



Engineering Services  
Terminal Engineering Center

Bend Municipal Airport (BDN)  
City of Bend, Oregon

AIRPORT TRAFFIC CONTROL TOWER  
SITING REPORT

**FINAL DECEMBER 22, 2022**



***CTBXaviation***

Developed by:  
In association with

 **CENTURY  
WEST**  
E N G I N E E R I N G



Submitted to FAA by the City of Bend

**SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

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**ATCT Siting Report (BDN)**  
**TABLE OF CONTENTS**

	<u>Page Number</u>
<b>Preface</b>	<b>EXECUTIVE SUMMARY</b>
Site Comparison Chart	4
Approval Authorizations	5
<b>1. BACKGROUND INFORMATION</b>	
1.1 General	6
1.2 Traffic Patterns	8
1.3 Instrument Approaches	9
1.4 FAA Contract Tower	10
1.5 Purpose of This Report	10
<b>2. SITES CONSIDERED</b>	
2.1 Candidate Sites	11
2.2 Sites Eliminated	12
2.3 Additional Site Eliminated	12
<b>3. PREFERRED SITES</b>	
3.1 Site 2	
3.1.1 Description	13
3.1.2 Site Reference Data	14
3.1.3 Siting Criteria Evaluation	14
3.2 Site 4	
3.2.1 Description	16
3.2.2 Site Reference Data	16
3.2.3 Siting Criteria Evaluation	17
3.3 Site 5	
3.3.1 Description	19
3.3.2 Site Reference Data	19
3.3.3 Siting Criteria Evaluation	20
<b>4. SITING ASSESSMENT</b>	22
<b>5. FINAL SITE RECOMMENDATION</b>	22
<b>6. CAB SIZE AND ORIENTATION</b>	23
<b>7. SUPPLEMENTAL INFORMATION</b>	23

**SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

---

**ATCT Siting Report (BDN)**  
**TABLE OF CONTENTS**

**APPENDICES**

Appendix A	Airport Concurrence Letter and Engineer's Certification
Appendix B	ROM Cost Estimate
Appendix C	All Sites Evaluated
Appendix D	Panoramic Screen Shots from 3D Computer Simulation
Appendix E	Drawings <ul style="list-style-type: none"><li><input type="checkbox"/> Cab Model &amp; Layout and Shaft Structures</li><li><input type="checkbox"/> Airport Layout Plan (ALP)</li><li><input type="checkbox"/> Recent Helicopter Traffic Pattern</li><li><input type="checkbox"/> Site Access and Infrastructure Plans</li></ul>
Appendix F	Obstruction Evaluations (TOPR/TERPS) / Airspace Analyses
Appendix G	Environmental Documentation
Appendix H	Visibility Performance Analysis (ATCTVAT)
Appendix I	Security Element for FCT
Appendix J	Meetings Minutes
Appendix K	Safety Risk Management Document
Appendix L	Report Amendments (Airspace Final Determination)

## **SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

---

## **EXECUTIVE SUMMARY**

### **The Recommended Site – SITE 5**

Site 5 is the recommended location as selected from three (3) preferred sites. The proposed tower cab will be eight sided with four (4) roof support columns positioned with respect to the Runway 16/34. A butt-glazed laminated window system is compatible with the 4 column design to provide expansive views. There will not be a base building since the supporting shaft will house all ATC building functions. The cab floor plan will have approximately 440 sf of floor area up to the consoles (less the stairwell) which can ultimately accommodate 4 controller positions plus a supervisor. Two (2) controllers and a supervisor are anticipated at the Commissioning of the ATCT. The cab eye height will be 85 feet Above Ground Level (AGL) and will utilize slatwall consoles for mounting displays and monitors. A 4 column window system. Site 5 is the recommended site as determined in accordance with the FAA Siting Assessment Panel. This site has been selected for the ATCT that best meets all siting criteria and is deemed safe under the Safety Management System. The proposed tower provides completely unobstructed views of all controlled airport surface areas and maximum visibility of airborne traffic.

### **Impacts**

The impacts resulting from the proposed construction of this ATCT at Site 5 are as follows. No other impacts to or from Site # have been determined.

- The FAA Flight Procedures Team (FPT) determined that there will not be an impact to existing TERPS IFR. No future changes to instrument procedures are known at this time.
- ATCT penetrates the FAR Part 77, 7:1 transition surface by 65' to Runway 16/34, a GPS instrument runway. The ATCT will be marked and lighted with obstruction lights in accordance with FAR Part 77 requirements.
- Dual transparent shades in the cab due to the effects of sunrise and sunset are recommended.

### **Elimination of Site – SITE 4**

Site 4 had been considered a preferred site; however, it was eliminated from further consideration during the 3D Validation and Safety Assessment Panel review process. It was deemed to be unacceptable because of site spatial limitations and extensive distance from Runway end 16 and the Heliport negatively impacting visibility of airport vehicles and aircraft.

**SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
 BEND MUNICIPAL AIRPORT (BDN)  
 BEND, OREGON

**Site Comparison Chart – BDN ATCT**

Item Description	Site 2	Site 4 (eliminated)	Site 5 RECOMMEND
Latitude	44° 05' 26.66" N	44° 05' 16.61" N	44° 05' 34.19" N
Longitude	121° 11' 53.65" W	121° 11' 53.56" W	121° 11' 52.99" W
Eye-Level (AGL)	85'	45'	85'
Eye-Level (AMSL)	3517'	3490'	3516'
Cab Floor Level (AGL)	80'	40'	80'
Cab Floor Level (AMSL)	3512'	3485'	3511'
Top of Tower (AGL)	115'	75'	115'
Top of Tower (AMSL)	3547'	3520'	3546'
Surveyed Ground Level (AMSL)	3432	3431'	3431
Maximum Distance (to farthest point on all runways and taxi ways)	2327'	1357'	3084
2-Point Lateral Discrimination (Deg)	Exceeds Minimum	Exceeds Minimum	Exceeds Minimum
Object Discrimination (Pass/Fail) Front View (Dodge Caravan)	PASS	PASS	PASS
Object Discrimination (Pass/Fail) Front View (C-172)	PASS	PASS	PASS
Line of Sight Angle of Incidence	1.40°	1.27°	1.04°
ATCT Orientation Primary Direction	West	West	West & North
Airport Quadrant	East	East	East
Cab Size (floor area)	440 sf	440 sf	440 sf
Columns/Mullions	Columns	Columns	Columns
Console Type (traditional, slat wall)	Slatwall	Slatwall	Slatwall
Land Area (available)	1 acre	1 acre	1 acre
Access to ATCT Site (Yes or No)	Yes	Yes	Yes
Tech Ops Preliminary Review Issues	None	None	None
TERPS Impacts	None	None	None
14 CFR Part 77 Impacts	Penetrate 7:1 by 39'	Penetrate 7:1 by 21'	Penetrates 7:1 by 65'
Environmental Issues	Prev. Disturbed Land	Prev. Disturbed Land	Prev. Disturbed Land
ATCT Potential Impacts to Future & Existing Navaids	None	None	None
Comparative Cost Estimate* (\$100K per vertical foot)	\$14,954,205	N/A	\$14,901,705
Safety Assessment Initial Risk Ranking	L M H	L M H	L M H
Safety Assessment Predicted Residual Risk Ranking	L M H	L M H	L M H

\* For comparative planning purposes. Actual costs to be based on actual design and current trends.

**SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

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**APPROVAL AUTHORITIES**

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**Director of Air Traffic Services, Western Service Area**

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**Director of Technical Operations, Western Service Area**

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**Director of Air Traffic Control Facilities, FAA Headquarters**

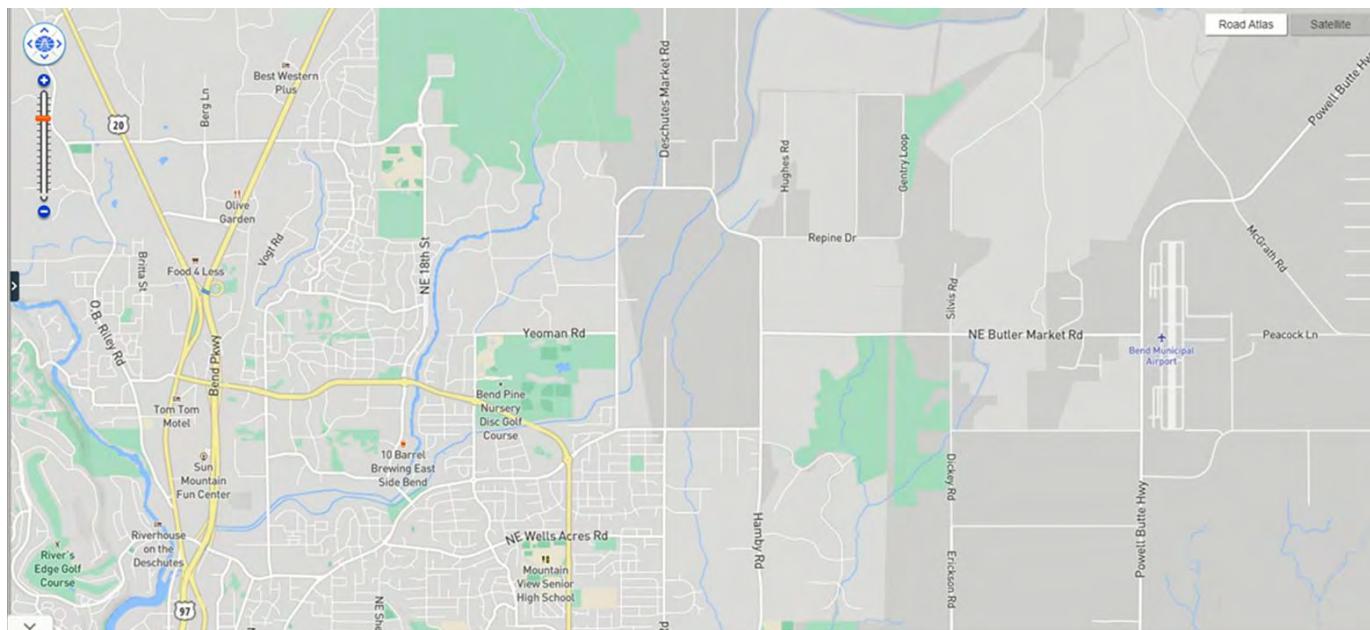
## SITING REPORT

### AIRPORT TRAFFIC CONTROL TOWER BEND MUNICIPAL AIRPORT (BDN) BEND, OREGON

## 1. BACKGROUND INFORMATION

### 1.1 GENERAL

The Bend Municipal Airport (BDN) serves the city of Bend and Deschutes County in Central Oregon. The FAA's National Plan of Integrated Airport Systems categorizes it as a general aviation facility. BDN is identified as a Category 2, High Activity Business and General Aviation airport by the Oregon Department of Aviation. The airport is located 6 miles northeast of the downtown business district of Bend. US Route 97 runs north-south through the city. The airport is accessed from US 97 via US 20E, continuing north on Powell Butte Road. The vicinity map of Bend is shown below.



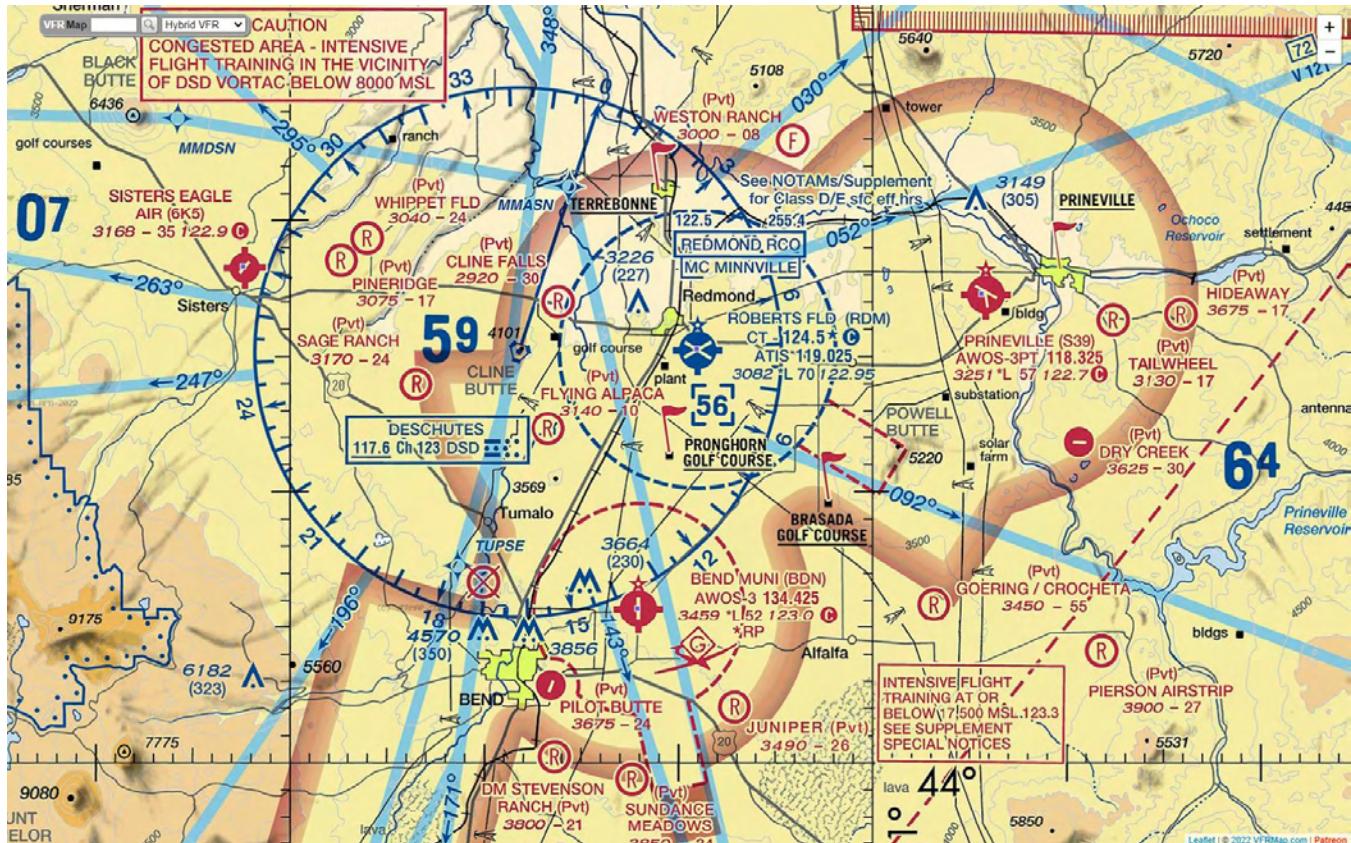
**Vicinity Map of Bend, Oregon**

BDN lies within 120 nautical miles east of the Eugene Mahlon Sweet Field Airport (EUG). Its distance to the two closest public airports is 10 nautical miles to Roberts Field (RDM) to the north and 17 nautical miles to Prineville Airport to the northeast. A portion of the aeronautical sectional chart depicting BDN's proximities to other area airports is shown below. Roberts Field has scheduled commercial airline service and a Federal Contract Tower (FCT) with operating hours of 0600-2200.

BDN caters to the needs of general aviation, hosts two flight training schools, and is home to numerous businesses. Their combined operations make Bend the third busiest airport in the state in terms of takeoffs and landings (over 140,000 total annual operations).

## SITING REPORT

### AIRPORT TRAFFIC CONTROL TOWER BEND MUNICIPAL AIRPORT (BDN) BEND, OREGON



**Aeronautical Sectional Chart – Bend Oregon Area**

Aircraft that generally operate at BDN include corporate jets, helicopters, and single and multi-engine propeller aircraft. Approach and Departure Control services are provided by the Seattle Center ARTCC. BDN is home to an average of 250 based aircraft and supports operations averaging over 385 per day. The airport supports the maintenance, fueling and training activities of Leading Edge Jet Center, as well as manufacture and sales of the Epic Aircraft Company. The company produces the FAA certified Epic E1000 single engine turboprop aircraft.

As depicted on the current Airport Layout Plan (Appendix E), the airport has one (1) paved runway, Runway 16-34, which is planned for extension to the south by 1060 feet. The runway data table is shown below. It is flanked on both sides with full length parallel taxiways. Most of the general aviation (FBOs, aircraft aprons, and hangars) is currently located on the west side of the airfield which is almost 100% developed. The east side has much more space for future hangar and aircraft parking apron development. It currently supports aircraft manufacturing, several hangars, and a heliport.

## SITING REPORT

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

BDN Runway Data Table

<u>Runway</u>	<u>Existing</u>	<u>Ultimate</u>
16-34	5200' X 75'	6260' X 75'



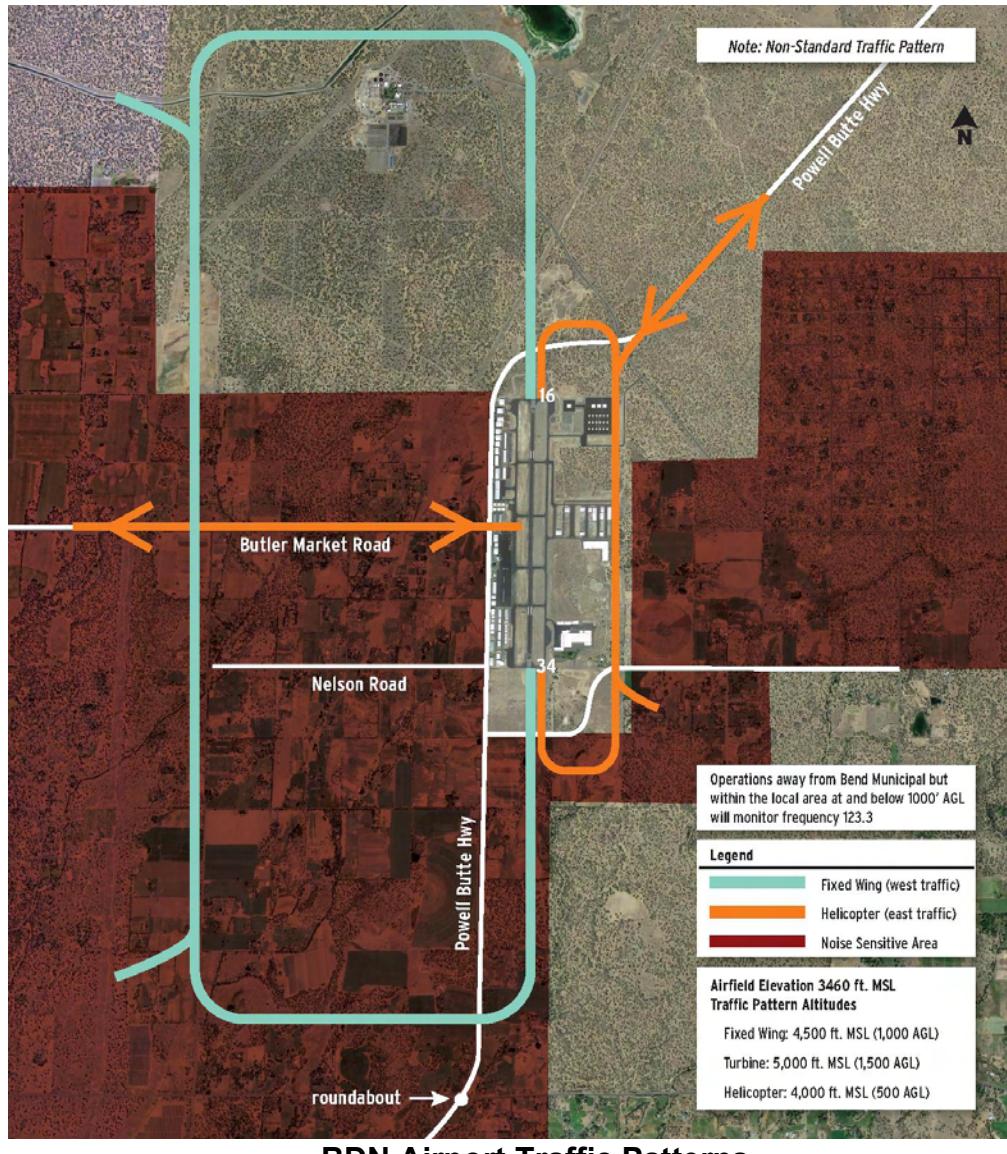
**Aerial Photo – BDN (Google Earth)**

### 1.2 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 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 uses 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, so pilots are asked to avoid flying over them whenever possible, or otherwise, are asked to maintain as much altitude as possible.

## SITING REPORT

### AIRPORT TRAFFIC CONTROL TOWER BEND MUNICIPAL AIRPORT (BDN) BEND, OREGON



### 1.3 INSTRUMENT APPROACHES & LIGHTING

The airport is currently equipped with the following approach and landing aids:

- Precision Approach Path Indicators – PAPI 4 for Runways 16 and 34
- Runway Markings – Non-Precision Instrument for Runways 16 and 34
- Runway Edge Lights – Medium Intensity
- Runway End Identifier Lights (REIL) – Runways 16 and 34

According to the airport management and master plan, there are currently no proposed developments for new or amended existing instrument approach procedures for BDN.

## **SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

---

BDN has four (4) published instrument approaches:

- RNAV (GPS) Runway 34
- RNAV (GPS) Y – Runway 16
- RNAV (GPS) Z – Runway 16
- VOR/DME – Runway 16

Central Oregon is in what is known as a “radar hole”. Since airports in the region are surrounded by high terrain, the current long-range radar from Seattle and Portland cannot track planes when they are flying within 4,000 feet of the ground. There is no Surveillance equipment located at BDN but Redmond Airport (RDM) has a BI-6 radar installed in 2008 that extends coverage to the ground at RDM and BDN. However, that information can only be displayed at the Seattle Center ATRCC for the foreseeable future.

### **1.4 FAA CONTRACT TOWER**

BDN was entered into the Federal Aviation Administration’s (FAA) Federal Contract Tower (FCT) Program in October of 2020. This program provides FAA funding of contract controllers while the Sponsor provides the building, ATC equipment and maintenance. A FCT is a non-Radar, Level 1 airport traffic control tower (a tower that does not use radar).

### **1.5 PURPOSE OF THIS REPORT**

The proposed facility will create a Visual Flight Rules (VFR) Airport Traffic Control Tower (ATCT) at the Bend Municipal Airport (BDN). In April 2022, the City of Bend authorized a Notice-to-Proceed to CTBXaviation of Merritt Island, Florida to conduct this Siting Study in accordance with Chapter 9 of FAA Order 6480.4C and the VISTA process dated 11/5/2021.

The purpose of this report is to document the most suitable location and height for an ATCT, based on the degree to which each siting criteria is met. The considerations will focus on the safety of air traffic operations from the proposed sites. This report also considers factors such as cost of construction, availability of utilities, airport facilities development and environmental issues. The ATCT height and site was determined based on the guidance and requirements set forth by FAA in the above referenced documents. This study was conducted in accordance with the FAA Alternate Siting Process and a Sponsor provided 3D airport simulation and ATCT model. The information developed is the basis of selecting a Recommended Site and resulting in an FAA approved Siting Report.

According to the above referenced FAA VISTA Siting Process, the site selection will be provided in accordance with the most recent version of the FAA Safety Management System (SMS) Manual. The final Siting Report includes a Safety Risk Management Document (see Appendix K) and a Preliminary Hazard List (PHL) (see Appendix M).

## **SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

---

The technical sources data for this study include the most recent Airport Layout Plan (ALP), Google Earth aerial photography, on-site photographs and field survey, the FAA Visibility Tool, a 3D model of the airport and the proposed ATCTs, site visits, utilities and access inventory, and preliminary tower design data.

## **2. SITES CONSIDERED**

### **2.1 CANDIDATE SITES**

After considering the whole airport, six (6) potential sites were identified and reviewed with airport management and the airport master plan consultant. The siting considerations listed in the FAA VISTA and 6480.4C documents were uniformly factored when evaluating the candidate sites. All the Candidate Sites were evaluated with the ATCTVAT (Appendix H). Candidate Sites are labeled 1, 2, 3, 4, 4A, and 5 as shown in Appendix C.

The Bend Municipal Airport identified the need for an Air Traffic Control Tower (ATCT) in the mid-2000s and initiated a preliminary siting study in 2008. Through that process three candidate sites were identified. The sites were further evaluated in the 2012 and 2021 Airport Master Plan projects. The following is a summary of the sites considered and the pros and cons of each site.

Site 1 – Site 1 is located on the east side of the airport near the airport property line. This site was originally identified in 2008 and was desirable because it is located on elevated terrain, provides easy vehicle access from Gibson Road, and had access to utilities that were constructed to support the Epic Aircraft and Aero Facilities developments. At the time this site was originally considered, the east side of the airport had very limited development. In the 2008 analysis Site 1 had the highest cab eye height at 75 feet and was the least desirable of the options considered.

Site 2 – Site 2 is located on the east side adjacent to the parallel taxiway on the southern third of the runway. This site was considered desirable with good site lines to both ends of the runway and parallel taxiways. It also benefitted from rising terrain that limited the cab eye height to 45 feet based on the 2008 analysis. The proposed location is in an undeveloped area on the airport which was viewed positively. Concerns were primarily related to the costs of providing vehicle access and utilities to the site compared to other locations.

Site 3 – Site 3 was proposed on the west side of the airport in the southernmost area of the parking apron. The site provided the lowest cab eye height at 41 feet based on the 2008 evaluation. It is also close to other developed areas providing access to utilities and connections for vehicle access.

Site 4 – Site 4 and an additional site further to the south were considered during the development alternative of the 2021 Airport Master Plan. During the process a parallel runway was contemplated but discarded because it was not justified in the 20-year planning horizon.

## **SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

---

Site 4 is located on higher terrain reducing the cab eye height. Vehicle access and utilities are located close by. Negatives for the site included longer site lines to the north end of the runway, parallel taxiways, and helipad. The site also has a Central Oregon Irrigation District easement that would need to be avoided making site development somewhat challenging.

Site 4A – Site 4A is further south of Site 4 and was located off airport property with the intent of potentially working for the current runway and a possible future parallel runway that was ultimately removed from consideration on the airport layout plan. The site has challenging site lines to the north end of the runway, parallel taxiways, and helipad.

Site 5 – Site 5 is an alternative to the Site 2 location attempting to locate it closer to the midpoint of the runway. It was not promoted during the master plan development because it is located where parking apron and other aircraft use facilities are anticipated. It has similar benefits to Site 2 with good site lines. It shares the same challenges as Site 2 for site vehicle access and development of utilities. Site 5 is also closer to the helipad approach which could be negatively viewed by helicopter operators.

### **2.2 SITES ELIMINATED**

Sites 1,3, and 4A were eliminated from further study with input from airport staff and the city's airport master plan consultant for the following reasons. They were considered the least feasible and provided less safety and functional aspects than the three (3) that remained.

Site 1 was eliminated since it continues to be overcome by development. In the 2008 analysis Site 1 had the highest cab eye height at 75 feet and was the least desirable of the options considered. In the subsequent years, the east side of the airport has developed significantly, and this site is no longer optimal because of obstructed site lines.

Site 3 was eliminated because it would result in the loss of a significant portion of the west side parking apron that is highly utilized. That situation was not viewed favorably by airport users. The vehicle parking and security requirements for an ATCT would also have consumed additional land and created operational challenges for west side hangar tenants.

Site 4A was eliminated because the site has challenging site lines to the north end of the runway and parallel taxiways. It is also proposed on land that is not owned by the City of Bend. The land acquisition process could add two years to the development of an ATCT at this location.

### **2.3 ADDITIONAL SITE ELIMINATED**

As reconfirmed at the Siting Assessment Panel, Site 4 was eliminated by the FAA VISTA team, consultant, Air Traffic representative, and airport sponsor at the 3D Model validation session due to it being too far from the approach end of Runway 16 and heliport, plus site constraints.

## **SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

---

### **3. PREFERRED SITES**

The remaining sites for further consideration, Sites 2 and 5 were fully evaluated. Refer to Appendix C for their airfield locations.

#### **3.1 SITE 2**



##### **3.1.1 Description**

This site is located on the east side of the airfield in a previously disturbed but vegetated area. It is adjacent to future aviation development areas according to the current ALP. It is 523 feet east of the centerline of Runway 16-34.

There are no NAVAIDs or weather sensors in the vicinity. The existing ground is flat at an elevation 3432 feet MSL. The airport elevation is 3459 feet MSL which is at the high point of the airport located at the touchdown zone and physical approach end of Runway 34. The ATCT cab was evaluated at an eye level of 3517 feet MSL (85 feet AGL). The overall height estimated to the tops of the antennas and lightning rods is estimated for airspace determinations (35' above cab floor) at 3547 feet MSL (115 feet AGL).

The Air Traffic Control Specialists (ATCS) will mostly have northern and westerly views of the airfield. Lines of sight to all runway, taxiways, helipads, terminal apron will be unobstructed from this site and height.

## **SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

---

### **3.1.2 Site Reference Data**

Site 2 is located at Lat.  $44^{\circ} 05' 26.66''$ N; Long.  $121^{\circ} 11' 53.65''$ W at its center.

Ground Elevation is 3432 ft MSL

Eye Height is at 85' AGL (3517' MSL) is 5 feet above the proposed cab floor.

(A greater than minimum eye height of 85' AGL was confirmed at the Siting Assessment Panel)

### **3.1.3 Siting Criteria Evaluation**

**A. TERPS:** Analysis conducted by the FAA Flight Procedures Technical (FPT) Specialist indicated no effect on any of the flight procedures at BDN based on current published procedures and runway configuration. There are no planned changes to instrument procedures as reported by the airport management. A preliminary detailed analysis conducted by the consultant for this report is included in Appendix F which finds no impacts or effects on IFR procedures. A future 1060-foot runway extension to the south for Runway 16-34 is shown on the Airport Layout Plan (ALP) which has no effect on the TERPS results.

**B. 14 CFR Part 77:** The height of the air terminals on top of the ATCT are estimated to be a maximum of 115 feet AGL (35 feet above cab floor). Based on a Primary Surface of 500 feet wide, at that height they would penetrate the 7:1 transition surface by 39 feet, is outside of the Building Restriction Line (BRL) and will be lit with L-810 red steady burning obstruction lights, as required. Although, there is no penetration to the extended 8:1 heliport approach surface, it is worth noting that, at a horizontal distance of 3750 feet, there will be 326 feet of vertical clearance between it and the tops of air terminals on the ATCT.

**C. Impacts to Communications, Navigation, and Surveillance Equipment:** An FAA Tech Ops Preliminary Report (TOPR) determined that a TOPR analysis is not needed for this site as it is outside any facility protection areas (Appendix F). The consultant for this report observes that there are no tower communications issues anticipated. There is a VOR approach to BDN but the facility is located 10 NM NW away and will not be impacted by an ATCT structure at BDN. There are no Navigation facilities located at BDN. There is no Surveillance equipment located at BDN.

**D. Visibility Performance Requirements: Line-of-Sight (LOS) Angle of Incidence** was measured from the proposed eye height of 85 feet AGL (3517 feet MSL) relative to the ground elevation (3432 feet MSL) at Site 2. The LOS to the furthest movement area of the airport from Site 2 is to the approach end of Runway 16 at a distance of 4039. However, the Key Point to determine controller eye height is actually the extended future approach end of Runway 34 at a distance of 2327 feet. This is because the 34 end is about 50 feet higher than the 16 end and the higher end controls the application of the required angle of incidence of 48 minutes or 0.80 degrees. Calculations of eye heights are presented in Appendix H. Runway end elevations in this study were taken from the current Airport Layout Plan and checked by field survey. A required eye height of 85 feet AGL satisfies the FAA Angle of Incidence criteria as evidenced by the 3D computer simulation, is high enough to provide a clear Line-of-Sight (LOS) to the airport traffic pattern and all existing and future airfield movement areas as well as

## **SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

---

provide for functional spaces in the building below the cab. The FAA uses the typical distance from the cab floor to the Air Traffic Control Specialist's (ATCS) eye as 5 feet. When the 5 feet is subtracted from the eye height at Site 2, a cab floor height of 80 feet AGL (3512 feet MSL) is the result.

**Object Discrimination Analysis** is the metric that determines how well an object the size of a Dodge Caravan or a Cessna 152 can be identified from the proposed site and height. Site 2 at the 3517-foot MSL eye height produced Passing results (see Appendix H for ATCTVAT).

**2-Point Lateral Discrimination** is the analysis that quantifies the impact of tower height on the ability to laterally separate two critical points of the airport surface operations. A minimum of 8 minutes separation between objects adjacent to each other (such as aircraft on a runway end and its taxiway hold line). This separation is exceeded throughout the airfield from Site 2.

**E. Safety Assessment:** No hazards identified after increasing eye height to 85' (see Apps J & K).

**F. Operational Requirements:** Summarized from ATCS observations during the  
Siting Assessment Panel.

1. ATCT Orientation: See Appendix E for relative orientation to the airfield and runways.
2. Weather: No impacts.
3. Look-down Angle: Appendix D, Panoramic 3D Views depict a clear look down to the taxiway.
4. Look-up Angle: Appendix D, Panoramic 3D Views depict a clear look up angle.
5. Look-Across Angle: Appendix D, Panoramic 3D Views depict clear look across angles.
6. Construction: No impacts.
7. Access: A paved driveway with utilities will be extended to from an existing paved street (Gibson Air Road). Water and sewer exist on the site.
8. Non-Movement Areas: No apparent issues. Some hangar areas are obscured but access points to the parallel taxiways are visible.
9. Cab Size Evaluation: Sufficient for 2 to 5 controllers.
10. Rotating Beacon: Will be placed on top of the new ATCT.
11. Other: Cab eye height increased above minimum height to improve recognition.

**G. Economic Considerations:** (See Appendix E for Access and Infrastructure Costs)

**H. Environmental Considerations:** Appendix G. No known impacts. Previously

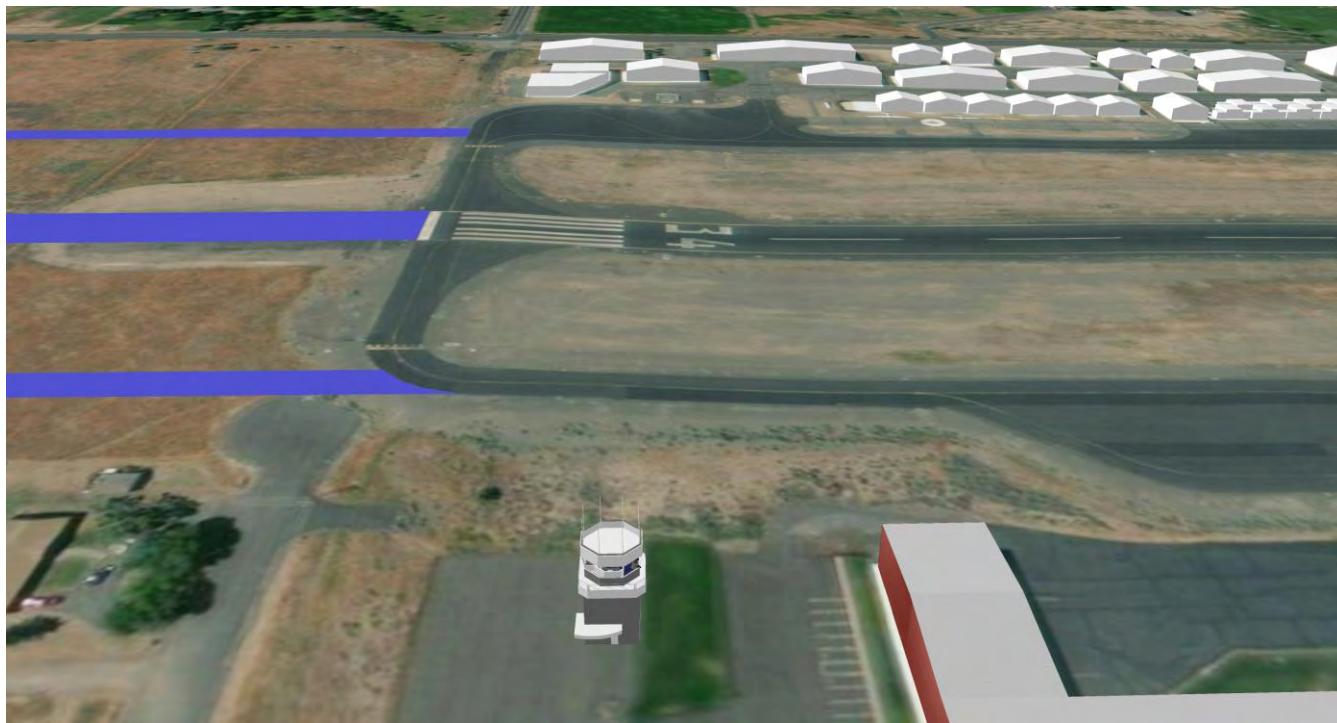
disturbed ground. Noted in FAA Order 5050.4: *para. 5-6.4 dd. FAA construction, reconstruction, or relocation of a non-Radar, Level 1 airport traffic control tower (a tower that does not use radar) at an existing visual flight rule airport, or FAA approval of an Airport Layout Plan (ALP) and/or Federal funding to do so, provided the action would occur on a previously disturbed area of the airport and not: (1) cause an increase in the number of aircraft operations, a change in the time of aircraft operations, or a change in the type of aircraft operating at the airport; (2) cause a significant noise increase in noise sensitive areas; or (3) cause significant air quality impacts. (ARP, ATO)*"

## **SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

---

### **3.2 SITE 4 (Eliminated at the 3D Model Evaluation session)**



#### **3.2.1 Description**

This site is located on the east side of the airfield in a previously disturbed and paved automobile parking area. It is adjacent to future aviation development areas. It is 530 feet east of the centerline of Runway 16-34.

There are no NAVAIDs or weather sensors in the vicinity. The existing ground is flat at an elevation 3445 feet MSL. The airport elevation is 3459 feet MSL which is at the high point of the airport located at the touchdown zone and physical approach end of Runway 34. The ATCT cab was evaluated at an eye level of 3490 feet MSL (45 feet AGL). The overall height estimated to the tops of the antennas and lightning rods is estimated for airspace determinations (35' above cab floor) at 3520 feet MSL (75 feet AGL).

The Air Traffic Control Specialists (ATCS) will mostly have northernly and western views of the airfield. Lines of sight to all runway, taxiways, terminal apron will be unobstructed from this site and height. Future hangar development will however block views to the helipads area.

#### **3.2.2 Site Reference Data**

Site 4 is located at Lat. 44° 05' 16.61"N; Long. 121° 11' 53.56"W at its center.

Ground Elevation is 3445 ft MSL

Eye Height is at 45' AGL (3490' MSL) is 5 feet above the proposed cab floor.

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## **SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

---

### **3.2.3 Siting Criteria Evaluation**

**A. TERPS:** Site 4 is eliminated and thus not analyzed by the FAA FPT Specialist. The consultant for this report observes there are no planned changes to procedures reported by the airport management. A preliminary detailed analysis conducted by the consultant for this report is included in Appendix F which finds no impacts or effects to IFR procedures. A future 1060-foot runway extension to the south for Runway 16-34 is shown on the Airport Layout Plan (ALP) which has no effect on the TERPS results.

**B. 14 CFR Part 77:** The height of the air terminals on top of the ATCT are estimated to be a maximum of 75 feet AGL (35 feet above cab floor). Based on a Primary Surface of 500 feet wide, at that height they would penetrate the 7:1 transition surface by 21 feet, is outside of the Building Restriction Line (BRL) and will be lit with L-810 red steady burning obstruction lights, as required. Although, there is no penetration to the extended 8:1 heliport approach surface, it is worth noting that, at a horizontal distance of 4800 feet, there will be 484 feet of vertical clearance between it and the tops of air terminals on the ATCT.

**C. Impacts to Communications, Navigation, and Surveillance Equipment:** An FAA Tech Ops Preliminary Report (TOPR) determined that a TOPR analysis is not needed for this site as it is outside any facility protection areas (Appendix F). There are no tower communications issues anticipated. There is a VOR approach to BDN but the facility is 10 NM NW which not be impacted by an ATCT structure at BDN. There are no Navigation facilities located at BDN. There is no Surveillance equipment located at BDN.

**D. Visibility Performance Requirements: Line-of-Sight (LOS) Angle of Incidence** was measured from the proposed eye height of 61 feet AGL (3490 feet MSL) relative to the ground elevation (3445 feet MSL) at Site 4. The LOS to the furthest movement area of the airport from Site 4 is to the approach end of Runway 16 at a distance of 5043 feet. However, the Key Point to determine controller eye height is actually the extended future approach end of Runway 34 at a distance of 1357 feet. This is because the 34 end is about 50 feet higher than the 16 end and the higher end controls the application of the required angle of incidence of 48 minutes or 0.80 degrees. Calculations of eye heights are presented in Appendix H. Runway end elevations in this study were taken from the current Airport Layout Plan and checked by field survey. An eye height of 45 feet AGL exceeds and satisfies the FAA Angle of Incidence criteria as evidenced by the 3D computer simulation. It will be high enough to provide a clear Line-of-Sight (LOS) to the airport traffic pattern and all existing and future airfield movement areas except the helipads on the north end of the airport. Future hangar development will block the view to that area. The cab eye height is raised 11 feet above the required minimum in order to provide for functional spaces in the building, three stories below the cab.

The FAA uses the typical distance from the cab floor to the Air Traffic Control Specialist's (ATCS) eye as 5 feet. When the 5 feet is subtracted from the eye height at Site 4, a cab floor height of 40 feet AGL (3485 feet MSL) is the result.

**SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

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**Object Discrimination Analysis** is the metric that determines how well an object the size of a Dodge Caravan or a Cessna 152 can be identified from the proposed site and height. Site 4 at the 3490-foot MSL eye height produced Passing results (see Appendix H for ATCTVAT).

**2-Point Lateral Discrimination** is the analysis that quantifies the impact of tower height on the ability to laterally separate two critical points of the airport surface operations. A minimum of 8 minutes separation between objects adjacent to each other (such as aircraft on a runway end and its taxiway hold line). This separation is exceeded throughout the airfield from Site 4.

**E. Safety Assessment: N/A**

A safety assessment and operational requirement evaluation were not completed during the siting study as Site 4 was eliminated from consideration during model validation.

**F. Operational Requirements: N/A**

A safety assessment and operational requirement evaluation were not completed during the siting study as Site 4 was eliminated from consideration during model validation.

**G. Economic Considerations:** (See Appendix E for Access and Infrastructure Costs)**H. Environmental Considerations:**

See Appendix G. No known impacts. Previously disturbed ground.

Noted in FAA Order 5050.4: *para. "5-6.4 dd. FAA construction, reconstruction, or relocation of a non-Radar,*

*Level 1 airport traffic control tower (a tower that does not use radar) at an existing visual flight rule airport, or FAA approval of an Airport Layout Plan (ALP) and/or Federal funding to do so, provided the action would occur on a previously disturbed area of the airport and not: (1) cause an increase in the number of aircraft operations, a change in the time of aircraft operations, or a change in the type of aircraft operating at the airport; (2) cause a significant noise increase in noise sensitive areas; or (3) cause significant air quality impacts. (ARP, ATO)"*

## SITING REPORT

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

### 3.3 SITE 5 (RECOMMENDED)



#### 3.3.1 Description

This site is located on the east side of the airfield in a previously disturbed but vegetated area. It is adjacent to future aviation development areas. It is 570 feet east of the centerline of Runway 16-34.

There are no NAVAIDS or weather sensors in the vicinity. The existing ground is flat at an elevation 3431 feet MSL. The airport elevation is 3459 feet MSL which is at the high point of the airport located at the touchdown zone and physical approach end of Runway 34. The ATCT cab was evaluated at an eye level of 3516 feet MSL (85feet AGL). The overall height estimated to the tops of the antennas and lightning rods is estimated for airspace determinations (35' above cab floor) at 3546 feet MSL (115 feet AGL).

The Air Traffic Control Specialists (ATCS) will mostly have western views (NW & SW to runway approaches) of the airfield. Lines of sight to all runway, taxiways, terminal apron will be unobstructed from this site and height.

#### 3.3.2 Site Reference Data

Site 5 is located at Lat. 44° 05' 34.19"N; Long. 121° 11' 52.99"W at its center.

Ground Elevation is 3431 ft MSL

Eye Height is at 85' AGL (3516' MSL) is 5 feet above the proposed cab floor.

## **SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

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### **3.3.3 Siting Criteria Evaluation**

**A. TERPS:** Analysis conducted by the FAA Flight Procedures Technical (FPT) Specialist indicated no effect on any of the flight procedures based on current published procedures and runway configuration. There are no planned changes to procedures reported by the airport management. In addition, a preliminary detailed analysis conducted by the consultant for this report is included in Appendix F which finds no impacts or effects to IFR procedures. A future 1060-foot runway extension to the south for Runway 16-34 is shown on the Airport Layout Plan (ALP) which has no effect on the TERPS results.

