspace that is not Class A, Class B, Class C, or Class D	Generally uncontrolled airspace that is not Class A, Class B, Class C, Class D, or Class E
Minimum Pilot Qualifications	Instrument Rating	Student*	Student*	Student*	Student*	Student*
Entry Requirements	IFR: ATC Clearance VFR: Operations Prohibited	ATC Clearance	IFR: ATC Clearance VFR: Two-Way Communication w/ ATC	IFR: ATC Clearance VFR: Two-Way Communication w/ ATC	IFR: ATC Clearance VFR: None	None
VFR Visibility Below 10,000 msl**	N/A	3 Statute Miles	3 Statute Miles	3 Statute Miles	3 Statute Miles	Day: 1 Statute Mile Night: 3 Statute Miles
VFR Cloud Clearance Below 10,000 msl***	N/A	Clear of Clouds	500 Below 1,000 Above 2,000 Horizontal	500 Below 1,000 Above 2,000 Horizontal	500 Below 1,000 Above 2,000 Horizontal	500 Below 1,000 Above 2,000 Horizontal***
VFR Visibility 10,000 msl and Above**	N/A	3 Statute Miles	3 Statute Miles	3 Statute Miles	5 Statute Miles	5 Statute Miles
VFR Cloud Clearance 10,000 msl and Above	N/A	Clear of Clouds	500 Below 1,000 Above 2,000 Horizontal	500 Below 1,000 Above 2,000 Horizontal	1,000 Below 1,000 Above 1 Statute Mile Horizontal	1,000 Below 1,000 Above 1 Statute Mile Horizontal

\*Prior to operating within Class B, C or D airspace (or Class E airspace with an operating control tower), student, sport, and recreational pilots must meet the applicable FAR Part 61 training and endorsement requirements. Solo student, sport, and recreational pilot operations are prohibited at those airports listed in FAR Part 91, appendix D, section 4.  
\*\*Student pilot operations require at least 3 statute miles visibility during the day and 5 statute miles visibility at night.  
\*\*\*Class G VFR cloud clearance at 1,200 agl and below (day); clear of clouds.

## LOCAL AREA AIRSPACE STRUCTURE

The Seattle/Klamath Falls Sectional Aeronautical Charts depict nearby airports, notable obstructions, special airspace designations and IFR routes in the vicinity of Bend Municipal Airport.

Bend Municipal Airport is located in an area of Class E airspace with a floor 700 feet above ground level. Radio

communication is not required for visual flight rules (VFR) operations in Class E airspace, although pilots are encouraged to use the common traffic advisory frequency (CTAF) when operating at the airport. Aircraft are required to obtain an air traffic control (ATC) clearance prior to operating in Class E airspace during instrument flight rules (IFR).

The local Class E airspace extends north-northeast to include areas surrounding Redmond-Roberts Field and Prineville Airport. A separate section of Class E airspace associated with Sunriver Airport extends to the southwest. Large areas of Class E airspace associated with enroute instrument airways and transition to terminal airspace extend in all directions beyond the Class E airspace associated with local area airports. This category of Class E airspace has a floor greater than 700 feet MSL.

Redmond-Roberts Field has an area of Class D airspace that is in effect when the airport's air traffic control tower (ATCT) is in operation (0600-2200 local). The Class D airspace extends in a 5-mile radius from the airport from the surface to 5,600 feet MSL. Aircraft operation in Class D airspace requires two-way radio contact with the Redmond control tower. When the tower is not in operation, the airspace surrounding Roberts Field reverts to Class E.

## SPECIAL USE AIRSPACE

Areas of special use airspace (SUA) in the vicinity of Bend Municipal Airport include the Juniper North & Low Military Operations Area (MOA) (22 miles southwest), Redhawk C MOA (24 miles northeast) and the Sisters Wilderness Areas (18+ miles west). Although VFR operations are not restricted in an MOA, pilots are advised to exercise extreme caution while flying within, near, or below an active MOA. Two low altitude military training routes (MTR) are located approximately 30 to 40 miles southeast of the airport. These routes are used by high speed military jet aircraft for low altitude training.

## CONTROLLED & UNCONTROLLED AIRSPACE

Bend Municipal Airport is an uncontrolled field and pilots use the airport Unicom/common traffic advisory frequency (CTAF) for communications on the ground and in the vicinity of the airport. The airport is identified as a glider operations area on aeronautical charts. Glider operations are integrated with powered aircraft operations on the runway.

## AIRSPACE - FAR PART 77, TERPS, AND RUNWAY END SITING SURFACES

In addition to the airspace classifications and operating environment pilots are more familiar with (described in the previous section above) there are a variety of rules, regulations, design standards, and policies associated with the protection of airspace, evaluation of proposed objects on and near airports, and their effects on navigable airspace. Airport Cooperative Research Program (ACRP) Report 38 - Understanding Airspace, Objects, and Their Effects on Airports provides a comprehensive description of the regulations, standards, evaluation criteria, and processes designed to protect the airspace surrounding airports and is summarized below for additional context of airspace evaluation and design to serve the Bend Municipal Airport.

### FAR Part 77—Objects Affecting Navigable Airspace

This FAR is the central regulation governing airspace protection, with cross-references to many other criteria documents. It sets forth the requirements for notifying the FAA of proposed construction; defines obstruction criteria; and describes aeronautical studies required to assess hazard status. The FAR Part 77 Surfaces associated with the Bend Municipal Airport have been codified in to the Deschutes County Code as the Airport Safety Combining Zone (AS). A summary of the Part 77 surfaces is depicted on Pages 32-33 within the Regional Setting - Land Use/Zoning discussion of this report.

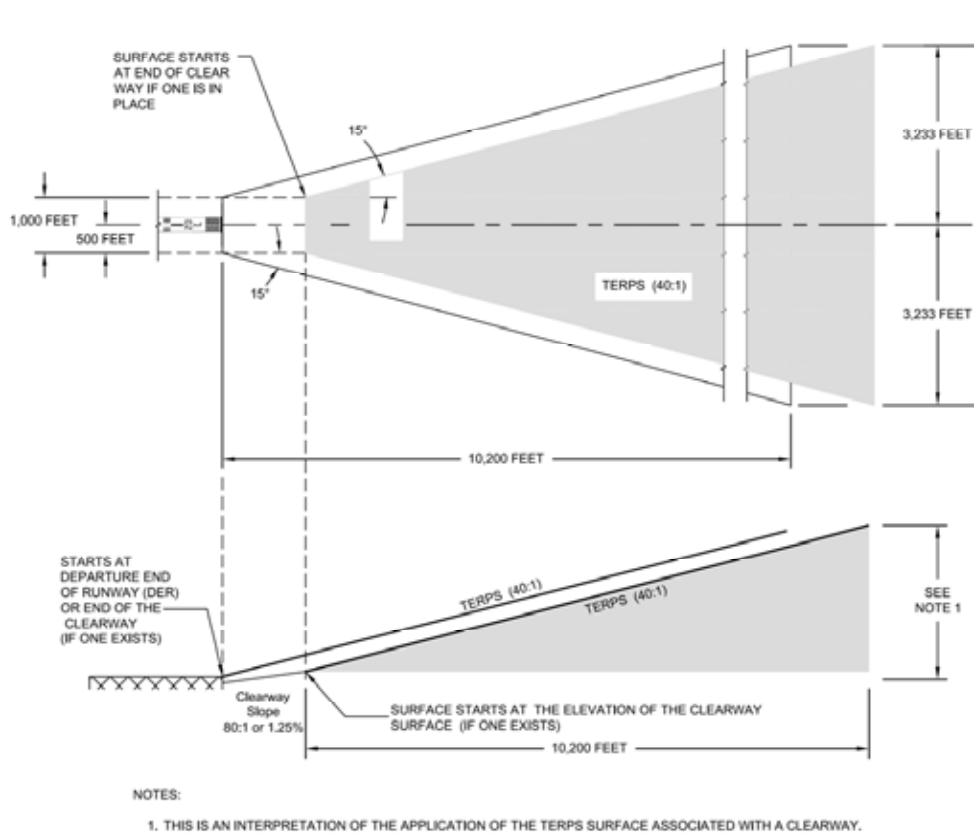
### FAA Order 8260.3B—United States Standard for Terminal Instrument Procedures (TERPS)

This Order, along with several derivative orders in the 8260 series and other related orders, define criteria that FAA flight procedure designers utilize when designing instrument flight procedures. Airspace protection requirements for instrument flight procedures are one of the types of obstruction standards referenced in FAR Part 77; they are also one of the most common criteria analyzed for hazard status in aeronautical studies.

### FAA AC 150/5300-13A—Airport Design

This AC is the principal document utilized by the FAA, airport sponsors, and planning consultants when planning and designing new airports or modifications to airports. Airspace clearances for key runway end features are defined in the AC's discussion of Runway End Siting Surfaces.

## TERPS (40:1) DEPARTURE SURFACE FOR INSTRUMENT RUNWAYS



Source: FAA AC 150-5300/13



## INSTRUMENT FLIGHT PROCEDURES

Instrument approach and departure procedures are developed by the FAA using electronic navigational aids to guide aircraft through a series of prescribed maneuvers in and out of an airport's terminal airspace. The procedures are designed to enable continued airport operation during instrument meteorological conditions (IMC), but are also used during visual conditions, particularly in conjunction with an instrument flight plan. The capabilities of each instrument approach are defined by the technical performance of the procedure platform (ground based navigational aids or satellite navigational aids) and the presence of nearby obstructions, which may affect the cloud ceiling and visibility minimums for the approach, and the routing for both the approach and missed approach procedure segments. The aircraft approach speed and corresponding descent rate may also affect approach minimums for different types of aircraft.

Bend Municipal Airport currently has four published nonprecision instrument approaches, including three global positioning system (GPS) procedures and one VOR/DME procedure that utilizes the Deschutes VORTAC. The RNAV (GPS) Z RWY 16 approach supports a procedure that provides vertical guidance to the runway end for aircraft equipped with the appropriate FAA-certified GPS receiver; the other approaches provide electronic course guidance only. All of the instrument approaches are authorized for category A-D aircraft, with varying approach minimums for both straight-in and circling procedures.

The airport also has a standard instrument departure (SID) authorized for both runways. The Bend One Departure (Obstacle) directs aircraft to make a climbing left turn after takeoff and proceed to the Deschutes VORTAC on 130-degree radial (310 degree course). The procedure notes numerous obstructions in the vicinity of the airport including trees, road and terrain. Copies of the instrument approach and departure procedure charts can be obtained from: [https://www.faa.gov/air\\_traffic/flight\\_info/aeronav/digital\\_products/dtpp/search/results/?cycle=1903&ident=BDN](https://www.faa.gov/air_traffic/flight_info/aeronav/digital_products/dtpp/search/results/?cycle=1903&ident=BDN)

TABLE 2-9: APPROACH PROCEDURE MINIMUMS

	MINIMUM ALTITUDE (MSL)	MINIMUM VISIBILITY (SM)	AIRCRAFT CATEGORY
RNAV (GPS) RWY 34			
LNAV MDA	4100	1	A, B
	4100	1 3/4	C
	4100	2	D
Circling	4100	1	A, B
	4100	1 3/4	C
	4100	2	D
RNAV (GPS) Y RWY 16			
LP MDA	3760	1	A, B, C, D
LNAV MDA	3800	1	A, B
	3800	1 1/8	C, D
	3940	1	A
Circling	4000	1	B
	4120	1 3/4	C
	4640	3	D
RNAV (GPS) Z RWY 16			
LPV DA	3682	1	A, B, C, D
LNAV/VNAV DA	3809	1 1/2	A, B, C, D
LNAV MDA	3840	1	A, B
	3840	1 1/4	C, D
Circling	3940	1	A
	3980	1	B
	4000	1 1/2	C
	4040	2	D
VOR/DME RWY 16			
S-16	3840	1	A, B
	3840	1 1/4	C, D
Circling	3940	1	A
	4000	1	B
	4120	1 3/4	C
	4640	3	D



## AIR TRAFFIC CONTROL TOWER (ATCT)

Since the preliminary airport traffic control tower siting analysis done for the Bend Municipal Airport was done in 2008 and subsequently reevaluated in the 2013 AMP (but removed from the plan altogether by the FAA Seattle ADO), the airport has experienced an impressive growth in its annual operations. The increased number of annual operations since 2008 when the idea was first discussed, coupled with the diverse mix of aircraft types with their various levels of pilot skills make enhanced airport traffic services the logical next step to enhance the airport's efficiency and maintain safety.

The most obvious solution for an airport such as BDN is to provide enhanced air traffic services through the construction of a "sticks and brick" ATCT and pursue entry into the Federal Contract Tower (FCT) Program. Traditional ATCTs are typically a single-use multistory facility designed to furnish the controllers in the tower cab an out-of-the-window view of the airfield and local airspace.

Today the FAA is in the process of revising their benefit/cost (B/C) analysis model, which is the basis for determining an airport's eligibility for inclusion into the FCT Program. The FAA is not currently accepting applications for the FCT program until the model is complete and released.

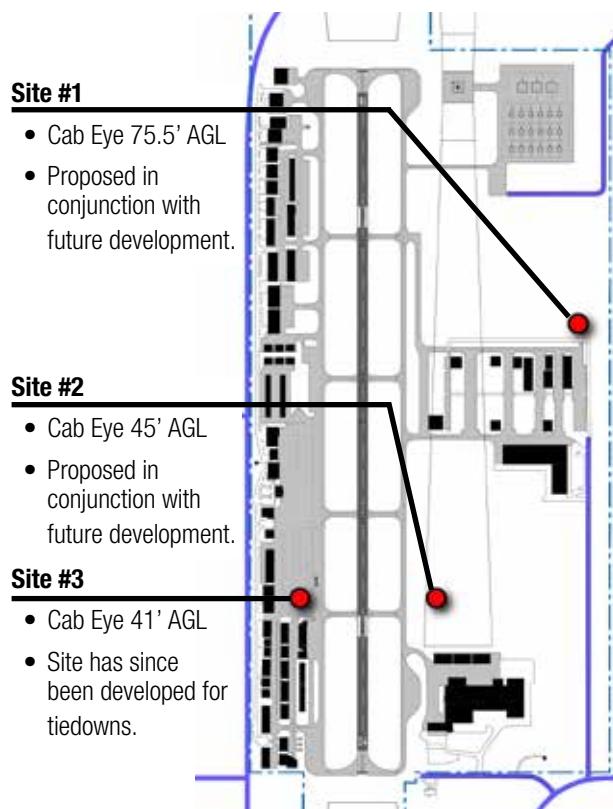
## REMOTE ATC OPPORTUNITIES

One alternative to construction of a traditional ATCT is remote tower technology presently being evaluated by the FAA at two locations in the United States; the Northern Colorado Regional Airport (FNL) in Colorado and the Leesburg Executive Airport (JYO) in Virginia.

A remote tower employs a variety of sensors, visual (cameras) and electronic (radars) to provide an air traffic controller located in a remote facility a comprehensive view of the airport surface and local airspace without direct visual observation. The goal of the remote tower is to support full Class D air traffic services similar to a "sticks and bricks" tower. Remote towers offer airports an alternative to provide airport traffic services without constructing an ATCT.

The two alternatives for providing airport traffic services, traditional ATCT and remote towers each have advantages and disadvantages. In determining which path to take the first consideration is the ability of the airport to fund the capital cost of either alternative. This discussion will be further examined in the Facility Requirements and Development Alternatives sections of the master plan.

## PREVIOUSLY STUDIED ATCT SITES



## TENANT SURVEY RESPONSE/DATA

Over half of survey respondents agree that an Air Traffic Control Tower is the most important airside facility improvement that would improve the overall experience at Bend Municipal Airport.

General comments from survey respondents typically described the need to address air traffic congestion to prevent any potential future incident.

Comments from survey respondents include:

- "I've had numerous close encounters at this airport with other aircraft on the ground and in the air"
- "I believe an air traffic control tower would alleviate many of the issues of congested airspace in and around the Bend airport. It would vastly increase safety and expedite the flow of air traffic."
- "There is only one must-have improvement and that is a control tower. I have personally witnessed and intervened to prevent multiple near misses on approach and in the traffic patterns that would not ever happen at a towered airport. It is just a matter of time before we have a mid air and multiple fatalities."



# Airport Administration

The Airport Administration section provides a summary of Airport Ownership & Management, Airport Finance, Rates and Charges, Rules and Regulations, and overview of FAA Grant Assurances and Compliance.

## AIRPORT OWNERSHIP & MANAGEMENT

Bend Municipal Airport is owned and operated by the City of Bend. It is located outside of City limits within Deschutes County. The airport is part of the Economic Development Department within the City and the Airport Manager reports to the Economic Development Director who reports to the City Manager. The airport is staffed with one full-time Airport Manager, one part-time Administration Assistant, and one part-time airport maintenance personnel. The Airport Manager maintains the airport to meet FAA, State, and Local regulations and requirements, oversees airport operations, manages the airports budget, airport leases and tenant relations.

The airport contracts out services through the City of Bend for finance, legal, human resources, information technology, and administration in order to minimize staffing needs at the airport.

Airport mowing and general maintenance is completed by airport maintenance personnel; however, the airport contracts out their snow removal operations as well as the electrical maintenance for their PAPI and AWOS systems. Airport lessees are responsible for managing their facilities and leased areas to meet the requirements defined in their leases and the airports Regulations, Policies and Guidelines document.

## AIRPORT FINANCE

The Airport operates as an enterprise fund with all revenue generated by the Airport remaining in the Airport's budget. This is required by FAA to prevent revenue diversion from Airport operations to general city services. The primary revenue generating sources for the Airport include hangar and ground lease rents and fuel flowage fees. The primary expenditures for the Airport include airport administration, maintenance and facility improvements. Many Airport administration responsibilities such as human resources, finance, grant administration, procurement and legal services are provided by City internal service departments. The Airport's capital improvement projects are typically funded through FAA grants with a local match that may be subsidized by ODA grants. City general fund short-term loan revenue and capital outlay expenses are not included in the Airport's operating revenues and expenses.

The FY2020 budget for Bend Municipal Airport (Table 2-10) identifies \$970,700 in revenues for the airport and \$1,117,500 in operating expenses for the airport, which results in a FY2020 net operating income of \$(146,800).

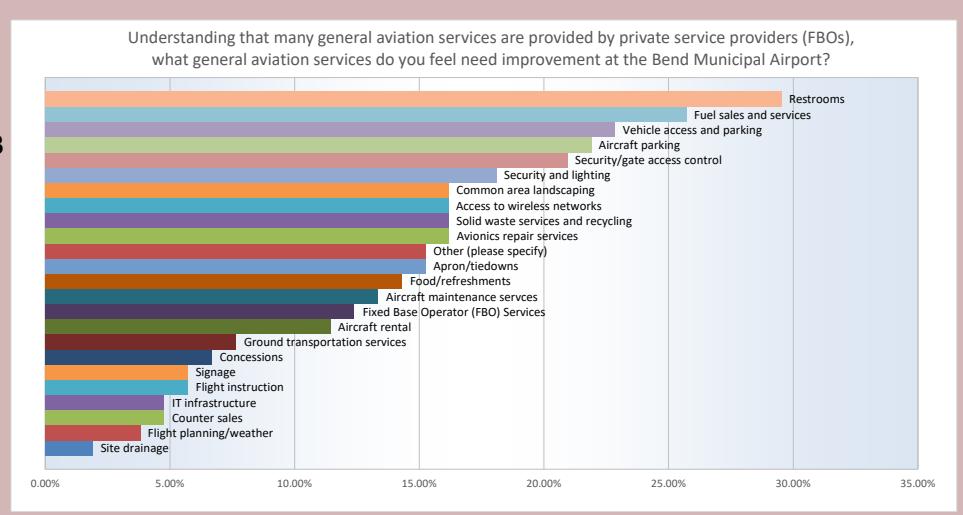
In reviewing the Airport's operating expenses, one full-time airport manager, and two part-time administrative and maintenance personnel cost approximately \$316,100 annually for salaries and benefits. The City will charge the Airport approximately \$410,500 annually for City services including finance, legal, human resources, and procurement over the 2019-2021 biennium. In addition, the Airport's materials and services are budgeted at \$221,900 for FY2020. Based on this information, it is recommended that the City periodically assess their fees for services and Airport staffing and compare them to other regional airports similar to Bend. It may also be beneficial for the City to consider

## TENANT SURVEY RESPONSE/DATA

**The most common general aviation services that need improvement, as identified by survey respondents, included public restrooms, fuel sales and services, vehicle access and parking, aircraft parking, and security/gate access controls.**

**Comments from survey respondents include:**

- **“Restrooms are a must, small 8x8 with sink, toilet and small wall heater. No reason the north and south can’t have one each side.”**
- **“Competition for fuel & general aviation services.”**
- **“After hours facilities should be provided- at least a free phone to call for help and a pilot-accessible waiting room.”**





updating an Airport Business Plan, which will focus on existing leases, rates and fees, development opportunities and constraints, as well as summarize the airport market area, demographics and economic profile.

In addition to the annual operating expenses of the airport, the airport is also repaying long-term debt, which is summarized in this section.

### Airport Debt

As of June 30, 2019, the airport had \$1,498,475 in long-term debt outstanding. The types of debt and projects are listed below:

- **Interfund Loan** – Interfund loans are allowed under the provisions of the Oregon Revised Statutes. On June 7, 2017 the City Council authorized a settlement that includes the acquisition of infrastructure on the east side of the Bend Municipal Airport. The Airport Fund did not have sufficient resources to pay for the capital expenditure. Funding was available in the Insurance and Risk Management Division of the Internal Service Fund and was provided as an interfund loan of \$1,000,000.
  - » Airport Capital Infrastructure Acquisition – Insurance and Risk Management Division of the City's Internal Service Fund (2017) - \$1,000,000
- **Notes Payable** – The City also utilizes infrastructure loan programs offered by the Oregon Business Development Department (OBDD) and through the Clean Water State Revolving Fund (CWSRF) program of the Oregon Department of Environmental Quality (DEQ) to finance its water and water reclamation capital improvements.
  - » OBDD - Eastside Airport Development (2007) - \$498,475.

The City of Bend offers general fund loans to City departments to provide cash flow for operations before grant funds are received on a reimbursement basis. The 2019-2021 Biennial Budget includes a \$1,000,000 short-term, year-end operating loan for the Airport.

### AIRPORT RATES AND CHARGES

In 2015, the City conducted a "Market Rent Study" for the airport. The report provided fair market rental rates for each of the T-hangars, ground rates, tiedown rates, and storage space rates as depicted in Table 2-11. Based on the report, fair market rent for improved ground leases was 31 cents per square foot, per year in 2015 and has increased to 34 cents, which reflects an increase of 3 percent per year. These rates coincide with nearby Redmond Municipal Airport's ground lease rates. This study is conducted every five years, the next study will be completed in 2020.

TABLE 2-10: AIRPORT REVENUE/EXPENSE SUMMARY

AIRPORT REVENUE	
Tiedown Fees	\$16,400
Fuel Flowage Fees	\$49,200
Ground Leases	\$424,600
Hangar Leases	\$414,600
Building Leases	\$48,700
ROW Leases	\$14,300
Miscellaneous Revenue	\$2,800
<b>TOTAL AIRPORT REVENUES</b>	<b>\$970,700</b>
AIRPORT EXPENSES	
Airport Personnel Services	(\$316,100)
City Administration & Support Services	(\$410,500)
1. Attorney Services	\$28,200
2. IT Services	\$28,700
3. Facilities Management Services	\$8,000
4. Administration & Human Resources Services	\$112,100
5. Finance Services	\$77,100
6. Purchasing Services	\$60,500
7. Insurance Premiums	\$46,400
8. LEAP	\$3,600
9. Other Small City Transfers	\$45,900
Materials and Services	(\$221,900)
1. Administration & Support Services	\$120,600
2. Operations & Maintenance General	\$12,800
3. Operations & Maintenance Building & Structure	\$54,100
4. Operations & Maintenance Aircraft Operations	\$34,400
Debt Service	(\$169,000)
1. Eastside Improvements	\$56,000
2. Interfund Loan from Insurance Fund	\$113,000
<b>TOTAL AIRPORT OPERATING EXPENSES</b>	<b>(\$1,117,500)</b>
<b>NET OPERATING INCOME</b>	<b>(\$146,800)</b>

TABLE 2-11: AIRPORT RATES AND CHARGES DATA

RATES AND CHARGES	
Tiedown Fees (Monthly)	\$42
Closed T-Hangar Buildings (Monthly)	
1. A-B Buildings	\$207
2. D-H Buildings	\$283
3. I & J Buildings	\$345
One-Time Fees	
1. Hangar Deposit Fee	\$200
2. Cleaning Deposit Fee	\$150
3. Lease Amendment/Sublease Fee	\$77/\$386
Long-term Parking Fees (Per Quarter)	\$77-100
Ground Lease Rates (Sq/Ft) (Per Year)	\$0.34
Additional Space Rates (Sq/Ft) (Per Year)	\$0.25



## CITY OF BEND RULES AND REGULATIONS

The City of Bend Code provides the legal framework and authority for actions regulated by the City of Bend as the sponsor of the Bend Municipal Airport. The City will operate the airport for the use and benefit of the public in order to make it available to all types, kinds, and classes of aeronautical activity on fair and reasonable terms and without unjust discrimination.

The 2018 Bend Municipal Airport, Regulation, Policies and Guidelines document includes the following:

- Rules and Regulations
- Aircraft Operations
- Violations Information
- Government Agreements
- Airport Master Plan / Airport Layout Plan Information
- Reservation of Rights to Individual Users
- General Requirements for Airport Operations
- General Aviation Minimum Standards
- Aeronautical Activities
- Airport Lease Policy for City and Private Owned Hangars
- Development Standards
- Airport Authority

## FAA COMPLIANCE OVERVIEW

A management program based on the FAA's "Planning for Compliance" guidance and the adoption of additional airport management "Best Practices" is recommended to address FAA compliance requirements and avoid noncompliance, which could have significant consequences.

Airport management "Best Practices" are developed to provide timely information and guidance related to good management practices and safe airport operations for airport managers and sponsors. The practices outlined herein are designed for use by the City of Bend for evaluating and improving their current and future operation and management program.

Airport sponsors must comply with various federal obligations through agreements and/or property conveyances, outlined in FAA Order 5190.6B, Airport Compliance Manual. The contractual federal obligations a sponsor accepts when receiving federal grant funds or transfer of federal property can be found in a variety of documents including:

- Grant agreements issued under the Federal Airport Act of 1946, the Airport and Airway Development Act of 1970, and Airport Improvement Act of 1982. Included in these agreements are the requirement for airport sponsors to comply with:
  - » Grant Assurances;
  - » Advisory Circulars;
  - » Application commitments;
  - » FAR procedures and submittals; and

## OREGON AVIATION LAWS

The Oregon Department of Aviation (ODA) has created both the Oregon Administrative Rules (OAR) and Oregon Revised Statutes (ORS) to govern airports within the state.

### OREGON ADMINISTRATIVE RULES (OAR)

- OAR Chapter 660, Division 13 – Airport Planning
- OAR Chapter 660, Division 13 – Exhibits
- OAR Chapter 738 – ODA
- Non-Commercial Leasing Policy
- Commercial Leasing Policy
- Category II Minimum Standards Policy
- Category IV Minimum Standards Policy
- Category V Minimum Standards Policy
- Insurance Requirements

### OREGON REVISED STATUTES (ORS)

- ORS 197 – Land Use Planning I
- ORS 197A – Land Use Planning II
- ORS 319 – Aviation Fuel Tax
- ORS 835 – Aviation Administration
- ORS 836 – Airports and Landing Fields
- ORS 837 – Aircraft Operations
- ORS 838 – Airport Districts

» Special conditions.

- Surplus airport property instruments of transfer;
- Deeds of conveyance;
- Commitments in environmental documents prepared in accordance with FAA requirements; and
- Separate written requirements between a sponsor and the FAA.

### Airport Compliance with Grant Assurances

As a recipient of both federal and state airport improvement grant funds, the City of Bend is contractually bound to various sponsor obligations referred to as "Grant Assurances", developed by the FAA and the Oregon Department of Aviation. These obligations, presented in detail in federal and state grants and state statute and administrative codes, document the commitments made by the airport sponsor to fulfill the intent of the grantor (FAA and State of Oregon) required when accepting federal and/or state funding for airport improvements. Failure to comply with the grant assurances may result in a finding of noncompliance and/or forfeiture of future funding. Grant assurances and their associated requirements are intended to protect the significant investment made by the FAA, State, and City to preserve and maintain the nation's airports as a valuable national transportation asset, as mandated by Congress.



## FAA Grant Assurances

The FAA's Airport Compliance Program defines the interpretation, administration, and oversight of federal sponsor obligations contained in grant assurances. The Airport Compliance Manual defines policies and procedures for the Airport Compliance Program. Although it is not regulatory or controlling with regard to airport sponsor conduct, it establishes the policies and procedures for FAA personnel to follow in carrying out the FAA's responsibilities for ensuring compliance by the sponsor.

The Airport Compliance Manual states the FAA Airport Compliance Program is: "...designed to monitor and enforce obligations agreed to by airport sponsors in exchange for valuable benefits and rights granted by the United States in return for substantial direct grants of funds and for conveyances of federal property for airport purposes. The Airport Compliance Program is designed to protect the public interest in civil aviation. Grants and property conveyances are made in exchange for binding commitments (federal obligations) designed to ensure that the public interest in civil aviation will be served. The FAA bears the important responsibility of seeing that these commitments are met. This order addresses the types of commitments, how they apply to airports, and what FAA personnel are required to do to enforce them."

According to the FAA, cooperation between the FAA, state, and local agencies should result in an airport system with the following attributes:

- Airports should be safe and efficient, located at optimum sites, and be developed and maintained to appropriate standards;
- Airports should be operated efficiently both for aeronautical users and the government, relying primarily on user fees and placing minimal burden on the general revenues of the local, state, and federal governments;
- Airports should be flexible and expandable, able to meet increased demand and accommodate new aircraft types;
- Airports should be permanent, with assurance that they will remain open for aeronautical use over the long-term;
- Airports should be compatible with surrounding communities, maintaining a balance between the needs of aviation and the requirements of residents in neighboring areas;
- Airports should be developed in concert with improvements to the air traffic control system;
- The airport system should support national objectives for defense, emergency readiness, and postal delivery;
- The airport system should be extensive, providing as many people as possible with convenient access to air transportation, typically not more than 20 miles of travel to the nearest NPIAS airport; and
- The airport system should help air transportation contribute to a productive national economy and international competitiveness.

The airport sponsor should have a clear understanding of

and comply with all assurances. The following sections describe the selected assurances in more detail.

### Project Planning, Design, And Contracting

#### Sponsor Fund Availability (Assurance #3)

Once a grant is given to the City of Bend (airport sponsor), the City commits to providing the funding to cover their portion of the total project cost. Currently this amount is ten percent of the total eligible project cost, although it may be higher depending on the particular project components or makeup. Once the project has been completed, the receiving airport also commits to having adequate funds to maintain and operate the airport in the appropriate manner to protect the investment in accordance with the terms of the assurances attached to and made a part of the grant agreement.

#### Consistency with Local Plans (Assurance #6)

All projects must be consistent with city and county comprehensive plans, transportation plans, zoning ordinances, development codes, and hazard mitigation plans. The City of Bend (airport sponsor) should familiarize themselves with local planning documents before a project is considered to ensure that all projects follow local plans and ordinances.

#### Accounting System Audit and Record Keeping (Assurance #13)

All project accounts and records must be made available at any time. Records should include documentation of cost, how monies were actually spent, funds paid by other sources, and any other financial records associated with the project at hand. Any books, records, documents, or papers that pertain to the project should be available at all times for an audit or examination.

### General Airport Assurances

#### Good title (Assurance #4)

The City of Bend (airport sponsor) must have a Good Title to affected property when considering projects associated with land, building, or equipment. Good Title means the sponsor can show complete ownership of the property without any legal questions, or show it will soon be acquired.

#### Preserving Rights and Powers (Assurance #5)

No actions are allowed, which might take away any rights or powers from the sponsor, which are necessary for the sponsor to perform or fulfill any condition set forth by the assurance included as part of the grant agreement.

#### Airport Layout Plan (ALP) (Assurance #29)

Bend Municipal Airport should maintain an up-to-date ALP, which should include current and future property boundaries, existing facilities/structures, locations of non-aviation areas,



and existing and proposed improvements. FAA requires proposed improvements to be depicted on the ALP in order to be eligible for FAA funding. If changes are made to the airport without authorization from the FAA, the FAA may require the airport to change the alteration back to the original condition or jeopardize future grant funding.

### **Disposal of Land (Assurance #31)**

Land purchased with the financial participation of an FAA Grant cannot be sold or disposed of by the airport sponsor at their sole discretion. Disposal of such lands are subject to FAA approval and a definitive process established by the FAA. If airport land is no longer considered necessary for airport purposes, and the sale is authorized by the FAA, the land must be sold at fair market value. Proceeds from the sale of the land must either be repaid to the FAA, or reinvested in another eligible airport improvement project.

### **Airport Operations And Land Use**

#### **Pavement Preventative Maintenance (Assurance #11)**

Since January 1995, the FAA has mandated that it will only give a grant for airport pavement replacement or reconstruction projects if an effective airport pavement maintenance-management program is in place. The Oregon Department of Aviation prepares and updates pavement reports for Bend Municipal Airport. These reports identify the maintenance of all pavements funded with federal financial assistance and provides a pavement condition index (PCI) rating (0 to 100) for various sections of aprons, runways, and taxiways; including, a score for overall airport pavements.

#### **Operations and Maintenance (Assurance #19)**

All federally funded airport facilities must operate at all times in a safe and serviceable manner and in accordance with the minimum standards as may be required or prescribed by applicable Federal, State, and Local agencies for maintenance and operations.

#### **Compatible Land Use (Assurance #21)**

Land uses around an airport should be planned and implemented in a manner that ensures surrounding development and activities are compatible with the airport. The airport is located outside of City limits within Deschutes County. The City of Bend as airport sponsor should work with Deschutes County to ensure there are zoning laws that protect the airport from incompatible land uses. Incompatible land uses around airports represents one of the greatest threats to the future viability of airports.

### **Day-To-Day Airport Management**

#### **Economic Non-Discrimination (Assurance #22)**

Any reasonable aeronautical activity offering service to the public should be permitted to operate at the airport as long

as the activity complies with airport established standards for that activity. Any contractor agreement made with the airport will have provisions making certain the person, firm, or corporation will not be discriminatory when it comes to services rendered including rates or prices charged to customers.

#### **Exclusive Rights (Assurance #23)**

No exclusive right for the use of the airport by any person providing, or intending to provide, aeronautical services to the public. However, an exception may be made if the airport sponsor can prove that permitting a similar business would be unreasonably costly, impractical, or result in a safety concern, the sponsor may consider granting an exclusive right.

### **Leases And Finances**

#### **Fee and Rental Structure (Assurance #24)**

An airport's fee and rental structure should be implemented with the goal of generating enough revenue from airport related fees and rents to become self-sufficient in funding the day-to-day operational needs. Airports should update their fees and rents on a regular basis to meet fair market value, often done through an appraisal or fee survey of nearby similar airports. Common fees charged by airports include fuel flowage fees, tie-down fees, landing fees, and hangar or ground lease rents.

#### **Airport Revenue (Assurance #25)**

Revenue generated by airport activities must be used to support the continued operation and maintenance of the airport. Use of airport revenue to support or subsidize non-aviation activities or to fund other City departments who are not using the funds for airport specific purposes is not allowed and is considered revenue diversion. Revenue diversion is a significant compliance issue for FAA.

For additional information on FAA Grant Assurances, please go to: [https://www.faa.gov/airports/aip/grant\\_assurances/#current-assurances](https://www.faa.gov/airports/aip/grant_assurances/#current-assurances)



# Existing Conditions Analysis Summary

The existing conditions analysis of the regional setting, landside, airside, and airport administrative elements of the Bend Municipal Airport identified several new conditions that affect the operation and development of the Airport and reaffirmed the known issues and opportunities. The findings documented in the Existing Conditions Analysis chapter and summarized below will be used to support subsequent studies and recommendations throughout the development of the master plan.



## REGIONAL SETTING

- BDN is a regional job and economic generator but growth on and around the Airport can be challenging and is limiting potential
- Significant Federal money has been invested
- Local role of Airport is broad and consistent with similar Urban GA airports
- BDN accounts for approximately half of all aircraft operations and based aircraft in Central Oregon and is third in the State of Oregon
- Operations/based aircraft continue to grow
- 2013 AMP was not adopted by Deschutes County
- Minimal environmental impacts identified in field surveys
- Powell Butte Highway and Butler Market Roundabout presents opportunities for new/better access to the Airport
- City of Bend is working with Deschutes County to address short-term zoning/development issues



## LANDSIDE ELEMENTS

- Utilities – System is well developed, will expand as required
- Fencing – Pursue perimeter fencing
- Airport Access Roads – Better connection to Powell Butte Highway and future loop road
- Vehicle Parking – Existing is adhoc and additional parking is required
- GA Development Areas – Over 60 acres available for new development
- Hangars – Hangar demand is high - over 30 on waitlist, there is a lack of modern T-hangars at reasonable rates



## AIRSIDE ELEMENTS

- Runway/helipad – Future extension of 16/34 is a primary issue
- Taxiways/taxilanes – Generally sufficient
- Apron/Tiedowns – According to tenants there is demand for more apron space and clear delineation/signage between what is public/reserved
- Pavement Condition – SW hangar area taxilanes are the short-term priority
- Support Facilities – Upgrade taxiway reflectors to lighting
- Airspace – Congestion in the airspace is a primary concern for users
- Approach Procedures – 250' and 1 statute mile is lowest available and helicopter specific approach is desired
- ATCT – An important improvement desired by the majority of Airport users



## AIRPORT ADMINISTRATION

- Owned and operated by the City of Bend, within Deschutes County jurisdiction
- Airport financial picture appears to be positive
- City should periodically assess their fees for services and airport staffing and compare them to other regional airports similar to Bend
- Rates and charges are consistent with area airports
- City should consider conducting an Airport Business Plan to further pursue new revenue potential and other development opportunities
- Airport is understood to be in compliance with all local, state, and federal laws and requirements





## Chapter 3: Aviation Activity Forecasts

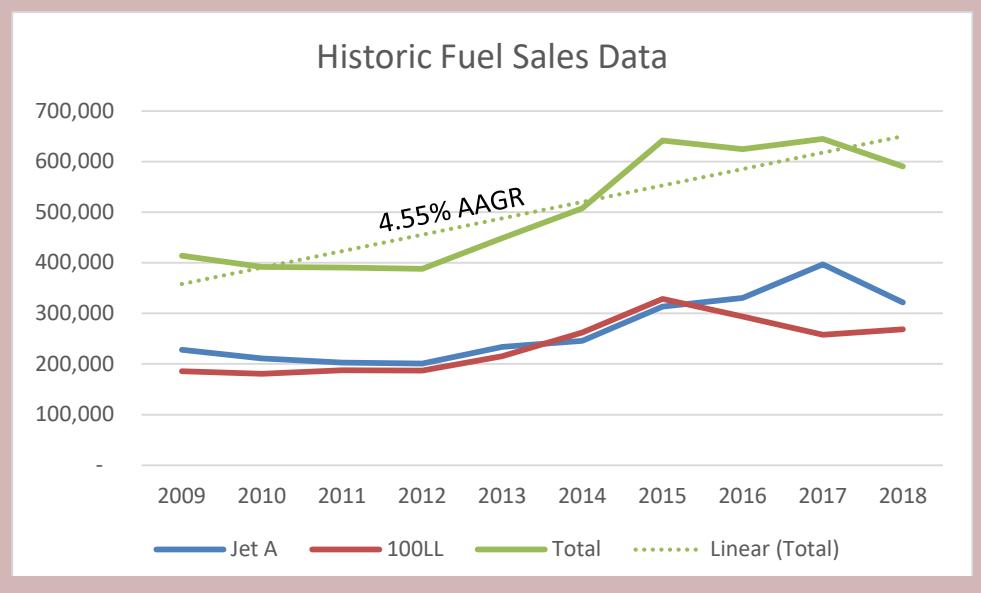
This chapter provides a thorough summary of historic aviation activity and updated forecasts of aviation activity for Bend Municipal Airport (BDN) for the twenty-year master plan horizon (2019-2039). The overall goal is to prepare forecasts that accurately reflect current conditions, relevant historic trends, and provide reasonable projections of future activity, which can be translated into specific airport facility needs anticipated during the next twenty years and beyond. The forecasts presented in this chapter are consistent with the Airport's role as an urban general aviation airport and they do not anticipate a change in the Airport's functional role, such as the initiation of commercial passenger or cargo service.

### Historic Aircraft Operations

A review of the FAA Terminal Area Forecast (TAF) data reveals continued growth in aircraft operations at the Bend Municipal Airport since the Great Recession in 2008. Local and Itinerant traffic have historically accounted for an almost equal share

#### FUEL SALES DATA

Fuel sales at the Bend Municipal Airport have increased 4.55% on average annually since 2009. 2018 was the first year that there has been only one fuel provider on the Airport which may explain the noticeable decline (-8.49%) in fuel sales between 2017 and 2018. Looking back beyond 2009 at fuel sales data there is a more tempered growth in fuel sales. Pre-recession fuel sales data indicates total gallons sold in 2006 was 607,000 gallons which was followed by a steep decline to an almost 20-year low in fuel sales in 2012 of 388,000 gallons.





of total operations at the Airport. TAF data estimates suggest that annual operations at the Bend Municipal Airport surpassed 140,000 annual operations in approximately 2014. TAF operations suggest an average annual growth rate (AAGR) of 5.9%.

The latest basedaircraft.com inventory update indicates that Bend Municipal Airport has 244 validated based aircraft as of November 2018, which is slightly less than figures depicted in the FAA TAF. However, this minor discrepancy between the two data sources is not uncommon and is typically due to the dates the data was recorded.

TAF data trends suggest the growth in based aircraft has been moderate with an average annual growth rate (AAGR) of 2.65%. It should be noted that the reliability of this historic based aircraft data is sometimes questionable. Bend Airport Management has kept an accurate count of based aircraft since at least 2010 when an updated count of 213 based aircraft was observed, therefore it is expected that recent data depicted since 2010 on the TAF is generally accurate and an acceptable source to identify trends in Based Aircraft. A net increase of 31 aircraft over the past 8 years since 2010 equates to a 1.82% annual percentage growth in based aircraft that has been realized at Bend Municipal Airport.

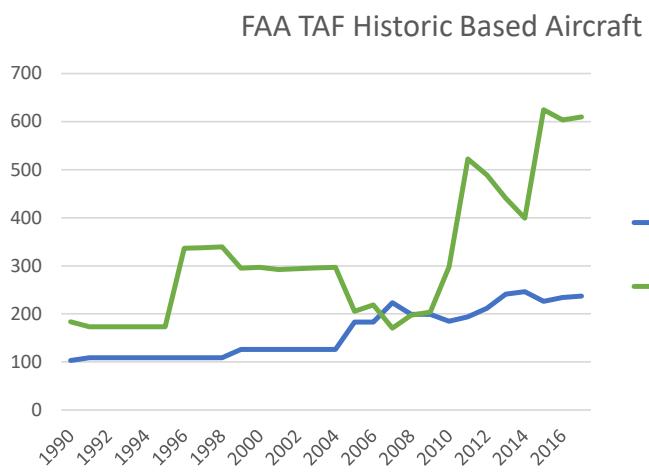
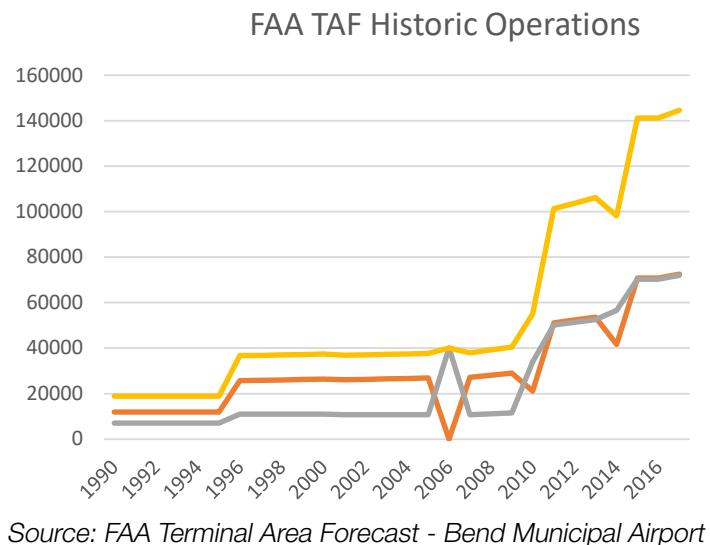


TABLE 2-5: BASED AIRCRAFT

	IN 5010 12/06/18	IN INVENTORY	CURRENTLY VALIDATED
Single Engine	190	207	191
Multi Engine	19	22	19
Jet	10	15	11
Helicopter	21	25	23
Glider	8	8	*
Ultra Light	3	3	*
<b>TOTAL</b>	<b>251</b>	<b>280**</b>	<b>244</b>

Source: Bend Airport Management, 12-18-2018

\* Glider and ultralight aircraft are not considered in the validated aircraft count.

\*\*The increased count in the inventory column includes aircraft that may have N-numbers reported at other airports or aircraft that are not in FAA registry.



Updated estimates of aircraft operational activity (2018) was created to support the subsequent task of updating the activity forecasts. To support this exercise, the airport's flight training operators provided annual aircraft flight hour totals for both fixed wing aircraft and helicopters. Estimates of both fixed wing aircraft and helicopter takeoffs and landings were generated using operator-provided averages per flight hour. The activity ratios reflected the mix of traffic pattern work, flights in local area (practice areas), and transient flights, and were consistent with flight training ratios used in previous master planning estimates.

Operator activity was also provided for non flight training activity including charter/contract flights and aircraft manufacturing. Estimates of glider and medevac flight activity were maintained from the previous master plan since the activity appears to be holding relatively steady. Finally, aircraft operations were estimated for all non-duplicated aircraft based on an operations-per-based aircraft-ratio (OPBA) of 220. This estimate of activity was consistent with the OPBA ratio used in the 2014 FAA-approved eastside helicopter operations area environmental assessment (EA) and reflects overall trends in fueling activity and changes in activity attributed to specific user segments.

As presented in Table 2-6, calendar year 2018 operations are estimated to be 168,913 for Bend Municipal Airport. The 2018 estimate is approximately 72.3 percent above the 2010 levels documented in the previous airport master plan, and 22.3 percent above 2014 levels documented in the HOA EA.

Although growth has been experienced in most activity segments at BDN, flight training activity has experienced particularly strong growth, increasing by more than 100 percent between 2010 and 2018. Flight training increased from 58 to 68 percent of the airport's overall air traffic between 2010 and 2018. Within its upward trend, the distribution between fixed wing and helicopter flight training activity has experienced significant fluctuations over the last eight years. Based on 2018 data, fixed wing flight training generated nearly twice the operations as helicopter flight training at BDN, directly opposite the flight training mix in 2010. The flight training operators indicate that market demand drives changes in the student and aircraft fleet composition over time.

TABLE 2-6: ESTIMATED AIRCRAFT OPERATIONS

	2010	2014	2018
Single Engine Piston	52,038	59,584	116,236
Multi Engine Piston	3,100	3,565	3,080
Turboprop	2,150	2,400	5,560
Jet	500	1,560	2,084
Glider	300	300	300
Helicopter	39,840	70,104	41,653
<b>TOTAL OPERATIONS</b>	<b>97,928</b>	<b>137,513</b>	<b>168,913</b>

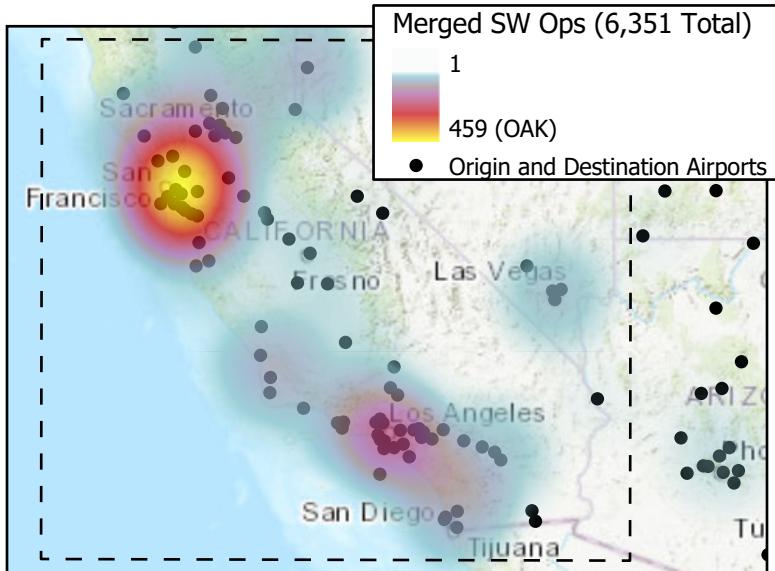
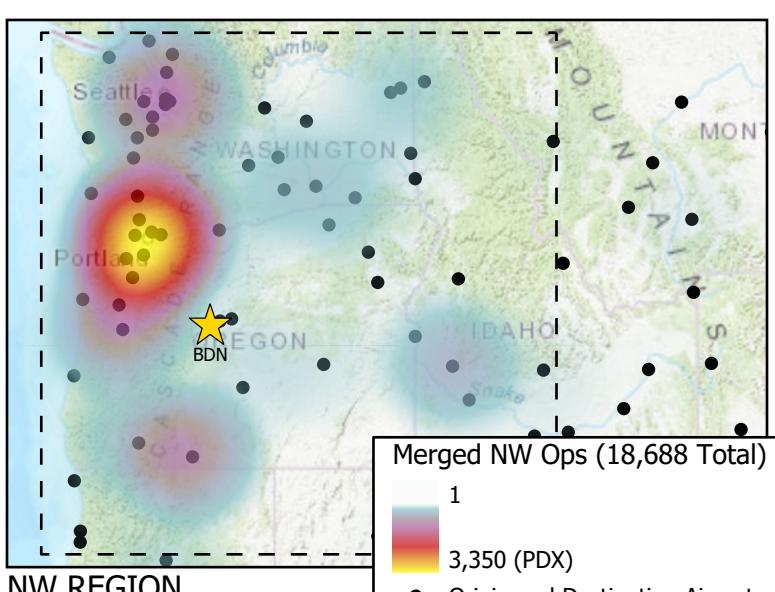
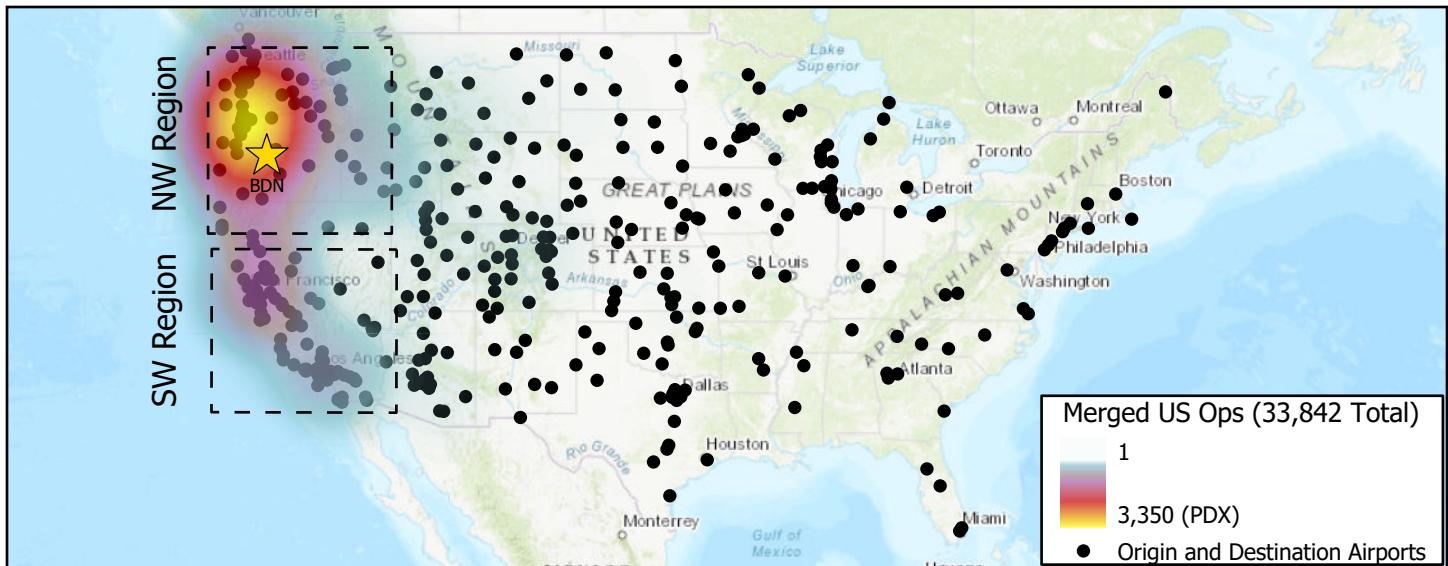
Source:

2010 Estimates obtained from 2013 Airport Master Plan.

2014 Estimates obtained from 2015 Helicopter Operations Area (HOA) Environmental Assessment.

2018 Estimates derived from Airport users/tenant interviews and updated data.

# BEND ORIGIN AND DESTINATION AIRPORTS ACTIVITY



## Where are aircraft flying to and from?

At least 719 airports across the USA, however the majority of the operations to and from origin/destination airports are in the Southwest or Northwest United States.

FAA TFMSC Operations data from 2010 – 2018 identified 719 airports with operations originating from or heading to Bend Municipal Airport. The effort to assess regions and/or city pairs that may exist between Bend Municipal and the rest of the United States provides deeper understanding of where aircraft are flying to/from. “Heat maps” were created from the data highlighting hotspots of operational activity related to BDN. Significant hotspots are shown around major metropolitan areas in the west (Seattle, Portland, San Francisco, Los Angeles, and Las Vegas), as well as smaller regional airports, primarily in the Northwest (Eugene, Corvallis, Klamath Falls, and Boise).

Of the nearly 34,000 operations in that time period, over 25,000 (74%) originated from or were destined to an airport in the western U.S. As is expected, the Northwest Region accounts for the bulk of that activity. Of the operations in the Northwest, 3,350 (10%) of the operations listed Portland International Airport (PDX) as the origin or destination airport. Flights to or from airports in the Southwest Region were less frequent, but still significant with 6,350 (19%) operations. Oakland International Airport (OAK) was the most commonly listed airport in the SW Region, recording 459 operations to or from BDN. These data suggest that BDN plays a significant operational role not only locally, but across the western US, and especially in the Northwest.



## EXISTING DESIGN AIRCRAFT AND FLEET MIX SUMMARY OF FAA TFMSC OPERATIONS DATA

In the 2013 AMP, the current and future design aircraft identified for Bend Municipal Airport was a medium size business jet, included in Aircraft Approach Category B and Airplane Design Group II (Airport Reference Code: B-II). The Cessna Citation CJ3 or Citation Bravo are representative of the type of business jets included in ARC B-II. They typically carry 4 to 6 passengers and are used extensively for flights of 1 to 3 hours, although their practical range may exceed 1,500 miles. These aircraft are classified as "large" general aviation airplanes based on their maximum takeoff weights above 12,500 pounds.

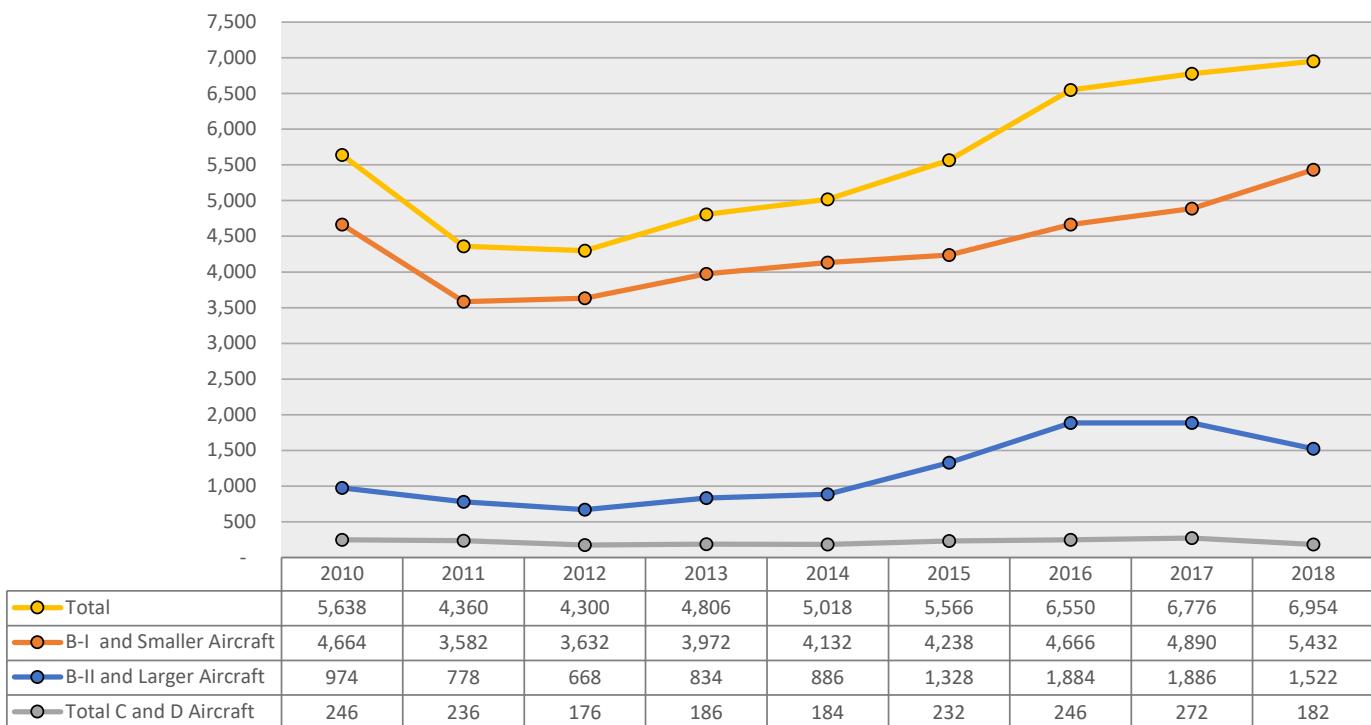
Based on an analysis of FAA TFMSC Data, the Bend Municipal Airport regularly accommodates Approach Category C or D aircraft activity (Airplane Design Groups I and II), although current levels are lower than the 500 annual operations required by FAA when defining a design aircraft. Typical aircraft in this category would include higher performance or larger aircraft such as Lear, Falcon, Hawker, Challenger, and Gulfstream business jets. These aircraft are accommodated at the Airport based on individual aircraft operational capabilities or facility limitations, such as runway length and pavement strength.

The current level of Approach Category C and D aircraft activity accommodated at the Airport appears to reflect established market demand that is tempered somewhat by existing aircraft operational constraints (available runway length). As noted in the 2013 Airport Master Plan, any incremental lengthening of Runway 16/34 intended to address the requirements of the B-II design aircraft would also allow greater operational flexibility for Category C and D aircraft.

FAA TFMSC data that counts actual IFR operations within the airspace system indicates steady growth in operations at the Bend Municipal Airport with an AAGR of 3.35% since 2010. In summary, B-I and Smaller IFR Ops increased 11.08% in 2018 and have grown on average of 2.52% on average over the period from 2010-2018.; B-II and Larger Aircraft IFR Ops declined -19.3% in 2018 but have grown on average of 8.67% over the period from 2010-2018; and Category C and D aircraft IFR Ops declined -33.09% in 2018 but have remained relatively steady on average over the period from 2010-2018.

**TFMSC data indicates B-II and Larger Aircraft totaled 1,522 operations in 2018 confirming that B-II is still the existing ARC.**

TFMSC IFR Operations Data





# DESIGN AIRCRAFT AND AIRPORT REFERENCE CODE (ARC)

The design aircraft represents the most demanding aircraft using the airport on a regular basis and determines the appropriate airport reference code (ARC) and airport design standards for airport development.

## AIRPORT REFERENCE CODE (ARC)

Aircraft Approach Category	Aircraft Approach Speed	Airplane Design Group	Aircraft Wingspan
A	less than or equal to 91	I	less than or equal to 49'
<b>B</b>	<b>92 to 121</b>	<b>II</b>	<b>50' to 79'</b>
C	122 to 141	III	80' to 118'
D	142 to 166	IV	119' to 171'

<b>A-I</b> <b>12,500 lbs. or less</b>	 <p>Beech Baron 55 Beech Bonanza <b>Cessna 182</b> Piper Archer</p>	<b>B-I</b> <b>12,500 lbs. or less</b>	 <p><b>Beech Baron 58</b> Beech King Air 100 Cessna 402 Cessna 421</p>
<b>A-II, B-II</b> <b>12,500 lbs. or less.</b>	 <p>Super King Air 200 <b>Pilatus PC-12</b> DCH Twin Otter Cessna Caravan</p>		
<b>EXISTING ARC - B-II</b> <b>Greater than 12,500 lbs.</b>	 <p>Super King Air 300, 350 Beech 1900 <b>Cessna Citation</b> Falcon 20, 50</p>	<b>A-III, B-III</b> <b>Greater than 12,500 lbs.</b>	 <p>DHC Dash 7, Dash 8 <b>Q-200, Q-300</b> DC-3 Convair 580</p>
<b>C-I, D-I</b>	 <p><b>Lear 25, 35, 55, 60</b> Israeli Westwind HS 125-700</p>		
<b>C-II, D-II</b>	 <p>Gulfstream II, III, IV <b>Canadair 600</b> Canadair Regional Jet Lockheed JetStar</p>	<b>C-III, D-III</b>	 <p>Boeing Business Jet <b>Gulfstream 650</b> B 737-300 Series MD-80, DC-9</p>
<b>C-IV, D-IV</b>	 <p><b>B - 757</b> B - 767 DC - 8-70 DC - 10</p>		



## SUMMARY OF RECENT AVIATION ACTIVITY FORECASTING EFFORTS

The two most recent forecasting efforts for the Bend Municipal Airport include the 2013 Airport Master Plan and the 2015 Helicopter Operations Area Environmental Assessment. The 2013 AMP set a base year of 2010 and the 2015 EA established a base year of 2014. Understanding these previous forecasting efforts provides added support for developing the future vision of the Airport as well as to validate the forecasting efforts to be developed as part of this planning process.

### 2013 Airport Master Plan - Aviation Activity Forecasts

#### Based Aircraft Forecasts

The 2013 AMP utilized an Increased Market Share approach as the preferred growth scenario for Based Aircraft projections. The application of this methodology was based on a marginal increase in Bend's total share of Oregon's general aviation fleet during the twenty year planning period. The tables provided herewithin summarize the various methodologies utilized to develop the Based Aircraft forecasts analyzed in the 2013 AMP. The forecasts identified 241 based aircraft in 2015 and 267 based aircraft in 2020. Interpolation of this data suggests that actual based aircraft growth at the Bend Municipal Airport has only been slightly slower than originally projected.

#### Aircraft Operations Forecasts

A Composite Aviation Agency Rate approach that utilized long-term growth rates reflected in the Oregon Department of Aviation and FAA operations forecasts for Bend at the time was utilized as the preferred growth scenario. Similar to the Based Aircraft forecasts, table herewithin provides a summary of the seven methodologies considered during the completion of the 2013 AMP aviation activity forecasting element. During the forecasting process the fleet mix of operations distribution was 60 percent fixed-wing and 40 percent helicopter. On an overall basis, single engine piston aircraft accounted for approximately 53 percent of operations, followed by helicopter (40%), multi-engine piston (3%), turboprop (2%), business jet (<1%) and gliders (<1%). However, since the completion of the 2013 AMP forecasts, operations of helicopters at the Airport have steadily increased and are estimated to have outpaced expected growth.

#### SUMMARY OF BASED AIRCRAFT FORECASTS (2013 BEND MUNICIPAL AIRPORT MASTER PLAN)

FORECASTS	2010	2015	2020	2025	2030
2002 Bend Airport Planning Update (2.45% AAR 2000-2020)	195	222	250		
2007 Oregon Aviation Plan (2.42% AAR 2005-2025)	210	237	264 <sup>1</sup>	295	329 <sup>1</sup>
FAA Terminal Area Forecast (2.20% AAR 2010-2030)	205	236	265	296	317
Bend Population Ratio (1.83% AAR 2010-2030)	215	237	262	284	309
Oregon Market Share - Maintain % (1.15% AAR 2010-2030)	215	228	241	255	270
Oregon Market Share - Increase % (2.15% AAR 2010-2030) <i>Preferred Projection</i>	215	241	267	297	329

#### SUMMARY OF AIRCRAFT OPERATIONS FORECASTS (2013 BEND MUNICIPAL AIRPORT MASTER PLAN)

FORECASTS	2010	2015	2020	2025	2030
2002 Bend Airport Planning Update (3.51% AAR 2000-2020)	56,406	64,612	73,100		
2007 Oregon Aviation Plan (2.41% AAR 2005-2025)	43,141	48,800	54,372 <sup>1</sup>	60,580	67,497 <sup>1</sup>
FAA Terminal Area Forecast (2.41% AAR 2010-2030)	41,756	48,032	54,306	60,580	67,259
Bend Population Ratio (2.31% AAR 2010-2030)	97,928	110,210	124,298	137,940	154,712
Oregon Market Share - Maintain % (1.48% AAR 2010-2030)	97,928	105,657	113,587	122,113	131,279
Oregon Market Share - Increase % (2.51% AAR 2010-2030)	97,928	111,601	126,368	142,724	160,823
Aviation Agency Composite Rate (2.41% AAR 2010-2030) <i>Preferred Projection</i>	97,928	110,311	124,260	139,972	157,672

1. Interpolated/Extrapolated based on 2015 and 2025 forecasts.



## 2015 Helicopter Operations Area - Environmental Assessment

As part of the scope for the Helicopter Operations Area (HOA) Environmental Assessment (EA), a review of current air traffic at Bend Municipal Airport was required to support updated aircraft noise analyses. The purpose of the review was two-fold: First, an updated base year data (2014) was required to establish (pre-build) existing conditions. Second, a comparison of current year air traffic with the Airport Master Plan forecasts for 2015 and 2020 was required to gauge the accuracy of the forecasts for use in evaluating future year noise impacts.

The updated aviation activity data from the HOA EA presented in the table herewithin indicates that the master plan's expectations of future growth had been realized—and exceeded in the short term. It was noted in the HOA EA that the master plan had identified development of a dedicated helicopter landing area and segregation between fixed wing aircraft and helicopter traffic patterns as a near term high priority improvement on the basis of safety. The higher than anticipated growth in air traffic in the subsequent 3 to 4 years highlighted the importance of the proposed facility improvements. Although the short-term spike in activity was indicative of an intense surge of activity, the longer term expectation of growth was tempered to reflect activity that could be sustained over an extended period.

### UPDATED AVIATION ACTIVITY FORECASTS (2015 HOA EA)

	BASE YEAR (2014)	BUILD YEAR (2016)	2020
Single-Engine Piston	59,584	61,000	68,700
Multi-Engine Piston	3,565	3,600	4,100
Turboprop	2,400	2,500	2,800
Business Jet	1,560	1,635	1,800
Glider	300	300	300
Helicopter	70,104	73,600	80,750
<b>TOTAL OPERATIONS</b>	<b>137,513</b>	<b>142,635</b>	<b>158,450</b>

For the purposes of evaluating the Proposed Action in the EA, an updated base year (2014) and future year forecasts of aviation activity were generated for the build year (12 months of activity following facility opening – assumed to be 2016) and for 2020 as it was considered reasonably foreseeable. The significant growth in activity that occurred between 2010 and 2014 coincided with both individual business activity (locally-based flight schools) and the early stages of recovery from the 2008 economic recession. It was anticipated that future growth consistent with state and national trends within general aviation could be sustained in the future. Therefore, the master plan's long term forecast growth rate of 2.41 percent (average annual rate) was applied to the updated estimate of activity for 2014.

The June 2014 airport estimate of based aircraft developed as part of the HOA EA was 249, which was between the 2015 and 2020 forecast (241 and 267 respectively) projections presented in the 2013 AMP. Unlike aircraft operations, based aircraft growth at the time of the HOA EA appeared to be tracking reasonably close to the forecast projections. This led planners to believe that transient and flight training activity were primarily responsible for the recent increase in air traffic. Therefore, no adjustment to the master plan based aircraft forecast was recommended within the HOA EA.



# Forecast Review and Approval Process

Draft Aviation Forecasts were submitted in Draft Working Paper #1 to FAA in May 2019 in coordination with PAC #2 and formally submitted for review in June 2019. Through the summer of 2019 FAA requested additional information on baseline activity estimates including request to use ADS-B data to document operations. In September 2020, the FAA issued a standards change that redefined the methodology for forecasts estimates and required the BDN forecasts to be revised to comply with the new standard. The new standard was based on data driven estimates utilizing TFMSC and ADS-B data for individual aircraft operating at the airport. The FAA HQ assumption was that this data applicable to BDN was readily available. In actuality, most the helicopters generating a significant number of operations were not ADS-B equipped. CWE provided additional operations memos to FAA and finally a revised forecast chapter in March 2020 incorporating FAA comments and revised operations estimates. Forecasts were finally approved by FAA in August 2020.

The forecast review process was also impacted by staff changes at the Seattle ADO and the nation wide impacts to aviation activity due to the COVID-19 Pandemic. Three different FAA planners were involved in the review process and now a fourth FAA planner has taken over review responsibilities for Oregon. COVID-19 has had a dramatic impact on airport operations across the country. This has impacted forecasts nationwide because FAA does not have confidence in how or when operations will return to pre-COVID levels. The Pandemic response also impacted forecast reviews because HQ planners were responsible for some elements of the CARES act implementation that occurred in the Spring of 2020.

The following "Forecast Appendices" are provided below to document the forecast approval process:

- Bend Aircraft Operations Memo - City of Bend Cover Letter
- Bend Aircraft Operations Memo
- Response to FAA Comments on Bend Aircraft Operations Memo
- Final Bend Aviation Activity Forecasts
- FAA Approval Letter

Additionally, FAA required the following statement be included within the aviation activity forecasts:

*"This forecast was prepared prior to the impacts of COVID-19. The forecast approval is based in reference to the data and methodologies used and the conclusions at the time the document was prepared. However, consideration must still be given to the significant impacts of COVID-19 on aviation activity; as a result, there is lower than normal confidence in future growth projections. FAA approval of the forecast does not provide justification to begin airport development. Justification for future projects will be made based on activity levels at the time the project is requested for development, rather than this forecast approval. Further documentation of actual activity levels reaching the planning activity levels will be needed prior to FAA participation in funding for eligible projects."*



## ECONOMIC DEVELOPMENT

October 1, 2019

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(541) 388-5505 tel  
Relay Users Dial 7-1-1  
(541) 385-6676 fax  
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Valerie Thorsen  
Airport Capacity Program Manager  
FAA Seattle Airports District Office (ADO)  
2200 S 216th Street  
Des Moines, WA 98198

Valerie:

In response to informal comments conveyed to our consultant by FAA Headquarters staff, Century West Engineering (CWE) has prepared the attached "Bend Municipal Airport – Aircraft Operations Estimates" memo dated September 2019. While we believe that the original Aircraft Operations Forecasts submitted to you on June 6, 2019 are reasonable based on the methodology used and approved in two previous forecasts for the Bend Municipal Airport (BDN), we are willing to concede and accept the lower operations estimates included in the memo in order to avoid an extended delay on the 2018 Airport Master Plan project.

Based on informal comments from FAA HQ requesting data based activity estimates, our consultant has analyzed additional data not available at the time the original forecasts were prepared to support the updated forecast included in the memo. ADS-B data is the only data found beyond the TFMSC counts that could be analyzed to provide a more accurate estimate of aircraft operations per flight hour for flight training activity. This process has been time consuming and caused a delay in the Airport Master Plan process.

The draft forecast and estimates of 2018 aviation activity were presented to the FAA Seattle Airports District Office (SEA-ADO) in Working Paper #1 on June 6, 2019. Operations estimates and subsequent forecast differ by more than 10 percent in the 5-year forecast and 15 percent in the 10-year period compared to the FAA Terminal Area Forecast (TAF) for BDN. This difference

between the actual operations and TAF figures was noted in the 2014 Helicopter Operations Area Environmental Assessment. In that approved forecast, the difference was 25%. The forecast submitted for the 2018 forecasts were just 16% different. Nonetheless, the difference in the forecast required FAA Headquarters (HQ) review per AC 150/5070-6B section 704, subsection g. The fact that the 2014 forecast also exceeded the TAF supports the argument that BDN operations are outpacing national trends.

Central Oregon and BDN activity and flight training have grown based on nationwide trends in training, significant growth in the community, and an average of 263 clear or mostly sunny days annually which make BDN a desirable location to fly. All of the available quantifiable aviation data indicates BDN is experiencing substantial growth. According to the US Census Bureau, Central Oregon has the third highest growth rate of any metropolitan area in the country.

Regular users of the Airport have been vocal about the noticeable increase in aviation activity based on their observations and what users have described as “close calls” of near mid-air collisions and increased difficulty entering the traffic pattern. Airport staff have also had routine contact from FAA Flight Standards District Offices (FSDO) and FAA Seattle Air Route Traffic Control Centers (ARTCC) staff regarding safety concerns related to the high volume of traffic at BDN. FAA staff, Airport Management, and local operators have expressed an urgent need to address the volume and mix of traffic at BDN.

These groups have indicated support for an air traffic control tower (ATCT) or a second runway to address the air traffic congestion. Providing a safer operating environment for the growing traffic in the region is a high priority for the City of Bend. The growing sentiment among professional pilots, air traffic controllers, and airport management familiar with BDN is that the time has come to address the growing demand at BDN to avoid a potential catastrophic accident before it occurs.

The City of Bend, as owner and sponsor of the Bend Municipal Airport would ask FAA to consider the additional information provided in the attached memo to support forecast approval to allow the Airport Master Plan project to continue without delay. We are committed to completing the planning process, identifying critical safety enhancements, and working towards implementation of improvements to improve the safety of operations at the airport.

Please let us know how we can assist you with your review.

Sincerely,



Carolyn Eagan  
Director, Economic Development Department

## MEMO

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**To: Valerie Thorsen, FAA SEA-ADO**  
**From: Century West Engineering**  
**Date: September 2019**  
**Re: Bend Municipal Airport – Aircraft Operations Estimates**

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### Introduction

Airport operations estimates for the Bend Municipal Airport (BDN) were developed to update the Aviation Forecasts for the 2018 Airport Master Plan project. FAA approved forecasts from the 2010 Bend Airport Master Plan and 2014 Helicopter Operations Area Environmental Assessment were reviewed to assess historic aviation activity at BDN. Current based aircraft and data supporting operations was collected to support estimates for the 2018 forecasts.

The draft forecasts and estimates of 2018 aviation activity were presented to the FAA Seattle Airports District Office (SEA-ADO) in Working Paper #1 on June 6, 2019. Operations estimates and subsequent forecasts differ by more than 10 percent in the 5-year forecasts and 15 percent in the 10-year period compared to the FAA Terminal Area Forecast (TAF) for BDN requiring FAA Headquarters (HQ) review per AC 150/5070-6B section 704, subsection g. The base line aviation activity data in conjunction with the aviation activity forecasts for the airport were forwarded to FAA HQ for review. No written comments have been received from the FAA, but informally FAA planners at FAA HQ have conveyed that more defensible data is required to substantiate the estimated base line aircraft operations data for the airport.

FAA Traffic Flow Management System Counts (TFMSC), documented fuel sales data, flight training records, reports from FAA Flight Standards District Offices (FSDO), and recently issued FAA Seattle Air Route Traffic Control Centers (ARTCC) Letter to Airman all substantiate the high traffic levels at BDN. FAA staff, Airport Management, and local operators have expressed an urgent need to address the volume and mix of traffic at BDN.

This memo and supporting analysis has been developed to validate the baseline activity and further document aircraft operations at the Bend Municipal Airport to provide the detail required for HQ approval of the aviation forecasts. It includes the following:

- Summary of Growth at BDN from 2010 to 2018
- 2018 Baseline Aviation Activity Data Methodology
- Fixed Wing Flight Training Aircraft Operations Analysis
- Updated 2018 Aviation Activity Estimates

## Growth in Air Traffic at Bend Municipal Airport

Central Oregon airspace and airports in the region are experiencing significant growth. FAA Traffic Flow Management System Counts (TFMSC) and fuel sales data verify quantifiable growth at BDN. Regular users of the Airport have been vocal about the noticeable increase in aviation activity based on their observations and what users have described as “close calls” of near mid-air collisions and increased difficulty entering the traffic pattern.

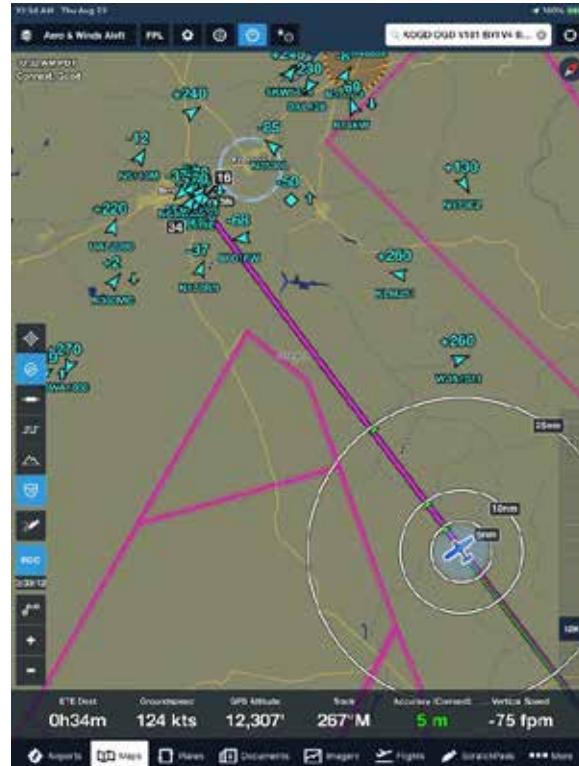


Figure 1 - FAA TFMSC Graph

Increased activity levels at BDN have been substantiated in a recent Letter to Airman (LTA-ZSE-14) issued 8/23/2019 by FAA Seattle Air Route Traffic Control Centers (ARTCC). The letter from FAA ARTCC advises pilots to “exercise caution and use extra vigilance” due to tremendous growth in air traffic that includes a diverse mix of flight school aircraft (helicopter and light aircraft), high performance turboprops, firefighting aircraft, and a variety of commercial aircraft all operating within close proximity of Bend and Redmond airports. Due to this increased activity, ARTCC opened a new sector in the area to increase safety. ARTCC recently contacted Bend airport management to initiate the process of lowering the existing Class E airspace down to the surface to provide an added level of safety and clearance for aircraft operating in IFR conditions.

Central Oregon and BDN activity and flight training have grown based on nationwide trends in training, significant growth in the community, and an average of 263 clear or mostly sunny days annually which make BDN a desirable location to fly. All of the available quantifiable aviation data indicates BDN is experiencing substantial growth. According to the US Census Bureau, Central Oregon has the third highest growth rate of any metropolitan area in the country.

Bend airport management has had numerous conversations in recent years with airport users, state and federal officials, and City staff about the increase in air traffic at BDN and the potential impacts the growth may have on safety. These groups have indicated support for an air traffic control tower (ATCT) to address the air traffic congestion. Providing a safer operating environment for the growing traffic in the region is a high priority for the City of Bend. The



growing sentiment among professional pilots, air traffic controllers, and airport management familiar with BDN is that the time has come to address the growing demand at BDN to avoid a potential catastrophic accident before it occurs.

### **Developing the 2018 Aircraft Operational Activity Estimates**

The Bend Municipal Airport does not have an air traffic control tower that counts aircraft operations. The FAA provides guidance for the development of aircraft operations estimates at non-towered airports in FAA Advisory Circulars 150/5070-6B, Airport Master Plans and other supporting guidance documents. The methodology to develop estimates for BDN was consistent with this guidance and previous BDN forecasts approved by FAA. BDN has several segments of general aviation activity, including flight training, aircraft manufacturing, medical-evacuation flights, business and personal travel, and recreational aviation. Estimates for each segment of general aviation activity were derived separately to accurately estimate aircraft operations.

The largest percentage of operations at BDN are associated with flight training activity. To develop estimates of flight training activity, flight training operators at BDN provided annual aircraft flight hour totals for both fixed wing aircraft and helicopters. Estimates of both fixed wing aircraft and helicopter takeoffs and landings were generated using operator-provided averages per flight hour. The activity ratios reflected the mix of traffic pattern work, flights in local area (practice areas), and transient flights, and were consistent with flight training ratios used in previous master planning estimates. These estimates per flight hour provided by BDN flight instructors were compared to similar ratios used by Hillsboro Aviation at Hillsboro and Troutdale airports during the 2010 Airport Master Plan.

Operator activity data was also collected for charter/contract flights and aircraft manufacturing. Estimates of glider and medevac flight activity were maintained from the previous master plan based on confirmation from operators that their activity levels have not changed. Finally, aircraft operations were estimated for all non-duplicated aircraft based on an operations-per-based aircraft-ratio (OPBA) of 220. This estimate of activity was consistent with the OPBA ratio used in the 2014 FAA-approved eastside helicopter operations area environmental assessment (EA) and reflects overall trends in fueling activity and changes in activity attributed to specific user segments. It should be noted that this is below the general recommendation for a GA airport like Bend per the following ratios:

#### *Airport Categories and Corresponding NPIAS OPBA*

- Basic GA Airports 250
- Local GA Airports 350

*Source: FAA Order 5090.5. Formulation of the NPIAS and ACIP*

For calendar year 2018, 168,913 operations were estimated for the Bend Municipal Airport master plan. The 2018 estimate is approximately 72.3 percent (9.03% AAGR) above the 2010 levels documented in the previous airport master plan, and 22.3 percent (5.58% AAGR) above 2014 levels documented in the eastside helicopter operations area environmental assessment as documented in the table below.

	2010 (MP)	2014 (EA)	2018 Estimate
Non Flight Training GA	40,000	48,996	52,121
Medevac/Charter (Part 135)	1,290	1,290	1,290
Helicopter Flight Training	38,880	63,094	38,573
Fixed Wing Flight Training	17,458	23,834	76,629
Giders	300	300	300
<b>Total</b>	<b>97,928</b>	<b>137,513</b>	<b>168,913</b>

Although growth has been experienced in most activity segments at BDN, flight training activity has experienced perhaps the most significant net change, increasing by more than 100 percent between operation estimates produced in 2010 and 2018. It is estimated that flight training increased from 58 to 68 percent of the airport's overall air traffic between 2010 and 2018. Within its upward trend, the distribution between fixed wing and helicopter flight training activity has experienced significant fluctuations over the last eight years. Based on updated 2018 data, fixed wing flight training generated nearly twice the operations as helicopter flight training at BDN, directly opposite the flight training mix in 2010. The flight training operators indicate that market demand drives changes in the student and aircraft fleet composition over time.

A table summary of the methodology to develop the updated operations data as presented within the 2018 Bend Municipal Airport Master Plan is provided in the table below.

Bend Municipal Airport (BDN) 2018 Annual Aircraft Operations Estimates					
	Activity Segments	Base Metric (Aircraft Fleet) (1)	Factor 1 Flight Hours (2)	Factor 2 Multiplier (3)	Total Operations
A	Leading Edge Aviation Helicopter Flight Training	10	5,510.4	7	<b>38,573</b>
B	Leading Edge Aviation Helicopter Contract	6	612.3	2	<b>1,225</b>
C	Leading Edge Aviation Fixed Wing Flight Training	13	10,516.5	6	<b>63,099</b>
D	Bend Aircraft Mechanics Fixed Wing Flight Training	7	2,255.0	6	<b>13,530</b>
E	EPIC (4)				<b>2,496</b>
F	Airlink Medevac Fixed Wing (5)				<b>645</b>
G	Airlink Medevac Helicopter (5)				<b>645</b>
H	Glider (6)				<b>300</b>
I	Non-Duplicated BAC OPBA (7,8,9)	220		220	<b>48,400</b>
<b>Total Aircraft Operations (GA)</b>					<b>168,913</b>

1. Number of active aircraft  
 2. Flight hours reported by operators  
 3. Average number of operations per flight hour (operator reported, consultant estimated)  
 4. Operator reported estimate (2018)  
 5. Medevac estimate used in 2010 master plan; assumed 50%/50% split for fixed wing and rotor  
 6. Annual Aircraft operations estimated from consultant based on available data  
 7. Non-Duplicated aircraft from validated count [www.basedaircraft.com](http://www.basedaircraft.com) (excludes flight training, contract, gliders, and medevac AC)  
 8. '12/18/18 Validated BAC Count (244), less 16 LEA AC, 7 Bend Mech AC, 1 MEDEVAC AC) [244-24= 220]  
 9. 220 OPBA referenced in 2014 EA was maintained to estimate non-flight training activity  
  
 A+B+C+D+E+F+G+H+I = 2018 Aircraft Operations (BDN)

## Fixed Wing Flight Training Aircraft Operations Analysis

Based on conversations with FAA HQ, it is understood that FAA's main concern was the level of flight training activity included in the initial estimates. Subsequently, Century West worked to substantiate the estimates for fixed wing flight training aircraft provided by flight training operators at BDN using newly available ADS-B flight track information available from Flightradar24.com. Based on research of available data, reliable data was not available for helicopters.

A typical training flight at BDN consists of an aircraft taking off and departing the pattern to practice aerial training maneuvers in nearby airspace and then returning to the traffic pattern. Typically, the training lesson consists of practice touch-and-go operations before and/or after the aerial maneuvers portion of the flight training lesson as depicted in the graphics below.

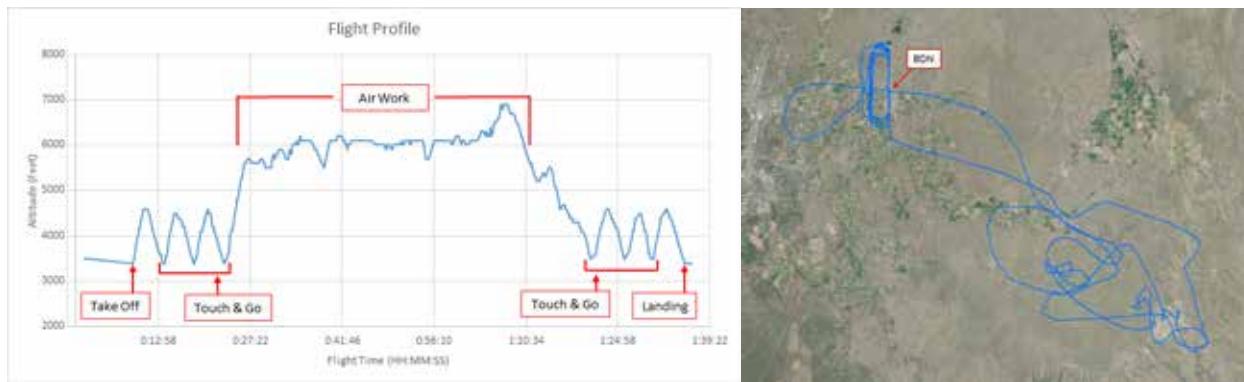


Figure 3- Flight Profile and Plot for Training Flight

Four Aircraft, two from each of the flight schools at BDN, were identified as representative of the BDN training fleet. As such, they were selected as subjects for analysis in an effort to determine a reasonable operations per flight hour estimate to be applied to the fleet. 578 ADS-B recorded flights were downloaded. Two-week ranges of flight dates were chosen to account for each of the four seasons of operations.

Flight Dates	Sampled Aircraft				Total
	N17HZ	N49CG	N733MG	N4432R	
9/4/2018 - 9/18/2018	31	35	29	18	113
12/4/2018 - 12/19/2018	27	17	26	29	99
3/6/2019 - 3/20/2019	65	63	38	23	189
6/6/2019 - 6/20/2019	43	53	47	34	177
<b>Total</b>	<b>166</b>	<b>168</b>	<b>140</b>	<b>104</b>	<b>578</b>

The flight track data files included:

- Point positions (Latitude/Longitude)
- Time stamp
- Aircraft Call Sign (Tail Number)
- Altitude
- Speed
- Heading

From these data, flight time and distance traveled were calculated for each reported position. Slope of the flight track was calculated using the reported altitude (y-axis) and distance traveled (x-axis). A 10-point floating sample was employed to smooth noise observed in the data minimizing false local maxima and minima.

Potential touch-and-go operations (2 operations) were identified by querying local minima in the calculated flight track profile - where slope changes from a negative value (descent) to a positive value (ascent). If a potential touch and go was identified, its position (Lat/Lon/Alt) was compared to that of BDN and was counted if it occurred within  $\frac{1}{2}$  mile of the runway, and descended to a maximum altitude of 3700 feet. These criteria are intentionally forgiving as loss of signal and decrease in precision of the ADS-B data was observed while aircraft were at low altitudes in the area of the airport.

Operations of origin (initial takeoffs) and destination (terminal landing) were not identified by the above described procedure. Instead it was assumed that if any of the first ten recorded positions were within  $\frac{1}{2}$  mile of the runway that flight originated at BDN, and if any of the final 10 reported positions were within  $\frac{1}{2}$  mile of the airport that flight terminated at BDN. The  $\frac{1}{2}$  mile buffer was used to account for noise observed in the GPS data reported in the vicinity of the airport near ground level as well as noise that is common during startup and initialization of the aircraft GPS.

After the flight records were analyzed, total flight time and total operations were calculated and an average operations per hour rate (flight-time weighted) for this dataset was determined to be 4 operations per flight hour. The results are summarized below.

ADS-B Flight Record Analysis Results	
Total Ops	2748
Total Flight Hours	678.1
Operations/Hour	4.05

## Updated 2018 Aviation Activity Estimates

Based on the updated analysis of fixed wing flight training operations, the multiplier for fixed wing flight training aircraft operations (Rows C and D in the table below) was reduced from 6 to 4 operations per flight hour resulting in a net reduction in total aircraft operation estimates. The helicopter flight training operations (Row A in the table below) was maintained at 7 operations per flight hour. It is generally understood that helicopter flight training operations experience more touch-and-go operations per training flight than the typical fixed wing flight training aircraft.

Operations by LEA Helicopter Contracts, Epic, Airlink, and Gliders (Rows B, E, F, G, H) were not changed from the original estimates as the estimates were considered to be reasonable and verifiable from the operators, and to account for a minimal share of the total operations. Non-duplicated BAC OPBA was also not changed as the OPBA methodology utilized is considered to be an acceptable tool for estimating operations at non-towered airports when no other verifiable data exists. The resultant operations from the 220 OPBA multiplier applied to the 220 non-duplicated based aircraft is considered to be a reasonable estimate for the existing base aircraft fleet operations and itinerant aircraft operations at BDN. The summary table of the updated activity data is provided below.

Bend Municipal Airport (BDN) 2018 Annual Aircraft Operations Estimates					
	Activity Segments	Base Metric (Aircraft Fleet) (1)	Factor 1 Flight Hours (2)	Factor 2 Multiplier (3)	Total Operations
<b>A</b>	Leading Edge Aviation Helicopter Flight Training	10	5,510.4	7	<b>38,573</b>
<b>B</b>	Leading Edge Aviation Helicopter Contract	6	612.3	2	<b>1,225</b>
<b>C</b>	Leading Edge Aviation Fixed Wing Flight Training	13	10,516.5	4	<b>42,066</b>
<b>D</b>	Bend Aircraft Mechanics Fixed Wing Flight Training	7	2,255.0	4	<b>9,020</b>
<b>E</b>	EPIC (4)				<b>2,496</b>
<b>F</b>	Airlink Medevac Fixed Wing (5)				<b>645</b>
<b>G</b>	Airlink Medevac Helicopter (5)				<b>645</b>
<b>H</b>	Glider (6)				<b>300</b>
<b>I</b>	Non-Duplicated BAC OPBA (7,8,9)	220		220	<b>48,400</b>
<b>Total Aircraft Operations (GA)</b>					<b>143,370</b>
1. Number of active aircraft 2. Flight hours reported by operators 3. Average number of operations per flight hour (Fixed Wing ADS-B Analysis Conducted by CWE, Operator Estimates for Helicopter Ops) 4. Operator reported estimate (2018) 5. Medevac estimate used in 2010 master plan; assumed 50%/50% split for fixed wing and rotor 6. Annual Aircraft operations estimated from consultant based on available data 7. Non-Duplicated aircraft from validated count <a href="http://www.basedaircraft.com">www.basedaircraft.com</a> (excludes flight training, contract, gliders, and medevac AC) 8. '12/18/18 Validated BAC Count (244), less 16 LEA AC, 7 Bend Mech AC, 1 MEDEVAC AC) [244-24= 220] 9. 220 OPBA referenced in 2014 EA was maintained to estimate non-flight training activity					
A+B+C+D+E+F+G+H+I = 2018 Aircraft Operations (BDN)					

The updated analysis and estimates resulted in a net reduction of operations from the original estimates by approximately 25,500 operations. Without undertaking a separate operational counting exercise at BDN, which is time consuming and outside of the scope of work for this project, the updated estimates are the best available data at the time of completion of the 2018 Bend Municipal Airport Master Plan. Revised estimates are also consistent with FAA Terminal Area Forecasts for the Bend Municipal Airport.

