

*DULUTH AIRPORT AUTHORITY*

# *JOINT AIRPORT ZONING BOARD*

## *AIRPORT ZONING ORDINANCE ANALYSIS*

*SEPTEMBER 2020*

**RS&H**



## 1 INTRODUCTION

Duluth International Airport (DLH) is located in northeastern Minnesota along Lake Superior in St. Louis County. DLH is operated by the Duluth Airport Authority (DAA) and is surrounded by four political jurisdictions including the Canosia Township, Rice Lake Township, City of Hermantown and City of Duluth. All four political jurisdictions are within St. Louis County, and according to Minnesota law the zoning requirements in the vicinity of the Airport are the responsibility of a Joint Airport Zoning Board (JAZB), which is responsible for protecting both landowners and airport operational safety.

The purpose of this document is to describe the proposed changes to the existing DLH Airport Zoning Ordinance in accordance with a 2019 change in Minnesota Statutes. The JAZB and Airport staff work together with the local jurisdictions to implement land use policies that conform to Minnesota Statute Chapter 360.063 Airport Zoning, protect vulnerable populations, and enable compatible development near the Airport. The Minnesota Airport Zoning statute outlines four zones restricting development adjacent to airports:

- » Clear Zone: Airport must control property in the Runway Protection Zone (RPZ) associated with the approach to the runway
- » Zone A: There shall be no buildings in the approach zone adjacent to the RPZ
- » Zone B: No land use of less than 3 acres should be found in an approach zone that extends outward from Zone A to a distance equal to one-third of the runway length
- » Zone C: All land within the horizontal zone, subject to uses that do not interfere with airport electronic facilities

The purpose of the State's Airport Zoning statute is to ensure that the following elements are considered when allowing or denying land uses in the vicinity of the Airport:

- » Location of vulnerable populations
- » Availability of contiguous open spaces
- » Land uses that surround the airport, create or cause interference, attract large assemblies of people, attract wildlife, cause interference with airport operations
- » Airspace protection
- » Social and economic costs of restricting land uses
- » Accident rate compared to statistically significant sample
- » Planned uses within the airport hazard area
- » Any other information relevant to safety or the Airport

The JAZB sets zoning requirements for the properties surrounding the Airport, and the communities also have established individual zoning or land use measures to help protect incompatible uses. Zoning for the Canosia Township is administered through St. Louis County.

The Airport is generally surrounded by undeveloped, institutional, commercial, transportation, and some residential uses. The adjacent land uses and zoning districts according to each municipality are as shown in Table 1:

Table 1  
Airport Adjacent Land Uses

Property Location	Zone	Current Zoning	Current Uses
<b>City of Duluth</b>			
RW 21	A	Rural Residential (RR-1), Industrial – General (I-G)	Undeveloped land, single-family homes
RW 3	A	MU-B, MU-N	Commercial-retail, theater, recreational vehicle/mobile home park, repair shop
RW 27	A	Rural Residential- 1 (RR-1), Residential Traditional (R-1)	Vacant land, single-family homes, self-storage space
RW 27	B	Rural Residential- 1 (RR-1)	Vacant land, single-family homes
<b>Canosia Township</b>			
RW 21	A	N/A	Auto-sales, undeveloped land, single-family homes, commercial-retail sales, storage and warehouse
<b>Rice Lake Township</b>			
RW 21	A	Rural Residential 1, Commercial	Undeveloped land, single-family homes,
RW 21	B	Rural Residential 1, Commercial	Auto-sales, undeveloped land, single-family homes, commercial-retail sales, storage and warehouse
<b>City of Hermantown</b>			
RW 3	B	Public Facilities, General Commercial, Business/Light Manufacturing, R1 Residential	Single-family homes, commercial-retail, theater, recreational vehicle/mobile home park, repair shop

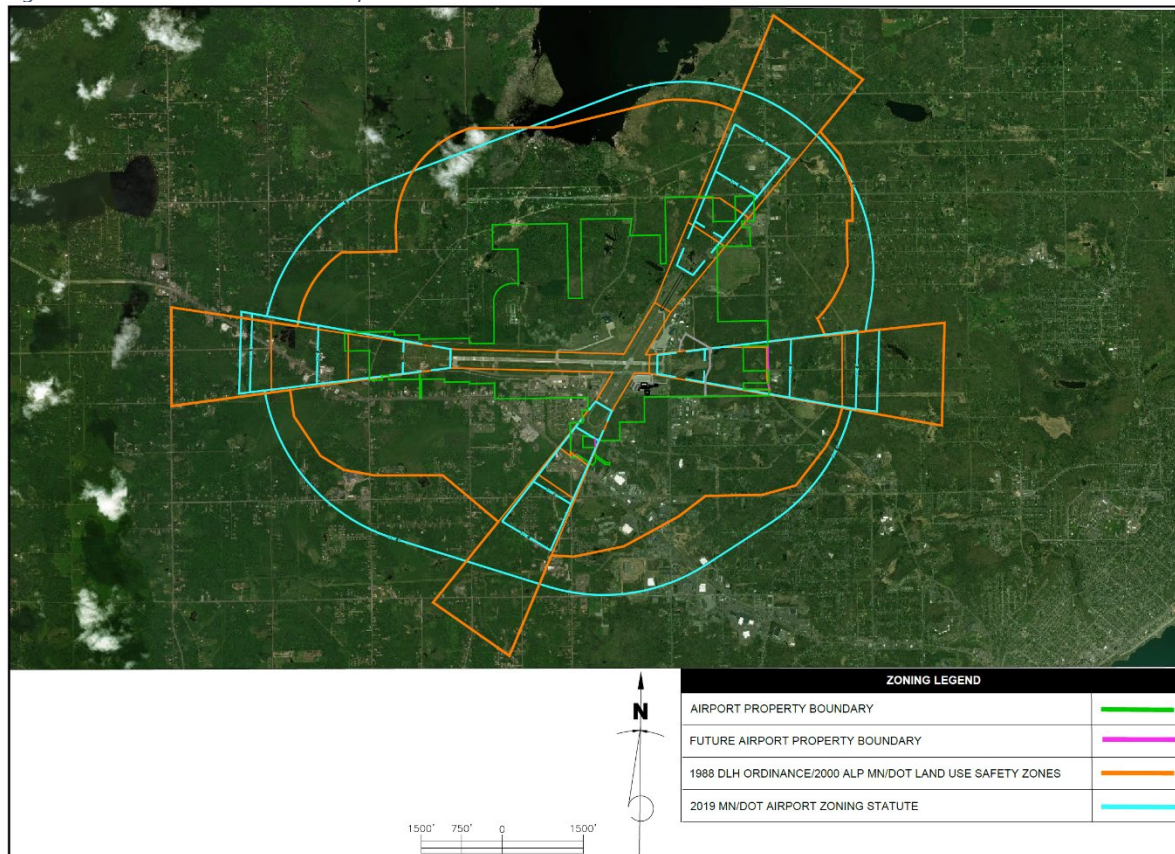


## EXISTING CUSTOM AIRPORT ZONES

Minnesota Statutes require airports to designate property near the Airport as belonging to three Land Use Safety Zones, designated as Zones A, B, and C. Zone A extends outward from the end of the primary surface and equal to two-thirds the length of the runway and restricts structures within the zone. Zone B extends outward from Safety Zone A and is equal to a distance of one-third of the length of the runway and includes density restrictions for permitted structures. Zone C includes general restrictions on light and radio interference and height within the horizontal zone<sup>1</sup> not included in Zone A or Zone B.