**B. 14 CFR Part 77:** The height of the air terminals on top of the ATCT are estimated to be a maximum of 115 feet AGL (35 feet above cab floor). Based on a Primary Surface of 500 feet wide, at that height they would penetrate the 7:1 transition surface by 65 feet which is allowable since an ATCT is fixed by function, is outside of the Building Restriction Line (BRL) and will be lit with L-810 red steady burning obstruction lights, as required. Although, there is no penetration to the extended 8:1 heliport approach surface, it is worth noting that, at a horizontal distance of 3030', there will be 237 feet of vertical clearance between it and the tops of air terminals on the ATCT.

**C. Impacts to Communications, Navigation, and Surveillance Equipment:** An FAA Tech Ops Preliminary Report (TOPR) determined that a TOPR analysis is not needed for this site as it is outside any facility protection areas (Appendix F). There are no tower communications issues anticipated. There is a VOR approach to BDN but the facility is 10 NM NW which not be impacted by an ATCT structure at BDN. There are no Navigation facilities located at BDN. There is no Surveillance equipment located at BDN.

**D. Visibility Performance Requirements: Line-of-Sight (LOS) Angle of Incidence** was measured from the proposed eye height of 85 feet AGL (3516 feet MSL) relative to the ground elevation (3431 feet MSL) at Site 5. The LOS to the furthest movement area of the airport from Site 5 is to the approach end of Runway 16 at a distance of 3330 feet. However, the Key Point to determine controller eye height is actually the extended future approach end of Runway 34 at a distance of 3084 feet. This is because the 34 end is about 50 feet higher than the 16 end and the higher end controls the application of the minimum angle of incidence of 48 minutes or 0.80 degrees. Calculations of eye heights are presented in Appendix H. Runway end elevations in this study were taken from the current Airport Layout Plan and checked by field survey. An eye height of 85 feet AGL satisfies the FAA Angle of Incidence criteria as evidenced by the 3D computer simulation. It will be high enough to provide a clear Line-of-Sight (LOS) to the airport traffic pattern and all existing and future airfield movement areas as well as provide for functional spaces in the building below the cab.

The FAA uses the typical distance from the cab floor to the Air Traffic Control Specialist's (ATCS) eye as 5 feet. When the 5 feet is subtracted from the eye height at Site 5, a cab floor height of 80 feet AGL (3511 feet MSL) is the result.

**SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

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**Object Discrimination Analysis** is the metric that determines how well an object the size of a Dodge Caravan or a Cessna 152 can be identified from the proposed site and height. Site 5 at the 3516-foot MSL eye height produced Passing results (see Appendix H for ATCTVAT).

**2-Point Lateral Discrimination** is the analysis that quantifies the impact of tower height on the ability to laterally separate two critical points of the airport surface operations. A minimum of 8 minutes separation between objects adjacent to each other (such as aircraft on a runway end and its taxiway hold line). This separation is exceeded throughout the airfield from Site 5.

**E. Safety Assessment:** No hazards identified after increasing eye height to 85' (see Apps J & K).

**F. Operational Requirements:**

Summarized from ATCS observations during the Siting Assessment Panel.

23. ATCT Orientation: See Appendix E for relative orientation to the airfield and runways.

24. Weather: No impacts.

25. Look-down Angle: Appendix D, Panoramic 3D Views depict a clear look down to the taxiway.

26. Look-up Angle: Appendix D, Panoramic 3D Views depict a clear look up angle.

27. Look-Across Angle: Appendix D, Panoramic 3D Views depict clear look across angles.

28. Construction: No impacts.

29. Access: A paved driveway with utilities will be extended from an existing paved street (Gibson Air Road). Water and Sewer currently run adjacent to the site.

30. Non-Movement Areas: No apparent issues. Some hangar areas are obscured but access points to the parallel taxiways are visible.

31. Cab Size Evaluation: Sufficient for 2 to 6 controllers.

32. Rotating Beacon: Will be placed on top of the new ATCT.

33. Other: Cab eye height increased above minimum height to improve recognition.

**G. Economic Considerations:** (See Appendix E for Access and Infrastructure Costs)

**H. Environmental Considerations:**

See Appendix G. No known impacts. Previously disturbed ground.

Noted in FAA Order 5050.4: *para. "5-6.4 dd. FAA construction, reconstruction, or relocation of a non-Radar, Level 1 airport traffic control tower (a tower that does not use radar) at an existing visual flight rule airport, or FAA approval of an Airport Layout Plan (ALP) and/or Federal funding to do so, provided the action would occur on a previously disturbed area of the airport and not: (1) cause an increase in the number of aircraft operations, a change in the time of aircraft operations, or a change in the type of aircraft operating at the airport; (2) cause a significant noise increase in noise sensitive areas; or (3) cause significant air quality impacts. (ARP, ATO)"*

## **SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

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## **4. SITING ASSESSMENT**

The two (2) remaining preferred sites have been evaluated, in this report, in accordance with FAA Order 6480.4C, Chapter 9, Alternate Siting Process and the VISTA Process for Contract Towers. They have undergone a Siting Assessment in accordance with the FAA Safety Management System (SMS) which is an objective identification of potential safety hazards and methods of removal or mitigation. Potential Hazards and Mitigation have been discussed and evaluated at the Siting Assessment Panel (SMP) held at the Bend Municipal Airport (BDN) on June 15, 2022.

## **5. FINAL SITE RECOMMENDATION AND APPROVAL**

**ATCT Site Recommendation**  
**BDN Airport Traffic Control Tower**  
**Bend Municipal Airport**

This Agreement is made by and between ATO Terminal Program Operations, and the Terminal Area Office, collectively known as the "Parties." The purpose of this agreement is to address the siting requirements for the new BDN ATCT.

Section 1. The parties agree that the siting requirements must be as follows:

Article 1: The location of the ATCT (NAD 1983 datum), herein after referred to as **Site 5**

Latitude: N 44° 05' 34.19"

Longitude: W 121° 11' 52.99"

Article 2: The Air Traffic Control Specialist (ATCS) eye height used in the computer simulation and panoramic photographs for the purposes of this agreement is **3516** feet Mean Sea Level (MSL) or **85** feet AGL, based on a **3431** feet MSL site elevation.

Article 3: The total ATCT height including antennae and all other obstructions will be approximately 3546 feet MSL or 115 feet AGL, assuming 35 feet from cab floor height level to top of structure and 3431 feet MSL site elevation.

Article 4: The parties are in general concurrence with the assumptions documented in the final site selection report.

Section 2. The Airport Sponsor agrees to notify the assigned Technical Operations Engineering Services (Terminal) project engineer of any proposed, planned, envisioned projects that would be constructed on airport property that could possibly impact the LOS from the recommended ATCT sites.

Section 3. This agreement does not constitute a waiver of any right guaranteed by law, rule, regulation, or contract on behalf of any party. The Approval Authorities (signatures at the beginning of this report) unanimously agree with the choice of **Site 5** for the new Airport Traffic Control Tower at the Bend Municipal Airport (BDN).

**SITING REPORT**

AIRPORT TRAFFIC CONTROL TOWER  
BEND MUNICIPAL AIRPORT (BDN)  
BEND, OREGON

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## 6. CAB SIZE AND ORIENTATION

The cab size will be an octagon of approximately 500 sf to the windowsills and 440 sf after the stairwell is subtracted. Its orientation and controller positions (LC, GC, FD, SUPE) are shown in Appendix E. Slatwall forconsoles and 4 columns window system have been chosen.

## 7. SUPPLEMENTAL INFORMATION

Appendix A – Airport Concurrence Letter and Engineer's Certification

Appendix B – ROM Cost Estimate

Appendix C – All Sites Evaluated (Potentials & Preferred)

Appendix D – Panoramic Views (3D Model Screenshots)

Appendix E – Drawings (Cab Layout, Orientation, ALP, Access & Infrastructure Plans)

Appendix F – Obstruction Evals (TOPR/TERPS)/Airspace Analyses (OE/AAA)/NAVAIDs

Appendix G – Environmental Documentation

Appendix H – Air Traffic Control Visibility Analysis Tool (ATCVAT)

Appendix I – Security Element for FCT

Appendix J – Meeting Minutes

Appendix K – Safety Risk Management Document

Appendix L – Report Amendment (Airspace Final Determination)

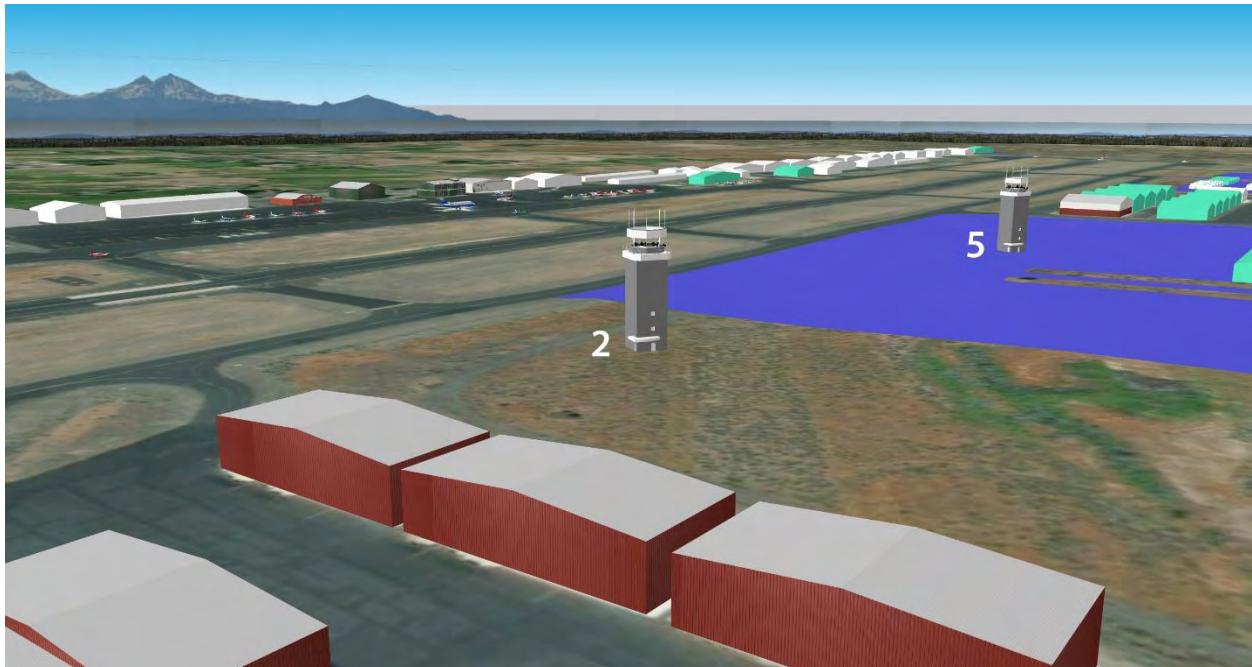
# APPENDICES



Bend Municipal Airport (BDN)  
City of Bend, Oregon

## AIRPORT TRAFFIC CONTROL TOWER SITING REPORT

**FINAL December 22, 2022**



*CTB***X**aviation

Developed by:  
In association with  
 **CENTURY  
WEST**  
ENGINEERING



CITY OF BEND

### **Appendix A – Airport Concurrence Letter**

**LOCATION**

710 NW Wall Street  
Downtown Bend

**MAILING ADDRESS**

PO Box 431  
Bend, OR 97709

**PHONE**

(541) 388-5505  
Relay Users Dial 7-1-1

**FAX**

(541) 385-6676

**WEB**

bendoregon.gov

**MAYOR**

Melanie Kebler

**MAYOR PRO-TEM**

Megan Perkins

**CITY COUNCILORS**

Anthony Broadman  
Barb Campbell  
Mike Riley  
Ariel Mendez

**CITY MANAGER**

Eric King

January 10, 2023

RE: Airport Concurrence Form  
New Airport Traffic Control Tower  
Bend Municipal Airport (BDN)  
Bend, Oregon

The City of Bend, acting as Sponsor for the Bend Municipal Airport, writes this letter to establish concurrence with the siting requirements and impacts of a new Airport Traffic Control Tower (ATCT) to permanently establish VFR Air Traffic Service at the Bend Municipal Airport. This signed document is intended to satisfy FAA national policy regarding written confirmation from the Airport owner/operator stating that the BDN airport user community has been advised about the new ATCT and the impacts that the project would have on their operations.

**Section 1.** The siting requirements are as follows:

1. The center point location for the new ATCT (NAD-83) is identified as Site 5.  
Lat. 44° 05' 34.19" N  
Long. 121° 11' 52.99" W
2. The overall maximum ATCT height (air terminals) will be 3,546 feet MSL (115 feet AGL).
3. The ATCT controller eye height used for evaluating line-of-sight is 3,516 feet MSL (85 feet AGL).
4. The exact location of the ATCT is subject to moving no more than 25 feet within the boundaries of the approved site to efficiently accommodate access, utilities, and parking.
5. The exact ATCT height is subject to and in accordance with Official Airspace Approval per FAA Form 7460-1 from the Seattle Airport District Office. The Airspace Final Determination dated December 22, 2022, found no objections with subsequent provisions as referenced by these cases:

ASN 2022-ANW-3233-NRA  
ASN 2022-ANW-3234-NRA  
ASN 2022-ANW-3235-NRA  
ASN 2022-ANW-3236-NRA

6. Sunrise, sunset, fog, snow, rain, look-down angle, ramp lighting, glare, industrial discharge, and other issues that can adversely affect controllers' view from the ATCT sight have been considered.

**Section 2.** The impacts that may result from the proposed contraction of a new ATCT at Site 5

1. As determined by the FAA Western Flight Procedures Team, the height of the new ATCT will not result in changes to existing instrument procedures.
2. FAA has determined that a TOPR is not needed as Site 5 is outside any facility protection areas.
3. Marking and lighting of the ATCT structure and Operational Safety on Airports During Construction will be complied with in accordance with the FAA's Final Determination letter dated, December 22, 2022.
4. A separate notice to the FAA is required for any construction equipment, such as temporary cranes, whose working limits would exceed the height and lateral dimensions of Site 5.
5. No other impacts.

**Section 3.** The submission of this signed document constitutes concurrence and adherence to FAA construction policy concerning appropriate public notification of the airport community regarding the intent to permanently commission the ATCT and any impacts therein concerning the use of the airport. The submission of this document does not waive the requirement of public comment as defined in the National Environmental Policy Act, the Council on Environmental Quality regulations implementing NEPA (Title 40 of the United States Code of Federal Regulations, Parts 1500-1517), and other statutes, orders, directives, or policy concerning environmental assessment and alternatives.

Name: Tracy Williams  
Tracy Williams, A.A. E., ACE

Title: Bend Municipal Airport Manager

City of Bend  
Bend Municipal Airport

June 2, 2022

Re: Siting Process for a Federal Contract Tower (FCT)  
Bend Municipal Airport (BDN)

This is to certify that the 3D Model of the BDN airport and proposed FCT has been developed in accordance with specifications as required by FAA VISTA.

Accuracy: Within +/- 6 inches vertical and +/- 1 foot horizontal

Virtual Reality: Model is capable of being presented using VR technology

Minimum Data: Latitude and Longitude of ATCT; Floor height of cab; Surrounding structures height for existing and future structures and airfield pavements have been sourced from the latest Airport Layout Plan (dated January 2022).

Sincerely,

**CTBXaviation**



Brian M. Lally, P.E. FL# 33347  
Principal / Managing Member



May 30, 2022

Brian Lally, PE  
CTBX, LC (CTBX)aviation  
380 Ramsey Lane  
Merritt Island, FL 32952

**SUBJECT: BEND MUNICIPAL AIRPORT (KBND) CONTROL TOWER SITING STUDY  
ACCURACY CERTIFICATION**

CTBX, LC (CTBX)aviation requested that John Thompson and Associates Inc. provide Latitude and Longitude and Elevation data at five proposed control tower sites as well as key points on the airfield, and at ground and roof elevations of specific buildings, for their use in evaluating proposed control tower sites. The field data was collected in April of 2022.

I, John P. Thompson, Oregon Professional Land Surveyor, License No. 49220 do hereby certify that the survey data as shown on Project No. CTBX0001 as annotated on AutoCAD file of the prior Airport Layout Plan (by others) of the Bend Municipal Airport for the: Proposed Control Tower Locations, Existing Pavement Key Points, Existing Airport Beacon Location and Recovered Runway Monument Data complies with the following standards of accuracy:

- A. Elevations are referenced to NAVD88 are accurate within 0.10 ft.
- B. Latitude / Longitude values are accurate within 00.00 seconds are referenced to NAD83(2011)(EPOCH 2010.0000)

**JOHN P. THOMPSON, P.L.S**

May 30, 2022

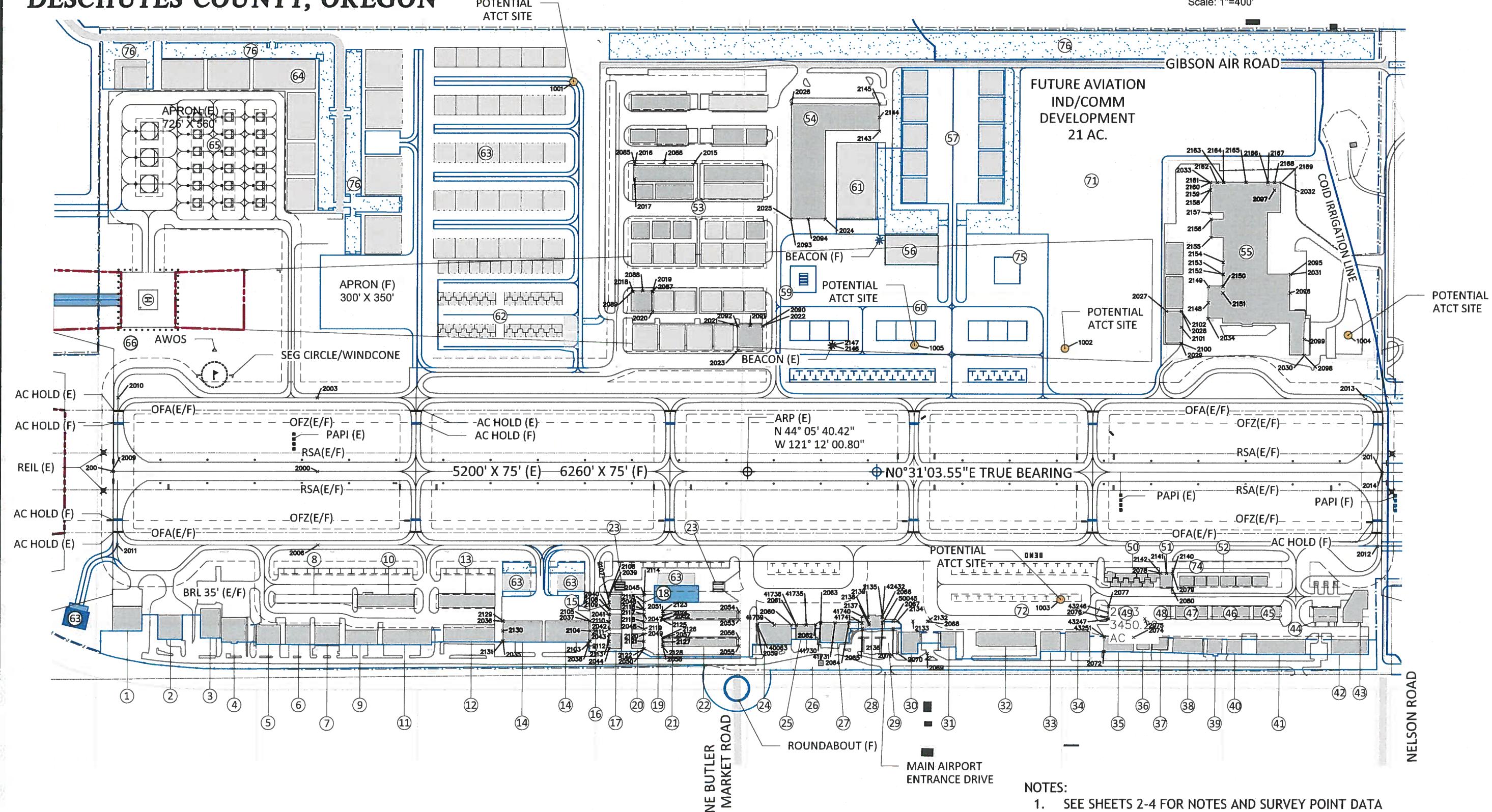


RENEWS: 06-30-20 22

# **CITY OF BEND MUNICIPAL AIRPORT CONTROL TOWER SITING STUDY DESCHUTES COUNTY, OREGON**

0' 400' 800'

Scale: 1"=400'



## NOTE

1. SEE SHEETS 2-4 FOR NOTES AND SURVEY POINT DATA TABLES

# CITY OF BEND MUNICIPAL AIRPORT CONTROL TOWER SITING STUDY DESCHUTES COUNTY, OREGON

EXISTING GROUND DATA TABLE				
ID NUMBER	LATITUDE	LONGITUDE	ELEVATION	DESCRIPTION
2015	N44° 05' 42.66"	W121° 11' 43.61"	3433.6	CONC
2016	N44° 05' 45.03"	W121° 11' 43.60"	3432.6	CONC
2017	N44° 05' 45.03"	W121° 11' 44.42"	3432.3	GRV_SHOT
2018	N44° 05' 45.08"	W121° 11' 50.74"	3426.5	CONC
2019	N44° 05' 44.29"	W121° 11' 50.74"	3426.5	CONC
2020	N44° 05' 44.29"	W121° 11' 51.84"	3426.0	GRV_SHOT
2021	N44° 05' 40.84"	W121° 11' 52.65"	3428.2	GRV_SHOT
2022	N44° 05' 39.85"	W121° 11' 52.65"	3428.6	GRV_SHOT
2023	N44° 05' 40.84"	W121° 11' 54.02"	3428.7	CONC
2024	N44° 05' 37.33"	W121° 11' 46.68"	3436.1	CONC
2025	N44° 05' 38.72"	W121° 11' 46.68"	3436.3	AC
2026	N44° 05' 38.71"	W121° 11' 40.23"	3436.3	AC
2027	N44° 05' 23.50"	W121° 11' 51.81"	3442.3	GS
2028	N44° 05' 22.91"	W121° 11' 51.81"	3443.0	CONC
2029	N44° 05' 22.91"	W121° 11' 53.59"	3443.2	CONC
2030	N44° 05' 17.92"	W121° 11' 54.28"	3443.0	GS
2031	N44° 05' 18.51"	W121° 11' 49.74"	3443.6	AC
2032	N44° 05' 18.90"	W121° 11' 44.61"	3442.6	GS
2033	N44° 05' 21.77"	W121° 11' 44.61"	3442.7	AC
2034	N44° 05' 21.83"	W121° 11' 52.22"	3443.7	CONC
2035	N44° 05' 50.29"	W121° 12' 10.23"	3418.3	GS
2036	N44° 05' 50.29"	W121° 12' 09.14"	3418.7	AC
2037	N44° 05' 46.78"	W121° 12' 09.14"	3423.4	AC
2038	N44° 05' 46.78"	W121° 12' 10.24"	3423.6	CONC
2039	N44° 05' 45.99"	W121° 12' 07.67"	3424.6	AC
2040	N44° 05' 45.99"	W121° 12' 08.49"	3424.5	AC
2041	N44° 05' 45.99"	W121° 12' 08.76"	3424.6	AC
2042	N44° 05' 45.99"	W121° 12' 09.59"	3424.6	AC
2043	N44° 05' 45.99"	W121° 12' 09.86"	3424.5	AC
2044	N44° 05' 45.99"	W121° 12' 10.68"	3424.6	AC

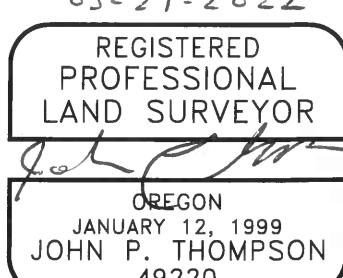
EXISTING GROUND DATA TABLE				
ID NUMBER	LATITUDE	LONGITUDE	ELEVATION	DESCRIPTION
2045	N44° 05' 44.58"	W121° 12' 07.67"	3429.0	AC
2046	N44° 05' 44.58"	W121° 12' 08.49"	3429.0	AC
2047	N44° 05' 44.58"	W121° 12' 08.76"	3429.0	AC
2048	N44° 05' 44.58"	W121° 12' 09.59"	3429.1	AC
2049	N44° 05' 44.58"	W121° 12' 09.86"	3429.0	AC
2050	N44° 05' 44.57"	W121° 12' 10.68"	3429.0	AC
2051	N44° 05' 43.82"	W121° 12' 08.60"	3429.9	AC
2052	N44° 05' 43.82"	W121° 12' 09.04"	3429.8	AC
2053	N44° 05' 40.73"	W121° 12' 09.05"	3430.0	AC
2054	N44° 05' 40.73"	W121° 12' 08.61"	3429.9	AC
2055	N44° 05' 40.73"	W121° 12' 10.52"	3429.9	AC
2056	N44° 05' 40.73"	W121° 12' 10.08"	3429.8	AC
2057	N44° 05' 43.82"	W121° 12' 10.08"	3429.8	AC
2058	N44° 05' 43.82"	W121° 12' 10.52"	3429.9	AC
2059	N44° 05' 40.00"	W121° 12' 09.35"	3432.7	AC
2060	N44° 05' 38.62"	W121° 12' 09.34"	3432.6	AC
2061	N44° 05' 38.42"	W121° 12' 09.34"	3433.8	AC
2062	N44° 05' 37.63"	W121° 12' 09.34"	3434.1	AC
2063	N44° 05' 37.43"	W121° 12' 09.22"	3436.2	AC
2064	N44° 05' 36.28"	W121° 12' 09.22"	3436.5	AC
2065	N44° 05' 35.74"	W121° 12' 09.54"	3437.7	GS
2066	N44° 05' 34.95"	W121° 12' 08.91"	3437.9	GRV_SHOT
2067	N44° 05' 34.50"	W121° 12' 09.15"	3439.6	CONC
2068	N44° 05' 33.11"	W121° 12' 09.15"	3440.1	AC
2069	N44° 05' 33.11"	W121° 12' 10.93"	3440.9	AC
2070	N44° 05' 34.30"	W121° 12' 10.93"	3439.4	GRV_SHOT
2071	N44° 05' 34.50"	W121° 12' 09.53"	3439.5	CONC
2072	N44° 05' 25.96"	W121° 12' 10.81"	3450.3	GS
2073	N44° 05' 25.95"	W121° 12' 09.99"	3450.2	AC
2074	N44° 05' 24.76"	W121° 12' 10.02"	3450.3	GS

EXISTING GROUND DATA TABLE				
ID NUMBER	LATITUDE	LONGITUDE	ELEVATION	DESCRIPTION
2075	N44° 05' 24.32"	W121° 12' 08.98"	3450.6	CONC
2076	N44° 05' 25.77"	W121° 12' 08.98"	3450.6	CONC
2077	N44° 05' 25.77"	W121° 12' 08.30"	3448.8	GS
2078	N44° 05' 23.69"	W121° 12' 06.43"	3450.6	GS
2079	N44° 05' 23.19"	W121° 12' 06.45"	3451.0	GS
2080	N44° 05' 23.21"	W121° 12' 07.30"	3451.1	GS

PROPOSED TOWER LOCATION DATA TABLE				
ID NUMBER	LATITUDE	LONGITUDE	ELEVATION	DESCRIPTION
1001	N44° 05' 47.53"	W121° 11' 39.00"	3428.18	KBDN TOWER SITE 1
1002	N44° 05' 27.61"	W121° 11' 53.89"	3432.06	KBDN TOWER SITE 2
1003	N44° 05' 27.72"	W121° 12' 07.91"	3445.88	KBDN TOWER SITE 3
1004	N44° 05' 16.16"	W121° 11' 53.13"	3445.10	KBDN TOWER SITE 4
1005	N44° 05' 33.70"	W121° 11' 53.71"	3431.12	KBDN TOWER SITE 5

#### NOTES:

1. THE SURVEY REFERENCE FRAME FOR THIS IS PROJECT:  
HORIZONTAL DATUM: NAD83(2011)(EPOCH 2010.0000)  
VERTICAL DATUM: NAVD88  
UNITS: INTERNATIONAL FOOT
2. NO EXISTING PACS OR SACS SURVEY CONTROL POINTS WERE RECOVERED DURING THIS SURVEY.
3. THE AIRPORT LAYOUT PLAN (ALP) WAS PROVIDED BY CENTURY WEST ENGINEERING INC. AND IS BASED ON THE 2019 AGIS SURVEY. THE ALP IS SHOWN FOR REFERENCE ONLY.



RENEWS 06-30-2022

# CITY OF BEND MUNICIPAL AIRPORT CONTROL TOWER SITING STUDY DESCHUTES COUNTY, OREGON

EXISTING BLDG ROOF OVERHANG DATA TABLE				
ID NUMBER	LATITUDE	LONGITUDE	ELEVATION	DESCRIPTION
2085	N44° 05' 45.05"	W121° 11' 43.58"	3454.5	BLDG_OH COR
2086	N44° 05' 43.84"	W121° 11' 43.55"	3464.6	BLDG_OH PEAK
2087	N44° 05' 44.27"	W121° 11' 50.72"	3449.2	BLDG_OH COR
2088	N44° 05' 44.69"	W121° 11' 50.68"	3456.1	BLDG_OH PEAK
2089	N44° 05' 45.10"	W121° 11' 50.72"	3449.2	BLDG_OH COR
2090	N44° 05' 39.83"	W121° 11' 52.63"	3451.5	BLDG_OH COR
2091	N44° 05' 40.34"	W121° 11' 52.63"	3460.2	BLDG_OH PEAK
2092	N44° 05' 40.86"	W121° 11' 52.63"	3451.5	BLDG_OH COR
2093	N44° 05' 38.72"	W121° 11' 46.68"	3463.0	BLDG_OH COR
2094	N44° 05' 38.02"	W121° 11' 46.68"	3466.4	BLDG_OH PEAK
2095	N44° 05' 18.51"	W121° 11' 49.75"	3468.3	BLDG_OH COR
2096	N44° 05' 18.51"	W121° 11' 50.78"	3471.5	BLDG_OH PEAK
2097	N44° 05' 19.18"	W121° 11' 45.03"	3469.4	BLDG_OH PEAK
2098	N44° 05' 17.93"	W121° 11' 54.27"	3467.7	BLDG_OH COR
2099	N44° 05' 17.93"	W121° 11' 53.38"	3470.5	BLDG_OH PEAK
2100	N44° 05' 22.91"	W121° 11' 53.60"	3463.5	BLDG_OH COR
2101	N44° 05' 22.91"	W121° 11' 52.70"	3468.0	BLDG_OH PEAK
2102	N44° 05' 22.91"	W121° 11' 51.80"	3463.5	BLDG_OH COR
2103	N44° 05' 46.76"	W121° 12' 10.27"	3448.7	BLDG_OH COR
2104	N44° 05' 46.76"	W121° 12' 09.69"	3452.1	BLDG_OH PEAK
2105	N44° 05' 46.76"	W121° 12' 09.11"	3448.7	BLDG_OH COR
2106	N44° 05' 46.00"	W121° 12' 07.66"	3444.2	BLDG_OH COR
2107	N44° 05' 46.00"	W121° 12' 08.08"	3445.4	BLDG_OH PEAK
2108	N44° 05' 46.00"	W121° 12' 08.50"	3444.2	BLDG_OH COR
2109	N44° 05' 45.99"	W121° 12' 08.76"	3444.2	BLDG_OH COR
2110	N44° 05' 45.99"	W121° 12' 09.18"	3445.4	BLDG_OH PEAK
2111	N44° 05' 45.99"	W121° 12' 09.60"	3444.2	BLDG_OH COR
2112	N44° 05' 45.99"	W121° 12' 09.86"	3444.2	BLDG_OH COR
2113	N44° 05' 45.99"	W121° 12' 10.27"	3445.5	BLDG_OH PEAK
2114	N44° 05' 44.58"	W121° 12' 07.66"	3448.5	BLDG_OH COR

EXISTING BLDG ROOF OVERHANG DATA TABLE				
ID NUMBER	LATITUDE	LONGITUDE	ELEVATION	DESCRIPTION
2115	N44° 05' 44.58"	W121° 12' 08.08"	3449.9	BLDG_OH PEAK
2116	N44° 05' 44.58"	W121° 12' 08.50"	3448.6	BLDG_OH COR
2117	N44° 05' 44.58"	W121° 12' 08.76"	3448.6	BLDG_OH COR
2118	N44° 05' 44.58"	W121° 12' 09.17"	3450.0	BLDG_OH PEAK
2119	N44° 05' 44.58"	W121° 12' 09.59"	3448.7	BLDG_OH COR
2120	N44° 05' 44.57"	W121° 12' 09.85"	3448.6	BLDG_OH COR
2121	N44° 05' 44.57"	W121° 12' 10.27"	3449.8	BLDG_OH PEAK
2122	N44° 05' 44.57"	W121° 12' 10.69"	3448.6	BLDG_OH COR
2123	N44° 05' 43.82"	W121° 12' 08.58"	3443.2	BLDG_OH COR
2124	N44° 05' 43.82"	W121° 12' 08.83"	3449.2	BLDG_OH PEAK
2125	N44° 05' 43.82"	W121° 12' 09.08"	3443.0	BLDG_OH COR
2126	N44° 05' 43.82"	W121° 12' 10.05"	3443.1	BLDG_OH COR
2127	N44° 05' 43.82"	W121° 12' 10.30"	3449.2	BLDG_OH PEAK
2128	N44° 05' 43.81"	W121° 12' 10.55"	3443.1	BLDG_OH COR
2129	N44° 05' 50.31"	W121° 12' 09.10"	3444.6	BLDG_OH COR
2130	N44° 05' 50.31"	W121° 12' 09.68"	3448.1	BLDG_OHPEAK
2131	N44° 05' 50.31"	W121° 12' 10.27"	3444.4	BLDG_OH COR
2132	N44° 05' 33.08"	W121° 12' 09.12"	3471.8	BLDG_OH COR
2133	N44° 05' 33.71"	W121° 12' 09.12"	3474.4	BLDG_OH PEAK
2134	N44° 05' 34.32"	W121° 12' 09.12"	3471.7	BLDG_OH COR
2135	N44° 05' 34.93"	W121° 12' 08.86"	3462.4	BLDG_OH COR
2136	N44° 05' 34.93"	W121° 12' 09.23"	3469.3	BLDG_OH PEAK
2140	N44° 05' 23.19"	W121° 12' 06.45"	3469.6	BLDG_OH COR
2141	N44° 05' 23.44"	W121° 12' 06.44"	3471.7	BLDG_OH PEAK
2142	N44° 05' 23.69"	W121° 12' 06.43"	3469.4	BLDG_OH COR
2143	N44° 05' 35.15"	W121° 11' 41.76"	3458.2	BLDG_OH COR
2144	N44° 05' 35.15"	W121° 11' 40.99"	3460.8	BLDG_OH PEAK
2145	N44° 05' 35.15"	W121° 11' 40.23"	3458.1	BLDG_OH COR
2148	N44° 05' 21.82"	W121° 11' 51.33"	3470.6	BLDG_OH PEAK
2149	N44° 05' 21.83"	W121° 11' 50.42"	3467.8	BLDG_OH COR

EXISTING BLDG ROOF OVERHANG DATA TABLE				
ID NUMBER	LATITUDE	LONGITUDE	ELEVATION	DESCRIPTION
2150	N44° 05' 21.23"	W121° 11' 50.43"	3467.8	BLDG_OH COR
2151	N44° 05' 21.23"	W121° 11' 50.78"	3471.6	BLDG_OH PEAK
2152	N44° 05' 21.23"	W121° 11' 49.74"	3468.3	BLDG_OH COR
2153	N44° 05' 21.23"	W121° 11' 49.76"	3463.8	BLDG_OH COR
2154	N44° 05' 21.23"	W121° 11' 49.07"	3463.8	BLDG_OH POL
2155	N44° 05' 21.73"	W121° 11' 47.69"	3461.8	BLDG_OH COR
2156	N44° 05' 21.73"	W121° 11' 46.66"	3461.7	BLDG_OH COR
2157	N44° 05' 21.78"	W121° 11' 46.33"	3461.6	BLDG_OH COR
2158	N44° 05' 21.77"	W121° 11' 45.03"	3461.5	BLDG_OH COR
2159	N44° 05' 21.77"	W121° 11' 45.03"	3467.9	BLDG_OH COR
2160	N44° 05' 21.77"	W121° 11' 44.61"	3468.0	BLDG_OH COR
2161	N44° 05' 21.77"	W121° 11' 44.61"	3467.9	BLDG_OH COR
2162	N44° 05' 21.49"	W121° 11' 44.61"	3469.5	BLDG_OH PEAK
2163	N44° 05' 21.22"	W121° 11' 44.61"	3468.0	BLDG_OH COR
2164	N44° 05' 21.23"	W121° 11' 44.61"	3463.9	BLDG_OH COR
2165	N44° 05' 20.33"	W121° 11' 44.61"	3467.7	BLDG_OH PEAK
2166	N44° 05' 19.44"	W121° 11' 44.62"	3464.0	BLDG_OH COR
2167	N44° 05' 19.45"	W121° 11' 44.61"	3468.0	BLDG_OH COR
2168	N44° 05' 19.18"	W121° 11' 44.61"	3469.4	BLDG_OH PEAK
2169	N44° 05' 18.90"	W121° 11' 44.61"	3468.0	BLDG_OH COR
40063	N44° 05' 40.01"	W121° 12' 09.34"	3453.0	BLDG_OH COR
41730	N44° 05' 37.44"	W121° 12' 09.22"	3458.2	BLDG_OH COR
41731	N44° 05' 36.85"	W121° 12' 09.22"	3463.3	BLDG_OH PEAK
41735	N44° 05' 38.03"	W121° 12' 09.34"	3455.9	BLDG_OH PEAK
41736	N44° 05' 38.43"	W121° 12' 09.34"	3452.2	BLDG_OH COR
41739	N44° 05' 39.31"	W121° 12' 09.34"	3458.9	BLDG_OH PEAK
41740	N44° 05' 35.76"	W121° 12' 08.87"	3461.9	BLDG_OHCOR
41741	N44° 05' 35.76"	W121° 12' 09.23"	3469.0	BLDG_OH PEAK
42432	N44° 05' 34.93"	W121° 12'		

**CITY OF BEND MUNICIPAL AIRPORT  
CONTROL TOWER SITING STUDY  
DESCHUTES COUNTY, OREGON**

EXISTING BLDG ROOF OVERHANG DATA TABLE				
ID NUMBER	LATITUDE	LONGITUDE	ELEVATION	DESCRIPTION
43247	N44° 05' 25.80"	W121° 12' 09.02"	3463.2	BLDG_OH COR
43250	N44° 05' 25.35"	W121° 12' 10.00"	3476.9	BLDG_OH PEAK
43251	N44° 05' 25.95"	W121° 12' 09.98"	3472.1	BLDG_OH COR
50045	N44° 05' 34.93"	W121° 12' 09.22"	3469.1	BLDG_OH PEAK

EXISTING AIRPORT BEACON DATA TABLE				
ID NUMBER	LATITUDE	LONGITUDE	ELEVATION	DESCRIPTION
2146	N44° 05' 37.03"	W121° 11' 53.73"	3426.8	C/L WOOD POLE @ GROUND
2147	N44° 05' 37.05"	W121° 11' 53.72"	3461.4	C/L BEACON LENS

EXISTING PAVEMENT KEY POINTS DATA TABLE				
ID NUMBER	LATITUDE	LONGITUDE	ELEVATION	DESCRIPTION
2000	N44° 05' 57.83"	W121° 12' 00.78"	3406.11	R/W C/L BREAK
2003	N44° 05' 57.85"	W121° 11' 56.67"	3405.54	T/W B C/L BREAK
2006	N44° 05' 57.80"	W121° 12' 04.89"	3405.82	T/W A C/L BREAK
2009	N44° 06' 06.17"	W121° 12' 00.77"	3403.01	R/W 16 C/L
2010	N44° 06' 05.92"	W121° 11' 56.66"	3401.22	T/W B C/L NORTH
2011	N44° 06' 05.92"	W121° 12' 04.88"	3403.53	T/W A C/L NORTH
2012	N44° 05' 14.92"	W121° 12' 04.93"	3458.52	T/W A C/L SOUTH
2013	N44° 05' 15.42"	W121° 11' 56.71"	3457.04	T/W B C/L SOUTH
2014	N44° 05' 14.75"	W121° 12' 00.82"	3459.41	R/W C/L 34

RECOVERED RUNWAY MONUMENT DATA TABLE				
ID NUMBER	LATITUDE	LONGITUDE	ELEVATION	DESCRIPTION
200	N44° 06' 06.09"	W121° 12' 00.77"	3403.03	FD_BC RW 16
201	N44° 05' 14.75"	W121° 12' 00.82"	3459.41	FD_BC RW 34

05-21-2022



OREGON  
JANUARY 12, 1999  
JOHN P. THOMPSON  
49220

RENEWS 06-30-2022

SHEET 4 OF 4

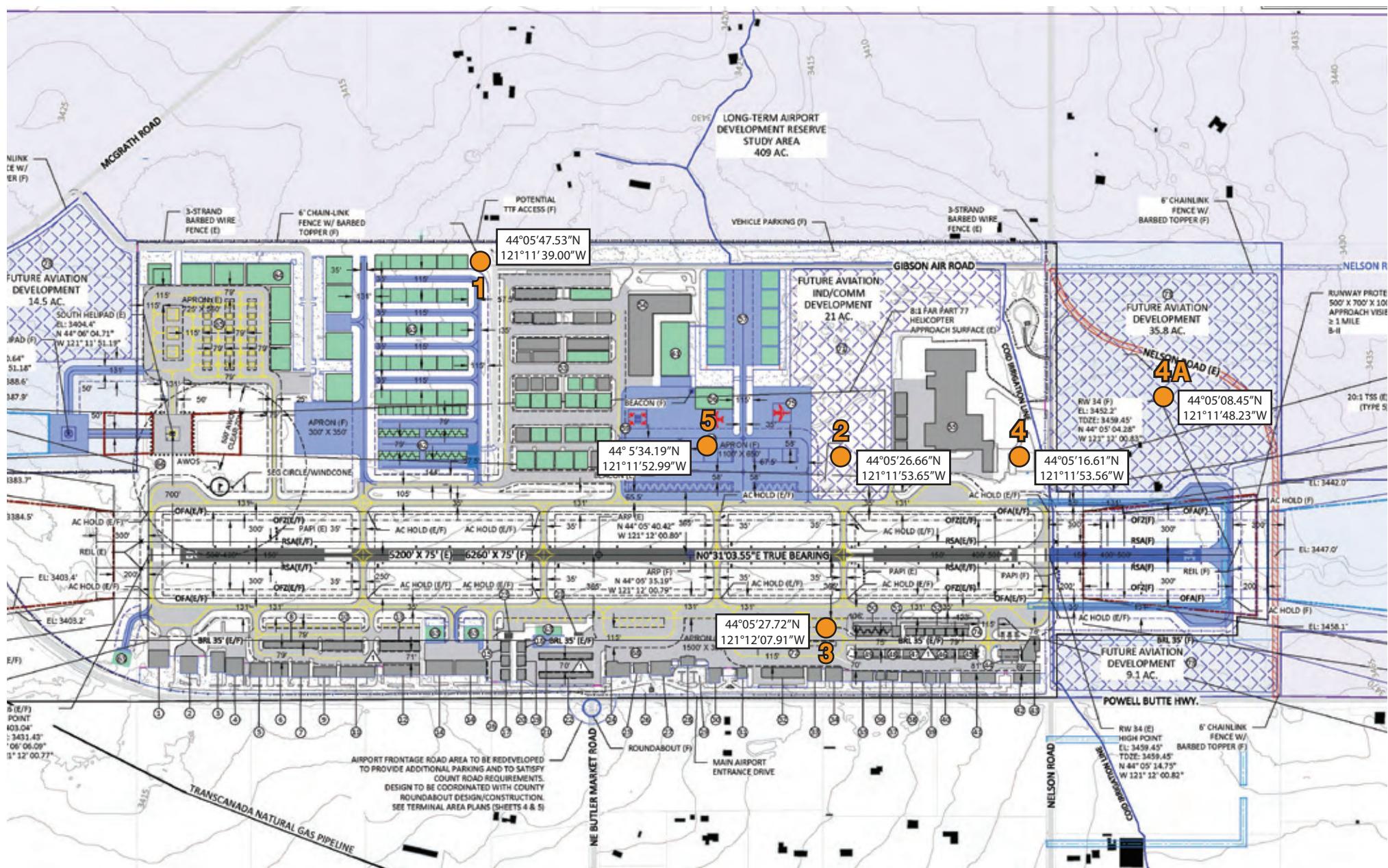
**Appendix B – Cost Estimate \***

**BEND MUNICIPAL AIRPORT CONTROL TOWER**

	<b>Site 2</b>	<b>Site 4</b>	<b>Site 5</b>
Proposed ATCT Height	85 ft eye	Eliminated	85 ft eye
Height (roof) x \$100,000	9,000,000		9,000,000
Inflation Year 2023 (17%)	10,530,000		10,530,000
Inflation Year 2024 (17%)	12,320,100		12,320,100
Cost Estimate (ATCT Only) est. FY '24	12,320,100		12,320,100
ATC MEL Equipment	600,000		600,000
Site Work	1,322,000		1,272,000
Total Construction Cost	14,242,100		14,192,100
Total Construction Cost + 5% Contingency	14,954,205		14,901,705

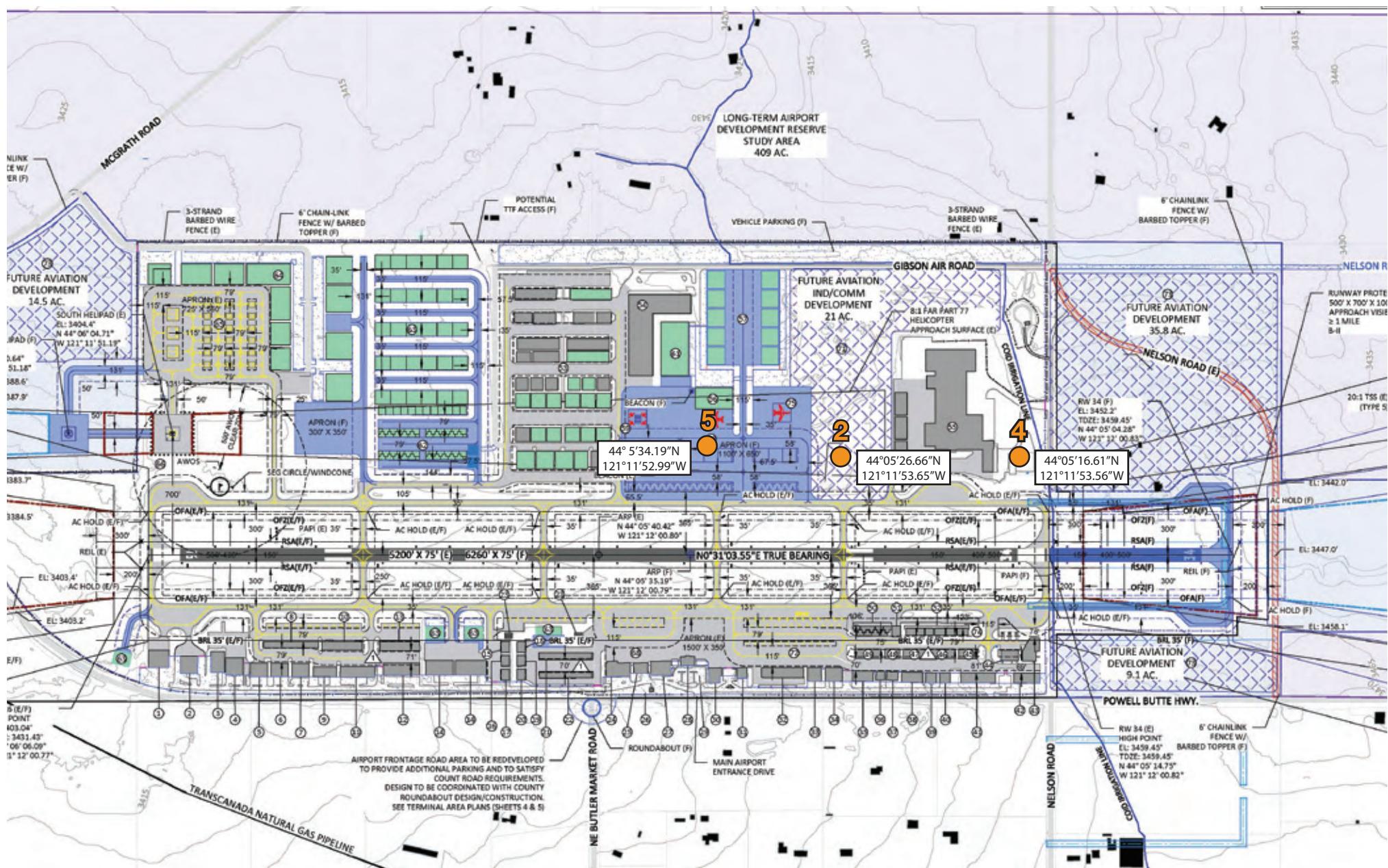
\* The comparative cost estimate on this FAA form above is not for budgetary purposes; it is for site comparison purposes only. Total Project Costs will consist of, but not necessarily limited to, the above construction, survey & testing, design, FAA Reimbursable Costs, and construction administration.