## MEMO

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**To: Robert Tykoski, FAA SEA-ADO**

**From: Century West Engineering**

**Date: January 16, 2020**

**Re: Response to FAA Comments regarding Sept 2019 Operations Memo for Bend Municipal Airport**

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FAA Comment #1. Overall, it's reasonably clear that Bend OR is a growing area that is supported by air traffic growth as well. Traffic growth at BDN is not in question. But the forecast process/methodology used is problematic.

- The forecast process/methodology used is similar to previous planning efforts at Bend and numerous other airports throughout the Country that have been approved by the FAA. The methodology is consistent with the scope of work for this project that was approved by FAA staff.

FAA Comment #2. While the Letter to Airman referenced in the operations memo give credence to increased activity at BDN, it does not by itself "substantiate" operations. It confirms that there is high level of air traffic through that corridor, but does not specify operations contributed to BDN. So it's a useful reference, but not indicative of specific activity levels.

- Local knowledge obtained from airport users in Central Oregon suggests that the majority of the operations and activity are occurring at BDN. While obtaining counts is the only way to verify and validate the estimated activity, we believe that at this point in the planning process (since counting operations were not included in the project scope) subjective and qualitative data presented thus far should be given consideration.

FAA Comment #3. Order 5090.5 limits the use of Operations per Based Aircraft (OPBA) to only basic and local airports. BDN is a regional airport per the NPIAS. Accordingly, BDN cannot use OPBA as a forecast methodology. Beyond the process rationale here, we have credible data that the OPBA multipliers of 200+ are much too high. Using this rationale to justify a new ATCT and/or runway is therefore not reasonable. Consideration should be given to conducting aircraft operations counts using commercially available aircraft counting hardware.

- OPBA for a busy GA airport like BDN was an acceptable methodology in Order 5090.3C (discontinued and replaced by Order 5090.5 on September 3, 2019) which was our guidance used to develop the scope of work. WP#1 and the methodologies employed were submitted to FAA in June 2019, 3 months before the new guidance provided in Order 5090.5.

FAA Comment #4. Further, OPBA is a methodology to estimate total annual operations as performed by a mix of the based aircraft and itinerant aircraft, in situations where no other data is available. However, in using OPBA for the non-duplicated based aircraft at BDN, it's likely that double counting of operations is occurring because that multiplier is estimating both operations by the based aircraft as well as itinerant operations (the latter likely overlaps with other activity segments).

- There is undoubtedly a gap in the available data, and when no other data is available we employ the OPBA methodology. However, upon further discussion with FAA staff, the methodology employed no longer utilizes the OPBA methodology.

FAA Comment #5. That OPBA was used previously at BDN and at other airports does not clear it to be used here, again.

- OPBA for a busy GA airport like BDN was an acceptable methodology in Order 5090.3C (discontinued and replaced by Order 5090.5 on September 3, 2019) which was our guidance used to develop the scope of work. WP#1 and the methodologies employed were submitted to FAA June 6, 2019, 3 months before the new guidance provided in Order 5090.5.

FAA Comment #6. Sufficient rational is not provided for the basis for helicopter operations. The methodology used in the draft forecast to estimate fixed-wing training operations was the same used to estimate helicopter operations. The revised memo applies a different methodology to estimate fixed-wing ops (using ADS-B data), but doesn't address the helicopter ops. Further justification is required to estimate base-year helicopter counts.

- The ADS-B methodology developed for fixed wing aircraft will not work to estimate the operations per flight hour for helicopters because the data does not yet exist. To date, LEA helicopters do not have ADS-B installed. Through discussions with other consultants even when they used camera based air traffic counting methods for recently approved FAA forecasts, operations for helicopter are still estimated based on interviews with operators validated through review of available flight hour logs. It has been demonstrated that

camera-based systems routinely do not provide adequate coverage to capture helicopter operations that occur at varied locations at an airport.

- See additional discussion included in response to FAA Comment #12

FAA Comment #7. TFMSC trends are referenced in the initial discussion, but are not actually used to establish operations for itinerant activity in the 2018 annual operations summary.

- The methodology previously utilized accounts for these operations. Including the TFMSC would have duplicated some operations.
- Based on further discussions with FAA regarding the lack of available flight track data, the TFMSC data has been incorporated in to the baseline operations data in conjunction with a VFR to IFR ratio provided by the FAA.

FAA Comment #8. Use of ADS-B data to capture flight training activity is a good step forward and is credible. However, the text needs to explain why the 4 aircraft selected for analysis were considered representative of the full training fleet. Or, could the entire training fleet be analyzed for the same period? No supporting rationale is provided in the text.

- The four aircraft selected are the only four aircraft (2 from each flight training provider) with one complete year of data available.

FAA Comment #9. Further with the ADS-B data, the Operations/Hour factor should be calculated specifically for each flight school, rather than using the average of 4 for both schools. One school seems to average 809 annual hours per aircraft in its fleet, whereas the other seems to average 322 annual hours per aircraft. This suggests operational trends between the schools may not be comparable. Accordingly, the average operations per hour for the two schools should be calculated separately.

Operator	Aircraft	Ops	Hours	Ops/Hour
Leading Edge	N17HZ	751	176.8	4.25
	N49CG	848	235.6	3.60
Bend Aircraft	N733MG	658	152.7	4.31
	N4432R	491	112.9	4.35
	<b>Total</b>	<b>2,748</b>	<b>678.1</b>	<b>4.05</b>

- Averages are 3.93 for LEA and 4.33 for Bend Aircraft.

FAA Comment #10. Any discussion regarding historic operations counts in relation to the TAF needs to be clarified regarding the source of that data. Since BDN does not have a control tower, ops counts reported in the TAF are taken from the 5010 form, which is supplied by the airport. The FAA does not verify those counts. Ops counts for BDN in the 2010 master plan and the 2014 EA were never validated through independent counting methods. Therefore, any implied growth rates from 2010 to 2018 are mostly subjective and may not be indicative of actual operations growth.

- While the counts were never validated through a counting exercise (not required by FAA), they were approved by the FAA. Subjectivity, qualitative data, and professional estimates have historically been the principle methods of the forecasting effort at non-towered airports. It is the best information available and therefore relevant. Furthermore, the subjective data developed to date appears to be consistent with the traffic congestion concerns raised by users of the airport, ARTCC staff, airport management, and aviation professionals' familiar with BDN.
- It is also noted that the FAA Hillsboro FSDO conducted an investigation that coincided with the last airport master plan related to citizen complaints about airport traffic pattern congestion, noise, and reported flight incidents (near misses) at BDN. The onsite field investigation conducted by FAA personnel recognized the high levels of activity, particularly the differences in activity generated by helicopters and fixed-wing aircraft within the traffic pattern that is reflected in the operations to flight hour ratios utilized for flight training operators at BDN.

FAA Comment #11. Additionally, the FAA does not provide forecasts for non-towered GA airports in the TAF. In the case of BDN, the Region submitted the 2010 master plan forecast prepared to APO for inclusion into the TAF so that a forecast was shown for the airport. APO adopted the master plan growth rate in the 2011 TAF and have applied that growth rate every year since. The growth rate is applied to annual operations counts as submitted by the airport in the 5010. Because APO is not providing independently prepared forecasts for airports like BDN, it is not necessarily an accurate statement to say that the sponsor's forecast is consistent to the TAF without providing context to the source of the TAF data.

- The forecasts used as the basis for the 2011 TAF update were coordinated and reviewed by Seattle ADO planning staff and were approved for the 2010 master plan and the 2016 Helicopter Operations Area EA.

**19-Nov-2019 Corrective actions requested on existing aircraft operations estimates, referencing row label in table on page 7 of memo:**

FAA Comment #12. [A] Helo training multiplier – ensure operations multiplier is consistent with the local operations definition used in FAA Order 7210.3. See excerpt below. Do not rely on location specific HIO counting method; not every up and down counts as an operation. Estimate average operations per hour with helo training operator over the course of the training program, referencing logs or training program as available. Document the methodology and its rationale in forecast chapter.

- The 7 operations per flight hour identified for Bend helicopter operations per flight hour was developed in consultation with the helicopter training operator Leading Edge Aviation (LEA) based on the typical operational characteristics of the helicopter traffic. This multiplier is not based on every up and down that may be experienced in one trip around the pattern. Century West has coordinated further with LEA which has substantiated their best estimate based on CFIs experience, an analysis of fixed wing and helicopter PTS/ACS maneuvers (attached), and overall pilot/owner operator experiences at Bend Municipal.
- In summary, helicopter operations are significantly different than typical fixed wing operations in a way that results in significantly more operations and trips around the pattern (operations in the airport environment) per flight hour than would be experienced in fixed wing operations training. A comparative analysis of the maneuvers and procedures identified in the fixed wing ACS (Airmen Certification Standards) and helicopter PTS (Practical Test Standards) commercial pilot certificate rating yielded the following:
  - 76% of required maneuvers from helicopter commercial rating are conducted in the airport environment while 56% percent of the maneuvers for airplane commercial rating are at the airport.
  - 17% of the hours for helicopter commercial training are cross county and 28% of the hours for airplane are cross country. Helicopter distance for cross country is 25NM and airplane is 50NM, so airplanes have to fly further away before it is considered cross county time.

- 11% of the hours for helicopter commercial training are solo, while 57% in airplane are solo. Since there is so much solo time in commercial airplane practicing maneuvers and building cross country time, airplane students conduct a larger percentage of this time away from the airport. Helicopter solo time is limited so it is typically spent at the airport, the only solo time outside of the airport is the required solo cross country.
- Also, the helicopter traffic pattern is lower AGL (500') than fixed wing traffic (1000') resulting in a reduction in the time to climb and time around the traffic pattern. The traffic pattern is also much smaller and tighter for helicopters than it is for fixed wing traffic. These two factors alone allow for increased frequency of operations when compared to fixed wing traffic.
- In a discussion with an Air Traffic Control Manager at a towered airport with significant helicopter operations it was mentioned that it is not uncommon for one helicopter to conduct as many as 40 operations (20 circuits in the pattern) in a single lesson.
- The operator-provided flight data was enhanced through interviews with the operators to fully understand their flight training activities, including the composition of typical flight training sessions for both fixed-wing aircraft and helicopters. The operator-provided information was verified through on-site observations by the Consultant of airport traffic pattern activity during a variety of conditions and conversation with air traffic controllers familiar with the typical operational characteristics of helicopters in the training environment. This step was critical in assuring relevancy in an otherwise textbook exercise. There is no evidence that the flight school operators are providing unreliable flight data.

FAA Comment #13. [C] use ADS-B data specific to this operator to establish multiplier

- LEA – 3.93/hr

FAA Comment #14. [D] use ADS-B data specific to this operator to establish multiplier

- Bend MX – 4.33/hr

FAA Comment #15. [C and D]: explain rationale for selection of the 2 sampled aircraft from each of the two fixed wing flight schools. Why are these 4 aircraft representative of the fleet of 20 training aircraft?

- They are the only 4 aircraft in the fleet that had ADS-B for the entire year.

FAA Comment #16. Add row for IFR transient operations using TFMSC as source, normalized per AC 150/5000-17.

- We have included the TFMSC data in lieu of the OPBA methodology.

FAA Comment #17. Add row for VFR transient operations as calculated from 12-month sample radar data (via National Offload Program request for data release), to exclude flight training activity from BDN-based operators.

- Data not available. Off-load data is available from the EUG beacon which is shadowed by the Cascade Range.
- Included the VFR to IFR Ratio of 3.48 provided by Robert Tykoski in a separate email (12/13/19) due to the lack of available radar flight tracks.

FAA Comment #18. For transient operations, avoid duplication with EPIC and Airlink Medevac operators.

- We have obtained letters from these operators indicating their operations. However, we have deleted these operations from the original table as they would likely be included in the VFR to IFR Ratio data or the TFMSC Data.

FAA Comment #19. [I] Use available and statistically valid survey data of based aircraft operators to establish separate multiplier for relevant groupings of based aircraft: Jet, Turboprop, SEP, MEP, Heli. Aggregate multipliers (e.g., 220 ops/based aircraft) cannot be used for a regional-level NPIAS airport.

- In a user survey submitted at the beginning of the planning process, 118 based aircraft (not including LEA, Bend Mx, Airlink, and Epic) were identified out of 111 total survey respondents. The survey respondents were asked to estimate their annual operations which totaled approximately 13,160 annual operations. This estimate of operations equates to 111.5 OPBA the surveyed based aircraft. If this factor was applied to the 220 non-duplicated based aircraft at BDN the result is 24,420 annual operations.
- This estimate could be applied to based aircraft, but we believe it does not capture the transient aircraft operations typically accounted for in the OPBA estimates. The TFMSC and VFR to IFR Ratio data provides a better estimate.

8/15/19

JO 7210.3BB

## Section 3. Local Operations

### 13-3-1. TABULATION

Count local operations as follows:

a. One count for an aircraft departing the airport area for a designated practice area and one count for

the aircraft returning from the designated practice area.

b. Two counts for each low approach below traffic pattern altitude that is a stop and go or touch-and-go operation.

Bend Municipal Airport (BDN) 2018 Annual Aircraft Operations Estimates					
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<b>E</b>	EPIC (4)				<b>2,496</b>
<b>F</b>	Airlink Medevac Fixed Wing (5)				<b>645</b>
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<b>I</b>	Non-Duplicated BAC OPBA (7,8,9)	220		220	<b>48,400</b>
<b>Total Aircraft Operations (GA)</b>					<b>143,370</b>
1. Number of active aircraft 2. Flight hours reported by operators 3. Average number of operations per flight hour (Fixed Wing ADS-B Analysis Conducted by CWE, Operator Estimates for Helicopter Ops) 4. Operator reported estimate (2018) 5. Medevac estimate used in 2010 master plan; assumed 50%/50% split for fixed wing and rotor 6. Annual Aircraft operations estimated from consultant based on available data 7. Non-Duplicated aircraft from validated count <a href="http://www.basedaircraft.com">www.basedaircraft.com</a> (excludes flight training, contract, gliders, and medevac AC) 8. '12/18/18 Validated BAC Count (244), less 16 LEA AC, 7 Bend Mech AC, 1 MEDEVAC AC) [244-24= 220] 9. 220 OPBA referenced in 2014 EA was maintained to estimate non-flight training activity					
A+B+C+D+E+F+G+H+I = 2018 Aircraft Operations (BDN)					

## Updated Operations Estimates

**Bend Municipal Airport (BDN)**  
**2018 Annual Aircraft Operations Estimates**

	Activity Segments	Base Metric (Aircraft Fleet) (1)	Factor 1 Flight Hours (2)	Factor 2 Multiplier (3)	Total Operations
<b>A</b>	<b>Leading Edge Aviation Helicopter Flight Training</b>	10	5,510.4	7	<b>38,573</b>
<b>B</b>	<b>Leading Edge Aviation Helicopter Contract</b>	6	612.3	2	<b>1,225</b>
<b>C</b>	<b>Leading Edge Aviation Fixed Wing Flight Training</b>	13	10,516.5	3.93	<b>41,330</b>
<b>D</b>	<b>Bend Aircraft Mechanics Fixed Wing Flight Training</b>	7	2,255.0	4.33	<b>9,764</b>
<b>E</b>	<b>TFMSC IFR Data</b>				<b>6,954</b>
<b>F</b>	<b>FAA Regional Airports VFR to IFR Ratio</b>			3.48	<b>24,199</b>
<b>Total Aircraft Operations (GA)</b>					<b>122,045</b>

Based on FAA comments received after WP#1 was provided for review, consideration for completing traffic counts at the airport has been given. The airport is considering completing counts outside the scope of the airport master plan. Since a physical counting exercise is outside the scope of master plan, we believe the methodology utilized to date is reasonable to use for conceptual planning analysis and long-term land use planning associated with the airport master plan. At the time when additional justification is necessary for future expansion or infrastructure projects, it is expected that a more robust counting exercise must occur as a separate project to justify funding.

We further believe that normal FAA requirements for airport sponsors to provide updated air traffic assessments prior to programming capacity-related projects provides an appropriate level of control for FAA to transition from the current airport master plan to actual project implementation. Given the timeframe estimated for justification of significant capacity improvements at BDN and the overall pace of development at BDN, it is likely that a new airport master plan will be required before capacity driven improvements begin to drive project formulation.

## Mike Dane

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**From:** Travis Warthen <TWarthen@flybend.com>  
**Sent:** Monday, January 13, 2020 14:09  
**To:** Mike Dane  
**Subject:** RE: Helicopter Ratio  
**Attachments:** Helicopter vs Airplane Commercial Rating.xlsx

Mike,

Attached is a spreadsheet that shows the differences in Airplane vs Helicopter required maneuvers and our approved FAA 141 hours from commercial rating.

76% of required maneuvers from Helicopter commercial rating are conducted in the airport environment while 56% percent of the maneuvers for Airplane commercial rating are at the airport.

17% of the hours for helicopter commercial training are cross county and 28% of the hours for airplane are cross country. Helicopter distance for cross country is 25NM and airplane is 50NM, so airplanes have to fly further away before it is considered cross county time.

11% of the hours for helicopter commercial training are solo, while 57% in airplane are solo. Since there is so much solo time in commercial airplane our student conduct a larger percentage of this time away from the airport. Helicopter solo time is limited so it is typically spent at the airport, the only solo time outside of the airport is the required solo cross country.

These items plus the fact the pattern is lower and smaller should easily justify the higher operation count ratio.

Let me know if you have any questions.

Thanks,

**Travis Warthen**  
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## BEND MUNICIPAL AIRPORT

### CHAPTER 3: AVIATION ACTIVITY FORECASTS

**Disclaimer (8/7/2020):** This forecast was prepared prior to the impacts of COVID-19. The forecast approval is based in reference to the data and methodologies used and the conclusions at the time the document was prepared. However, consideration must still be given to the significant impacts of COVID-19 on aviation activity; as a result, there is lower than normal confidence in future growth projections. FAA approval of the forecast does not provide justification to begin airport development. Justification for future projects will be made based on activity levels at the time the project is requested for development, rather than this forecast approval. Further documentation of actual activity levels reaching the planning activity levels will be needed prior to FAA participation in funding for eligible projects.

### 3.1 FORECAST OVERVIEW

The City of Bend and Deschutes County are growing across all indicators analyzed in this forecast chapter. In the ten years between 2008 and 2018, the Population Research Center (PRC) at Portland State University indicates the population of Deschutes County has grown by 27.4 percent, gross municipal product has grown by 28.0 percent, and employment has completely recovered and surpassed pre-recession levels.

Total operations at Bend Municipal Airport (BDN or the Airport) have increased by 24.6 percent over the last eight years. Totals operations are forecasted to increase by 59.4 percent from 2018 to 2038, reaching 194,500 by 2038. Based aircraft are expected to total 303 by 2038 with single-engine piston seeing the largest growth of 59 additional based aircraft (from 2018) due to the growth of the flight schools. BDN, with its fixed base operator (FBO), fuel for both piston and jet aircraft, and no control tower, remains the primary general aviation (GA) airport in Deschutes County. **Table 3-1** shows a summary of the demand forecasts.

**TABLE 3-1: FORECAST SUMMARY**

Category	2010	2018	2038	CAGR 2018-2038
<b>Aircraft Operations</b>	<b>97,928</b>	<b>122,045</b>	<b>194,500</b>	<b>2.4%</b>
<b>Itinerant Operations</b>	<b>44,558</b>	<b>39,996</b>	<b>66,000</b>	<b>2.5%</b>
Air Carrier	0	0	0	0.0%
Commuter/Air Taxi	1,290	1,290	1,800	1.7%
GA	32,000	24,630	34,300	1.7%
Flight Training	11,268	14,076	29,900	3.8%
<b>Local Operations</b>	<b>53,370</b>	<b>82,049</b>	<b>128,500</b>	<b>2.3%</b>
GA	8,300	6,458	8,900	1.6%
Flight Training	45,070	75,591	119,600	2.3%
<hr/>				
<b>Based Aircraft</b>	<b>215</b>	<b>244</b>	<b>303</b>	<b>1.1%</b>
Single-Engine Piston	148	191	240	1.1%
Multi-Engine Piston	15	19	18	-0.3%
Jet & Turbo-Prop	14	11	16	1.9%
Helicopter	30	23	29	1.1%
Other	8	0	0	0.0%

**CAGR:** Compound Annual Growth Rate

Source: 2010 operation data is air traffic estimates based on the 2010 BDN Master Plan, 2010 based aircraft totals based on 2010 BDN Master Plan, validated based aircraft from BasedAircraft.com for 2018, operations based on estimates for 2018, Master Plan forecasts for 2038.

## 3.2 INTRODUCTION TO FORECASTS

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

- Based Aircraft
- Aircraft Operations (Itinerant, Local, Flight Training)

The aviation activity forecasts have a base year of 2018 and use the Federal Aviation Administration (FAA) fiscal year (October to September). The base year is 2018 because that is the last year of complete data available when the forecasts were prepared. The forecast covers a 20-year period with reporting intervals at 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 or will need to be modified to handle future demand (operations and based aircraft). The FAA Seattle Airports District Office reviews forecasts for rationality and comparison to the FAA TAF.

The chapter is organized in the following sections:

- Community Profile
- Aviation Activity Profile
- General Aviation Forecasts
- Flight Training Forecasts
- Critical Aircraft
- Forecast Summary

**Table 3-2** describes the data sources used in this chapter.

### 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 ARC is a composite of the AAC and ADG of the critical aircraft.

### Based Aircraft

Aircraft that are stored at BDN, either 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.

### 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 at one airport and terminates at a different airport. For example, an aircraft flying from BDN to another airport.

### Local Operation

An operation that originates and terminates at the same airport. For example, an aircraft takes off from BDN, remains near the airport to practice flight maneuvers, and then lands at BDN.

### 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 3-2: DESCRIPTION OF DATA SOURCES**

Source	Description
<b>FAA TAF</b>	The FAA TAF, published in February 2019, provides forecasts for operations and based aircraft at BDN. The forecasts are based on growth rates from the previously prepared master plan forecast that were approved by the FAA. These forecasts serve as a comparison for forecasts prepared as part of this planning effort and provide historical information on aircraft activity. Due to the absence of a control tower at BDN, the TAF does not provide much historical context.
<b>FAA Aerospace Forecast</b>	The Aerospace Forecast 2018-2038 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.
<b>Traffic Flow Management System Counts (TFMSC)</b>	The TFMSC includes data collected from flight plans. These operations are categorized by aircraft type and used to identify trends in the BDN fleet mix. The advantage of the TFMSC data is its degree of detail and insights into the itinerant users of BDN. 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.
<b>Socioeconomic Data</b>	<p>Socioeconomic data is provided by data vendor Woods &amp; Poole, Inc. (W&amp;P). Population data is provided by the PRC at Portland State University.</p> <p>The Census provides population estimates for the City of Bend and Deschutes County with the most recent estimates coming from the 2015 American Community Survey. The Census provides the current estimate for 2018 as of July 1, 2018. Census data was consulted but not used to compare the population of Bend to Deschutes County. Data is from 2010 to 2018.</p> <p>The PRC produces the annual population estimates for Oregon and its counties and cities, as well as the estimates by age and sex for the state and its counties. These estimates are used by the state and local governments, various organizations, and agencies for revenue sharing, funds allocation, and planning purposes.</p> <p>The W&amp;P dataset considers the Bend-Redmond Metropolitan Statistical Area and provides 124 data categories with records from 1970 to 2018 and forecast through 2040. Data categories considered include population, employment, earnings and income, and gross municipal product.</p>

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

**TABLE 3-2: DESCRIPTION OF DATA SOURCES (CONTINUED)**

Source	Description
<b>State Plans</b>	The Oregon Aviation System Plan (OASP) was last prepared in 2007, and projects aviation activity through 2025 from the forecast base year of 2005. The OASP projects that GA operations in the state will increase from 1,917,541 operations in 2015 to 2,216,213 in 2025. Based aircraft will increase from 5,569 in 2015 to 6,225 in 2025. BDN is listed as a Category II – Urban General Aviation Airport.
<b>Stakeholders</b>	The aviation forecasting team collected data from the airport sponsor and the City of Bend and collected data from tenants from the tenant survey that was issued to airport users.
<b>FBO</b>	While fuel consumption data was consulted, it was not used for the forecast. FBO provided details on current flight training operations and based aircraft fleet. This information was consulted and used for flight training operation forecasts.

## 3.3 COMMUNITY PROFILE

The community profile describes the location of BDN and the community it serves. BDN is in the Bend Micropolitan Statistical Area (MSA), which coincides with the boundary of Deschutes County. The MSA includes the service area of the Airport. This section describes the community population, employment and economic development, gross regional product (GRP), and the catchment areas and competition. These characteristics comprehensively form BDN's community profile.

### 3.3.1 POPULATION

**Table 3-3** shows the PRC population records for the MSA from 2008 to 2018 and the forecast through 2038. The MSA grew at a compound annual growth rate (CAGR) of 2.5 percent from 2008 and 2018, increasing the total population by more than 54,000. The MSA population is forecasted to grow at a CAGR of 1.6 percent, reaching more than 260,000 by 2038. **Table 3-4** shows PRC estimates to compare the City of Bend and Deschutes County populations. The City of Bend makes up 47.4 percent of the total population in Deschutes County. The City of Bend and Deschutes County have been experiencing growth from 2008 to 2018. The City of Bend has a CAGR of 2.3 percent while Deschutes County is outpacing the City in population growth with a CAGR of 2.5 percent.

March 23, 2020

**Table 3-3: Deschutes County Population**

Year	Population	Percent Change
2008	148,297	N/A
2013	165,485	11.6%
<b>2018</b>	<b>188,980</b>	<b>14.2%</b>
2023	202,547	7.2%
2028	222,368	9.8%
2033	241,413	8.6%
2038	260,130	7.8%
CAGR (2008-2018)	2.5%	N/A
CAGR (2018-2038)	1.6%	N/A

**CAGR:** Compound Annual Growth Rate

Source: PRC

**Table 3-4: Population Comparisons**

Year	City of Bend	Percent of County Population	Percent Change	Deschutes County	Percent Change
2008	71,001	47.9%	N/A	148,297	N/A
2009	73,815	48.2%	4.0%	153,026	3.2%
2010	76,740	48.6%	4.0%	157,905	3.2%
2011	77,633	48.4%	1.2%	160,392	1.6%
2012	78,536	48.2%	1.2%	162,919	1.6%
2013	79,450	48.0%	1.2%	165,485	1.6%
2014	80,375	47.8%	1.2%	168,092	1.6%
2015	81,310	47.6%	1.2%	170,740	1.6%
2016	83,500	47.3%	2.7%	176,635	3.5%
2017	86,765	47.4%	3.9%	182,930	3.6%
2018	89,505	47.4%	3.2%	188,980	3.3%
CAGR	2.3%	-0.1%	N/A	2.5%	N/A

**CAGR:** Compound Annual Growth Rate

Source: PRC

### 3.3.2 EMPLOYMENT AND ECONOMIC DEVELOPMENT

In terms of economics, Woods & Poole data indicate that the economy of the Bend-Redmond MSA has shown recovery since the end of the 2007-2009 recession and has seen continued growth after economic recovery. MSA employment has seen an increase of 18.8 percent since 2008, with total employment growing at an annual average rate of 1.7 percent from 2008 to 2018. Employment per capita dropped from 0.62 in 2008 to 0.57 in 2018. Economic recovery and growth continue to increase total employment, with a 11.2 percent increase between 2013 and 2018. Woods & Poole forecasts total employment to continue growing over the next 20 years with a CAGR of 1.8 percent and an employment per capita ratio of 0.60 by 2038.

March 23, 2020

Top industries by total employment in 2008 were:

- Retail trade
- Health care and social assistance
- Accommodation and food services
- Construction
- State and local government

These industries continued to make up the top five industries by employment in 2018 with real estate, rental, and leasing overtaking construction. Construction falls out of the top industries by employment due to the decline in labor intensive industries (construction, mining, and manufacturing) and growth in less labor-intensive industries like healthcare and professional services. From 2013 to 2018, every industry in the top five saw recovery and growth in total employment. Forecasts show that, by 2038, health care & social assistance will continue to employ the most people in the MSA and that state and local government employment will be overtaken by professional and tech services. Total employment and jobs per capita are presented in **Table 3-5**. Top industries by employment and sales are presented in **Table 3-6**.

**Table 3-5: MSA Employment**

Calendar Year	Total Employment	Percent Change	Employment/Capita
2008	91,423	N/A	0.62
2013	97,706	6.9%	0.59
<b>2018</b>	<b>108,633</b>	<b>11.2%</b>	<b>0.57</b>
2023	119,835	10.3%	0.59
2028	131,404	9.7%	0.59
2033	144,927	10.3%	0.60
2038	155,313	7.2%	0.60
CAGR (2008-2018)	1.7%	N/A	-0.7%
CAGR (2018-2038)	1.8%	N/A	0.2%

**Note:** Employment per Capita = Total Employment / Total Population

**CAGR:** Compound Annual Growth Rate

Source: Woods & Poole

**Table 3-6: Top Industries by Employment and Retail Sales**

MSA Top 5 Industries by Employment 2008 – 2018						
Rank	Industry	Jobs	Industry	Jobs	Δ	Jobs
1	Retail Trade	11,274	Retail Trade	11,980	6.3%	Health Care & Social
2	Health Care & Social	10,001	Health Care & Social	11,824	18.2%	Retail Trade
3	Accom. + Food Serv.	7,903	Accom. + Food Serv.	8,926	12.9%	Accom. + Food Serv.
4	Construction	7,816	Real Estate & Rental	7,487	12.8%	State + Local Govt.
5	State + Local Govt.	6,986	State + Local Govt.	7,482	7.1%	Real Estate & Rental
MSA Top 5 Industries by Retail Sales 2008 – 2018						
Rank	Industry	Sales (\$M)	Industry	Sales (\$M)	Δ	Sales(\$M)
1	Motor Vehicles & Parts	\$715.8	Motor Vehicles & Parts	\$869.1	21.4%	Motor Vehicles & Parts
2	Gen. Merchandise	\$690.0	Gen. Merchandise	\$753.0	9.1%	Gen. Merchandise
3	F&B Retail	\$450.2	F&B Retail	\$522.5	16.1%	F&B Retail
4	Eating & Drinking Places	\$316.8	Eating & Drinking Places	\$382.4	20.7%	Eating & Drinking Places
5	Building Materials	\$305.7	Building Materials	\$312.1	2.1%	Building Materials
MSA Top 5 Industries by Employment 2018 – 2038						
Rank	Industry	Jobs	Industry	Jobs	Δ	Jobs
1	Health Care & Social	13,908	Health Care & Social	19,148	37.7%	Health Care & Social
2	Retail Trade	13,469	Retail Trade	15,758	17.0%	Retail Trade
3	Accom. + Food Serv.	9,845	Accom. + Food Serv.	11,747	19.3%	Accom. + Food Serv.
4	State + Local Govt.	8,231	Real Estate & Rental	9,925	20.6%	Real Estate & Rental
5	Real Estate & Rental	8,227	State + Local Govt.	9,602	16.7%	Prof. & Tech Services
MSA Top 5 Industries by Retail Sales 2018 – 2038						
Rank	Industry	Sales (\$M)	Industry	Sales (\$M)	Δ	Sales(\$M)
1	Motor Vehicles & Parts	\$1,055.0	Motor Vehicles & Parts	\$1,325.9	25.7%	Motor Vehicles & Parts
2	Gen. Merchandise	\$854.6	Gen. Merchandise	\$1,131.2	32.4%	Gen. Merchandise
3	F&B Retail	\$578.2	F&B Retail	\$685.0	18.5%	Eating & Drinking Places
4	Eating & Drinking Places	\$450.5	Eating & Drinking Places	\$613.1	36.1%	F&B Retail
5	Building Materials	\$357.7	Building Materials	\$451.7	26.3%	Building Materials

**Notes:** Δ = Total percent change from period before (10 years). Retail sales presented in millions of inflation-adjusted 2018 dollars. Accom. + Food Serv. = Accommodation and Food Services (e.g. hotels). F&B Retail = Food and Beverage Retail (e.g. grocery stores). Gen. Merchandise = General Merchandise is a wide array of retail except for food and beverage (e.g. clothing, hardware, etc.). Health Care & Social Assistance. Real Estate & Rental = Real Estate & Leasing. Building Materials = Building Materials & Garden. Prof & Tech Services = Professional & Tech Services

Source: Woods & Poole

### 3.3.3 GROSS REGIONAL PRODUCT (GRP)

GRP is the value of goods and services produced in the MSA. GRP serves as an index for the health of the overall economy. GRP increases as the economy produces more goods, more valuable goods, and a combination of the two. **Table 3-7** shows the GRP of the MSA from 2008 to 2038.

**Table 3-7: MSA Gross Regional Product**

Calendar Year	GRP (\$M)	Percent Change
2008	\$7,488.27	N/A
2013	\$8,492.49	13.4%
2018	\$9,580.66	12.8%
2021	\$10,709.46	11.8%
2028	\$11,886.67	11.0%
2031	\$13,274.26	11.7%
2038	\$14,346.64	8.1%
<b>CAGR</b>		
'08 - '18	2.5%	N/A
'18 - '38	2.0%	N/A

**Note:** GRP is inflation-adjusted 2018 dollars

Source: Woods & Pool

### 3.3.4 CATCHMENT AREA 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.

BDN is one of three GA airports serving Deschutes County. Deschutes County has two other GA airports and one commercial airport: Sisters Eagle Air (6K5), which is 20 miles away from BDN; Sunriver Airport (S21), which is 22 miles away; and Redmond Municipal Airport (RDM), which is 11 miles away. These airports provide GA users with choices for aircraft storage and service. RDM is the only airport in Deschutes County that has a precision approach. **Table 3-8** provides a summary of these airports.

**Table 3-8: Nearby Airports**

Airport	Characteristics			Markets Served			
	Runway Length	Instrument Procedure	Jet A & FBO	Large Jets	Small Jets	Turbo-Props	Piston
Bend (BDN)	5,200 feet	Non-Precision	Yes	No <sup>1</sup>	Yes	Yes	Yes
Redmond (RDM)	7,038 feet 7,006 feet	Precision Non-Precision	Yes	Yes	Yes	Yes	Yes
Sisters (6K5)	3,560 feet	Visual	No	No	No	No	Yes
Sunriver (S21)	5,461 feet	Non-Precision	No (FBO) Yes (Jet A)	No	Yes	Yes	Yes

<sup>1</sup>: Large jets can and do land at BDN. However, the lack of a precision instrument approach and the existing runway length means that BDN does not have all-weather reliability and enough runway length during hot temperatures that owners of large jets look for when basing their aircraft. BDN serves large jets on an itinerant basis but does not have any based large jets.

Sources: Airport Facilities: FAA Airport Facilities Directory; Primary Market: Consultant assessment derived from based aircraft records and available facilities listed on the 5010 (runway length, fuel, instrument procedures)

Markets served by each airport are described in **Table 3-8**. 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. They tend not to be operated when visibility is particularly low or during stormy weather due to their susceptibility to strong winds and turbulence. For this reason, piston aircraft owners generally have fewer requirements for the airport where they base their aircraft than business jet owners have.

Large jets, such as a Gulfstream IV, can and do land at BDN. However, the lack of a precision instrument approach and the existing runway length means that the Airport does not have all-weather reliability and does not have enough runway length during hot days that owners of large jets look for when choosing a permanent base for their aircraft. BDN serves large jets on an itinerant basis but does not have any based large jets. Existing based jet aircraft include the Cessna Citation Mustang, Cessna Citation 550, and Cessna Citation 510.

BDN is the only GA airport in Deschutes County that has an FBO and both 100LL and Jet A fuel, all of which are services that attract GA pilots to BDN. RDM also has an FBO and both 100LL and Jet A fuel, but RDM is a commercial service airport. S21 has 100LL and Jet A fuel but does not have an FBO. The lack of services at 6K5 and S21 diminish the level of competition BDN has with these airports for GA users.

## 3.4 AVIATION ACTIVITY PROFILE

The aviation activity profile is the baseline of the forecasts. The profile shows trends in activity at the Airport and explains what, how, and why changes have occurred. Sources for the information used in this document include the FAA, the City of Bend, and Airport tenants. This section is organized in the following order:

- FAA Terminal Area Forecast
- General Aviation
- Military
- Itinerant Air Taxi Operations

### 3.4.1 FAA Terminal Area Forecast (TAF)

Historic TAF data for airports comes from FAA Form 5010, which airports submits annually to the FAA. The TAF reports forecasts for airports because the growth rates applied to the 5010 data are approved by the FAA from master plan forecasts. The TAF includes all airports in the FAA National Plan of Integrated Airport Systems and is not a forecast prepared by the FAA for airports. The TAF reports data using the FAA fiscal year (October to September).

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 within 15 percent over the ten-year period, can be approved by the Airport District offices. Forecasts outside of these tolerances go to FAA Headquarters for review.

Data in the TAF includes passenger enplanements, operations, and based aircraft, but does not breakdown operations by aircraft type, peak activity levels, critical aircraft, or air cargo. The February 2019 TAF was used for this forecast. The TAF provides a record of aviation activity at BDN from 1990 to 2018, and forecasts from 2019 to 2040. Due to the absence of an airport traffic control tower, records are considered estimates.

### 3.4.2 General Aviation (GA)

GA describes flight activities that are not performed by passenger and cargo airlines and the military. GA 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 GA businesses and activities at BDN.

## GA Businesses

GA businesses include those that offer services to the flying public (e.g., FBOs), those that design and construct aircraft, and companies that use aircraft as part of their business (e.g., aerial photography, flight training, sightseeing, and employee transport). There are currently three GA businesses at BDN:

- Leading Edge Jet Center
  - The only FBO at BDN.
  - Sells 100LL and Jet A fuel for full service or self service.
  - Is a part 141 flight school and part 145 repair station.
  - Offers overnight hangar space and tie downs, de-icing service, courtesy cars, passenger lounge, and pilot's lounge.
- Bend Aircraft Mechanics
  - Offers aircraft maintenance and flight training.
- Bentley Air
  - Offers aircraft maintenance, avionics sales and service, aircraft modifications, and aircraft parts.

## Flight Training

Leading Edge Jet Center and Bend Aircraft Mechanics both offer flight training services to people who want to learn how to fly. The flight training information in this section was provided during interviews with each flight school at the Airport. Bend Aircraft Mechanics have seven fixed wing aircraft in their based aircraft fleet at BDN for 2018. Leading Edge Jet Center has a total fleet of 29 based aircraft at BDN for 2018. This fleet includes 13 fixed wing aircraft and 16 helicopters. Only 10 of the 16 helicopters are used for flight training operations. Table 3-9 shows historic flight training estimates for 2010, 2014, and current 2018 estimates. Flight training operation estimates for 2018 are below.

- Leading Edge Jet Center
  - Fixed wing flight training – 10,516.5 flight hours, 3.93 operations per flight hour, for a total of 41,330 operations in 2018.
  - Helicopter flight training – 5,510.4 flight hours, 7 operations per flight hour, for a total of 38,573 operations.
  - 79,903 estimated total operations.
- Bend Aircraft Mechanics
  - Fixed wing flight training – 2,255 flight hours, 4.33 operations per flight hour, for a total of 9,764 operations.
- Total flight training operations estimated for 2018 are 89,667.
- There are 30 flight training aircraft at BDN for 2018.

**Table 3-9: Flight Training Estimates**

Calendar Year	Fixed Wing Operations	Helicopter Operations	Total
2010	17,458	38,880	56,338
2014	23,834	63,094	86,927
2018	51,094	38,573	89,667
<b>CAGR</b>			
'10 - '18	14.4%	-0.1%	6.0%
'14 - '18	21.0%	-11.6%	0.8%

**CAGR:** Compound Annual Growth Rate

Source: 2010 operation estimates come from the 2010 Master Plan. 2014 operation estimates come from the 2014 Environmental Assessment. 2018 operation estimates come from 2018 Master Plan.

The 2010 Master Plan for BDN estimated that there were 56,338 flight training operations for 2010. The 2014 Environmental Assessment for BDN estimated there were 86,927 flight training operations for 2014. Comparing the 2010 Master Plan and the 2018 flight training operation estimates, flight training operations have increased by 33,329 operations, an increase of 59.2 percent, and growth rate of 6.0 percent since the 2010 flight training operation estimates. Flight training operations between fixed wing and helicopters have flipped due to the pilot shortage and the need for pilots who can fly fixed wing aircraft in the airlines.

There are two factors for the growth in flight training operations between 2010 and 2018: the demand for pilots from airlines nationwide and the Central Oregon Community College (COCC) campus in the city of Bend. Airlines are currently experiencing a pilot shortage. As pilots retire, airlines must hire new pilots to replace the retiring pilots, creating a demand for people who have the flight training and necessary experience to operate commercial aircraft. The expense of learning how to fly and the experience that airlines and the FAA require to fly commercially compounds the pilot shortage problem. COCC has an aviation program that teaches students to learn to fly at a faster rate than a four year college and provides a path for students to graduate and enter the aviation industry.

### COCC Aviation Program

The COCC aviation program is a two-year program that allows students to earn their private pilots' licenses. Students can earn up to the CFI certificate/rating (CFI, CFI). **Table 3-10** shows the current and historic enrollment of the program for students who are learning to fly. Enrollment has almost doubled since 2008, with peak enrollment in 2015 of 207 students. COCC has a current waitlist of 50 students who want to learn to fly. There has not been a waitlist for students prior to 2018. Students have access to student federal financial aid and scholarships (aviation and academic) to help afford attending COCC,

COCC plans to expand the aviation program by increasing the number of students they can handle but there are factors that limit the pace of expansion. These factors include:

- Flight Training Aircraft Availability.
- CFI Availability.
- Concerns about Congested Airspace.
- Restriction on the number of veterans in program set by Department of Veteran Affairs.

COCC does not have any plans on expanding the curriculum of the aviation program because the college already offers everything through instructor certification and is able to have students earn necessary flight hours. The more students that earn their CFI ratings, the availability of CFIs will increase. Additional flight training aircraft that are added at BDN will increase the amount of available flight training aircraft for students. The Department of Veteran Affairs restricts the number of veterans that can enroll at COCC at any given time and the number of veteran students will always have a cap unless the Department of Veteran Affairs increases the number of veteran students allowed. Airspace at BDN is busy, not only due to the amount of flight training students learning to fly, but also for non-flight training GA activity. If capacity at BDN becomes an issue, then the amount of flight training operations can stagnate or decline due to COCC limiting how many students they can handle.

**Table 3-10: COCC Enrollments**

Year	BDN Operations
2008	100
2009	115
2010	130
2011	140
2012	170
2013	190
2014	178
2015	207
2016	185
2017	196
2018	189
CAGR	6.6%

**CAGR:** Compound Annual Growth Rate

Source: COCC. COCC introduced tracking software in 2014 to keep track of enrollments. Enrollments before 2014 are estimates. Enrollments only include students who are learning to fly.

On average, COCC graduates 25 to 30 students per year at a 70 percent completion rate, with student employment after graduation averaging over 80 percent. Employment after graduation averages over 80 percent in part due to positive feedback from the industry regarding quality graduates from COCC and the Horizon Airlines Pilot Development Program. The Horizon Airlines Pilot Development Program is a competitive program where Horizon Airlines presents and interviews qualified candidates twice a year for the chance of a job upon graduation. While the Horizon Airlines Pilot Development Program is competitive and only qualified graduates are considered, the program develops a pipeline for students to become commercial pilots. COCC has informally hosted other airlines and helicopter companies for recruiting visits because of quality graduates entering the industry, examples of recruiters include Sky West Airlines and Piedmont Airlines.

### **Itinerant GA Operations**

Itinerant GA operations originate and terminate at different airports. Operators may include business travelers, student pilots performing cross country training flights, and recreational pilots. The TAF combines both itinerant GA and itinerant flight training operations; there is not a separate category in the TAF for each type of operation. Flight training operations will have a separate forecast from itinerant GA operations in this chapter. The 2010, 2014, and 2018 itinerant GA operations totals in **Table 3-9** is less itinerant flight training operations. Itinerant GA operations made up 20.2 percent of overall operations at BDN in 2018. The CAGR for BDN itinerant GA operations is -1.3 percent but is misleading due to the separation of itinerant GA operations and itinerant flight training operations. If itinerant flight training operations are added to itinerant GA operations, the result is 38,707 operations in 2018, a CAGR of 3.3 percent. BDN itinerant GA operations have outperformed those of the United States, which have declined at an average of 1.6 percent per year from 2008 to 2018. BDN itinerant GA operations have also outperformed those of Oregon, which has declined at an average of 0.5 percent per year from 2008 to 2018. Itinerant GA operations at BDN, Oregon, and the United States are shown in **Table 3-11**.

**Table 3-11: Itinerant GA Operations**

Year	BDN Itinerant GA Operations	% Change	United States Itinerant GA Operations	% Change	Oregon Itinerant GA Operations	% Change
2008	28,100	N/A	37,770,688	N/A	786,821	N/A
2009	28,990	3.2%	35,489,531	-6.0%	777,300	-1.2%
<b>2010</b>	<b>32,000</b>	<b>10.4%</b>	<b>34,399,258</b>	<b>-3.1%</b>	<b>674,812</b>	<b>-13.2%</b>
2011	49,041	53.3%	33,765,675	-1.8%	730,230	8.2%
2012	50,243	2.5%	33,639,470	-0.4%	746,710	2.3%
2013	51,474	2.5%	33,100,686	-1.6%	728,348	-2.5%
<b>2014</b>	<b>39,197</b>	<b>-23.9%</b>	<b>32,570,102</b>	<b>-1.6%</b>	<b>732,630</b>	<b>0.6%</b>
2015	69,737	77.9%	32,390,079	-0.6%	740,597	1.1%
2016	69,737	0.0%	32,023,522	-1.1%	714,325	-3.5%
2017	69,737	0.0%	31,830,540	-0.6%	703,457	-1.5%
<b>2018</b>	<b>24,630</b>	<b>-64.7</b>	<b>32,147,657</b>	<b>1.0%</b>	<b>744,816</b>	<b>5.9%</b>
CAGR	-1.3%	N/A	-1.6%	N/A	-0.5%	N/A

**CAGR:** Compound Annual Growth Rate

Source: 2008 to 2009, 2011 to 2013, 2015 to 2017 data from FAA Terminal Area Forecast, 2010 data is air traffic estimates based on the 2010 BDN Master Plan, 2014 data based on estimate from 2014 Environmental Assessment (EA) for Eastside Helicopter Operations Area, 2018 data based on estimate of current operations.

TAF operations for GA airports without a control tower, like BDN, are estimates. Itinerant GA operation estimates were updated for 2010, 2014, and 2018, instead of using TAF operation totals for those years. These operation estimates replace the TAF operation totals because they represent itinerant GA operations that are not itinerant flight training operations. The economic recession in 2008 led to operations declining nationally. Nationally, itinerant GA operations fell by approximately 2.3 million operations (-6.0 percent) in 2009 and declined further in 2010 by approximately 1.1 million operations (-3.1 percent). The TAF shows no change in itinerant GA operations at BDN between 2015 and 2017.

National itinerant GA operations declined at a CAGR of 1.6 percent from 2008 to 2018. National itinerant GA operations grew by approximately 300,000 operations in 2018, the first time these operations increased in the past ten years. The decline in national itinerant operations is indicative of an industry in the process of adjustment. Some GA sectors are growing while others are declining. The 2018 FAA Aerospace Forecast shows that, in 2018, aircraft with piston engines made up 68.7 percent of the national GA fleet, and turbine (jet and turbo-prop) aircraft made up 14.6 percent. Hours flown by piston aircraft have declined by an annual average of 1.9 percent since 2008, while hours flown by turbine aircraft have grown by 2.3 percent per year. Similarly, the overall number of active piston aircraft has declined by an annual average of 1.8 percent while active turbine aircraft have grown by an annual average of 2.8 percent.

The number of active rotorcraft (helicopters) have grown by an annual average of 1.9 percent, and other aircraft (experimental, sport, gliders, ultralights) declined by an annual average of 1.9 percent since 2008. Oregon itinerant GA operations declined at a CAGR of 0.5 percent from 2008 to 2018. Oregon itinerant GA operations have been increasing since 2010, adding approximately 70,000 additional operations but still below the total itinerant operations in 2008.

The GA market is readjusting to 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 are growing segments within the itinerant GA market due to helicopter and turbine growth.

Factors that help BDN sustain its level of itinerant GA operations include having a FBO, 100LL and Jet A fuels, aircraft maintenance services, growing economy, and growth in high tech industries.

### Local GA Operations

Local GA operations originate and terminate at the same airport and are generally performed by pilots (both student and licensed) that are practicing landings. Local operations can vary greatly based on the level of flight training at an airport, and how active the resident GA community is. Local operations include touch-and-go landings, as defined earlier in this chapter, which count as two operations. The TAF combines both local GA and local flight training operations; there is not a separate category in the TAF for both types of operations. Flight training operations will have a separate forecast from local GA operations in this chapter. The 2010, 2014, and 2018 local GA operation totals in **Table 3-12** is less local flight training operations. Local GA operations at BDN, Oregon, and nationally are shown in **Table 3-12**.

Table 3-12: Local GA Operations

Year	BDN Local Operations	% Change	United States Local GA Operations	% Change	Oregon Local GA Operations	% Change
2008	11,146	N/A	40,174,056	N/A	715,191	-8.3%
2009	11,511	3.3%	38,036,901	-5.3%	655,810	-4.8%
<b>2010</b>	<b>8,300</b>	-27.9%	<b>36,759,001</b>	-3.4%	<b>624,246</b>	-2.9%
2011	50,144	504.1%	36,073,183	-1.9%	606,205	0.7%
2012	51,357	2.4%	35,878,132	-0.5%	610,524	2.8%
2013	52,600	2.4%	35,664,061	-0.6%	627,889	-1.2%
<b>2014</b>	<b>10,099</b>	-80.8%	<b>35,566,984</b>	-0.3%	<b>620,051</b>	7.7%
2015	70,338	596.5%	35,859,806	0.8%	667,554	-4.6%
2016	70,338	0.0%	35,516,176	-1.0%	636,684	1.1%
2017	70,338	0.0%	35,548,148	0.1%	643,388	3.1%
<b>2018</b>	<b>6,458</b>	-90.8%	<b>36,243,419</b>	2.0%	<b>663,252</b>	-8.3%
CAGR	-5.3%	N/A	-1.0%	N/A	-0.8%	N/A

**CAGR:** Compound Annual Growth Rate

Source: 2008 to 2009, 2011 to 2013, 2015 to 2017 data from FAA Terminal Area Forecast, 2010 data is air traffic estimates based on the 2010 BDN Master Plan, 2014 data based on estimate from 2014 EA for Eastside Helicopter Operations Area, 2018 data based on estimate of current operations.

Local GA operation estimates were updated for 2010, 2014, and 2018, instead of using TAF operation totals for those years. These operation estimates replace the TAF operation totals because they represent local GA operations that are not local flight training operations. Nationally, local GA operations fell by approximately 2.1 million operations (-5.3 percent) in 2009 and declined further in 2010 by approximately 1.3 million operations (-3.4 percent). There was no change in the TAF estimate for local GA operations at BDN between 2015 to 2017. The CAGR for BDN local operations is -5.3 percent but is misleading due to the separation of local GA operations and local flight training operations. If local flight training operations are added to local GA operations, the result is 82,049 operations in 2018, a CAGR of 22.1 percent which is a positive rate. Nationally, local GA operations remained essentially flat between 2012 to 2017 and has seen growth of approximately 700,000 operations (2.0 percent) in 2018. Oregon local GA operations declined at a CAGR of 0.8 percent from 2008 to 2018. Oregon local GA operations have been increasing since 2010, adding approximately 8,000 additional operations but still below the total local operations in 2008.

BDN has two factors that help to retain and grow local operations: recreational pilots on the airport, and the number of based aircraft on the field. Recreational pilots routinely practice touch-and-go operations to accumulate flight hours. As of 2018, BDN has 244 based aircraft, which includes 191 single-engine piston (SEP) aircraft, 19 multi-engine piston (MEP) aircraft, 11 jets, and 23 helicopters. Local operations generally consist of helicopter and SEP aircraft. This means there is a strong presence of local pilots that base their aircraft at BDN and conduct local operations from the Airport.

## Based Aircraft Terminology

### Single-Engine Piston (SEP)

SEP aircraft have one piston-powered engine. These aircraft are generally smaller and often used for flight training and recreational flying but may be used for municipal business trips. Depending on weight and operator certification, these aircraft generally require only one pilot.

### Multi-Engine Piston (MEP)

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

### Jets

Jet aircraft have 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 aircraft, 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 have 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

This category includes experimental, sport, glider, and ultralight aircraft. These aircraft are used for recreational flying.

- Experimental aircraft refer to kit airplanes built by users or third parties other than the original manufacturer. Experimental aircraft share many characteristics with SEP aircraft; 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 pounds 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 BDN. Based aircraft do not include visiting itinerant aircraft. The FAA breaks down based aircraft into distinct categories based on an aircraft's propulsion system, engine configuration, and weight. As mentioned previously, based on 2018 counts, there are 191 SEP aircraft at BDN. This makes up 78.3 percent of the total based fleet. Additionally, there are 11 jets, 19 MEP aircraft, and 23 helicopters. There are no "Other" aircraft based at BDN. **Table 3-13** shows based aircraft records from 2008 to 2018.

**Table 3-13: Based Aircraft Fleet**

Year	SEP	Jet	MEP	Heli.	Other	Total	Change
2008	160	4	16	8	11	199	N/A
2009	160	4	16	8	11	199	0.0%
<b>2010</b>	<b>148</b>	<b>14</b>	<b>15</b>	<b>30</b>	<b>8</b>	<b>215</b>	<b>8.0%</b>
2011	156	6	16	16	0	194	-9.8%
2012	159	6	16	28	3	212	9.3%
2013	172	7	19	32	11	241	13.7%
2014	188	7	17	23	11	246	2.1%
2015	181	7	19	19	0	226	-8.1%
2016	179	10	15	19	11	234	3.5%
2017	196	10	16	21	11	254	8.5%
<b>2018</b>	<b>191</b>	<b>11</b>	<b>19</b>	<b>23</b>	<b>0</b>	<b>244</b>	<b>-3.9%</b>
CAGR 08-18	1.8%	10.6%	1.7%	11.1%	-100.0%	2.1%	N/A

**CAGR:** Compound Annual Growth Rate

Source: 2008 to 2009, 2011 to 2013, 2015 to 2017 data from FAA Terminal Area Forecast, 2010 based aircraft totals based on 2010 BDN Master Plan, validated based aircraft from BasedAircraft.com for 2018.

Based aircraft totals at BDN have increased since 2008. Factors contributing to the increase of based aircraft from 2008 include the favorable flying conditions in central Oregon, an FBO at BDN, and flight training growth resulting in a growing flight training fleet at BDN. The number of based aircraft peaked at 254 in 2017 and hit a low of 185 in 2010. Factors contributing to the decline of based aircraft in 2010 include the recession, rising oil prices, growing costs associated with earning a private pilot's license, and growing cost of aircraft ownership. Historical data in the 2018 FAA Aerospace Forecast show that SEP and MEP aircraft have been retired and have not been replaced, with the combined fleet declining by 1.3 percent a year from 2010 to 2018. The national turbine fleet has grown by 2.2 percent per year, and the helicopter fleet has grown by 1.5 percent per year during this time.

The based aircraft fleet at BDN is also made up of the flight training aircraft from Bend Aircraft Mechanics and Leading Edge Jet Center. The flight schools have a total of 30 aircraft (19 SEP, 1 MEP, and 10 helicopters). Based aircraft for the flight schools will be forecasted separately from the rest of the based aircraft fleet at BDN.

### 3.4.3 MILITARY

There are no based military aircraft at BDN. The TAF indicates that there are no local military operations in the previous ten years or in the forecast, and that a total of 100 itinerant military operations occurred annually starting in 2010 and will continue with no change through 2040. 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 not 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.

### 3.4.4 GLIDERS

There was an estimate of 300 glider operations at BDN in 2018. Gliders can't be validated as based aircraft because they are easier to transport between airports compared to fixed wing aircraft. If gliders were counted as based aircraft, this could result in inaccurate based aircraft totals for airports. Glider operations occur at BDN during the spring and summer but will leave during the winter due to snow. Glider operations return to BDN once winter is over and there is no more snow. For planning purposes, glider operations are considered to remain constant throughout the forecast period.

### 3.4.4 ITINERANT AIR TAXI OPERATIONS

Itinerant taxi operations are aircraft with less than 60 seats that operate under Title 14 of the Code of Federal Regulations Part 91 (14 CFR 91), which pertains to GA, and 14 CFR 135, which pertains to on-demand air taxis (not airlines). Passengers who use air taxi operations under 14 CFR 91 and 135 are not counted towards enplanements for an airport, and the operators of these flights do not file passenger information with the U.S. Department of Transportation. There are no enplanements at the Airport.

Itinerant air taxi operation estimates were updated for 2010, 2014, and 2018, instead of using TAF operation totals for those years. These operation estimates are used in place of the TAF operation totals because the TAF only repeats 1,000 operations for each year and does not accurately reflect existing itinerant air taxi operations at BDN. Itinerant air taxi operations represent medevac and Part 135 charter operations. The FAA TAF indicates that national itinerant air taxi operations have been declining at average CAGR of 3.5 percent and Oregon itinerant air taxi operations have been declining at a CAGR of 6.5 percent from 2008 to 2018. Itinerant air taxi operations are shown in **Table 3-14**.

**Table 3-14: Itinerant Air Taxi Operations**

Year	BDN	% Change	United States	% Change	Oregon	% Change
2008	0	N/A	13,810,809	N/A	193,500	N/A
2009	0	0.0%	12,274,595	-11.1%	162,854	-15.8%
<b>2010</b>	<b>1,290</b>	<b>1290.0%</b>	<b>12,132,768</b>	<b>-1.2%</b>	<b>156,997</b>	<b>-3.6%</b>
2011	1,000	-22.5%	11,924,426	-1.7%	153,521	-2.2%
2012	1,000	0.0%	11,677,354	-2.1%	145,498	-5.2%
2013	1,000	0.0%	11,480,554	-1.7%	140,086	-3.7%
<b>2014</b>	<b>1,290</b>	<b>29.0%</b>	<b>11,043,849</b>	<b>-3.8%</b>	<b>131,923</b>	<b>-5.8%</b>
2015	1,000	-22.5%	10,502,680	-4.9%	113,625	-13.9%
2016	1,000	0.0%	10,096,885	-3.9%	105,322	-7.3%
2017	1,000	0.0%	9,696,583	-4.0%	101,031	-4.1%
<b>2018</b>	<b>1,290</b>	<b>29.0%</b>	<b>9,650,237</b>	<b>-0.5%</b>	<b>98,614</b>	<b>-2.4%</b>
CAGR	0.0%	N/A	-3.5%	N/A	-6.5%	N/A

**CAGR:** Compound Annual Growth Rate, CAGR is between 2010 to 2018 due to 2008 to 2009 having zero operations.

Source: 2008 to 2009, 2011 to 2013, 2015 to 2017 data from FAA Terminal Area Forecast, 2010 data is air traffic estimates based on the 2010 BDN Master Plan, 2014 data based on estimate from 2014 EA for Eastside Helicopter Operations Area, 2018 data based on estimate of current operations.

The gain of approximately 1,290 operations (1,290 percent) from 2009 to 2010 represents a readjustment in the estimate of itinerant air taxi operations at BDN. The CAGR between 2010 to 2018 is 0.0 percent due to the estimates for itinerant air taxi operations remaining flat. The economic recession in 2008 brought about a decline in national operations from 2008 to 2011. National itinerant air taxi operations fell by approximately 1.6 million operations (-11.1 percent) in 2009 and continued to decline to 2018. The TAF shows no change in itinerant air taxi operations at BDN between 2010 and 2017. The CAGR for BDN itinerant air taxi operations is misleading due to the jump in estimated operations in 2010 and 2018. Nationally, itinerant air taxi operations declined after the recession and continue to decline.

## 3.5 GENERAL AVIATION FORECASTS

GA forecasts consider flight training operations and flight training aircraft, based aircraft, itinerant (non-flight training) GA operations, and local (non-flight training) GA operations. GA covers the aspects of terrestrial flight that are not commercial or military, such as recreational flying, business aviation, flight instruction, and emergency services.

### 3.5.1 FLIGHT TRAINING OPERATIONS AND FLIGHT TRAINING AIRCRAFT

#### Methods

Flight training operation forecasts employ estimates of flight training operations at BDN for 2018 and information provided by the flight schools on their operations. Three forecasts (low, medium, and high) were created using the available data.

- Flight Training Information
  - Seven additional fixed wing aircraft to fleets in 2019.
  - Ten to 12 additional fixed wing aircraft to fleets in the next three to five years.
  - Could be adding one or two helicopters to fleets in the next ten years. Helicopter training has slowed down though.
  - 4.33 operations per flight hour for Bend Aircraft Mechanics fixed wing aircraft.
  - 3.93 operations per flight hour for Leading Edge fixed wing aircraft.
  - Seven operations per flight hour for helicopters.
  - Growth will continue if BDN can handle aircraft traffic.
  - Growth continues to stay strong due to airline demand in pilots and students learning to fly at BDN.
- Assumptions
  - Helicopter training has slowed down. The forecasts will assume there is the possibility that helicopters will not be added to the flight school fleets.
  - Flight schools near term information on growth ends at 2024.
  - Information from flight schools suggest that the overall growth in flight training is in part due to airline demand for new pilots.

**Low Forecast** – The low forecast follows the criteria below.

- Total of 17 additional aircraft for the flight schools by 2024. This is based on the low end of additional aircraft that each flight school plans and expects to add.
- Total aircraft were multiplied by the existing 2018 annual flight hours per aircraft for each flight school to obtain total annual flight hours.
- Leading Edge - Total annual flight hours were multiplied by 3.93 operations per flight hour for fixed wing and seven operations per flight hour for helicopters to obtain total operations between 2019 to 2024.
- Bend Aircraft Mechanics – Total annual flight hours were multiplied by 4.33 operations per flight hour for fixed wing operations to obtain total operations between 2019 to 2024.
- Future flight training operations between 2025 to 2038 remain flat because the near term information that was available about the flight schools ends at 2024.

**Medium Forecast** – The medium forecast follows the criteria below.

- Total of 20 additional aircraft for the flight schools by 2024. This is based on the medium end of additional aircraft that each flight school could add.

March 23, 2020

- Total aircraft were multiplied by the existing 2018 annual flight hours per aircraft for each flight school to obtain total annual flight hours.
- Leading Edge - Total annual flight hours were multiplied by 3.93 operations per flight hour for fixed wing and seven operations per flight hour for helicopters to obtain total operations between 2019 to 2024.
- Bend Aircraft Mechanics – Total annual flight hours were multiplied by 4.33 operations per flight hour for fixed wing operations to obtain total operations between 2019 to 2024.
- Future flight training operations between 2025 to 2038 remain flat because the near term information that was available about the flight schools ends at 2024.

**High Forecast** - The high forecast follows the criteria below.

- Total of 24 additional aircraft for the flight schools by 2024. This is based on the high end of additional aircraft that each flight school could add.
- Total aircraft were multiplied by the existing 2018 annual flight hours per aircraft for each flight school to obtain total annual flight hours.
- Leading Edge - Total annual flight hours were multiplied by 3.93 operations per flight hour for fixed wing and seven operations per flight hour for helicopters to obtain total operations between 2019 to 2024.
- Bend Aircraft Mechanics – Total annual flight hours were multiplied by 4.33 operations per flight hour for fixed wing operations to obtain total operations between 2019 to 2024.
- Future flight training operations between 2025 to 2038 remain flat because the near term information that was available about the flight schools ends at 2024.

### **Preferred Forecast (Low Forecast) and Flight Training Based Aircraft**

The preferred flight training operations forecast is the low forecast, which was selected for the following reasons:

- The forecast uses the best available data, and information from the flight schools to forecast future operations.
- Flight training operations can be volatile, meaning these types of operations can increase and decrease depending on outside factors. Possible factors are economic downturns, the number of students currently enrolled in the aviation program at COCC, the amount of flight training aircraft available, the availability of CFIs, and the future congestion of BDN airspace.

March 23, 2020

This method produces growth of flight training operations with a CAGR of 2.6 percent. Flight training operation forecasts are shown in **Table 3-15** and **Figure 3-1**. **Table 3-16** shows the breakdown of local and itinerant operations based on the preferred forecast.

**Table 3-15: Flight Training Operation Forecasts**

Year	Low (Preferred)	Medium	High
2018	89,667	89,667	89,667
2023	143,800	153,300	161,300
2028	149,500	158,700	171,600
2033	149,500	158,700	171,600
2038	149,500	158,700	171,600
CAGR	2.6%	2.9%	3.3%

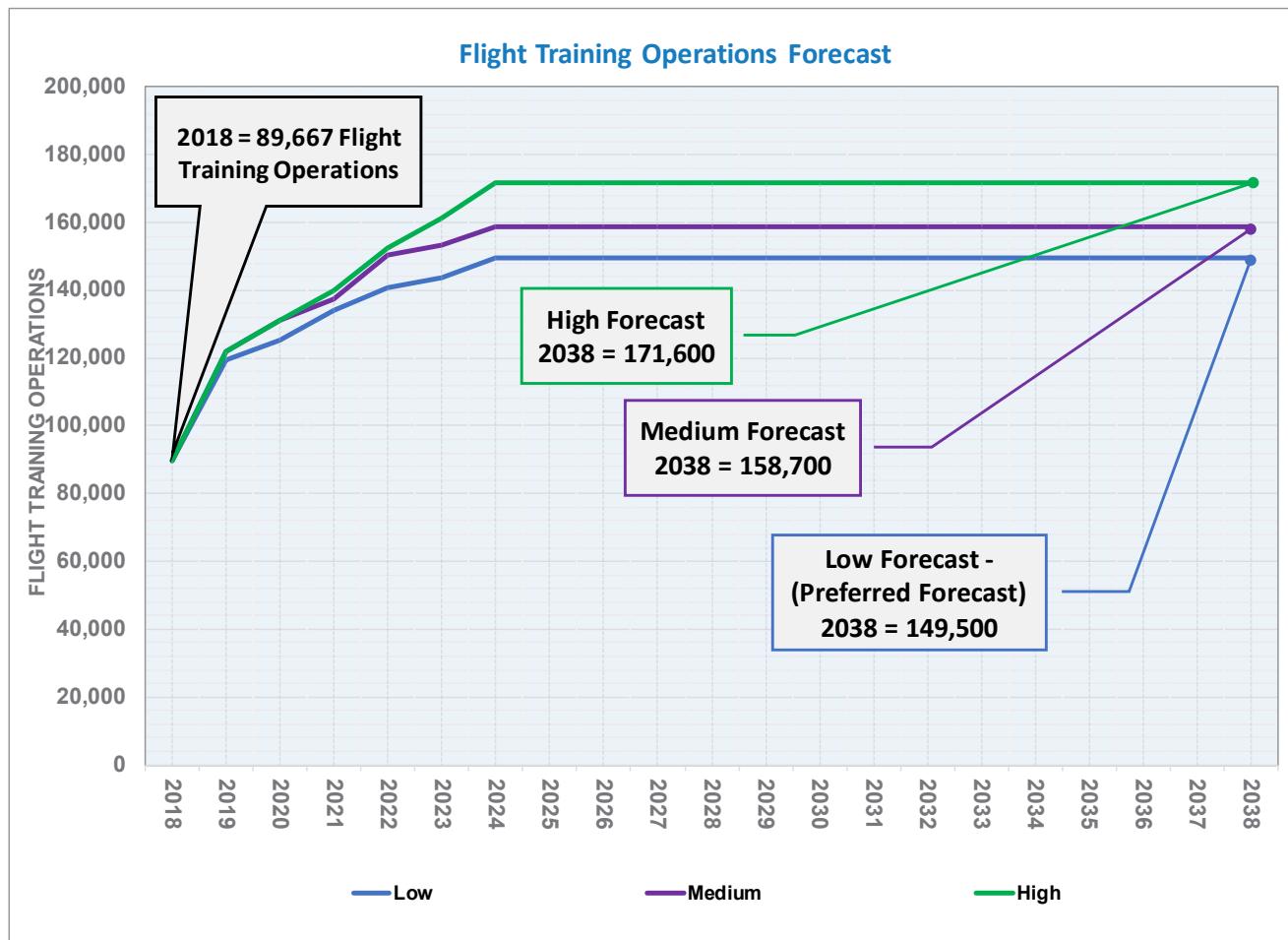
**CAGR:** Compound Annual Growth Rate

**Table 3-16: Preferred Forecast (Low Forecast) – Local and Itinerant**

Year	Local	Itinerant	Total Operations
2018	75,591	14,076	89,667
2023	115,040	28,760	143,800
2028	119,600	29,900	149,500
2033	119,600	29,900	149,500
2038	119,600	29,900	149,500
CAGR	2.3%	3.8%	2.6%

**CAGR:** Compound Annual Growth Rate

Figure 3-1: Flight Training Operations Forecast



**Table 3-17** shows the breakdown of future flight training based aircraft at BDN using the preferred forecast. **Table 3-18** shows the breakdown of future fixed wing and helicopter flight training operations at BDN using the preferred forecast. Flight training based aircraft will be added to the based aircraft forecasts after forecasting methods are chosen.

Table 3-17: Preferred Flight Training Based Aircraft Forecast

Year	Fixed Wing	Helicopter	Total
2018	20	10	30
2023	35	10	45
2028	37	10	47
2033	37	10	47
2038	37	10	47
CAGR	3.1%	0.0%	2.3%

CAGR: Compound Annual Growth Rate

**Table 3-18: Preferred Flight Training Operations Forecast Based on Aircraft Type**

Year	Fixed Wing	Helicopter	Total
2018	51,094	38,573	89,667
2023	105,200	38,600	143,800
2028	110,900	38,600	149,500
2033	110,900	38,600	149,500
2038	110,900	38,600	149,500
CAGR	4.0%	0.0%	2.6%

**CAGR:** Compound Annual Growth Rate

### 3.5.2 BASED AIRCRAFT

Based aircraft are those stored at BDN, either in hangars or tie-downs. Based aircraft forecasts are used to define aircraft parking and storage needs. Preferred Flight training based aircraft totals from **Table 3-17** will be added to the methods used for forecasting non-flight training based aircraft after non-flight training based aircraft have been forecasted.

#### Methods

Based aircraft forecasts employ FAA Aerospace Forecast analysis, ten-year historic non-flight training based aircraft growth rate analysis, trendline analysis, and a hybrid forecast using the Aerospace Forecast and the ten-year historic non-flight training based aircraft growth rate analysis.

**FAA Aerospace Forecast Analysis** takes the national growth rate of based aircraft based on type (SEP: -0.9%, MEP: -0.4%, jet: 1.9%, helicopter: 1.9%, other: 0.0%) to project future non-flight training based aircraft. The Aerospace Forecast helps guide local forecasts by serving as a point of comparison between local and national trends. A forecast was developed using this methodology.

**Ten-Year Historic Non-Flight Training Based Aircraft Growth Rate Analysis** takes the ten-year growth rate for historic non-flight training based aircraft at BDN and applies the growth rate to all aircraft types. **Table 3-13** shows the total existing based aircraft at BDN between 2008 and 2018. There are 244 total based aircraft at BDN in 2018, 30 of the based aircraft are for flight training. The 30 flight training based aircraft were subtracted from the 2018 total and results in 214 non-flight training based aircraft for 2018. The gain of 15 based aircraft (199 non-flight training based aircraft in 2008, 214 non-flight training based aircraft in 2018) results in an annual growth rate of 0.7 percent. The growth rate of 0.7 percent was applied to all aircraft types to forecast future total non-flight training based aircraft. A forecast was developed using this methodology.

March 23, 2020

**Trendline Analysis** takes the previous ten years of based aircraft data and projects it into the future. Trendline analysis ends up with 341 based aircraft in 2038 for BDN. According to the TAF, the most based aircraft at BDN was 254 in 2017. A forecast was developed but not used for this method of forecasting because the total of 341 based aircraft does not incorporate flight training based aircraft yet and seems unreasonable given the historic based aircraft totals at BDN.

**Hybrid Analysis** takes the percent of the national growth rate of based aircraft based on type and the ten-year historic growth rate for non-flight training based aircraft at BDN. The hybrid analysis was created to take into effect national and historic trends. The Aerospace Forecast forecasts growth in jets, helicopters, and other aircraft, and a decline in MEP. Growth rates from the Aerospace Forecast were used in the hybrid to represent the national trends of these aircraft (SEP: -0.9%, MEP: -0.4%, jet: 1.9%, helicopter: 1.9%, other: 0.0%). The ten-year historic growth rate of non-flight training based aircraft indicates an increase in non-flight training based aircraft at BDN. The ten-year historic growth rate was used to forecast SEP aircraft. A forecast was developed using this methodology so national and local trends could both be incorporated into the forecast.

### Preferred Forecast (Hybrid Forecast) and TAF Comparison

The TAF shows that based aircraft are to increase to 312 aircraft in 2028 and reach 364 based aircraft through 2038 for a CAGR of 1.7 percent.

The preferred based aircraft forecast is the hybrid forecast using both the Aerospace Forecast and ten-year historic non-flight training based aircraft growth rate analysis. The hybrid forecast was selected for the following reasons:

- The Aerospace Forecast provided national growth rates for jets, MEP, helicopters, and other aircraft.
- The previous ten years of non-flight training based aircraft shows an increase in total non-flight training based aircraft, resulting in a CAGR of 0.7 percent. This rate was used to forecast SEP aircraft because it represents a historic local trend of non-flight training based aircraft at BDN.
- SEP aircraft make up 78.3 percent of total based aircraft at BDN in 2018. If the Aerospace Forecast growth rate of -0.9 percent was used instead of the ten-year historic non-flight training based aircraft growth rate of 0.7 percent, the decline in future non-flight training based aircraft would not represent the local trends for SEP at BDN.

March 23, 2020

Based aircraft forecasts less flight training based aircraft are shown in **Table 3-19** and **Figure 3-2**. Based aircraft forecasts including preferred flight training based aircraft totals from **Table 3-17** are shown in **Table 3-20** and **Figure 3-3**. The preferred based aircraft forecast with preferred flight training aircraft is shown in **Table 3-21**.

**Table 3-19: Based Aircraft Forecast – Less Flight Training Based Aircraft**

Year	Hybrid (Preferred)	Aerospace	10 Year Historic	TAF
2018	214	214	214	262
2023	222	208	221	291
2028	230	202	230	312
2033	241	199	238	335
2038	251	195	248	364
CAGR	0.8%	-0.5%	0.7%	1.7%

CAGR: Compound Annual Growth

**Figure 3-2: Based Aircraft Forecast – Less Flight Training Based Aircraft**

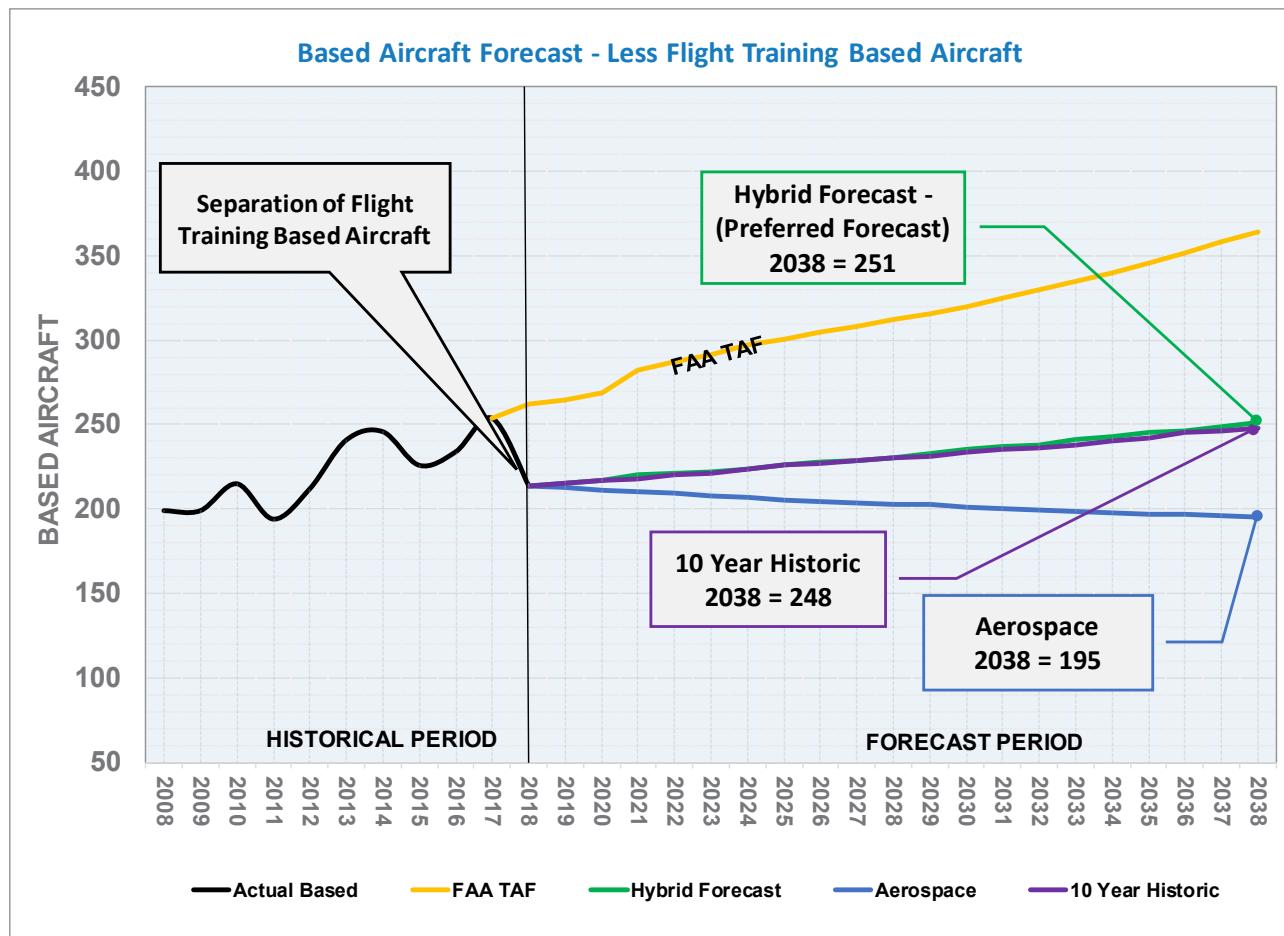


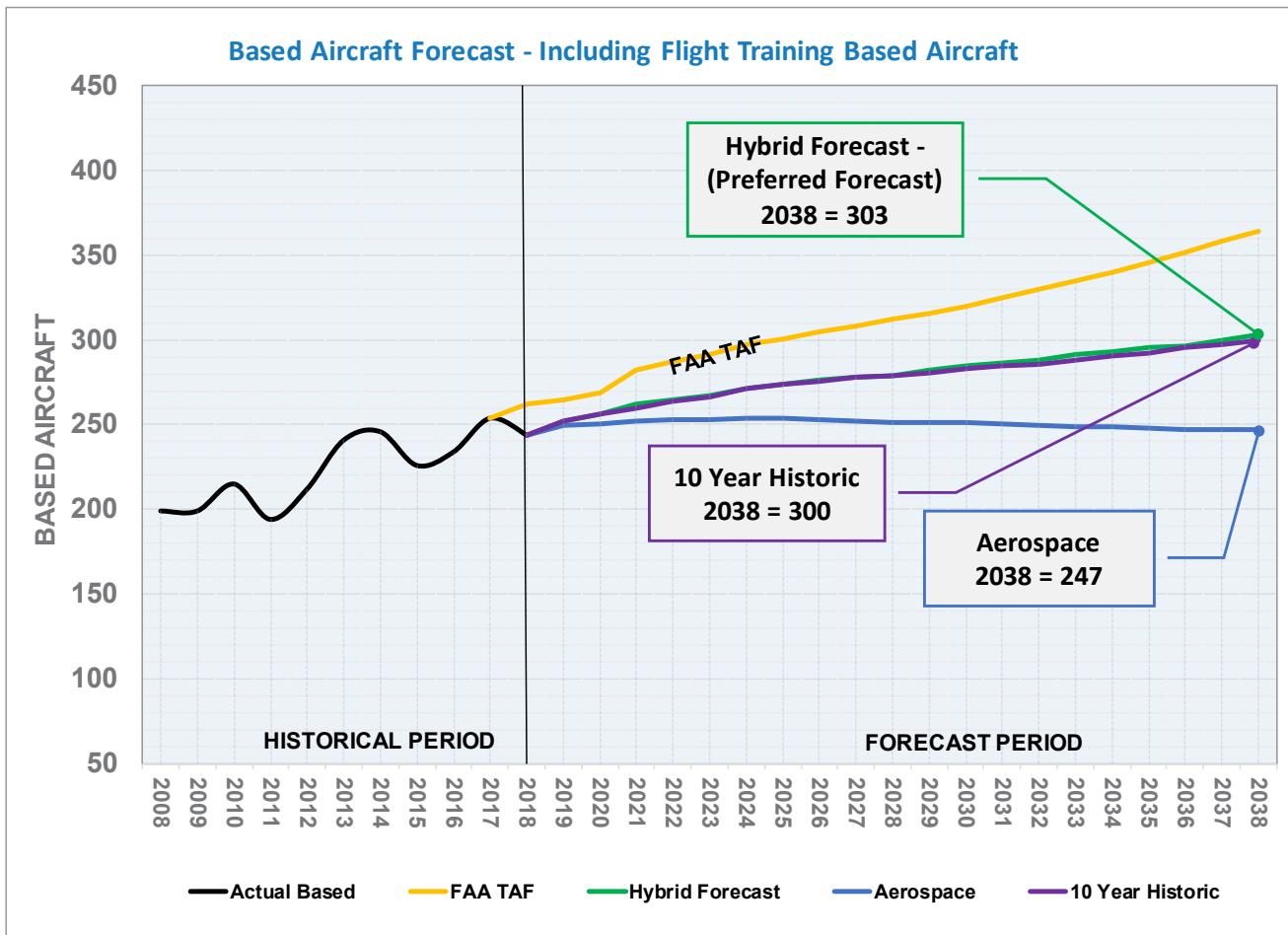
Table 3-20: Based Aircraft Forecast – Including Flight Training Based Aircraft

Year	Hybrid (Preferred)	Aerospace	10 Year Historic	TAF	TAF % Difference
2018	244	244	244	262	6.9%
2023	267	253	266	291	8.2%
2028	279	251	279	312	10.6%
2033	291	249	288	335	13.1%
2038	303	247	300	364	16.8%
CAGR	1.8%	0.1%	1.0%	1.7%	N/A

Note: TAF % Difference column is the percentage difference between the Hybrid Forecast and TAF

CAGR: Compound Annual Growth

Figure 3-3: Based Aircraft Forecast – Including Flight Training Based Aircraft



**Table 3-21: Preferred Based Aircraft Forecast – Aircraft Types**

Year	SEP	Jet	MEP	Helicopter	Other	Total
2018	191	11	19	23	0	244
2023	212	12	19	24	0	267
2028	223	13	18	25	0	279
2033	231	15	18	27	0	291
2038	240	16	18	29	0	303
CAGR	1.1%	1.9%	-0.3%	1.1%	0.0%	1.8%

**CAGR:** Compound Annual Growth

**SEP:** Single Engine Piston

**MEP:** Multi Engine Piston

### 3.5.3 ITINERANT GA OPERATIONS

#### Methods

Itinerant GA forecasts employ FAA Aerospace Forecast growth rates, a state market share analysis, a national market share analysis, a correlation analysis, and a trendline analysis. Each method was considered; however, some were dropped due to the lack of accurate historical data. Flight training itinerant operation totals from the preferred flight training itinerant operations forecast will be added to the three methods used for forecasting itinerant GA operations.

**FAA Aerospace Forecast Analysis** takes the national growth rate of itinerant GA operations (0.2%) to project future activity. The FAA Aerospace Forecast helps guide local forecasts by serving as a point of comparison between local trends and national trends. A forecast was developed using FAA Aerospace Forecast growth rates for itinerant GA operations because the FAA Aerospace Forecast projects growth in itinerant GA operations, and the FAA Aerospace Forecast provides a look at the national trend of itinerant GA operations.

**State Non-FAA Facilities Analysis** takes the TAF 2018 to 2038 Oregon Non-FAA facilities growth rate of 1.7 percent for itinerant GA operations to project future activity. Non-FAA facilities includes airports that do not have a control tower. Because there is no control tower at BDN, operation counts are estimates when the Airport submits the annual 5010 to the FAA. A forecast was developed using the Oregon Non-FAA facilities growth rate because of the unreliable nature of historical operation counts at BDN, and the Non-FAA facilities growth rate is a reasonable growth rate to project future activity because BDN is a Non-FAA facility.

**National Non-FAA Facilities Analysis** takes the TAF 2018 to 2038 National Non-FAA facilities growth rate of 0.4 percent for itinerant GA operations to project future activity. Non-FAA facilities includes airports that do not have a control tower. Because there is no control tower at BDN, operation counts are estimates when the Airport submits the annual 5010 to the FAA. A forecast was developed using the National Non-FAA facilities growth rate because of the unreliable nature of historical operation counts at BDN, and the Non-FAA facilities growth rate is a reasonable growth rate to project future activity because BDN is a Non-FAA facility.

**Correlation Analysis** determines if itinerant GA operations show a relationship with other variables that can be used to forecast future operations. Variables that exhibit correlation may have a relationship where growth of one variable (for example, household income) may cause the growth of another (such as purchases of consumer goods). Correlation is rated on a scale between negative one (strong negative correlation) and positive one (strong positive correlation) and expressed as " $r$ ". A score of close to positive or negative one suggests that two variables may be related, and a score of close to zero suggests that there may be no relation between the variables. Correlation does not necessarily indicate that a change by one variable causes the change in another; therefore, professional judgement and interpretation are necessary to illustrate how the linkage may work in the real world.

Itinerant GA operations show strong positive correlation with the national jet fleet ( $r = 0.61$ ) and MSA retail sales ( $r = 0.53$ ), and strong negative correlation with national itinerant GA operations ( $r = -0.60$ ) and the national single engine piston fleet ( $r = -0.59$ ). TAF estimates for the previous ten years of itinerant GA operations for BDN have a large increase in operations from 2010 to 2011 and 2013 to 2015, and remain flat between 2015 and 2017, making the data unreliable. As a result, correlation analysis was not used to develop forecasts for itinerant GA operations because inputs must be accurate, otherwise the outputs are not defensible.

**Trendline Analysis** takes the previous ten years of itinerant GA operations data and projects it into the future. TAF estimates for the previous ten years of itinerant operations for BDN have a large drop in operations from 2017 to 2018 due to the TAF including itinerant flight training operations in the data. This makes the data unreliable because flight training operations are forecasted separately from itinerant GA operations. Therefore, a trendline forecast was not developed for itinerant GA operations.

## Preferred Forecast (State Non-FAA Facility Forecast) and TAF Comparison

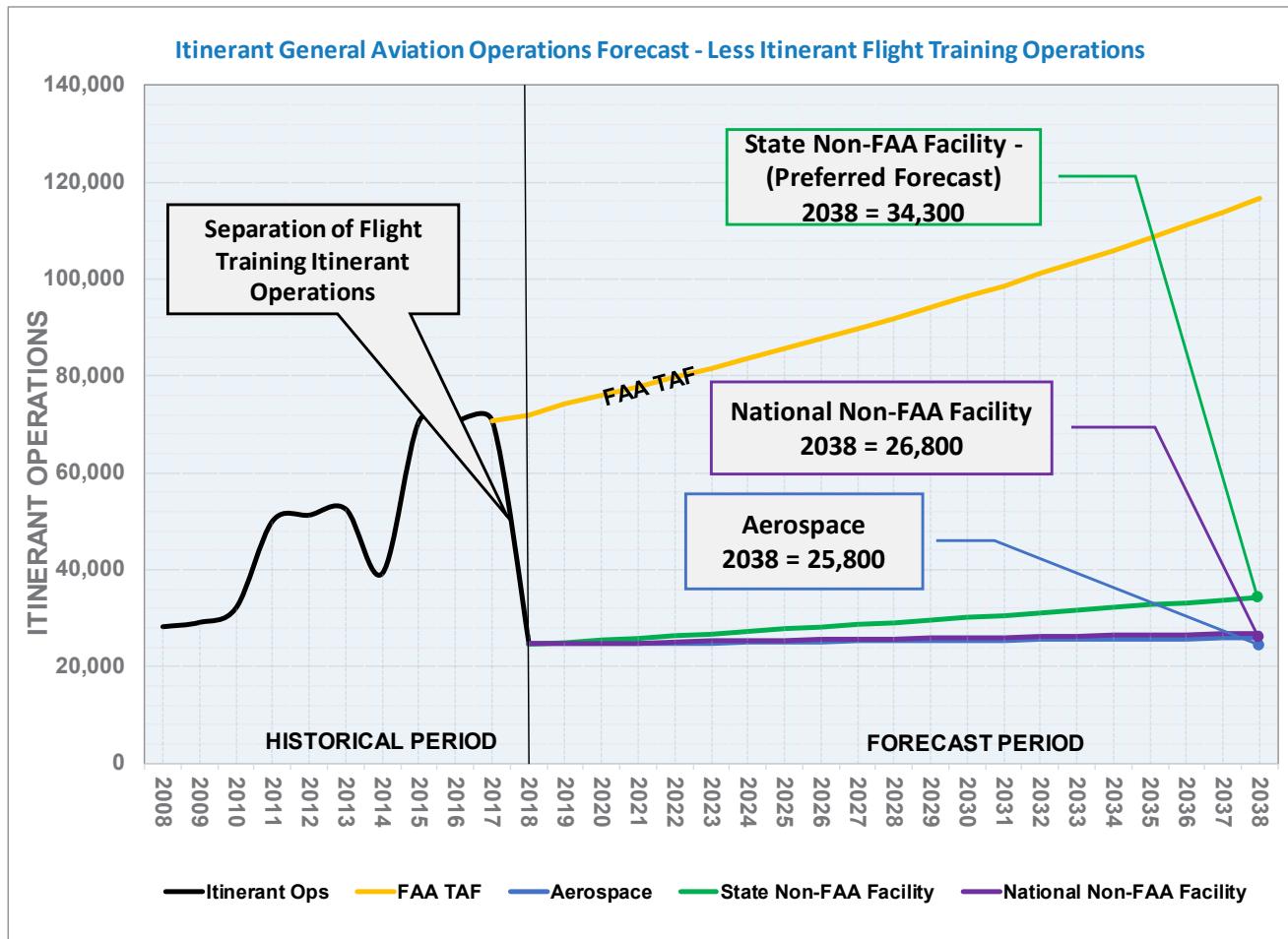
The preferred itinerant GA operations forecast is the State Non-FAA Facility Forecast. This method produces growth of itinerant GA operations with a CAGR of 1.7 percent. The TAF reports that Oregon itinerant GA operations will continue to grow over the next 20 years, meaning itinerant GA operations at BDN will grow as well. Itinerant GA operation forecasts less flight training itinerant operations are shown in **Table 3-22** and **Figure 3-4**. Itinerant GA operation forecasts including flight training itinerant operations from **Table 3-16** are shown in **Table 3-23** and **Figure 3-5**. The difference between the preferred forecast and the TAF in **Table 3-23** is due to the TAF not reporting itinerant GA operations into separate categories for flight training and non-flight training. Flight training operations at BDN are approximated to be 80 percent local and 20 percent itinerant, which results in a smaller portion of flight training operations adding to the overall itinerant GA operations forecast. Fewer itinerant flight training operations leads to a greater difference between the TAF and itinerant GA operations.

