Crystal Airport (MIC)
Joint Airport Zoning Board

Analysis of Custom Zoning Factors

Table of Contents

JAZB Purpose and Goals

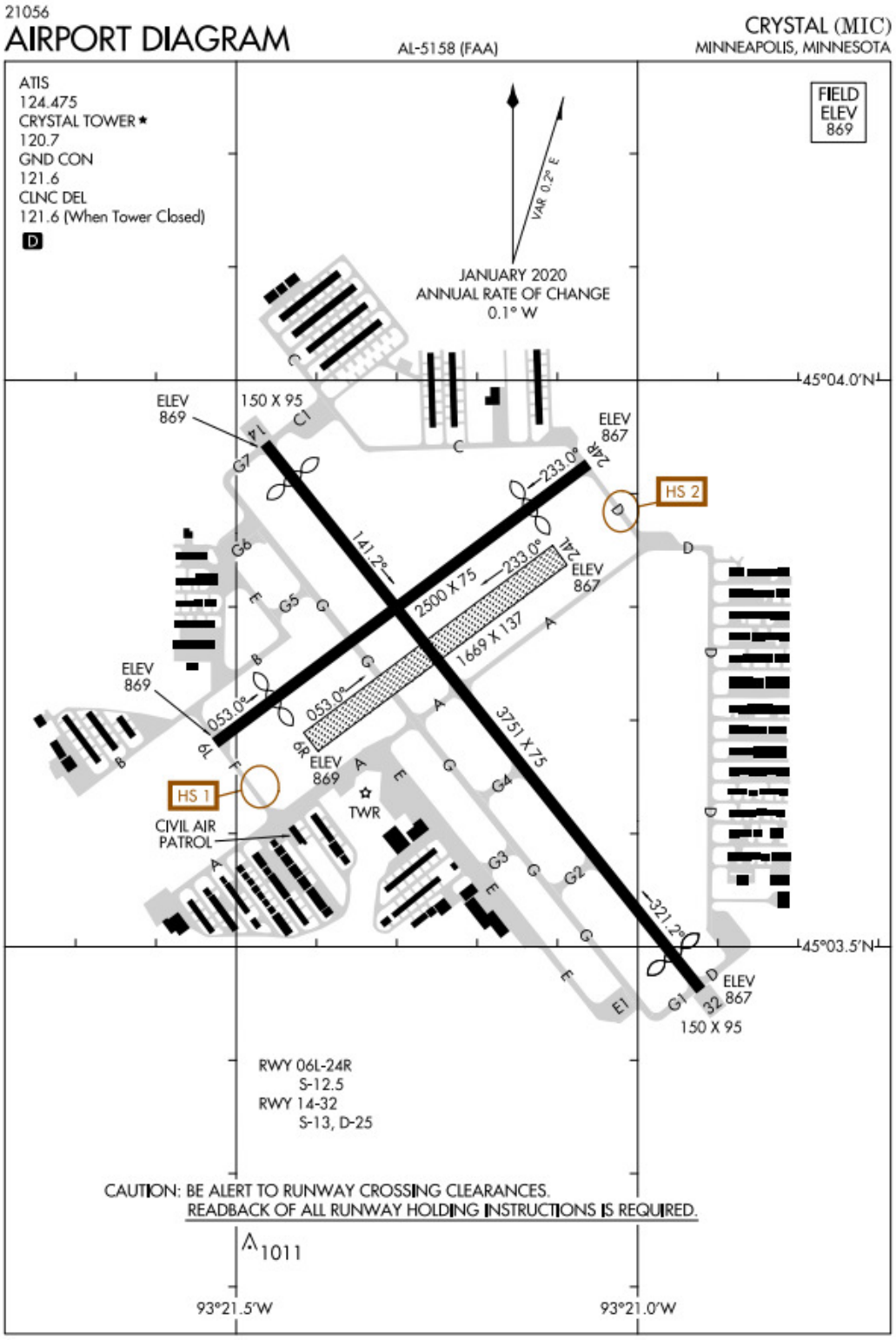
A Joint Airport Zoning Board (JAZB) is tasked with developing a zoning ordinance regulating land use and the height of structures and objects around an airport as described in Minnesota Statutes 360.061 through 360.074. A JAZB is comprised of representatives from the cities, counties and/or townships that control land use development around an airport. In the case of Crystal Airport (MIC), affected municipalities include Brooklyn Center, Brooklyn Park, Crystal, New Hope, Minneapolis, and Robbinsdale.

The JAZB's purpose is to, through a collaborative process, develop an airport zoning ordinance that achieves a reasonable level of safety while considering compatible community development and the social and economic costs of restricting land uses. The JAZB considers the requirements of Minnesota Statutes in developing airport zoning regulations, provides opportunity for public input, submits the proposed regulations to MnDOT for approval, adopts the final regulations, and transmits the regulations to affected municipalities for incorporation into local zoning codes. The MnDOT Commissioner reserves the authority to determine whether the proposed Ordinance meets the reasonable level of safety threshold.

In 1983, a JAZB was convened to adopt an airport zoning ordinance for MIC. The newly constituted JAZB will be replacing the 1983 Ordinance due to several changes that have occurred since that time, including new MnDOT zoning requirements, the closure of parallel primary Runway 14R/32L, the lengthening of primary Runway 14L/32R (now 14/32), and the shortening of turf crosswind runway 6R/24L. The current airfield layout is depicted on the FAA Airport Diagram shown in **Figure 1**.

State law provides JAZBs with two alternatives for developing their airport zoning overlay district: 1) adopt the ordinance based on the MnDOT Commissioner's standards, or 2) develop a custom zoning ordinance that is tailored to the unique needs of the surrounding communities. Based on a vote conducted by JAZB members on February 11, 2022, the board has opted to establish a custom zoning ordinance.

Figure 1: MIC Airport Diagram



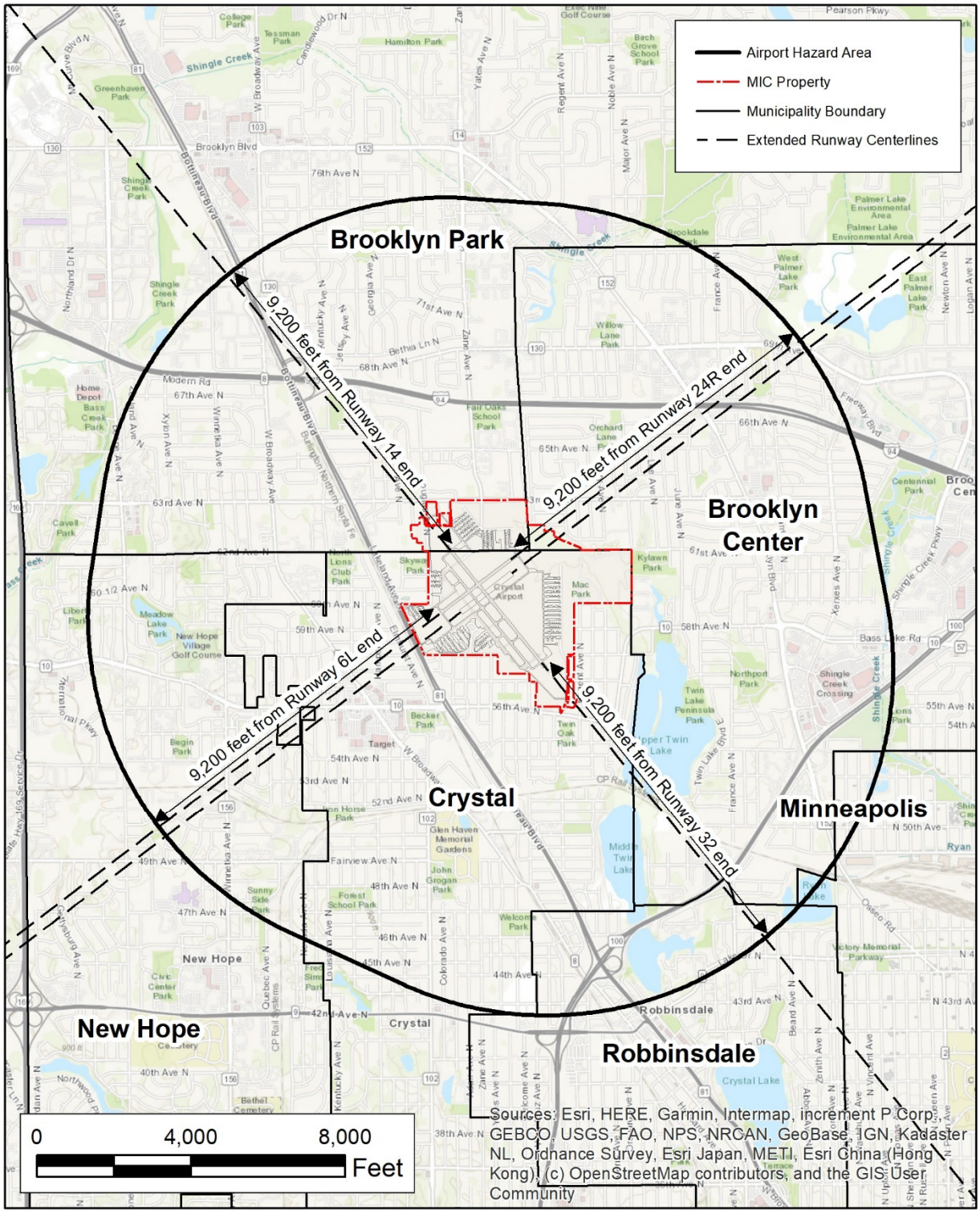
The JAZB followed the statutory requirements by analyzing all the custom zoning factors set forth in Minn. Stat. Section 360.0656. These factors include the following:

(1) The location of the airport, the surrounding land uses, and the character of neighborhoods in the vicinity of the airport, including:
    (a) The location of vulnerable populations, including schools, hospitals, and nursing homes, in the airport hazard area;
    (b) The location of land uses that attract large assemblies of people in the airport hazard area;
    (c) The availability of contiguous open spaces in the airport hazard area;
    (d) The location of wildlife attractants in the airport hazard area;
    (e) Airport ownership and control of the federal Runway Protection Zones and the department's Clear Zone;
    (f) Land uses that create or cause interference with the operations of radio or electronic facilities used by the airport or aircraft;
    (g) 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;
    (h) Land uses that otherwise inhibit a pilot's ability to land, take off, or maneuver the aircraft;
    (i) Airspace protection to prevent the creation of air navigation hazards in the airport hazard area; and
    (j) The social and economic costs of restricting land uses.
(2) The airport's type of operations and how the operations affect safety surrounding the airport;
(3) The accident rate of the airport compared to a statistically significant sample, including an analysis of accident distribution based on the rate with a higher accident incidence;
(4) The planned land uses within an airport hazard area, including any applicable platting, zoning, comprehensive plan, or transportation plan; and
(5) Any other information relevant to safety or the airport.

The airport zoning statute references analysis of these factors with respect to the "airport hazard area". For the purposes of this report, the airport hazard area is defined as property that lies under the extents of the current 14 CFR Part 77 airspace surfaces for Crystal Airport. This airport hazard area is depicted in **Figure 2**.

Section A ("Custom Zoning Factors") describes the application of the custom zoning factors to the Crystal Airport. **Section B ("Proposed Custom Zoning")** explains how the Ordinance addresses the custom zoning factors to ensure a reasonable level of safety.

Figure 2: Airport Hazard Area



A. Custom Zoning Factors

1. Location of the airport, the surrounding land uses, and the character of neighborhoods in the vicinity of the airport;

Crystal Airport (IATA: MIC, ICAO: KMIC) is one of seven airports owned and operated by the Metropolitan Airports Commission (MAC). The MAC is an airport authority created by the State of Minnesota in 1943 to provide coordinated aviation services within the Twin Cities Metropolitan Area. The airport is in Hennepin County, approximately seven miles northwest of downtown Minneapolis. It lies within the City of Crystal, with portions of airport property falling within the City of Brooklyn Park on the north side of the airport and the City of Brooklyn Center on the northwest corner of the airport.

The airport was founded in 1946 as a private airfield and was purchased by the MAC in 1948. Existing airport property is approximately 436 acres, of which approximately 350 acres is located within the City of Crystal, approximately 76 acres of which are located within the City of Brooklyn Park, and approximately 10 acres of which are located within the City of Brooklyn Center.

City of Crystal

The City of Crystal is a suburb of Minneapolis in Hennepin County, and, as of April 1, 2020, had a population of 23,330 or approximately 4,086 people per square mile. Incorporated in 1960, it is the descendant municipality of the original Village of Crystal, which was established in 1887. By the turn of the century the Village had become disorganized, having ceded land and population to new towns and annexations. To stem the tide of land loss, the Village was reorganized in 1911, preventing its annexation by the growing City of Minneapolis. Today it is a first-ring suburb of Minneapolis and is the predominant host of Crystal Airport, its runways, and most of its ground facilities. It is bordered to the north by Brooklyn Park, to the northwest by Brooklyn Center, to the southwest by Robbinsdale, to the south by Golden Valley, and to the west by New Hope. Most of the northern area of the City of Crystal falls within the airport hazard area, as shown in **Figure 2**.

The city is primarily made up of R1-Low Density Residential zoning, with some commercial and industrial zones concentrated amongst its throughway corridors, south of the airport. The city has a separate zoning district for the airport (A1).

