

CHAPTER 2: RUNWAYS & TAXIWAYS

Introduction

This Chapter of the Airport Master Plan is focused on the Runway and Taxiway system at the airport which is commonly referred to as the airfield where aircraft takeoff, land and maneuver on the ground. Please note that **Chapter 3: Terminal Area and Support Facilities** will look at the apron, hangars and other facilities supporting the airport. These two chapters will address existing and future facility needs at Mobridge Municipal Airport (MBG).

As the chapter analyzes various components of the runway and taxiways at MBG, it will review current conditions and any deficiencies that do not meet FAA design standards. It will consider the future critical design aircraft and provide facility requirements to accommodate these aircraft through the planning period. The chapter will further present the alternatives that were considered to meet future needs and the preferred airfield alternative chosen. The chapter includes the following elements:

- [Critical Design Aircraft](#)
- [Meteorological Information](#)
- [Runways](#)
- [Taxiways](#)
- [Airfield Data Summary](#)
- [Alternatives](#)
- [Preferred Alternative](#)

Critical Design Aircraft

The critical design aircraft types must be identified to determine the appropriate airport design standards to incorporate into airport planning. As discussed in the previous chapter, the current and future critical design aircraft is a B-II aircraft which has a taxiway design group (TDG) 2A and greater than 12,500 pounds. This is based on Alpine Air operating the Beechcraft 1900. The existing/future critical design aircraft will be **ARC B-II TDG 2A**. The existing and future critical design aircraft characteristics at Mobridge Municipal Airport (MBG) are summarized in the following sections.

Table 2-1 – Airfield Design Aircraft Summary

Design Characteristics	Runway 12-30	Runway 17-35
Aircraft Make/Model	Beechcraft 1900C	Various
Airplane Approach Category	B	A/B
Airplane Design Group	II	I
Taxiway Design Group	2A	1A
Wingspan	58' 0"	<49'
Length	47' 10"	-
Height	15' 6"	-
Cockpit to Main Gear	23' 8"	<20'
Main Gear Width	18' 7"	<15'
Approach Speed (1.3 x Stall)	113 knots	90 knots
Maximum Takeoff Weight	16,600 pounds	12,500 pounds
Landing Gear Configuration	Dual Wheel	Single Wheel

Source: Beechcraft, KLJ Analysis

Meteorological Factors

Meteorological conditions that affect the facility requirements of an airport include but are not limited to wind direction, wind speed, cloud ceiling, visibility, and temperature. Hourly meteorological data was reviewed data from the MBG Automated Surface Observation System (ASOS) facility available from the National Climatic Data Center (NCDC). Periodic “special” weather observations within each hour were removed. This method provides considers the true average weather trends at an airport without skewing conditions toward IFR where multiple observations may be taken each hour due to changing conditions.

Wind coverage and weather conditions are evaluated based on the two different flight rules, VFR and IFR. Visual Meteorological Conditions (VMC) are encountered when the visibility is 3 nautical miles or greater, and the cloud ceiling height is 1,000 feet or greater. Conditions less than these weather minimums are considered Instrument Meteorological Conditions (IMC) requiring all flights to be op

Meteorological Facilities

Metrological facilities provide users with up-to-date weather information at the airport to aid in pilot decision making for safe flight operations.

Wind Indicator(s)

Wind direction indicators provide an immediate visual indication of the wind direction and velocity. A segmented circle provides a visual indication of the wind direction and velocity together with runway alignment and/or traffic pattern information.

The primary wind cone for the airport is located north of Runway 12-30 and west of Runway 17-35. There is no segmented circle. There are no supplemental wind cones.

Weather Reporting

There are two types of weather reporting systems on an airport. The Automated Surface Observing System (ASOS) program was a joint effort between the Federal Aviation Administration and the National Weather Service (NWS) to deploy a network of high-grade weather monitoring stations across the United States. ASOS serves as a primary climatological observing network in the United States and have equipment that provides weather observations every minute. A second-tier Automated Weather Observation System (AWOS) has varying sets of equipment packages to provide local weather observations. MBG has an ASOS maintained by the NWS.

Temperature

Average high temperature data for the hottest month was reviewed from climate data available from the NCDC for MBG. Using locally available data, the average high temperature in the hottest month from 1991-2020 was 87.4 degrees Fahrenheit reported in July. Temperature affects recommended runway lengths.

WIND COVERAGE

Prevailing winds are generally aligned with the airport's primary runway. Crosswind or tailwind conditions can be hazardous to aircraft operations if they exceed the operational capabilities of the airplane or flight crew. The smallest aircraft are typically the most affected operationally by crosswinds.



A runway's wind coverage is determined by an aircraft's ability to operate with a "direct" crosswind, which is defined as 90 degrees to the direction of travel. For planning purposes, FAA has defined the maximum direct crosswind for small aircraft as 12 miles per hour (10.5 knots). For increasingly larger aircraft, a 15-mile

per hour (13 knot) direct crosswind is used up through 23-mile per hour (20 knots) for the largest aircraft. Aircraft can operate safely in progressively higher wind speeds as the crosswind angle decreases and the wind direction aligns more closely with the direction of flight. In addition, some aircraft are designed to safely operate with higher crosswind components. Ideally, an aircraft will take off and land directly into the wind or with a light crosswind. The FAA recommends that primary runways accommodate at least 95 percent of local wind conditions; when this level of coverage is not provided, the FAA recommends development of a crosswind runway.

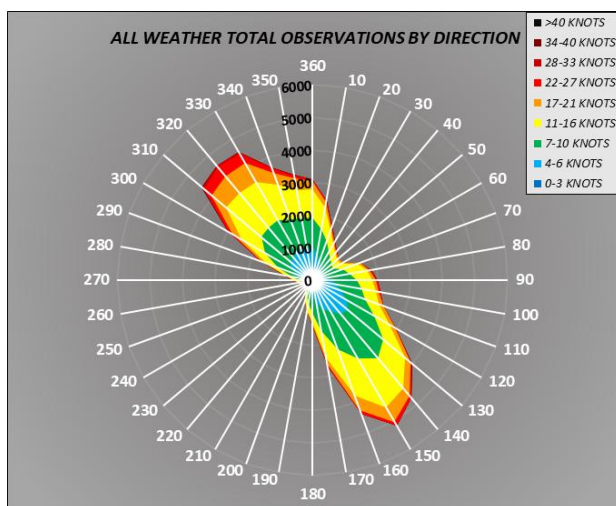


Table 2-3 – FAA Wind Coverage Standards

AAC-ADG	Maximum Crosswind Component
A-I & B-I	10.5 knots
A-II & B-II	13.0 knots
A-III, B-III & C/D I-III	16.0 knots

Source: FAA AC 150/5300-13B, Change 1

Runway 12-30 has 92.67% coverage in all-weather conditions for 10.5 knot winds and when combined with Runway 17-35, the airport has 98.32% coverage. **Table 2-4** provides the calculated all-weather wind coverage for the airport.

Table 2-4 – All-Weather Wind Coverage

Runway	Crosswind Component (Wind Speed)		
	10.5 knots	13.0 knots	16.0 knots
Runway 12-30	92.67%	96.90%	99.03%
Runway 17-35	88.29%	93.95%	
Combined*	98.32%	99.36%	99.03%

Source: KMBG ASOS (2013-2022) 86,117 Total Observations. *Combined assumes up to maximum design aircraft crosswind component for each runway.

Pilots can fly with visual reference to the ground and other aircraft during most weather conditions. This is known as Visual Meteorological Conditions (VMC). Pilots are required to reference flight instruments and be on a FAA Instrument Flight Rules (IFR) flight plan when the cloud ceiling is less than 1,000 feet above ground level (AGL) or the flight visibility is less than 3 statute miles. These conditions are known as Instrument Meteorological Conditions (IMC) and require a pilot to be instrument rated.

Wind coverage during VMC is evaluated to determine the ideal alignment for runways used during visual operations, such as VFR flight training. The coverage for Runway 12-30 alone is below 95% for 10.5 knots but when combined with Runway 17-35 there is 98.43% coverage with these winds. See **Table 2-5**.