## **Appendix C – All Sites Evaluated**



# POTENTIAL CANDIDATE ATCT SITES AT BDN

## 1, 2, 3, 4, 4A and 5

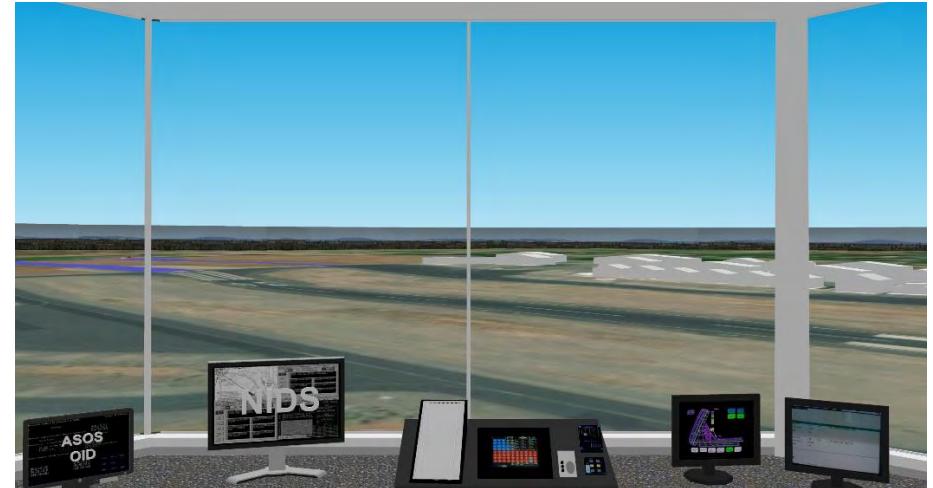


# PREFERRED ATCT SITES AT BDN 2, 4 and 5

## **Appendix D – Panoramic Views**



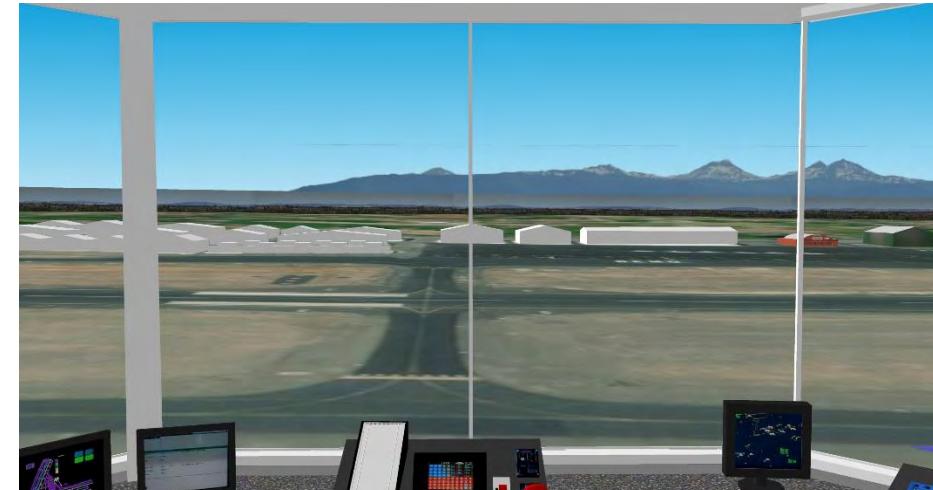
South to R/W end 34



Panning CW



Looking West towards Terminal Apron

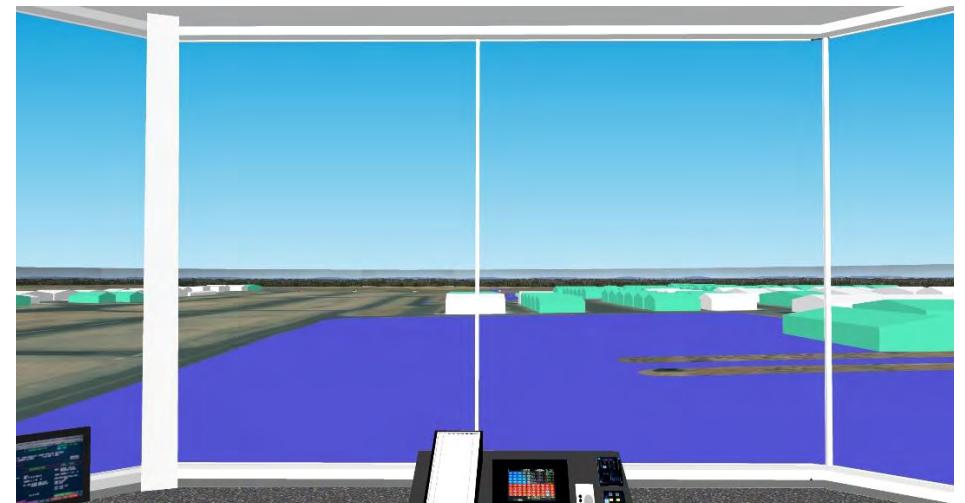


Looking West – Look Down to T/W B

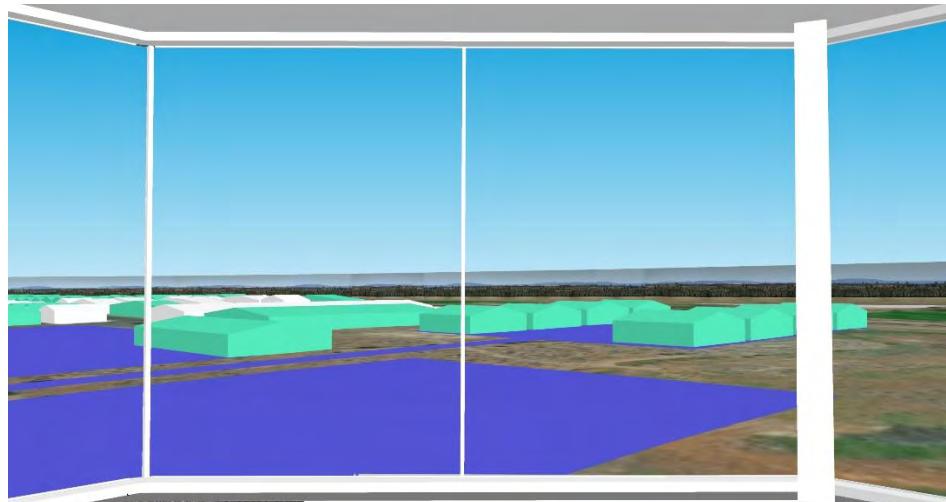
**SITE 2 – 3D MODEL SCREENSHOTS** (note blue bldgs & purple pvmts are future; others existing)



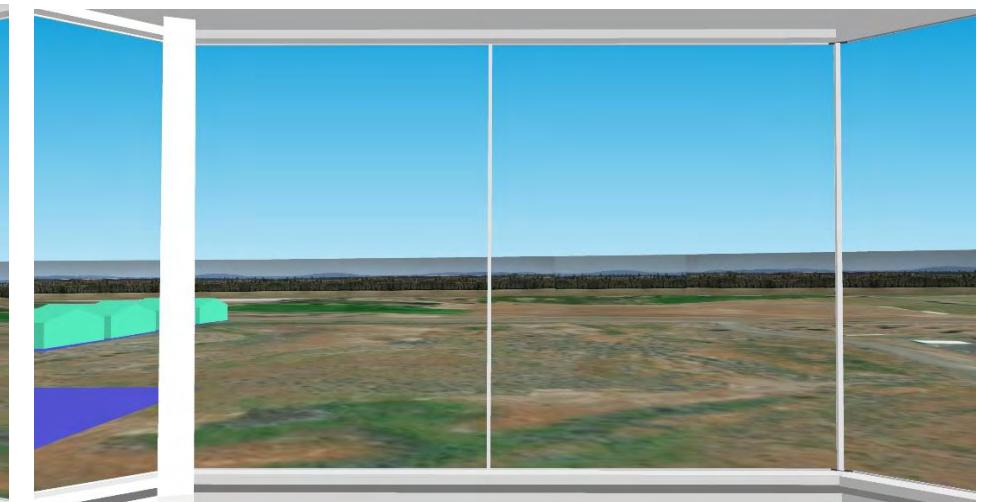
Panning CW to NW



Looking North to R/W end 16

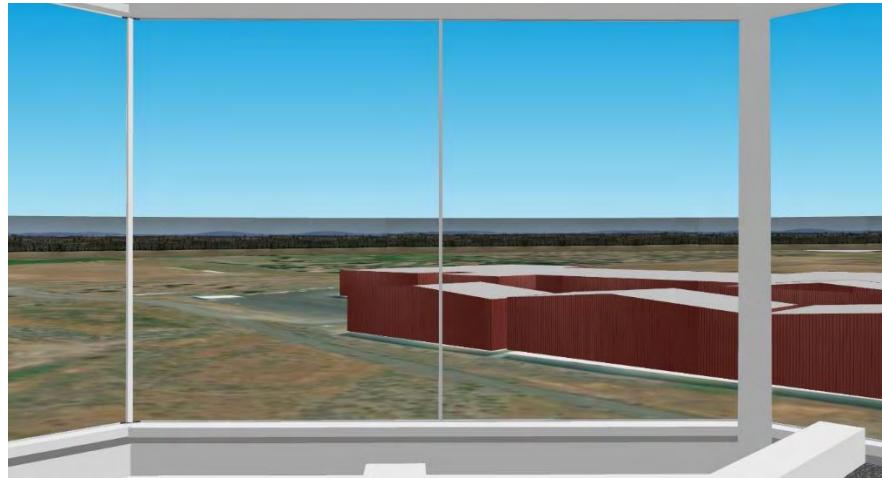


Panning CW to NE

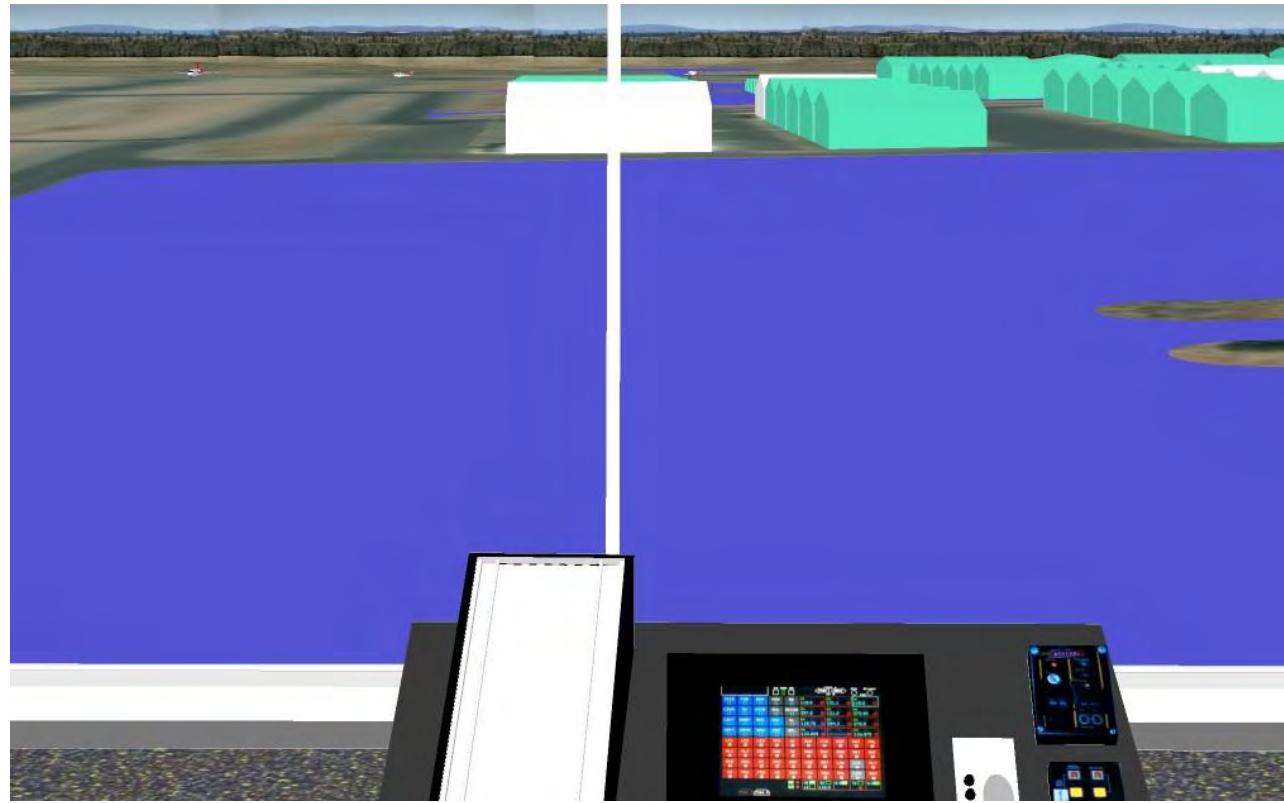


Panning CW to East

**SITE 2 – 3D MODEL SCREENSHOTS** (note blue bldgs & purple pvmnts are future; others existing)

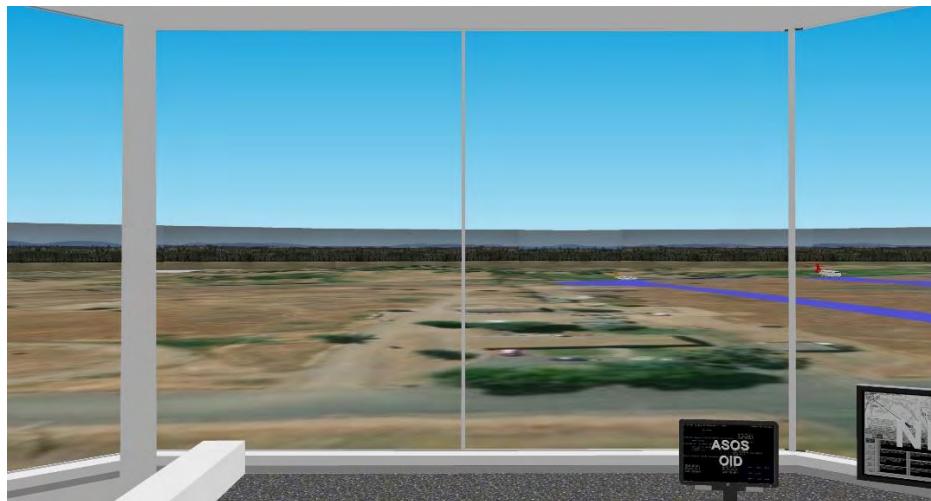


Panning CW to SE

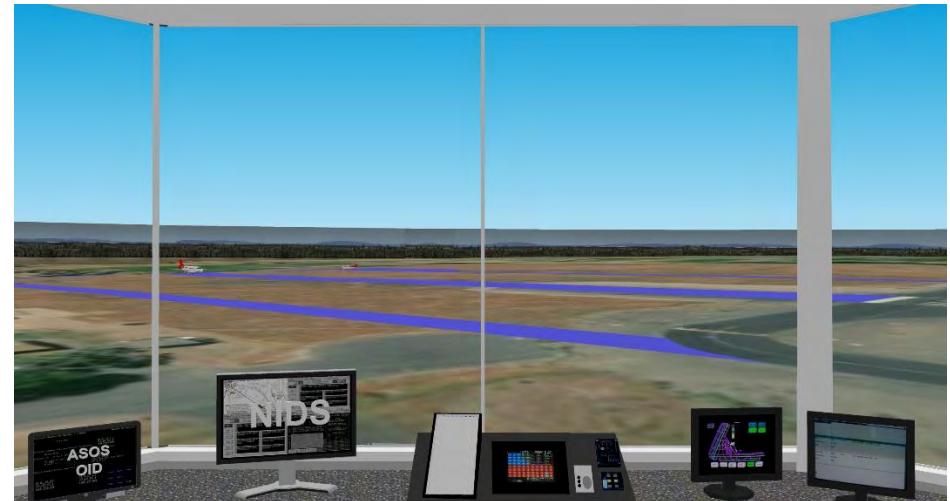


Site 2 Binocular View of Helipad

**SITE 2 – 3D MODEL SCREENSHOTS** (note blue bldgs & purple pvmnts are future; others existing)



Looking South to R/W 34



Panning CW SW to Future 1050' R/W Extension

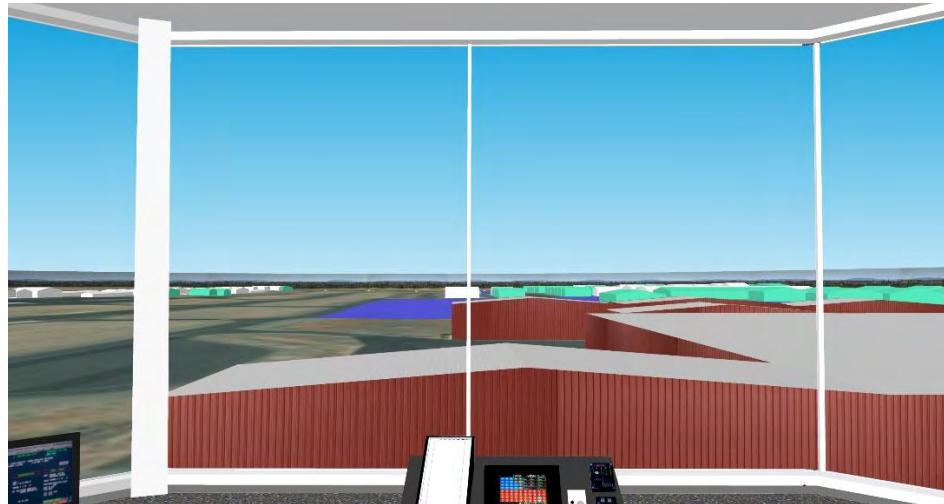


Looking East to SE Hangar Area

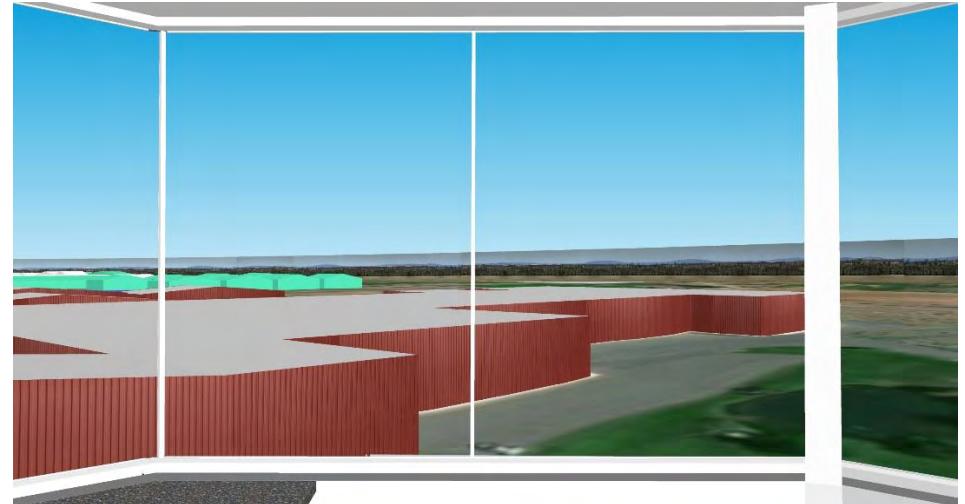


Panning CW to NE

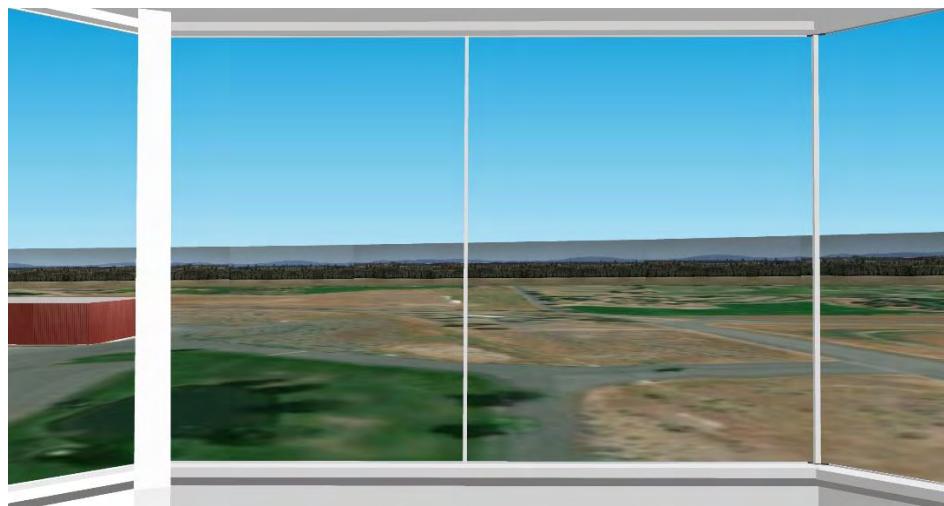
**SITE 4 – 3D MODEL SCREENSHOTS** (note blue bldgs & purple pvmts are future; others existing)



**Looking North to R/W end 16**



**Panning CW to NE**

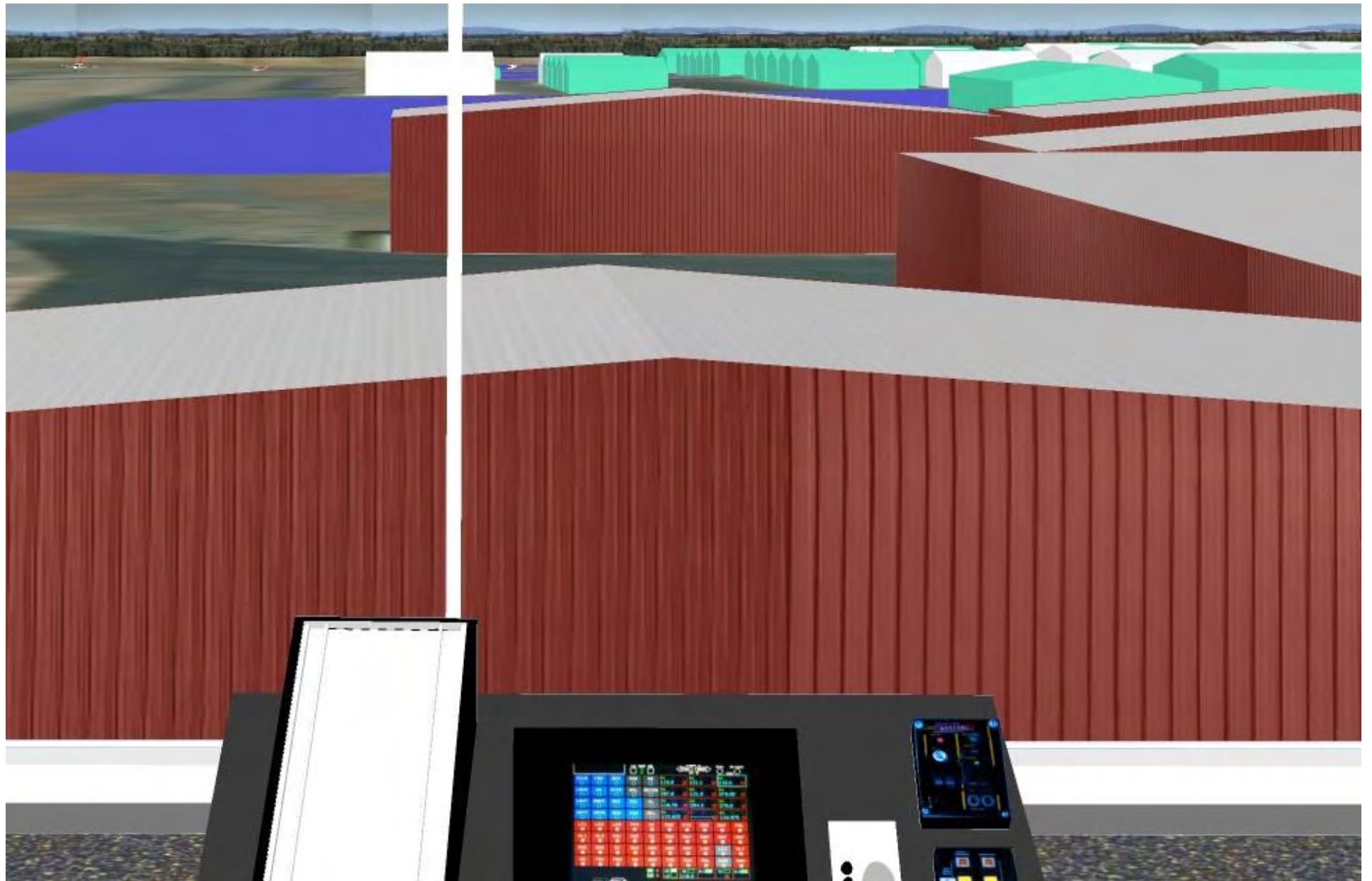


**Looking East**



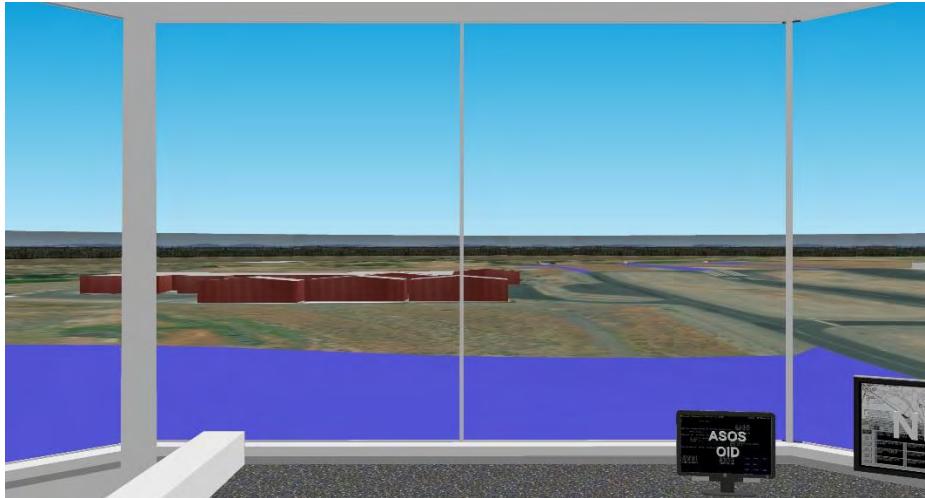
**Panning CW to SE**

**SITE 4 – 3D MODEL SCREENSHOTS** (note blue bldgs & purple pvmts are future; others existing)

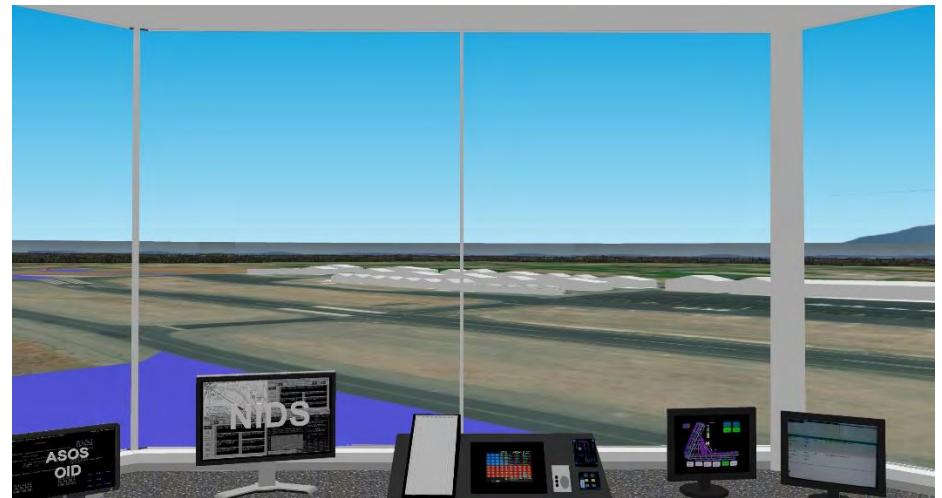


**Site 4 Binocular View to Helipad**

**SITE 4 – 3D MODEL SCREENSHOTS** (note blue bldgs & purple pvmts are future; others existing)



**Looking South to R/W end 34**



**Panning CW to SW**



**Looking West to Main Terminal Area**

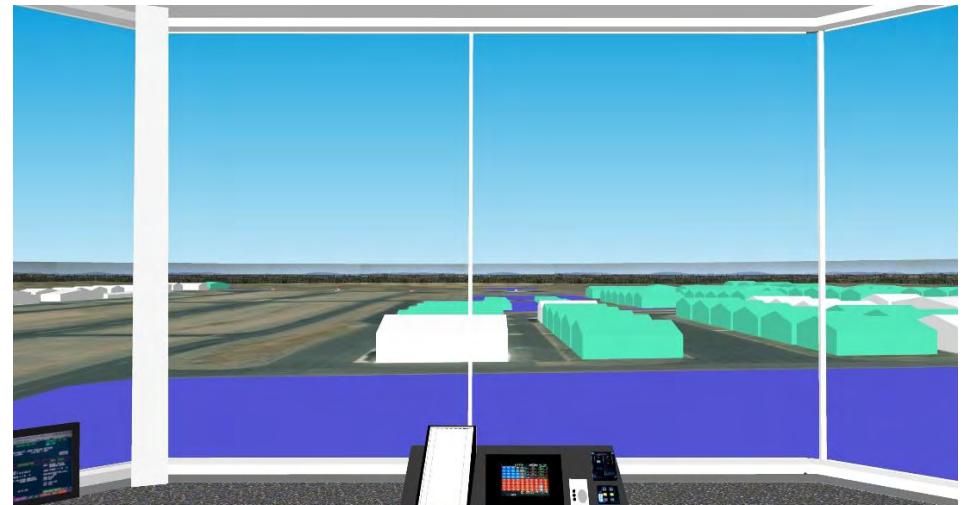


**Looking West Lookdown Angle to T/W B**

**SITE 5– 3D MODEL SCREENSHOTS** (note blue bldgs & purple pvmts are future; others existing)



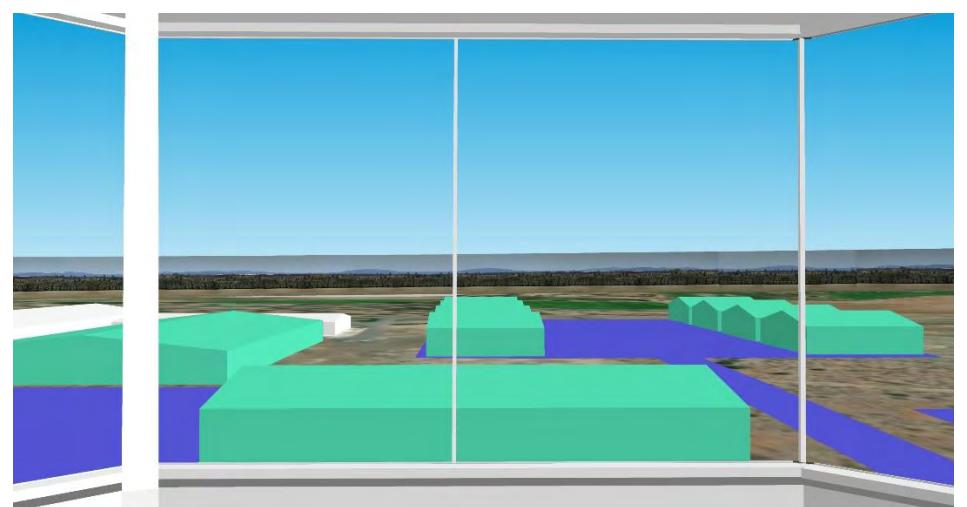
Panning CW to NW



Looking North to R/W End 16

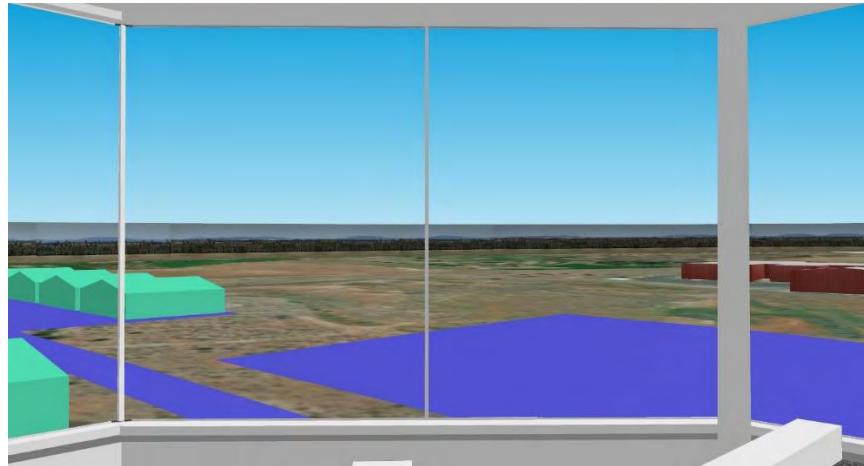


Panning CW to NE

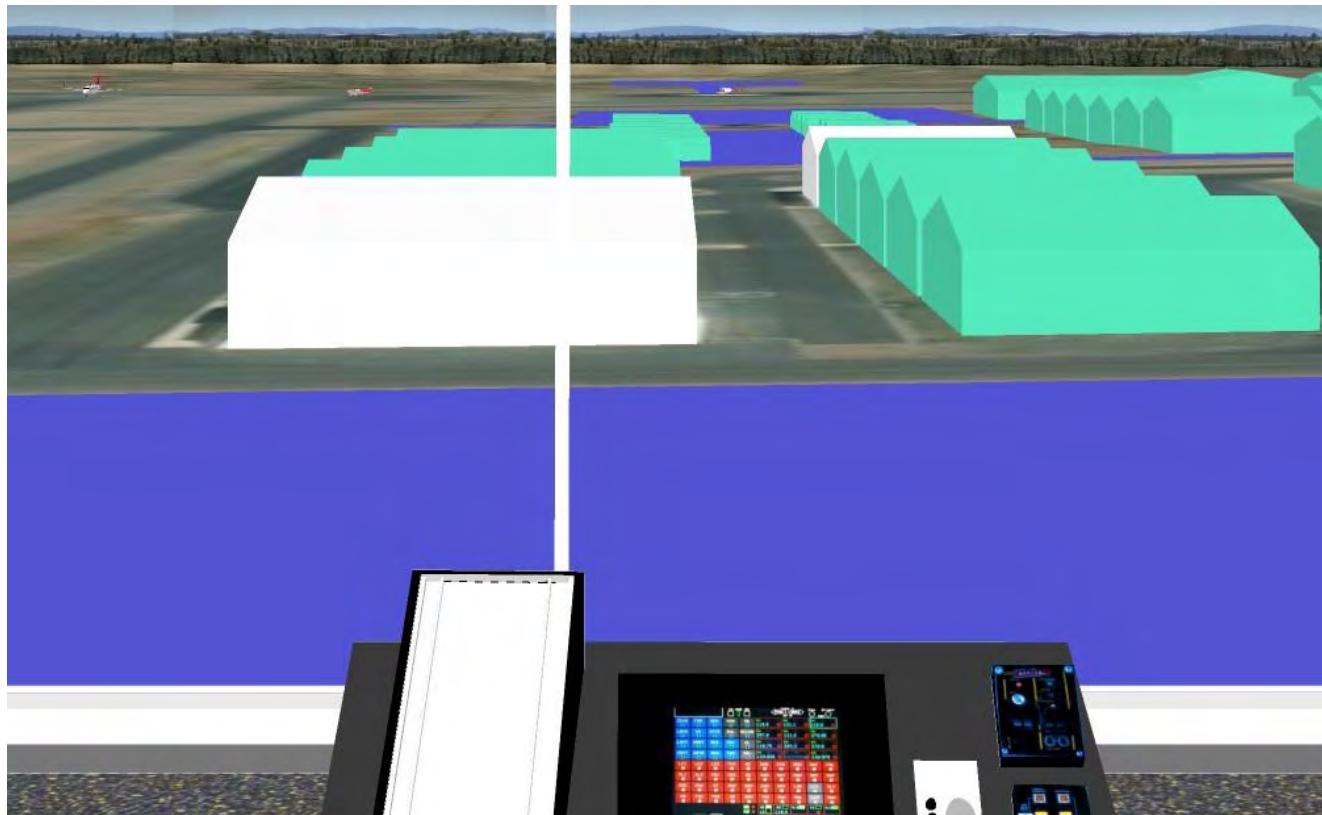


Looking East

**SITE 5– 3D MODEL SCREENSHOTS** (note blue bldgs & purple pvmts are future; others existing)



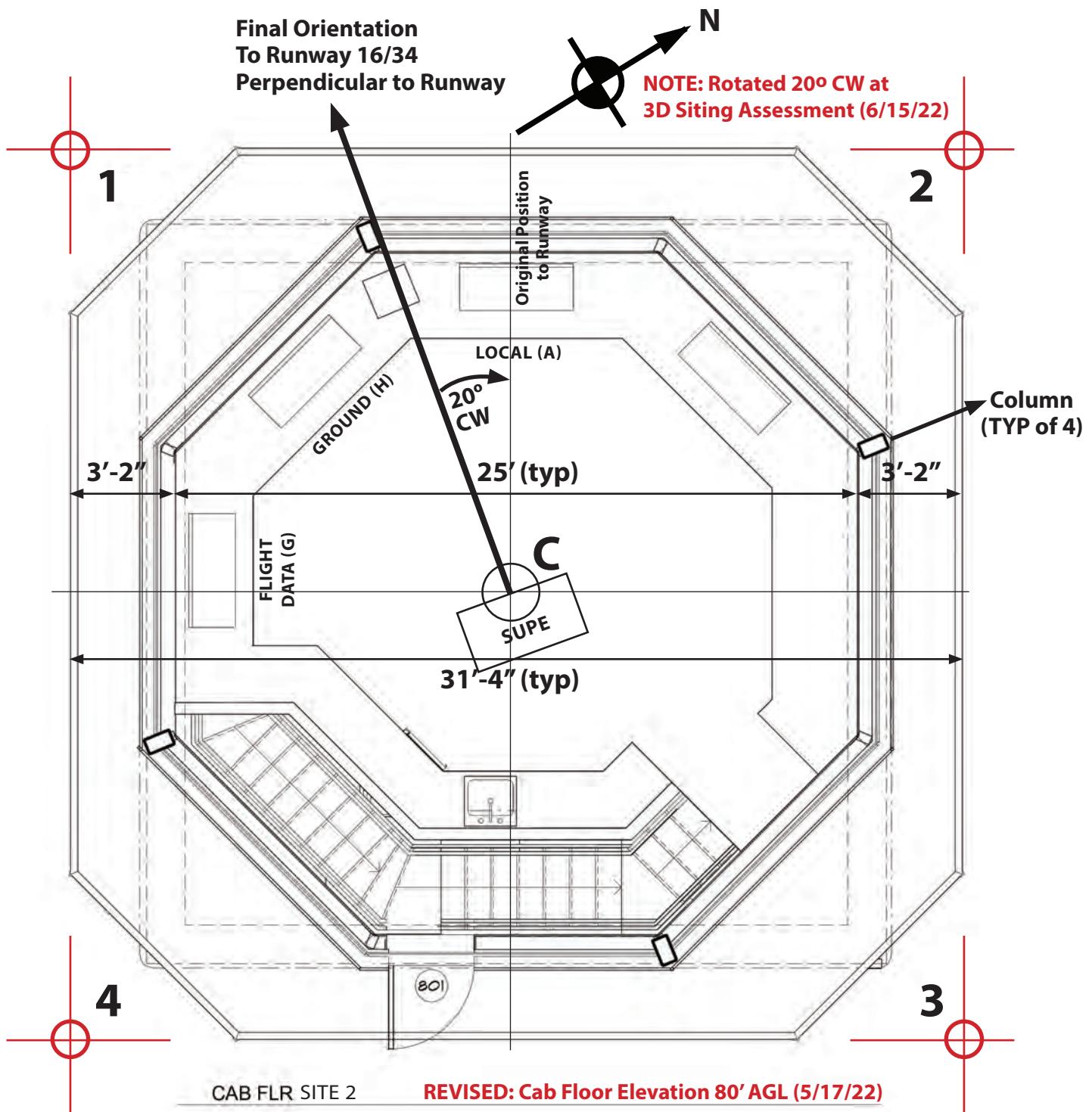
Panning CW to SE



Site 5 Binocular View to Helipad

**SITE 5– 3D MODEL SCREENSHOTS** (note blue bldgs & purple pvmts are future; others existing)

**Appendix E – Drawings (Cab Layout, Orientation, Airport Layout Plan,  
Building Profile, Site Access & Utilities, Heliport Pattern)**