Crystal's Comprehensive Plan introduces the potential for transit-oriented development (TOD) and mixed-use commercial/residential land uses. With the proposed extension of the Metro Blue Line light-rail through Crystal into Brooklyn Park along County Highway 81 (Bottineau Blvd) southwest of and adjacent to the airport, there is potential for new development near the airport, both in terms of higher density, through TOD and a greater variety of uses. The city does have some high-density zoning, such as that covering the Cavanagh Senior Apartments, which

fall within airport hazard area. However, the City's code limits its high-density residential zoning to 5 stories or 60 feet, whichever is less, preventing penetrations to the imaginary FAA Part 77 surfaces radiating away from the airport. Furthermore, neither the 1983 Ordinance nor the City's zoning code allows for structures to be built that exceed such surfaces without a variance.

City of Brooklyn Park

Brooklyn Park is a suburb of Minneapolis in Hennepin County and had a 2020 population of 86,478 and density of 3,300 people per square mile. Incorporated as Brooklyn Township in the 1800s, it was not until 1954 and 1969 that it was incorporated as a Village and City, respectively. Brooklyn Park is bordered by Brooklyn Center to the southeast, Crystal and New Hope to the south, Maple Grove and Osseo to the west, Champlin to the north, and the Mississippi River to the east. The northernmost portions of Crystal Airport fall within the boundaries of Brooklyn Park, namely the Runway 14 end and the northern t-hangars and related access road. The airport hazard area covers the southernmost corner of Brooklyn Park.

The city is predominantly zoned for single-family detached residences with scattered areas of higher density, especially in the form of 2.5 and 3 story multi-family residences. The City's zoning code has a mechanism to account for higher density "Large" residential structures, but those areas zoned as such are not near the airport.

City of Brooklyn Center

Brooklyn Center is a suburb of Minneapolis in Hennepin County located between Crystal to the west, the Mississippi River to the east, Brooklyn Park to the north, and Minneapolis and Robbinsdale to the south. The city had a 2020 population of 33,782 and a density of 4,244 people per square mile. Brooklyn Center was organized as a village out of the remnants of Brooklyn Township in 1911, becoming a city in 1966. The portion of the airport within Brooklyn Center does not feature any airport facilities or infrastructure. While no airport facilities exist within the boundaries of the city, the airport hazard area covers much of the west side of Brooklyn Center.

The city is predominantly zoned for single-family detached dwellings with some limited story multi-family areas to the south, abutting Minneapolis. Portions of this higher density housing fall within airport hazard area in the southwest corner of the city.

Other Cities within the Airport Hazard Area

The cities of New Hope, Robbinsdale, and Minneapolis all fall within the airport hazard area, although none of these cities hosts any Crystal Airport property and nearly all portions of these cities are located more than a mile from the airport.

New Hope is a suburb of Minneapolis in Hennepin County and is bordered by Brooklyn Park to the north and Crystal to the east. It had a 2020 population is 21,929 and a density of 4,351 people per square mile. The northeastern part of the city falls within the airport hazard area. The city is

primarily zoned for low-density, single-family housing, although there are some higher density areas, up to 6 stories or 72 feet (whichever is higher).

Robbinsdale is a suburb of Minneapolis in Hennepin County and is bordered by Minneapolis to the east, Brooklyn Center to the north, and Crystal to the west. It had a 2020 population of 14,646 and a density of 5,249 people per square mile. Approximately 320 acres of the northeastern part of the city falls within the airport hazard area. This area is primarily zoned for low-density residential as well as some business and low-rise medium density residential uses.

Minneapolis is the largest city in Minnesota, the county seat of Hennepin County, and the center of the Minneapolis-St. Paul-Bloomington Metropolitan Statistical Area. It is bordered by Robbinsdale to the west and Brooklyn Center to the north. Approximately 48 acres of the northeastern corner of Minneapolis fall within the MIC airport hazard area. This small portion of Minneapolis is zoned almost exclusively low-density multi-family residential.

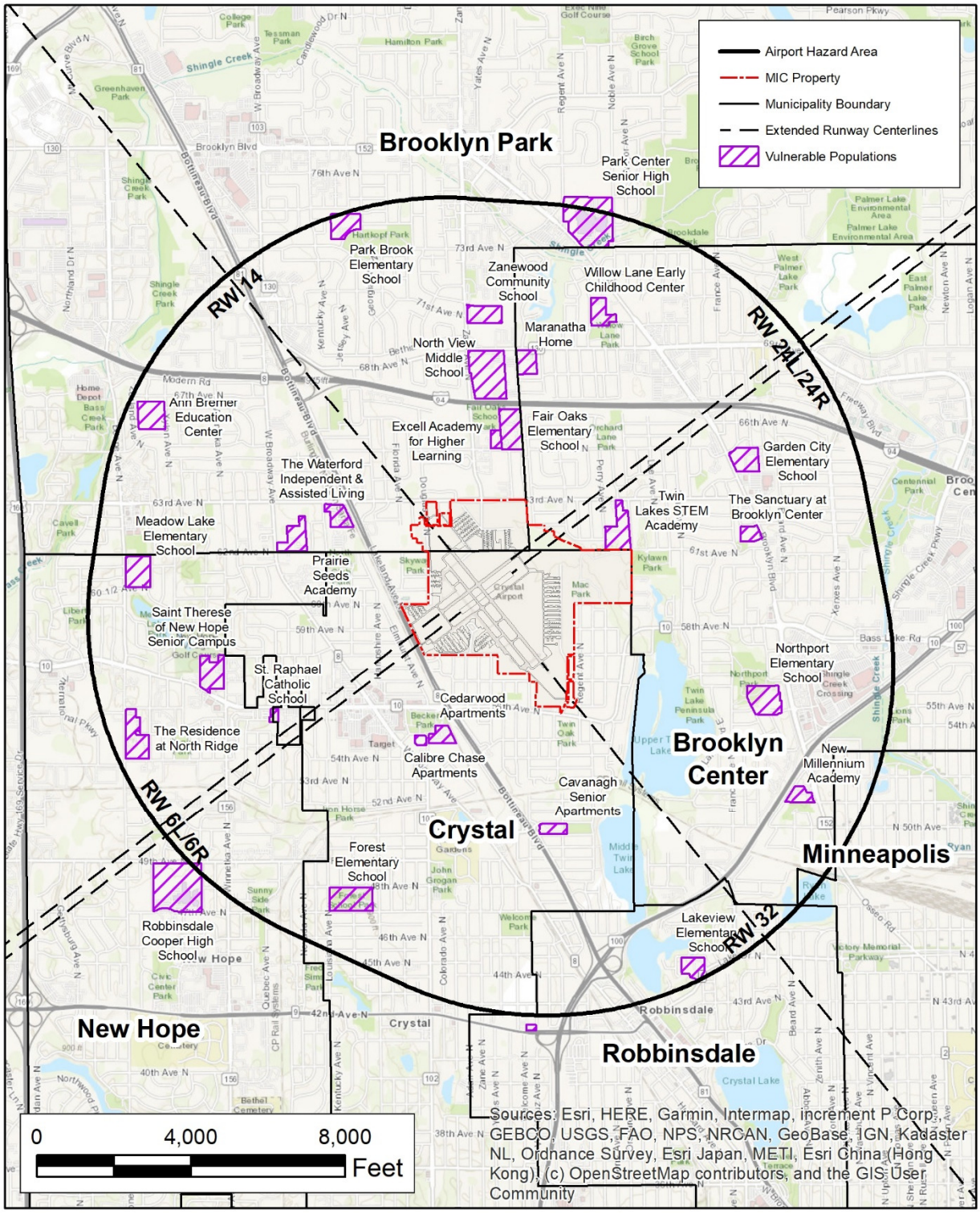
a) the location of vulnerable populations, including schools, hospitals, and nursing homes, in the airport hazard area;

Vulnerable populations include groups that may need additional care within the community, such as the elderly, children, and the sick. These land uses include retirement and nursing homes, schools, and hospitals. The locations of the following vulnerable populations within the airport hazard area are depicted in **Figure 3**.

- Zanewood Community School
- North View Middle School
- Maranatha Home
- Fair Oaks Elementary School
- Excell Academy for Higher Learning
- Twin Lakes STEM Academy
- Odyssey Academy
- Garden City Elementary School
- The Sanctuary at Brooklyn Center (Home)
- Northport Elementary School
- Cavanagh Senior Apartments
- St. Raphael Catholic School
- Saint Therese Senior Living of New Hope
- Prairie Seeds Academy
- The Waterford Independent and Assisted Living
- The Residence at North Ridge
- Calibre Chase Apartments
- Cedarwood Apartments
- Forest Elementary School
- Evergreen Montessori School
- Robbinsdale Cooper High School
- Ann Bremer Education Center
- Smiling Faces Academy
- Children's Music Academy of Brooklyn Park
- Meadow Lake Elementary School
- Park Brook Elementary
- Park Center Senior High School
- Brooklyn Middle Science, Technology, Engineering, Arts, and Math School
- St. Alphonsus Catholic School
- Spiritual Life Church and Bible College
- Progeny Academy
- New Millennium Academy
- Lakeview Elementary School
- Willow Lane Early Childhood Center

.

Figure 3: Existing Vulnerable Populations

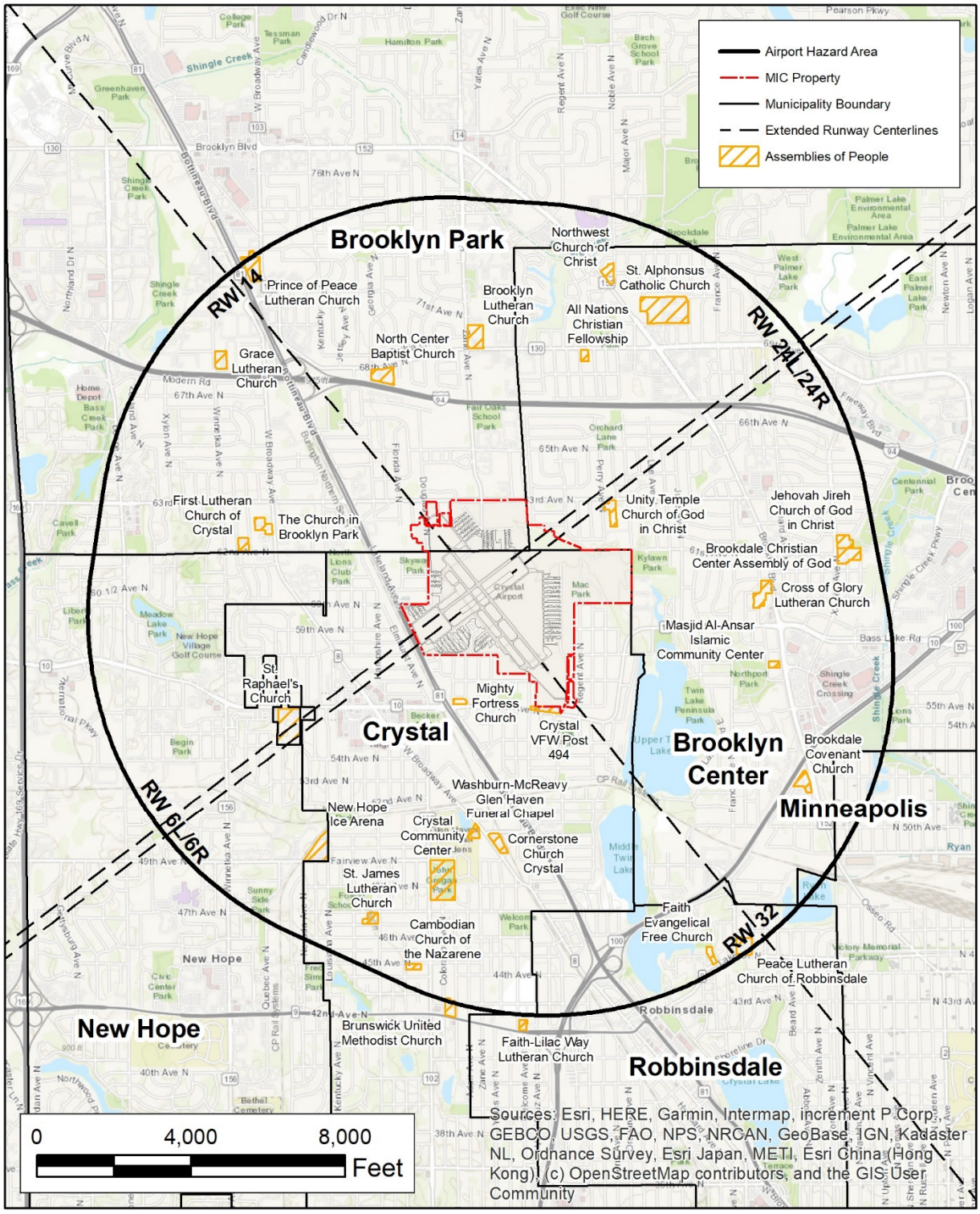


b) the location of land uses that attract large assemblies of people in the airport hazard area;
Within the airport hazard area are several buildings and properties that regularly host large gatherings of people, usually for special occasions, religious services, or sporting events. These uses are predominantly churches, mosques, event halls, and community centers. The location of the following land uses that attract large assemblies of people within the airport hazard area are depicted in **Figure 4**.

