FLYING CLOUD AIRPORT

LONG-TERM PLAN 2040

APPENDIX B

NOISE TECHNICAL MEMORANDOUM

MINNEAPOLIS SAINT PAUL METROPOLITAN AIRPORTS COMMISSION
MAC

Flying Cloud (FCM) Long-Term Plan (LTP)
Noise Contour Fleet Mix Draft Technical Memorandum

HNTB has been tasked to assist the Metropolitan Airports Commission (MAC) in support of the development of the 2040 Long-Term Plan (LTP) Noise Contour for the Flying Cloud Airport (FCM). This technical memorandum presents a summary of the methodologies and data sources used in the analysis, specifically the development of the base year (normalized 2021) and the future (forecast 2040) fleet mixes to support the noise analysis.

1. Methodology and Data Source

The MAC provided HNTB the MAC Noise & Operations Monitoring System (MACNOMS) data for the period between July 2021 to June 2022. This period was selected because MACNOMS was enhanced in July 2021 to accurately capture touch-and-go (TGO) operations, which represent a significant proportion of activity at FCM. A forecast was prepared in the LTP process and was included in the Flying Cloud Airport Long-Term Plan 2040 (LTP Report). The following sections describe the methodologies and data sources in the noise analysis fleet mix development based on the forecast in the LTP Report.

1.1 Introduction

MACNOMS data between July 2021 and June 2022 were used as the basis to develop the fleet mixes. Aircraft that account for approximately 99% of the total MACNOMS operations were retained in the fleet mix. Total arrivals and departures within the MACNOMS data were balanced, after which a proprietary General Aviation (GA) forecast model was utilized to project operations by each individual aircraft type for 2040. After applying the forecast model, projected operations were scaled to match the 2040 forecast operations by Aircraft Approach Category (AAC), Airplane Design Group (ADG), and aircraft type (piston, turboprop, jet, military, and helicopter). **Table 1** shows the base year (calendar year 2021) and future (2040) forecast operations by aircraft classification.

The base year operations were calculated using historical MACNOMS data, followed by proportionally distributing discrepancies between total MACNOMS operations counts and the total FAA Operations Network (OPSNET) operations counts (Normalized 2021). The calendar year 2040 operations were calculated by a weighted sum of the Terminal Area Forecast (TAF) fiscal year 2040 operations (75% weight) and fiscal year 2041 operations (25% weight), which were forecast as part of the LTP (Forecast 2040). Different growth factors for each AAC, ADG, and aircraft type were applied to forecast the 2040 operations, consistent with the FAA approved forecast[1]. Based on the discussion with the MAC, it was assumed that the operations in AAC-ADG groups C-III, D-II, and D-III would be the same in 2040 as in 2021.

[1] Table 2-37: Base Scenario Forecast Fleet Mix by AAC-ADG Combination (Calendar Year), Flying Cloud Airport Long-Term Plan 2040, January 2023.

Table 1: Base Year (2021) and Future (2040) Operations by Aircraft Classification

AAC-ADG	Normalized 2021	Forecast 2040
A-I	104,314	104,225
A-II	1,657	2,907
B-I	5,959	7,839
B-II	13,954	21,860
C-I	1,072	1,686
C-II	2,393	3,820
C-III	10	10
D-II	26	26
D-III	17	17
Helicopter	2,190	1,828
Total[1]	131,593	144,217

[1]: Totals may not sum up due to rounding

Source: HNTB Forecast Report Table 2-36.

1.2 Operations Balancing

The MACNOMS operations were balanced such that the number of arrivals equaled the number of departures for the same aircraft. In instances where arrivals or departures for each aircraft type were not equal, the operations were scaled up to ensure they were balanced.

1.3 Operations by AAC, ADG, and Aircraft Type Groups

Aircraft types in the MACNOMS data were categorized into AAC (A, B, C, and D), ADG (I, II, and III), and aircraft type groups (jet, piston, turboprop, military, and helicopter) based on FAA's Aircraft Characteristics Database[2], aircraft manufacturer specifications, performance data, and internet research. In some instances, the AAC, ADG, and aircraft types could not be determined because a particular make and model was not available in the MACNOMS data. In addition, the total number of 2021 operations differed between the MACNOMS data and the base year forecast. Therefore, the MACNOMS data was adjusted to develop the base year and forecast fleet mixes. To account for these incomplete data, the operations forecast distributed these undefined aircraft operations to AACs, ADGs, and aircraft type in the base year, creating a normalized operations count. The distribution of operations into each AAC, ADG, and aircraft type combination was proportional to these combinations' share of operations. Helicopter operations were excluded from this normalization and did not receive any share of the operations performed by undefined aircraft types. **Table 2** depicts the steps taken to normalize the 2021 operations[3].

2 Aircraft Characteristics Database, Oct 2018, FAA, https://www.faa.gov/airports/engineering/aircraft_char_database, accessed Oct 2022.

[3] Figure 2-15, Distribution of Base Year Undefined Aircraft Operations to A- I Operations, Flying Cloud Airport Long-Term Plan 2040, January 2023.

Table 2: Operations by AAC, ADG, and Aircraft Type Groups

AAC / ADG / Operation Type	2021 Operations (MACNOMS)	Proportion of Piston Operations	Piston Operations Added	Proportion of Total Operations	Additional Operations Added	Normalized 2021 Operations
	(a)	(b)	(c) = (b) * (x)	(d)	(e) = (d) * [(y) + (z)]	(a) + (c) + (e)
A-I Piston	71,662	96.3%	1,291	78.0%	29,713	102,666
A-I Carrier Jet & Jet	145	N/A	0	0.2%	60	205
A-I Turboprop	1,483	N/A	0	1.6%	615	2,098
N/A-N/A Piston	1,341 (x)					
N/A-N/A Unknown	1,253 (y)					
Difference from OPSNET	36,864 (z)					

Source: LTP Report Figure 2-15 (numbers shown for Fiscal Year).

After the 2021 operations were normalized, growth factors in each AAC, ADG, and aircraft groups were applied. The specific growth factors can be found in Table 2-11 of the LTP Report. **Table 3** shows the normalized 2021 and forecast 2040 operations.

Table 3: Operations by AAC, ADG, and Aircraft Type Groups

Groups	Normalized 2021	2040 Forecast
A-I Piston	102,138	100,707
A-I Jet	203	313
A-I Turboprop	1,974	3,205
A-I Total	104,315	104,225
A-II Turboprop	1,657	2,907
A-II Total	1,657	2,907
B-I Piston	3,055	3,161
B-I Jet	2,723	4,354
B-I Turboprop	176	303
B-I Military	4	21
B-I Total	5,958	7,839
B-II Piston	660	762
B-II Jet	8,071	8,084
B-II Turboprop	5,223	13,014
B-II Total	13,954	21,860
C-I Jet	1,072	1,686
C-I Total	1,072	1,686
C-II Jet	2,393	3,820
C-II Total	2,393	3,820
C-III Jet	10	10
C-III Total	10	10
D-II Jet	26	26
D-II Total	26	26
D-III Jet	17	17
D-III Total	17	17
Helicopter	2,190	1,828
Helicopter Total	2,190	1,828
Total	131,593	144,217

Source: LTP Report Table 2-34.

