

---

## **Appendix C**

NAVAIDS Plan

---

## Navigational Aids (NAVAIDS) and Automated Weather Observing Systems (AWOS) in Wisconsin

The ability of a state's airport system to serve the regional and statewide economy depends on uninterrupted service. During periods of low cloud ceilings and reduced visibility, airports and pilots depend on instrument approaches and navigational aids (NAVAIDS) to safely navigate and land aircraft. Flying under instrument flight rules (IFR) allows pilots to fly and land safely when low clouds or reduced visibility prevent the pilot from flying safely by visual means alone, or visual flight rules (VFR).

The precision of these NAVAIDS determines the minimum altitude and visibility a pilot can encounter and still locate a runway to land safely. The higher these minima, as defined in an instrument approach procedure, the less frequently an airport can be used during periods of low visibility and adverse weather conditions; therefore, forcing a pilot to seek an alternative airport. For example, an airport with a lowest cloud ceiling of 500 feet and visibility of one mile is not as accessible in inclement weather conditions as an airport with a lowest ceiling of 200 feet and minimum visibility of ½ mile. Published instrument approaches and NAVAIDS help to maximize an airport's usefulness to the local community and businesses, commercial passengers, corporate flight departments, the air cargo industry and all other areas of the aviation industry.

The primary goal of this appendix is to update Wisconsin's existing plan for continuous, all-weather access to communities throughout the state. This plan was laid out in the *Wisconsin Air Navigational Aids System Plan 2020* and published in 1999. This appendix will update the system of navigational and visual landing aids laid out in the original plan to meet the needs of users of the Wisconsin Airport System. A secondary goal is to recommend a system of on-site weather reporting capabilities.

This goal is achieved by recommending optimal instrument approach procedures at all of the 98 public use airports in the Wisconsin system. Recommendations are based on the current and future airport classifications determined in **Chapter 2**.

This appendix contains several elements, including the following:

- An overview and evaluation of the current and future NAVAID and visual landing aid technology, including those recommended under FAA's Next Generation Air Transportation System (NextGen) program
- An inventory of NAVAIDS and visual landing aids at Wisconsin system airports
- The development of planning criteria based on two different instrument approach capability alternatives
- An analysis of the best instrument approach capabilities at each system airport in comparison with the two alternatives
- Cost comparisons of the two alternatives
- Recommendations based on the plan's recommended alternative
- An overview and evaluation of the best weather reporting technology available to airports in the United States



- 
- Recommendations for the installation or upgrade of weather reporting systems at each Wisconsin system airport
  - A consideration of future classifications for approach capabilities and weather reporting facilities

## **1.1 Review of Technology**

CDM Smith conducted a review of available airport technologies to ensure the Wisconsin airport system is keeping pace with technological advances. This review is split into four sections. The first two sections discuss enroute and terminal NAVAIDs. Examples of enroute NAVAIDs include distance measuring equipment (DME) and the global positioning system (GPS). Examples of terminal NAVAIDs include non-directional radio beacons (NDBs), which are currently being phased out by the FAA, and instrument landing systems (ILS). Following is a review of available visual landing aids and a brief overview of the FAA's transition from ground-based equipment to NextGen space-based navigation.

### **1.1.1 Enroute NAVAIDS**

Certain NAVAIDs are used primarily for enroute navigation requiring a ground station to transmit and receive radio signals. These ground stations can be located on an airport site or offsite.

#### **1.1.1.1 Very High Frequency Omnidirectional Range Transmitters (VOR)**

VORs are short-range radio navigation equipment systems for use by aircraft consisting of ground systems, which transmit radio signals to airborne receivers in aircraft. A VOR station transmits very high frequency (VHF) master signals, 360 degrees in azimuth, oriented from magnetic north, which are received by aircraft and allow a pilot to follow a radial to or from a VOR. A VOR signal indicates direction to or from the VOR transmitter, but it does not indicate distance. With approximately 3,000 VORs operating worldwide, they are one of the standard commercial and GA navigation systems in the world.

Like many ground-based approach systems, installation of VOR systems has slowed in the interest of satellite-based technology. However, many remain in use due to their usefulness to small GA aircraft that are not yet equipped with global positioning systems receivers. In addition, the FAA plans to maintain a minimum operating network of VORs through 2020 to serve as backups to satellite-based navigation. In Wisconsin, nearly half of the airports in the system continue to have approaches based on VORs.

#### **1.1.1.2 Distance Measuring Equipment (DME)**

DME units provide the pilot with information relating to distance in nautical miles, ground speed and time of travel from the aircraft to the DME ground station. The ultra high frequency (UHF) DME systems are incorporated with VORs, transmitting signals from DME-equipped aircraft to ground receivers so that the pilot can measure the distance to the VOR. Low-power DMEs are used alongside instrument landing system (ILS) glide slope antennae, providing an accurate distance to touchdown function. This standalone DME use is expected to continue.



---

### 1.1.1.3 Tactical Air Navigation (TACAN)

A TACAN is a UHF navigational aid that serves as a VOR/DME system for military aircraft.

### 1.1.1.4 VHF Omnidirectional Range/Tactical Aircraft Control (VORTAC)

A VORTAC is a system consisting of a VOR and TACAN. The unit provides VOR azimuth, TACAN azimuth, and TACAN distance (DME) simultaneously. VORTAC operates as a unified NAVAID despite consisting of more than one component, operational facility and antenna.

### 1.1.1.5 Global Positioning System (GPS)

GPS is a satellite system used for navigation, position determination and time information. GPS satellites radiate precisely-timed signals which are coded, so a receiver on or near the earth's surface can determine the transmission time delay from the precise satellite position. When a receiver has a direct line of sight to at least four of the 24 satellites, it can determine its precise three-dimensional position and time. This system provides pilots with approach capability at all runways, including horizontal guidance, vertical guidance and three-dimensional position in space. GPS is considered the future of instrument landing systems.

There are two levels of service provided by GPS: the precise positioning service (PPS) and the standard positioning service (SPS). The PPS is a very precise GPS available only to the Department of Defense and other authorized users, while the SPS is available to all civil users worldwide. It provides accuracy under 32 feet.

The SPS is suitable for many GPS applications but lacks the accuracy, integrity, availability and continuity of service requirements for aircraft approach guidance. To augment SPS for aviation purposes, the FAA has developed two differential correction systems:

- **Wide area augmentation system (WAAS):** A network of stations that receive GPS signals and make corrections, allowing for CAT I approach accuracy of 52 feet laterally and 13.1 feet vertically. The WAAS network provides coverage for most of North America.
- **Local area augmentation system (LAAS):** A much more accurate correction to the GPS signal, consisting of systems of local reference receivers placed at precisely-surveyed locations. These receivers formulate a correction message which is relayed to users via a VHF data link. LAAS is capable of achieving up to CAT III approach capabilities. LAAS networks have a coverage radius of approximately 25 miles.

### 1.1.1.6 GPS Approaches

GPS approaches, or area navigation (RNAV), allow aircraft to choose any desired course within the signal coverage of a network of beacons. This system helps to reduce flight distance, lower airspace congestion and allow aircraft to land during inclement weather at airports that do not have ground-based NAVAIDs.

- **Localizer performance with vertical guidance (LPV):** LPV is the highest WAAS-enabled GPS instrument approach currently available without specialized aircrew training requirements, achieving approach capabilities comparable to a CAT I ILS. Like an ILS an Approach Light System is required to achieve CAT I ILS like minima. LPV is largely replacing ILS as the standard precision approach at airports.



- **Lateral navigation/vertical navigation (LNAV/VNAV):** Allows pilots to follow a fixed glide slope toward a runway. LNAV/VNAV guides the aircraft to a distance of about 12,000 feet before the threshold at an average decision height of 1,150 feet. LNAV/VNAV approaches have an accuracy calculation of 65-160 feet and lower approach minima than LNAV.
- **Lateral navigation (LNAV):** Provides messages to the pilot indicating errors in the lateral direction of an aircraft. Using an LNAV approach requires incremental descent as opposed to following a fixed glide slope. LNAV is a non-precision approach due to the lack of vertical guidance, having higher approach minimums than LPV and LNAV/VNAV.
- **Circling:** A circling approach is used when a runway is not aligned within 30 degrees of the instrument approach course, or the final approach requires at least 400 feet of descent per nautical mile. These conditions require some visual maneuvering of the aircraft. It is common for a circling approach to be used to land on an alternate runway than the runway having the instrument approach. A circling approach is more difficult and less safe than straight-in landing, requiring a pilot to maintain visual contact with the runway at all times.

## 1.1.2 Terminal NAVAIDs

Other NAVAIDs are primarily used for terminal navigation (aircraft landings and enroute flight operations) particularly during instrument flight rule conditions. The following section includes many types of terminal NAVAIDs.

### 1.1.2.1 Non-directional Radio Beacons (NDB)

NDBs transmit non-directional radio signals that are used by pilots to determine and display a bearing (but not distance) to any radio station within its frequency and sensitivity range. Because NDB signals follow the curvature of the earth, they can be received at greater distances by aircraft flying at lower altitudes than signals from a VOR or TACAN.

In recent years, the FAA has moved to decommission many NDB approaches on runways that also have a satellite-based navigation in an effort to eliminate redundancies. In Wisconsin, NDB approaches have been phased out in the years since *Wisconsin Air Navigational Aids System Plan 2020* was published. In 1999, a total of 55 airports in Wisconsin had at least one NDB approach. Today this number has decreased to 24 airports.

### 1.1.2.2 Instrument Landing System (ILS)

An ILS is an approach system designed to provide precise horizontal and vertical guidance (a precision approach) for an aircraft making its final approach to a runway. There are three levels of ILS precision based on the capability of ground equipment, the capability of the aircraft crew to navigate the approach and the existence or absence of approach obstructions. These levels are referred to as Category I (CAT I), Category II (CAT II) and Category III (CAT III):

- CAT I – can provide navigational guidance to as low as 200 feet above ground level
- CAT II – can provide navigational guidance to as low as 100 feet above ground level
- CAT III – can provide navigational guidance to ground level



---

An ILS consists of a localizer, glide slope, various approach and runway lights, and outer marker radio beacons for range information (many of the latter have been uninstalled). The localizer is the horizontal guidance component of an ILS. It allows pilots to maintain horizontal guidance with a runway until visual contact can be made. The glide slope is the vertical guidance component of an ILS. It allows pilots to maintain vertical guidance with a runway until visual contact has been made.

Unlike other ground-based navigation, the FAA has not removed any ILS systems at this time, but installation of new systems has slowed considerably. In Wisconsin, two airports, which did not previously have an ILS have installed one since *Wisconsin Air Navigational Aids System Plan 2020* was published. The FAA is expected to begin phasing out CAT I systems in 2015, with all CAT II and CAT III installations remaining operational until at least 2020. Even with the advent of satellite-based navigation, the FAA views ILS as an important backup to new technologies.

### **1.1.2.3 Simplified Directional Facility (SDF)**

The simplified directional facility (SDF) is a localizer-based instrument that provides a final non-precision approach. The SDF does not offer vertical guidance, and the approach course may or may not be aligned with the runway as its antenna may be offset from the runway centerline. The SDF offers a less precise approach than the ILS.

### **1.1.2.4 Automatic Dependent Surveillance-Broadcast (ADS-B)**

ADS-B is a surveillance technology for tracking aircraft and the FAA's satellite-based NextGen successor to radar. ADS-B makes aircraft visible in real time to both air traffic control and other aircraft equipped with ADS-B, sending both position and velocity data every second. ADS-B requires aircraft to be equipped with two avionics components; an ADS-B unit and a high integrity GPS navigation source. By 2020, the FAA will require most aircraft in the United States to operate with some form of ADS-B out. A universal access transceiver (UAT) is the data link specifically approved for use with ADS-B. The following ADS-B components offer additional services.

#### **1.1.2.4.1 Traffic Information Services-Broadcast (TIS-B)**

TIS-B provides free traffic reporting services to UAT equipped aircraft, thereby enabling pilots and air traffic controllers to greatly enhance communication and safety. TIS-B allows older non-ADS-B equipped aircraft that are tracked by radar to have their location and track information broadcast to ADS-B equipped aircraft, essentially providing ADS-B aircraft with an image of radar similar to what air traffic controllers see on the ground.

#### **1.1.2.4.2 Flight Information Services-Broadcast (FIS-B)**

FIS-B is a ground-to-air ADS-B component that provides weather and other non-control, aeronautical data to UAT-equipped aircraft. Like TIS-B, FIS-B enables pilots and air traffic controllers to greatly enhance communication and safety in the aircraft cockpit and on the ground.

### **1.1.3 Visual Landing Aids**

Visual landing aids allow pilots to make visual contact with runways, approach paths, and glide slopes, particularly at night or other times of reduced visibility.



### 1.1.3.1 Runway Lighting

Runway lighting, also commonly called runway edge lighting, lines the edges of the entire runway and is used to enhance visibility during periods of reduced visibility. Runway lighting is white except on instrument approach runways, where yellow lighting replaces white on the last 2,000 feet of runway (or half of the runway length, whichever is less). Runway lighting is classified according to its intensity and includes high intensity runway lighting (HIRL), medium intensity runway lighting (MIRL) and low intensity runway lighting (LIRL). HIRL is required for runways with precision instrument approaches.

### 1.1.3.2 Runway End Indicator Lighting (REIL)

REILs are pairs of synchronized flashing white lights located laterally at the end of a runway which are omnidirectional or unidirectional toward the approach. REIL systems are used to identify runways that lack contrast with the surrounding terrain or are surrounded by a prevalence of other lighting. They are also used during times of reduced visibility.

### 1.1.3.3 Approach Lighting System (ALS)

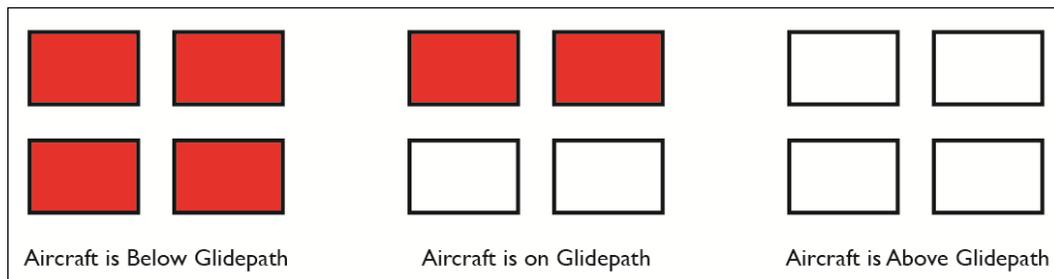
An ALS is a lighting system that extends outward from a runway end, consisting of lightbars, strobe lights or a combination of the two. An ALS is typically installed on runways with instrument approach capabilities to allow pilots to visually align with a runway while on approach. Many types of ALS exist, but two of the most popular are the medium intensity approach lighting system with runway alignment indicator lights (MALSR) and the medium intensity approach lighting system with sequenced flashing lights (MALSF).