- All Nations Christian Fellowship
- Brookdale Christian Center
- Brookdale Covenant Church
- Brooklyn Lutheran Church
- Brooklyn United Methodist Church
- Brunswick United Methodist Church
- Cambodian Church of the Nazarene
- Cornerstone Church Crystal
- Cross of Glory Lutheran Church
- Crystal Community Center
- Crystal VFW #494
- Faith Evangelical Free Church
- Faith-Lilac Way Lutheran Church
- First Lutheran Church of Crystal
- Jehovah Jireh Church of God in Christ
- Grace Lutheran Church
- Masjid Al-Ansar Islamic Community Center
- Mighty Fortress Church
- New Hope Ice Arena
- North Center Baptist Church
- Northwest Church of Christ
- Peace Lutheran Church
- Prince of Peace Lutheran Church
- St. Alphonsus Catholic Church
- St. James Lutheran Church
- St. Raphael's Church
- The Church in Brooklyn Park
- Trinity Church, Brooklyn Center
- Unity Temple Church of God in Christ
- Washburn-McReavy Glen Haven Funeral Chapel and Memorial Gardens

In addition to these listed locations that host large assemblies of people, some locations of vulnerable populations identified in A.1.a (Figure 3) also include theatres, meeting rooms, and sports facilities that could also draw concentrated crowds of people, such as for baseball games, chapel services, or graduation ceremonies. While such uses are not the primary function of these locations, they occasionally can function as spaces for large assemblies of people.

Figure 4: Existing Large Assemblies of People



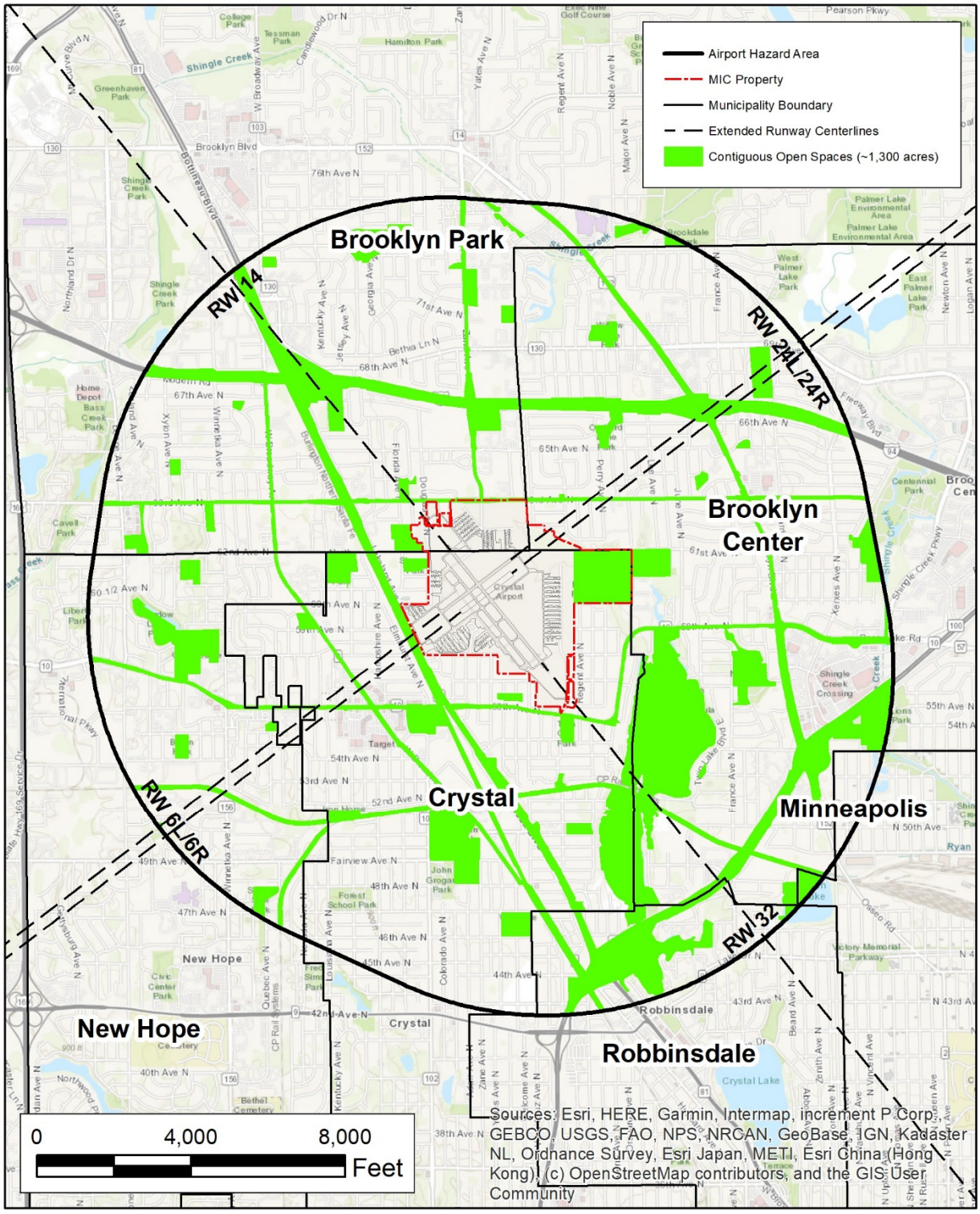
c) the availability of contiguous open spaces in the airport hazard area;

Contiguous open spaces near an airport lower the risk of an aircraft accident occurring in densely populated areas. The locations of the following contiguous open spaces within the airport hazard area are depicted in **Figure 5**.

- Parks
  - BC Little League Thurs Park
  - Becker Park
  - Begin Park, New Hope
  - Broadway Park
  - Brookdale Park
  - Brookdale Park and Dog Park
  - Brooklane Park
  - Cahlander Park
  - Cavanaugh School Park
  - Centennial Park
  - Centerbook Golf Course
  - Cherry Meadows Park
  - Crystal Little League Fields
  - Dorothy Mary Park
  - Edgewood Park
  - Fair Oaks School Park
  - Forest Park
  - Freeway Park
  - Garden City Park
  - Happy Hollow Park
  - Hartkopf Park
  - Hubert H. Humphrey Park
  - Iron Horse Park
  - Kylawn Park
  - Lakeland Park
  - Lakeside Park
  - Lion's Soo Line Park
  - Lions Park, Crystal
  - Lions Park, Brooklyn Center
  - Little Acre Park
  - MAC Wildlife Park
  - Marlin Park
  - Meadow Brook Lane Park
  - New Hope Village Golf Course
  - North Bass Lake Park
  - North Lions Park, Crystal
  - Northport Park
  - Northview Middle School Park
  - Orchard lane Park
  - Palmer Lake Environmental Nature Area
  - Schilling Park
  - Shingle Creek Parkway
  - Skyway Park
  - Southbrook Park
  - Striefel Park
  - Sunny Lane Park
  - Sunnyside Park
  - Twin Lake Beach Park
  - Twin Lake North Park
  - Twin Lake Peninsula Park
  - Twin Oak Park
  - Wangstad Park
  - Welcome Park, Crystal
  - Willow Lane Park
  - Zanewood Park
- Bodies of Water
  - Upper Twin Lake
  - Middle Twin Lake
  - Lower Twin Lake
  - Ryan Lake
  - Meadow Lake
  - Shingle Creek
- Major Thoroughfares
  - 63rd Ave N
  - Bass Lake Rd
  - BNSF Railroad
  - Bottineau Blvd
  - Brooklyn Blvd
  - CP Railroad
  - Interstate 94
  - Shingle Creek Parkway
  - State Highway 100
  - West Broadway
  - Zane Ave N
- Cemeteries
  - Brooklyn-Crystal Cemetery
  - Mound Cemetery
  - Glen Haven Memorial Gardens

Some locations of vulnerable populations identified in section A.1.a also feature contiguous open spaces, such as baseball and soccer fields. While these locations are not primarily used as parks, parts of their parcels share the characteristics of a park.

Figure 5: Existing Contiguous Open Space



d) the location of wildlife attractants in the airport hazard area;

In 1970, the MAC entered into an agreement with the Cities of Crystal and Brooklyn Center, through their respective conservation commissions, in cooperation with area school districts, to lease approximately 40 acres of airport property for the purpose of developing an open-space area to provide environmental, nature study, and wildlife preservation facilities for community education and enjoyment. From an airport operations standpoint, this area is used primarily for stormwater management and drainage purposes. Several public walking trails have been established through the site. This area attracts many types of wildlife but is actively managed to reduce wildlife hazards. Other wildlife attractants in the area include Twin Lakes, Ryan Lake, and Meadow Lake. The locations of these wildlife attractants are depicted in **Figure 6**. There are no other traditional attractants for mass wildlife such as large forests or wetlands, wastewater treatment plants, landfills, or waste transfer stations in the airport hazard area.

e) Airport ownership or control of the federal Runway Protection Zone and the department's Clear Zone;

The Runway Protection Zone (RPZ) is a trapezoidal area beyond each runway end that is meant to be clear of incompatible land uses based on FAA standards, as described in Advisory Circular (AC) 150/5300-13B, *Airport Design*. To the extent possible, the FAA expects airport sponsors to take all possible measures to protect against and remove or mitigate incompatible land uses within the RPZ. MnDOT similarly encourages airports to own or control its clear zones and more emphasis has been placed in recent years for Minnesota airports to acquire all encompassed land within the clear zones. The State MnDOT clear zones are marginally wider and longer than the RPZ in some cases. Control of these zones protects people and property on the ground as well as aircraft using the runways.

The RPZs and MnDOT Clear Zones for each runway end at Crystal Airport are shown in **Figure 7**. Each RPZ is contained on Airport property. The MnDOT clear zone extends past airport property and overlays single-family residential properties on four of the six runway ends.

Figure 6: Existing Wildlife Attractants

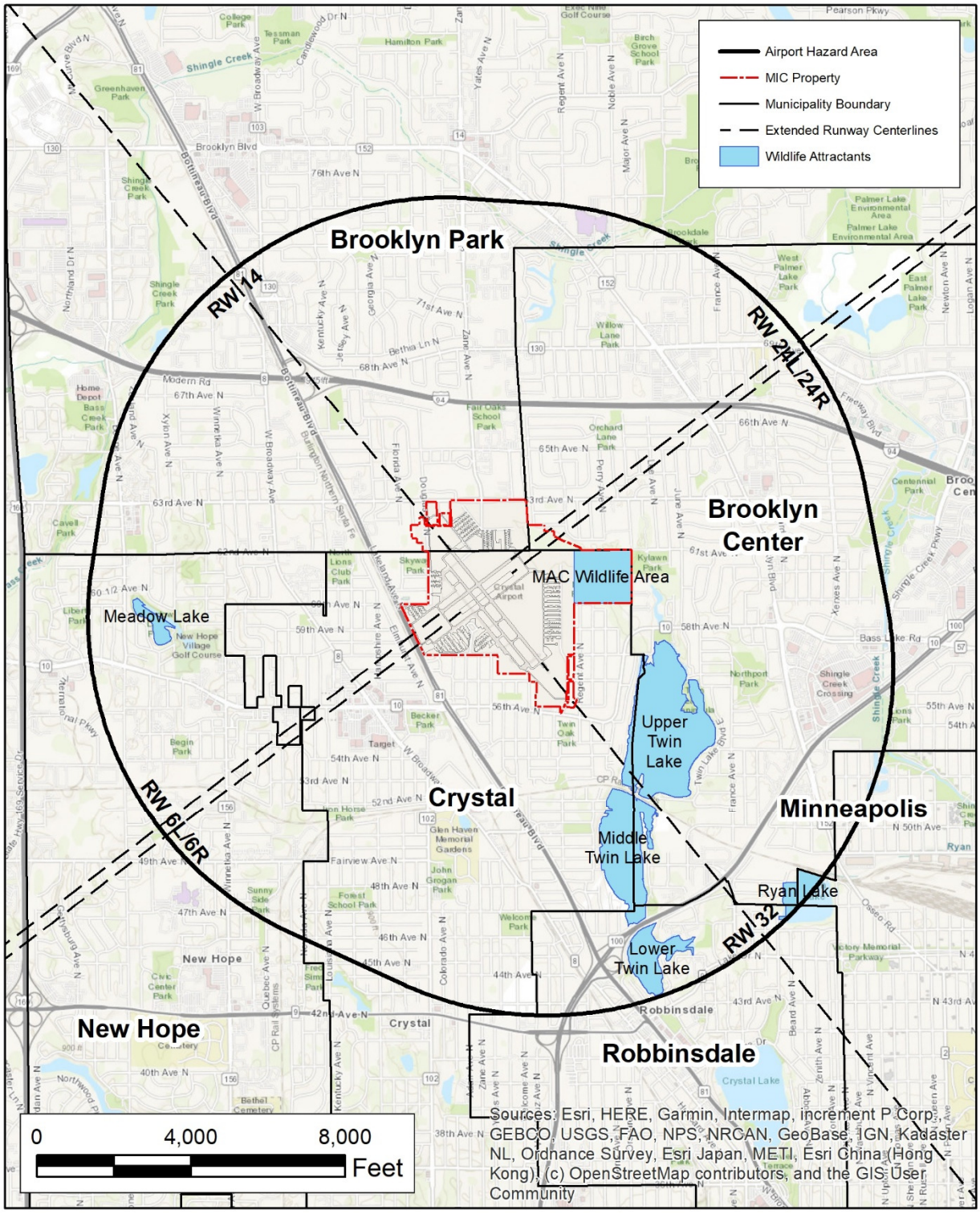
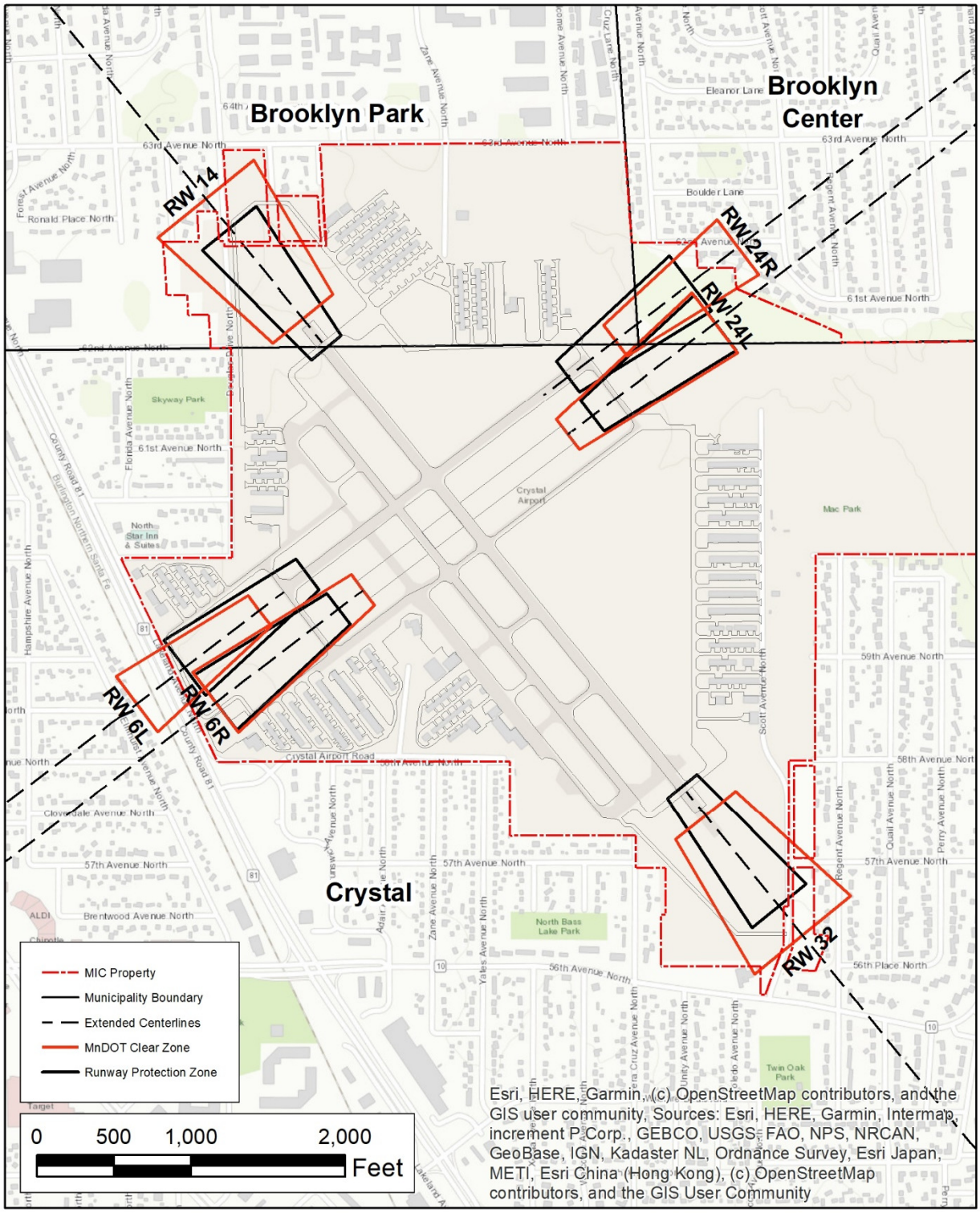