Table 2-5 – VMC Wind Coverage

Runway	Crosswind Component (Wind Speed)		
	10.5 knots	13.0 knots	16.0 knots
Runway 12-30	93.18%	97.19%	99.19%
Runway 17-35	88.37%	94.04%	-
Combined*	98.43%	99.39%	99.19%

Source: KMBG ASOS (2013-2022) 80,544 Total Observations

*Combined assumes up to maximum design aircraft crosswind component for each runway

Crosswind Runway Requirements

For the crosswind runway, a minimum of 500 annual operations must occur by aircraft needing the crosswind runway to support FAA funding. The existing crosswind runway is only available during daytime visual conditions. During these times, there is a wind coverage for Runway 12-30 is less than 95 percent by 2.94 percent. This means that 2.94 percent of the time the design aircraft (FAA ARC A-I and B-I) requires a crosswind runway for the airport to achieve a minimum of 95 percent total wind coverage. **Aviation demand forecasts show that ARC A-I and B-I aircraft needing the crosswind runway MBG currently is below 500 annual operations.**

In accordance with AC 150/5300-13B, Appendix B paragraph B.2.3.2 if it is not possible for an airport to have a crosswind runway, an acceptable approach is to allow the primary runway to be wider and therefore allow small aircraft a wider tolerance to land on that wider runway. Smaller A/B-I aircraft like those intended to use the turf crosswind require a 60' wide paved runway. The primary runway 12-30 is 75' wide and therefore provides that wider tolerance and is partially addressing the need of a crosswind at MBG.

In regards to Instrument conditions, wind coverage during IMC is evaluated to determine the ideal alignment for instrument approach to an airport's runway. The existing wind coverage at MBG is below 95% as shown in **Table 2-6**.

Table 2-6 – IMC Wind Coverage

Runway	Crosswind Component (Wind Speed)		
	10.5 knots	13.0 knots	16.0 knots
Runway 12-30	85.23%	92.64%	96.82%
Runway 12 Only*	49.38%	51.84%	53.01%
Runway 30 Only*	43.60%	48.56%	51.57%

Source: KMBG ASOS (2013-2022) 5,573 Total Observations. *Includes 7.75% calm and crosswind conditions that can be accommodated with either runway end

Instrument Approach Conditions

Instrument approach procedures to a runway end are used by landing aircraft to navigate to the airport during instrument conditions when the cloud ceiling is less than 1,000 feet and/or visibility is less than 3 miles. Establishing approaches with the lowest possible weather minimums allow the airport to maximize its operational utility. Each approach type requires differing infrastructure and navigational aids. Types of approach procedures include non-precision approach (NPA), approach with vertical guidance (APV) and precision instrument approach (PA). See **Appendix B: General Aviation Airports – 101** for details on the requirements of different levels of instrument approach procedures. **Table 2-7** is a list of the major approach categories and associated capabilities.

Based on true hourly weather data summarized in **Table 2-8**, the airport experiences VMC weather conditions 93.53 percent of the time. When considering the current instrument approach weather minimums of 600-foot cloud ceiling and 1-mile flight visibility, the airport has weather conditions below this criterion roughly 8 days per year where the airport is not usable.

Table 2-7 – Instrument Approach Procedure Visibility Minimums

Typical Categories of Approaches					
Approach	Category	Vertical Guidance	Lowest Ceiling	Lowest Visibility	Ground Based Aids
Visual			1,000'	3 miles	
RNAV LNAV	NPA	No	250'	¾ mile	MIRL, VGSI*
RNAV LNAV/VNAV	APV	Yes	250'	¾ mile	MIRL, VGSI*
RNAV LPV**	APV	Yes	250'	¾ mile	MIRL, VGSI*
VOR	NPA	No	250'	¾ mile	VOR, MIRL, VGSI*
ILS CAT I	PA	Yes	200'	½ mile	GS, LOC, MIRL, MALSR
ILS CAT II	PA	Yes	100'	¼ mile	GS, LOC, HIRL, ALSF-1 or ALSF-2, TDZ/CL
ILS CAT III a	PA	Yes	0'	RVR 700'	GS, LOC, RVR, HIRL, ALSF, TDZ/CL
ILS CAT III b	PA	Yes	0'	RVR 600'	GS, LOC, RVR, HIRL, ALSF, TDZ/CL
ILS CAT III c	PA	Yes	0'	0'	GS, LOC, RVR, HIRL, ALSF, TDZ/CL

Source: KLJ Analysis; * Recommended; ** Often the best RNAV minimums but requires aircraft equipped with WAAS receiver

Table 2-8 – Meteorological Analysis

Weather Condition	Percentage			Days Per Year	Hours Per Year
VMC	93.53%			341.4	8,193
Usable IMC - 1 Mile Visibility 557-foot Ceiling Runway 12 292-foot Ceiling Runway 30	4.29%			15.7	376
Existing Usability	97.82%			357.1	8,569
Additional Capture with IMC Improvements	Rwy 12	Wind Calm	Rwy 30		
1 Mile Visibility 300-foot Ceiling Runway 12 292-foot Ceiling Runway 30 Parallel Taxiway Required	0.66%	0.00%	0.00%	2.4	58
$\frac{3}{4}$ Mile Visibility 300-foot Ceiling Runway 12 292-foot Ceiling Runway 30 Parallel Taxiway Required	0.11%	0.01%	0.17%	1.0	24
Below Weather Minimums	2.18%			7.9	191
Total	100.00%			365.0	8,760

Source: KMBG ASOS (2013-2022) 86,117 Total Observations

Two IAPs (see **Table 2-9**) are available for Runways 12 and 30 with satellite-based NAVAIDS. Instrument approach weather minimums are a result of the approach type, airport infrastructure, and any prevailing airspace obstructions. Coordination with FAA Flight Procedures is recommended to review the feasibility of implementing any improvements to approach procedures. The full copy of the Approach Plates are in **Appendix B: General Aviation Airports 101**.

Table 2-9 – Instrument Approach Procedures

Approach Procedure	Approach Type		Lowest Cloud Ceiling Minimum (HAT)	Lowest Visibility Minimum (n.m.)
RNAV (GPS) RWY 12 (N/A at Night)	Non-Precision	LPV	-	-
		LNAV/VNAV	-	-
		LNAV	557 feet	1 mile
		Circling	645 feet	1 mile
RNAV (GPS) RWY 30	Non-Precision	LPV	349 feet	1 mile
		LNAV/VNAV	292 feet	1 1/8 mile
		LNAV	699 feet	1 mile
		Circling	684 feet	1 mile

Source: Airnav

Note: HAT = Height Above Touchdown, n.m. = nautical miles (reported), LPV = Localizer Performance with Vertical Guidance, LNAV = Lateral Navigation, VNAV = Vertical Navigation

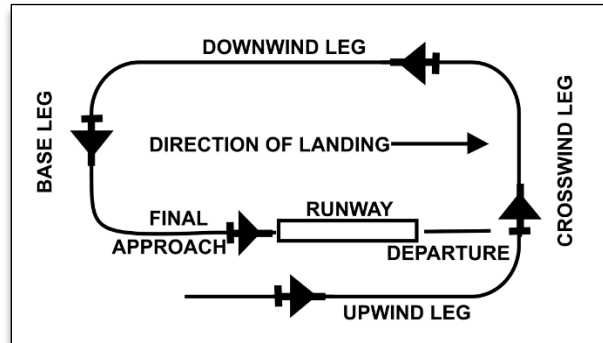
Aeronautical survey data collected as part of this master planning study will provide obstacle data which will be used to improve any deficiencies related to the instrument approach procedures at MBG.

Approach/Departure Procedures

Aircraft operate under either Visual Flight Rules (VFR) or Instrument Flight Rules (IFR) depending on weather conditions and/or operational standards.

Visual Approach/Departure Procedures

Under VFR, pilots are advised to utilize a standard rectangular traffic pattern around the runway to approach or depart an airport. Standard traffic pattern legs include upwind, crosswind, downwind, base, and final. Departures are typically straight-out from a departing runway, a 90-degree crosswind, or 180 degree downwind. Arrivals typically enter a traffic pattern 45 degrees to a downwind leg for landing.