### 1.1.3.4 Visual Glide Slope Indicators (VGSIs)

VGSI are ground lighting devices that define a vertical approach path, helping pilots to determine if their approach is too high or low for an ideal landing. Several types of VGSI exist, including, but not limited to, the following:

- **Visual approach slope indicator (VASI):** The VASI consists of two sets of white and red lights installed along the length of the approach end of the runway. As shown on **Figure C-1**, the lights appear in a vertical arrangement to aircraft pilots on approach. When the higher, further set of lights is red and the lower white, the pilot is on the proper glide path. When both are white, the aircraft is too high. When both are red, the aircraft is approaching the runway too low. The installation of new VASI units has declined in favor of PAPI units.

**Figure C-1 – VASI Lighting as it Appears to Approaching Aircraft**

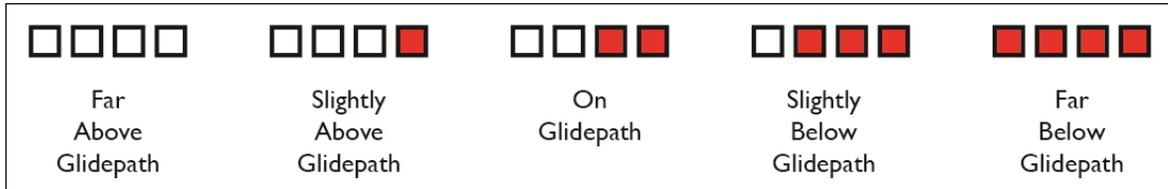


Source: CDM Smith



- Precision approach path indicator (PAPI):** The PAPI is a more refined, detailed version of the VASI that employs a four light system. The PAPI uses two white lights and two red lights to indicate that an aircraft is aligned properly with the glide slope. Three or four red lights indicate that an aircraft is slightly or drastically beneath the glide slope, while three or four white lights indicate that the aircraft’s approach is slightly or drastically above the optimum angle. This information is detailed visually in **Figure C-2**.

**Figure C-2 – PAPI Lighting as it Appears to Approaching Aircraft**



Source: CDM Smith

### 1.1.3.5 Rotating Beacon

A rotating beacon indicates the location of an airport to pilots at night or during low visibility conditions. Beacons rotate at a constant speed to produce the visual effect of a light flashing at regular intervals, similar to a lighthouse. Differing rates of flash and lighting color signify the type of airport or heliport.

### 1.1.4 Trends and Recommendations

NextGen is a catch-all term for the shift from ground-based navigation to satellite-based equipment. The FAA is focused on implementing NextGen changes throughout the national airport system. NextGen is focused on providing increased safety, greater design flexibility, better use of existing capacity and improved access, and reduced environmental impacts.<sup>1</sup>

For NAVAIDs, NextGen means a shift to the satellite navigation of GPS/RNAV and LPV, including the WAAS and LAAS. Because the implementation of these systems require little or no on-site equipment, airports can achieve higher approach standards for a far lower cost than would be required to install an ILS or other legacy NAVAIDs. The FAA also aims to reduce the federal cost burden that is associated with maintaining the network of thousands of ground-based navigational systems. The cost shifts from the federal government to aircraft owners, who must upgrade their aircrafts with the equipment necessary to perform these approaches.

In Wisconsin, industry trends have been in line with the FAA’s goals to provide a satellite-based NextGen navigation system. Since the date of the original NAVAIDs plan (1999), more than 150 new GPS/RNAV approaches have been published at Wisconsin system airports. The installation of ILS systems has slowed (installation at two airports that did not previously have an ILS and a total of five installed system-wide since the previous study), as has the installation of other ground-based approaches and NAVAIDs.

<sup>1</sup> Federal Aviation Administration.



Recommendations in this plan include the continued installation of GPS/RNAV systems to be augmented where necessary by LPV approaches and the use of WAAS and LAAS. This plan does not, however, include recommendations for the removal of ground-based navigation systems which are currently in use at Wisconsin airports. Most ground based NAVAIDS are owned by the FAA who will determine their future status. Detailed recommendations are included later in this appendix.

Note that final decision on implementation of these recommendations comes down to the FAA. The FAA controls funding for new NAVAID and approach systems and also makes decisions on when to phase out older technology. While the recommendations in this plan will be used to shape the FAA’s decisions, the availability of funding will ultimately decide what is installed and when.

## 1.2 Inventory of NAVAIDS and Visual Landing Aids

The primary goal of this plan is to recommend instrument approach capabilities at SASP airports that will provide continuous all-weather access to communities throughout Wisconsin. An airport’s instrument approach capability is measured by a combination of two factors: minimum cloud ceiling and visibility minimum. Minimum cloud ceiling is a vertical measurement (in feet) of the height above the airport. Visibility minimum is a horizontal measurement (in statute miles) of the visibility from the approaching aircraft to the runway. These two minima are considered by the FAA when encountering IFR weather conditions. These minima take into account runway length, approach instrumentation, runway lighting, terrain and any obstructions in the approach paths.

The following sections provide a comprehensive inventory of NAVAIDS, visual landing aids and published instrument approaches – including visibility and cloud ceiling minima – at Wisconsin system airports. We will use this inventory of published instrument approaches to form the basis of our recommendations.

### 1.2.1 Inventory of Existing NAVAIDS

**Table C-1** summarizes the presence of seven NAVAIDS at Wisconsin system airports. In total, 24 system airports have an NDB, 46 have a VOR approach, and 27 have an LOC. RNAV/GPS approaches are installed at 84 system airports, while 17 have an ILS. TACANs and SDFs are installed at only two and three airports, respectively. **Table C-2** details the presence of these NAVAIDS at Wisconsin system airports.

**Table C-1**  
**Summary of Existing NAVAIDS at Wisconsin System Airports**

NAVAID	Number of Wisconsin System Airports with NAVAID	Percent of System Total
NDB	24	24.5%
VOR	46	46.9%
LOC	27	27.6%
RNAV/GPS	84	85.7%
ILS	17	17.3%
TACAN	2	2.0%
SDF	3	3.1%

*Source:* Short Elliott Hendrickson Inc.



**Table C-2  
Existing NAVAIDs at Wisconsin System Airports**

City	Airport Name	NDB	VOR	LOC	RNAV/ GPS	ILS	TACAN	SDF
Appleton	Outagamie County Regional	-	Yes	Yes	Yes	Yes	-	-
Eau Claire	Chippewa Valley Regional	Yes	Yes	Yes	Yes	Yes	-	-
Green Bay	Austin Straubel International	-	Yes	Yes	Yes	Yes	Yes	-
La Crosse	La Crosse Regional	Yes	Yes	Yes	Yes	Yes	-	-
Madison	Dane County Regional	-	Yes	Yes	Yes	Yes	Yes	-
Milwaukee	General Mitchell International	-	-	Yes	Yes	Yes	-	-
Mosinee	Central Wisconsin	-	Yes	Yes	Yes	Yes	-	-
Rhineland	Rhineland-Oneida County	-	Yes	Yes	Yes	Yes	-	-
East Troy	East Troy Municipal	-	Yes	-	Yes	-	-	-
Fond du Lac	Fond du Lac County	-	Yes	Yes	Yes	-	-	-
Janesville	Southern Wisconsin Regional	-	Yes	Yes	Yes	Yes	-	-
Kenosha	Kenosha Regional	-	Yes	Yes	Yes	Yes	-	-
Middleton	Middleton Municipal-Morey Field	-	Yes	Yes	Yes	-	-	-
Milwaukee	Lawrence J. Timmerman	-	Yes	Yes	Yes	-	-	-
New Richmond	New Richmond Regional	Yes	-	-	Yes	-	-	-
Oshkosh	Wittman Regional	Yes	Yes	Yes	Yes	Yes	-	-
Racine	John H. Batten	-	Yes	-	Yes	Yes	-	-
Rice Lake	Rice Lake Regional - Carl's Field	-	Yes	Yes	Yes	Yes	-	-
Sheboygan	Sheboygan County Memorial	-	Yes	Yes	Yes	Yes	-	-
Stevens Point	Stevens Point Municipal	-	Yes	Yes	Yes	Yes	-	-
Waukesha	Waukesha County	-	Yes	Yes	Yes	Yes	-	-
West Bend	West Bend Municipal	-	Yes	Yes	Yes	-	-	-
Amery	Amery Municipal	-	-	-	Yes	-	-	-
Antigo	Langlade County	Yes	-	-	Yes	-	-	-
Ashland	John F. Kennedy Memorial	-	Yes	Yes	Yes	-	-	-
Baraboo	Baraboo-Wisconsin Dells	-	Yes	Yes	Yes	-	-	-
Black River Falls	Black River Falls Area	Yes	-	-	Yes	-	-	-
Boscobel	Boscobel	-	Yes	-	Yes	-	-	-
Brookfield	Capitol Drive	-	-	-	-	-	-	-
Burlington	Burlington Municipal	-	Yes	-	Yes	-	-	-
Chetek	Chetek Municipal - Southworth	-	Yes	-	Yes	-	-	-
Clintonville	Clintonville Municipal	-	-	-	Yes	-	-	-
Cumberland	Cumberland Municipal	-	Yes	-	Yes	-	-	-
Eagle River	Eagle River Union	-	Yes	Yes	Yes	-	-	-
Fort Atkinson	Fort Atkinson Municipal	-	Yes	-	Yes	-	-	-
Friendship-Adams	Adams County Legion Field	-	-	-	Yes	-	-	-



**Table C-2 (Continued)**  
**Existing NAVAIDs at Wisconsin System Airports**

City	Airport Name	NDB	VOR	LOC	RNAV/ GPS	ILS	TACAN	SDF
Hartford	Hartford Municipal	Yes	Yes	-	Yes	-	-	-
Hayward	Sawyer County	-	-	Yes	Yes	-	-	-
Juneau	Dodge County	Yes	-	Yes	Yes	-	-	-
Ladysmith	Rusk County	Yes	-	-	Yes	-	-	-
Land O'Lakes	King's Land O'Lakes	Yes	-	-	Yes	-	-	-
Lone Rock	Tri-County Regional	-	Yes	Yes	Yes	-	-	-
Manitowoc	Manitowoc County	-	Yes	Yes	Yes	Yes	-	-
Marshfield	Marshfield Municipal - Roy Shwery Field	Yes	-	-	Yes	-	-	Yes
Medford	Taylor County	Yes	-	-	Yes	-	-	-
Menomonie	Menomonie Municipal - Score Field	-	Yes	-	Yes	-	-	-
Merrill	Merrill Municipal	Yes	-	-	Yes	-	-	-
Mineral Point	Iowa County	Yes	-	-	Yes	-	-	-
Minocqua-Woodruff	Lakeland/Noble F. Lee Memorial Field	Yes	-	Yes	Yes	-	-	-
Monroe	Monroe Municipal	-	Yes	-	Yes	-	-	-
Osceola	L. O. Simenstad Municipal	-	-	-	Yes	-	-	-
Palmyra	Palmyra Municipal	-	-	-	-	-	-	-
Phillips	Price County	Yes	-	-	Yes	-	-	-
Platteville	Platteville Municipal	-	-	-	Yes	-	-	-
Portage	Portage Municipal	-	Yes	-	Yes	-	-	-
Prairie du Chien	Prairie du Chien	-	Yes	-	Yes	-	-	-
Prairie du Sac	Sauk Prairie	-	-	-	Yes	-	-	-
Reedsburg	Reedsburg Municipal	-	Yes	-	Yes	-	-	-
Shawano	Shawano Municipal	-	-	-	Yes	-	-	-
Shell Lake	Shell Lake Municipal	-	Yes	-	Yes	-	-	-
Siren	Burnett County	-	Yes	-	Yes	-	-	-
Sparta	Sparta/Fort McCoy	Yes	-	-	Yes	-	-	-
Sturgeon Bay	Door County Cherryland	-	-	-	Yes	-	-	Yes
Superior	Richard I. Bong	-	-	-	Yes	-	-	-
Tomahawk	Tomahawk Regional	-	Yes	-	Yes	-	-	-
Viroqua	Viroqua Municipal	-	-	-	Yes	-	-	-
Watertown	Watertown Municipal	Yes	Yes	-	Yes	-	-	-
Waupaca	Waupaca Municipal	Yes	-	-	Yes	-	-	-
Wausau	Wausau Downtown	Yes	Yes	-	Yes	-	-	-
Wisconsin Rapids	Alexander Field-South Wood County	Yes	Yes	-	Yes	-	-	Yes



**Table C-2 (Continued)**  
**Existing NAVAIDs at Wisconsin System Airports**

City	Airport Name	NDB	VOR	LOC	RNAV/ GPS	ILS	TACAN	SDF
Barron	Barron Municipal	-	-	-	-	-	-	-
Boulder Junction	Boulder Junction	-	-	-	-	-	-	-
Boyceville	Boyceville Municipal	-	-	-	Yes	-	-	-
Cable	Cable Union	-	-	-	Yes	-	-	-
Cassville	Cassville Municipal	-	-	-	-	-	-	-
Crandon	Crandon Municipal	-	-	-	-	-	-	-
Crivitz	Crivitz Municipal	-	-	-	-	-	-	-
Ephraim-Gibraltar	Ephraim-Gibraltar	-	-	-	Yes	-	-	-
Grantsburg	Grantsburg Municipal	-	Yes	-	Yes	-	-	-
Hillsboro	Joshua Sanford Field	-	-	-	-	-	-	-
La Pointe	Major Gilbert Field	-	-	-	Yes	-	-	-
Lancaster	Lancaster Municipal	-	-	-	-	-	-	-
Madison	Blackhawk Airfield	-	Yes	-	Yes	-	-	-
Manitowish Waters	Manitowish Waters	-	-	-	Yes	-	-	-
Necedah	Necedah	-	-	-	Yes	-	-	-
Neillsville	Neillsville Municipal	Yes	-	-	Yes	-	-	-
New Holstein	New Holstein Municipal	-	Yes	-	Yes	-	-	-
New Lisbon	Mauston-New Lisbon Union	-	-	-	Yes	-	-	-
Oconto	J. Douglas Bake Memorial	Yes	-	-	Yes	-	-	-
Park Falls	Park Falls Municipal	Yes	-	-	Yes	-	-	-
Prentice	Prentice	-	-	-	-	-	-	-
Richland Center	Richland	-	Yes	-	Yes	-	-	-
Solon Springs	Solon Springs Municipal	-	-	-	Yes	-	-	-
Three Lakes	Three Lakes Municipal	-	-	-	-	-	-	-
Tomah	Bloyer Field	-	-	-	-	-	-	-
Washington Island	Washington Island	-	-	-	-	-	-	-
Wautoma	Wautoma Municipal	-	-	-	Yes	-	-	-
Wild Rose	Wild Rose Idlewild	-	-	-	-	-	-	-

Source: Short Elliott Hendrickson Inc.

**Table C-3** details all instrument approaches published at Wisconsin system airports, including their cloud ceiling and visibility minima. Eighty-four airports, or 86 percent of the total system, have some type of published instrument approach. These 84 airports have a total of 344 instrument approaches that use many of the systems and NAVAIDs listed above. The lowest approach minima are achieved through the use of either an ILS or RNAV (GPS) system. The location of Wisconsin airports with published instrument approaches is shown on **Figure C-1**.