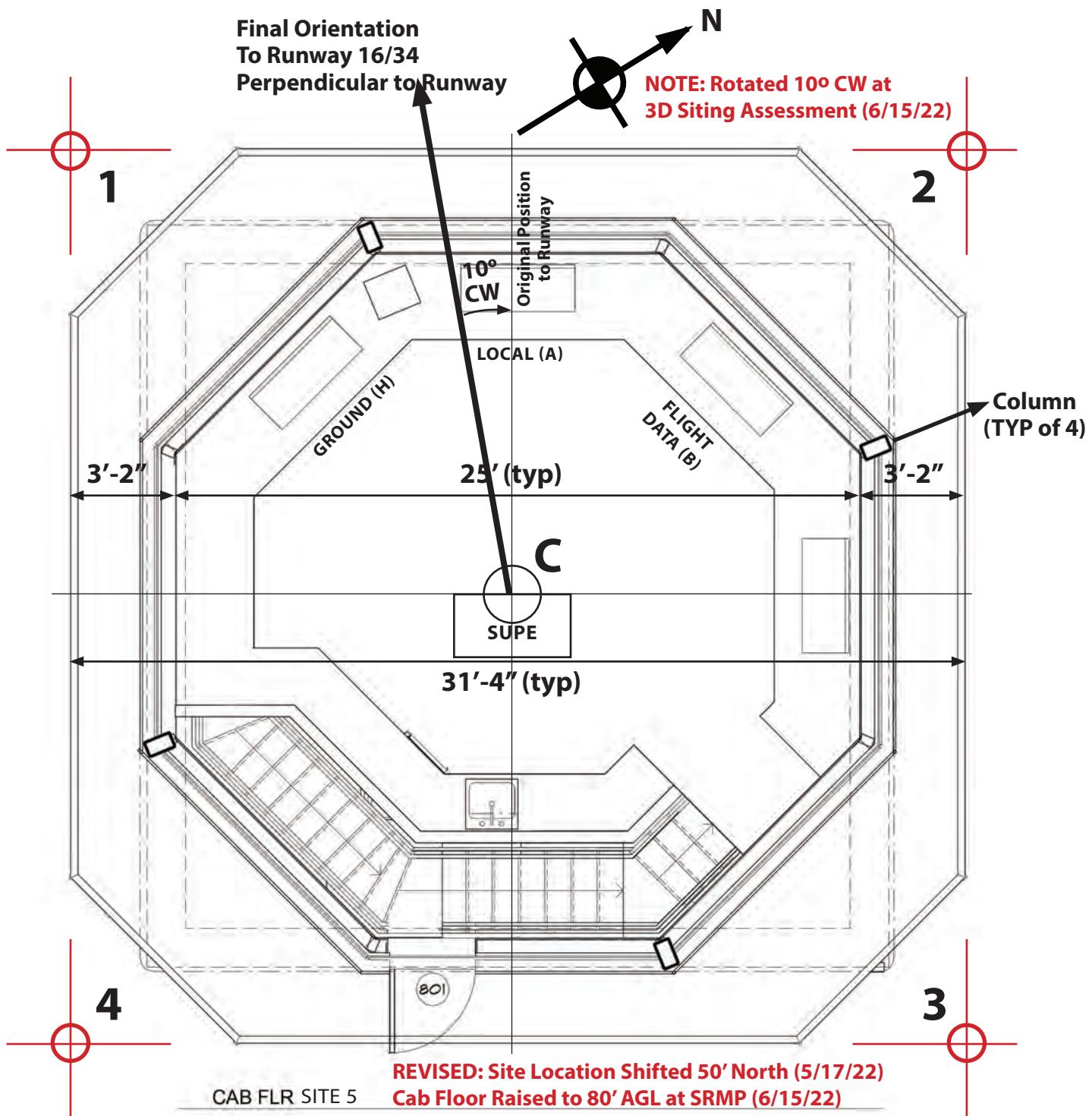


CAB FLR SITE 2

REVISED: Cab Floor Elevation 80' AGL (5/17/22)

POINT	LATITUDE N	LONGITUDE W	DISTANCE TO RUNWAY 16-34 CENTERLINE
C	44°05'26.66"N	121°11'53.65"W	522.77 FT
1	44°05'26.60"N	121°11'53.94"W	501.40 FT
2	44°05'26.87"N	121°11'53.73"W	516.73 FT
3	44°05'26.72"N	121°11'53.36"W	543.73 FT
4	44°05'26.45"N	121°11'53.57"W	528.40 FT

CITY OF BEND 	AIRPORT TRAFFIC CONTROL TOWER (ATCT)	Designed by:	CTBX
	BDN - CAB FLOOR PLAN	Drawn by:	MBL
	BASIS OF DESIGN	6/20/22	Checked by:

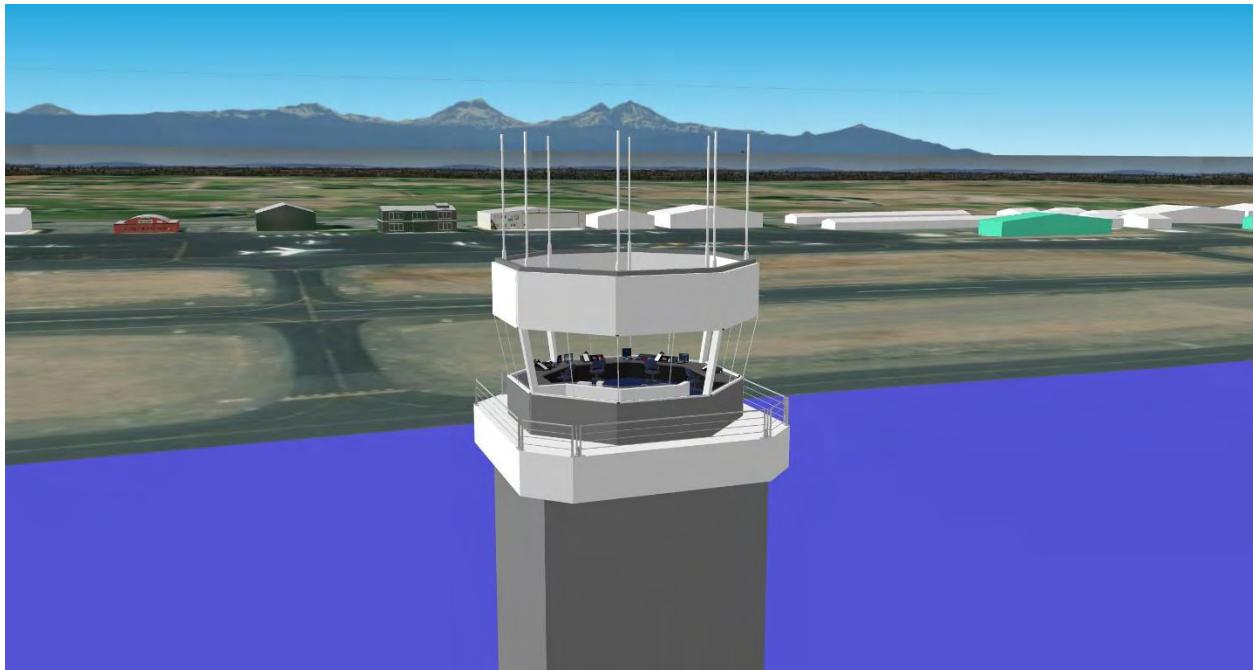


POINT	LATITUDE N	LONGITUDE W	DISTANCE TO RUNWAY 16-34 CENTERLINE
C	44° 5'34.19"N	121°11'52.99"W	569.99 FT
1	44° 5'34.13"N	121°11'53.28"W	548.82 FT
2	44° 5'34.40"N	121°11'53.07"W	564.15 FT
3	44° 5'34.25"N	121°11'52.70"W	591.15 FT
4	44° 5'33.98"N	121°11'52.91"W	575.82 FT

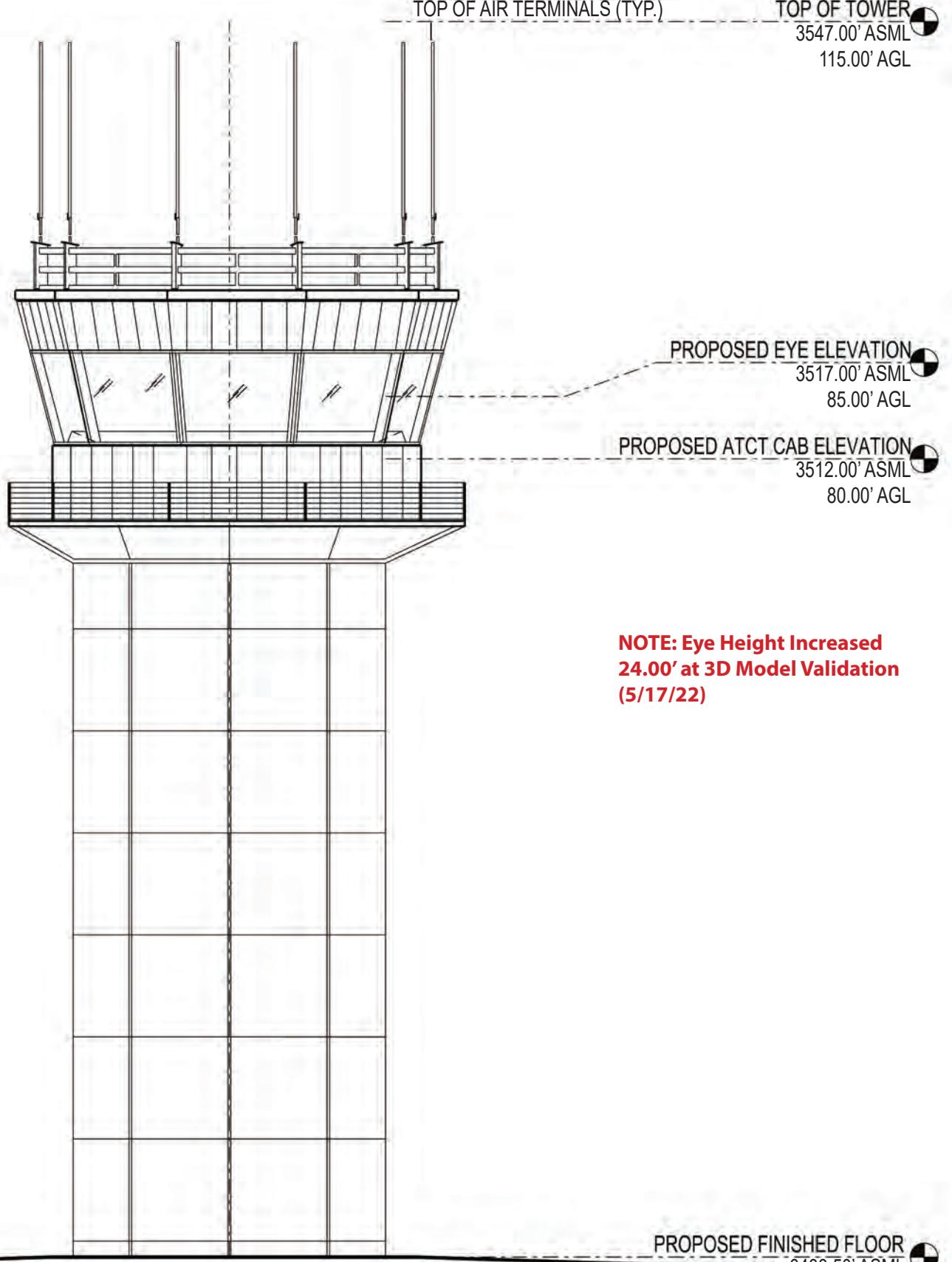
 <b>CITY OF BEND</b>	<b>AIRPORT TRAFFIC CONTROL TOWER (ATCT)</b>	Designed by:	<b>CTBX</b>
	<b>BDN - CAB FLOOR PLAN</b>	Drawn by:	<b>MBL</b>
	<b>BASIS OF DESIGN</b>	6/20/22	Checked by: <b>MBL</b>



**BDN 4-COLUMN CAB DESIGN**



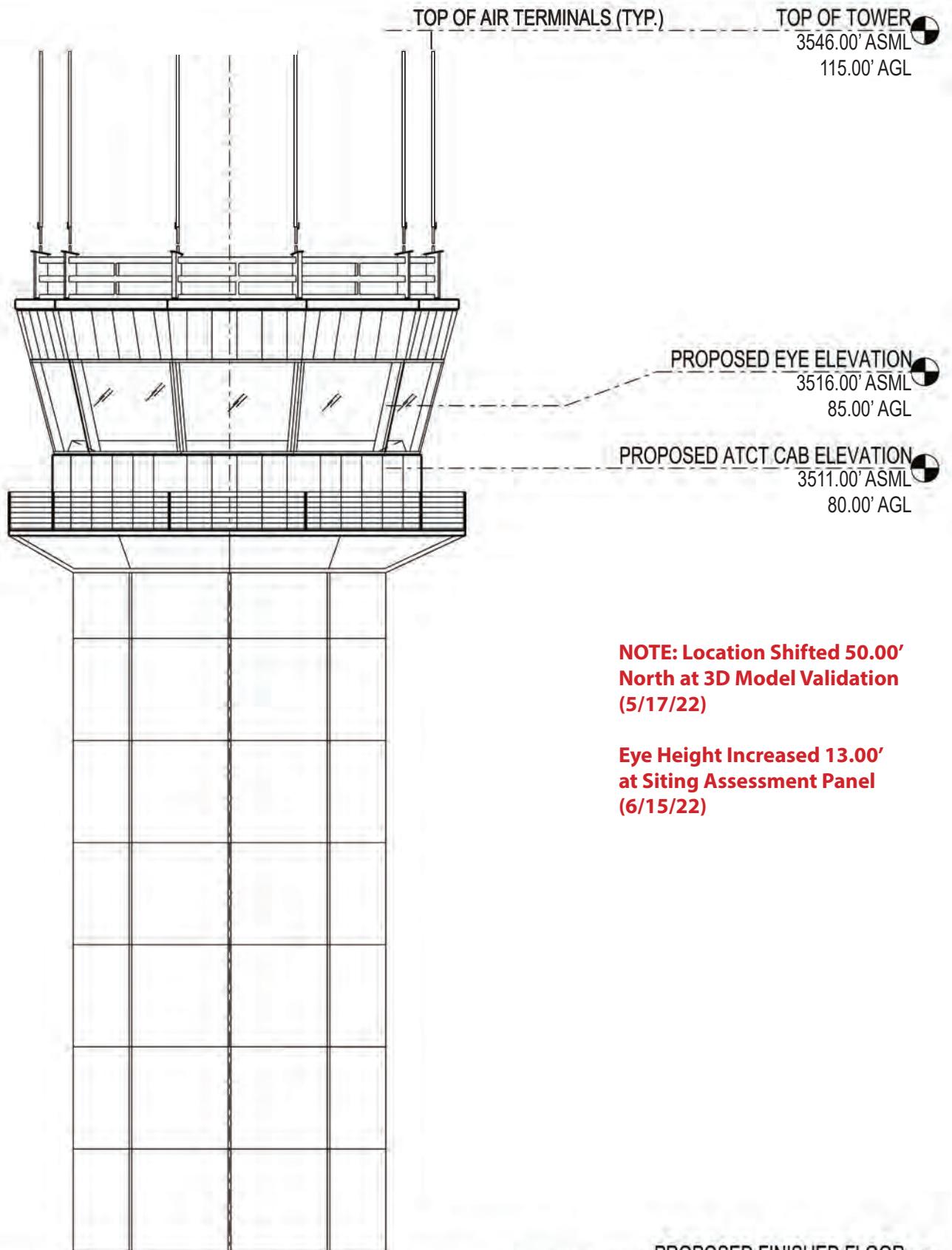
**BDN 3D MODEL RENDERING**



# BDN - Site 2

LATITUDE: 44°05'26.66"N

LONGITUDE: 121°11'53.65"W



# BDN - Site 5

LATITUDE: 44°05'34.19"N

LONGITUDE: 121°11'52.99"W

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-STAND 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.

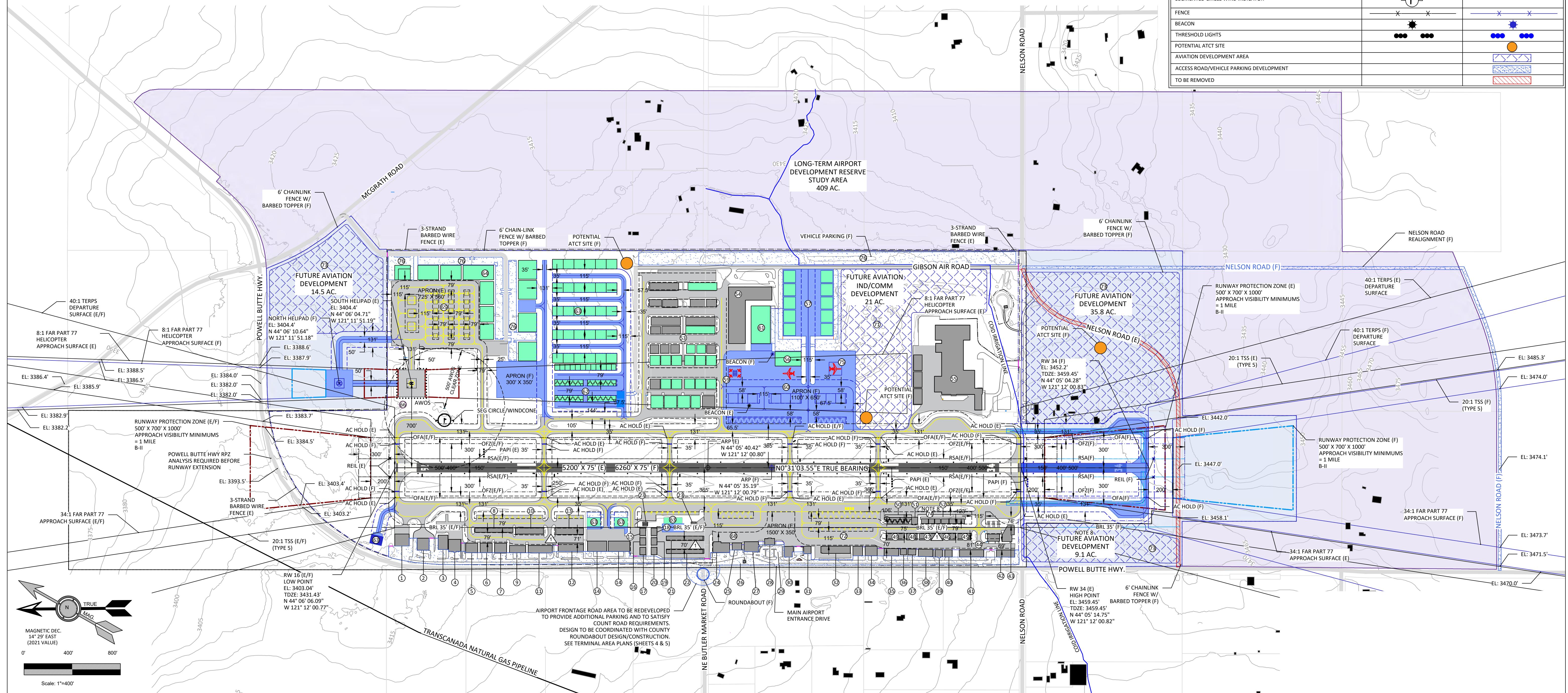
9. POTENTIAL TTF ACCESS REQUESTS WILL REQUIRE FURTHER FAA COORDINATION.

MODIFICATION TO STANDARDS

NO.	ITEM	DESCRIPTION	DISPOSITION
1	TAXILANE OFA (FUTURE)	LESS THAN ADG I STANDARD BETWEEN HANGARS	MODIFIED FAA TAXILANE CLEARING FORMULA. RECONFIGURE HANGER 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 (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		



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

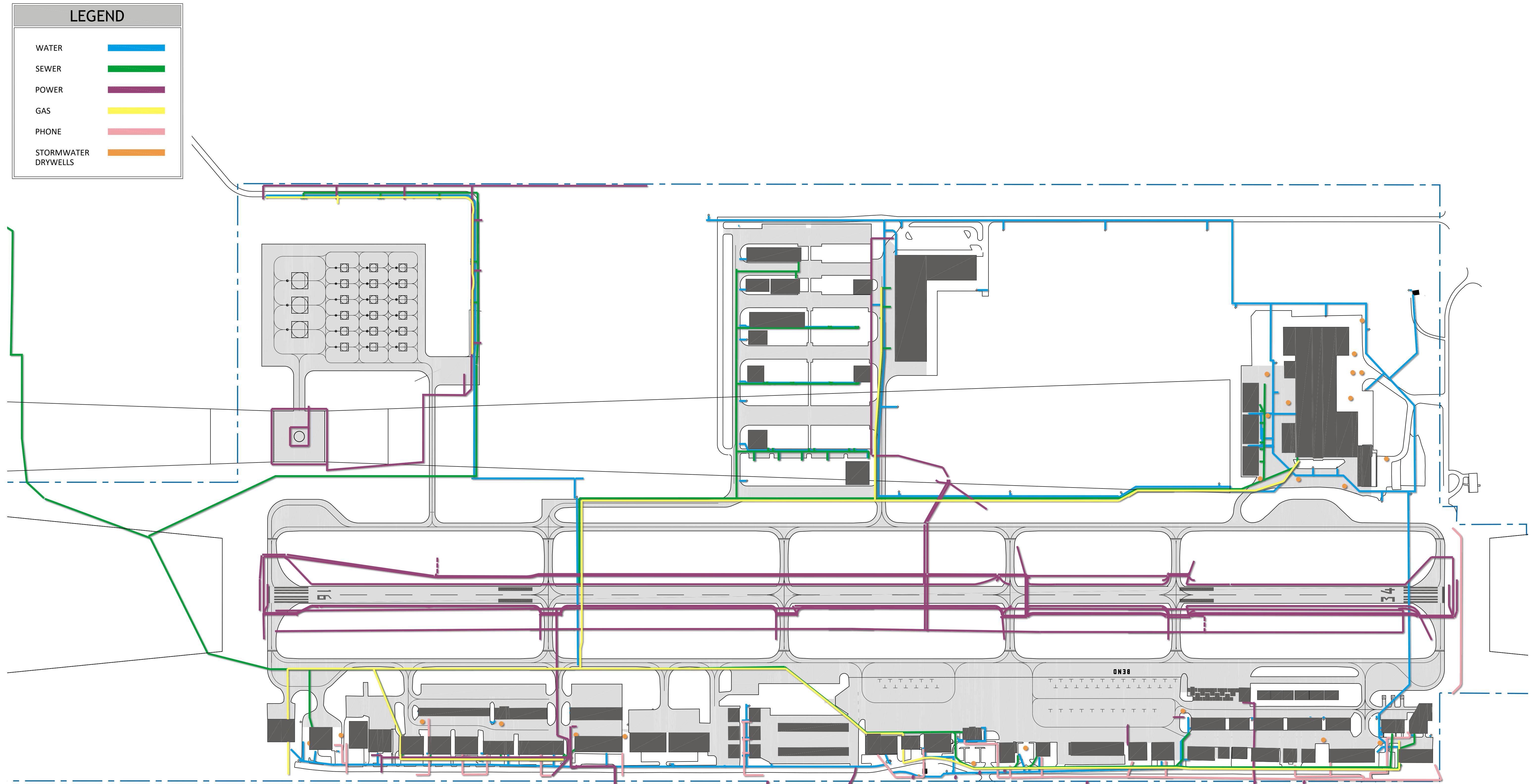
BEND OFFICE  
1020 SW EMKAY DRIVE, #100  
BEND, OR 97702  
541.322.8962 OFFICE  
541.382.2423 FAX

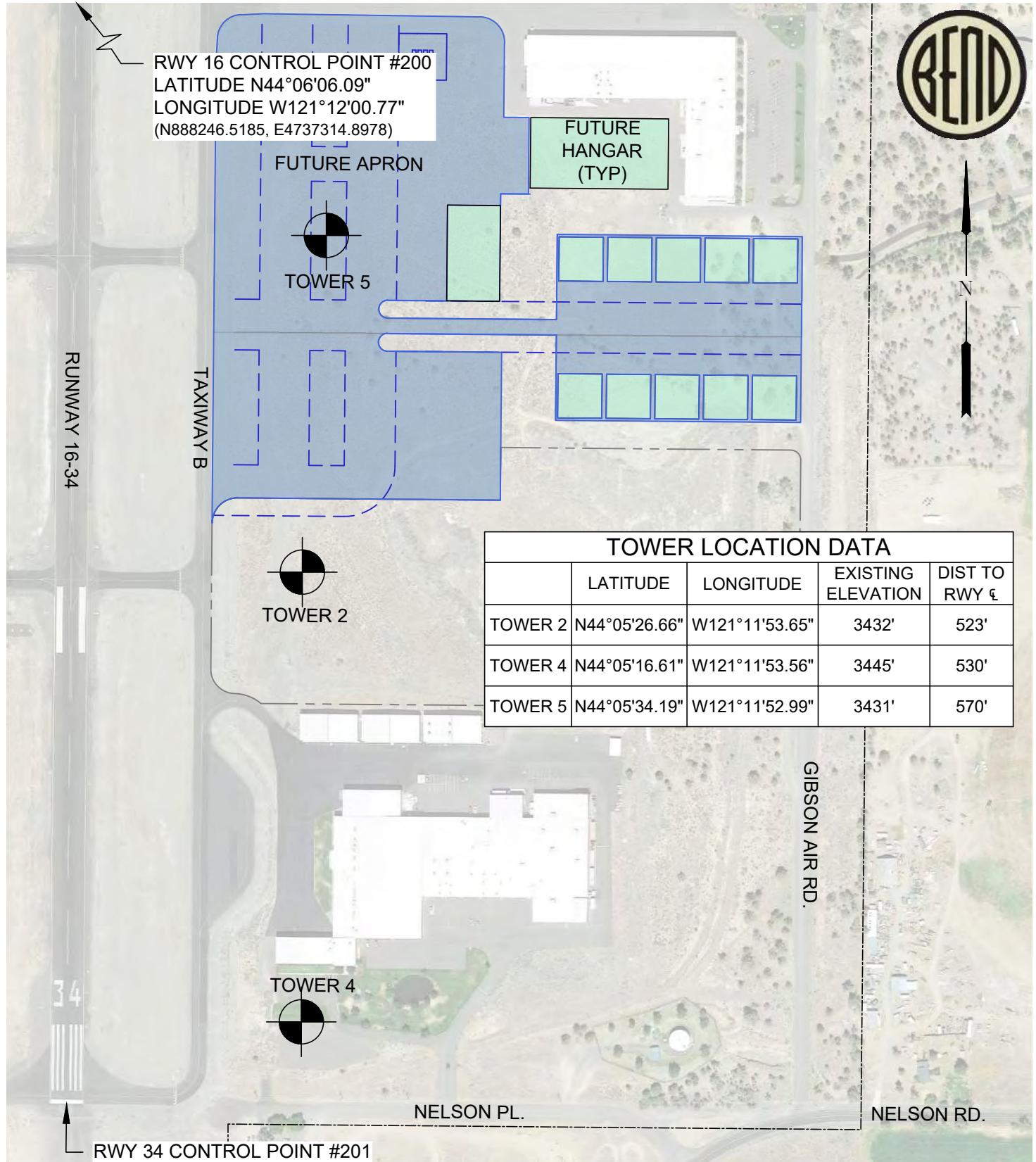
DESIGNED BY: MD DRAWN BY: MS  
CHECKED BY: WMR SCALE: AS SHOWN  
DATE: JANUARY 2022 PROJECT NO: 10051.110.01

BEND MUNICIPAL AIRPORT

AIRPORT LAYOUT PLAN

FIGURE NO.  
-  
SHEET NO.  
3 OF 18





RWY 34 CONTROL POINT #201  
LATITUDE N44°05'14.75",  
LONGITUDE W121°12'00.82"  
(N883047.1809, E4737268.0246)

**SURVEY CONTROL**  
HORIZONTAL DATUM: OREGON STATE PLAN SOUTH NAD83  
VERTICAL DATUM: NAVD88  
UNITS: INTERNATIONAL FT

**CENTURY WEST**

ENGINEERING  
541.322.8962 BEND OFFICE  
541.382.2423 FAX 1020 SW EMKAY DRIVE, #100  
BEND, OR 97702

CITY OF BEND - BEND MUNICIPAL AIRPORT  
CONTROL TOWER SITE SELECTION

DRAWING NO.  
**EX-01**

**KEY PLAN**

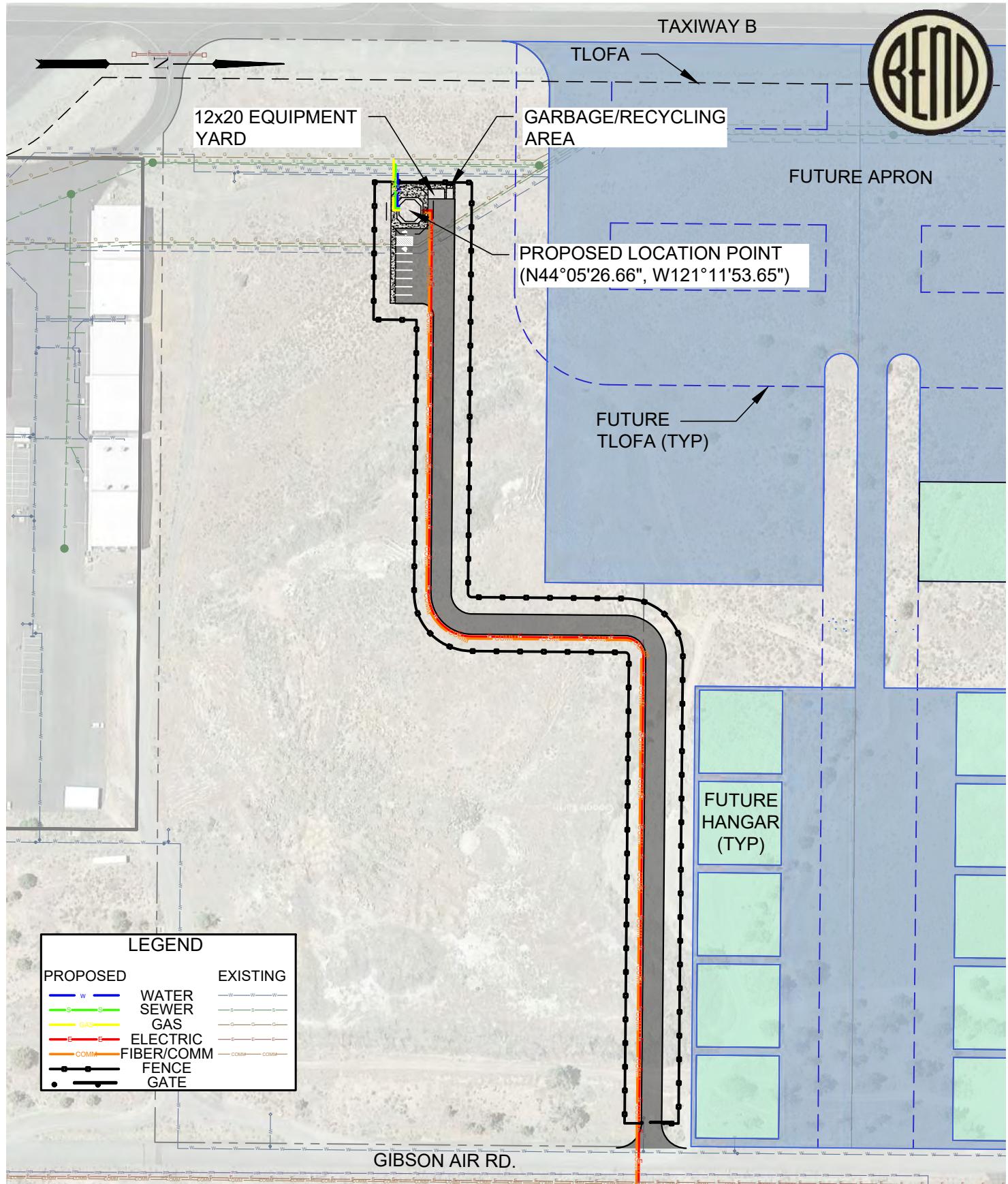
PROJECT NO: XXXXX.XXX.XX

DATE:

MAY 2022

SCALE: NO SCALE

PAGE NUMBER  
XX OF XX



**CENTURY WEST**

ENGINEERING  
541.322.8962 BEND OFFICE  
541.382.2423 FAX 1020 SW EMKAY DRIVE, #100  
BEND, OR 97702

CITY OF BEND - BEND MUNICIPAL AIRPORT  
CONTROL TOWER SITE SELECTION

PROJECT NO: XXXXX.XXX.XX

DATE:

MAY 2022

SCALE: NO SCALE

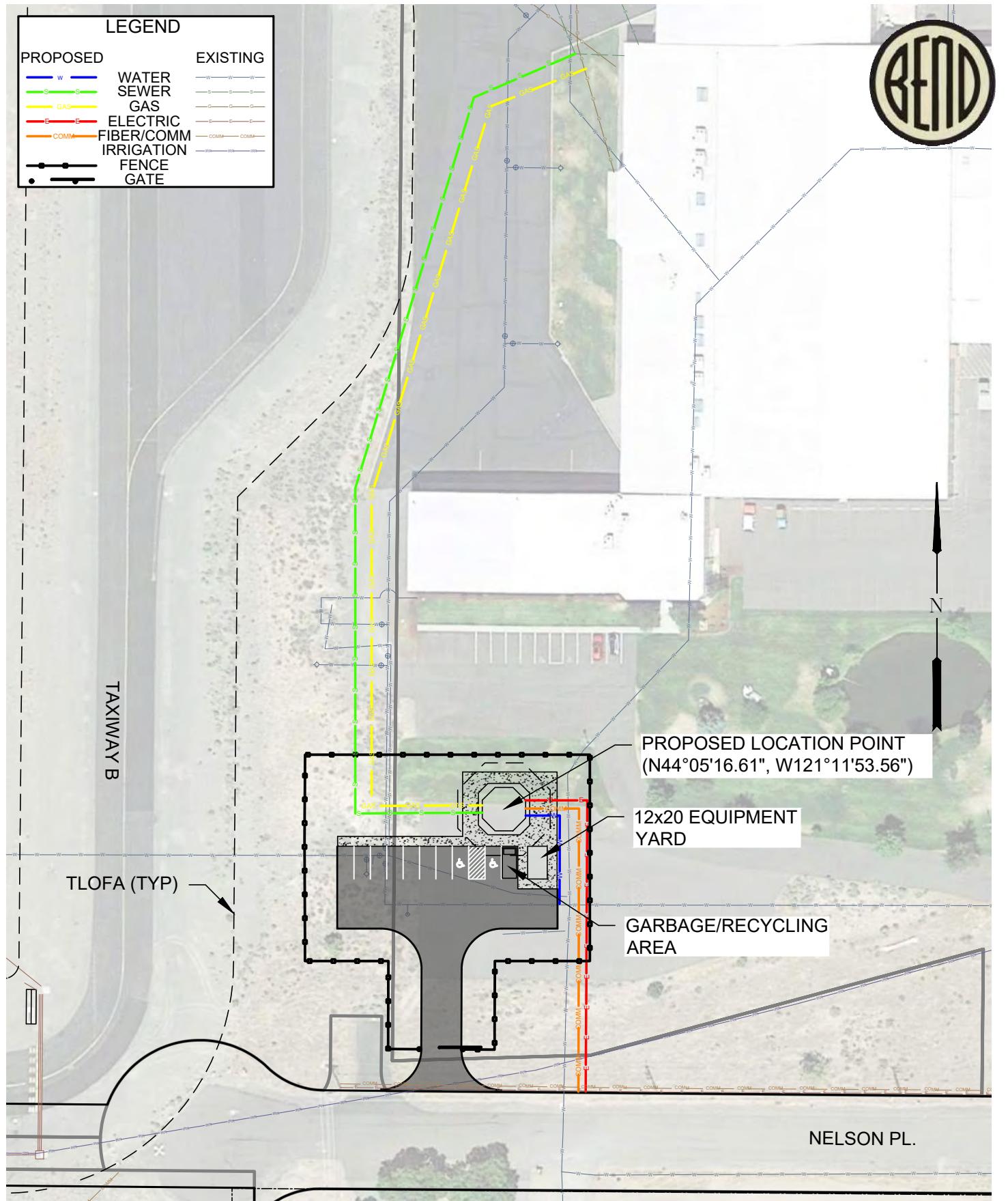
DRAWING NO.

EX-02

PAGE NUMBER  
XX OF XX



CONSTRUCTION COST ESTIMATE						
City of Bend Municipal Airport ATCT Site Selection						
PROPOSED LOCATION NO. 2				COUNTY		
PROJECT NUMBER	TYPE OF WORK		DATE	Deschutes		
	TRAFFIC CONTROL TOWER CONSTRUCTION			4/27/2022	PREPARED BY	
ITEM NUMBER	ITEM DESCRIPTION	UNIT	AMOUNT	UNIT COST	TOTAL	
<b>GENERAL</b>						
1	Mobilization	1	LS	\$ 96,119.20	\$ 96,119	
2	Survey	1	LS	\$ 25,000.00	\$ 25,000	
3	Traffic Control	1	LS	\$ 5,000.00	\$ 5,000	
4	Unclassified Excavation and Disposal	1455	CY	\$ 60.00	\$ 87,300	
5	Clearing and Grubbing	3.6	ACRE	\$ 10,000.00	\$ 36,000	
6	Temporary Erosion and Sediment Control	1	LS	\$ 5,000.00	\$ 5,000	
<b>UTILITY COORDINATION</b>						
7	Trench Safety System	1	LS	\$ 10,000.00	\$ 10,000	
8	4" Cable Conduit (PVC Conduit and Wire)	1400	LF	\$ 35.00	\$ 49,000	
9	6" 3-Phase Electrical Conduit (PVC Conduit and Wire)	1400	LF	\$ 50.00	\$ 70,000	
10	2" Gas Conduit (HDPE)	70	LF	\$ 30.00	\$ 2,100	
11	4" Fiber Optic/Telephone Conduit (PVC Conduit and Wire)	1400	LF	\$ 35.00	\$ 49,000	
12	8" Sewer Main (PVC)	70	LF	\$ 125.00	\$ 8,750	
13	2" Water Service (Copper)	70	LF	\$ 45.00	\$ 3,150	
<b>PAVING</b>						
14	Asphalt Top Course	1010	Tons	\$ 150.00	\$ 151,500	
15	Aggregate Base	700	CY	\$ 125.00	\$ 87,500	
16	Tack Coat	4200	SY	\$ 0.60	\$ 2,520	
17	Striping	340	LF	\$ 1.50	\$ 510	
<b>MISCELLANEOUS SITE WORK</b>						
18	Concrete Sidewalk	2200	SF	\$ 25.00	\$ 55,000	
19	6' HT. Barbed Wire Chain Link Fence	2925	LF	\$ 50.00	\$ 146,250	
20	6' HT. Barbed Wire Chain Link Motorized Gate	1	EA	\$ 50,000.00	\$ 50,000	
21	Topsoil and Seed	2.7	ACRE	\$ 43,560.00	\$ 117,612	
<b>SUBTOTAL, Construction Items</b>					\$ 1,057,311.20	
	Misc. Contingencies (25%)				\$ 264,327.80	
<b>TOTAL PROJECT COST</b>						<b>\$ 1,321,639.00</b>



**CENTURY WEST**

ENGINEERING  
541.322.8962 BEND OFFICE  
541.382.2423 FAX 1020 SW EMKAY DRIVE, #100  
BEND, OR 97702

CITY OF BEND - BEND MUNICIPAL AIRPORT  
CONTROL TOWER SITE SELECTION

**TOWER SITE 4**

PROJECT NO: XXXXX.XXX.XX

DATE:

MAY 2022

SCALE: NO SCALE

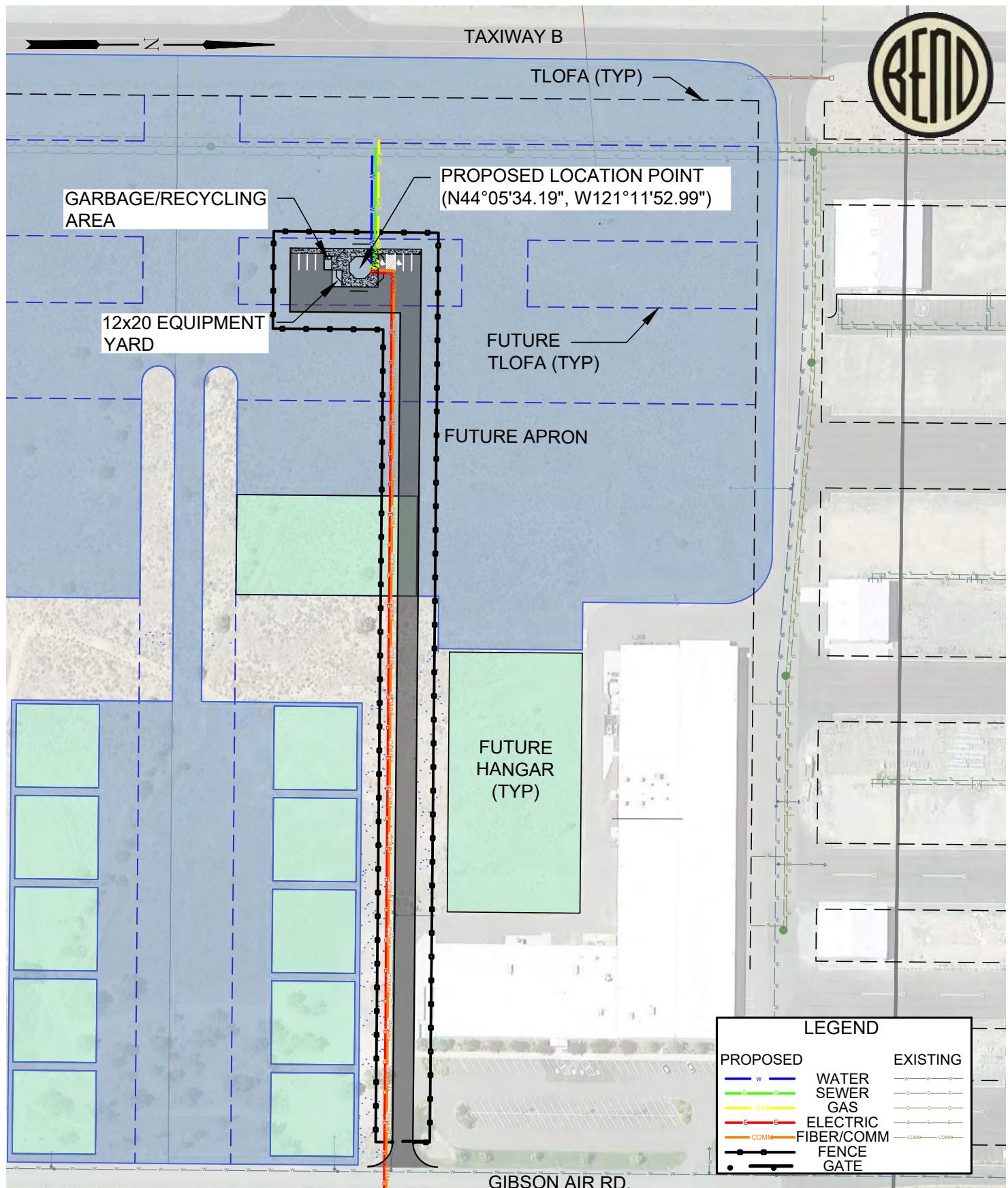
DRAWING NO.