Figure 7: Existing FAA RPZs and State Clear Zones



f) Land uses that create or cause interference with the operation of radio or electronic facilities used by the airport or aircraft;

Please see the analysis for 1.h. below.

g) 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;

Please see the analysis for 1.h. below.

h) Land uses that otherwise inhibit a pilot's ability to land take off, or maneuver the aircraft;

There are no known land uses that make it difficult for pilots to distinguish between airport lights and non-airport lights, that result in glare in the eyes of pilots using the airport, that impair visibility near the airport, or otherwise endanger the landing, taking off, or maneuvering of the aircraft. There also are no known land uses which create or cause interference with the operations of radio or electronic facilities on the airport or with radio or electronic communications between the airport and aircraft.

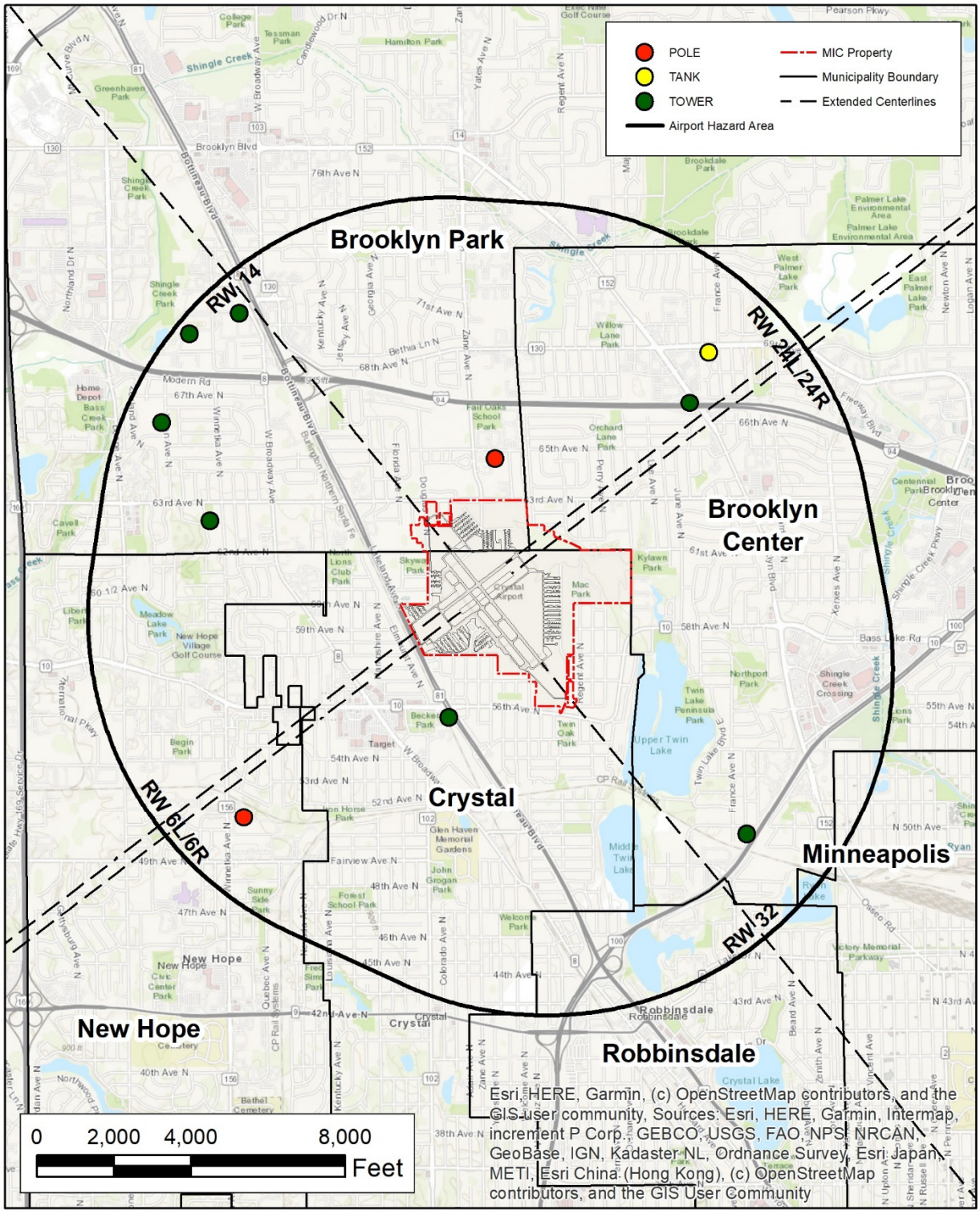
i) Airspace protection to prevent the creation of air navigation hazards in the airport hazard area; and

The 1983 Ordinance also created airspace zoning which limits the height of buildings and other obstacles that can present a hazard to aircraft in flight. The locations of significant man-made tall structures in the airport hazard area identified by the FAA digital obstacle file database, including any known poles, antennas, cell towers, power lines, and water towers, are depicted in **Figure 8**. None of these structures penetrate the current FAR Part 77 imaginary surfaces for MIC.

j) the social and economic costs of restricting land uses;

Zoning restrictions have the potential to interrupt the market driven growth of an area, as demand for various land uses change. For the area around Crystal Airport, this could manifest in the form of restraining land value for those properties within the airport hazard area. Especially as the Twin Cities Metro Area sees increased demand for housing, those properties whose density is limited by zoning restrictions may miss out on an opportunity to increase their density. The cities also forego additional tax revenue from the increased land usage that would be allowed were no restrictions to exist. There is also the potential that additional land use restrictions on private property could result in takings claims.

Figure 8: Existing Significant Man-Made Structures



2. Airport's type of operations and how the operations affect safety surrounding the airport

MIC accommodates personal, recreational, educational, and business general aviation users. There is also occasional military usage by the North Hennepin Composite Squadron of the Civil Air Patrol. The Airport has 130 based aircraft, which are comprised of 123 single engine aircraft, three helicopters, and four multi-engine aircraft. As shown in **Table 1**, the airport has experienced an even distribution of local and itinerant traffic making up on average approximately 37,500 operations (takeoffs and landings) per year.

Table 1: Annual Aircraft Operations at Crystal Airport (2017-2021)

Year	Itinerant Operations				Local Operations			Total Aircraft Operations
	Air Taxi	General Aviation	Military	Total Itinerant	Civil	Military	Total Local	
2021	423	19,076	55	**19,554**	17,892	16	**17,908**	**37,462**
2020	420	19,152	28	**19,600**	17,708	14	**17,722**	**37,322**
2019	458	21,520	46	**22,024**	19,495	22	**19,517**	**41,541**
2018	523	19,796	245	**20,564**	17,500	45	**17,545**	**38,109**
2017	505	18,253	68	**18,826**	15,347	50	**15,397**	**34,223**
Average	**466**	**19,559**	**88**	**20,114**	**17,588**	**29**	**17,618**	**37,731**

Source: FAA Air Traffic Activity Data System (ATADS)

As shown in **Table 2**, over 80 percent of arrivals and departures occur on primary Runway 14/32. This is due to several factors, including its alignment with the prevailing wind, its longer available runway length, and the lack of instrument approach procedures on the crosswind runways.

Table 2: Crystal Airport Operational Runway Use Distribution

Operations from January 1, 2017 to February 28, 2022

Runway	Length	Arrivals	% Arrivals	Departures	% Departures
14	3,751 feet	35,199	41.1%	34,793	41.9%
32		33,051	38.6%	35,417	42.7%
6	2,500 feet	8,409	9.8%	6,367	7.7%
24		9,036	10.5%	6,340	7.6%
Total		**85,695**	**100%**	**82,917**	**100%**

Source: MAC Noise and Operations Monitoring System (MACNOMS)

Note: For this analysis, operations on the turf runway (6R/24L) have been combined with operations on the paved crosswind runway (6L/24R).

3. 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

Table 3 compares the historical accident rate per 100,000 aircraft operations at Crystal Airport and the State of Minnesota for the 25-year period from 1997 to 2021, based on available accident records from the National Transportation Safety Board (NTSB). The NTSB defines an aircraft accident as an occurrence in which people on board or on the ground sustained serious or fatal injuries or in which the aircraft incurred substantial damage to the extent that it could no longer be considered airworthy. Only two of the 14 accidents at Crystal Airport during this timeframe occurred off airport property, with neither of them resulting to injuries to people or damage to properties on the ground.

Table 3: Accident Rate Comparison for Crystal Airport and State of Minnesota (1997-2021)

Data Point	Crystal Airport	State of Minnesota
Total Aircraft Operations	1,940,322	52,598,381
Total Aircraft Accidents at or near an Airport	14	466
Accident Rate per 100,000 Aircraft Operations	0.72	0.89

Sources:
Accident data from NTSB Case Analysis and Reporting Online (CAROL) query tool
Crystal operations data from FAA Air Traffic Activity Data System (ATADS) query tool
State of Minnesota operations data from FAA Terminal Area Forecast (TAF) query tool

This comparison suggests the long-term accident rate at Crystal Airport is less than that experienced at all airports in Minnesota over the same period. Because there have been relatively few actual aircraft accidents near Crystal Airport, a larger set of generalized accident location data is needed to conduct a safety risk analysis. Using a methodology described in **Appendix A**, the safety-risk analysis calculated accident probability and frequency likelihood on and near Crystal Airport.

4. Planned land uses within an airport hazard area, including any applicable platting, zoning, comprehensive plan, or transportation plan

The airport is surrounded by land that has thoroughly developed since the airport's founding nearly 80 years ago. Most of its neighbors are single-family detached homes on compact lots, in Crystal, Brooklyn Park, and Brooklyn Center. However, given their positions as first ring suburbs to a fast-growing metropolitan center, the pressure for denser development and taller buildings can be expected. This increased density may come in terms of upscaling density within existing zones, such as allowing multi-family dwellings to be built to the scale of one-family detached dwellings, and permitting low-rise, multi-family units to be built. In Crystal, such low-rise structures would be limited to a maximum height of 60 ft or 5 stories (whichever is less). Brooklyn Park caps their zoning at 40 feet, though with a variance a residential building can be built in a high-density zone as tall as 100 feet.