**Table 3-22: Itinerant GA Operations Forecast – Less Flight Training Itinerant Operations**

Year	Aerospace	State Non-FAA Facility (Preferred)	National Non-FAA Facility	TAF
2018	24,630	<b>24,630</b>	24,630	72,040
2023	24,900	<b>26,800</b>	25,200	81,595
2028	25,200	<b>29,100</b>	25,700	91,885
2033	25,500	<b>31,600</b>	26,300	103,488
2038	25,800	<b>34,300</b>	26,800	116,570
CAGR	0.2%	<b>1.7%</b>	0.4%	2.4%

**CAGR:** Compound Annual Growth Rate

Figure 3-4: Itinerant GA Operations Forecast – Less Flight Training Itinerant Operations



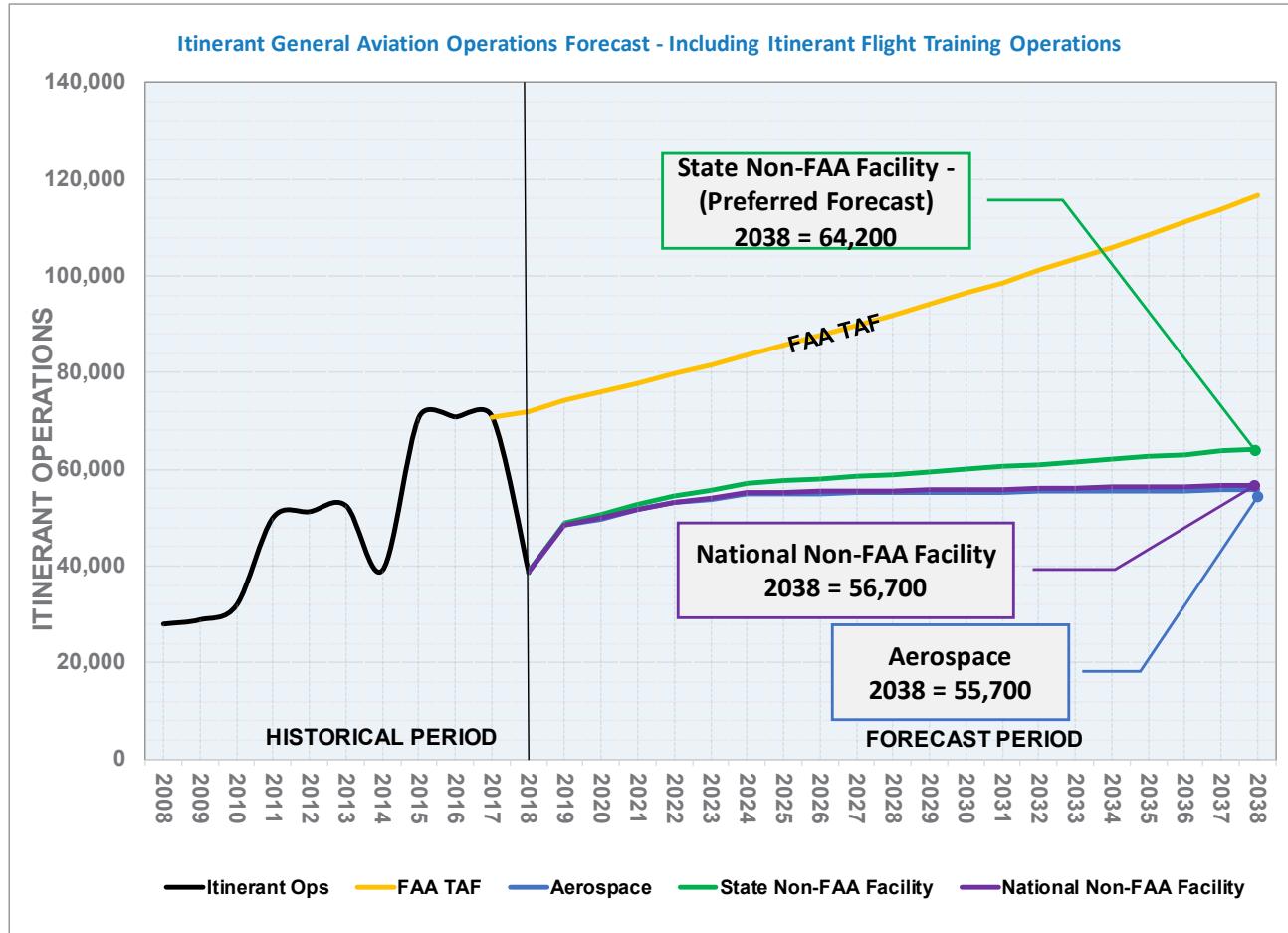
Note: TAF includes flight training operations

Table 3-23: Itinerant GA Operations Forecast – Including Flight Training Itinerant Operations

Year	Aerospace	State Non-FAA Facility (Preferred)	National Non-FAA Facility	TAF	TAF % Difference
2018	38,706	38,706	38,706	72,040	46.3%
2023	53,660	55,560	53,960	81,595	34.2%
2028	55,100	59,000	55,600	91,885	40.0%
2033	55,400	61,500	56,200	103,488	46.5%
2038	55,700	64,200	56,700	116,570	52.2%
CAGR	1.8%	2.6%	1.9%	2.4%	N/A

Note: TAF % Difference column is the percentage difference between the State Non-FAA Facility Forecast and TAF

CAGR: Compound Annual Growth Rate

**Figure 3-5: Itinerant GA Operations Forecast – Including Flight Training Itinerant Operations**

Note: TAF includes flight training operations

### 3.5.4 LOCAL GA OPERATIONS FORECAST

#### Methods

Local GA forecasts employ correlation analysis, FAA Aerospace Forecast analysis, state market share analysis, national market share analysis, and trend analysis. While each method was considered, some were dropped due to the lack of accurate historical data. Flight training local operation totals from the preferred flight training local operations forecast will be added to the three methods used for forecasting local GA operations.

**Correlation Analysis** determines if local GA operations show a relationship with local variables that can be used to forecast future operations. Local GA operations show strong positive correlation with the national jet fleet ( $r = 0.53$ ) and national based aircraft market share ( $r = 0.53$ ). TAF estimates for the previous ten years of local operations for BDN have a spike in operations from 2009 to 2010 (approximately 22,500 more operations) and remain flat between 2015 to 2017. TAF estimates normally are unreliable when historic local GA operations do not change year over year. As a result, correlation analysis was not used to develop forecasts for local GA operations because inputs must be accurate, otherwise the outputs are not defensible.

**FAA Aerospace Forecast Analysis** takes the national growth rate (0.3%) of local GA activity to project future activity. The FAA Aerospace Forecast helps guide local forecasts by serving as a point of comparison between local and national trends. A forecast was developed using Aerospace Forecast growth rates for local GA operations because the Aerospace Forecast projects growth in local GA operations, and the FAA Aerospace Forecast provides a look at the national trend of local GA operations.

**State Non-FAA Facilities Analysis** takes the TAF 2018 to 2038 Oregon Non-FAA facilities growth rate of 1.6 percent for local GA operations to project future activity. Non-FAA facilities includes airports that do not have a control tower. Because there is no control tower at BDN, operation counts are estimates when the Airport submits the annual 5010 to the FAA. A forecast was developed using the Oregon Non-FAA facilities growth rate because of the unreliable nature of historical operation counts at BDN, and the Non-FAA facilities growth rate is a reasonable growth rate to project future activity because BDN is a Non-FAA facility.

**National Non-FAA Facilities Analysis** takes the TAF 2018 to 2038 National Non-FAA facilities growth rate of 0.4 percent for local GA operations to project future activity. Non-FAA facilities includes airports that do not have a control tower. Because there is no control tower at BDN, operation counts are estimates when the Airport submits the annual 5010 to the FAA. A forecast was developed using the National Non-FAA facilities growth rate because of the unreliable nature of historical operation counts at BDN, and the Non-FAA facilities growth rate is a reasonable growth rate to project future activity because BDN is a Non-FAA facility.

**Trendline Analysis** takes the previous ten years of local GA operations data and projects it into the future. TAF estimates for the previous ten years of local GA operations for BDN have a large increase in operations from 2009 to 2010 and remain flat from 2015 to 2017, making the data unreliable. Therefore, a trendline forecast was not developed for local GA operations.

## Preferred Forecast (State Non-FAA Facility Forecast) and TAF Comparison

As stated in the FAA document *Forecast Process for the 2018 TAF*, GA operations are assessed based on past trends. The TAF for BDN is likely repeating because the growth rate in local operations is low, the same estimate for local operations was being reported on the 5010, and the limited amount of data on operations keeps the forecast of local operations in the TAF the same.

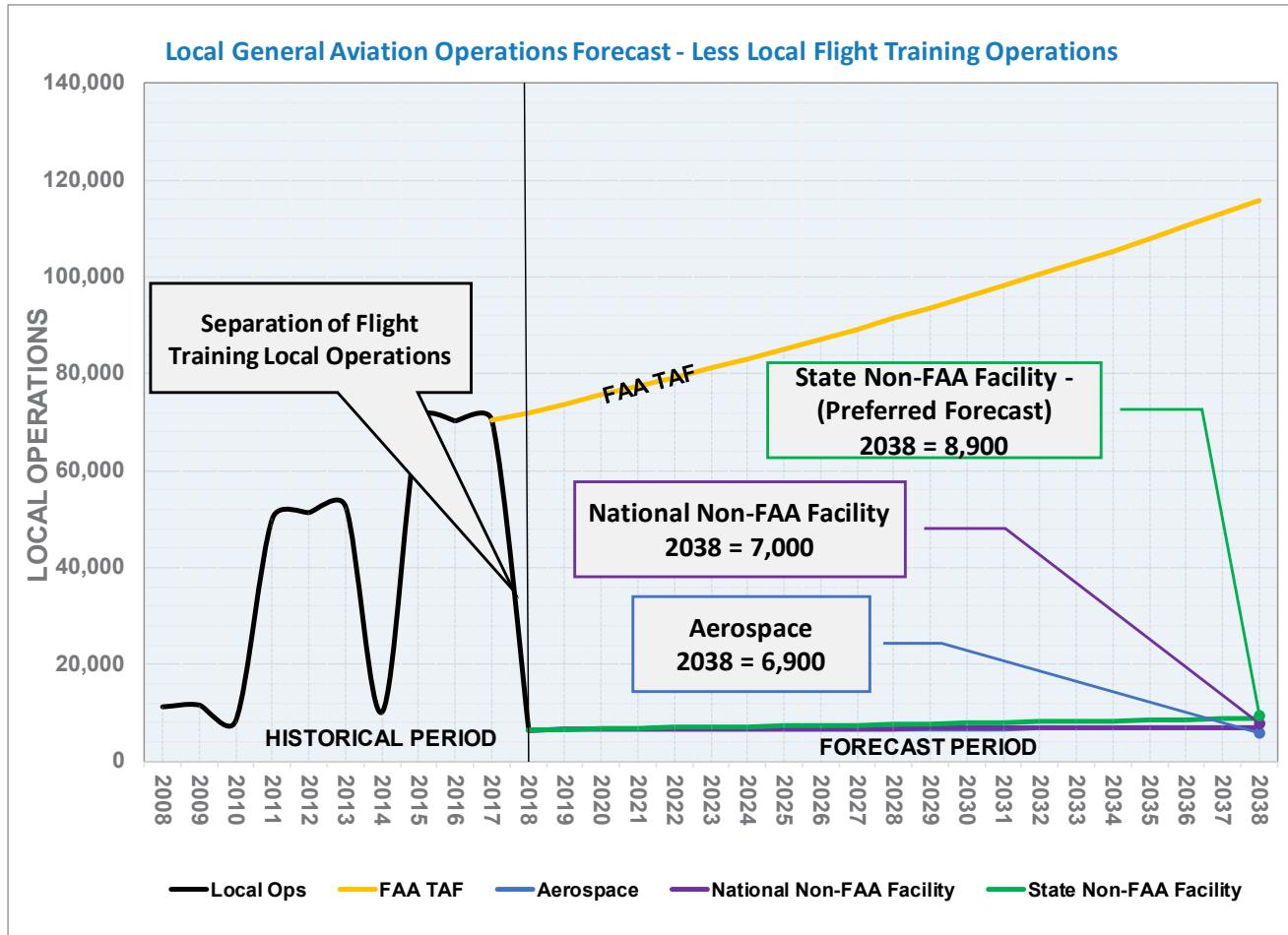
The preferred local GA operations forecast is the State Non-FAA Facility forecast. This method produces growth of local GA operations with a CAGR of 1.6 percent. The TAF indicates that national local GA operations will continue to grow over the next 20 years, meaning local GA operations at BDN will grow as well. Local GA operation forecasts less flight training local operations are shown in **Table 3-24** and **Figure 3-6**. Local GA operation forecasts including flight training local operations from **Table 3-16** are shown in **Table 3-25** and **Figure 3-7**. The difference between the preferred forecast and the TAF in **Table 3-25** is due to the TAF not reporting local GA operations into separate categories for flight training and non-flight training. Flight training operations at BDN are approximated to be 80 percent local and 20 percent itinerant, which results in a larger portion of flight training operations adding to the overall local GA operations forecast. The larger portion of local flight training operations leads to a greater difference between the TAF and local GA operations.

**Table 3-24: Local GA Operations Forecast – Less Flight Training Operations**

Year	Aerospace	State Non-FAA Facility (Preferred)	National Non-FAA Facility	TAF
2018	6,458	6,458	6,458	72,040
2023	6,600	7,000	6,600	81,145
2028	6,700	7,600	6,700	91,366
2033	6,800	8,200	6,900	102,873
2038	6,900	8,900	7,000	115,830
CAGR	0.3%	1.6%	0.4%	2.4%

**CAGR:** Compound Annual Growth Rate

Figure 3-6: Local GA Operations Forecast – Less Flight Training Operations



Note: TAF includes flight training operations

Table 3-25: Local GA Operations Forecast – Including Flight Training Operations

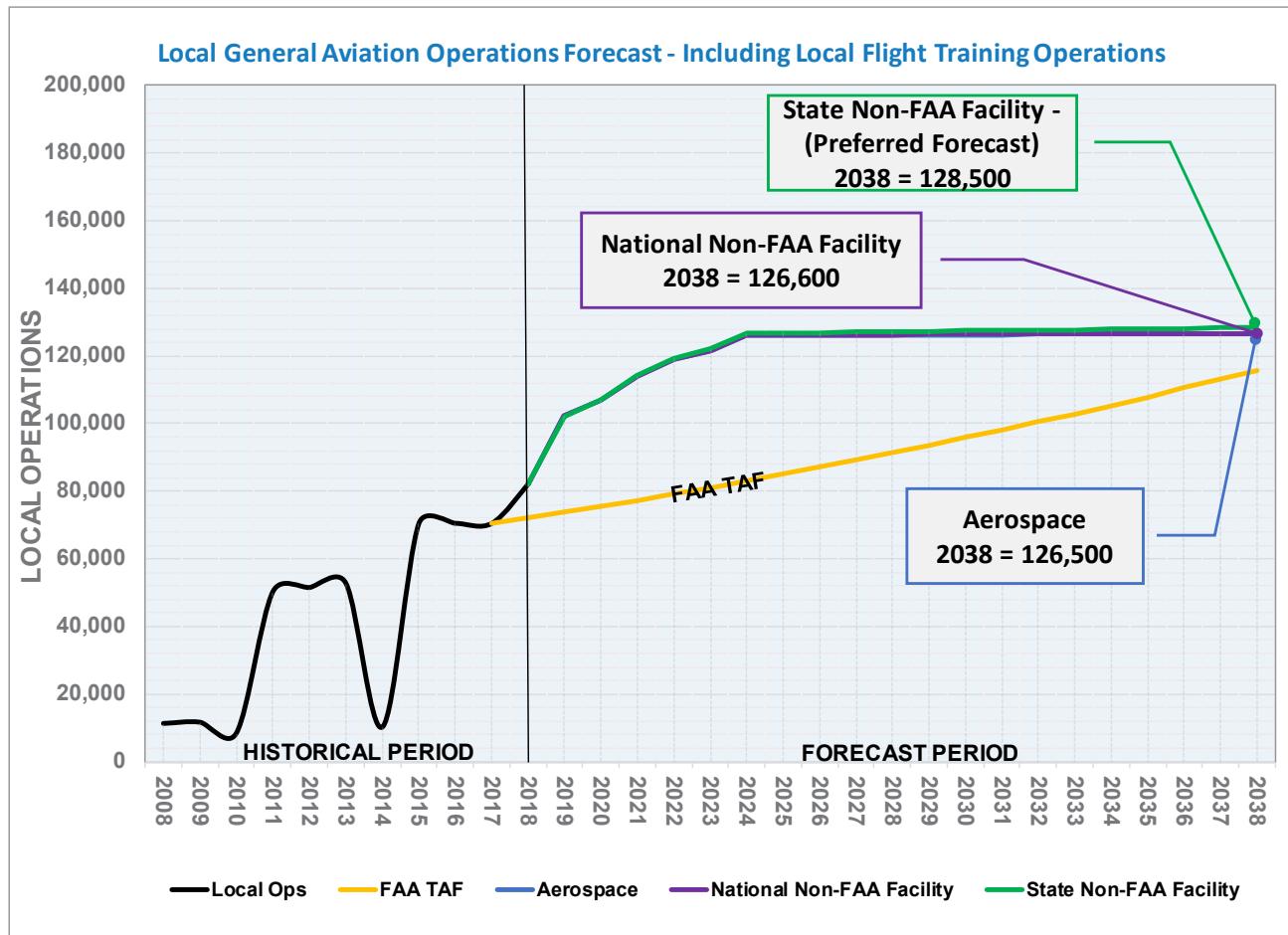
Year	Aerospace	State Non-FAA Facility (Preferred)	National Non-FAA Facility	TAF	TAF % Difference
2018	82,049	82,049	82,049	72,040	13.9%
2023	121,640	122,040	121,640	81,145	49.9%
2028	126,300	127,200	126,300	91,366	38.2%
2033	126,400	127,800	126,500	102,873	22.9%
2038	126,500	128,500	126,600	115,830	9.2%
CAGR	2.2%	2.3%	2.2%	2.4%	N/A

Note: TAF % Difference column is the percentage difference between the State Non-FAA Facility Forecast and TAF

CAGR: Compound Annual Growth Rate

March 23, 2020

Figure 3-7: Local GA Operations Forecast – Including Flight Training Operations



Note: TAF includes flight training operations

### 3.5.5 ITINERANT AIR TAXI OPERATIONS

Itinerant air taxi operations are those that begin and end flights at different airports. Itinerant air taxi operations are conducted by small or large private jets.

#### Methods

Itinerant air taxi operation forecasts employ correlation analysis, state market share analysis, national market share analysis, and trendline analysis.

**Correlation Analysis** determines if itinerant air taxi operations show a relationship with local variables that can be used to forecast future itinerant air taxi operations. Itinerant air taxi operations show strong positive correlation with MSA population ( $r = 0.73$ ), MSA employment ( $r = 0.59$ ), and MSA GRP ( $r = 0.69$ ). TAF estimates for the previous ten years of itinerant air taxi operations for BDN have a spike in operations from 2009 to 2010 (approximately 1,000 more operations) and remain flat between 2010 and 2018. The TAF estimates for itinerant air taxi operations suggests that the estimate readjustment in 2010 was necessary due to itinerant air taxi operations increasing, albeit slowly after the readjustment. Forecasts were developed using MSA employment and MSA GRP for itinerant air taxi operations due to historic itinerant air taxi operations, the growth of high value industries in the MSA, and the regional economy of the MSA growing. The  $r$  values of 0.59, 0.69, and 0.73 are not growth rates and are not used for forecasting. The  $r$  values are used only to determine the strength of relationships between MSA employment and MSA GRP to historic itinerant air taxi operations. Historic itinerant air taxi operations show little change, but itinerant air taxi operations represent Part 135 and medevac operations, and these types of operations show a strong relationship with a growing economy and work force. The MSA employment growth rate used was 1.7 percent, which is shown on **Table 3-5**. The MSA GRP growth rate used was 2.0 percent, shown on **Table 3-7**.

**State Non-FAA Facilities Analysis** takes the TAF 2018 to 2038 Oregon Non-FAA facilities growth rate of 0.5 percent for itinerant air taxi operations to project future activity. Non-FAA facilities includes airports that do not have a control tower. Because there is no control tower at BDN, operation counts are estimates when the Airport submits the annual 5010 to the FAA. A forecast was developed using the Oregon Non-FAA facilities growth rate because of the unreliable nature of historical operation counts at BDN, and the Non-FAA facilities growth rate is a reasonable growth rate to project future activity because BDN is a Non-FAA facility.

**Trendline Analysis** takes the previous ten years of itinerant air taxi operations data and projects it into the future. TAF estimates for the previous ten years of itinerant air taxi operations for BDN remain flat from 2010 to 2018, making the data unreliable. Therefore, a trendline forecast was not developed for itinerant air taxi operations.

### Preferred Forecast (MSA Employment Forecast) and TAF Comparison

The TAF is likely repeating no growth because the growth rate for itinerant air taxi operations is low, the same estimate for itinerant air operations was being reported on the 5010, and the limited amount of data on operations keeps the forecast of itinerant air taxi operations in the TAF the same.

The preferred itinerant air taxi forecast is the one based on MSA employment. The TAF reports itinerant air taxi operations for BDN, which have remained flat since 2010 and are reported to remain flat until 2038. Since the TAF estimate has not been readjusted since 2010, itinerant air taxi operation counts may not reflect actual activity. The City of Bend is experiencing an increase in the amount of people employed in high value industries like health care. Total employment in health care is expected to increase by approximately 11,800 by 2038. High value industries are primary customers of charter flights. As employment increases, the potential for itinerant air taxi operations increases. Itinerant air taxi operations forecasts are shown in **Table 3-26** and **Figure 3-8**. The difference between the preferred forecast and the TAF in **Table 3-26** is due to the TAF reporting the same itinerant air taxi operations every year. The preferred forecast shows growth in itinerant air taxi operations over the forecast period and as forecast itinerant air taxi operations increase, the difference between the TAF and preferred forecast increases. The difference between the TAF and preferred forecast is also due to the total operations in 2018 starting off 29 percent higher than the TAF, which leads to subsequent years being higher.

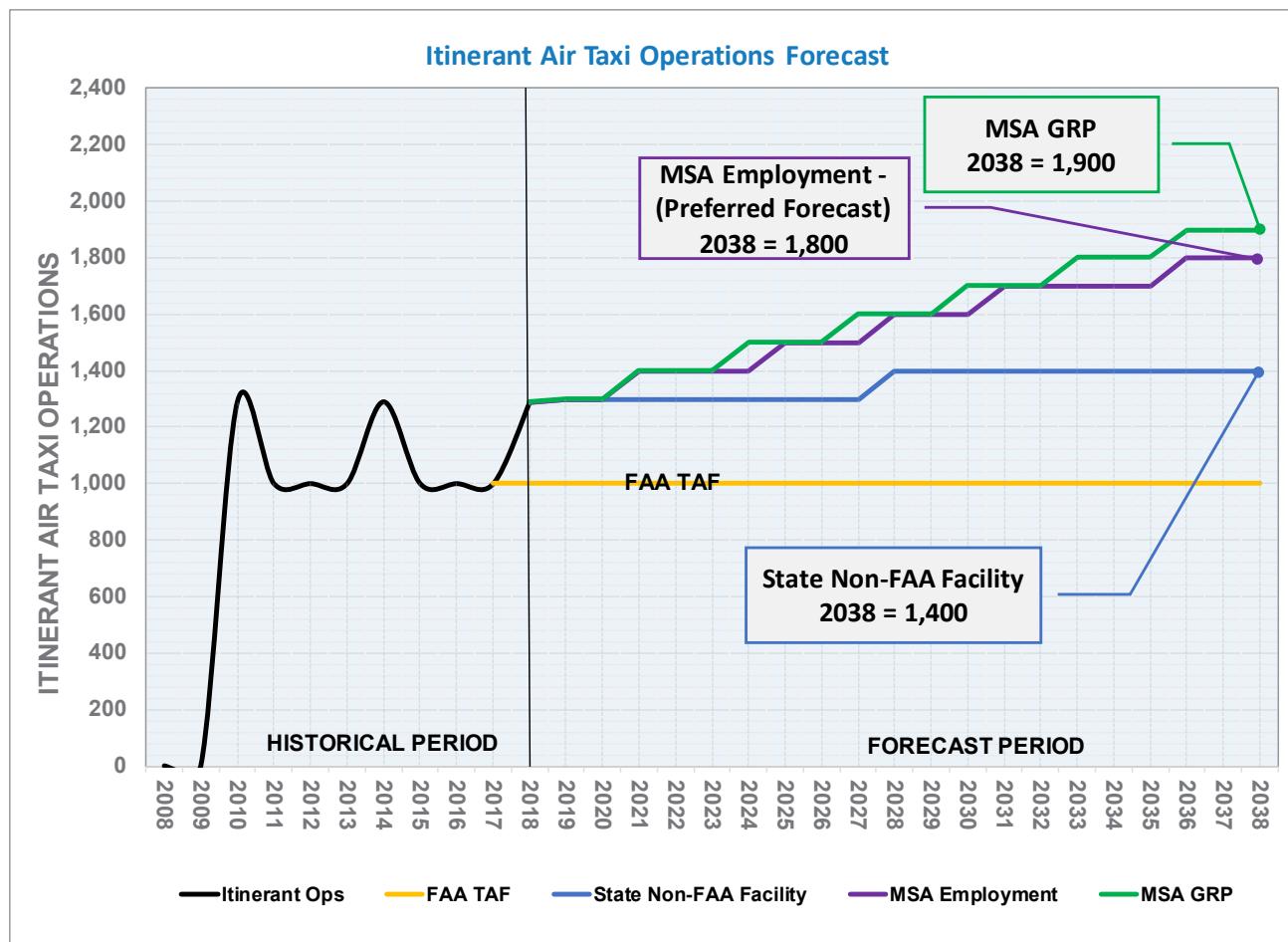
**Table 3-26: Itinerant Air Taxi Operations Forecast**

Year	State Non-FAA Facility	MSA Employment (Preferred)	GRP	TAF	TAF % Difference
2018	1,290	<b>1,290</b>	1,290	1,000	29.0%
2023	1,300	<b>1,400</b>	1,400	1,000	30.0%
2028	1,400	<b>1,600</b>	1,600	1,000	40.0%
2033	1,400	<b>1,700</b>	1,800	1,000	40.0%
2038	1,400	<b>1,800</b>	1,900	1,000	40.0%
CAGR	0.4%	<b>1.7%</b>	2.0%	0.0%	N/A

**Note:** TAF % Difference column is the percentage difference between the MSA Employment Forecast and TAF

**CAGR:** Compound Annual Growth

Figure 3-8: Itinerant Air Taxi Operations Forecast



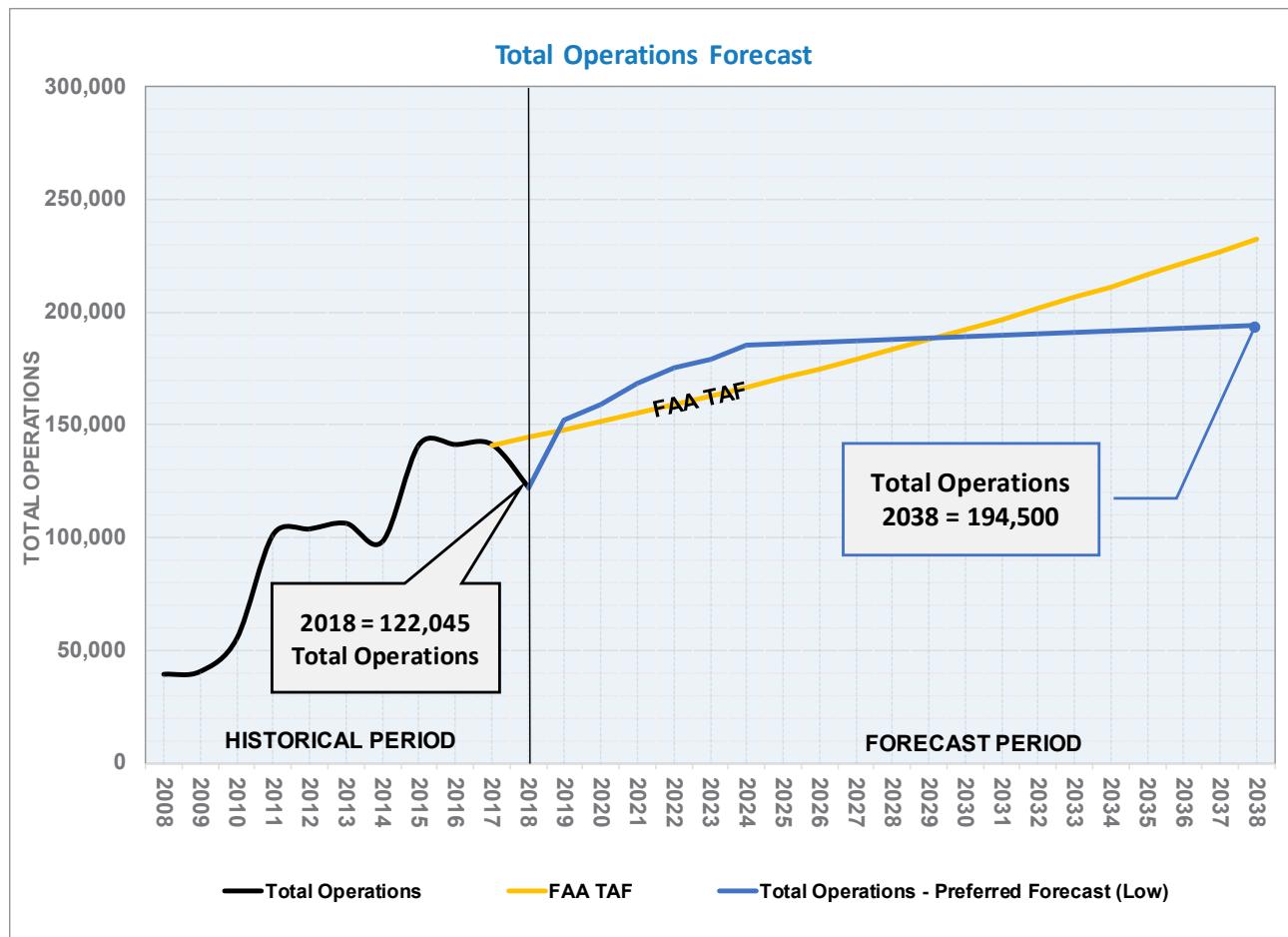
### 3.5.6 TOTAL OPERATIONS

Total operations combine the preferred forecasts for itinerant GA operations, local GA operations, and itinerant air taxi operations. Total operations are shown in **Table 3-27** and **Figure 3-9**.

Table 3-27: Total Operations

Year	TAF	Total Ops	TAF % Difference
2018	144,586	122,045	18.5%
2023	162,840	179,000	9.0%
2028	183,351	187,800	2.4%
2033	206,461	191,000	8.1%
2038	232,500	194,500	19.5%
CAGR	2.4%	2.4%	N/A

CAGR: Compound Annual Growth

**Figure 3-9: Total Operations**

### 3.6 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. 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 Terminology in Section 3.2 of this chapter. The critical aircraft will be used to design and scale improvement projects and setbacks in **Chapter 4, Facility Requirements** and **Chapter 5, Improvement Alternatives**.

The TFMSC data source provides a sample of aircraft operations at the Airport, but not the total number of operations. TFMSC only captures operations by aircraft that file flight plans under Instrument Flight Rules (IFR). Operations occurring under Visual Flight Rules (VFR) are not captured. Therefore, aircraft with no flight plans will be missing from the sample data. Due to the absence of an airport traffic control tower, the number of total operations at the Airport are considered estimates.

Future operations by ARC are calculated differently depending on the type of aircraft. Aircraft with an ARC of A-II, B-II, and those with approach categories of C or greater and design groups of III or greater are expected to be well accounted for in the TFMSC records. While some aircraft cancel flight plans prior to landing at BDN and are thus missing from the TFMSC, it is expected that the order of magnitude presented by the TFMSC is generally accurate.

Smaller aircraft types, (A-I and B-I) are also accounted for in TFMSC but these aircraft often fly under VFR which are operations that are not included in TFMSC. Future operations by these ARCs are estimated by identifying the relative percentage of these aircraft types operations relative to total estimate operations less operations by larger aircraft. These smaller aircraft essentially make up the balance of remaining operations for BDN. **Table 3-28** lists a breakdown of data for operations by ARC for the total operations at BDN from 2008 to 2018. **Table 3-29** lists a breakdown of operations by ARC for the total operations at BDN from 2018 to 2038.

**Table 3-28: ARC Operations Sample Data (TFMSC)**

Year	A-I	A-II <sup>2</sup>	B-I	B-II <sup>1</sup>	C-I	C-II	C-III	D-I	D-II	D-III	Sample Operations
2010	2,192	1,536	936	728	70	140	0	22	10	2	5,636
2011	1,412	1,338	832	542	88	96	2	30	20	0	4,360
2012	1,636	960	1,036	492	62	48	0	40	22	4	4,300
2013	1,620	1,144	1,208	648	84	56	2	26	16	2	4,806
2014	1,744	1,164	1,224	702	48	108	0	8	18	2	5,018
2015	1,974	1,114	1,150	1,096	84	106	4	10	28	0	5,566
2016	2,108	1,106	1,452	1,638	78	120	4	18	14	12	6,550
2017	1,786	1,480	1,624	1,614	92	132	10	16	12	10	6,776
2018	2,182	1,550	1,700	1,340	52	98	4	16	8	4	6,954

1: Column B-II includes B-III and B-IV due to the limited number of operations (10 total operations between 2010 to 2018).

2: Column A-II includes A-III due to limited number of operations (2 total operations between 2010 to 2018).

**Notes:** ARC counts were determined by selecting the max annual operations from the TFMSC.

Sources: TFMSC

**Table 3-29: Forecasted Annual ARC Operations**

Year	A-I	A-II <sup>2</sup>	B-I	B-II <sup>1</sup>	C-I	C-II	C-III	D-I	D-II	D-III	Total Operations
2018	30,640	1,550	19,999	1,340	52	98	4	16	8	4	53,711
2023	34,778	1,423	22,853	1,100	82	113	4	23	18	4	60,400
2028	38,349	1,570	25,199	1,212	91	125	4	26	20	5	66,600
2033	42,207	1,727	27,734	1,334	100	137	4	28	22	5	73,300
2038	46,410	1,899	30,497	1,467	110	151	4	31	25	6	80,600

1: Column B-II includes B-III and B-IV due to the limited number of operations (10 total operations between 2010 to 2018).

2: Column A-II includes A-III due to limited number of operations (2 total operations between 2010 to 2018).

**Notes:** Operations were calculated by determining the average annual operations of each ARC from the data shown in **Table 3-28**, then extrapolating the average data to the 2018, and forecasted total number of operations at BDN.

Source: TFMSC

The existing and future ARC for BDN on the Airport Layout Plan (ALP) is B-II. Based on the sample data shown in **Table 3-28**, the most demanding type of aircraft by ARC to exceed 500 annual operations at the Airport is B-II. Therefore, the existing ARC for the Airport will remain B-II. Based on the data shown in **Table 3-29**, the most demanding type of aircraft by ARC forecasted to exceed 500 annual operations at the Airport is B-II. Therefore, the future ARC of BDN will remain B-II.

There is no single B-II aircraft that exceeds the 500 annual operations threshold; therefore, a representative B-II aircraft is selected to be the critical aircraft. **Table 3-30** lists the recent number of operations by individual B-II aircraft available from the TFMSC data. Of the two aircraft with the most operations over the past eight years (Citation CJ3 and Citation II), the CJ3 has the wider wingspan and has more historical operations at BDN. Therefore, the Cessna Citation CJ3 is the existing critical aircraft for the Airport. The future critical aircraft is forecasted to remain the Cessna Citation CJ3.

**Table 3-30: TFMSC B-II Operations**

Rank	Aircraft Type	2010	2011	2012	2013	2014	2015	2016	2017	2018
1	C25B - Cessna Citation CJ3	262	108	96	140	134	178	196	282	218
2	C550 - Cessna Citation II/Bravo	44	52	50	38	94	222	240	254	326
3	BE9T - Beech F90 King Air	0	8	0	4	2	150	516	256	200
4	B350 - Beech Super King Air 350	42	54	46	90	104	102	96	136	168
5	BE20 - Beech 200 Super King	86	60	48	72	58	130	60	152	112
6	C560 - Cessna Citation V/Ultra/Encore	70	72	64	106	66	98	138	100	56
7	C56X - Cessna Excel/XLS	38	52	48	54	66	52	66	70	58
8	F2TH - Dassault Falcon 2000	32	34	32	36	32	38	40	36	40
9	E55P - Embraer Phenom 300	0	4	6	2	34	10	42	52	64

Source: TFMSC

### 3.7 FORECAST SUMMARY

The forecast summary is presented in **Table 3-31** and **Table 3-32**. These are the forecast highlights:

- BDN is the only GA airport in Deschutes County to offer both 100LL and Jet A fuels and has an FBO.
- Single-engine and multi-engine piston aircraft will be retired faster than they are replaced. Jet, turbo-prop, helicopter, and other aircraft (experimental, gliders, light sport) are growing segments.
- Local and itinerant GA operations will grow, albeit at a slow rate; however, BDN has facilities that will attract pilots.
- Operations and based aircraft at BDN will grow primarily by flight training growth.
- The future ARC for BDN will remain B-II and the critical aircraft is the Cessna Citation II/Bravo.

**Table 3-31: Forecast/TAF Comparison**

AIRPORT NAME: Bend Municipal Airport				
	<u>Year</u>	<u>Airport Forecast</u>	<u>TAF</u>	<u>AF/TAF (% Difference)</u>
<b>Passenger Enplanements</b>				
Base yr.	2018	0	0	0.0%
Base yr. + 5yrs.	2023	0	0	0.0%
Base yr. + 10yrs.	2028	0	0	0.0%
Base yr. + 15yrs.	2033	0	0	0.0%
<b>Commercial Operations</b>				
Base yr.	2018	1,290	1,000	29.0%
Base yr. + 5yrs.	2023	1,400	1,000	40.0%
Base yr. + 10yrs.	2028	1,600	1,000	60.0%
Base yr. + 15yrs.	2033	1,700	1,000	70.0%
<b>Total Operations</b>				
Base yr.	2018	122,045	144,586	-15.6%
Base yr. + 5yrs.	2023	179,000	162,840	9.9%
Base yr. + 10yrs.	2028	187,800	183,351	2.4%
Base yr. + 15yrs.	2033	191,000	206,461	-7.5%
<b>Based Aircraft</b>				
Base yr.	2018	244	262	-6.9%
Base yr. + 5yrs.	2023	267	291	-8.2%
Base yr. + 10yrs.	2028	279	312	-10.6%
Base yr. + 15yrs.	2033	291	335	-13.1%
<b>Local Operations (Including Local Flight Training Operations)</b>				
Base yr.	2018	82,049	72,040	13.9%
Base yr. + 5yrs.	2023	122,040	81,145	50.4%
Base yr. + 10yrs.	2028	127,200	91,366	39.2%
Base yr. + 15yrs.	2033	127,800	102,873	24.2%
<b>Itinerant Operations (Including Itinerant Flight Training Operations)</b>				
Base yr.	2018	53,390	72,546	-26.4%
Base yr. + 5yrs.	2023	56,700	81,695	-30.6%
Base yr. + 10yrs.	2028	59,000	91,985	-35.9%
Base yr. + 15yrs.	2033	61,500	103,588	-40.6%
<b>Itinerant Air Taxi Operations</b>				
Base yr.	2018	1,290	1,000	29.0%
Base yr. + 5yrs.	2023	1,400	1,000	40.0%
Base yr. + 10yrs.	2028	1,600	1,000	60.0%
Base yr. + 15yrs.	2033	1,700	1,000	70.0%
<b>NOTES:</b> TAF data is on a U.S. Government fiscal year basis (October through September). AF/TAF (% Difference) column has embedded formulas.				

### Table 3-32: TAF Forecast Worksheet

AIRPORT NAME:	Bend Municipal Airport	A. Forecast Levels and Growth Rates						2018 Specify base year:	Average Annual Compound Growth Rates	
		Base Yr. Level	Base Yr. + 1yr.	Base Yr. + 5yrs.	Base Yr. + 10yrs.	Base Yr. + 15yrs.	Base yr. to +1	Base yr. to +5	Base yr. to +10	Base yr. to +15
<b>Passenger Enplanements</b>										
Air Carrier	0	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%
Commuter	0	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%
<b>TOTAL</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>
<b>Operations</b>										
<b>Interim</b>										
Air carrier	0	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%
Commuter/air taxi	1,290	1,300	1,400	1,600	1,700	1,700	0.8%	1.7%	2.2%	1.9%
Total Commercial Operations	1,290	1,300	1,400	1,600	1,700	1,700	0.8%	1.7%	2.2%	1.9%
General aviation	24,630	25,000	26,800	29,100	31,600	31,600	1.5%	1.7%	1.7%	1.7%
Military	0	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%
Flight Training	14,076	23,900	28,760	29,900	29,900	29,900	0.0%	0.0%	0.0%	0.0%
<b>Local</b>	<b>6,458</b>	<b>6,600</b>	<b>7,000</b>	<b>7,600</b>	<b>8,200</b>	<b>8,200</b>	<b>2.2%</b>	<b>1.6%</b>	<b>1.6%</b>	<b>1.6%</b>
General aviation	0	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%
Military	75,591	95,600	115,040	119,600	119,600	119,600	0.0%	0.0%	0.0%	0.0%
Flight Training	122,045	152,400	179,000	187,800	191,000	191,000	24.9%	8.0%	4.4%	3.0%
<b>TOTAL OPERATIONS</b>	<b>7,142</b>	<b>7,241</b>	<b>7,768</b>	<b>8,513</b>	<b>9,208</b>	<b>9,208</b>	<b>1.4%</b>	<b>1.7%</b>	<b>1.8%</b>	<b>1.7%</b>
Instrument Operations	0	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%
Peak Hour Operations	0	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%
Cargo/mail (enplaned+deplaned tons)	244	252	267	279	279	279	3.3%	1.8%	1.8%	1.2%
<b>Based Aircraft</b>										
Single Engine (Nonjet)	191	199	212	223	231	231	4.2%	2.1%	1.6%	1.3%
Multi Engine (Nonjet)	11	19	19	18	18	18	72.7%	11.6%	5.0%	3.3%
Jet Engine	19	11	12	13	15	15	-42.1%	-8.8%	-3.7%	-1.6%
Helicopter	23	23	24	25	27	27	0.0%	0.9%	0.8%	1.1%
Other	0	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%
<b>TOTAL</b>	<b>244</b>	<b>252</b>	<b>267</b>	<b>279</b>	<b>279</b>	<b>279</b>	<b>3.3%</b>	<b>1.8%</b>	<b>1.8%</b>	<b>1.2%</b>
<b>B. Operational Factors</b>										
<b>Average aircraft size (seats)</b>										
Air carrier	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commuter	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Average enplaning load factor</b>										
Air carrier	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Commuter	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>GA operations per based aircraft</b>	<b>495</b>	<b>600</b>	<b>665</b>	<b>668</b>	<b>650</b>	<b>650</b>	<b>1.3%</b>	<b>1.8%</b>	<b>1.8%</b>	<b>1.2%</b>



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Seattle Airports District Office  
2200 S 216<sup>th</sup> St  
Des Moines, WA 98198

August 7, 2020

Tracy Williams, Airport Manager  
Bend Municipal Airport – City of Bend  
710 NW Wall Street  
Bend, Oregon 97703

Bend Municipal Airport  
Bend, OR  
AIP: 3-41-0007-027-2018  
Forecast Approval

Dear Mrs. Williams:

The Federal Aviation Administration (FAA) reviewed forecast information for the subject airport. FAA approves the forecast as presented in Chapter 3 of the Master Plan and as shown below:

AIRPORT NAME:	Bend Municipal Airport	A. Forecast Levels and Growth Rates									
		Specify base year: 2018					Average Annual Compound Growth Rates				
		Base Yr. Level	Base Yr. + 1yr.	Base Yr. + 5yrs.	Base Yr. + 10yrs.	Base Yr. + 15yrs.	Base yr. to +1	Base yr. to +5	Base yr. to +10	Base yr. to +15	
<b>Passenger Enplanements</b>											
Air Carrier	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%	0.0%	
Commuter	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%	0.0%	
<b>TOTAL</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	
<b>Operations</b>											
<u>  Inherent</u>											
Air carrier	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%	0.0%	
Commuter/air taxi	1,290	1,300	1,400	1,600	1,700	0.8%	1.7%	2.2%	1.9%		
Total Commercial Operations	1,290	1,300	1,400	1,600	1,700	0.8%	1.7%	2.2%	1.9%		
General aviation	24,630	25,000	26,800	29,100	31,600	1.5%	1.7%	1.7%	1.7%		
Military	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%		
Flight Training	14,076	23,900	28,760	29,900	29,900						
<u>  Local</u>											
General aviation	6,458	6,600	7,000	7,600	8,200	2.2%	1.6%	1.6%	1.6%		
Military	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%		
Flight Training	75,591	95,600	115,040	119,600	119,600						
<b>TOTAL OPERATIONS</b>	<b>122,045</b>	<b>152,400</b>	<b>179,000</b>	<b>187,800</b>	<b>191,000</b>	<b>24.9%</b>	<b>8.0%</b>	<b>4.4%</b>	<b>3.0%</b>		
<b>Instrument Operations</b>	<b>7,142</b>	<b>7,241</b>	<b>7,768</b>	<b>8,513</b>	<b>9,208</b>	<b>1.4%</b>	<b>1.7%</b>	<b>1.8%</b>	<b>1.7%</b>		
<b>Peak Hour Operations</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>		
<b>Cargo/mail (enplaned+deplaned tons)</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>		
<b>Based Aircraft</b>											
Single Engine (Nonjet)	191	199	212	223	231	4.2%	2.1%	1.6%	1.3%		
Multi Engine (Nonjet)	11	19	19	18	18	72.7%	11.6%	5.0%	3.3%		
Jet Engine	19	11	12	13	15	-42.1%	-8.8%	-3.7%	-1.6%		
Helicopter	23	23	24	25	27	0.0%	0.9%	0.8%	1.1%		
Other	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%		
<b>TOTAL</b>	<b>244</b>	<b>252</b>	<b>267</b>	<b>279</b>	<b>291</b>	<b>3.3%</b>	<b>1.8%</b>	<b>1.3%</b>	<b>1.2%</b>		

The FAA also approves B-II for the existing and future critical aircraft. We found the forecast to be supported by reasonable planning assumptions and current data. Your forecast appears to be developed using acceptable forecasting methodologies.



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2200 S 216<sup>th</sup> St  
Des Moines, WA 98198

This forecast was prepared prior to the impacts of COVID-19. The forecast approval is based in reference to the data and methodologies used and the conclusions at the time the document was prepared. However, consideration must still be given to the significant impacts of COVID-19 on aviation activity; as a result, there is lower than normal confidence in future growth projections. FAA approval of the forecast does not provide justification to begin airport development.

Justification for future projects will be made based on activity levels at the time the project is requested for development, rather than this forecast approval. Further documentation of actual activity levels reaching the planning activity levels will be needed prior to FAA participation in funding for eligible projects. Further, the approved forecasts may be subject to additional analysis or the FAA may request a sensitivity analysis if this data is to be used for environmental or Part 150 noise planning purposes.

If you have questions, please call me at 406-441-5408.

Sincerely,

**KENNETH S EATON**

Digitally signed by KENNETH S EATON

Date: 2020.08.07 13:58:10 -06'00'

Scott Eaton  
Airport Planner, FAA Helena Airports District Office  
Acting Airport Planner, FAA Seattle Airports District Office

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# EXPLORE SOLUTIONS

NEEDS, GOALS, IDEAS,  
SOLUTIONS, AND  
ALTERNATIVES



# Chapter 4: Facility Goals/Requirements

## Introduction

The facility goals and requirements analysis was developed based on the information obtained from project stakeholders during Regional Stakeholder Meeting #1, PAC Meeting #1/Open House #1, PAC Meeting #2, and stakeholder surveys. The justification and support for the proposed goals and requirements is presented here within and also in Chapter 2 - Existing Conditions Analysis and Chapter 3 - Aviation Activity Forecasts. Additional justification will be required before FAA funding can be programmed.

The evaluation of airport facility goals and requirements utilizes established planning criteria to determine the future facility needs for Bend Municipal Airport through the current 20-year planning period within the Regional Setting, Landside Elements, Airside Elements, and Airport Administration Elements of the Airport.

The facility goals and requirements evaluation is used to identify the adequacy or inadequacy of existing airport facilities, identify new facilities that may be desired by Airport users, and identify facilities required to satisfy demand during the 20-year planning period. Potential options and preliminary costs for providing the recommended facilities anticipated to occur in the 20-year planning period will be evaluated in Chapter 5 - Airport Development Alternatives, to determine the most cost effective and efficient means for meeting projected facility goals and requirements.

### PAC MEETING #2

PAC Meeting #2 served as the primary opportunity to discuss recommended facility goals and requirements with community stakeholders. The proposed goals and requirements were discussed with City staff in advance of the meeting and presented to the PAC. The facility goals and requirements presented throughout this chapter represent the wants, needs, and required facility improvements to satisfy future demand.

**FACILITY GOAL** - The goals, policies, and objectives developed in response to issues/opportunities identified in the Existing Conditions Analysis and Aviation Activity Forecasts.

**FACILITY REQUIREMENT** - The facility improvements required to satisfy identified capacity/demand requirements and FAA standards.



# Critical Aircraft and Airport Design Standards

The existing and future critical aircraft are determined based on the current and projected level of activity described in Chapter 3, Aviation Activity Forecasts. The critical aircraft establishes existing and future airport planning & design standards that will guide future planning, design, and development of the Airport.

## CRITICAL AIRCRAFT AND AIRPORT REFERENCE CODE

As discussed in Chapter 3, the recommended existing and future critical aircraft is the Cessna Citation II/Bravo. The critical aircraft is intended to represent the most demanding aircraft using the airport on a regular basis and establish the Airport Reference Code (ARC) which is an airport designation that signifies the airports highest Runway Design Code (RDC), minus the visibility component of the RDC. **The existing and future ARC for Bend Airport is B-II and will remain B-II throughout the planning period.**

## RUNWAY DESIGN CODE

The Runway Design Code (RDC) is comprised of the selected Aircraft Approach Category (AAC), the Airplane Design Group (ADG), and the approach visibility minimums of a specific runway end. For airports with more than one runway, each runway will have its own RDC. The RDC provides the information needed to determine specific runway design standards. The approach visibility minimums refer to the visibility minimums expressed by runway visual range (RVR) values in feet. **The existing RDC for the Runway 16/34 is B-II-5000. The future RDC for the airport will remain B-II-5000 throughout the planning period.**

## APPROACH AND DEPARTURE REFERENCE CODE

The Approach and Departure Reference Codes (APRC and DPRC respectively) represent the current operational capabilities of each specific runway end and adjacent taxiways. The approach reference code uses the physical characteristics of the design aircraft (approach speed and wingspan/tail height) and the approach visibility minimums (expressed in RVR values) and runway to taxiway separation on the airfield to define specific standards. **The existing APRC for Runway 16/34 is B-II-5000. The future APRC for the existing runway as well as that for any proposed runway is anticipated to remain B-II-5000.**

The departure reference code uses only the physical characteristics of the design aircraft and runway to taxiway separation. **The existing and future DRPC for Runway 16/34 is B-II.**

## TAXIWAY DESIGN GROUP

Taxiway Design Group (TDG) is based on the dimensions of the aircraft landing gear including distance from the cockpit to the main gear (CMG) and main gear width (MGW). These dimensions affect an aircraft's ability to safely maneuver around the airport taxiways and dictate pavement fillet design. Taxiways and taxilanes can be constructed to different TDGs based on the expected use of that taxiway/taxilane by the design aircraft. Currently the primary taxiways providing access to and from the runway and apron areas at the airport accommodate ADG II aircraft, which is best represented by TDG II. Taxilanes in some hangar areas primarily serve ADG I aircraft and are best represented by TDG IA.





## FAA DESIGN STANDARDS

FAA Advisory Circular 150/5300-13A Airport Design serves as the primary reference in establishing the geometry of airfield facilities. A comparison of existing condition dimensions and future design standards for the runway is summarized in **Table 4-1**.

### FAA DESIGN STANDARDS

Specific design standards and conditions applicable to Bend Municipal Airport facilities are presented in the following sections of this chapter within the sidebar "FAA Design Standards." For additional information reference appropriate sections within AC 150/5300-13A.

TABLE 4-1: FAA DESIGN STANDARDS SUMMARY

FAA STANDARD	RUNWAY 16/34 EXISTING CONDITIONS	RUNWAY 16/34 ARC B-II NOT LOWER THAN 1-MILE OR VISUAL EXISTING/FUTURE STANDARD	RUNWAY 16/34 ARC A/B-II NOT LOWER THAN 3/4-MILE COMPARISON STANDARD <sup>1</sup>
Runway Length	5,200	1	A, B, C, D
Runway Width	75	75	75
Runway Shoulder Width	10	10	10
Runway Obstacle Free Zone • Width • Beyond RWY End • Prior to Landing Threshold	150 300 300	150 300 300	150 300 300
Runway Obstacle Free Zone • Width • Beyond RWY End • Prior to Landing Threshold	400 200 200	400 200 200	400 200 200
Object Free Area • Width • Beyond RWY End • Prior to Landing Threshold	500 300 300	500 300 300	500 300 300
Runway Protection Zone Length	RWY 16: 1,000 RWY 34: 1,000	RWY 16: 1,000 RWY 34: 1,000	RWY 16: 1,700 RWY 34: 1,700
Runway Protection Zone Inner Width	RWY 16: 500 RWY 34: 500	RWY 16: 500 RWY 34: 500	RWY 16: 1000 RWY 34: 1000
Runway Protection Zone Outer Width	RWY 16: 700 RWY 34: 700	RWY 16: 700 RWY 34: 700	RWY 16: 1,510 RWY 34: 1,510
Runway Centerline to: Parallel Taxiway/ Taxilane CL Aircraft Parking Area	300 365 <sup>2</sup>	240 250	240 250

**Notes:**

1. Not lower than 3/4 mile B-II standards depicted for the purpose of comparison.
2. Distance between Runway 16/34 centerline and closest apron tiedowns.



# Airport Capacity and Delay

Airport capacity and annual aircraft delay computations are needed to design and evaluate airport development and improvement projects. The method for computing airport capacity and aircraft delay is described in FAA Advisory Circular 150-5060-5f (AC 5) Airport Capacity and Delay.

## TOTAL OPERATIONS AND AIRPORT CAPACITY

Total operations combine the preferred forecasts for itinerant GA operations, local GA operations, and itinerant air taxi operations.

Combining preferred forecasts (itinerant GA, local GA and itinerant air taxi) results in BDN reaching 84.5 percent of the Annual Service Volume (ASV) in 2038. Per, AC 5f ASV is a reasonable estimate of an airport's annual capacity, it accounts for differences in runway use, aircraft mix, weather conditions, etc., that would be encountered over a one year period. The estimate of an airport's annual capacity is a measure of the maximum number of aircraft operations which can be accommodated on an airport in an hour. As an airport reaches capacity, individual aircraft delay is increased. An example of individual aircraft delay is when arriving or departing aircraft must wait due to the amount of traffic that is currently operating at an airport at a given time. When an airport exceeds its ASV, individual aircraft delay increases, resulting in airport users waiting longer to conduct operations. Reductions in aircraft delay can be best achieved through airport improvements that increase capacity.

Using AC 5, the runway use configuration for BDN is determined to be configuration 1. The mix index, which is the equation (C+3D) was used to determine the mix index for BDN. In the equation, C is the percent of airplanes over 12,500 pounds but not over 300,000 pounds that operate at BDN, and D is the percent of airplanes over 300,000 pounds that operate at BDN. Using the forecasted operations in the Forecast Chapter, the mix index was equated to be less than one percent. With the mix index between zero percent and 20 percent, and the runway use configuration being 1, the ASV was determined to be 230,000 operations per year. According to AC 5 runway use configuration 1 has a Visual

Flight Rules (VFR) hourly capacity of 98 operations, and an Instrument Flight Rules (IFR) capacity of 59 operations.

The VFR and IFR hourly capacities for Runway use configuration 1 are based on assumptions listed below.

- Runway use configuration
- Percent of arrivals
- Percent of Touch and Go operations
- Taxiways
- Airspace limitations
- Runway instrumentation

Table 2-1 in AC 5 details assumptions to be made for determining percent arrivals and percent Touch and Go operations. The mix index between zero and 20 percent leads to the assumption that the percent of arrivals is 50 percent, and the percent of Touch and Go operations is between zero and 50 percent. These assumptions, which are incorporated into Figure 2-1 in AC 5 for determining runway use configuration, results in an average daily demand of 290 operations in the peak month, and an average hourly demand of 9 operations in the peak month. BDN has two full length parallel taxiways with four entrance/exit taxiways and eight connector taxiways. There are no airspace limitations at BDN that adversely impact operations. Runway 16/34 does not have an ILS or air traffic control tower (ATCT) but does have published instrument approaches for both ends of the runway.

BDN has a helipad that is 700 feet away from the existing runway. The separation between the helipad and the centerline of the runway meets the minimum 700 feet for simultaneous VFR operations. Helicopters operate on both the runway and helipad. To show how helicopter operations affect capacity, two sets of data were generated.

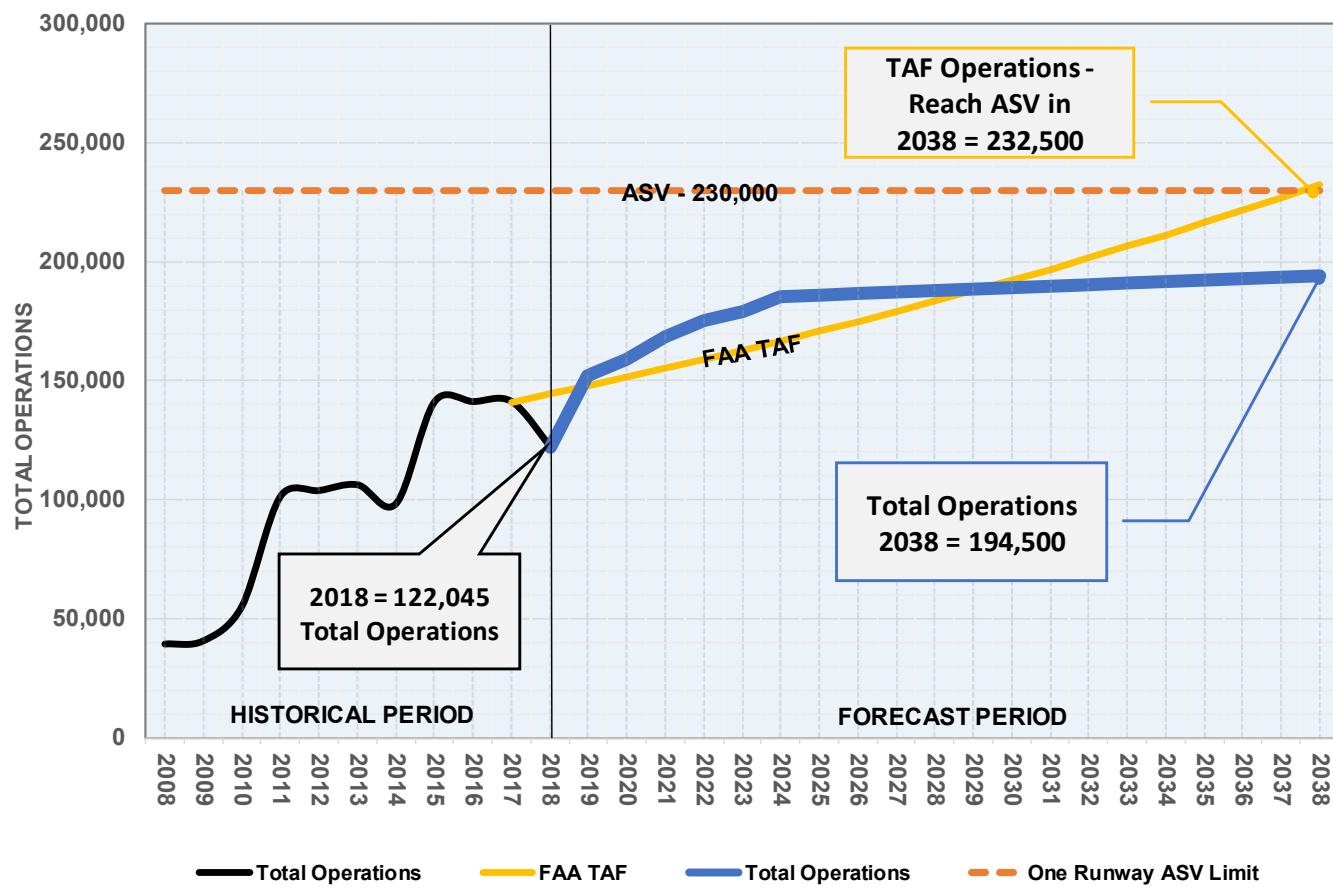
Total operations that include helicopter operations, this assumes all helicopters use only the runway. And total operations less helicopter operations, this assumes all helicopters use only the helipad. Helicopters that only use the helipad will reduce the amount of demand on the runway. Total operations including helicopter operations are shown in **Table 4-2** and **Figure 4-1**. Total operations less helicopter operations are shown in **Table 4-3** and **Figure 4-2**.

**TABLE 4-2: TOTAL OPERATIONS FORECAST – INCLUDING HELICOPTER OPERATIONS**

YEAR	TAF	TOTAL OPS	TAF % DIFFERENCE
2018	144,586	122,045	15.6%
2023	162,840	179,000	9.9%
2028	183,351	187,800	2.4%
2033	206,461	191,000	7.5%
2038	232,500	194,500	16.3%
CAGR	2.4%	2.4%	N/A
CAGR: Compound Annual Growth			



FIGURE 4-1: TOTAL OPERATIONS FORECAST – INCLUDING HELICOPTER OPERATIONS



Terminal Area Forecast (TAF) data is included as a point of reference. The TAF for BDN shows airport operations eventually crossing the ASV threshold. Whereas neither the total operations including helicopter operations nor total operations less helicopter operations totals cross the ASV within the twenty-year planning period.

#### Delay – Including Helicopter Operations

Using AC 5, existing operations account for 53 percent of the ASV, an Annual Demand ASV ratio of 0.53. Using Figure 2-2 in AC 5f, Average Aircraft Delay for Long Range Planning, the average delay per aircraft in minutes ranges from 0.1 to 0.6 minutes. This results in a total annual aircraft delay ranging between 12,205 to 73,227 minutes. Future operations in 2038 will account for an Annual Demand ASV ratio of 0.85, 85 percent of ASV. Average delay per aircraft will range between 0.5 to 1.6 minutes. This results in a total annual aircraft delay ranging between 97,250 to 311,200 minutes.

**BDN will still have capacity to handle operations within the 20-year forecast period, however, average delay per aircraft will increase as BDN continues to see growth in total operations.**

#### Delay – Less Helicopter Operations

Using AC 5, existing operations account for 36 percent of the ASV, an Annual Demand ASV ratio of 0.36. Using Figure 2-2 in AC 5f, Average Aircraft Delay for Long Range Planning, the average delay per aircraft in minutes ranges from 0.1 to 0.3 minutes. This results in a total annual aircraft delay ranging between 8,347 to 25,042 minutes. Future operations in 2038 will account for an Annual Demand ASV ratio of 0.68, 68 percent of ASV. Average delay per aircraft will range between 0.3 to 1.0 minutes. This results in a total annual aircraft delay ranging between 46,770 to 155,900 minutes.

**BDN will still have capacity to handle operations within the 20-year forecast period, however, average delay per aircraft will increase as BDN continues to see growth in total operations.**

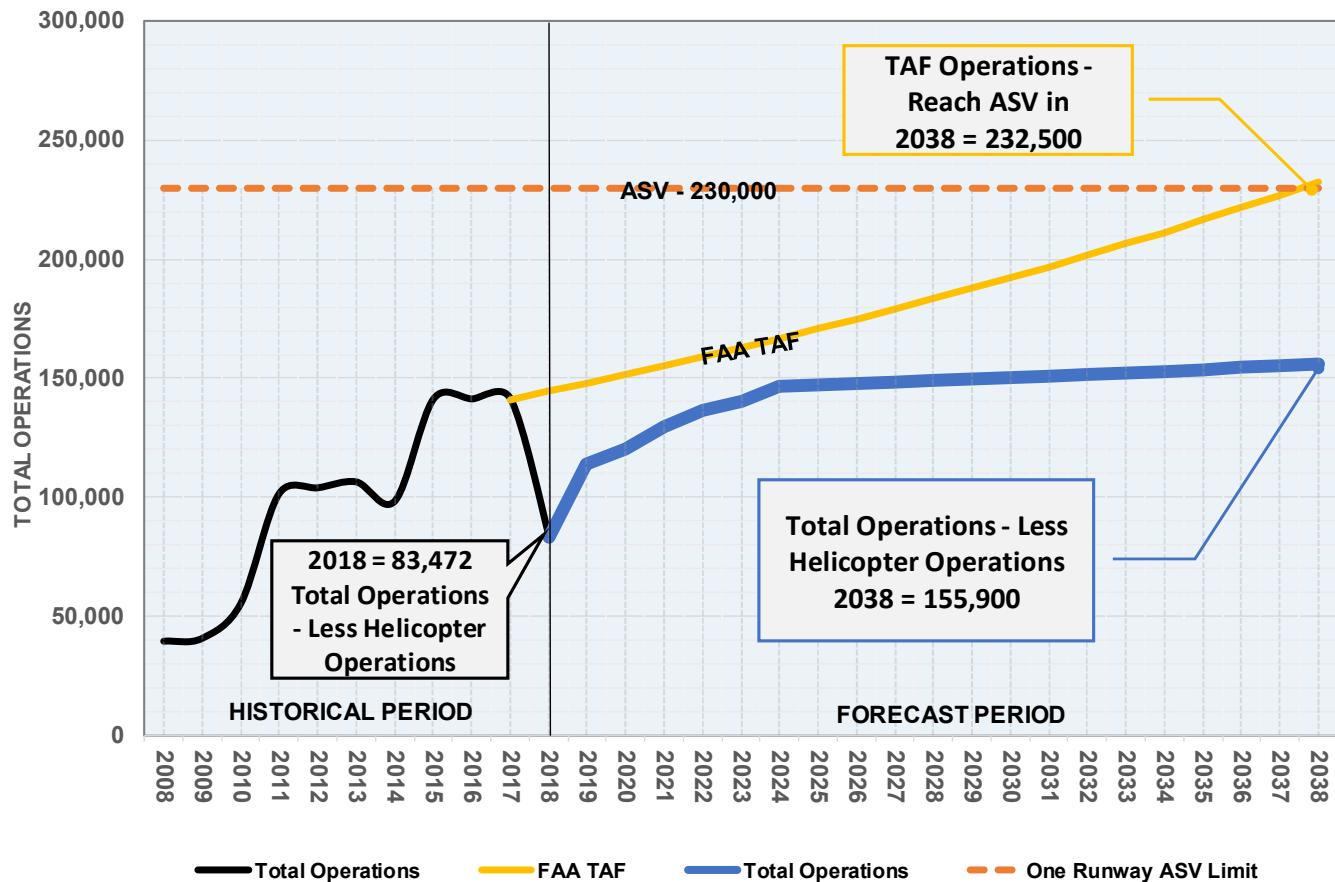


TABLE 4-3: TOTAL OPERATIONS FORECAST – LESS HELICOPTER OPERATIONS

YEAR	TAF	TOTAL OPS	TAF % DIFFERENCE
2018	144,586	83,472	42.3%
2023	162,840	140,400	13.8%
2028	183,351	149,200	18.6%
2033	206,461	152,400	26.2%
2038	232,500	155,900	32.9%
CAGR	2.4%	3.2%	N/A

CAGR: Compound Annual Growth

FIGURE 4-2: TOTAL OPERATIONS FORECAST – LESS HELICOPTER OPERATIONS



# Regional Setting Goals and Requirements

The goals and requirements for the Airport Regional Setting are comprised of those that affect the regional context of the Airport. The regional setting is focused on the impacts that the Airport has on the social, economic, and environmental issues of the region, county, and city. The regional setting impacts considered include, location and vicinity, socio-economic factors, airport operations and system role, relevant studies, environmental data, local surface transportation, and land use/zoning on and around the airport.



## LOCATION AND VICINITY

Bend Municipal Airport is located approximately five miles northeast of the City of Bend, outside the city limits in unincorporated Deschutes County. In Regional Stakeholder Meeting #1, participants indicated that the relatively remote location of the Airport – over 5 miles from downtown, and 3 miles from NE 27th St – isolates it from the surrounding community and amenities.

To address this issue, planners suggested that the City establish the Airport as a regional employment center/regional town center and work with the County to encourage new non-aviation commercial and industrial development around the Airport. These types of development would improve perceived negative impacts of the Airport's distance from the City. For example, commercial development could provide dining options for airport employees and users who currently must travel up to 20 minutes to restaurants in Bend.

There are numerous challenges to this concept that may exist. The City of Bend UGB would need to be expanded to encompass the Airport, resistance from current airport neighbors should be expected, and any approved changes would need to be consistent with, and incorporated into the City and County Comprehensive and Transportation System Plans.

### FACILITY GOAL:

**It is recommended that the City identify BDN and some adjacent land as a regional employment center and/or regional town center and encourage new non-aviation commercial and industrial development within a reasonable distance of the Airport.**



## COMMUNITY SOCIO-ECONOMIC DATA

The Bend-Redmond Metropolitan Statistical Area (MSA) is one of the fastest growing regions in the U.S. These trends can be attributed to considerable growth in key family-wage paying industries, abundant outdoor recreation activities available in the area, and a growing education market. Population forecasts project continued strong growth in the region throughout the 20-year planning period.

The Central Oregon economy has shown significant signs of growth since the recession. The average annual growth rate of the Bend-Redmond MSA Per Capita Real GDP has averaged 0.97% since 2007. From 2013 to 2017, the average annual growth rate was substantially higher on average at 4.16%. A detailed socio-economic analysis is presented in Chapter 3: Aviation Activity Forecasts.

While the Airport has experienced strong operational growth recently, it has not seen the physical growth that would be expected to accompany these regional socio-economic trends. This may be attributed to the public's and regional officials' limited understanding of the asset to which they have access, and the benefits that it can provide to both airport users and the community as a whole.

The strong regional growth outlook along with increased public awareness and support of the Airport should be leveraged to encourage further growth and development compatible with aviation and non-aviation uses on and around Bend Municipal Airport.

### **FACILITY GOAL:**

**It is recommended that the Airport work with regional partners/stakeholders to develop new employment opportunities at and around BDN.**

### **FACILITY GOAL:**

**It is recommended that the City develop an Airport public outreach strategy to increase public awareness and perception of BDN within the City of Bend as well as the greater Central Oregon Community.**

### **FACILITY GOAL:**

**It is recommended that the City pursue new opportunities within the framework of the Rural Enterprise Zone (E-zone) which may include expansion of the E-zone to areas immediately adjacent to the Airport.**

## AIRPORT ROLE

The Airport fills several roles within the context of National, State, and Local perspectives. Nationally, it is classified as a Regional General Aviation Airport in the National Plan of Integrated Airport Systems (NPIAS) where its role is to support regional economies by connecting communities to intrastate and interstate markets. In the state of Oregon, it is classified as a Category II – Urban General Aviation Airport, where it supports GA aircraft and accommodates corporate aviation activity, including piston and turbine engine aircraft, business jets, helicopters, gliders and other GA operations. Locally, according to a survey of airport users and stakeholders, the airport does not serve a single primary role, but rather fills many roles in the community, including serving recreational aircraft users; accommodating existing and future business/corporate aircraft; and providing opportunities for aviation related manufacturing, business, and commerce.

### **FACILITY GOAL:**

**It is recommended that the Airport continue to serve existing general aviation uses at the Airport and support growth in new aviation uses when/where opportunities may exist.**

### **FACILITY GOAL:**

**It is recommended that the City identify BDN as a regional employment center and/or regional town center for long-range planning purposes and encourage new non-aviation commercial/industrial development at and around BDN.**

## AIRPORT HISTORY

Bend Municipal Airport has been in continual public use since 1942 and has evolved significantly in that time. Since 1999 the FAA has invested over \$27M in federal grants to fund improvements and upgrades to the Airport, including runway and taxiway construction and rehabilitation, installation of weather reporting equipment, apron construction and improvements, and environmental and master planning studies.

### **FACILITY GOAL:**

**It is recommended that the Airport continue to work with State and FAA partners to support facility improvements and growth to accommodate anticipated aviation demand.**



## AREA AIRPORTS CONTEXTUAL ANALYSIS

The Bend Municipal Airport service area extends north and south along Highway 97, overlapping with service areas for several other central Oregon airports including Roberts Field, Prineville, Sisters, Sunriver, and Madras. GA services are provided at all of these airports. Roberts Field in Redmond also offers commercial service to the region. Due in part to the wide variety of general aviation and business aviation aircraft visiting Bend from outside the local area, operational growth at the airport has historically been strong. Currently Bend Municipal Airport accounts for nearly half of all operations and based aircraft in Central Oregon. This trend of growth at the Airport is expected to continue through the forecasted planning period.

### FACILITY GOAL:

**It is recommended that the City leverage the significant operational presence at the Bend Municipal Airport to market the Airport as critical regional infrastructure and an important economic development engine for the Central Oregon Region.**

## AIRPORT OPERATIONAL DATA

Historically Bend Municipal Airport has experienced substantial operational growth and is the 3rd busiest airport in Oregon. Since 2010 based aircraft and operations counts have increased by an estimated 30 percent and 73 percent, respectively. Currently the Airport accounts for nearly half of all GA operations in Central Oregon. The airport is expected to continue these trends over the 20-year planning period as operational growth is projected to continue at a compound average rate of 1.8 percent for based aircraft and 2.4 percent for operations. A detailed discussion of the operational forecasts is presented in Chapter 3 – Aviation Activity Forecasts.

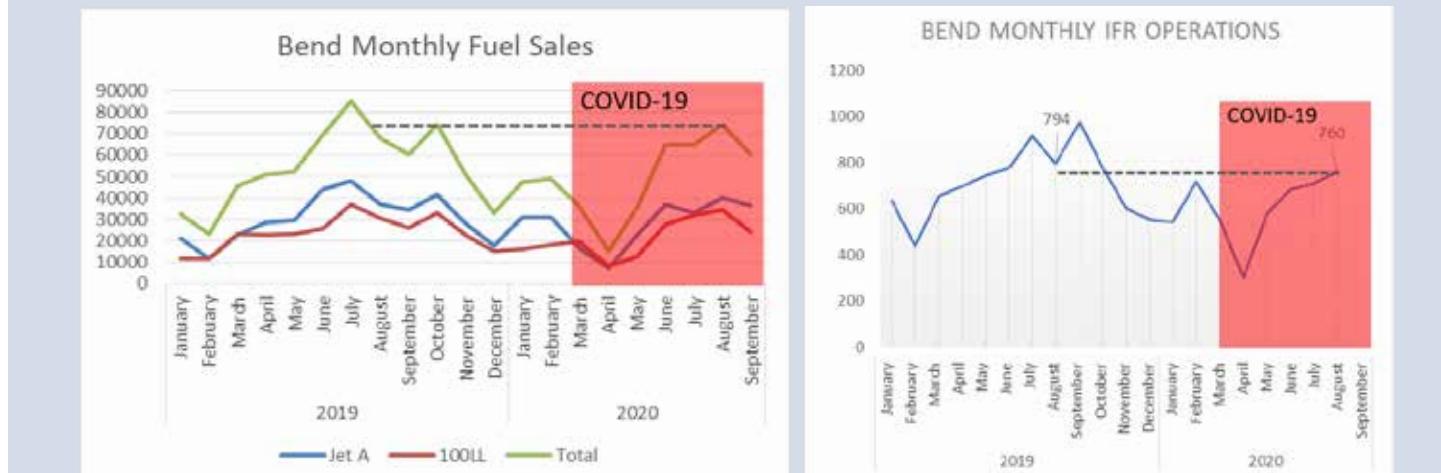
### FACILITY REQUIREMENT:

**It is recommended that the Airport continue to monitor trends in aviation activity and work closely with FAA in the programming of future development projects to accommodate forecast growth.**

### COVID-19 IMPACTS ON AIRPORT OPERATIONS

The forecasts presented in Chapter 3 - Aviation Activity Forecasts were prepared prior to the impacts of the COVID-19 global pandemic. While the short-term effects of the pandemic on aviation activity are very evident, the long-term impacts are unknown at the time of this writing. As a result, the FAA has expressed a lower than normal confidence in future growth projections and has indicated that justification for future projects will be made based on activity levels at the time the project is requested for development.

Fuel sales records and IFR operations data, effective indicators of operational activity, from 2020 depict a sharp decrease in operations from February to April, followed by nearly complete recovery in June. These data suggest that while state and local restrictions that were implemented to fight the COVID-19 pandemic had a significant impact on aviation activity at the Airport, these impacts were not long lasting and aviation readily recovered as restrictions were lifted. However, it should also be noted that at the time of this writing, the pandemic is still ongoing. The implications of further waves of viral activity across the region and country, as well as the aviation industry's ability to endure further restrictions are unknown at this time.





## RELEVANT STUDIES

There are several local, regional, and statewide studies available that contain a significant amount of information related to the Airport or the greater community. The studies listed below - discussed in more detail in Chapter 2 – Existing Conditions Analysis - have been incorporated into the planning process to provide greater context in the development of this plan.

- City of Bend Comprehensive Plan & Transportation System Plan (TSP)
- Rural Enterprise Zone Study
- Deschutes County Comprehensive Plan
- Deschutes County Transportation System Plan (TSP)
- 2013 Bend Airport Master Plan (AMP)
- 2015 Bend Helicopter Operations Area (HOA) Environmental Assessment (EA)
- Oregon Aviation Plan (OAP)

### FACILITY GOAL:

**It is recommended that the Airport work with local and state entities to update local comprehensive plans and transportation system plans to reflect this Airport Master Plan update.**

### FACILITY GOAL:

**It is recommended that steps be taken to address specific needs identified in the OAP as they pertain to the Airport's role in the state airport system.**

## ENVIRONMENTAL DATA

A comprehensive environmental review of the following cultural and environmental impact categories is discussed in greater detail in Chapter 2 – Existing Conditions Analysis:

- Solid Waste and Recycling Practices
- Cultural Resources
- Section 4(f) of the U.S. Department of Transportation Act Biotic Resources
- Federally listed Endangered and Threatened Species and Critical Habitats
- Wetlands and Waters of the U.S. Floodplains
- Stormwater and Water Quality
- Air Quality
- Noise Contours

Based on this review, minimal environmental impacts and issues were identified at the Airport. Issues of concern include airport noise mitigation, and the impact of the airport on the climate.

### FACILITY GOAL:

**It is recommended that the City balance airport neighbors' sensitivity to airport noise with continued growth in aviation activity at BDN.**

### FACILITY GOAL:

**It is recommended that the Airport support Bend Community Climate Action Plan - Consider installing electric vehicle charging stations on the Airport and converting on-airport City fleet vehicles to an all-electric fleet.**

### FACILITY REQUIREMENT:

**It is recommended that the Airport conduct additional environmental investigation/analysis for future infrastructure improvements as required by NEPA and FAA requirements.**

## LOCAL SURFACE TRANSPORTATION SYSTEM ANALYSIS

Surface transportation access to the Airport is provided via Powell Butte Highway at Butler Market Road on the west side. The Deschutes County Transportation Plan identifies Powell Butte Highway as “a former state highway that is now a rural arterial within Deschutes County.” Users have suggested that accessing the west side of the airport from Powell Butte Highway can be difficult and at times unsafe due to the high speed of traffic on the highway. The City has stated Deschutes County has plans in place to make improvements to the intersection of Powell Butte Highway and Butler Market Road, including the construction of a roundabout to improve traffic flow and safety at the airport entrance.

On the east side the HOA is accessed via a new asphalt drive off McGrath Road. The Aero and Epic Facilities are accessed via a Gibson Air Road off of Nelson Road.

### FACILITY GOAL:

**It is recommended that opportunities for improved Airport access be considered in conjunction with planned roundabout improvements.**

### FACILITY GOAL:

**It is recommended that the Airport work with FAA, State, and regional stakeholders to plan for local surface transportation system improvements that may be required to accommodate growth in Airport facilities.**



## LAND USE/ZONING ANALYSIS

Bend Municipal Airport is located outside the Bend city limits and urban growth boundary (UGB). The eastern edge of the City of Bend UGB is approximately 2.25 miles west of the Airport's western boundary. Land use controls and zoning for the airport and in the immediate vicinity of the airport are administered by Deschutes County.

The Airport is designated by Deschutes County as an AD – Airport Development Zone in Chapter 18.76 of the Deschutes County Code. The AD Zone is composed of three separate zoning districts, each with its own set of allowed uses and distinct regulations:

- Airport Operations District (AOD): which is intended to accommodate and protect airfield facilities such as runways, taxiways, and aircraft fueling.
- Aviation Support District (ASD): which includes all the items from the AOD and adds aircraft hangars, aircraft tiedowns, airport or aviation-related businesses that benefit from an airport location, and airport restaurants.
- Aviation-Related Industrial District (ARID): which expands the uses allowed in the ASD to include industrial businesses that benefit from an airport location.

These restrictive zoning districts have created challenges in the permitting and approval processes required for new developments. The challenges are the root cause for the lack of development at the HOA, and by extension, the underutilization of that facility. The Airport, City, and County would be benefitted by a simplification of the AD zone through consolidation of the zoning districts into a single zone.

The Airport is surrounded by Multi-use and Exclusive Farm Use (EFU) zones. Deschutes County has adopted airport overlay zones related to airport airspace protection and compatible land use planning.

### FACILITY GOAL:

**It is recommended that the City work with the County to update zoning code districts to simplify and improve the permitting process for future development on the Airport.**

### FACILITY GOAL:

**It is recommended that the City/County pursue aviation compatible commercial/industrial uses for adjacent off-airport land under Deschutes County jurisdiction.**

## Landside Goals and Requirements

Landside facilities include GA development areas, airport fencing, airport surface roads, vehicle parking, hangars, and utilities.

Regional Setting	Landside Elements	Airside Elements	Airport Administration
<b>Develop Understanding</b>	Location & Vicinity Socio-Economic Data Airport Role Airport History Area Airports Context Airport Operations Relevant Studies Environmental Data Local Surface Transportation Land Use/Zoning	General Aviation (GA) Development Areas Airport Fencing Airport Surface Roads Vehicle Parking Hangars Utilities	Runway/Helipad Taxiways/Taxilanes Aprons/Tiedowns Pavement Condition Support Facilities Area Airspace Instrument Flight Procedures Air Traffic Control Tower (ATCT)
<b>Explore Solutions</b>			
<b>Implementation</b>			

## GENERAL AVIATION (GA) DEVELOPMENT AREAS

Bend Municipal Airport is commonly divided into four GA development areas:

- The Northwest Development area consists of 176,000 square feet of existing development and is currently completely built out.
- The Southwest Development Area is nearly completely built out with 232,000 square feet of existing aviation development, including the FBO and terminal building. The main entry to the airport is in this area.
- The Northeast Development Area primarily includes the HOA and 13.5 acres of area available for helicopter related development. There are currently approximately 140,000 square feet of future hangar and commercial development in local planning review. A proposal for 123,000 square feet of commercial hangar development in this area is currently in the planning review stages.
- The Southeast Development Area contains the existing Aero and Epic facilities, as well as approximately 50 acres of property available for aviation related development. Development in some of these areas may be difficult due to existing grade challenges.

### FACILITY REQUIREMENT:

**It is recommended that space for future aviation and non-aviation related commercial/industrial development uses be identified during the development alternatives process.**

## AIRPORT PERIMETER FENCING

The airport currently has 3-strand wire fencing around the Airport with no security fencing/access control gates in place. Numerous stakeholders in the planning process identified a need for security fencing and access control gates on the Airport. The 2012 AMP also identified a need for security perimeter fencing.

### FACILITY REQUIREMENT:

**It is recommended that the Airport install perimeter fencing and access control gates consistent with Urban GA airports of similar size.**



## AIRPORT SURFACE ROADS

There are limited vehicle surface roads located on the airport. Access to the terminal building, apron, hangars, and west side businesses are primarily provided via a frontage road that parallels Powell Butte Highway along the west edge of the property. Users can access limited designated parking adjacent to the frontage road and walk directly to their hangar, tiedown, etc. However, a shortage of parking on the west side has resulted in users creating ad hoc parking along frontage road. In some instances users can access the airfield directly from frontage road and drive to their hangar to access their aircraft.

Vehicle traffic to facilities on the east side of the Airport is provided via designated on-airport surface roads, taxiways, taxilanes, and aprons. Nelson Road and Gibson Air Road provide access to the east side of the airport. An asphalt drive provides access to the HOA from McGrath Road. The Epic and Aero facilities are accessed via Gibson Road. Once in these areas, users use aprons and taxiway to navigate the facilities. Surface access on the airport is generally considered adequate.

In survey responses from users, it was noted that the frontage road is unattractive and does not reflect the vision users of the Airport would like to see. It was also noted that access to Powell Butte Highway from the frontage road can be unsafe due to high speed of travel on Powell Butte and lack of turning and merging lanes.

### **FACILITY GOAL:**

**It is recommended that the Airport improve the appearance of Airport frontage road and combine with parallel/angle parking along frontage road where space is available, and regulations allow.**

### **FACILITY GOAL:**

**It is recommended that access to and from Powell Butte Highway be reconfigured to improve visibility and driver safety in conjunction with the programmed Powell Butte Highway/Butler Market roundabout project.**

### **FACILITY GOAL:**

**It is recommended that the current on-airport surface roads be maintained and updated as required by future airport development identified in the development alternatives process.**

## **VEHICLE PARKING**

There are 809 designated vehicle parking stalls on airport property. The east side has 465 stalls, and the west side has 344 stalls. There is also space for approximately 234 vehicles along the west side of the frontage road on the west side that are commonly used for a total of 578 estimated parking spots on the west side.

A comprehensive surface parking analysis based on existing Deschutes County Code (section 18.116) standards for airport off-street parking was completed in this planning process. The results indicated that there is a surplus of existing parking available on the Airport. However, through discussions with airport users, employees, and stakeholders, it was clear that there is a known shortage of vehicle parking on the west side that has forced users to create ad hoc, undesignated parking along the frontage road. This suggests that the County standards for airport vehicle parking are underperforming when applied to these real-world conditions. Further study is warranted to identify the true vehicle parking needs at the Airport and provide an appropriate update to the County development code.

### **FACILITY REQUIREMENT:**

**It is recommended that a parking study be conducted in an effort to maximize available vehicle parking on the west side of the Airport. The existing parking on the east side should be maintained and updated with future development.**

## **TRANSPORTATION GROWTH MANAGEMENT (TGM) GRANT**

In July 2020, on behalf of the City of Bend, consultants applied for Oregon DOT/DLCD Transportation Growth Management (TGM) grant funding to further study access, circulation, and vehicle parking on and adjacent to the Airport. The request for funding was not approved.

The objective of the requested funds was to develop a planning study to coordinate the proposed transportation improvements along Powell Butte highway and identify future improvements to airport access points, the airport frontage road, and airport parking along the frontage road. It was expected that the planning study would establish a vision for the future transportation improvements; identify changes to current zoning and setbacks; and identify preliminary design alternatives for the roundabout that consider impacts on existing airport facilities, airport access, airport frontage road configuration, airport frontage road circulation, and vehicle parking configuration at the Bend Municipal Airport.

While the study was not funded, it is anticipated that future funding opportunities to address the facility needs identified in this master plan will be pursued in partnership with City of Bend and Deschutes County.



## HANGARS

Bend Municipal Airport has a variety of hangar types on the property including t-hangars, conventional box hangars, and commercial hangars to serve the based fleet of aircraft. Currently, there is an estimated 543,400 sf of hangar space. All available space is occupied and there is a waitlist of 33 individuals for hangars at the Airport. Hangar utilization rates tend to vary by aircraft type. It is estimated that 80% of single-engine aircraft, 95% of multi-engine aircraft, and 100% of jets and turboprops are stored in hangars. Required aircraft storage space also varies based on the type and size of the aircraft. At Bend Municipal Airport it is common for some users to lease more conventional hangar space than would normally be required for their specific aircraft. As a result, planning standards of 3,000 sf per single-engine aircraft, 5,000 sf per multi-engine aircraft, 6,000 sf per jet or turboprop, and 2,500 sf per helicopter were used to project parking space requirements. These values exceed the normally used standards, but reflect the conditions observed at BDN. A planning standard of 1,200 sf per aircraft for t-hangar storage was used as only one airplane can occupy a t-hangar at a time.

Using these parameters and the current based aircraft count, a current surplus of 23,000 sf of conventional hangar space and 25,000 sf deficiency of t-hangar space was identified. This matches the current trend at the Airport to underutilize conventional hangar space, as well as showing a shortage of t-hangar space that matches the 30+ person wait list for hangar space. The aviation activity forecasts project an increase of 59 based aircraft over the 20-year planning period resulting in a need for approximately 128,000 sf of additional hangar space over the planning period, comprised of 50,000 sf of t-hangars, and 78,000 sf of conventional hangars. The west side of the Airport is nearly entirely built out. As such, all future hangar and apron parking should be planned on the east side.

A summary of the hangar analysis results is presented in **Table 4-4**.

Previous planning efforts have sought to address the need for hangar space at the airport. The 2012 Airport Master Plan identified and depicted on the ALP approximately 106,000 square feet of t-hangar space and 78,000 square feet of conventional and commercial box hangar space in

the Northeast Development Area. A more recent site plan developed for airport management identified approximately 123,000 square feet of available commercial hangar space around the HOA apron. The recommendations of these studies remain valid and should be considered in the development alternatives process.

### FACILITY REQUIREMENT:

**It is recommended that the Airport develop an additional 25,000 square feet of t-hangar space to meet current demand. Previous planning efforts including the previous airport master plan should be considered through the development alternatives process. A total of 128,000 square feet of hangar space should be made available by 2038.**

### FACILITY GOAL:

**It is recommended that the City make necessary investments to improve rental hangars through maintenance operations and/or new development.**

### FACILITY GOAL:

**Through lease surcharges and rebates, and designating appropriately sized hangar areas on the ALP, encourage developers to construct the smallest hangar possible to deter excessive hangar sizes housing only one single-engine aircraft that results in underutilized aircraft storage.**

## UTILITIES

The Airport has significant utility infrastructure in place. These systems are discussed in greater detail in Chapter 2- Existing Conditions Analysis.

### FACILITY GOAL:

**It is recommended that the Airport continue to expand utilities when and where it is necessary to accommodate future growth and require developers to expand utilities where appropriate.**

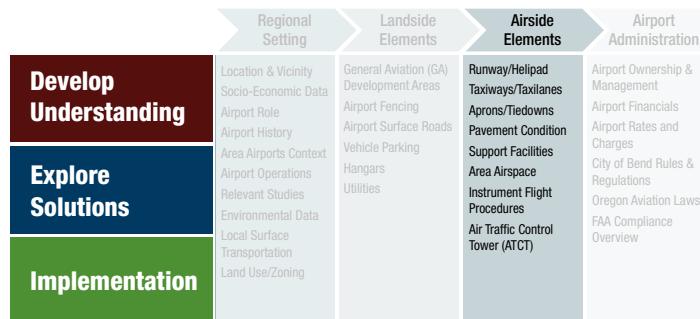
**TABLE 4-4: AIRPORT HANGARS SURPLUS/DEFICIENCY ANALYSIS**

	EXISTING CONDITIONS	EXISTING SURPLUS/DEFICIENCY	2023 SURPLUS/DEFICIENCY	2028 SURPLUS/DEFICIENCY	2033 SURPLUS/DEFICIENCY	2038 SURPLUS/DEFICIENCY
T-Hangar	73,292 SF	(25,258) SF	(35,968) SF	(41,518) SF	(45,598) SF	(50,188) SF
Conventional/Box Hangar	470,114 SF	23,339 SF	(11,686) SF	(29,461) SF	(56,161) SF	(78,136) SF
<b>Total SF</b>	<b>543,406 SF</b>	<b>(1,919) SF</b>	<b>(47,654) SF</b>	<b>(70,979) SF</b>	<b>(101,759) SF</b>	<b>(128,324) SF</b>



# Airside Goals and Requirements

Airside facilities include the runways, taxiways/taxilanes, apron/aircraft parking areas, airfield pavement, support facilities (navigational aids, signage, and lighting systems), area airspace, instrument flight procedures, and air traffic control tower (ATCT).



## RUNWAY/HELIPAD

Facility goals and requirements for Runway 16/34 were evaluated relative to runway orientation, length, width, and FAA design standards.

### Runway Orientation and Crosswind Coverage

Runway orientation is a function of wind velocity and direction, combined with the ability of aircraft to operate under given conditions. FAA has defined the maximum allowable crosswind for ADG I aircraft as 10.5 knots, 13 knots for ADG II aircraft, and 16 knots for larger general aviation aircraft.

The FAA recommends that primary runways accommodate at least 95 percent of local crosswind conditions. When this level of coverage is not provided, the FAA recommends consideration of a crosswind runway. An updated analysis of wind data observed at the Airport's AWOS utilizing 10 years of observations indicates that Runway 16/34 is able to accommodate more than 99% of all-weather wind conditions for both small and larger general aviation aircraft. The results of the analysis are summarized in **Table 4-5**.