**EX-03**

PAGE NUMBER  
XX OF XX



CONSTRUCTION COST ESTIMATE						
City of Bend Municipal Airport ATCT Site Selection						
PROPOSED LOCATION NO. 4				COUNTY		
PROJECT NUMBER	TYPE OF WORK			DATE	PREPARED BY	
	TRAFFIC CONTROL TOWER CONSTRUCTION			4/27/2022	Century West Engineering	
ITEM NUMBER	ITEM DESCRIPTION	UNIT	AMOUNT	UNIT COST	TOTAL	
<b>GENERAL</b>						
1	Mobilization	1	LS	\$ 45,203.12	\$ 45,203	
2	Survey	1	LS	\$ 25,000.00	\$ 25,000	
3	Traffic Control	1	LS	\$ 5,000.00	\$ 5,000	
4	Unclassified Excavation and Disposal	275	CY	\$ 60.00	\$ 16,500	
5	Clearing and Grubbing	0.02	ACRE	\$ 10,000.00	\$ 200	
6	Temporary Erosion and Sediment Control	1	LS	\$ 5,000.00	\$ 5,000	
<b>UTILITY COORDINATION</b>						
7	Trench Safety System	1	LS	\$ 10,000.00	\$ 10,000	
8	4" Cable Conduit (PVC Conduit and Wire)	215	LF	\$ 35.00	\$ 7,525	
9	6" 3-Phase Electrical Conduit (PVC Conduit and Wire)	215	LF	\$ 50.00	\$ 10,750	
10	2" Gas Conduit (HDPE)	1000	LF	\$ 30.00	\$ 30,000	
11	4" Fiber Optic/Telephone Conduit (PVC Conduit and Wire)	215	LF	\$ 35.00	\$ 7,525	
12	8" Sewer Main (PVC)	1000	LF	\$ 125.00	\$ 125,000	
13	2" Water Service (Copper)	75	LF	\$ 45.00	\$ 3,375	
<b>PAVING</b>						
14	Asphalt Top Course	240	Tons	\$ 150.00	\$ 36,000	
15	Aggregate Base	165	CY	\$ 125.00	\$ 20,625	
16	Tack Coat	1000	SY	\$ 0.60	\$ 600	
17	Striping	340	LF	\$ 1.50	\$ 510	
<b>MISCELLANEOUS SITE WORK</b>						
18	Concrete Sidewalk	2542	SF	\$ 25.00	\$ 63,550	
19	6' HT. Barbed Wire Chain Link Fence	680	LF	\$ 50.00	\$ 34,000	
20	6' HT. Barbed Wire Chain Link Motorized Gate	1	EA	\$ 50,000.00	\$ 50,000	
21	Topsoil and Seed	0.02	ACRE	\$ 43,560.00	\$ 871	
<b>SUBTOTAL, Construction Items</b>					<b>\$ 497,234.32</b>	
	Misc. Contingencies (25%)				\$ 124,308.58	
<b>TOTAL PROJECT COST</b>						<b>\$ 621,542.90</b>



**CENTURY**  
**WEST**

ENGINEERING  
541.322.8962 BEND OFFICE  
541.382.2423 FAX 1020 SW EMKAY DRIVE, #100  
BEND, OR 97702

CITY OF BEND - BEND MUNICIPAL AIRPORT  
CONTROL TOWER SITE SELECTION

TOWER SITE 5

PROJECT NO: XXXXX.XXX.XX

DATE:

MAY 2022

SCALE: NO SCALE

DRAWING NO.  
**EX-04**

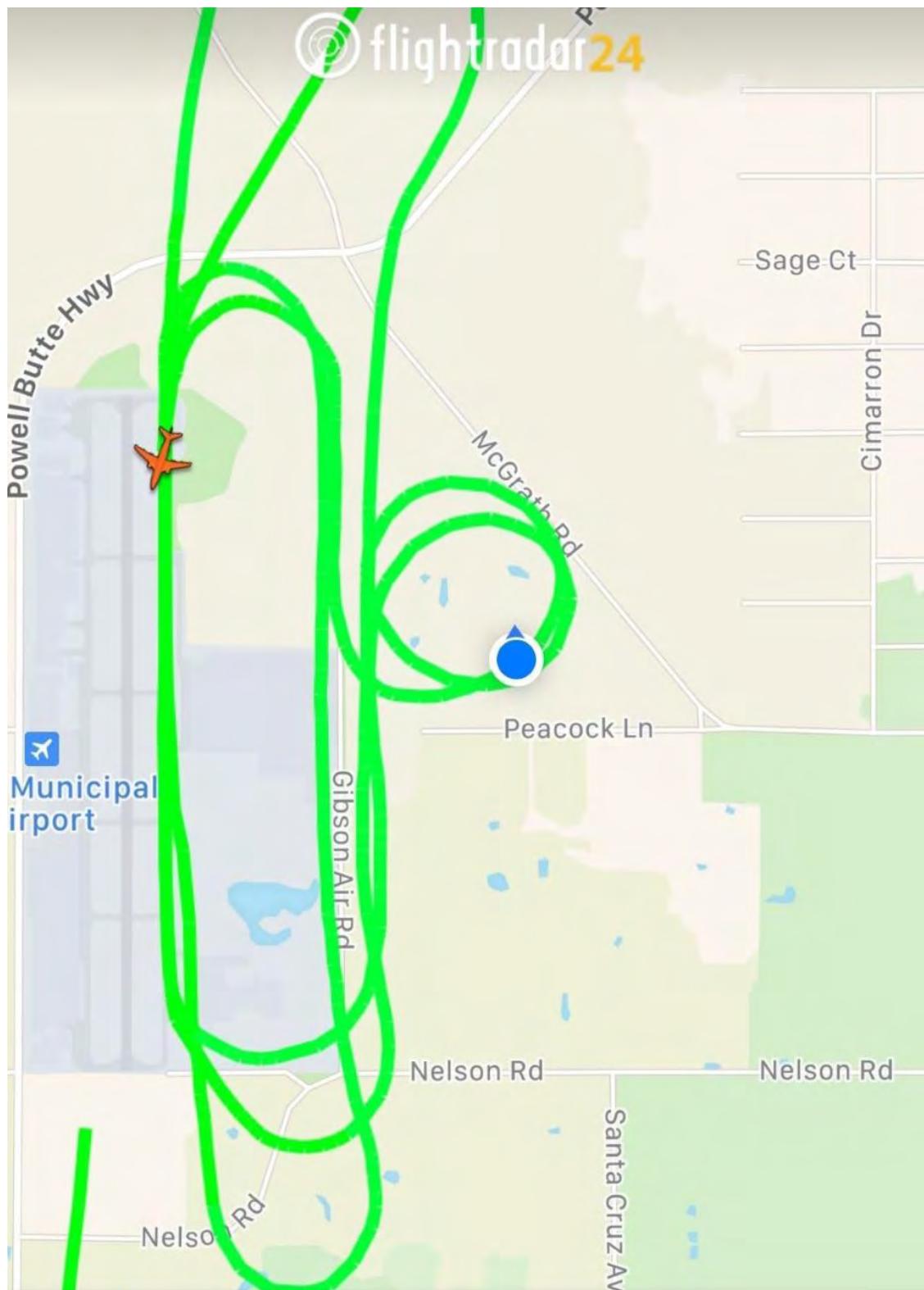
PAGE NUMBER  
XX OF XX



## CONSTRUCTION COST ESTIMATE

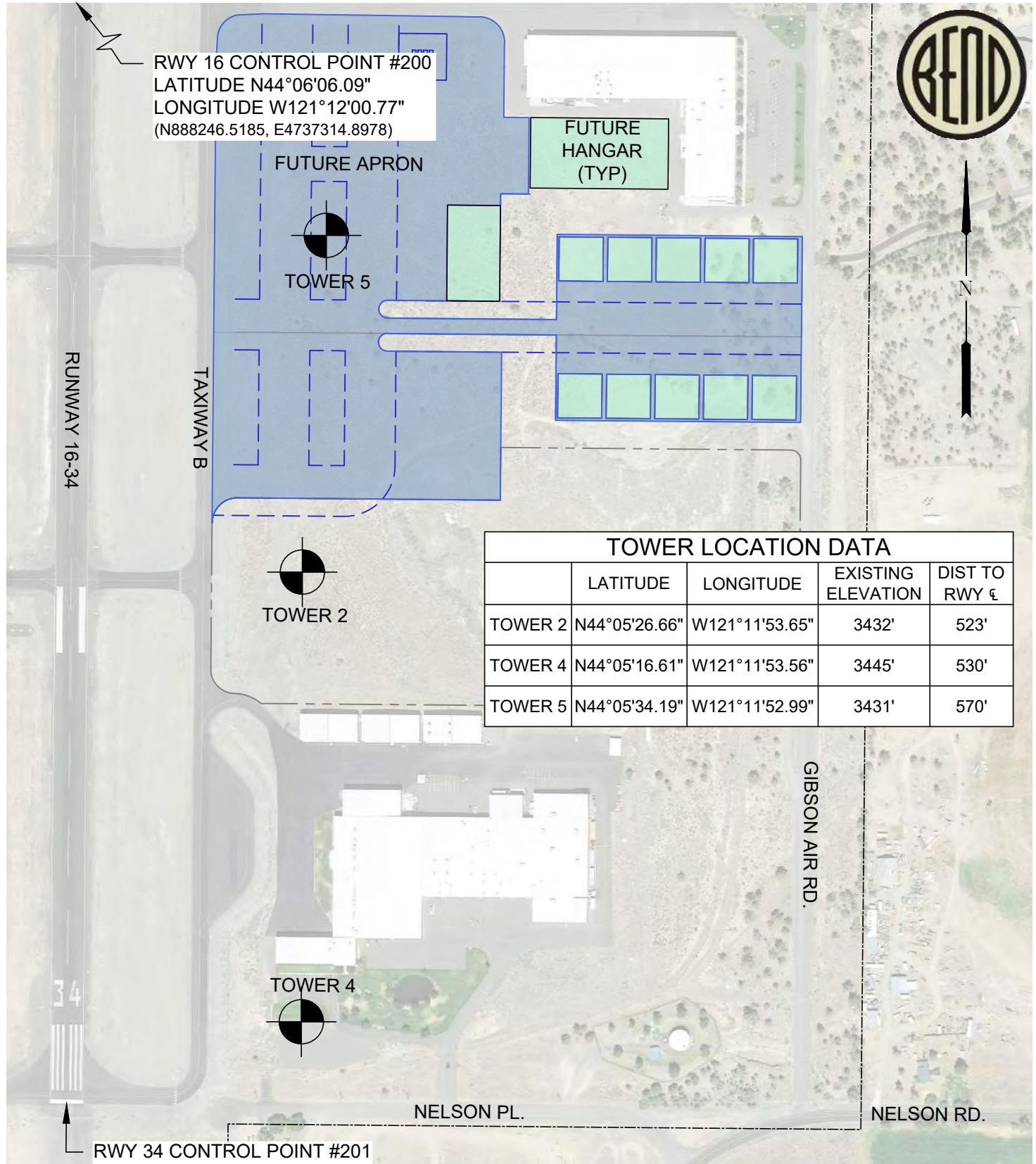
### City of Bend Municipal Airport ATCT Site Selection

CONSTRUCTION COST ESTIMATE City of Bend Municipal Airport ATCT Site Selection						
PROPOSED LOCATION NO. 5					COUNTRY Deschutes	
PROJECT NUMBER	TYPE OF WORK	TRAFFIC CONTROL TOWER CONSTRUCTION		DATE	PREPARED BY Century West Engineering	
ITEM NUMBER	ITEM DESCRIPTION		UNIT	AMOUNT	UNIT COST	TOTAL
<strong>GENERAL</strong>						
1	Mobilization		1	LS	\$ 92,508.60	\$ 92,508.60
2	Survey		1	LS	\$ 25,000.00	\$ 25,000.00
3	Traffic Control		1	LS	\$ 5,000.00	\$ 5,000.00
4	Unclassified Excavation and Disposal		1470	CY	\$ 60.00	\$ 88,200.00
5	Clearing and Grubbing		3.2	ACRE	\$ 10,000.00	\$ 32,000.00
6	Temporary Erosion and Sediment Control		1	LS	\$ 5,000.00	\$ 5,000.00
<strong>UTILITY COORDINATION</strong>						
7	Trench Safety System		1	LS	\$ 10,000.00	\$ 10,000.00
8	4" Cable Conduit (PVC Conduit and Wire)		1200	LF	\$ 35.00	\$ 42,000.00
9	6" 3-Phase Electrical Conduit (PVC Conduit and Wire)		1200	LF	\$ 50.00	\$ 60,000.00
10	2" Gas Conduit (HDPE)		160	LF	\$ 30.00	\$ 4,800.00
11	4" Fiber Optic/Telephone Conduit (PVC Conduit and Wire)		1200	LF	\$ 35.00	\$ 42,000.00
12	8" Sewer Main (PVC)		160	LF	\$ 125.00	\$ 20,000.00
13	2" Water Service (Copper)		160	LF	\$ 45.00	\$ 7,200.00
<strong>PAVING</strong>						
14	Asphalt Top Course		1015	Tons	\$ 150.00	\$ 152,250.00
15	Aggregate Base		705	CY	\$ 125.00	\$ 88,125.00
16	Tack Coat		4230	SY	\$ 0.60	\$ 2,538.00
17	Striping		340	LF	\$ 1.50	\$ 510.00
<strong>MISCELLANEOUS SITE WORK</strong>						
18	Concrete Sidewalk		2381	SF	\$ 25.00	\$ 59,525.00
19	6' HT. Barbed Wire Chain Link Fence		2615	LF	\$ 50.00	\$ 130,750.00
20	6' HT. Barbed Wire Chain Link Motorized Gate		1	EA	\$ 50,000.00	\$ 50,000.00
21	Topsoil and Seed		2.3	ACRE	\$ 43,560.00	\$ 100,188.00
<strong>SUBTOTAL, Construction Items</strong>						\$ 1,017,594.60
	Misc. Contingencies (25%)					\$ 254,398.65
<strong>TOTAL PROJECT COST</strong>						\$ 1,271,993.25



Current Helicopter Traffic Pattern  
(to become more standard & controlled)  
Arrivals and Departures on East Parallel Taxiway B

**Appendix F – Obstruction Evaluations/Airport Airspace Analysis (OE/AAA)**



RWY 34 CONTROL POINT #201  
LATITUDE N44°05'14.75",  
LONGITUDE W121°12'00.82"  
(N883047.1809, E4737268.0246)

**SURVEY CONTROL**  
HORIZONTAL DATUM: OREGON STATE PLAN SOUTH NAD83  
VERTICAL DATUM: NAVD88  
UNITS: INTERNATIONAL FT



541.322.8962 BEND OFFICE  
541.382.2423 FAX 1020 SW EMKAY DRIVE, #100  
BEND, OR 97702

CITY OF BEND - BEND MUNICIPAL AIRPORT  
CONTROL TOWER SITE SELECTION

DRAWING NO.

EX-01

KEY PLAN

PROJECT NO: XXXXX.XXX.XX

DATE:

MAY 2022

SCALE: NO SCALE

PAGE NUMBER  
XX OF XX

**From:** Boyer, Franklin E-CTR (FAA) <franklin.e-ctr.boyer@faa.gov>  
**Sent:** Wednesday, May 18, 2022 7:55 AM  
**To:** Oleck, Perry J (FAA) <perry.j.oleck@faa.gov>  
**Cc:** Parker, David G (FAA) <David.G.Parker@faa.gov>; Brian Lally <blally@ctbxaviation.com>; Ikeda, Jon (FAA) <Jon.Ikeda@faa.gov>  
**Subject:** RE: Bend, OR (BDN) Control Tower Siting

Thank You Perry, can you please provide the NTE height, I may want to go a little higher.

fb

**From:** Oleck, Perry J (FAA) <[perry.j.oleck@faa.gov](mailto:perry.j.oleck@faa.gov)>  
**Sent:** Tuesday, May 17, 2022 2:18 PM  
**To:** Boyer, Franklin E-CTR (FAA) <[franklin.e-ctr.boyer@faa.gov](mailto:franklin.e-ctr.boyer@faa.gov)>  
**Cc:** Parker, David G (FAA) <[David.G.Parker@faa.gov](mailto:David.G.Parker@faa.gov)>  
**Subject:** Bend, OR (BDN) Control Tower Siting

Franklin,

I sat in for Dave Parker as the TERPs POC for Western Service Area. I was having some issues with my Teams meeting site, but I did listen in on the phone to the entire meeting. I removed site 4 from the TERPs evaluation and adjusted site 2 to the proposed eye height of 85 ft. With that according to my calculations put site 2 the top of tower at 3547 AMSL. The evaluation of site 2 and site 5 shows no effect on any of the flight procedures at BDN. If you have any questions please let me know.

Respectfully,

**Perry Oleck**

Oakland District (TWOA) and VOR MON Program  
Western Flight Procedures Team (AJV-W24)  
Mission Support Services | Air Traffic Organization (ATO)  
**Federal Aviation Administration**

Office: (206) 231-2276  
Email: [Perry.J.Oleck@faa.gov](mailto:Perry.J.Oleck@faa.gov)  
Web: [www.faa.gov/go/missionsupport](http://www.faa.gov/go/missionsupport)



[IFP Information Gateway](#)

**Airspace Analysis  
Bend Municipal Airport  
Proposed New ATCT Locations**

**Summary Report**

Three (3) proposed sites for a new Air Traffic Control Tower at the Bend Municipal Airport, Bend, OR, were provided to me by CTBXaviation. I was asked to evaluate each site at a primary MSL elevation determined by CTBXaviation. The locations and elevations evaluated are as follows:

**Proposed Elevations**

SITE	AGL Height	Ground Elev.	MSL Elevation	Geodetic Coordinates
2	115'	3432'	3547'	44 05 26.66N-121 11 53.65W
4	75'	3445'	3520'	44 05 16.61N-121 11 53.56W
5	115'	3431'	3546'	44 05 34.19N-121 11 52.99W

**Existing Instrument Approaches**

Using the FAA Terminal Area Route Generation Evaluation & Traffic Simulation (TARGETS) Tool and the Instrument Approach Procedure Automation (IAPA) Tool I have evaluated all of the currently published Instrument Approach Procedures and Departure Procedures at the Bend Municipal Airport using the site coordinates and MSL elevations provided to me by CTBXaviation. In addition, I evaluated a proposed straight-in LNAV procedure to a proposed new Runway 34 with a 1060 foot extension to the south. Total landing distance available of 6260 feet.

The three proposed ATCT sites evaluated will not affect any of the existing instrument approach or departure procedures at the airport. There is ample clearance over all three.

Proposed Control Tower Site 2, at the proposed MSL elevation of 3547 feet, does not affect any currently published or proposed instrument approach or departure procedures at the Bend Municipal Airport. The controlling procedure for Tower Site 2 is the RNAV (GPS) Y RWY 16 LP (localizer performance) missed approach which has 113.27 feet of clearance over the site.

Proposed Control Tower Site 4, at the proposed MSL elevation of 3520 feet, does not affect any currently published or proposed instrument approach or departure procedures at the Bend Municipal Airport. Tower Site 4 was eliminated by the FAA during the 3-D Model Validation.

Proposed Control Tower Site 5, at the proposed MSL elevation of 3546 feet, does not affect any currently published or proposed instrument approach or departure procedures at the Bend Municipal Airport. The controlling procedure for Tower Site 5 is the RNAV (GPS) Y RWY 16 LP (localizer performance) missed approach which has 114.00 feet of clearance over the site.

### **Proposed Instrument Approach**

A proposed straight-in LNAV procedure to Rwy 34 was also evaluated. The Airport Layout Plan (ALP) for Rwy 34 shows a proposed 1060 foot extension to the south with no displaced threshold for a landing distance of 6260 feet. For the purpose of this evaluation, it was assumed that the threshold elevation would be 3452.2 feet MSL which is consistent with the most recent (ALP). The proposed tower locations do not affect an LNAV RWY 34 approach procedure.

### **Circling and Departure Minimums**

Circling minimums were evaluated, and the proposed tower locations do not affect circling minimums at the airport.

Departure procedures were evaluated, and the proposed tower locations do not affect departure minimums or departure procedures at the airport.

John D. Mogul  
Airspace Consultant

**From:** Jagielo, Evan (FAA) <Evan.Jagielo@faa.gov>  
**Sent:** Tuesday, May 10, 2022 12:02 PM  
**To:** Boyer, Franklin E-CTR (FAA) <franklin.e-ctr.boyer@faa.gov>  
**Subject:** RE: BEND (BDN) coordinates & heights

Thanks Frank. Fortunately, a TOPR is not needed for these 3 sites as they are outside any facility protection areas (see below):



Best regards,  
-Evan

**From:** L. Nelson Spohnheimer <[nelson@spohnheimerconsulting.com](mailto:nelson@spohnheimerconsulting.com)>  
**Sent:** Monday, January 10, 2022 6:04 PM  
**To:** Brian Lally <[blally@ctbxaviation.com](mailto:blally@ctbxaviation.com)>

Nav -

VOR - There's a VOR approach, but closest is 10 NM NW (Deschutes, w of Redmond)

ILS - none, only single VOR & RNAV approaches

Comm - No RTR in the data base, but there is a CTAF outlet, so some FBO has a radio on the counter? (No RTR shown for Redmond either, and as you know it has moderate scheduled service, so maybe my database is a tad out of date (2017)? Still, I surely can't see an RTR at BDN.

Surveillance - has to be out of Redmond's.

This says there are no ground facilities of note, and that no study should be needed.

L. Nelson Spohnheimer  
[Nelson@SpohnheimerConsulting.com](mailto:Nelson@SpohnheimerConsulting.com)



**BDN ATCT FAR Part 77 Estimate**

Dist to RW CL	Primary Surf Width	Horiz Dist under 7:1	Elevation at RW CL	7:1 Surface Elevation	Height at Top of Tower	FAR PART 77 Penetration
SITE 2	520 FT	500 FT	270 FT	3445' msl	3484' msl	3523' msl
SITE 4	530 FT	500 FT	280 FT	3459' msl	3499' msl	3520' msl
SITE 5	570 FT	500 FT	320 FT	3435 ' msl	3481' msl	3546' msl

## **Appendix G – Environmental Documentation**

## Memo

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**To:** Brian Lally – CTBX  
**From:** Century West  
**Date:** May 20, 2022  
**Project:** Bend Municipal Airport – ATCT Siting Study  
**Re:** Site Assessment Civil Site Improvements

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This memo includes a summary of information requested by CTBX that was consolidated or prepared by Century West Engineering. The information is to provide background for development at the Bend Municipal Airport and specific site evaluations for three candidate sites for the possible location of an air traffic control tower.

CTBX requested the following information:

- An environmental summary of the east side of the airport
- Soils description of the east side of the airport from USDA Soils Survey and/or past projects
- A narrative and ROM cost estimate to go with your Access and Utilities graphics
- Identify all local and environmental permits that will be required for the project to proceed with construction along with estimated permitting and connection fee

### Bend Municipal Airport – Environmental Summary

**Cultural Resources** - Historical and Archaeological Resources National Register of Historic Places (NRHP) is responsible for listing districts, sites, buildings, structures and objects significant to American history. The Northern Paiute were a seminomadic people that inhabited the Bend area and four significant prehistoric sites in the Bend vicinity have been marked for protection. The Lava Island Rockshelter was a site for manufacturing tools and obsidian from Newberry crater was used to make dart and arrow points. The Peninsula 1 site on the Deschutes River and the Lava Butte site both show evidence of fishing and hunting activities (Aikens 1993). All sites are located far enough away from the airport to have little issue with any future development. Documents are available from the Oregon State Historic Preservation Office (SHPO) and can be used to determine if historical or archaeological resources have been recorded in the vicinity of the Airport. Chapter 23 in the Deschutes County Comprehensive Plan of 2002 outlines historic resources inventoried by the county. These resources are identified in an attempt to be preserved and protected as historic and cultural resources. Of the thirty-five inventoried sites, only two are within five miles of the airport. The Eastern Star Grange was the first grange, organized in 1912, and Young School served local homesteaders in the 1930s.

Consultants have previously conducted six cultural resource studies at the Airport at land that almost covers the entirety of Airport property. For the 2022 Airport Master Plan project a study was conducted that 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.*

**2022 Airport Master Plan NEPA Review** - An environmental screening for the following environmental impact categories were included as part of the Master Plan and summarized relevant information on the following NEPA impact categories:

- 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 (*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. Other species protected by the MBTA may also be present at that time of year, and therefore be susceptible to disturbance by construction activities.

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 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 full Environmental Science Associates (ESA) report is located in the appendices of this report.*

#### **Bend Municipal Airport - Site Soil Conditions Summary**

**SURFACE CONDITIONS** - The airport is located within relatively flat terrain. The project area generally slopes up gently from west to east and from north to south. However, site grading for recent projects and stockpiling of excess fill materials has created more uneven terrain toward the west end of the current project area. A large fill stockpile extends across the south portion of the proposed heliport, northeast of the existing wind cone and AWOS. The general location of the stockpiled fill is shown on Figure 2A. The thickest portion of the fill is greater than 10 feet deep. The fill was likely generated from cuts during the construction of Taxiway B. Fill was also placed to a more limited extent immediately east of Taxiway B (in the vicinity of TP-9). The eastern portion of the project area (within the proposed apron and parking lot and along the proposed driveway) is mostly undeveloped. The ground surface is typically covered with juniper trees, scattered sagebrush and other short shrubs and Bend Municipal Airport – Helicopter Operations Area September 24, 2015 Geotechnical Investigation 3 Project 2151052 Bend, Oregon Century West Engineering Corporation weeds. Scattered cobble to boulder-sized rock fragments cover portions of the site. A shallow ridge of basaltic bedrock is exposed within the apron area,

extending approximately east-west (south of BH-34 and north of BH-36 and BH-37). Similar rock outcroppings were not observed within the project limits but have been noted in other areas of the airport. Shallow bedrock was encountered across the site, as discussed below.

**SUBSURFACE CONDITIONS** - The explorations encountered similar subsurface conditions across the site, typically including a relatively thin layer of soil over bedrock. The native soil consists of light brown silty sand (eolian deposits). The silt is non-plastic and the sand is typically fine to medium-grained. Scattered basaltic rock fragments were encountered within the silty sand at some locations. Outside of fill areas, the explorations encountered silty sand to depths ranging from  $\pm 0.3$  to 5 feet, with an average depth of less than 2 feet. In some areas the native soil is covered by fill. The fill is a mixture of the on-site materials (i.e., silty sand and excavated rock fragments) generated from previous earthwork. The ratio of soil to rock fragments is likely variable within the fill areas. It appears the excavated rock has had little processing and varies from gravel to boulder-sized fragments. The soil is underlain by basaltic bedrock (Basalt of Newberry volcano). The surface basalt is typically highly to moderately weathered and vesicular. Relative rock strengths appear to range from very soft to medium hard (R1 to R3) near the surface. However, we anticipate the rock will become less weathered and harder (R4 to R5) with depth. The test pits (excavated using a Bobcat 331 mini-excavator) encountered practical digging refusal at a maximum depth of  $\pm 1.5$  feet below the bedrock surface, and often experienced digging refusal on the rock surface. The bedrock surface elevations and depth of practical digging refusal encountered in the test pits are summarized in Table 1B. For borings drilled outside the fill areas, we estimate the drilling refusal was experienced within a few inches below the bedrock surface. This is based on the observed drilling action and comparison between borings and test pits completed adjacent to each other. The drilling refusal depths encountered in the borings are summarized in Table 2B.

**GROUND WATER** - We observed no ground water infiltration in the explorations and the soils were typically dry to damp at the time of the exploration. The soil appears to be relatively well-drained. However, based on the shallow depth to bedrock and the undulating rock surface, it is possible water could perch on the bedrock beneath the pavement (particularly within depressions in the rock) during periods of extended rainfall or snow melt. The airport is located in a semi-arid environment and heavy rainfall events are typically limited. Therefore, shallow ground water accumulation is expected to be a short-term condition.

*Geotechnical information sourced from the "Bend Municipal Airport – Helicopter Operations Area Geotechnical Investigation, September 24, 2015. Project 2151052.", prepared by Foundation Engineering, Inc.*

## ATCT Site Assessment Summary

**PERMITTING REQUIREMENTS** - Five potential air traffic control tower sites were identified through previous planning studies at the Bend Municipal Airport. These locations were narrowed down to three preferred sites from the original 5 including sites 2, 4 and 5. It is anticipated that the project will not require any City of Bend permits nor service development connection fees. However, the project will need to be permitted for both Deschutes County land use and building. These permits will include a permit for the structure that will be based on the valuation of the building and any SDC fees related to road improvement for the project. Road improvement SDCs will be determined with a unit cost of \$4757/peak hour trip generated from the development. Other County building permits will be standard mechanical, electrical, and plumbing. It is anticipated that a 1200c permit with DEQ will not be required, however coordination with DEQ will be needed for confirmation.

**Site layouts and cost estimates are included in the PDF titled “Bend Airport ATCT Site Layouts and Cost Estimates 052022”.**

DESCRIPTIONS OF THE PROPOSED SITES ARE AS FOLLOWS:

### Site 2

#### Site Access:

Location 2 is sited within airport undeveloped property zoned for IND/COMM development. Refer to the key plan drawing within this document for additional location information. In order to access the site, approximately 1500' of asphalt roadway shall be constructed within the undeveloped property. The new access road will connect to Gibson Air Rd east of the location. Site Demolition, Preparation, Clearing, Utilities, Parking, Layout and Access Roads can be seen on site 2's respective conceptual drawings included within this document.

#### Utilities:

Location 2 is sited within proximity to existing water, sewer, and gas installed throughout the Airport's development east of Taxiway B. The site is also approximately 1500' west of CEC overhead power and phone/cable that runs parallel to Gibson Air Rd. Refer to the key plan drawing within this document for additional location information.

**Water:** An existing City of Bend 12" ductile iron water main is currently installed approximately 40' away from the proposed site 2 tower. Size and material will need to be confirmed with field exploration and potholing.

**Sewer:** An existing City of Bend 8" PVC gravity sewer main is currently installed approximately 40' away from the proposed site 2 tower.

**Cable:** An overhead cable conduit is currently installed approximately 1500' east of the proposed site 2 tower on CEC utility poles.

**Telephone:** An overhead telephone conduit is currently installed approximately 1500' east of the proposed site 2 tower on CEC utility poles

**Electric:** CEC 3-Phase overhead power is currently installed approximately 1500' east of the proposed site 2 tower.

Gas: An existing gas service conduit is currently installed approximately 40' away from the proposed site 2 tower.

#### **Site 4**

##### Site Access:

Location 4 is sited directly south of 22550 Nelson Place, on airport property currently leased to Epic Aircraft. The property is zoned for IND/COMM development. Refer to the key plan drawing within this document for additional location information. In order to access the site, approximately 100' of asphalt driveway will need to be constructed and connected to Nelson Place directly south. Site Demolition, Preparation, Clearing, Utilities, Parking, Layout and Access Roads can be seen on site 4's respective conceptual drawings included within this document.

##### Utilities:

Location 4 is sited within proximity to existing water, sewer, and gas installed throughout the Airport's development east of Taxiway B. The site is also approximately 100' north of CEC overhead power and phone/cable that runs parallel to Nelson Place. Refer to the key plan drawing within this document for additional location information.

Water: An existing City of Bend 12" C-900 water main is currently installed approximately 50' away from the proposed site 4 tower. Size and material will need to be confirmed with field exploration and potholing.

Sewer: An existing City of Bend 8" PVC gravity sewer main is currently installed approximately 600' north of proposed site 4 tower.

Cable: An overhead cable conduit is currently installed approximately 100' south of the proposed site 4 tower on CEC utility poles.

Telephone: An overhead telephone conduit is currently installed approximately 100' south of the proposed site 4 tower on CEC utility poles

Electric: CEC 3-Phase overhead power is currently installed approximately 100' south of the proposed site 4 tower, running parallel to Nelson Place.

Gas: An existing gas service conduit is currently installed approximately 600' north of the proposed site 4 tower.

#### **Site 5**

##### Site Access:

Location 5 is sited within airport undeveloped property zoned for IND/COMM development. Refer to the key plan drawing within this document for additional location information. In order to access the site, approximately 1000' of asphalt roadway shall be constructed within the undeveloped property. The new access road will connect to Gibson Air Rd east of the location. Site Demolition, Preparation, Clearing, Utilities, Parking, Layout and Access Roads can be seen on site 5's respective conceptual drawings included within this document.

##### Utilities:



Location 5 is sited within proximity to existing water, sewer, and gas installed throughout the Airport's development east of Taxiway B. The site is also approximately 1000' west of CEC overhead power and phone/cable that runs parallel to Gibson Air Rd. Refer to the key plan drawing within this document for additional location information.

Water: An existing City of Bend 12" ductile iron water main is currently installed approximately 150' away from the proposed site 5 tower. Size and material will need to be confirmed with field exploration and potholing.

Sewer: An existing City of Bend 8" PVC gravity sewer main is currently installed approximately 150' away from the proposed site 5 tower.

Cable: An overhead cable conduit is currently installed approximately 1000' east of the proposed site 5 tower on CEC utility poles.

Telephone: An overhead telephone conduit is currently installed approximately 1000' east of the proposed site 5 tower on CEC utility poles.

Electric: CEC 3-Phase overhead power is currently installed approximately 1000' east of the proposed site 5 tower.

Gas: An existing gas service conduit is currently installed approximately 150' away from the proposed site 5 tower.

## **APPENDIX**

**STATE OF OREGON ARCHAEOLOGICAL SITE RECORD**

## State of Oregon Archaeological Site Record

Administrative Data								
Smithsonian Number:				Alt Site Nbrs:	18/2763-1			
Site Name:				Form Type:	New			
Managing Office*:	Municipal (describe)			County:	Deschutes			
Owners(s):	Municipal (describe)							
Ownership/Management Notes:	City of Bend / Bend Municipal Airport							
National Register Status:	Status Not Eligible	Role Fieldworker	Date 12/04/2018	Author Carmen Sarjeant				
Site Identification								
Site Type	<ul style="list-style-type: none"> <li>Other</li> <li>Refuse Scatter</li> </ul>							
Features*:	<ul style="list-style-type: none"> <li>Refuse scatter</li> <li>Rock Alignment</li> </ul>	Cultural Periods(s)*:			<ul style="list-style-type: none"> <li>Depression/WWII (1929-1950)</li> </ul>			
Dimensions:	Length 220	Width 4	Units Meters		Area 880 Sq m			
Depth of Cultural Deposits	0 cm							
General Age	Historic							
Location Data								
Legal Description:	Township 17 S	Range 13 E	Section 20	1/4 S	1/4 NW	1/4 SW	DLC Meridian Willamette	
UTM Coordinates	Type Feature	East 644178	North 4882906	Method GPS < 10m		Zone 10	Datum 83	
Map References	Map Name/Year BEND AIRPORT 7'			Revision Year 2017				
Access Description	Exit Highway 20 north onto Powell Butte Road, approximately 7 kilometers (km) (4.3 miles [mi]) east of central Bend. Continue northeast then north on Powell Butte Road towards the Bend Municipal Airport for 3.5 km (2.2 mi), then turn east onto Nelson Road. Continue east then north on Nelson Road for 0.9 km, then turn west and continue on Nelson Road for 330 meters (m) (1,083 feet [ft]), and park at the end of the cul-de-sac, adjacent to the Bend Municipal Airport Runway. From here, walk south 250 m (820 ft) to reach the eastern end of the linear stone rubble alignment and the debris scatter at the eastern limit of the City of Bend parcel. The site extends west approximately 250 m (820 ft) to the western limit of the City of Bend parcel.							
Environmental Data								
Province	High Lava Plain							
Basin	Deschutes							
Subbasin	LOWER CROOKED R							
Drainage Name								
Elevation	From 3451 To 3451 ft							
Aspect	Aspect: ALL							
Depositional Environment								
Soil Description	The soils are 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.							
Vegetation Description								
Culturally Significant Vegetation								
Water Sources	Name Deschutes	Type River	Stream Type Perennial	Stream Class	Distance 8700 meters	Direction 270 deg		
Site Setting	The site is within the shrub steppe vegetation zone with western juniper ( <i>Juniperus occidentalis</i> ). Sagebrush ( <i>Artemisia tridentata</i> ), rabbitbrush ( <i>Chrysothamnus</i> sp.), and bluebunch wheatgrass ( <i>Agropyron spicatum</i> ) dominate the landscape. The site is on topographically flat land in an area where basalt and basaltic andesite lava flows have been deposited and produced porous bedrock.							
Site Description								
Site 18/2763-1 consists of a historic-period linear stone rubble alignment and debris scatter								

<b>Site Description</b>		<p>found on the surface at the east end of the alignment. The alignment is oriented west to east, and appears to extend further west onto private land; the segment on private land has not been recorded. The alignment is approximately 220 m (722 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 alignment, some sections have been removed. One section of the alignment has been dismantled and reassembled directly north of the original alignment. The linear stone rubble alignment presumably served as a fence or as a designated location to place volcanic rock from the surrounding land for field clearing. A 1953 aerial photograph shows that the land to the north of the alignment appears to have been ploughed and cleared of vegetation, and the land to the south was composed of scattered native juniper trees (USGS 1953). Since a divide in land uses is identifiable either side of the alignment in aerial photography from 1953, the stone alignment may have been in place at this time. The small scatter of historic-period debris measures 2x2 m (6.6x6.6 ft), and includes one cylindrical can, one rectangular 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. 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. No further information has been found about the linear stone rubble alignment or debris scatter. The site is recommended to be not eligible for the NRHP.</p>			
<b>Dates of Use</b>		From 0 1953	To 1953 0	BP/AD/BC AD AD	Method Historic Record Historic Record
<b>Site Observations</b>		Present Cans Ceramics Metal Other		Quantity 2 2 3	
<b>Estimated Counts</b>		Prehistoric:      Historic: 7			
<b>Rock Art</b>					
<b>No Rock Art Specified</b>					
<b>Site Condition</b>					
<b>Visit Date</b>		11/12/2018			
<b>Site Condition</b>		Fair- Site Damage between 40% and 60%			
<b>Field Recorder</b>		Carmen Sarjeant, Archaeological Investigations Northwest, Inc.			
<b>Artifacts Collected?</b>		No			
<b>Activities/Work Performed</b>		Pedestrian survey of surrounding field and recording of the site.			
<b>Impacts/Impact Agents</b>					
<b>Protective Measures Recommended</b>					
<b>Bibliographic References</b>					
Author Sarjeant, Carmen, and Lucie Tisdale	Publication Year 2018	Title Cultural Resource Survey for the Bend Municipal Airport Master Plan, Deschutes County, Oregon. AINW Report No. 4136.	Agency/Organization Archaeological Investigations Northwest, Portland, Oregon	Primary Reference Yes	User Agency
U.S. Geological Survey (USGS)	1953	Aerial Reconnaissance Photograph ID#ARA010906307907. Available, <a href="http://earthexplorer.usgs.gov/metadata/4660/ARA010906307907/">http://earthexplorer.usgs.gov/metadata/4660/ARA010906307907/</a> , accessed November 8, 2018.	U.S. Geological Survey (USGS)	No	
<b>Files Uploads</b>					
<ul style="list-style-type: none"> <li><a href="#">Site 18-2763-1 Aerial Overview.pdf</a></li> <li><a href="#">OR Site form Photos 18-2763-1.pdf</a></li> <li><a href="#">Site 18_2763_1 Topo Map.pdf</a></li> </ul>					
<b>Form Entry Recorder:</b>		Carmen Sarjeant		Date: 11/12/2018	

# State of Oregon Archaeological Site Record Site Form

## Photos

**Smithsonian Number:**

**Alt Site Numbers:** 18/2763-1



Overview of the historic-period linear stone rubble alignment oriented west to east. The view is towards the west.



Overview of a collapsed section of the historic-period linear stone rubble alignment. The surface scatter of historic-period debris was found on the stone alignment section to the left of the ditch. The view is towards the northeast.