**Table C-3  
Published Instrument Approaches at Wisconsin System Airports**

City	Airport Name	Instrument Approach	Lowest Straight In Approach Ceiling (feet)	Lowest Straight In Approach Visibility (miles)	Lowest Circling Approach Ceiling (feet)	Lowest Circling Approach Visibility (miles)
Appleton	Outagamie County Regional	VOR/DME RWY 21	522	1	482	1
		VOR/DME RWY 03	492	3/4	462	1
		RNAV (GPS) RWY 30	200	1/2	422	1
		RNAV (GPS) RWY 21	250	1	367	1 1/4
		RNAV (GPS) RWY 12	200	3/4	422	1
		RNAV (GPS) RWY 03	250	1/2	482	1 1/4
		ILS or LOC RWY 30	200	1/2	422	1
		ILS or LOC RWY 03	200	1/2	462	1
Eau Claire	Chippewa Valley Regional	NDB RWY 22	567	3/4	567	1
		VOR-A	NA	NA	867	1
		LOC/DME BC RWY 04	491	1	547	1
		RNAV (GPS) RWY 22	270	1/2	547	1
		RNAV (GPS) RWY 04	200	3/4	547	1
		ILS or LOC RWY 22	200	1/2	567	1
Green Bay	Austin Straubel International	VOR-A	NA	NA	505	1
		VOR/DME or TACAN RWY 36	416	1	505	1
		LOC BC RWY 24	419	1	505	1
		RNAV (GPS) RWY 36	200	1/2	505	1
		RNAV (GPS) RWY 24	289	1	505	1
		RNAV (GPS) RWY 18	284	1	505	1
		RNAV (GPS) RWY 06	200	1/2	505	1
		ILS or LOC RWY 36	516	1/2	505	1
		ILS or LOC RWY 06	200	1/2	505	1
La Crosse	La Crosse Regional	NDB RWY 18	1,147	1 1/4	1,145	1 1/4
		VOR RWY 36	507	1	505	1
		VOR RWY 13	465	1	525	1
		RNAV (GPS) RWY 36	300	1	485	1
		RNAV (GPS) RWY 31	986	1 1/4	985	1 1/4
		RNAV (GPS) RWY 21	1,166	1 1/4	1,165	1 1/4
		RNAV (GPS) RWY 18	272	1/2	705	1
		RNAV (GPS) RWY 13	302	1	485	1
		RNAV (GPS) RWY 03	553	1	965	1 1/4
		ILS or LOC RWY 18	200	1/2	525	1



**Table C-3 (Continued)**  
**Published Instrument Approaches at Wisconsin System Airports**

City	Airport Name	Instrument Approach	Lowest Straight In Approach Ceiling (feet)	Lowest Straight In Approach Visibility (miles)	Lowest Circling Approach Ceiling (feet)	Lowest Circling Approach Visibility (miles)
Madison	Dane County Regional	VOR/DME or TACAN RWY 18	500	1/2	513	1
		VOR/DME or TACAN RWY 32	559	1	533	1
		VOR RWY 14	439	1	513	1
		VOR RWY 18	500	1/2	533	1
		VOR RWY 21	813	1	813	1
		VOR RWY 32	698	1	673	1
		VOR RWY 36	458	1	513	1
		HI-TACAN RWY 18	480	3/4	573	1 1/2
		HI-TACAN RWY 36	458	3/4	573	1 1/2
		VOR/DME or TACAN RWY 14	559	1	533	1
		RNAV (GPS) RWY 36	200	1/2	533	1
		RNAV (GPS) RWY 32	360	1 1/8	533	1
		ILS or LOC RWY 21	250	1/2	533	1
		ILS or LOC/DME RWY 18	200	1/2	533	1
		ILS or LOC/DME RWY 36	200	1/2	533	1
		RNAV (GPS) RWY 14	200	3/4	533	1
		RNAV (GPS) RWY 18	200	1/2	533	1
RNAV (GPS) RWY 21	493	1 1/4	533	1 3/4		
Milwaukee	General Mitchell International	RNAV (GPS) RWY 13	470	1	517	1
		RNAV (GPS) RWY 19L	446	1	517	1
		RNAV (GPS) RWY 19R	200	1/2	511	1
		RNAV (GPS) RWY 25L	290	1	511	1
		RNAV (GPS) RWY 25R	486	1	517	1
		RNAV (GPS) RWY 31	470	1	517	1
Milwaukee	General Mitchell International	LOC RWY 25L	490	1	511	1
		RNAV (GPS) RWY 07R	200	1/2	511	1
		RNAV (GPS) RWY 07L	468	1	517	1
		ILS or LOC RWY 01L	200	1/2	517	1
		ILS or LOC RWY 07R	451	1/2	511	1
		ILS or LOC RWY 19R	200	1/2	511	1
		ILS RWY 01L (CAT II)	100	1/4	NA	NA
		ILS RWY 01L (CAT III)	0	0	NA	NA
		RNAV (GPS) RWY 01L	200	1/2	517	1
RNAV (GPS) RWY 01R	443	1	517	1		



**Table C-3 (Continued)**  
**Published Instrument Approaches at Wisconsin System Airports**

City	Airport Name	Instrument Approach	Lowest Straight In Approach Ceiling (feet)	Lowest Straight In Approach Visibility (miles)	Lowest Circling Approach Ceiling (feet)	Lowest Circling Approach Visibility (miles)
Mosinee	Central Wisconsin	VOR or GPS-A	NA	NA	463	1 1/2
		VOR/DME RWY 35	395	1	463	1
		RNAV (GPS) RWY 35	200	1/2	463	1
		RNAV (GPS) RWY 26	250	1	463	1
		RNAV (GPS) RWY 17	257	1	463	1
		RNAV (GPS) RWY 08	200	1/2	463	1
		ILS or LOC RWY 35	200	1/2	463	1
		ILS or LOC RWY 08	200	1/2	463	1
Rhinelander	Rhinelander-Oneida County	ILS or LOC RWY 09	200	1/2	396	1
		RNAV (GPS) RWY 09	200	1/2	396	1
		RNAV (GPS) RWY 15	380	1	396	1
		RNAV (GPS) RWY 27	200	3/4	556	1
		RNAV (GPS) RWY 33	250	1	496	1
		VOR/DME RWY 27	614	1	596	1
		VOR RWY 09	376	1/2	436	1
East Troy	East Troy Municipal	RNAV (GPS) RWY 08	397	1	440	1
		RNAV (GPS) RWY 26	250	1	440	1
		VOR/DME-A	NA	NA	480	1
Fond du Lac	Fond du Lac County	RNAV (GPS) RWY 36	330	3/4	612	1
		LOC/DME RWY 36	385	3/4	612	1
		VOR/DME or GPS RWY 18	570	1	612	1
		VOR/DME RWY 36	625	1/2	611	1
Janesville	Southern Wisconsin Regional	RNAV (GPS) RWY 32	394	3/4	452	1
		RNAV (GPS) RWY 22	315	1	512	1
		RNAV (GPS) RWY 14	200	3/4	472	1
		RNAV (GPS) RWY 04	200	1/2	512	1
		ILS or LOC RWY 32	200	1/2	452	1
		ILS or LOC RWY 04	200	1/2	592	1
Kenosha	Kenosha Regional	VOR RWY 25R	568	1	558	1
		VOR RWY 15	479	1	458	1
		RNAV (GPS) RWY 33	439	1	458	1
		RNAV (GPS) RWY 25R	250	1	458	1
		RNAV (GPS) RWY 15	479	1	458	1
		RNAV (GPS) RWY 07L	200	1/2	458	1
		ILS or LOC RWY 07L	200	1/2	458	1
Middleton	Middleton Municipal-Morey Field	RNAV (GPS) RWY 10	522	1 3/4	652	1
		RNAV (GPS) RWY 28	398	1 1/2	632	1
		LOC/DME RWY 10	652	1	652	1
		VOR RWY 10	752	1	752	1
		VOR RWY 28	572	1	632	1



**Table C-3 (Continued)**  
**Published Instrument Approaches at Wisconsin System Airports**

City	Airport Name	Instrument Approach	Lowest Straight In Approach Ceiling (feet)	Lowest Straight In Approach Visibility (miles)	Lowest Circling Approach Ceiling (feet)	Lowest Circling Approach Visibility (miles)
Milwaukee	Lawrence J. Timmerman	VOR RWY 15L	536	1	555	1
		VOR RWY 04L	563	1	555	1
		LOC RWY 15L	376	1	475	1
		RNAV (GPS) RWY 22R	422	1	475	1
		RNAV (GPS) RWY 15L	250	1	475	1
		RNAV (GPS) RWY 04L	503	1	555	1
New Richmond	New Richmond Regional	RNAV (GPS) RWY 14	274	1	522	1
		RNAV (GPS) RWY 32	250	1	522	1
		NDB RWY 14	723	1	723	1
Oshkosh	Wittman Regional	NDB RWY 36	532	3/4	532	1
		VOR RWY 36	432	1/2	472	1
		VOR RWY 27	439	1	472	1
		VOR RWY 18	467	1	472	1
		VOR RWY 09	563	1	552	1
		LOC/DME RWY 18	367	1	472	1
		RNAV (GPS) RWY 36	302	1/2	472	1 1/4
		RNAV (GPS) RWY 27	358	1	472	1
		RNAV (GPS) RWY 18	387	1	472	1
		RNAV (GPS) RWY 09	563	1	552	1
ILS or LOC RWY 36	200	1/2	472	1		
Racine	John H. Batten	ILS RWY 04	255	1	506	1
		RNAV (GPS) RWY 04	320	1	486	1
		RNAV (GPS) RWY 22	283	1	466	1
		RNAV (GPS) RWY 32	393	1	466	1
		VOR RWY 04L	472	1	466	1
Rice Lake	Rice Lake Regional - Carl's Field	ILS or LOC RWY 01	200	1/2	513	1
		RNAV (GPS) RWY 01	289	1/2	493	1 1/4
		RNAV (GPS) RWY 19	531	1	531	1
		VOR/DME RWY 19	591	1	591	1
		VOR RWY 01	419	1/2	491	1
Sheboygan	Sheboygan County Memorial	ILS or LOC/DME RWY 21	249	1/2	465	1
		RNAV (GPS) RWY 03	297	1	465	1
		RNAV (GPS) RWY 13	405	1	465	1
		RNAV (GPS) RWY 21	316	1/2	485	1
		RNAV (GPS) RWY 31	476	1	466	1
		VOR RWY 03	416	1	465	1
		VOR RWY 21	757	1/2	745	1



**Table C-3 (Continued)**  
**Published Instrument Approaches at Wisconsin System Airports**

City	Airport Name	Instrument Approach	Lowest Straight In Approach Ceiling (feet)	Lowest Straight In Approach Visibility (miles)	Lowest Circling Approach Ceiling (feet)	Lowest Circling Approach Visibility (miles)
Stevens Point	Stevens Point Municipal	VOR/DME RWY 30	372	1	470	1
		VOR/DME RWY 21	390	3/4	470	1
		VOR/DME RWY 03	432	1	470	1
		RNAV (GPS) RWY 30	412	1	470	1
		RNAV (GPS) RWY 21	200	3/4	470	1
		RNAV (GPS) RWY 12	652	1	650	1
		RNAV (GPS) RWY 03	301	1	470	1
		ILS or LOC RWY 21	470	3/4	470	1
Waukesha	Waukesha County	ILS or LOC RWY 10	200	1/2	549	1
		RNAV (GPS) RWY 10	200	1/2	549	1
		RNAV (GPS) RWY 28	514	1	549	1
		VOR-A	NA	NA	549	1
West Bend	West Bend Municipal	RNAV (GPS) RWY 06	533	1	533	1
		RNAV (GPS) RWY 13	598	1	593	1
		RNAV (GPS) RWY 24	312	1	533	1
		RNAV (GPS) RWY 31	296	1	533	1
		LOC RWY 31	520	1	512	1
		VOR RWY 13	658	1	652	1
		VOR RWY 24	616	1	613	1
Amery	Amery Municipal	RNAV (GPS) RWY 18	520	1	672	1
		RNAV (GPS) RWY 36	612	1	672	1
Antigo	Langlade County	RNAV (GPS) RWY 16	399	1	599	1
		RNAV (GPS) RWY 34	439	1	599	1
		NDB RWY 16	779	1	779	1
Ashland	John F. Kennedy Memorial	RNAV (GPS) RWY 02	336	1 1/4	473	1
		RNAV (GPS) RWY 13	328	1 1/4	413	1
		RNAV (GPS) RWY 20	360	1 1/4	413	1
		RNAV (GPS) RWY 31	293	1	413	1
		LOC/DME RWY 02	375	1	414	1
		VOR RWY 02	794	1	793	1
VOR RWY 31	573	1	573	1		
Baraboo	Baraboo-Wisconsin Dells	RNAV (GPS) RWY 01	295	1	560	1
		RNAV (GPS) RWY 19	440	1	560	1
		LOC/DME RWY 01	380	1	560	1
		VOR-A	NA	NA	600	1
Black River Falls	Black River Falls Area	RNAV (GPS) RWY 08	724	1	724	1
		NDB RWY 08	1,084	1 1/4	1,084	1 1/4
Boscobel	Boscobel	RNAV (GPS) RWY 07	370	1 1/4	887	1 1/4
		RNAV (GPS) RWY 25	308	1	887	1 1/4
		VOR/DME RWY 25	949	1 1/4	947	1 1/4
Brookfield	Capitol Drive	<i>none</i>				



**Table C-3 (Continued)**  
**Published Instrument Approaches at Wisconsin System Airports**

City	Airport Name	Instrument Approach	Lowest Straight In Approach Ceiling (feet)	Lowest Straight In Approach Visibility (miles)	Lowest Circling Approach Ceiling (feet)	Lowest Circling Approach Visibility (miles)
Burlington	Burlington Municipal	RNAV (GPS) RWY 29	541	1	561	1
		VOR or GPS-A	NA	NA	621	1
		VOR RWY 29	521	1	561	1
Chetek	Chetek Municipal - Southworth	RNAV (GPS) RWY 17	585	1	585	1
		RNAV (GPS) RWY 35	525	1	585	1
		VOR/DME-A	NA	NA	622	1
Clintonville	Clintonville Municipal	RNAV (GPS) RWY 04	357	1 1/4	518	1
		RNAV (GPS) RWY 14	303	1	518	1
		RNAV (GPS) RWY 22	362	1 1/4	518	1
		RNAV (GPS) RWY 32	323	1 1/4	518	1
Cumberland	Cumberland Municipal	GPS RWY 27	422	1	539	1
		VOR/DME-A	NA	NA	539	1
Eagle River	Eagle River Union	RNAV (GPS) RWY 04	328	1 1/4	478	1 1/4
		RNAV (GPS) RWY 22	370	1 1/4	478	1
		LOC/DME RWY 04	358	1	478	1
		VOR/DME RWY 04	618	1	618	1
Fort Atkinson	Fort Atkinson Municipal	RNAV (GPS) RWY 03	540	1	600	1
		RNAV (GPS) RWY 21	500	1	600	1
		VOR-A	NA	NA	620	1
Friendship-Adams	Adams County Legion Field	RNAV (GPS) RWY 33	524	1	664	1
Hartford	Hartford Municipal	RNAV (GPS) RWY 11	304	1	471	1
		RNAV (GPS) RWY 29	554	1	551	1
Hayward	Sawyer County	RNAV (GPS) RWY 02	300	1	664	1
		RNAV (GPS) RWY 20	295	1	664	2
		LOC/DME RWY 20	344	1	664	1
Juneau	Dodge County	RNAV (GPS) RWY 02	256	1	506	1
		RNAV (GPS) RWY 08	407	1	506	1
		RNAV (GPS) RWY 20	280	1	506	1
		RNAV (GPS) RWY 26	426	1	506	1
		LOC RWY 26	446	1	506	1
		NDB RWY 02	567	1	566	1
Ladysmith	Rusk County	RNAV (GPS) RWY 14	250	3/4	440	1
		RNAV (GPS) RWY 32	250	3/4	460	1
		NDB RWY 32	593	1	580	1
Land O'Lakes	King's Land O'Lakes	RNAV (GPS) RWY 14	516	1	516	1
		RNAV (GPS) RWY 32	436	1	496	1
		NDB RWY 14	616	1	616	1
		NDB RWY 32	816	1	816	1