2. Base Year Fleet Mix

The base year fleet mix was developed by scaling base year operations in each AAC, ADG, and aircraft type group proportionally to match the operation totals in each group in **Table 2**.

3. Future Fleet Mix

The future fleet mix was developed using a GA operations forecast model that considers production duration and production rate for specific GA aircraft. An aircraft's start and end production year were incorporated in the model. For aircraft types that are still in production, an

average production period for different aircraft categories (jet, turboprop, single-engine piston, multi-engine piston, and helicopter) was assumed. The model also references the FAA 2022-2042 Aerospace Forecast to establish different growth rates for single engine pistons, multi-engine pistons, turboprops, helicopters, and jets. The resultant operations were scaled proportionally to match the forecast operations in each group.

3.1 GA Operation Forecast Model

The proprietary GA operation forecast model assumes newer aircraft models or more popular aircraft models with higher production rates will grow at faster paces relative to older and less popular aircraft models. The GA operation forecast model applies two adjustment factors: an incremental increase factor and a retirement factor. The incremental increase factor applies to aircraft types that are still in production. The retirement factor considers the average age of a specific aircraft and applies a reduction based on the aircraft age. The last step of the adjustment references the FAA 2022-2042 Aerospace Forecast[4] on average flight hours by categories, which include single engine pistons, multi-engine pistons, turboprops, helicopters, and jets. As a result, multi-engine piston aircraft are forecast to grow faster compared to single engine piston aircraft, as indicated in the FAA forecast. Operations were then scaled proportionally to match the HNTB forecast operations in each group.

Table 3 shows the base year (2021) and future (2040) fleet mixes.

4 FAA Aerospace Forecast, FY 2022-2042, FAA, https://www.faa.gov/data_research/aviation/aerospace_forecasts, accessed Oct 2022.

Table 4: Base Year (Normalized 2021) and Future (Forecast 2040) Fleet Mixes

Group	Aircraft ID	Aircraft Description	Normalized 2021				Forecast 2040			
			Arrival	Departure	TGO	Total	Arrival	Departure	TGO	Total
A-I Piston	7ECA	American Champion Citabria	23	23	29	75	23	23	29	74
	A1	Aviat Husky A-1	57	57	35	149	48	48	30	127
	A5	ICON A5	40	40	6	86	195	195	30	420
	AA5	Grumman AA-5A Cheetah; AA-5 Tiger	28	28	25	80	21	21	19	61
	AC11	Rockwell Commander 114	57	57	92	207	57	57	92	206
	AT6	North American AT-6	29	29	28	86	18	18	17	52
	B75N	Boeing-Stearman Model 75	11	11	77	99	18	18	128	164
	BE23	Beechcraft Model 23 Musketeer	79	79	114	271	60	60	87	207
	BE55	Beechcraft Model E-55	94	94	14	202	80	80	12	172
	BE76	Beechcraft Model 76 Duchess	54	54	48	156	61	61	54	175
	C150	Cessna 150 Single Engine SEPF	826	826	857	2,509	533	533	553	1,619
	C152	Cessna 152 Single Engine SEPF	1,575	1,575	6,276	9,425	1,544	1,544	6,152	9,239
	C172	Cessna 172 Single Engine SEPF	6,230	6,230	15,898	28,359	6,978	6,978	17,806	31,762
	C175	Cessna 175 Skylark	37	37	2	76	30	30	1	61
	C177	Cessna 177 Cardinal	128	128	49	304	97	97	38	232
	C180	Cessna 180 Skywagon	122	122	103	347	76	76	64	216
	C182	Cessna 182 Skylane	926	926	366	2,219	1,038	1,038	410	2,485
	C206	Cessna 206 Stationair	133	133	6	272	158	158	7	324
	C210	Cessna 210 Centurion	285	285	60	631	211	211	44	467
	C310	Cessna 310 Twin Engine Piston aircraft	54	54	6	114	39	39	4	82
	C77R	Cessna 177RG Cardinal	31	31	8	69	25	25	6	56
	C82R	Cessna 182 R	34	34	146	214	28	28	120	175
	COL4	Cessna 400 Corvallis/Lancair LC41/Columbia 400	69	69	6	145	170	170	15	356
	DA20	Diamond DA20/DV20 Katana	65	65	46	176	75	75	53	202
	DA40	Diamond DA40 SEPF	105	105	34	244	221	221	71	513

Group	Aircraft ID	Aircraft Description	Normalized 2021				Forecast 2040			
			Arrival	Departure	TGO	Total	Arrival	Departure	TGO	Total
A-I Piston	GYRO	AutoGyro GmbH Cavalon	18	18	40	77	60	60	129	248
	KODI	Kodiak Quest Single Engine Turboprop	89	89	3	182	244	244	8	496
	LANC	Avro 683 Lancaster (Quad-piston)	40	40	15	96	67	67	26	159
	M020	Mooney Mark 20 Series	52	52	-	105	33	33	-	65
	M20P	Mooney Mark 20 Series	273	273	43	589	188	188	30	406
	M20T	Mooney Mark 20 Series	131	131	6	269	64	64	3	131
	NAVI	Ryan L-17/U-18 Navion	32	32	15	80	36	36	17	88
	P210	Cessna P210 Centurion (Pressurized)	35	35	3	74	29	29	2	60
	P28B	Piper PA-28-201T/235/236 Cherokee Pathfinder/Dakota	37	37	11	85	36	36	11	83
	P28R	Piper PA-28R-180/200/201 Cherokee Arrow I/II/III	934	934	1,108	2,975	986	986	1,170	3,142
	PA16	Piper PA-16 Clipper	54	54	5	113	90	90	8	188
	PA18	Piper PA-18 Super Cub	86	86	11	183	64	64	8	136
	PA22	Piper PA-22 Colt	49	49	25	123	51	51	25	127
	PA24	Piper PA-24 Comanche	82	82	15	179	47	47	9	102
	PA28	Piper PA-28-151 Cherokee Warrior	7,887	7,887	22,373	38,147	5,087	5,087	14,431	24,606
	PA30	Piper PA-30 Twin Comanche	236	236	172	644	175	175	128	477
	PA31	Piper PA-31 Navajo	91	91	3	185	88	88	3	180
	PA32	Piper PA-32 Cherokee Six	163	163	28	353	160	160	27	348
	PA34	Piper PA-34 Seneca	123	123	14	261	136	136	15	287
	PA44	Piper PA-44 Seminole	620	620	1,181	2,421	554	554	1,056	2,164
	PA46	Piper PA-46 Malibu	119	119	12	250	86	86	9	181
	RV6	Van's Aircraft RV-6	45	45	6	96	30	30	4	65
	S22T	Cirrus SR22 Turbo	651	651	144	1,446	1,696	1,696	375	3,766
	SNJ4	North American T-6/SNJ-4	37	37	51	125	22	22	30	75
	SR20	Cirrus SR20	802	802	929	2,534	1,599	1,599	1,852	5,050
	SR22	Cirrus SR22	1,591	1,591	421	3,603	3,474	3,474	920	7,868