# State of Oregon Archaeological Site Record Site Form

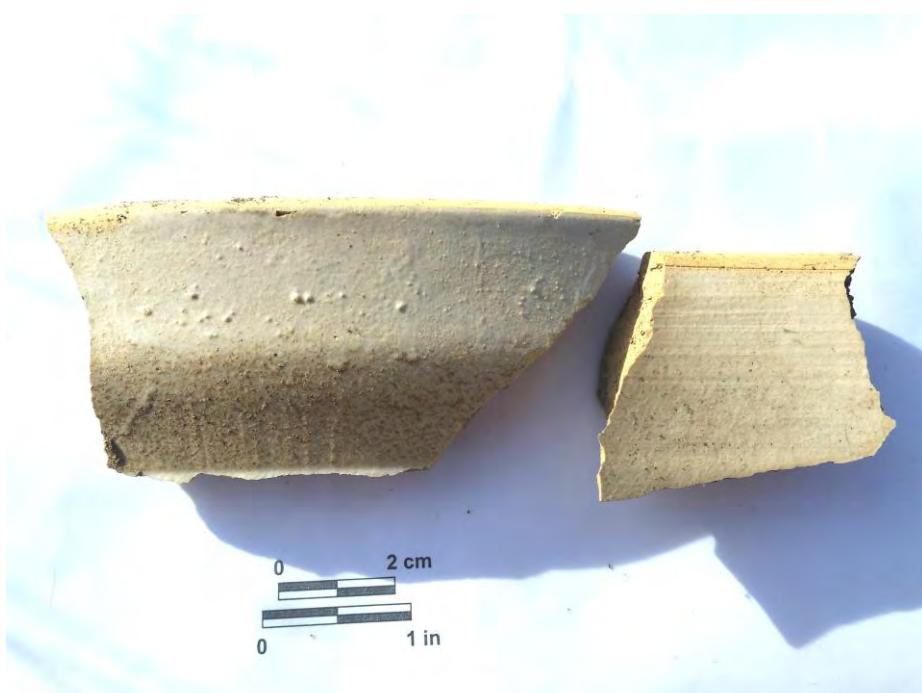
## Photos, continued

**Smithsonian Number:**

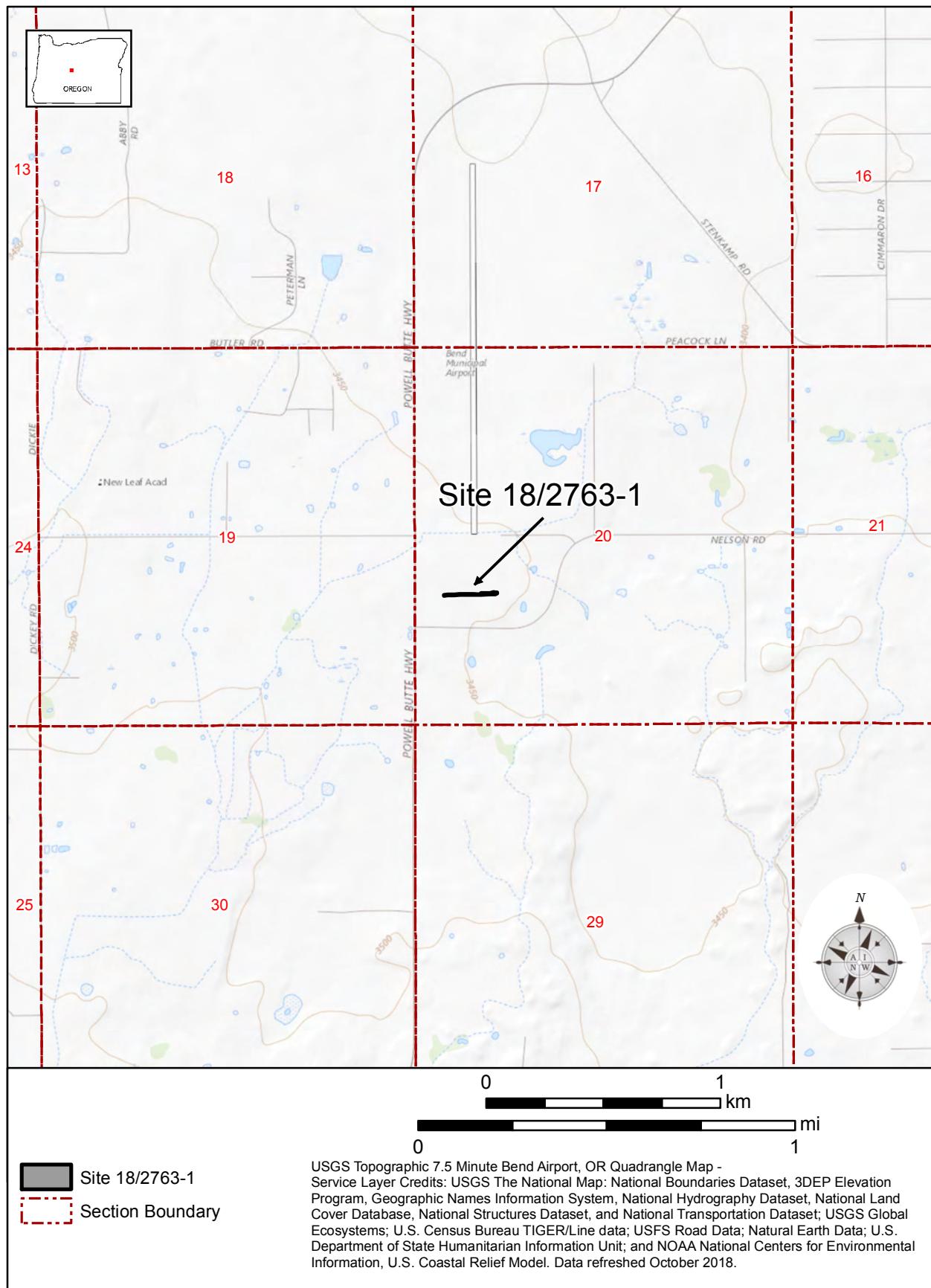
**Alt Site Numbers:** 18/2763-1

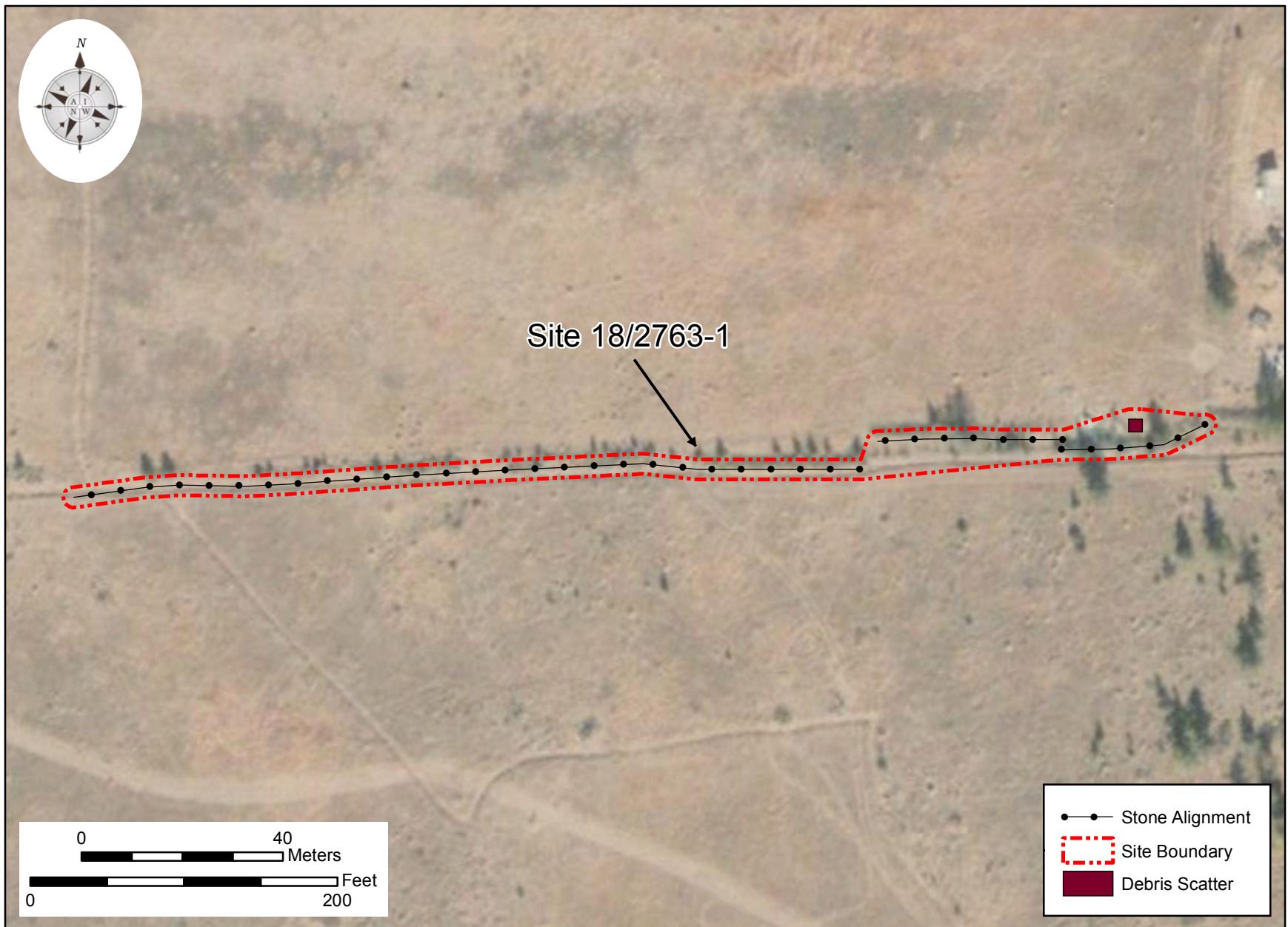


The surface scatter of historic-period debris, showing a metal can and an unidentified metal object.



Two fragments of ceramic crockery from the surface scatter of historic-period debris found along the linear stone rubble alignment.





Report #

# State Historic Preservation Office

## Report Cover Page

Year:

Title:

Author(s):

Agency/Client:

District/Contractor:

Agency/Client Report#:

Project Acres:

Survey Acres:

County(ies):

Township:

Range:

Section(s):

Township:

Range:

Section(s):

Archaeological Permit Number(s):

Accession Number:

Reports submitted to: Tribes: UOMNCH: LCIS:

Curation:

Report Addresses Testing:

Have tribes been  
contacted or consulted?

List tribes:

List any other groups  
contacted or consulted:

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 #

# *State Historic Preservation Office*

## *Report Summary of Resources*

### *and NRHP Eligibility*

Archaeological:

Site:      Isolate:      Built Environment:      TCP:      HPRCSIT:      Other:

Count:

**\*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:

RESOURCES

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.

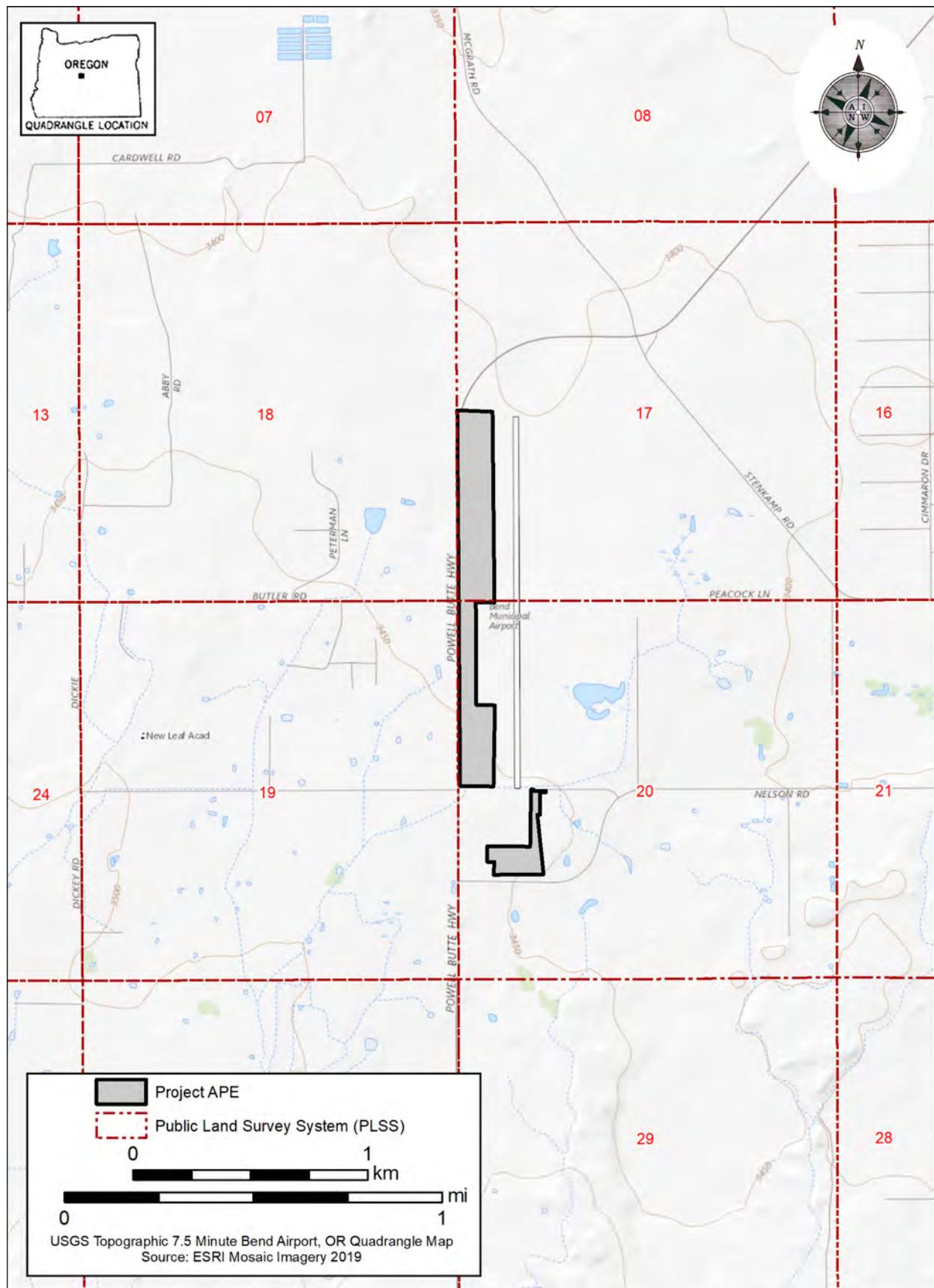


Figure 1. The location of the project APE for the Bend Municipal Airport Master Plan, Deschutes County, Oregon.

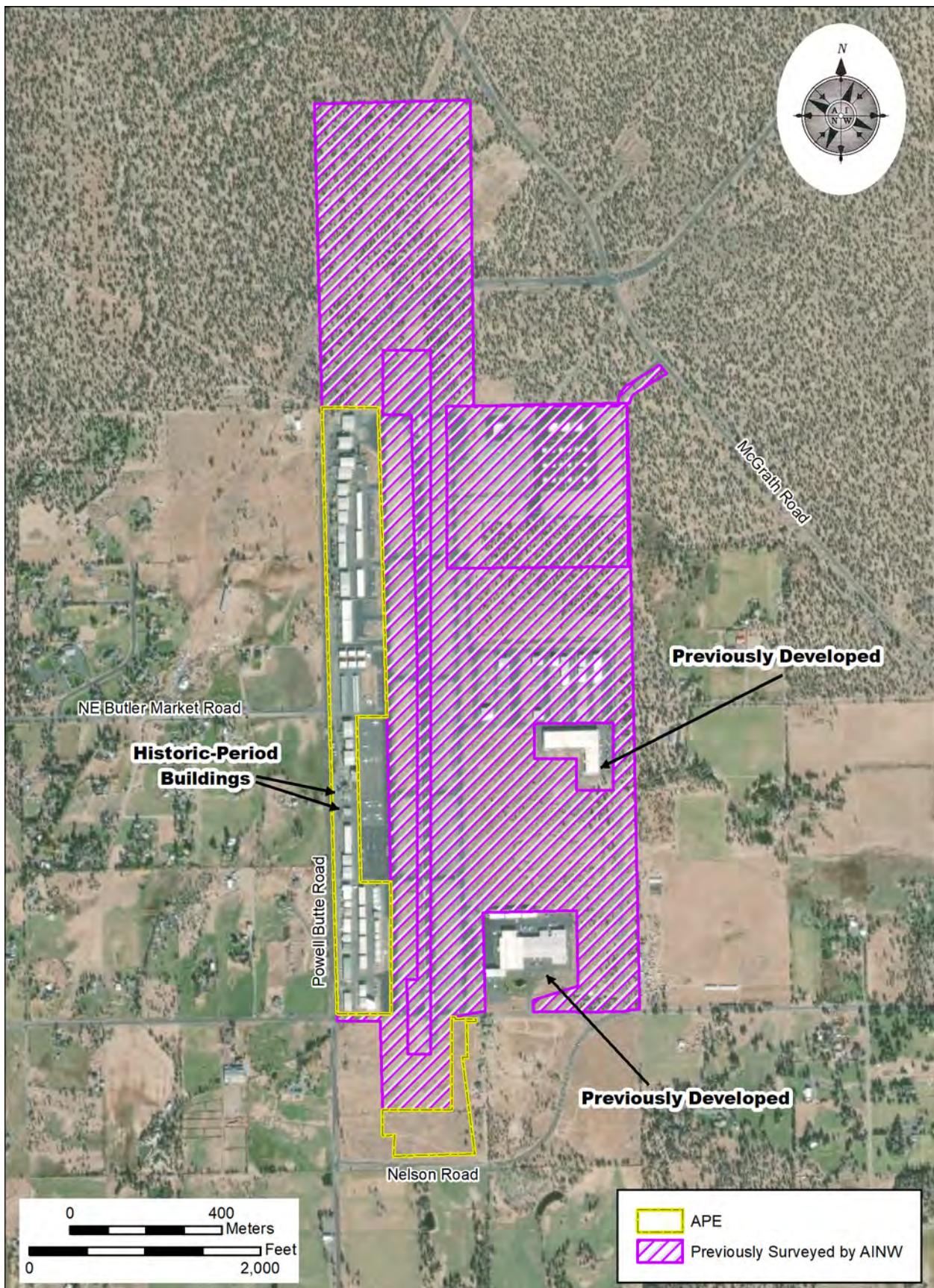


Figure 2. The location of the project APE, showing the previously developed or surveyed areas within the Bend Municipal Airport.

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.

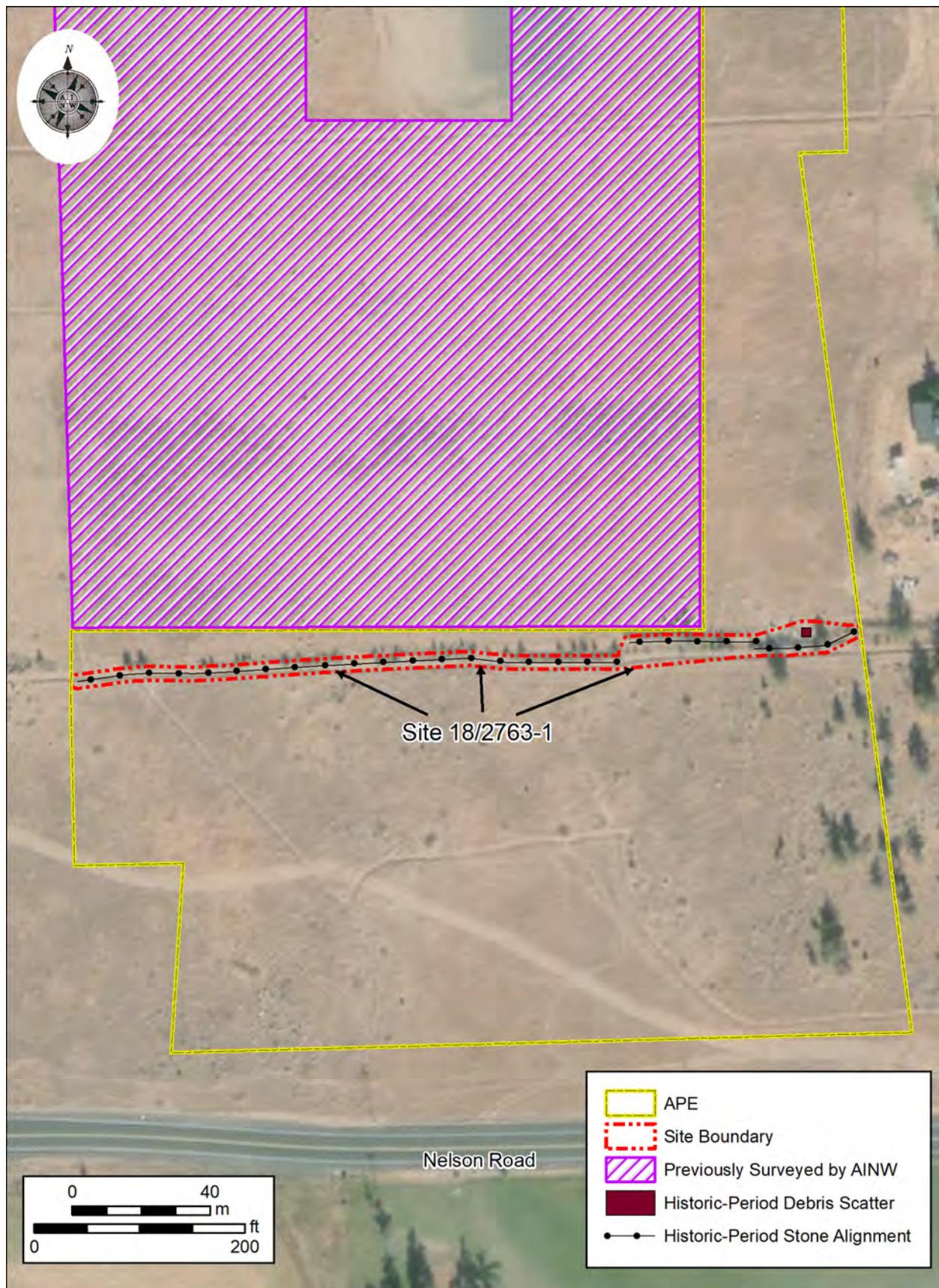
AINW previously conducted six archaeological surveys for various Airport improvements (Figure 2) (Buchanan and Fagan 2008; Cowan and Fagan 2014, 2015; Cowan et al. 2015; Ogle and Fagan 2005a, 2005b). These six previous studies focused on archaeology of the undeveloped portions of the Airport while the 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).



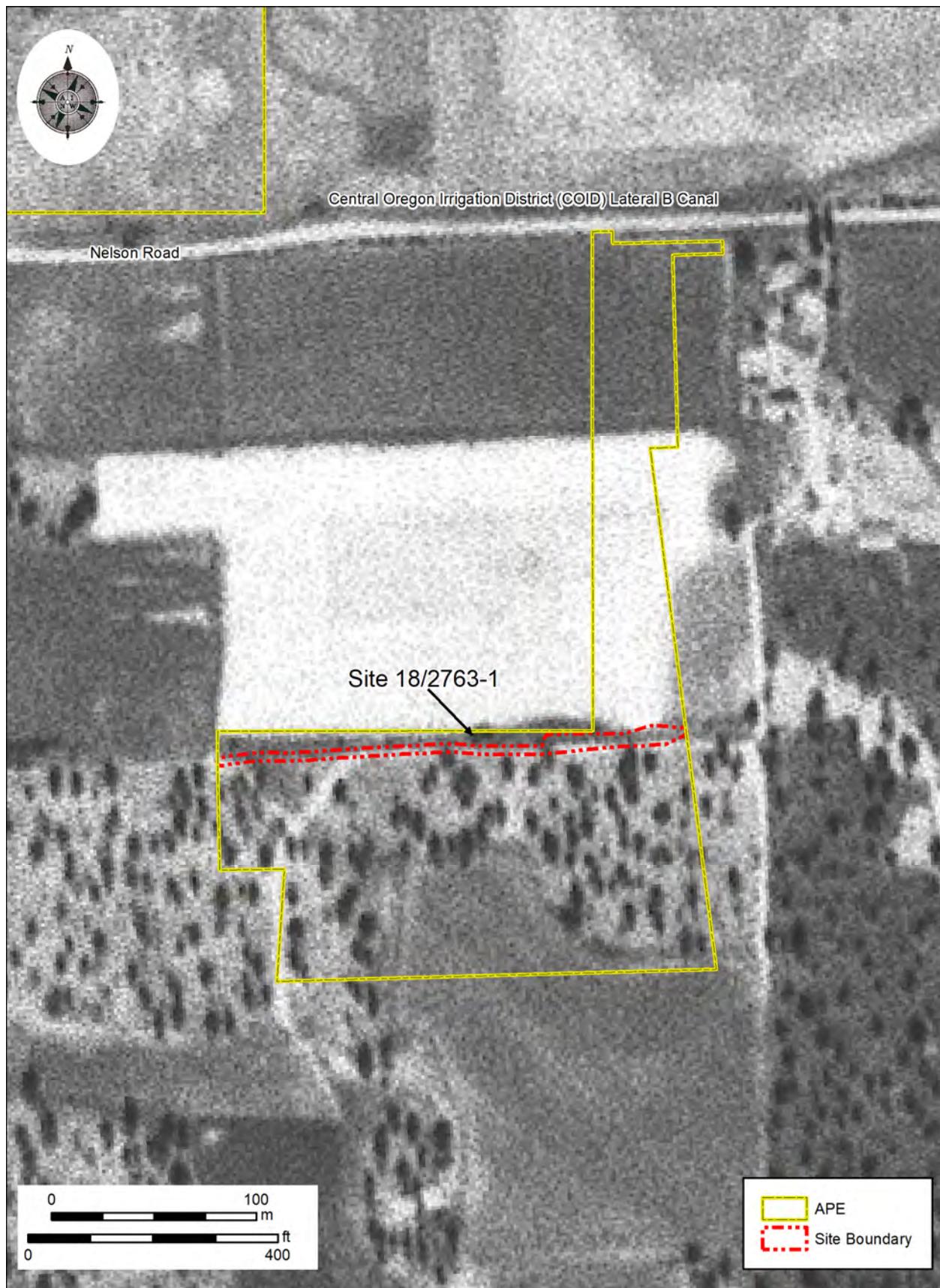


Figure 4. The location of the project APE and site 18/2763-1 on a 1953 USGS aerial photograph (USGS 1953).

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.

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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**

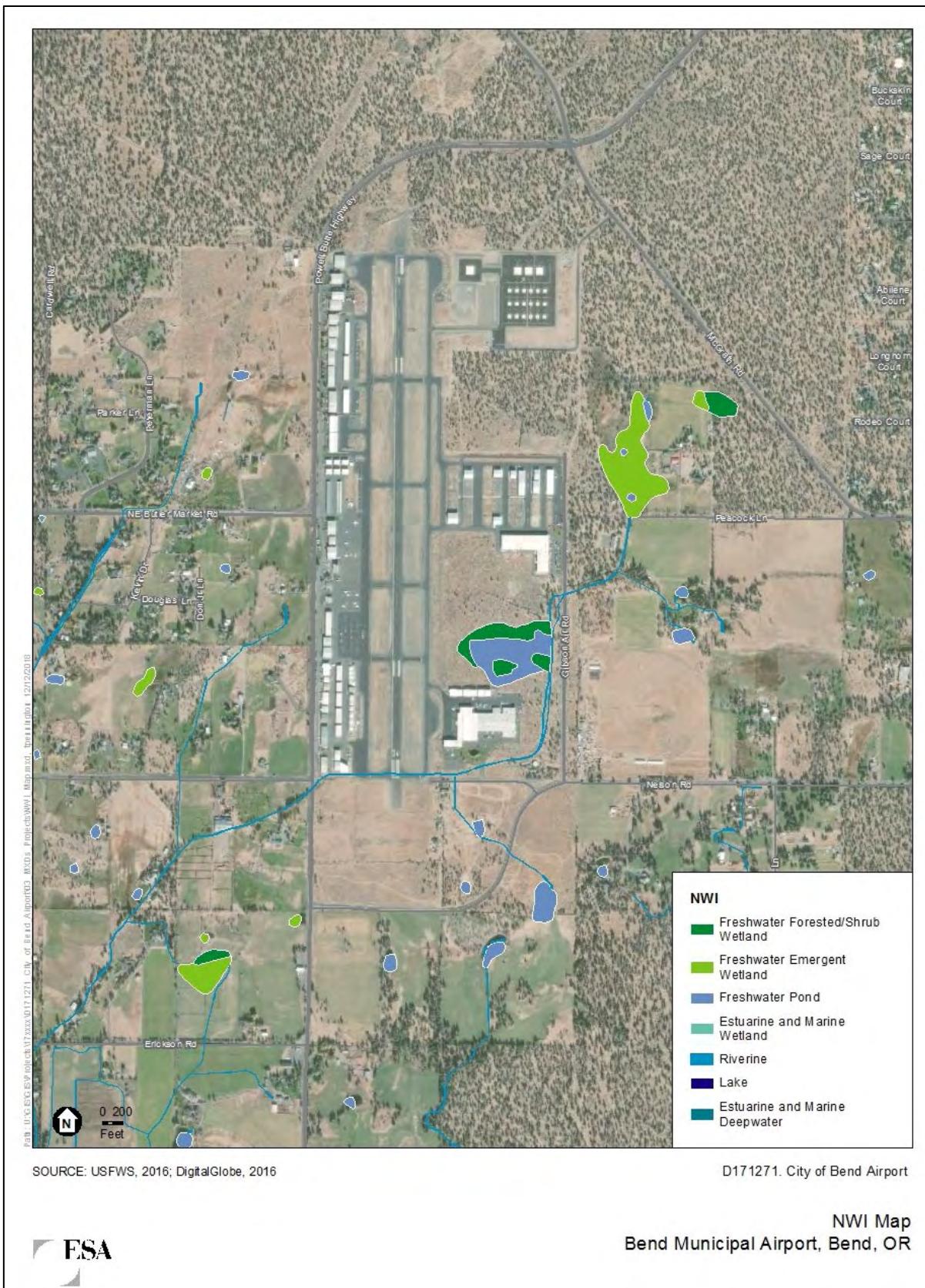
The Bend Municipal Airport and surrounding areas is not located in a National Ambient Air Quality Standards (NAAQS) Maintenance area for the State of Oregon (Oregon Department of Environmental Quality). The EPA established NAAQS for a limited number of pollutants with the enactment of the Clean Air Act 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.

## **REFERENCES**

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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**

**STATE OF OREGON ARCHAEOLOGICAL SITE RECORD**

## State of Oregon Archaeological Site Record

Administrative Data								
Smithsonian Number:				Alt Site Nbrs:	18/2763-1			
Site Name:				Form Type:	New			
Managing Office*:	Municipal (describe)			County:	Deschutes			
Owners(s):	Municipal (describe)							
Ownership/Management Notes:	City of Bend / Bend Municipal Airport							
National Register Status:	Status Not Eligible	Role Fieldworker	Date 12/04/2018	Author Carmen Sarjeant				
Site Identification								
Site Type	<ul style="list-style-type: none"> <li>Other</li> <li>Refuse Scatter</li> </ul>							
Features*:	<ul style="list-style-type: none"> <li>Refuse scatter</li> <li>Rock Alignment</li> </ul>	Cultural Periods(s)*:			<ul style="list-style-type: none"> <li>Depression/WWII (1929-1950)</li> </ul>			
Dimensions:	Length 230	Width 4	Units Meters		Area 920 Sq m			
Depth of Cultural Deposits	0 cm							
General Age	Historic							
Location Data								
Legal Description:	Township 17 S	Range 13 E	Section 20	1/4 S	1/4 NW	1/4 SW	DLC Meridian Willamette	
UTM Coordinates	Type Feature	East 644178	North 4882906	Method GPS < 10m		Zone 10	Datum 83	
Map References	Map Name/Year BEND AIRPORT 7'			Revision Year 2017				
Access Description	Exit Highway 20 north onto Powell Butte Road, approximately 7 kilometers (km) (4.3 miles [mi]) east of central Bend. Continue northeast then north on Powell Butte Road towards the Bend Municipal Airport for 3.5 km (2.2 mi), then turn east onto Nelson Road. Continue east then north on Nelson Road for 0.9 km, then turn west and continue on Nelson Road for 330 meters (m) (1,083 feet [ft]), and park at the end of the cul-de-sac, adjacent to the Bend Municipal Airport Runway. From here, walk south 250 m (820 ft) to reach the eastern end of the linear stone rubble alignment and the debris scatter at the eastern limit of the City of Bend parcel. The site extends west approximately 230 m (755 ft) to the western limit of the City of Bend parcel.							
Environmental Data								
Province	High Lava Plain							
Basin	Deschutes							
Subbasin	LOWER CROOKED R							
Drainage Name								
Elevation	From 3451 To 3451 ft							
Aspect	Aspect: ALL							
Depositional Environment								
Soil Description	The soils are 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.							
Vegetation Description								
Culturally Significant Vegetation								
Water Sources	Name Deschutes	Type River	Stream Type Perennial	Stream Class	Distance 8700 meters	Direction 270 deg		
Site Setting	The site is within the shrub steppe vegetation zone with western juniper ( <i>Juniperus occidentalis</i> ). Sagebrush ( <i>Artemisia tridentata</i> ), rabbitbrush ( <i>Chrysothamnus</i> sp.), and bluebunch wheatgrass ( <i>Agropyron spicatum</i> ) dominate the landscape. The site is on topographically flat land in an area where basalt and basaltic andesite lava flows have been deposited and produced porous bedrock.							
Site Description								
Site 18/2763-1 consists of a historic-period linear stone rubble alignment and debris scatter								

<b>Site Description</b>		<p>found on the surface at the east end of the alignment. The alignment is oriented west to east, and appears to extend further west onto private land; the segment on private land has not been recorded due to no access on private land during the survey. 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 alignment, some sections have been removed. One section of the alignment has been dismantled and reassembled directly north of the original alignment. The linear stone rubble alignment presumably served as a fence or as a designated location to place volcanic rock from the surrounding land for field clearing. A 1953 aerial photograph shows that the land to the north of the alignment appears to have been ploughed and cleared of vegetation, and the land to the south was composed of scattered native juniper trees (USGS 1953). Since a divide in land uses is identifiable either side of the alignment in aerial photography from 1953, the stone alignment may have been in place at this time. The small scatter of historic-period debris measures 2x2 m (6.6x6.6 ft), and includes one cylindrical can, one rectangular 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. 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. No further information has been found about the linear stone rubble alignment or debris scatter. The site is recommended to be not eligible for the NRHP.</p>											
<b>Dates of Use</b>		From 0 1953	To 1953 0	BP/AD/BC AD AD	Method Historic Record Historic Record								
<b>Site Observations</b>		<table border="1"> <tr> <td>Present</td> <td>Quantity</td> </tr> <tr> <td>Cans</td> <td>2</td> </tr> <tr> <td>Ceramics</td> <td>2</td> </tr> <tr> <td>Metal Other</td> <td>3</td> </tr> </table>				Present	Quantity	Cans	2	Ceramics	2	Metal Other	3
Present	Quantity												
Cans	2												
Ceramics	2												
Metal Other	3												
<b>Estimated Counts</b>		Prehistoric:      Historic: 7											
<b>Rock Art</b>													
<b>No Rock Art Specified</b>													
<b>Site Condition</b>													
<b>Visit Date</b>		11/12/2018											
<b>Site Condition</b>		Fair- Site Damage between 40% and 60%											
<b>Field Recorder</b>		Carmen Sarjeant, Archaeological Investigations Northwest, Inc.											
<b>Artifacts Collected?</b>		No											
<b>Activities/Work Performed</b>		Pedestrian survey of surrounding field and recording of the site.											
<b>Impacts/Impact Agents</b>													
<b>Protective Measures Recommended</b>													
<b>Bibliographic References</b>													
Author Sarjeant, Carmen, and Lucie Tisdale	Publication Year 2018	Title Cultural Resource Survey for the Bend Municipal Airport Master Plan, Deschutes County, Oregon. AINW Report No. 4136.	Agency/Organization Archaeological Investigations Northwest, Portland, Oregon	Primary Reference Yes	User Agency								
U.S. Geological Survey (USGS)	1953	Aerial Reconnaissance Photograph ID#ARA010906307907. Available, <a href="http://earthexplorer.usgs.gov/metadata/4660/ARA010906307907/">http://earthexplorer.usgs.gov/metadata/4660/ARA010906307907/</a> , accessed November 8, 2018.	U.S. Geological Survey (USGS)	No									
<b>Files Uploads</b>													
<ul style="list-style-type: none"> <li><a href="#">Site 18-2763-1 Aerial Overview.pdf</a></li> <li><a href="#">OR Site form Photos 18-2763-1.pdf</a></li> <li><a href="#">Site 18-2763-1 Topo Map.pdf</a></li> </ul>													
<b>Form Entry Recorder:</b>		Carmen Sarjeant		Date: 11/12/2018									

# State of Oregon Archaeological Site Record Site Form

## Photos

**Smithsonian Number:**

**Alt Site Numbers:** 18/2763-1



Overview of the historic-period linear stone rubble alignment oriented west to east. The view is towards the west.



Overview of a collapsed section of the historic-period linear stone rubble alignment. The surface scatter of historic-period debris was found on the stone alignment section to the left of the ditch. The view is towards the northeast.

# State of Oregon Archaeological Site Record Site Form

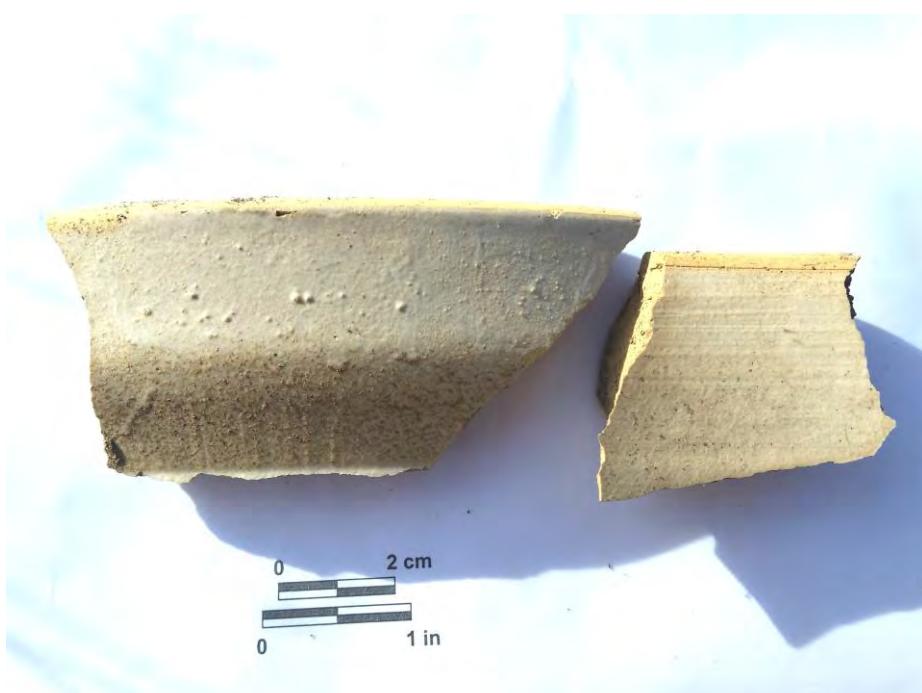
## Photos, continued

**Smithsonian Number:**

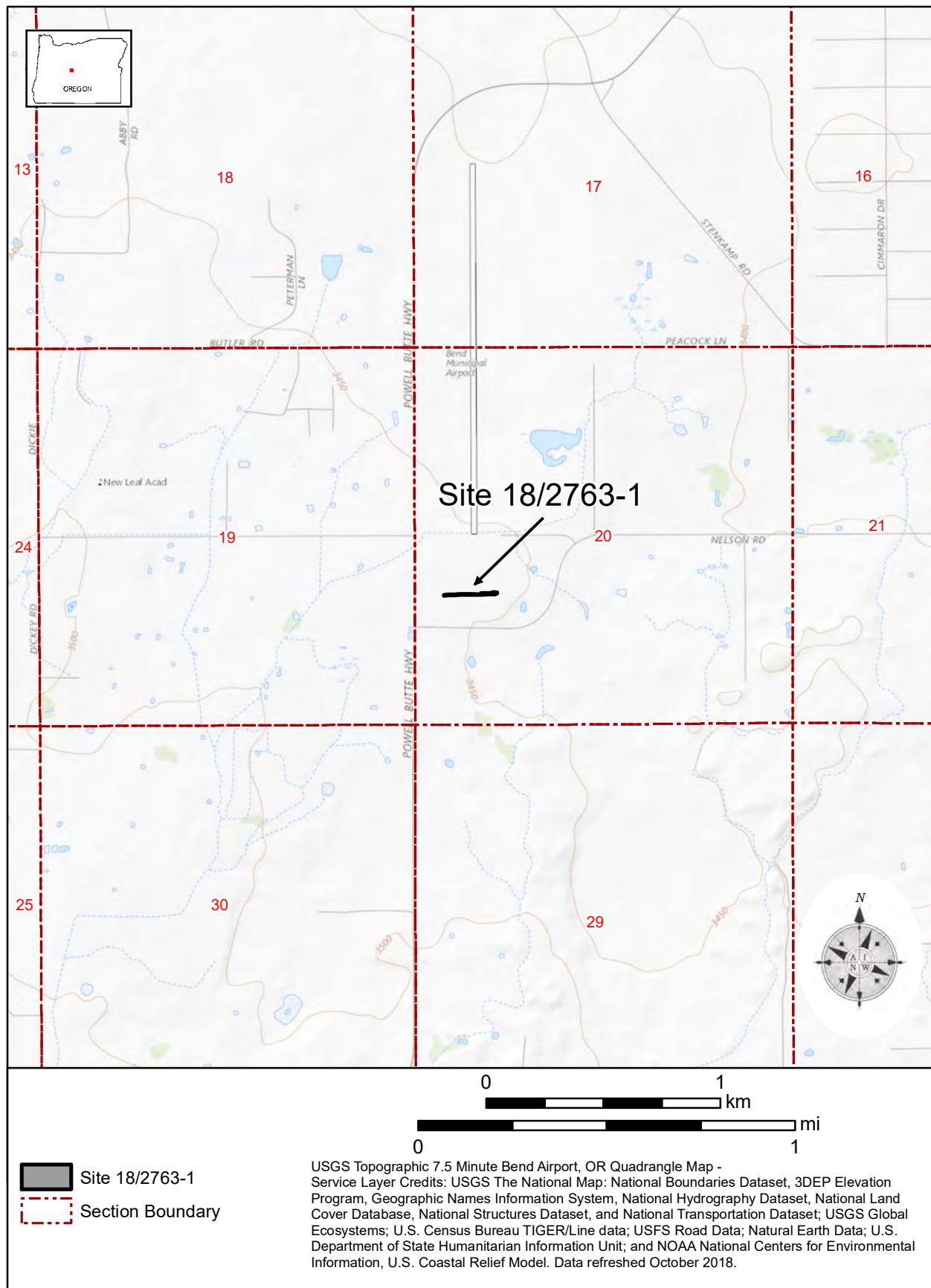
**Alt Site Numbers:** 18/2763-1

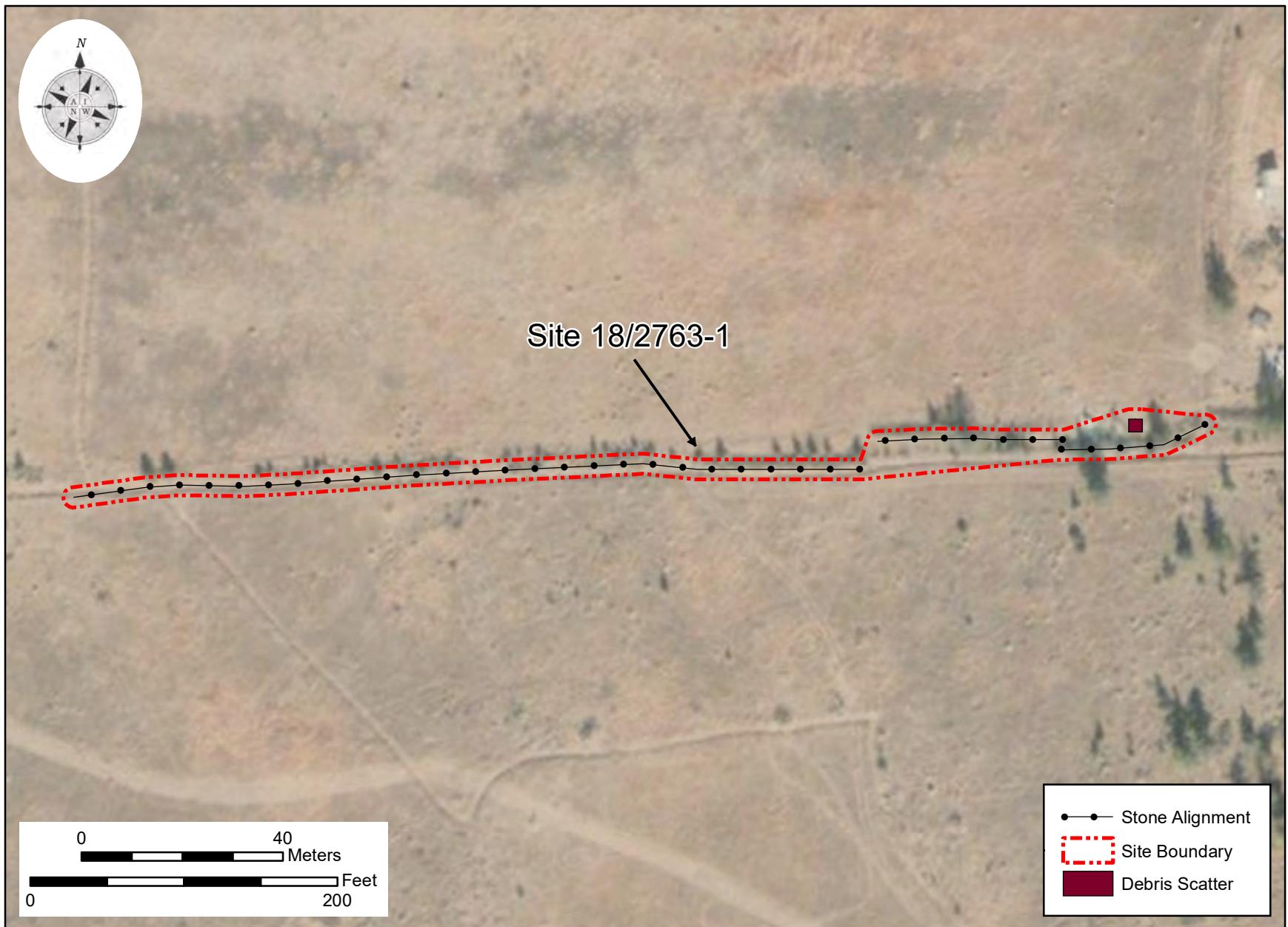


The surface scatter of historic-period debris, showing a metal can and an unidentified metal object.



Two fragments of ceramic crockery from the surface scatter of historic-period debris found along the linear stone rubble alignment.





## **Appendix H – Air Traffic Control Visibility Analysis Tool (ATCVAT)**

BDN Height & Visibility Analysis					
	Site No.	Eye Height (AGL)	Ground Elevation (MSL)	Distance to Keypoint	Key Point / Elevation (MSL)
44°05'47.53"N 121°11'39.00"W	1	97'	3428'	4662'	34 / 3460'
		10'		2459'	16 / 3403'
44°05'26.66"N 121°11'53.65"W	2	85'	3432'	2327'	34 / 3460'
		28'		4029'	16 / 3403'
44°05'27.72"N 121°12'07.91"W	3	49'	3445'	2430'	34 / 3460'
		13'		3924'	16 / 3403'
44°05'16.61"N 121°11'53.56"W	4	34'	3445'	1357'	34 / 3460'
		29'		5043'	16 / 3403'
44°05'08.45"N 121°11'48.23"W	4A	42'	3444'	5912'	16 / 3403'
		31'		1010'	34 / 3460'
44°05'34.19"N 121°11'52.99"W	5	85'	3431'	3084'	34 / 3460'
		19'		3330'	16 / 3403'

NOTE 1: Runway 34 is the future approach end including a 1060' extension to the south.

NOTE 2: Highlighted Site Nos. are selected as Preferred Sites.

NOTE 3: Eye Height of Site 4 is proposed to be 45' AGL to accommodate 3 floors below the cab.

NOTE 4: Heights for Sites 2 and 5 were increased above the minimum as a result of the Siting Assessment Panel.

# Visibility Siting Requirements Human Factors Analyses

**Objective:** Two human performance metrics, Object Discrimination Analysis and Object Discrimination and Line of Sight (LOS) Angle of Incidence, were used to assess the impact of tower height on air traffic control tower specialist distance perception.

**Technical Approach:** the tower visibility analysis tool (<http://www.hf.faa.gov/visibility>) was used to assess the human performance metrics<sup>1</sup>.