**Table C-3 (Continued)**  
**Published Instrument Approaches at Wisconsin System Airports**

City	Airport Name	Instrument Approach	Lowest Straight In Approach Ceiling (feet)	Lowest Straight In Approach Visibility (miles)	Lowest Circling Approach Ceiling (feet)	Lowest Circling Approach Visibility (miles)
Lone Rock	Tri-County Regional	RNAV (GPS) RWY 09	277	1	803	1
		RNAV (GPS) RWY 27	658	2s	803	1
		LOC RWY 27	643	1	783	1
		VOR-A	943	1 1/4	803	1
Manitowoc	Manitowoc County	ILS or LOC RWY 17	200	1/2	549	1
		RNAV (GPS) RWY 17	200	1/2	549	1
		RNAV (GPS) RWY 35	355	1 1/4	549	1
		VOR/DME RWY 35	509	1	549	1
		VOR RWY 17	449	1/2	549	1
Marshfield	Marshfield Municipal - Roy Shwery Field	RNAV (GPS) RWY 16	319	1	443	1
		RNAV (GPS) RWY 34	250	3/4	443	1 3/4
		SDF RWY 34	383	1/2	423	1
		NDB RWY 05	687	1	662	1
		NDB RWY 16	662	1	662	1
Medford	Taylor County	RNAV (GPS) RWY 27	300	1	462	1
		NDB RWY 34	601	1	582	1
Menomonie	Menomonie Municipal - Score Field	RNAV (GPS) RWY 09	299	1	545	1
		RNAV (GPS) RWY 27	250	1	545	1
		VOR/DME RWY 27	666	1	665	1
Merrill	Merrill Municipal	RNAV (GPS) RWY 07	317	1 1/4	442	1
		RNAV (GPS) RWY 25	329	1 1/4	442	1
		NDB RWY 07	702	1	702	1
		NDB RWY 16	822	1	822	1
Mineral Point	Iowa County	RNAV (GPS) RWY 04	375	1	449	1
		RNAV (GPS) RWY 11	367	1	449	1
		RNAV (GPS) RWY 22	409	1	449	1
		RNAV (GPS) RWY 29	417	1	449	1
		NDB RWY 22	749	1	749	1
Minocqua-Woodruff	Lakeland/Noble F. Lee Memorial Field	RNAV (GPS) RWY 18	344	1 1/4	471	1
		RNAV (GPS) RWY 28	515	1	511	1
		RNAV (GPS) RWY 36	321	1	471	1
		LOC RWY 36	473	1	471	1
		NDB RWY 28	575	1	571	1
Monroe	Monroe Municipal	RNAV (GPS) RWY 12	394	1	454	1
		RNAV (GPS) RWY 30	410	1	454	1
		VOR/DME RWY 30	390	1	454	1
Osceola	L. O. Simenstad Municipal	RNAV (GPS) RWY 28	574	1	574	1



**Table C-3 (Continued)**  
**Published Instrument Approaches at Wisconsin System Airports**

City	Airport Name	Instrument Approach	Lowest Straight In Approach Ceiling (feet)	Lowest Straight In Approach Visibility (miles)	Lowest Circling Approach Ceiling (feet)	Lowest Circling Approach Visibility (miles)
Palmyra	Palmyra Municipal	<i>none</i>				
Phillips	Price County	RNAV (GPS) RWY 01	325	1 1/4	603	1
		RNAV (GPS) RWY 06	375	1	603	1
		RNAV (GPS) RWY 19	346	1 1/8	603	1
		RNAV (GPS) RWY 24	428	1	603	1
Platteville	Platteville Municipal	RNAV (GPS) RWY 07	250	1	415	1
		RNAV (GPS) RWY 15	250	1	475	1
		RNAV (GPS) RWY 25	418	1	415	1
		RNAV (GPS) RWY 33	250	1	415	1
Portage	Portage Municipal	VOR/DME or GPS-A	NA	NA	615	1
		VOR/DME RNAV or GPS RWY 17	582	1	615	1
Prairie du Chien	Prairie du Chien	RNAV (GPS) RWY 14	669	1	919	1
		RNAV (GPS) RWY 29	861	1	919	1
		RNAV (GPS) RWY 32	910	1 1/4	919	1 1/4
		VOR/DME RWY 29	941	1 1/4	939	1 1/4
Prairie du Sac	Sauk Prairie	RNAV (GPS) RWY 18	568	1	568	1
		RNAV (GPS) RWY 36	568	1	568	1
Reedsburg	Reedsburg Municipal	VOR or GPS-A	NA	NA	755	1
Shawano	Shawano Municipal	GPS RWY 30	649	1	649	1
Shell Lake	Shell Lake Municipal	RNAV (GPS) RWY 14	508	1	608	1
		RNAV (GPS) RWY 32	568	1	608	1
		VOR/DME RWY 32	668	1	668	1
Siren	Burnett County	VOR or GPS RWY 05	631	1	631	1
Sparta	Sparta/Fort McCoy	RNAV (GPS) RWY 11	250	7/8	682	1
		RNAV (GPS) RWY 29	276	7/8	682	1
		NDB RWY 29	729	1	722	1
Sturgeon Bay	Door County Cherryland	RNAV (GPS) RWY 02	289	1	435	1
		RNAV (GPS) RWY 10	400	1	436	1
		RNAV (GPS) RWY 20	250	1	435	1
		RNAV (GPS) RWY 28	480	1	476	1
		SDF RWY 02	515	1	515	1
Superior	Richard I. Bong	GPS RWY 03	408	1	546	1
		GPS RWY 13	506	1	546	1
		GPS RWY 31	386	1	546	1
Tomahawk	Tomahawk Regional	RNAV (GPS) RWY 09	250	1	473	1
		RNAV (GPS) RWY 27	250	1	453	1
		VOR/DME-A	NA	NA	594	1
Viroqua	Viroqua Municipal	RNAV (GPS) RWY 11	508	1	768	1
		RNAV (GPS) RWY 29	688	1	768	1



**Table C-3 (Continued)**  
**Published Instrument Approaches at Wisconsin System Airports**

City	Airport Name	Instrument Approach	Lowest Straight In Approach Ceiling (feet)	Lowest Straight In Approach Visibility (miles)	Lowest Circling Approach Ceiling (feet)	Lowest Circling Approach Visibility (miles)
Watertown	Watertown Municipal	RNAV (GPS) RWY 05	619	1	607	1
		RNAV (GPS) RWY 11	807	1	807	1
		RNAV (GPS) RWY 23	597	1	587	1
		RNAV (GPS) RWY 29	567	1	567	1
		VOR/DME RWY 29	587	1	587	1
		NDB RWY 05	619	1	607	1
		NDB RWY 23	837	1	827	1
Waupaca	Waupaca Municipal	RNAV (GPS) RWY 10	250	1	580	1
		RNAV (GPS) RWY 28	475	1	580	1
		NDB RWY 31	621	1	660	1
Wausau	Wausau Downtown	RNAV (GPS) RWY 12	465	1	639	1
		VOR or GPS-A	NA	NA	639	1
		NDB-B	NA	NA	639	1
Wisconsin Rapids	Alexander Field-South Wood County	GPS RWY 20	499	1	499	1
		SDF RWY 02	342	1	459	1
		VOR/DME or GPS-A	NA	NA	559	1
		NDB or GPS RWY 02	462	1	459	1
		NDB or GPS RWY 29	700	1	699	1
Barron	Barron Municipal	<i>none</i>				
Boulder Junction	Boulder Junction	<i>none</i>				
Boyceville	Boyceville Municipal	RNAV (GPS) RWY 08	476	1	713	1 mile
		RNAV (GPS) RWY 26	513	1	713	1 mile
Cable	Cable Union	GPS RWY 34	760	1	800	1 mile
Cassville	Cassville Municipal	<i>none</i>				
Crandon	Crandon Municipal	<i>none</i>				
Crivitz	Crivitz Municipal	<i>none</i>				
Ephraim-Gibraltar	Ephraim-Gibraltar	RNAV (GPS) RWY 14	538	1	567	1 mile
		RNAV (GPS) RWY 32	498	1	567	1 mile
Grantsburg	Grantsburg Municipal	VOR/DME or GPS-A	NA	NA	553	1 mile
Hillsboro	Joshua Sanford Field	<i>none</i>				
La Pointe	Major Gilbert Field	RNAV (GPS) RWY 04	591	1	591	1 mile
		RNAV (GPS) RWY 22	651	1	651	1 mile
Lancaster	Lancaster Municipal	<i>none</i>				
Madison	Blackhawk Airfield	VOR or GPS-A	NA	NA	600	1 mile
Manitowish Waters	Manitowish Waters	RNAV (GPS) RWY 14	550	1	550	1 mile
		RNAV (GPS) RWY 32	430	1	470	1 mile
Necedah	Necedah	RNAV (GPS) RWY 36	621	1	661	1 mile
Neillsville	Neillsville Municipal	GPS RWY 27	483	1	523	1 mile
		NDB RWY 27	603	1	603	1 mile



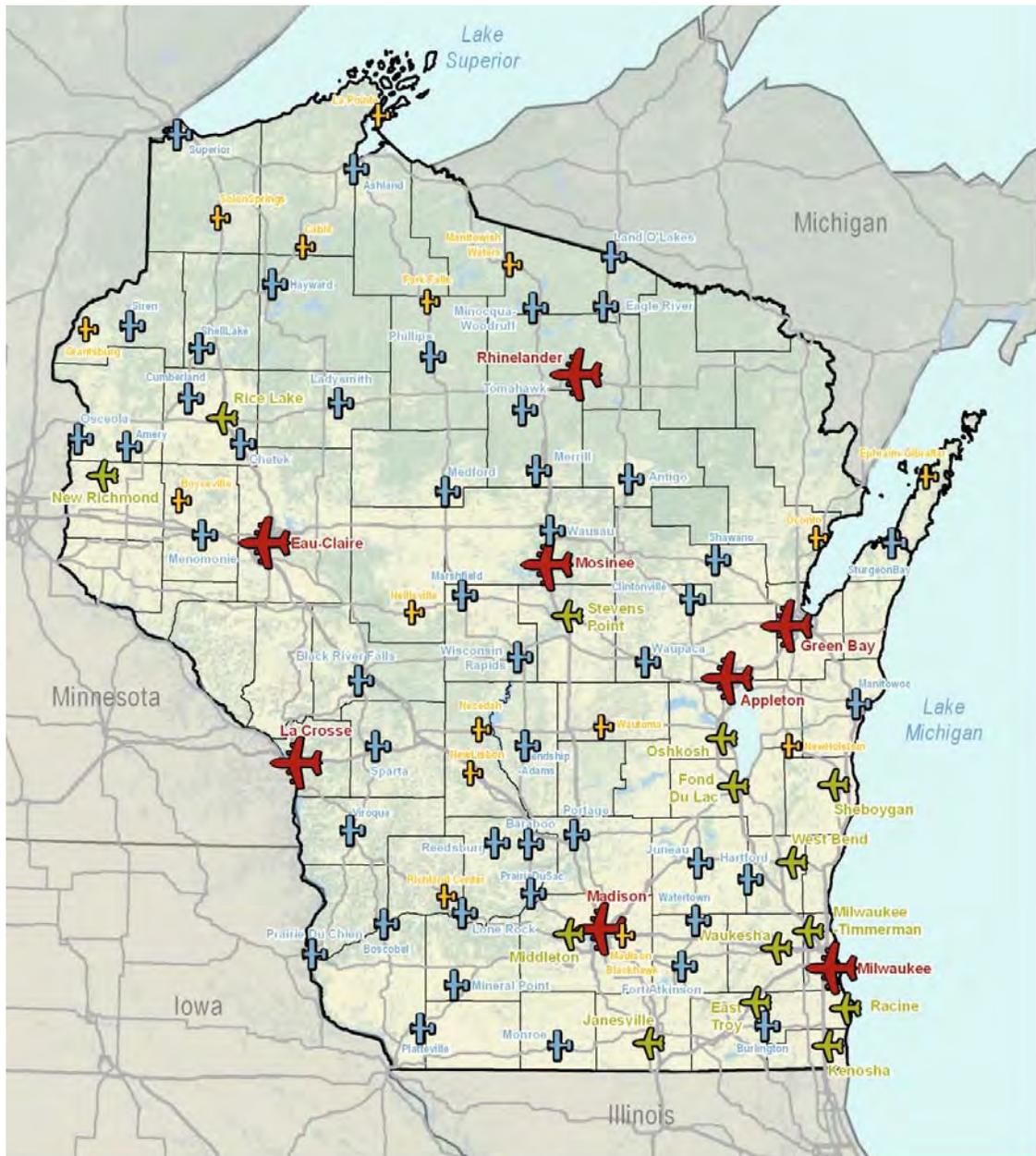
**Table C-3 (Continued)**  
**Published Instrument Approaches at Wisconsin System Airports**

City	Airport Name	Instrument Approach	Lowest Straight In Approach Ceiling (feet)	Lowest Straight In Approach Visibility (miles)	Lowest Circling Approach Ceiling (feet)	Lowest Circling Approach Visibility (miles)
New Holstein	New Holstein Municipal	RNAV (GPS) RWY 14	349	1 1/8	548	1 mile
		RNAV (GPS) RWY 32	399	1 3/8	548	1 mile
		VOR/DME-A	NA	NA	568	1 mile
New Lisbon	Mauston-New Lisbon Union	GPS RWY 32	537	1	674	1 mile
Oconto	J. Douglas Bake Memorial	GPS RWY 11	596	1	596	1 mile
		NDB or GPS RWY 29	636	1	636	1 mile
Park Falls	Park Falls Municipal	RNAV (GPS) RWY 18	526	1	560	1 mile
		RNAV (GPS) RWY 36	500	1	560	1 mile
		NDB RWY 36	700	1	700	1 mile
Prentice	Prentice	<i>none</i>				
Richland Center	Richland	VOR or GPS-A	NA	NA	878	1 mile
Solon Springs	Solon Springs Municipal	RNAV (GPS) RWY 19	698	1	698	1 mile
Three Lakes	Three Lakes Municipal	<i>none</i>				
Tomah	Bloyer Field	<i>none</i>				
Washington Island	Washington Island	<i>none</i>				
Wautoma	Wautoma Municipal	GPS RWY 31	581	1	621	1 mile
Wild Rose	Wild Rose Idlewild	<i>none</i>				

Source: Federal Aviation Administration



**Figure C-3 – Wisconsin Airports with Published Instrument Approaches**



-  Commercial Service
-  Large General Aviation
-  Medium General Aviation
-  Small General Aviation

- Major Roads
-  Interstates
  -  Highways



0 12.5 25 50 Miles

Source: WISDOT, ESRI, WisDNR, Wilbur Smith Associates



## 1.2.2 Inventory of Visual Landing Aids

**Table C-4** offers full details of visual landing aids on all Wisconsin system airport runways. In total, 95 of 98 system airports have some form of runway edge lighting on their primary runway. Seventy-six airports have a VGSI (PAPI or VASI) on at least one end of their primary runway. In addition, 68 system airports have REILs on at least one end of their primary runway, and 22 system airports have some form of approach lighting system on their primary runway. **Table C-5** details rotating beacons at the 98 system airports. In total, 93 of 98 system airports are equipped with a rotating beacon.