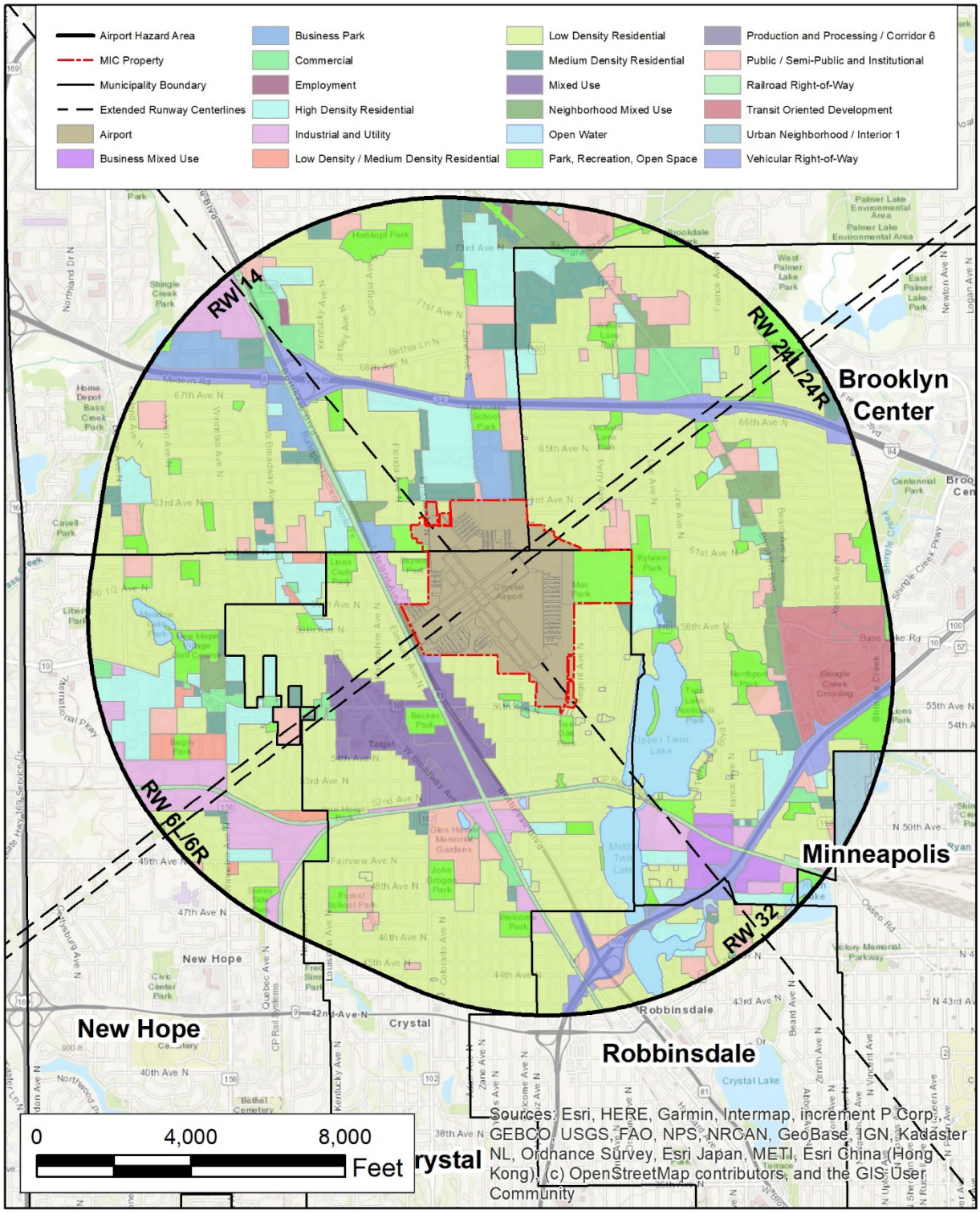
The area has two transit-oriented development (TOD) style projects that could affect the character of the JAZB cities. The first project is the development of a future Brooklyn Boulevard Overlay district which will run the length of Brooklyn Center, from Minneapolis to Brooklyn Park. Future Brooklyn Center Land Use Maps show this overlay district as having denser zoning, more mixed commercial/residential spaces, and other Planned Unit Development (PUD) zones both along the boulevard and Brooklyn Center's border with Minneapolis. The second TOD project is the METRO Blue Line Extension which will connect Brooklyn Park and Crystal with the rest of the METRO Transit System. This extension project includes two new stations in Crystal and four new stations in Brooklyn Park and is accompanied by plans for TOD around those stations.

Planned future land uses in the airport hazard area, as reported by the cities to the Metropolitan Council as of April 8, 2022, are shown in **Figure 9**.

5. Any other information relevant to safety or the airport

No supplemental information is available at this time.

Figure 9: Planned Future Land Uses



Source: Metropolitan Council, April 8, 2022

B. Proposed Custom Zoning

This section provides a summary description of the proposed Airport Zoning Ordinance for Crystal Airport.

1. Proposed Airspace Zone (Height Limitations)

The 1983 Airport Zoning Ordinance for Crystal Airport has been largely effective in preventing both airspace obstructions and land uses that interfere with the safety of flight operations.

The proposed Airspace Zone in the proposed Ordinance, when combined with the land use restrictions for proposed JAZB Land Use Zones 1 and 2, prevents interference with flight safety and addresses the custom zoning factors to ensure a reasonable level of safety to the full extent of the airport hazard area. Proposed height limitations are based on FAA airspace protection criteria out to the limits of the FAR Part 77 conical surface, as shown in **Figure 10**.

Additionally, the Ordinance clarifies that all construction or alteration of existing structures in an Airspace Zone shall comply with the requirements for filing notice to the FAA under the 7460 Obstruction Evaluation process.

If a proposed development seeks to penetrate the height limitations stipulated by the proposed Airspace Zone, a variance will have to be approved by the Board of Adjustment.

2. Proposed JAZB Land Use Zone 1

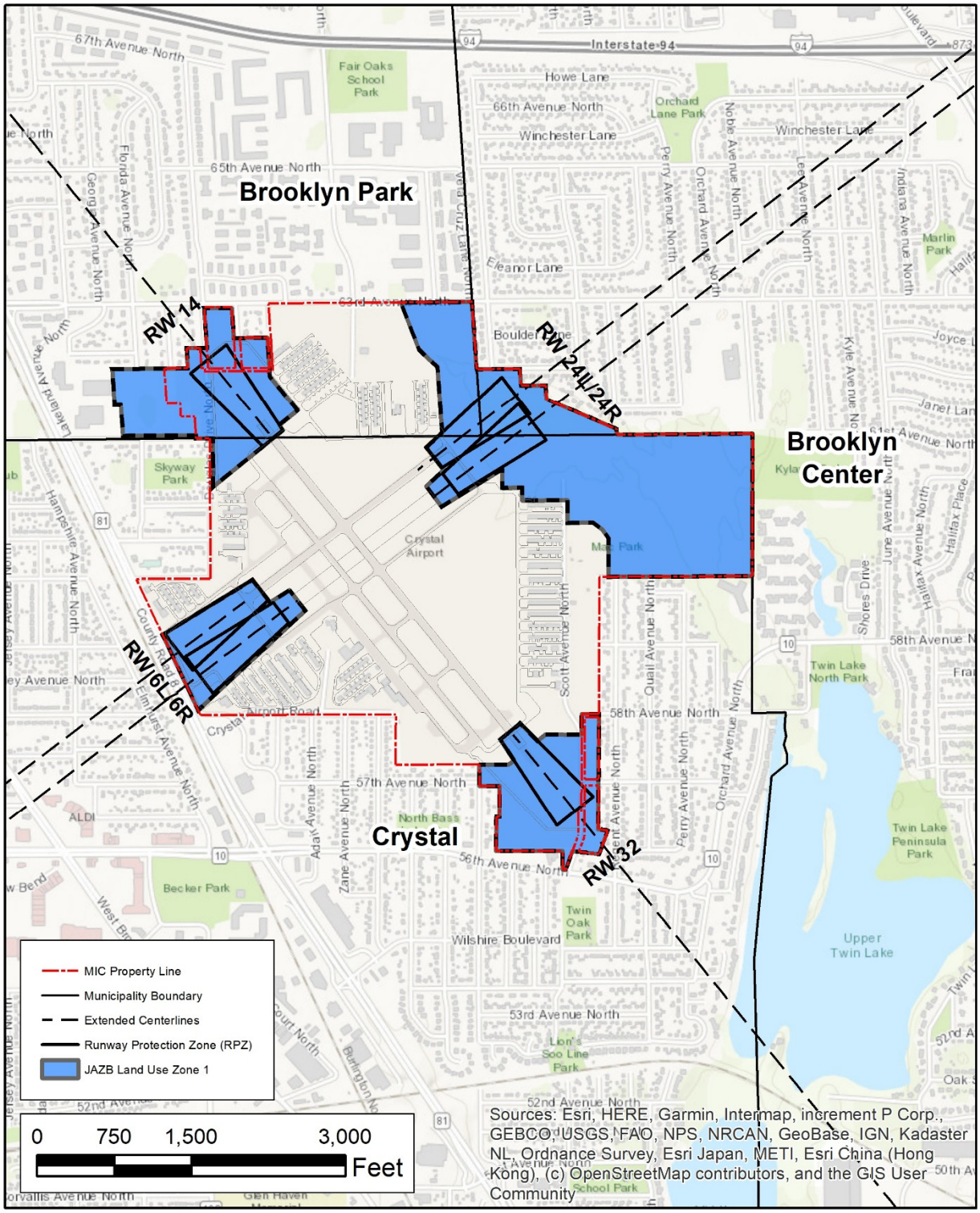
Proposed JAZB Land Use Zone 1 is the most restrictive land use zone that prohibits buildings, other structural hazards, and land uses that bring together dense, confined assembly of people thereon. Permitted uses in this zone would include agriculture (seasonal crops), horticulture, animal husbandry, wildlife habitat, light outdoor recreation, cemeteries, roadways and vehicle parking, railroads, and other aeronautical uses, provided they are granted formal Airport Layout Plan approval by the FAA.

The JAZB determined that the boundaries of proposed JAZB Land Use Zone 1, as shown in **Figure 11**, provide a reasonable level of safety by protecting the following areas:

- Federal RPZs
- Undeveloped airport property adjacent to the RPZs
- Off-airport property not planned for future development adjacent to the RPZs

Figure 10: Proposed Airspace Zoning

Figure 11: Proposed JAZB Land Use Zone 1



3. Proposed JAZB Land Use Zone 2 (Land Use)

Proposed JAZB Land Use Zone 2 is a less-restrictive land use zone with general prohibitions against land uses that interfere with flight safety. Prohibited land uses are those that would:

- Create or cause interference with the operations of radio or electronic facilities
- Create or cause interference with radio or electronic communications between airport and aircraft
- Make it difficult for pilots to distinguish between airport lights and other lights
- Result in glare in the eyes of pilots using the airport
- Impair visibility in the vicinity of the airport
- Is deemed a hazard to air navigation by the FAA or MnDOT as part of an FAA 7460 obstruction evaluation
- Otherwise endanger the landing, taking off, or maneuvering of aircraft in the runway approach areas

Proposed JAZB Land Use Zone 2 does not seek to prohibit the use of rooftop solar panels on homes or restrict the use of FCC-approved amateur radio stations.

The JAZB believes that the appropriate boundary for Proposed JAZB Land Use Zone 2 is the FAR Part 77 horizontal airspace surface (5,000-foot radius from the ends of each runway's primary surface), as shown in **Figure 12**.

4. Rationale for Development of JAZB Land Use Zones

The JAZB believes the proposed JAZB Land Use Zones and 1 and 2 address the custom zoning factors to ensure a reasonable level of safety for the reasons described below.