In order to recognize established growth patterns and land use, as well as to ensure future development is compatible with the airport environment, the Minnesota Department of Transportation (MnDOT) Department of Aeronautics allows a JAZB to revise its Airport Zoning Ordinance to define custom runway safety zones. In 1998, the JAZB adopted land uses pursuant to Minnesota Statutes 360.061- 360.074. This ordinance applies to the City of Duluth, City of Hermantown and Rice Lake Township. The zones defined by the 2019 statute revision and the 1998 custom zones are shown in Figure 1. The orange line represents the existing Custom Airport Zones and the blue line represents the standard Airport Zones as defined by the statute.

Figure 1 Standard and Custom Airport Zones



Source: RS&H 2020

<sup>1</sup> The horizontal zone is defined as all land that lies directly under an imaginary horizontal surface as defined in Minnesota Rule 8800.1200.

## 2 REGULATORY REQUIREMENTS

The JAZB's existing custom land use safety zone ordinance must be revised to reflect a planned extension to Runway 3-21. In addition, the revision must be accomplished in accordance with a 2019 revision to Minnesota Statute 360.0656 that created new guidelines for establishing the custom zones and for State of Minnesota review.

### CUSTOM AIRPORT ZONE STANDARDS

The Custom Airport Zoning Standards contained within Minnesota Statute 360.0656 set the requirements for a community to establish the validity of the proposed custom zones as well as the process for presenting the proposed custom zones to the state Commissioner of the Department of Transportation for approval.

The development and assessment of the proposed Custom Airport Zones is defined by the Statute as requiring analysis of the following:

- » The location of the airport, the surrounding land uses, and the character of neighborhoods in the vicinity of the airport, including:
  - The location of vulnerable populations, including schools, hospitals, and nursing homes, in the airport hazard area
  - The location of land uses that attract large assemblies of people in the airport hazard area
  - The availability of contiguous open spaces in the airport hazard area
  - The location of wildlife attractants in the airport hazard area
  - Airport ownership or control of the federal Runway Protection Zone and the department's Clear Zone
  - Land uses that create or cause interference with the operation of radio or electronic facilities used by the airport or aircraft
  - Land uses that make it difficult for pilots to distinguish between airport lights and other lights, result in glare in the eyes of pilots using the airport, or impair visibility in the vicinity of the airport
  - Land uses that otherwise inhibit a pilot's ability to land, take off, or maneuver the aircraft
  - Airspace protection to prevent the creation of air navigation hazards in the airport hazard area
  - The social and economic costs of restricting land uses
- » The airport's type of operations and how the operations affect safety surrounding the airport
- » The accident rate at the airport compared to a statistically significant sample, including an analysis of accident distribution based on the rate with a higher accident incidence
- » The planned land uses within an airport hazard area, including any applicable platting, zoning, comprehensive plan, or transportation plan
- » Any other information relevant to safety or the airport

### DULUTH INTERNATIONAL AIRPORT APPROACH

The analytical targets outlined in the Statute and summarized in the previous section were then translated to key metrics for integration into the revised Custom Airport Zones. In order to avoid confusion between

the standard zones defined by the Statute in Figure 1 and the Custom Airport Zones proposed by the JAZB, the proposed Custom Airport Zones are referred to as Zone 1, Zone 2, and Zone 3. Custom Zone 1 is roughly analogous to standard Zone A; Custom Zone 2 is roughly analogous to standard Zone B; and Custom Zone 3 is roughly analogous to standard Zone C. The following are key goals associated with the development of the new Custom Airport Zones:

- » Existing land uses are not affected
- » For future development:
  - Zone 1: In approach zones of a runway, shall not contain buildings
    - » Approach surface = Imaginary surface longitudinally centered on extended centerline at each end of a runway
  - Zone 2: Extends outward from Zone 1, each use shall not be less than 2.5 acres and prohibits uses that attract/house crowds
    - » Places of public assembly
    - » Schools
    - » Hospitals
  - Zone 3: Subject to uses that do not create or cause interference with airport operations
    - » Electronic facilities
    - » Make it difficult for pilots to distinguish airport lights
    - » Glare

### Zoning Standards in Duluth International Airport Zones

This section illustrates for each of the requirements in Minnesota Statute 360.0656 how the proposed Duluth International Airport Zones meet that requirement. Note that respecting the character of the surrounding community was emphasized in all stages of Custom Zone development. The Ordinance was written such that existing land uses would be permitted to remain.

**Requirement 1:** *Analyze the location of the airport, the surrounding land uses, and the character of neighborhoods in the vicinity of the airport, including:*

- *the location of vulnerable populations, including schools, hospitals, and nursing homes, in the airport hazard area.*

**Analysis:** The location of affected schools, hospitals, and nursing homes was determined using Google Earth data, GIS data, and Street View imagery. Two properties of interest were identified – one school and one nursing home. Neither property is located in either proposed Zone 1 or proposed Zone 2. The properties found within the proposed Zone 3 are described in Table 2 and depicted in Figure 2.

The area surrounding the Airport is primarily vacant land and low-density development. The two existing locations of vulnerable populations, which according to the Statute can remain in place, are both at the outskirts of the standard Zone C and the proposed Zone 3. The existing community development patterns indicate that vulnerable populations are likely to cluster closer to the more developed areas of Duluth and in areas of higher density development. There are no existing development patterns that indicate higher density growth in the vicinity of the Airport is likely.

Table 2  
Vulnerable populations in the vicinity of the Airport

Schools		
Name	Location	Zone
Hermantown Middle School	1.53 miles southwest from Runway 9	Within Zone 3 and 2019 MnDOT Zoning Statute Zone C

Nursing Homes		
Name	Location	Zone
Edgewood Adult Day Club	1.76 miles south of Runway 3	Within Zone 3 and 2019 MnDOT Zoning Statute Zone C

Source: RS&H, Inc 2020

**Conclusion:** Because Zone 1 consists exclusively of Airport property, facilities containing vulnerable populations will not be developed in Zone 1. Future development of properties containing vulnerable populations are unlikely to be developed in Zone 2. Future development of properties containing vulnerable populations are acceptable in Zone 3.

**Requirement 2:** *Analyze the location of the airport, the surrounding land uses, and the character of neighborhoods in the vicinity of the airport, including:*

- *the location of land uses that attract large assemblies of people in the airport hazard area.*

**Analysis:** Chapter 360 of the Minnesota Statutes does not define what constitutes a “large assembly of people,” and for the purposes of this analysis was defined to mean a location or facility that may attract a number and density of people in excess of what would typically be found in a retail establishment or residential area. “Large assembly” was interpreted to mean several hundred people collected in a dense environment, such as may be found at a church, concert venue, or indoor recreational facility.

Such existing land uses were determined using Google Earth data, GIS data, and Street View imagery. Six properties of interest were identified – three churches, a movie theater complex, a bowling/games center, and a meeting/event center.

There were no properties of interest in Zone 1. However, a church was found within Zone 2. It is important to note that Chapter 360 of the Minnesota Statutes does not impact existing development. The properties found within the proposed Zone 3 are described in Table 3 and depicted in Figure 2.