**TABLE 4-5: RUNWAY 16-34 WIND ANALYSIS**

	<b>10.5 KT</b>	<b>13 KT</b>	<b>16 KT</b>
IFR	98.56%	99.23%	99.66%
VFR	96.87%	98.82%	99.74%
All-Weather	96.93%	98.83%	99.74%

Source: <https://airports-gis.faa.gov/wind>

### FACILITY REQUIREMENT:

It is recommended that the current runway configuration should be maintained throughout the planning period.

## Runway Length

The future design aircraft for Bend Municipal Airport identified in Chapter 3 – Aviation Activity Forecasts is a Cessna Citation 550, a medium size business jet (above 12,500 pounds). FAA Advisory Circular (AC) 150-5325-4B, Runway Length Requirements for Airport Design identifies a group of “airplanes that make up 75 percent of the fleet” and a group of “airplanes that make up 100% of fleet”. FAA Traffic Flow Management System Counts (TFMSC) data prepared pre-COVID and presented in **Table 4-6** and **Table 4-7** summarizes representative aircraft and operations by aircraft within these groups. The AC goes on to provide guidance on selecting the appropriate group of aircraft and runway length curves. It states that designers should use 75% of Fleet curves when the aircraft under evaluation are not found in the 100% of Fleet aircraft group. If a relatively few airplanes under evaluation are listed in the 100% of Fleet aircraft group, then the 100% of Fleet length curves should be used for planning purposes.

## RUNWAY 16/34 DESIGNATION UPDATE

### Magnetic Declination and Heading

While runways are designed and oriented using wind direction data measured in true compass headings, navigation to and from the runway relies on magnetic compass readings. As such, runways are identified relative to magnetic north. Runway ends are identified by points on a compass, from 1-36, reflecting the magnetic heading to the nearest 10 degrees.

The difference between true north and magnetic north – known as **“Magnetic Declination”** - is dependent on the geographic location on the Earth, and it is constantly changing with the Earth's magnetic field. This phenomenon necessitates that runway (magnetic) headings and designations are periodically updated to account for the change in magnetic declination.

The true compass headings of Runway 16-34 are 180° and 360°, respectively. In 2021 the magnetic declination at the Airport will be 14.5° E. This indicates that the respective magnetic headings of Runway 16-34 will be 165.5° and 345.5° and the runway designation should be updated to 17-35.

### FACILITY REQUIREMENT:

It is recommended that the runway designation be updated to 17/35 to account for the change in magnetic declination.



TABLE 4-6: AC 150/5325-4A - 75% AND 100% OF FLEET AIRCRAFT

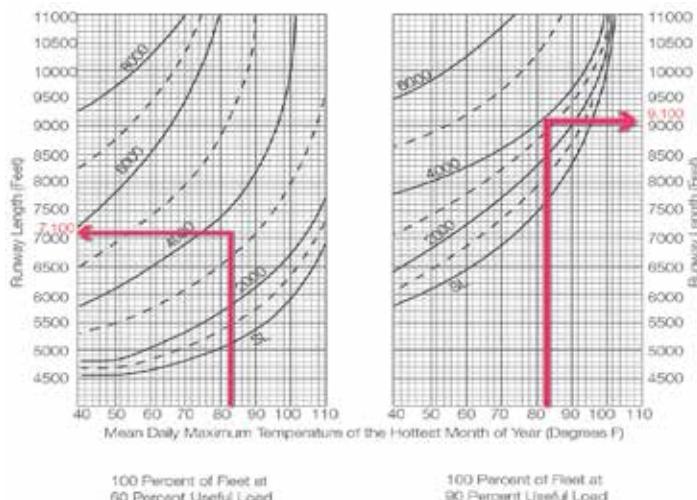
75% OF FLEET	100% OF FLEET
British Aerospace - Bae 125-700	British Aerospace - Bae Corporate 800, 1000
Beechcraft, Mitsubishi - Beechjet - 400A, Premier I	Bombardier - <b>Challenger 600</b> , 601-3A/3ER, 604
Bombardier - <b>Challenger 300</b>	Cessna - S550 Citation S/II, <b>650 Citation III/IV, 750 Citation X</b>
Cessna - <b>Citation I, II, III, V, VII, CJ-2, Bravo, Excel, Encore, Sovereign</b>	Dessault - <b>Falcon 900C/900EX, 2000/2000EX</b>
Dessault - Falcon 10, <b>20, 50</b>	IAI - <b>Astra 1125, Galaxy 1126</b>
Israel Aircraft Industries - Jet Commander 112, 1123, 1124	Learjet - <b>45XR, 55/55B/55C, 60</b>
Learjet - 20 series, <b>30 series, 40, 45</b>	Raytheon Hawker - <b>Horizon, 800/800 XP, 1000</b>
Raytheon Hawker - Hawker 400, 600	Sabreliner - 65/75
Rockwell - Saberliner 75	

Notes: 1. Red text indicates aircraft operating at BDN according to samples TFMSC data.

The previous master planning effort selected the 75% of Fleet group for runway length analysis based on the classification of the design aircraft which resulted in a runway length of 6,260'. The TFMSC data presented in Table 2 from 2009-2018 provides ample justification for the runway length depicted on the 2012 AMP. The data also identifies regular operations from aircraft in the 100% of Fleet group.

The FAA has not defined an operational threshold for applying 100% of fleet runway length requirements. However, the TFMSC data show consistent operational counts by aircraft in the FAA provided 100% of fleet aircraft list, indicating that the runway length derived using those methods, is appropriate for planning purposes. Anticipating a continued growing trend in business class aircraft and continued population growth in Central Oregon, it is prudent planning to use the 100% of Fleet length curves for long-term planning of the ultimate runway length at BDN. Whether it be 20, 30, or 40 years out, it is realistic to expect that the ultimate length provided by the 100% of the Fleet curve will be justifiable outside of the planning period and should be depicted on the ALP for long-range local land use planning.

FIGURE 4-3: 100 PERCENT FLEET AT 60 OR 90 PERCENT USEFUL LOAD CURVES



The runway at Bend is located at 3,460 MSL, the mean max temp is 83.7°F, and the difference in runway end elevations is 56'. Using these inputs and the runway length curves for 100% of fleet, unadjusted runway lengths of 7,100' and 9,100' were identified to accommodate 100% of the fleet at 60% and 90% of useful loads, respectively as depicted in **Figure 4-3**.

Further adjustments of the above lengths are required to account for effective runway gradient and wet and slippery conditions. Runway gradient is addressed by increasing the unadjusted runway length at a rate of 10' for each 1' of difference between runway high and low points. These elevations were not available for Bend Municipal Airport at the time of analysis, so the runway end elevations were used instead. The runway ends have an elevation difference of 56' which will add 560' to the calculated runway length. Adjustments for wet and slippery conditions apply for runway up to 5,500' at 60% useful load and 7,000' at 90% useful load. Bend exceeds these limits in each case and no adjustment is needed.

Based on local conditions and the methodology outlined in AC 150/5325-4A, a runway length of 7,660' feet is needed to accommodate 100 percent of large airplanes (60,000 pounds or less maximum gross takeoff weight) at 60 percent useful load. A length of 9,660' feet is needed to accommodate 100 percent of large airplanes (60,000 pounds or less maximum gross takeoff weight) at 90 percent useful load.

Data from 2009-2018 TFMSC records were used to identify 719 airports with operations originating from or heading to BDN in an effort to assess and better understand length of haul data. "Heat maps" were created from the data highlighting hotspots of operational activity related to the BDN ([Bend Origin and Destination Airports Activity figure on page 68](#)). Significant hotspots are shown around both major metropolitan areas in the west (Seattle, Portland, San Francisco, Los Angeles, and Las Vegas), as well as smaller regional airports, primarily in the Northwest (Eugene, Corvallis, Klamath Falls, and Boise).



TABLE 4-7: TFMSC IFR DATA - SELECT JET AIRCRAFT OPERATIONS

TFMSC IFR Data - Select Jet Aircraft Operations														
TFMSC IFR Data - Select Jet Aircraft Operations														
Aircraft	Aircraft Designator	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Average Annual Operations
Phenom 300	E55P	0	0	4	6	2	34	10	42	52	66	34	50	25
Premier I	PRM1	2	8	2	2	16	8	8	10	6	52	44	20	15
Challenger 300	CL30	104	24	16	24	40	116	80	112	124	76	36	48	67
Challenger 600*	CL60	8	20	4	14	4	16	10	16	32	22	10	6	14
Cessna 500 Citation	C500	10	16	2	6	0	0	0	2	0	0	2	2	3
Cessna 501 Citation	C501	8	24	24	92	170	154	128	142	144	86	66	42	90
Cessna 525 Citation - CJ2	C25A	26	20	16	18	14	10	14	28	34	118	188	88	48
Cessna 525 Citation - CJ3	C25B	196	262	108	96	140	134	178	196	282	220	156	120	174
Cessna 550 Citation Bravo	C550	40	44	52	50	38	94	222	240	254	352	344	270	167
Cessna 551 Citation	C551	2	4	0	0	4	0	16	6	6	0	0	2	3
Cessna 560 Citation Encore	C560	48	70	72	64	106	66	98	138	100	78	78	30	79
Cessna 560 Citation Excel	C56X	40	38	52	48	54	66	52	66	70	58	84	106	61
Cessna 650 Citation*	C650	44	40	20	16	18	8	12	22	4	2	0	0	16
Cessna 680 Citation Sovereign	C680	2	6	8	2	18	18	26	12	28	10	48	40	18
Cessna 700 Longitude	C700	0	0	0	0	0	0	0	0	0	4	0	6	1
Cessna 750 Citation*	C750	2	6	6	10	6	14	10	10	20	6	12	14	10
Falcon 10	FA10	2	0	0	4	0	8	4	2	2	0	6	0	2
Falcon 20	FA20	0	6	0	2	0	0	0	2	0	0	0	0	1
Falcon 50	FA50	6	8	2	2	4	10	8	18	14	6	8	28	10
Falcon 900*	F900	2	0	4	0	0	0	4	6	4	6	14	0	3
Falcon 2000*	F2TH	2	32	34	32	36	32	38	40	36	44	20	18	30
Astra 1125 *	ASTR	54	84	80	14	20	16	22	16	14	8	2	4	28
Galaxy 1126*	GALX	2	8	2	4	6	14	18	12	8	12	8	14	9
Westwind 1124	WW24	2	0	8	2	2	2	6	2	4	0	0	2	3
Lear 21	UJ25	4	4	10	0	0	0	0	0	0	0	0	0	2
Lear 28	UJ28	0	0	0	2	0	0	0	0	0	0	0	0	0
Lear 31	UJ31	12	4	6	6	24	8	8	12	26	14	2	6	11
Lear 35	UJ35	18	22	26	40	26	8	10	18	16	18	18	8	19
Lear 40	UJ40	22	22	16	20	18	10	18	10	10	4	0	0	12
Lear 45*	UJ45	14	14	20	18	6	6	12	26	10	6	6	6	12
Lear 55*	UJ55	4	8	0	0	4	0	0	0	0	0	0	0	1
Lear 60*	UJ60	16	10	10	8	10	4	6	2	18	16	8	6	10
Lear 75	UJ75	0	0	0	0	0	0	6	4	2	2	4	4	2
Mitsubishi Mu-300 Diamond	MU30	0	0	0	0	0	4	2	0	0	0	0	0	1
Beech Jet 400	BE40	156	74	26	18	2	8	14	10	12	16	20	22	32
Hawker 400	BE45	2	0	0	0	0	0	0	0	0	0	0	0	0
Hawker Horizon*	HA4T	0	0	0	0	10	14	2	4	6	6	16	4	5
Hawker 800*	H25B	12	8	18	8	20	18	34	26	30	18	16	64	23
Hawker 1000*	H25C	0	2	4	2	4	0	0	2	0	0	0	0	1
Gulfstream 150	G150	0	2	0	0	2	4	0	2	0	0	4	2	1
Gulfstream 280	G280	0	0	0	0	0	0	6	12	4	2	6	10	3
Embraer ERJ 135	E135	0	6	2	2	0	0	0	0	0	0	0	0	1
Gulfstream IV/G400	GLF4	18	10	20	22	16	18	28	14	12	8	10	8	15
Gulfstream V/G500	GLF5	8	2	0	4	2	2	0	8	8	0	6	2	4
Gulfstream VI/G600	GLF6	0	0	0	0	0	0	0	4	2	2	0	0	1
Bombardier Global Express	GLEX	0	0	0	0	0	0	0	2	4	0	10	4	2
<b>Total</b>		<b>888</b>	<b>908</b>	<b>674</b>	<b>658</b>	<b>842</b>	<b>924</b>	<b>1110</b>	<b>1296</b>	<b>1392</b>	<b>1334</b>	<b>1286</b>	<b>1058</b>	<b>1031</b>
Operations by 75% of the Fleet Group Aircraft		702	656	450	504	678	758	908	1,072	1,180	1,172	1,138	890	842
Operations by 100% of Fleet Group Aircraft		160	232	202	126	144	142	168	182	182	146	112	136	161
Operations by AC with MTOW > 60,000 lbs.		26	12	20	26	18	20	28	28	26	10	26	14	21
Select Aircraft identified in TFMSC Data		0	8	2	2	2	4	6	14	4	2	10	12	6

## Notes:

1. Operation averages are rounded to the nearest whole number
2. \*100% of Fleet aircraft - requires at least 5,000-foot runways at mean sea level and at the standard temperature of 59°F.
3. Red Text indicates Design Aircraft



Of the nearly 34,000 operations in that time period, over 25,000 (74%) originated from or were destined to an airport in the western U.S. As is expected the Northwest Region accounts for the bulk of that activity, with nearly 19,000 (55%) Bend-related operations. Of those, 3,350 (10%) of the operations listed Portland International (PDX) as the origin or destination airport. Flights to or from airports in the Southwest Region were less frequent, but still significant with 6,350 (19%) operations. Oakland International Airport (OAK) was the most commonly listed airport in the region, recording 459 operations to or from BND. These data suggest that BDN plays a significant operational role not only locally, but across the western US, especially in the Northwest.

Based on available length of haul information identified in the TFMSC data and numerous discussions with local operators, the planning team recommends long-term planning for a runway length based on the 100% of the Fleet at 60% Useful Load curve for an ultimate runway length of 7,660'.

#### **FACILITY REQUIREMENT:**

**It is recommended that the Airport plan for a future runway length of 6,260' in the short-term and an ultimate length of 7,660' beyond the 20-year planning period.**

#### **Runway Width and Shoulders**

Runway 16/34 is 75 feet wide and has 10 feet wide gravel shoulders, which meet the dimensional standard for ARC B-II with current approach visibility minimums (Not Lower than 1 Mile). The current conditions meet FAA design standards.

#### **FACILITY REQUIREMENT:**

**It is recommended that the runway be maintained at its existing width of 75 feet to meet requirements for a B-II (Not Lower than 1 Mile) runway.**

#### **Second Runway Length Analysis (Long-Term Planning)**

Forecasted operations data presented in Chapter 3, Aviation Activity Forecasts, indicate that the annual operations will reach 85% of the annual service volume (ASV) for a single runway limit of 230,000 annual operations within the next 20 years. Although the ASV is not projected to be surpassed in the 20-year planning period, it is likely that it will be surpassed in the 50-year long term planning period. As such, it is appropriate to consider a second runway as a long-term planning exercise.

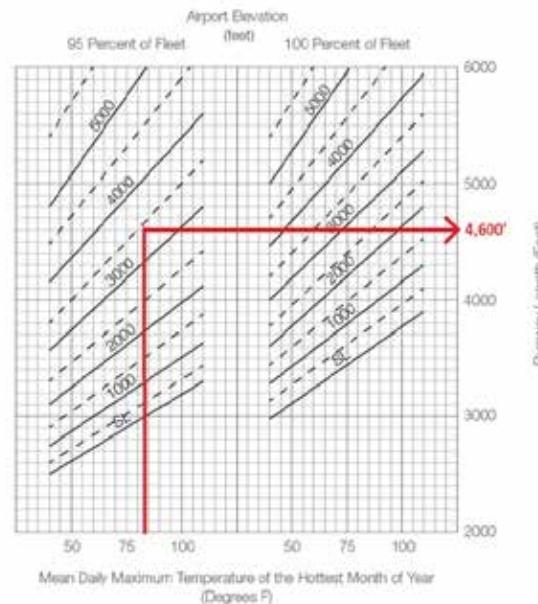
According to the operations forecasts, A-I, II and B-I (small) aircraft are projected to experience the most growth on the airport by 2038, rising to a combined total of nearly 79,000 annual operations. The “small” classification denotes that these aircraft have a maximum certified takeoff weight of less than 12,500 lbs. This class of aircraft are the primary driver for the need for a secondary runway. As discussed previously for Runway 16/34, FAA Advisory Circular (AC) 150-5325-4B,

Runway Length Requirements for Airport Design provides guidance for determining runway lengths based on the approach speed and size of the aircraft that will use it. Chapter 2, Section 205, of the AC outlines the procedure for small airplanes with approach speeds of 50 knots or more and with maximum certificated takeoff weight of 12,500 pounds or less.

The AC provides length curves for 95% and 100% of fleet. The difference between the two categories are based on the airport's location and the amount of existing or planned aviation activities. The AC states that the designer should use 95% of Fleet curves for airports that are intended to serve medium sized population communities with a diversity of usage and a greater potential for increased aviation activities. Also included in this category are those airports that are primarily intended to serve low-activity areas. 100% of fleet curves should be used for airports that are primarily intended to serve communities located on the fringe of a metropolitan area or a relatively large population remote from a metropolitan area.

Bend Municipal Airport serves the City of Bend, a medium sized community and is host to a variety of aviation activities. The local conditions were applied to the 95% of Fleet curves to determine a required runway length of 4,600' (**Figure 4-4**). Siting and orientation of the runway will be addressed during the Development Alternatives chapter of this master plan.

**FIGURE 4-4: SMALL AIRPLANES WITH FEWER THAN 10 PASSENGER SEATS**



#### **FACILITY GOAL:**

**It is recommended that the Airport plan for a second runway to be constructed in the 50-year long term planning period at a length of 4,600' to accommodate 95% of small airplanes with approach speeds of 50 knots or more.**



## Helipad/Helicopter Runway

A helicopter runway based on the configuration at Portland-Hillsboro Airport was depicted in the 2012 AMP to provide the separation of fixed-wing and helicopter air traffic operating at the Airport. However, only a single helicopter landing pad was constructed in 2016 as part of the Helicopter Operations Area (HOA) in the Northeast Development Area because including the second pad would have required property acquisition. As constructed, the HOA provides a dedicated helipad capable of simultaneous operation with the runway with a traffic pattern that does not conflict with patterns associated with the runway. It also provides increased separation between rotorcraft and fixed wing operations and decreased interactions between the different types of aircraft. Based on conversations with Leading Edge Staff, the construction of the second helipad and "runway" portion of the helicopter runway concept would relocate the majority of helicopter operations to the HOA and provide more separation between flight training helicopters and fixed-wing traffic than exists today.

Utilization of the HOA and helipad has been hampered by the lack of facilities in the area due to challenges in the County zoning/permitting process. At this time there are no support facilities at the HOA.

### FACILITY REQUIREMENT:

**It is recommended that the Helicopter Runway depicted on the 2012 AMP be constructed to further limit the use of runway and taxiway facilities by helicopter activity.**

### FACILITY REQUIREMENT:

**It is recommended that the City work with the County to streamline the development permitting processes to encourage development and increase the utilization of the HOA and helipad.**

## Runway/Helipad Protection Zones (RPZ/HPZ)

FAA has provided interim guidance regarding RPZs and incompatible land uses, with a particular focus on roads. This guidance directs airport sponsors to evaluate any planned changes to existing RPZs that introduce or increase the presence of roads in RPZs. Existing roads within RPZs are also to be evaluated during master planning to determine if feasible alternatives exist for realignment of a road outside RPZs or for changes to the RPZs themselves. The FAA Seattle Airports District Office has subsequently indicated that the primary focus of this policy is related to proposed changes to RPZs—as the result of a change to a runway end/RPZ location, approach visibility minimums, or the built items located in an RPZ. Any proposed changes in the length or configuration of the runway/runway displaced threshold that changes the location of existing RPZs evaluated in this study are subject to review by FAA headquarters in Washington D.C.

In much the same way RPZs protect people and property on the ground near runways, Heliport Protection Zones are intended to enhance the protection of people and property near heliports. HPZs are defined as the inner 280 feet of the heliport approach. Heliport owners are encouraged to control the land uses within the HPZ through property acquisitions and aviation easements.

### FACILITY REQUIREMENT:

**It is recommended that existing RPZs and HPZs should be cleared of incompatible land uses and potential alternatives for each RPZ and HPZ be considered in coordination with future runway configuration alternatives analysis.**

### FAA DESIGN STANDARDS

#### Runway Protection Zone (RPZ)

**Standards:** ADG II/Not Lower than 1 Mile RPZs comprise 13.77 acres. RPZs should be owned by the Airport or under control by easement and should be clear of incompatible land uses such as roads and buildings.

**Condition:** Both Runway 16 and 34 RPZs are located entirely on the airport property. Runway 34 RPZ is clear of incompatible land uses. However, Runway 16 RPZ is crossed by Powell Butte Highway.

#### Heliport Protection Zone (HPZ)

**Standards:** HPZs comprise the inner 280' of the heliport approach surface. HPZs should be owned by the Airport or under control by easements, and should be clear of incompatible land uses such as roads and buildings.

**Condition:** The south HPZ associated with the HOA helipad is located entirely on land owned by the Airport and contains no incompatible land uses. The north HPZ also contains no incompatible land uses, but it extends on to property that is neither owned by the Airport nor controlled by an easement.

#### Runway Width/Shoulders

**Standards:** ADG II standard runway width for runways with visual or not lower than 1 mile visibility is 75' with 10' shoulders.

**Condition:** Existing Runway 16/34 is 75' wide with 10' shoulders which is consistent with standards.





## TAXIWAYS & TAXILANES

The existing taxiway and taxilane systems were analyzed relative to existing hangars siting, apron and aircraft parking requirements, runway access, and FAA design standards.

### Taxiways

The full-length parallel taxiway, run-up aprons, and connector taxiways generally meet standards with one exception. The midfield connector taxiways A2, A3, and A4 providing direct access to the runway from east apron parking areas are not recommended and should be relocated so pilots can more easily distinguish between the taxiways and runway.

#### **FACILITY REQUIREMENT:**

**It is recommended that the connector taxiways located near the terminal apron be relocated to a new position to remove the direct runway access.**

### Taxilanes

Several non-standard conditions were observed in several areas. Taxilane OFA and TSA obstructions in the forms of hangars, roads, debris, non-standard taxilane geometry, and parked aircraft and vehicles were identified in the east hangar areas. Similar obstructions in the forms of fire hydrants, and parked vehicles and trailers were observed in the Aero Facility on the east side of the runway.

The TSA and TOFA obstructions in the southwest t-hangar area are the product of hangars and other structures being constructed without adequate clearances from the taxilanes. The majority of the aircraft stored in this area are small single-engine piston aircraft, and they have been operating in the area for many years without incident. It is anticipated that these taxilane conditions will remain until the area is redeveloped. Until that time, a modification to standards should be pursued using FAA Engineering Brief (EB) 78 to determine maximum aircraft wingspans capable of safely accessing the hangar area. Utilizing formulas provided in EB 78, referencing the existing taxilane positions and clearances in the hangar area it can be determined that aircraft with a maximum wingspan of 41 feet can safely navigate the hangar area taxilanes.

#### **FACILITY REQUIREMENT:**

**It is recommended that in the short term the Airport pursue a modification of standards to allow aircraft with wingspans up to 41 feet to operate within the southwest hangar area. In the long-term, an alternatives evaluation focused on the configuration of these hangar developments in relation to taxilane OFAs and TSAs should be conducted in the development alternatives process to identify a preferred solution.**

#### **FACILITY GOAL:**

**It is recommended that the Airport create policies and educate users regarding the importance of maintaining clear TSA and TOFAs on the airport. Users should be encouraged to park their vehicles and aircraft in designated parking areas or inside their hangars.**

## FAA DESIGN STANDARDS

### Runway – Parallel Taxiway/Taxilane Separation

**Standards:** ADG II standard is 240' separation between runway to parallel taxiway for B-II runways with not lower than 1 mile visibility.

**Condition:** Runway to parallel taxiways "A" and "B" separations are each 300'. These distances exceed required FAA design standards.

### Taxiway Safety Area (TSA)

**Standards:** ADG II standard is 79' wide or 39.5' each side of taxiway centerline for the entire length of the taxiway. Additional gradient standards apply.

**Condition:** The existing TSAs on the Airport appear to meet FAA dimensional and grading standards.

### Taxiway Object Free Area (TOFA)

**Standards:** TOFA for ADG II standards is 131' wide or 65.5' each side of taxiway centerline.

**Condition:** The existing TOFA for parallel taxiway "A" and connector taxiways appear to meet FAA dimensional criteria. The TOFA for parallel taxiway "B" is obstructed near the north run-up apron by the segmented circle.

### Taxilane Object Free Area (TLOFA)

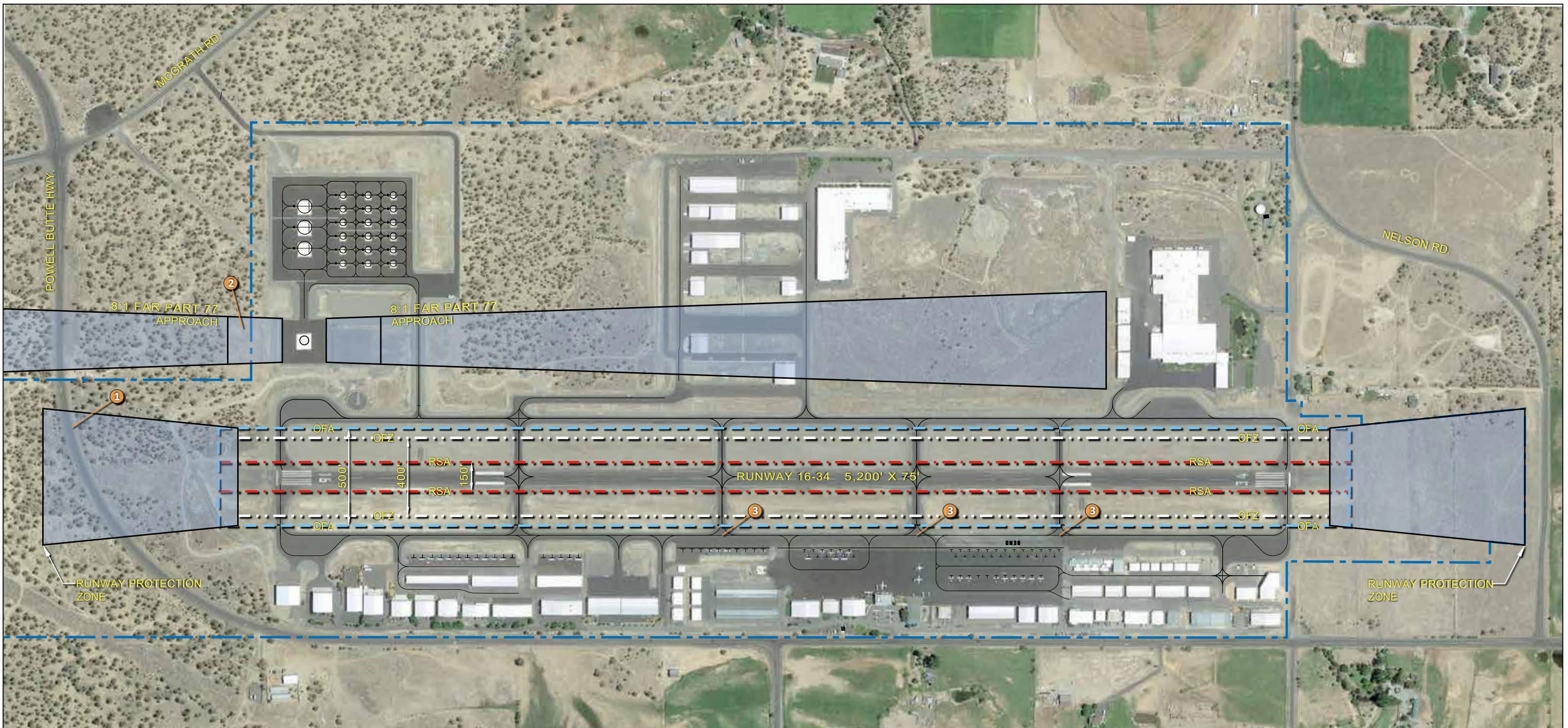
**Standards:** TLOFA for ADG I standards is 79' or 39.5' each side of centerline. TLOFA for ADG II standards is 115' wide or 57.5' each side of taxiway centerline.

**Condition:** TLOFA and TSA obstructions exist in several areas on the east and west side hangar developments, specifically in Aerofacilities (ADG II) on the east side and t-hangars in the southwest development area (ADG I).

### Parallel Taxilane to Taxiway Separation

**Standards:** Parallel taxilane centerline to taxiway centerline separation standards for ADG II is 105'.

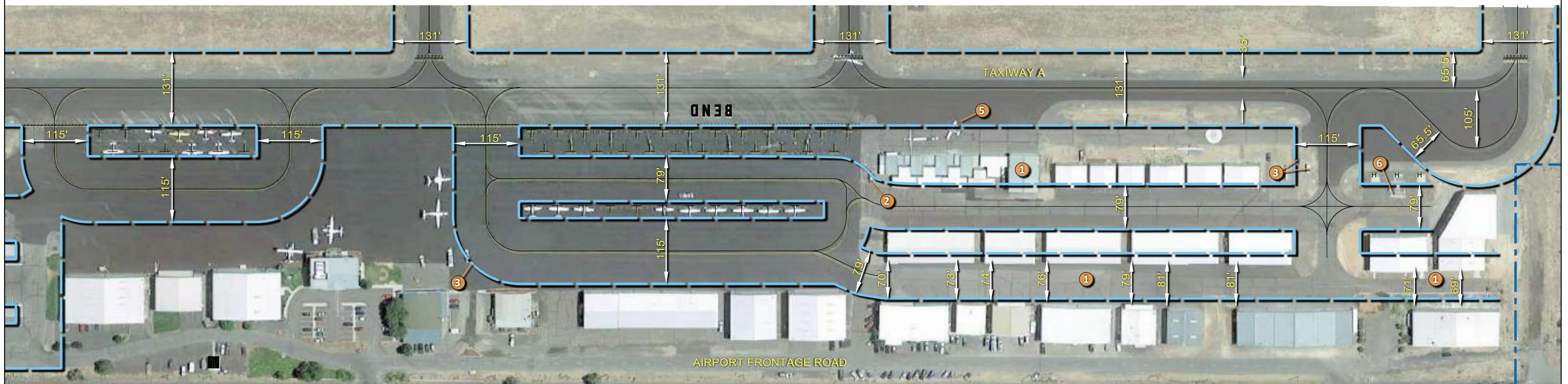
**Condition:** Parallel taxilane centerline to taxiway centerline separation between Taxiway "B" and the parallel taxiway "BB" is 105' and meets standards.


**FAA AIRPORT DESIGN STANDARD**

- ① RUNWAY PROTECTION ZONE - ROAD
- ② HELIPORT PROTECTION ZONE - PROPERTY CONTROL
- ③ APRON TO RUNWAY DIRECT ACCESS

**NON STANDARD CONDITIONS - RUNWAY/HELIPAD**
**BEND MUNICIPAL AIRPORT  
AIRPORT MASTER PLAN**
**CENTURY  
WEST**  
ENGINEERING





#### FAA AIRPORT DESIGN STANDARD

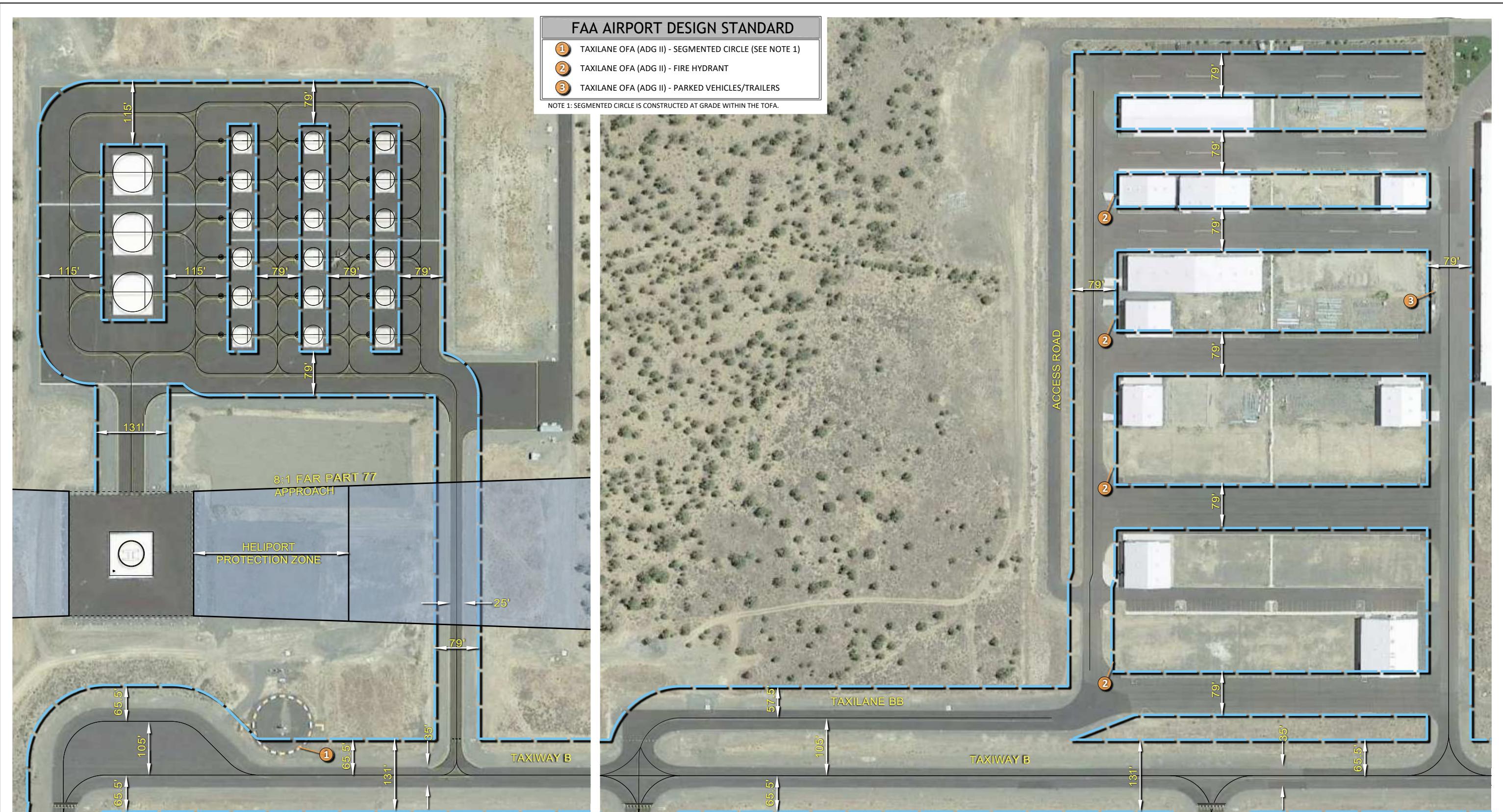
- |                                               |                                          |
|-----------------------------------------------|------------------------------------------|
| ① TAXILANE OFA (ADG I) - HANGARS (<79' CLEAR) | ⑤ TAXIWAY OFA (ADG II) - PARKED AIRCRAFT |
| ② TAXILANE OFA (ADG I) - PARKED VEHICLES      | ⑥ TAXILANE OFA (ADG I) - DEBRIS          |
| ③ TAXILANE OFA (ADG II) - PARKED VEHICLES     | ⑦ TAXILANE OFA (ADG I) - ACCESS ROAD     |
| ④ TAXILANE OFA (ADG I) - PARKED AIRCRAFT      | ⑧ UNUSUAL TAXIWAY GEOMETRY               |

NON STANDARD CONDITIONS - WESTSIDE

BEND MUNICIPAL AIRPORT  
AIRPORT MASTER PLAN

 CENTURY  
WEST  
E N G I N E E R I N G





## NON STANDARD CONDITIONS - EASTSIDE

# BEND MUNICIPAL AIRPORT AIRPORT MASTER PLAN

The logo for Century West Engineering. It features a stylized 'V' shape composed of blue and white horizontal bars on the left, followed by the words 'CENTURY' and 'WEST' in a bold, black, sans-serif font. Below this, a horizontal line spans the width, with the word 'ENGINEERING' in a smaller, black, sans-serif font centered below it.





## APRON/TIEDOWNS

Requirements for aircraft parking aprons were analyzed using FAA methodology described in FAA Advisory Circular 150/5300-13A Airport Design, Change 1. These methods and results are described below.

### Local Aircraft Parking

The Airport provides 27 aircraft parking stands (tiedowns) for rent to accommodate based aircraft that are not stored in hangars. Currently there is a waitlist of 13 users for tiedown space. One of those users are also listed on the hangar waitlist, indicating that they will consider either means of aircraft storage. For planning purposes, it is assumed that 20% of based single-engine aircraft and 5% of based multi-engine aircraft will be stored on the apron. The remaining aircraft are assumed to be stored in hangars. Considering this, it is estimated that 39 tiedown locations – 38 for single-engine and 1 for multi-engine aircraft – are required to accommodate the current based fleet. A total of 49 tiedowns will be needed at the end of the 20-year planning period. Currently there are 27 tiedowns available, creating a need of 12 tiedowns in the near term, and an additional 10 by the end of the planning period to accommodate projected growth in based aircraft. These results are in line with the known current parking shortage as indicated by the 12-person tiedown waitlist.

The 2012 Airport master plan identified on the approved ALP space for an additional 26 ADG I tiedowns on a proposed apron in the Southeast Development area. This space is still available and should be considered in the development alternatives evaluation process.

### FACILITY REQUIREMENT:

**It is recommended that in order to accommodate local aircraft 12 additional tiedowns should be made available to accommodate the current fleet. An additional 10 should be made available by the end of the 20-year planning period resulting in a total of 49 tiedowns on the Airport in 2038.**

### Transient Aircraft Parking

To estimate parking requirements for transient small, fixed-wing aircraft, it is assumed that 50% of projected average daily operations are transient, and 50% of transient aircraft will park on the apron. Applying these assumptions to the itinerant operations fleet mix forecast, it is estimated that 29 tiedowns are needed to accommodate the current transient aircraft visiting the Airport. A total of 46 tiedowns will be required to accommodate itinerant aircraft by 2038. Currently there are 48 tiedowns available to transient aircraft, creating a current surplus of 19 tiedowns. This surplus is projected to decrease to 2 tiedowns by the end of the planning period.

As discussed below in the Helicopter Parking section, several ADG I tiedown locations on the west apron near Leading Edge Aviation are frequently occupied by helicopters. Due to the geometry of these aircraft, a single helicopter requires three ADG I parking stands to maintain rotor clearances. As a result, the 27 tiedowns in this area adjacent to Taxiway A can be brought to capacity by only nine helicopters, blocking parking to 18 otherwise available tiedowns, essentially eliminating the current transient aircraft parking surplus identified above.

### FACILITY REQUIREMENT:

**To accommodate growth in transient aircraft operations, it is recommended that 12 new tiedowns be built in the 5-year term, 17 in the 10-year, and 24 in the 20-year. (Group I Tiedowns – AC 150/5300/13A, Appendix 5)**

### Corporate Aircraft Parking

Bend Municipal Airport regularly sees activity by business class aircraft including dual-engine piston aircraft, turboprops, and business jets. At this time, there is apron space on the west side near the Leading Edge FBO that can handle drive through parking for up to 6 business aircraft. Based on projections, the current configuration will be sufficient throughout the planning period since a maximum need of 4 parking positions is projected through 2038.

**Facility Requirement:** It is recommended that the current drive-through parking apron on the west apron be maintained through the 20-year planning period.

### Helicopter Parking

The Airport is home to a sizable fleet of locally based helicopters used for flight training. These helicopters are normally stored in hangars overnight and parked on the west apron near Leading Edge Aviation in parking designated for transient small fixed-wing aircraft. In 2017 a new Helicopter Operations Area (HOA) was constructed to provide parking for up to 21 helicopters. Due to challenges in obtaining County development approvals, no hangars, or other support facilities have been constructed in that area. As a result, the HOA is underutilized and the vast majority of helicopter parking continues to occur on the west apron, occupying fixed wing aircraft parking and creating a short supply. As previously mentioned, the City of Bend and Deschutes County are currently working to obtain approvals to begin development at the HOA.

### FACILITY GOAL:

**It is recommended that the City of Bend and Deschutes County should continue to work toward the approvals necessary to develop support facilities at the HOA so that helicopter operations can be relocated to, and use the existing HOA facilities.**



To differentiate between large and small helicopter operations, it was estimated that 85% of helicopter operations can be attributed to small helicopters and 15% to large helicopters. Operations estimates indicate that 8 parking positions are required to satisfy the existing demand by small helicopters. There are currently 18 spaces available in the HOA to these aircraft indicating a surplus of 10 parking positions if they are utilized. The parking needs by small helicopters are expected to increase to 13 positions in 2038 resulting in a future surplus of 5 positions over the planning period.

The same methods were performed using operations estimates for large helicopters. The results suggest that there is a current need for a total of 2 tiedowns to satisfy existing demand from large helicopters. There are 3 appropriate parking positions located at the HOA suggesting a surplus of 1 in the current period. Operations forecasts indicate that there will be a need of 3 positions by 2023, which can be accommodated by the current HOA configuration. This level of large helicopter parking needs is projected to remain steady through the remainder of the planning period.

It should be noted that since all current helicopter parking positions are located on the HOA and are not receiving regular use at this time, the parking surpluses identified in the current term are not reflected in the real world conditions at the Airport. It is assumed that supporting facilities will be developed in the coming years at the HOA, and with those developments helicopter operations will move to the HOA enabling the utilization of that parking while also opening up parking for fixed-wing aircraft on the west aprons.

A summary of the aircraft parking requirements discussed above is shown in **Table 4-8** below.

## **FACILITY REQUIREMENT:**

It is recommended that helicopter operations and parking be relocated to the HOA to free fixed wing parking locations on the west apron currently occupied by helicopters.

## FACILITY GOAL:

Clearly identify the aircraft parking areas that are leased to FBOs, flight schools, monthly tenants, and those that are open to transient aircraft.

TABLE 4-8: SUMMARY OF AIRCRAFT PARKING REQUIREMENTS

	BASE YEAR 2018	2023	2028	2033	2038
	<b>BASED AIRCRAFT FORECAST</b>				
<b>SINGLE-ENGINE</b>	191	212	223	231	240
<b>MULTI-ENGINE</b>	19	19	18	18	18
<b>JET/TURBINE</b>	11	12	13	15	16
<b>HELICOPTER</b>	23	24	25	27	29
	<b>AIRCRAFT PARKING/APRON AREA</b>				
	EXISTING	SURPLUS/ DEFICIENCY	SURPLUS/ DEFICIENCY	SURPLUS/ DEFICIENCY	SURPLUS/ DEFICIENCY
Locally Based Tiedowns (@ 300 SY each)	27 Tiedowns 8100 SY	(12) Tiedowns (3600) SY	(16) Tiedowns (4800) SY	(19) Tiedowns (5700) SY	(20) Tiedowns (6000) SY
Small Aircraft Itinerant Tiedowns (@ 360 SY each)	48 Tiedowns 17280 SY	19 Tiedowns 6840 SY	6 Tiedowns 2160 SY	4 Tiedowns 1440 SY	3 Tiedowns 1080 SY
Business Aircraft Parking Tiedowns (@ 625 SY each)	6 Tiedowns 3750 SY	3 Tiedowns 1875 SY	2 Tiedowns 1250 SY	2 Tiedowns 1250 SY	2 Tiedowns 1250 SY
Small Helicopter Parking Tiedowns (@ 380 SY each)	18 Tiedowns 6840 SY	10 Tiedowns 3800 SY	6 Tiedowns 2280 SY	5 Tiedowns 1900 SY	5 Tiedowns 1900 SY
Large Helicopter Parking Tiedowns (@ 1300 SY each)	3 Tiedowns 3900 SY	1 Tiedowns 0 SY	0 Tiedowns 0 SY	0 Tiedowns 0 SY	0 Tiedowns 0 SY
<b>Total Parking Tiedowns</b>	<b>102 Tiedowns</b>	<b>21</b>	<b>(2) Tiedowns</b>	<b>(8) Tiedowns</b>	<b>(10) Tiedowns</b>
<b>Total Apron Area (SY)</b>	<b>39870 SY</b>	<b>10215 SY</b>	<b>890 SY</b>	<b>(1110) SY</b>	<b>(1770) SY</b>



## PAVEMENT CONDITION

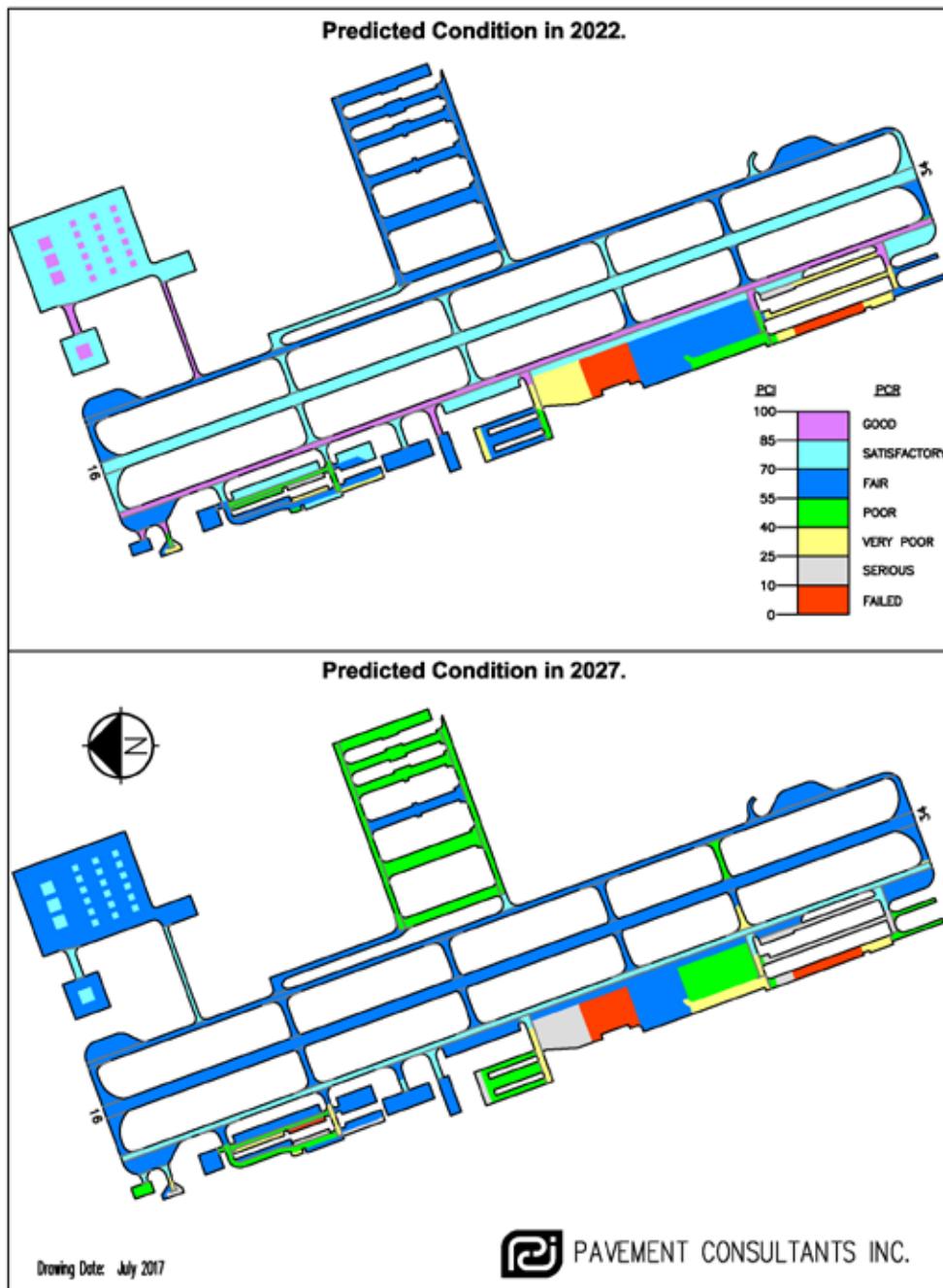
An updated Pavement Evaluation/Maintenance Management Program inspection, performed by Oregon Department of Aviation, was conducted in 2017. A graphical depiction of pavement condition in 2017 along with predicted conditions for 2022 and 2027 (assuming no future pavement maintenance) is presented below. The airfield pavements are in generally good condition. A summary of pavement conditions on the Airfield provided in the 2016 pavement condition report states:

*"Section PCIs at Bend Municipal Airport range from a low of 6 (a PCR of "Failed") to a high of 100 (a PCR of "Good"). The area-weighted average PCI for all airport pavements is 80, corresponding to an overall PCR of "Satisfactory".*

*The primary distresses observed during the inspection: longitudinal and transverse cracking, weathering, patching, alligator cracking, block cracking, and oil spills.*

### FACILITY REQUIREMENT:

It is recommended that continued maintenance be conducted in accordance with ODA PMP recommendations to maximize the longevity of the airfield pavements through the planning period.





## SUPPORT FACILITIES

### Runway Lighting

Runway 16/34 currently has a Medium Intensity Runway Lighting (MIRL) system in place and it is in good condition. Lighting systems have a typical life of twenty years, though some systems may operate reliably for longer periods. For planning purposes, the useful life of airfield lighting is considered to be twenty years.

#### **FACILITY REQUIREMENT:**

**It is recommended that the runway lighting system be maintained through the remainder of its useful life. The lighting should be updated as necessary to address any changes to the runway identified in the Development Alternative analysis process.**

### Taxiway Markings

The runway markings at the Airport as noted in the Inventory Chapter are consistent with FAA standards for color (white), configuration, and approach type and are considered to be in good condition. The Runway end identifier markings reflect the current runway end identifiers, 16 and 34, based the magnetic heading of each runway end. In 2021 the magnetic declination at the airport is expected to necessitate an update the runway end identifiers to 17 and 35, at which time the markings will be required to be updated.

#### **FACILITY REQUIREMENT:**

**It is recommended runway markings be maintained consistent with the ODA Pavement Maintenance Program. In the event of a change in runway magnetic heading or the development of and IAP, the Airport should plan to update the runway markings accordingly.**

### Taxiway/Apron Lighting

The Airport currently has taxiway reflector markers in place along all taxiway and apron edges. The reflectors are in good condition. The current OAP recommends that Medium Intensity Taxiway Lights (MITL) be installed at Category II – Urban General Aviation Airport. In PAC and Stakeholder meetings several participants expressed a need for taxiway lighting at the Airport to enhance visibility on the airfield.

#### **FACILITY REQUIREMENT:**

**It is recommended that the City consider updating the taxiway and apron reflectors to MITL in conjunction with future taxiway projects identified in the Development Alternative analysis process.**

### Taxiway Markings

The taxiway markings at the Airport are consistent with FAA standards for color (yellow) and configuration and are considered to be in good condition.

#### **FACILITY REQUIREMENT:**

**It is recommended that taxiway markings be maintained in a manner consistent with the ODA Pavement Maintenance Program and updated as needed for future taxiway projects.**

### Airfield Lighting

The Airport has a rotating beacon mounted on a tower on the east side of the runway near midfield and two lighted wind cones, one located near midfield, the second is located in the segmented circle near the north end of the runway. The rotating beacon and lighted wind cones are operable, in good condition, and meet standards for location, type, and color.

#### **FACILITY REQUIREMENT:**

**It is recommended that the existing airfield lighting system be maintained in its current configuration and updated as required.**

### Airfield Signage

The runway-taxiway system has extensive lighted signage that conveys directional, location, and runway clearance information to pilots. Upon a recent site survey, all lighted signs appeared to be in good working condition. It is generally recommended that airfield signs be lighted to enhance pilot visibility and airfield safety.

#### **FACILITY GOAL:**

**It is recommended that the current airfield signage be maintained and updated as required by future airfield development.**

### Weather Reporting

Bend Municipal Airport has an AWOS installed on site that records and broadcasts altimeter, wind, temperature, dewpoint, density altitude, visibility, and cloud/ceiling data. In addition to broadcasting these data in real-time, they are also transmitted to the National Climatic Data Center (NCDC) where they are stored and available to be downloaded for runway wind coverage and other meteorological studies.

#### **FACILITY REQUIREMENT:**

**It is recommended that the AWOS continue to be maintained and updated as needed.**

### Navigational Aids (NAVAIDS)

Navigational Aids (NAVAIDS) provide navigational assistance to aircraft as they approach or depart the airport. NAVAIDS are classified as either electronic or visual. There are no electronic NAVAIDS located at the Airport, but the Redmond VOR is located 12 miles to the northwest.

Runways 16 and 34 each have a 4-box Precision Approach Path Indicators (PAPIs) and Runway End Identifier Lights



(REIL)- both visual NAVAIDs. The PAPIs provide glideslope data to approaching aircraft. The REILs identify the runway end to approaching aircraft via flashing strobes positioned on each side of the runway ends. Both visual NAVAID systems are operational and in good condition.

#### **FACILITY REQUIREMENT:**

**It is recommended that the PAPIs and REILs continue to be maintained in their current configurations. In the event of changes to the runway, they should be relocated or reconfigured as necessary.**

#### **Aircraft Fuel**

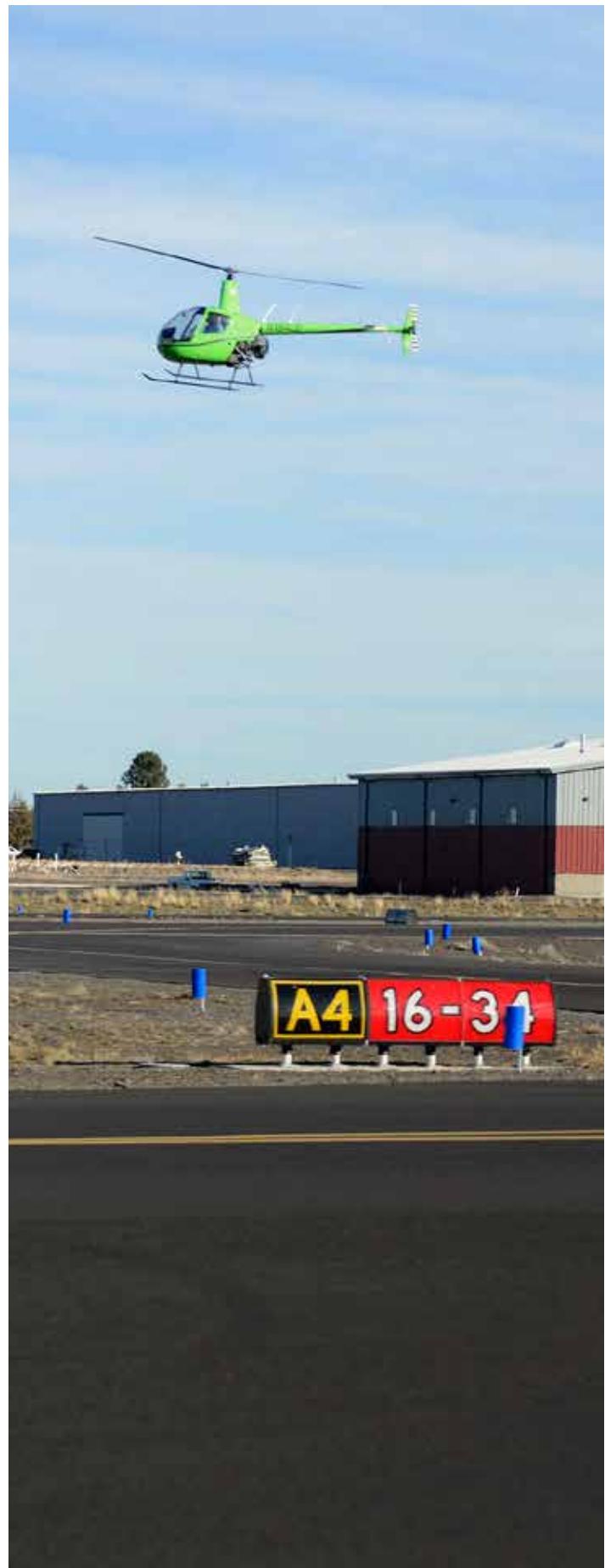
The Airport offers 100-octane low lead (100LL) aviation gasoline (AVGAS) and jet fuel (Jet-A) for sale through the local fixed based operator (FBO), Leading Edge Aviation. Leading Edge owns and maintains the fuel storage and dispensing system that includes two above ground double-wall tanks and a 24-hour credit card payment system for self-fueling in the “north fuel farm area.” One tank is 100LL and the other is Jet A. Leading Edge also owns the existing south fuel farm tanks – two 10,000-gallon tanks one of each Jet-A and 100LL - which are currently used for bulk fuel storage only. Leading Edge also has seven mobile fuel trucks available for aircraft fueling. Airport users have expressed a need for a second fuel source to promote competition on the airport.

#### **FACILITY GOAL:**

**It is recommended that the Airport create and promote opportunities for additional fuel vendors on the Airport and identify another site suitable for self-serve fuel tanks.**

#### **FACILITY GOAL:**

**It is recommended that the Airport maintain existing and future fuel facilities to standards.**





## TRAFFIC PATTERNS

The airport utilizes non-standard traffic patterns with the goal of increasing pilot awareness and reducing aircraft noise impacts for airport neighbors through the City of Bend's Fly-Friendly program. The airport traffic pattern consists of a pattern altitude of 1,000 feet above ground level for fixed wing traffic, 1,500 feet above ground level for larger turbine aircraft, and 500 feet for helicopters. Fixed wing traffic operates primarily on the west side of the runway and local helicopter traffic operates on the east side of the runway.

In addition to established traffic patterns, pilots are also encouraged to avoid overflight of noise sensitive areas and observe noise reduction procedures when in proximity of the Airport. The Fly-Friendly program and associated traffic patterns are discussed in further detail and illustrated on page 53 in Chapter 2 – Existing Conditions Analysis.

### COMMUNITY GOAL:

**It is recommended that the airport continue to promote fly-friendly practices for area pilots and Airport neighbors.**

### COMMUNITY GOAL:

**It is recommended that the Airport update traffic patterns and fly-friendly practices as required by the proposals generated in the Airport Master Plan.**

## AIRSPACE – FAR PART 77, TERPS, AND RUNWAY END SITING SURFACES

There are a variety of rules, regulations, design standards, and policies utilized to protect the airspace around the airport through the evaluation of potential obstacles against defined 3-dimensional limits known as "imaginary surfaces". These surfaces are described in the following:

### FAR Part 77

This FAR is the central regulation governing airspace protection, with cross-references to many other criteria documents. It sets forth the requirements for notifying the FAA of proposed construction; defines obstruction criteria; and describes aeronautical studies required to assess hazard status. The FAR Part 77 Surfaces associated with the Bend Municipal Airport have been codified into the Deschutes County Code as the Airport Safety Combining Zone (AS). A summary of the Part 77 surfaces is depicted on Pages 32-33 within the Regional Setting - Land Use/Zoning discussion of this report.

### FAA Order 8260.3B—United States Standard for Terminal Instrument Procedures (TERPS)

This Order, along with several derivative orders in the 8260 series and other related orders, define criteria that FAA flight

procedure designers utilize when designing instrument flight procedures. Airspace protection requirements for instrument flight procedures are one of the types of obstruction standards referenced in FAR Part 77; they are also one of the most common criteria analyzed for hazard status in aeronautical studies.

### FAA AC 150/5300-13A—Airport Design

This AC is the principal document utilized by the FAA, airport sponsors, and planning consultants when planning and designing new airports or modifications to airports. Airspace clearances for key runway end features are defined in the AC's discussion of Runway End Siting Surfaces.

The surfaces described in the documents referenced above will be depicted in the Airport Layout Plan drawing set. The existing and future surfaces will be evaluated during the production of the ALP and all obstacles will be identified and the appropriate dispositions determined.

### FACILITY GOAL:

**It is recommended that the Airport continue to work with FAA Flight Procedures to provide required data for future airspace analysis.**

### FACILITY REQUIREMENT:

**It is recommended that the City conduct future obstruction removal projects as required to maintain clear approach surfaces.**

## INSTRUMENT FLIGHT PROCEDURES

Bend Municipal Airport currently has four published non-precision instrument approaches, including three global positioning system (GPS) procedures and one VOR/DME procedure that utilizes the Deschutes VORTAC. The RNAV (GPS) Z RWY 16 approach supports a procedure that provides vertical guidance to the runway end for aircraft equipped with the appropriate FAA-certified GPS receiver; the other approaches provide electronic course guidance only. All the instrument approaches are authorized for category A-D aircraft, with varying approach minimums for both straight-in and circling procedures. The airport also has a standard instrument departure authorized for both runways.

Public comments received at PAC meetings indicate a desire for a helicopter approach/departure procedure at the Airport to aid in flight training and general helicopter operations.

### FACILITY REQUIREMENT:

**It is recommended that the Airport work with FAA (or private IAP developer) to develop a helicopter specific IAP.**



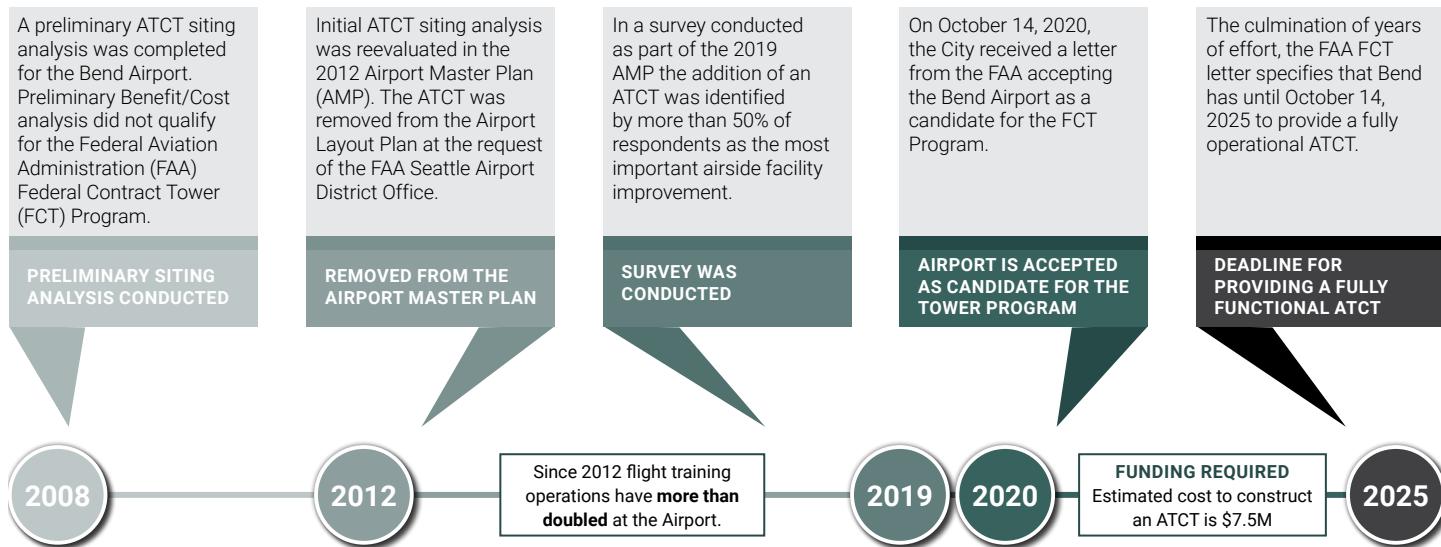
## AIR TRAFFIC CONTROL TOWER (ATCT)

Airspace congestion has consistently been identified by airport users as the most important issue facing the Airport. Since the preliminary airport traffic control tower siting analysis done for the Bend Municipal Airport was done in 2008 and subsequently reevaluated in the 2013 AMP (but removed from the plan altogether by the FAA Seattle ADO), the airport has experienced impressive growth in its annual operations. The increased number of annual operations since 2008 when the idea was first discussed, coupled with the diverse mix of aircraft types with their various levels of pilot skills again indicates that an air traffic control tower is needed at the Airport to enhance the Airport's efficiency and maintain safety.

### FACILITY GOAL:

**It is recommended that the Airport work with FAA, state, and regional partners to evaluate local and regional solutions to the congested and busy airspace at the Airport including the construction of an ATCT.**

## THE NEED FOR AN AIR TRAFFIC CONTROL TOWER CONTINUES TO GROW



### SEATTLE ARTCC STATEMENT

"Seattle ATC frequently observes numerous aircraft operating in the traffic pattern and within close proximity to KBDN. The lack of an ATCT serving the airport fosters an extremely difficult operating environment for arriving and departing aircraft. The construction of an ATCT would organize the flow of traffic and absolutely facilitate safer, more efficient aircraft operations at KBDN."

**Kevin Miller – SEA ARTCC, Air Traffic Specialist**



# Airport Management Goals and Requirements

Airport Management goals and requirements include recommendations and best practices for Airport Ownership & Management, Airport Finance, Rates and Charges, Rules and Regulations, and FAA Grant Assurances and Compliance.



## OWNERSHIP AND MANAGEMENT

The Airport is owned, operated, and managed by the City of Bend. The airport employs a full time Airport Manager, a full time Administrative Assistant, and one part time maintenance personnel. Finance, legal, HR, IT, and some administrative services are contracted out to the City of Bend.

Mowing and general grounds work on the Airport is completed by the maintenance personnel, but snow removal and electrical maintenance of airport lighting systems are contracted to outside providers. Airport lessees are responsible for managing their facilities and leased areas to meet the requirements defined in their leases and the airports Regulations, Policies and Guidelines.

As discussed previously, Deschutes County has zoning jurisdiction at the airport and is responsible for approving proposed development through their permitting process.

### FACILITY GOAL:

**It is recommended that the City continue to work closely with Deschutes County to improve the development approval process to efficiently satisfy future demand for facilities.**

### FACILITY GOAL:

**It is recommended that the Airport facilities be maintained to standards and levels consistent with similar Urban GA airports.**

### FACILITY GOAL:

**It is recommended that the City, County, and greater community facilitate the implementation of the vision, goals, and actions depicted in the Airport Master Plan.**

## AIRPORT FINANCE

Based on a review of the most recent financial records available, Bend Municipal Airport currently operates at a slight loss and requires supplemental support from the City in the form of grants and long term loans. However, the deficit is not overwhelming and could be made up by new revenue streams through expanded aviation and non-aviation development.

### FACILITY GOAL:

**It is recommended that the City consider conducting an Airport Business Plan to further pursue new revenue potential and other development opportunities.**

## AIRPORT RATES AND CHARGES

Upon a review of the Market Rent Study completed in 2015 as well as further review of other airports of similar size and classification, it was determined that the rates and charges levied at Bend Municipal Airport are generally consistent with other area airports. An updated Market Rent Study is due to be completed in 2020.

### FACILITY GOAL:

**It is recommended that the City continue to periodically assess fees for services and airport staffing for parity with other similar Urban GA airports.**

## CITY OF BEND RULES AND REGULATIONS

The City of Bend Code provides the legal framework and authority for actions regulated by the City of Bend as the sponsor of the Bend Municipal Airport. The City will operate the airport for the use and benefit of the public in order to make it available to all types, kinds, and classes of aeronautical activity on fair and reasonable terms and without unjust discrimination.

### FACILITY GOAL:

**It is recommended that the City maintain the current framework of rules and regulations and update them as needed.**

## FAA COMPLIANCE OVERVIEW

Upon a review of local, state, and federal regulations, the Airport is understood to be in compliance with all requirements. A detailed discussion of the applicable regulations is presented on page 61 in Chapter 2 – Existing Conditions Analysis.

### FACILITY GOAL:

**It is recommended that the City continue to work with state and federal partners to ensure compliance.**



# Summary of Facility Goals and Requirements

The facility goals and requirements identified in this chapter serve as the foundation to explore the solutions required to satisfy future demand, meet FAA design standards, and develop the facilities envisioned by stakeholders. The critical elements identified for further study and consideration include:

## REGIONAL SETTING

- Identify BDN and some adjacent land as a regional employment center and/or regional town center and encourage new non-aviation commercial and industrial development within a reasonable distance of the Airport.
- Leverage the significant operational presence at the Bend Municipal Airport to market the Airport as critical regional infrastructure and an important economic development engine for the Central Oregon Region.
- Pursue new opportunities within the framework of the Rural Enterprise Zone (E-zone) which may include expansion of the E-zone to areas immediately adjacent to the Airport.
- Work with local and state entities to update local comprehensive plans and transportation system plans to reflect this Airport Master Plan update.
- Address specific needs identified in the OAP as they pertain to the Airport's role in the state airport system.
- Improvements to the Airport access in conjunction with planned roundabout improvements on Powell Butte Highway.
- Update zoning code districts to simplify and improve permitting and development process for future construction on the Airport.

## LANDSIDE ELEMENTS

- Provide adequate space for future aviation and non-aviation related development.
- Install perimeter fencing.
- Improve the appearance and provide safety improvements to the airport frontage road.
- Study vehicle parking to maximize available parking on the west side.
- Develop 25,000 square feet of t-hangar space to meet current demand and 128,000 square feet of total hangar space to meet future demand.
- Through lease surcharges and rebates, encourage developers to construct appropriately sized hangars.

## AIRSIDE ELEMENTS

- Update Runway 16/34 designation and markings to account for change in magnetic declination.
- Construct helicopter runway depicted in 2012 AMP to address airspace capacity concerns.
- Plan for an ultimate (20-50 years) second runway to address airspace capacity concerns.
- Extend Runway 16/34 to 6,260 feet (future), and 7,660 feet (ultimate).
- Address non-allowable land use in runway 16 RPZ (Powell Butte Highway).
- Control land use in the north HPZ through land acquisition or easements.
- Remove direct runway access at connector taxiways A2, A3, and A4.
- Address non-standard conditions in hangar areas.
- Add 12 aircraft tie downs to meet current demand of based aircraft and 22 tiedowns by 2038 to meet future demand.
- Update taxiway reflectors to MITL.
- Development of a helicopter specific IAP.

## AIRPORT MANAGEMENT

- Streamline County development permitting and approval processes to encourage new development on and around the Airport
- Conduct an Airport Business Plan to further pursue new revenue potential and other development opportunities.

The Airport is expected to undergo significant growth over the 20-year planning period. As a result, the projected facility needs discussed above are in many cases, significant. The most challenging updates include lengthening of the existing runway, relocating Powell Butte Highway outside of runway 16 RPZ, removal of non-standard taxiway and taxilane conditions, and addressing vehicle and aircraft parking shortages. The future need for expanded facilities, such as hangars, will be driven by market demand. The existing property is not capable of accommodating all of the recommendations discussed, and land acquisitions should be investigated to facilitate the suggested improvements.



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# Chapter 5: Development Alternatives

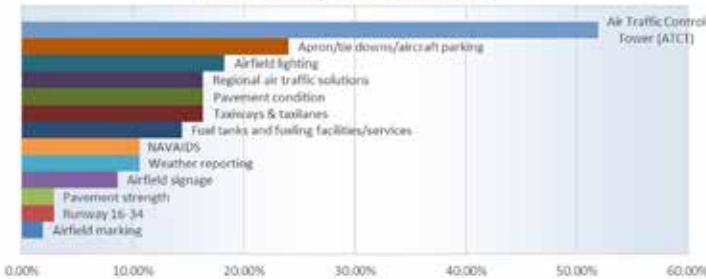
## Introduction

Current and long-term planning for Bend Municipal Airport is based on maintaining and improving the Airport's ability to serve a range of general aviation and business aviation type aircraft while also accommodating the Airport's large fleet of GA fixed wing aircraft and helicopters. The Airport facilities accommodate a wide variety of aircraft types including conventional fixed-wing and rotary-wing aircraft. This unique mix of aircraft activity requires facility improvements capable of accommodating demand while maintaining air safety for all users.

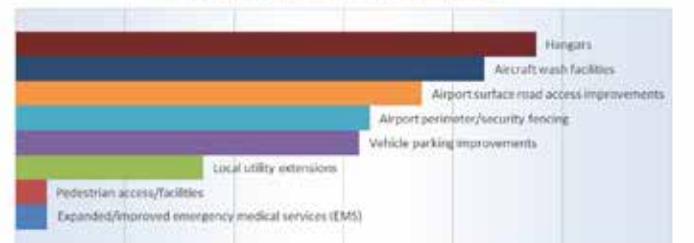
The alternatives depicted in this chapter address current and future facility demands and FAA airport design requirements discussed in Chapter 4 – Facility Requirements. All proposed facility improvements depicted within each alternative are evaluated against a set of categories that include cost estimates, operational capability, FAA design standards, airspace compatibility; and land use, transportation, and environmental compatibility.

The FAA recommends that airport master plans be developed in an “unconstrained” manner when initially defining future demand and related facility improvements, rather than establishing pre-defined limits that drive the planning process. The evaluation of development alternatives for the Airport will be unconstrained, consistent with FAA guidance, forecast demand, and the defined facility goals and requirements.

### Airside Priorities



### Landside Priorities





# Summary of Development Alternatives Analysis Process

Developing effective alternatives for evaluation represents the first step in a multi-step process that leads to the selection of a preferred alternative. It is important to note that the current FAA-approved airport layout plan (ALP) identifies future improvements recommended in the last master planning process.

The first step in the development alternatives analysis process is to identify focused project elements needed to satisfy the facility requirements and then analyzed for further consideration. These project elements are then narrowed further into primary and secondary elements:

- Primary elements are improvements that present particularly complex and challenging issues, including those that require large property acquisitions or complex engineering solutions.
- Secondary elements are planned improvements that have greater planning flexibility and typically fill-in around and/or support primary elements.

## PRIMARY ELEMENTS

The primary elements determined to meet the facility requirements and goals identified by stakeholders and planners include:

- Runway 16/34
  - » Runway length and end locations
  - » Runway 16 RPZ land use mitigation
- Parallel Runway – Long Range Planning
  - » Runway Protection Zones
  - » Runway length and end locations
  - » Parallel taxiways
  - » Cross field taxiway
- Air Traffic Control Tower (ATCT)
- Surface Transportation System

## SECONDARY ELEMENTS

The secondary elements, which fit in around the primary elements, required to satisfy facility goals and requirements include:

- Hangar development
- Apron/tiedowns
- Utility extensions to support development
- West side vehicle parking

- Airport loop road
- Airport security/perimeter fencing
- Navaids
- Airfield lighting
- Others

*\*Not all elements identified above will be depicted or evaluated within the alternatives.*

Next individual development alternatives are created to incorporate the relevant primary and secondary elements, with the goal of identifying general preferences for both individual items and the overall concepts being presented. The process allows the widest range of ideas to be considered and the most effective facility development concept to be defined.

The evaluation process utilized in this study is based on guidance provided in AC 150/5070-6B Airport Master Planning. Evaluation criteria categories selected to support the evaluation of development alternatives include:

**Cost Estimate** – Includes rough order magnitude cost estimates for the large definable projects typically associated with the primary elements to provide an apples-to-apples comparison of major elements depicted in the alternative.

**Operational Capability** – Includes criteria that evaluate how well the airport functions as a system and can satisfy future activity levels, meet functional objectives such as accommodating the design aircraft, and provide for the most efficient taxiway system or aircraft parking layout.

**FAA Design Standards** – Includes an analysis of existing FAA design standards and various requirements or areas of focus currently identified by Advisory Circulars.

**Airspace Compatibility** – Includes the identification and analysis of the impacts that proposed changes to the airport environment would have on the local and regional airspace systems.

**Land Use, Transportation, and Environmental Compatibility** – Includes an analysis of best planning practices as they relate to land use, transportation systems, and a cursory analysis/identification of potential environmental effects as defined in FAA order 1050.1 Environmental Impacts Policies and Procedures and FAA Order 5050.4 FAA Airports Guidance for complying with NEPA.

By analyzing the development alternatives against the evaluation criteria presented above, and subsequently discussed with local stakeholders and interested Airport users, an iterative process of identifying and selecting elements of a preferred alternative will emerge that can best accommodate all required facility improvements. Based on the preferences of the airport sponsor, these elements will be

consolidated into a draft preferred alternative that can be refined further as the City proceeds through the process of finalizing the remaining elements of the airport master plan. Throughout this process, public input and coordination with the Planning Advisory Committee (PAC), FAA, and City of Bend will also help to shape the preferred alternative.

Once the preferred alternative is selected by the City, a detailed implementation plan 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.

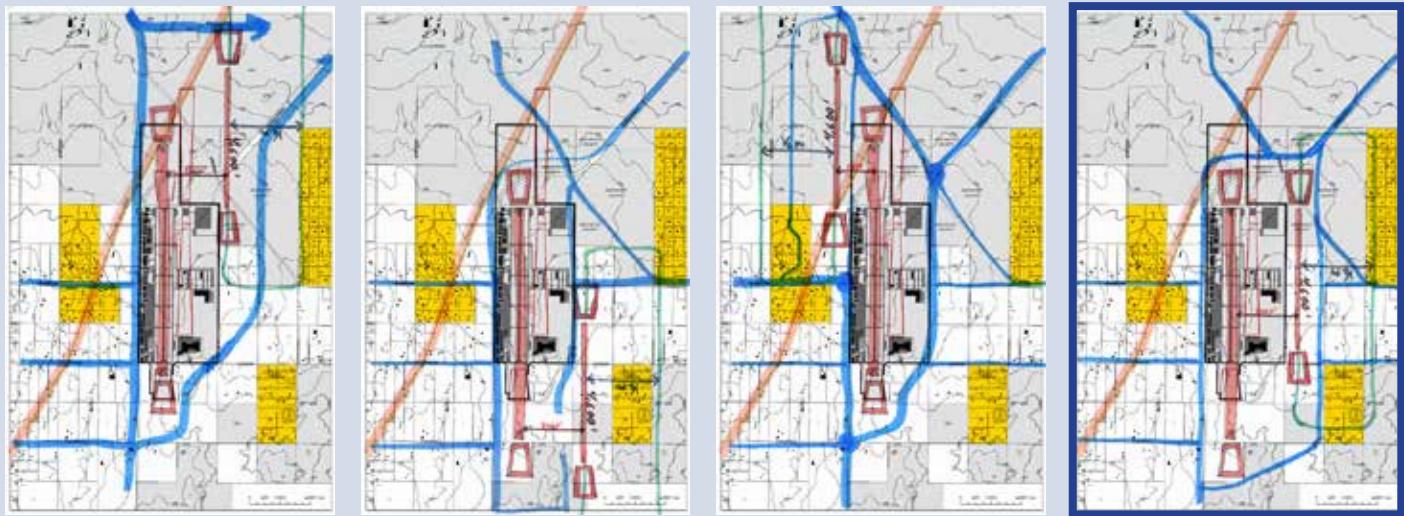
## **EXISTING, FUTURE, AND ULTIMATE FACILITIES**

In a rapidly growing community like Bend and Deschutes County, it is prudent planning to consider the major facility improvements that may be required outside of the planning period. For the purposes of this analysis, the existing and future (0-20 years) facilities will be analyzed according to the evaluation criteria described above. Ultimate (20+ years) facilities will be depicted, discussed, and included for additional context and consideration.

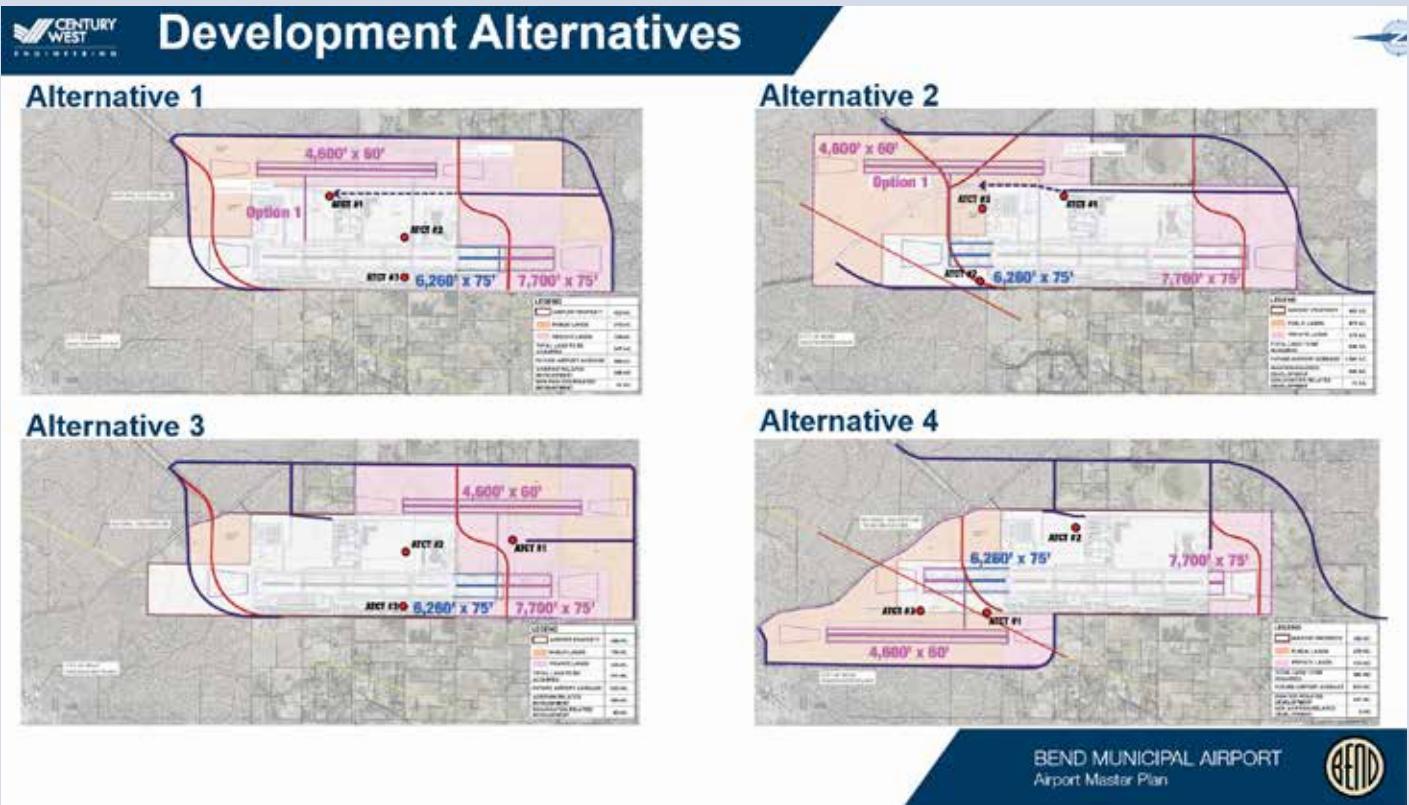


## CONCEPTUAL ALTERNATIVES - PAC MEETING #2 AND PAC MEETING #3

During the development of the aviation activity forecasts, it became apparent that the number of operations experienced at the Airport could guide the planning process to consider a second parallel runway to address fixed-wing aircraft capacity constraints. As a result, planners sketched out several conceptual alternatives to depict what the addition of a second runway could look like for future discussions with PAC members. Three options were presented in PAC Meeting #2 and a fourth option (highlighted with blue border) was developed in coordination with PAC members at PAC #2 for further consideration.



The planning team further refined the alternatives with the information gleaned from PAC members in PAC #2 and developed the following alternatives for presentation in PAC #3. The four alternatives depicting different runway configurations were analyzed internally by consultants, City staff, and PAC members. Much of the information provided in PAC #2 and PAC #3 served as the foundation for the development of the alternatives presented in this summary of the development alternatives.





# Development Alternatives

The development alternatives are intended to facilitate a discussion about the most effective way to meet the facility needs of the airport. The facility needs identified in the previous chapter and depicted accordingly within each development alternative include a variety of airside and landside needs. Items such as lighting improvements, minor roadway extensions and pavement maintenance do not typically require an alternatives analysis and will be incorporated into the preferred development alternative and the ALP. The development alternatives have been organized accordingly:

- No-Build Alternative
- Alternative 1
- Alternative 2
- Alternative 3
- Alternative 3A
- Alternative 4
- PAC Preferred Alternative
- City Preferred Alternative

The development alternatives described below are illustrated in Figures 5-1 through 5-8. They are intended to illustrate the key elements of each proposed alternative.

It is important to note that the eventual preferred alternative selected by the City may come from one of the alternatives, a combination or hybrid of the alternatives, or a new concept that evolves through the evaluation and discussion of the alternatives. As noted earlier, the City of Bend has the option of limiting future facility improvements based on financial considerations or development limitations.

## NO BUILD ALTERNATIVE (NO FIGURE)

In addition to proactive options that are designed to respond to defined future facility needs, a “no build” option also exists, in which the City of Bend may choose to maintain existing facilities and capabilities without investing in facility upgrades or expansion to address future demand. The existing airfield configuration would remain unchanged from its present configuration and the airport would essentially be operated in a “maintenance-only” mode.

The primary result of this alternative would be the inability of the airport to accommodate aviation demand beyond current facility capabilities. Future aviation activity would eventually be constrained by the capacity, safety, and operational limits of the existing airport facilities. In addition, the absence of new facility development effectively limits the airport sponsor's ability to increase airport revenues and operate the airport on a financially sustainable basis over the long term.

The no-action alternative establishes a baseline from which the action alternatives can be developed and compared. The purpose and need for the action alternatives are defined by the findings of the forecasts and facilities requirements analyses. The factors associated with both current and future aircraft activity (potential for congestion, safety, etc.) are the underlying rationale for making facility improvements. Market factors (demand) effectively determine the level and pace of private investment (hangar construction, business relocation to the airport, etc.) at an airport. Public investment in facilities is driven by safety, capacity, and the ability to operate an airport on a financially sustainable basis.

Based on the factors noted above, the no-action alternative is inconsistent with the management and development policies established by the City of Bend and its commitment to provide a safe and efficient air transportation facility to serve the surrounding areas that is socially, environmentally, and economically sustainable.



## DEVELOPMENT ALTERNATIVE 1

Development Alternative 1 (Figure 5-1) proposes a 1,060 feet runway extension with appurtenant taxiways to the south, resulting in a future runway length of 6,260 feet to satisfy demand over the 20-year planning period.

For long-term planning purposes an additional 1,400 feet runway extension and parallel taxiways are proposed on the south end, resulting in an ultimate runway length of 7,660 feet. To address capacity concerns identified by project stakeholders, a secondary parallel runway - with appurtenant parallel and connector taxiways - measuring 4,600 feet long by 60 feet wide, is proposed on existing private property east of the current airport boundary. The parallel runway is joined to the existing runway/taxiway system via a cross-field taxiway at Taxiway Bravo Two, which was selected as the preferred location during the evaluation of initial concepts presented in PAC #2 and PAC #3.

Three sites are proposed for an ACTC. The first is on the east edge of the property, north of Aero Facilities. The second is located on the west apron in the current transient aircraft parking/tiedown area near the terminal building and the Leading Edge hangars. The third is located on the east side of the runway and Taxiway Bravo directly east of the second site. Further evaluation of these sites is required to identify an optimal ATCT location.

This concept reroutes a portion of Powell Butte Highway to the north of the existing 16 RPZ and relocates Nelson Road to avoid the future Runway 34 RPZ. Access to the HOA will continue to be provided by the existing drive, extended to meet the rerouted Powell Butte Highway. A new airport loop road that runs around the ultimate south and east boundaries of the airport will facilitate access to the Epic and Aero Facilities which was previously provided by Nelson Road. In total, 2.2 miles of existing road are removed, and 3.8 miles of new road are built under this alternative.

To accommodate the future elements, the development alternative proposes the acquisition of 43 acres of public land and 67 acres of private land, resulting in a future total airport area of 532 acres. In addition to accommodating airside improvements, the acquired property will provide space for 155 acres of additional aviation development, and 26 acres of non-aviation development.

To accommodate the ultimate elements, the development alternative requires the acquisition of a total of 213 acres of public land and 334 acres of private land, resulting in an ultimate airport property area of 969 acres. The property acquisitions will accommodate 345 acres of aviation development and 124 acres of non-aviation development. All ultimate property areas are inclusive of the previously listed future property acquisitions.

For comparison purposes, high-level, rough order magnitude cost estimates were completed using the best information available at the time of this writing. The 20-year planning period estimate for this scenario is \$19.4 million. The bulk of that cost stems from the required property acquisitions, runway/taxiway extension, relocation of Powell Butte Highway and Nelson Road, and the construction of an ATCT.

### Operational Compatibility

The future and ultimate extensions to the primary runway will satisfy the forecasted demand for the growing jet market over the 20-year planning period and beyond. The addition of an ultimate parallel runway will address growing capacity concerns and air traffic pattern concerns by moving the bulk of the small single-engine piston flight training operations off the primary runway and into a dedicated pattern.

The Aircraft parking/tiedowns configuration identified in the 2012 Airport Master Plan and the current ALP can accommodate the projected demand for future aircraft parking. No elements proposed in Development Alternative 1 conflict with the 2012 AMP/ALP aircraft parking areas. As such, the aircraft parking configuration depicted in on current ALP is recommended for this concept.

Future aviation related development identified in this scenario total 155 acres. This amount of development may exceed the 50-year demand.

Since additional study of the airport frontage road, east side parking areas, and the planned roundabout at Butler Market Road and Powell Butte Highway is required to maximize available parking and address Deschutes County road requirements, this development alternative concept does not specifically address those issues. However, the elements identified in the alternative do not conflict with future surface road improvements in those areas.

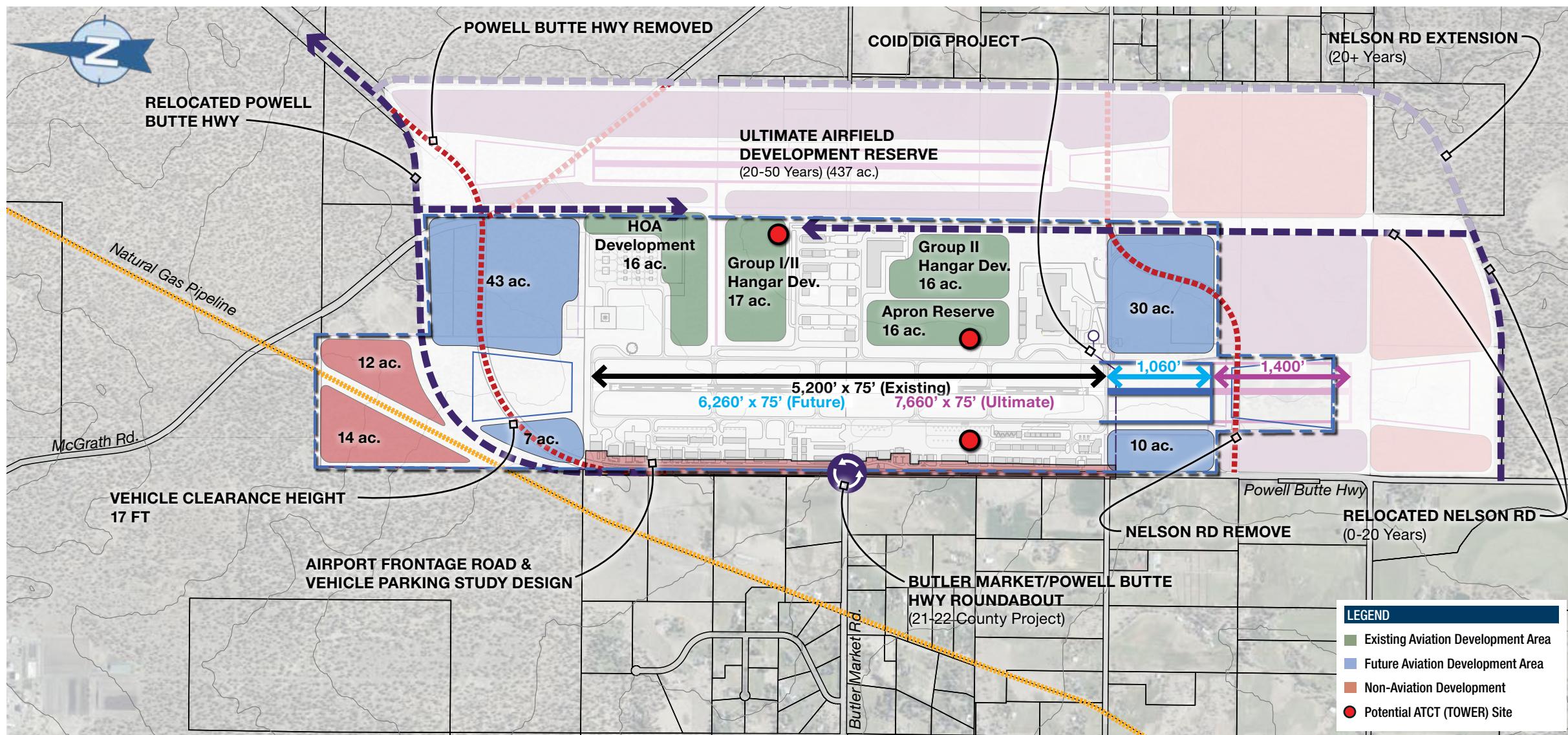
### PAC MEETING #3

Conversations between the planning team and project stakeholders leading up to PAC Meeting #3 provided some evidence that Alternative 1 or a close iteration was most likely to be the preferred alternative for many of the stakeholders.