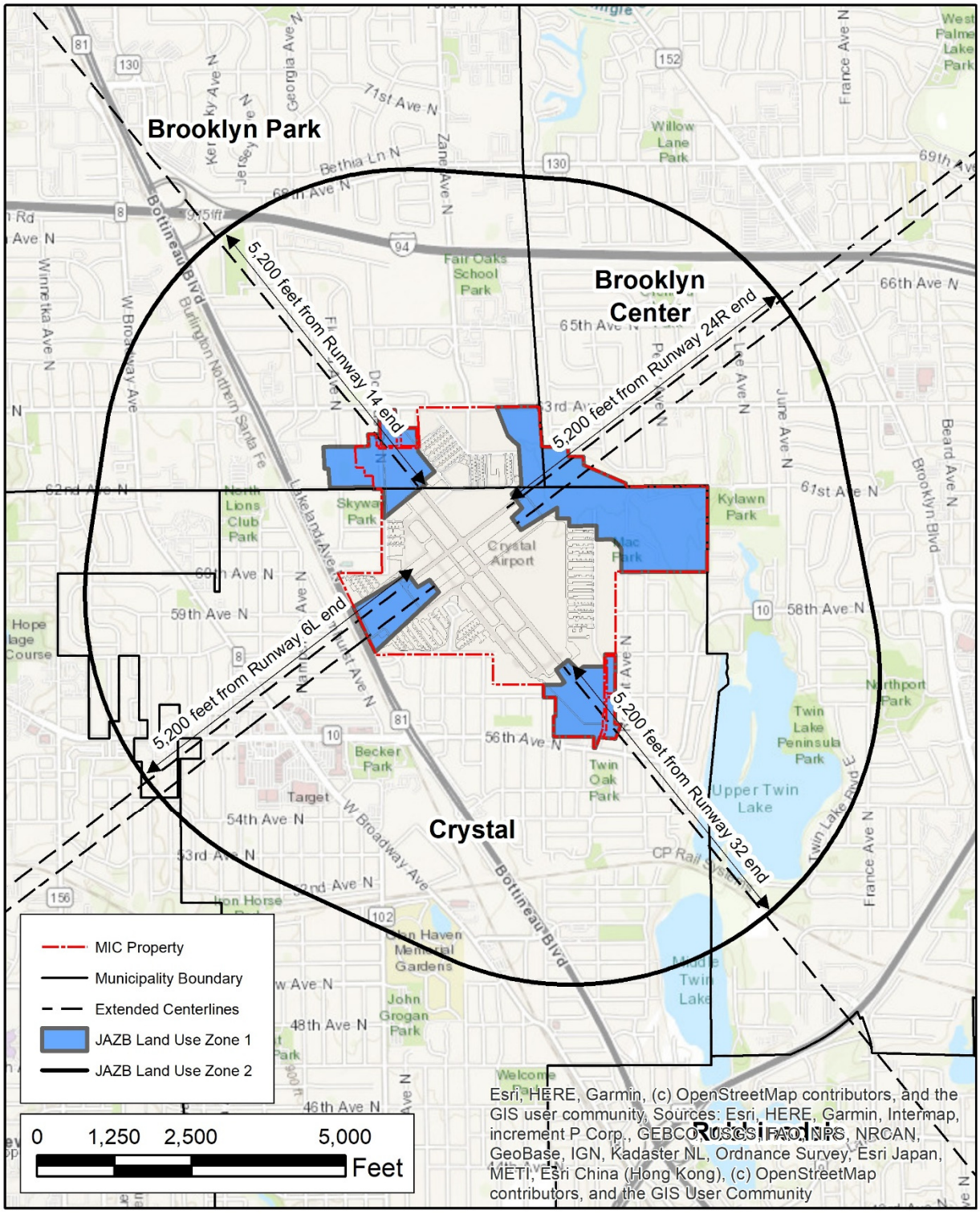
a) JAZB Land Use Zone 1 encompasses all the FAA RPZs as shown on **Figure 11**.

b) ~68.7% of accident probability is captured within JAZB Land Use Zone 1 and the airport property line as documented in the Safety/Risk Study (see **Appendix A**).

c) Beyond JAZB Land Use Zone 1, safety-related benefits of additional zoning restrictions diminish rapidly. Additional accident probability captured under the approach surfaces out to the length of the current runways beyond JAZB Land Use Zone 1 accounts for only ~2.49% of accident probability at Crystal Airport as documented in the Safety/Risk Study (see **Appendix A**).

d) The accident probability per acre within JAZB Land Use Zone 1 is 0.08%. As documented in **Appendix A**, the accident probability per acre drops off significantly beyond JAZB Land Use Zone 1 (0.012%), demonstrating that JAZB Land Use Zone 1 conforms to a reasonable level of safety.

Figure 12: Proposed JAZB Land Use Zone 2



e) Existing and future land uses under the approach surfaces out to the length of the current runways do not promote the type of new development associated with vulnerable populations (schools, hospitals, nursing homes, etc.) or new land uses that attract large assemblies of people. Applying additional land use restrictions in these established, low-density residential development areas would not likely result in a material or measurable safety benefit. Additional land use restrictions would, however, create social and economic costs by placing new burdens on many property owners.

f) Nearly 1,300 acres of land within the airport hazard area (total of approximately 8,000 acres) are identified as contiguous open space (see **Figure 5**). This area is evenly distributed under proposed JAZB Land Use Zone 2, which affords the pilot options to avoid densely populated areas in the event of an off-airport accident.

Custom Zoning Factors Cross-Reference

When developing and adopting custom airport zoning regulations under this section, the municipality, county, or joint airport zoning board must include in the record a detailed analysis that explains how the proposed custom airport zoning regulations addressed the following factors to ensure a reasonable level of safety.

(1) The location of the airport, the surrounding land uses, and the character of neighborhoods in the vicinity of the airport, including:

(i) The location of vulnerable populations, including schools, hospitals, and nursing homes, in the airport hazard area;
- Section A.1.a, Figure 3

(ii) The location of land uses that attract large assemblies of people in the airport hazard area;
- Section A.1.b, Figure 4

(iii) The availability of contiguous open spaces in the airport hazard area;
- Section A.1.c, Figure 5

(iv) The location of wildlife attractants in the airport hazard area;
- Section A.1.d, Figure 6

(v) Airport ownership and control of the federal Runway Protection Zones and the department's Clear Zone;
- Section A.1.e, Figure 7

(vi) Land uses that create or cause interference with the operations of radio or electronic facilities used by the airport or aircraft;
- Section A.1.f

(vii) 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;
- Section A.1.g

(viii) Land uses that otherwise inhibit a pilot's ability to land, take off, or maneuver the aircraft;
- Section A.1.h

(ix) Airspace protection to prevent the creation of air navigation hazards in the airport hazard area; and

- Section A.1.i, Figure 8

(x) The social and economic costs of restricting land uses.

- Section A.1.j

(2) The airport's type of operations and how the operations affect safety surrounding the airport;

- Section A.2

(3) The accident rate of the airport compared to a statistically significant sample, including an analysis of accident distribution based on the rate with a higher accident incidence;

- Section A.3, Appendix A

(4) The planned land uses within an airport hazard area, including any applicable platting, zoning, comprehensive plan, or transportation plan; and

- Section A.4, Figure 9

(5) Any other information relevant to safety or the airport.

- Section A.5

Appendix A
Safety Risk Analysis Methodology

Analytical Framework & Methodology for Calculating Accident Probability

Aircraft accidents occurring off airport property are rare at Crystal Airport. The National Transportation Safety Board (NTSB) Case Analysis and Reporting Online (CAROL) query tool identifies only 14 reportable accidents[1] among the approximately 2,000,000 take-offs and landings accidents at MIC since 1997. Only two of these 14 accidents occurred off airport property, with neither of them resulting in injuries to people or damage to properties on the ground, and only one of them occurring within Commissioner Standard Safety Zones A or B. In the period 1997 – 2021, MIC had an accident rate of 0.72 accidents per 100,000 operations (0.10 when considering only those off airport property), which is less than the statewide rate of 0.89 accidents per 100,000 operations.

The Crystal Airport JAZB has evaluated safety compatibility of nearby land uses as a function of statistical risk. Because accidents are so rare, it has been an accepted methodology by the MNDOT Commissioner[2] for JAZBs to use a dataset of accidents occurring nationwide among the aircraft most likely to be operating on runways of similar length to the airport being studied.[3] By examining the available data on types and locations of accidents in conjunction with information on airplane operational parameters, it is possible to estimate where accidents could occur in the future. The dataset initially collected for the California Airport Land Use Handbook (California Study) provides documentation of accidents relative to the runway end depending on whether an airplane is climbing/taking off or approaching/landing. Additional discussion on how and why aircraft accidents occur at various operating parameters can be found in the California Airport Land Use Planning Handbook, Appendix E – Aircraft Accident Characteristics.

This analysis applies the national dataset from the California Study to Crystal Airport by georeferencing specific aircraft accident data points according to their bearing and distance from the actual runway end locations at Crystal. It also applies weighting factors for each data point based on the proportion of aircraft operations on each runway and the higher prevalence of departure accidents versus arrival accidents in the California Study national dataset. At the most granular level of analysis, the probability of an accident is determined on a grid where each parcel is 300' by 300' (approximately two acres); this allows land use policy decisions to be closely considered rather than painted too broadly.

[1] The NTSB defines an aircraft accident as an occurrence in which people on board or on the ground sustained serious or fatal injuries or in which the aircraft incurred substantial damage to the extent that it could no longer be considered airworthy.

[2] The analytical method used in this report is similar to the method as used at Flying Cloud and Lake Elmo airports to support local zoning regulations approved by the MNDOT Order for the Lake Elmo Airport, Docket 192, Order 631, entered on December 28, 2020; and, the MNDOT Order for Flying Cloud Airport, Docket 190, Order 623, entered on January 17, 2019.

[3] General aviation accident location distribution research conducted by the University of California at Berkeley for the California Airport Land Use Planning Handbook (California Study) is cited in the reports approved by MNDOT as most complete known data set available for this analysis. A link to the California Study report is provided here.

Accident Risk at MIC

Figures 13 and 14 show the arrival and departure accident locations, respectively, from the California Study national dataset for runway lengths less than 4,000 feet when applied to the geography of MIC. When the dataset is applied probabilistically as shown in **Figure 15**, this analysis estimates that ~66.8% of probable accidents at or near Crystal Airport would occur on airport property.

It is important to reiterate that the accidents depicted on **Figures 13 and 14** are not actual accident locations at MIC, but a representative set of nationwide data compiled to help the industry better understand where general aviation accidents are most likely to occur.

Detailed Methodology of Safety/Risk Analysis

1. **Select accident location data set to use for analysis**
   The general aviation accident location distribution research conducted by the University of California at Berkeley for the California Airport Land Use Planning Handbook (California Study) remains the most complete known data set available for this analysis. A link to the updated California Study report is provided here.

   The California Study looked at several thousand NTSB accident records from across the nation and plotted the location of nearly 900 accidents that had off-airport land-use compatibility implications. The data used for Crystal was filtered to only plot accidents occurring on runways with lengths less than 4,000 feet, as Crystal's longest runway (Runway 14/32) is only 3,751 feet long. **Figures 13 and 14** show the location of the filtered California Study accident locations superimposed on the appropriate Crystal Airport runway ends to provide a representative sample of where accidents are likely to occur in relation to each runway.

2. **Generalize accident locations to avoid an implication of precision**
   The California Study developed a grid spacing system of 300 feet by 300 feet to group accident data points according to relative degrees of geographic concentration. For consistency purposes, a 300-foot by 300-foot grid system was used in this analysis. Aircraft accident locations are not expressed as individual point locations, but as accident probabilities per grid square.

3. **Normalize accident location data to account for Crystal Airport runway use patterns and the number of data points off each runway**
   This process effectively weighs the accident location data to account for the difference in runway end operational volumes and the number of accident location data points off each runway end to ensure that each location is considered equally. For example, Runway 14/32 has 4.5 times the operations of crosswind Runways 6L/24R and 6R/24L and therefore accident probability is weighted as such.

4. **Calculate the probability of an accident occurring within each grid square**
   The probability of an accident occurring within each grid square was calculated using GIS geo-spatial analysis. The sum of the probability for the extent of the entire grid is 100%. A "heat map" symbolizing the accident probability in each grid square is shown in **Figure 15**.

5. **Calculate the frequency of an accident occurring within each grid square**
   The frequency of an accident occurring within each grid square, expressed in terms of "years between accidents," was calculated using GIS geo-spatial analysis. A "heat map" symbolizing the number of years between accidents in each grid square is shown in **Figure 16**.

6. **Evaluate Proposed JAZB Land Use Zone 1**
   Figure 17 shows accident probabilities within and adjacent to Proposed JAZB Land Use Zone 1.

   Figure 18 shows accident frequencies, expressed in terms of years between accidents, within and adjacent to Proposed JAZB Land Use Zone 1.

   The safety/risk analysis for Proposed JAZB Land Use Zone 1 by itself indicates the following results:
   - ~13.5% accident probability captured within Proposed JAZB Land Use Zone 1.
   - ~22 years between accidents within Proposed JAZB Land Use Zone 1.

   The safety/risk analysis for Proposed JAZB Land Use Zone 1, when combined with the rest of airport-owned property, indicates the following results:
   - ~68.7% accident probability captured within Proposed JAZB Land Use Zone 1 and airport property line.
     - This leaves a ~31.3% chance that any given accident will occur off airport property or outside Proposed JAZB Land Use Zone 1. This is much higher than the actual 14% historical rate of accidents occurring off airport property at Crystal (2 out of 14 accidents from 1997 to 2021).
   - ~4 years between accidents within Proposed JAZB Land Use Zone 1 and airport property line.

   The analysis also calculated accident probability beyond proposed JAZB Land Use Zone 1, under the approach surface for the length of each runway. The results are compared to the accident probability within proposed JAZB Land Use Zone 1 in **Table 4** below, and in **Figure 19**.