Table 3  
Land uses that may attract large numbers of people

Churches		
Name	Location	Zone
Gethsemane Covenant Church	0.94 miles southwest of Runway 9	Within Zone 3 and 2019 Mn/DOT Zoning Statute Zone B
Grace Lutheran Church	1.46 miles west of Runway 9	Within Zone 2 and 2019 Mn/DOT Zoning Statute Zone B
New Life Lutheran Church	1.16 miles southeast of Runway 3	Within Zone 3 and 2019 Mn/DOT Zoning Statute Zone C

Movie Theater		
Name	Location	Zone
Marcus Lakes Cinema	0.77 miles southwest of Runway 3	Within Zone 3 and 2019 Mn/DOT Zoning Statute Zone A

Bowling/Games Center		
Name	Location	Zone
Skyline Social & Games	0.73 miles southwest of Runway 3	Within Zone 3 and 2019 Mn/DOT Zoning Statute Zone A

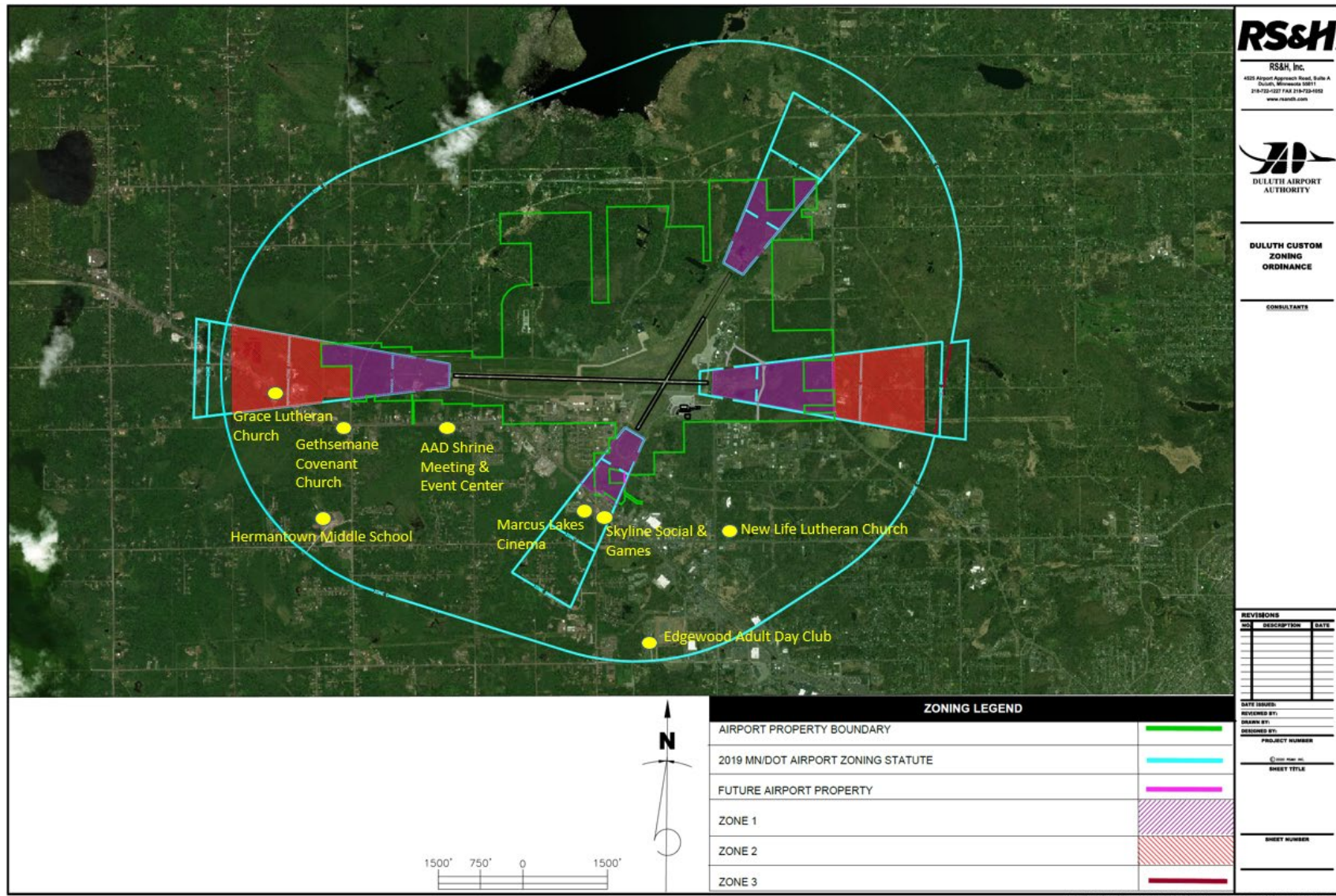
  

Meeting/Event Centers		
Name	Location	Zone
AAD Shrine Meeting and Event Center	0.42 miles of south of Runway 9	Within Zone 3 and 2019 MnDOT Zoning Statute Zone C

Source: RS&H, Inc 2020



Figure 2  
Locations of Services



The area surrounding the Airport is primarily vacant land and low-density development. A strip of commercial development along US Highway 53 stretches along the southern border of the Airport property and includes all of the existing venues that may attract large numbers of people. The highway runs primarily parallel to the main runway (Runway 9-27) and crosses the extended runway centerline for Runway 3-21 approximately 3,450 feet (0.65 miles) south of the runway threshold.

Because Zone 1 is free of development and Zone 3 allows large assemblies of people, closer inspection of Zone 2 areas was conducted. There are two areas of interest – off the end of Runway 3 and off the end of Runway 9.

- Runway 3 end: Highway 53 crosses the Runway 3-21 extended centerline approximately 3,400 feet (0.65 miles) south of the threshold. This road is the only commercial corridor that intersects the extended centerline within the Airport Hazard Area, and is therefore the only road on which a future facility that may attract large assemblies of people is likely to be proposed for development. Most of the parcels along Highway 53 that fall into the standard Zone B are developed already, and therefore the associated land use is not subject to the zone revision.

Two parcels remain undeveloped in this area that would fall within the standard Zone B. There is no Zone 2 proposed for this runway end.

- Runway 9 end: Highway 53 crosses the Runway 9-27 extended centerline approximately 9,000 feet (1.7 miles) west of the threshold. This road is the only commercial corridor that intersects the extended centerline within the Airport Hazard Area, and is therefore the only road on which a future facility that may attract large assemblies of people is likely to be proposed for development. Existing development in the area primarily consists of low-density commercial facilities such as small-scale industrial, consumer storage facilities, and automobile sales/repair facilities.

As distance from the Airport increases, the area takes on rural characteristics of low-density and large property sizes. Given the characteristics of the area and the increasingly rural environment as distance from the City of Duluth increases, it is reasonable to assume that future land uses will resemble existing land uses.

**Conclusion:** Future development of properties containing land uses that may attract large assemblies of people will not be developed in Zone 1. Future development of properties containing land uses that may attract large assemblies of people are unlikely to be developed in Zone 2. Future development of properties containing vulnerable populations are acceptable in Zone 3.