Group	Aircraft ID	Aircraft Description	Normalized 2021				Forecast 2040			
			Arrival	Departure	TGO	Total	Arrival	Departure	TGO	Total
A-I Piston	STOL	Cub Crafters Carbon Cub CCK-2000	43	43	5	91	210	210	22	443
	T210	Cessna 210 Centurion Turbo	103	103	3	210	87	87	3	177
	T34	Ayres S2R-T34 Turbo-Thrush	43	43	40	126	48	48	45	142
A-I Piston Total			25,562	25,562	51,014	102,138	27,249	27,249	46,208	100,706
A-I Jet	E50P	Embraer EMB500 Phenom 100	8	8	0	17	2	2	0	4
	E550	Embraer EMB550 Phenom 300	22	22	-	43	10	10	-	20
	HDJT	Honda Jet	6	6	0	12	10	10	1	22
	SF50	Cirrus Vision SF50	62	62	7	131	126	126	14	267
A-I Jet Total			98	98	8	203	149	149	15	313
A-I Turboprop	P46T	Piper PA-46-500TP Malibu Meridian	361	361	-	722	469	469	-	938
	TBM7	Socata TBM 700	266	266	4	536	194	194	3	391
	TBM8	Socata TBM 850 Single Engine Turboprop	95	95	1	192	46	46	1	92
	TBM9	Daher TMB900	260	260	4	524	884	884	15	1,784
A-I Turboprop Total			982	982	10	1,974	1,593	1,593	19	3,205
A-I Total			26,641	26,641	51,032	104,315	28,991	28,991	46,242	104,225
A-II Turboprop	C208	Cessna 208 Caravan I	102	102	12	216	151	151	17	319
	DHC6	de Havilland Canada DHC-6 Twin Otter	84	84	-	167	190	190	-	379
	PC12	Pilatus PC-12	633	633	8	1,274	1,097	1,097	14	2,209
A-II Turboprop Total			819	819	20	1,657	1,438	1,438	31	2,907
A-II Total			819	819	20	1,657	1,438	1,438	31	2,907
B-I Piston	B58T	Beechcraft Baron 58 Turbo	38	38	1	78	34	34	1	70
	BE33	Beechcraft Model 33 Debonair/Bonanza	148	148	30	326	103	103	21	228
	BE35	Beechcraft Model 35 Bonanza	232	232	64	529	106	106	29	241
	BE36	Beechcraft Model 36 Bonanza	422	422	62	906	356	356	52	763
	BE58	Beechcraft Model 58 Baron	164	164	16	345	152	152	15	318
	C340	Cessna 340 Twin Piston MEVP	63	63	-	127	53	53	-	106
	C414	Cessna 414 Chancellor MEVP	57	57	-	114	46	46	-	91

Group	Aircraft ID	Aircraft Description	Normalized 2021				Forecast 2040			
			Arrival	Departure	TGO	Total	Arrival	Departure	TGO	Total
B-I Piston	C421	Cessna 421 Golden Eagle	83	83	5	172	64	64	4	132
	DA42	Diamond DA42 Twin Star	120	120	116	356	269	269	260	798
	DA62	Diamond DA62	18	18	67	104	73	73	267	414
B-I Piston Total			1,347	1,347	362	3,056	1,256	1,256	649	3,161
B-I Jet	BE40	Beechcraft Beechjet 400	829	829	11	1,668	1,230	1,230	16	2,477
	C25M	Cessna CitationJet CJ1, 525	67	67	-	134	297	297	-	594
	C510	Cessna Citation Mustang	68	68	-	136	80	80	-	160
	C525	Cessna CitationJet CJ1, 525	217	217	8	443	321	321	12	654
	EA50	Eclipse 500 VLJ	30	30	-	59	25	25	-	51
	FA10	Dassault Falcon 10	97	97	12	207	167	167	20	354
	PRM1	Raytheon 390 Premier	38	38	1	77	32	32	1	66
B-I Jet Total			1,346	1,346	32	2,723	2,152	2,152	49	4,354
B-I Turboprop	C425	Cessna 425 (Corsair/Conquest)	88	88	-	176	151	151	-	303
B-I Turboprop Total			88	88	-	176	151	151	-	303
B-I Military	L39	Aero L-39 Albatros	2	2	-	4	10	10	-	21
B-I Military Total			2	2	-	4	10	10	-	21
B-I Total			2,783	2,783	394	5,959	3,570	3,570	698	7,839
B-II Piston	AC50	Rockwell Aero Commander 500	326	326	9	660	376	376	10	762
B-II Piston Total			326	326	9	660	376	376	10	762
B-II Jet	C25A	Cessna CitationJet CJ2, 525A	91	91	-	181	53	53	-	107
	C25B	Cessna CitationJet CJ3, 525B	184	184	1	370	313	313	2	628
	C25C	Cessna CitationJet CJ4, 525C	216	216	3	435	486	486	6	978
	C550	Cessna Citation 550 Citation II	173	173	-	347	213	213	-	426
	C55B	Cessna Citation 550 Citation II	16	16	-	31	19	19	-	38
	C560	Cessna 560 Citation V, Ultra & Ultra Encore	349	349	-	697	316	316	-	633
	C56X	Cessna 560XL Citation Excel	1,032	1,032	1	2,064	1,306	1,306	2	2,613
	C650	Cessna Citation III	132	132	1	265	162	162	2	326

Group	Aircraft ID	Aircraft Description	Normalized 2021				Forecast 2040			
			Arrival	Departure	TGO	Total	Arrival	Departure	TGO	Total
B-II Jet	C680	Cessna 680 Citation Sovereign	640	640	8	1,287	1,086	1,086	13	2,186
	C68A	Cessna Citation Latitude	421	421	4	845	1,521	1,521	14	3,057
	C750	Cessna 750 series/Citation X	156	156	1	314	181	181	2	364
	F2TH	Dassault Falcon 2000	184	184	-	368	195	195	-	390
	F900	Dassault Falcon 900	219	219	7	445	197	197	6	399
	FA20	Dassault Falcon 20 Mystere 20 /200	65	65	1	131	71	71	1	143
	FA50	Dassault Falcon 50	106	106	4	216	134	134	5	273
	PC24	Pilatus PC-24	37	37	-	74	226	226	-	451
B-II Jet Total			4,020	4,020	31	8,071	6,481	6,481	52	13,014
B-II Turboprop	B190	Beechcraft 1900D	187	187	1	375	314	314	2	630
	B350	Beechcraft Super King Air 350/300B	238	238	9	485	297	297	12	606
	BE20	Beechcraft Model 200 (Super) King Air 200	1,465	1,465	29	2,958	2,287	2,287	46	4,620
	BE30	Beechcraft Super King Air 300	352	352	15	719	437	437	19	892
	BE9L	Beechcraft Model 90 King Air	229	229	76	534	463	463	155	1,081
	BE9T	Beechcraft Super King Air F90	42	42	1	84	70	70	2	142
	C441	Cessna 441 (Conquest/Conquest2)	32	32	2	66	53	53	4	109
	SW4	Swearingen Merlin IV /Fairchild Merlin IV	1	1	-	1	1	1	-	2
B-II Turboprop Total			2,544	2,544	135	5,223	3,923	3,923	238	8,084
B-II Total			6,890	6,890	175	13,954	10,779	10,779	301	21,860
C-I Jet	H25B	Hawker 800/800 XP/850 XP Twin Turbojet/Bae 125-800	197	197	8	403	314	314	13	642
	LJ40	Learjet 40 Twin Jet	46	46	-	92	95	95	-	190
	LJ45	Learjet 45 Twin Jet	256	256	4	517	397	397	6	800
	LJ60	Learjet 60 Twin Jet	30	30	-	61	27	27	-	54
C-I Jet Total			530	530	12	1,072	833	833	20	1,686
C-I Total			530	530	12	1,072	833	833	20	1,686
C-II Jet	C700	Cessna Citation Longitude	25	25	5	56	109	109	24	242
	CL30	Bombardier Challenger 300	356	356	1	714	433	433	2	867