**Table C-4**  
**Visual Landing Aids at Wisconsin System Airports**

City	Airport Name	Runway Number	Lighting	PAPIs	VASIs	REILs	Approach Lighting
Appleton	Outagamie County Regional	03/21	HIRL	Both Ends	-	One End	MALSR
		12/30	HIRL	One End	One End	One End	MALSR
Eau Claire	Chippewa Valley Regional	04/22	HIRL	Both Ends	-	One End	MALSR
		14/32	MIRL	Both Ends	-	One End	-
Green Bay	Austin Straubel International	18/36	HIRL	Both Ends	-	One End	MALSR
		06/24	HIRL	Both Ends	-	-	MALSR
La Crosse	La Crosse Regional	18/36	HIRL	One End	One End	One End	MALSR
		13/31	HIRL	-	Both Ends	One End	-
		03/21	HIRL	Both Ends	-	-	-
Madison	Dane County Regional	18/36	HIRL	Both Ends	-	-	MALSR
		03/21	HIRL	Both Ends	-	One End	MALSR
		14/32	HIRL	Both Ends	-	One End	-
Milwaukee	General Mitchell International	01L/19R	HIRL	Both Ends	-	-	MALSR
		07R/25L	HIRL	Both Ends	-	One End	MALSR
		13/31	MIRL	Both Ends	-	Both Ends	-
		07L/25R	MIRL	One End	One End	Both Ends	-
		01R/19L	MIRL	-	-	One End	-
Mosinee	Central Wisconsin	08/26	HIRL	One End	-	One End	MALSR
		17/35	HIRL	One End	-	One End	MALSR
Rhinelander	Rhinelander-Oneida County	09/27	HIRL	One End	One End	One End	MALSR
		15/33	HIRL	One End	One End	Both Ends	-
East Troy	East Troy Municipal	08/26	MIRL	One End	-	Both Ends	-
		18/36	Edge Markers	-	-	-	-
Fond du Lac	Fond du Lac County	18/36	HIRL	Both Ends	-	One End	MALSR
		09/27	MIRL	-	-	-	-
Janesville	Southern Wisconsin Regional	14/32	HIRL	One End	One End	One End	MALSR
		04/22	HIRL	One End	One End	One End	MALSR
		18/36	MIRL	-	-	-	-



**Table C-4 (Continued)**  
**Visual Landing Aids at Wisconsin System Airports**

City	Airport Name	Runway Number	Lighting	PAPIs	VASIs	REILs	Approach Lighting
Kenosha	Kenosha Regional	07L/25R	HIRL	One End	One End	One End	MALSR
		15/33	HIRL	-	Both Ends	One End	-
		07R/25L	MIRL	Both Ends	-	-	-
Middleton	Middleton Municipal-Morey Field	10/28	MIRL	Both Ends	-	Both Ends	-
		01/19	-	-	-	-	-
Milwaukee	Lawrence J. Timmerman	15L/33R	MIRL	-	Both Ends	One End	-
		04L/22R	MIRL	-	Both Ends	Both Ends	-
		15R/33L	-	-	-	-	-
		04R/22L	-	-	-	-	-
New Richmond	New Richmond Regional	14/32	MIRL	Both Ends	-	Both Ends	-
		04/22	-	-	-	-	-
Oshkosh	Wittman Regional	18/36	HIRL	One End	One End	One End	MALSR
		09/27	HIRL	One End	One End	Both Ends	-
		04/22	-	-	-	-	-
		13/31	-	-	-	-	-
Racine	John H. Batten	04/22	HIRL	Both Ends	-	Both Ends	MALSF
		14/32	MIRL	One End	-	Both Ends	-
Rice Lake	Rice Lake Regional - Carl's Field	01/19	MIRL	Both Ends	-	One End	MALSR
		13/31	MIRL	Both Ends	-	Both Ends	-
Sheboygan	Sheboygan County Memorial	03/21	HIRL	Both Ends	-	One End	MALSR
		13/31	MIRL	Both Ends	-	-	-
Stevens Point	Stevens Point Municipal	03/21	HIRL	Both Ends	-	One End	MALS
		12/30	HIRL	-	-	-	-
Waukesha	Waukesha County	10/28	HIRL	One End	One End	One End	MALSR
		18/36	MIRL	Both Ends	-	Both Ends	-
West Bend	West Bend Municipal	13/31	MIRL	-	Both Ends	Both Ends	-
		06/24	MIRL	-	-	-	-
Amery	Amery Municipal	18/36	MIRL	-	Both Ends	Both Ends	-
Antigo	Langlade County	16/34	MIRL	Both Ends	-	Both Ends	-
		08/26	MIRL	Both Ends	-	-	-
Ashland	John F. Kennedy Memorial	02/20	MIRL	Both Ends	-	One End	-
		13/31	MIRL	One End	-	-	-
Baraboo	Baraboo-Wisconsin Dells	01/19	HIRL	One End	-	Both Ends	-
		14/32	-	-	-	-	-
Black River Falls	Black River Falls Area	08/26	MIRL	Both Ends	-	One End	-
Boscobel	Boscobel	07/25	MIRL	Both Ends	-	Both Ends	-
		02/20	MIRL	-	-	-	-



**Table C-4 (Continued)**  
**Visual Landing Aids at Wisconsin System Airports**

City	Airport Name	Runway Number	Lighting	PAPIs	VASIs	REILs	Approach Lighting
Brookfield	Capitol Drive	03/21	MIRL	-	Both Ends	One End	-
		09/27	-	-	-	-	-
		18/36	-	-	-	-	-
Burlington	Burlington Municipal	11/29	MIRL	One End	One End	Both Ends	-
		01/19	Edge Markers	-	-	-	-
Chetek	Chetek Municipal - Southworth	17/35	MIRL	Both Ends	-	Both Ends	-
		07/25	-	-	-	-	-
Clintonville	Clintonville Municipal	14/32	MIRL	One End	-	One End	-
		04/22	MIRL	-	-	-	-
		09/27	-	-	-	-	-
Cumberland	Cumberland Municipal	09/27	MIRL	-	Both Ends	One End	-
		18/36	Edge Markers	-	-	-	-
Eagle River	Eagle River Union	04/22	MIRL	Both Ends	-	Both Ends	-
		13/31	MIRL	-	-	-	-
Fort Atkinson	Fort Atkinson Municipal	03/21	MIRL	One End	-	-	-
Friendship-Adams	Adams County Legion Field	15/33	MIRL	Both Ends	-	Both Ends	-
		08/26	Edge Markers	-	-	-	-
Hartford	Hartford Municipal	11/29	MIRL	-	-	-	-
		18/36	-	-	-	-	-
Hayward	Sawyer County	02/20	MIRL	Both Ends	-	Both Ends	-
		16/34	-	-	-	-	-
Juneau	Dodge County	08/26	MIRL	Both Ends	-	-	MALSF
		02/20	MIRL	Both Ends	-	Both Ends	-
Ladysmith	Rusk County	14/32	MIRL	Both Ends	-	Both Ends	-
		01/19	MIRL	-	-	-	-
Land O'Lakes	King's Land O'Lakes	14/32	MIRL	Both Ends	-	One End	-
		05/23	Edge Markers	-	-	-	-
Lone Rock	Tri-County Regional	09/27	MIRL	Both Ends	-	One End	-
		18/36	MIRL	-	-	-	-
Manitowoc	Manitowoc County	17/35	HIRL	-	Both Ends	One End	MALSR
		07/25	MIRL	-	-	-	-
Marshfield	Marshfield Municipal - Roy Shwery Field	16/34	MIRL	-	Both Ends	One End	MALSR
		04/22	MIRL	One End	-	One End	-
Medford	Taylor County	09/27	MIRL	Both Ends	-	Both Ends	-
		16/34	MIRL	Both Ends	-	One End	-



**Table C-4 (Continued)**  
**Visual Landing Aids at Wisconsin System Airports**

City	Airport Name	Runway Number	Lighting	PAPIs	VASIs	REILs	Approach Lighting
Menomonie	Menomonie Municipal - Score Field	09/27	MIRL	Both Ends	-	Both Ends	-
		18/36	MIRL	Both Ends	-	One End	-
Merrill	Merrill Municipal	07/25	MIRL	Both Ends	-	Both Ends	-
		16/34	MIRL	-	-	-	-
Mineral Point	Iowa County	11/29	MIRL	Both Ends	-	Both Ends	-
		04/22	MIRL	Both Ends	-	-	-
Minocqua-Woodruff	Lakeland/Noble F. Lee Memorial Field	18/36	HIRL	-	Both Ends	Both Ends	MALSR
		10/28	MIRL	One End	-	One End	-
Monroe	Monroe Municipal	12/30	MIRL	Both Ends	-	Both Ends	-
		02/20	MIRL	One End	-	Both Ends	-
Osceola	L. O. Simenstad Municipal	10/28	MIRL	Both Ends	-	One End	-
		04/22	-	-	-	-	-
Palmyra	Palmyra Municipal	09/27	LIRL	-	-	-	-
Phillips	Price County	01/19	MIRL	Both Ends	-	Both Ends	-
		06/24	MIRL	-	Both Ends	One End	-
Platteville	Platteville Municipal	15/33	MIRL	One End	-	Both Ends	-
		07/25	MIRL	-	-	-	-
Portage	Portage Municipal	17/35	MIRL	One End	-	One End	-
		04/22	-	-	-	-	-
Prairie du Chien	Prairie du Chien	14/32	MIRL	Both Ends	-	Both Ends	-
		11/29	MIRL	-	-	-	-
Prairie du Sac	Sauk Prairie	18/36	MIRL	-	-	Both Ends	-
Reedsburg	Reedsburg Municipal	18/36	MIRL	One End	-	Both Ends	-
		07/25	MIRL	-	-	-	-
Shawano	Shawano Municipal	11/29	MIRL	-	-	-	-
		17/35	MIRL	-	-	-	-
Shell Lake	Shell Lake Municipal	14/32	MIRL	Both Ends	-	One End	-
Siren	Burnett County	14/32	MIRL	Both Ends	-	Both Ends	-
		05/23	MIRL	Both Ends	-	Both Ends	-
Sparta	Sparta/Fort McCoy	11/29	MIRL	One End	-	Both Ends	-
		01/19	MIRL	-	-	-	-
Sturgeon Bay	Door County Cherryland	02/20	MIRL	Both Ends	-	Both Ends	LDIN
		10/28	MIRL	Both Ends	-	Both Ends	-
Superior	Richard I. Bong	03/21	MIRL	One End	-	Both Ends	-
		13/31	MIRL	One End	-	Both Ends	-
Tomahawk	Tomahawk Regional	09/27	MIRL	Both Ends	-	Both Ends	-
Viroqua	Viroqua Municipal	11/29	MIRL	Both Ends	-	Both ends	-
		02/20	Edge Markers	-	-	-	-



**Table C-4 (Continued)**  
**Visual Landing Aids at Wisconsin System Airports**

City	Airport Name	Runway Number	Lighting	PAPIs	VASIs	REILs	Approach Lighting
Watertown	Watertown Municipal	05/23	MIRL	Both Ends	-	Both Ends	-
		11/29	MIRL	-	-	-	-
Waupaca	Waupaca Municipal	10/28	MIRL	Both Ends	-	Both Ends	-
		13/31	MIRL	Both Ends	-	-	-
Wausau	Wausau Downtown	12/30	MIRL	Both Ends	-	Both Ends	-
		04/22	MIRL	-	-	-	-
Wisconsin Rapids	Alexander Field-South Wood County	02/20	MIRL	Both Ends	-	Both Ends	-
		11/29	MIRL	One End	-	-	-
		18/36	Edge Markers	-	-	-	-
Barron	Barron Municipal	09/27	Edge Markers	-	-	-	-
Boulder Junction	Boulder Junction	05/23	Edge Markers	-	-	-	-
		16/34	Edge Markers	-	-	-	-
Boyceville	Boyceville Municipal	08/26	MIRL	Both Ends	-	One End	-
Cable	Cable Union	16/34	LIRL	-	-	One End	-
		08/26	Edge Markers	-	-	-	-
Cassville	Cassville Municipal	11/29	LIRL	-	-	-	-
Crandon	Crandon Municipal	11/29	LIRL	-	-	-	-
		01/19	-	-	-	-	-
Crivitz	Crivitz Municipal	18/36	LIRL	-	-	-	-
		09/27	-	-	-	-	-
Ephraim-Gibraltar	Ephraim-Gibraltar	14/32	MIRL	Both Ends	-	-	-
		01/19	Edge Markers	-	-	-	-
Grantsburg	Grantsburg Municipal	12/30	MIRL	-	-	-	-
		05/23	Edge Markers	-	-	-	-
Hillsboro	Joshua Sanford Field	05/23	LIRL	-	One End	-	-
La Pointe	Major Gilbert Field	04/22	LIRL	Both Ends	-	-	-
Lancaster	Lancaster Municipal	18/36	LIRL	-	-	-	-
Madison	Blackhawk Airfield	04/22	-	-	-	-	-
		09/27	LIRL	-	-	-	-
Manitowish Waters	Manitowish Waters	14/32	MIRL	One End	-	-	-
		04/22	Edge Markers	-	-	-	-
Necedah	Necedah	18/36	LIRL	-	-	-	-
Neillsville	Neillsville Municipal	09/27	LIRL	-	Both Ends	-	-
New Holstein	New Holstein Municipal	14/32	MIRL	-	-	Both Ends	-
		04/22	-	-	-	-	-



**Table C-4 (Continued)**  
**Visual Landing Aids at Wisconsin System Airports**

City	Airport Name	Runway Number	Lighting	PAPIs	VASIs	REILs	Approach Lighting
New Lisbon	Mauston-New Lisbon Union	14/32	MIRL	-	Both Ends	-	-
Oconto	J. Douglas Bake Memorial	11/29 04/22	MIRL -	- -	- -	One End -	- -
Park Falls	Park Falls Municipal	18/36	MIRL	Both Ends	-	-	-
Prentice	Prentice	09/27	MIRL	-	-	-	-
Richland Center	Richland	17/35 09/27	MIRL Edge Markers	Both Ends -	- -	Both Ends -	- -
Solon Springs	Solon Springs Municipal	01/19	LIRL	-	-	-	-
Three Lakes	Three Lakes Municipal	03/21	LIRL	One End	-	-	-
Tomah	Bloyer Field	07/25	MIRL	Both Ends	-	Both Ends	-
Washington Island	Washington Island	14/32 02/20	LIRL -	- -	- -	- -	- -
Wautoma	Wautoma Municipal	13/31 08/26 05/23	MIRL - -	- - -	- - -	- - -	- - -
Wild Rose	Wild Rose Idlewild	09/27 18/36	LIRL Edge Markers	- -	- -	- -	- -

Source: Short Elliott Hendrickson Inc.