**Requirement 3:** *Analyze the location of the airport, the surrounding land uses, and the character of neighborhoods in the vicinity of the airport, including:*

- *The availability of contiguous open spaces in the airport hazard area*

**Analysis:** Research shows that in more than 95 percent of aircraft accidents the pilot has some measure of control of the aircraft well into the ground impact sequence. For that reason, open contiguous parcels adjacent to the airport are desirable – particularly along the extended runway centerline. A pilot experiencing fuel exhaustion or mechanical failure can then steer toward the open parcels to complete an off-airport landing.

The proposed custom zoning ordinance requires a minimum parcel size of 2.5 acres in Zone 2, as well as the presence of at least one undeveloped open space of at least 2.5 acres. The intent of this requirement is to ensure very low-density development so as to give pilots options in the case of a forced landing, thereby increasing the safety of people on the ground. This strategy provides ample area for a pilot of a stricken airplane to guide it away from population on the ground.

For example, a Cessna 172 – the most popular general aviation aircraft ever manufactured – requires approximately 600 feet for a controlled landing to a full stop on grass.

- Runway 3 end: Except for a stretch of commercial properties along Highway 53 south of the Airport, the primary development in this area is low-density residential with lot sizes in excess of 1 acre, as well as several undeveloped parcels of greater than 15 acres (though ownership may vary). Most of the undeveloped land and much of the residential property is wooded.
- Runway 9 end: Except for the low-density rural commercial land uses along Highway 53, Zone 2 off the end of Runway 9-27 west of the Airport is primarily agricultural and complies with the intent to maintain contiguous open areas. Some of the undeveloped land is wooded, but most is either small scrub vegetation or open fields.
- Runway 21 end: Two roadways, Martin Road and Rice Lake Road serve properties off the north end of Runway 3-21. Development along both of these roads is limited to low-density rural commercial and residential properties. The majority of the land in this area is undeveloped and forested, although some areas of open field and scrub vegetation exist on either side of the approach corridor.
- Runway 27 end: Rice Lake Road intersects the extended runway centerline approximately 5,500 feet (1 mile) east of the threshold. Development along this road and throughout the area is limited to low-density rural commercial and residential properties. The majority of the land in this area is undeveloped and forested, although some areas of open field and scrub vegetation exist on either side of the approach corridor.

**Conclusion:** Zone 1 is contained fully on Airport property and will not be developed. Future development in Zone 2 will remain low-density, with a minimum parcel size of 2.5 acres. The rural atmosphere surrounding the Airport will maintain sufficient buffer for the pilot of a malfunctioning airport to steer clear of structures.

**Requirement 4:** *Analyze the location of the airport, the surrounding land uses, and the character of neighborhoods in the vicinity of the airport, including:*

- *The location of wildlife attractants in the airport hazard area*

**Analysis:** The location of land uses that attract wildlife were determined using Google Earth data, GIS data, and Street View imagery. Wildlife attractants include open water, golf courses, wetland areas, fairgrounds, landfills, and wastewater treatment facilities.

- Runway 3 end: No properties of interest were found in this area. Based on existing development patterns, no additional development of wildlife attractants is likely in this area.

Runway 9 end: No properties of interest were found in this area with the exception of a borrow pit that sometimes retains water located approximately 8,500 feet (1.6 miles) west of the runway threshold. Based on existing development patterns, no additional development of wildlife attractants is likely in this area.

- Runway 21 end: The former Rice Lake Landfill east of the extended runway centerline was closed and capped in 2003 and should not serve as a wildlife attractant. Based on existing development patterns, no additional development of wildlife attractants is likely in this area.
- Runway 27 end: Three small ponds of approximately 2 acres each currently exist within a half mile of the runway threshold and on either side of the extended runway centerline. Based on existing development patterns, no additional development of wildlife attractants is likely in this area.

**Conclusion:** Based on existing development patterns, no new wildlife attractants are likely to be established in the foreseeable future.

**Requirement 5:** *Analyze the location of the airport, the surrounding land uses, and the character of neighborhoods in the vicinity of the airport, including:*

- *Airport ownership or control of the federal Runway Protection Zone and the department's Clear Zone*

**Analysis:** All Runway Protection Zones are contained within airport property and are free of development. The custom zoning ordinance calls for that status to continue.

**Conclusion:** The proposed custom zones fully comply with the standard zones.

**Requirements 6, 7 and 8:** *Analyze the location of the airport, the surrounding land uses, and the character of neighborhoods in the vicinity of the airport, including:*

- *Land uses that create or cause interference with the operation of radio or electronic facilities used by the airport or aircraft*
- *Land uses that make it difficult for pilots to distinguish between airport lights and other lights, result in glare in the eyes of pilots using the airport, or impair visibility in the vicinity of the airport*



- *Land uses that otherwise inhibit a pilot's ability to land, take off, or maneuver the aircraft*

**Analysis:** Land uses that create or cause interference with electronic airport facilities; create glare; or inhibit a pilot's ability to maneuver aircraft include antennas, cell-towers, and existing obstructions such as trees or poles. Obstructions in the vicinity of the Airport are depicted and included in the Airport's most recent Airport Layout Plan. The airspace of DLH is also protected by the City of Duluth Unified Development Code 50-18.2 Airport Overlay District and City of Duluth Unified Development Code 50-17.5 Airport Zoning District. These ordinances prohibit new structures that may interfere with the Airport's operations and prevents air navigation hazards.

The general low-density development and small-town characteristics of the community preclude many of the kinds of development that typically challenge pilots in the airport environment. For example, a well-lit multilane highway can, in some instances, be confused for a runway. However, the highways in the vicinity of the Airport are four-lane divided roads that generally do not have streetlights. Furthermore, the preponderance of wooded lots breaks up what light islands there are and prevents the illusion of runway lighting.

Because the community is generally low-density development, building developers have no incentive to build tall structures, as they are not cost effective in this kind of community. Low structures not only do not represent obstructions to navigation, but they also do not have the same potential to create glare as do, for example, high rise glazed buildings.

**Conclusion:** Hazards created by land use are primarily the result of the forested areas in the vicinity of the airport. The tree canopy likely presents more of a hazard to aircraft than any built structures.

**Requirement 9:** *Analyze the location of the airport, the surrounding land uses, and the character of neighborhoods in the vicinity of the airport, including:*

- *Airspace protection to prevent the creation of air navigation hazards in the airport hazard area*

**Analysis:** Existing land uses are shown in Table 1 on page 2. The Airport is mostly surrounded by commercial retail uses containing buildings of one or two stories, or undeveloped land.

The area around the Airport is subject to measures related to height, land use, and other safety considerations as indicated in the Land Use Element of the 2035 Imagine Duluth Comprehensive Plan. The City of Duluth Unified Development Code 50-18.2 Airport Overlay District and City of Duluth Unified Development Code 50-17.5 Airport Zoning District supplement the regulations of the general purpose zoning districts and restricts the heights of established uses, construction, maintenance, or objects of natural growth above airspace surfaces.

**Conclusion:** Existing land uses, the proposed custom zones, and existing land use plans all combine to ensure no existing or future land uses intrude on the airspace surrounding the Airport.