Group	Aircraft ID	Aircraft Description	Normalized 2021				Forecast 2040			
			Arrival	Departure	TGO	Total	Arrival	Departure	TGO	Total
C-II Jet	CL35	Bombardier Challenger 350	231	231	-	461	597	597	-	1,194
	CL60	Canadair Bombardier CL600/610 Challenger Twin Jet	80	80	-	160	55	55	-	111
	E545	Embraer Legacy 545	33	33	-	66	99	99	-	198
	E55P	Embraer EMB550 Phenom 300	340	340	26	706	531	531	40	1,103
	GALX	IAI 1126 Astra Galaxy/Gulfstream 200	115	115	-	230	52	52	-	104
C-II Jet Total			1,180	1,180	33	2,393	1,877	1,877	66	3,820
C-II Total			1,180	1,180	33	2,393	1,877	1,877	66	3,820
C-III Jet	CRJ9	Bombardier CRJ 900 Regional Jet	1	1	-	2	1	1	-	2
	GL5T	Bombardier Global 5000 BD-700	1	1	-	3	1	1	-	3
	GLEX	Bombardier BD-700 Global Express	3	3	-	6	3	3	-	6
C-III Jet Total			5	5	-	10	5	5	-	10
C-III Total			5	5	-	10	5	5	-	10
D-II Jet	GLF4	Gulfstream IV	13	13	-	26	13	13	-	26
D-II Jet Total			13	13	-	26	13	13	-	26
D-II Total			13	13	-	26	13	13	-	26
D-III Jet	GLF6	Gulfstream VI / G650	9	9	-	17	9	9	-	17
D-III Jet Total			9	9	-	17	9	9	-	17
D-III Total			9	9	-	17	9	9	-	17
Helicopter	B206	Agusta / AgustaWestland AB-206	84	84	7	174	35	35	3	73
	HCG2	Guimbal Cabri G2	228	228	842	1,299	255	255	939	1,449
	R44	Robinson R44 Clipper/Raven Helicopter	136	136	360	631	46	46	121	213
	R66	Robinson R66	10	10	65	86	11	11	70	92
Helicopter Total			458	458	1,274	2,190	347	347	1,134	1,828
Grand Total			39,327	39,327	52,939	131,593	47,863	47,863	48,491	144,217

Totals may not sum up due to rounding

Source: HNTB analysis, 2022

4. **Summary**

This technical memorandum documents the methodologies and data sources in the development of the base year (normalized 2021) and future (forecast 2040) fleet mixes for FCM. The July 2021 to June 2022 MACNOMS data were used as the main data source to develop the fleet mixes. Aircraft that accounted for more than 99% of the MACNOMS operations were retained and categorized by the FAA AAC, ADG, and aircraft type groups (piston, turboprop, jet, helicopter, and military). After arrivals and departures were balanced, operations were scaled proportionally to match the 2021 forecast operations by AAC, ADG, and aircraft type groups for the base year (normalized 2021) fleet mix. For the future (forecast 2040) fleet mix, a GA operation forecast model and the FAA 2022-2042 Aerospace Forecast were applied to project individual aircraft operations. The resultant aircraft operations were scaled proportionally to match the HNTB LTP operations forecast by AAC, ADG, and aircraft type groups.

As always, we appreciate the opportunity to provide noise analysis and support to the MAC. Should you have any questions regarding the content of this technical memorandum, please do not hesitate to call me at 540-257-3728 or email yxu@hntb.com.

Best Regards,

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Attachment 2

AEDT Fleet Mix

Table 2-1: Base Year AEDT Fleet Mix

Aircraft ID	AEDT ANP Type	Aircraft Description	Arrival		Departure		Touch-and-Go		Grand Total
			Day	Night	Day	Night	Day	Night	
7ECA	CNA172	American Champion Citabria	23	-	23	-	29	-	75
A1	CNA172	Aviat Husky A-1	56	2	54	3	32	3	149
A5	GASEPF	ICON A5	40	-	40	-	6	-	86
AA5	GASEPF	Grumman AA-5A Cheetah; AA-5 Tiger	28	-	28	-	23	2	80
AC11	GASEPV	Rockwell Commander 114	57	-	57	-	92	-	207
AC50	BEC58P	Rockwell Aero Commander 500	297	28	20	305	5	4	660
AT6	GASEPV	North American AT-6	28	2	29	-	28	-	86
B190	1900D	Beechcraft 1900D	138	49	184	3	-	1	375
B206	B206L	Agusta / AgustaWestland AB-206 LongRanger Helicopter	84	-	76	8	7	-	174
B350	DHC6	Beechcraft Super King Air 350/300B	225	13	214	24	9	-	485
B58T	BEC58P	Beechcraft Baron 58 Turbo	36	3	37	1	1	-	78
B75N	GASEPV	Boeing-Stearman Model 75	11	-	11	-	77	-	99
BE20	DHC6	Beechcraft Model 200 (Super) King Air 200	1,133	332	1,050	415	29	-	2,958
BE23	GASEPF	Beechcraft Model 23 Musketeer	77	2	79	-	112	2	271
BE30	DHC6	Beechcraft Super King Air 300	325	26	247	105	13	2	719
BE33	GASEPV	Beechcraft Model 33 Debonair/Bonanza	145	3	145	3	30	-	326
BE35	GASEPV	Beechcraft Model 35 Bonanza	230	3	228	4	64	-	529
BE36	GASEPV	Beechcraft Model 36 Bonanza	415	7	418	4	62	-	906
BE40	MU3001	Beechcraft Beechjet 400	672	157	647	182	9	1	1,668
BE55	T42	Beechcraft Model E-55	93	2	91	3	14	-	202
BE58	BEC58P	Beechcraft Model 58 Baron	156	8	163	1	16	-	345
BE76	BEC58P	Beechcraft Model 76 Duchess	54	-	54	-	48	-	156
BE9L	DHC6	Beechcraft Model 90 King Air	213	15	213	16	76	-	534
BE9T	DHC6	Beechcraft Super King Air F90	40	1	40	1	1	-	84
C150	GASEPF	Cessna 150 Single Engine SEPF	802	25	814	13	840	17	2,509
C152	GASEPF	Cessna 152 Single Engine SEPF	1,522	52	1,564	11	6,158	118	9,425