Standard VFR Airport Traffic Pattern (Source: FAA)

IFR/Obstacle Departure Procedures

Special procedures are published at airports to provide aircraft with adequate obstacle clearance. Examples include increased aircraft climb rates or recommended turns. The information below describes the current departure procedures for MBG.

MOBRIDGE, SD

MOBRIDGE MUNI(MBG)

TAKEOFF MINIMUMS AND (OBSTACLE) DEPARTURE PROCEDURES

AMDT 1 30JUN11 (11181) (FAA)

TAKEOFF MINIMUMS:

Rwys 17, 35, NA-Environmental

DEPARTURE PROCEDURE:

Rwy 12, climb heading 118° to 2600 before turning left.

TAKEOFF OBSTACLE NOTES:

Rwy 12, tower 2587' from DER, 651' right of centerline, 40' AGL/ 1810' MSL.

Pole 3567' from DER, 12' right of centerline, 11' AGL/ 1790' MSL.

Tree 1495' from DER, 230' right of centerline, 29' AGL/ 1738' MSL.

Trees and poles beginning 1698' from DER, 160' left of centerline, up to 75' AGL/ 1811' MSL.

Terrain and road beginning 153' from DER, 307' left of centerline, up to 17' AGL/1749' MSL.

Rwy 30, terrain and road beginning 36' from DER, left to right across centerline, up to 17' AGL/1710' MSL.

RUNWAY APPROACH/DEPARTURE SURFACES

FAA identifies sloping approach surfaces that must be cleared at an absolute minimum for safety for landing aircraft. These surfaces are identified in paragraph 3.6 of [FAA AC 150/5300-13B, Change 1](#) and can be found in **Appendix B: General Aviation Airports 101**.

The departure surface applies to runways with instrument departures available. It begins at the end of the takeoff distance available and extends upward and outward at a 40:1 slope. No new penetrations are allowed unless an FAA study has been completed and a determination of no hazard has been issued.

The applicable approach/departure surface standards are identified in **Table 2-10**.

Table 2-10 – Approach/Departure Surface Requirements

Runway End(s)	Par. 3.6 Surface	Description	Slope
Existing & Ultimate			
17, 35	2	Approach end of runways expected to serve small airplanes with approach speeds of 50 knots or more	20:1
12, 30	5	Approaches supporting instrument operations with a localizer type direction aid with glidepath	20:1
12, 30	6	Approach end of runways to accommodate approaches with vertical guidance	30:1
12, 30	7	Departure runway ends for all instrument operations	40:1

Source: FAA AC 150/5300-13B Change 1, KLJ Analysis

Runways 12 and 30 are available for instrument departures. There are penetrations to the existing Runway 12 and 30 instrument departure surfaces that are noted in FAA publications (see information noted above). All existing AC 150/5300-13B approach surfaces are clear of obstructions.

Figure 2-1 – Airfield Facilities Map



Runways

MBG has two (2) runways. Runway 12-30 is the airport's primary runway and currently serves in all weather conditions. Runway 17-35 is a crosswind turf runway available in daytime VFR conditions except for any snow or wet conditions.

Table 2-11 – Runway Facility Summary

Component	Runway 12-30	Runway 17-35
Runway Length (feet)	4,410	2,399
Runway Width (feet)	75	250
Runway Surface Material	Bituminous	Turf
Runway Surface Treatment	None	None
Pavement Strength	15,000 SW	N/A
Runway Design Code	A/B-II-5000	A/B-I-Visual
Runway Safety Area	150' Wide	120' Wide
Object Free Area	500' Wide	250' Wide
Object Free Zone	400' Wide	250' Wide
Runway Protection Zone	500' x 700' x 1000'	250' x 450' x 1000'

Source: Aeronav, AC 150-5300-13B Chane 1

Runway Design Codes

The Runway Design Code (RDC) is a code that provides the design standards for the specific runway based on design aircraft and instrument approach minimums. Further information about Runway Design Codes can be found in **Appendix B: General Aviation Airports 101**.

Runway 12-30: The existing RDC is A/B-II-5000 for both runway ends.

Runway 17-35: The existing RDC is A/B-I (Small)-VIS for both runway ends.

Runway Reference Codes

Runway Reference Codes (RRCs) indicate current operational capabilities where no special operations procedures are necessary, and without consideration of the actual runway length. The existing operational capabilities of the runway are derived based on a taxiway separation distance.

Runway 12-30 and 17-35: Neither of these runways have parallel taxiways and therefore the runways do not have either approach reference codes or departure reference codes. **If a parallel taxiway were to be constructed for Runway 12-30 the approach reference code (APRC) will be B/II/4000 for a runway centerline to taxiway centerline separation of at least 240 feet. The departure reference code (DPRC) will be B/II.**

Design Standards

Basic Safety Standards

One primary purpose of this master plan is to review and achieve compliance with all FAA safety and design standards. The design standards vary based on the RDC and RRC as established by the design aircraft. Some of the safety standards include:

- Runway Safety Area (RSA)
- Runway Object Free Area (ROFA)
- Runway Obstacle Free Zone (ROFZ)

Other basic design standards include runway width, runway surface gradient, runway shoulder width, blast pad, and required separation distances to markings, objects, and other infrastructure for safety. Critical areas associated with navigational aids as well as airspace requirements are described further in this chapter.

The existing RSA, ROFA and ROFZ standards for all runways meet existing airport design standards. Any improvements needed will be identified in ultimate configuration. The basic safety standards dimensional requirements for all runways are summarized in **Table 2-12**.

Table 2-12 – Runway Safety Design Standards

Standard	Runway 12-30	Runway 17-35
Runway Safety Area (RSA)	5,010' x 150'	2,879' x 120'
Runway Object Free Area (ROFA)	5,010' x 500'	2,879' x 250'
Runway Obstacle Free Zone (ROFZ)	4,810' x 400'	2,799' x 250'

Source: KLJ Analysis

Runway Protection Zone

The Runway Protection Zone (RPZ) is a trapezoidal land use area at ground level prior to the landing threshold or beyond the runway end. The RPZ's function is to enhance the protection of people and property on the ground. The RPZ size varies based on the runway's RDC. The RPZ is further broken down to Approach RPZ and Departure RPZ.

Airport owners should, at a minimum, maintain the RPZ clear of all facilities supporting incompatible activities, such as residential structures. It is desirable to clear all above-ground objects from the RPZ. Protection of the RPZ is achieved through airport control over RPZs including fee title ownership or clear zone easement.

The land uses in the existing RPZs are acceptable except for one residence that is on the outer edge of the Runway 30 RPZ. **It is recommended in the future for the City of Mobridge to obtain control of the residence to clear the Runway 30 End RPZ.** Further review is required if new land uses, runway end locations, or a change in the size of the RPZ is proposed and a land use requiring FAA coordination is in the RPZ.

Runway Visibility Zone (RVZ)

The airport has intersecting runways therefore a RVZ exists to prevent obstructions from blocking a pilots view and keep a clear Line of Sight (LOS). Currently, there are two of the tiedowns that when an aircraft above three feet high are parked, creates an obstruction to the LOS. Also, if crops west of

runway 17-35 are taller than five feet are also an obstruction. **It is recommended the tiedowns be moved and crops be maintained below five feet within the RVZ.**

Runway Length & Width

Runway width is driven by the RDC and approach visibility minimums for each runway as identified in FAA AC 150/5300-13B.

As of the date this Master Plan study was initiated, [FAA AC 150/5325-4B, Runway Length Requirements for Airport Design](#) was the current guidance for determining runway lengths at airports. A new guidance from the Airport Cooperative Research Program (ACRP) was the Small Aircraft Runway Length Analysis Tool (SARLAT). A detailed analysis using these two methods including FAA runway length charts and aircraft performance data is in **Appendix D: Runway Length Evaluation**.