Throughout PAC Meeting #3 it became more clear that Alternative 1 was most likely to become the preferred alternative. The majority of PAC members that participated in the meeting agreed that the best solution for any runway extension was towards the south and that the inclusion of a parallel runway was likely necessary for long-range planning purposes.



## Alternative 1 (Figure 5-1)



- Main runway extension - to south
  - » 6260' in 20-year planning period
  - » 7,660' for long-range planning (20+ yrs)
- Parallel runway - long-range planning
  - » 4,600' x 60'
- Cross-field taxiway at Bravo Two
- Total Airport Acreage
  - » Existing - 422 acres
  - » Future - 532 acres
  - » Ultimate - 969 acres (20+ yrs)
- Public Roads - 3.2 mi. new/1.5 mi. remove (20-year planning period)
- ATCT - Three potential sites to be evaluated

### Cost Estimates: (20-year planning period)

Private Land Acquisition - \$1.5 million  
 Runway Extension - \$5.2 million  
 COID Line - \$100,000  
 PBH Relocation - \$2 million  
 Nelson Road Relocation - \$3.1 million  
 ATCT - \$7.5 million  
 Total - \$19.4 million

### Operational Capability:

- Ultimate primary runway extension satisfies potential demand for growing corporate jet market and long-range planning needs
- Ultimate parallel runway satisfies growing demand capacity concerns
- Future aviation related development land identified may exceed 50 year demand
- Airport frontage road/vehicle parking study required to maximize available parking and address Deschutes County road requirements
- 2012 AMP identified apron/tie-downs space satisfies future demand

### FAA Design Standards:

- No new non-standard conditions are created
- New development areas allow for expansion and new opportunities to address existing site constraints on apron/aircraft parking/taxilanes
- Cross-field taxiway at Bravo Two allows for connected airport system
- PBH/RPZ incompatibility resolved

### Airspace Compatibility:

- Potential conflicts/challenges between HOA and Ultimate Parallel Runway Traffic Patterns
- Main runway extension south minimizes conflicts with RDM
- Inclusion of ATCT sites and ultimate parallel runway to address airspace capacity concerns

### Land Use, Transportation, and Environmental Compatibility:

- Substantial EFU (in production) ultimately will be converted to aviation related development
- Goal exceptions required and neighborhood compatibility requires further study
- New eastside access road required
- Pipeline can remain unimpeded
- More private than public land to be acquired
- COID line dig to support runway extension
- Further NEPA analysis/study required





## FAA Design Standards

The elements identified in this concept do not create any new non-standard conditions. Existing non-standard conditions (i.e., OFA conflicts in hangar areas) are addressed through redevelopment of existing facilities, expansion to new existing/future/ultimate development areas, or a modification of standards. Direct runway access from the west apron is addressed through reconfiguration of the offending apron exits.

The existing incompatible land use in the Runway 16 RPZ is addressed by the relocation of Powell Butte Highway to north. Previously uncontrolled property located in the north HPZ in the HOA is controlled through public property acquisition.

An ultimate cross field taxiway between existing Taxiway Bravo Two and the proposed ultimate parallel runway/taxiway system join the two facilities, allowing for a connected airport system.

## Airspace Compatibility

Future and ultimate runway extensions to the south of the existing pavement minimize potential conflicts with Redmond-Roberts Field traffic to the north by extending the runway away from the airfield's traffic.

The addition of the ultimate parallel runway on the east side of the airport potentially could potentially create traffic pattern conflicts/challenges with the HOA helicopter traffic. In PAC #2 it was discussed that this location for an ultimate parallel runway would work best to deconflict ultimate traffic patterns.

The inclusion of an ATCT at one of the three proposed sites, along with the ultimate parallel runway will substantially improve the current airspace capacity issues at the Airport. Furthermore, the ATCT would alleviate traffic pattern conflicts between the HOA and ultimate parallel runway through active ATC provided by the tower.

## Land Use, Transportation, and Environmental Compatibility

This development alternative concept proposes the acquisition of 110 acres of property in the 20-year planning period and 547 acres in the 50-year long term planning period. In both cases, the bulk of the land to be purchased is privately owned and is currently zoned as Exclusive Farm Use (EFU). These properties will be rezoned to aviation related development and goal exceptions will be sought.

Nelson Road is removed and replaced with an airport loop road to accommodate the future and ultimate runway extensions to the south. Powell Butte Highway is realigned to the north to remove the incompatible land use from the Runway 16 RPZ. These road realignments necessitate the

extension of the east side access roads to meet the new alignments of Powell Butte Highway on the north and the loop road to the south.

Changes in traffic patterns due to the future/ultimate extensions of the primary runway and the addition of an ultimate parallel runway will likely impact residential areas that were previously unaffected. Neighborhood impacts, including noise mitigation, and environmental impacts require further study and likely land use goal exceptions.

Of the two pipelines in the vicinity of the Airport, one the Central Oregon Irrigation District (COID) pipeline, is impacted. In this concept, the existing COID pipeline alignment conflicts with the proposed future and ultimate runway extension and is to be lowered to a depth that would support runway/taxiway construction over the existing location. The natural gas pipeline located west and north of the airport property is not impacted in this alternative.



## DEVELOPMENT ALTERNATIVE 2

Development Alternative 2 (Figure 5-2) proposes a 1,060 feet runway extension with appurtenant taxiways to the north, resulting in a future runway length of 6,260 feet to satisfy demand over the 20-year planning period. For long-term planning purposes an additional 1,400 feet runway extension and parallel taxiways are proposed on the south end, resulting in an ultimate runway length of 7,660 feet.

Three sites are proposed for an ATCT. The first is east of the runway and Taxiway Bravo, on the western edge of the current Aero Facilities development. The second is located on the west apron in the current transient aircraft parking/tiedown area near the terminal building and the Leading Edge hangars. The third is located on the east side of the runway and Taxiway Bravo directly east of the second site. Further evaluation of these sites is required to identify an optimal ATCT location.

This concept reroutes a portion of Powell Butte Highway to the north along the eastern edge of the natural gas pipeline ROW to remove the incompatible land use from the existing 16 RPZ. Nelson Road on the south is relocated to avoid the ultimate Runway 34 RPZ. Access to the HOA continues to be provided by the existing drive from McGrath Road. A new airport loop road that runs around the ultimate south and east boundaries of the airport facilitates access to the Epic and Aero Facilities which was previously provided by Nelson Road. In total, 1.9 miles of existing road are removed and 3.7 miles of new road are built under this alternative.

To accommodate the future elements, the development alternative proposes the acquisition of 58 acres of public land, resulting in a future total airport area of 480 acres. No private land is identified for acquisition in the 20-year planning period. In addition to accommodating airfield improvements, the acquired property provides spaces for 137 acres of additional aviation development, and 14 acres of non-aviation development.

To accommodate the ultimate elements, the development alternative suggests the acquisition of a total of 58 acres of public land and 142 acres of private land, resulting in an ultimate airport property area of 622 acres. The ultimate property acquisitions accommodate 186 acres of aviation development and 54 acres of non-aviation development. All ultimate property areas provided are inclusive of the previously listed future property acquisitions.

The 20-year planning period estimate for this scenario is \$17.5 million. The runway/taxiway extensions, ATCT, and the realignments of Powell Butte Highway and Nelson Road are the primary contributors to the overall estimated costs of this development alternative.

## Operational Compatibility

Chapter 4 – Facility Requirements and Goals identified a future runway length of 6,260 feet and an ultimate runway length of 7,660 feet to meet anticipated demand by the growing jet market over the 20-year and 50-year planning periods. Development Alternative 2 proposes runway extensions of 1,060 (future) and 1,400 feet (ultimate), resulting in future and ultimate runway lengths that meet Facility Requirements.

The aircraft parking/tiedowns configuration identified in the 2012 Airport Master Plan and the current ALP can accommodate the projected demand for future aircraft parking. No elements proposed in Development Alternative 2 conflict with the 2012 AMP/ALP aircraft parking areas. As such, the aircraft parking configuration depicted in on current ALP is proposed for this concept.

Future aviation related development identified in this scenario total 137 acres in the 20-year term and 186 acres in the 50-year term. This amount of development may exceed demand in the respective time periods.

Since additional study of the airport frontage road and east side parking areas is required to maximize available parking and address Deschutes County road requirements, this development alternative concept does not specifically address those issues. However, the elements identified in the alternative do not conflict with future improvements in those areas.

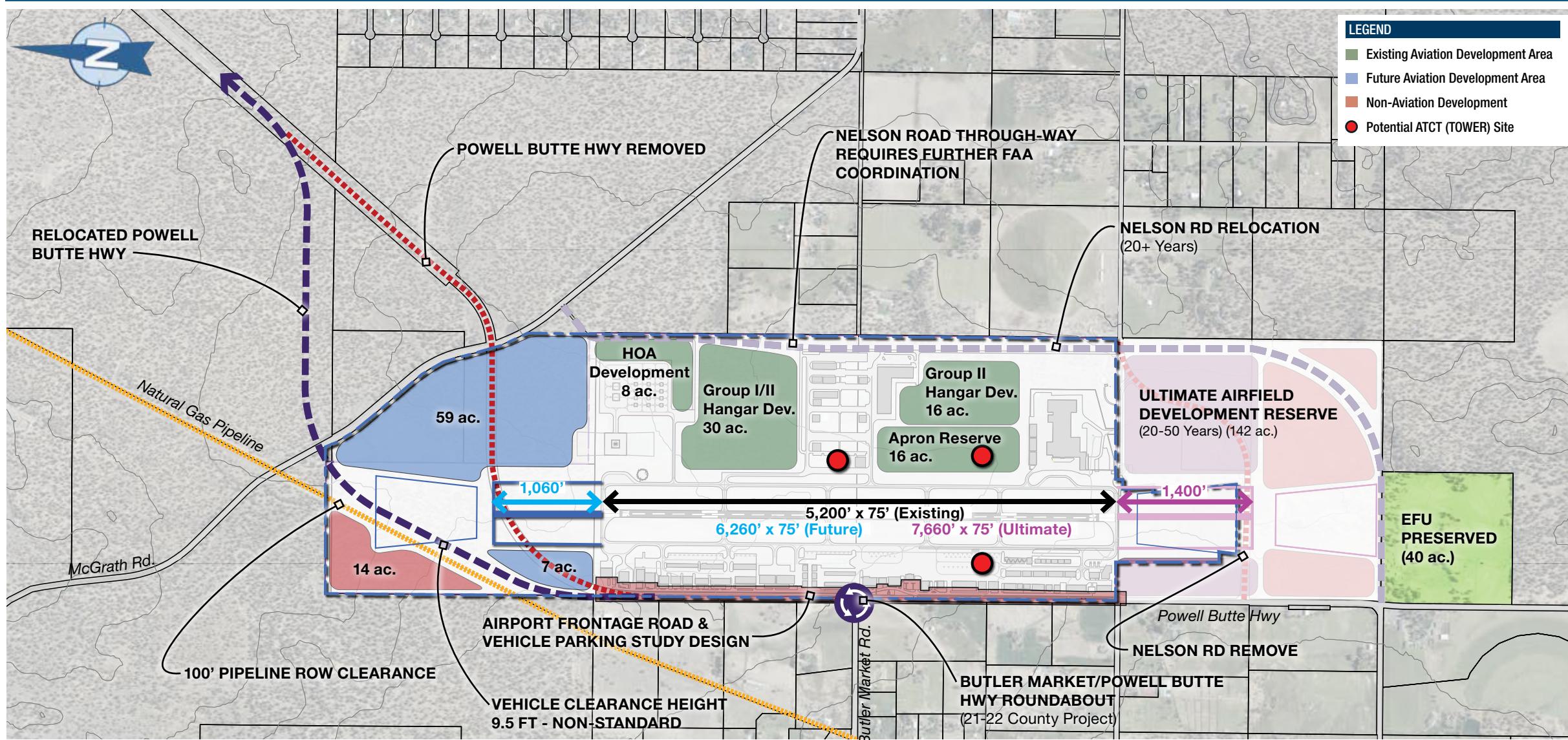
## FAA Design Standards

The existing incompatible land use in the Runway 16 RPZ is addressed by the relocation of Powell Butte Highway to the north and previously uncontrolled property located in the north HPZ in the HOA is controlled through property acquisition and the existing OFA/TSA conflicts in the hangar areas are addressed through redevelopment of existing facilities, expansion to new existing/future/ultimate development areas, or a modification of standards. Direct runway access from the west apron is addressed through reconfiguration of the offending apron exits.

While the relocation of Powell Butte Highway removes the incompatible land use from the existing RPZ, due to the constraint by the natural gas pipeline and associated ROW, the road and the pipeline bisect the future Runway 16 RPZ. Furthermore, the road crosses into the RPZ approximately 500 feet from the runway end. Depending on the topography of the area, the position of the road may not meet vehicle clearance requirements in the FAR Part 77 Approach.



## Alternative 2 (Figure 5-2)



- Main runway extension - split north and south
  - » 6,260' from north side extension in 20-year planning period
  - » 7,660' from south side extension depicted for long-range planning
- Total Airport Acreage
  - » Existing - 422 acres
  - » Future - 480 acres
  - » Ultimate - 622 acres
- Public Roads - 1.3 mi. new/1.2 mi. remove (20-year planning period)
- ATCT - Three potential sites to be evaluated

### Cost Estimates: (20-year planning period)

Private Land Acquisition - NA  
 Runway Extension - \$7.4 million  
 PBH Relocation - \$2.6 million  
 ATCT - \$7.5 million  
 Total - \$17.5 million

### Operational Capability:

- Ultimate primary runway extension satisfies potential demand for growing corporate jet market and long-range planning needs
- Future aviation related development land identified may exceed 50 year demand
- Airport frontage road/vehicle parking study required to maximize available parking and address Deschutes County road requirements
- 2012 AMP identified apron/tie-downs space satisfies future demand

### FAA Design Standards:

- New development areas allow for expansion and new opportunities to address existing site constraints on apron/aircraft parking/taxilanes
- Pipeline/PBH/RPZ relocation creates new RPZ incompatibility
- North extension approach surface vehicle clearance height does not meet standards and would likely result in the runway extension being reduced by 190' to an extension of 870' to provide acceptable vehicle clearance.

### Airspace Compatibility:

- Inclusion of ATCT sites to address airspace capacity concerns
- Northern extension of primary runway may create new conflicts with RDM traffic

### Land Use, Transportation, and Environmental Compatibility:

- Smaller impact on EFU (in production) land
- Goal exceptions may be required (20+ years)
- New eastside access road required (20+ years)
- Pipeline remains but RPZ impact requires further study
- More private than public land to be acquired
- COID line dig to support ultimate runway extension (20+ years) not depicted
- Further NEPA analysis/study required





## Airspace Compatibility

The future runway extension to the north of the existing pavement may create new conflicts with Redmond-Roberts Field traffic to the north by extending the runway and associated traffic 1,060 feet toward the airfield's traffic pattern. Construction of an ATCT at one of the three proposed sites will substantially improve the current airspace capacity issues at the Airport and may help mitigate conflicts with Redmond traffic.

## Land Use, Transportation, and Environmental Compatibility

This development alternative concept proposes the acquisition of 58 acres of property in the 20-year planning period and 200 acres in the 50-year long term planning period. Compared to the previous concept, these acquisitions have a much smaller impact of the surrounding EFU land. No EFU property is identified for acquisition in the 20-year planning period and a total of 142 acres of EFU land is identified in the 50-year long term planning period. If acquired, the ultimate property acquisitions will be rezoned to aviation related development. State land use goal exceptions may require further study.

Powell Butte Highway is realigned to the north to remove the existing incompatible land use from the Runway 16 RPZ. Nelson Road is removed and replaced with an airport loop road south and east of the property to accommodate the ultimate runway extensions to the south. The loop road extends to McGrath Road at the current HOA access drive where traffic continues either southeast on McGrath Road or Northwest to the new alignment and intersection of Powell Butte Highway.

Changes in traffic patterns due to the future/ultimate extensions of the primary are minimal and will likely have little impact on previously unaffected areas. Extensive noise mitigation measures are not anticipated. Further NEPA studies will be required to assess environmental impact of construction projects.

Both pipelines in the vicinity of the Airport are impacted in this development alternative. The natural gas pipeline is not identified to be relocated in this concept. Unless relocated, the pipeline will conflict with the future Runway 16 RPZ and considered an incompatible land use. The existing COID pipeline alignment conflicts with the ultimate runway extension and is to be lowered to a depth that would support runway/taxiway construction over the existing location when the ultimate extension to the south occurs.



## DEVELOPMENT ALTERNATIVE 3

Development Alternative 3 (Figure 5-3) proposes a 1,060 feet runway extension with appurtenant taxiways to the south, resulting in a future runway length of 6,260 feet to satisfy demand over the 20-year planning period.

For long-term planning purposes an additional 1,400 feet runway extension and parallel taxiways are proposed to be added future extension on the south end, resulting in an ultimate runway length of 7,660 feet. A secondary parallel runway - with appurtenant parallel and connector taxiways - measuring 4,600 feet long by 60 feet wide, is proposed on existing private property near the southeast airport boundary. The parallel runway is joined to the existing runway/taxiway system via a cross field taxiway at the future Runway 34 end.

Three sites are proposed for an ACTC. The first is located on a currently privately owned parcel southeast of the airport property, south of Epic Facilities. The second is located on the west apron in the current transient aircraft parking/tiedown area near the terminal building and the Leading Edge hangars. The third is located on the east side of the runway and Taxiway Bravo directly east of the second site on property designated as apron reserve. Further evaluation of these sites is required to identify an optimal ATCT location.

This concept relocates Nelson Road to avoid a conflict with the future Runway 34 RPZ. A new airport loop road that runs around the ultimate south and east boundaries of the airport facilitates access to Epic and Aero Facilities which was previously provided by Nelson Road. Access to the HOA continues to be provided by the existing drive and Powell Butte Highway. In total, 0.9 miles of existing road are removed, and 4.1 miles of new road are built under this alternative.

To accommodate the future elements, the development alternative proposes the acquisition of 91 acres of private land, resulting in a future total airport area of 513 acres. No publicly owned land is identified for acquisition in this concept in the 20-year planning term. In addition to accommodating airside improvements, the acquired property provides space for 124 acres of additional aviation development, and 59 acres of non-aviation development.

To accommodate the ultimate elements, the development alternative requires the acquisition of a total of 179 acres of public land and 303 acres of private land, resulting in an ultimate airport property area of 904 acres. The property acquisitions accommodate 312 acres of aviation development and 120 acres of non-aviation development. All ultimate property areas are inclusive of the previously listed future property acquisitions.

For comparison purposes, high-level, rough order magnitude cost estimates were completed using the best information

available at the time of this writing. This the 20-year planning period estimate for this scenario is \$19.4 million. The bulk of that cost stem from the required property acquisitions, runway/taxiway extension, and relocation of Nelson Road.

### Operational Compatibility

The future and ultimate extensions to the primary runway satisfy the forecasted demand for the growing jet market over the 20-year and long-range time periods, respectfully. The addition of an ultimate parallel runway addresses growing capacity concerns and air traffic pattern concerns by moving the bulk of the small single-engine piston flight training operations off the primary runway and into a dedicated pattern.

The aircraft parking/tiedowns configuration identified in the 2012 Airport Master Plan and the current ALP can accommodate the projected demand for future aircraft parking. No elements proposed in this concept conflict with the 2012 AMP/ALP aircraft parking areas. As such, the aircraft parking configuration depicted in on current ALP is proposed for this concept.

Future aviation related development identified in this scenario total 124 acres. This amount of development may exceed the 50-year demand.

Since additional study of the airport frontage road and east side parking areas is required to maximize available parking and address Deschutes County road requirements, this development alternative concept does not specifically address those issues. However, the elements identified in the alternative do not conflict with future improvements in those areas.

### FAA Design Standards

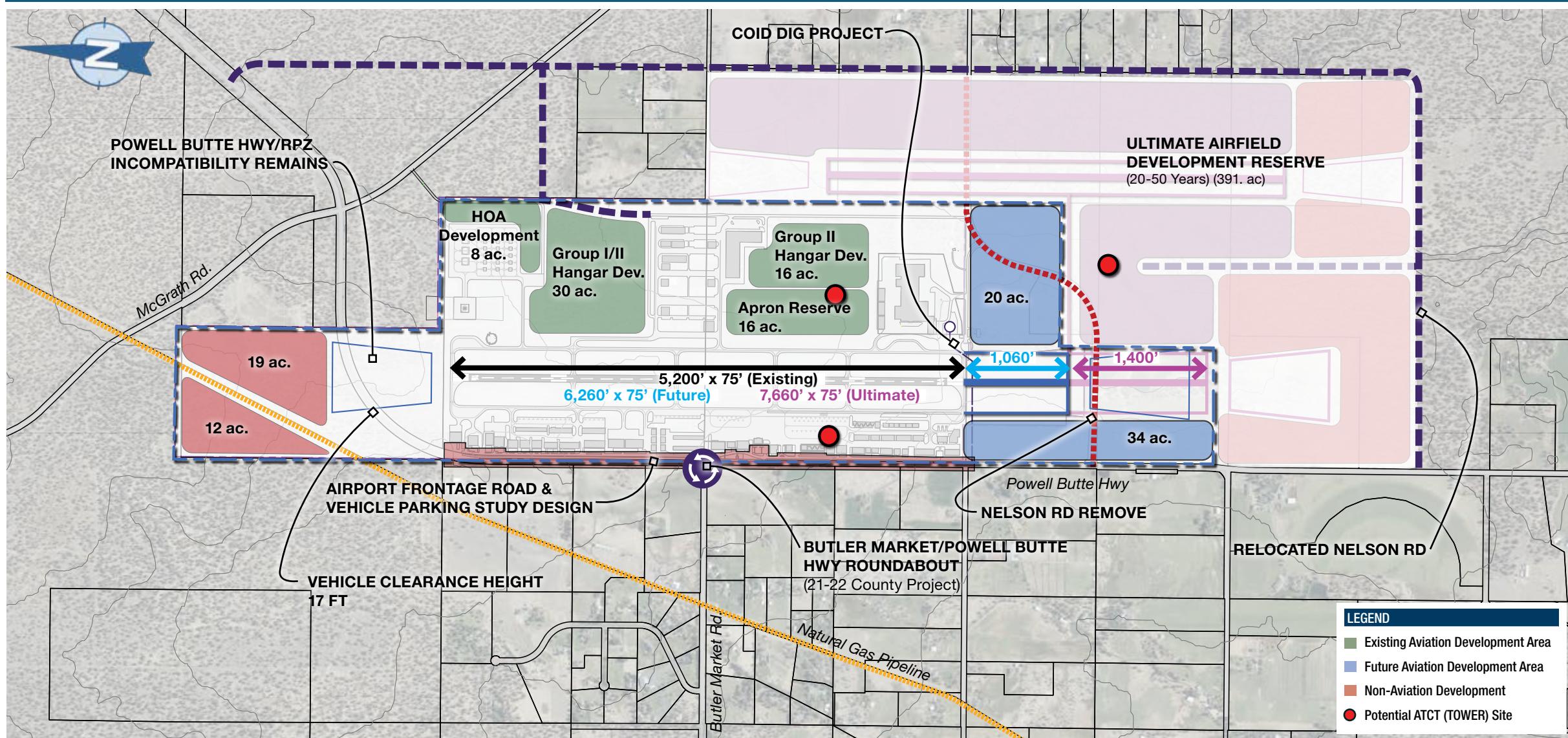
The elements identified in this concept do not create any new non-standard conditions. Existing non-standard conditions (i.e., OFA conflicts in hangar areas) are addressed through redevelopment of existing facilities, expansion to new existing/future/ultimate development areas, or a modification of standards. Direct runway access from the west apron is addressed through reconfiguration of the offending apron exits.

The existing incompatible land use in the Runway 16 RPZ remains as Powell Butte Highway is not rerouted in this concept. However, no changes to Runway 16 end are proposed that which would trigger a land use review in the RPZ. Previously uncontrolled property located in the north HPZ in the HOA is controlled through property acquisition.

An ultimate cross field taxiway between existing Taxiway Bravo Two and the proposed ultimate parallel runway/taxiway system join the two facilities, allowing for a connected airport system.



## Alternative 3 (Figure 5-3)



- Main runway extension - to south
  - » 6,260' in 20-year planning period
  - » 7,660' for long-range planning
- Parallel runway - long-range planning
  - » 4,600' x 60'
- Cross-field taxiway at Future Bravo Seven
- Total Airport Acreage
  - » Existing - 422 acres
  - » Future - 513 acres
  - » Ultimate - 904 acres
- Public Roads - 3.5 mi. new/.9 mi. remove (20-year planning period)
- ATCT - Three potential sites to be evaluated

### Cost Estimates: (20-year planning period)

Private Land Acquisition - \$2 million  
 Runway Extension - \$5.2 million  
 COID Line - \$100,000  
 Nelson Road Relocation - \$4.6 million  
 ATCT - \$7.5 million  
 Total - \$19.4 million

### Operational Capability:

- Ultimate primary runway extension satisfies potential demand for growing corporate jet market and long-range planning needs
- Ultimate parallel runway satisfies growing demand capacity concerns
- Future aviation related development land identified may exceed 50 year demand
- Airport frontage road/vehicle parking study required to maximize available parking and address Deschutes County road requirements
- 2012 AMP identified apron/tie-downs space satisfies future demand

### FAA Design Standards:

- No new non-standard conditions are created
- New development areas allow for expansion and new opportunities to address existing site constraints on apron/aircraft parking/taxilanes
- Cross-field taxiway at future Bravo Seven allows for connected airport system
- PBH/RPZ incompatibility remains in its existing condition

### Airspace Compatibility:

- Potential conflicts/challenges between HOA and Ultimate Parallel Runway Traffic Patterns
- Main runway extension south minimizes conflicts with RDM
- Inclusion of ATCT sites and ultimate parallel runway to address airspace capacity concerns

### Land Use, Transportation, and Environmental Compatibility:

- Substantial EFU (in production) ultimately will be converted to aviation related development
- Goal exceptions requires further study
- Nelson Road relocation depicted for ultimate configuration compatibility
- Pipeline can remain unimpeded
- More private than public land to be acquired
- COID line dig to support runway extension
- Further NEPA analysis/study required



## Airspace Compatibility

Future and ultimate runway extensions to the south of the existing pavement minimizes potential conflicts with Redmond-Roberts Field traffic to the north by extending the runway away from the airfield's traffic.

The addition of the ultimate parallel runway on the east side of the airport potentially could potentially create traffic pattern conflicts/challenges with the HOA helicopter traffic. Though the location at the south end of the airport has a lower impact than a more northern site.

The inclusion of an ATCT at one of the three proposed sites, along with the ultimate parallel runway substantially improves the current airspace capacity issues at the Airport. Furthermore, the ATCT alleviates traffic pattern conflicts between the HOA and ultimate parallel runway through active ATC provided by the tower.

## Land Use, Transportation, and Environmental Compatibility

This development alternative concept proposes the acquisition of 91 acres of property in the 20-year planning period and 482 acres in the 50-year long term planning period. With the exception of the 179 acres identified for purchase north of Runway 16 end, the bulk of the land to be purchased is privately owned and is currently zoned as Exclusive Farm Use (EFU). These properties will be rezoned to aviation related development. State land use goal exceptions may be required and further study is recommended.

Nelson Road is removed and replaced with a new access road from Powell Butte Highway to accommodate the future and ultimate runway extensions to the south. In the 50-year planning period, the road is extended north around the east side of the property where it rejoins Powell Butte Highway to create a loop road around the airport. Powell Butte Highway is realigned to the north to remove the incompatible land use from the Runway 16 RPZ. These road realignments necessitate the extension of the east side access roads to meet the new alignments of Powell Butte Highway on the north and the loop road to the south.

Changes in air traffic patterns due to the future/ultimate extensions of the primary runway and the addition of an ultimate parallel runway will likely impact residential areas that were previously unaffected. Neighborhood impacts, including noise mitigation, and environmental impacts require further study.

Of the two pipelines in the vicinity of the Airport, only the Central Oregon Irrigation District (COID) pipeline is impacted. In this concept, the existing COID pipeline alignment conflicts with the proposed future runway extension and will be lowered to a depth that would support runway/taxiway construction over the existing location. The natural gas pipeline located west and north of the airport property is not impacted.



## DEVELOPMENT ALTERNATIVE 3A

Development Alternative 3A (Figure 5-4) is nearly identical to and offers all the same enhancements that were proposed under Development Alternative 3. However, in this concept, 530 feet of runway and parallel taxiways are removed from the Runway 16 end to address the incompatible land use (Powell Butte Road) in the RPZ. The removed length is replaced, and an additional 1,060 feet added on the Runway 34 end resulting in a future runway length of 6,260 feet to satisfy demand over the 20-year planning period. An additional 1,400 feet of runway is added to the future south end in the 50-year planning period resulting in an ultimate runway length of 7,660 feet.

While this shift of the runway does not affect the property acquisitions described in the previous concept, it slightly alters the planned land development areas. This concept proposes 129 acres of aviation related development and 50 acres of non-aviation development in the 20-year planning period. In the 50-year long term planning period, 321 acres are identified for aviation related development and 111 acres for non-aviation related development. All other elements in this concept match those of Development Alternative 3.

This the 20-year planning period estimate for this scenario is \$22.9 million. The bulk of that cost stem from the required property acquisitions, runway/taxiway extension, and relocation of Nelson Road.

### Operational Compatibility

The future and ultimate extensions to the primary runway satisfy the forecasted demand for the growing jet market over the 20-year and 50-year time periods. The addition of an ultimate parallel runway addresses growing capacity concerns and air traffic pattern concerns by moving the bulk of the small single-engine piston flight training operations off the primary runway and into a dedicated pattern.

The aircraft parking/tiedowns configuration identified in the 2012 Airport Master Plan and the current ALP can accommodate the projected demand for future aircraft parking. No elements proposed in Development Alternative 1 conflict with the 2012 AMP/ALP aircraft parking areas. As such, the aircraft parking configuration depicted in on current ALP is proposed for this concept.

Future aviation related development identified in this scenario total 129 acres. This amount of development may exceed the 50-year demand.

Since additional study of the airport frontage road and east side parking areas is required to maximize available parking and address Deschutes County road requirements, this development alternative concept does not specifically address those issues. However, the elements identified in the alternative do not conflict with future improvements in those areas.

### FAA Design Standards

Existing non-standard conditions (i.e., OFA conflicts in hangar areas) are addressed through redevelopment of existing facilities, expansion to new existing/future/ultimate development areas, or a modification of standards. Direct runway access from the west apron is addressed through reconfiguration of the offending apron exits.

The existing incompatible land use in the Runway 16 RPZ is eliminated by the shift of the runway 530 feet south of its current position. Previously uncontrolled property located in the north HPZ in the HOA is controlled through property acquisition. However, this runway shift creates new direct runway access points at the future runup aprons with the HOA taxiway and west apron tie down areas.

An ultimate cross field taxiway between existing Taxiway Bravo Two and the proposed ultimate parallel runway/taxiway system join the two facilities, allowing for a connected airport system.

### Airspace Compatibility

The runway shift coupled with future and ultimate runway extensions to the south of the existing pavement further minimizes potential conflicts with Redmond-Roberts Field traffic to the north by extending the runway away from the airfield's traffic.

The location of the ultimate parallel runway on the southeast side of the airport potentially could potentially create traffic pattern conflicts/challenges with the HOA helicopter traffic, though the impacts would likely be less than that of Development Alternative 1 as the parallel runway is located farther south, away from the HOA.

The inclusion of an ATCT at one of the three proposed sites, along with the ultimate parallel runway will substantially improve the current airspace capacity issues at the Airport. Furthermore, the ATCT alleviates traffic pattern conflicts between the HOA and ultimate parallel runway through active ATC provided by the tower.

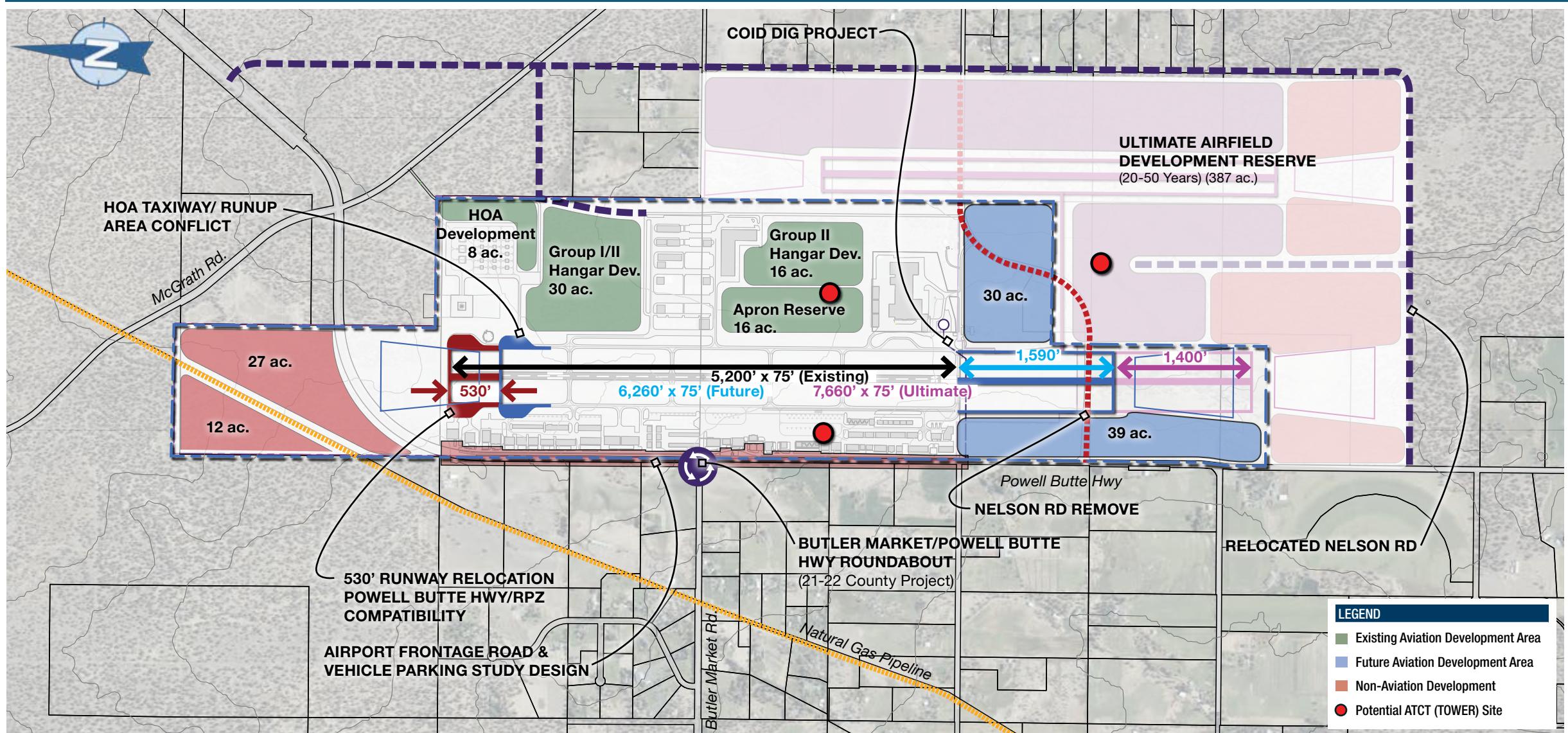
### Land Use, Transportation, and Environmental Compatibility

This development alternative concept proposes the acquisition of 91 acres of property in the 20-year planning period and 482 acres in the 50-year long term planning period. Except the 179 acres identified for purchase north of Runway 16 end, the bulk of the land to be purchased is privately owned and is currently zoned as Exclusive Farm Use (EFU). These properties are rezoned to aviation related development. Goal exceptions associated with these acquisitions require further study.

Nelson Road is removed and replaced with a new access road from Powell Butte Highway to accommodate the future and ultimate runway extensions to the south. In the 50-year



## Alternative 3A (Figure 5-4)



- Main runway extension - to south
  - » 530' removed on north end for RPZ
  - » 6,260' in 20-year planning period
  - » 7,660' for long-range planning
- Parallel runway - long-range planning
  - » 4,600' x 60'
- Cross-field taxiway at Future Bravo Seven
- Total Airport Acreage
  - » Existing - 422 acres
  - » Future - 513 acres
  - » Ultimate - 904 acres
- Public Roads - 3.5 mi. new/.9 mi. remove (20-year planning period)
- ATCT - Three potential sites to be evaluated

### Cost Estimates: (20-year planning period)

Private Land Acquisition - \$2.2 million  
 Runway Extension - \$8.5 million  
 COID Line - \$100,000  
 Nelson Road Relocation - \$4.6 million  
 ATCT - \$7.5 million  
 Total - \$22.9 million

### Operational Capability:

- Ultimate primary runway extension satisfies potential demand for growing corporate jet market and long-range planning needs
- Ultimate parallel runway satisfies growing demand capacity concerns
- Future aviation related development land identified may exceed 50 year demand
- Airport frontage road/vehicle parking study required to maximize available parking and address Deschutes County road requirements
- 2012 AMP identified apron/tie-downs space satisfies future demand

### FAA Design Standards:

- New development areas allow for expansion and new opportunities to address existing site constraints on apron/aircraft parking/taxilanes
- Cross-field taxiway at future Bravo Seven allows for connected airport system
- PBH/RPZ incompatibility is addressed by 530' shift
  - » New non-standard conditions at future runup areas with HOA taxiway and Westside tiedown

### Airspace Compatibility:

- Potential conflicts/challenges between HOA and Ultimate Parallel Runway Traffic Patterns
- Main runway shift to south further minimizes conflicts with RDM
- Inclusion of ATCT sites and ultimate parallel runway to address airspace capacity concerns

### Land Use, Transportation, and Environmental Compatibility:

- Substantial EFU (in production) ultimately will be converted to aviation related development
- Goal exceptions requires further study
- Nelson Road relocation depicted for ultimate configuration compatibility
- Pipeline can remain unimpeded
- More private than public land to be acquired
- COID line dig to support runway extension
- Further NEPA analysis/study required



planning period, this road is extended north around the east side of the property where rejoins Powell Butte Highway to form a loop road around the airport. Powell Butte Highway is realigned to the north to remove the incompatible land use from the Runway 16 RPZ. These road realignments necessitate the extension of the east side access roads to meet the new alignments of Powell Butte Highway on the north and the loop road to the south.

Changes in air traffic patterns due to the future/ultimate extensions of the primary runway and the addition of an ultimate parallel runway will likely impact residential areas that were previously unaffected. Neighborhood impacts, including noise mitigation, and environmental impacts require further study.

Of the two pipelines in the vicinity of the Airport, only the Central Oregon Irrigation District (COID) pipeline is impacted. In this concept, the existing COID pipeline alignment conflicts with the proposed future runway extension and is to be lowered to a depth that would support runway/taxiway construction over the existing location. The natural gas pipeline located west and north of the airport property is not impacted.



## DEVELOPMENT ALTERNATIVE 4

Development Alternative 4 (Figure 5-5) proposes a 1,060 feet runway extension with appurtenant taxiways to the north, resulting in a future runway length of 6,260 feet to satisfy demand over the 20-year planning period. For long-term planning purposes the runway is extended to an ultimate length of 7,660 feet by the construction of 220 feet of new runway on the Runway 16 end and 370 feet on the runway 34 end. Splitting the ultimate runway extension in this fashion serves to minimize the amount of privately owned and EFU land acquired.

The three sites proposed for an ATCT are the same as those proposed in Alternative 1. The first is on the east edge of the property, north of Aero Facilities. The second is located on the west apron in the current transient aircraft parking/tiedown area near the terminal building and the Leading Edge hangars. The third is located on the east side of the runway and Taxiway Bravo directly east of the second site. Further evaluation of these sites is needed to identify an optimal ATCT location.

This concept removes a portion of Powell Butte Highway starting where the road curves east near the north end of the Airport and ending at the existing intersection with McGrath Road to address the incompatible land use in the RPZ. Powell Butte Highway is rerouted from a point south of the Airport near Ericson Road, along the east boundary of the airport until it rejoins the existing Powell Butte Highway northeast of the airport. A portion of Nelson Road at the south end of the Airport is removed to avoid a land use conflict with the ultimate runway RPZ.

Access to the HOA continues to be provided by the existing drive from McGrath Road and a connector road from the relocated Powell Butte Highway. The relocated Powell Butte Highway also facilitates access to the Epic and Aero Facilities, which was previously provided by Nelson Road. In total, 1.1 miles of existing road are removed and 3.7 miles of new road are built under this alternative.

To accommodate the future elements depicted in this concept, the development alternative proposes the acquisition of 58 acres of public land, resulting in a future total airport area of 480 acres. No private land is identified for acquisition in the 20-year planning period. In addition to accommodating airfield improvements, the acquired property provides space for 137 acres of additional aviation development. This concept does not reserve additional land for future non-aviation related development.

To accommodate the ultimate elements, the development alternative requires the acquisition of a total of 58 acres of public land and 75 acres of private land, resulting in an ultimate airport property area of 555 acres. The property

acquisitions will accommodate 137 acres of aviation development and 64 acres of non-aviation development. All ultimate property areas provided are inclusive of the previously listed future property acquisitions.

The 20-year planning period estimate for this scenario is \$20.9 million. The runway/taxiway extensions, ATCT, and the realignments of Powell Butte Highway and removal of Nelson Road are the primary contributors to the overall estimated costs of this development alternative.

### Operational Compatibility

The future and ultimate extensions to the primary runway satisfy the forecasted demand for the growing jet market over the 20-year and long-range time periods, respectfully. The addition of an ultimate parallel runway addresses growing capacity and air traffic pattern concerns by moving the bulk of the small single-engine piston flight training operations off the primary runway and into a dedicated pattern.

The aircraft parking/tiedowns configuration identified in the 2012 Airport Master Plan and the current ALP can accommodate the projected demand for future aircraft parking. No elements proposed in this concept conflict with the 2012 AMP/ALP aircraft parking areas. As such, the aircraft parking configuration depicted in on current ALP is again proposed for this concept.

Future aviation related development identified in this scenario total 137 acres in the 20-year and 50-year terms. This amount of development may exceed demand in the respective time periods.

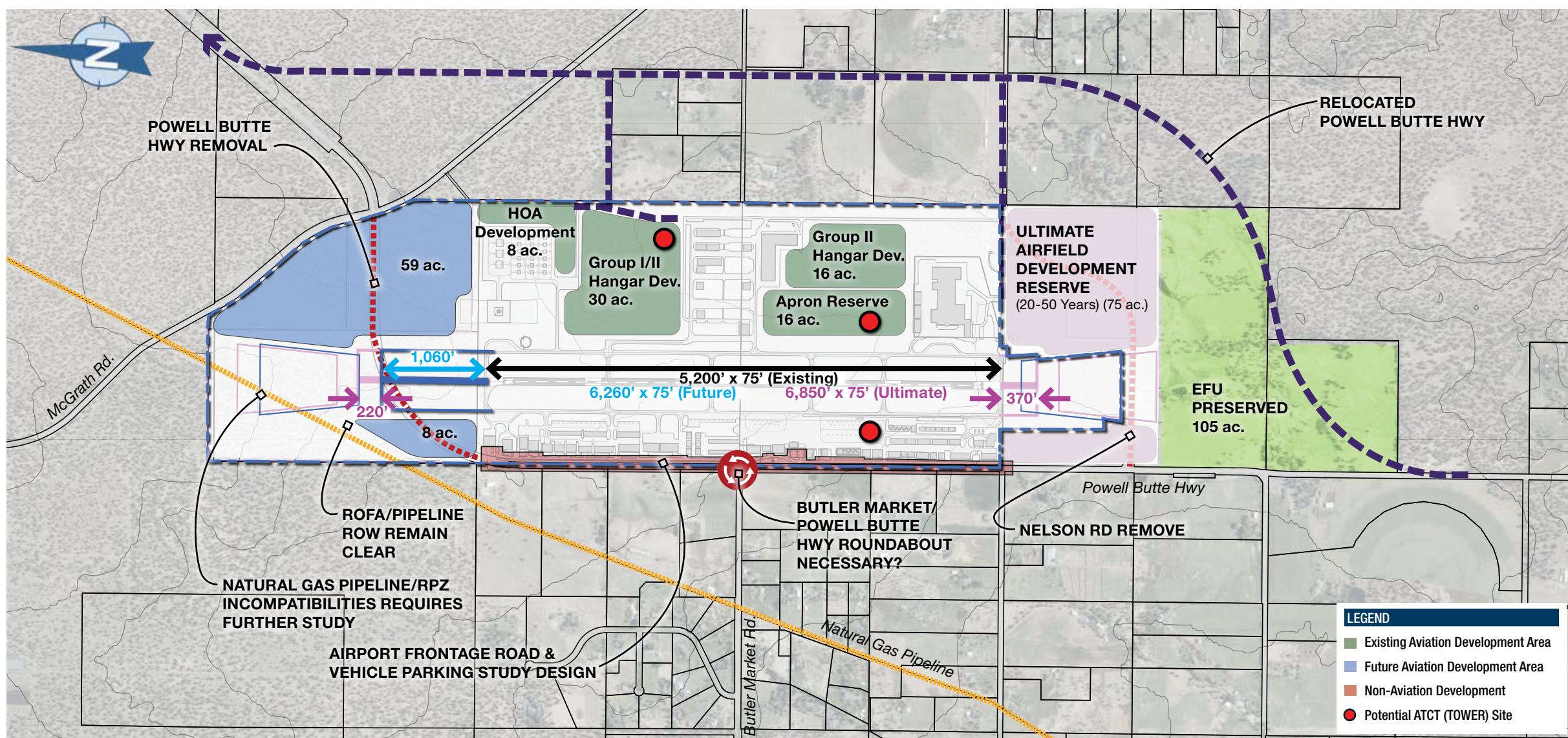
Since additional study of the airport frontage road and east side parking areas is required to maximize available parking and address Deschutes County road requirements, this development alternative concept does not specifically address those issues. However, the elements identified in the alternative do not conflict with future improvements in those areas.

### FAA Design Standards

Elements in this development alternative address the existing non-standard conditions. The existing incompatible land use in the Runway 16 RPZ is addressed by the relocation of Powell Butte Highway to east and previously uncontrolled property located in the north HPZ in the HOA is controlled through property acquisition. The existing OFA/TSA conflicts in the hangar areas are addressed through redevelopment of existing facilities, expansion to new existing/future/ultimate development areas, or a modification of standards. Direct runway access from the west apron is addressed through reconfiguration of the offending apron exits.



## Alternative 4 (Figure 5-5)



- Main runway extension - to north and south
  - » Minimal property acquisition for runway extension
  - » 6260' in 20-year planning period
  - » 6850' for long-range planning
- Total Airport Acreage
  - » Existing - 422 acres
  - » Future - 480 acres
  - » Ultimate - 555 acres
- PBH relocated to east side of Airport
- Public Roads - 3.7 mi. new/1.1 mi. remove (20-year planning period)
- Preserves 100 acres of EFU land
- ATCT - Three potential sites to be evaluated

### Cost Estimates: (20-year planning period)

Private Land Acquisition - NA  
 Runway Extension - \$7.4 million  
 PBH Relocation - \$6 million  
 ATCT - \$7.5 million  
 Total - \$20.9 million

### Operational Capability:

- Ultimate primary runway extension satisfies potential demand for growing corporate jet market and long-range planning needs
- Future aviation related development land identified may exceed 50 year demand
- Airport frontage road/vehicle parking study required to maximize available parking and address Deschutes County road requirements
- 2012 AMP identified apron/tie-downs space satisfies future demand

### FAA Design Standards:

- New development areas allow for expansion and new opportunities to address existing site constraints on apron/aircraft parking/taxilanes
- Pipeline/RPZ relocation creates potential new RPZ incompatibility that requires further study

### Airspace Compatibility:

- Inclusion of ATCT sites to address airspace capacity concerns
- Northern extension of primary runway may create new conflicts with RDM traffic

### Land Use, Transportation, and Environmental Compatibility:

- Smallest impact on EFU (in production) land
- Goal exceptions for PBH relocation may be required
- Pipeline remains but RPZ impact requires further study
- More public than private land to be acquired
- COID line dig to support ultimate runway extension (20+ years) not depicted
- Further NEPA analysis/study required





## Airspace Compatibility

The future runway extension to the north of the existing pavement may create new conflicts with Redmond-Roberts Field traffic by extending the runway and associated traffic 1,060 feet toward the airfield's traffic pattern in the 20-year term.

Construction of an ATCT at one of the three proposed sites will substantially improve the current airspace capacity issues at the Airport and may help mitigate conflicts with Redmond traffic.

## Land Use, Transportation, and Environmental Compatibility

This development alternative concept proposes the acquisition of 58 acres of property in the 20-year planning period and 133 acres in the 50-year long term planning period. Compared to the previous concepts, this has a much smaller impact of the surrounding EFU land. No EFU property is identified for acquisition in the 20-year planning period and a total of 75 acres of EFU land is identified in the 50-year long term planning period. The ultimate property acquisitions will be rezoned to aviation related development. State land use goal exceptions will require further study.

Powell Butte Highway is realigned around the east side of the Airport to remove the existing incompatible land use from the Runway 16 RPZ. Nelson Road is removed and traffic rerouted on the new Powell Butte Highway alignment to facilitate the ultimate runway extension to the south. Access to the southeast development areas is provided via a drive to (realigned) Powell Butte Highway on the east. The HOA is accessed by similar connection to Powell Butte Highway or the existing drive from McGrath Road.

Changes in traffic patterns due to the future/ultimate extensions of the runway are minimal and will likely have little impact on previously unaffected areas. Extensive noise mitigation measures are not anticipated. Further NEPA studies will be required to assess environmental impact of construction projects.

Both pipelines in the vicinity of the Airport are impacted in this development alternative. The natural gas pipeline is not identified to be relocated in this concept. Unless relocated the pipeline will conflict with the future Runway 16 RPZ and be considered an incompatible land use. The existing COID pipeline alignment conflicts with the ultimate runway extension and will need to be lowered to a depth that would support runway/taxiway construction over the existing location if that work were to take place.

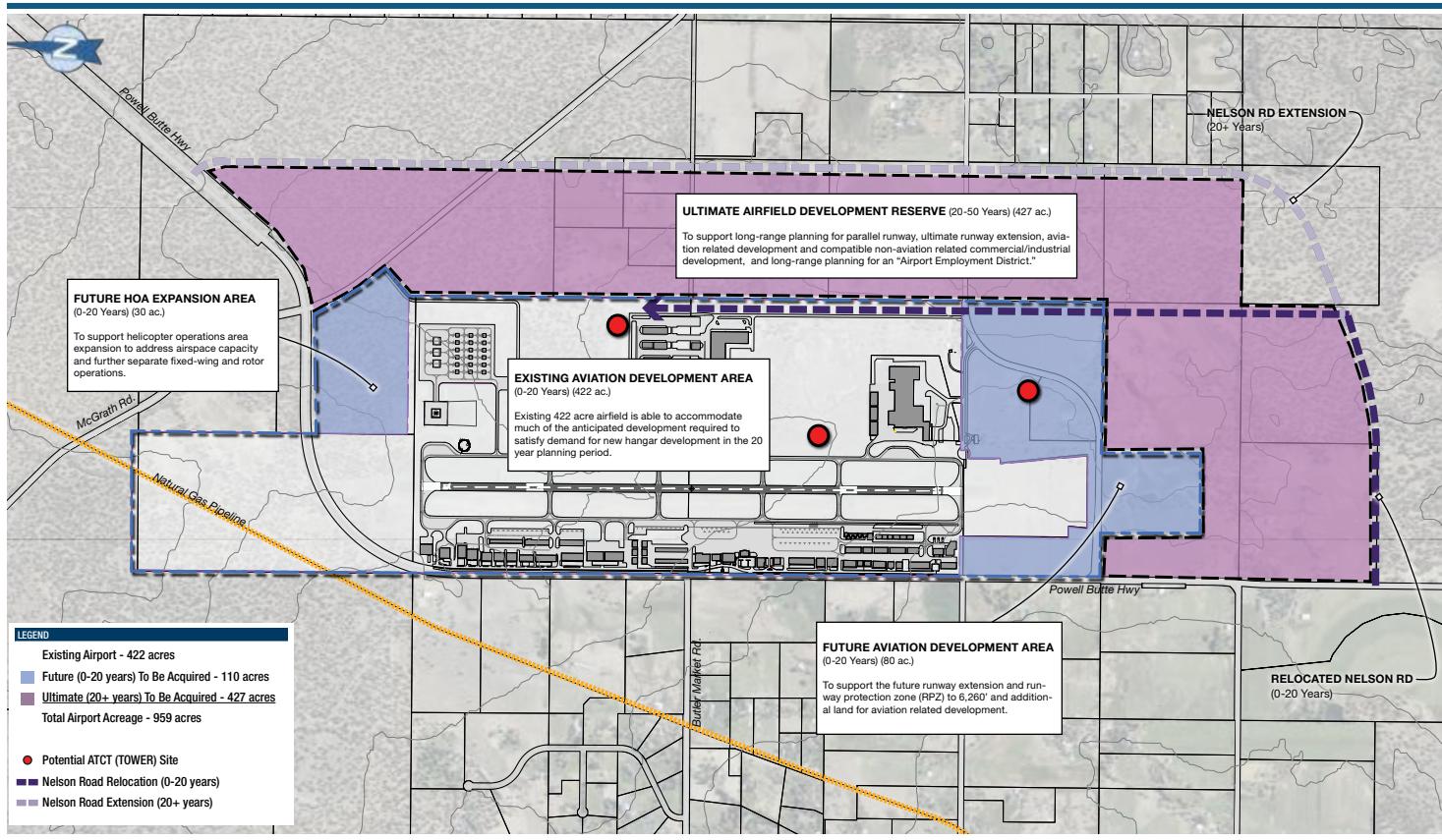


# Preferred Development Alternative

The process of selecting the preferred development alternative began in PAC Meeting #3 when it became clear that PAC members were generally leaning towards Alternative 1 as their preferred alternative. Leading up to PAC Meeting #4 the planning team had additional conversations with project stakeholders and PAC members that resulted in the presentation of a recommended preferred alternative to the PAC based largely on Alternative 1 (Figure 5-1). The most notable difference between Alternative 1 and the PAC Preferred Alternative is that all Ultimate Aviation Related Development proposed in Alternative 1 had been removed for depiction and the land was proposed to be identified as an “urban infrastructure reserve” or similar designation that will need to be considered in the comprehensive plan update/adoption process. Conversations with stakeholders and PAC members during this time provided input and guidance on all future planning recommendations presented. The recommended preferred alternative developed by consultants and Airport staff based on the planning process did not meet any major opposition from PAC members during PAC #4 and was carried forward by consultants as the PAC Preferred Alternative (Figure 5-6).

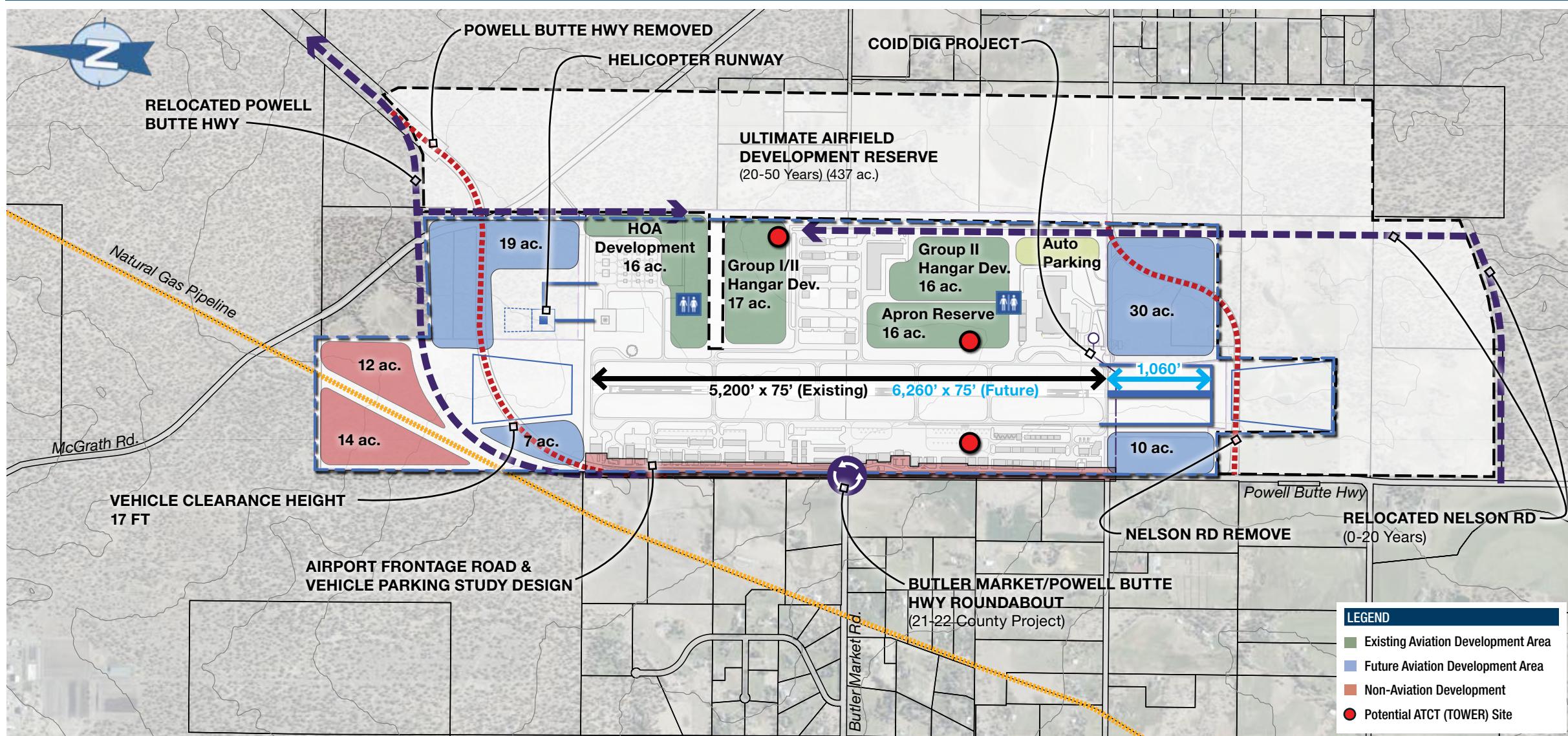
The City Preferred Alternative (Figure 5-7) was ultimately selected by the City after several internal meetings amongst City and County staff that followed PAC Meeting #4. The only notable change from the PAC Preferred Alternative is to the Powell Butte Highway/RPZ Relocation project. Based on conversations with County staff, it was understood that there was little appetite to discuss the relocation of Powell Butte and the City should seek to pursue maintaining the existing condition with the FAA if it was an option. The FAA position on this existing RPZ condition is that it will require an RPZ Analysis Memo and further discussion with FAA SEA-ADO staff.

The City Preferred Alternative identifies future aviation expansion areas, facility improvements, local surface transportation projects, and ultimate airfield development reserve areas to address existing capacity constraints and satisfy growing demand for aviation activities in the Bend and Central Oregon Region.





## PAC Preferred Alternative (Figure 5-6)



- Main runway extension - to south
  - » 6260' in 20-year planning period
  - » Ultimate Airfield Reserve provides space for 7,660' x 75' (20+ yrs)
- Ultimate Airfield Reserve provides space for 4,600' x 60' (20+ yrs)
- Includes Helicopter Runway
- Total Airport Acreage
  - » Existing - 422 acres
  - » Future - 532 acres
  - » Ultimate - 969 acres (20+ yrs)
- Public Roads - 3.2 mi. new/1.5 mi. remove (20-year planning period)
- ATCT - Three potential sites to be evaluated

### Cost Estimates: (20-year planning period)

Private Land Acquisition - \$1.5 million  
 Runway Extension - \$5.2 million  
 COID Line - \$100,000  
 PBH Relocation - \$2 million  
 Nelson Road Relocation - \$3.1 million  
 ATCT - \$7.5 million  
 Total - \$19.4 million

### Operational Capability:

- Ultimate Airfield Reserve area satisfies potential demand for growing corporate jet market and long-range planning needs
- Ultimate Airfield Reserve satisfies growing demand/capacity concerns
- Future aviation related development land identified may exceed 50 year demand
- Airport frontage road/vehicle parking study required to maximize available parking and address Deschutes County road requirements
- Identified 16 acre Apron Reserve area satisfies future demand

### FAA Design Standards:

- No new non-standard conditions are created
- New development areas allow for expansion and new opportunities to address existing site constraints on apron/aircraft parking/taxilanes
- Cross-field taxiway at Bravo Two allows for connected airport system
- PBH/RPZ incompatibility resolved

### Airspace Compatibility:

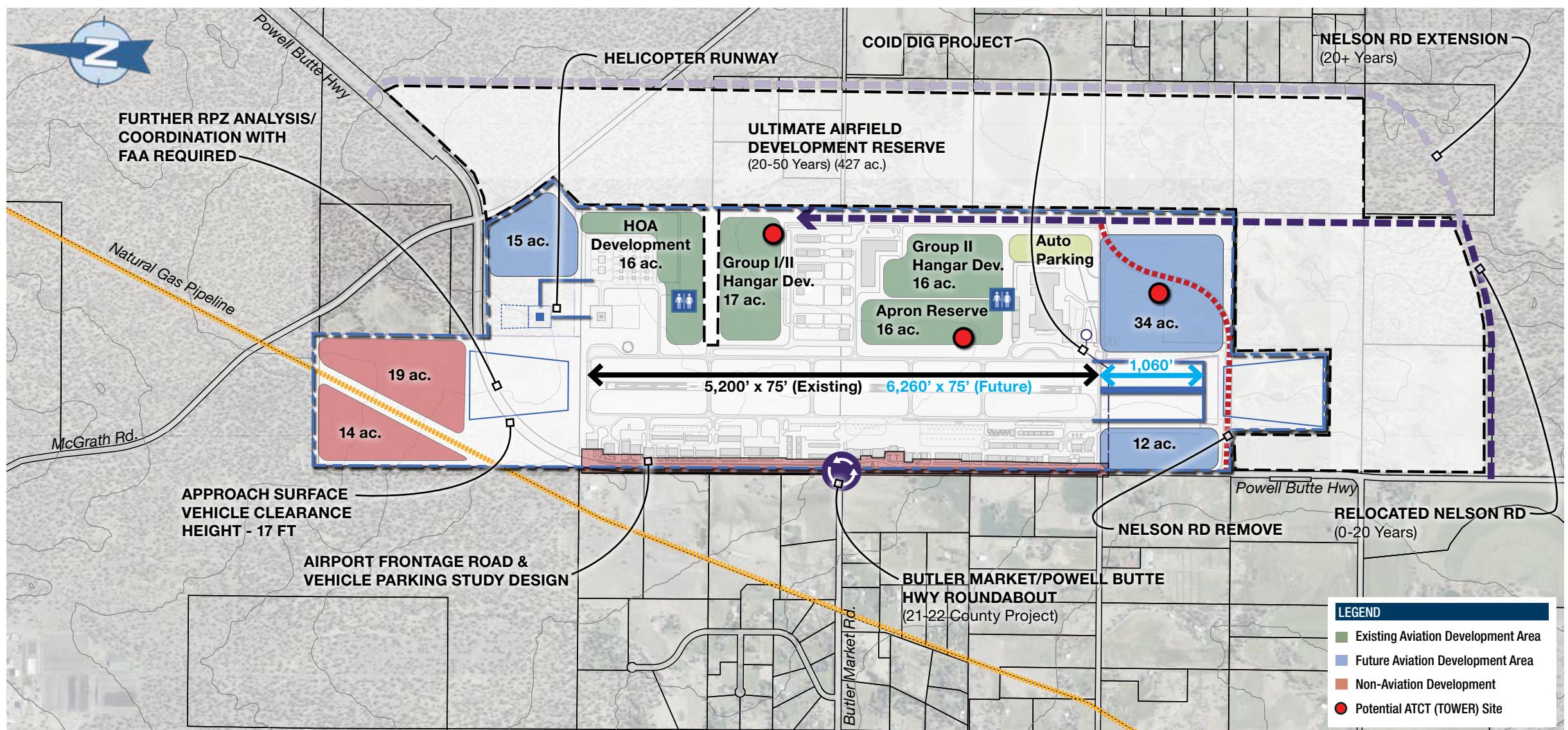
- Helicopter Runway concept presented in 2012 AMP best option to separate existing helicopter and fixed-wing traffic
- Potential conflicts/challenges between HOA and Ultimate Parallel Runway Traffic Patterns
- Main runway extension south minimizes conflicts with RDM
- Inclusion of ATCT sites and ultimate airfield reserve to address airspace capacity concerns

### Land Use, Transportation, and Environmental Compatibility:

- Substantial EFU (in production) ultimately will be converted to aviation related development
- Goal exceptions required and neighborhood compatibility requires further study
- New eastside access road required
- Natural Gas pipeline can remain unimpeded
- More private than public land to be acquired
- COID line dig to support runway extension
- Further NEPA analysis/study required



## City Preferred Alternative (Figure 5-7)



- Main runway extension - to south
    - » 6260' x 75'
    - » Ultimate Airfield Reserve provides space for main runway extension to 7,660' x 75' (20+ yrs)
  - Ultimate Airfield Reserve provides space for parallel runway 4,600' x 60' (20+ yrs)
  - Includes Helicopter Runway
    - » Further FAA justification required
  - Total Airport Acreage
    - » Existing - 422 acres
    - » Future - 532 acres (0-20 years)
    - » Ultimate - 959 acres (20+ years)
  - Public Roads - 2.3 mi. new/.9 mi. remove
  - ATCT - Three potential sites to be evaluated

### Cost Estimates: (20-year planning period)

Private Land Acquisition - \$1.5 million  
Runway Extension - \$5.2 million  
COID Line - \$100,000  
Nelson Road Relocation - \$3.1 million  
ATCT - \$7.5 million  
Total - \$17.4 million

## Operational Capability:

- Ultimate Airfield Reserve area satisfies potential demand for growing corporate jet market and long-range planning needs
  - May not completely satisfy long-range growing demand/capacity concerns
  - Future aviation related development land identified may exceed 50 year demand
  - Airport frontage road/vehicle parking study required to maximize available parking and address Deschutes County road requirements
  - Identified 16 acre Apron Reserve area satisfies future demand

## FAA Design Standards:

- No new non-standard conditions are created
  - New development areas allow for expansion and new opportunities to address existing site constraints on apron/aircraft parking/taxilanes
  - Cross-field taxiway at Bravo Two allows for connected airport system if necessary
  - PBH/RPZ incompatibility remains - RPZ Analysis to permit existing condition to remain will be considered at the time of the runway extension

## Airspace Compatibility:

- Helicopter Runway concept presented in 2012  
AMP best option to separate existing helicopter  
and fixed-wing traffic
  - Main runway extension south minimizes conflicts  
with RDM
  - Inclusion of ATCT sites and ultimate airfield  
reserve to address airspace capacity concerns

## Land Use, Transportation, and Environmental Compatibility:

- EFU will be converted to aviation related development
  - Goal exceptions required
  - New eastside access road required
  - Natural Gas pipeline can remain unimpeded
  - More private than public land to be acquired
  - COID line dig to support runway extension
  - Further NEPA analysis/study required



## PERIMETER FENCING ALTERNATIVES

Two options and their respective pros/cons for perimeter fencing were presented and discussed at PAC #4. The PAC overwhelmingly agreed that Option 1 was the preferred layout for a future perimeter fence understanding that details could change during the final design.

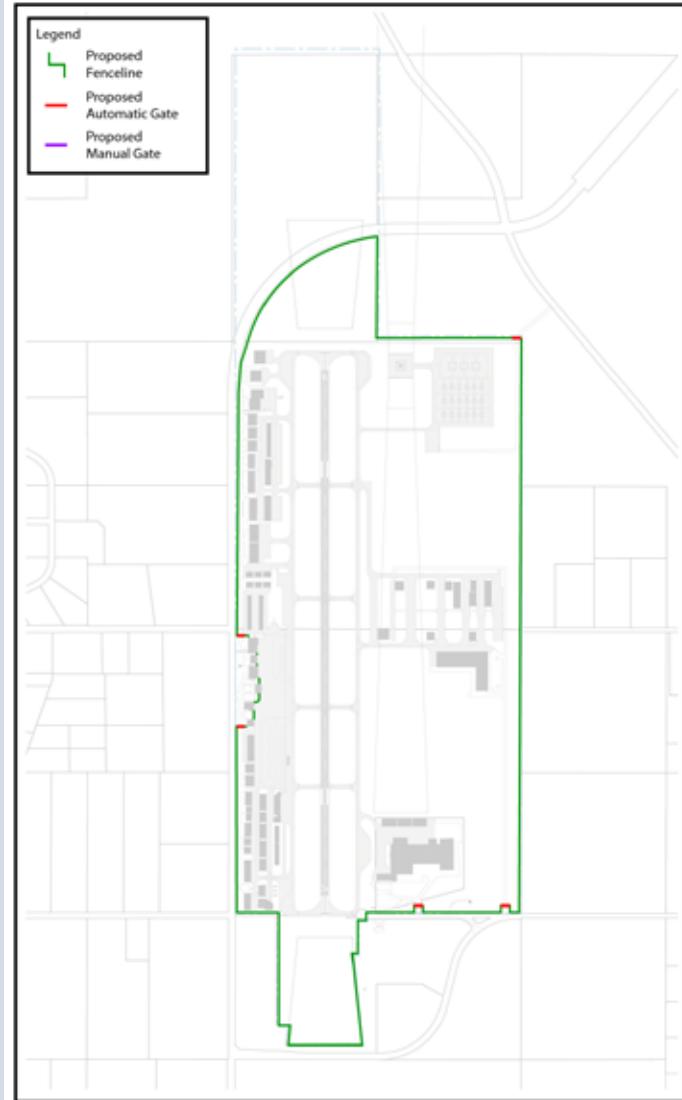
Option 1: The pros from Option 1 include the improved appearance from PBH, easier public access to businesses, provides controlled airfield access, and compatibility with future frontage road and vehicle parking improvements. The cons associated with Option 1 included the potential that more gates might mean a more expensive project and multiple access points would equate to a more complex construction project.

Option 2: The pros from Option 1 include ease of construction, reduces instances of unauthorized visitors, and fewer gates may mean less expensive construction. The cons include limited business access, appearance from PBH, PBH Right-of-way issues, and the alignment does not entirely separate vehicles from aircraft.

### OPTION 1



### OPTION 2



# IMPLEMENTATION

## HOW YOU GET THERE



# Chapter 6: Airport Layout Plan

The purpose of this chapter is present the updated Airport Layout Plan drawing set to reflect current conditions, updated master plan development recommendations, and all applicable FAA requirements. The major projects proposed in the Capital Improvement Program (CIP) will be shown on the ALP in schematic form.

## Introduction

The options considered for the long-term development of Bend Municipal Airport resulted in the selection of a preferred alternative. The preferred alternative has been incorporated into the airport layout plan drawings, which are depicted in this chapter. The set of airport plans, which is referred to in aggregate as the "Airport Layout Plan" (ALP) has been prepared in accordance with FAA guidelines. The drawings illustrate existing conditions, recommended changes in airfield facilities, property ownership, land use, and obstruction removal. The ALP drawing set presented at the end of this chapter is comprised of the following sheets:

- [Sheet 1 – Title Sheet](#)
- [Sheet 2 – Airport Data Sheet](#)
- [Sheet 3 – Airport Layout Plan](#)
- [Sheet 4 – Southwest Terminal Area Plan](#)
- [Sheet 5 – Northwest Terminal Area Plan](#)
- [Sheet 6 – Southeast Terminal Area Plan](#)
- [Sheet 7 – Southeast Terminal Area Plan](#)
- [Sheet 8 – Airport Airspace Plan \(FAR Part 77\)](#)
- [Sheet 9 – Runway 16 Inner Approach Surface Plan and Profile](#)
- [Sheet 10 – Runway 34 Inner Approach Surface Plan and Profile](#)
- [Sheet 11 – Runway 16/34 Departure Surface Plan and Profile](#)
- [Sheet 12 – Helicopter Airspace Plan and Profile \(FAR Part 77\)](#)
- [Sheet 13 – Off Airport Land Use Plan](#)
- [Sheet 14 – On Airport Land Use Plan](#)
- [Sheet 15 – Exhibit "A" Airport Property Plan](#)
- [Sheet 16 – FAR Part 77 Obstruction Tables](#)
- [Sheet 17 – FAR Part 77 Obstruction Tables](#)
- [Sheet 18 – Runway Departure Surface Obstruction Tables](#)



## AIRPORT LAYOUT PLAN DRAWINGS

The airport layout plan drawing set provides detailed information for existing and future facilities. The future improvements depicted in the drawing set are consistent with the airport master plan's updated twenty-year capital improvement program contained in Chapter 7 - Implementation Plan. The ALP drawing set will be submitted along with the draft final airport master plan report to the Federal Aviation Administration (FAA) for review and approval. The drawings will be reviewed by the FAA Airports District Office (ADO) with additional review coordinated with other FAA offices (Flight Procedures, Flight Standards, etc.). Once approved, the final ALP drawing set will be signed by the City of Bend and the FAA Seattle-ADO. As individual projects are completed, minor "pen and ink" updates to the ALP drawings may be completed (with FAA coordination) without updating the airport master plan. A complete update of the full ALP drawing set will be conducted as part of the next master plan update.

The airport layout plan drawings are prepared using computer-aided drafting (CAD) software, which allows for easier updating and revision. The drawing files may also be imported into geographic information systems (GIS) software to support land use planning, airport overlay zone mapping, etc.

A brief summary of the individual drawings is provided below:

### AIRPORT DATA SHEET

The Airport Data Sheet drawing contains detailed runway and taxiway dimensions, FAA dimensional standards, wind roses, and other data that is reflected on the sheets in the drawing set in tabular format. Pertinent data for existing and future airport facilities are presented.

### AIRPORT LAYOUT PLAN

The Airport Layout Plan (ALP) drawing graphically depicts existing and future airfield facilities. Future facilities are color-coded to distinguish them from existing facilities and are represented in the airport master plan's twenty-year capital improvement program (CIP) as individual projects or project groups.

Notable facility improvements include:

- Installation of perimeter fencing and access gates.
- Expanded vehicle parking facilities through the redevelopment of the west-side airport frontage road, and the identification of additional parking areas on the east side to coincide with future aviation-compatible development areas.
- Hangar development and redevelopment areas are identified on both sides of the property.
- Additional aircraft parking for ADG I and II aircraft, and helicopters is accommodated through east-side apron development.

- Runway 16/34 is to be extended to the south by 1,060 feet to a total length of 6,260 feet.
- Nelson Road is depicted for relocation to accommodate an ultimate potential runway length of 7,700.
- Powell Butte Highway is depicted to remain in its current location on the north end with the expectation that an RPZ analysis will be required before the runway extension
- A second helipad is depicted in the HOA to facilitate the separation of fixed-wing and helicopter operations.
- Three ATCT sites are identified for further evaluation in the ATCT Site Selection Study. (See Appendix E for additional information)

## TERMINAL AREA PLAN DRAWINGS

The Terminal Area Plan provides additional detail for existing and proposed facilities in the landside areas. The Terminal Area Plan focuses on the main apron area, fuel facilities, Fixed Base Operator, and hangar areas. At Bend Municipal Airport, there are a variety of such facilities located throughout the airport. In order to provide sufficient detail for all the pertinent features, the Terminal Area Plan is presented in four separate sheets each focusing on a quadrant of the airport property.

### Southwest Terminal Area Plan

The Southwest Terminal Area Plan sheet focuses on the airfield west of the runway from the extended centerline of NE Butler Market Road to a line 400' south of the south edge of the existing apron. Highlights of the Southwest Terminal Area include the FBO building and GA terminal apron, leased hangars, tiedowns for based and itinerant aircraft (ADG I/II), and pull-through parking for business class aircraft. Currently, the based aircraft parking spots in this area are leased to Leading Edge Aviation.

Areas of proposed development depicted in the area include the redevelopment of the existing Airport Frontage Road, a new roundabout at NE Butler Road (Deschutes County project), and a 9.1-acre aviation development area planned to the south of the existing apron. There are no new hangars or apron expansions planned in this area. The existing non-standard condition related to the taxilane object free area (TLOFA) within the existing hangar development is identified. It is planned that a Modification of Standards (MOS) utilizing the modified FAA taxilane clearing formula found in FAA Engineering Brief 78 will be used in the interim and hangars that have reached the end of their useful life will be built to Group I standards when the time comes.



## **Northwest Terminal Area Plan**

The Northwest Terminal Area Plan sheet focuses on the airfield west of the runway from the extended centerline of NE Butler Market Road to a line 500' north of the existing apron. Highlights of the Northwest Terminal Area include a mix of conventional and T-hangars, parking tiedowns for based aircraft (ADG I), and fuel dispensing and storage areas. Three new hangars are planned in this area. The first located directly east of City Hangar B and will include construction of additional apron area adjacent to the hangar. The remaining two hangars are proposed directly east of the Maveric Air hangars, across the existing apron. Apron expansions and the widening of the access taxilane are expected to facilitate access to the new hangars.

Similar to the Southwest Terminal Area Plan, the redevelopment of the existing Airport Frontage Road is depicted with the County's NE Butler Market Road roundabout project. No further development areas are proposed in this area.

## **Southeast Terminal Area Plan**

The Southeast Terminal Area Plan sheet focuses on the airfield east of the runway from Taxiway B1 to the northern extent of the Aero Facilities development. Highlights of existing facilities include the Aero Facilities hangar area, and the Epic Aircraft manufacturing facilities. Proposed facilities include a potential ATCT site, a ADG II conventional hangar area with appurtenant apron space and vehicle parking, and a new terminal apron with a FBO building, a commercial hangar, fueling area, aircraft wash pad, and parking facilities for ADG I and II aircraft.

Future development areas include the area east of Gibson Road identified for the development of additional vehicle parking, and approximately 21 acres of aviation industrial/commercial use development area between the Epic and Aero facilities.

## **Northeast Terminal Area Plan**

The Northeast Terminal Area Plan sheet focuses on the airfield east of the runway and north of the Aero Facilities development. This quadrant of the airport terminal area is dominated by the current Helicopter Operations Area (HOA) which includes a dedicated helipad and helicopter parking.

Planned development in this area includes a second helipad to be north of the existing pad, commercial hangars to be constructed around the HOA apron, and two hangar and apron areas to be built off of Taxiway BB that will accommodate ADG I and ADG II storage with aviation related commercial development as well as conventional box and T-hangar developments.

## **FAR PART 77 AIRPORT AIRSPACE PLAN**

The FAR Part 77 Airspace drawings depict the protected airspace defined for Runway 16/34 and the HOA helipad in Federal Air Regulation (FAR) Part 77, Objects Affecting Navigable Airspace. The airspace plan drawings depict the five "imaginary surfaces" defined in FAR Part 77, Subpart C including the primary, transitional, approach, horizontal, and conical surfaces. These imaginary surfaces were previously described in the Facility Requirements Chapter. FAR Part 77 surfaces should be free of built or terrain obstructions to the greatest extent possible. Objects that penetrate FAR Part 77 surfaces may require action to mark or removal depending on their severity, location, and the feasibility of the action. The drawings are supplemented by tables detailing the obstacles with recommended dispositions. Obstacles presented on the Airspace Plan were provided by the AGIS survey data. Only obstacles identified by the AGIS data are presented on these sheets.

The physical characteristics of the FAR Part 77 surfaces are defined by the size of aircraft using the runway and the approach capabilities of the runway.

**Runway 16/34 Approach Surfaces:** Extends 10,000 feet from the end of the runway primary surface. Both runway ends have an approach surface slope of 34:1, which represents the horizontal distance (34') required for each increment of vertical rise (1').

**Runway 16/34 Primary Surface:** Based on the visual approach standards for utility runways, the primary surface is 500 feet wide extending 200 feet beyond each end of the runway. The primary surface is a flat plane of airspace centered on the runway with the same elevation as the nearest point on the runway centerline.

**Transitional Surface:** The runway transitional surfaces extend outward and upward from the outer edges of the primary surface. The transitional surfaces have a slope of 7:1 (1' of rise for every 7' of horizontal distance) and extend to an elevation 150 feet above airfield elevation and connect to the runway horizontal surface.

**Horizontal Surface:** The horizontal surface is drawn from 10,000-foot radii that extend from both ends of the primary surface to form an oval centered on the runway. The horizontal surface is a flat plane of airspace with an elevation 150 feet above airport elevation.

**Conical Surface:** The conical surface extends from the outer edge of the horizontal surface at a slope of 20:1 (1' of rise for every 20' of horizontal distance) for 4,000 feet.

Due to the density of the data available from the AGIS survey it is not feasible to detail every obstacle identified in a legible fashion at the scale required. As such, only obstructions – defined as obstacles that are less than 10 feet below



the controlling surface or higher – and traverseways at the approach surface edges are identified by red triangles and called out with an ID number that references the profiles shown on the sheet and obstruction tables located at the end of the sheet set. All other obstacles are identified by gray circles and are not called out. For information on these non-obstructing obstacles, please consult FAA's ADIP website (<https://adip.faa.gov>). To further improve the legibility of the sheets, critical areas with dense obstacle groupings are displayed at a larger scale on inset maps. The transitional surface is depicted in the inset at the bottom of this sheet, and the inner approach surfaces are detailed on the Inner Approach sheets (sheets 9 & 10).

## RUNWAY INNER APPROACH PLAN AND PROFILE DRAWINGS

The Runway Inner Approach Surface drawings depict detailed plan and profile views of the inner portion approach surfaces from the future runway end to a position where the surface is 100 feet above the runway end. The drawings provide additional detail in identify obstructions, terrain and other physical features within the approach surfaces. The drawings include obstruction IDs for obstructions depicted on the drawing, using the same numbering identifiers from the overall FAR Part 77 Airspace Plan. Only obstructions that are 10 feet below the approach surface or higher, and traverseways are called out on the sheet and listed in the obstruction tables at the end of the sheet set. For information on all other obstacles, please consult ADIP.

## RUNWAY DEPARTURE SURFACE PLAN AND PROFILE DRAWINGS

The Departure Surface drawing depicts a plan and profile view of the departure surfaces and associated obstacles. Runway departure surfaces are defined in AC 150/5300-13A. Each surface originates at the future runway end or clearway and extends out for 10,200 feet at slope of 40:1 (1 foot of vertical rise for every 40 feet of horizontal distance). The surface has an inner width of 1000 feet and an outer width of 6,466 feet. This drawing provides details on obstructions, terrain and other features as they relate to departing aircraft. Obstacles that are less than 10 feet below the departure surface or higher, and traversways are depicted by red triangles and are called out with a unique ID number that is referenced in the profile views and obstruction tables located at the end of the sheet set. For information on non-obstructing obstacles, consult ADIP.

## HELICOPTER INNER APPROACH PLAN AND PROFILE DRAWINGS

The Helicopter Inner Approach Surface drawing depicts a detailed plan and profile views of the FAR Part 77 primary, approach, and transitional surfaces from the existing and future helipads to a position where the approach surfaces meet the runway Part 77 horizontal surface.

Part 77 helicopter surfaces differ from the runway surfaces in size and slope. They are defined as follows:

**Primary surface.** The area of the primary surface coincides in size and shape with the designated take-off and landing area. This surface is a horizontal plane at the elevation of the established heliport elevation.

**Approach surface.** The approach surface begins at each end of the heliport primary surface with the same width as the primary surface, and extends outward and upward for a horizontal distance of 4,000 feet where its width is 500 feet. The slope of the approach surface is 8 to 1 for civil heliports and 10 to 1 for military heliports.

**Transitional surfaces.** Transitional surfaces extend outward and upward from the lateral boundaries of the primary surface and from the approach surfaces at a slope of 2 to 1 for a distance of 250 feet measured horizontally from the centerline of the primary and approach surfaces.

The plan view drawing shows a comprehensive view of both helicopter and runway obstacles. As was the case on previous sheets, obstructions are identified by red triangles and called out with ID numbers that are referenced in the profile views and obstruction tables. As this drawing is focused on the helicopter surfaces, only obstructions controlled by the helicopter primary, approach, and transitional surfaces are specifically called out. Transitional surface obstructions are depicted on the plan view only, as the profile view is intended to focus on primary and approach obstacles.



## AIRPORT LAND USE PLAN DRAWINGS

The Airport Land Use Plan drawings depict, in two separate sheets, the existing and future land use designations for the airport and surrounding areas.

The Off-Airport Land Use Plan drawing depicts the land use classifications of the property beyond the Airport boundary that are impacted by the Part 77 Surfaces and associated airspace overlay zoning districts. Land use classifications were derived from city and county comprehensive plans and zoning districts. While the City of Bend owns the airport, land use of the property and surrounding areas falls under the jurisdiction of Deschutes County. Future traffic patterns and noise contours are also included on the plan for reference. At a future time, Deschutes County will need to update the AO Zone to reflect the overlay surfaces depicted in this sheet.

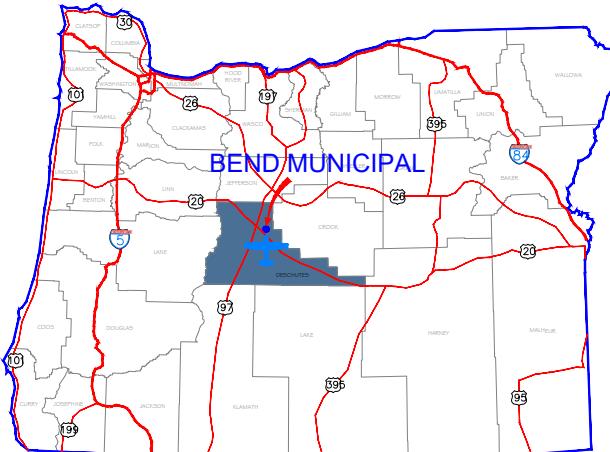
The On-Airport Land Use Plan drawing details the major use classifications of the Airport property. Existing zoning districts are depicted in the inset view at the top of the sheet. The area justified for aviation related development in the 20-year planning period is depicted in the main map view as Airport Development (AD) district, which is consistent with appropriate Deschutes County comprehensive plan designation. Through the planning process, a need to simplify the zoning districts on the airport property was identified. It is anticipated that a zoning code update will be completed in coordination with the adoption of the AMP in to the comprehensive plan.

A Long-term Airport Development Reserve study area is also identified and depicted based on information gleaned throughout the planning process. Based on discussions with Deschutes County and City of Bend planning staff, it is recommended that a comprehensive plan policy that recognizes the importance of developing a master plan for the areas around the Airport will need to be developed. Furthermore, the area depicted as long-term airport development reserve study-area is identified as such due to the substantial growth experienced in the Bend area and the resultant capacity constraints observed at the Bend Municipal Airport and does not guarantee future aviation related development will occur within the study area. These two sheets (in coordination with the entire ALP drawing set) will serve as the primary guiding documents for adoption in to the Deschutes County Comprehensive Plan.

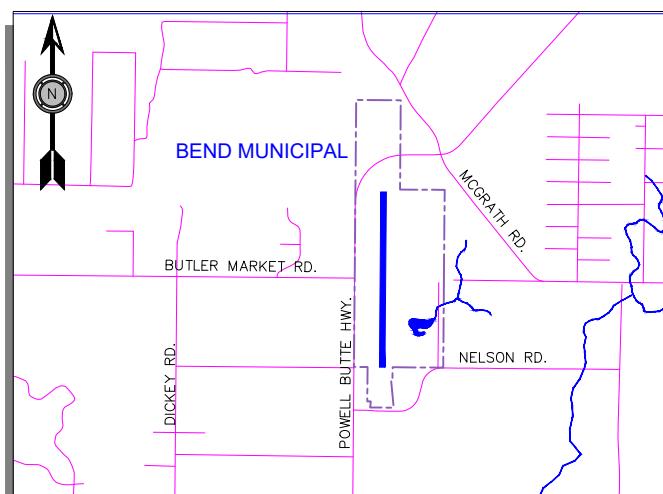
## EXHIBIT "A" – AIRPORT PROPERTY PLAN

The Airport Property Plan drawing depicts all property owned or controlled by the City included in the airport. The drawing notes the form of ownership or control (fee simple, easement, etc.) and the date of acquisition per FAA guidelines. Planned property acquisitions are also identified on the drawing and listed in the Land Data Table as "To Be Acquired". Though a thorough public records search was completed to gather relevant data, some details were not readily available. A formal property title search may be required to verify the missing data.

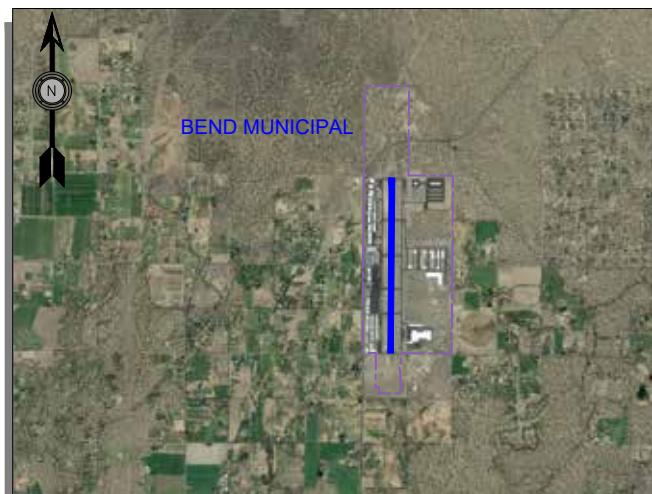




**LOCATION MAP**



**VICINITY MAP**



**AERIAL PHOTO**

# BEND MUNICIPAL AIRPORT

## AIRPORT LAYOUT PLAN

### BEND, OREGON

### JANUARY 2022

#### ALP APPROVAL & EXHIBIT A ACCEPTANCE

Bend Municipal Airport | Bend, OR

January 2022

#### Background

The updated Airport Layout Plan (ALP) for Bend Municipal Airport (BDN) consists of Sheets 1 through 18 dated January 2022. These documents were developed based on the conclusions of the 2021 Airport Master Plan study. An aeronautical study (no. 2021-ANM-3566-NRA) was conducted on the proposed development. This determination does not constitute FAA approval or disapproval of the physical development involved in the proposal. It is a determination with respect to the safe and efficient use of navigable airspace by aircraft and with respect to the safety of persons and property on the ground.

#### ALP

The ALP consists of Sheets 1 through 18. It was prepared in accordance with current FAA airport design standards, FAA Standard Operating Procedure 2.00. The last ALP for the Bend Municipal Airport was approved by FAA in October 2013. Major changes in this January 2022 ALP from the previous version include:

- Depicted 1000' runway extension to south instead of north
  - Powell Butte Highway proposed to remain (requires RPZ analysis per notation before extension can be programmed)
  - Planned Nelson Road relocation to accommodate ultimate runway length in the 50-year planning period
- Identified three potential ATCT sites for further study
- Depicted future hold markings at 200' off runway centerline
- Identified future infli hanger sites on west side not previously depicted
- Depicted east side hanger development areas and future sites for aviation related commercial
- Depicted approximately 73 acres for future acquisition to accommodate runway extension and appurtenant taxiway/hanger development
- Depicted approximately 32 acres for helicopter operations area expansion
- Identified "long-term airport development reserve study area" to consider future airfield capacity improvements anticipated in the 50-year planning period

This ALP approval is conditioned on acknowledgement that any development on airport property requiring Federal environmental approval must receive such written approval from FAA prior to commencement of the subject development. This ALP approval is also conditioned on acceptance of the plan under local land use laws. We encourage appropriate agencies to adopt land use and height restrictive zoning based on the plan.

Approval of the plan does not indicate that the United States will participate in the cost of any development proposed. AIP funding requires evidence of eligibility and justification at the time a funding request is ripe for consideration. When construction of any proposed structure or development indicated on the plan is undertaken, such construction requires normal 45-day advance notification to FAA for review in accordance with applicable Federal Aviation

Page 1 of 2

Regulations (i.e., Parts 77, 157, 152, etc.). More notice is generally beneficial to ensure that all statutory, regulatory, technical and operational issues can be addressed in a timely manner.