Table 2-1: Base Year AEDT Fleet Mix

Aircraft ID	AEDT ANP Type	Aircraft Description	Arrival		Departure		Touch-and-Go		Grand Total
			Day	Night	Day	Night	Day	Night	
C172	CNA172	Cessna 172 Single Engine SEPF	6,044	186	6,152	78	15,691	208	28,359
C175	CNA172	Cessna 175 Skylark	37	-	37	-	2	-	76
C177	CNA172	Cessna 177 Cardinal	120	8	117	11	49	-	304
C180	GASEPV	Cessna 180 Skywagon	120	2	120	2	103	-	347
C182	CNA182	Cessna 182 Skylane	904	23	914	12	360	6	2,219
C206	CNA206	Cessna 206 Stationair	131	2	131	2	6	-	272
C208	CNA208	Cessna 208 Caravan I	101	1	96	6	12	-	216
C210	GASEPV	Cessna 210 Centurion	275	11	278	8	52	8	631
C25A	CNA500	Cessna CitationJet CJ2, 525A	85	5	83	7	-	-	181
C25B	CNA500	Cessna CitationJet CJ3, 525B	178	6	177	7	1	-	370
C25C	CNA525C	Cessna CitationJet CJ4, 525C	204	12	206	10	3	-	435
C25M	CNA500	Cessna CitationJet CJ1, 525	66	1	66	1	-	-	134
C310	BEC58P	Cessna 310 Twin Engine Piston aircraft	46	8	52	2	6	-	114
C340	BEC58P	Cessna 340 Twin Piston MEVP	62	1	58	5	-	-	127
C414	BEC58P	Cessna 414 Chancellor MEVP	54	3	54	3	-	-	114
C421	BEC58P	Cessna 421 Golden Eagle	82	1	80	3	5	-	172
C425	CNA441	Cessna 425 (Corsair/Conquest)	81	7	86	2	-	-	176
C441	CNA441	Cessna 441 (Conquest/Conquest2)	32	-	31	1	2	-	66
C510	CNA510	Cessna Citation Mustang	67	1	68	-	-	-	136
C525	CNA500	Cessna CitationJet CJ1, 525	199	18	205	13	8	-	443
C550	CNA55B	Cessna Citation 550 Citation II	171	3	167	7	-	-	347
C55B	CNA55B	Cessna Citation 550 Citation II Bravo	13	2	14	1	-	-	31
C560	CNA560E	Cessna 560 Citation V, Ultra & Ultra Encore	163	12	162	12	-	-	349
C560	CNA560U	Cessna 560 Citation V, Ultra & Ultra Encore	163	12	162	12	-	-	349
C56X	CNA560U	Cessna 560XL Citation Excel	960	72	951	81	1	-	2,064
C650	CIT3	Cessna Citation III	128	4	111	21	1	-	265

Table 2-1: Base Year AEDT Fleet Mix

Aircraft ID	AEDT ANP Type	Aircraft Description	Arrival		Departure		Touch-and-Go		Grand Total
			Day	Night	Day	Night	Day	Night	
C680	CNA680	Cessna 680 Citation Sovereign	602	38	557	82	8	-	1,287
C68A	CNA680	Cessna Citation Latitude	398	22	402	19	4	-	845
C700	CNA680	Cessna Citation Longitude	24	1	25	-	5	-	56
C750	CNA750	Cessna 750 series/Citation X	153	3	144	13	1	-	314
C77R	GASEPV	Cessna 177RG Cardinal	31	-	29	2	8	-	69
C82R	CNA182	Cessna 182 R	34	-	34	-	146	-	214
CL30	CL600	Bombardier Challenger 300	304	52	307	49	1	-	714
CL35	CL600	Bombardier Challenger 350	219	11	218	13	-	-	461
CL60	CL600	Canadair Bombardier CL600/610 Challenger Twin Jet	78	2	78	2	-	-	160
COL4	GASEPV	Cessna 400 Corvallis/Lancair LC41/Columbia 400	69	-	69	-	6	-	145
CRJ9	CRJ9-ER	Bombardier CRJ 900 Regional Jet	0	-	0	-	-	-	1
CRJ9	CRJ9-LR	Bombardier CRJ 900 Regional Jet	0	-	0	-	-	-	1
DA20	GASEPF	Diamond DA20/DV20 Katana	65	-	65	-	46	-	176
DA40	GASEPV	Diamond DA40 SEPF	105	-	105	-	34	-	244
DA42	PA30	Diamond DA42 Twin Star	116	4	119	1	116	-	356
DA62	PA30	Diamond DA62	18	-	18	-	67	-	104
DHC6	DHC6	de Havilland Canada DHC-6 Twin Otter	84	-	84	-	-	-	167
E50P	CNA510	Embraer EMB500 Phenom 100	8	0	8	-	0	-	17
E545	CNA510	Embraer Legacy 545	32	1	32	1	-	-	66
E550	CNA55B	Embraer EMB550 Phenom 300	21	0	17	4	-	-	43
E55P	CNA55B	Embraer EMB550 Phenom 300	333	7	321	19	26	-	706
EA50	ECLIPSE500	Eclipse 500 VLJ	30	-	30	-	-	-	59
F2TH	CNA750	Dassault Falcon 2000	177	7	180	4	-	-	368
F900	FAL900EX	Dassault Falcon 900	193	27	213	6	7	-	445
FA10	LEAR35	Dassault Falcon 10	88	10	88	10	12	-	207
FA20	FAL20	Dassault Falcon 20 Mystere 20 /200	60	6	59	6	1	-	131