Small Airplanes Up to 12,500 Pounds

The FAA design approach to determine recommended runway length in small aircraft is identified in Chapter 2 of [FAA AC 150/5325-4B](#). The method requires several steps to be performed including identifying percentage of fleet and using airport data to calculate runway length based on curves. Calculations for MBG are identified in **Table 2-13**.

Table 2-13 – FAA AC 150/5345-4B Runway Length Requirements

Airport and Runway Data	
Airport Elevation	1,716 feet
Mean Daily Maximum Temperature of Hottest Month	87.4°F
Aircraft Classification	Recommended Runway Length
Small Airplanes 12,500 Pounds or less	
10 or more passenger seats	4,410 feet
Less than 10 passenger seats at 100 percent of fleet	4,280 feet
Less than 10 passenger seats at 95 percent of fleet	3,700 feet
Other Notable Aircraft	
Cessna Citation XL	4,900 feet
Beechcraft 1900D	3,900 feet
Pilatus PC-12	3,400 feet
Beechcraft King Air 200	2,300 feet

Source: [FAA AC 150/5325-4B](#), KLI Analysis

Note: Runway length requirements estimated based on charts for airport planning purposes only.

For small general aviation aircraft, the FAA runway length requirements of 10 or more passenger seats would apply at MBG due to its current and forecasted critical aircraft. **The recommended runway length for small general aviation aircraft is 4,410 feet.** This matches the existing runway length for Runway 12-30.

Crosswind Runway

FAA recommends secondary “crosswind” runways have a length capable of accommodating the lower crosswind capable aircraft expected to use this runway. The length of a runway must now be justified to accommodate the aircraft that requires its use.

At MBG, Runway 17-35 is needed to provide adequate 95 percent wind coverage for ARC A/B-I aircraft under a 13-knot crosswind component. FAA states the crosswind runway length shall be 100 percent of the recommended runway length for the lower crosswind capable airplanes using the primary runway.

The FAA recommended runway length is 1,800 feet. This is based on a Cessna 185 Skywagon that commonly use turf runways.

Pavement Condition/Strength

Airfield pavements should be adequately maintained, rehabilitated and reconstructed to meet the operational needs of the airport. The published pavement strength is based on the construction materials, thickness, aircraft weight, gear configuration and operational frequency for the pavement to perform over its useful life.

At MBG, the current surface treatment for Runway 12-30 is asphalt with a single wheel weight bearing capacity of 15,000 pounds single wheel according to the airport master record. In 2018, the runway was reconstructed as part of the Capital Improvement Plan and according to the 2024 Pavement Condition Index (PCI) study, airfield pavements were in good condition.

The FAA standard for measuring the reporting pavement strength on runways with pavement strengths greater than 12,500 pounds is defined in [FAA AC 150/5335-5D, Standard Method of Reporting Airport Pavement Strength - PCR](#). The Aircraft Classification Rating – Pavement Classification Rating (ACR-PCR) method is defined within this guidance. The PCR values measures the cumulative damage resulting from an aircraft fleet mix. In general, the PCR value should equal or exceed the ACR value assigned for the design aircraft. Larger aircraft could occasionally exceed the pavement strength but not on a regular basis. The PCR for Runway 12-30 is 99 which is a good condition.

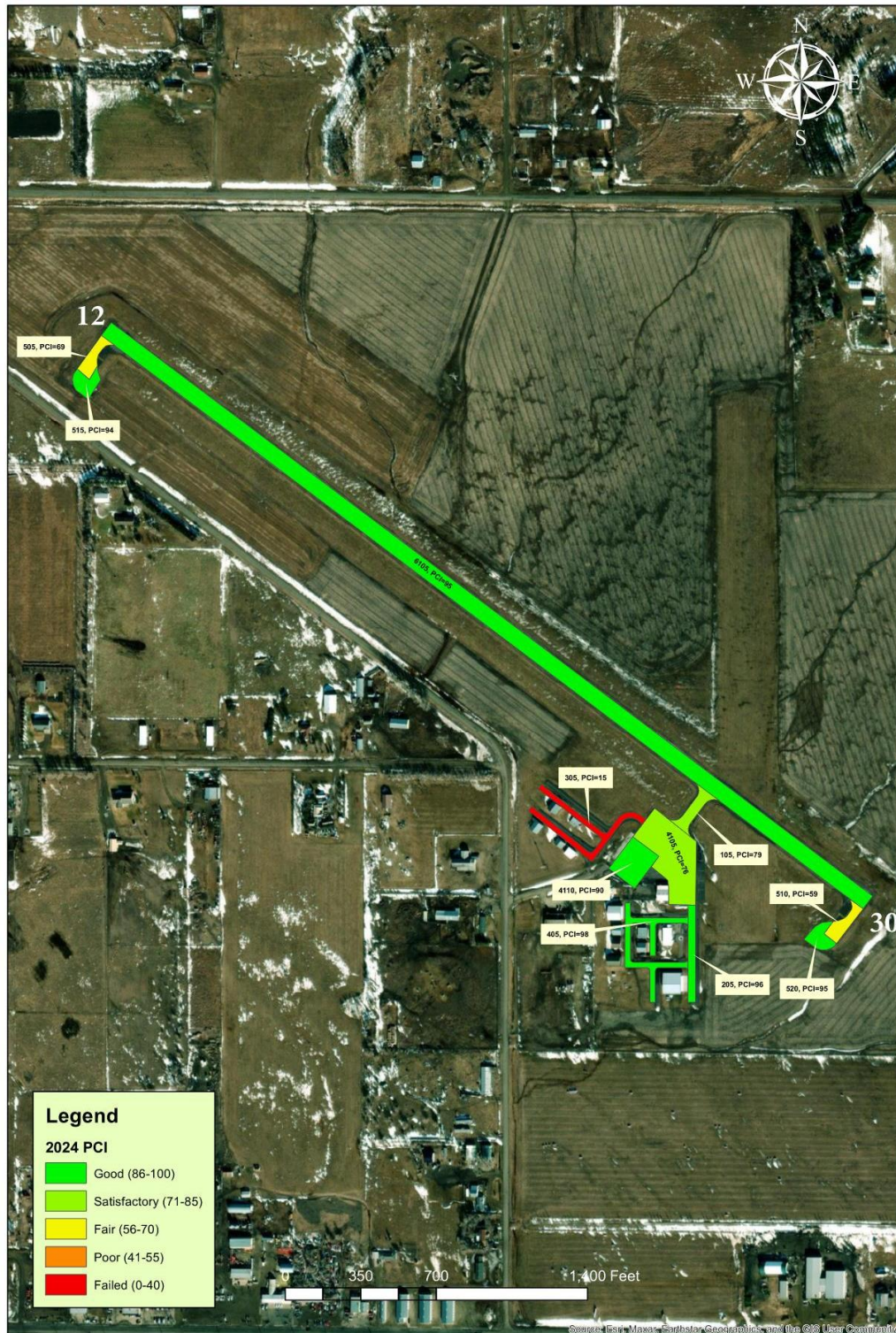
Runway Designation

Runway designation is determined by the magnetic bearing (azimuth) of the runway centerline which is relative to the location of the magnetic north pole. The runway designator number is the whole number nearest the one-tenth of the magnetic azimuth along the runway centerline.

The 2024 magnetic declination at MBG is 5° 14' east, changing 0° 4' west per year as the location of the magnetic north pole moves over time. **No changes are needed in the runway designations** through the planning period. The official FAA published magnetic declination is 9° east from 1990.

Figure 2-2 – 2024 Pavement Condition Index

Mobridge Municipal Airport (MBG) 2024 Pavement Condition Index (PCI) Study



Source: SD DOT Office of Aeronautics

Visual Navigation Aids

Visual aids are installed to provide airport usability during periods of darkness and/or low visibility. Pavement markings and lighting systems available at the airport are summarized in the following sections.

Airport Beacon

The airport beacon serves as the airport identification light so approaching pilots can identify the airport location from sunset to sunrise. The airport beacon's location at MBG adequately serves the airport without known obstructions to its line of sight.

Runway Lighting

Runway edge lights are placed off the edge of the runway surface to help pilots define the edges and end of the runway during night and low visibility conditions.