Table 4: Accident Probability and Frequency Within Proposed JAZB Land Use Zone 1 and Under Approach Surface Beyond Proposed JAZB Land Use Zone 1

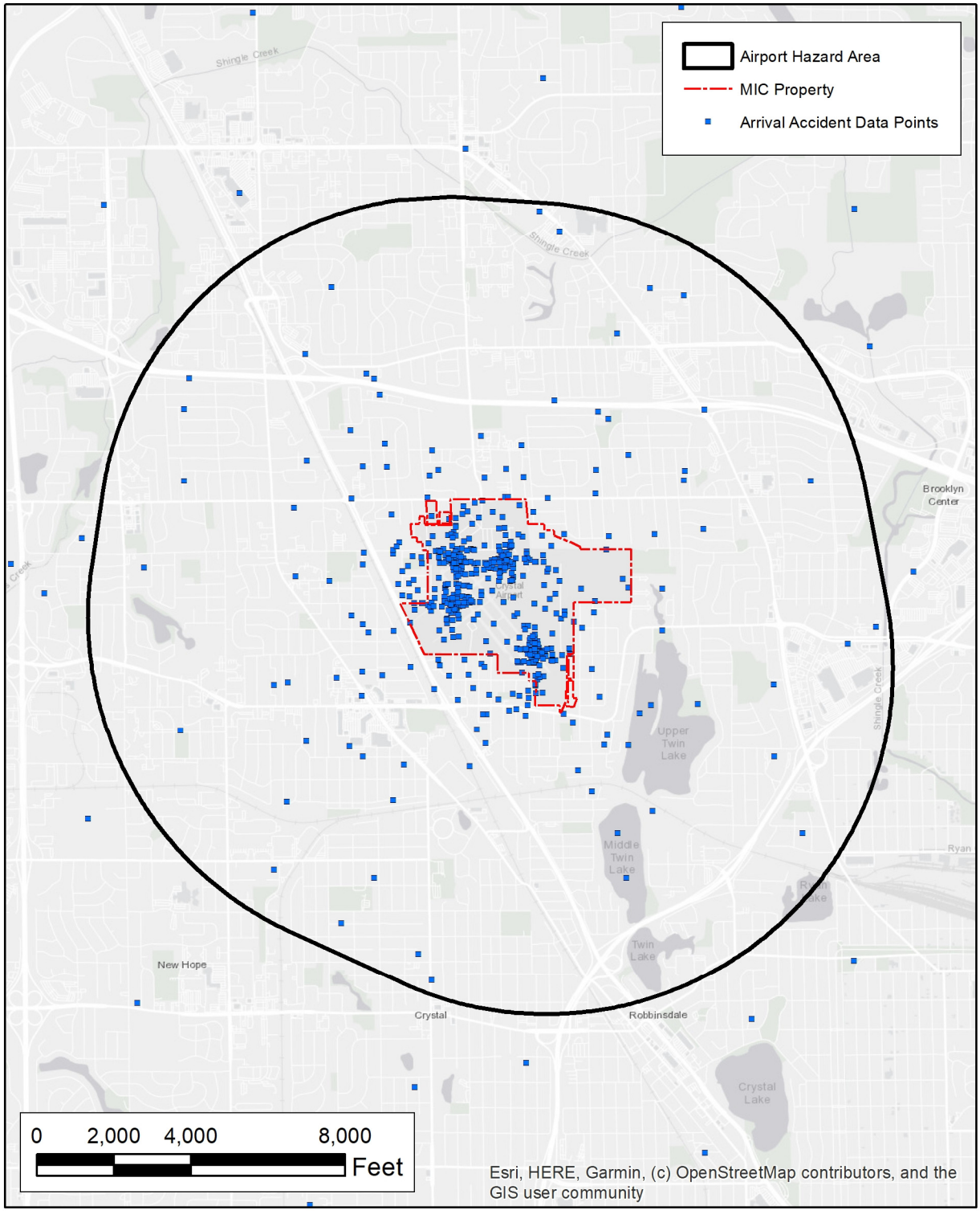
	Within Proposed JAZB Land Use Zone 1		**Under Approach Surface Beyond Proposed JAZB Land Use Zone 1**	
Runway	Accident Probability	Years Between Accidents	Accident Probability	Years Between Accidents
14	4.30%	69	1.00%	298
32	3.98%	75	1.02%	292
6	1.16%	257	0.36%	827
24	4.07%	73	0.11%	2707

Lastly, as a comparison, the analysis calculated the accident probability per acre within proposed JAZB Land Use Zone 1 off each runway end versus the accident probability per acre beyond proposed JAZB Land Use Zone 1, under the approach surface for the proposed length of each runway. As shown in **Table 5** below, the accident probability per acre drops off significantly beyond proposed JAZB Land Use Zone 1.

Table 5: Accident Probability Per Acre

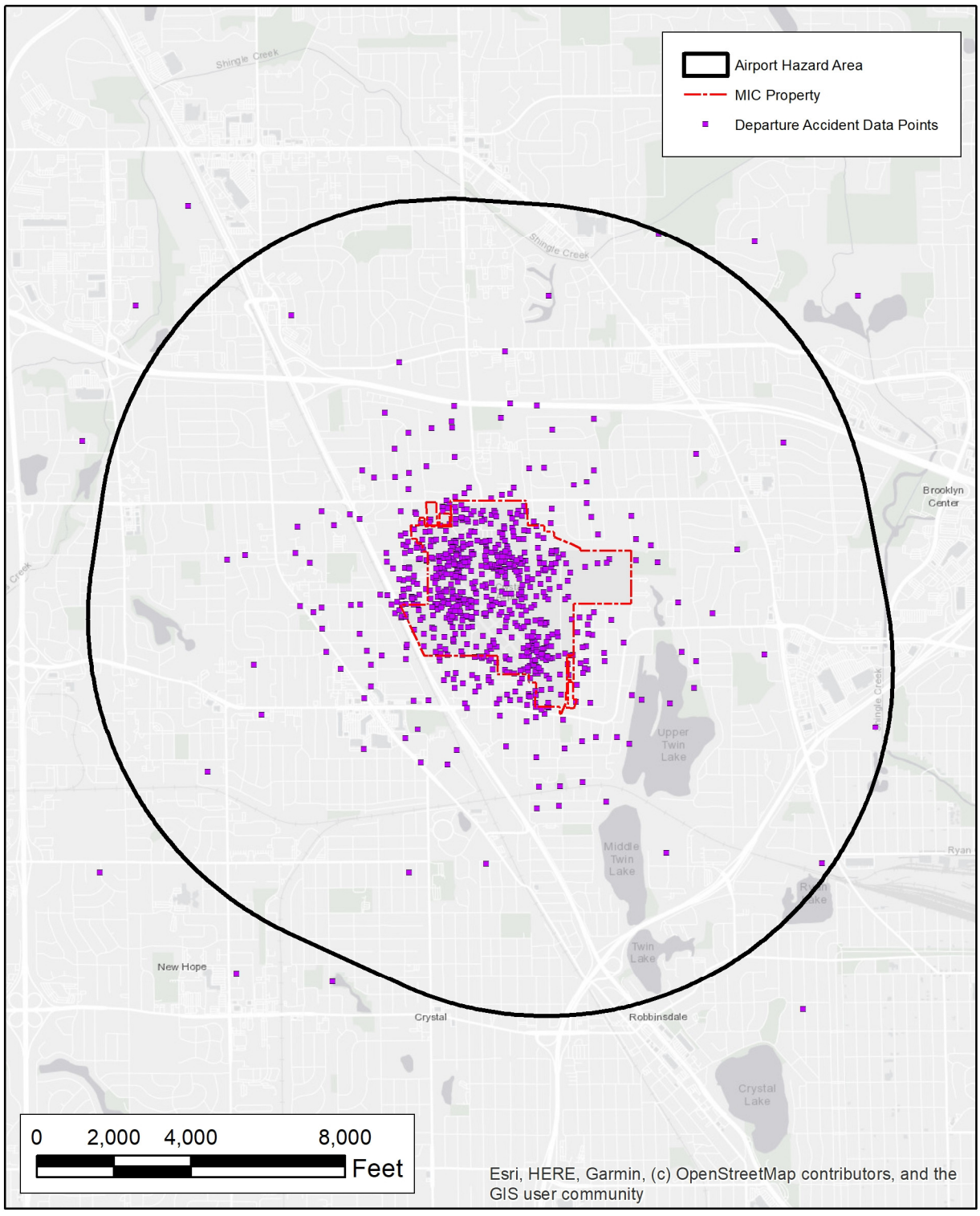
Runway	Within Proposed JAZB Land Use Zone 1	Under Approach Surface Beyond Proposed JAZB Land Use Zone 1
14	0.12%	0.012%
32	0.15%	0.013%
6	0.06%	0.014%
24	0.04%	0.005%

Figure 13: National Arrival Accident Dataset Applied to Crystal Airport



Notes: This graphic depicts accident locations from the California Study national dataset and not actual Crystal Airport accident locations. A total of 612 arrival accident data points were included in the analysis.

Figure 14: National Departure Accident Dataset Applied to Crystal Airport



Notes: This graphic depicts accident locations from the California Study national dataset and not actual Crystal Airport accident locations. A total of 764 departure accident data points were included in the analysis.

Figure 15: Safety/Risk Study Accident Probabilities

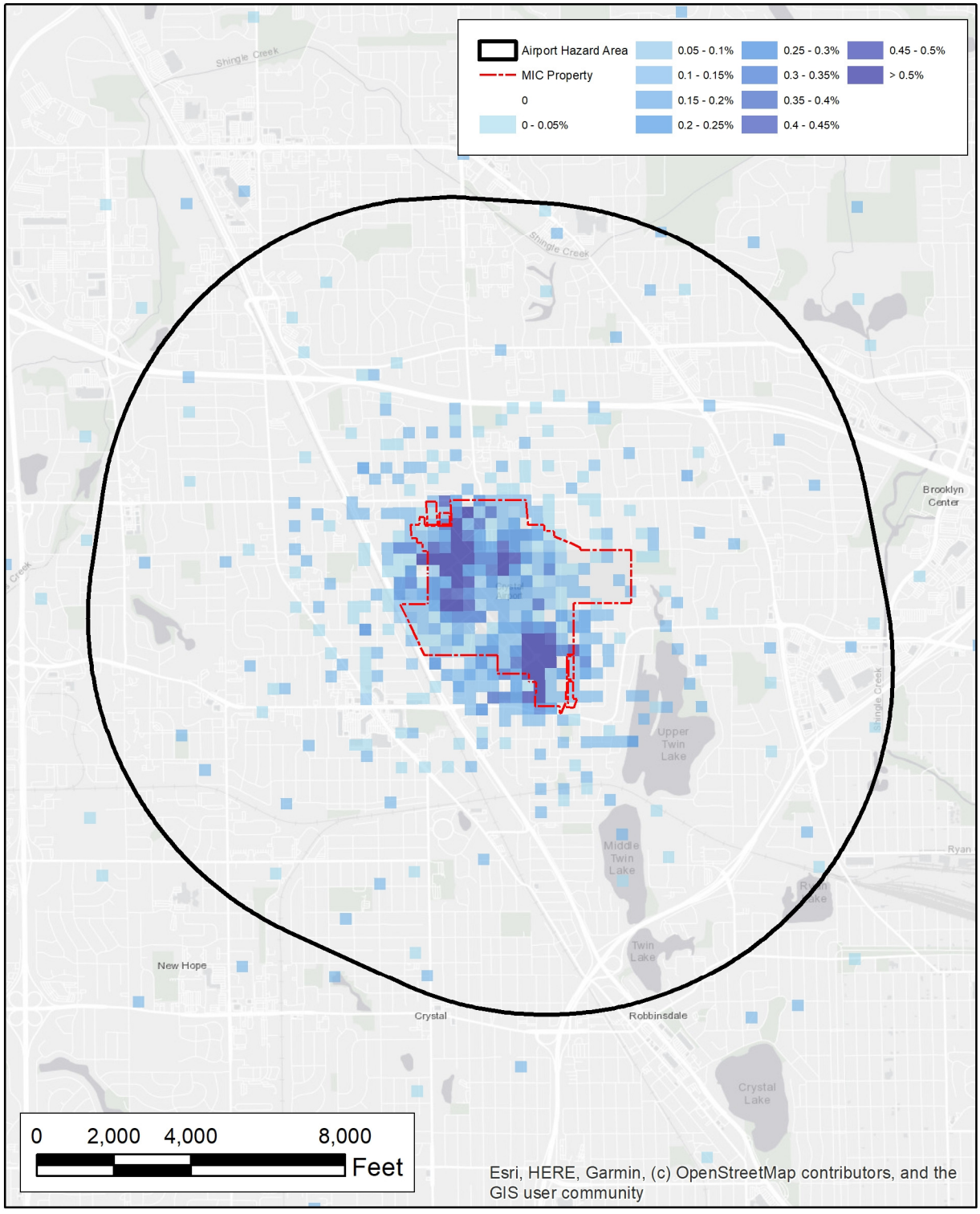


Figure 16: Safety/Risk Study Accident Frequency (Years Between Accidents)