**Requirement 10:** *Analyze the location of the airport, the surrounding land uses, and the character of neighborhoods in the vicinity of the airport, including:*

- *The social and economic costs of restricting land uses*

**Analysis:** The social and economic costs of restricting uses were analyzed from both the airport perspective and community perspective. The concept of custom zones is to maintain safety without adding restrictions that would socially and economically impact the residents of the communities near the Airport. This takes into consideration the economic costs of impeding new development, which has three primary impacts: the loss of potential tax revenue, the loss of employment opportunities, and the cost to the governmental agency to acquire property or development rights from the property owners.

Social repercussions of relocation and displacement of existing homes and businesses to the community were also considered when creating the custom zones. For example, restricting future commercial development along Highway 53 in an area that has existing commercial development has legal implications that could result in challenges to the zoning ordinance by property owners because it could be considered a taking. Acquiring commercial properties and forcing those businesses to relocate could disrupt long-established development patterns in the area that would ripple throughout the community.

**Conclusion:** The custom zones minimize these important social and economic costs associated with the relocation and displacement of homes and existing businesses.

**Requirement 11:** *Analyze the airport's type of operations and how the operations affect safety surrounding the airport*

**Analysis:** Duluth International Airport is classified in the National Plan of Integrated Airports System (NPIAS) as a Non-hub Primary airport. FAA records show the Airport has approximately 60,000 operations per year, and the FAA's Terminal Area Forecast (issued before COVID-19 impacts) projected approximately the same level of activity through the year 2045. In the last 20 years, commercial operations constituted an average of approximately 17% of operations, and the TAF projects that to increase slightly to 18% in the next 20 years. Military operations are projected to remain constant at the historic level of 8%. General aviation operations make up the remaining 74-75%. Runway 9/27 has a length of 10,591 feet, providing ample margin for error for aircraft that may be experiencing difficulties during landing.

For commercial aircraft, most of the operations have been and are anticipated to continue to be air taxi/commuter type aircraft rather than the mainline air carrier fleet. Air taxi/commuter aircraft are typically smaller and slower than mainline air carrier aircraft. Therefore, in the event of an accident, a commuter-type aircraft carries much less kinetic energy into the crash, reducing the debris field and damage on the ground when compared to a mainline air carrier aircraft.

With respect to general aviation aircraft, it should be noted that the Airport houses a production facility for a popular line of single-engine piston aircraft and a very light single-engine jet. Flights associated with the production facility constitute a significant portion of the recorded general aviation operations. The design of the aircraft produced at the factory is mature, and test flights are conducted by experienced

factory test pilots. Only one accident associated with the production facility at the Airport has been recorded, and that was of a pre-production prototype in 1999. The aircraft produced at the Airport are all equipped with an aircraft parachute system that allows the pilot of an airplane in distress to deploy a parachute that lowers the entire airplane to the ground at a speed less than the descent rate of a building elevator. This dramatically reduces impact damage and the potential for injury. (The pre-production prototype that crashed in 1999 had not yet been equipped with the parachute.)

The Airport houses the 148<sup>th</sup> Fighter Wing of the Air National Guard, which includes a fleet of approximately 20 F-16CM aircraft. The F-16 is a frontline aircraft used by the US military and has an accident rate (Class A and Class B) of approximately 3.1 per 100,000 flight hours. Almost all F-16 accidents occur outside the Airport environment. In the last four years, only one US F-16 accident has occurred worldwide in the vicinity of an airport.

The Airport is equipped with a highly capable Instrument Landing System (Special Authorization Category I and Category II approaches are available) to Runway 9 as well as a standard ILS approach into Runway 27. All runways are served by RNAV GPS approaches as well as radar approach procedures. Taken together, these approaches ensure that pilots are provided advanced capability to navigate to the Airport and land during inclement weather.

The types of operations associated with the Airport generally involve small airplanes, many of which are equipped with whole-aircraft parachutes. Small, slow airplanes have much less kinetic energy, resulting in small debris fields in the event they crash. Furthermore, the excellent instrument approaches and long primary runway provide additional capability for aircraft under duress due to mechanical problems or inclement weather.

**Conclusion:** The custom zones recognize the potential for aircraft accidents in the vicinity of the runway ends and are appropriately sized to the primary types of operations at the Airport.

**Requirement 12:** *Analyze the accident rate at the airport compared to a statistically significant sample, including an analysis of accident distribution based on the rate with a higher accident incidence*

**Analysis:** In the 20 years from January 2000-December 2019, there have been two civil aviation accidents within DLH's Airport environment that rose to the level of accident as defined by the National Transportation Safety Board. Both were general aviation accidents. One (January 2008) involved a poor landing of a general aviation aircraft that resulted in a broken nose gear. The accident was contained within the runway safety area of Runway 9-27.

The other (July 2000) involved a spatial disorientation loss of control after an instrument departure in fog from Runway 9 and a resulting crash in a wooded area approximately 1.8 miles north-northeast of the departure end of the runway. The NTSB report does not specify the exact location, but analysis from aerial imagery suggests ground impact was within the standard Zone C and proposed custom Zone 3.

These two events represent an accident rate of 0.158 per 100,000 operations over the 20-year period. By comparison, the accident rate for all US air carriers during the same interval was 0.187 per 100,000 operations. The 28<sup>th</sup> Joseph T Nall Report, published in October 2019, found that over a 10-year period from January 2007 through December 2016, there were a total of 4,749 non-commercial general aviation airplane accidents in the US that occurred either on landing or on takeoff/initial climb. FAA's Traffic Flow Management System Counts found that over the same period there were approximately 70.7 million general aviation operations. Together, these data put the accident rate in the airport environment for all US general aviation at approximately 6.717 per 100,000 operations – far higher than the rate exhibited at DLH.

The small sample size of local aviation accidents requires examination of a broader universe of airports to determine potential accident site distribution. One key study was the 2008 ACRP Report 3, *Analysis of Aircraft Overruns and Undershoots for Runway Safety Areas*, which examined landing undershoots, landing overruns and takeoff overruns to identify the location and extent of hazardous areas near the runway ends. ARCP Report 3 looked at 459 air carrier accidents and incidents in the vicinity of the airport to determine the value of Runway Safety Areas. Data for the study was compiled from the National Transportation Safety Board, FAA, NASA's Aviation Safety Reporting System, Canada's Transportation Safety Board, the United Kingdom's Air Accident Investigation Branch and France's Bureau d'Enquêtes et d'Analyses.

In the course of the analysis, the research team developed a series of risk models that created a probability distribution for the point of first impact for landing undershoots and the final stopping location for landing and takeoff overruns. Although the purpose of ACRP Report 3 was to analyze Runway Safety Areas, an intermediary step involved creating probability formulas for each of the three accident/incident scenarios that reflected the real world probability of an accident aircraft's position relative to the threshold and the extended runway centerline. This analysis included only landing undershoots, landing overruns, and takeoff overruns. Runway loss-of-control accidents were not considered, as they occur independently of the location of the runway ends and typically remain on airport property.

The study created probability formulas that show the distribution of landing undershoots, landing overruns, and departure overruns based on longitudinal distance from the threshold and lateral distance from the extended centerline. Those probability formulas gave the following distances in which the probability of containing the accident would be 80%, 90%, and 95%, shown in Table 4.