Runway 12-30 is equipped with Medium Intensity Runway Lighting (MIRL). The lighting was last replaced in 2018 and is currently in good working condition.

Runway 17-35 has no lighting. It only has white marker cones.

It is recommended the airport maintain good working condition for the runway lighting.

Pilot-Controlled Lighting

Airfield lighting systems allow for pilots to control the complexity and intensity of lights.

The MIRLs for Runway 12-30 can be activated by pilots using the common traffic advisory frequency.

Visual Approach Slope Lighting

Visual approach slope lighting provides vertical descent guidance to pilots for a specific runway end. These approach aids enable the pilot to acquire and maintain the correct glide path for landing. Precision Approach Path Indicator Lights (PAPI) are the current FAA standard equipment installed for this purpose, however other types of equipment exist, including visual approach slope indicator lights (VASI).

Both PAPI and VASI function similarly. They both have red and white lights that are used by the pilot to indicate whether they are too high, too low, or on the appropriate glidepath. Precision approach path indicators project light along a standard glide path to a runway end, with red and white colored lights indicating the aircraft's vertical position (above, below, or on glide path) relative to the defined glide path. Visual approach slope indicators project a beam of light having a white segment in the upper part of the beam and red segment in the lower part of the beam.

Mobridge has two box PAPIs on both ends of Runway 12-30. The PAPIs are set at a 3.00-degree angle for each runway end. The airport should continue to maintain the PAPI lighting in good condition.

Airfield Guidance Signs

Guidance signs provide location, direction, and guidance information to pilots on the ground to enhance awareness. Signs are placed around the airfield to identify runway and taxiway intersections, runway hold positions and other guidance. Mandatory signs are red and identify an intersection with a runway or critical safety zone. Other types of signs include location, direction, destination, and distance remaining signs.

MBG has mandatory and location signage on the airfield. All types of signage are lighted and marked in accordance with [FAA AC 150/5340-18F, Standards for Airport Sign Systems](#).

Pavement Markings

Pavement markings help airport users visually identify important features on the airfield. FAA has defined numerous different pavement markings to promote safety and situational awareness as defined by [FAA AC 150/5340-1, Standards for Airport Markings](#).

The minimum required runway markings for a standard runway are as follows:

- Visual (landing designator, centerline)
- Non-Precision (landing designator, centerline, threshold)
- Precision (landing designator, centerline, threshold, aiming point, touchdown zone, edge)

Runway 12-30 is marked with non-precision runway markings which include a landing designator, centerline, threshold markings, and aiming point.

Taxiways

Taxiways provide for the safe and efficient movement of aircraft between the runway and other operational areas of the airport. The taxiway system should provide critical links to airside infrastructure, increase capacity and reduce the risk of an incursion with traffic on the runway. The taxiway system should meet the standards design requirements identified in FAA AC 150/5300-13B.

FAA identifies the design requirements for taxiways. The design standards vary based on individual aircraft geometric and landing gear characteristics. The Taxiway Design Group (TDG) and Airplane Design Group (ADG) identified for the design aircraft using a particular taxiway. Some of the safety standards include:

- Taxiway Width
- Taxiway/Taxilane Safety Area (TSA)
- Taxiway Edge Safety Margin (TESM)
- Taxiway/Taxilane Object Free Area (TOFA)

Other design standards include taxiway shoulder width to prevent jet blast soil erosion or debris ingestion for jet engines and required separation distances to other taxiways/taxilanes. More information can be found in **Appendix B: General Aviation Airports 101**.

For MBG, the taxiway system consists of a paved 35 feet wide taxiway that connects the terminal apron to Runway 12-30 just south of the Runway 30 aiming point. Additionally, each runway end has a taxiway turnaround.

System Design

FAA has placed a renewed emphasis on taxiway design in their updated airport design standards. Fundamental elements help develop an efficient system to meet demands, reduce pilot confusion and enhance safety. Considerations include:

-
- Design taxiways to meet FAA design standards for existing and future users considering expandability of airport facilities.
 - Design taxiway intersections so the cockpit is over the centerline with a sufficient taxiway edge safety margin.
 - Simplify taxiway intersections to reduce pilot confusion using the three-node concept, where a pilot has no more than three choices at an intersection.
 - Eliminate “hot spots” identified by the FAA Runway Safety Action Team where enhanced pilot awareness is encouraged.
 - Minimize the number of runway crossings and avoid direct access from the apron to the runway.
 - Eliminate aligned taxiways whose centerline coincides with a runway centerline.
 - Other considerations include avoiding wide expanses of pavement and avoiding “high energy intersections” near the middle third of a runway.
 - The main taxiway provides “direct access” from the apron to the runway environment.
- Ultimately, direct access taxiways should be reconfigured to require a turn from the apron onto the parallel taxiway before entering the runway. The airport should plan for the addition of a parallel taxiway meeting design requirements of a TDG-2A aircraft.**

PAVEMENT CONDITION

Taxiway pavements were rehabilitated in 2018 and according to the 2024 PCI study, all taxiway pavements are in good condition except for the runway end turnarounds. Both turnarounds have part of the pavement with a PCI of 59-69 which is fair. Reference **Figure 2-2** for more details.

TAXIWAY LIGHTING

Taxiway edge lighting delineates the taxiway and apron edges. The taxiway connecting the terminal apron to the runway features medium intensity taxiway lighting (MITL) while the taxiway turn arounds are marked with reflectors. **It is recommended the airport continue to maintain the MITL system on the airfield and include MITL when a parallel taxiway is constructed.**

PAVEMENT MARKINGS

Taxiway and taxilane markings are important for directional guidance for taxiing aircraft and ground vehicles. Taxiways at MBG include centerline markings and painted holding position markings to prevent aircraft from entering critical areas such as an active runway environment.

Airside Data Summary

The following **Tables 2-14** and **2-15** provide summary data of the facility requirements and recommendations associated with Runways 12-30 and 17-35 at MBG through the planning periods in this study.

Table 2-14 - Runway 12-30 Design Standard Matrix

Design Standard	Actual Conditions	Facility Requirement	
		Existing	Future
Runway Identification	12-30	12-30	12-30
Runway Classification	Other-Than-Utility	Other-Than-Utility	Other-Than-Utility
Aircraft Classification	Large Aircraft	Large Aircraft	Large Aircraft
Runway Design Code (RDC)	B-II-5000	B-II-5000	B-II-5000
Approach Reference Code (APRC)	N/A	B-II-5000	B-II-5000
Departure Reference Code (DPRC)	N/A	B-II	B-II
Pavement Strength (Wheel Loading)	15,000 (SW)	16,600 (DW)	16,600 (DW)
Line of Sight Requirements Met	No	Yes	Yes
Runway Length	4,410'	4,410'	4,410'
Runway Width	75'	75'	75'
Displaced Threshold	0'	0'	0'
Runway Safety Area (RSA) Width	150''	150'	150'
RSA Length Past Departure End	300	300'	300'
RSA Length Prior to Threshold	300'	300'	300'
Runway Lighting Type	MIRL	MIRL	MIRL
Approach RPZ Start from Runway	County Road (12) Residence (30)	200'	200'
Approach RPZ Length		1,000'	1,000'
Approach RPZ Inner Width		500'	500'
Approach RPZ Outer Width		700'	700'
Runway Marking Type	Non-precision	Non-precision	Non-precision
Part 77 Approach Category	34:1	34:1	34:1
Approach Type	NPI	NPI	NPI
Visibility Minimums	1 mile	1 mile	1 mile
Runway Departure Surface	Yes	Yes	Yes
ROFA Width	500'	500'	500'
ROFA Length Past Departure End	300'	300'	300'
ROFA Length Prior to Threshold	300'	300'	300'
ROFZ Length Past Runway	200'	200'	200'
ROFZ Width	400'	400'	400'
13B Paragraph 3.6 Approach Surface	5 (Both)	5 (Both)	5 (Both)
Start from Runway End	200'	200'	200'
Length	10,000'	10,000'	10,000'
Inner Width	400'	400'	400'
Outer Width	3,400'	3,400'	3,400'
Slope	20:1	20:1	20:1
Runway and Taxiway Separation	N/A	240'	240'
Runway and Parking Separation	255'	250'	250'
Runway and Hold Line Separation	200'	200'	200'