#### Exhibit A

The Exhibit A – Airport Property Map is depicted on Sheet 15. It has been prepared in accordance with FAA Standard Operating Procedure 3.00 and developed based on the following:

- Airport parcels
  - Existing fee and easement parcels are based on recorded conveyance documents obtained through unofficial site research and property records available online and from previous ALP drawing set property map data.
  - Proposed Future and Ultimate airport property interests are shown based on the development plans and design standards shown on the ALP.
- Existing fee and easement parcels, as well as recorded encumbrance boundaries, are drawn as described in publicly available conveyance documents.
- A review of the Federal grant history and associated parcel naming convention was completed and maintained based on previous Exhibit A documentation as part of previous ALP updates.

The last Exhibit A was updated in October 2013. Major changes in this January 2020 Exhibit A Update from the previous version include:

- Updated Future and Ultimate airport property interests for the revised airport development plans and design standards as identified on the ALP.
- Identified several additional on-airport encumbrances such as mineral rights, right-of-way, and utility easements.

#### Signature Blocks

The FAA signature below acknowledges approval of the ALP and acceptance of the Exhibit A.

FAA:

Benjamin Mello

Signature: Email: benjamin.mello@faa.gov

Tracy Williams, AAE

Signature: Email: tracy.williams@bendoregon.gov

Century West Engineering Corporation

Signature: Email: wriggs@centurywest.com

Page 2 of 2

NO.	DATE	BY	APPR	REVISIONS

VERIFY SCALES  
BAR IS ONE INCH ON  
ORIGINAL DRAWING.  
0" 1"  
IF NOT ONE INCH ON  
THIS SHEET, ADJUST  
SCALES ACCORDINGLY.

**CENTURY  
WEST**  
ENGINEERING

DESIGNED BY: MD DRAWN BY: MS CHECKED BY: WMR SCALE: AS SHOWN  
DATE: JANUARY 2022 PROJECT NO: 10051.110.01

**BEND MUNICIPAL AIRPORT**

**TITLE SHEET**

FIGURE NO.

—

SHEET NO.

1 OF 18



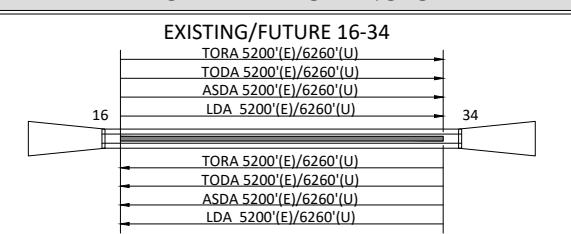
## AIRPORT DATA TABLE

DESCRIPTION	EXISTING	FUTURE
FAA IDENTIFIER	BDN	SAME
AIRPORT REFERENCE CODE (ARC)	B-II	SAME
MEAN MAX. DAILY TEMPERATURE	83.7°	SAME
AIRPORT ELEVATION	3459.5'	SAME
ARP COORDINATES	LAT. LONG.	N 44° 05' 40.42" W 121° 12' 00.80"
AIRPORT CRITICAL AIRCRAFT	CESSNA CITATION II/BRAVO	SAME
MAGNETIC DECLINATION	14°29'E (2021 NGDC)	ANNUAL RATE OF CHANGE 0°5'W
AIRPORT ACREAGE	422	532
NPIAS SERVICE LEVEL	REGIONAL GENERAL AVIATION	SAME
STATE ROLE	CAT II - URBAN GA	SAME
HORIZONTAL DATUM	NAD 83	-
VERTICAL DATUM	NAVD 88	-

## RUNWAY DATA TABLE

RUNWAY 16-34			
	EXISTING	FUTURE	
CLASSIFICATION	LARGER THAN UTILITY	SAME	
RUNWAY DESIGN CODE (RDC)	B/II/5000	SAME	
APPROACH REFERENCE CODE (APRC)	B/II/5000	SAME	
DEPARTURE REFERENCE CODE (DPRC)	B/II	SAME	
RUNWAY LENGTH AND WIDTH	5200' X 75'	6260' X 75'	
RUNWAY PAVEMENT TYPE	ASPHALT	SAME	
RUNWAY PAVEMENT STRENGTH (IN 1000 LBS)	30 SW	SAME	
AIRPORT PAVEMENT STRENGTH (PCN)	N/A	SAME	
RUNWAY PERCENT WIND COVERAGE (10.5KT/13KT)	96.93% / 98.83%	SAME	
RUNWAY PERCENT GRADIENT / MAXIMUM GRADE	1.096%/1.61%	SAME	
Critical Aircraft (ARC)	CESSNA CITATION II/BRAVO	SAME	
WINGSPAN	<79	SAME	
WEIGHT	>12,000 LBS.	SAME	
APPROACH SPEED	<121 KNOTS	SAME	
FAR PART 77 DESIGNATION	LARGER THAN UTILITY - NON PRECISION	SAME	
TERMINAL NAVAIDS	VOR (DSD)/DME; GPS	SAME	
TAXIWAY LIGHTING	REFLECTORS	MITL	
TAXIWAY MARKING	BASIC	SAME	
RUNWAY LIGHTING	MIRL	SAME	
AERONAUTICAL SURVEY REQUIRED	NON-VERTICAL	NON-VERTICAL	
CONDITION	STANDARD	CONDITION	STANDARD
RUNWAY SAFETY AREA LENGTH AND WIDTH	5800' X 150'	5800' X 150'	6860' X 150'
LENGTH BEYOND RUNWAY END	300'	300'	300'
OBJECT FREE AREA LENGTH AND WIDTH	5800' X 500'	5800' X 500'	6860' X 500'
LENGTH BEYOND RUNWAY END	300'	300'	300'
OBSTACLE FREE ZONE LENGTH AND WIDTH	5600' X 400'	5600' X 400'	6660' X 400'
LENGTH BEYOND RUNWAY END	200'	200'	200'
OBSTACLE FREE ZONE PENETRATION	NO	NO	NO
RUNWAY END	16	34	16
RUNWAY PROTECTION ZONE	500' X 700' X 1,000'	500' X 700' X 1,000'	SAME
RUNWAY APPROACH CATEGORY	NPI	NPI	SAME
RUNWAY APPROACH SLOPE PART 77 REQUIRED	34:1	34:1	SAME
APPROACH VISIBILITY MINIMUMS	≥ 1-MILE	≥ 1-MILE	SAME
RUNWAY MARKINGS	NPI	NPI	SAME
RUNWAY END COORDINATES	LAT. LONG.	N 44° 06' 06.09" W 121° 12' 00.77"	N 44° 05' 14.75" W 121° 12' 00.82"
RUNWAY END ELEVATION	3403.04'	3459.45'	SAME
DISPLACED THRESHOLD ELEVATION	N/A	N/A	N/A
TOUCHDOWN ZONE ELEVATION	3431.43'	3459.44'	SAME
INSTRUMENTATION AND APPROACH AIDS	GPS	GPS	SAME
VISUAL AIDS	REILS, PAPI-4	REILS, PAPI-4	SAME
DEPARTURE SURFACE	YES	YES	SAME
THRESHOLD SITING SURFACE	NO PENETRATIONS	NO PENETRATIONS	SAME

## DECLARED DISTANCES



## APRON DIMENSIONS

	SQUARE FOOTAGE APPROX.
APRON EXISTING	1,337,759
APRON FUTURE	2,228,464

## BUILDING/FACILITY KEY

	DESCRIPTION	ADDRESS	OWNER
①	HANGAR	63400	PALADIN DATA
②	HANGAR	63380	CURRY INV.
③	HANGAR	63360	BRONSON (SNOWLINE)
④	HANGAR	63354	BRONSON (PRECISE FLIGHT)
⑤	HANGAR	63348	DKS HOLDINGS (PRO. AIR SERVICES)
⑥	HANGAR	63342	WETTER (LEADING EDGE AVIATION)
⑦	HANGAR	63336	HENSLEY
⑧	HANGAR	63334	JUNIPER INVESTMENTS (KEN SMITH)
⑨	HANGAR	63330	CITY HANGAR (A-B)
⑩	HANGAR	63316	CITY HANGAR - J (A-L)
⑪	HANGAR	63326	#1: DIESTEL, #2: SHAKER, #3: NOVOTEL
⑫	HANGAR	63296	ELECTRONICS INTERNATIONAL
⑬	HANGAR	63290	CITY HANGAR - I (1-10)
⑭	HANGAR	63286	MAVERICK AIR / BANEY
⑮	HANGAR	63240	HARTLEY
⑯	HANGAR	63250	BENNETT
⑰	HANGAR	63260	LEE, G.
⑱	HANGAR	63230	VOLO
⑲	HANGAR	63220	GUINN
⑳	HANGAR	63210	DEGRYSE
㉑	HANGAR	63170	CITY HANGAR - B (1-10)
㉒	HANGAR	63160	CITY HANGAR - A (1-10)
㉓	FUEL STORAGE	-	PRIVATE
㉔	HANGAR	63144	JUNIPER (AIRLIFE)
㉕	HANGAR	63140	JUNIPER (PRO AIR)
㉖	WATER SYSTEM FCLT.	-	CITY
㉗	HANGAR	63138	STEWART (PRO AIR) (COCC)
㉘	FBO / GA TERMINAL	63136	CITY
㉙	VEHICLE PARKING	-	CITY
㉚	HANGAR	63132	PRO AIR (FBO HANGAR / PRO SHOP)
㉛	HANGAR	63120	STEVE GIBSON
㉜	HANGAR	63110	BEND MUNI. CONDO HANGARS - MS (1-7)
㉝	HANGAR	63102	AVIATION PROPERTIES
㉞	HANGAR	63100	RANGER CORP.
㉟	HANGAR	63048	60 AVIATION, LLC
㉟	HANGAR	63044	PANDIAN
㉟	HANGAR	63038	BELL SPENCER
㉟	HANGAR	63032	HOGUE / STORCH
㉟	HANGAR	63026	ALLEN
㉟	HANGAR	63020	HOLT
㉟	HANGAR	63010	METCALFE
㉟	HANGAR (3-BAY)	63008	WINDWARD PERFORMANCE
㉟	HANGAR	63006	ADVANCE AVIATION
㉟	HANGAR	63004	ADVANCE AVIATION
㉟	HANGAR	63000	PEVERIER
㉟	HANGAR	63002	PEVERIER (GRIFFIN INTERNATIONAL)
㉟	HANGAR	63054	CITY HANGAR - H (1-4)
㉟	HANGAR	63058	CITY HANGAR - G (1-6)
㉟	HANGAR	63062	CITY HANGAR - F (1-5)
㉟	HANGAR	63066	CITY HANGAR - E (1-3)
㉟	HANGAR	63070	CITY HANGAR - D (1-6)
㉟	HANGAR	63098	TA1: JACQUES (EASTSIDE)
㉟	HANGAR	63096	TA2: JACQUES (WESTSIDE)
㉟	HANGAR	63086	TB2: BRONSON (WESTSIDE)
㉟	HANGAR	63094	TA3: HOLLERN / A & PR (EASTSIDE)
㉟	HANGAR	63084	TB3: FOSTER (WESTSIDE)
㉟	HANGAR	-	PRIVATE
㉟	HANGAR	-	PRIVATE
㉟	GROUND LEASE	-	AERO FACILITIES
㉟	GROUND LEASE	-	EPIC
㉟	GROUND LEASE	-	CESSNA
㉟	FBO (FUTURE)	-	PRIVATE
㉟	COMMERCIAL HANGARS (FUTURE)	-	PRIVATE
㉟	FUEL STORAGE / DISPENSING (FUTURE)	-	AIRPORT / PRIVATE
㉟	FUEL STORAGE (FUTURE)	-	PRIVATE
㉟	AIRCRAFT PARKING APRON (FUTURE)	-	AIRPORT
㉟	COMMERCIAL HANGAR (FUTURE)	-	PRIVATE
㉟	T-HANGARS	-	AIRPORT / PRIVATE
㉟	SMALL / MEDIUM CONVENTIONAL HANGARS (FUTURE)	-	PRIVATE
㉟	FBO / COMMERCIAL HANGARS (FUTURE)	-	PRIVATE
㉟	PUBLIC USE HELICOPTER PARKING APRON	-	AIRPORT
㉟	HELICOPTER LANDING PADS	-	PRIVATE
㉟	SMALL / MEDIUM CONVENTIONAL HANGARS (FUTURE)	-	PRIVATE
㉟	AIRCRAFT PARKING APRON (RECONFIGURED - FUTURE)	-	AIRPORT
㉟	AIRCRAFT TIEDOWN APRON (FUTURE)	-	AIRPORT
㉟	FUEL STORAGE / DISPENSING (FUTURE)	-	AIRPORT / PRIVATE
㉟	AVIATION IND/COMM DEVELOPMENT RESERVE	-	PRIVATE
㉟	AIRCRAFT PARKING APRON (RECONFIGURED - FUTURE)	-	AIRPORT
㉟	AVIATION RELATED DEVELOPMENT RESERVE	-	PRIVATE
㉟	GUIDER STAGING AREA (EXISTING)	-	AIRPORT
㉟	AIRCRAFT WASH PAD (FUTURE)	-	AIRPORT
㉟	VEHICLE PARKING (FUTURE)	-	AIRPORT

**CENTURY  
WEST**  
ENGINEERING

BEND OFFICE  
1020 SW EMKAY DRIVE, #100  
BEND, OR 97702  
541.322.8962 OFFICE  
541.382.2423 FAX

DESIGNED BY: MD DRAWN BY: MS CHECKED BY: WMR SCALE: AS SHOWN

DATE: JANUARY 2022 PROJECT NO: 10051.110.01

## LEGEND

	EXISTING	FUTURE
BUILDINGS		
RUNWAY PAVEMENT		
OTHER AIRFIELD PAVEMENT		
DEVELOPMENT RESERVE		
BUILDING RESTRICTION LINE (BRL)		
AIRPORT PROPERTY LINE		
RUNWAY SAFETY AREA (RSA)		
OBJECT FREE AREA (OFA)		
OBSTACLE FREE ZONE (OFZ)		
TAXIWAY OBJECT FREE AREA (TOFA)		
RUNWAY PROTECTION ZONE (RPZ)		
GROUND CONTOURS	</td	



**NOTES:**

1. HEIGHTS LISTED FOR TRAVERSEWAYS ARE GROUND ELEVATIONS AND DO NOT INCLUDE FAR PART 77 TRAVERSEWAY ADJUSTMENTS.
2. SEE DATA SHEET (SHEET 2) FOR FACILITY / BUILDING KEY
3. SEE TERMINAL AREA PLAN (SHEETS 4 & 5) FOR TERMINAL AREA TAXIWAY/TAXILANE DETAILS.
4. RUNWAY HOLD LINES ARE SPACED 250' FROM RUNWAY CENTERLINE.
5. ALL TAXIWAYS HAVE 15' SHOULDERS AND 7.5' TAXIWAY EDGE SAFETY MARGINS (TESM).
6. EXISTING 3-STRAINED BARBED WIRE PERIMETER FENCING TO BE UPGRADED TO 6' CHAINLINK WITH BARBED WIRE TOPPER AND ACCESS GATES. SEE PERIMETER FENCE AND GATE DATA TABLE ON SHEET 2.

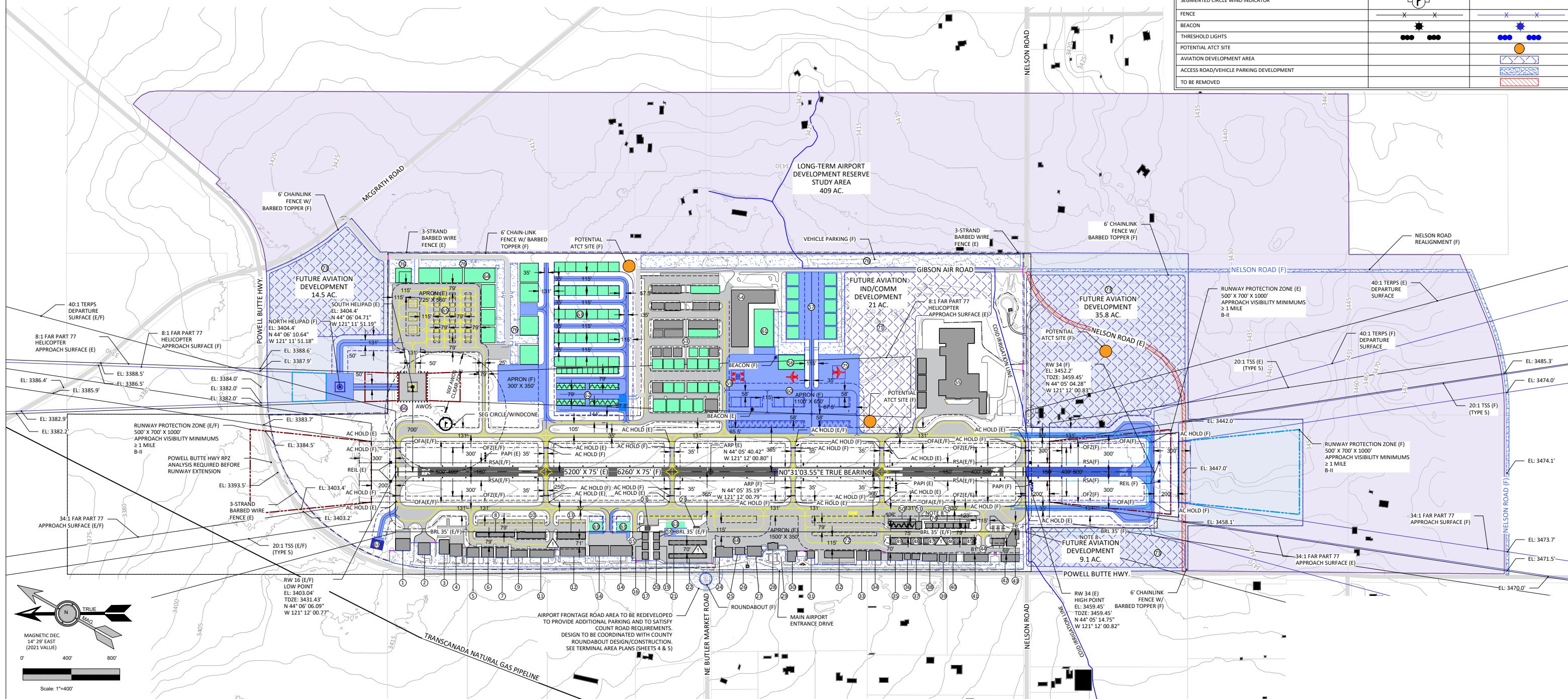
7. PACS/SACS MONUMENTS WERE NOT RECOVERED DURING THE 2019 AGIS SURVEY.
8. GLIDER OPERATIONS AREA TO BE RELOCATED TO THE SW AVIATION DEVELOPMENT AREA AT THE TIME OF RUNWAY EXTENSION.
9. POTENTIAL TTF ACCESS REQUESTS WILL REQUIRE FURTHER FAA COORDINATION.

## MODIFICATION TO STANDARDS

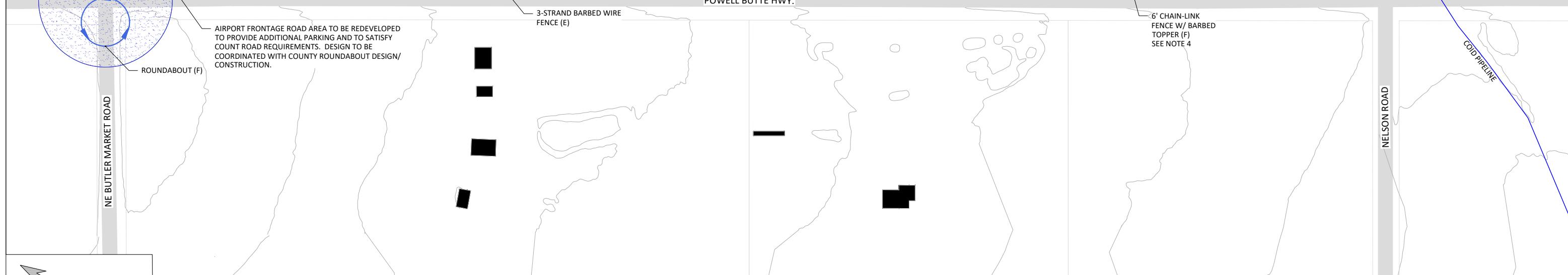
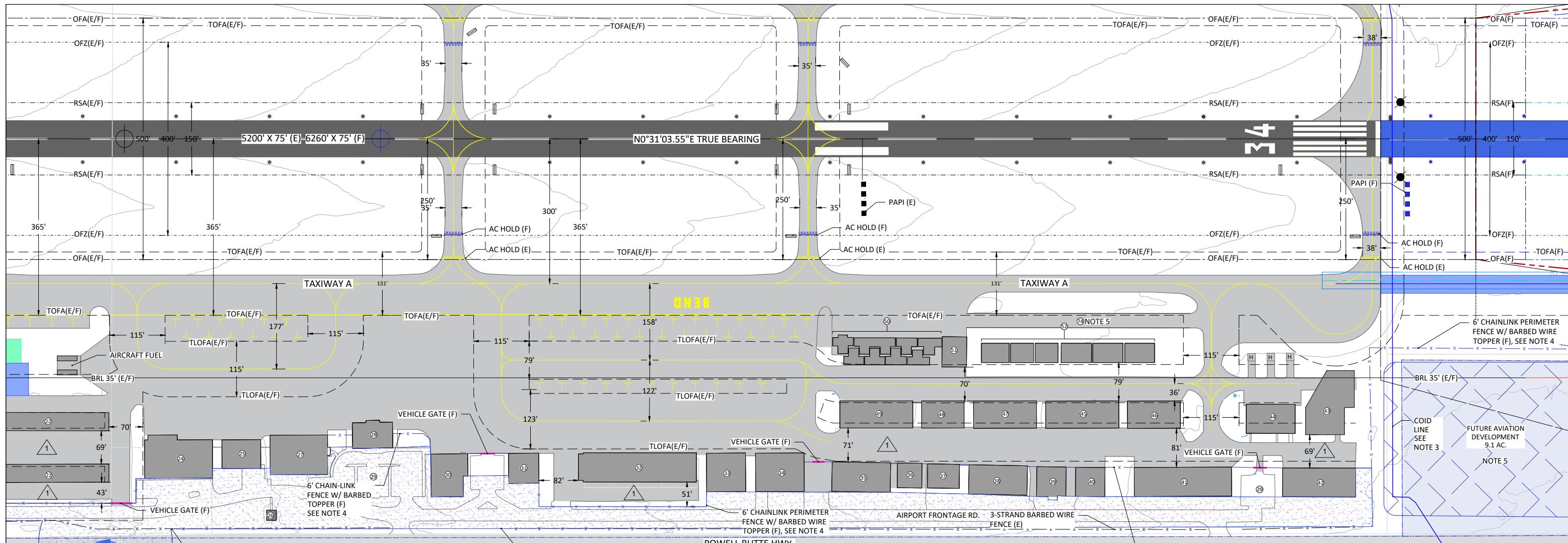
NO.	ITEM	DESCRIPTION	DISPOSITION
1	TAXILANE OFA (FUTURE)	LESS THAN ADG I STANDARD BETWEEN HANGARS	MODIFIED FAA TAXILANE CLEARING FORMULA. RECONFIGURE HANGAR AREA AT END OF USEFUL LIFE

## LEGEND

	EXISTING	FUTURE
BUILDINGS		
RUNWAY PAVEMENT		
OTHER AIRFIELD PAVEMENT		
DEVELOPMENT RESERVE		
BUILDING RESTRICTION LINE (BRL)	BRL (E)	BRL (F)
AIRPORT PROPERTY LINE		
RUNWAY SAFETY AREA (RSA)		
OBJECT FREE AREA (OFA)		
OBSTACLE FREE ZONE (OFZ)		
TAXIWAY OBJECT FREE AREA (TOFA)		
RUNWAY PROTECTION ZONE (RPZ)		
GROUND CONTOURS		
AIRPORT REFERENCE POINT (ARP)		
REIL		
VISUAL GUIDANCE INDICATORS (PAPI)		
WIND INDICATOR		
SEGMENTED CIRCLE WIND INDICATOR		
FENCE		
BEACON		
THRESHOLD LIGHTS		
POTENTIAL ATCT SITE		
AVIATION DEVELOPMENT AREA		
ACCESS ROAD/VEHICLE PARKING DEVELOPMENT		
TO BE REMOVED		







**NOTE:**

1. SEE DATA SHEET (SHEET 2) FOR FACILITY / BUILDING KEY
2. SEE DATA SHEET FOR FULL LEGEND
3. NO DEVELOPMENT POSSIBLE UNTIL COID DIG PROJECT IS COMPLETE - ANTICIPATED TO BE COMPLETED IN COORDINATION WITH THE RUNWAY EXTENSION PROJECT.
4. AIRPORT PERIMETER TO BE FENCED WITH 6' CHAINLINK WITH BARBED WIRE TOPPER. FENCE WILL BE ROUTED BETWEEN BUILDINGS WHERE POSSIBLE.
5. GLIDER OPERATIONS AREA TO BE RELOCATED TO THE SW FUTURE AVIATION DEVELOPMENT AREA AT THE TIME OF RUNWAY EXTENSION.

0' 100' 200'  
Scale: 1"=100'

MODIFICATION TO STANDARDS			
NO.	ITEM	DESCRIPTION	DISPOSITION
1	TAXILANE OFA (FUTURE)	LESS THAN ADG I STANDARD BETWEEN HANGARS	MODIFIED FAA TAXILANE CLEARING FORMULA. RECONFIGURE HANGAR AREA AT END OF USEFUL LIFE

NO.	DATE	BY	APPR	REVISIONS

VERIFY SCALES  
BAR IS ONE INCH ON  
ORIGINAL DRAWING.  
0" 1"  
IF NOT ONE INCH ON  
THIS SHEET, ADJUST  
SCALES ACCORDINGLY.

**CENTURY  
WEST**  
ENGINEERING

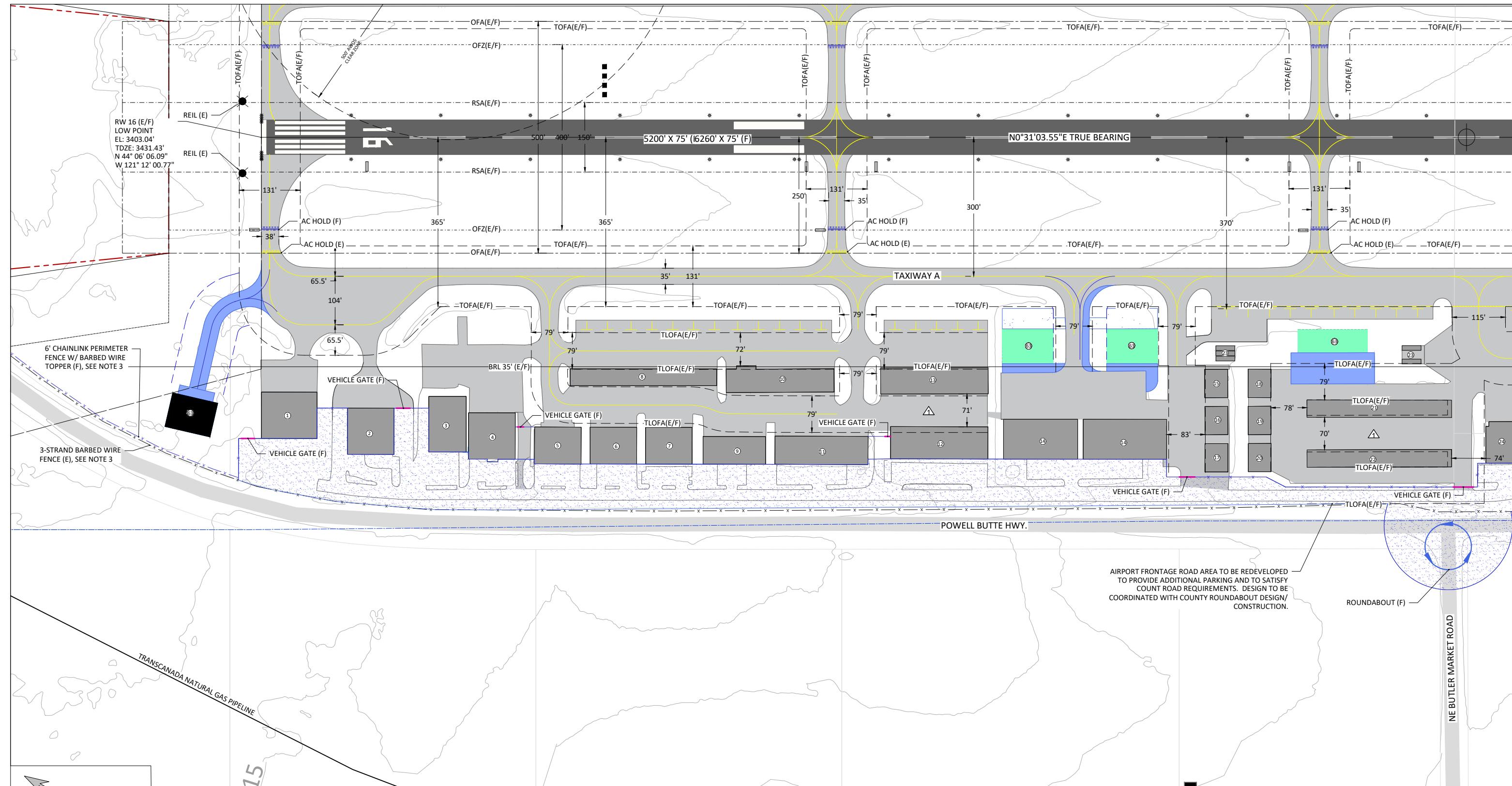
BEND OFFICE  
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541.382.2423 FAX

DESIGNED BY: MD DRAWN BY: MS CHECKED BY: WMR SCALE: AS SHOWN  
DATE: JANUARY 2022 PROJECT NO: 10051.110.01

**BEND MUNICIPAL AIRPORT**  
**SOUTHWEST TERMINAL AREA PLAN**

FIGURE NO.  
-  
SHEET NO.  
4 OF 18




**NOTE:**

1. SEE DATA SHEET (SHEET 2) FOR FACILITY / BUILDING KEY
2. SEE DATA SHEET (SHEET 2) FOR LEGEND
3. AIRPORT PERIMETER TO BE FENCED WITH 6' CHAINLINK WITH BARBED WIRE TOPPER. FENCE TO BE ROUTED BETWEEN BUILDINGS WHERE POSSIBLE.

VERIFY SCALES  
BAR IS ONE INCH ON  
ORIGINAL DRAWING.  
0" 1"  
IF NOT ONE INCH ON  
THIS SHEET, ADJUST  
SCALES ACCORDINGLY.

NO.	DATE	BY	APPR	REVISIONS

MODIFICATION TO STANDARDS			
NO.	ITEM	DESCRIPTION	DISPOSITION
1	TAXILANE OFA (FUTURE)	LESS THAN ADG I STANDARD BETWEEN HANGARS	MODIFIED FAA TAXILANE CLEARING FORMULA. RECONFIGURE HANGAR AREA AT END OF USEFUL LIFE



BEND OFFICE  
1020 SW EMKAY DRIVE, #100  
BEND, OR 97702  
541.322.8962 OFFICE  
541.382.2423 FAX

DESIGNED BY: MD DRAWN BY: MS CHECKED BY: WMR SCALE: AS SHOWN  
DATE: JANUARY 2022 PROJECT NO: 10051.110.01

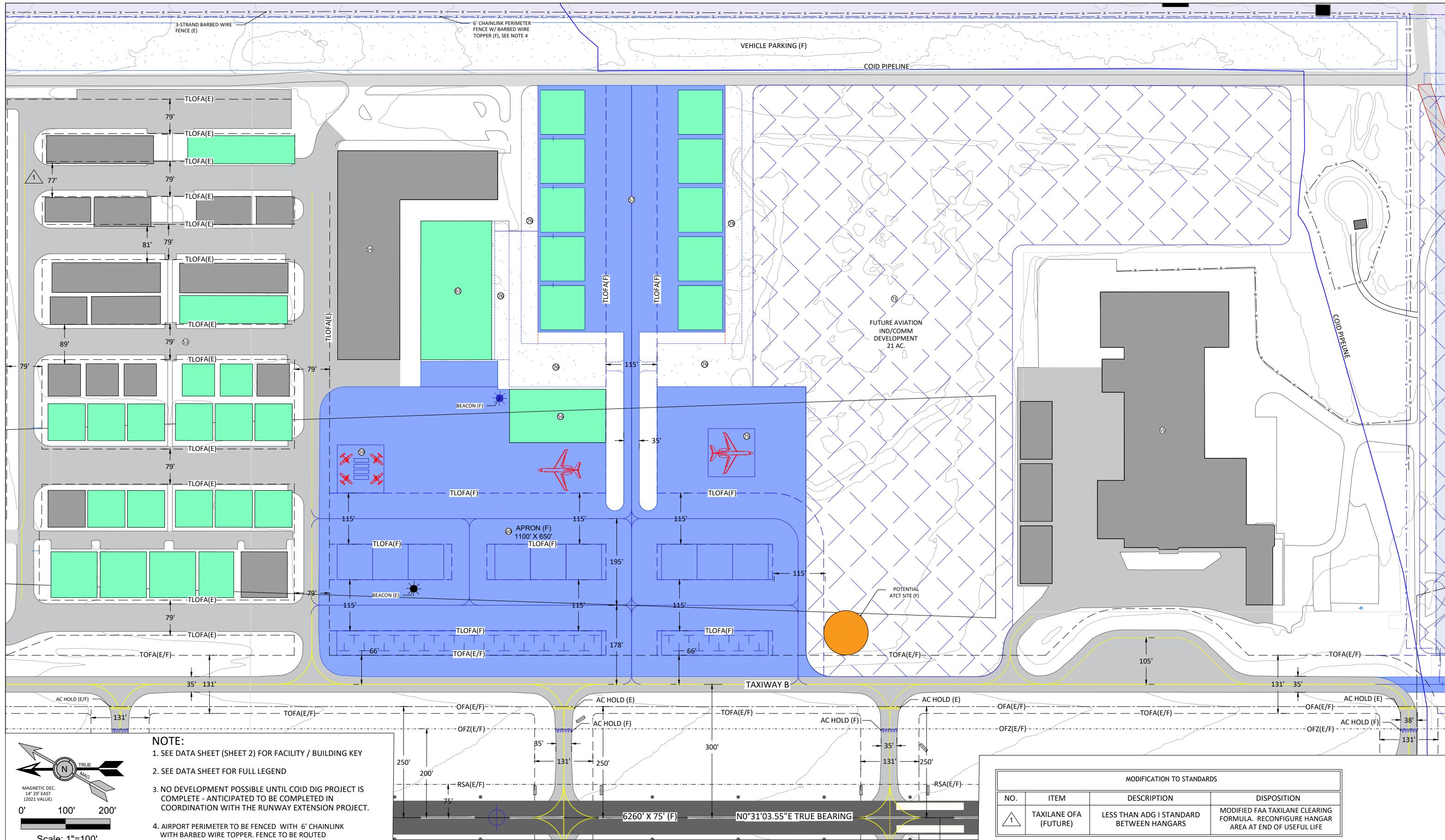
## BEND MUNICIPAL AIRPORT

### NORTHWEST TERMINAL AREA PLAN

FIGURE NO.

SHEET NO.  
5 OF 18





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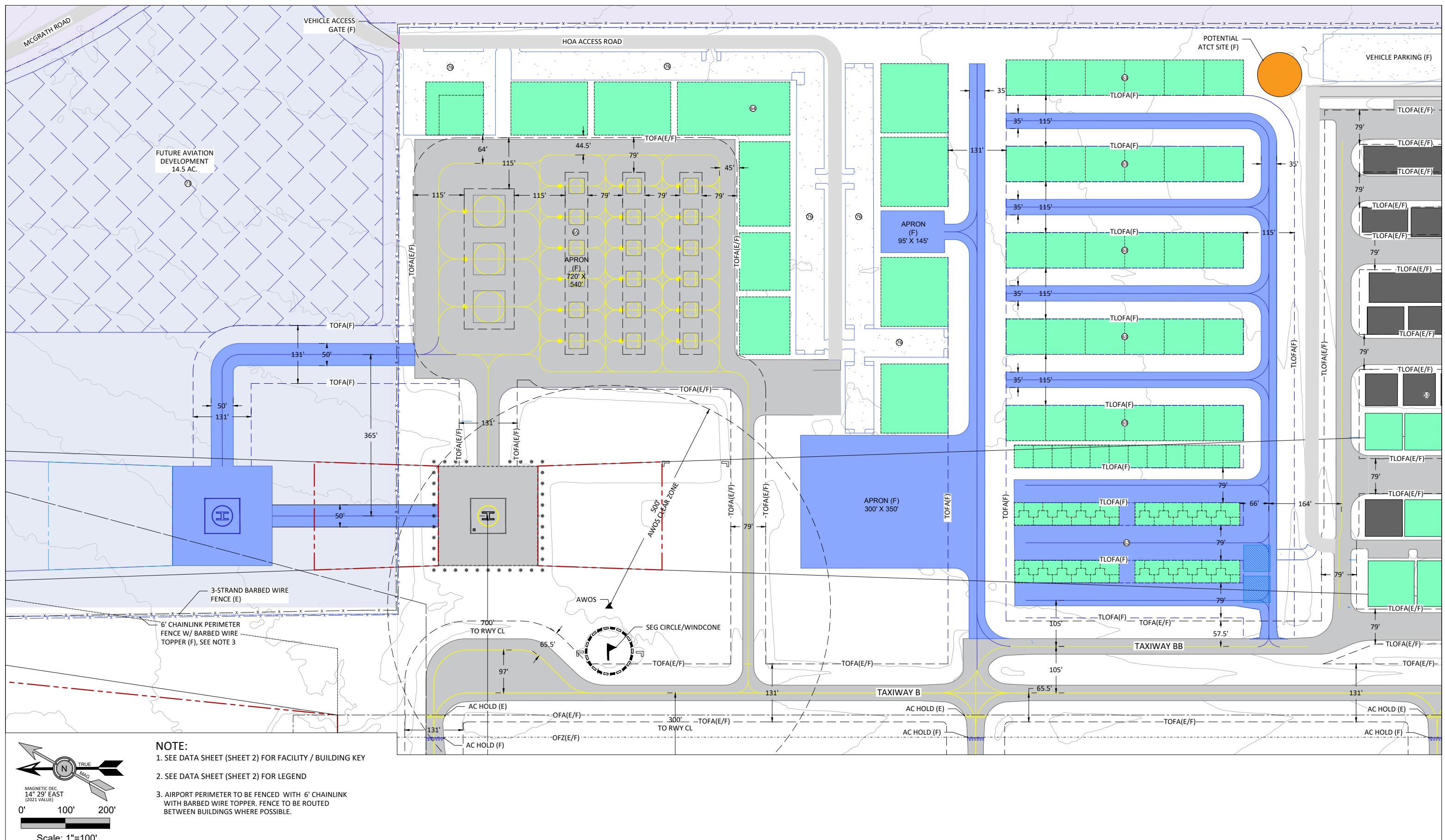
ED BY: MD	DRAWN BY: MS	CHECK
JANUARY 2022		PROJECT

# BEND MUNICIPAL AIRPORT

## SOUTHEAST TERMINAL AREA PLAN

FIGURE NO.  
-  
SHEET NO.  
6 OF 18





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541.382.2423 FAX

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DATE: JANUARY 2022	PROJECT NO: 10051.110.01		

# BEND MUNICIPAL AIRPORT

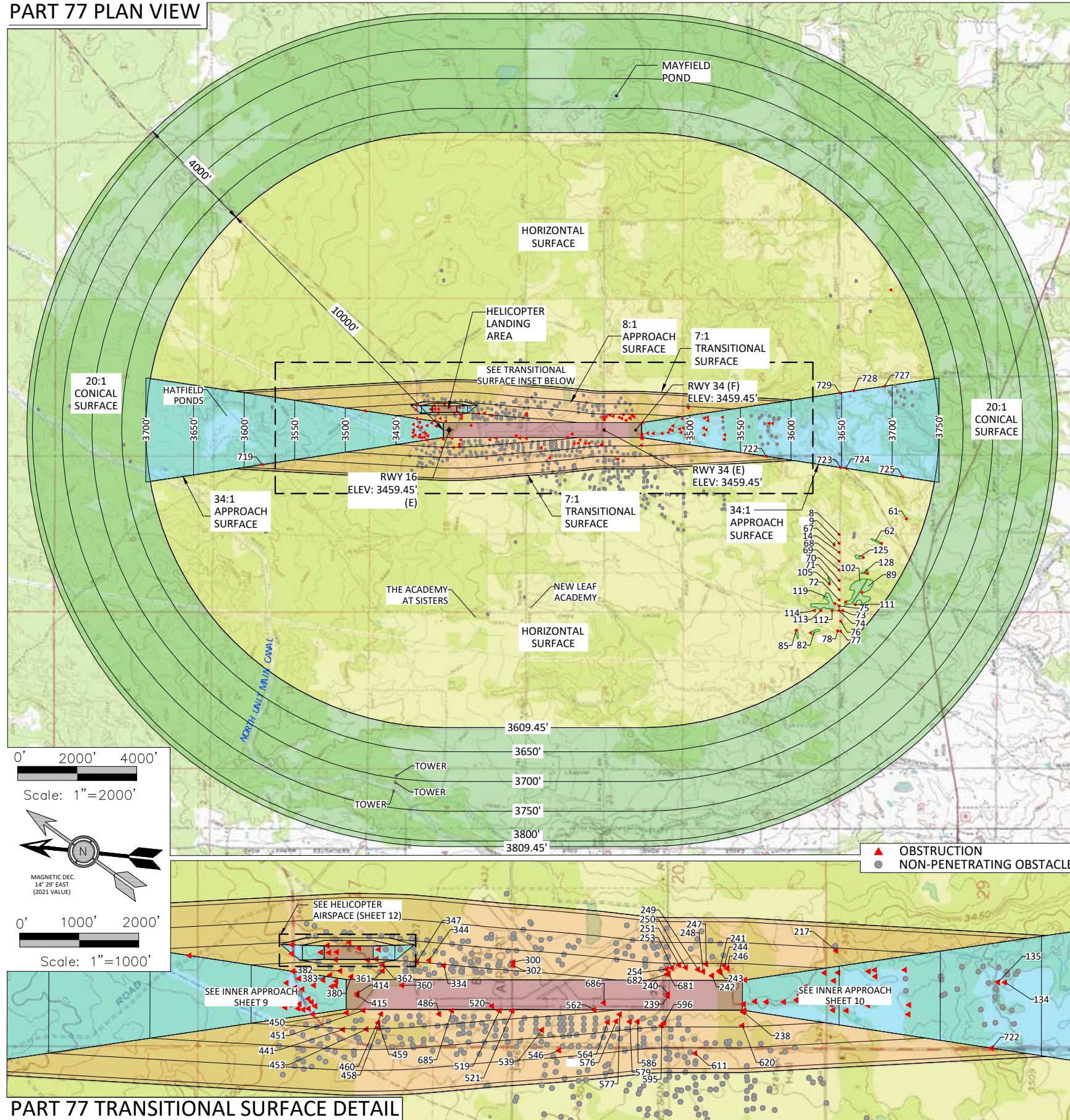
## NORTHEAST TERMINAL AREA PLAN

FIGURE NO.

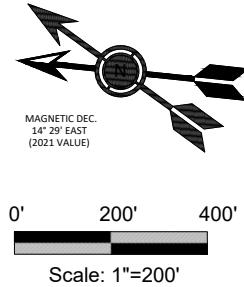
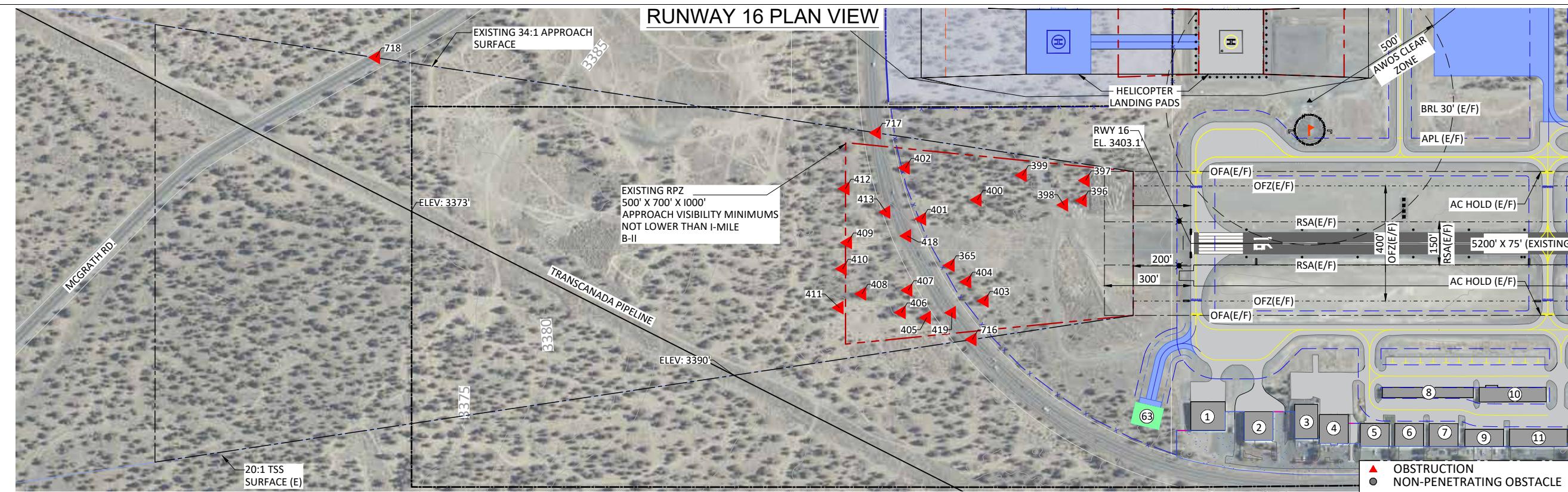
SHEET NO.  
7 OF 15



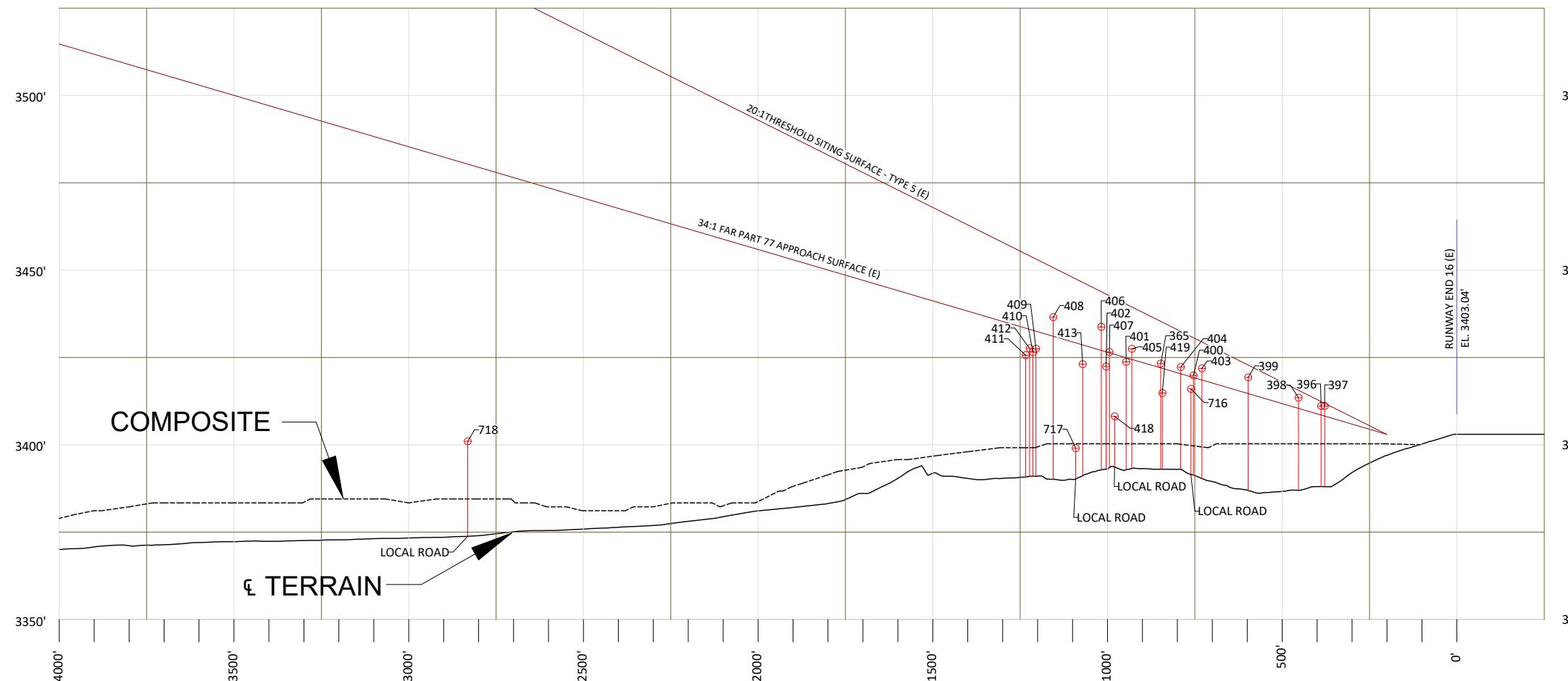
## PART 77 PLAN VIEW







## RUNWAY 16 PROFILE VIEW



## NOTES:

1. DETAILED DATA ARE PROVIDED FOR OBSTACLES IDENTIFIED BY RED TRIANGLES THAT ARE LESS THAN 10' BELOW THE CONTROLLING SURFACE OR ARE IDENTIFIED AS TRAVERSEWAYS. THE LOCATIONS OF OTHER OBSTACLES ARE DEPICTED BY GRAY DOTS FOR REFERENCE. CONSULT ADIP FOR DETAILED INFO ON THESE FEATURES.
  2. SEE SHEETS 16 & 17 FOR OBSTACLE TABLES.
  3. SEE SHEET 8 FOR OUTER APPROACH SURFACE DETAILS
  4. SEE SHEET 3 FOR FULL LEGEND AND FACILITY/BUILDING KEY.

- OBSTACLE > 10' BELOW SURFACE
- OBSTACLE < 10' BELOW SURFACE  
AND HIGHER OR TRAVERSEWAY

NO.	DATE	BY	APPR	REVISIONS

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SCALES ACCORDING

Century West  
Engineering

DESIGNED BY: MD DRAWN BY: MS DATE: JANUARY 2020

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BEND, OR 97702  
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ECT NO:	

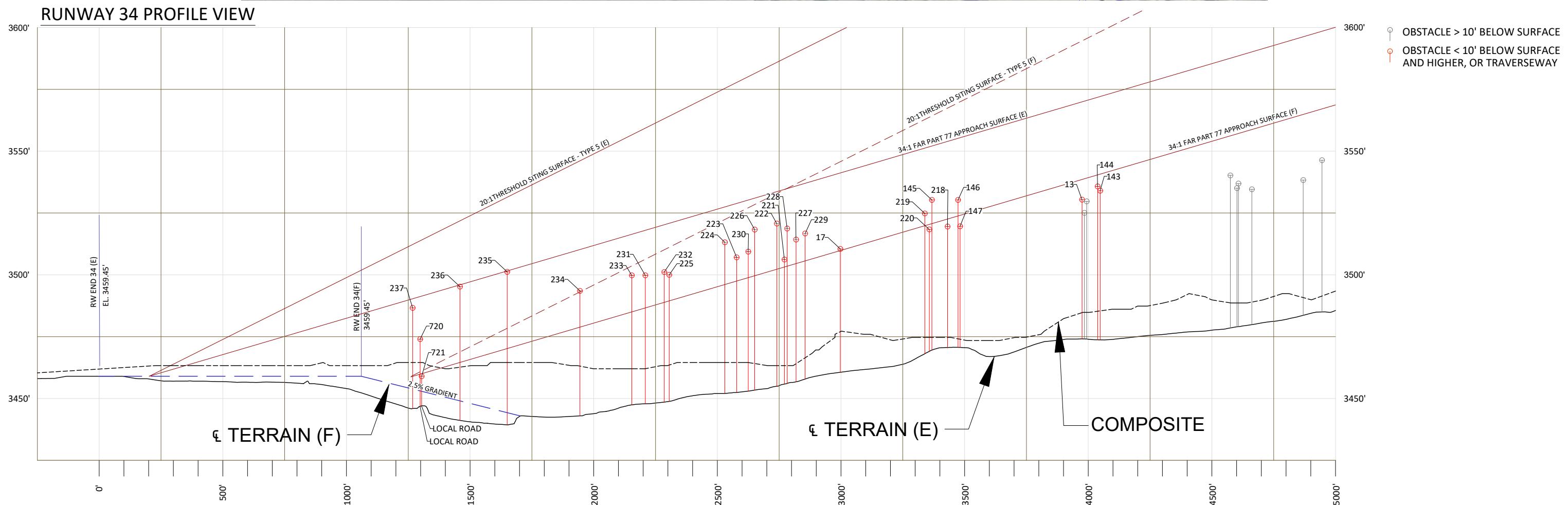
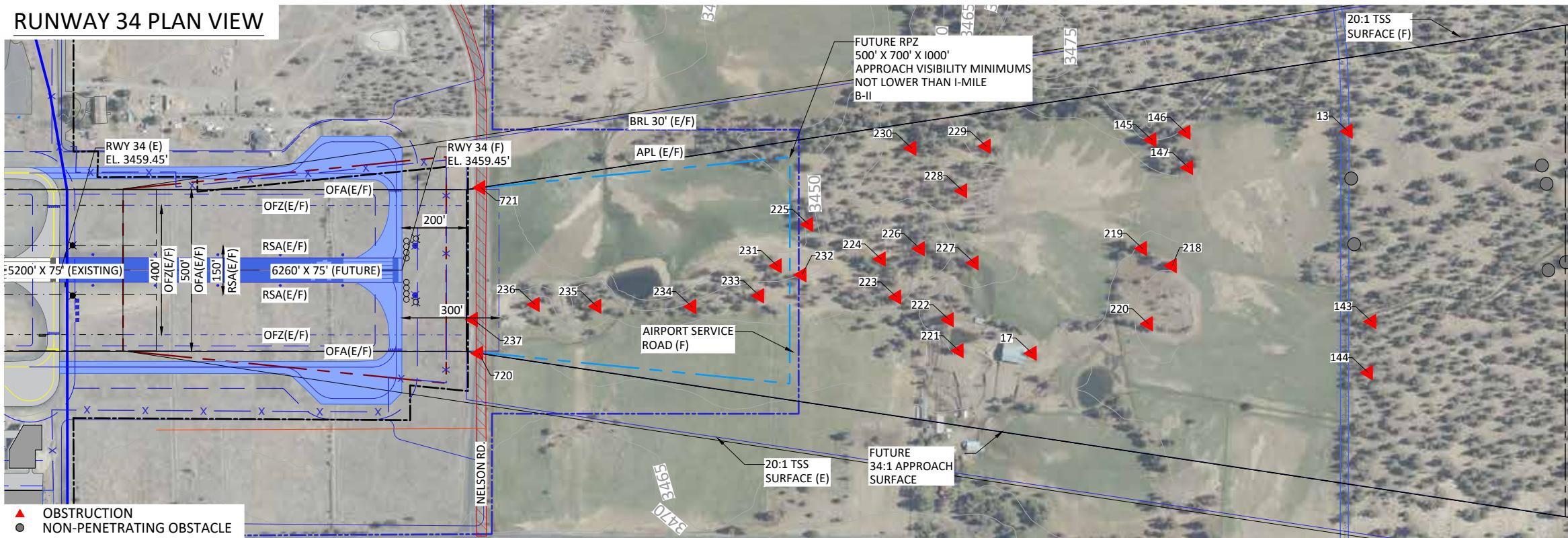
## BEND MUNICIPAL AIRPORT

## RUNWAY 16 INNER APPROACH SURFACE

FIGURE NO

SHEET NO  
9 OF 18





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DATE: JANUARY 2022 PROJECT NO: 10051.110.01

**BEND MUNICIPAL AIRPORT**

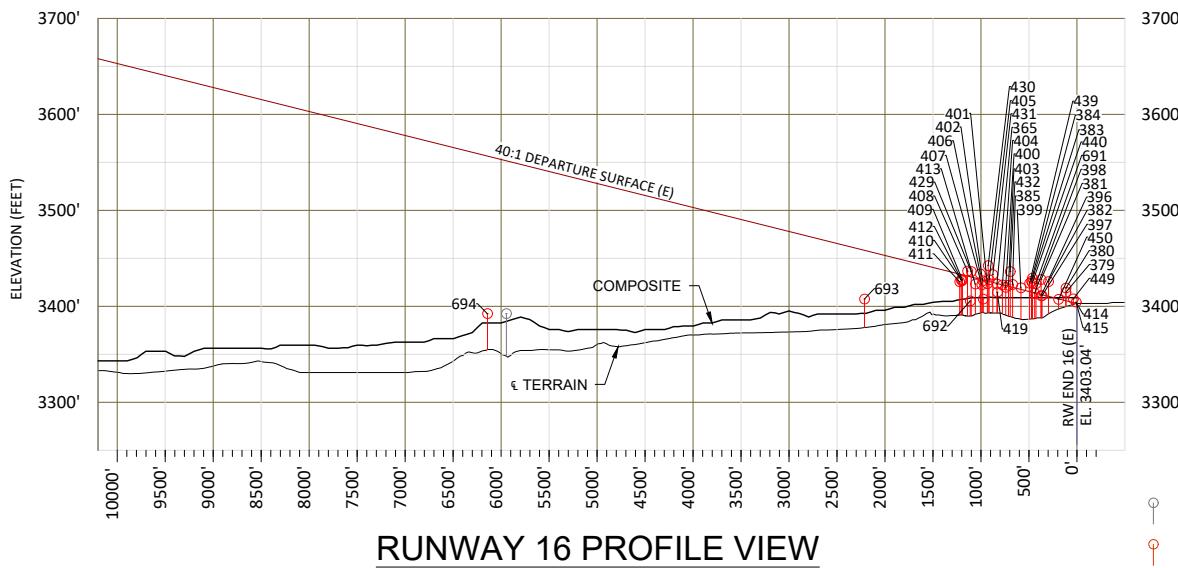
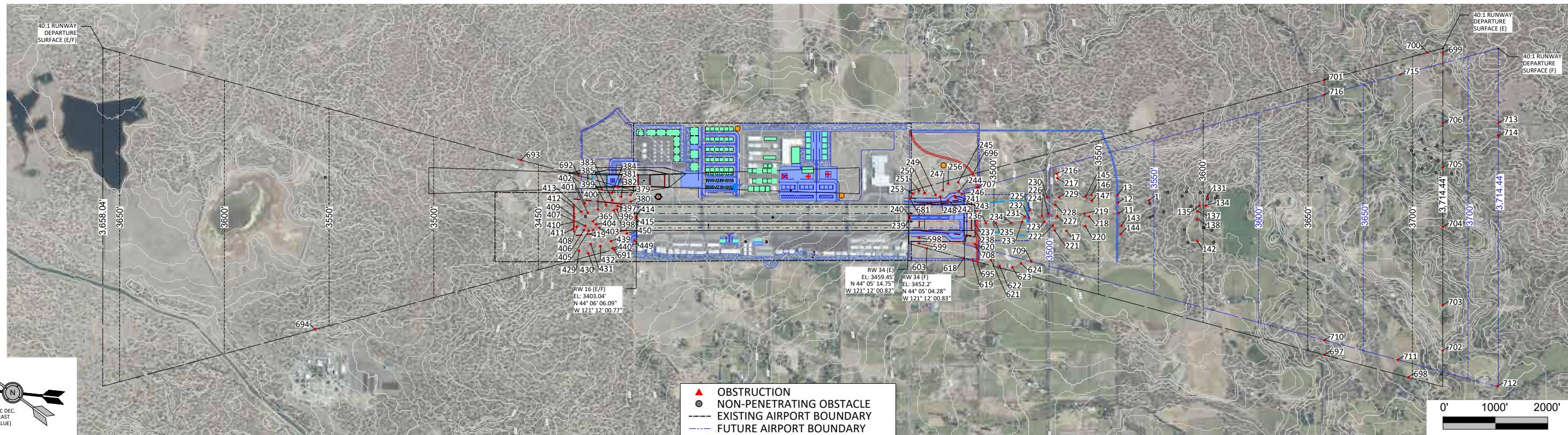
**RUNWAY 34 INNER APPROACH SURFACE**

FIGURE NO.

SHEET NO.  
10 OF 18



## RUNWAY 16-34 PLAN VIEW



### NOTES:

- DETAILED DATA ARE PROVIDED FOR OBSTACLES IDENTIFIED BY RED TRIANGLES THAT ARE LESS THAN 10' BELOW THE CONTROLLING SURFACE. THE LOCATIONS OF OTHER OBSTACLES ARE DEPICTED BY GRAY DOTS FOR REFERENCE. CONSULT ADIP FOR DETAILED INFO ON THESE FEATURES.

2. SEE SHEET 17 FOR OBSTACLE TABLES.

3. REFERENCE OBSTACLE TABLES FOR TRAVERSEWAYS DETAILS.

4. SEE SHEET 3 FOR FULL LEGEND AND FACILITY/BUILDING KEY.

NO.	DATE	BY	APPR	REVISIONS

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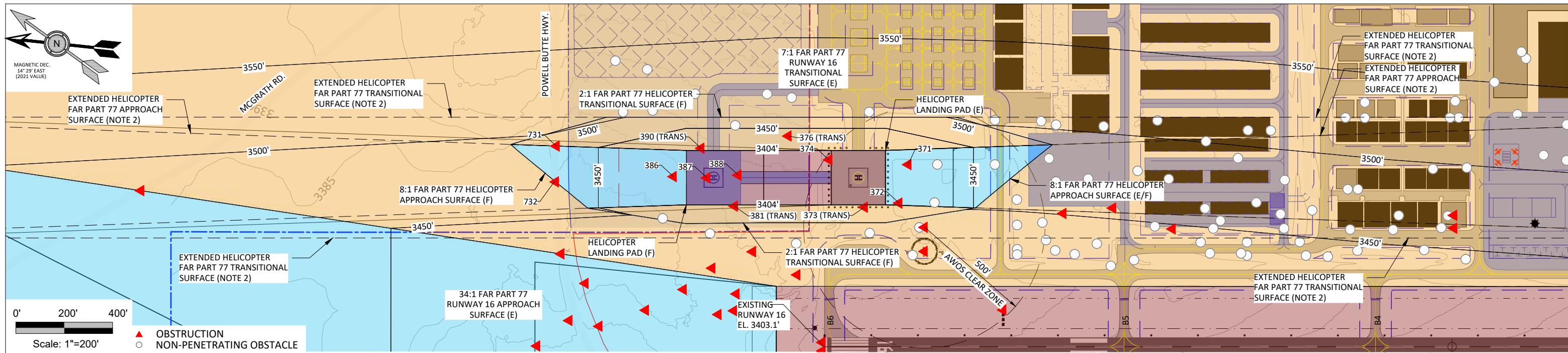
**BEND MUNICIPAL AIRPORT**

**RUNWAY 16-34 DEPARTURE SURFACE  
PLAN AND PROFILE**

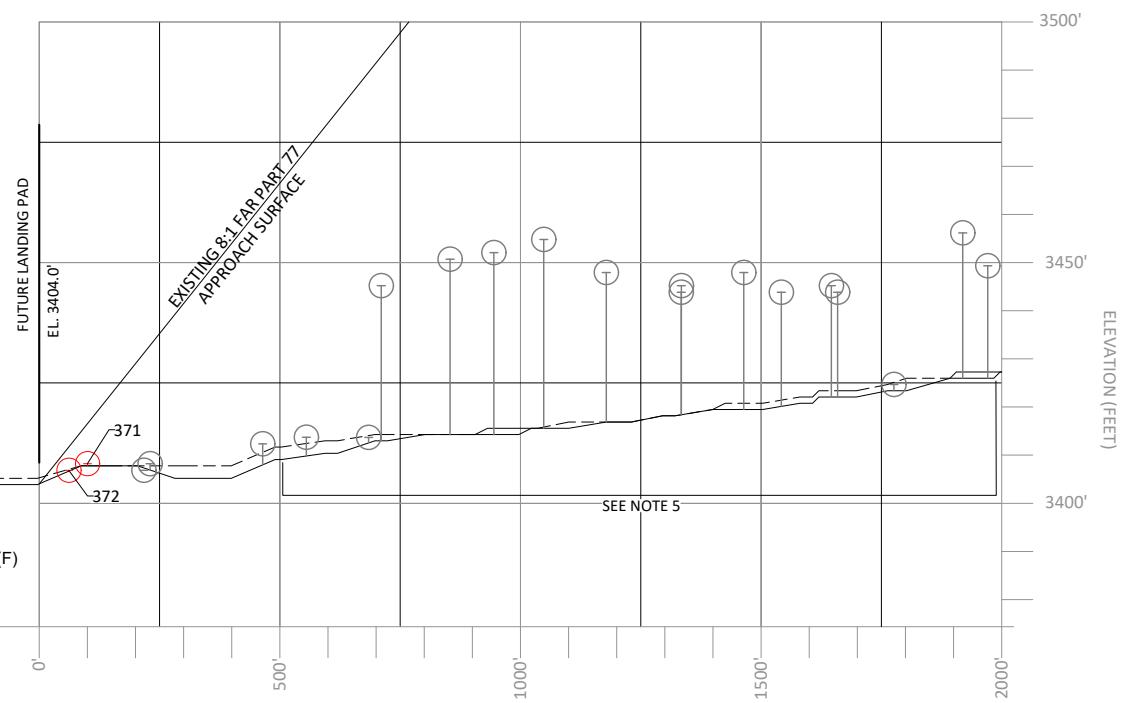
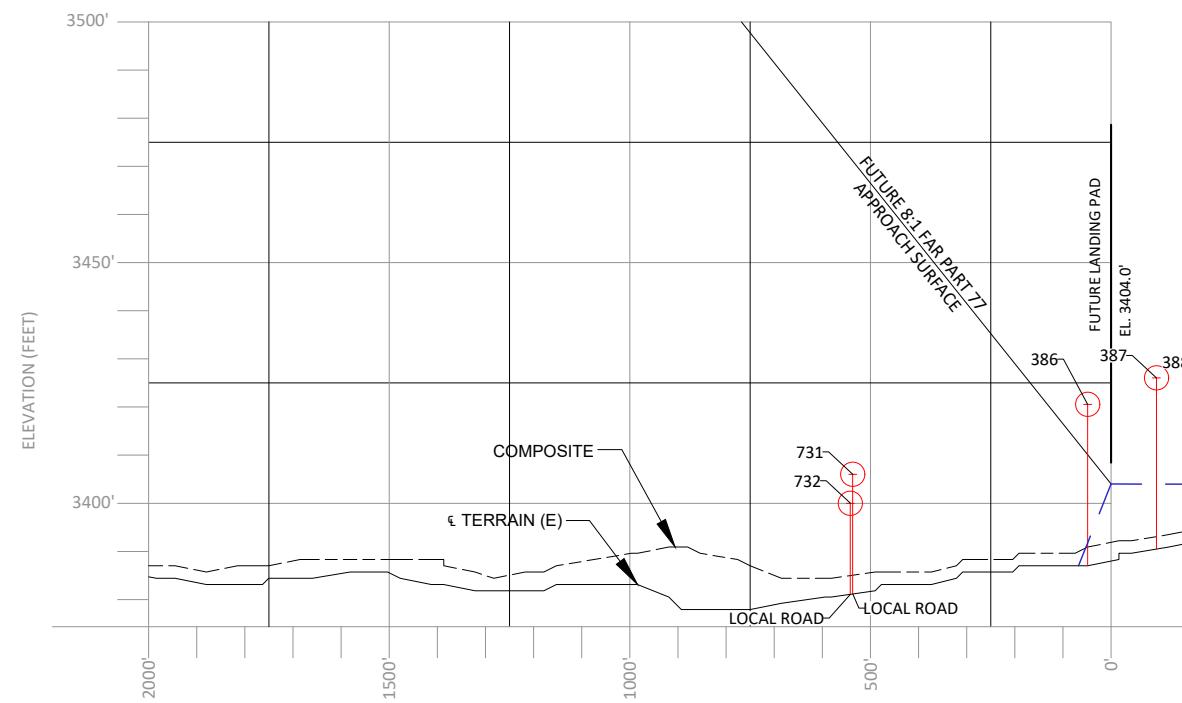
FIGURE NO.

SHEET NO.  
11 OF 18





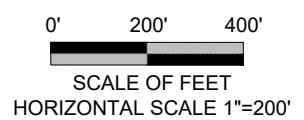
# HELICOPTER LANDING AREA PLAN VIEW



## NOTES:

1. SEE AIRPORT LAYOUT PLAN (SHEET 3) FOR FULL LEGEND.
  2. HELICOPTER APPROACH AND TRANSITIONAL SURFACES WHERE SURFACE HEIGHTS EXCEED THE CONTROLLING HEIGHTS OF THE RUNWAY TRANSITIONAL SURFACE ARE DEPICTED BY DASHED LINES FOR REFERENCE.
  3. DETAILED DATA ARE PROVIDED FOR OBSTACLES IDENTIFIED BY RED TRIANGLES THAT ARE LESS THAN 10' BELOW THE CONTROLLING SURFACE OR ARE IDENTIFIED AS TRAVERSEWAYS. THE LOCATIONS OF OTHER OBSTACLES ARE DEPICTED BY GRAY DOTS FOR REFERENCE. CONSULT ADIP FOR DETAILED INFO ON THESE FEATURES.
  4. SEE AIRPORT AIRSPACE PLAN (SHEET 8) AND RW 16 INNER APPROACH PLAN (SHEET 9) FOR DETAILS FOR UNLABELED OBSTACLES.
  5. HELIPAD TRANSITIONAL SURFACE OBSTRUCTIONS ARE DEPICTED AND LABELED IN THE PLAN VIEW, BUT NOT IN APPROACH SURFACE PROFILE VIEW. SEE OBSTRUCTION TABLES ON SHEET 17 FOR DETAILS.

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# HELICOPTER LANDING AREA PROFILE VIEW

- OBSTACLE > 10' BELOW SURFACE
- OBSTACLE < 10' BELOW SURFACE  
AND HIGHER OR TRAVERSEWAY



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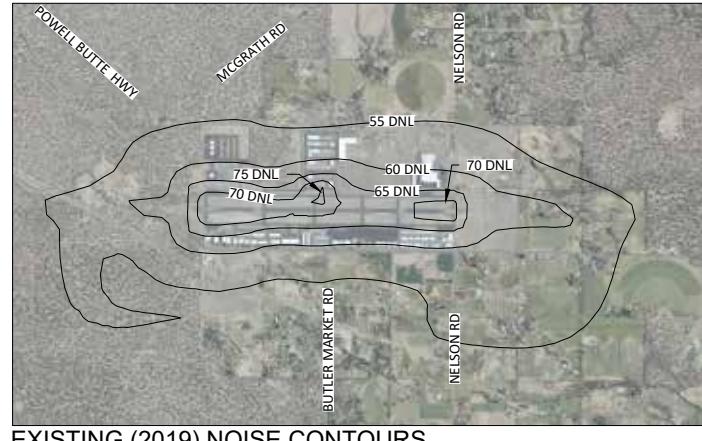
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	PROJECT NO: 10051.110.01	

## BEND MUNICIPAL AIRPORT

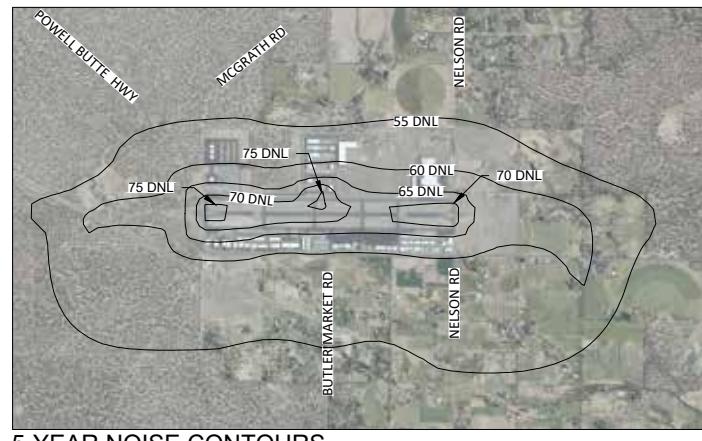
## HELICOPTER AIRSPACE PLAN AND PROFILE (PART 77)

FIGURE NO.  
-  
SHEET NO.  
12 OF 18

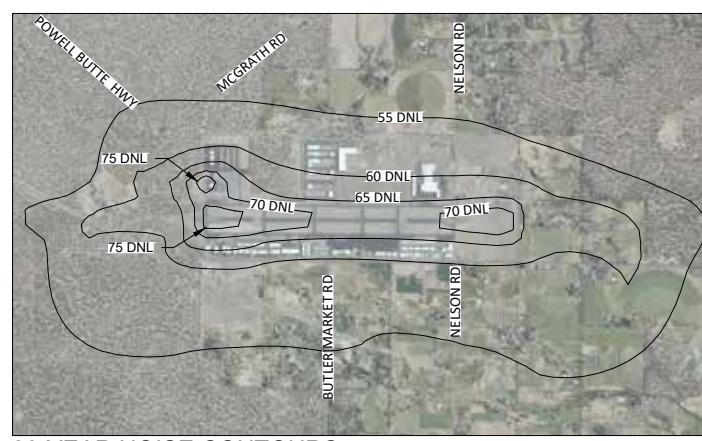




EXISTING (2019) NOISE CONTOURS



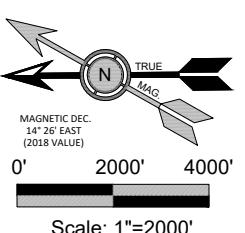
5-YEAR NOISE CONTOURS



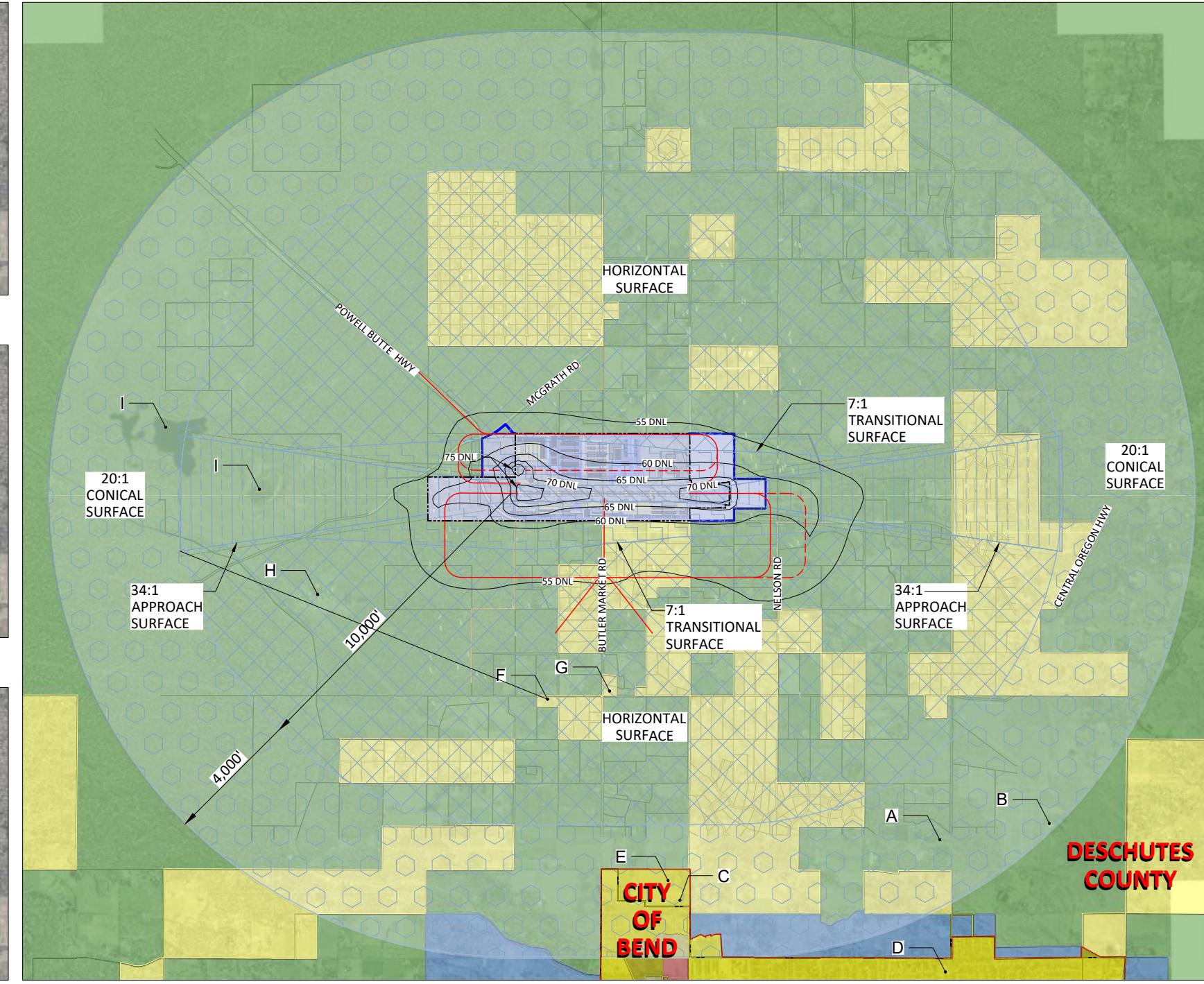
20-YEAR NOISE CONTOURS

NOTES:

1. THE AIRPORT IS LOCATED OUTSIDE THE CITY OF BEND URBAN GROWTH AREA IN UNINCORPORATED DESCHUTES COUNTY.
2. EXISTING AIRPORT LAND ZONED EFUAL IS RECOMMENDED FOR RE-ZONING TO AIRPORT DEVELOPMENT (AD).
3. FUTURE PROPERTY ACQUISITION OF PARCELS ZONED EFU ALSO RECOMMENDED FOR RE-ZONING TO AD.
4. CURRENT AD ZONE SUB-DISTRICTS ARE RECOMMENDED FOR REMOVAL AND REZONING TO AD.
5. CURRENT AO OVERLAY DISTRICT IS RECOMMENDED FOR UPDATE TO REFLECT PLANNED PART 77 AIRSPACE AS SHOWN.



Scale: 1"=2000'



LEGEND

	AIRPORT PROPERTY BOUNDARY
	FUTURE AIRPORT PROPERTY BOUNDARY
	RPZ
	FUTURE RPZ
	EXISTING AIR TRAFFIC PATTERN
	FUTURE AIR TRAFFIC PATTERN
	NOISE CONTOUR
	CITY LIMITS
	URBAN GROWTH BOUNDARY
	ROADWAY
	FUTURE ROADWAY
	AIRFIELD PAVEMENT
	FUTURE AIRFIELD PAVEMENT
	BUILDING
	FUTURE BUILDING

LAND USE

	AIRPORT DEVELOPMENT (AD)
	AGRICULTURAL (AG)
	GENERAL COMMERCIAL (GC)
	HIGH DENSITY RESIDENTIAL (HDR)
	MEDIUM DENSITY RESIDENTIAL (MDR)
	STANDARD DENSITY RESIDENTIAL (SDR)
	RURAL RESIDENTIAL EXCEPTION AREA (RREA)
	URBAN RESERVE (UR)

PUBLIC FACILITY KEY

A	BIG SKY PARK
B	CHRISTIAN LIFE CENTER
C	THE FELLOWSHIP AT BEND
D	EASTMONT CHURCH
E	BEND SEVENTH DAY ADVENTIST CHURCH
F	THE ACADEMY AT SISTERS
G	NEW LEAF ACADEMY
H	BEND WASTEWATER PLANT
I	HATFIELD PONDS

PART 77 SURFACES

	PRIMARY SURFACE
	APPROACH SURFACE
	TRANSITIONAL SURFACE
	HORIZONTAL SURFACE
	CONICAL SURFACE

NO.	DATE	BY	APPR	REVISIONS

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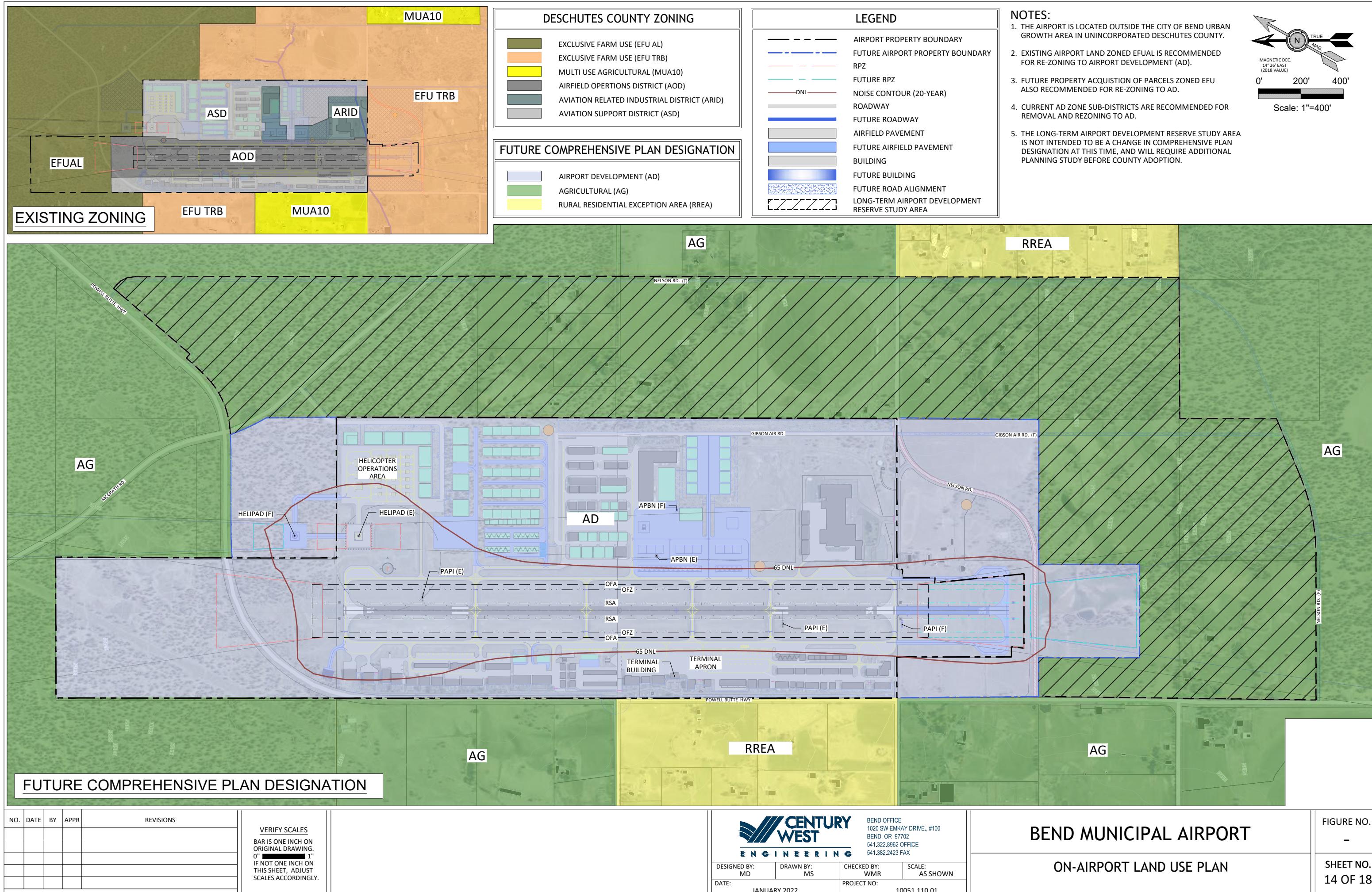
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1020 SW EMKAY DRIVE, #100  
BEND, OR 97702  
541.322.8962 OFFICE  
541.382.2423 FAX  
DESIGNED BY: MD DRAWN BY: MS CHECKED BY: WMR SCALE: AS SHOWN  
DATE: JANUARY 2022 PROJECT NO: 10051.110.01

BEND MUNICIPAL AIRPORT

OFF-AIRPORT LAND USE PLAN

FIGURE NO.  
-  
SHEET NO.  
13 OF 18







## LAND DATA TABLE

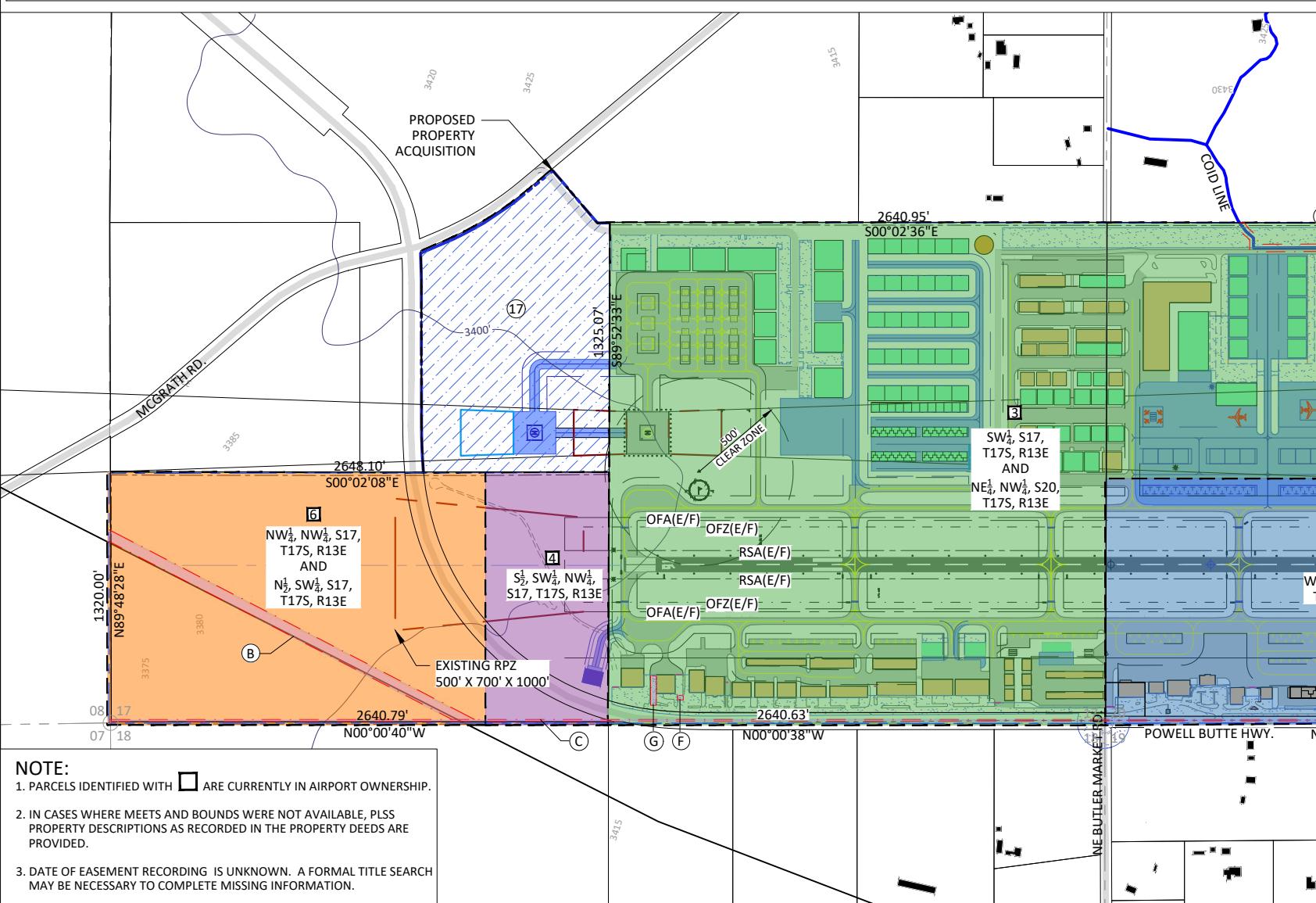
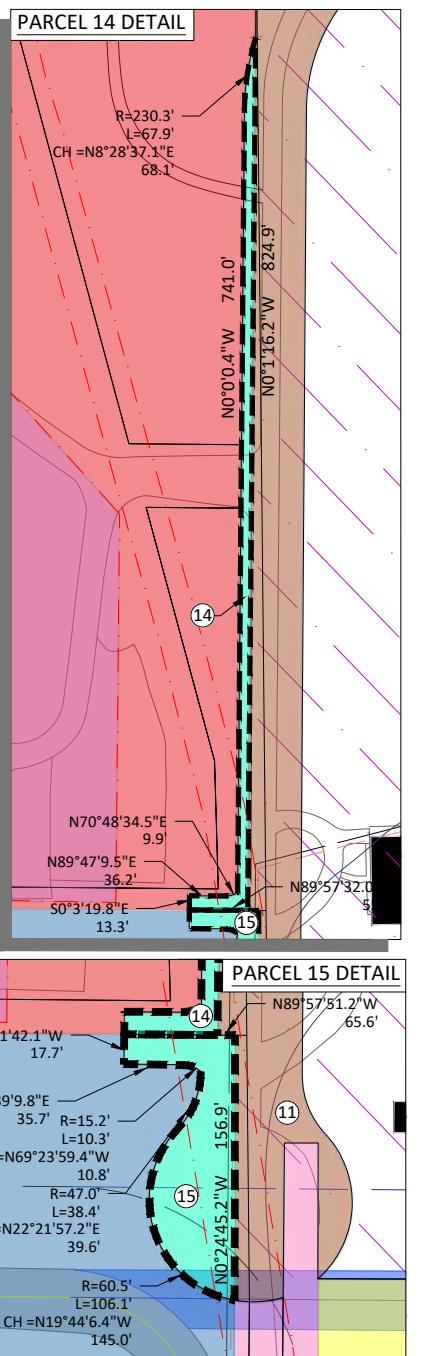
PARCEL	GRANTOR	ACRES	RECORDING DATE	BOOK	PAGE	INTEREST	INSTRUMENT	PURPOSE	FED. AGREEMENT	NOTES
1	EUGENE AND DORA FITZGERALD	40	5-13-42	61	360	fee	deed	development	5-13-42	
2	HAROLD AND EMMA SHANNO	80	7-29-42	61	521	fee	deed	development	7-29-42	
3	U.S.A.	200	9-18-51	91	230	patent	deed	development	sec. 16-FAAP	
4	DESCHUTES COUNTY	20	8-29-77	257	348	fee	deed	development	ADAP-01	
5	PATRICK AND MARJORIE GIBSON	14.6	3-31-80	319	623	fee	deed	development	ADAP-01	
6	DESCHUTES COUNTY	60.2	10-25-84	78	739	fee	deed	development	AIP-02	29.75 ACRES USED AS SPONSOR MATCH FOR AIP-03
7	GIBSON AIRPARK LLC	4.99	8-1-03	2003	68022	fee	deed	development	AIP-010	
8	DESCHUTES COUNTY	1.78	8-4-03	2003	68022	fee	deed	development	AIP-010	PREVIOUSLY TRANSFERRED TO COUNTY, TO BE REACQUIRED
9	DESCHUTES COUNTY	2.60	8-4-03	2003	68022	fee	deed	development	AIP-010	PREVIOUSLY TRANSFERRED TO COUNTY, TO BE REACQUIRED
10	DESCHUTES COUNTY	0.32	9-10-04	2004	54375	fee	deed	development	AIP-011	PREVIOUSLY TRANSFERRED TO COUNTY, TO BE REACQUIRED
11	DESCHUTES COUNTY	0.42	9-10-04	2004	54375	fee	deed	development	AIP-011	PREVIOUSLY TRANSFERRED TO COUNTY, TO BE REACQUIRED
12	GIBSON AIRPARK LLC	0.12	9-10-04	2004	54375	fee	deed	development	AIP-011	
13	DESCHUTES COUNTY	0.76	PENDING			fee	-	development	N/A	ACQUIRED FROM COUNTY AFTER REALIGNMENT OF NELSON RD.
14	DESCHUTES COUNTY	0.38	PENDING			fee	-	development	N/A	PREVIOUSLY TRANSFERRED TO COUNTY, TO BE REACQUIRED
15	DESCHUTES COUNTY	0.17	PENDING			fee	-	development	N/A	PREVIOUSLY TRANSFERRED TO COUNTY, TO BE REACQUIRED
16	DESCHUTES COUNTY	0.03	PENDING			fee	-	development	N/A	PREVIOUSLY TRANSFERRED TO COUNTY, TO BE REACQUIRED
17	DESCHUTES COUNTY	31.75	-			fee	-	development	N/A	TO BE ACQUIRED
18	TRITON-AMERICA, LLC	19.23	-			fee	-	development	N/A	TO BE ACQUIRED
19	TRITON-AMERICA, LLC	27.82	-			fee	-	development	N/A	TO BE ACQUIRED
20	TRITON-AMERICA, LLC	6.97	-			fee	-	development	N/A	TO BE ACQUIRED
21	FRANK MARRON	19.14	-			fee	-	development	N/A	TO BE ACQUIRED

## EASEMENTS

PARCEL	GRANTOR		DATE
A	CENTRAL OREGON IRRIGATION DISTRICT	CANALS AND DITCHES	AUGUST 13, 1952
B	CITY OF PACIFIC GAS TRANSMISSION CO.	GAS TRANSMISSION LINE	JUNE 8, 1972
C	CENTRAL ELECTRIC COOPERATION, INC.	POWER LINE	MARCH 23, 1979
	PACIFIC POWER AND LIGHT CO.	CORRECTED BY V11 P900	SEPTEMBER 7, 1982
D	PACIFIC POWER AND LIGHT CO.	POWER EASEMENT FOR WASTEWATER	APRIL 25, 1983
	CITY TO DESCHUTES COUNTY	NW 1/4, NW 1/4, SEC.17, T17S, R.13E	FEBRUARY 14, 1991
E	PACIFIC AVIATION COMPOSITES U.S.A. LLC.	WATERLINE	AUGUST 7, 1997
F	SMC CORP. TO CITY OF BEND	WATERLINE	APRIL 6, 1999
G	SMC CORP. TO CITY OF BEND	WATERLINE	APRIL 6, 1999
H	COLUMBIA AIRCRAFT (FORMERLY LANCAIR)	WATERLINE	APRIL 6, 2004
I	COLUMBIA AIRCRAFT (FORMERLY LANCAIR)	EASEMENT FOR EXISTING WATERLINE	APRIL 6, 2004
J	CITY OF BEND TO CENTRAL OREGON IRRIGATION DISTRICT	IRRIGATION LINE EASEMENT	(NOTE 3)

## LEGEND

	EXISTING PAVEMENT
	FUTURE PAVEMENT
	EASEMENT (EXISTING)
	AIRPORT PROPERTY LINE (EXISTING)
	AIRPORT PROPERTY LINE (FUTURE)
	PARCEL LINES
	PLSS SECTION LINE



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DATE: JANUARY 2022 PROJECT NO: 10051.110.01

**BEND MUNICIPAL AIRPORT**

**EXHIBIT "A" AIRPORT PROPERTY PLAN**

FIGURE NO.