As evident from Table 4, there is a greater than 95% probability that a runway-area accident would be contained within an area between the runway threshold and a point 1,782 from the threshold, and within 500 feet of the runway extended centerlines. This area fits wholly within the Runway Protection Zone of each runway, and all RPZs are contained wholly within Airport property.

Table 4  
Accident containment probability

	80% Probability	90% Probability	95% Probability
Landing Undershoot			
Distance from Threshold (ft)	671	1,170	1,764
Distance from Centerline (ft)	49	136	286
Landing Overrun			
Distance from Threshold (ft)	552	803	1,057
Distance from Centerline (ft)	70	145	249
Departure Overrun			
Distance from Threshold (ft)	994	1,392	1,782
Distance from Centerline (ft)	129	287	500

Source: ACRP 3, Table 10 and Table 11 Raw Data

**Conclusion:** The Airport's low historical accident rate and the existing land use protections in place through the existing RPZs provide an acceptable level of safety for the community in the vicinity of the airport. Statistically, an aircraft could be expected to crash within the airport hazard area off one of the runway ends but outside the RPZ approximately once every 800 years.

**Requirement 13:** Analyze the planned land uses within an airport hazard area, including any applicable platting, zoning, comprehensive plan, or transportation plan

**Analysis:** Current land use guidance created by surrounding jurisdictions show there are no planned land uses that impact the custom zones as proposed.

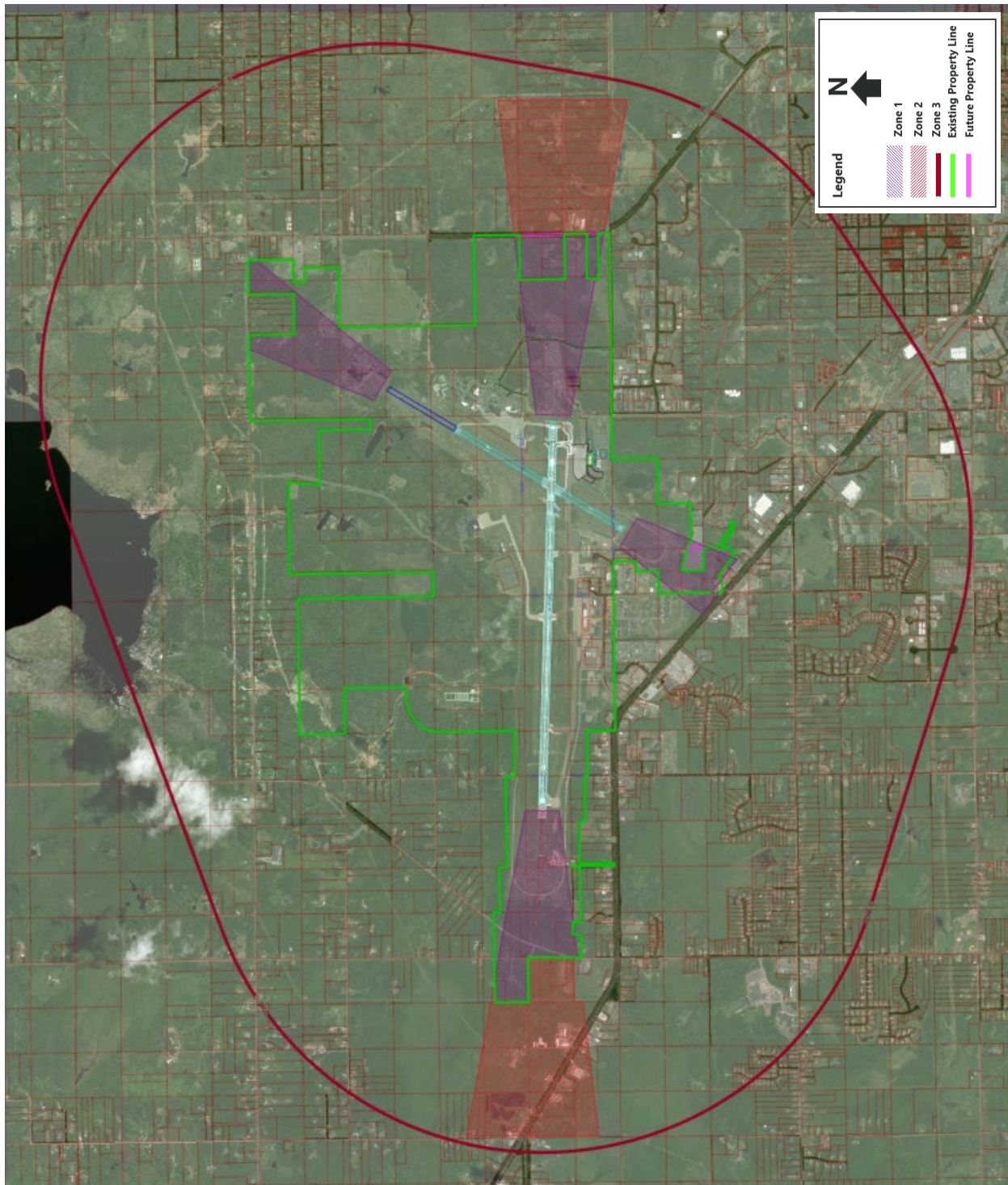
The custom zones are compatible with the current comprehensive, zoning, or transportation plans in place at in the surrounding jurisdictions. These include the Imagine Duluth 2035 Governing Principles and Policies and the 2001 City of Hermantown Comprehensive Plan. In addition, the Rice Lake Township Zoning Section 4 requires that all structures shall meet any airport related height restrictions that are in the Duluth International Joint Airport Zoning Ordinance at the time the building permit for such building is applied for. In the St. Louis County Comprehensive Plan, the L-U-10.7 Objective requires coordination with local airport authorities as needed to protect local airports from encroachment by incompatible land uses by limiting development within protective airport zones.

**Conclusion:** The custom zones do not impact the existing municipal plans and reinforce the policies found within each plan.

Based on the analysis, a Custom Airport Zone map was created, as shown in Figure 3. Following that figure, Figure 4, Figure 5, Figure 6, and Figure 7 show closeup depictions of each runway end.