Note: **RED** indicates a known deficiency to existing minimum design standards

Source: FAA AC 150/5300-13B Change 1, KLJ Analysis

Table 2-15 - Runway 17-35 Design Standard Matrix

Design Standard	Actual Conditions	Facility Requirement
		Existing/Future
Runway Identification	17-35	17-35
Runway Classification	Utility	Utility
Aircraft Classification	Small Aircraft	Small Aircraft
Runway Design Code (RDC)	A/B-I-Visual	A/B-I-Visual
Approach Reference Code (APRC)	N/A	N/A
Departure Reference Code (DPRC)	N/A	N/A
Pavement Surface Type	Turf	Turf
Line of Sight Requirements Met	No	Yes
Runway Length	2,387'	2,387'
Runway Width	250'	120'
Runway Safety Area (RSA) Width	120''	120'
RSA Length Past Departure End	240	240'
RSA Length Prior to Threshold	240'	240'
Runway Lighting Type	N/A	N/A
Approach RPZ Start from Runway	County Road (17)	200'
Approach RPZ Length		1,000'
Approach RPZ Inner Width		250'
Approach RPZ Outer Width		450'
Runway Markings	Cones	Cones
Part 77 Approach Slope	20:1	20:1
Part 77 Approach Type	Visual	Visual
ROFA Width	250'	250'
ROFA Length Past Departure End	240'	240'
ROFA Length Prior to Threshold	240'	240'
ROFZ Length Past Runway	200'	200'
ROFZ Width	250'	250'
13B Paragraph 3.6 Approach Surface	2	2
Start from Runway End	0'	0'
Length	5,000'	5,000'
Inner Width	250'	250'
Outer Width	700'	700'
Slope	20:1	34:1
Runway and Taxiway Separation	N/A	150'
Runway and Parking Separation	200'	125'
Runway and Hold Line Separation	150'	150'

Note: **RED** indicates a known deficiency to existing minimum design standards

Source: FAA AC 150/5300-13B Change 1, KLJ Analysis

Airfield Summary

This section identifies safety, capacity and development needs for the Mobridge Municipal Airport based on forecasted activity levels. These recommendations provide the basis for formulating development alternatives to adequately address recommended improvements. The following summarizes the facility deficiencies and recommendations:

- **Primary Runway:** Runway 12 approach has a 557-foot ceiling and Runway 30 approach has a 292-foot ceiling, both with a 1-mile visibility. It is recommended to reduce the Runway 12 approach to a 300-foot ceiling and maintain both runway approaches to 1 mile visibility.
- **Turf Runway:** There are currently less than 500 annual operations for the turf runway. The continuation of the Turf Runway should be considered in alternative analysis.
- **Runway Protection Zone (RPZ) Control:** There is currently a house within the Runway 30 End RPZ. The City of Mobridge should acquire the residential property at the first opportunity.
- **Runway Visibility Zone (RVZ) Penetrations:** Planes on two apron tiedowns and crops over five feet high block a pilots line of sight (LOS). All objects need to be removed and crops need to be cut.
- **Direct Access to the Runway:** The current connecting taxiway to the runway from the apron area needs to have a 90-degree turn before accessing the runway. This should be corrected by configuring the apron area or constructing a parallel taxiway to create a turn before runway access.
- **Obstructions:** There are two AC 5300-13B approach penetrations, one off Runway 12 and the other off Runway 17. There are more than a dozen obstacles in the Part 77 surface for Runway 12 and Runway 30. It is recommended to analyze each penetration and obstacle and determine a possible removal plan.

Any existing deficiencies to airport design standards would need to be noted in the ALP and a Modification to Design Standards requested from FAA if they are to remain.

Alternatives

A wide range of alternatives are evaluated to determine the best solution for the airport to meet facility needs. In many cases the process is iterative to react to new information and input. Please refer to the alternative analysis process in **Chapter 1** for details on the factors considered.

A range of alternatives were prepared for consideration, and those initial alternatives were reviewed by the Planning Advisory Committee to create a narrower slate of alternatives for further review. In the end a preferred alternative was selected and portrayed at the end of this chapter.

Primary Runway approaches

The current Runway 12 approach does not have sufficient obstruction height information resulting in a 557-foot ceiling. Both Runway approaches have a 1-mile visibility. The Runway 12 approach is not available at night currently due to the lack of obstruction height information.

No Change: Keep runway approaches the same.

Advantages:

- No new capital improvement costs
- Runway 12 night operations will be restored with Aeronautical Survey data from this project

Disadvantages:

- Runway 12 continues with higher minimums

Option 1 – Reduce 12 Ceiling to 300 Feet: Lower the ceiling for Runway 12 approach to 300 feet with both runway ends with a 1-mile visibility.

Advantages:

- Increases airport usage by 0.66%
- Additional accessibility, especially for medical operations

Disadvantages:

- None

Option 2 – Reduce 12 Ceiling and Runway Visibility: Lower the ceiling for Runway 12 approach to 300 feet and both runway ends reduced to a ¾ mile visibility.

Advantages:

- Increases airport usage by 0.95% (0.29% more than Option 1)
- Additional accessibility, especially for medical operations

Disadvantages:

- Requires a parallel taxiway
- Need to acquire additional land or easements for larger RPZs on both runway ends. (additional 22 acres for Runway 12 and additional 26 acres for Runway 30) including 2 more residences

See **Table 2-8 – Meteorological Analysis** earlier in the chapter for alternative improvements.

Turf Runway alternatives

The current turf runway has less than 500 annual operations which would make it difficult to receive federal funding if the runway needed to be constructed today. The airport does however have the runway and ownership of applicable safety surfaces so there is little difficulty in order to maintain the turf runway. There were discussions about the actual need for the Turf Runway. Some users stated the Turf Runway is preferred for the type of aircraft or the wind directions. Others stated it is hardly used. There is no forecasted growth for use of the Turf Runway.

No Change: Keep the current Turf Runway as is.

Advantages:

- No new capital improvement costs

Disadvantages:

- Limits apron development only to the northwest
- Required to remove 3 existing aircraft tiedowns in RVZ

Option 1 - Remove Turf Runway: Remove the current turf runway and do not plan for another turf runway.

Advantages:

- No RVZ issues
- Ability to expand apron to the southeast or northwest

Disadvantages:

- The single primary runway would not meet the 95% wind coverage

Option 2 – Parallel Turf Runway, 300 Feet: Create a 2,400 foot long by 100-foot-wide turf runway parallel to Runway 12-30 with a 300 feet centerline separation.