Table 2-1: Base Year AEDT Fleet Mix

Aircraft ID	AEDT ANP Type	Aircraft Description	Arrival		Departure		Touch-and-Go		Grand Total
			Day	Night	Day	Night	Day	Night	
FA50	FAL900EX	Dassault Falcon 50	99	8	95	11	4	-	216
GALX	CNA750	IAI 1126 Astra Galaxy/Gulfstream 200	111	4	114	1	-	-	230
GL5T	BD-700-1A11	Bombardier Global 5000 BD-700	2	-	2	-	-	-	3
GLEX	BD-700-1A10	Bombardier BD-700 Global Express	2	-	2	-	-	-	5
GLF4	GIV	Gulfstream IV	12	1	13	-	-	-	26
GLF6	G650ER	Gulfstream VI / G650	9	-	9	-	-	-	17
GYRO	R22	AutoGyro GmbH Cavalon	18	-	18	-	40	-	77
H25B	LEAR35	Hawker 800/800 XP/850 XP Twin Turbojet/Bae 125-800	190	7	183	14	8	-	403
HCG2	SC300C	Guimbal Cabri G2	226	2	228	-	842	-	1,299
HDJT	CNA680	Honda Jet	3	0	3	0	0	-	6
HDJT	MU3001	Honda Jet	3	0	3	0	0	-	6
KODI	CNA208	Kodiak Quest Single Engine Turboprop	89	-	89	-	3	-	182
L39	HAWK	Aero L-39 Albatros	2	-	2	-	-	-	4
LANC	DC6	Avro 683 Lancaster (Quad-piston)	40	-	40	-	15	-	96
LJ40	LEAR35	Learjet 40 Twin Jet	45	1	42	4	-	-	92
LJ45	LEAR35	Learjet 45 Twin Jet	247	9	241	15	4	-	517
LJ60	LEAR35	Learjet 60 Twin Jet	30	-	30	-	-	-	61
M020	GASEPV	Mooney Mark 20 Series	52	-	51	2	-	-	105
M20P	GASEPV	Mooney Mark 20 Series	262	11	265	8	38	5	589
M20T	GASEPV	Mooney Mark 20 Series	122	9	130	2	-	6	269
NAVI	GASEPV	Ryan L-17/U-18 Navion	32	-	32	-	15	-	80
P210	GASEPV	Cessna P210 Centurion (Pressurized)	34	2	35	-	3	-	74
P28B	GASEPF	Piper PA-28-201T/235/236 Cherokee Pathfinder/Dakota	35	2	33	4	11	-	85
P28R	GASEPF	Piper PA-28R-180/200/201 Cherokee Arrow I/II/III	890	44	928	6	1,092	15	2,975
P46T	CNA441	Piper PA-46-500TP Malibu Meridian	175	5	175	5	-	-	361

Table 2-1: Base Year AEDT Fleet Mix

Aircraft ID	AEDT ANP Type	Aircraft Description	Arrival		Departure		Touch-and-Go		Grand Total
			Day	Night	Day	Night	Day	Night	
P46T	GASEPF	Piper PA-46-500TP Malibu Meridian	175	5	175	5	-	-	361
PA16	GASEPF	Piper PA-16 Clipper	54	-	52	2	5	-	113
PA18	GASEPF	Piper PA-18 Super Cub	86	-	85	2	11	-	183
PA22	CNA172	Piper PA-22 Colt	49	-	49	-	25	-	123
PA24	GASEPV	Piper PA-24 Comanche	82	-	82	-	15	-	179
PA28	PA28	Piper PA-28-151 Cherokee Warrior	7,538	349	7,683	204	21,581	792	38,147
PA30	PA30	Piper PA-30 Twin Comanche	230	6	236	-	172	-	644
PA31	BEC58P	Piper PA-31 Navajo	86	5	83	8	3	-	185
PA32	GASEPV	Piper PA-32 Cherokee Six	159	3	158	5	28	-	353
PA34	BEC58P	Piper PA-34 Seneca	122	2	120	3	14	-	261
PA44	PA30	Piper PA-44 Seminole	586	33	611	9	1,168	14	2,421
PA46	PA31	Piper PA-46 Malibu	113	6	111	8	12	-	250
PC12	CNA208	Pilatus PC-12	607	26	555	78	7	1	1,274
PC24	CNA55B	Pilatus PC-24	36	1	36	1	-	-	74
PRM1	CNA55B	Raytheon 390 Premier	37	1	36	3	1	-	77
R44	R44	Robinson R44 Clipper/Raven Helicopter	133	2	136	-	360	-	631
R66	R44	Robinson R66	10	-	10	-	65	-	86
RV6	GASEPV	Van's Aircraft RV-6	45	-	45	-	6	-	96
S22T	COMSEP	Cirrus SR22 Turbo	637	14	635	16	142	2	1,446
SF50	CNA510	Cirrus Vision SF50	61	1	60	2	7	-	131
SNJ4	GASEPV	North American T-6/SNJ-4	37	-	37	-	51	-	125
SR20	COMSEP	Cirrus SR20	781	22	796	6	905	25	2,534
SR22	COMSEP	Cirrus SR22	1,574	17	1,544	46	413	8	3,603
STOL	GASEPF	Cub Crafters Carbon Cub CCK-2000	43	-	43	-	5	-	91
SW4	DHC6	Swearingen Merlin IV /Fairchild Merlin IV	-	1	1	-	-	-	1
T210	CNA20T	Cessna 210 Centurion Turbo	103	-	100	3	3	-	210

Table 2-1: Base Year AEDT Fleet Mix

Aircraft ID	AEDT ANP Type	Aircraft Description	Arrival		Departure		Touch-and-Go		Grand Total
			Day	Night	Day	Night	Day	Night	
T34	GASEPV	Ayres S2R-T34 Turbo-Thrush	43	-	43	-	40	-	126
TBM7	GASEPV	Socata TBM 700	260	6	261	4	4	-	536
TBM8	CNA441	Socata TBM 850 Single Engine Turboprop	91	5	92	3	1	-	192
TBM9	CNA208	Daher TMB900	259	1	259	1	4	-	524
Grand Total			**37,396**	**1,931**	**37,203**	**2,123**	**51,701**	**1,239**	**131,593**

Totals may not sum up due to rounding

Source: HNTB analysis, 2023

Table 2-2: 2040 LTP AEDT Fleet Mix

Aircraft ID	AEDT ANP Type	Aircraft Description	Arrival		Departure		Touch-and-Go		Grand Total
			Day	Night	Day	Night	Day	Night	
7ECA	CNA172	American Champion Citabria	23	-	23	-	29	-	74
A1	CNA172	Aviat Husky A-1	47	1	46	3	27	3	127
A5	GASEPF	ICON A5	195	-	195	-	30	-	420
AA5	GASEPF	Grumman AA-5A Cheetah; AA-5 Tiger	21	-	21	-	18	1	61
AC11	GASEPV	Rockwell Commander 114	57	-	57	-	92	-	206
AC50	BEC58P	Rockwell Aero Commander 500	343	33	24	352	6	4	762
AT6	GASEPV	North American AT-6	17	1	18	-	17	-	52
B190	1900D	Beechcraft 1900D	232	83	309	6	-	2	630
B206	B206L	Agusta / AgustaWestland AB-206 LongRanger Helicopter	35	-	32	3	3	-	73
B350	DHC6	Beechcraft Super King Air 350/300B	281	17	268	29	12	-	606
B58T	BEC58P	Beechcraft Baron 58 Turbo	32	2	33	1	1	-	70
B75N	GASEPV	Boeing-Stearman Model 75	18	-	18	-	128	-	164
BE20	DHC6	Beechcraft Model 200 (Super) King Air 200	1,769	519	1,640	648	46	-	4,620
BE23	GASEPF	Beechcraft Model 23 Musketeer	59	1	60	-	86	1	207
BE30	DHC6	Beechcraft Super King Air 300	404	33	307	130	16	3	892
BE33	GASEPV	Beechcraft Model 33 Debonair/Bonanza	101	2	101	2	21	-	228
BE35	GASEPV	Beechcraft Model 35 Bonanza	105	1	104	2	29	-	241
BE36	GASEPV	Beechcraft Model 36 Bonanza	350	6	352	3	52	-	763
BE40	MU3001	Beechcraft Beechjet 400	997	233	961	270	14	2	2,477
BE55	T42	Beechcraft Model E-55	79	1	77	3	12	-	172
BE58	BEC58P	Beechcraft Model 58 Baron	144	8	151	1	15	-	318
BE76	BEC58P	Beechcraft Model 76 Duchess	61	-	61	-	54	-	175
BE9L	DHC6	Beechcraft Model 90 King Air	432	31	430	33	155	-	1,081
BE9T	DHC6	Beechcraft Super King Air F90	68	2	68	2	2	-	142
C150	GASEPF	Cessna 150 Single Engine SEPF	517	16	525	8	542	11	1,619
C152	GASEPF	Cessna 152 Single Engine SEPF	1,492	51	1,533	11	6,036	116	9,239