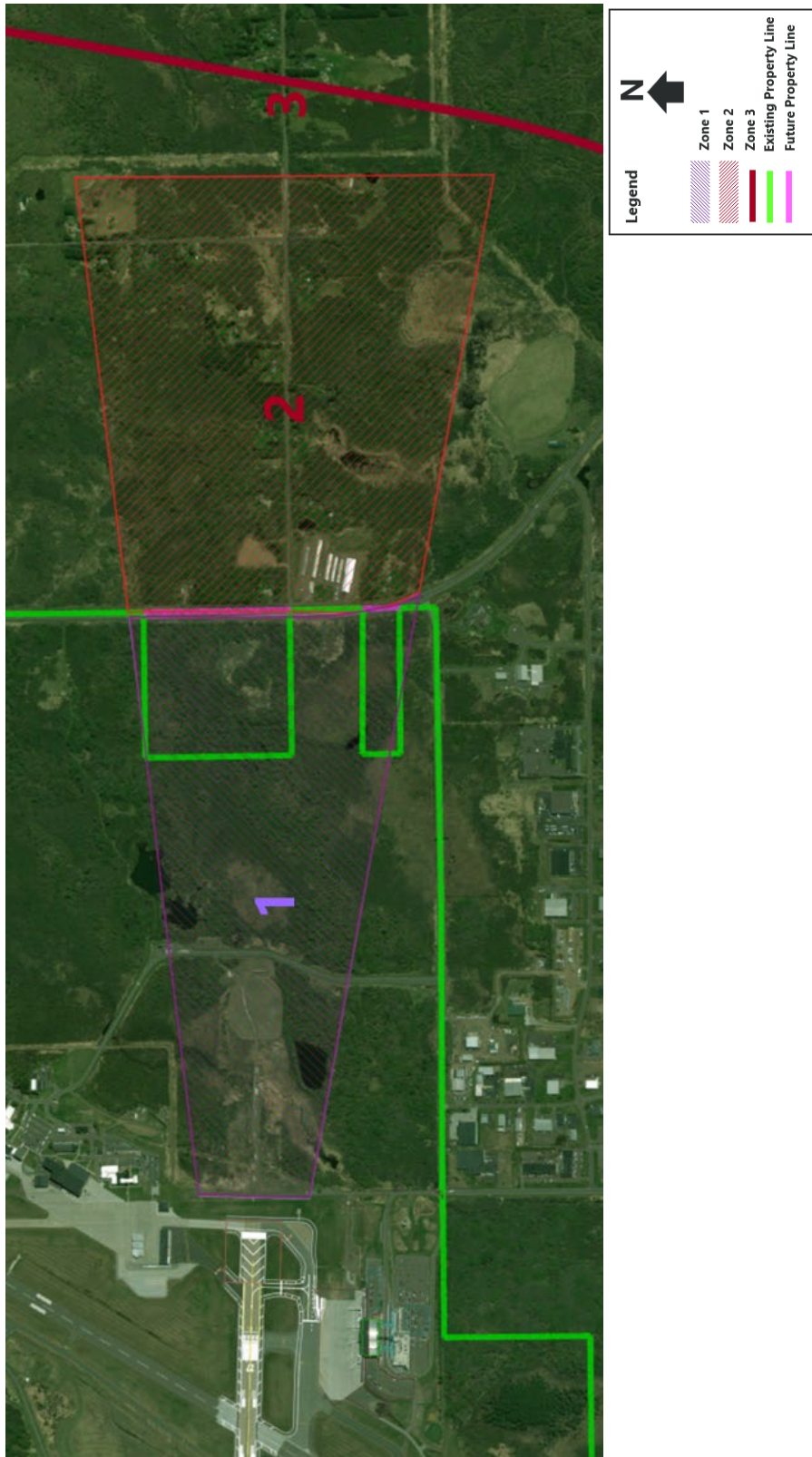
Figure 3  
Proposed Custom Airport Zones