**Table C-5**  
**Rotating Beacons at Wisconsin System Airports**

City	Airport Name	Rotating Beacon
Appleton	Outagamie County Regional	Yes
Eau Claire	Chippewa Valley Regional	Yes
Green Bay	Austin Straubel International	Yes
La Crosse	La Crosse Regional	Yes
Madison	Dane County Regional	Yes
Milwaukee	General Mitchell International	Yes
Mosinee	Central Wisconsin	Yes
Rhineland	Rhineland-Oneida County	Yes
East Troy	East Troy Municipal	Yes
Fond du Lac	Fond du Lac County	Yes
Janesville	Southern Wisconsin Regional	Yes
Kenosha	Kenosha Regional	Yes
Middleton	Middleton Municipal-Morey Field	Yes
Milwaukee	Lawrence J. Timmerman	Yes



**Table C-5 (Continued)**  
**Rotating Beacons at Wisconsin System Airports**

<b>City</b>	<b>Airport Name</b>	<b>Rotating Beacon</b>
New Richmond	New Richmond Regional	Yes
Oshkosh	Wittman Regional	Yes
Racine	John H. Batten	Yes
Rice Lake	Rice Lake Regional - Carl's Field	Yes
Sheboygan	Sheboygan County Memorial	Yes
Stevens Point	Stevens Point Municipal	Yes
Waukesha	Waukesha County	Yes
West Bend	West Bend Municipal	Yes
Amery	Amery Municipal	Yes
Antigo	Langlade County	Yes
Ashland	John F. Kennedy Memorial	Yes
Baraboo	Baraboo-Wisconsin Dells	Yes
Black River Falls	Black River Falls Area	Yes
Boscobel	Boscobel	Yes
Brookfield	Capitol Drive	Yes
Burlington	Burlington Municipal	Yes
Chetek	Chetek Municipal - Southworth	Yes
Clintonville	Clintonville Municipal	Yes
Cumberland	Cumberland Municipal	Yes
Eagle River	Eagle River Union	Yes
Fort Atkinson	Fort Atkinson Municipal	Yes
Friendship-Adams	Adams County Legion Field	Yes
Hartford	Hartford Municipal	Yes
Hayward	Sawyer County	Yes
Juneau	Dodge County	Yes
Ladysmith	Rusk County	Yes
Land O'Lakes	King's Land O' Lakes	Yes
Lone Rock	Tri-County Regional	Yes
Manitowoc	Manitowoc County	Yes
Marshfield	Marshfield Municipal - Roy Shwery Field	Yes
Medford	Taylor County	Yes
Menomonie	Menomonie Municipal - Score Field	Yes
Merrill	Merrill Municipal	Yes
Mineral Point	Iowa County	Yes
Minocqua-Woodruff	Lakeland/Noble F. Lee Memorial Field	Yes
Monroe	Monroe Municipal	Yes
Osceola	L. O. Simenstad Municipal	Yes
Palmyra	Palmyra Municipal	No



**Table C-5 (Continued)**  
**Rotating Beacons at Wisconsin System Airports**

<b>City</b>	<b>Airport Name</b>	<b>Rotating Beacon</b>
Phillips	Price County	Yes
Platteville	Platteville Municipal	Yes
Portage	Portage Municipal	Yes
Prairie du Chien	Prairie du Chien	Yes
Prairie du Sac	Sauk Prairie	Yes
Reedsburg	Reedsburg Municipal	Yes
Shawano	Shawano Municipal	Yes
Shell Lake	Shell Lake Municipal	Yes
Siren	Burnett County	Yes
Sparta	Sparta/Fort McCoy	Yes
Sturgeon Bay	Door County Cherryland	Yes
Superior	Richard I. Bong	Yes
Tomahawk	Tomahawk Regional	Yes
Viroqua	Viroqua Municipal	Yes
Watertown	Watertown Municipal	Yes
Waupaca	Waupaca Municipal	Yes
Wausau	Wausau Downtown	Yes
Wisconsin Rapids	Alexander Field-South Wood County	Yes
Barron	Barron Municipal	No
Boulder Junction	Boulder Junction	No
Boyceville	Boyceville Municipal	Yes
Cable	Cable Union	Yes
Cassville	Cassville Municipal	No
Crandon	Crandon Municipal	Yes
Crivitz	Crivitz Municipal	Yes
Ephraim-Gibraltar	Ephraim-Gibraltar	Yes
Grantsburg	Grantsburg Municipal	Yes
Hillsboro	Joshua Sanford Field	No
La Pointe	Major Gilbert Field	Yes
Lancaster	Lancaster Municipal	Yes
Madison	Blackhawk Airfield	Yes
Manitowish Waters	Manitowish Waters	Yes
Necedah	Necedah	Yes
Neillsville	Neillsville Municipal	Yes
New Holstein	New Holstein Municipal	Yes
New Lisbon	Mauston-New Lisbon Union	Yes
Oconto	J. Douglas Bake Memorial	Yes
Park Falls	Park Falls Municipal	Yes
Prentice	Prentice	Yes



**Table C-5 (Continued)**  
**Rotating Beacons at Wisconsin System Airports**

City	Airport Name	Rotating Beacon
Richland Center	Richland	Yes
Solon Springs	Solon Springs Municipal	Yes
Three Lakes	Three Lakes Municipal	Yes
Tomah	Bloyer Field	Yes
Washington Island	Washington Island	Yes
Wautoma	Wautoma Municipal	Yes
Wild Rose	Wild Rose Idlewild	Yes

Source: Short Elliott Hendrickson Inc.

### 1.3 Instrument Approach Capability Alternatives

As detailed in previous sections, the goal of this plan is to recommend approach capabilities for SASP airports that allow all-weather access. To achieve this, goals for approach minima have been set for each of the four airport classifications. Two sets of alternatives were developed based on the *FAA Advisory Circular 150/5300-13*. **Table C-6** details these alternatives for each airport classification, with cloud ceiling expressed in feet and visibility in statute miles.

**Table C-6**  
**Instrument Approach Capability Alternatives**

Airport Classification	Recommended Alternative	Alternative #2
Commercial Service	200' ceiling and 1/2 mile visibility	200' ceiling and 1/2 mile visibility
Large GA	200' to 300' ceiling and 1/2 mile visibility	200' to 300' ceiling and 3/4 mile visibility
Medium GA	400' to 600' ceiling and 3/4 mile visibility	400' to 600' ceiling and 1 mile visibility
Small GA	400' to 600' ceiling and 1 mile visibility	400' to 600' ceiling and 1 mile visibility

Sources: CDM Smith, Short Elliott Hendrickson Inc., Wisconsin Department of Transportation

The higher the level of service at airports in each classification, the more advanced the instrument approach system needs to be, allowing for lower cloud ceiling and visibility minima. Airports in the commercial service classification are required to have a 200 foot cloud ceiling and visibility minimum of 1/2 mile. Large GA airports are required to have a cloud ceiling between 200 and 300 feet in both alternatives. In the recommended alternative, the visibility minimum is set at 1/2 mile, while it is set at 3/4 mile in alternative #2. Medium GA airports are required to have a 400 to 600 foot cloud ceiling, with a 3/4 mile visibility minimum in the recommended alternative and one mile visibility minimum in alternative #2. Airports in the small GA classification are required to have a 400 to 600 foot cloud ceiling and one mile visibility in both alternatives. All airports were evaluated for the alternative demands of their respective classifications.



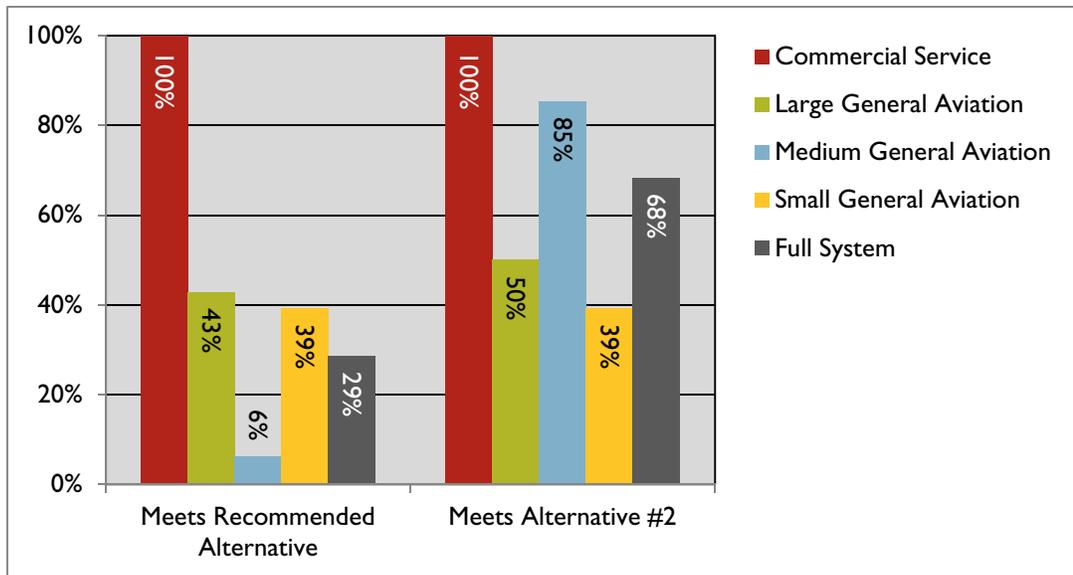
Approach standards in the recommended alternative were based on the cost of achieving the approach minima, the level of service recommended of each airport classification and the past experience of the Wisconsin Bureau of Aeronautics.

### 1.3.1 Alternative Compliance

Alternative compliance is based only on an airport’s best possible instrument approach. For example, if an airport has a VOR approach that does not meet visibility minima, but also has an ILS that does, the airport is considered to meet the demands of that alternative.

**Chart C-1** summarizes compliance. In total, 29 percent of the Wisconsin airport system meets approach capabilities for the recommended alternative, while 68 percent meets requirements for alternative #2. All commercial service airports meet the approach requirements of both alternatives. By GA classification, 43 percent of large GA, six percent of medium GA, and 39 percent of small GA meet the recommended alternative. A greater percentage of system airports meet the requirements of alternative #2, with 50 percent of large GA, 85 percent of medium GA, and 39 percent of small GA meeting the requirements.

**Chart C-1**  
**Summary of Approach Alternative Compliance**



Sources: CDM Smith, Short Elliott Hendrickson Inc.



**Table C-7** Alternative compliance for each system airport by detailing each airport’s best approach minima.

**Table C-7  
Airport Compliance with Approach Capability Alternatives**

City	Airport Name	Lowest Approach Visibility (miles)	Lowest Approach Ceiling (feet)	Meets Recommended Alternative Minima	Meets Alternative #2 Minima
<b>Commercial Service</b>				<b>200' and 1/2 mile</b>	<b>200' and 1/2 mile</b>
Appleton	Outagamie County Regional	1/2 mile	200	Yes	Yes
Eau Claire	Chippewa Valley Regional	1/2 mile	200	Yes	Yes
Green Bay	Austin Straubel International	1/2 mile	200	Yes	Yes
La Crosse	La Crosse Regional	1/2 mile	200	Yes	Yes
Madison	Dane County Regional	1/2 mile	200	Yes	Yes
Milwaukee	General Mitchell International	0	0	Yes	Yes
Mosinee	Central Wisconsin	1/2 mile	200	Yes	Yes
Rhineland	Rhineland-Oneida County	1/2 mile	200	Yes	Yes
<b>Large GA</b>				<b>200' to 300' and 1/2 mile</b>	<b>200' to 300' and 3/4 mile</b>
East Troy	East Troy Municipal	1 mile	250	No	No
Fond du Lac	Fond du Lac County	1/2 mile	330	No	No
Janesville	Southern Wisconsin Regional	1/2 mile	200	Yes	Yes
Kenosha	Kenosha Regional	1/2 mile	200	Yes	Yes
Middleton	Middleton Municipal-Morey Field	1 mile	398	No	No
Milwaukee	Lawrence J. Timmerman	1 mile	250	No	No
New Richmond	New Richmond Regional	1 mile	250	No	No
Oshkosh	Wittman Regional	1/2 mile	200	Yes	Yes
Racine	John H. Batten	1 mile	255	No	No
Rice Lake	Rice Lake Regional - Carl's Field	1/2 mile	200	Yes	Yes
Sheboygan	Sheboygan County Memorial	1/2 mile	249	Yes	Yes
Stevens Point	Stevens Point Municipal	3/4 mile	200	No	Yes
Waukesha	Waukesha County	1/2 mile	200	Yes	Yes
West Bend	West Bend Municipal	1 mile	296	No	No



**Table C-7 (Continued)**  
**Airport Compliance with Approach Capability Alternatives**

City	Airport Name	Lowest Approach Visibility (miles)	Lowest Approach Ceiling (feet)	Meets Recommended Alternative Minima	Meets Alternative #2 Minima
<b>Medium GA</b>				<b>400' to 600' and 3/4 mile</b>	<b>400' to 600' and 1 mile</b>
Amery	Amery Municipal	1 mile	520	No	Yes
Antigo	Langlade County	1 mile	399	No	Yes
Ashland	John F. Kennedy Memorial	1 mile	293	No	Yes
Baraboo	Baraboo-Wisconsin Dells	1 mile	295	No	Yes
Black River Falls	Black River Falls Area	1 mile	724	No	No
Boscobel	Boscobel	1 mile	308	No	Yes
Brookfield	Capitol Drive	Visual	Visual	No	No
Burlington	Burlington Municipal	1 mile	521	No	Yes
Chetek	Chetek Municipal - Southworth	1 mile	525	No	Yes
Clintonville	Clintonville Municipal	1 mile	303	No	Yes
Cumberland	Cumberland Municipal	1 mile	422	No	Yes
Eagle River	Eagle River Union	1 mile	328	No	Yes
Fort Atkinson	Fort Atkinson Municipal	1 mile	500	No	Yes
Friendship-Adams	Adams County Legion Field	1 mile	524	No	Yes
Hartford	Hartford Municipal	1 mile	304	No	Yes
Hayward	Sawyer County	1 mile	295	No	Yes
Juneau	Dodge County	1 mile	256	No	Yes
Ladysmith	Rusk County	3/4 mile	250	Yes	Yes
Land O'Lakes	King's Land O'Lakes	1 mile	436	No	Yes
Lone Rock	Tri-County Regional	1 mile	277	No	Yes
Manitowoc	Manitowoc County	1/2 mile	200	Yes	Yes
Marshfield	Marshfield Municipal - Roy Shwery Field	1/2 mile	250	Yes	Yes
Medford	Taylor County	1 mile	300	No	Yes
Menomonie	Menomonie Municipal - Score Field	1 mile	250	No	Yes
Merrill	Merrill Municipal	1 mile	317	No	Yes
Mineral Point	Iowa County	1 mile	367	No	Yes
Minocqua-Woodruff	Lakeland/Noble F. Lee Memorial Field	1 mile	321	No	Yes
Monroe	Monroe Municipal	1 mile	390	No	Yes
Osceola	L. O. Simenstad Municipal	1 mile	574	No	Yes
Palmyra	Palmyra Municipal	Visual	Visual	No	No
Phillips	Price County	1 mile	325	No	Yes