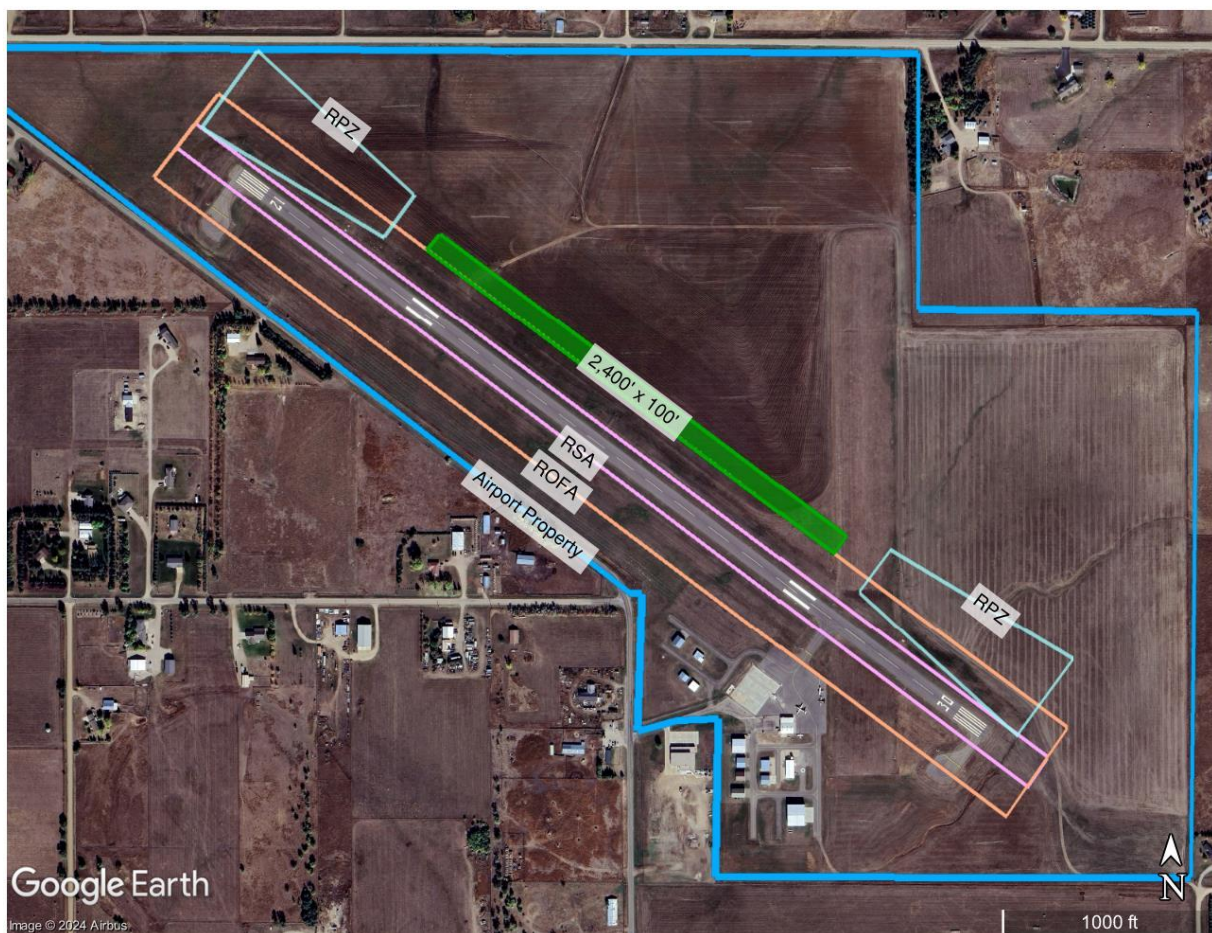
Advantages:

- Provides Turf Runway for users that utilize turf
- Both RPZs are within current airport property
- Apron can be expanded to the northwest and southeast
- No RVZ issues

Disadvantages

- No crosswind advantage with parallel Turf Runway

Figure 2-3 – Parallel Taxiway Option 2



Option 3 – Parallel Turf Runway, Within the RSA: Construct a 2,400 foot long by 100-foot-wide turf runway parallel to Runway 12-30 and within the runway safety area (RSA) which is 120-foot centerline separation.

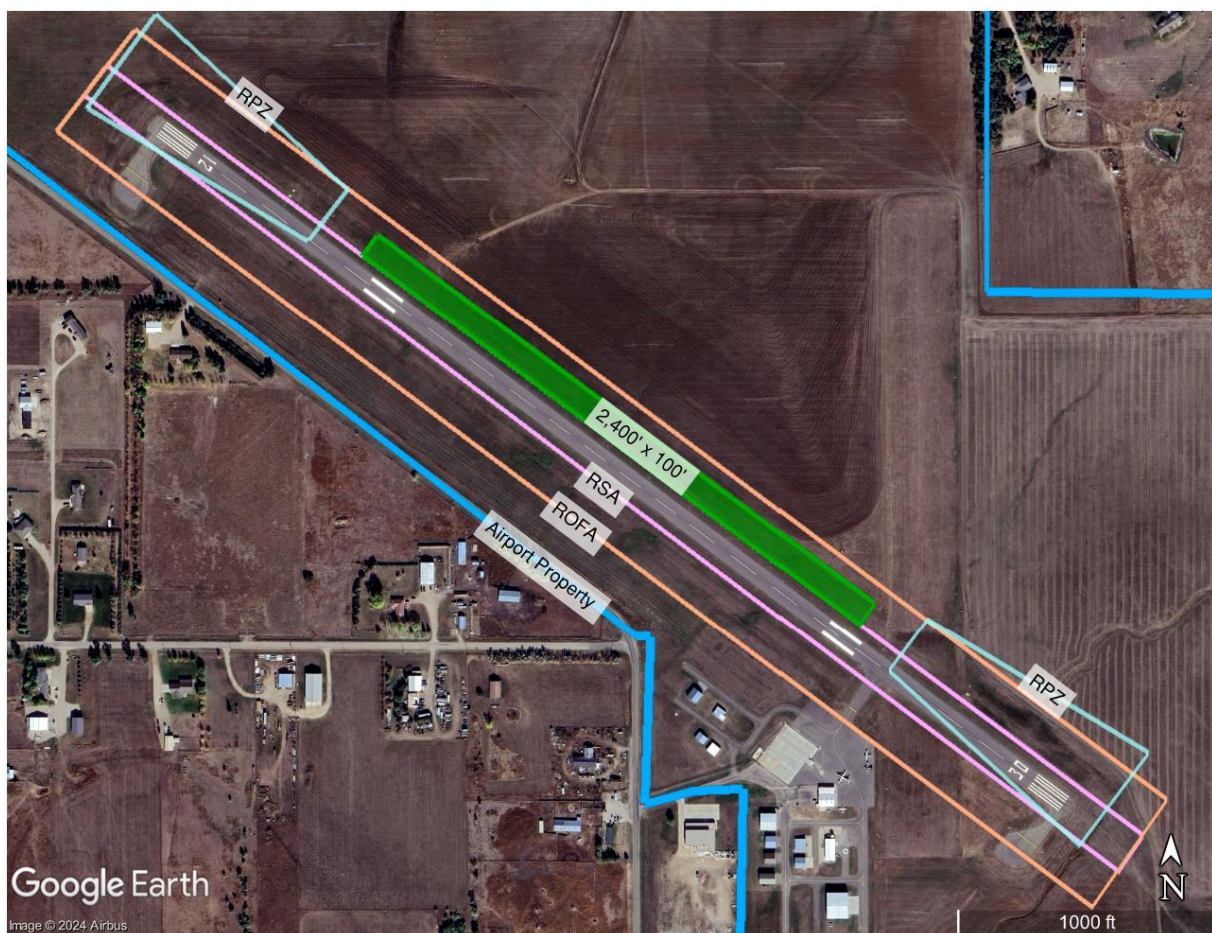
Advantages:

- Provides Turf Runway for users that utilize turf
- RPZ are within current airport property

Disadvantages:

- Only one runway could be used at a time
- No crosswind advantage with a parallel Turf Runway

Figure 2-4 - Parallel Taxiway Option 3



Parallel Taxiway

Currently the runway has turnarounds at both ends causing aircraft to back taxi on the active runway. It has also been stated that the turnarounds are hard to navigate during winter months for larger aircraft. Having a parallel taxiway would eliminate back taxiing and the need for a tight turn around.

Option 1 – 240-foot Separation: Standard taxiway to runway centerline separation for design group B-II is 240 feet.