-

SHEET NO.  
15 OF 18



FAR PART 77 RUNWAY 16-34 PRIMARY SURFACE OBSTRUCTIONS										
OBSTACLE ID	DESCRIPTION	SURVEY DATE	SURFACE	GROUND ELEVATION (FT)	AGL (FT)	TOP HEIGHT (FT)	SURFACE HEIGHT (FT)	PENETRATION (FT)	DISPOSITION	MITIGATION TIMEFRAME
239	RUNWAY LIGHT	10/11/2018	PRIM	3459.6	1.1	3460.8	3459.4	1.4	FIXED BY FUNCTION	NO ACTION
240	RUNWAY LIGHT	10/11/2018	PRIM	3459.5	1.3	3460.8	3459.4	1.4	FIXED BY FUNCTION	NO ACTION
360	PAPI 16	10/11/2018	PRIM	3404.3	3.0	3407.3	3405.3	2.0	FIXED BY FUNCTION	NO ACTION
414	RUNWAY LIGHT	10/11/2018	PRIM	3403.0	1.4	3404.4	3403.0	1.3	FIXED BY FUNCTION	NO ACTION
415	RUNWAY LIGHT	10/11/2018	PRIM	3403.1	1.2	3404.3	3403.0	1.2	FIXED BY FUNCTION	NO ACTION
520	TAXIWAY LIGHT	10/11/2018	PRIM	3423.8	1.8	3425.6	3424.3	1.4	FIXED BY FUNCTION	NO ACTION
562	TAXIWAY SIGN	10/11/2018	PRIM	3444.0	2.0	3446.0	3444.0	2.0	FIXED BY FUNCTION	NO ACTION
686	PAPI 34	10/11/2018	PRIM	3444.7	3.3	3448.0	3446.6	1.4	FIXED BY FUNCTION	NO ACTION

FAR PART 77 RUNWAY 16-34 TRANSITIONAL SURFACE OBSTRUCTIONS										
OBSTACLE ID	DESCRIPTION	SURVEY DATE	SURFACE	GROUND ELEVATION (FT)	AGL (FT)	TOP HEIGHT (FT)	SURFACE HEIGHT (FT)	PENETRATION (FT)	DISPOSITION	MITIGATION TIMEFRAME
217	TREE	10/11/2018	TRANS	3461.6	82.0	3543.6	3536.5	7.1	TO BE REMOVED	15-20 YEARS
241	TREE	10/11/2018	TRANS	3452.4	43.4	3495.8	3476.3	19.5	TO BE REMOVED	15-20 YEARS
242	TREE	10/11/2018	TRANS	3454.8	29.8	3484.6	3465.6	19.0	TO BE REMOVED	15-20 YEARS
243	TREE	10/11/2018	TRANS	3452.8	40.3	3493.1	3472.2	20.9	TO BE REMOVED	15-20 YEARS
244	TREE	10/11/2018	TRANS	3449.8	44.2	3494.1	3488.8	5.3	TO BE REMOVED	15-20 YEARS
246	CATENARY	10/11/2018	TRANS	3449.0	36.2	3485.3	3480.8	4.4	TO BE REMOVED	15-20 YEARS
247	TREE	10/11/2018	TRANS	3453.2	40.7	3493.9	3494.0	-0.1	NO OBSTRUCTION	NO ACTION
248	TREE	10/11/2018	TRANS	3455.0	26.0	3481.0	3476.3	4.7	TO BE REMOVED	15-20 YEARS
249	TREE	10/11/2018	TRANS	3454.6	40.1	3494.7	3482.0	12.7	TO BE REMOVED	15-20 YEARS
250	TREE	10/11/2018	TRANS	3452.8	40.1	3493.0	3488.4	4.6	TO BE REMOVED	15-20 YEARS
251	TREE	10/11/2018	TRANS	3451.4	45.2	3496.6	3494.7	1.9	TO BE REMOVED	15-20 YEARS
253	TREE	10/11/2018	TRANS	3451.9	35.3	3487.2	3488.6	-1.4	NO OBSTRUCTION	NO ACTION
254	POLE	10/11/2018	TRANS	3449.9	34.9	3484.8	3485.5	-0.7	NO OBSTRUCTION	NO ACTION
300	BUILDING	10/11/2018	TRANS	3427.7	32.5	3460.1	3469.9	-9.8	NO OBSTRUCTION	NO ACTION
302	BUILDING	10/11/2018	TRANS	3428.3	31.9	3460.1	3462.4	-2.2	NO OBSTRUCTION	NO ACTION
334	TREE	10/11/2018	TRANS	3415.1	30.1	3445.2	3447.3	-2.1	NO OBSTRUCTION	NO ACTION
344	TREE	10/11/2018	TRANS	3415.8	37.1	3452.9	3456.4	-3.5	NO OBSTRUCTION	NO ACTION
347	TREE	10/11/2018	TRANS	3414.2	34.6	3448.8	3450.8	-2.0	NO OBSTRUCTION	NO ACTION
361	WINDSOCK	10/11/2018	TRANS	3405.5	25.1	3430.7	3424.5	6.1	TO BE REMOVED	15-20 YEARS
362	POLE	10/11/2018	TRANS	3405.3	35.8	3441.1	3438.8	2.4	TO BE REMOVED	15-20 YEARS
380	TREE	10/11/2018	TRANS	3390.3	28.7	3419.0	3409.8	9.2	TO BE REMOVED	15-20 YEARS
382	TREE	10/11/2018	TRANS	3390.4	35.5	3425.9	3424.3	1.6	TO BE REMOVED	15-20 YEARS
383	TREE	10/11/2018	TRANS	3387.8	41.6	3429.3	3415.9	13.5	TO BE REMOVED	15-20 YEARS
681	PRIMARY ROAD	10/11/2018	TRANS	3451.6	15.0	3466.6	3475.3	-8.7	NO OBSTRUCTION	NO ACTION
682	PRIMARY ROAD	10/11/2018	TRANS	3451.4	15.0	3466.4	3473.8	-7.3	NO OBSTRUCTION	NO ACTION
238	CATENARY	10/11/2018	TRANS	3456.3	29.6	3485.8	3456.6	29.2	TO BE REMOVED	15-20 YEARS
441	TREE	10/11/2018	TRANS	3404.0	39.2	3443.2	3452.5	-9.3	NO OBSTRUCTION	NO ACTION
450	SCRUB	10/11/2018	TRANS	3404.1	3.2	3407.3	3411.4	-4.1	NO OBSTRUCTION	NO ACTION
451	TAXIWAY LIGHT	10/11/2018	TRANS	3403.3	1.9	3405.1	3406.0	-0.9	NO OBSTRUCTION	NO ACTION
453	POLE	10/11/2018	TRANS	3405.5	37.6	3443.1	3451.2	-8.1	NO OBSTRUCTION	NO ACTION
458	TREE	10/11/2018	TRANS	3409.3	32.5	3441.8	3448.3	-6.5	NO OBSTRUCTION	NO ACTION
459	TREE	10/11/2018	TRANS	3408.1	19.6	3427.7	3436.1	-8.4	NO OBSTRUCTION	NO ACTION
460	TAXIWAY LIGHT	10/11/2018	TRANS	3404.0	1.8	3405.8	3415.2	-9.4	NO OBSTRUCTION	NO ACTION
486	TAXIWAY LIGHT	10/11/2018	TRANS	3412.5	1.4	3413.9	3423.5	-9.6	NO OBSTRUCTION	NO ACTION
519	TAXIWAY LIGHT	10/11/2018	TRANS	3425.4	1.8	3427.2	3428.7	-1.5	NO OBSTRUCTION	NO ACTION
521	TAXIWAY LIGHT	10/11/2018	TRANS	3428.3	1.7	3430.0	3431.0	-1.0	NO OBSTRUCTION	NO ACTION
539	BUILDING	10/11/2018	TRANS	3437.5	36.0	3473.5	3481.6	-8.2	NO OBSTRUCTION	NO ACTION
546	TREE	10/11/2018	TRANS	3442.1	87.8	3529.9	3533.7	-3.8	NO OBSTRUCTION	NO ACTION
564	BUILDING	10/11/2018	TRANS	3448.8	19.9	3468.7	3477.2	-8.4	NO OBSTRUCTION	NO ACTION
576	BUILDING	10/11/2018	TRANS	3451.2	22.0	3473.2	3477.4	-4.2	NO OBSTRUCTION	NO ACTION
577	TAXIWAY LIGHT	10/11/2018	TRANS	3450.7	2.2	3452.9	3461.8	-9.0	NO OBSTRUCTION	NO ACTION
579	BUILDING	10/11/2018	TRANS	3455.1	19.1	3474.3	3481.5	-7.3	NO OBSTRUCTION	NO ACTION
586	BUILDING	10/11/2018	TRANS	3457.0	19.9	3476.9	3483.6	-6.7	NO OBSTRUCTION	NO ACTION
595	BUILDING	10/11/2018	TRANS	3461.0	33.5	3494.4	3496.2	-1.8	NO OBSTRUCTION	NO ACTION
596	BUILDING	10/11/2018	TRANS	3461.6	29.8	3491.4	3490.6	0.8	TO BE REMOVED	15-20 YEARS
611	TREE	10/11/2018	TRANS	3472.8	78.1	3550.9	3560.9	-10.0	NO OBSTRUCTION	NO ACTION
620	POLE	10/11/2018	TRANS	3459.9	33.9	3493.8	3489.1	4.7	TO BE REMOVED	15-20 YEARS
685	TAXIWAY LIGHT	10/11/2018	TRANS	3414.8	1.7	3416.6	3418.5	-1.9	NO OBSTRUCTION	NO ACTION

FAR PART 77 RUNWAY 16-34 HORIZONTAL SURFACE OBSTRUCTIONS										
OBSTACLE ID	DESCRIPTION	SURVEY DATE	SURFACE	GROUND ELEVATION (FT)	AGL (FT)	TOP HEIGHT (FT)	SURFACE HEIGHT (FT)	PENETRATION (FT)	DISPOSITION	MITIGATION TIMEFRAME



FAR PART 77 RUNWAY 34 APPROACH SURFACE OBSTRUCTIONS										
OBSTACLE ID	DESCRIPTION	SURVEY DATE	SURFACE	GROUND ELEVATION (FT)	AGL (FT)	TOP HEIGHT (FT)	SURFACE HEIGHT (FT)	PENETRATION (FT)	DISPOSITION	MITIGATION TIMEFRAME
13	TREE	10/11/2018	APPR34	3465.2	65.2	3530.4	3539.7	-9.3	NO OBSTRUCTION	NO ACTION
17	TREE	10/11/2018	APPR34	3462.0	48.5	3510.5	3510.9	-0.5	NO OBSTRUCTION	NO ACTION
134	TREE	10/11/2018	APPR34	3514.3	69.9	3584.1	3589.2	-5.0	NO OBSTRUCTION	NO ACTION
135	TREE	10/11/2018	APPR34	3510.7	69.0	3579.7	3585.7	-6.1	NO OBSTRUCTION	NO ACTION
143	TREE	10/11/2018	APPR34	3473.9	60.1	3534.0	3541.8	-7.8	NO OBSTRUCTION	NO ACTION
144	TREE	10/11/2018	APPR34	3473.6	62.1	3535.7	3541.5	-5.8	NO OBSTRUCTION	NO ACTION
145	TREE	10/11/2018	APPR34	3466.8	63.5	3530.3	3521.8	8.5	TO BE REMOVED	0-10 YEARS
146	TREE	10/11/2018	APPR34	3466.8	63.5	3530.3	3524.9	5.4	TO BE REMOVED	0-10 YEARS
147	TREE	10/11/2018	APPR34	3468.4	51.2	3519.6	3525.2	-5.6	NO OBSTRUCTION	NO ACTION
218	TREE	10/11/2018	APPR34	3466.2	53.3	3519.5	3523.7	-4.2	NO OBSTRUCTION	NO ACTION
219	TREE	10/11/2018	APPR34	3463.1	61.8	3524.8	3521.0	3.9	TO BE REMOVED	0-10 YEARS
220	TREE	10/11/2018	APPR34	3466.2	52.1	3518.3	3521.5	-3.2	NO OBSTRUCTION	NO ACTION
221	TREE	10/11/2018	APPR34	3456.2	50.0	3506.2	3504.3	1.9	TO BE REMOVED	0-10 YEARS
222	TREE	10/11/2018	APPR34	3457.6	63.1	3520.7	3503.4	17.3	TO BE REMOVED	0-10 YEARS
223	TREE	10/11/2018	APPR34	3447.0	60.0	3507.1	3498.6	8.5	TO BE REMOVED	0-10 YEARS
224	TREE	10/11/2018	APPR34	3444.5	68.7	3513.2	3497.2	16.0	TO BE REMOVED	0-10 YEARS
225	TREE	10/11/2018	APPR34	3442.1	57.9	3500.0	3490.6	9.4	TO BE REMOVED	0-10 YEARS
226	TREE	10/11/2018	APPR34	3449.1	69.1	3518.3	3500.7	17.5	TO BE REMOVED	0-10 YEARS
227	TREE	10/11/2018	APPR34	3454.6	59.6	3514.3	3505.7	8.6	TO BE REMOVED	0-10 YEARS
228	TREE	10/11/2018	APPR34	3453.2	65.5	3518.7	3504.6	14.1	TO BE REMOVED	0-10 YEARS
229	TREE	10/11/2018	APPR34	3453.6	63.1	3516.7	3506.7	10.0	TO BE REMOVED	0-10 YEARS
230	TREE	10/11/2018	APPR34	3452.9	56.4	3509.4	3500.0	9.4	TO BE REMOVED	0-10 YEARS
231	TREE	10/11/2018	APPR34	3443.1	56.7	3499.8	3487.7	12.1	TO BE REMOVED	0-10 YEARS
232	TREE	10/11/2018	APPR34	3443.6	57.5	3501.1	3490.0	11.1	TO BE REMOVED	0-10 YEARS
233	TREE	10/11/2018	APPR34	3448.4	51.4	3499.8	3486.1	13.7	TO BE REMOVED	0-10 YEARS
234	TREE	10/11/2018	APPR34	3453.7	39.8	3493.5	3479.9	13.6	TO BE REMOVED	0-10 YEARS
235	TREE	10/11/2018	APPR34	3449.4	51.8	3501.2	3471.3	29.9	TO BE REMOVED	0-10 YEARS
236	TREE	10/11/2018	APPR34	3450.7	44.5	3495.2	3465.7	29.5	TO BE REMOVED	0-10 YEARS
237	POLE	10/11/2018	APPR34	3451.9	34.7	3486.6	3460.1	26.6	TO BE LIGHTED	0-10 YEARS
720	LOCAL ROAD	10/11/2018	APPR34	3458.6	15.0	3473.6	3453.3	20.3	TO BE RELOCATED	0-10 YEARS
721	LOCAL ROAD	10/11/2018	APPR34	3443.9	15.0	3458.9	3453.5	5.4	TO BE RELOCATED	0-10 YEARS
722	LOCAL ROAD	10/11/2018	APPR34	3491.3	15.0	3506.3	3575.5	-69.2	NO OBSTRUCTION	NO ACTION
723	LOCAL ROAD	10/11/2018	APPR34	3526.0	15.0	3541.0	3648.7	-107.7	NO OBSTRUCTION	NO ACTION
724	LOCAL ROAD	10/11/2018	APPR34	3529.5	15.0	3544.5	3654.2	-109.7	NO OBSTRUCTION	NO ACTION
725	PRIVATE ROAD	10/11/2018	APPR34	3527.3	10.0	3537.3	3710.5	-173.2	NO OBSTRUCTION	NO ACTION
727	LOCAL ROAD	10/11/2018	APPR34	3538.7	15.0	3553.7	3692.4	-138.7	NO OBSTRUCTION	NO ACTION
728	LOCAL ROAD	10/11/2018	APPR34	3524.1	15.0	3539.1	3661.8	-122.7	NO OBSTRUCTION	NO ACTION
729	LOCAL ROAD	10/11/2018	APPR34	3521.9	15.0	3536.9	3648.3	-111.4	NO OBSTRUCTION	NO ACTION

FAR PART 77 HELICOPTER PRIMARY SURFACE OBSTRUCTIONS										
OBSTACLE ID	DESCRIPTION	SURVEY DATE	SURFACE	GROUND ELEVATION (FT)	AGL (FT)	TOP HEIGHT (FT)	SURFACE HEIGHT (FT)	PENETRATION (FT)	DISPOSITION	
374	HELIPAD LIGHT	10/11/2018	PRIM HELI	3404.6	2.5	3407.1	3404.2	2.9	FIXED BY FUNCTION	NO ACTION
387	TREE	10/11/2018	PRIM HELI	3390.8	36.0	3426.7	3404.4	22.3	TO BE REMOVED	0-10 YEARS
388	TREE	10/11/2018	PRIM HELI	3393.7	31.5	3425.3	3404.4	20.9	TO BE REMOVED	0-10 YEARS

FAR PART 77 HELICOPTER 16 APPROACH SURFACE OBSTRUCTIONS										
OBSTACLE ID	DESCRIPTION	SURVEY DATE	SURFACE	GROUND ELEVATION (FT)	AGL (FT)	TOP HEIGHT (FT)	SURFACE HEIGHT (FT)	PENETRATION (FT)	DISPOSITION	
386	TREE	10/11/2018	APPR 16 HELI	3388.5	32.3	3420.8	3411.1	9.7	TO BE REMOVED	0-10 YEARS
731	LOCAL ROAD	10/11/2018	APPR 16 HELI	3390.9	15.0	3405.9	3471.7	-65.8	NO OBSTRUCTION	NO ACTION
732	LOCAL ROAD	10/11/2018	APPR 16 HELI	3384.7	15.0	3399.7	3472.2	-72.5	NO OBSTRUCTION	NO ACTION

FAR PART 77 HELICOPTER 34 APPROACH SURFACE OBSTRUCTIONS										
OBSTACLE ID	DESCRIPTION	SURVEY DATE	SURFACE	GROUND ELEVATION (FT)	AGL (FT)	TOP HEIGHT (FT)	SURFACE HEIGHT (FT)	PENETRATION (FT)	DISPOSITION	
371	GROUND	10/11/2018	APPR 34 HELI	3408.3	0.0	3408.3	3416.1	-7.8	NO OBSTRUCTION	NO ACTION
372	GROUND	10/11/2018	APPR 34 HELI	3406.9	0.0	3406.9	3414.4	-4.6	NO OBSTRUCTION	NO ACTION

FAR PART 77 HELICOPTER TRANSITIONAL SURFACE OBSTRUCTIONS	
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RUNWAY 16 (EXISTING) DEPARTURE SURFACE OBSTRUCTIONS										
OBSTACLE ID	DESCRIPTION	SURVEY DATE	SURFACE	GROUND ELEVATION (FT)	AGL (FT)	TOP HEIGHT (FT)	SURFACE HEIGHT (FT)	PENETRATION (FT)	DISPOSITION	MITIGATION TIMEFRAME
216	TREE	10/11/2018	DEPART RW34 (E)	3459.9	73.6	3529.5	3529.9	3.6	TO BE REMOVED	15-20 YEARS
217	TREE	10/11/2018	DEPART RW34 (E)	3461.6	82.0	3543.6	3530.3	13.2	TO BE REMOVED	15-20 YEARS
222	TREE	10/11/2018	DEPART RW34 (E)	3457.6	63.1	3520.7	3528.3	-7.6	NO OBSTRUCTION	NO ACTION
224	TREE	10/11/2018	DEPART RW34 (E)	3444.5	68.7	3513.2	3523.0	-9.9	NO OBSTRUCTION	NO ACTION
226	TREE	10/11/2018	DEPART RW34 (E)	3449.1	69.1	3518.3	3526.0	-7.8	NO OBSTRUCTION	NO ACTION
235	TREE	10/11/2018	DEPART RW34 (E)	3449.4	51.8	3501.2	3501.0	0.2	TO BE REMOVED	15-20 YEARS
236	TREE	10/11/2018	DEPART RW34 (E)	3450.7	44.5	3495.2	3496.2	-1.0	NO OBSTRUCTION	NO ACTION
237	POLE	10/11/2018	DEPART RW34 (E)	3451.9	34.7	3486.6	3491.4	-4.8	NO OBSTRUCTION	NO ACTION
238	CATENARY	10/11/2018	DEPART RW34 (E)	3456.3	29.6	3485.8	3491.3	-5.5	NO OBSTRUCTION	NO ACTION
239	RUNWAY LIGHT	10/11/2018	DEPART RW34 (E)	3459.6	1.1	3460.8	3459.7	1.1	FIXED BY FUNCTION	NO ACTION
240	RUNWAY LIGHT	10/11/2018	DEPART RW34 (E)	3459.5	1.3	3460.8	3459.7	1.1	FIXED BY FUNCTION	NO ACTION
241	TREE	10/11/2018	DEPART RW34 (E)	3452.4	43.4	3495.8	3481.2	14.6	TO BE REMOVED	15-20 YEARS
242	TREE	10/11/2018	DEPART RW34 (E)	3454.8	29.8	3484.6	3478.1	6.4	TO BE REMOVED	15-20 YEARS
243	TREE	10/11/2018	DEPART RW34 (E)	3452.8	40.3	3493.1	3481.8	11.4	TO BE REMOVED	15-20 YEARS
244	TREE	10/11/2018	DEPART RW34 (E)	3449.8	44.2	3494.1	3483.3	10.7	TO BE REMOVED	15-20 YEARS
245	TREE	10/11/2018	DEPART RW34 (E)	3447.8	47.7	3495.5	3482.9	12.5	TO BE REMOVED	15-20 YEARS
246	CATENARY	10/11/2018	DEPART RW34 (E)	3449.0	36.2	3485.3	3484.7	0.6	TO BE LIGHTED	15-20 YEARS
247	TREE	10/11/2018	DEPART RW34 (E)	3453.2	40.7	3493.9	3475.7	18.1	TO BE REMOVED	15-20 YEARS
248	TREE	10/11/2018	DEPART RW34 (E)	3455.0	26.0	3481.0	3474.4	6.6	TO BE REMOVED	15-20 YEARS
249	TREE	10/11/2018	DEPART RW34 (E)	3454.6	40.1	3494.7	3472.2	22.4	TO BE REMOVED	15-20 YEARS
250	TREE	10/11/2018	DEPART RW34 (E)	3452.8	40.1	3493.0	3467.1	25.9	TO BE REMOVED	15-20 YEARS
251	TREE	10/11/2018	DEPART RW34 (E)	3451.4	45.2	3496.6	3464.4	32.2	TO BE REMOVED	15-20 YEARS
253	TREE	10/11/2018	DEPART RW34 (E)	3451.9	35.3	3487.2	3461.3	25.9	TO BE REMOVED	15-20 YEARS
256	TREE	10/11/2018	DEPART RW34 (E)	3450.9	34.9	3485.9	3478.2	7.7	TO BE REMOVED	15-20 YEARS
598	GROUND	10/11/2018	DEPART RW34 (E)	3461.5	0.0	3461.5	3464.2	-2.7	NO OBSTRUCTION	NO ACTION
599	GROUND	10/11/2018	DEPART RW34 (E)	3464.0	0.0	3464.0	3464.2	-0.2	NO OBSTRUCTION	NO ACTION
603	FENCE	10/11/2018	DEPART RW34 (E)	3467.1	3.4	3470.6	3468.0	2.5	TO BE LIGHTED	15-20 YEARS
618	TREE	10/11/2018	DEPART RW34 (E)	3466.1	36.6	3502.7	3485.7	17.0	TO BE REMOVED	15-20 YEARS
619	POLE	10/11/2018	DEPART RW34 (E)	3466.0	38.1	3504.1	3489.8	14.3	TO BE LIGHTED	15-20 YEARS
620	POLE	10/11/2018	DEPART RW34 (E)	3459.9	33.9	3493.8	3490.9	2.8	TO BE LIGHTED	15-20 YEARS
621	POLE	10/11/2018	DEPART RW34 (E)	3466.6	37.8	3504.4	3498.7	5.7	TO BE LIGHTED	15-20 YEARS
622	TREE	10/11/2018	DEPART RW34 (E)	3472.7	53.6	3526.3	3502.8	23.5	TO BE REMOVED	15-20 YEARS
623	TREE	10/11/2018	DEPART RW34 (E)	3472.0	49.9	3521.9	3508.9	12.9	TO BE REMOVED	15-20 YEARS
624	TREE	10/11/2018	DEPART RW34 (E)	3469.3	59.0	3528.3	3513.0	15.3	TO BE REMOVED	15-20 YEARS
681	PRIMARY ROAD	10/11/2018	DEPART RW34 (E)	3451.6	15.0	3466.6	3459.9	6.7	TO BE RELOCATED	15-20 YEARS
695	LOCAL ROAD	10/11/2018	DEPART RW34 (E)	3469.8	15.0	3484.8	3492.2	-7.4	NO OBSTRUCTION	NO ACTION
696	LOCAL ROAD	10/11/2018	DEPART RW34 (E)	3441.4	15.0	3456.4	3489.9	-33.5	NO OBSTRUCTION	NO ACTION
697	LOCAL ROAD	10/11/2018	DEPART RW34 (E)	3535.2	15.0	3550.2	3657.8	-107.6	NO OBSTRUCTION	NO ACTION
698	LOCAL ROAD	10/11/2018	DEPART RW34 (E)	3543.0	15.0	3558.0	3697.9	-139.9	NO OBSTRUCTION	NO ACTION
699	PRIVATE ROAD	10/11/2018	DEPART RW34 (E)	3520.0	10.0	3530.0	3714.5	-184.4	NO OBSTRUCTION	NO ACTION
700	PRIVATE ROAD	10/11/2018	DEPART RW34 (E)	3513.6	10.0	3523.6	3707.0	-183.4	NO OBSTRUCTION	NO ACTION
701	LOCAL ROAD	10/11/2018	DEPART RW34 (E)	3492.6	15.0	3507.6	3657.4	-149.8	NO OBSTRUCTION	NO ACTION
702	PRIVATE ROAD	10/11/2018	DEPART RW34 (E)	3549.2	10.0	3559.2	3714.5	-155.3	NO OBSTRUCTION	NO ACTION
703	PRIVATE ROAD	10/11/2018	DEPART RW34 (E)	3529.8	10.0	3539.8	3714.5	-174.7	NO OBSTRUCTION	NO ACTION
704	LOCAL ROAD	10/11/2018	DEPART RW34 (E)	3528.9	15.0	3543.9	3714.5	-170.6	NO OBSTRUCTION	NO ACTION
705	LOCAL ROAD	10/11/2018	DEPART RW34 (E)	3563.4	15.0	3578.4	3714.5	-136.1	NO OBSTRUCTION	NO ACTION
706	LOCAL ROAD	10/11/2018	DEPART RW34 (E)	3544.3	15.0	3559.3	3714.5	-155.2	NO OBSTRUCTION	NO ACTION

RUNWAY 16 (FUTURE) DEPARTURE SURFACE OBSTRUCTIONS										
OBSTACLE ID	DESCRIPTION	SURVEY DATE	SURFACE	GROUND ELEVATION (FT)	AGL (FT)	TOP HEIGHT (FT)	SURFACE HEIGHT (FT)	PENETRATION (FT)	DISPOSITION	MITIGATION TIMEFRAME
1	TREE	10/11/2018	DEPART RW34 (F)	3470.3	69.9	3540.3	3547.6	-7.4	NO OBSTRUCTION	NO ACTION
11	TREE	10/11/2018	DEPART RW34 (F)	3469.0	60.7	3529.7	3533.1	-3.4	NO OBSTRUCTION	NO ACTION
12	TREE	10/11/2018	DEPART RW34 (F)	3465.8	59.3	3525.1	3532.9	-7.8	NO OBSTRUCTION	NO ACTION
13	TREE	10/11/2018	DEPART RW34 (F)	3465.2	65.2	3530.4	3532.6	-2.3	NO OBSTRUCTION	NO ACTION
17	TREE	10/11/2018	DEPART RW34 (F)	3462.0	48.5	3510.5	3508.2	2.3	TO BE REMOVED	15-20 YEARS
131	TREE	10/11/2018	DEPART RW34 (F)	3519.2	48.5	3567.6	3575.5	-7.9	NO OBSTRUCTION	NO ACTION
134	TREE	10/11/2018	DEPART RW34 (F)	3514.3	69.9	3584.1	3574.7	9.4	TO BE REMOVED	15-20 YEARS
135	TREE	10/11/2018	DEPART RW34 (F)	3510.7	69.0	3579.7	3571.8	7.9	TO BE REMOVED	15-20 YEARS
137	TREE	10/11/2018	DEPART RW34 (F)	3505.1	57.1	3562.2	3570.9	-8.8	NO OBSTRUCTION	NO ACTION
138	TREE	10/11/2018	DEPART RW34 (F)	3506.1	54.9	3561.0	3570.6	-9.5	NO OBSTRUCTION	NO ACTION
142	TREE	10/11/2018	DEPART RW34 (F)	3500.4	61.2	3561.6	3570.7	-9.2	NO OBSTRUCTION	NO ACTION





# Chapter 7: Strategies & Actions, Capital Improvement Plan, and Financial Plan

The purpose of this chapter is to provide an implementable plan for the key facility improvements identified in Chapter 4: Facility Goals and Requirements that were analyzed in Chapter 5: Development Alternatives and depicted in Chapter 6: Airport Layout Plan.

## Introduction

The implementation planning process began with the identification of several key improvement areas based on the public involvement process and general consensus on the direction of the Airport and the relevant strategies and actions intended to facilitate discussion in Regional Stakeholder Meeting #2 and PAC Meeting #5. The process was designed to confirm priorities with stakeholders, and provide future direction for City staff. The implementation planning phase also includes the development of the 20-year Airport Capital Improvement Program (ACIP) and projections of anticipated airport operating revenue and expenses in the form of a financial plan for the 20-year planning period.

## Strategies and Actions

The strategies and actions identified in Table 7-1 were developed due to airport management's request for clear and concise list of actions that may be required to implement specific land use, transportation, and environmental projects required to achieve the desired outcome. It was intended that this supplemental effort would ensure:

- Airport improvements identified throughout the planning process were linked to other activities within the community's capital improvement program.
- Land-use regulations that needed to be adjusted to reflect the plan's goals would be accomplished within a reasonable timeline.
- Clear direction on responsibilities, schedule, and funding was provided.
- Key players and agencies responsible for implementing each element of the plan were identified.

Several "Key Improvement Areas" were developed based on stakeholder involvement, public meetings, and numerous conversations and meetings with airport management, FAA staff, County planners, and additional City staff. The key improvement areas identified to organize the proposed strategies and actions for further consideration included:

### AIRPORT MASTER PLAN (AMP) ADOPTION AND IMPLEMENTATION

Early in the scoping process airport management expressed the need for a planning document that laid the groundwork for future adoption of the AMP into the Deschutes County Comprehensive Plan. City staff also identified a need for the plan to address the challenges associated with obtaining County approval to develop on the Airport. Throughout the planning



process, planners were mindful of these issues and the necessary steps that would serve as a continuation of the planning process, but would follow the completion of the AMP as separate ongoing actions to be completed at the local level.

## AIRSPACE CONGESTION

Throughout the planning process airport users and neighbors expressed serious concerns about air traffic congestion and noise. Due to the high activity at the Airport it became clear that an Air Traffic Control Tower (ATCT) was the single most important facility improvement for the future of the Bend Municipal Airport. Since the City's selection of the Preferred Alternative, airport management have been pursuing funding options and working through the process of developing a site selection study and the ultimate design and construction of an ATCT. Airport management are also involved in regular and ongoing conversations and meetings with airport users and airport neighbors to address noise concerns and to maintain and update the "Airport Fly-Friendly Program".

## SURFACE TRANSPORTATION

Surface transportation issues both on and off the airport were discussed in some detail during the facility requirements and alternatives process. Deschutes County has identified a roundabout for construction at the Powell Butt Highway and Butler Market intersection in the near future and it was clear that this would be an ideal time to coordinate much needed access improvements to the Airport. The possibility of constructing the roundabout in conjunction with a westside parking/frontage road improvement project was also considered. However, due to the costs associated with constructing airport parking and frontage road improvements and the need to develop a design consistent with the imminent roundabout, it was determined that the projects would likely occur independently. The need for improved access and additional parking on the westside of the Airport is still a major concern for many users. Additional surface transportation issues of importance identified for further consideration include the Powell Butte Highway/RPZ analysis (required before the Runway 16-34 extension can occur), the relocation of Nelson Road to accommodate an ultimate runway length of 7,660', and improved eastside access roads to accommodate existing and future delivery trucks, future employees, and additional general aviation hangar development.

## EASTSIDE AVIATION DEVELOPMENT

During the development of the alternatives, several potential developers had reached out to airport management with proposals to develop new hangars on the eastside. Some

of these proposals have broken ground or are in the early stages of permitting approval and some have not become anything more than an idea. Due to the topography, grade challenges, and need for utility expansion, it became clear that airport management would have to coordinate closely with developers to provide orderly development of new facilities on the eastside. Numerous development projects are still in the early planning stages and proposals for future aviation-related commercial and industrial development have been discussed. City staff, working closely with County planning staff, are continuously working to reduce barriers to long-range development planning.

## AIRSIDE FACILITIES

Airside facilities depicted in Table 7-1 by approximate order of priority - as identified by project stakeholders - include the construction of an ATCT, airport perimeter fence, westside taxilane pavement/stormwater improvements, an eastside aircraft parking apron, southwest apron reconstruction, HOA Phase II expansion, and Runway 16-34 extension. Participation in the Oregon Department of Aviation (ODA) Pavement Maintenance Program (PMP) is also identified. The ongoing maintenance and expansion/improvement of federally funded airfield pavements to address existing and future capacity constraints is a continuous process in which the City coordinates regularly with FAA Airport District Office staff for a variety of permitting, environmental, design, and construction tasks.

## AIRPORT ADMINISTRATION

The ongoing efforts by airport management and City staff to identify future funding sources for major capital improvements and opportunities to achieve financial self-sufficiency are ongoing. Consultants recommend the City complete a focused Airport Business and Strategic Plan to further guide airport management through the development process. As operations continue to increase it will become even more important for continued dialogue between airport management and airport neighbors and the formation of an "Airport Neighborhood Group" may be helpful to that cause. It is also prudent that the airport create clear and concise policies/standards for development by updating the airport rules and regulations as necessary. Developing a comprehensive airport solid waste and recycling plan consistent with Deschutes County best management practices would serve as a positive step towards reducing airport generated solid waste materials and debris.



TABLE 7-1: IMPLEMENTATION STRATEGIES AND ACTIONS

KEY IMPROVEMENT AREAS	STRATEGIES	ACTIONS
Airport Master Plan Adoption and Implementation	Work with City Staff and Deschutes County to assist with AMP Adoption process	Initiate AMP Adoption with Deschutes County (Application/hearings/etc.)
	Work with Deschutes County to expedite on-airport development approvals	Update Deschutes County Zoning Code language and zoning code designations to effectively implement aviation related development
	Work with Deschutes County to further explore the future "Airport Employment District" concept	Establish "Airport Employment District" working group with County and City staff to coordinate future development on/around Bend Municipal Airport
Airspace Congestion	Design/Construct Air Traffic Control Tower (ATCT)	Secure funding for ATCT design/construction - In Process
	Work with airport users and neighbors to update "Airport Fly-Friendly Program"	Establish "Airport Neighborhood Group" comprised of airport users and neighbors to update Airport Fly-Friendly Program
	Continue to monitor and analyze aircraft operational metrics for justification of future capacity improvements	Develop FAA approved aircraft operations counting/analysis program
Surface Transportation	Improve Airport access/frontage road and vehicle parking areas in coordination with County roundabout project at PBH and Butler Market.	Secure funding for airport access/frontage road/vehicle parking design and improvement study
	Pursue RPZ Analysis and assessment for PBH/RPZ incompatibility	Submit to FAA-HQ in coordination with future runway extension project
	Relocate Nelson Road to accommodate Ultimate runway length of 7,660'	Coordinate with Deschutes County to identify suitable alignment for relocated Nelson Road
	Improve Eastside airport access roads	Design/construct access improvements in coordination with relocated Nelson Road
Eastside Aviation Development	Coordinate with developers to provide orderly development of new facilities that exhibit efficient use of developable space	Identify suitable sites - according to "aircraft design group" - for new aviation related development
	Identify local projects that can be completed by the City of Bend and Deschutes County to generate new revenue for the Airport and improve the overall functionality of the Airport for all users	Identify/priorities and secure funding for projects such as utility improvements, taxilane extensions, etc.
	Reduce barriers to long-range development planning	Conduct comprehensive geotechnical investigation and topographic survey of developable areas to facilitate long-range development planning For large development areas, develop utilities master plan to guide City staff in development reviews with incremental tenant funded development
Airfield Facilities	Design/Construct Air Traffic Control Tower	Work with FAA to satisfy justification, environmental, and design requirements
	Design/Construct Airport Perimeter Fencing	Work with FAA to satisfy justification, environmental, and design requirements
	Design/Construct Westside Taxilane Pavement Reconstruction/Stormwater Improvements	Work with FAA to satisfy justification, environmental, and design requirements
	Design/Construct Eastside Aircraft Parking Apron	Work with FAA to satisfy justification, environmental, and design requirements
	Design/Construct Southwest Apron Reconstruction	Work with FAA to satisfy justification, environmental, and design requirements
	Ongoing Pavement Maintenance with ODA	Work with FAA/ODA to maintain federally funded airfield pavements
	Design Construct Helicopter Operations Area - Phase II	Work with FAA to satisfy justification, environmental, and design requirements
	Design/Construct Runway 16-34 Extension	Work with FAA to satisfy justification, environmental, and design requirements
Airport Administration	Identify new revenue sources and opportunities for financial self-sufficiency	Complete Airport Business/Strategic Plan
	Work with Airport neighbors to address noise concerns	Establish "Airport Neighborhood Group" to provide ongoing communication with airport users/neighbors
	Create clear, concise policies and standards for development at the Airport	Update 2018 "Bend Municipal Airport Regulations, Policies, and Guidelines"
	Reduce airport generated solid waste materials	Develop a comprehensive Airport Solid Waste and Recycling Plan.





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# Capital Improvement Plan (CIP)

The following sections outline the recommended development program and funding assumptions presented in Table 7-2: 20-Year Capital Improvement Program. The scheduling has been prepared according to the facility requirements determined through the master plan evaluation. The projected staging of development projects is based upon anticipated needs and investment priorities with input from stakeholders during the public meetings through an assessment of the presented strategies and actions depicted in Table 7-1.

Actual activity levels may vary from projected levels; therefore, the staging of development in this section should be viewed as a general guide. When activity does vary from projected levels, implementation of development projects should occur when demand warrants, rather than according to the estimated staging presented in this chapter. In addition to major projects, the airport will continue to require regular facility maintenance such as pavement maintenance, vegetation control, sweeping, lighting repair and fuel system maintenance.

The first phase of the capital improvement program includes the highest priority projects recommended during the first five years. Intermediate and long term projects are anticipated to occur in the 6 to 20 year period, although changes in demand or other conditions could accelerate or slow demand for some improvements.

## SHORT-TERM PROJECTS (YEARS 1-5)

The first priority in the short-term planning period is the completion of an Air Traffic Control Tower (ATCT) Site Selection Study. Throughout the planning process the need to address air traffic capacity constraints was identified by Airport users and project stakeholders. The remaining priorities in the first year of the planning period include adopting the completed Airport Master Plan into the Deschutes County Comprehensive Plan and a Runway 16-34 Seal Coat and Guidance Sign LED Update.

Other priorities identified in the short-term planning period include:

- Air Traffic Control Tower - Design and Construction
- Taxiway A and B Sealcoat, Edge Lighting, and Beacon
- Westside Public Restroom Construction
- Airport Perimeter Fencing - Design and Construction

## INTERMEDIATE-TERM PROJECTS (YEARS 6-10)

The intermediate-term planning period includes both airside and landside facility improvements focused on expanding aircraft parking/hangar capacity, improving vehicle parking and access, and maintaining existing airfield pavements. The projects anticipated in the intermediate term include an eastside utilities master plan, southwest taxilane reconstruction/stormwater improvements, airport access/frontage road improvements, eastside parking apron design and construction, and the construction of public restrooms on the eastside of the airfield.

## LONG-TERM PROJECTS YEARS 11-20

Long-term projects identified include an airport master plan update, southwest apron reconstruction, eastside airport access road/intersection improvements, land acquisition for Phase II expansion of the helicopter operations area (HOA), and the appurtenant projects for the planned extension of Runway 16-34 to 6,260'.

A summary of the project costs by phase is presented below in Table 7-3:

TABLE 7-3: SUMMARY OF CAPITAL IMPROVEMENT PROGRAM

PHASE	TOTAL PROJECT COST	TOTAL PLANNED FAA	TOTAL LOCAL
Short-term (Years 1-5)	\$16,756,000	\$7,124,400	\$9,631,600
Intermediate-Term (Years 6-10)	\$13,740,000	\$6,231,000	\$8,259,000
Long-Term (Years 11-20)	\$20,750,000	\$19,158,000	\$3,092,000
<b>TOTAL (YEARS 1-20)</b>	<b>\$51,246,000</b>	<b>\$32,513,400</b>	<b>\$20,982,600</b>



TABLE 7-2: 20-YEAR CAPITAL IMPROVEMENT PROGRAM

YEAR	PROJECT	PROJECT CATEGORY	PROJECT COST	FAA NPE ENTITLEMENT	OTHER FAA **	LOCAL COSTS ***
<b>Non-Primary Entitlements Accumulation Total (6-Years) Includes 2021 Carryover NPE</b>						
2022	Air Traffic Control Tower - Site Selection Study	Planning	\$250,000	\$0	\$225,000	\$25,000
	AMP Adoption - Deschutes County Comprehensive Plan	Planning	\$50,000	\$0	\$0	\$50,000
	PMP*	Pavement Maintenance	\$20,000	\$0	\$0	\$20,000
	Runway 16-34 Seal Coat and Guidance Sign LED Update	Construction	\$1,600,000	\$300,000	\$1,140,000	\$160,000
<b>SUBTOTAL - YEAR 1</b>			<b>\$1,920,000</b>	<b>\$300,000</b>	<b>\$1,365,000</b>	<b>\$255,000</b>
2023	Air Traffic Control Tower	Environmental/Design	\$750,000	\$0	\$0	\$750,000
<b>SUBTOTAL - YEAR 2</b>			<b>\$750,000</b>	<b>\$0</b>	<b>\$0</b>	<b>\$750,000</b>
2024	Air Traffic Control Tower	Construction	\$7,500,000	\$0	\$0	\$7,500,000
<b>SUBTOTAL - YEAR 3</b>			<b>\$7,500,000</b>	<b>\$0</b>	<b>\$0</b>	<b>\$7,500,000</b>
2025	Taxiway A and B Sealcoat, Edge Lighting, Beacon	Design/Construction	\$3,056,000	\$450,000	\$2,300,400	\$305,600
	Westside Public Restroom Construction (4 stall - 2 room)	Construction	\$500,000	\$0	\$0	\$500,000
	PMP*	Pavement Maintenance	\$20,000	\$0	\$0	\$20,000
<b>SUBTOTAL - YEAR 4</b>			<b>\$3,576,000</b>	<b>\$450,000</b>	<b>\$2,300,400</b>	<b>\$825,600</b>
2026	Airport Perimeter Fencing	Design/Construction	\$3,010,000	\$150,000	\$2,559,000	\$301,000
<b>SUBTOTAL - YEAR 5</b>			<b>\$3,010,000</b>	<b>\$150,000</b>	<b>\$2,559,000</b>	<b>\$301,000</b>
<b>5-YEAR TOTAL:</b>			<b>\$16,756,000</b>	<b>\$900,000</b>	<b>\$6,224,400</b>	<b>\$9,631,600</b>
<b>Non-Primary Entitlements Accumulation Total (5-Years)</b>						
2027-2031	Eastside Utilities Master Plan	Planning	\$100,000	\$0	\$0	\$100,000
	Southwest Taxilane Reconstruction/ Stormwater Improvements****	Design/Construction	\$750,000	\$0	\$0	\$750,000
	PMP*	Pavement Maintenance	\$20,000	\$0	\$0	\$20,000
	Airport Access/Frontage Road Improvements	Design/Construction	\$6,260,000	\$0	\$0	\$6,260,000
	Eastside Parking Apron	Design/Construction	\$6,090,000	\$0	\$5,481,000	\$609,000
	PMP*	Pavement Maintenance	\$20,000	\$0	\$0	\$20,000
	Eastside Public Restroom Construction (4 stall - 2 room)	Construction	\$500,000	\$0	\$0	\$500,000
<b>5-YEAR TOTAL:</b>			<b>\$13,740,000</b>	<b>\$750,000</b>	<b>\$5,481,000</b>	<b>\$8,259,000</b>
<b>Non-Primary Entitlements Accumulation Total (10-Years)</b>						
2032-2041	Airport Master Plan Update	Planning	\$500,000	\$0	\$450,000	\$50,000
	Southwest Apron Reconstruction	Design/Construction	\$3,070,000	\$0	\$2,763,000	\$307,000
	Eastside Airport Access Road/Intersection Improvements	Design/Construction	\$1,070,000	\$0	\$0	\$1,070,000
	PMP*	Pavement Maintenance	\$20,000	\$0	\$0	\$20,000
	Land Acquisition - Deschutes County Land for HOA Phase II	Planning	\$350,000	\$0	\$315,000	\$35,000
	HOA Phase II Improvements	Design/Construction	\$5,700,000	\$0	\$5,130,000	\$570,000
	PMP*	Pavement Maintenance	\$20,000	\$0	\$0	\$20,000
	Powell Butte Highway and Runway 16 RPZ Analysis	Planning	\$100,000	\$0	\$90,000	\$10,000
	PMP*	Pavement Maintenance	\$20,000	\$0	\$0	\$20,000
	Runway 16-34 Extension - Land Acquisition	Planning	\$1,500,000	\$0	\$1,350,000	\$150,000
	Relocate Nelson Road	Design/Construction	\$3,100,000	\$0	\$2,790,000	\$310,000
<b>10-YEAR TOTAL:</b>			<b>\$20,750,000</b>	<b>\$1,500,000</b>	<b>\$17,658,000</b>	<b>\$3,092,000</b>

Note: Contingencies for project engineering, and construction services are included in lump sum project costs. Environmental contingencies are not included.

\* Participation in ODA PMP/PEP program is assumed. Actual project costs and local cost share to be determined.

\*\* Other FAA Funding Total listed for reference only based on general project eligibility; FAA funding levels are expected to be below projected needs.

\*\*\* Local (City) costs at 10% (City may apply for a ODA grant for a portion of matching funds)

\*\*\*\* Cost estimate reflects local funding with work to be completed by City of Bend Streets Department.





## CAPITAL FUNDING SOURCES & PROGRAMS

Capital funding is critical to airport development and essential for project success. There are several options available for City of Bend to partner with state and federal agencies to fund the capital development requirements needed to continue operating safely, efficiently, and economically. This section describes those funding resources.

### Federal Grants

Federal funding is provided through the Federal Airport Improvement Program (AIP). The Airport Improvement Program is the latest evolution of a funding program originally authorized by Congress in 1946 as the Federal Aid to Airports Program (FAAP). The AIP provides Entitlement funds for commercial service and cargo airports based on the number of annual enplaned passengers and amount of air cargo handled. Other appropriations of AIP funds go to states, general aviation airports, reliever airports, and other commercial service airports, as well as for noise compatibility planning. Any remaining AIP funds at the national level are designated as Discretionary funds and may be used by the FAA to fund eligible projects. Discretionary funds are typically used to enhance airport capacity, safety, and/or security and are often directed to specific national priorities such as the recent program to improve Runway Safety Areas. These annual entitlement funds can only be used for eligible capital improvement projects and may not be used to support airport operation and maintenance costs.

AIP funding programs include:

- **AIP Entitlement Grants:** The FAA Reauthorization Act of 2018 was signed into law in October of 2018, extending the authorization for Federal Aviation Administration (FAA) programs, including the AIP program, and related revenue authorities through 2023. Ashland Municipal Airport is classified in the current NPIAS as a Local General Aviation Airport. FAA Order 5100.38D, Airport Improvement Handbook, adjusts the percentage of Federal shares for allowable project costs for certain states. In the Order, Table 4-8 "Federal Shares by Airport Classification in Public Land States" stipulates that the Federal match in the State of Oregon is 90-percent for Non-primary General Aviation airports.
- **AIP Discretionary Grants:** The FAA also provides Discretionary grants to airports for projects that have a high Federal priority and enhance safety, security, or capacity. These grants are over and above Entitlement funding. Discretionary grant amounts can vary significantly compared to Entitlements and are awarded at the FAA's sole discretion. Discretionary grant applications are evaluated based on need, the FAA's project priority ranking system, and the FAA's assessment of a project's significance within the national airport and airway system.
- **FAA Facilities and Equipment Funds.** Additional funds are available under the FAA Facilities and Equipment Program. Money is available in the FAA Facilities and Equipment (F&E) program to purchase

navigation aids and air safety-related technical equipment, including Airport Traffic Control Towers (ATCTs) for use at commercial service airports in the National Airport System. Each F&E project is evaluated independently using a cost-benefit analysis to determine funding eligibility and priority ranking. Qualified projects are funded in total (i.e., 100 percent) by the FAA, while remaining projects would likely be eligible for funding through the AIP or PFC programs. In addition, an airport can apply for NAVAID maintenance funding through the F&E program for those facilities not funded through the F&E program

FAA funding is limited to projects that have a clearly defined need and are identified through preparation of an FAA approved Airport Layout Plan (ALP). Periodic updates of the ALP are required when new or unanticipated project needs or opportunities exist that require use of FAA funds and to reflect the status of completed projects. The FAA will generally not participate in projects involving vehicle parking, utilities, building renovations, or projects associated with non-aviation development.

Projects such as hangar construction or fuel systems are eligible for funding, although the FAA considers this category of project to be considered a much lower priority than other airfield needs.

### State of Oregon

No specific level of Oregon Department of Aviation (ODA) funding has been assumed in the CIP presented in Table 7-2. It is recommended that the city maximize use of any ODA or other State funding available in the planning period.

### Pavement Maintenance Program

The Pavement Management Program (PMP) programs airfield pavement maintenance funds on established multi-year cycles. The PMP is funded by a portion of the fuel tax revenues. Forty-five percent of the original fuel taxes collected (\$0.01/gallon on Jet-A and \$0.09/gallon on AVGAS) are used to fund the PMP. (It should be noted that the remainder of the revenues collected from the original \$0.01/gallon Jet-A and \$0.09/gallon AVGAS fuel taxes equaling 55 percent are used to fund the operation of Oregon's 28 state owned airports and ODA administrative costs.) This program is intended to preserve and maintain existing airfield pavements in order to maximize their useful lives and the economic value of the pavement. Several short-term pavement maintenance projects are identified in the most recent PMP as noted earlier. The program funds pavement maintenance and associated improvements (crack filling, repair, sealcoats, etc.), including some items that have not traditionally been eligible for FAA funding.

Funding for the PMP is generated through collection of aviation fuel taxes. ODA manages the PMP through an annual consultant services contract and work is programmed on a three-year regional rotation. The program includes a



regular schedule of inspections and subsequent field work.

Benefits from the PMP include:

- Economy of scale in bidding contracts;
- Federal/State/Local partnerships that maximize airport improvement funds; and
- PMP is not a grant program and local match is on a sliding scale (50% - 5% required).
- The PMP includes the following features:
- Review prior year's Pavement Condition Index (PCI) reports;
- Only consider PCIs below 70;
- Apply budget;
- Limit work to patching, crack sealing, fog sealing, slurry sealing;
- Add allowance for markings; and
- Program to include approximately 20 airports per year, depending on funding levels.

#### Financial Aid To Municipalities (Fam) Grants

ODA's Financial Aid to Municipalities (FAM) grant program has been suspended in recent years due to a lack of funding. House Bill 2075 (discussed later in this chapter) established a new source of funding revenue for aviation programs within the state. This bill resulted in the creation of three new programs that have essentially replaced FAM Grants. In order to facilitate these new programs, the rules used to administer funds under FAM have been amended to incorporate the language of House Bill 2075 and serve as the funding mechanism for these new programs.

#### Connect Oregon Grants

The Oregon Legislature authorized funding for air, marine, rail, and transit infrastructure, known as ConnectOregon in 2005. This program is intended to improve commerce, reduce delay, and enhance safety for the state's multi-modal transportation system.

Lottery-based bonds, sold by the Oregon Department of Administrative Services are used to fund the program. The funds are deposited into Oregon's Multimodal Transportation Fund and administered by the Oregon Department of Transportation Local Government Section. ConnectOregon funds cannot be used for projects eligible for Oregon's Highway Fund, thereby providing less competition for aviation projects seeking ConnectOregon funding.

In 2014, after the fifth installment of funding, the Legislature had provided \$382 million to the program. Connect Oregon grants fund up to 80-percent of project costs with a 20-percent sponsor match and loans up to 100-percent of project costs.

#### House Bill 2075

House Bill 2075 (HR 2075) increased the tax on aircraft fuels, providing new revenues for the State Aviation Account. HR 2075 increased the fuel tax on both Jet-A and AVGAS by

\$0.02/gallon resulting in a new tax on Jet-A of \$0.03 per gallon and AVGAS of \$0.11 per gallon. The additional \$0.02/gallon in revenues on Jet-A and AVGAS generated by HR 2075 will be distributed to fund a variety of aviation needs through ODA's new Aviation System Action Program (ASAP) fund.

ASAP allocates and distributes the additional \$0.02/gallon revenues generated by HR 2075 among three new programs: COAR - Critical Oregon Airport Relief Program; ROAR – Rural Oregon Aviation Relief Program; and SOAR – State Owned Airports Reserve Program. The specific programs are outlined below.

COAR - Fifty percent of the revenues from the \$0.02/gallon fuel tax increase will be distributed as follows:

- (A) To assist airports in Oregon with match requirements for Federal Aviation Administration (FAA) Airport Improvement Program grants;
- (B) To make grants for emergency preparedness and infrastructure projects, in accordance with the Oregon Resilience Plan, including seismic studies, emergency generators, etc.;
- (C) To make grants for:
  1. Services critical or essential to aviation including, but not limited to, fuel, sewer, water and weather equipment.
  2. Aviation-related business development including, but not limited to, hangars, parking for business aircraft and related facilities.
  3. Airport development for local economic benefit including, but not limited to, signs and marketing.

ROAR – Twenty-five percent of the revenues from the \$0.02/gallon fuel tax increase will be distributed to assist commercial air service to rural Oregon.

SOAR – Twenty-five percent of the revenues from the \$0.02/gallon fuel tax increase will be distributed to state owned airports for:

- (A) Safety improvements recommended by the Oregon State Aviation Board and local community airports;
- (B) Infrastructure projects at public use airports.

#### State Capital Improvement Program (SCIP)

The FAA's Seattle Airport District Office (ADO) is working with state aviation agencies in Oregon and Washington to develop a coordinated "State" Capital Improvement Program, known as the SCIP. The SCIP is intended to become the primary tool used by FAA, state aviation agencies, and local airport sponsors to prioritize funding. The program has reached full



implementation with current and near-term future funding decisions prioritized through evaluation formulas. Airport sponsors are asked to provide annual updates to their short-term project lists in order to maintain a current system of defined project needs. The short-term priorities identified in the master plan CIP will be imported into the SCIP and will be subject to additional prioritization for funding in competitive statewide evaluations.

### **Local Funding**

The locally funded (city/tenant) portion of the CIP for the twenty-year planning period is estimated to be approximately \$1,950,100 as currently defined. Hangar and building construction and maintenance costs have not been included in the CIP, since no FAA funding is assumed.

A portion of local matching funds are generated through airport revenues, including fuel sales, land leases, and hangar rentals. Airport sponsors occasionally fund infrastructure and revenue-generating development, including hangars and buildings, either through an inter fund loan or the issuance of long-term debt (revenue or general obligation bonds).



# Financial Plan

Projections of the airport operating revenue and expenses have been prepared in coordination with City of Bend staff to account for the first six years of the 20-year CIP presented in Table 7-2. The City of Bend staff provided a summary of the most recent complete year (FY2021) of financial data to be used as the baseline for the revenue and expense projections. Specific assumptions regarding potential changes in expenses or revenues was coordinated between the City of Bend and consultants and reflects the general time frame for major revenue-generating projects or increased maintenance or operational costs. Many of the projections presented within will not accurately reflect existing or anticipated City of Bend budget estimates due to project phasing and grant cycle/payment delays that cannot be accounted for in this analysis. The purpose of this financial projection is to identify the levels of airport-generated funding that may be available to support the capital improvement program during the current planning period.

## AIRPORT REVENUE PROJECTIONS

The FY2021 actual revenues for Bend Municipal Airport presented in Table 7-4 identifies \$1,371,214 in revenue including FAA grant funds and outside loan proceeds. Due to the implementation of the 2020 Airport Market Rate Appraisal, FY21 annual fee revenue (exclusive of FAA grants and outside loans) increased to \$1.15M from the \$970,700 presented in Table 2-10. Additionally, FY2021 Hangar and Ground Lease revenue includes some FY2020 rents that were paused during the first several months of the COVID-19 pandemic and collected in FY2021 when the pause period ended. The City anticipates a minimum of 3% increase each year for ground and hangar and building leases until the next market rate appraisal in 2025, ground lease revenue takes a larger bump in FY2022 due to an anticipated one-time significant payment, and then returns to baseline projections with an anticipated annual increase of at least 3%. The remaining revenue projections from tiedown fees, fuel flowage fees and ROW leases are anticipated to increase at approximately 1-3% each year. Miscellaneous revenue projections are not included in this projection because it is not a reliable/secure source of revenue. The FAA grant funding and loan proceeds included in the projections is not guaranteed. However, to obtain a comprehensive understanding of the projected financial needs, FAA grants (90% of total project cost) and loan proceeds were included in the analysis as determined by major construction projects presented in the CIP in Table 7-2.

## AIRPORT EXPENSE PROJECTIONS

Airport Operating Expenses are trending at just under \$1.1M annually, and trend at 1%-3% increase annually. The net result being that Airport annual fee revenue covers annual operating costs without support from the City's General Fund. This is a significant financial milestone. When major construction projects are factored in to the projections, it is evident that additional sources of revenue will need to be identified to make up for future funding shortages.

In reviewing the Airport's operating expenses, one full-time airport manager, and two part-time administrative and maintenance personnel cost approximately \$300,000 to \$400,000 annually for salaries and benefits over the planning period. The City will charge the Airport approximately \$400,000 annually for City services including finance, legal, human resources, and procurement over the period. In addition, the Airport's materials and services are budgeted at between \$200,000 to \$268,000. Capital outlays for vehicles and equipment are not planned to exceed \$40,000. Debt Service and Major Construction projects are included to depict planning FAA grants and outside loans anticipated during the planning period.

## SUMMARY OF REVENUE/EXPENSE PROJECTIONS

As previously mentioned, annual fee revenues collected cover annual operating costs without support from the City's general fund. When major construction projects are factored in to the analysis it becomes clear that additional revenues will be required to match federal grants and make timely payments of obligated debts. Ongoing capital improvement expenditures will include a local match for federal grants and the full or partial cost of projects not eligible for FAA funding. The City of Bend will need to evaluate the financial feasibility and timing of major capital projects. The option of public-private partnerships, state grant funding, or other cost sharing arrangements may also be explored for projects not eligible for FAA funding. These decisions should be made based on market conditions, expected return on investment, and any intangible benefits provided to the community or specific user groups that would result from the project.



TABLE 7-4: AIRPORT FINANCIAL PLAN

AIRPORT REVENUE	FY2021 (ACTUAL)	FY2022	FY2023	FY2024	FY2025	FY2026	FY2027
Tiedown Fees	\$14,637	\$15,600	\$16,000	\$16,522	\$17,018	\$17,528	\$18,054
Fuel Flowage Fees	\$59,933	\$60,733	\$61,533	\$62,333	\$63,133	\$63,933	\$64,733
Ground Leases	\$569,473	\$578,790	\$535,115	\$549,464	\$564,242	\$579,465	\$595,144
Hangar Leases	\$404,503	\$391,873	\$403,630	\$415,739	\$428,211	\$441,057	\$454,289
Building Leases	\$56,598	\$67,500	\$69,507	\$71,574	\$73,704	\$75,897	\$78,156
ROW Leases	\$14,739	\$15,144	\$15,598	\$16,066	\$16,548	\$17,044	\$17,556
Miscellaneous Revenue	\$42,440	\$0	\$0	\$0	\$0	\$0	\$0
FAA Grant Proceeds	\$104,291	\$1,665,000	\$0	\$0	\$2,750,400	\$2,709,000	0
Loan Proceeds	\$104,600	\$0	\$750,000	\$7,500,000	\$500,000	\$0	\$0
<b>TOTAL AIRPORT REVENUES</b>	<b>\$1,371,214</b>	<b>\$2,794,640</b>	<b>\$1,851,383</b>	<b>\$8,631,698</b>	<b>\$4,413,256</b>	<b>\$3,903,924</b>	<b>\$1,227,932</b>
AIRPORT EXPENSES							
Airport Personnel Services	(\$280,691)	(\$361,100)	(\$384,100)	(\$389,915)	(\$403,285)	(\$419,118)	(\$419,118)
City Administration & Support Services	(\$341,357)	(\$380,300)	(\$381,300)	(\$382,374)	(\$391,632)	(\$402,056)	(\$413,097)
Materials and Services	(\$131,713)	(\$268,600)	(\$204,900)	(\$209,408)	(\$214,015)	(\$218,723)	(\$223,535)
Capital Outlay	(\$34,010)	\$0	(\$36,500)	\$0	\$0	\$0	\$0
Debt Service	(\$165,008)	(\$67,000)	(\$65,000)	(\$778,000)	(\$775,000)	(\$773,000)	(\$778,000)
Major Construction Projects	(\$139,266)	(\$1,920,000)	(\$750,000)	(\$7,500,000)	(\$3,576,000)	(\$3,010,000)	(\$100,000)
<b>TOTAL AIRPORT OPERATING EXPENSES</b>	<b>(\$1,092,045)</b>	<b>(\$2,997,000)</b>	<b>(\$1,785,300)</b>	<b>(\$9,259,697)</b>	<b>(\$5,359,932)</b>	<b>(\$4,822,897)</b>	<b>(\$1,933,750)</b>
<b>NET OPERATING INCOME</b>	<b>\$279,169</b>	<b>(\$202,360)</b>	<b>\$66,083</b>	<b>(\$627,999)</b>	<b>(\$3,697,076)</b>	<b>(\$877,573)</b>	<b>\$2,003,182</b>

Notes: Airport Financial Plan projections presented above do not accurately reflect existing or anticipated City of Bend budget estimates due to project phasing and grant cycle/payment delays that cannot be accounted for in this analysis.

# Appendices

**Appendix A: Cultural Resources Survey**

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**Appendix B: Environmental Screening**

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**Appendix C: Noise Contour Data Inputs/Output**

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**Appendix D: Recycling and Solid Waste Management**

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**Appendix E: Preliminary ATCT Analysis**

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**Appendix F: Glossary of Aviation Terms and Abbreviations**

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## Appendix A: Cultural Resources Survey

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Report #

SHPO Use

Year: 2019

# State Historic Preservation Office

## Report Cover Page

Title: Cultural Resource Survey for the Bend Municipal Airport Master Plan, Deschutes County, Oregon

**REPORT**

Author(s): Carmen Sarjeant and Lucie Tisdale

Agency/Client: Archaeological Investigations Northwest, Inc. (AINW)

District/Contractor: Century West Engineering Corporation

Agency/Client Report#: AINW Report No. 4136

Project Acres: 56

Survey Acres: 5.4

County(ies): Deschutes					
Township:		Range:		Section(s):	
17	S	13	E	20	

**TESTING**

Archaeological Permit Number(s):

Accession Number:

Reports submitted to: Tribes:  UOMNCH:  LCIS: 

Curation:

Report Addresses Testing: **CONSULTATION**Have tribes been contacted or consulted? 

List tribes:

List any other groups contacted or consulted:

**PA/  
MOA**Report is associated with: PA  MOA **REPORTS WITHOUT A COMPLETE AND ACCURATE COVER PAGE AND APPROPRIATE ADDITIONAL PAGES MAY BE RETURNED. CHECK THE SHPO WEBSITE TO MAKE SURE YOU HAVE THE MOST CURRENT VERSION.**



Report #  
SHPO Use

*State Historic Preservation Office  
Report Summary of Resources  
and NRHP Eligibility*

RESOURCES      Archaeological:  
Site:      Isolate:      Built Environment:      TCP:      HPRCSIT:      Other:  
Count:      1      0      0      0      0      0

**\*Please be sure all archaeological forms have been submitted on-line**

**EVALUATE PROPERTIES UNDER ALL FOUR CRITERIA.  
BE SURE TO INCLUDE JUSTIFICATION IN THE REPORT**

Oregon  
On-Line

Form #: Trinomial: Temp# or Name: Criterion A: Criterion B: Criterion C: Criterion D:  
22895      18/2763-1      Not Eligible      Not Eligible      Not Eligible      Not Eligible

NRHP ELIGIBILITY



May 22, 2019

REPORT NO. 4136

Archaeological Investigations Northwest, Inc.

# CULTURAL RESOURCE SURVEY FOR THE BEND MUNICIPAL AIRPORT MASTER PLAN, DESCHUTES COUNTY, OREGON

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<b>PROJECT:</b>	Bend Municipal Airport Master Plan update for expansion and development
<b>TYPE:</b>	Cultural resource survey
<b>LOCATION:</b>	Section 20, Township 17 South, Range 13 East, Willamette Meridian
<b>USGS QUAD:</b>	<i>Bend Airport, OR</i> , 7.5-minute, 2017
<b>COUNTY:</b>	Deschutes
<b>APE:</b>	56 acres
<b>AREA SURVEYED:</b>	5.4 acres
<b>FINDINGS:</b>	<p><i>Archaeological Resources</i></p> <ul style="list-style-type: none"><li>• A linear stone rubble alignment and a small scatter of historic-period debris were found in the APE (temporary site number 18/2763-1).</li><li>• Historic-period site 18/2763-1 is recommended to be not eligible for listing in the National Register of Historic Places (NRHP).</li></ul> <p><i>Historic Resources</i></p> <ul style="list-style-type: none"><li>• Two individual historic-period buildings were identified within the Bend Municipal Airport on the west side of the runway. AINW recommends that the two buildings be evaluated for NRHP eligibility.</li></ul>
<b>PREPARERS:</b>	Carmen Sarjeant, Ph.D., R.P.A., and Lucie Tisdale, M.A., R.P.A.

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## INTRODUCTION

Century West Engineering Corporation has contracted with Archaeological Investigations Northwest, Inc. (AINW), to conduct a cultural resource study for the Bend Municipal Airport (Airport). The Airport is owned and operated by the City of Bend (City). The City, in cooperation with the Federal Aviation Administration (FAA), is preparing an Airport Master Plan update. The Airport is in northeast unincorporated Deschutes County, Oregon, 3 kilometers (km) (1.9 miles [mi]) east of the city limits of Bend (Figure 1).

The current project Area of Potential Effects (APE) encompasses two separate locations within Airport lands. The first APE location is an area not previously surveyed south of the existing runway and north of Nelson Road and is 5.4 acres in size (Figures 1 and 2). Since no historic-period buildings or structures were identified within the 5.4 acres, this area was archaeologically surveyed and is designated the 5.4-acre APE throughout the report. AINW reviewed historic maps and aerial photographs to identify historic-period buildings within the Airport property situated between the runway and Powell Butte Road (Figure 2). This area is the second APE location.

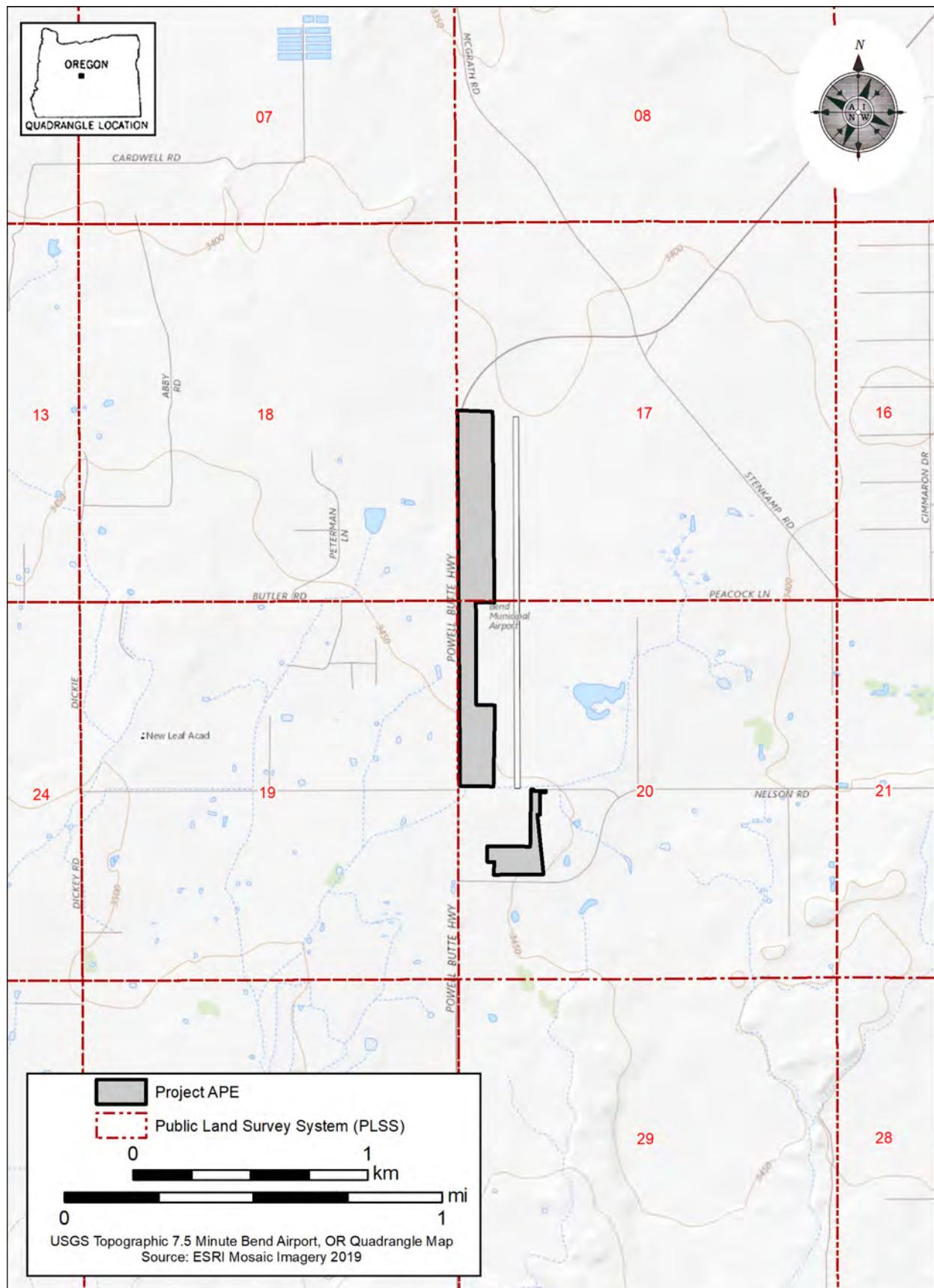


Figure 1. The location of the project APE for the Bend Municipal Airport Master Plan, Deschutes County, Oregon.

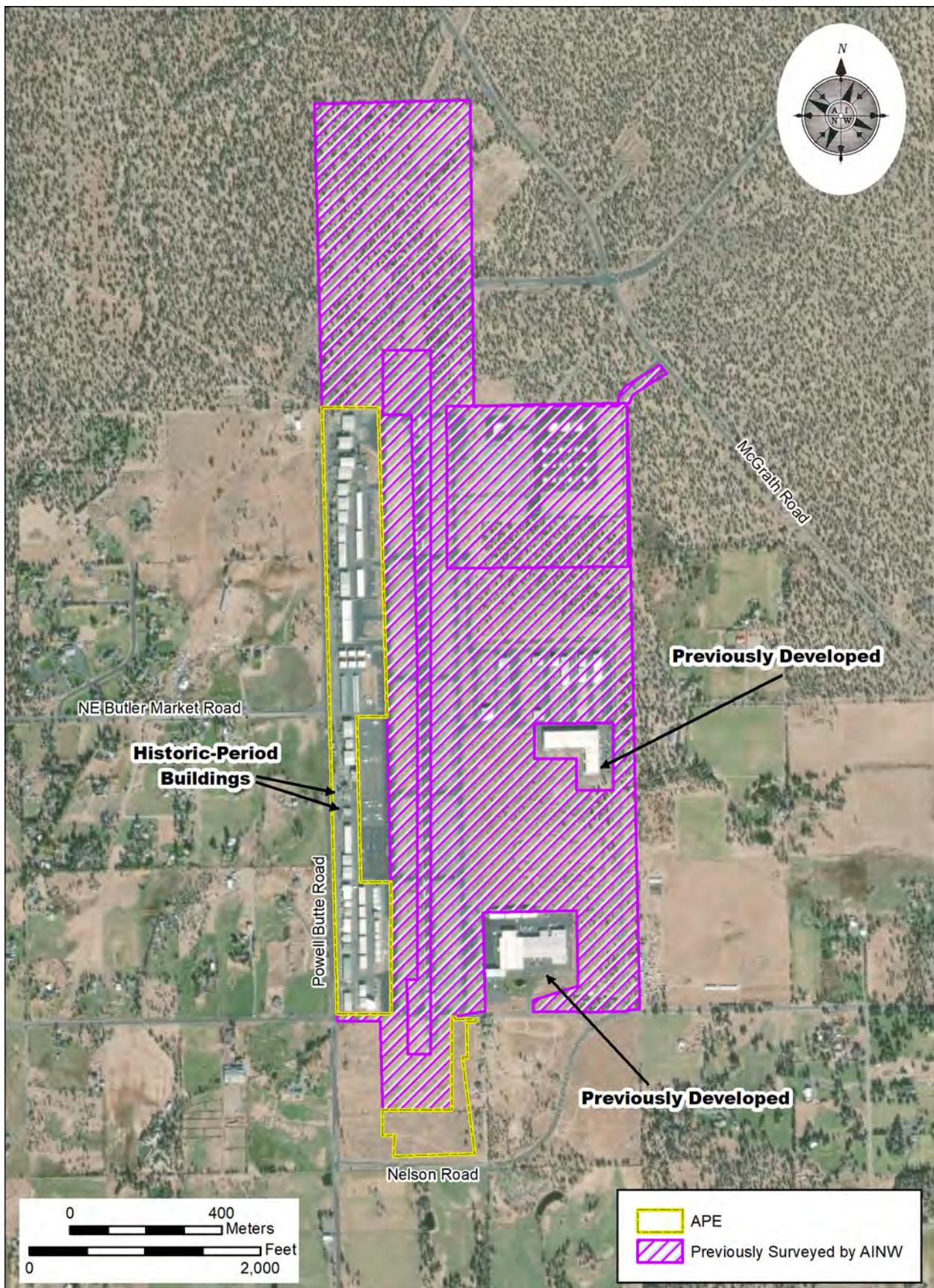


Figure 2. The location of the project APE, showing the previously developed or surveyed areas within the Bend Municipal Airport.

During the pedestrian survey, a historic-period linear stone rubble alignment with a small scatter of historic-period debris was found within the APE (temporary site number 18/2763-1) (Figures 3 and 4). This resource is recommended to be not eligible for listing in the National Register of Historic Places (NRHP). No historic-period buildings or other structures were present within the 5.4-acre APE. No further work is recommended for the project APE for archaeological resources.

AINW previously conducted six archaeological surveys for various Airport improvements (Figure 2) (Buchanan and Fagan 2008; Cowan and Fagan 2014, 2015; Cowan et al. 2015; Ogle and Fagan 2005a, 2005b). These six previous studies focused on archaeology of the undeveloped portions of the Airport while the buildings within the Airport property were not inspected. AINW has conducted a review of aerial photographs and examined the County tax records for building information and found that two buildings within the Airport property are of 50 years of age or older. AINW recommends additional background review and evaluation for NRHP-eligibility for the two historic-period buildings.

The cultural resource survey was completed in compliance with Section 106 of the National Historic Preservation Act (NHPA), as amended, and its implementing regulations (366 CFR 800) for review by the FAA. The survey was also conducted in accordance with state laws protecting significant archaeological sites (ORS 358.910) and significant buildings and structures that are publicly owned (ORS 358.653). The cultural resource survey was directed by AINW staff meeting the professional qualifications of the Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation, and was performed following the standards and guidelines of the Oregon State Historic Preservation Office (SHPO).

## LOCATION AND ENVIRONMENTAL SETTING

The project APE is located 3 km (1.9 mi) east of the Bend city limits in the southwest quarter of Section 20, Township 17 South, Range 13 East, Willamette Meridian (Figure 1). The project is in the northwest portion of the High Lava Plains physiographic province of the Deschutes River Valley (Franklin and Dyrness 1973:6). The APE for the archaeological survey is roughly L-shaped and located directly south of the Airport runway and its safety area, north of Nelson Road, and is surrounded by undeveloped private lands on the east, south, and west (Figure 2). The Central Oregon Irrigation District (COID) Lateral B Canal was formerly at the south end of the runway, north and adjacent to the current archaeological survey APE, and would have facilitated irrigation in the surrounding fields for crops since the early twentieth century (Hall 1994). The COID Lateral B Canal no longer exists at this location and has been replaced by piping (Gary Judd, personal communication 2018).

The archaeological survey APE is in an area where basalt and basaltic andesite lava flows have been deposited (Oregon Department of Geology and Mineral Industries 2018). The area consists of young lava flows that have produced porous bedrock. Volcanic activity includes recent lava flows south of Bend at Lava Butte, 20 km (12 mi) southwest of the Airport, and pumice from an eruption at Newberry Volcano, 40 km (25 mi) south of the Airport. About 4,000 years ago, the pumice from Newberry Volcano spread northward near the Airport (Franklin and Dyrness 1973:6, 32-34; Orr and Orr 1996:269-270).

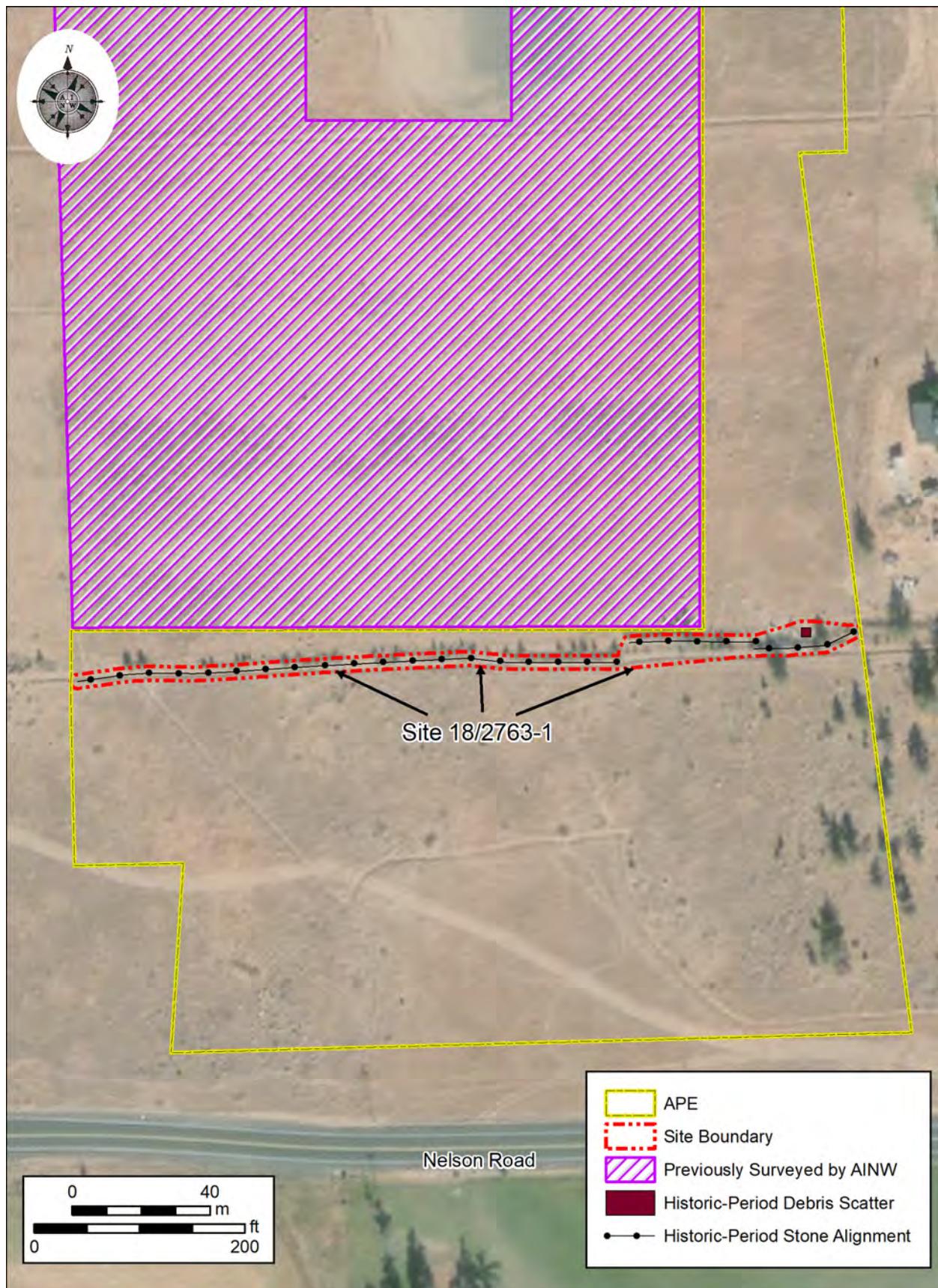




Figure 4. The location of the project APE and site 18/2763-1 on a 1953 USGS aerial photograph (USGS 1953).

The soils within the project APE were predominantly sandy, with many outcrops of volcanic rock. The project APE is mapped as within the Deskamp loamy sand and Gosney-Rock outcrop series. Deskamp and Gosney series are both formed in ash on top of basalt bedrock (U.S. Department of Agriculture, Natural Resources Conservation Service 2003, 2009, 2018). The project area is within the shrub steppe vegetation zone characterized by western juniper (*Juniperus occidentalis*). Sagebrush (*Artemesia tridentata*), rabbitbrush (*Chrysothamnus* sp.), and bluebunch wheatgrass (*Agropyron spicatum*) dominate the landscape, and were all observed within the survey area (Franklin and Dyrness 1973:45, 167, 234-236).

## CULTURAL SETTING

### Native Peoples

The project APE is located within the traditional territory of the Northern Paiute, who included seminomadic groups spanning extensive areas in Nevada, California, Idaho, and the majority of southeastern Oregon when Euroamericans arrived in the area in the early to mid-nineteenth century. It has been suggested the Northern Paiute displaced Sahaptin or Molala groups as they moved into central Oregon from the southeast. The expansive distribution of the Northern Paiute peoples covered various environments with diverse resources (Houser 1996:8-10).

The High Lava Plains desert environment provided few vegetation and small game procurement opportunities, and the Northern Paiute in central Oregon engaged in seasonal mobility to acquire a range of resources. Deer, antelope, bighorn sheep, and birds were hunted. Traps were also used and made of sagebrush, rocks, and tree branches. Weirs and platforms were used in fishing practices, and seeds, roots, and berries were gathered (Fowler and Liljeblad 1986:435-443; Houser 1996:8-10).

Conical structures were built for winter habitation near springs or rivers in small sedentary settlements, including along the Deschutes River near Bend. These structures were covered with tule or grass. In summer, camps of windbreaks or shades were occupied by family groups in areas that were foraged for seasonally available resources. The Northern Paiute acquired horses during the late 1840s and 1850s, improving mobility for subsistence practices and travel (Fowler and Liljeblad 1986:443, 456; Houser 1996:8-10).

### Historic Background

Early European exploration in central Oregon near the Deschutes River included that of Peter Skene Ogden of the Hudson's Bay Company between 1825 and 1827, and trappers, explorers, migrants and stockmen visited the area (Deschutes County Historical Society 1985:6-7; Hatton 1978:31). Euroamericans began to settle the Bend area from the 1870s and 1880s, but it took until 1900 to plat the town once irrigation projects began construction from the Deschutes River (Hatton 1978:31). The Bend-to-Prineville wagon road, approximately 3 km (1.9 mi) northwest of the Airport, was used to transport mail from Prineville to Bend from 1880 to 1915 (Follansbee and Frances 1980a).

Agriculture in the area required substantial irrigation and canal projects, which began in the early twentieth century by the Deschutes Irrigation and Power Company. Laterals associated with these irrigation projects are within the Airport lands, including the former COID Lateral B Canal (currently

piped underground) located directly north of the current archaeological survey APE, and the Pilot Butte Irrigation Canal located to the west of the Airport, outside of the project APE. Both canals were constructed between 1904 and 1907 (Central Oregon Irrigation District 2018; Hall 1994:19-22).

Historic maps of Township 17 South, Range 13 East in the vicinity of the Airport show little development in the late nineteenth century. The General Land Office (GLO) map of 1871 shows no development within Sections 17 and 20, in which the Airport is now located (GLO 1871). South of the project APE, the Old Immigrant Road, which led to the Deschutes River, is shown on the 1871 map. The 1929 U.S. Geologic Survey (USGS) topographic map indicates there were scattered structures and roads in the vicinity of the Airport as part of the outer Bend area (USGS 1929).

During World War II, the central Oregon area was used for military training, including the area east of Bend near U.S. Highway 20. North of the Airport, a number of rock features constructed for machine gun emplacements used during training exercises have been found (Follansbee and Frances 1980b). The Airport was built after a federal land patent (Serial Patent 11331117) was issued to the City in 1951 under the Federal Airport Act (Bureau of Land Management 1951).

A 1953 aerial photograph shows airport buildings to the west of a paved north-south oriented runway and the COID Canal segment and a road to the north of the current 5.4-acre APE (Figure 4) (USGS 1953). The northern portion of the current 5.4-acre APE appears to have been used as an agricultural field, and most of the southern portion was sparsely covered with trees. A dirt road appears to extend westward between the treed area and the agricultural field, and then splits, extending both northward and southward. A residence is depicted east of the farthest northern portion of the 5.4-acre APE (USGS 1953).

By 1980, aerial photographs show little change within the Airport vicinity, except for additional buildings that had been constructed (USGS 1962, 1980). Development at the Airport increased substantially in the last 20 years, including the construction of additional hangars and buildings, runway expansions, and a helipad. Nelson Road was re-routed in 2005; the section of the road directly north of the current 5.4-acre APE was truncated and modified into a cul-de-sac, and a new road section was added 25 meters (m) (82 feet [ft]) to the south to provide access from Powell Butte Road. One small structure was shown in the aerial photographs from the 1990s in the 5.4-acre APE, and it appears to have been removed between 2014 and 2017 (Google Earth 1994, 2000, 2005, 2014, 2017, 2018).

## PREVIOUS CULTURAL RESOURCE STUDIES

AINW conducted a review of the records available on the Oregon Archaeological Records Remote Access online database and materials in the AINW library to identify previous archaeological surveys and known archaeological resources within 3.2 km (2 mi) of the project APE. A reconnaissance survey was completed in 2003, and for proposed Airport improvements, no cultural resources were identified (Stutesman 2003).

AINW has conducted six archaeological studies and identified eleven archaeological and historic-period resources within the Airport property (Figure 2) (Buchanan and Fagan 2008; Cowan and Fagan 2014, 2015; Cowan et al. 2015; Ogle and Fagan 2005a, 2005b). These studies included runway

improvements and airport expansion, the addition of a helipad, an east side ramp, and an access road. An archaeological survey conducted in May 2005 by AINW of 14.4 acres of runway improvements identified no archaeological resources east of and adjacent to the developed Airport facilities (Ogle and Fagan 2005a).

In September 2005, AINW revisited the Airport and conducted an archaeological survey of 246 acres of Bend Airport lands except for those areas that had been developed and were inaccessible to survey and the previously surveyed 14.4 acres that had been surveyed in May of the same year. AINW identified six archaeological and historic resources (Ogle and Fagan 2005b). These resources were found 2.4 km (1.5 mi) north of the current 5.4-acre APE and consisted of a pre-contact lithic scatter (site 35DS1888); a historic-period debris scatter (site 35DS1963); a World War II-era rock feature for machine gun emplacement (site 35DS1890); a segment of the COID Lateral B Canal (05/1192-5); historic-period culturally modified trees (05/1192-4); and an isolated obsidian biface fragment (Ogle and Fagan 2005b).

AINW conducted an archaeological evaluation and assessment at site 35DS1963 in August 2007, and also identified a pre-contact lithic scatter, site 35DS1877, and an isolated obsidian flake (Buchanan and Fagan 2008). None of the resources identified during the previous Airport surveys were recommended to be eligible for listing in the NRHP (Buchanan and Fagan 2008; Ogle and Fagan 2005b).

Cultural resource surveys performed by AINW in 2014 and 2015 for proposed helicopter facilities approximately 1.6 km (1 mi) north-northeast of the current APE identified an additional three archaeological resources at the Airport (Cowan and Fagan 2014, 2015). Two of these resources were historic-period debris scatters (sites 35DS2782 and 35DS2784), and were recommended to be not eligible for listing in the NRHP (Cowan and Fagan 2015). The third resource, a multicomponent site (35DS2783) with a pre-contact obsidian flake and a historic-period debris scatter, was evaluated with additional testing and recommended as not eligible for listing in the NRHP (Cowan et al. 2015).

Outside of the Airport, at least 25 cultural resource studies have been conducted within a 3.2 km (2 mi) radius of the project APE. These studies were predominantly located north and northwest of the project APE (BECON 1982; Crowley 1980; Curtis and Lebow 1997; Derr et al. 2014; Follansbee 1980; Follansbee and Frances 1980a, 1980b; Gray and Tonsfeldt n.d.; Moratto et al. 1994; Simmons 1982; Stephenson et al. 1978; Stephenson 1979; Wilson 1992). Many studies have also occurred west and southwest of the project APE (Baker 2015a, 2015b; Fackler and Fortin 2017; Madsen 1985; McAlister and Connolly 2008; Sharp et al. 1998; Smith and Tatum 2015; Stuemke 2008; Volkenand 2016, 2017). Few studies have been completed to the east (Gregory 1998) and south (Gregory 2003) of the project APE. A total of 36 archaeological resources and one historic-period resource were identified in these studies within 3.2 km (2 mi) of the project APE. These resources are concentrated southwest and north of the Airport, between 0.8 and 3.2 km (0.5 and 2 mi) from the current project APE.