**Table C-7 (Continued)**  
**Airport Compliance with Approach Capability Alternatives**

City	Airport Name	Lowest Approach Visibility (miles)	Lowest Approach Ceiling (feet)	Meets Recommended Alternative Minima	Meets Alternative #2 Minima
Platteville	Platteville Municipal	1 mile	250	No	Yes
Portage	Portage Municipal	1 mile	582	No	Yes
Prairie du Chien	Prairie du Chien	1 mile	669	No	No
Prairie du Sac	Sauk Prairie	1 mile	568	No	Yes
Reedsburg	Reedsburg Municipal	1 mile	755	No	No
Shawano	Shawano Municipal	1 mile	649	No	No
Shell Lake	Shell Lake Municipal	1 mile	508	No	Yes
Siren	Burnett County	1 mile	631	No	No
Sparta	Sparta/Fort McCoy	7/8 mile	250	No	Yes
Sturgeon Bay	Door County Cherryland	1 mile	250	No	Yes
Superior	Richard I. Bong	1 mile	386	No	Yes
Tomahawk	Tomahawk Regional	1 mile	250	No	Yes
Viroqua	Viroqua Municipal	1 mile	508	No	Yes
Watertown	Watertown Municipal	1 mile	567	No	Yes
Waupaca	Waupaca Municipal	1 mile	250	No	Yes
Wausau	Wausau Downtown	1 mile	465	No	Yes
Wisconsin Rapids	Alexander Field-South Wood County	1 mile	342	No	Yes
<b>Small GA</b>				<b>400' to 600' and 1 mile</b>	<b>400' to 600' and 1 mile</b>
Barron	Barron Municipal	Visual	Visual	No	No
Boulder Junction	Boulder Junction	Visual	Visual	No	No
Boyceville	Boyceville Municipal	1 mile	476	Yes	Yes
Cable	Cable Union	1 mile	760	No	No
Cassville	Cassville Municipal	Visual	Visual	No	No
Crandon	Crandon Municipal	Visual	Visual	No	No
Crivitz	Crivitz Municipal	Visual	Visual	No	No
Ephraim-Gibraltar	Ephraim-Gibraltar	1 mile	498	Yes	Yes
Grantsburg	Grantsburg Municipal	1 mile	553	Yes	Yes
Hillsboro	Joshua Sanford Field	Visual	Visual	No	No
La Pointe	Major Gilbert Field	1 mile	591	Yes	Yes
Lancaster	Lancaster Municipal	Visual	Visual	No	No
Madison	Blackhawk Airfield	1 mile	600	Yes	Yes
Manitowish Waters	Manitowish Waters	1 mile	430	Yes	Yes



**Table C-7 (Continued)**  
**Airport Compliance with Approach Capability Alternatives**

City	Airport Name	Lowest Approach Visibility (miles)	Lowest Approach Ceiling (feet)	Meets Recommended Alternative Minima	Meets Alternative #2 Minima
Necedah	Necedah	1 mile	621	No	No
Neillsville	Neillsville Municipal	1 mile	483	Yes	Yes
New Holstein	New Holstein Municipal	1 1/8 mile	349	No	No
New Lisbon	Mauston-New Lisbon Union	1 mile	537	Yes	Yes
Oconto	J. Douglas Bake Memorial	1 mile	596	Yes	Yes
Park Falls	Park Falls Municipal	1 mile	500	Yes	Yes
Prentice	Prentice	Visual	Visual	No	No
Richland Center	Richland	1 mile	878	No	No
Solon Springs	Solon Springs Municipal	1 mile	698	No	No
Three Lakes	Three Lakes Municipal	Visual	Visual	No	No
Tomah	Bloyer Field	Visual	Visual	No	No
Washington Island	Washington Island	Visual	Visual	No	No
Wautoma	Wautoma Municipal	1 mile	581	Yes	Yes
Wild Rose	Wild Rose Idlewild	Visual	Visual	No	No

Sources: CDM Smith, Short Elliott Hendrickson Inc., Wisconsin Department of Transportation

## 1.4 Instrument Approach Capability Recommendations

To achieve the instrument approach requirements in the recommended alternative, airports in the Wisconsin system are recommended to use the most current satellite-based technology. All commercial service airports meet the requirements of the recommended alternative, and no facility upgrades are recommended at this time. Large GA airports that do not currently meet minima are recommended to install or upgrade to a GPS/LPV capable of achieving a 200 to 300 foot cloud ceiling and ½ visibility minima. Airports in the medium GA classification are recommended to install or upgrade to a GPS/RNAV capable of achieving a 400 to 600 foot cloud ceiling and ¾ mile visibility minima. Airports in the small GA classification are recommended to install or upgrade to a GPS/RNAV capable of achieving a 400 to 600 foot cloud ceiling and one mile visibility minima.

Some airports will not be able to achieve the recommended instrument approach capability due to obstructions that are impractical to remove, environmental impacts or excessive costs of implementation.

Table C-8 summarizes these requirements.



**Table C-8  
Instrument Approach Recommendations to Meet  
Recommended Alternative**

<b>Airport Classification</b>	<b>Recommended Alternative</b>	<b>Recommended Instrument Approach</b>
Commercial Service	200' ceiling and 1/2 mile visibility	GPS/LPV with WAAS/LAAS
Large GA	200' to 300' ceiling and 1/2 mile visibility	GPS/LPV with WAAS/LAAS
Medium GA	400' to 600' ceiling and 3/4 mile visibility	GPS/RNAV
Small GA	400' to 600' ceiling and 1 mile visibility	GPS/RNAV

*Source:* CDM Smith, Short Elliott Hendrickson Inc., Wisconsin Department of Transportation

## 1.5 Recommended Improvement Costs

Following the recommendation of approach capabilities to each of the airport classifications, the next step is to assign and compare the costs of the two alternatives. **Table C-9** sums and compares the estimated costs of the recommended alternative and alternative #2 for each of the four classifications. Because there are no upgrades recommended for commercial service airports, there is zero cost estimated for either alternative. The total estimated cost for the recommended alternative is more than \$275 million, with nearly \$125 million attributed to projects at large GA airports, nearly \$111 million at medium GA airports and more than \$39 million at small GA airports. At nearly \$127 million, the total estimated cost of alternative #2 is considerably lower. By classification, this cost is estimated at more than \$77 million for large GA, nearly \$110 million for medium GA and more than \$39 million for small GA airports.

**Table C-9  
Instrument Approach Recommendations to Meet  
Recommended Alternative**

<b>Classification</b>	<b>Cost of Recommended Alternative</b>	<b>Cost of Alternate #2</b>
Commercial Service	\$0	\$0
Large GA	\$124,667,000	\$77,501,200
Medium GA	\$110,934,000	\$9,991,000
Small GA	\$39,456,900	\$39,456,900
<b>Full Wisconsin System</b>	<b>\$275,057,900</b>	<b>\$126,949,100</b>

*Sources:* Short Elliott Hendrickson Inc., Wisconsin Department of Transportation

The difference in the estimated costs of the two alternatives can largely be attributed to projects at medium GA airports that would be necessary to achieve the recommended approach minima. Because only six percent of airports in the classification meet the recommended alternative (3/4 mile visibility and 400' to 600' ceiling), as opposed to 85 percent meeting alternative #2 (one mile visibility and 400' to 600' ceiling), there are far more projects recommended.



**Table C-10** provides details about the estimated costs per airport. The projects required for upgrading approach capabilities include, but are not limited to; land acquisition, building relocation, airport layout plan updates, approach surveys, runway and taxiway extensions, and the installation of navigational and visual aids such as runway and approach lighting. Individual cost estimates were prepared for each large and small GA airport, while costs for medium GA airports not meeting the recommended alternative were estimated differently. For medium GA airports, the estimated costs of six airports (two needing minor upgrades, two needing moderate upgrades, and two needing a major upgrades to airport infrastructure) were averaged. This average cost was applied to each of the medium GA airports that require upgrades to meet the ¾ mile visibility of the recommended alternative.

**Table C-10  
Instrument Approach Improvement Costs Per Airport**

City	Airport Name	Cost of Recommended Alternative	Cost of Alternative #2
<b>Commercial Service</b>		<b>200' and 1/2 mile</b>	<b>200' and 1/2 mile</b>
Appleton	Outagamie County Regional	Existing	Existing
Eau Claire	Chippewa Valley Regional	Existing	Existing
Green Bay	Austin Straubel International	Existing	Existing
La Crosse	La Crosse Regional	Existing	Existing
Madison	Dane County Regional	Existing	Existing
Milwaukee	General Mitchell International	Existing	Existing
Mosinee	Central Wisconsin	Existing	Existing
Rhineland	Rhineland-Oneida County	Existing	Existing
<b>Commercial Service Total</b>		<b>\$0</b>	<b>\$0</b>
<b>Large GA</b>		<b>200' to 300' and 1/2 mile</b>	<b>200' to 300' and 3/4 mile</b>
East Troy	East Troy Municipal	\$6,945,300	\$3,255,700
Fond du Lac	Fond du Lac County	\$100,000	\$100,000
Janesville	Southern Wisconsin Regional	Existing	Existing
Kenosha	Kenosha Regional	Existing	Existing
Middleton	Middleton Municipal-Morey Field	\$13,051,800	\$10,680,000
Milwaukee	Lawrence J. Timmerman	\$80,969,000	\$46,875,000
New Richmond	New Richmond Regional	\$8,241,500	\$5,341,500
Oshkosh	Wittman Regional	Existing	Existing
Racine	John H. Batten	\$8,975,400	\$6,990,000
Rice Lake	Rice Lake Regional - Carl's Field	Existing	Existing
Sheboygan	Sheboygan County Memorial	Existing	Existing
Stevens Point	Stevens Point Municipal	\$375,000	Existing
Waukesha	Waukesha County	Existing	Existing
West Bend	West Bend Municipal	\$6,009,000	\$4,259,000
<b>Large GA Total</b>		<b>\$124,667,000</b>	<b>\$77,501,200</b>



**Table C-10 (Continued)**  
**Instrument Approach Improvement Costs Per Airport**

City	Airport Name	Cost of Recommended Alternative	Cost of Alternative #2
<b>Medium GA</b>		<b>400' to 600' and 3/4 mile</b>	<b>400' to 600' and 1 mile</b>
Amery	Amery Municipal	\$2,465,200	Existing
Antigo	Langlade County	\$2,465,200	Existing
Ashland	John F. Kennedy Memorial	\$2,465,200	Existing
Baraboo	Baraboo-Wisconsin Dells	\$2,465,200	Existing
Black River Falls	Black River Falls Area	\$2,465,200	\$100,000
Boscobel	Boscobel	\$2,465,200	Existing
Brookfield	Capitol Drive	\$2,465,200	\$6,170,000
Burlington	Burlington Municipal	\$2,465,200	Existing
Chetek	Chetek Municipal - Southworth	\$2,465,200	Existing
Clintonville	Clintonville Municipal	\$2,465,200	Existing
Cumberland	Cumberland Municipal	\$2,465,200	Existing
Eagle River	Eagle River Union	\$2,465,200	Existing
Fort Atkinson	Fort Atkinson Municipal	\$2,465,200	Existing
Friendship-Adams	Adams County Legion Field	\$2,465,200	Existing
Hartford	Hartford Municipal	\$2,465,200	Existing
Hayward	Sawyer County	\$2,465,200	Existing
Juneau	Dodge County	\$2,465,200	Existing
Ladysmith	Rusk County	Existing	Existing
Land O'Lakes	King's Land O'Lakes	\$2,465,200	Existing
Lone Rock	Tri-County Regional	\$2,465,200	Existing
Manitowoc	Manitowoc County	Existing	Existing
Marshfield	Marshfield Municipal - Roy Shwery Field	Existing	Existing
Medford	Taylor County	\$2,465,200	Existing
Menomonie	Menomonie Municipal - Score Field	\$2,465,200	Existing
Merrill	Merrill Municipal	\$2,465,200	Existing
Mineral Point	Iowa County	\$2,465,200	Existing
Minocqua-Woodruff	Lakeland/Noble F. Lee Memorial Field	\$2,465,200	Existing
Monroe	Monroe Municipal	\$2,465,200	Existing
Osceola	L. O. Simenstad Municipal	\$2,465,200	Existing
Palmyra	Palmyra Municipal	\$2,465,200	\$3,421,000
Phillips	Price County	\$2,465,200	Existing
Platteville	Platteville Municipal	\$2,465,200	Existing
Portage	Portage Municipal	\$2,465,200	Existing
Prairie du Chien	Prairie du Chien	\$2,465,200	Existing



**Table C-10 (Continued)**  
**Instrument Approach Improvement Costs Per Airport**

City	Airport Name	Cost of Recommended Alternative	Cost of Alternative #2
Prairie du Sac	Sauk Prairie	\$2,465,200	Existing
Reedsburg	Reedsburg Municipal	\$2,465,200	\$100,000
Shawano	Shawano Municipal	\$2,465,200	\$100,000
Shell Lake	Shell Lake Municipal	\$2,465,200	Existing
Siren	Burnett County	\$2,465,200	\$100,000
Sparta	Sparta/Fort McCoy	\$2,465,200	Existing
Sturgeon Bay	Door County Cherryland	\$2,465,200	Existing
Superior	Richard I. Bong	\$2,465,200	Existing
Tomahawk	Tomahawk Regional	\$2,465,200	Existing
Viroqua	Viroqua Municipal	\$2,465,200	Existing
Watertown	Watertown Municipal	\$2,465,200	Existing
Waupaca	Waupaca Municipal	\$2,465,200	Existing
Wausau	Wausau Downtown	\$2,465,200	Existing
Wisconsin Rapids	Alexander Field-South Wood County	\$2,465,200	Existing
<b>Medium GA Total</b>		<b>\$110,934,000</b>	<b>\$9,991,000</b>
<b>Small GA</b>		<b>400' to 600' and 1 mile</b>	<b>400' to 600' and 1 mile</b>
Barron	Barron Municipal	\$2,781,200	\$2,781,200
Boulder Junction	Boulder Junction	\$1,032,300	\$1,032,300
Boyceville	Boyceville Municipal	Existing	Existing
Cable	Cable Union	\$100,000	\$100,000
Cassville	Cassville Municipal	\$18,699,500	\$18,699,500
Crandon	Crandon Municipal	\$100,000	\$100,000
Crivitz	Crivitz Municipal	\$1,714,900	\$1,714,900
Ephraim-Gibraltar	Ephraim-Gibraltar	Existing	Existing
Grantsburg	Grantsburg Municipal	Existing	Existing
Hillsboro	Joshua Sanford Field	\$3,494,100	\$3,494,100
La Pointe	Major Gilbert Field	Existing	Existing
Lancaster	Lancaster Municipal	\$5,332,000	\$5,332,000
Madison	Blackhawk Airfield	Existing	Existing
Manitowish Waters	Manitowish Waters	Existing	Existing
Necedah	Necedah	\$100,000	\$100,000
Neillsville	Neillsville Municipal	Existing	Existing
New Holstein	New Holstein Municipal	Existing	Existing
New Lisbon	Mauston-New Lisbon Union	Existing	Existing
Oconto	J. Douglas Bake Memorial	Existing	Existing
Park Falls	Park Falls Municipal	Existing	Existing



**Table C-10 (Continued)**  
**Instrument Approach Improvement Costs Per Airport**

City	Airport Name	Cost of Recommended Alternative	Cost of Alternative #2
Prentice	Prentice	\$1,577,300	\$1,577,300
Richland Center	Richland	\$100,000	\$100,000
Solon Springs	Solon Springs Municipal	\$100,000	\$100,000
Three Lakes	Three Lakes Municipal	\$100,000	\$100,000
Tomah	Bloyer Field	\$354,500	\$354,500
Washington Island	Washington Island	\$1,671,100	\$1,671,100
Wautoma	Wautoma Municipal	Existing	Existing
Wild Rose	Wild Rose Idlewild	\$2,200,000	\$2,200,000
<b>Small GA Total</b>		<b>\$39,456,900</b>	<b>\$39,456,900</b>

Sources: Short Elliott Hendrickson Inc., Wisconsin Department of Transportation

## 1.6 Weather Reporting Capabilities at Wisconsin Airports

In addition to an airport’s NAVAIDs, visual landing aids, and approach technology, up-to-the-minute and accurate weather reporting are essential to safe and timely aircraft operations. Automated weather reporting systems disseminate weather information to pilots through an automated VHF airband radio frequency. The following sections review the most common and current automated weather reporting systems and include recommendations for each classification in the Wisconsin Airport System.