Air Traffic Control Tower: **LOS Site 2 Future RW End 34 - Eye 85' AGL**

Light Level: **Sunlight Clouds**

Ground Turbulence: **Medium**

Target Object: **Dodge Caravan**, target orientation: **Front View**

Observer Eye Height: **85**

Vertical Elevation Change Between Observer and Key Point (feet): **57**

Ground Elevation at Tower (MSL): **3432**

Ground Elevation at Key Point (MSL): **3460**

Tower to Key Point Distance: **2327** (feet)      **0.71** (km)

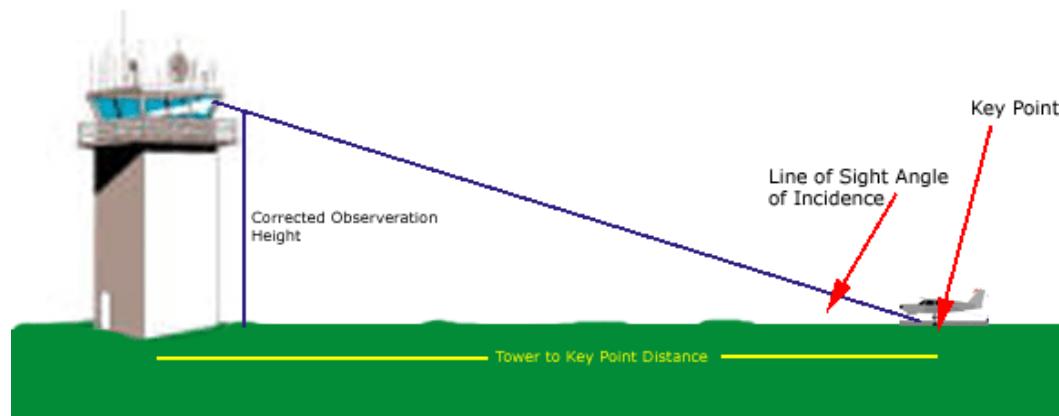
Visibility Range: **10**(Miles)      **16.09** (km)

## 1. Object Discrimination Analysis Results

Criteria	Threshold	Tower Results	Pass/Fail
probability(detection)	95.5%	100%	Pass
probability(recognition)	11.5%	96.4%	Pass
Probability(recognition)	0.91%	66.45%	Pass

## 2. Line of Sight (LOS) Angle of Incidence

Threshold	Tower Results	Pass/Fail
0.8 degrees or 48 minutes	1.40degrees	PASS: Change in elevation between observer and key point should be no less than 32 feet.



<sup>1</sup>Krebs, Hewitt, Murrill, and Driggers, 2005. *How High is High Enough? Quantifying the Impact of Air Traffic Control Tower Observation Height on Distance Perception*, International Symposium on Aviation Psychology, 1-5.

# Visibility Siting Requirements Human Factors Analyses

**Objective:** Two human performance metrics, Object Discrimination Analysis and Object Discrimination and Line of Sight (LOS) Angle of Incidence, were used to assess the impact of tower height on air traffic control tower specialist distance perception.

**Technical Approach:** the tower visibility analysis tool (<http://www.hf.faa.gov/visibility>) was used to assess the human performance metrics<sup>1</sup>.

Air Traffic Control Tower: **Site 4 height adjusted to 45' AGL for functional needs in shaft below**  
Light Level: **Sunlight Clouds**

Ground Turbulence: **Medium**

Target Object: **Dodge Caravan**, target orientation: **Front View**

Observer Eye Height: **45**

Vertical Elevation Change Between Observer and Key Point (feet): **30**

Ground Elevation at Tower (MSL): **3445**

Ground Elevation at Key Point (MSL): **3460**

Tower to Key Point Distance: **1357** (feet)      **0.41** (km)

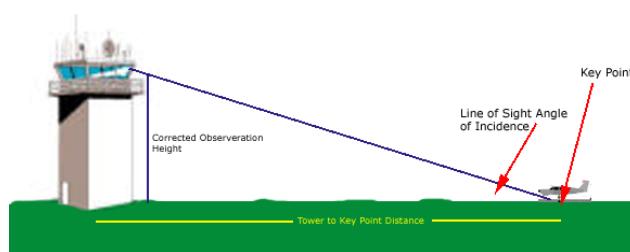
Visibility Range: **10**(Miles)      **16.09** (km)

## 1. Object Discrimination Analysis Results

Criteria	Threshold	Tower Results	Pass/Fail
probability(detection)	95.5%	100%	Pass
probability(recognition)	11.5%	99.6%	Pass

## 2. Line of Sight (LOS) Angle of Incidence

Threshold	Tower Results	Pass/Fail
0.8 degrees or 48 minutes	1.27degrees	PASS: Change in elevation between observer and key point should be no less than 19 feet.



<sup>1</sup>Krebs, Hewitt, Murrill, and Driggers, 2005. *How High is High Enough? Quantifying the Impact of Air Traffic Control Tower Observation Height on Distance Perception*, International Symposium on Aviation Psychology, 1-5.

# Visibility Siting Requirements Human Factors Analyses

**Objective:** Two human performance metrics, Object Discrimination Analysis and Object Discrimination and Line of Sight (LOS) Angle of Incidence, were used to assess the impact of tower height on air traffic control tower specialist distance perception.

**Technical Approach:** the tower visibility analysis tool (<http://www.hf.faa.gov/visibility>) was used to assess the human performance metrics<sup>1</sup>.

Air Traffic Control Tower: **LOS Site 5 Future RW End 34 - Eye 85' AGL**

Light Level: **Sunlight Clouds**

Ground Turbulence: **Medium**

Target Object: **Dodge Caravan**, target orientation: **Front View**

Observer Eye Height: **85**

Vertical Elevation Change Between Observer and Key Point (feet): **56**

Ground Elevation at Tower (MSL): **3431**

Ground Elevation at Key Point (MSL): **3460**

Tower to Key Point Distance: **3084** (feet)      **0.94** (km)

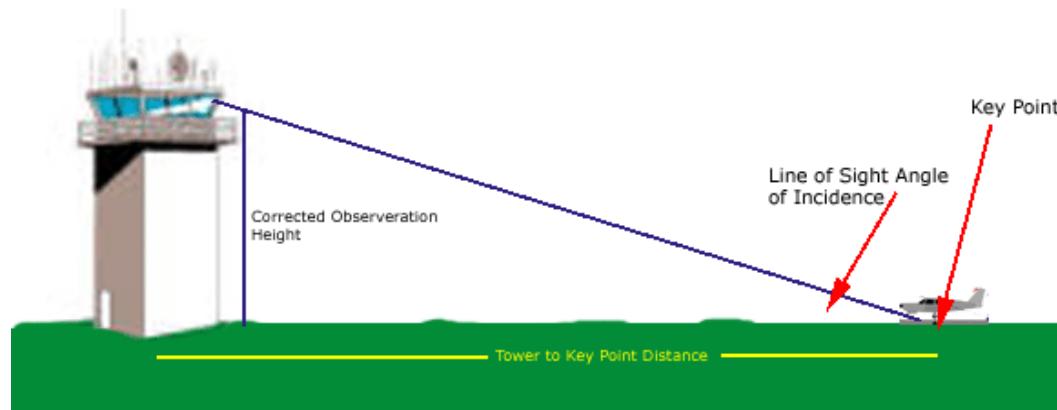
Visibility Range: **10**(Miles)      **16.09** (km)

## 1. Object Discrimination Analysis Results

Criteria	Threshold	Tower Results	Pass/Fail
probability(detection)	95.5%	99.9%	Pass
probability(recognition)	11.5%	89.6%	Pass
Probability(identification)	0.91%	39.04%	Pass

## 2. Line of Sight (LOS) Angle of Incidence

Threshold	Tower Results	Pass/Fail
0.8 degrees or 48 minutes	1.04degrees	PASS: Change in elevation between observer and key point should be no less than 43 feet.



<sup>1</sup>Krebs, Hewitt, Murrill, and Driggers, 2005. *How High is High Enough? Quantifying the Impact of Air Traffic Control Tower Observation Height on Distance Perception*, International Symposium on Aviation Psychology, 1-5.

## **Appendix I – FCT Security Element**

<b>AXF Guidance Memorandum</b>	<b>U. S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION Office of Security and Hazardous Materials Office of Infrastructure Protection - AXF</b>	<b>AXF-2019-T-03</b>
<b>SUBJ: INFORMATION: Updated Security Measures for Sponsor-Owned or Sponsor-Leased Federal Contract Towers (FCT)</b>	<b>Date: March 7, 2019</b>	

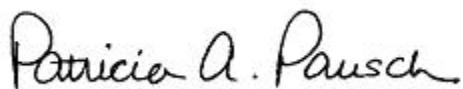
1. **Purpose:** This Guidance Memorandum provides updated security measures in a revised Risk Assessment Tool (RAT) to use when conducting security assessments at sponsor-owned or sponsor-leased FCTs, Facility Security Level (FSL) -1A facilities.

2. **Background:** Collaborating with the FCT Program Office, the ATO Strategic Planning Office, and the Office of the Chief Counsel (AGC), AXF identified practical and contract-compliant security measures to apply at sponsor-owned or sponsor-leased FCTs. The attached RAT reflects these security requirements.

3. **Guidance:** Assessment activity at FSL 1A sponsor-owned or sponsor-leased FCTs is currently deferred until otherwise directed by AXF-1. Servicing Security Elements (SSEs) are to use the attached RAT for FSL-1A facilities when assessment activity resumes. Although there are differences between FAA Order 1600.69C and the attached RAT, the security measures identified in the RAT will supersede those in the order. The next update to FAA Order 1600.69 will incorporate these changes in security requirements.

Government (FAA)-owned or government (FAA)-leased FCTs will continue to follow the requirements in FAA Order 1600.69C identified for FSL-1 facilities. FCTs located on military bases or those staffed by a military entity are exempt from FAA facility security requirements. They will apply the physical security requirements of their military command.

Any open security findings in FSRS-1 referencing requirements not found in the attached RAT will be administratively closed by AXF-100.



Patricia A. Pausch  
Director, Office of Infrastructure Protection, AXF-1

Attachment:  
Facility Security Requirements for Sponsor-Owned or Sponsor-Leased FCTs (FSL-1A)

**FCT Sponsor-Owned or Sponsor-Leased Security Requirements**

**FSL 1A Facility**

<b>ISC - Category</b>	<b>MASTER RAT: FCT FSL 1A Sponsor-Owned/Leased Security Requirements</b>	<b>FAA Order 1600.69C Reference</b>	<b>Findings are examples. N/A for reqs clarity.</b>
SITE	Does the facility have the required perimeter fencing? FCT FSL 1A facilities may use a non-standard, minimum 6-foot high security fence, unless the tower is within the operations area or part of the terminal building, in which case no fence is required.	FAA Order 1600.69C, Chapter 4, Paragraph 4-1-8.	The facility does not have a fence that meets requirements.
SITE	Are the fence and gates in good condition and not in need of repair?	FAA Order 1600.69C, Chapter 4, Paragraph 4-1-8.	Fence and gates are in poor condition and must be repaired.
SITE	Does the fence have a 20-foot clear zone on the outside of the fence?	FAA Order 1600.69C Chapter 4, Paragraph 4-1-8c.	The fence does not have a 20-foot clear zone on the outside of the fence.
SITE	Does the fence have a 20-foot buffer zone from the fence inward?	FAA Order 1600.69C, Chapter 4, Paragraph 4-1-6.	The fence does not have a 20-foot buffer zone from the fence inward.
SITE	Are gates secured at all times?	FAA Order 1600.69C Chapter 4, Paragraph 4-1-8b(7).	Gates are not secured at all times.
SITE	Does the gate (vehicle and pedestrian) construction maintain the structural integrity of the fence?	FAA Order 1600.69C Chapter 4, Paragraph 4-1-8 b(6).	Gate construction does not maintain the structural integrity of the fence.
SITE	Are gates locked using either the FAA standard locking system or other commercially available locks as long as they are BHMA grade 1 locking system equivalent.	FAA Order 1600.69C Chapter 4, Paragraph 4-1-8 b(7).	The gate does not have the FAA standard locking system or a BHMA grade 1 locking system installed.
SITE	Does the facility have security lighting that provide sufficient illumination (not less than 0.5 FC) in the area surrounding the base of the ATCT?	FAA Order 1600.69C, Chapter 4, Paragraph 4-1-9 and Table 4-1-1.	The facility does not have security lighting that provides sufficient illumination in the area surrounding the base of the ATCT.
SITE	Does the facility have security lighting that provide sufficient illumination (not less than 0.8 FC) in the parking area if parking is not adjacent to the facility?	FAA Order 1600.69C, Chapter 4, Paragraph 4-1-9 and Table 4-1-1.	The facility does not have security lighting that provides sufficient illumination in the parking area, as required.
SITE	Are "No Weapons" signs posted at all building entry points to all staffed facilities? FCT FSL 1A facilities can use locally produced signs in lieu of FAA-issued signs.	FAA Order 1600.69C Chapter 4, Paragraph 4-1-7b(2) and Table 4-1-2.	"No Weapons" signs are not posted at all building entry points at all staffed facilities.
SITE	Are "Restricted Area" signs posted, where required? FCT FSL 1A facilities can use locally produced signs in lieu of FAA-issued signs.	FAA Order 160.69C, Chapter 4, Paragraph 4-1-7.b.(6) and Table 4-1-2.	"Restricted Area" signs are not posted where required.
SITE	Are exterior critical operational areas secured to prevent unauthorized access?	FAA Order 1600.69C Chapter 4, Paragraph 4-4-6a and Tables 4-1-1 and 4-3-1.	There are no physical controls in place preventing unauthorized access to exterior critical operational areas.
ENTRY	Are all exterior doors and critical interior doors through which the Facility Manager restricts access kept locked unless there are dedicated personnel providing access control?	FAA Order 1600.69C Chapter 4, Paragraph 4-1-11a.	Exterior doors and critical interior doors restricting access are not secured at all times.

**FCT Sponsor-Owned or Sponsor-Leased Security Requirements**

**FSL 1A Facility**

<b>ISC - Category</b>	<b>MASTER RAT: FCT FSL 1A Sponsor-Owned/Leased Security Requirements</b>	<b>FAA Order 1600.69C Reference</b>	<b>Findings are examples. N/A for reqts clarity.</b>
ENTRY	Are mechanical push-button key pads or hard coded electronic keypads used for access control at facility perimeter equipped with either an FAA standard locking system that is used when the facility is unoccupied.	FAA Order 1600.69C Chapter 4, Paragraph 4-1-12e.	Mechanical push-key button or hard coded electronic keypads used for access control are not equipped with an FAA standard or BHMA grade 1 locking system.
ENTRY	Are visitor doors equipped with functioning Entry Control Video (ECV) (Video and Intercom) and remote release capability?	FAA Order 1600.69C Chapter 4, Paragraph 4-3-5b and 4-3-5b(1).	Doors with remote release capability controlling visitor access do not have ECV or the screening equipment is not functioning properly.
ENTRY	Are the number of access doors utilized for ingress and egress kept to a minimum to support operations?	FAA Order 1600.69C Chapter 4, Paragraph 4-1-11a.	There are an excessive number of access doors utilized for ingress and egress.
ENTRY	Is the facility using either the FAA standard or a BHMA grade 1 locking system?	FAA Order 1600.69C Chapter 4, Paragraph 4-1-12.	The facility is not using the FAA standard or a BHMA grade 1 locking system.
ENTRY	Has a Key Control Officer (KCO) been appointed in writing?	FAA Order 1600.69C Chapter 4, Paragraph 4-4-9a.	The KCO is not appointed in writing.
ENTRY	Does the KCO maintain a record of the total number of keys and cores, number issued and number on hand?	FAA Order 1600.69C Chapter 4, Paragraph 4-4-9b.	There is no accurate record of the total number of keys, cores, number issued, and number of keys on hand.
ENTRY	Has the annual key and core inventory been conducted?	FAA Order 1600.69C Chapter 4, Paragraph 4-4-9d.	The annual key and core inventories are not being conducted.
ENTRY	Are unissued keys maintained in a locked container?	FAA Order 1600.69C Chapter 4, Paragraph 4-4-9c.	Unissued keys are not stored in a locked container.
ENTRY	Are the quantity of keys, cards, or combinations kept to a minimum and issued only to persons who need them for official duties?	FAA Order 1600.69C Chapter 4, Paragraph 4-4-9c.	Keys are not being issued based on operational need.
ENTRY	Are keys retrieved by the issuing authority from personnel who leave, transfer, or retire?	FAA Order 1600.69C Chapter 4, Paragraph 4-4-9c(1).	Keys are not being retrieved from personnel who leave, transfer, or retire.
OPS/ADM	Are cipher lock codes and other combinations/codes changed and documented, as required?	FAA Order 1600.69C Chapter 4, Paragraph 4-4-9 b(6).	Security combination/codes are not changed or documented, as required.
ENTRY	Are lost keys reported to the SSE as required?	FAA Order 1600.69C Chapter 4, Paragraph 4-4-9 f(1).	Lost keys are not reported to the SSE.
ENTRY	Is only authorized agency photo I.D. media utilized at the facility, or other approved ID media being displayed? FCT personnel at FSL 1A facilities with fewer than 10 personnel assigned to the facility are not required to wear ID media unless required by local security procedures; however, they must have it in their possession.	FAA Order 1600.69C, Chapter 4, Paragraph 4-2-8a,b,c.	Personnel at the facility do not display or do not have in their possession authorized agency photo ID, or other approved ID media, as required.
INTERIOR	Does the facility limit unescorted access to critical operational areas to only those personnel that need it to perform their duties?	FAA Order 1600.69C, Chapter 4, Paragraph 4-4-6 .	The facility is not limiting unescorted access to critical areas to only those personnel who need it to perform their duties.

**FCT Sponsor-Owned or Sponsor-Leased Security Requirements**  
**FSL 1A Facility**

<b>ISC - Category</b>	<b>MASTER RAT: FCT FSL 1A Sponsor-Owned/Leased Security Requirements</b>	<b>FAA Order 1600.69C Reference</b>	<b>Findings are examples. N/A for reqts clarity.</b>
INTERIOR	Is access to critical administrative areas controlled?	FAA Order 1600.69C, Chapter 4, Paragraph 4-4-6b.	The facility does not control access to critical administrative areas.
INTERIOR	Are interior critical operational areas secured to prevent unauthorized access, except when occupied?	FAA Order 1600.69C, Chapter 4. Paragraph 4-4-6a and Tables 4-1-1 and 4-3-1.	Interior doors leading to critical areas are not secured at all times.
ENTRY	Are visitors being escorted, as required.	FAA Order 1600.69C Chapter 4, Paragraph 4-2-9a.	Visitors are not being escorted, as required.
ENTRY	Are all visitors logged in on the DOT/FAA Visitor Register (FAA Form 1600.8) or electronic equivalent?	FAA Order 1600.69C Chapter 4, Paragraph 4-2-9b.	A record of visitors are not being kept, as required.
OPS/ADM	Have the facilities reported any loss or theft of ID media?	FAA Order 1600.69C Chapter 4, Paragraph 4-2-8d(5).	Incident reports of loss or theft of ID media are not reported to the SSE.
INTERIOR	Are facility personnel protecting Sensitive Unclassified Information (SUI) such as Privacy Act, Sensitive Security Information (SSI), and For Official Use Only (FOUO) as required?	FAA Order 1600.75, Chapter 3, Appendix D and Appendix E, FAA Order 1280.1B, Chapter 3, Paragraph 1j. and FAA Order 1600.69C Chapter 4, Paragraph 4-4-4b & b(1)(4).	Personnel are not protecting Sensitive Unclassified Information (SUI) such as Privacy Act, SSI and FOUO.
OPS/ADM	Has the Facility Manager established procedures for the receipt and distribution of security threat and intelligence awareness information?	FAA Order 1600.69C, Chapter 4, Paragraph 4-4-8.	The facility has not established procedures for the receipt and distribution of security threats and intelligence awareness information.
INTERIOR	Are there adequate security measures for high value materials? (There is no FSP requirement so the SSE will determine compliance by speaking with the FM)	FAA Order 1600.69C Chapter 4. Paragraph 4-4-10a(2)b,c.	There are insufficient protective measures in place for high value materials.
OPS/ADM	Has all incidents of loss, theft, fraud, or damage been properly reported?	FAA Order 1600.69C Chapter 4, Paragraph 4-4-11.	All instances of known loss, theft, fraud, or damage have not been reported to the SSE.
OPS/ADM	Has the facility implemented adequate theft prevention measures to include removal of property from the facility? (There is no FSP requirement so the SSE will determine compliance by speaking with the FM)	FAA Order 1600.69C Chapter 4, Paragraph 4-4-10a,b.	There are no theft prevention measures or procedures for removal of property from the facility.
OPS/ADM	Is the facility accredited?	FAA Order 1600.69C Chapter 3, Paragraph 3-6.	The facility is not accredited.
OPS/ADM	Have annual security education and awareness briefings been conducted, as required to all personnel at facility?	FAA Order 1600.69C Chapter 4, Paragraph 4-4-5b(3).	Annual security education and awareness briefings have not been conducted to all personnel at facility.
OPS/ADM	Have contractor background checks been conducted as required?	FAA Order 1600.72A, Chapter 1, Paragraph 10g.	Contractor checks have not been conducted as required.
OPS/ADM	Is the facility updating the SSE on the progress and/or closure of all open findings?	FAA Order 1600.69C Chapter 3, Paragraph 3-4e(1).	The facility is not complying with the reporting response timeline.

## **Appendix J – Meeting Minutes**

# Bend, OR (BDN) Establishment of Federal Contract Tower (FCT)

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## AGENDA – Minutes

*Date: Jan 18, 2022*

*Time: 1:00 – 2:00*

*Medium: Teams*

### Chair – Lisa Mitchell

### Attendees/Participants:

Steve Mares- FAA PRG Tamra Lee – FAA NPT

Joe Dalke – FAA ADO Monica Holguin – PRG

Benjamin Mello – FAA ADO

Tracy Williams – City of Bend

## AGENDA ITEMS

- **Introductions**
- **Sponsor questions regarding email from FAA's Airport District Office**
  - **Looks like the City can move forward with Phases I & II and what funding can be used?**
    - For funding, FY 22 - 150k Yr AIP, BIL annual funding is 736k, looks like the number of base jets dropped to 9 which moves BDN to regional vs national. This impacts the 736k substantially for FY23 and forward. Also in the future, please provide a letter indicating the portion of funds going towards the Tower.
    - For the RFP – advisory circular outlines the breakdown of how this needs to be done. Phase I & II are fine, but the procurement process needs to be updated as outlined in the email, specifically environmental assessment as the need is determined.
  - **What if I send for bid and only have one response?**
    - If only one response from contractor, be sure to document it.
- **Discuss Sponsor schedule – does a newer version exist? (dated 12/27/21)**
  - Sponsor will update the schedule accordingly after this meeting and distribute. At this time, it looks to shift 1 month from current version.
- **Discuss steps forward**
  - Reimbursable Agreement for FAA support of the sponsors project – Initially for Siting review and eventually amend for further needs.
  - FAA to set up a Discovery meeting for initial Reimbursable Agreement
- **New business -**
  - None
- **Adjourn**

# Bend, OR (BDN) Establishment of Federal Contract Tower (FCT)

## AGENDA – Minutes

Date: Jan 31, 2022

Time: 2:00 – 3:00

Medium: Teams

Chair – Lisa Mitchell

<b><i>Invitees and Attendance</i></b>			
Steve Mares - FAA PRG FCT PIM	X	Tamra Lee – FAA NPT	X
Son Le – FAA NPM	X	Cathy Chamberlin – FAA – SSC Mgr	X
Raymond Chan – FAA ES – Terminal	X	Eyung Gov – FAA ES	
Colin Ngai – FAA		Jon Ikeda – FAA ES	X
Viet Vo – FAA PRG		Destaing Dobbins – FAA CE	X
Monica Holguin – PRG	X	Khanh Tran – FAA PRG	X
Andrew Son – FAA		Anna Asghar – FAA ES	X
Tracy Williams – City of Bend	X	Frank Boyer – FAA OKC	
Tina Lindenberg-Kirchner – City of Bend	X	David Abbas – City of Bend	X
W Matt Rogers – Century West	X	Brian Lally – CTBX Aviation	X

## AGENDA

### General Discussion

#### *Introductions*

#### ***Purpose of Meeting:***

- This is a discovery meeting for all stakeholders to discuss the FAA's required support of the sponsor's project for the establishment of a Federal Contract Tower at Bend Municipal Airport, Bend Oregon.
- Address the questions send via email from the Sponsor –

***Background*** – The sponsor has received a candidate acceptance letter from the FAA for a Federal Contract Tower at Bend Municipal Airport in Bend, OR with a required completion date of October 2025.

#### ***Overview of Sponsor Projects (Scope and Timelines) –***

- The sponsor will be utilizing the VISTA process and has already been in contact with the FAA's representative in OKC, Frank Boyer, for the process for 3D modeling.
- Tracy presented their proposed schedule requesting approval to move forward from the FAA. Tracy noted it was a tight schedule to meet the 2025 deadline for commissioning.
- Raymond Chan stated ES will support the sponsor's schedule and project by reviewing the prepared Siting Study at Draft, Advance and Final in accordance with the FAA's VISTA Siting Process.
- Sponsors representative stated TERPS process will be done preliminarily and as necessary moving forward to avoid a hard stop too late in the process.

### **Addressing questions presented**

- *Attached is the Project Schedule. It is very tight to meet the October 2025 deadline as per the FCT Program Office letter (copy attached). Is this timeline hard and fast?*
  - Steve responded via email the October 2025 date for commissioning in the Candidate Acceptance letter is a firm date and failure to meet that date would result in the applicant to reapply to the program.
- *Assuming the City can issue an NTP for March 9 (first City Council meeting of the month), the Consultant indicates from communications with Frank Boyer, the 3D Model Validation (May 25) and the FAA Siting Panel (June 8) can be met. If anything slips before then, we will have to reschedule those dates for July instead. Frank Boyer is reportedly getting busy because of the number of tower projects popping up with the Infrastructure money (BIL). We hope to keep our place in line. Is this a reasonable expectation?*
  - See FAA's Engineering Service (ES) response to support of Siting Study's provided by the Sponsor and/or its representative.

**Reimbursable Agreement** – An initial agreement will be prepared for review of Siting Study progress. The agreement is expected to be amended as the sponsor project progress for any additional FAA support.

**Next Steps** – Lisa will prepare a draft reimbursable agreement to present to the sponsor targeting February 11, 2022 as well as a timeline for the agreement to be put into implementation and the FAA's support of the project to begin. The FAA committed to doing their best to get documentation to The City for review and execution as quickly as possible.

Sponsor stated their Board meets each **1<sup>st</sup> and 3<sup>rd</sup> Wednesday of the month**. Tracy is aiming for a package to present **March 9**, this is an optimistic date and if unable, the next opportunity to present will be **March 23, 2022**

**Adjourn**

**Bend Municipal Airport (BDN)**  
**Bend, Oregon**  
**Model Validation Minutes**  
**05/17/22**

**Purpose:** To validate the TIX model for the siting on 06/15/2022.

**Participants:**

Anthony Goodwin	Matt Ballon
Benjamin Mello	Michael Lally
Brian Lally	Matthew Josal
Frank Boyer	Mathew Rogers
Garry Brown	Michael Dasaro
George Buley	Nicole Windsong
Jeff Fischer	Perry Oleck
Joe Sims	Stephen Hedden
Jon Ikeda	Tamra Lee
Joseph Dalke	Tim Proctor
Larry Crowley	Tracy Williams (Airport Manager/Airport Sponsor)
Lillie Smith	

1. Introductions. Frank Boyer presented the in-brief. The cab is 440 sq ft with 8 sides and slatwall configuration. The team will evaluate LOS using both columns and mullions. TERPS – no issues. TOPR – localizer issue, but not a show stopper. All pre-sites pass human factors.
2. Reviewed 3-D Model. Michael Lally presented an aerial view of the airport model.

Benjamin Mello requested to see an actual footprint of the new ATCT, since approximately 3 acres has been requested for construction. Brian Lally responded that the schematics for all of the pre-sites will be in a draft siting report that will be released within a week, and acreage is being assessed (each site was assessed with variations of 1 acre to 3 acres due to footprint and access roads, per Mathew Rogers). B. Mellow asked if fencing is required for this airport and B. Lally responded that a 6 ft. chain link fence is required.

Jon Ikeda asked if the assumption is that these are occupied or unoccupied shafts. B. Lally responded that these will be occupied shafts. J. Ikeda requested access and utility plans; B. Lally responded that it will be in the draft siting report. B. Mello asked if the FAA is not supporting occupied shafts, J. Ikeda responded that FAA builds generally do not support occupied shafts. F. Boyer noted that it is possible that BIL ATCTs may include occupied shafts.

B. Mello noted that the helopad and a few other changes are missing from the 3-D model. Tracy Williams added that there have been several changes to the airport recently and she will work with the engineers and development team (CBTX) to update the model. M. Rogers stated that a walkthrough was performed in the last week and changes/notes have been submitted to the development team (CBTX). F. Boyer asked if any of these changes will impact the LOS. S. Rogers replied that he does not think LOS will be impacted by any of the recent construction.

3. Review of Pre-sites with VR
  - a. Site 2 (oriented West) will be evaluated at 56 ft AGL floor height with slatwall and columns/mullions. Columns are 6x10 (4 columns), mullions are 4x8. Assessments provided by Tim Proctor:
    - 1) Stairs – Stair location is acceptable

**Bend Municipal Airport (BDN)**  
**Bend, Oregon**  
**Model Validation Minutes**  
**05/17/22**

2) Control Positions (the primary RWY is 16):

- LC – B
- GC/FD – A
- CIC – H
- SUPE/FD – Desk in back

3) Rotating Beacon – T. Williams noted that the airport currently has standalone beacon on its own site, and asked if it will be moved. J. Ikeda said that this is an FCT, so ownership is the airport making access not a problem. B. Lally noted that the beacon will probably be relocated to the top of the tower, since it is a non-standard height and would shine into the towers. T. Williams requested that the beacon be placed on top of tower and be upgraded, if possible.

4) Column View (4 columns, 6x10 each) – Moved up to 80 ft AGL floor; 85 ft. AGL eye level. Rotated 30 deg CW, no issues from LC or GC.

T. Proctor asked if the helipad on the north side of the airport could be seen from the tower and if it is an obstruction. M. Lally responded that it is not an obstruction. T. Proctor noted that this is a movement area, and needs to be viewable from the tower. T. Williams noted that the LOS concerning this helipad is a very serious issue and needs to be closely reviewed by Safety; 1/3 of the airport's traffic is from helicopters. Moved the tower to 80 ft AGL floor; 85 ft. AGL eye level. From this height with columns, LC looking towards RWY 16, you can see the approach end. M. Lally moved columns 30 degrees CW and the view from LC to the runways ends 16 and helipad are clear and RWY 34 is clear. From GC, LOS is good.

5) Mullions View (8 mullions, 4x8 each). – Moved up to 80 ft AGL floor; 85 ft. AGL eye level. Rotated 30 deg CW, no issues from LC or GC. From LC, looking south there are no LOS issues. From GC, the taxiway immediately below the tower is visible.

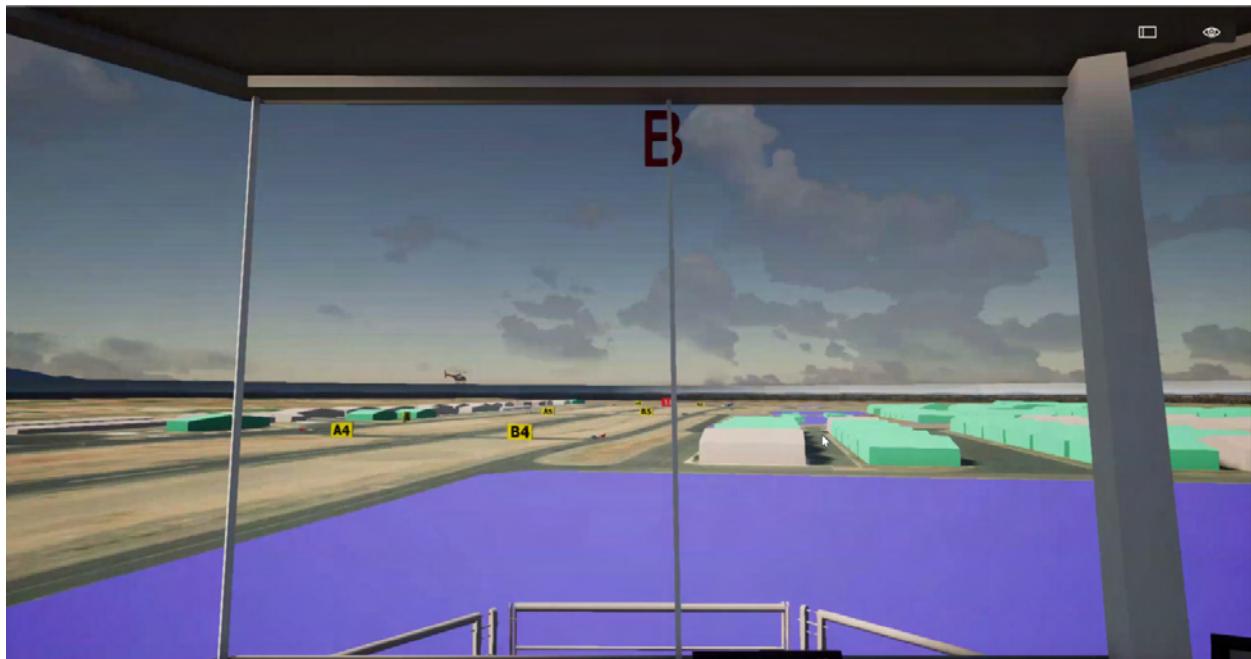


**Site 2**

**Bend Municipal Airport (BDN)**  
**Bend, Oregon**  
**Model Validation Minutes**  
**05/17/22**

b. Site 5 (oriented West) will be evaluated at 67 ft AGL floor height with slatwall and columns/mullions.

- 1) Stairs – Stair location good
- 2) Control Positions:
  - LC – B
  - GC/FD – A
  - CIC – H
  - SUPE/FD – Desk in back
- 3) Mullions View – Rotated 30 deg CW, no issues from LC or GC. View to RWY 16, RWY 34, and helipad look good.



**Site 5**

- 4) Column View – Rotated 30 deg CW, no issues from LC or GC. Good.

c. T. Williams noted that Site 4 is not viable due to distance from the primary runway 16, even with the runway extension.

**Actions:**

1. Michael Lally to update the model as discussed during the model validation (all updates to the airport per Tracy Williams to include hold short lines moving closer to the runways, new/current construction, etc.). Place aircraft at hold short lines and landing/arrivals.
2. Recommended Site. During the actual siting exercise, the ATM and Airport Manager will select the recommended site and need to provide the advantages and disadvantages of both sites.

**Bend Municipal Airport (BDN)**

**Bend, Oregon**

**Meeting Minutes**

**June 15, 2022**

Federal Aviation Administration (FAA) representatives of the Western Service Area (WSA) and Airport participated in the new Federal Contract Tower (FCT) siting activities at the Bend Municipal Airport (BDN) located in Bend, Oregon, on 06/15/22. The team followed VISTA Memorandum, dated 11/05/21. The Safety Risk Management (SRM) Specialist facilitated the SRM Panel.

**Facilitator:** Frank Boyer

**SRM Specialist:** Garry Brown

**Modeler:** Michael Lally

**Participants:** See Attachment 1

**1. Purpose of Visit**

To select a Recommended site for a new ATCT at BDN airport.

**2. Agenda**

- a. Introductions
- b. Reasons for Visit – National Coordinator (NC)
- c. Airport Layout Plan (ALP) Overview
- d. 3-D training for Control Personnel – Modeler
- e. Assessment of Preferred Sites – Control Personnel
- f. SRM Panel Assessment

**3. Background**

Bend Municipal Airport is identified as a Category 2, High Activity Business and General Aviation - 98% general aviation, 2% air taxi, and 1% military. This is an FCT tower staffed by FCT controllers. The Airport consultants developed the 3-D model and the VIDTA team facilitated the Line of Sight and safety assessment. The tower cab size will be 440 sf, slatwall, occupied shaft and ATC prefers columns. Site-5 is selected as the recommended site. There are no TERPS/TOPR issues.

**4. Overview of Airport/Preferred Sites**

Michael Lally presented an overview of the model. Color definitions. Blue – Future Pavement; Purple – Undeveloped/Available Area(s); Green – Future Building(s); and White/Textured Existing Structure(s). Site 2 and Site 5 were identified on the model. The cab will be an 8-sided 440 square foot cab with slatwall (for open viewing space of movement areas).

**Bend Municipal Airport (BDN)**

**Bend, Oregon**

**Meeting Minutes**

**June 15, 2022**

Per the Airport Manager/Tracy Williams, the rotating beacon will be located to the top of the new ATCT. The airport does not currently have ramp lights; when ramp lights are installed, the airport will need to consider the impact ramp lights will have on operations (e.g., ramp lights are on high poles and may cause obstructions, glare issues, etc.).

**5. Preferred Site Assessment by the Air Traffic Control Team – See Attachment 2.**

**6. SRM Panel**

Garry Brown conducted a safety analysis on the preferred sites. Site 2 and Site 5 do not have any hazards. G. Brown will provide the final safety analysis to Frank Boyer.

**7. Conclusions**

**Recommended Site:** Air Traffic and Airport Personnel selected Site 5 as the Recommended site; there were no objections from the SMEs.

**Final Controller Positions:** Local Control (LC) at Panel A; Ground Control (GC) at Panel H; (Flight Data) FD at Panel G, and Supervisor (SUPE) at desk in back by stairs.

**Orientation:** West

**Console System:** Slatwall

**Column/Mullion Orientation:** The ATM/Tim Proctor and T. Williams prefer columns due to Line-of-Sight (LOS) issues with mullions.

**Construction Issues (Visibility):** None.

**8. Actions – See Attachment 9**

**Bend Municipal Airport (BDN)**

**Bend, Oregon**

**Meeting Minutes**

**June 15, 2022**

**Attachment 1 – Participants List**

Anthony Goodwin	Larry Crowley
Benjamin Mello	Lillie Smith
Brian Lally	Matt Ballon
Charles Kolb	Matt Rogers
Colin Ngai	Matthew Josal
Ed DeLisle	Michael Lally
Frank Boyer	Monica Holguin
Garry Brown	Rollo DeVore
George Buley	Ron Pierce
Jeff Fischer	Nicole Wysong
Joe Sims	Stephen Hedden
Jon Ikeda	Steve Szehner
Jordan Flores	Tim Proctor (ATM)
Judi Realph	Tom Headley
Ken Legary	Tracy Williams (Airport Manager/Airport Sponsor)

**Attachment 2 – Sites Assessed**

**1. Site 2**

T. Proctor identified and verified controller positions: Local Control (LC) at Panel A; Ground Control (GC) at Panel H; (Flight Data) FD at Panel G, and Supervisor (SUPE) at desk in back by stairs.

**NOTE:** GC moved from Panel B to Panel H to alleviate visibility issues for Taxiway Bravo.

- A. Orientation: West
- B. Above Ground Level (AGL): 80 feet (ft.) AGL floor; 85 ft. AGL eye level
- C. Final Cab Rotation: 20 degrees clockwise (CW) from original position
- D. Ground Level: 3,432 ft. Mean Sea Level (MSL)
- E. Weather:
  - Sunset, Evening to West (in May, ~07:45 PM): Potential hazard identified by Safety. ATC identified a glare issue with sunset; installation of cab shades/double blinds will mitigate this concern.
  - Sunrise: No potential hazards identified.
- F. Reference Location: East side of airfield; 523 ft. east of Runway 16/34 centerline.

**Bend Municipal Airport (BDN)**

**Bend, Oregon**

**Meeting Minutes**

**June 15, 2022**

G. Cab Mullion/Column Orientation: Both mullions and columns were assessed by T. Proctor. T. Proctor and T. Williams prefer columns due to LOS issues with mullions.

- (1) **Columns:** Per John Ikeda, columns can be 10 x 10 or 10 x 15 (model reflects 8 x 10). From LC, all looks good. T. Proctor noted that from GC, runway ends and helipad are visible; all looks good. Non-movement areas are visible. LOS is good.
- (2) **Mullions:** From LC, mullion at Alpha 1 (between Panel G and Panel H) blocks view near approach end of Runway 34 (can be mitigated by moving head to improved view). From GC, the view is good.

Cab rotated 3 degrees counterclockwise (CCW). No improvement and some views from LC are worse. Rotated cab another 7 degrees CCW. After these rotations, the approach end view is better; however, the view of Bravo 4 is blocked (can be mitigated by moving head to improved view). The views with the 10 degree CCW rotation is the best shown.

**NOTE:** Comm is Runway 16.

H. Stairs: Good (after rotation) per T. Proctor

I. Advantages: No advantages are noted for this site.

J. Disadvantages:

- Could interfere with airport future development activities.
- Utility run and access road is farther away from Site 2 than Site 5.

## **2. Site 5 (Recommended Site)**

T. Proctor identified and verified controller positions: LC at Panel A; GC at Panel B; FD at Panel H, and SUPE at desk in back by stairs.

**NOTE:** GC moved from Panel B to Panel H to alleviate visibility issues for Taxiway Bravo.

- A. Orientation: West
- B. AGL:
  - Original Height, 05/17/22: 68 ft. AGL floor; 73 ft. AGL eye level
  - **Revised Height, 06/15/22: 80 ft. AGL floor; 85 ft. AGL eye level**
- C. Final Cab Rotation: 10 degrees CW from original position
- D. Ground Level: 3,431 ft. MSL

**Bend Municipal Airport (BDN)**

**Bend, Oregon**

**Meeting Minutes**

**June 15, 2022**

**E. Weather:**

- Sunset, Evening to West (in May, ~07:45 PM): Potential hazard identified by Safety. ATC identified a glare issue with sunset; installation of cab shades/double blinds will mitigate this concern.
- Sunrise: No potential hazards identified.

**F. Reference Location: East side of airfield; 570 ft. east of Runway 16/34 centerline.**

**G. Cab Mullion/Column Orientation:** Both mullions and columns were assessed by T. Proctor. T. Proctor and T. Williams prefer columns due to LOS issues with mullions.

**NOTE:** T. Williams conveyed that the current runway is 5,200 ft., but the plan is to expand to 6,260 ft.

(1) **Columns:** From LC, hold short lines and runways ends are good; no issues at all. From GC, view is good; main ramp and helipad are viewable.

At the new height (80 ft. AGL floor; 85 ft. AGL eye level), columns were reassessed. T. Proctor noted that all views were improved.

(2) **Mullions:** Cab rotated 10 degrees CCW. From LC, the mullion between Panel G and Panel H is blocking the approach end of 34. The cab was rotated another 10 degrees CCW (20 degrees CCW total). From LC, the approach end of Runway 16 is good and view is better.

T. Williams discussed that since 1/3 of the airport traffic is helicopters, the tower cannot go lower, but higher would be better. F. Boyer noted that at 80 ft., TERPS should not be impacted. The tower height was moved up to 80 ft. AGL floor, 85 ft. AGL eye level. T. Proctor noted that the vantage point is much better.

**G. Stairs: Good (after rotation) per T. Proctor**

**H. Advantages:**

- Site 5 will remain central to runways even after the upcoming runway expansion is complete.
- Overall view from Site 5 is better.
- The utility run and access road are shorter for Site 5 than Site 2.