Two nearby sites have been recommended to be eligible for listing in the NRHP, sites 35DS1678 and 35DS115. Site 35DS1678 was identified during a cultural resource survey for a natural gas pipeline project, 0.8 km (0.5 mi) northwest of the project APE. The site consists of Central Oregon Canal (i.e. COID) laterals, a rock feature, an abandoned cistern, rock piles, and a historic-period debris scatter (Cheung et al. 1992; Moratto et al. 1994). Site 35DS115, also known as Young's Cave, is a pre-contact site with lithic and faunal remains at a lava tube cave, identified during the City's sludge disposal and effluent ponds project, 2.6 km (1.6 mi) northwest of the current project APE (BECON 1982).

Few cultural resource studies have been conducted south of the Airport, directly to the south, west and east. Pre-contact and historic-period resources have been identified on the High Lava Plains within and surrounding the Airport. No evidence of buildings in the 5.4-acre APE is present until the 1990s, when a small structure appears in aerial photography. The structure appears to have been recently dismantled.

## ARCHAEOLOGICAL FIELD SURVEY METHODS AND FINDINGS

The archaeological pedestrian survey was conducted on November 12, 2018, by AINW supervising archaeologist Carmen Sarjeant, Ph.D., R.P.A., and staff archaeologist Lea Loiselle, B.A. The project was under the overall supervision and management of Lucie Tisdale, M.A., R.P.A. The pedestrian survey was conducted by walking transects spaced no more than 10 m (33 ft) apart within the 5.4-acre APE (Figures 2 and 3).

The vegetation within the survey area included sagebrush, rabbitbrush, grasses, and juniper trees (Photo 1). Large juniper trees were observed in the southeastern corner of the survey area. Ground surface visibility ranged from poor to good (0% to 50%) with greater visibility within soils disturbed by animal activity or within shallow ditches. The soil was loose and sandy, and volcanic rock was found dispersed across the surface of the flat terrain of the 5.4-acre APE.

A linear stone rubble alignment oriented west-east and a small scatter of historic-period debris at the east end of the alignment was recorded as an archaeological resource (temporary site number 18/2763-1) (Figures 3 and 4; Photo 2). The stone appears to be rubble accumulated from field clearing, and was laid along the edge of the former agricultural field immediately south of the area surveyed in 2005 (Ogle and Fagan 2005b:9). Historic-period site 18/2763-1 is described further below, and a site form is in the Appendix.

To the north of the stone rubble alignment, on the east side and just outside of the 5.4-acre APE, there was a large pile of modern debris from a dismantled structure, including wood, wire nails without rust, and a refrigerator. The structure was present throughout the 1990s in aerial photographs, but does not appear before 1980, and was probably dismantled between 2014 and 2017 (USGS 1980; Google Earth 1994, 2014, 2017) when it no longer appears in the aerial photographs. The debris is modern. No historic-period buildings or other structures were present within the 5.4-acre APE.

There were five segments of shallow ditches (Photo 3) of an undetermined age and function in the surveyed APE; three are in the northern portion and two are in the southern portion of the 5.4-acre APE. Piles of local rock were often placed near these ditches. In the northern portion of the APE, one of the ditches is oriented west-east and extends towards the west immediately south of the boundary of the Airport safety area (2005 survey area). A second ditch extends west-east between the stone rubble alignment (site 18/2763-1) to the north and a two-track road to the south; and another is oriented north-south, intersecting the east end of the stone alignment, therefore post-dating the stone rubble alignment.



**Photo 1.** Overview of the APE from the northern portion. The view is towards the south.



**Photo 2.** Overview of a shallow ditch in the APE, oriented west-east. The view is towards the west.



**Photo 3. Overview of the linear stone rubble alignment of historic-period site 18/2763-1. A shallow ditch extends along the south side of the stone alignment. The view is towards the west.**

In the southern portion of the 5.4-acre APE, south of the stone rubble alignment (site 18/2763-1), two ditches follow the former tree line. The trees appear to have been burnt down in the 2000s as depicted in aerial photographs (Google Earth 1994, 2000, 2005, 2017). While irrigation ditches likely extended from the COID Lateral B Canal, north of the current survey APE, none of the ditches observed during the current survey can be confirmed as historic-period constructions. The observed ditches can be seen in more recent aerial photographs (Google Earth 1994, 2000, 2005, 2017; USGS 1980). Since the age and function of these ditches cannot be determined, and some of the ditches appear to be modern in construction, the ditches have not been recorded as archaeological or historic resources.

#### **Site 18/2763-1**

Site 18/2763-1 consists of a historic-period linear stone rubble alignment and a debris scatter found on the ground surface at the east end of the alignment (Figures 3 and 4; Photos 3 through 5). The alignment is oriented west-east and extends across the 5.4-acre. The alignment appears to extend further west of the City-owned property and onto private land; the segment on private land has not been recorded. The alignment is approximately 230 m (755 ft) long, 1 m (3.3 ft) high, and is up to 4 m (13 ft) wide in some segments. Along the length of the stone alignment, some sections have been removed. One section looks to have been dismantled and reassembled directly north of the original alignment. There are remnants of barbed wire and fence posts near the stone alignment.



**Photo 4.** Overview of the linear stone rubble alignment of historic-period site 18/2763-1 with an arrow showing the shallow ditch cut through the alignment. A historic-period debris scatter was on top of the stone alignment section to the left of the ditch. The view is towards the northeast.



**Photo 5.** Two fragments of crockery from the debris scatter found on top of a section of the linear stone rubble alignment of historic-period site 18/2763-1.

The linear stone rubble alignment presumably served as a fence or as a designated location to place volcanic rock from the surrounding land as field clearing. Similar examples were observed in the adjacent parcels outside of the APE. A 1953 aerial photograph shows that the land to the north of the stone rubble alignment appears to have been ploughed and cleared of vegetation, and the land to the south was composed of scattered native juniper trees (Figure 4) (USGS 1953). Since a divide in land uses is identifiable on the north and south sides of the alignment visible in the aerial photography from 1953, the stone alignment may have been in place at this time. A north-south oriented shallow ditch has been cut through the stone alignment at the eastern portion of the 5.4-acre APE (Photo 4). A two-track road and a ditch run along the south side of the stone alignment.

A small scatter of historic-period debris measuring 2x2 m (6.6x6.6 ft) was found on and adjacent to a section of the stone rubble alignment. The scatter includes one cylindrical metal can, one rectangular metal can, one unidentified metal item, two pieces of crockery, and two pieces of sheet metal on top of and next to the eastern end of the stone alignment (Photos 4 and 5). There were no identifiable marks on the cans and crockery. AINW Senior Historical Archaeologist, Judith Chapman, M.A., R.P.A., examined photographs of the artifacts and determined they are most likely at least 50 years old.

Site 18/2763-1 is recommended to be not eligible for listing in the NRHP. The site is not associated with any specific significant events or people (Criteria A and B). The linear stone rubble alignment is not a distinctive example of architectural style or construction, and other examples have been observed in the wider region (Criterion C). The site has been modified by modern activities, and the stone alignment and low-density debris scatter are unlikely to yield significant information about the past (Criterion D). No further work is recommended in the current project APE for archaeological resources.

## Historic Resources

AINW reviewed historic maps and aerial photographs to identify historic resources within the 50.6-acre Airport property that comprises the second APE and Airport facilities. AINW also examined County tax records for year built dates of the buildings and structures within the Airport to determine the potential for the Bend Municipal Airport to represent a historic district that meets the minimum age requirements for listing in the NRHP. The airport has been in continuous use since 1942 and was used for flight training during World War II.

The Bend Municipal Airport has been extensively modified, especially within the last 30 years, likely making it not eligible for listing in the NRHP as a historic district. County tax records and Google Earth images show that the buildings in the southern end (south of NE Butler Market Road) of the airport were built in the 1990s, and that the buildings in the northern end (north of NE Butler Market Road) were built within the last 10 years. However, two buildings at 63132 and 63120 Powell Butte Road may meet the NRHP eligibility requirements as individual historic resources.

The two buildings on Powell Butte Road sit next to each other west of the runway and are centrally located within the airport complex. The two buildings are City-owned hangars and occupied by tenants. County tax records have no construction dates on file for these buildings, but they are present on the 1953 aerial photograph of the airport (USGS 1953) and are on a 1962 topographic map of the area (USGS 1962). Based on this information, the two buildings meet the minimum age requirement to be considered for listing in the NRHP. AINW recommends that the two buildings be evaluated for NRHP eligibility.

## SUMMARY AND RECOMMENDATIONS

AINW has completed a cultural resource survey for the Bend Municipal Airport Master Plan project. The pedestrian survey of the archaeological survey portion of the APE resulted in the identification of one historic-period archaeological site (temporary site number 18/2763-1) consisting of a linear stone rubble alignment that may have been deposited along the edge of an agricultural field to act as a fence line or was deposited at the edge of an agricultural field while clearing the field. A small historic-period debris scatter was found within the eastern portion of the stone alignment. Site 18/2763-1 is recommended to be not eligible for listing in the NRHP. No further archaeological work is recommended in the current project.

AINW has conducted a review of aerial photographs and examined the County tax records for building information and found that two buildings within the Airport property are over 50 years in age. AINW recommends that these buildings be documented and evaluated for NRHP eligibility. Based on the background review, the Bend Municipal Airport is likely not eligible for listing in the NRHP as a historic district. However, the two historic-period buildings may be individually eligible historic resources.

## REFERENCES

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## Appendix B: Environmental Screening

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# memorandum

date        January 31, 2019  
to        Mike Dane, AICP and Matt Rogers, P.E.  
cc  
from        Toni Pennington  
subject    Bend Municipal Airport – Master Plan Update Environmental Screening

Environmental Science Associates (ESA) was retained by Century West Engineering, on behalf of the City of Bend, to assist with the Bend Municipal Airport Master Plan Update. The Master Plan will provide the City with a plan to address the development needs at the Airport for a 20-year planning horizon and develop a realistic program for implementation within known funding constraints. ESA's role is to provide an environmental screening for the following elements that will be included in the Master Plan; each are discussed in the below sections:

- Land Use
- Section 4(f) of the U.S. Department of Transportation Act
- Biotic Resources
- Federally-listed Endangered and Threatened Species and Critical Habitats
- Wetlands and Waters of the U.S.
- Floodplains
- Stormwater and Water Quality
- Air Quality

## LAND USE

The Airport is located in Deschutes County, outside the City of Bend's Urban Growth Boundary (UGB). The existing Airport parcel is designated Airport Development (AD) in the County's Comprehensive Plan while the areas to the north, south, east, and northwest of the Airport are designated Agriculture. The area immediately to west of the intersection of Butler Market Road and Powell Butte Highway (west of the Airport) is designated Rural Residential Exception Area. The AD designation is defined as: "To allow development compatible with airport use while mitigating impacts on surrounding lands". The Agriculture designation is defined as: "To preserve and maintain agricultural lands for farm use." The County's Comprehensive Plan acknowledges the importance of the airports relative to economic development. While the Airport is zoned AD, it should be noted that the County zoning map shows a small area to the north of the airport in grey that does not match any of the colors in the zoning designation legend; it is assumed that this area should be the same color as AD which would result in consistency between the zoning and Comprehensive Plan maps.

Areas to the north and south of the Airport where expansions are being evaluated are zoned Exclusive Farm Use (EFU). The area to the north is in the Alfalfa Subzone (EFUAL) and the area to the south is in the Tumalo/Redmond/Bend Subzone (EFUTRB). Chapter 18.16 of the County zoning ordinance indicates that the

purpose of the EFU zones “...is to preserve and maintain agricultural lands and to serve as a sanctuary for farm uses.” The ordinance provides a lengthy list of permitted uses including farm use and accessory building typically associated with farm use; propagation or harvesting of a forest product; operations associated with geothermal resources; infrastructure improvements (i.e., reconstruction or modification of public roads; creation, restoration or enhancement of wetlands; fire service facilities serving rural area; composting in conjunction with and auxiliary to farm use; and marijuana production. Permitted uses subject to special provisions (Section 18.16.025) include churches and cemeteries; utility facilities; winery; farm stands; agri-tourism; dog training; processing of farm crops; and procession of marijuana. Section 18.16.030 provides a list of conditional uses for those on high value farmland or non-high value farmland subject to applicable provisions. Conditional uses include nonfarm dwelling; commercial activities in conjunction with a farm use; operation for mining and processing of geothermal resources, natural gas or oil; transmission towers over 200 feet in height; commercial utility facilities; construction of additional passing and travel lanes; improvement of public road and highway-related facilities; transportation improvements on rural lands allowed by OAR 660-012-0065; activities associated with aquatic species; wind power generation; photovoltaic solar power generation; dog boarding or training; and equine therapy. Section 18.16.031 provides a list of conditional uses on non-high value farmland only, which includes solid waste facility, golf course, private parks, playgrounds, hunting and fishing preserves, and campgrounds. Section 18.16.033 provides a list of conditional uses on high value farmland, which essentially provides for maintenance, enhancement or expansion of solid waste facilities, golf courses, or public or private schools.

Section 18.16.055 addresses land divisions of property zoned EFU and provides requirements for irrigated and nonirrigated lands. For irrigated land division in the EFUTRB, the resulting subdivision must result in parcels that demonstrate 23 acres of irrigated acres. For irrigated land division in the EFUAL, the resulting subdivision must demonstrate 36 irrigated acres.

With regard to the County’s Comprehensive Plan, Section 5.10 identifies lands where the County has demonstrated an exception to meeting the requirements of the Statewide Planning Goals. The purpose for the exceptions is to allow some flexibility in rural areas under specific circumstances. The exceptions are divided into 1979 exceptions associated with the preparation of the County 1979 Comprehensive Plan and Additional Exceptions. The Bend Municipal Airport is listed under the Additional Exceptions and the Comprehensive Plan states that “The Bend Municipal Airport received an exception to Goal 3 to allow for the necessary and expected use of airport property.”. More specifically, the Comprehensive Plan refers to Ordinances 80-203 and 80-222. Based on ESA’s review of Ordinance 80-203, it does not appear to provide exceptions for the Bend Municipal Airport. ESA has not been able to locate Ordinance 80-222. However, based on an email from Peter Russell, Senior Transportation Planner, on December 19, 2018, Ordinance 80-222 applies to property described as 20-17-13, Tax Lots 200 and 300 as well as 17-13-17, Tax Lot 200. What is unclear is whether Ordinance 80-222 currently covers the entire extent of the existing airport or if it only covers those properties when the exception was granted. In addition, based on a follow-up email from Peter Russell dated December 21, 2018 the area to the north of the developed Airport but within the area designated Airport and zoned AD, appears to be covered by the Goal 3 exception identified in Ordinance 80-222, since Ordinance 80-222 pertains to lands that are vacant but in airport use. The potential relocation of Powell Butte Highway (being examined as part of the Master Plan Update) could be allowed as a conditional use under Section 18.16.030.Y., transportation improvement on rural lands allowed by OAR 660-012-0065. Based on the input received and ESA’s research, it does not appear that the exception pertains to areas that are not zoned Airport (i.e., areas to the south of the Airport).

In addition, the Airport is located in the Deschutes County Rural Enterprise Zone (E-zone), which was approved in April 2008, and offers traded-sector employers (companies that sell goods or services outside the local area and expand its economic base) and other eligible companies three (3) to five (5) year property tax exemptions on certain new capital investments that create jobs in the designated areas. The E-zone provides economic support to facilities at the Airport. This does not seem to directly affect the Master Plan Update.

Land use issues and opportunities on and off the airport as it relates to potential airport development and runway extension alternatives has been an ongoing discussion since the 2013 Airport Master Plan. There needs to be a clear understanding of Deschutes County zoning designations within the airport property boundary and immediate vicinity as well as an effort to identify and depict permitted and conditional uses, and summarize applicable development standards. Based on ESA's research to date and on the emails from Peter Russell, the following are questions to be addressed:

- Obtain a copy of Ordinance 80-222.
- On the County zoning map, clarify the zoning of the small area just north of the AD zone where a small grey area does not correspond to any feature in the zoning designation legend.
- Confirm parcels to which Ordinance 80-222 applies; that is, does Ordinance 80-222 cover any properties to the south of the Airport property.
- Confirm Ordinance 80-222 applies to vacant lands designated Airport.
- Confirm the use of Code Section 18.16.030.Y for the relocation of Powell Butte Highway.
- Determine process for potential expansion to the south; would a Goal 3 Exception be necessary and, if so how is this accomplished?
- Does the proposed expansion follow parcel lines?
- Does Ordinance 80-222 cover the entire extents of existing airport property or just those owned when the exception was granted?

#### **SECTION 4(F) OF THE U.S. DEPARTMENT OF TRANSPORTATION ACT**

There are no parks or other public lands adjacent to the Airport.

#### **BIOTIC RESOURCES**

Vegetation in the vicinity of the Airport is characteristic of a typical eastern Oregon western juniper (*Juniperus occidentalis*) plant community. These areas occupy intermediate moisture zones between a Ponderosa pine (*Pinus ponderosa*) and steppe or shrub-steppe habitats. Most annual moisture is received during the winter as snow while summers are hot with little to no moisture. Most areas of the Airport grounds are managed and mowed grassy and herbaceous areas. Other areas of the Airport are dominated by western juniper in the tree layer and rabbitbrush (*Chrysothamnus viscidiflorus*) and big sagebrush (*Artemesia tridentata*) in the shrub layer. The herb layer is characterized by cheat grass (*Bromus tectorum*), various thistles, yarrow (*Achillea millefolium*), and tumbleweed (*Salsola tragus*).

Migratory Bird Treaty Act (MBTA) protected species that may be present and breed within three-miles of the Airport were identified (Table 1). Other species protected by the MBTA may also be present at that time of year, and therefore be susceptible to disturbance by construction activities.

**TABLE 1. MBTA - PROTECTED SPECIES THAT MAY BE IN THE VICINITY OF THE AIRPORT**

MBTA Species	Potential to Breed at Airport	Local Breeding Season
Brewer's sparrow ( <i>Spizella breweri</i> )	Yes	May 15 to Aug 10
Golden Eagle ( <i>Aquila chrysaetos</i> )	No	Apr 1 to Aug 31
Green-tailed towhee ( <i>Pipilo chlorurus</i> )	No	May 1 to Aug 10
Lesser yellowlegs ( <i>Tringa flavipes</i> )	No	Breeds elsewhere
Lewis's woodpecker ( <i>Melanerpes lewis</i> )	No	Apr 20 to Sep 30
Long-billed curlew ( <i>Numenius americanus</i> )	No	Apr 1 to Jul 31
Olive-sided flycatcher ( <i>Contopus cooperi</i> )	No	May 20 to Aug 31
Pinyon jay ( <i>Gymnorhinus cyanocephalus</i> )	No	Feb 15 to Jul 15
Red-tail hawk ( <i>Buteo jamaicensis</i> ) <a href="https://myodfw.com/wildlife-viewing/species/raptors">https://myodfw.com/wildlife-viewing/species/raptors</a>	Yes	Feb to Aug
Sage thrasher ( <i>Oreoscoptes montanus</i> )	No	Apr 15 to Aug 10
Williamson's sapsucker ( <i>Sphyrapicus thyroideus</i> )	No	May 1 to Jul 31
Willow flycatcher ( <i>Empidonax traillii</i> )	No	May 20 to Aug 31

Primary source of information: U.S. Fish and Wildlife's (USFWS) Information for Planning and Conservation (IPaC)

#### FEDERALLY-LISTED ENDANGERED AND THREATENED SPECIES AND CRITICAL HABITATS

To determine what species and critical habitat protected under the Endangered Species Act could occur in the vicinity of the Airport, the USFWS website was queried and data reviewed from the Oregon Biodiversity Information Center (ORBIC 2018). A table listing the federally-listed species identified for Deschutes County is included in Table 2. The species with some potential to occur near or within the project area are discussed below. The other species do not occur in or near the project area due to lack of supporting habitat features.

The nearest known occurrences of gray wolf (*Canis lupus*) (endangered west of Highways 395, 78, and 95) is in the White River Unit in southern Wasco County (ODFW 2018) where at least two pups were observed in 2018 (ODFW 2018). It is highly unlikely that gray wolf will occur at the Airport given they are not found in areas with high human density/activity and a lack of ungulate prey. Additionally, and there are no documented sightings of gray wolves within a one mile radius of the Airport.

**TABLE 2. USFWS SPECIES BY COUNTY REPORT (DESCHUTES CO., OREGON)**

Group	Name	Population	Status
Amphibians	Oregon spotted frog ( <i>Rana pretiosa</i> )	Wherever found	Threatened
Birds	Yellow-billed cuckoo ( <i>Coccyzus americanus</i> )	Western U.S. DPS	Threatened
	Northern spotted owl ( <i>Strix occidentalis caurina</i> )	Wherever found	Threatened
Conifers and Cycads	Whitebark pine ( <i>Pinus albicaulis</i> )	Wherever found	Candidate
Fishes	Bull trout ( <i>Salvelinus confluentus</i> )	U.S.A., conterminous lower 48 states	Threatened
	Oregon chub ( <i>Oregonichthys crameri</i> )	Wherever found	Recovery
Mammals	Gray wolf ( <i>Canis lupus</i> )	U.S.A., multiple states including portions of OR	Endangered
	North American wolverine ( <i>Gulo gulo luscus</i> )	Wherever found	Proposed threatened

## WETLANDS AND WATERS OF THE U.S.

Wetlands are under the jurisdiction of both Oregon Department of State Lands (DSL) and the U.S. Army Corps of Engineers (Corps) and are protected under the State of Oregon Removal Fill Law and Section 404 of the Clean Water Act. Both agencies use the Corps of Engineers Wetland Delineation Manual (Experimental Laboratory 1987) and the Arid West Wetland Delineation Supplement Manual (Corps of Engineers 2008) for determining wetland and their extent. An area is determined to be a wetland if it has a dominance of hydrophytic vegetation (plants that grow in wet conditions), hydric soils, and positive wetland hydrology. The Natural Resource Conservation Service (NRCS) maps the majority of the Airport as having Deskamp loamy sand, 0 to 3 percent slopes, and Gosney-rock outcrop-Deskamp complex, 0 to 15 percent slopes to the north and south ends of the study area. Deskamp loamy sand and Gosneyrock outcrop are both considered somewhat excessively drained soils and found in old lava plains at elevations between 3,000 and 4,000 feet. Neither soil found in the project area meets the definition of “hydric soil” by the NRCS.

A wetland reconnaissance was conducted by Environmental Science Associates (ESA) on November 30, 2018 to examine areas mapped as freshwater pond, freshwater forested/shrub wetland, and riverine by the National Wetlands Inventory (NWI) (Figure 1). Aerial imagery suggests that all of these areas once actively conveyed water. However, based on more recent aerial imagery and the November site visit, the riverine channel (a Central Oregon Irrigation District[(COID] lateral) has been covered with the exception of approximately 85 feet of daylit canal between Powell Butte Rd. and a culvert. In this area, flowing water and hydrophytic (albeit dormant) vegetation (e.g., *Carex* sp., *Rumex* sp., and *Iris pseudacorus*) was observed (Figures 2 and 3). Moving east from the culvert, the channel is piped underground across the remainder of the airport property to the east, then north. The roughly 6-acre NWI mapped freshwater pond-freshwater forested/shrub wetland east of the existing runway no longer receives water from the canal and is completely dry with no remnant hydric features observed (Figure 4). Upland plant species, including rabbitbrush and thistle, were observed. On the east side of the airport property, the remnant canal is open but, again, no longer conveys water.

The COID lateral would be considered a jurisdictional water of the U.S. by the Corps ("A tributary can be a natural, man-altered, or man-made water and includes waters such as rivers, streams, canals, and ditches not excluded under paragraph (b) of this section." 328.3 (c)(3). However, the canal would not be a jurisdictional waterbody of the State (under OAR 141-085-0515).

## **FLOODPLAINS**

The Federal Emergency Management Agency's Flood Insurance Rate Map does not identify any floodplains in the area.

## **STORMWATER AND WATER QUALITY**

The Airport is typically flat, with no significant closed drainage depressions or drainage patterns. Stormwater appears to runoff impervious surfaces and infiltrate well before reaching any water body with protected fish or amphibians.

## **AIR QUALITY**

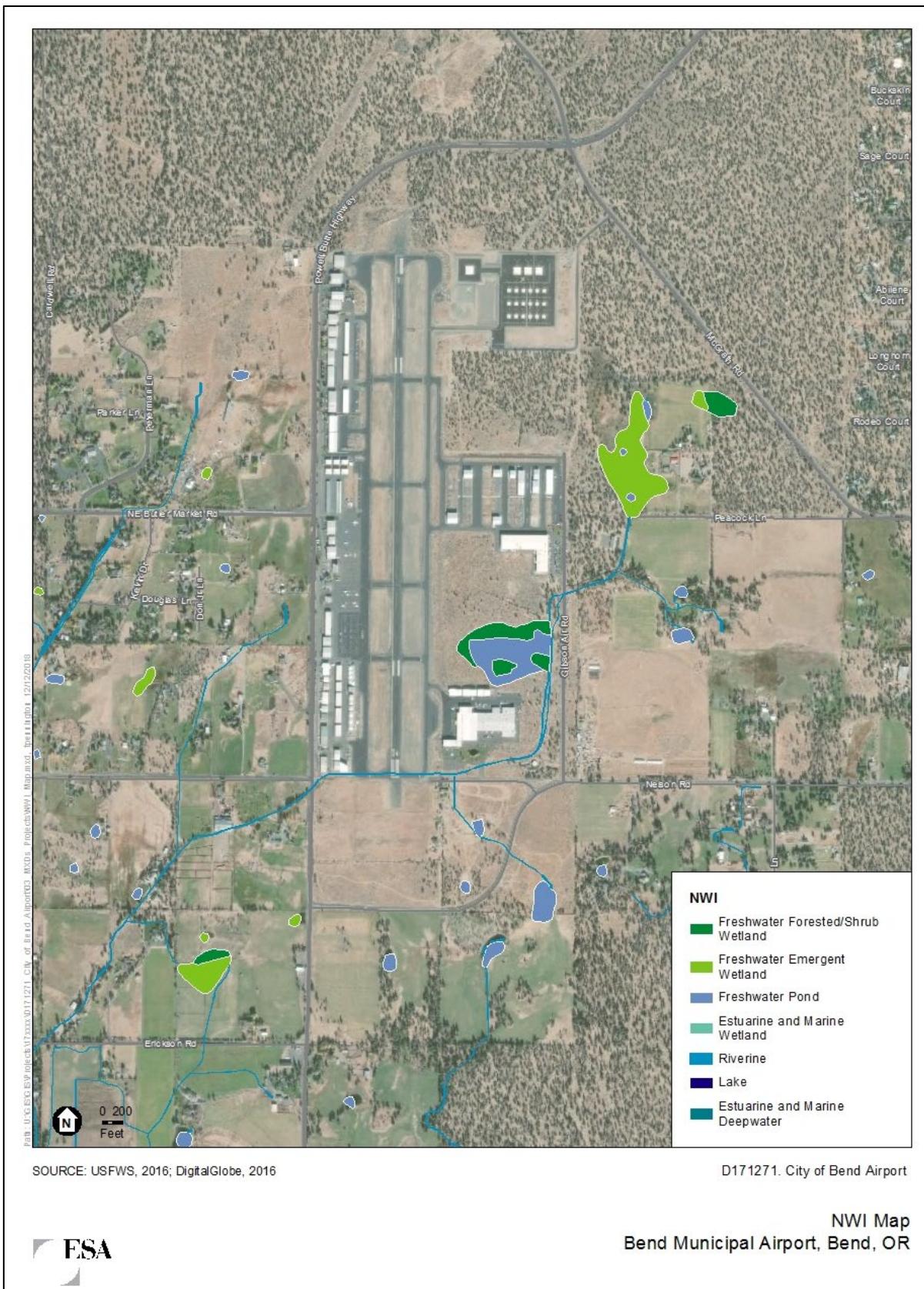
The Bend Municipal Airport and surrounding areas is not located in a National Ambient Air Quality Standards (NAAQS) Maintenance area for the State of Oregon (Oregon Department of Environmental Quality). The EPA established NAAQS for a limited number of pollutants with the enactment of the Clean Air Act of 1970 and the Amendments of 1975 and 1977. The pollutants of most concern in an arid environment such as Bend, Oregon, are particulates. The primary impacts to local air quality from 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 at and from terminals, service trucks, fuel trucks, and auxiliary equipment such as emergency generators. Aircraft engine emissions 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.

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## **FIGURES**



**Figure 1.** National Wetland Inventory for the Bend Municipal Airport and Proposed Modifications



**Figure 2.** The open COID canal entering the southwest portion of the airport property (facing west).



**Figure 3.** COID canal from Figure 2 as it enters a pipe on the southwest portion of the property (facing northwest).



**Figure 4.** Remnant NWI mapped freshwater pond-freshwater forested/shrub wetland (facing north)



## Appendix C: Noise Contour Data Inputs/Output

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## Runway End Utilization

Operation Category by Aircraft Type	Runway End		Helicopter Track		
	16	34	North Flow	South Flow	Cross Field
Commuter/Air Taxi	72%	28%			
<b>GA Itinerant</b>					
Jets/Turboprops	72%	28%			
Single Engine Piston	70%	30%			
Helicopter			49%	21%	30%
<b>Flight Training Itinerant</b>					
Single Engine Fixed Pitch	70%	30%			
Helicopter			49%	21%	30%
<b>GA Local</b>	70%	30%			
<b>Flight Training Local</b>					
Single Engine Fixed Pitch	70%	30%			
Helicopter			30%	70%	0%

## Operations Time of Day %

Operations by Time of Day	Day (7AM – 10PM)	Night (10PM - 7AM)
All aircraft	96%	4%

## Track Utilization Fixed Wing

Track Utilization	Runway 16		Runway 34		
	Arrival Tracks	Straight In	Right Traffic	Straight In	Left Traffic
Commuter/Air Taxi		75%	25%	75%	25%
<b>GA Itinerant</b>					
Jets		75%	25%	75%	25%
Turboprops		75%	25%	75%	25%
Single Engine Piston		50%	50%	50%	50%
<b>Flight Training Itinerant</b>		50%	50%	50%	50%
Departure Tracks	Straight Out	Right Traffic	Straight Out	Left Traffic	
	Commuter/Air Taxi	90%	10%	90%	10%
<b>GA Itinerant</b>					
Jets	90%	10%	90%	10%	
Turboprops	75%	25%	75%	25%	
Single Engine Piston	50%	50%	50%	50%	
<b>Flight Training Itinerant</b>	50%	50%	50%	50%	
Touch & Go Tracks	Runway 16		Runway 34		
	GA Local	100%		100%	
<b>Flight Training Local</b>		100%		100%	

## Track Utilization Helicopter

Track Utilization	Helicopter (Existing Taxiway)			Future Helipad			
	Arrival Tracks	North Flow	South Flow	Cross Field	North Flow	South Flow	Cross Field
GA Itinerant		100%	100%	100%	100%	100%	100%
Flight Training Itinerant		100%	100%	100%	100%	100%	100%
Departure Tracks	North Flow	South Flow	Cross Field	North Flow	South Flow	Cross Field	
	GA Itinerant	100%	100%	100%	100%	100%	100%
Flight Training Itinerant	100%	100%	100%	100%	100%	100%	100%
Touch & Go Tracks	North Flow	South Flow		North Flow	South Flow		
	Flight Training Itinerant	100%		100%	100%		100%



## Operations by Aircraft Type

Aircraft	Runway Utilization Category	Base	5 Year	20 Year
Citation 550	Commuter / Air Taxi	916	994	1,278
Phenom 300 (EMB 505)	Commuter / Air Taxi	271	294	378
King Air 350	Commuter / Air Taxi	103	112	144
Citation CJ1	GA Itinerant	789	885	1,244
Beech Baron 58	GA Itinerant	389	372	325
King Air 350	GA Itinerant	1,000	1,083	1,374
Pilatus PC-12	GA Itinerant	2,000	2,165	2,747
Learjet 60	GA Itinerant	68	77	108
GASEPV (single engine variable pitch)	GA Itinerant	4,935	5,380	6,904
GASEPF (single engine fixed pitch)	GA Itinerant	14,804	16,141	20,712
Helicopter EC-135	GA Itinerant	645	698	886
GASEPF (single engine fixed pitch)	Flight Training Itinerant	8,023	20,995	22,126
Helicopter (R44)	Flight Training Itinerant	6,053	7,765	7,774
GASEPV (single engine variable pitch)	GA Local	1,615	1,750	2,225
GASEPF (single engine fixed pitch)	GA Local	4,844	5,250	6,675
GASEPF (single engine fixed pitch)	Flight Training Local	43,087	83,979	88,504
Helicopter (R44)	Flight Training Local	32,504	31,061	31,096
<b>Total</b>		<b>122,045</b>	<b>179,000</b>	<b>194,500</b>

## Track Utilization Arrivals

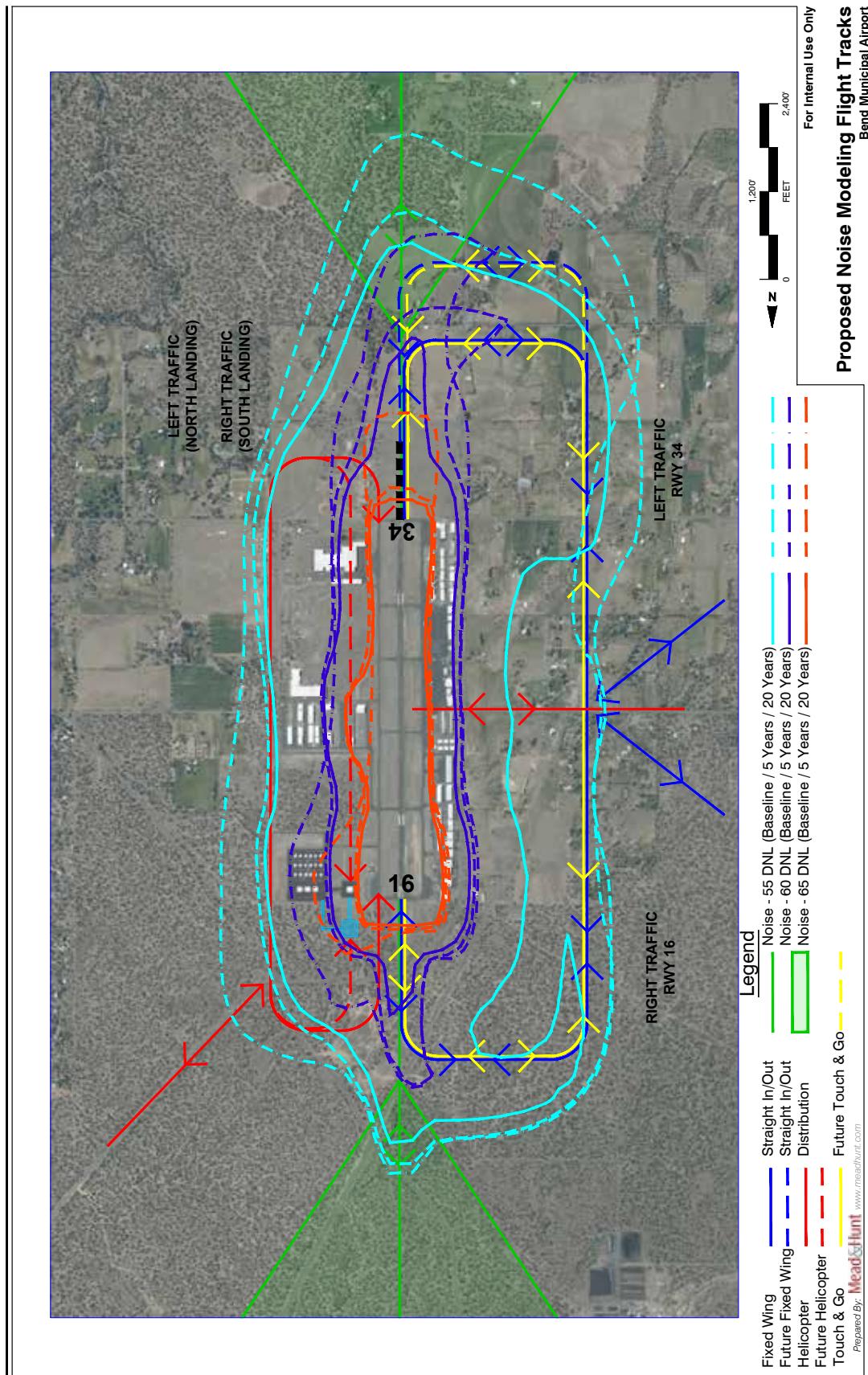
Arrival Track Utilization	Runway 16		Runway 34		Helicopter (Existing Taxiway)			Future Helipad		
	Straight In	Right Traffic	Straight In	Left Traffic	North Flow	South Flow	Cross Field	North Flow	South Flow	Cross Field
Commuter/Air Taxi	75%	25%	75%	25%						
GA Itinerant										
Jets	75%	25%	75%	25%						
Turboprops	75%	25%	75%	25%						
Single Engine Piston	50%	50%	50%	50%						
Helicopter					100%	100%	100%	100%	100%	100%
Flight Training Itinerant										
Single Engine Fixed Pitch	50%	50%	50%	50%						
Helicopter					100%	100%	100%	100%	100%	100%

## Track Utilization Departures

Departure Track Utilization	Runway 16		Runway 34		Helicopter (Existing Taxiway)			Future Helipad		
	Straight Out	Right Traffic	Straight Out	Left Traffic	North Flow	South Flow	Cross Field	North Flow	South Flow	Cross Field
Commuter/Air Taxi	90%	10%	90%	10%						
GA Itinerant										
Jets	90%	10%	90%	10%						
Turboprops	75%	25%	75%	25%						
Single Engine Piston	50%	50%	50%	50%						
Helicopter					100%	100%	100%	100%	100%	100%
Flight Training Itinerant										
Single Engine Fixed Pitch	50%	50%	50%	50%						
Helicopter					100%	100%	100%	100%	100%	100%

## Track Utilization T&amp;G

Touch & Go Track Utilization	Runway 16	Runway 34	Helicopter (Existing Taxiway)		Future Helipad	
			North Flow	South Flow	North Flow	South Flow
GA Local		100%	100%			
Flight Training Local						
Single Engine Fixed Pitch		100%	100%			
Helicopter			100%	100%	100%	100%





## Appendix D: Recycling and Solid Waste Management

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# Recycling and Solid Waste Management

## Introduction

The Recycling and Solid Waste Management Plan discusses the solid waste generated at Bend Municipal Airport, their recycling practices, and any opportunities for reducing waste at the airport.

On September 30, 2014, the Federal Aviation Administration (FAA) established guidance on preparing airport recycling and solid waste management plans as an element of an airport master plan update. This guidance was in response to Section 133 of the FAA Modernization and Reform Act (FMRA) of 2012 (and later FMRA of 2018) which amended 49 U.S. Code § 47106 to establish the requirement for all airport master plan updates to include a recycling plan that addresses the following:

- Local Recycling Management and Programs;
- Waste Audit;
- Recycling Feasibility;
- Plan to Minimize Solid Waste Generation;
- Operational and Maintenance Requirements;
- Waste Management Contracts;
- Potential for Cost Savings or Revenue Generation; and
- Future Development and Recommendations.

Typical types of waste generated at general aviation airports include:

- Construction and Demolition Waste – Solid waste produced during the excavation, clearing, demolition, construction, and or renovation of airport pavements, buildings, roads, or utilities.
- Yard Waste – Yard waste includes grass clippings, weeds, trees, shrubs, and other debris generated during landscape maintenance.
- Hazardous Wastes – Hazardous wastes are identified in regulation 40 CFR 261.31-33, which are typically corrosive, ignitable, toxic, or reactive. This type of waste requires specific handling, treatment, and disposal.
- Universal Hazardous Waste – The Environmental Protection Agency (EPA) provide less stringent regulations for universal wastes as defined in 40 CFR Part 273, Universal Waste Rule.

To assist airports in developing their recycling program, the FAA has created the *Recycling, Reuse, and Waste Reduction at Airports: A Synthesis Document*. The FAA provides guidance to airports in two key focus areas:

- Programs to encourage recycling, reduction, and reuse of materials; and
- Programs to encourage airports to reduce their energy consumption.



# Local Recycling Management and Programs

Bend Garbage and Recycling provides solid waste removal and recycling services to Bend Municipal Airport. State, County, and City recycling management and solid waste programs pertinent to the Airport include:

## State of Oregon

In 1983, the Recycling Opportunity Act was the first law in the U.S. to require that people statewide be provided with an opportunity to recycle. This statute established solid waste management policies for waste prevention, reuse and recycling. To conserve energy and natural resources the statute uses a solid waste management hierarchy

- Reduce the amount of waste generated;
- Reuse materials for their original intended use;
- Recycle what cannot be reused;
- Compost what cannot be reused or recycled;
- Recover energy from what cannot be reused, recycled, or composted; and
- Dispose of residual materials safely.

The Recycling Opportunity Act also required that:

- Wasteshed counties, except for the City of Milton-Freewater and the greater Portland tri-county area known as the Metro wasteshed, are to have recycling depots; and
- Cities with populations over 4,000 are to provide monthly curbside recycling collection service to all garbage service customers.

The 1991 Oregon Recycling Act (Senate Bill 66) strengthened the states recycling requirements and created a recovery goal of 50 percent by year 2000. This statute also established a household hazardous waste program; required recycled content in glass containers, directories and newsprint publications; established requirements for recycling rigid plastic containers to promote market development; and required the Department of Environmental Quality to calculate annual recovery rates and develop a solid waste management plan. In 2005, House Bill 3744 established a new wasteshed goal and extended Oregon's statewide recovery goals of 45 percent in 2005 and 50 percent in 2009.

In 2011, DEQ convened a workgroup to help develop a long-term vision and framework for responsible materials management in Oregon. The Oregon Environmental Quality Commission adopted the resulting Materials Management in Oregon: 2050 Vision and Framework for Action (2050 Vision). The 2050 Vision is also Oregon's State Integrated Resource and Solid Waste Management Plan and guides statewide policy for managing materials throughout their entire life cycles, including recovery, reduction, reuse, and recycling.

In June 2015, the Oregon Legislature passed Senate Bill (SB 263), to enable DEQ, local governments, and Oregonians to make progress under the 2050 Vision. Among other things, SB 263:

- Raised statewide recovery rates;
- Set statewide material-specific recovery rates for food waste, plastic waste, and carpet waste;
- Made wastesheds' self-determined recovery goals voluntary to give local governments more flexibility;
- Increased to thirteen the number of recycling program elements available to local governments;
- Amended the expanded education and promotion program element to include a contamination reduction education aspect;
- Increased minimum numbers of recycling program elements required for certain cities based on their population sizes and distances from Portland;
- Added seven waste prevention education and reuse program elements, requiring minimums ranging from three to five elements depending on cities' populations or location within the Metro;
- Allows a local government using a DEQ-approved alternative program the flexibility of meeting either the lesser of its recovery goal or recovery levels comparable to similar communities;
- Expands statewide the opportunity to recycle to residential and commercial tenants of multi-tenant properties with collection service; and
- Permits DEQ to develop outcome-based recovery goals to measure recovery using methods besides materials' weight, such as energy savings.

Under the current legislation, the State's mandatory rate of material recovery from the general solid waste stream is 52% for 2020 and rises to 55% for 2025 and subsequent years. The law also sets mandatory material-specific recovery rates for: food waste (25% by 2020); plastic waste (25% by 2020); and carpet waste (25% by 2025).



## City of Bend

While the City of Bend is the owner of the Bend Municipal Airport, Solid Waste and Recycling standards are set by Deschutes County, which has jurisdiction.

## Deschutes County

The Department of Solid Waste oversees the management of solid waste and recycling in Deschutes County. Knott Landfill Recycling and Transfer Facility, the only landfill in the County, is estimated to remain open until 2029. For waste disposal, four Transfer Stations provide services for outlying areas of Deschutes County. These include:

- Negus Transfer Station, located in Redmond
- Northwest Transfer Station, between Bend and Sisters
- Southwest Transfer Station, north of La Pine
- Alfalfa Transfer Station, off Walker Road near Alfalfa

Deschutes Recycling, located at Knott Landfill Recycling and Transfer Facility, and all four of the transfer stations provide full recycling opportunities. Recycling is available for commingled recyclables, cardboard, glass, appliances, auto batteries, computer monitors, CPUs, printers, keyboards and mice, TVs, other electronics, motor oil, tires, scrap metal, wood waste and yard debris.

## Waste Audit

Tenants and users of the Bend Municipal Airport generate a limited amount of waste on site. Specific sources of on-site waste include:

- Fixed base operator (FBO) buildings generate paper waste, plastic bottles, aluminum cans and other typical office trash. As part of the FBO operations, they can produce used oil and aircraft parts such as tires, filters, etc.
- Private hangars and buildings can create a variety of waste, depending on the function of the building. Hangars typically produce anything from typical household trash to used oil and aircraft parts.
- Manufacturers and on-airport businesses generate similar waste to off-airport businesses such as paper waste and other typical office trash. They can also produce used oil and aircraft parts such as tires, filters, etc. depending on the nature of their business.

## Waste Disposal

No state or federal requirements apply to the waste that is generated on the airport. Each individual tenant is responsible for disposal of their own waste and any hazardous materials.

In a survey submitted to Airport tenants, over half of respondents indicated they personally hauled away any of their waste generated at the Airport. The majority of remaining respondents indicated a private waste removal company provides waste removal services or they place any waste in appropriate on-airport recycling and waste bins.

## CONSTRUCTION WASTE

Construction waste at Bend may include waste generated from excavation, construction, demolition, renovation, or maintenance of airport facilities and structures. Disposal of construction waste and debris is the responsibility of the contractor for each specific project on airport.



# Recycling Feasibility

The following items may be recycled for free and may be mixed in a commingle bin or dropped off at any disposal site:

- Aluminum/Tin
- Magazines, Catalogs, Newspaper and Mixed Paper
- Paper bags
- Paperboard
- Plastic Bottles/Tubs

The following items may be recycled for free at all disposal sites:

- Auto Batteries
- BBQ's
- Corrugated Cardboard
- Select E-waste
- Glass Bottles and Jars
- Lawnmower
- Motor Oil
- Paint & Stains
- Propane Tanks
- Scrap Metal

The following items can be recycled for a fee and must be dropped off at a Knott Recycling Center or select transfer stations:

- Antifreeze
- Appliances
- Select E-waste
- Microwaves
- Sod
- Stumps
- Tires
- Wood waste
- Yard debris

## Plan to Minimize Solid Waste Generation

### METHODS TO REDUCE SOLID WASTE

There are limited opportunities to reduce solid waste generation at the airport since little waste is produced. However, the airport should still establish a goal to reduce the amount of solid waste generated. While the airport is not responsible for waste generated by airport tenants, informational brochures on recycling opportunities could be distributed to all the airport tenants to encourage them to recycle their waste.

## Operational and Maintenance Requirements

Operational and maintenance requirements at the airport are minimal. The City of Bend is responsible for mowing the airfield. When the airfield is mowed, the clippings are left in place, which is a standard practice for airports. Additional maintenance would include items such as weed management in pavement cracks and changing of airfield light bulbs. The airport does not use chemical deicing for airfield pavements during winter months.

## Waste Management Contracts

All airport tenants are required to follow The Bend Municipal Airport Regulations, Policies, and Guidelines as a condition of their lease. These regulations were reviewed for information regarding waste and recycling. No hauling or landfill contracts are available.

The Bend Municipal Airport Regulations, Policies, and Guidelines state that,

*"No person shall throw, dump or deposit any waste, refuse or garbage on the Airport. All waste, refuse or garbage shall be placed and kept in closed garbage cans or containers and all operating areas shall be kept in a safe, neat, clean and orderly manner at all times and in such manner as to minimize any hazards. All hazardous waste must be controlled and disposed of in accordance with all State and City Environmental Regulations."*



Although tenants are responsible for their own waste from the hangar, no mention for the opportunity for recycling of solid waste is included in airport regulations. The Airport does not provide any dumpsters or similar receptacles for waste disposal on the facility.

To promote additional solid waste disposal and recycling opportunities, language should be added to the hangar lease that encourages the tenant to use Knott Recycling center and County transfer stations, and to be conscientious of any waste generated in their hangar or business.

## Future Development and Recommendations

### FUTURE DEVELOPMENT

Future development projects at the airport include tenant improvements, landside and airside facility development, and rehabilitation projects. The demolition and waste associated with each of these projects would be the responsibility of the contractor performing the work. It is assumed that the demolition waste would be taken to the transfer station or landfill.

### RECOMMENDATIONS

#### Immediate

An immediate recommendation would be for the City to create an Airport Solid Waste and Recycling Plan, utilizing guidance from FAA in the *Airport Recycling, Reuse, and Waste Reduction at Airports: A Synthesis Document*.

It is recommended that the Airport continue the existing practice of leaving airfield clippings in place. This practice saves money on disposal fees while preserving the aesthetics of the infield area and providing needed nutrients to the turf.

#### Short-Term

A short-term recommendation would be to add a statement into hangar leases advising tenants of the recycling options available through Deschutes County Department of Solid Waste and to encourage tenants to recycle and minimize waste. Additionally, informational brochures on recycling opportunities could be distributed to all hangar tenants to encourage them to recycle their waste. Informational brochures should be distributed in electronic formats whenever possible.

The City could also consider making solid waste and recycling dumpsters available on the property to encourage airport tenants to properly dispose of and recycle their waste.

#### Ongoing

An ongoing recommendation would be to reevaluate the airport's solid waste plan, especially after development has occurred. Any increase in hangars and additional businesses at the airport may increase the amount of waste generated.



## Appendix E: Preliminary ATCT Analysis

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### Airspace and Facility Consolidation

#### Airspace:

An airport traffic control tower (ATCT) at Bend will, by necessity, be required to coordinate closely with the Seattle Air Route Traffic Control Center (ARTCC) and the Redmond ATCT via Letters of Agreement (LOA) and direct voice/digital communication. These LOAs and facility coordination will deal with:

1. ATCT Hours of operation
2. Standard Operational Procedures (SOP)
3. Instrument approach/departure procedures
4. Instrument flight plan releases
5. Handoffs
6. Opposite Direction Operations (ODO)
7. Airport conditions
8. Emergency procedures
9. Coordination and Interaction with Redmond ATCT
- 10.etc.

Close coordination between the Bend Municipal Airport and Roberts Field Airport ATCT in Redmond is necessitated by the fact that the two airports are in close proximity ( $11.5 \pm$  sm) creating operational complications for each.

An ATCT, whether traditional or remote at Bend, would greatly benefit from a STARS or other track-based display possibly driven by SWIM data to furnish the controllers with greater situational awareness. The BI-6 located at Redmond will provide excellent coverage of the Bend airspace. When augmented with ADS-B data, the system additionally could provide surface traffic movement information for ADS-B equipped aircraft and ground vehicles equipped with “squitters”. The Redmond ATCT does not currently have a radar display which hampers the efficiency of air traffic services at both airports.



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### Bend Municipal Airport

### Airport Traffic Control Alternatives

### Discussion

The choice facing Bend is between moving ahead with a legacy ATCT, implementing a remote tower emerging technology solution, or remaining a non-towered airport. Below are a few of the pluses and minuses of each.

#### **Airport Traffic Control Options:**

##### Traditional ATCT:

###### Advantages:

1. Widely employed throughout the NAS;
2. Certified to provide airport traffic services;
3. Straightforward well understood process for siting, design, and construction.

###### Disadvantages:

1. Fixed structure not readily adaptable to airport growth;
2. Capital and O&M cost;
3. Not easily repurposed when being replaced – high demolition cost.

##### Remote Tower:

###### Advantages:

1. Provides controllers with enhanced situational awareness of the airport environs via HD video cameras that can provide visual target designation, tagging and tracking based on sensor inputs (radar, ADS-B, visual, IR, etc.).
2. Digital video technologies, such as digital zooming, coupled with tracking pan-tilt-zoom (PTZ) cameras provide the controller with powerful tools that can improve controller situational awareness of the airport surface and airspace when coupled with a track-based (radar) display.
3. Flexibility – A remote tower system is readily scalable and expandable to accommodate airport growth.
4. Lower capital costs than a traditional ATCT.
5. The remote tower airfield equipment is easier to install and requires less utilities (water, sewer) and no fire protection or elevator.
6. Small sensor footprint has minimum impact on airport land use.

###### Disadvantages:



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5. The remote tower airfield equipment is easier to install and requires less utilities (water, sewer) and no fire protection or elevator.
6. Small sensor footprint has minimum impact on airport land use.

###### Disadvantages:



## Appendix F: Glossary of Aviation Terms and Abbreviations

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# GLOSSARY OF AVIATION TERMS

*The following glossary of aviation terms was compiled from a variety of aviation industry sources.*

**Above Ground Level (AGL)** – As measured above the ground; used to identify heights of built items (towers, etc.) on aeronautical charts in terms of absolute height above the ground.

**Accelerate Stop Distance Available (ASDA)** – The length of the takeoff run available plus the length of a stopway, when available.

**Agricultural Aviation** – The use of fixed-wing or rotor-wing aircraft in the aerial application of agricultural products (i.e., fertilizers, pesticides, etc.).

**Air Cargo** – All commercial air express and air freight with the exception of airmail and parcel post.

**Air Carrier/Airline** – All regularly scheduled airline activity performed by airlines certificated in accordance with Federal Aviation Regulations (FAR Part 121).

**Air Taxi** – Operations of aircraft “for hire” for specific trips, commonly referred to as aircraft available for charter (FAR Part 135).

**Aircraft Approach Category** – Grouping of aircraft based on the speed they are traveling when configured for landing (typically 1.3 times the aircraft stall speed in landing configuration). As a rule of thumb, slower approach speeds mean smaller airport dimensions and faster approach speeds require larger dimensions. The aircraft approach categories are:

- Category A - Speed less than 91 knots;
- Category B - Speed 91 knots or more but less than 121 knots
- Category C - Speed 121 knots or more but less than 141 knots
- Category D - Speed 141 knots or more but less than 166 knots
- Category E - Speed 166 knots or more

**Aircraft Holding Area** – An area typically located adjacent to a taxiway and runway end designed to accommodate aircraft prior to departure (for pre-takeoff engine checks, instrument flight plan clearances, etc.). Per FAA design standards, aircraft holding areas should be located outside the runway safety area (RSA) and obstacle free zone (OFZ) and aircraft located in the holding area should not interfere with normal taxiway use (taxiway object free area). Sometimes referred to as holding bays or “elephant ear.” Smaller areas (aircraft turnarounds) are used to facilitate aircraft movement on runways without exit taxiways or where back-taxiing is required.

**Aircraft Operation** – A landing or takeoff is one operation. An aircraft that takes off and then lands creates two aircraft operations.

**Aircraft Owners and Pilots Association (AOPA)** – A general aviation organization.

**Aircraft Parking Line (APL)** – A setback depicted on an ALP or other drawings that defines the minimum separation between aircraft parking areas and an adjacent runway or taxiway. The APL dimension reflects runway and taxiway clearances (object free area, etc.) and FAR Part 77 airspace surface clearance (transitional surface penetrations) for parked aircraft. Typically the tail height of the parked aircraft is used to determine adequate clearance for the transitional surface.

**Airplane Design Group** – A grouping of airplanes based on wingspan and tail height. As with Approach Category, the wider the wingspan, the bigger the aircraft is, the more room it takes up for operating on an airport. The Airplane Design Groups are:

- |            |                                                                                                   |
|------------|---------------------------------------------------------------------------------------------------|
| Group I:   | Up to but not including 49 feet or tail height up to but not including 20 feet.                   |
| Group II:  | 49 feet up to but not including 79 feet or tail height from 20 up to but not including 30 feet.   |
| Group III: | 79 feet up to but not including 118 feet or tail height from 30 up to but not including 45 feet.  |
| Group IV:  | 118 feet up to but not including 171 feet or tail height from 45 up to but not including 60 feet. |
| Group V:   | 171 feet up to but not including 214 feet or tail height from 60 up to but not including 66 feet. |
| Group VI:  | 214 feet up to but not including 262 feet or tail height from 66 up to but not including 80 feet. |

**Airport** – A landing area regularly used by aircraft for receiving or discharging passengers or cargo, including heliports and seaplane bases.

**Airport Beacon (also Rotating Beacon)** – A visual navigational aid that displays alternating green and white flashes for a lighted land airport and white for an unlighted land airport.

# GLOSSARY OF AVIATION TERMS

**Airports District Office (ADO)** – The local “office of the FAA that coordinates planning and construction projects. The Seattle ADO is responsible for airports located in Washington, Oregon, and Idaho.

**Airport Improvement Program (AIP)** – The funding program administered by the Federal Aviation Administration (FAA) with user fees which are dedicated to improvement of the national airport system. This program currently provides 95% of funding for eligible airport improvement projects. The local sponsor of the project (i.e., airport owner) provides the remaining 5% known as the “match.”

**Airport Layout Plan (ALP)** – The FAA approved drawing which shows the existing and anticipated layout of an airport for the next 20 years. An ALP is prepared using FAA design standards. Future development projects must be consistent with the ALP to be eligible for FAA funding. ALP drawings are typically updated every 7 to 10 years to reflect significant changes, or as needed.

**Airport Reference Code (ARC)** – An FAA airport coding system that is defined based on the critical or design aircraft for an airport or individual runway. The ARC is an alpha-numeric code based on aircraft approach speed and airplane wingspan (see definitions in glossary). The ARC is used to determine the appropriate design standards for runways, taxiways, and other associated facilities. An airport designed to accommodate a Piper Cub (an A-I aircraft) requires less room than an airport designed to accommodate a Boeing 747 (a D-V aircraft).

**Airport Reference Point (ARP)** – The approximate mid-point of an airfield that is designated as the official airport location.

**Aircraft Rescue and Fire Fighting (ARFF)** – On airport emergency response required for certificated commercial service airports (see FAR Part 139).

**Airside** – The portion of an airport that includes aircraft movement areas (runways, taxiways, etc.)

**Airspace** – The area above the ground in which aircraft travel. It is divided into enroute and terminal airspace, with corridors, routes, and restricted zones established for the control and safety of air traffic.

**Alternate Airport** – An airport that is available for landing when the intended airport becomes unavailable. Required for instrument flight planning in the event that weather conditions at destination airport fall below approach minimums (cloud ceiling or visibility).

**Annual Service Volume (ASV)** – An estimate of how many aircraft operations an airport can handle based upon the number, type and configuration of runways, aircraft mix (large vs. small, etc.), instrumentation, and weather conditions with a “reasonable” amount of delay. ASV is a primary planning standard used to determine when a runway (or an airport) is nearing its capacity, and may require new runways or taxiways. As operations levels approach ASV, the amount of delay per operation increases; once ASV is exceeded, “excessive” delay generally exists.

**Approach End of Runway** - The end of the runway used for landing. Pilots generally land into the wind and choose a runway end that best aligns with the wind.

**Approach Light System (ALS)** – Configurations of lights positioned symmetrically beyond the runway threshold and the extended runway centerline. The ALS visually augments the electronic navigational aids for the runway.

**Approach Reference Code (APRC)** – The APRC is composed of three components: AAC, ADG, and visibility minimums. Visibility minimums are expressed as Runway Visual Range (RVR) values in feet of 1600, 2400, 4000, and 5000 (nominally corresponding to lower than 1/2 mile, lower than 3/4 mile but not lower than 1/2 mile, not lower than 3/4 mile, and not lower than one mile, respectively).

**Approach Surface (Also FAR Part 77 Approach)** – An imaginary (invisible) surface that rises and extends from the ends of a runway to provide an unobstructed path for aircraft to land or take off. The size and slope of the approach surface vary depending upon the size of aircraft that are accommodated and the approach capabilities (visual or instrument).

**Apron** - An area on an airport designated for the parking, loading, fueling, or servicing of aircraft (also referred to as tarmac and ramp).

**Aqueous Film Forming Foam (AFFF)** – A primary fire-fighting agent that is used to create a blanket that smothers flame or prevents ignition (fuel spills, etc.). AFFF is also used to foam runways during emergency landings.

**Asphalt or Asphaltic Concrete (AC)** – Flexible oil-based pavement used for airfield facilities (runways, taxiways, aircraft parking apron, etc.); also commonly used for road construction.

## GLOSSARY OF AVIATION TERMS

**Automated Surface Observation System (ASOS) and Automated Weather Observation System (AWOS)** – Automated observation systems providing continuous on-site weather data, designed to support aviation activities and weather forecasting.

**AVGAS** – Highly refined gasoline used in airplanes with piston engines. The current grade of AVGAS available is 100 Octane Low Lead (100LL).

**Avigation Easement** – A grant of property interest (airspace) over land to ensure unobstructed flight. Typically acquired by airport owners to protect the integrity of runway approaches. Restrictions typically include maximum height limitations for natural (trees, etc.) or built items, but may also address permitted land uses by the owner of the underlying land that are compatible with airport operations.

**Back-Taxiing** – The practice of aircraft taxiing on a runway before takeoff or after landing, normally, in the opposite direction of the runway's traffic pattern. Back-taxiing is generally required on runways without taxiway access to both runway ends.

**Based Aircraft** – Aircraft permanently stationed at an airport usually through some form of agreement with the airport owner. Used as a measure of activity at an airport.

**Capacity** – A measure of the maximum number of aircraft operations that can be accommodated on the runways of an airport in an hour.

**Ceiling** – The height above the ground or water to base of the lowest cloud layers covering more than 50 percent of the sky.

**Charter** – Operations of aircraft "for hire" for specific trips, commonly referred to an aircraft available for charter.

**Circle to Land or Circling Approach** – An instrument approach procedure that allows pilots to "circle" the airfield to land on any authorized runway once visual contact with the runway environment is established and maintained throughout the procedure.

**Commercial Service Airport** – An airport designed and constructed to serve scheduled or unscheduled commercial airlines. Commercial service airports are certified under FAR Part 139.

**Common Traffic Advisory Frequency (CTAF)** – A frequency used by pilots to communicate and obtain airport advisories at an uncontrolled airport.

**Complimentary Fire Extinguishing Agent** – Fire extinguishing agents that provide rapid fire suppression, which may be used in conjunction with principal agents (e.g., foam). Examples include sodium-based and potassium-based dry chemicals, Halocarbons, and Carbon dioxide. Also recommended for electrical and metal fires where water-based foams are not used. Complimentary agents are paired with principal agents based on their compatibility of use.

**Conical Surface** – One of the FAR Part 77 "Imaginary" Surfaces. The conical surface extends outward and upward from the edge of the horizontal surface at a slope of 20:1 to a horizontal distance of 4,000 feet.

**Controlling Obstruction** – The highest obstruction relative to a defined plane of airspace (i.e., approach surface, etc.).

**Critical Aircraft** – Aircraft which controls one or more design items based on wingspan, approach speed and/or maximum certificated take-off weight. The same aircraft may not be critical to all design items (i.e., runway length, pavement strength, etc.). Also referred to as "design aircraft."

**Crosswind** – Wind direction that is not parallel to the runway or the path of an aircraft.

**Crosswind Runway** – An additional runway (secondary, tertiary, etc.) that provides wind coverage not adequately provided by the primary runway. Crosswind runways are generally eligible for FAA funding when a primary runway accommodates less than 95 percent of documented wind conditions (see wind rose).

**Decision Height (DH)** – For precision instrument approaches, the height (typically in feet or meters above runway end touchdown zone elevation) at which a decision to land or execute a missed approach must be made by the pilot.

**Declared Distances** – The distances the airport owner declares available for airplane operations (e.g., takeoff run, takeoff distance, accelerate-stop distance, and landing distance). In cases where runways meet all FAA design criteria without modification, declared distances equal the total runway length. In cases where any declared distances are less than full runway length, the dimension should be published in the FAA Airport/Facility Directory (A/FD).

**Departure Reference Code (DPRC)** – The DPRC represents aircraft that can take off from a runway while any aircraft are present on adjacent taxiways, under particular meteorological conditions with no special operational procedures necessary.

## GLOSSARY OF AVIATION TERMS

**Departure Surface** – A surface that extends upward from the departure end of an instrument runway that should be free of any obstacle penetrations. For instrument runways other than air carrier, the slope is 40:1, extending 10,200 feet from the runway end. Air carrier runways have a similar surface designed for one-engine inoperative conditions with a slope of 62.5: 1.

**Design Aircraft** – Aircraft which controls one or more design items based on wingspan, approach speed and/or maximum certificated takeoff weight. The same aircraft may not represent the design aircraft for all design items (i.e., runway length, pavement strength, etc.). Also referred to as “critical aircraft.”

**Displaced Threshold** – A landing threshold located at a point other than on the runway end, usually provided to mitigate close-in obstructions to runway approaches for landing aircraft. The area between the runway end and the displaced threshold accommodates aircraft taxi and takeoff, but not landing.

**Distance Measuring Equipment (DME)** – Equipment that provides electronic distance information to enroute or approaching aircraft from a land-based transponder that sends and receives pulses of fixed duration and separation. The ground stations are typically co-located with VORs, but they can also be co-located with an ILS.

**Distance Remaining Signs** – Airfield signs that indicate to pilots the amount of useable runway remaining in 1,000-foot increments. The signs are located along the side of the runway, visible for each direction of runway operation.

**DNL** – Day-night sound levels, a mathematical method of measuring noise exposure based on cumulative, rather than single event impacts. Night time operations (10pm to 7AM) are assessed a noise penalty to reflect the increased noise sensitivity that exists during normal hours of rest. Previously referred to as Ldn.

**Easement** – An agreement that provides use or access of land or airspace (see aviation easement) in exchange for compensation.

**Enplanements** – Domestic, territorial, and international revenue passengers who board an aircraft in the states in scheduled and non-scheduled service of aircraft in intrastate, interstate, and foreign commerce and includes intransit passengers (passengers on board international flights that transit an airport in the US for non-traffic purposes).

**Entitlements** – Distribution of Airport Improvement Plan (AIP) funds by FAA from the Airport & Airways Trust Fund to commercial service airport sponsors based on passenger enplanements or cargo volumes and smaller fixed amounts for general aviation airports (Non-Primary Entitlements).

**Experimental Aircraft** – See homebuilt aircraft.

**Federal Aviation Administration (FAA)** – The FAA is the branch of the U.S. Department of Transportation that is responsible for the development of airports and air navigation systems.

**FAR Part 77** – Federal Air Regulations (FAR) which establish standards for determining obstructions in navigable airspace and defines imaginary (airspace) surfaces for airports and heliports that are designed to prevent hazards to air navigation. FAR Part 77 surfaces include approach, primary, transitional, horizontal, and conical surfaces. The dimensions of surfaces can vary with the runway classification (large or small airplanes) and approach type of each runway end (visual, non-precision instrument, precision instrument). The slope of an approach surface also varies by approach type and runway classification. FAR Part 77 also applies to helicopter landing areas.

**FAR Part 139** – Federal Aviation Regulations which establish standards for airports with scheduled passenger commercial air service. Airports accommodating scheduled passenger service with aircraft more than 9 passenger seats must be certified as a “Part 139” airport. Airports that are not certified under Part 139 may accommodate scheduled commercial passenger service with aircraft having 9 passenger seats or less.

**Final Approach Fix (FAF)** – The fix (location) from which the final instrument approach to an airport is executed; also identifies beginning of final approach segment.

**Final Approach Point (FAP)** – For non-precision instrument approaches, the point at which an aircraft is established inbound for the approach and where the final descent may begin.

**Fixed Base Operator (FBO)** – An individual or company located at an airport providing aviation services. Sometimes further defined as a “full service” FBO or a limited service. Full service FBOs typically provide a broad range of services (flight instruction, aircraft rental, charter, fueling, repair, etc.) where a limited service FBO provides only one or two services (such as fueling, flight instruction or repair).

**Fixed Wing** – A plane with one or more “fixed wings,” as opposed to a helicopter that utilizes a rotary wing.

# GLOSSARY OF AVIATION TERMS

**Flexible Pavement** – Typically constructed with an asphalt surface course and one or more layers of base and subbase courses that rest on a subgrade layer.

**Flight Service Station (FSS)** – FAA or contracted service for pilots to contact (on the ground or in the air) to get weather and airport information. Flight plans are also filed with the FSS.

**General Aviation (GA)** – All civil (non-military) aviation operations other than scheduled air services and non-scheduled air transport operations for hire.

**Glide Slope (GS)** – For precision instrument approaches, such as an instrument landing system (ILS), the component that provides electronic vertical guidance to aircraft.

**Global Positioning System (GPS)** – GPS is a system of navigating which uses multiple satellites to establish the location and altitude of an aircraft with a high degree of accuracy. GPS supports both enroute flight and instrument approach procedures.

**Helicopter Landing Pad (Helipad)** – A designated landing area for rotor wing aircraft. Requires protected FAR Part 77 imaginary surfaces, as defined for heliports (FAR Part 77.29).

**Helicopter Parking Area** – A designated area for rotor wing aircraft parking that is typically accessed via hover-taxi or ground taxiing from a designated landing area (e.g., helipad or runway-taxiway system). If not used as a designated landing area, helicopter parking pads do not require dedicated FAR Part 77 imaginary surfaces.

**Heliport** – A designated helicopter landing facility (as defined by FAR Part 77).

**Height Above Airport (HAA)** – The height of the published minimum descent altitude (MDA) above the published airport elevation. This is normally published in conjunction with circling minimums.

**High Intensity Runway Lights (HIRL)** – High intensity (i.e., very bright) lights are used on instrument runways to help pilots to see the runway when visibility is poor.

**High Speed (Taxiway) Exit** – An acute-angled exit taxiway extending from a runway to an adjacent parallel taxiway which allows landing aircraft to exit the runway at a higher rate of speed than is possible with standard (90-degree) exit taxiways.

**Hold Line (Aircraft Hold Line)** – Pavement markings located on taxiways that connect to runways, indicating where aircraft should stop before entering runway environment. At controlled

airports, air traffic control clearance is required to proceed beyond a hold line. At uncontrolled airports, pilots are responsible for ensuring that a runway is clear prior to accessing for takeoff.

**Hold/Holding Procedure** – A defined maneuver in controlled airspace that allows aircraft to circle above a fixed point (often over a navigational aid or GPS waypoint) and altitude while awaiting further clearance from air traffic control.

**Home Built Aircraft** – An aircraft built by an amateur from a kit or specific design (not an FAA certified factory built aircraft). The aircraft built under the supervision of an FAA-licensed mechanic and are certified by FAA as “Experimental.”

**Horizontal Surface** – One of the FAR Part 77 Imaginary (invisible) Surfaces. The horizontal surface is an imaginary flat surface 150 feet above the established airport elevation (typically the highest point on the airfield). Its perimeter is constructed by swinging arcs (circles) from each runway end and connecting the arcs with straight lines. The oval-shaped horizontal surface connects to other Part 77 surfaces extending upward from the runway and also beyond its perimeter.

**Initial Approach Point/Fix (IAP/IAF)** – For instrument approaches, a designated point where an aircraft may begin the approach procedure.

**Instrument Approach Procedure (IAP)** – A series of defined maneuvers designed to enable the safe transition between enroute instrument flight and landing under instrument flight conditions at a particular airport or heliport. IAPs define specific requirements for aircraft altitude, course, and missed approach procedures. See precision or non-precision instrument approach.

**Instrument Flight Rules (IFR)** – IFR refers to the set of rules pilots must follow when they are flying in bad weather. Pilots are required to follow these rules when operating in controlled airspace with visibility (ability to see in front of themselves) of less than three miles and/or ceiling (a layer of clouds) lower than 1,000 feet.

**Instrument Landing System (ILS)** – An ILS is an electronic navigational aid system that guides aircraft for a landing in bad weather. Classified as a precision instrument approach, it is designed to provide a precise approach path for course alignment and vertical descent of aircraft. Generally consists of a localizer, glide slope, outer marker, and middle marker. ILS runways are generally equipped with an approach lighting system (ALS) to maximize approach capabilities. A Category I ILS allows aircraft to descend as low as 200 feet above runway elevation with  $\frac{1}{2}$  mile visibility.

## GLOSSARY OF AVIATION TERMS

**Instrument Meteorological Conditions (IMC)** – Meteorological conditions expressed in terms of visibility, distance from clouds, and ceiling less than minima specified for visual meteorological conditions.

**Instrument Runway** – A runway equipped with electronic navigational aids that accommodate straight-in precision or non-precision instrument approaches.

**Itinerant Operation** – All aircraft operations at an airport other than local, i.e., flights that come in from another airport.

**Jet Fuel** – Highly refined grade of kerosene used by turbine engine aircraft. Jet-A is currently the common commercial grade of jet fuel.

**Knot (Nautical Mile)** – one nautical mile = 1.152 statute miles.

**Landing Area** – That part of the movement area intended for the landing and takeoff of aircraft.

**Landing Distance Available (LDA)** – The length of runway which is available and suitable for the ground run of an airplane landing.

**Landside** – The portion of an airport that includes aircraft parking areas, fueling, hangars, airport terminal area facilities, vehicle parking and other associated facilities.

**Larger than Utility Runway** – As defined under FAR Part 77, a runway designed and constructed to serve large planes (aircraft with maximum takeoff weights greater than 12,500 pounds).

**Ldn** – Noise measurement metric (see DNL)

**Left Traffic** – A term used to describe which side of a runway the airport traffic pattern is located. Left traffic indicates that the runway will be to the pilot's left when in the traffic pattern. Left traffic is standard unless otherwise noted in facility directories at a particular airport.

**Large Aircraft** – An aircraft with a maximum takeoff weight more than 12,500 lbs.

**Light Sport Aircraft (LSA)** – A basic aircraft certified by FAA that can be flown by pilots with limited flight training (Sport Pilot certificates), but also provide lower cost access to basic aircraft for all pilot levels. LSA design limits include maximum a gross takeoff weight of 1,320 pounds (land planes) and a maximum of two seats.

**Local Area Augmentation System (LAAS)** – GPS-based instrument approach that utilizes ground-based systems to augment satellite coverage to provide vertical (glideslope) and horizontal (course) guidance.

**Local Operation** – Aircraft operation in the traffic pattern or within sight of the tower, or aircraft known to be departing or arriving from flight in local practice areas, or aircraft executing practice instrument approaches at the airport.

**Localizer** – The component of an instrument landing system (ILS) that provides electronic lateral (course) guidance to aircraft. Also used to support non-precision localizer approaches.

**LORAN C** – A navigation system using land based radio signals, which indicates position and ground speed, but not elevation. (See GPS)

**Localizer Performance with Vertical Guidance (LPV)** – Satellite navigation (SATNAV) based GPS approaches providing "near category I" precision approach capabilities with course and vertical guidance. LPV approaches are expected to eventually replace traditional step-down, VOR and NDB procedures by providing a constant, ILS glideslope-like descent path. LPV approaches use high-accuracy WAAS signals, which allow narrower glideslope and approach centerline obstacle clearance areas.

**Magnetic Declination** – Also called magnetic variation, is the angle between magnetic north and true north. Declination is considered positive east of true north and negative when west. Magnetic declination changes over time and with location. Runway end numbers, which reflect the magnetic heading/alignment (within 5 degrees +/-) occasionally require change due to declination.

**MALSR** – Medium-intensity Approach Lighting System with Runway alignment indicator lights. An approach lighting system (ALS) which provides visual guidance to landing aircraft.

**Medevac** – Fixed wing or rotor-wing aircraft used to transport critical medical patients. These aircraft are equipped to provide life support during transport.

**Medium Intensity Runway Lights (MIRL)** – Runway edge lights which are not as intense as HIRLs (high intensity runway lights). Typical at medium and smaller airports which do not have sophisticated instrument landing systems.

# GLOSSARY OF AVIATION TERMS

**Microwave Landing System (MLS)** – An instrument landing system operating in the microwave spectrum, which provides lateral and vertical guidance to aircraft with compatible equipment. Originally developed as the “next-generation” replacement for the ILS, the FAA discontinued the MLS program in favor of GPS-based systems.

**Minimum Descent Altitude (MDA)** – The lowest altitude in a non-precision instrument approach that an aircraft may descend without establishing visual contact with the runway or airport environment.

**Minimums** – Weather condition requirements established for a particular operation or type of operation.

**Missed Approach Procedure** – A prescribed maneuver conducted by a pilot when an instrument approach cannot be completed to a landing. Usually requires aircraft to climb from the airport environment to a specific holding location where another approach can be executed or the aircraft can divert to another airport.

**Missed Approach Point (MAP)** – The defined location in a non-precision instrument approach where the procedure must be terminated if the pilot has not visually established the runway or airport environment.

**Movement Area** – The runways, taxiways and other areas of the airport used for taxiing, takeoff and landing of aircraft, i.e., for aircraft movement.

**MSL** - Elevation above Mean Sea Level.

**National Plan of Integrated Airport Systems (NPIAS)** – The NPIAS is the federal airport classification system that includes public use airports that meet specific eligibility and activity criteria. A “NPIAS designation” is required for an airport to be eligible to receive FAA funding for airport projects.

**Navigational Aid (Navaid)** – Any visual or electronic device that helps a pilot navigate. Can be for use to land at an airport or for traveling from point A to point B.

**Noise Contours** – Continuous lines of equal noise level usually drawn around a noise source, such as runway, highway or railway. The lines are generally plotted in 5-decibel increments, with higher noise levels located nearer the noise source, and lesser exposure levels extending away from the source.

**Non-Directional Beacon (NDB)** – Non-Directional Beacon which transmits a signal on which a pilot may “home” using equipment installed in the aircraft.

**Non-Precision Instrument (NPI) Approach** - A non-precision instrument approach provides horizontal (course) guidance to pilots for landing. NPI approaches often involve a series of “step down” sequences where aircraft descend in increments (based on terrain clearance), rather than following a continuous glide path. The pilot is responsible for maintaining altitude control between approach segments since no “vertical” guidance is provided.

**Obstacle Clearance Surface (OCS)** – As defined by FAA, an approach surface that is used in conjunction with alternative threshold siting/clearing criteria to mitigate obstructions within runway approach surfaces. Dimensions, slope and placement depend on runway type and approach capabilities. Also known as Obstacle Clearance Approach (OCA).

**Obstruction** – An object (tree, house, road, phone pole, etc.) that penetrates an imaginary surface described in FAR Part 77.

**Obstruction Chart (OC)** – A chart that depicts surveyed obstructions that penetrate a FAR Part 77 imaginary surface surrounding an airport. OC charts are developed by the National Ocean Service (NOS) based on a comprehensive survey that provides detailed location (latitude/longitude coordinates) and elevation data in addition to critical airfield data.

**Parallel Taxiway** – A taxiway that is aligned parallel to a runway, with connecting taxiways to allow efficient movement of aircraft between the runway and taxiway. The parallel taxiway effectively separates taxiing aircraft from arriving and departing aircraft located on the runway. Used to increase runway capacity and improve safety.

**Passenger Facility Charge (PFC)** – A user fee charged by commercial service airports for enplaning passengers. Airports must apply to the FAA and meet certain requirements in order to impose a PFC.

**Pavement Condition Index (PCI)** – A scale of 0-100 that is used to rate airfield pavements ranging from failed to excellent based on visual inspection. Future PCIs can be predicted based on pavement type, age, condition and use as part of a pavement maintenance program.

**Pavement Strength or Weight Bearing Capacity** – The design limits of airfield pavement expressed in maximum aircraft weight for specific and landing gear configurations (i.e., single wheel, dual wheel, etc.) Small general aviation airport pavements are typically designed to accommodate aircraft weighing up to 12,500 pounds with a single-wheel landing gear.

# GLOSSARY OF AVIATION TERMS

**Portland Cement Concrete (PCC)** – Rigid pavement used for airfield facilities (runways, taxiways, aircraft parking, helipads, etc.).

**Precision Approach Path Indicator (PAPI)** – A system of lights located by the approach end of a runway that provides visual approach slope guidance to aircraft during approach to landing. The lights typically show green if a pilot is on the correct flight path, and turn red if a pilot is too low.

**Precision Instrument Runway (PIR)** – A runway equipped with a “precision” instrument approach (descent and course guidance), which allows aircraft to land in bad weather.

**Precision Instrument Approach** – An instrument approach that provides electronic lateral (course) and vertical (descent) guidance to a runway end. A non-precision instrument approach typically provides only course guidance and the pilot is responsible for managing defined altitude assignments at designated points within the approach.

**Primary Runway** – That runway which provides the best wind coverage, etc., and receives the most usage at the airport.

**Primary Surface** – One of the FAR Part 77 Imaginary Surfaces, the primary surface is centered on top of the runway and extends 200 feet beyond each end. The width is from 250' to 1,000' wide depending upon the type of airplanes using the runway.

**Principal Fire Extinguishing Agent** – Fire extinguishing agents that provide permanent control of fire through a fire-smothering foam blanket. Examples include protein foam, aqueous film forming foam and fluoroprotein foam.

**Procedure Turn (PT)** – A maneuver in which a turn is made away from a designated track followed by a turn in an opposite direction to permit an aircraft to intercept the track in the opposite direction (usually inbound).

**Area Navigation (RNAV)** – is a method of instrument flight navigation that allows an aircraft to choose a course within a network of navigation beacons rather than navigating directly to and from the beacons. Originally developed in the 1960, RNAV elements are now being integrated into GPS-based navigation.

**Relocated Threshold** – A runway threshold (takeoff and landing point) that is located at a point other than the (original) runway end. Usually provided to mitigate nonstandard runway safety area (RSA) dimensions beyond a runway end. When a runway threshold is relocated, the published length of the runway is reduced and the pavement between the relocated threshold and to the original end of the

runway is not available for aircraft takeoff or landing. This pavement is typically marked as taxiway, marked as unusable, or is removed.

**Required Navigation Performance (RNP)** – A type of performance-based navigation system that allows an aircraft to fly a specific path between two 3-dimensionally defined points in space. RNP approaches require on-board performance monitoring and alerting. RNP also refers to the level of performance required for a specific procedure or a specific block of airspace. For example, an RNP of .3 means the aircraft navigation system must be able to calculate its position to within a circle with a radius of 3 tenths of a nautical mile. RNP approaches have been designed with RNP values down to .1, which allow aircraft to follow precise 3 dimensional curved flight paths through congested airspace, around noise sensitive areas, or through difficult terrain.

**Rigid Pavement** – Typically constructed of Portland cement concrete (PCC), consisting of a slab placed on a prepared layer of imported materials.

**Rotorcraft** – A helicopter.

**Runway** – A defined area intended to accommodate aircraft takeoff and landing. Runways may be paved (asphalt or concrete) or unpaved (gravel, turf, dirt, etc.), depending on use. Water runways are defined takeoff and landing areas for use by seaplanes.

**Runway Bearing** – The angle of a runway centerline expressed in degrees (east or west) relative to true north.

**Runway Design Code (RDC)** – The RDC is comprised of the AAC, ADG, and approach visibility minimums of a particular runway. The RDC provides the information needed to determine applicable design standards. The AAC is based on aircraft approach speed. The ADG is based on either the aircraft wingspan or tail height; (whichever is most restrictive) of the largest aircraft expected to operate on the runway and taxiways adjacent to the runway. The approach visibility minimums represent RVR values in feet of 1,200, 1,600, 2,400, 4,000, and 5,000 (corresponding to lower than 1/4 mile, lower than 1/2 mile but not lower than 1/4 mile, lower than 3/4 mile but not lower than 1/2 mile, lower than 1 mile but not lower than 3/4 mile, and not lower than 1 mile, respectively).

**Runway Designation Numbers** – Numbers painted on the ends of a runway indicating runway orientation (in degrees) relative to magnetic north. “20” = 200 degrees magnetic, which means that the final approach for Runway 20 is approximately 200 degrees (+/- 5 degrees).

# GLOSSARY OF AVIATION TERMS

**Runway End Identifier Lights (REILs)** – Two high-intensity sequenced strobe lights that help pilots identify a runway end during landing in darkness or poor visibility.

**Runway Object Free Area (OFA)** – A defined area surrounding a runway that should be free of any obstructions that could interfere with aircraft operations. The dimensions for the OFA increase for runways accommodating larger or faster aircraft.

**Runway Protection Zone (RPZ)** – A trapezoid-shaped area located beyond the end of a runway that is intended to be clear of people or built items. The geometry of the RPZ often coincides with the inner portion of the runway approach surface. However, unlike the approach surface, the RPZ is a defined area on the ground that does not have a vertical slope component for obstruction clearance. The size of the RPZ increases as runway approach capabilities or aircraft approach speeds increase. Previously defined as “clear zone.”

**Runway Safety Area (RSA)** – A symmetrical ground area extending along the sides and beyond the ends of a runway that is intended to accommodate inadvertent aircraft passage without causing damage. The dimensions for the RSA increase for runways accommodating larger or faster aircraft. FAA standards include surface condition (compaction, etc.) and absence of obstructions. Any items that must be located within an RSA because of their function (runway lights, airfield signage, wind cones, etc.) must be frangible (breakable) to avoid significant aircraft damage.

**Segmented Circle** – A system of visual indicators designed to show a pilot in the air the direction of the traffic pattern at that airport.

**Small Aircraft** – An aircraft that weighs 12,500 lbs. or less.

**Straight-In Approach** – An instrument approach that directs aircraft to a specific runway end.

**Statute Mile** – 5,280 feet (a nautical mile = 6,080 feet)

**Stop and Go** – An aircraft operation where the aircraft lands and comes to a full stop on the runway before takeoff is initiated.

**T-Hangar** – A rectangular aircraft storage hangar with several interlocking “T” units that minimizes building per storage unit. Usually two-sided with either bi-fold or sliding doors.

**Takeoff Distance Available (TODA)** – the length of the takeoff run available plus the length of clearway, if available.

**Takeoff Run Available (TORA)** – the length of runway available and suitable for the ground run of aircraft when taking off.

**Taxilane** – A defined path used by aircraft to move within aircraft parking apron, hangar areas and other landside facilities.

**Taxiway** – A defined path used by aircraft to move from one point to another on an airport.

**Threshold** – The beginning of that portion of a runway that is useable for landing.

**Taxiway Design Group (TDG)** – The TDG is based on the undercarriage dimensions of the aircraft. TDG is used to determine taxiway/taxilane width and fillet standards, and in some instances, runway to taxiway and taxiway/taxilane separation requirements.

**Threshold Lights** – Components of runway edge lighting system located at the ends of runways and at displaced thresholds. Threshold lights typically have split lenses (green/red) that identify the beginning and ends of usable runway.

**Through-the-Fence** – Term used to describe how off-airport aviation users (private airparks, hangars, etc.) access an airport “through-the-fence,” rather than having facilities located on airport property.

**Tiedown** – A place where an aircraft is parked and “tied down.” Surface can be grass, gravel or paved. Tiedown anchors may be permanently installed or temporary.

**Touch and Go** – An aircraft operation involving a landing followed by a takeoff without the aircraft coming to a full stop or exiting the runway.

**Traffic Pattern** – The flow of traffic that is prescribed for aircraft landing and taking off from an airport. Traffic patterns are typically rectangular in shape, with upwind, crosswind, base and downwind legs and a final approach surrounding a runway.

**Traffic Pattern Altitude** – The established altitude for a runway traffic pattern, typically 800 to 1,000 feet above ground level (AGL).

**Transitional Surfaces** – One of the FAR Part 77 Imaginary Surfaces, the transitional surface extend outward and upward at right angles to the runway centerline and the extended runway centerline at a slope of 7:1 from the sides of the primary surface and from the sides of the approach surfaces.

# GLOSSARY OF AVIATION TERMS

**Universal Communications (UNICOM)** – Is an air-ground communication facility operated by a private agency to provide advisory service at uncontrolled airports.

**Utility Runway** – As defined under FAR Part 77, a runway designed and constructed to serve small planes (aircraft with maximum takeoff weights of 12,500 pounds or less).

**Vertical Navigation (VNAV)** – Vertical navigation descent data or descent path, typically associated with published GPS instrument approaches. The use of any VNAV approach technique requires operator approval, certified VNAV-capable avionics, and flight crew training.

**VOR - Very High Frequency Omnidirectional Range** – A ground based electronic navigational aid that transmits radials in all directions in the VHF frequency spectrum. The VOR provides azimuth guidance to aircraft by reception of radio signals.

**VORTAC** – VOR collocated with ultra high frequency tactical air navigation (TACAN)

**Visual Approach Slope Indicator (VASI)** – A system of lights located by the approach end of a runway which provides visual approach slope guidance to aircraft during approach to landing. The lights typically show some combination of green and white if a pilot is on the correct flight path, and turn red if a pilot is too low.

**Visual Flight Rules (VFR)** – Rules that govern the procedures to conducting flight under visual conditions. The term is also used in the US to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan.

**Visual Guidance Indicator (VGI)** – Equipment designed to provide visual guidance for pilots for landing through the use of different color light beams. Visual Approach Slope Indicators (VASI) and Precision Approach Path Indicators (PAPI) defined above are examples.

**Waypoint** – A specified geographical location used to define an area navigation route or the flight path of an aircraft employing area navigation.

**Wide Area Augmentation System (WAAS)** – GPS-based instrument approach that can provide both vertical (glideslope) and horizontal (course) guidance. WAAS-GPS approaches are able to provide approach minimums nearly comparable to a Category I Instrument Landing System (ILS).

**Wind Rose** – A diagram that depicts observed wind data direction and speed on a 360-degree compass rose. Existing or planned proposed runway alignments are overlaid to determine wind coverage levels based on the crosswind limits of the design aircraft.

**Wind Cone** – A device located near landing areas used by pilots to verify wind direction and velocity. Usually manufactured with brightly colored fabric and may be lighted for nighttime visibility. Also referred to as "wind sock."

## LIST OF ABBREVIATIONS

AC – Advisory Circular	ILS – Instrument Landing System
AC – Asphaltic Concrete	IMC – Instrument Meteorological Conditions
ACM – Airport Certification Manual	LDA – Landing Distance Available
ADG – Airplane Design Group	LDA - Localizer Directional Aid
ADO – Airport District Office	LIRL – Low Intensity Runway Lighting
AGL – Above Ground Level	LOC – Localizer
AIP – Airport Improvement Program	MALSR – Medium Intensity Approach Lighting System (MALS) with Runway Alignment Indicator Lights (RAIL)
ALP – Airport Layout Plan	MIRL – Medium Intensity Runway Lighting
ALS – Approach Lighting System	MITL – Medium Intensity Taxiway Lighting
AOA – Airport Operations Area	MTOW – Maximum Takeoff Weight
APL – Aircraft Parking Line	NAVAID – Navigation Aid
APRC – Approach Reference Code	NDB – Non-Directional Beacon
ARC – Airport Reference Code	NEPA – National Environmental Policy Act
ARFF – Aircraft Rescue and Fire Fighting	NGS – National Geodetic Survey
ARP - Airport Reference Point	NPIAS – National Plan of Integrated Airport Systems
ASDA – Accelerate-Stop Distance Available	OCS – Obstacle Clearance Surface
ASV – Annual Service Volume	ODALS – Omnidirectional Airport Lighting System
ATC – Air Traffic Control	OFA – Object Free Area
ATCT – Airport Traffic Control Tower	OFZ – Obstacle Free Zone
ASOS – Automated Surface Observation System	PAPI – Precision Approach Path Indicator
AWOS – Automated Weather Observation System	PCC – Portland Cement Concrete
BRL – Building Restriction Line	PCI – Pavement Condition Index
CFR – Code of Federal Regulations	PCN – Pavement Condition Number
CTAF – Common Traffic Advisory Frequency	POFZ – Precision Obstacle Free Zone
DPRC – Departure Reference Code	RAIL – Runway Alignment Indicator Lights
DME – Distance Measuring Equipment	RDC – Runway Design Code
FAA – Federal Aviation Administration	REIL – Runway End Identifier Lights
FAR – Federal Air Regulation	RNAV – Area Navigation
FBO – Fixed Base Operator	ROFA – Runway Object Free Area
GIS – Geographic Information System	ROFZ – Runway Obstacle Free Zone
GS – Glide Slope	RPZ – Runway Protection Zone
GPS – Global Positioning System	RSA – Runway Safety Area
HIRL – High Intensity Runway Lighting	RVR – Runway Visual Range
IFR – Instrument Flight Rules	

## LIST OF ABBREVIATIONS

RVZ – Runway Visibility Zone  
TDG – Taxiway Design Group  
TSA- Taxiway Safety Area  
TSA – Transportation Security Administration  
TODA – Takeoff Distance Available  
TOFA – Taxiway/Taxilane Object Free Area  
TORA – Takeoff Run Available  
TSS – Threshold Siting Surface  
TVOR – Terminal Very High Frequency Omni-directional Range  
UAS – Unmanned Aircraft Systems  
UGA – Urban Growth Area  
UGB – Urban Growth Boundary  
UHF – Ultra-High Frequency  
USDA – United States Department of Agriculture  
USGS – U.S. Geological Survey  
UNICOM – Universal Communications  
VASI – Visual Approach Slope Indicator  
VFR – Visual Flight Rules  
VGI - Visual Guidance Indicators  
VOR – Very High Frequency Omni-Directional Range





CITY OF BEND

BEND MUNICIPAL AIRPORT