### 1.6.1 Review of Weather Reporting Technology

As was the case with recommending NAVAIDs and visual landing aids, a review of technology is essential to assuring that the Wisconsin Airport System has the best and most current weather reporting technology available. The following are the standard and most commonly used weather reporting systems at airports in the United States.

#### 1.6.1.1 Automated Weather Observing System (AWOS)

The AWOS is one of the two most commonly used weather reporting technologies available to airports. AWOS units are operated and controlled by the FAA, state and local governments and private agencies. There are seven standard AWOS systems including:

- **AWOS I:** Reports wind speed and direction, wind gust, variable wind direction, temperature, dew point in Celsius, altimeter setting and density altitude
- **AWOS II:** Includes all capabilities of AWOS I plus visibility, variable visibility, precipitation and day/night
- **AWOS III:** Includes all capabilities of AWOS II plus sky condition and cloud height up to 12,000 feet
- **AWOS III/P:** Includes all capabilities of AWOS III plus present weather and precipitation identification
- **AWOS III/T:** Includes all capabilities of AWOS III plus thunderstorm and lightening detection



- **AWOS III/PT:** Includes all capabilities of AWOS III plus current weather and lightning detection
- **AWOS III/PTZ:** Includes all capabilities of AWOS III plus current weather, lightning detection and freezing rain detection

### 1.6.1.2 Automated Surface Observing System (ASOS)

The ASOS is the other most commonly used weather reporting technology at airports in the United States. As opposed to an AWOS, an ASOS system is operated and controlled by the National Weather Service (NWS), FAA and Department of Defense (DOD). An ASOS is comparable in weather reporting capabilities to an AWOS III/PTZ. In addition, it is able to report dew point in Fahrenheit, present weather conditions, icing, lightning detection, sea level pressure and precipitation accumulation.

### 1.6.1.3 Automated Weather Sensor System (AWSS)

The AWSS is a less common weather reporting system that is controlled by the FAA. The abilities of an AWSS are comparable to those of an AWOS III or ASOS.

## 1.6.2 Weather Reporting System Recommendations

**Table C-11** lists recommended weather reporting systems by airport classification. Airports in the commercial service and large GA classifications are recommended to install or upgrade to an AWOS III/PT system or have an ASOS, which is comparable in abilities to an AWOS III/PTZ. Airports in the medium GA classification are recommended to have either an ASOS or any AWOS system. There is no recommendation for small GA airports.

**Table C-11  
Weather Reporting System Recommendations**

Airport Classification	Recommended Weather Reporting System
Commercial Service	AWOS III/PT or ASOS
Large GA	AWOS III/PT or ASOS
Medium GA	AWOS or ASOS
Small GA	Not an Objective

*Sources:* CDM Smith, Short Elliott Hendrickson Inc., Wisconsin Department of Transportation

Airports with no on-site weather reporting systems, and airports in larger classifications should be given priority for upgrades to Wisconsin’s weather reporting network. This would mean that East Troy in the large GA category be given the highest priority recommendation for the installation of an AWOS III/PT, followed by medium GA airports with no onsite weather reporting system. Next are large GA airports that currently have onsite weather reporting systems but are recommended to receive an upgrade to AWOS III/PT.



Estimated costs to upgrade weather reporting facilities in the Wisconsin Airport System are summarized in **Table C-12**. The total estimated cost is \$1.2 million, with \$230,000 attributed to large GA airports and \$990,000 to medium GA airports. Because all commercial service airports in the system have either an ASOS or AWOS III/PTZ, there are no recommended improvements to weather reporting at these airports. These estimated costs vary by airport depending on what facilities are already in existence. For example, it costs less to upgrade from an AWOS III to an AWOS III/PT than to install a new system. Estimated costs per airport are detailed in **Table C-13**.

**Table C-12**  
**Weather Reporting System Recommendations Costs by Classification**

Airport Classification	Estimated Cost to Meet Recommendations
Commercial Service	\$0
Large GA	\$230,000
Medium GA	\$990,000
Small GA	\$0
<b>Wisconsin Airport System Total:</b>	<b>\$1,220,000</b>

*Sources:* CDM Smith, Short Elliott Hendrickson Inc., Wisconsin Department of Transportation

**Table C-13**  
**Weather Reporting System Recommendation Costs Per Airport**

City	Airport Name	Current Weather Reporting	Meets Requirements	Cost to Meet Recommendation
<b>Commercial Service: AWOS III/PT or ASOS</b>				
Appleton	Outagamie County Regional	AWOS III/PT	Yes	\$0
Eau Claire	Chippewa Valley Regional	ASOS	Yes	\$0
Green Bay	Austin Straubel International	ASOS	Yes	\$0
La Crosse	La Crosse Regional	ASOS	Yes	\$0
Madison	Dane County Regional	ASOS	Yes	\$0
Milwaukee	General Mitchell International	ASOS	Yes	\$0
Mosinee	Central Wisconsin	AWOS III/PT	Yes	\$0
Rhineland	Rhineland-Oneida County	ASOS	Yes	\$0
<b>Commercial Service Total:</b>				<b>0</b>
<b>Large GA: AWOS III/PT or ASOS</b>				
East Troy	East Troy Municipal	None	No	\$110,000
Fond du Lac	Fond du Lac County	ASOS	Yes	\$0
Janesville	Southern Wisconsin Regional	AWOS III/P	No	\$20,000
Kenosha	Kenosha Regional	ASOS	Yes	\$0
Middleton	Middleton Municipal-Morey Field	AWOS III	No	\$20,000
Milwaukee	Lawrence J. Timmerman	AWOS III/PT	Yes	\$0
New Richmond	New Richmond Regional	AWOS III/P	No	\$20,000



**Table C-13 (Continued)**  
**Weather Reporting System Recommendation Costs Per Airport**

City	Airport Name	Current Weather Reporting	Meets Requirements	Cost to Meet Recommendation
<b>Large GA: AWOS III/PT</b>				
Oshkosh	Wittman Regional	ASOS	Yes	\$0
Racine	John H. Batten	ASOS	Yes	\$0
Rice Lake	Rice Lake Regional - Carl's Field	AWOS III/PT	Yes	\$0
Sheboygan	Sheboygan County Memorial	ASOS	Yes	\$0
Stevens Point	Stevens Point Municipal	AWOS III/P	No	\$20,000
Waukesha	Waukesha County	AWOS III/P	No	\$20,000
West Bend	West Bend Municipal	AWOS III/P	No	\$20,000
<b>Large GA Total:</b>				<b>\$230,000</b>
<b>Medium GA: AWOS or ASOS</b>				
Amery	Amery Municipal	None	No	\$90,000
Antigo	Langlade County	AWOS III/P	Yes	\$0
Ashland	John F. Kennedy Memorial	ASOS	Yes	\$0
Baraboo	Baraboo-Wisconsin Dells	AWOS III/P	Yes	\$0
Black River Falls	Black River Falls Area	AWOS III/PT	Yes	\$0
Boscobel	Boscobel	ASOS	Yes	\$0
Brookfield	Capitol Drive	None	No	\$90,000
Burlington	Burlington Municipal	AWOS III/P	Yes	\$0
Chetek	Chetek Municipal - Southworth	None	No	\$90,000
Clintonville	Clintonville Municipal	AWOS III/P	Yes	\$0
Cumberland	Cumberland Municipal	AWOS III/PT	Yes	\$0
Eagle River	Eagle River Union	AWOS III/P	Yes	\$0
Fort Atkinson	Fort Atkinson Municipal	None	No	\$90,000
Friendship-Adams	Adams County Legion Field	None	No	\$90,000
Hartford	Hartford Municipal	None	No	\$90,000
Hayward	Sawyer County	ASOS	Yes	\$0
Juneau	Dodge County	AWOS III/P	Yes	\$0
Ladysmith	Rusk County	AWOS III/PT	Yes	\$0
Land O'Lakes	King's Land O'Lakes	AWOS III/PT	Yes	\$0
Lone Rock	Tri-County Regional	ASOS	Yes	\$0
Manitowoc	Manitowoc County	AWOS III	Yes	\$0
Marshfield	Marshfield Municipal - Roy Shwery Field	ASOS	Yes	\$0
Medford	Taylor County	AWOS III/P	Yes	\$0
Menomonie	Menomonie Municipal - Score Field	AWOS III/PT	Yes	\$0
Merrill	Merrill Municipal	AWOS III/PT	Yes	\$0
Mineral Point	Iowa County	AWOS III/P	Yes	\$0



**Table C-13 (Continued)**  
**Weather Reporting System Recommendation Costs Per Airport**

City	Airport Name	Current Weather Reporting	Meets Requirements	Cost to Meet Recommendation
Minocqua-Woodruff	Lakeland/Noble F. Lee Memorial Field	AWOS III/PT	Yes	\$0
Monroe	Monroe Municipal	AWOS III/P	Yes	\$0
Osceola	L. O. Simenstad Municipal	AWOS III/P	Yes	\$0
Palmyra	Palmyra Municipal	None	No	\$90,000
Phillips	Price County	AWOS III/PT	Yes	\$0
Platteville	Platteville Municipal	AWOS III	Yes	\$0
Portage	Portage Municipal	None	No	\$90,000
Prairie du Chien	Prairie du Chien	AWOS III/P	Yes	\$0
Prairie du Sac	Sauk Prairie	None	No	\$90,000
Reedsburg	Reedsburg Municipal	None	No	\$90,000
Shawano	Shawano Municipal	AWOS III/PT	Yes	\$0
Shell Lake	Shell Lake Municipal	None	No	\$90,000
Siren	Burnett County	AWOS III/P	Yes	\$0
Sparta	Sparta/Fort McCoy	AWOS III/PT	Yes	\$0
Sturgeon Bay	Door County Cherryland	AWOS III	Yes	\$0
Superior	Richard I. Bong	AWOS III/P	Yes	\$0
Tomahawk	Tomahawk Regional	AWOS III	Yes	\$0
Viroqua	Viroqua Municipal	AWOS III/PT	Yes	\$0
Watertown	Watertown Municipal	AWOS III/P	Yes	\$0
Waupaca	Waupaca Municipal	AWOS III/P	Yes	\$0
Wausau	Wausau Downtown	ASOS	Yes	\$0
Wisconsin Rapids	Alexander Field-South Wood County	ASOS	Yes	\$0
<b>Medium GA Total:</b>				<b>\$990,000</b>

*Sources: CDM Smith, Short Elliott Hendrickson Inc., Wisconsin Department of Transportation*

In addition to these costs, there is a cost associated with the maintenance and upkeep of the current AWOS/ASOS system in Wisconsin. The BOA has an ongoing contract with a vendor to provide 100 percent maintenance and data dissemination to the AWOS systems in the state. Currently, this is provided at an estimated cost of \$173,880 for the 38 systems currently maintained by the state.



## 1.7 Future Classification Considerations

In addition to the current classifications assigned in **Chapter 2**, there are recommendations for future classification changes. Three medium GA airports (Ashland, Hayward, and Medford) were recommended to have a future classification of large GA, while Oconto was recommended to change classification from small to medium GA. While no specific approach and weather reporting recommendations are included based on future classifications, it is important to consider the recommended improvements in the event that these airports change classifications.

**Table C-14** details approach requirements at these airports under their future classifications. All three airports that have a future classification of large GA will be recommended to lower their visibility minimum from  $\frac{3}{4}$  mile to  $\frac{1}{2}$  mile. These airports already meet their current and future cloud ceiling requirements. Oconto also meets current and future cloud ceiling requirements, but we recommend the airport reduce its visibility minimum to  $\frac{3}{4}$  mile to meet the requirements for medium GA airports.

**Table C-14**  
**Future Classification Considerations for Approach Capabilities**

City	Airport Name	Lowest Approach Visibility (miles)	Lowest Approach Ceiling (feet)	Future Approach Recommendation
<b>Large GA: 200' to 300' ceiling and 1/2 mile visibility</b>				
Ashland	John F. Kennedy Memorial	1 mile	293	Upgrade to 1/2 mile visibility
Hayward	Sawyer County	1 mile	295	Upgrade to 1/2 mile visibility
Medford	Taylor County	1 mile	300	Upgrade to 1/2 mile visibility
<b>Medium GA: 400' to 600' ceiling and 3/4 mile visibility</b>				
Oconto	J. Douglas Bake Memorial	1 mile	596	Upgrade to 3/4 mile visibility

Source: CDM Smith, Short Elliott Hendrickson Inc., Wisconsin Department of Transportation



**Table C-15** includes weather reporting recommendations under future classifications. All of these airports meet the goals of their current classifications, but system upgrades or installations is recommended in the event of a classification change. Of the three airports with a future classification of large GA, two have existing ASOS systems and will not require an upgrade, while Medford will be recommended to upgrade the existing AWOS III/P to an AWOS III/PT. For Oconto, an AWOS or ASOS will be recommended.

**Table C-15  
Future Classification Considerations for Weather Reporting Facilities**

City	Airport Name	Current Weather Reporting	Future Recommendation
<b>Large GA: AWOS III/PT or ASOS</b>			
Ashland	John F. Kennedy Memorial	ASOS	None
Hayward	Sawyer County	ASOS	None
Medford	Taylor County	AWOS III/P	Upgrade to AWOS III/PT
<b>Medium GA: AWOS or ASOS</b>			
Oconto	J. Douglas Bake Memorial	None	Install AWOS or ASOS

*Sources: CDM Smith, Short Elliott Hendrickson Inc., Wisconsin Department of Transportation*