**I. Disadvantages: No disadvantages are noted for this site.**

**Bend Municipal Airport (BDN)**

Bend, Oregon

Meeting Minutes

June 15, 2022

**Attachment 3 – Site Comparison Chart**

Item Description	Site 2	Site 5
Recommended Site	—	<b>Recommended</b>
Latitude	44°05'26.66"N	44°05'34.19"N
Longitude	121°11'53.65"W	121°11'52.99"W
Cab Size	450 square foot	450 square foot
Cab Orientation	West	West and North
Columns or Mullions	Columns	Columns
Eye-Level (AGL) *	85'	85'
Eye-Level (AMSL)	3517'	3516'
Cab Floor Level (AGL)	80'	80'
Cab Floor Level (AMSL)	3412'	3411'
Top of Tower (AGL)	115'	115'
Top of Tower (AMSL)	3547'	3546'
Estimated Ground Level at Tower *	3432'	3431'
Ground Elevation at Key Point (Threshold Elev) *	3460'	3460'
Tower to Key Point Distance (Farthest RWY distance) (RWY Threshold) *	2327'	3084'
2-Point Lateral Discrimination (Deg)	Exceeds Minimum	Exceeds Minimum
Object Discrimination		
Caravan – Front View	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Caravan – Side View	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Cessna 172 – Front View	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Cessna 172 – Side View	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Line of Sight Angle of Incidence (.8 lockdown)	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail Value: 1.40	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail Value: 1.04
TERPS No Effect Height (NEH)	N/A did not break TERPS heights	N/A did not break TERPS heights
Airspace – Lat/Longs (4 corners)	Center: 44°05'26.66"N, 121°11'53.65"W Corner1: 44°05'26.60"N, 121°11'53.94"W Corner 2: 44°05'26.87"N, 121°11'53.73"W Corner 3: 44°05'26.72"N, 121°11'53.36"W Corner 4: 44°05'26.45"N, 121°11'53.57"W	Center: 44°5'34.19"N, 121°11'52.99"W Corner 1: 44°5'34.13"N, 121°11'53.28"W Corner 2: 44°5'34.40"N, 121°11'53.07"W Corner 3: 44°5'34.25"N, 121°11'52.70"W Corner 4: 44°5'33.98"N, 121°11'52.91"W
4-Corners images		
Stair Location	East	East

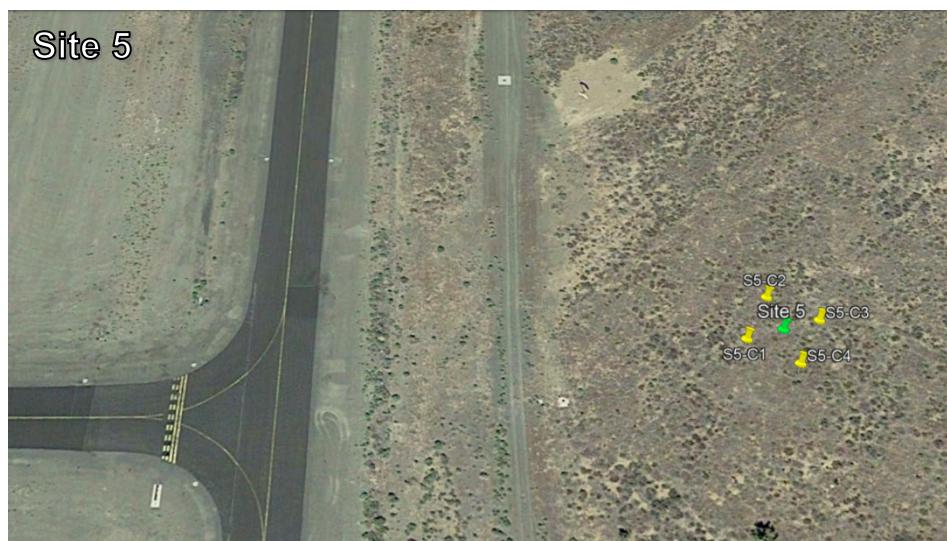
\* Human Factors data.

**Bend Municipal Airport (BDN)**

**Bend, Oregon**

**Meeting Minutes**

**June 15, 2022**



**Bend Municipal Airport (BDN)**

**Bend, Oregon**

**Meeting Minutes**

**June 15, 2022**

**Attachment 4 – TERPS Analysis**

**Airspace Analysis**

Bend Municipal Airport

Proposed New ATCT Locations

**Summary Report**

Three (3) proposed sites for a new Air Traffic Control Tower at the Bend Municipal Airport, Bend, OR, were provided to me by CTBXaviation. I was asked to evaluate each site at a primary MSL elevation determined by CTBXaviation. The locations and elevations evaluated are as follows:

**Proposed Elevations**

SITE	AGL Height	Ground Elev.	MSL Elevation	Geodetic Coordinates
2	91'	3432'	3523'	44 05 26.66N-121 11 53.65W
4	75'	3445'	3520'	44 05 16.61N-121 11 53.56W
5	102'	3431'	3533'	44 05 33.70N-121 11 52.99W

**Existing Instrument Approaches**

Using the FAA Terminal Area Route Generation Evaluation & Traffic Simulation (TARGETS) Tool and the Instrument Approach Procedure Automation (IAPA) Tool I have evaluated all of the currently published Instrument Approach Procedures and Departure Procedures at the Bend Municipal Airport using the site coordinates and MSL elevations provided to me by CTBXaviation. In addition, I evaluated a proposed straight-in LNAV procedure to a proposed new Runway 34 with a 1060 foot extension to the south. Total landing distance available of 6260 feet.

The three proposed ATCT sites will not affect any of the existing instrument approach or departure procedures at the airport. There is ample clearance over all three.

Proposed Control Tower Site 2, at the proposed MSL elevation of 3523 feet, does not affect any currently published or proposed instrument approach or departure procedures at the Bend Municipal Airport. The controlling procedure for Tower Site 2 is the RNAV (GPS) Y RWY 16 LP (localizer performance) missed approach which has 137.42 feet of clearance over the site.

**Bend Municipal Airport (BDN)**

**Bend, Oregon**

**Meeting Minutes**

**June 15, 2022**

Proposed Control Tower Site 4, at the proposed MSL elevation of 3520 feet, does not affect any currently published or proposed instrument approach or departure procedures at the Bend Municipal Airport. The controlling procedure for Tower Site 4 is the RNAV (GPS) Y RWY 16 LP (localizer performance) missed approach which has 165.89 feet of clearance over the site.

Proposed Control Tower Site 5, at the proposed MSL elevation of 3533 feet, does not affect any currently published or proposed instrument approach or departure procedures at the Bend Municipal Airport. The controlling procedure for Tower Site 5 is the RNAV (GPS) Y RWY 16 LP (localizer performance) missed approach which has 127.00 feet of clearance over the site.

**Proposed Instrument Approach**

A proposed straight-in LNAV procedure to Rwy 34 was also evaluated. The Airport Layout Plan (ALP) for Rwy 34 shows a proposed 1060 foot extension to the south with no displaced threshold for a landing distance of 6260 feet. For the purpose of this evaluation it was assumed that the threshold elevation would be 3452.2 feet MSL which is consistent with the most recent (ALP). The proposed tower locations do not affect an LNAV RWY 34 approach procedure.

**Circling and Departure Minimums**

Circling minimums were evaluated, and the proposed tower locations do not affect circling minimums at the airport.

Departure procedures were evaluated, and the proposed tower locations do not affect departure minimums or departure procedures at the airport.

John D. Mogul  
Airspace Consultant

**FAA TERPS Assessments:**

**From:** Oleck, Perry J (FAA) <perry.j.oleck@faa.gov> **Sent:** Tuesday, May 17, 2022 2:18 PM  
**To:** Boyer, Franklin E-CTR (FAA) <franklin.e-ctr.boyer@faa.gov> **Cc:** Parker, David G (FAA) <David.G.Parker@faa.gov> **Subject:** Bend, OR (BDN) Control Tower Siting

Franklin,  
I sat in for Dave Parker as the TERPs POC for Western Service Area. I was having some issues with my Teams meeting site, but I did listen in on the phone to the entire meeting. I removed site 4 from the TERPs evaluation and adjusted site 2 to the proposed eye height of 85 ft. With that according to my calculations put site 2 the top of tower at 3547 AMSL. The evaluation of site 2 and site 5 shows no effect on any of the flight procedures at BDN. If you have any questions please let me know.

**Bend Municipal Airport (BDN)**

**Bend, Oregon**

**Meeting Minutes**

**June 15, 2022**

Respectfully,

**Perry Oleck**

Oakland District (TWOA) and VOR MON Program

Western Flight Procedures Team (AJV-W24)

Mission Support Services | Air Traffic Organization (ATO)

**Federal Aviation Administration**

**Office:** (206) 231-2276

**Email:** Perry.J.Oleck@faa.gov

**Web:** [www.faa.gov/go/missionsupport](http://www.faa.gov/go/missionsupport)

IFP Information Gateway

**Bend Municipal Airport (BDN)**

Bend, Oregon

Meeting Minutes

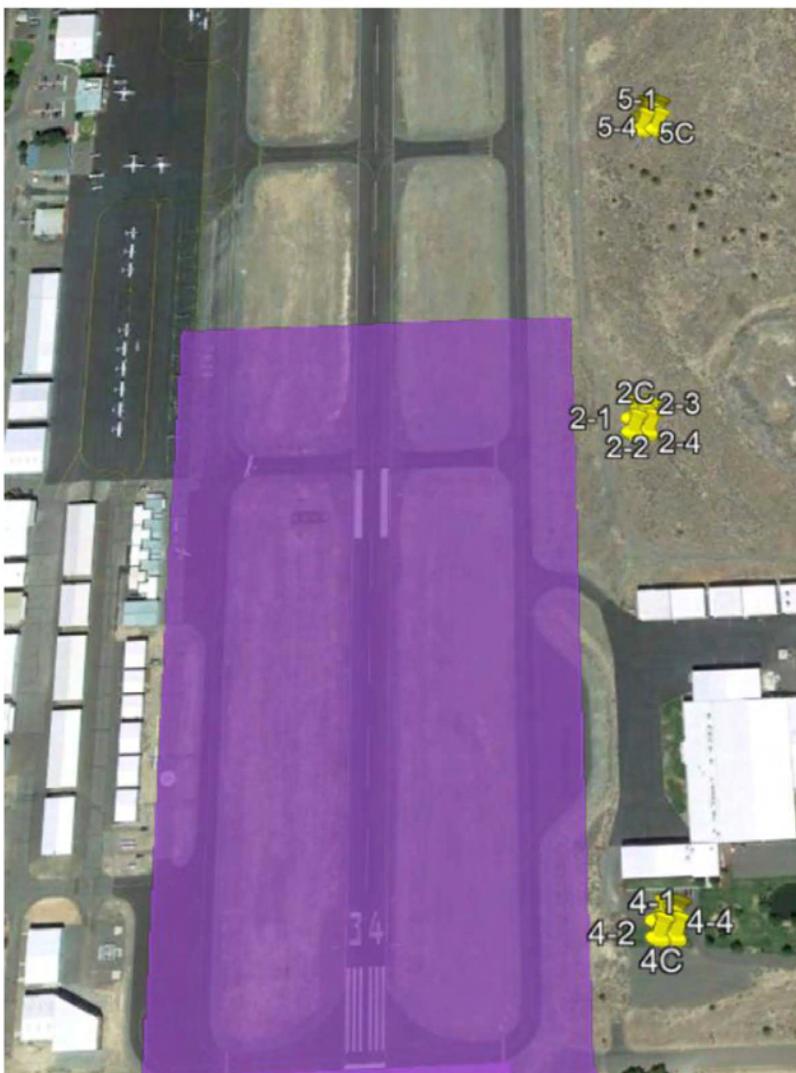
June 15, 2022

**Attachment 5 – Technical Operations Preliminary Report (TOPR)**

The three BDN preferred sites are located outside of facility protection areas and do not require TOPR analysis. Refer to email below.

**From:** Jagielo, Evan (FAA) <Evan.Jagielo@faa.gov>  
**Sent:** Tuesday, May 10, 2022 12:02 PM  
**To:** Boyer, Franklin E-CTR (FAA) <franklin.e-ctr.boyer@faa.gov>  
**Subject:** RE: BEND (BDN) coordinates & heights

Thanks Frank. Fortunately, a TOPR is not needed for these 3 sites as they are outside any facility protection areas (see below):



Best regards,  
-Evan

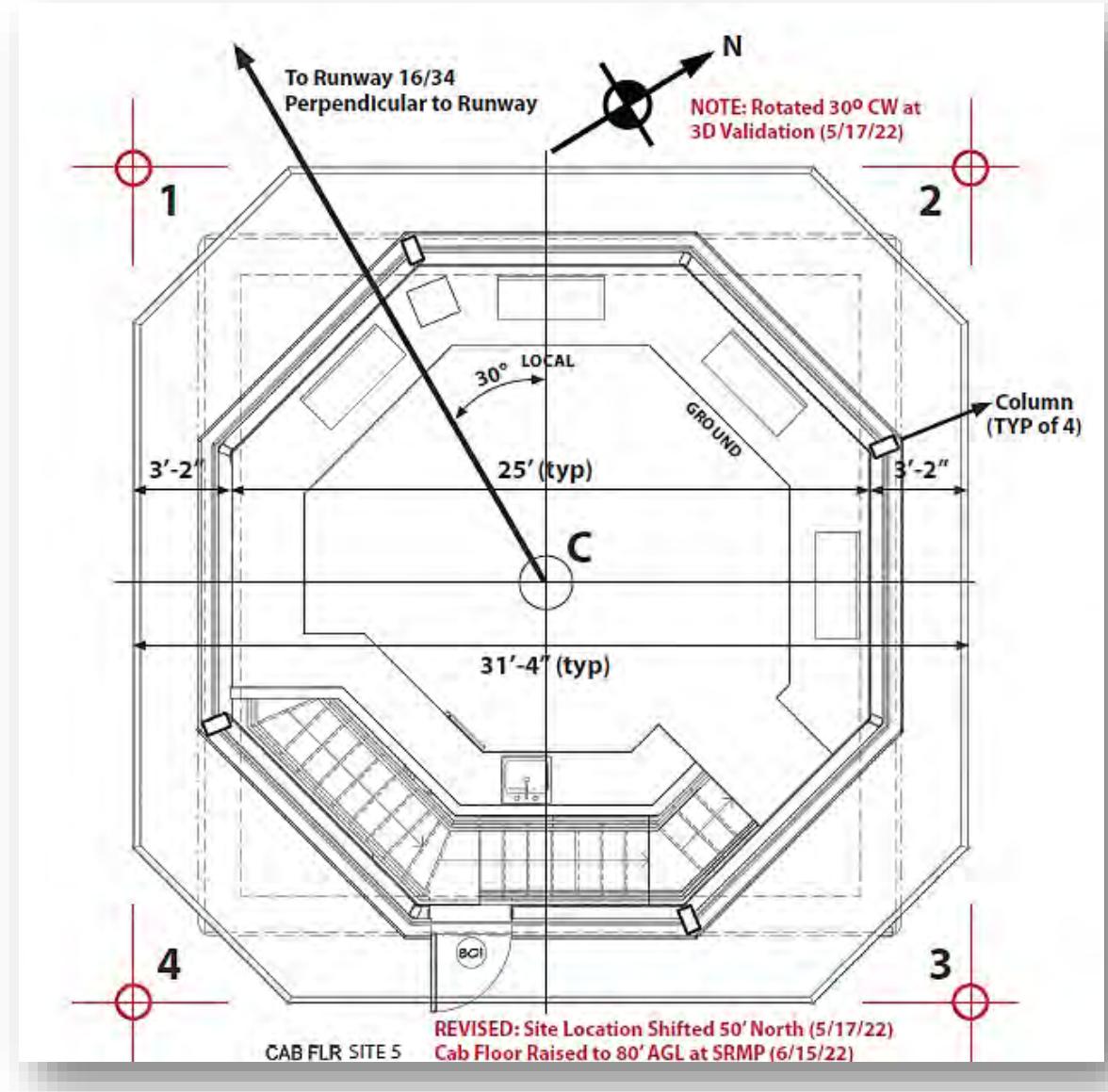
Bend Municipal Airport (BDN)

Bend, Oregon

Meeting Minutes

June 15, 2022

Attachment 6 – Cab Layout/Orientation



Attachment 7 – Candidate Acceptance Letter

TBD

**Bend Municipal Airport (BDN)**

**Bend, Oregon**

**Meeting Minutes**

**June 15, 2022**

**Attachment 8 – Memo of Record**

**Memo of Record**

**Bend Municipal Airport (BDN), Bend, Oregon**

**for a new**

**Airport Traffic Control Tower (ATCT)**

The team members below concur with the following Recommended Site:

**Tim Proctor 6/15/22**

Tim Proctor Date  
Local ATCT Representative

**Anthony D. Goodwin** Digitally signed by Anthony D. Goodwin  
Date: 2022.06.16 06:17:39 -07'00'

Anthony Goodwin Date  
ATC Requirements

  
Franklin E. Boyer Date  
AJW Terminal Facilities National Coordinator

**Tracy Williams 6/15/22**

Tracy Williams Date  
Airport Sponsor, Bend Municipal Airport

June 15, 2022

**Bend Municipal Airport (BDN)**

**Bend, Oregon**

**Meeting Minutes**

**June 15, 2022**

**Attachment 9 – Action Items**

<b>Item</b>	<b>Action</b>	<b>POC</b>	<b>Telephone</b>	<b>Due Date</b>	<b>Comments</b>
1	Add Recommended Site to ALP	Airport Sponsor			Add the Recommended site to the ALP.
2	View Final 3-D Model and Cab Size Recommendation	3-D Modeler Airport Sponsor			The 3-D modeler will provide screenshots of the proposed cab model and its orientation to the Airport Sponsor for each preferred site, for use in the Siting Report preparation. These items document the cab layout, cab size, column/mullion configuration, and orientation (referenced to a runway) for each preferred site.
3	Final Airspace Studies	Airport Sponsor			The Airport Sponsor must comply with the FAA OE/AAA requirements on the preferred sites (refer to the OE/AAA Web site). Include final determination letter on the preferred sites.
4	Environmental Study. The Airport Sponsor is responsible for obtaining applicable environmental approvals per Federal, state, and local requirements.	Airport Sponsor			The Airport Sponsor is responsible for obtaining applicable environmental approvals per Federal, state, and local requirements.
5	Prepare Siting Report. The Airport Sponsor is responsible for development of the Siting Report. If the Airport Sponsor developed the model, the Airport Sponsor must include, in the Siting Report, a letter from the licensed engineer certifying the model is developed in accordance with the required accuracy (within $\pm 6$ inches vertical / $\pm 1$ feet horizontal), as well as the signature of the engineer and the appropriate seal. A template is available.	Airport Sponsor			The draft Siting Report must be developed in accordance with Appendix C. The Airport Sponsor will deliver the draft of the Siting Report to all participants. After the Airport Sponsor has resolved all comments, the Airport Sponsor will submit the final report to the FCT PIM.

**Bend Municipal Airport (BDN)**

Bend, Oregon

**Meeting Minutes**

**June 15, 2022**

Item	Action	POC	Telephone	Due Date	Comments
6	Service Area Siting Report Briefing and Approval.	PIM			The FCT PPM will brief the Siting Report to the Service Area Director of Air Traffic Operations and Service Area Director of Technical Operations for their concurrence.
7	Headquarters Final Siting Report Briefing and Approval.	PIM			The FCT PPM will submit the final siting report to Terminal Facilities Execution, who will brief the Siting Report to the Director of Air Traffic Control Facilities and Engineering Services for their concurrence.
8	Final Report Distribution.	Technical Writer			After Headquarters approval of the Siting Report, the report will be posted on the Terminal Facilities Execution DEI Siting KSN Web site. An electronic copy of the Siting Report will be delivered to the Airport Sponsor.
9	Design Phase: ATC Review Control Positions.	Airport Sponsor ATC			During the Design phase, ATC should review the control positions to optimize configuration.
10	Siting Report Renewal Process. Refer to Chapter 8, Siting Report Renewal Process.	National Coordinator		18 months after siting exercise is completed.	Refer to Chapter 8, Siting Report Renewal Process.

## BDN ATCT SITING PANEL @ AIRPORT MANAGER'S OFFICE

63132 Powell Butte Highway, Suite 202, Bend, OR (2<sup>nd</sup> Floor of the Green Building)

63132 Powell Butte Rd - Google

63132 Powell Butte Highway, Be

Restaurants Hotels Attractions Transit Parking Pharmacies ATMs

63132 Powell Butte Rd

Building

Directions Save Nearby Send to phone Share

63132 Powell Butte Rd, Bend, OR 97701

Suggest an edit on 63132 Powell Butte Rd

Add a missing place

Add your business

Add a label

Photos

At this place

Big Mountain Heli Tours Bend, Oregon

Layers

Google

Imagery ©2022 Maxar Technologies, State of Oregon, Map data ©2022 United States, Terms, Privacy, Send feedback, 50 ft

81°F Sunny 1:08 PM 6/2/2022

## **Appendix K – Safety Risk Management Document**

# SRM Document Details

## SRM Document is Finalized

### Project :

P-5974 - WSA QCG Bend Municipal Airport New FCT CSA Safety Risk Management Document without Hazards

### SRM Document :

**D-8750 - SMTS2022071400283 - WSA QCG Bend Municipal Airport (BDN) New FCT CSA Safety Risk Management Document without Hazards**

### Project Description :

The Bend Municipal Airport (BDN) is a public use non-towered airport owned by the City of Bend, Oregon. BDN has a single north/south Runway 16/34 that measures 5,260 feet long by 75 feet wide. BDN has two full-length parallel Taxiways A and B with connecting taxiways along both sides of the runway.

BDN is located six miles northeast of Bend, OR and is primarily a General Aviation (GA) airport, with two flight training schools. Aircraft operating out of BDN include corporate jets, helicopters, and single and multi-engine propeller aircraft. Approach and departure control services are provided by the Seattle ARTCC (ZSE). Helicopter traffic makes up about 33 percent of operations at the airport. BDN is the third busiest airport in the state in terms of takeoffs and landings and had about 140,000 operations in FY 2021.

A Siting Comparative Safety Assessment (CSA) was conducted on 06/15/2022 for a new FAA Contract Tower at BDN. Meeting attendees both in the room and virtually via Zoom participated in siting activities for the proposed BDN FCT and conducted a Safety Risk Management (SRM) Panel (SRMP) for Sites 2 and 5. Attendees applied the Air Traffic Organization (ATO) SRM process as defined by the ATO Safety Management System (SMS) Manual.

Air Traffic representatives followed FAA Siting Order 6480.4 and VISTA procedures for a new FCT location. All items in the siting criteria were discussed and impacts assessed and documented. The siting team members provided inputs on the advantages and disadvantages of Sites 2 and 5. Site 4 was eliminated from consideration in previous siting meetings.

The SRM Panel safety analysis did not reveal hazards or any perceived/calculated increase in safety risk. SRM Panel attendees determined that no further safety analysis is required according to the Air Traffic Organization Safety Management System (SMS) Manual, April 2019 Version, and the proposed change may be implemented into the NAS.

### SRM Document Type :

OPS

### Were Hazards Identified? :

No

### Hazards :

Haz #	Hazard ID	Hazard	Initial Risk	Predicted Risk	Phase	Last Update
--- No Hazards ---						

### Safety Requirements :

SR #	Safety Requirement	POC	Organization	Status	Status Date	Last Update
--- No Safety Requirements ---						

### Safety Performance Targets/Monitoring Plans :

SRMd ID	Haz #	SPT #	Target	POC	Monitoring Dates	Status	Status Date	Phase	Last Update
<i>--- No Safety Performance Targets ---</i>									

**Signatures :**

**Concurrer**

Ronald CTR Pierce - **signed 01-Aug-2022**

**Approver**

Peter Abbey - **signed 18-Jul-2022**

David CTR McCann - **signed 05-Aug-2022**

All Signatures Obtained.

**AJI-3 Director Signature Required :**

No

**Attachments :**

File - BDN ALP Drawing Set 1 note 07-08-2022.docx 11.6 KB (14-Jul-2022 by Stephen Hedden)



File - (Image) 492.7 KB (14-Jul-2022 by Stephen Hedden)

File - BDN SITING RPT APPs FINAL DRAFT JUNE 20 2022 v1.0.pdf 26.4 MB (14-Jul-2022 by Stephen Hedden)

File - BDN\_Minutes\_061522.pdf 1.6 MB (20-Jul-2022 by Stephen Hedden)

SRMd - Bend Municipal Airport New FCT Final 1.00 07-14-22.docx 66.7 KB (02-Aug-2022 by Stephen Hedden)

File - Bend\_Airport\_Snow\_Removal\_.pdf 9.8 MB (14-Jul-2022 by Stephen Hedden)

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File - VISTA-3-D\_Siting\_In-BDN 6-15-2022.pptx 235.8 KB (14-Jul-2022 by Stephen Hedden)

**Created :**

14-Jul-2022 by Stephen Hedden

**Finalized :**

10-Aug-2022 by Stephen Hedden

**Last Update :**

10-Aug-2022 by Stephen Hedden

Document finalized

**Component List Key :** Open **Locked** **Finalized** **Suspended** **Void**

## Bend Municipal Airport New FCT CSA Safety Risk Management Document without Hazards

### EXECUTIVE SUMMARY

**Title:** Bend Municipal Airport New FCT CSA

**Initiating Organization:** BDN

**Impacted Organizations:** BDN, RDM, ZSE

**Safety Analysis Type:** OPS

**Signatures:**

Concurrence: Ron Pierce, QA/QC, Serco Inc.

Approval: Peter Abbey, General Manager, Seattle District (TWSE-GM)

### SMTS Project Overview

The Bend Municipal Airport (BDN) is a public use non-towered airport owned by the City of Bend, Oregon. BDN has a single north/south Runway 16/34 that measures 5,260 feet long by 75 feet wide. BDN has two full-length parallel Taxiways A and B with connecting taxiways along both sides of the runway.

BDN is located six miles northeast of Bend, OR and is primarily a General Aviation (GA) airport, with two flight training schools. Aircraft operating out of BDN include corporate jets, helicopters, and single and multi-engine propeller aircraft. Approach and departure control services are provided by the Seattle ARTCC (ZSE). Helicopter traffic makes up about 33 percent of operations at the airport. BDN is the third busiest airport in the state in terms of takeoffs and landings and had about 140,000 operations in FY 2021.

A Siting Comparative Safety Assessment (CSA) was conducted on 06/15/2022 for a new FAA Contract Tower (FCT) at BDN. Meeting attendees both in the room and virtually via Zoom participated in siting activities for the proposed BDN FCT and conducted a Safety Risk Management (SRM) Panel (SRMP) for Sites 2 and 5. Attendees applied the Air Traffic Organization (ATO) SRM process as defined by the ATO Safety Management System (SMS) Manual.

The SRM Panel convened to assess the change to the National Airspace System (NAS) and associated hazards. The sponsor with support from the Virtual Immersive Siting Tower Assessment (VISTA) team and the Western Service Center (WSC) Quality Control Group (QCG) organized the SRM Panel, comprising stakeholders associated with the change. Stakeholders included representatives from BDN, Redmond (RDM), the WSC Planning and Requirements Group (PRG), Seattle Airports District Office (ADO), Seattle ARTCC (ZSE), Runway Safety, Engineering Services, Program Management Organizations (PMO), Serco Inc., and CTBXAviation.

Air Traffic representatives followed FAA Siting Order 6480.4 and VISTA procedures for a new FCT location. All items in the siting criteria were discussed and impacts assessed and documented. The siting team members provided inputs on the advantages and disadvantages of Sites 2 and 5. Site 4 was eliminated from consideration in previous siting meetings.

The SRM Panel safety analysis did not reveal hazards or any perceived/calculated increase in safety risk. SRM Panel attendees determined that no further safety analysis is required according to the Air Traffic Organization Safety Management System (SMS) Manual, April 2019 Version, and the proposed change may be implemented into the NAS.

## Bend Municipal Airport New FCT CSA Safety Risk Management Document without Hazards

### SECTION 1: CURRENT SYSTEM

BDN is a public use non-towered airport owned by the City of Bend, Oregon. BDN's single north/south Runway 16/34 is 5,260 feet long by 75 feet wide with a planned ultimate length of 6,060 feet long by 75 feet wide. BDN has two full-length parallel Taxiways A and B with connecting Taxiways A1, A2, A3, A4, A5, A6, B1, B3, B4, B5, and B6.

Located six miles northeast of Bend, Oregon, BDN caters to the needs of GA, hosts two flight training schools, and is home to multiple businesses. Aircraft that generally operate at BDN include corporate jets, helicopters, and single/multi-engine propeller aircraft. Approach and departure control services are provided by ZSE.

Helicopter traffic makes up about 33 percent of operations at the airport. BDN is the third busiest airport in the state in terms of takeoffs and landings and had about 140,000 operations in 2021: an average of about 387 operations per day: 70,000 local GA, 68,600 transient GA, less than 1,400 air taxi, and less than 1,400 military for the 12-month period ending June 15, 2019. Currently 250 aircraft are based at BDN.

### 5M Model

<b>Mission</b> (purpose of NAS change/operation)	Safely conduct air traffic operations in the proposed new BDN FCT. Identify potential safety hazards, assess risk, and propose mitigations associated with the proposed NAS change.
<b>(hu)Man</b> (operators, stakeholders)	Controllers, pilots, BDN, RDM, ZSE
<b>Machine</b> (equipment used in system)	FCT cab equipment positioning/adjustability
<b>Management</b> (procedures, policies governing/managing system)	JO 7110.65, JO 7210.3, FAA Order 6480.4, SOP, LOA, ACAC checklist, Advisory Circular, CSPP, NOTAM
<b>Media</b> (environment system is operated)	BDN, RDM, ZSE air traffic environment

### SECTION 2: DESCRIPTION OF CHANGE

A siting assessment meeting was conducted at BDN on 06/15/2022 by the FAA Terminal Facilities Siting team to determine the location and configuration for a new FCT at BDN. The FCT Siting assessment was completed onsite using 3-D goggles with some attendees attending virtually via ZOOM meeting. The goal is to assess potential hazards and apply the best outcome to a new FCT Siting process.

Two sites were assessed: Site 2 and Site 5. Site 2 had been considered a preferred site; however, it was deemed a secondary alternative to preferred site 5 during the 3-D Validation and Safety Assessment Panel review process. It was deemed to be unacceptable because of site spatial limitations and extensive distance from Runway end 16 impacting visibility of airport vehicles and aircraft.

BDN proposes to identify Site 5 as the preferred site and determine physical characteristics for a new FCT. Representatives followed FAA Siting Order 6480.4 and VISTA procedures/process to identify the site for the FCT:

- Site 2: Latitude: 44° 05' 26.66" N, Longitude: 121° 11' 53.65"W; Floor Level 80 feet Above Ground Level (AGL), Eye Level 85 feet AGL.
- Site 5: Latitude: 44° 05' 34.19" N, Longitude: 121° 11' 52.99"W; Floor Level 80 feet AGL, Eye Level 85 feet AGL.

## Bend Municipal Airport New FCT CSA Safety Risk Management Document without Hazards

The Tower Selection Worksheet for Site 5 along with a BDN image that shows the original site locations are attachments in the Safety Management Tracking System (SMTS).

### **SECTION 3: RATIONALE FOR A SAFETY FINDING WITHOUT HAZARDS**

SRM Panel attendees conducted a thorough safety analysis using the siting checklist for a new FCT at BDN using 3-D goggles on-site, via ZOOM meeting, and VISTA procedures. Attendees applied the ATO SRM process and discussed dimensions and Line of Sight (LOS) from each operating position in the tower cab. SRM Panel attendees talked about mullions versus columns and options available for the design for optimal operational advantages for Site 2 and Site 5. Attendees discussed various aircraft movements and positions on the airport and decided to rotate the tower cab 30 degrees to achieve the preferred position for LOS for Site 2. The SRM Panel ultimately agreed Site 5 provided the best operational advantages and identified it as the preferred site. SRM Panel attendees reviewed each site with columns only and agreed they provided optimal LOS over mullions. Site 5 does not require the crossing of any controlled surfaces to access.

Attendees said the Local Control (LC) and Ground Control (GC) positions are interchangeable and can be combined depending on flow with great LOS. The internal dimensions of the FCT will be 440 square feet of usable space with stairs included. Glare from the sun when setting was discussed as a potential concern. SRM Panel attendees said double screen shades will be installed to mitigate late evening glare issues. It was mentioned that double shade presentation may be darker than expected and an adjustment for controllers. Smoke was discussed as having an impact on air traffic operations; however, it was agreed that this is a regional phenomenon is not unique to BDN.

SRM Panel attendees said the rotator beacon is currently located on stilts at the airport, but will be relocated on the top of the FCT. Maintenance of the beacon will be easier on top of the FCT. Attendees questioned the routing of wiring to the beacon and antennas on top of the tower cab. The columns will provide for routing of all cable requirements of the FCT. SRM Panel attendees said BDN does not currently have ramp lights, but with the potential of installation in the future, attendees said emphasis will be placed on the positioning of lights to prevent impact to controllers.

SRM Panel attendees brainstormed to develop a Preliminary Hazard List (PHL), but did not identify hazards associated with the change. Attendees agreed that the Site 5 location and access would not increase risk. The SRMP determined that the changes do not introduce hazards into the NAS and, therefore, no further safety analysis is required according to the ATO SMS Manual.

### **SECTION 4: DISSENTION**

Not applicable.

### **SECTION 5: SRM PANEL ATTENDEES**

The SRM Panel convened on 06/15/2022 to perform a thorough analysis of the mission statement. Subject Matter Experts (SME) from across the agency were invited to leverage their operational experience, and experts in the SRM process were present to maintain its integrity. The following table lists SRM Panel attendees.

**Bend Municipal Airport New FCT CSA Safety Risk Management Document without Hazards****Change Proponent**

Name	Title, Organization	Email	Phone
Franklin Boyer	Facilitator, National Coordinator Liaison	franklin.e-ctr.boyer@faa.gov	941-504-0210

**Members**

Name	Title, Organization	Email	Phone
George Buley	Runway Safety (AJI-144)	george.buley@faa.gov	206-231-2288
Ron Pierce	QA/QC, Serco	rpierce@serco-na.com	615-618-3351
Tim Proctor	ATM, RDM, Serco	tproctor@serco-na.com	541-548-2574

**Subject Matter Experts**

Name	Title, Organization	Email	Phone
Matthew Ballon	Modelers, Vista	matthew.ctr.ballon@faa.gov	--
Ed Delisle	SMQC, ZSE (TWSE1-ZSE)	ed.delisle@faa.gov	253-351-3500
Rollo DeVore	Systems Engineer, PMO/NEXTGEN (AJW-2444)	rollo.l-ctr.devore@faa.gov	206-231-2943
Jeff Fisher	Modelers, Vista	jeff.CTR.fischer@faa.gov	--
Anthony Goodwin	Requirements Specialist, PRG (AJV-W31)	anthony.d.goodwin@faa.gov	206-231-2930
Tom Headley	CTBXAVIATION	theadley@centurywest.com	--
Monica Holguin	PIT Team Manager, PRG (AJV-W37)	monica.holguin@faa.gov	206-231-2839
Jon Ikeda	Systems Engineer, Engineering Services (AJW-2W11A)	jon.ikeda@faa.gov	206-231-2559
Matthew Josal	ATSS, PRG (AJV-W33)	matthew.josal@faa.gov	206-231-2966
Charles Kolb	Systems Engineer, Terminal Planning & Controls, WSA SAL Support (AJW-2444)	charles.ctr.kolb@faa.gov	206-231-2944
Brian Lally	CTBXAVIATION	blally@ctbxaviation.com	321-591-0204
Michael Lally	CTBXAVIATION	mlally@ctbxaviation.com	--
Benjamin Mello	ANM-SEA-ADO Engineer	benjamin.j.mello@faa.gov	206-231-4134
Colin Ngai	Engineer, Engineering Services (AJW-2W11A)	colin.ngai@faa.gov	206-231-2565
Judi S Realph	QC, ZSE (TWSE1-ZSE)	judi.s.realph@faa.gov	253-351-3500
Matt Rogers	CTBXAVIATION	wrogers@centurywest.com	--
Tracy Williams	Airport Manager, Bend Municipal Airport	trwilliams@bendoregon.gov	541-693-2168

**Observers**

Name	Title, Organization	Email	Phone

**Bend Municipal Airport New FCT CSA Safety Risk Management Document without Hazards**

Kenneth Legary	Technical Writer, QCG, WSC	kenneth.ctr.legary@faa.gov	206-231-2319
Steve Szehner	Technical Writer, QCG, WSC	stephen.szehner@faa.gov	206-231-2325
Nicole Wysong	ATSS, PRG (AJV-W31)	nicole.wysong@faa.gov	206-231-2947

**Facilitation Team**

Name	Title, Organization	Email	Phone
Franklin Boyer	Facilitator, NC Liaison	franklin.e-ctr.boyer@faa.gov	941-504-0210
Garry Brown	Facilitator, SRM Specialist, QCG, WSC	garry.f.brown@faa.gov	206-231-2317
Larry Crowley	Facilitator, SRM Specialist, QCG, WSC	larry.crowley@faa.gov	206-231-2320
Steve Hedden	Technical Writer, QCG, WSC	stephen.hedden@faa.gov	206-231-2324
Lillie Smith	Technical Writer, AJW-244	lillie.m-ctr.smith@faa.gov	--

**APPENDICES/SMTS ATTACHMENTS**

1. BDN ALP Drawing Set 1
2. BDN Siting RPT APPs Final August 15, 2022 v1.0
3. VISTA-3-D\_Siting\_In-BDN 6-15-2022
4. BDN Airport Snow Removal

# Project Package P-5974 - WSA QCG Bend Municipal Airport New FCT CSA Safety Risk Management Document without Hazards

## Project :

P-5974 - WSA QCG Bend Municipal Airport New FCT CSA Safety Risk Management Document without Hazards

## Project Type :

Operations - Local Change / Issue

## Description :

The Bend Municipal Airport (BDN) is a public use non-towered airport owned by the City of Bend, Oregon. BDN has a single north/south Runway 16/34 that measures 5,260 feet long by 75 feet wide. BDN has two full-length parallel Taxiways A and B with connecting taxiways along both sides of the runway.

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## Change Proponent Organization :

TWSE1ZSE - ZSE - SEATTLE, WA ARTCC (ATO : AJT : AJTW : TWSE : TWSE1 : TWSE1ZSE)

## Affected Facilities :

P80 Portland (TRACON)

## SRM Documents :

SRMd ID	SRMD Document	Type	Created	Phase	Last Update
SMTS2022071400283	WSA QCG Bend Municipal Airport (BDN) New FCT CSA Safety Risk Management Document without Hazards	OPS	14-Jul-2022	LOCKED	01-Aug-2022

## Hazards :

Proj #	SRMd ID	Haz #	Hazard ID	Hazard	Phase	Last Update
--- No Hazards ---						

**Safety Requirements :**

SRMd ID	SR #	Safety Requirement	POC	Organization	Status	Status Date	Last Update
--- No Safety Requirements ---							

**Safety Performance Targets/Monitoring Plans :**

SRMd ID	Haz #	SPT #	Target	POC	Monitoring Dates	Status	Status Date	Phase	Last Update
--- No Safety Performance Targets ---									

**Project Managers :**

Stephen Hedden

**Created :**

14-Jul-2022 by Stephen Hedden

**Last Update :**

02-Aug-2022 by Stephen Hedden

Component List Key : Open Locked Finalized Suspended Void**SRMd: SMTS2022071400283 - WSA QCG Bend Municipal Airport (BDN) New FCT CSA Safety Risk Management Document without Hazards****SRM Document is Locked - Pending Signatures****Project :**

P-5974 - WSA QCG Bend Municipal Airport New FCT CSA Safety Risk Management Document without Hazards

**SRM Document :**

D-8750 - SMTS2022071400283 - WSA QCG Bend Municipal Airport (BDN) New FCT CSA Safety Risk Management Document without Hazards

**Project Description :**

The Bend Municipal Airport (BDN) is a public use non-towered airport owned by the City of Bend, Oregon. BDN has a single north/south Runway 16/34 that measures 5,260 feet long by 75 feet wide. BDN has two full-length parallel Taxiways A and B with connecting taxiways along both sides of the runway.

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no further safety analysis is required according to the Air Traffic Organization Safety Management System (SMS) Manual, April 2019 Version, and the proposed change may be implemented into the NAS.

#### SRM Document Type :

OPS

#### Were Hazards Identified? :

No

#### Hazards :

Haz #	Hazard ID	Hazard	Initial Risk	Predicted Risk	Phase	Last Update
--- No Hazards ---						

#### Safety Requirements :

SR #	Safety Requirement	POC	Organization	Status	Status Date	Last Update
--- No Safety Requirements ---						

#### Safety Performance Targets/Monitoring Plans :

SRMd ID	Haz #	SPT #	Target	POC	Monitoring Dates	Status	Status Date	Phase	Last Update
--- No Safety Performance Targets ---									

#### Signatures :

##### Concurred

Ronald CTR Pierce - **signed 01-Aug-2022**

##### Approved

Peter Abbey - **signed 18-Jul-2022**

David CTR McCann - *signature pending*

#### AJI-3 Director Signature Required :

No

#### Attachments :

File - BDN ALP Drawing Set 1 note 07-08-2022.docx 11.6 KB (14-Jul-2022 by Stephen Hedden)



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File - BDN SITING RPT APPs FINAL DRAFT JUNE 20 2022 v1.0.pdf 26.4 MB (14-Jul-2022 by Stephen Hedden)

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#### Created :

14-Jul-2022 by Stephen Hedden

#### Locked :

14-Jul-2022 by Stephen Hedden

**Last Update :**

01-Aug-2022 by Ronald CTR Pierce

**Component List Key :** Open **Locked** **Finalized** **Suspended** **Void**

**Appendix L – Siting Report Amendments**

**AIRSPACE FINAL DETERMINATION**



## Federal Aviation Administration

December 22, 2022

TO:  
City of Bend  
Attn: Tracy Williams  
BOX 431  
Bend, OR 97709  
trwilliams@bendoregon.gov

CC:  
CTBX Aviation  
Attn: Brian Lally  
1980 North Atlantic Avenue  
Suite 711  
Cocoa Beach, FL 32931  
blally@ctbxaviation.com

RE: (*See attached Table 1 for referenced case(s)*)  
\*\*FINAL DETERMINATION\*\*

Table 1 - Letter Referenced Case(s)

ASN	Prior ASN	Location	Latitude (NAD83)	Longitude (NAD83)	AGL (Feet)	AMSL (Feet)
2022-ANM-3233-NRA		BEND,OR	44-05-34.13N	121-11-53.28W	115	3546
2022-ANM-3234-NRA		BEND,OR	44-05-34.40N	121-11-53.07W	115	3546
2022-ANM-3235-NRA		BEND,OR	44-05-34.25N	121-11-52.70W	115	3546
2022-ANM-3236-NRA		BEND,OR	44-05-33.98N	121-11-52.91W	115	3546

Description: FOR USE TO CONSTRUCT CONTROL TOWER AT BDN. PLEASE PROVIDE NASWATCH, PART 77, AND TERPS DETERMINATIONS, AS REQ'D. SITE 5: Lat/Long = POINT 1 of 4 LAT 44D-05M-34.13S LONG 121D-11M-53.28S CORNER OF 4 WALLED SHAFT CONSERVATIVELY MEASURED TO THE WIDTH OF CATWALK. Air Terminals/Antennas on top of proposed building. See attached exhibits for distance to runway, tower orientation, roof elevation vs antennas, and survey accuracy certification.

We do not object with conditions to the construction described in this proposal provided:

You comply with the requirements set forth in FAA Advisory Circular 150/5370-2, "Operational Safety on Airports During Construction."

As a condition to this Determination, the structure is marked and/or lighted in accordance with (Buildings, Structures, Antennas, etc.) Chapters 4 and 5 of Advisory Circular 70/7460-1M, Obstruction Marking and Lighting.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

This structure will exceed the RWY 16/34 Part 77 Transitional surface. This structure must be lighted with red obstruction lights in accordance with FAA Advisory Circular 70/7460-1, Obstruction Marking and Lighting, Chapters 4, 5, and 14. Copy of the current AC 70/7460-1 can be viewed and/or downloaded at [https://www.faa.gov/regulations\\_policies/advisory\\_circulars/index.cfm/go/document.current/documentNumber/70\\_7460-1](https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.current/documentNumber/70_7460-1).

Our concurrence does not constitute authority to transmit on any frequency in the band listed by the proponent on this application. That authority must come from the FCC. No radio transmissions can begin without FCC approval/license. Please coordinate with the FAA on the specific frequency (ies) via the WebFCR application (<https://webfcr.faa.gov>). Once frequency obtained, the proponent must apply for authorization to transmit with the FCC.

For current Advisory Circulars go to [www.oeaaa.faa.gov](http://www.oeaaa.faa.gov)

A separate notice to the FAA is required for any construction equipment, such as temporary cranes, whose working limits would exceed the height and lateral dimensions of your proposal.

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.

In making this determination, the FAA has considered matters such as the effects the proposal would have on existing or planned traffic patterns of neighboring airports, the effects it would have on the existing airspace structure and projected programs of the FAA, the effects it would have on the safety of persons and property on the ground, and the effects that existing or proposed manmade objects (on file with the FAA), and known natural objects within the affected area would have on the airport proposal.

If you have any questions concerning this determination contact Joseph Dalke (206) 231-4137 [joseph.dalke@faa.gov](mailto:joseph.dalke@faa.gov). On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2022-ANM-3233-NRA.

Joseph Dalke  
ADO  
**Signature Control No: 550909754-565879407**