Table 2-2: 2040 LTP AEDT Fleet Mix

Aircraft ID	AEDT ANP Type	Aircraft Description	Arrival		Departure		Touch-and-Go		Grand Total
			Day	Night	Day	Night	Day	Night	
C172	CNA172	Cessna 172 Single Engine SEPF	6,769	208	6,890	88	17,573	233	31,762
C175	CNA172	Cessna 175 Skylark	30	-	30	-	1	-	61
C177	CNA172	Cessna 177 Cardinal	92	6	89	8	38	-	232
C180	GASEPV	Cessna 180 Skywagon	75	1	75	1	64	-	216
C182	CNA182	Cessna 182 Skylane	1,012	25	1,024	14	403	7	2,485
C206	CNA206	Cessna 206 Stationair	156	2	156	2	7	-	324
C208	CNA208	Cessna 208 Caravan I	149	2	142	9	17	-	319
C210	GASEPV	Cessna 210 Centurion	203	8	205	6	39	6	467
C25A	CNA500	Cessna CitationJet CJ2, 525A	50	3	49	4	-	-	107
C25B	CNA500	Cessna CitationJet CJ3, 525B	303	10	301	12	2	-	628
C25C	CNA525C	Cessna CitationJet CJ4, 525C	459	27	463	23	6	-	978
C25M	CNA500	Cessna CitationJet CJ1, 525	292	5	292	5	-	-	594
C310	BEC58P	Cessna 310 Twin Engine Piston aircraft	33	6	37	1	4	-	82
C340	BEC58P	Cessna 340 Twin Piston MEVP	52	1	48	4	-	-	106
C414	BEC58P	Cessna 414 Chancellor MEVP	43	2	43	2	-	-	91
C421	BEC58P	Cessna 421 Golden Eagle	63	1	62	2	4	-	132
C425	CNA441	Cessna 425 (Corsair/Conquest)	140	11	148	4	-	-	303
C441	CNA441	Cessna 441 (Conquest/Conquest2)	53	-	51	2	4	-	109
C510	CNA510	Cessna Citation Mustang	78	1	80	-	-	-	160
C525	CNA500	Cessna CitationJet CJ1, 525	294	26	302	18	12	-	654
C550	CNA55B	Cessna Citation 550 Citation II	210	3	205	8	-	-	426
C55B	CNA55B	Cessna Citation 550 Citation II Bravo	16	3	18	1	-	-	38
C560	CNA560E	Cessna 560 Citation V, Ultra & Ultra Encore	148	11	147	11	-	-	316
C560	CNA560U	Cessna 560 Citation V, Ultra & Ultra Encore	148	11	147	11	-	-	316
C56X	CNA560U	Cessna 560XL Citation Excel	1,215	91	1,203	102	2	-	2,613
C650	CIT3	Cessna Citation III	157	5	137	26	2	-	326

Table 2-2: 2040 LTP AEDT Fleet Mix

Aircraft ID	AEDT ANP Type	Aircraft Description	Arrival		Departure		Touch-and-Go		Grand Total
			Day	Night	Day	Night	Day	Night	
C680	CNA680	Cessna 680 Citation Sovereign	1,022	64	946	140	13	-	2,186
C68A	CNA680	Cessna Citation Latitude	1,440	81	1,452	69	14	-	3,057
C700	CNA680	Cessna Citation Longitude	105	4	109	-	24	-	242
C750	CNA750	Cessna 750 series/Citation X	178	4	167	15	2	-	364
C77R	GASEPV	Cessna 177RG Cardinal	25	-	24	1	6	-	56
C82R	CNA182	Cessna 182 R	28	-	28	-	120	-	175
CL30	CL600	Bombardier Challenger 300	370	63	373	59	2	-	867
CL35	CL600	Bombardier Challenger 350	568	29	564	32	-	-	1,194
CL60	CL600	Canadair Bombardier CL600/610 Challenger Twin Jet	54	2	54	2	-	-	111
COL4	GASEPV	Cessna 400 Corvallis/Lancair LC41/Columbia 400	170	-	170	-	15	-	356
CRJ9	CRJ9-ER	Bombardier CRJ 900 Regional Jet	0	-	0	-	-	-	1
CRJ9	CRJ9-LR	Bombardier CRJ 900 Regional Jet	0	-	0	-	-	-	1
DA20	GASEPF	Diamond DA20/DV20 Katana	75	-	75	-	53	-	202
DA40	GASEPV	Diamond DA40 SEPF	221	-	221	-	71	-	513
DA42	PA30	Diamond DA42 Twin Star	260	9	266	3	260	-	798
DA62	PA30	Diamond DA62	73	-	73	-	267	-	414
DHC6	DHC6	de Havilland Canada DHC-6 Twin Otter	190	-	190	-	-	-	379
E50P	CNA510	Embraer EMB500 Phenom 100	2	0	2	-	0	-	4
E545	CNA510	Embraer Legacy 545	96	3	96	3	-	-	198
E550	CNA55B	Embraer EMB550 Phenom 300	10	0	8	2	-	-	20
E55P	CNA55B	Embraer EMB550 Phenom 300	521	11	501	30	40	-	1,103
EA50	ECLIPSE500	Eclipse 500 VLJ	25	-	25	-	-	-	51
F2TH	CNA750	Dassault Falcon 2000	187	8	191	4	-	-	390
F900	FAL900EX	Dassault Falcon 900	173	24	191	6	6	-	399
FA10	LEAR35	Dassault Falcon 10	150	16	150	17	20	-	354
FA20	FAL20	Dassault Falcon 20 Mystere 20 /200	65	6	64	7	1	-	143