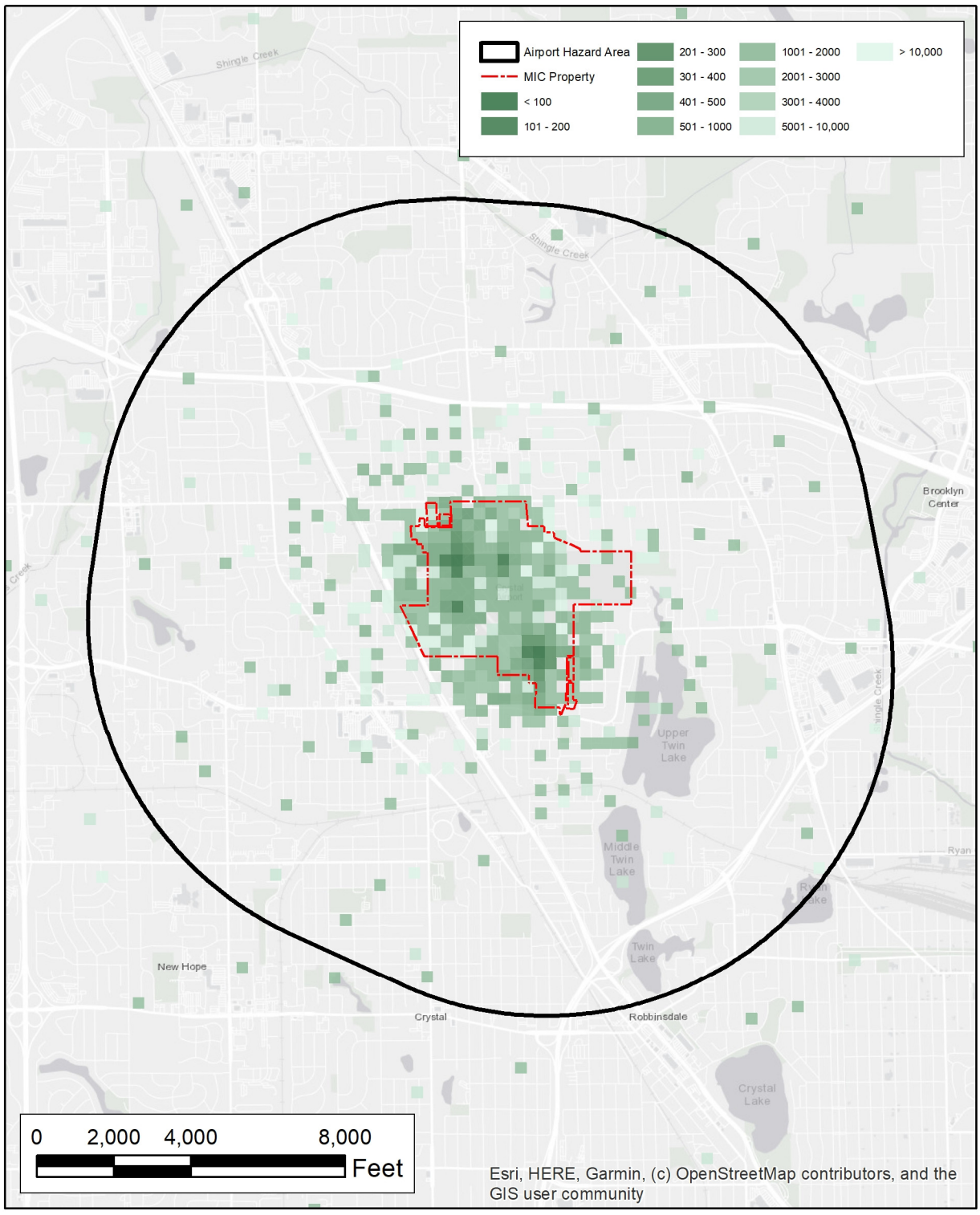


Figure 17: Proposed JAZB Land Use Zone 1 Accident Probability by Grid

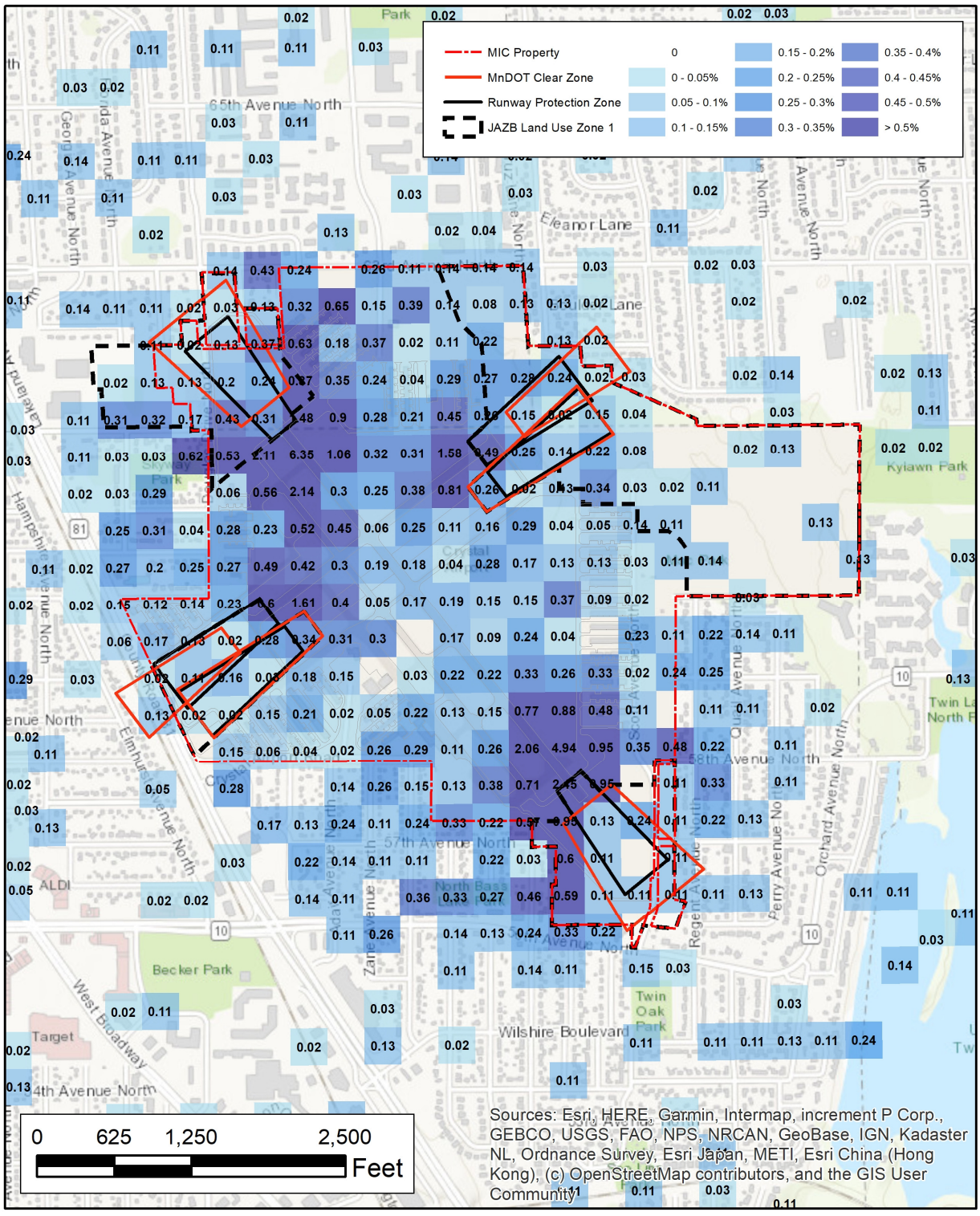


Figure 18: Proposed JAZB Zone 1 Accident Frequency by Grid

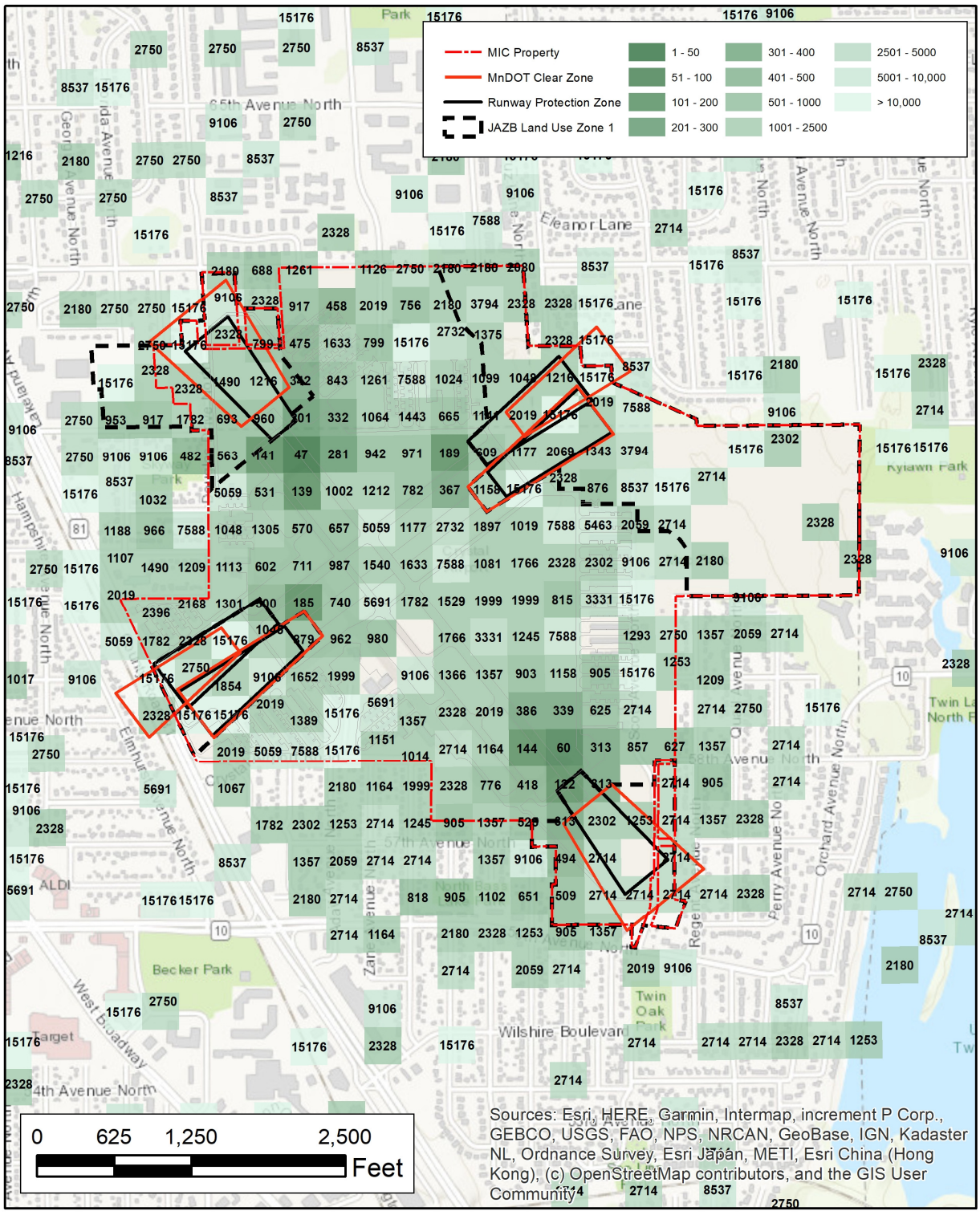
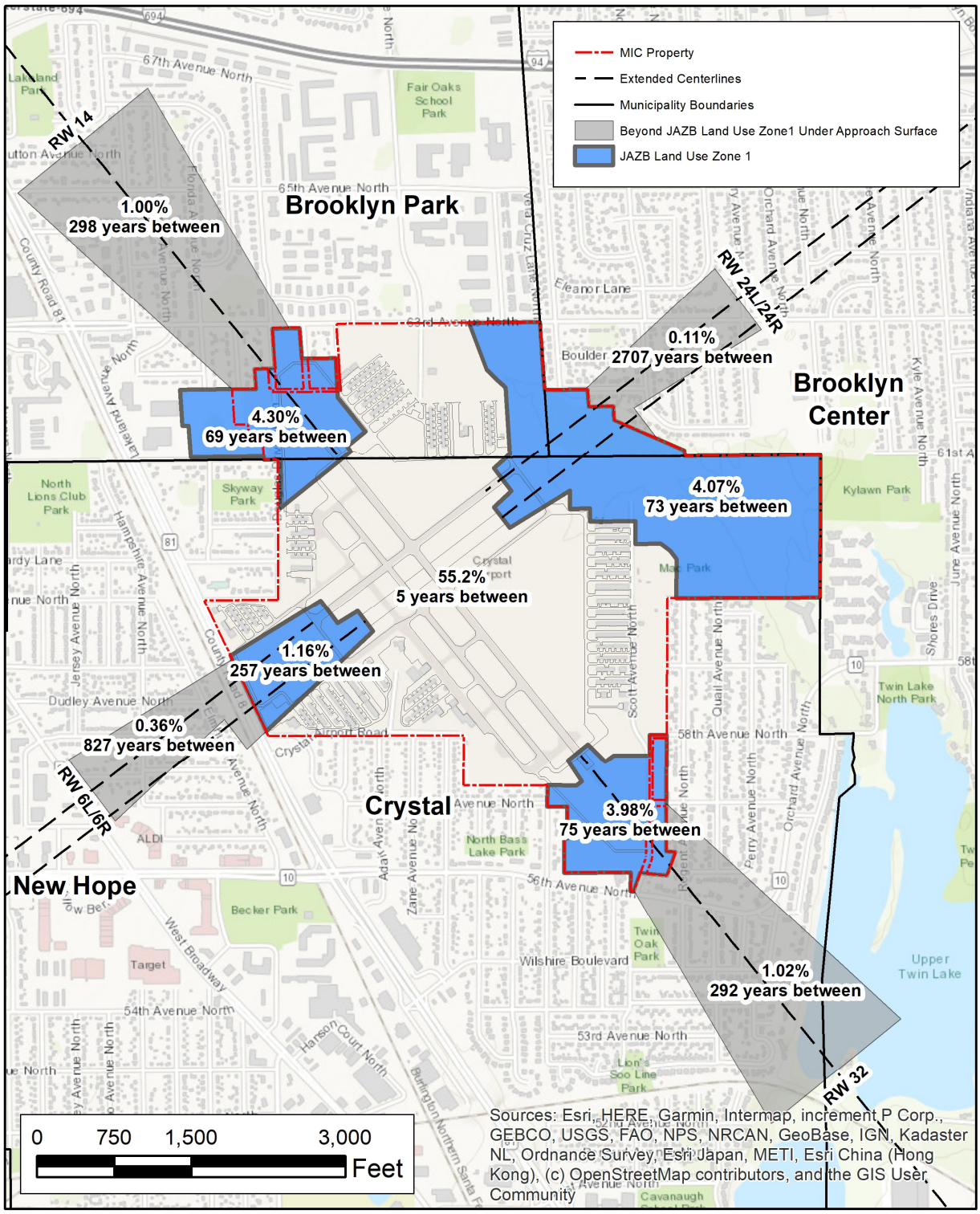


Figure 19: Accident Probability Beyond Proposed JAZB Land Use Zone 1



Note: Approach surface shown beyond Proposed JAZB Zone 1 is the initial portion of the FAR Part 77 approach surface that is equal to the runway length. This represents the total area of Safety Zones A and B as defined by the Commissioner's Standard.