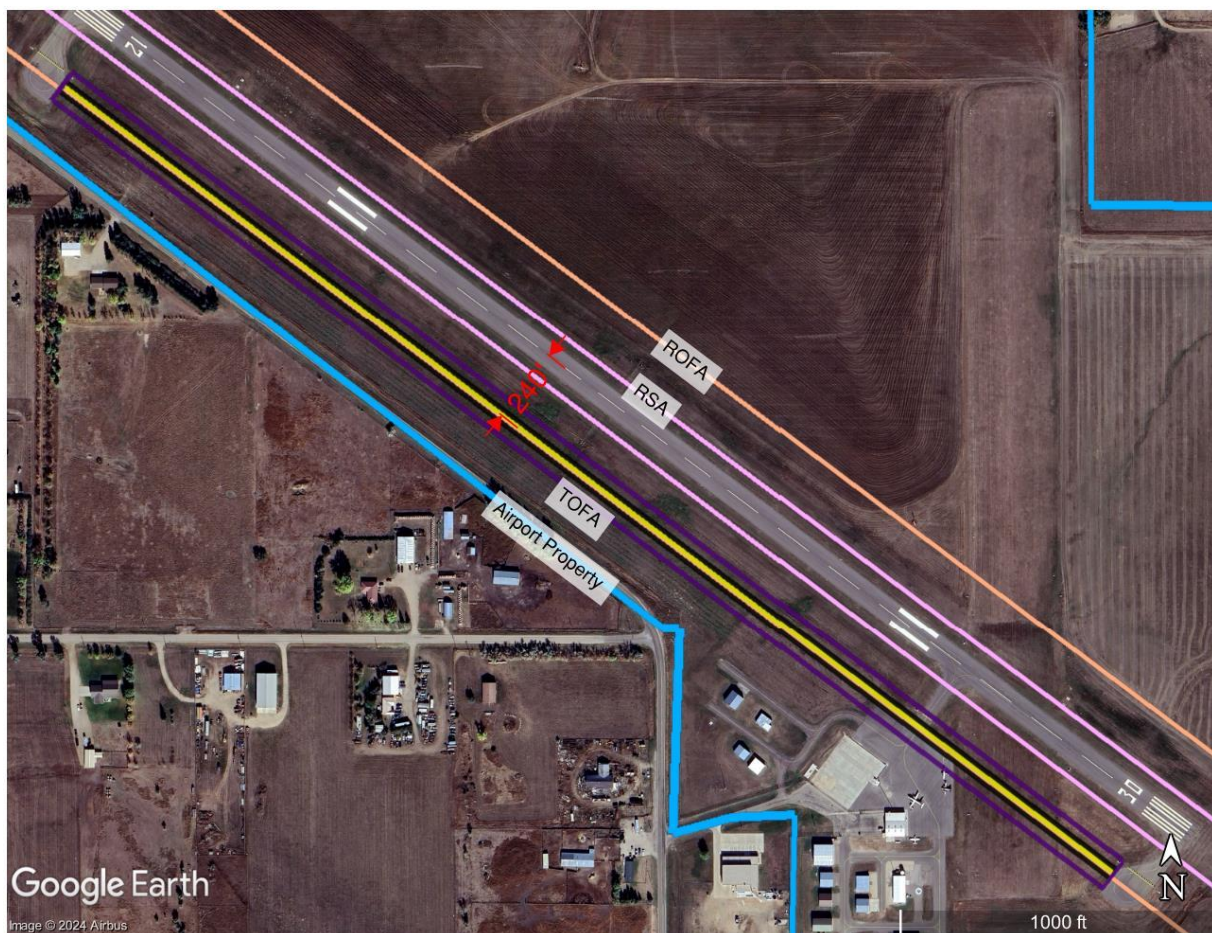
Advantages:

- No back taxiing on the runway

Disadvantages:

- Changes the layout of the turnarounds
- Impacts the tiedown and apron area
- Hold position is placed at 200' from runway centerline and 240' spacing provides little distance for an aircraft to turn 90 degrees to the runway while at the hold position

Figure 2-5 – Parallel Taxiway Option 1



Option 2 – 300-foot Separation: The 300-foot separation is for design group A/B-II (less than $\frac{3}{4}$ mile visibility) or C-II aircraft.

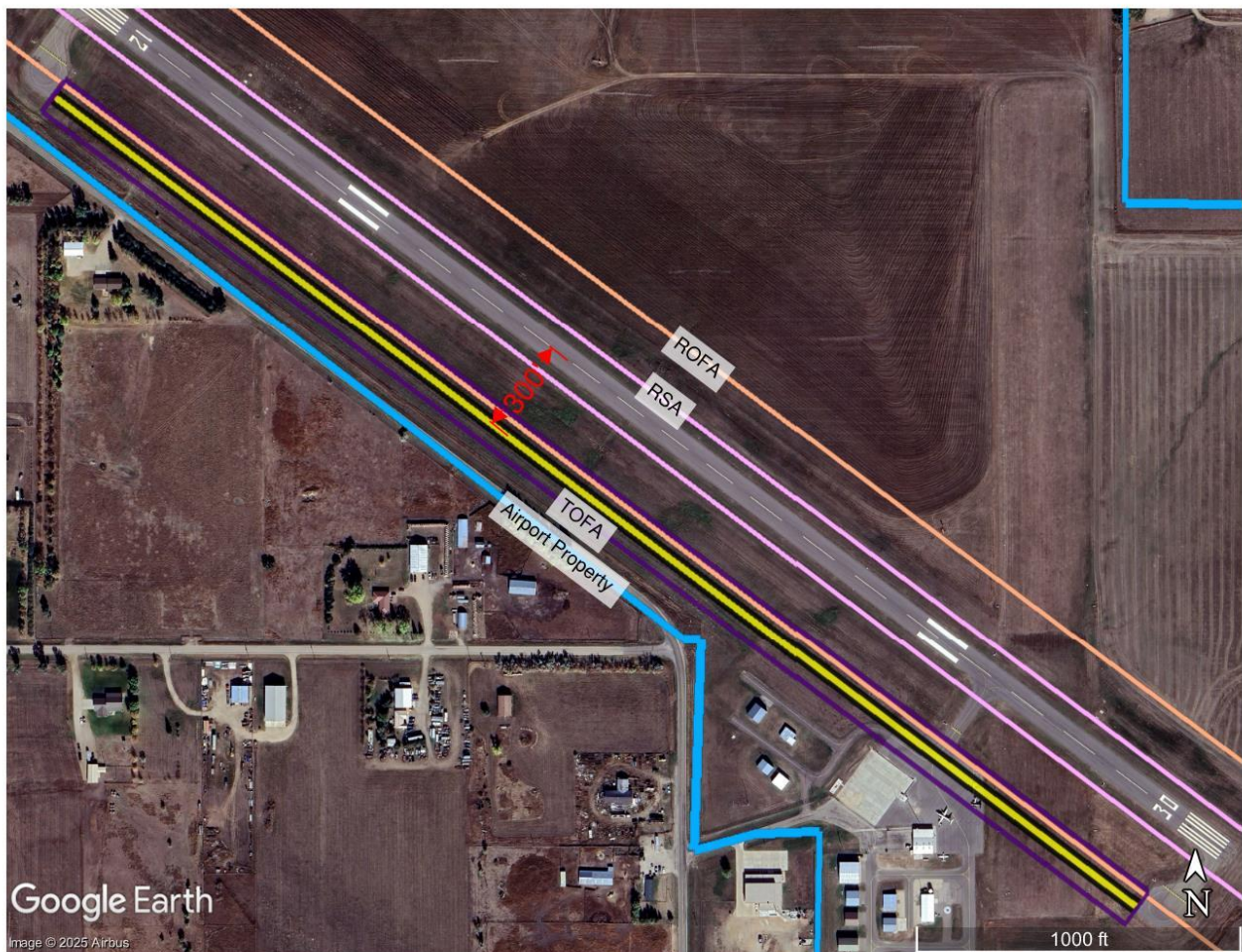
Advantages:

- No back taxiing on the runway
- Current turnarounds can remain relatively the same
- Hold position is placed at 200' from runway centerline and a 300' separation allows an aircraft to turn 90 degrees to the runway at the hold line

Disadvantages:

- Impacts the tiedowns and apron area

Figure 2-6 – Parallel Taxiway Option 2



Preferred Alternative Summary

The preferred development identified in this chapter includes the following:

- Enhance the airport accessibility by continuing to have a 1-mile visibility while lowering the Runway 12 end ceiling to 300 feet.
- The turf runway will remain in the current location with the current length to meet the 95% wind coverage. The height restrictions within the RVZ will need to be maintained.
- A parallel taxiway with a 300-foot centerline separation will be planned to be implemented.

Figure 2-7 – Finalized Airfield Alternative