Source: RS&H 2020

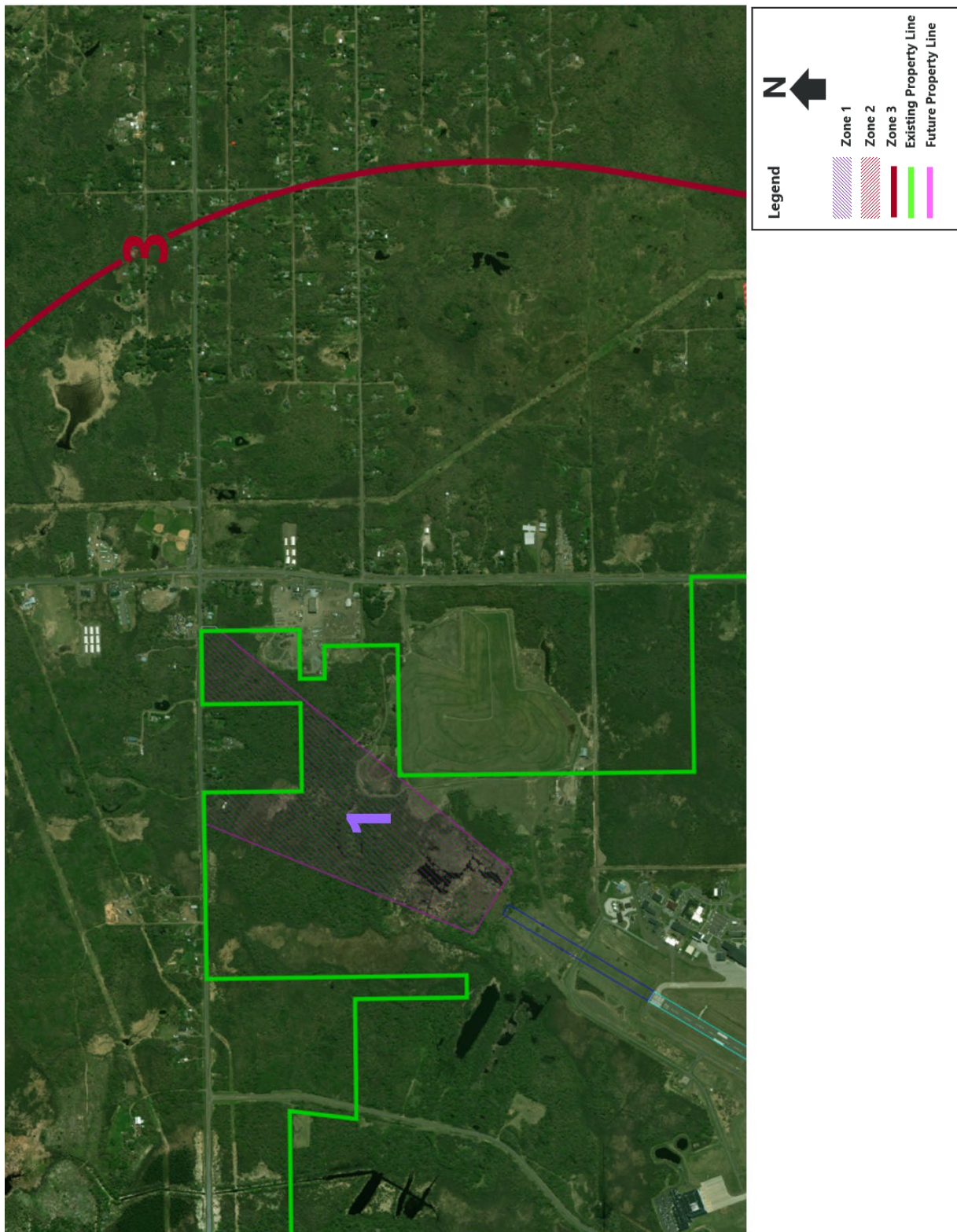


Figure 4  
Runway 27 End



Source: RS&H 2020

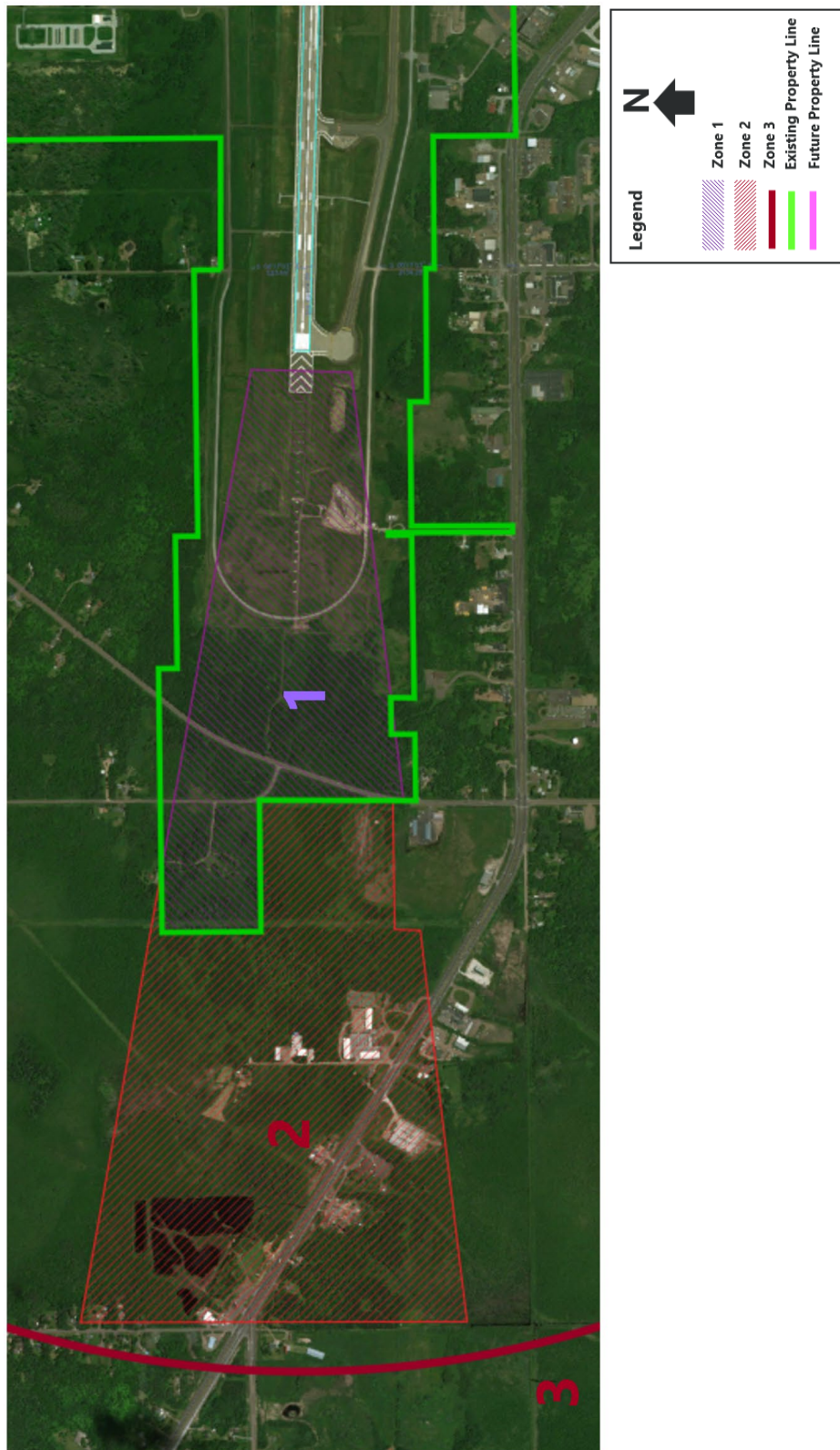
Figure 5  
Runway 21 End



Source: RS&H 2020

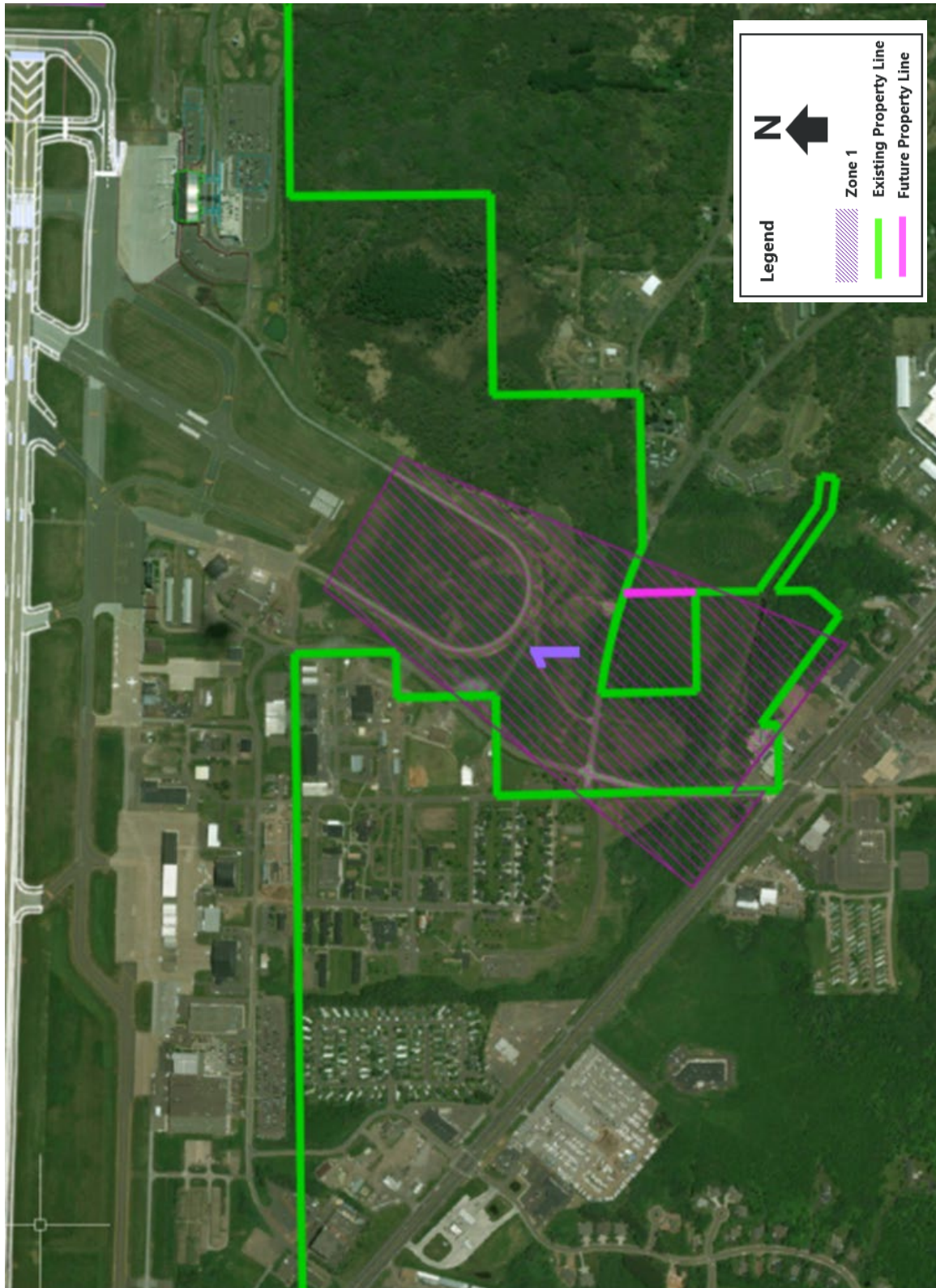


Figure 6  
Runway 9 End



Source: RS&H 2020

Figure 7  
Runway 3 End



Source: RS&H 2020