Table 2-2: 2040 LTP AEDT Fleet Mix

Aircraft ID	AEDT ANP Type	Aircraft Description	Arrival		Departure		Touch-and-Go		Grand Total
			Day	Night	Day	Night	Day	Night	
FA50	FAL900EX	Dassault Falcon 50	125	10	120	14	5	-	273
GALX	CNA750	IAI 1126 Astra Galaxy/Gulfstream 200	50	2	52	1	-	-	104
GL5T	BD-700-1A11	Bombardier Global 5000 BD-700	2	-	2	-	-	-	3
GLEX	BD-700-1A10	Bombardier BD-700 Global Express	2	-	2	-	-	-	5
GLF4	GIV	Gulfstream IV	12	1	13	-	-	-	26
GLF6	G650ER	Gulfstream VI / G650	9	-	9	-	-	-	17
GYRO	R22	AutoGyro GmbH Cavalon	60	-	60	-	129	-	248
H25B	LEAR35	Hawker 800/800 XP/850 XP Twin Turbojet/Bae 125-800	303	11	292	23	13	-	642
HCG2	SC300C	Guimbal Cabri G2	252	3	255	-	939	-	1,449
HDJT	CNA680	Honda Jet	5	0	5	0	0	-	11
HDJT	MU3001	Honda Jet	5	0	5	0	0	-	11
KODI	CNA208	Kodiak Quest Single Engine Turboprop	244	-	244	-	8	-	496
L39	HAWK	Aero L-39 Albatros	10	-	10	-	-	-	21
LANC	DC6	Avro 683 Lancaster (Quad-piston)	67	-	67	-	26	-	159
LJ40	LEAR35	Learjet 40 Twin Jet	93	2	87	8	-	-	190
LJ45	LEAR35	Learjet 45 Twin Jet	382	15	373	24	6	-	800
LJ60	LEAR35	Learjet 60 Twin Jet	27	-	27	-	-	-	54
M020	GASEPV	Mooney Mark 20 Series	33	-	32	1	-	-	65
M20P	GASEPV	Mooney Mark 20 Series	181	8	183	5	26	3	406
M20T	GASEPV	Mooney Mark 20 Series	59	4	63	1	-	3	131
NAVI	GASEPV	Ryan L-17/U-18 Navion	36	-	36	-	17	-	88
P210	GASEPV	Cessna P210 Centurion (Pressurized)	27	1	29	-	2	-	60
P28B	GASEPF	Piper PA-28-201T/235/236 Cherokee Pathfinder/Dakota	35	2	32	4	11	-	83

Table 2-2: 2040 LTP AEDT Fleet Mix

Aircraft ID	AEDT ANP Type	Aircraft Description	Arrival		Departure		Touch-and-Go		Grand Total
			Day	Night	Day	Night	Day	Night	
P28R	GASEPF	Piper PA-28R-180/200/201 Cherokee Arrow I/II/III	940	46	980	6	1,153	16	3,142
P46T	CNA441	Piper PA-46-500TP Malibu Meridian	228	7	228	7	-	-	469
P46T	GASEPF	Piper PA-46-500TP Malibu Meridian	228	7	228	7	-	-	469
PA16	GASEPF	Piper PA-16 Clipper	90	-	88	3	8	-	188
PA18	GASEPF	Piper PA-18 Super Cub	64	-	63	1	8	-	136
PA22	CNA172	Piper PA-22 Colt	51	-	51	-	25	-	127
PA24	GASEPV	Piper PA-24 Comanche	47	-	47	-	9	-	102
PA28	PA28	Piper PA-28-151 Cherokee Warrior	4,862	225	4,956	132	13,920	511	24,606
PA30	PA30	Piper PA-30 Twin Comanche	170	4	175	-	128	-	477
PA31	BEC58P	Piper PA-31 Navajo	84	4	81	7	3	-	180
PA32	GASEPV	Piper PA-32 Cherokee Six	157	3	156	5	27	-	348
PA34	BEC58P	Piper PA-34 Seneca	134	2	132	3	15	-	287
PA44	PA30	Piper PA-44 Seminole	524	30	546	8	1,043	12	2,164
PA46	PA31	Piper PA-46 Malibu	82	4	80	6	9	-	181
PC12	CNA208	Pilatus PC-12	1,052	45	961	136	12	2	2,209
PC24	CNA55B	Pilatus PC-24	218	8	218	8	-	-	451
PRM1	CNA55B	Raytheon 390 Premier	31	1	30	2	1	-	66
R44	R44	Robinson R44 Clipper/Raven Helicopter	45	1	46	-	121	-	213
R66	R44	Robinson R66	11	-	11	-	70	-	92
RV6	GASEPV	Van's Aircraft RV-6	30	-	30	-	4	-	65
S22T	COMSEP	Cirrus SR22 Turbo	1,659	37	1,654	42	371	4	3,766
SF50	CNA510	Cirrus Vision SF50	124	2	122	4	14	-	267
SNJ4	GASEPV	North American T-6/SNJ-4	22	-	22	-	30	-	75
SR20	COMSEP	Cirrus SR20	1,556	43	1,587	12	1,803	49	5,050
SR22	COMSEP	Cirrus SR22	3,436	38	3,372	101	903	17	7,868
STOL	GASEPF	Cub Crafters Carbon Cub CCK-2000	210	-	210	-	22	-	443

Table 2-2: 2040 LTP AEDT Fleet Mix

Aircraft ID	AEDT ANP Type	Aircraft Description	Arrival		Departure		Touch-and-Go		Grand Total
			Day	Night	Day	Night	Day	Night	
SW4	DHC6	Swearingen Merlin IV /Fairchild Merlin IV	-	1	1	-	-	-	2
T210	CNA20T	Cessna 210 Centurion Turbo	87	-	85	3	3	-	177
T34	GASEPV	Ayres S2R-T34 Turbo-Thrush	48	-	48	-	45	-	142
TBM7	GASEPV	Socata TBM 700	190	4	191	3	3	-	391
TBM8	CNA441	Socata TBM 850 Single Engine Turboprop	43	2	44	1	1	-	92
TBM9	CNA208	Daher TMB900	879	5	879	5	15	-	1,784
Grand Total			**45,450**	**2,413**	**45,015**	**2,847**	**47,485**	**1,006**	**144,217**

Totals may not sum up due to rounding

Source: HNTB analysis, 2023

Flying Cloud (FCM) Long-Term Plan (LTP)
Noise Contour Flight Tracks Development Draft Technical Memorandum

HNTB has been tasked to assist the Metropolitan Airports Commission (MAC) in support of the development of the 2040 Long-Term Plan (LTP) Noise Contour for the Flying Cloud Airport (FCM). This memorandum summarizes the development of representative noise model flight tracks based on the July 2021 – June 2022 MAC Noise & Operations Monitoring System (MACNOMS) data. HNTB selected a four-month sample of radar data including one month in summer, autumn, winter, and spring. The sample months include the following:

- August 2021 (peak month)
- November 2021
- February 2022
- May 2022

Figures 1 through **36** depict the arrival and departure flight tracks in the 4-month sample of radar data for jet, piston, and turboprop by runway. **Figures 37** to **38** show the helicopter arrival and departure flight tracks. **Figure 39** illustrates the touch-and-go flight tracks. The blue (arrival) and green (departure) tracks in the figures show the 4-month sample of radar data by operation type (arrival, departure, and touch and go), and aircraft type (jet, turboprop, piston, and helicopter)It should be noted that the noise model flight tracks are also dispersed to account for flight procedure deviations, but they are not shown for simplicity as the number of dispersed tracks (3 -7 dispersed track for every 'backbone' track) would overwhelm other elements in the figures.

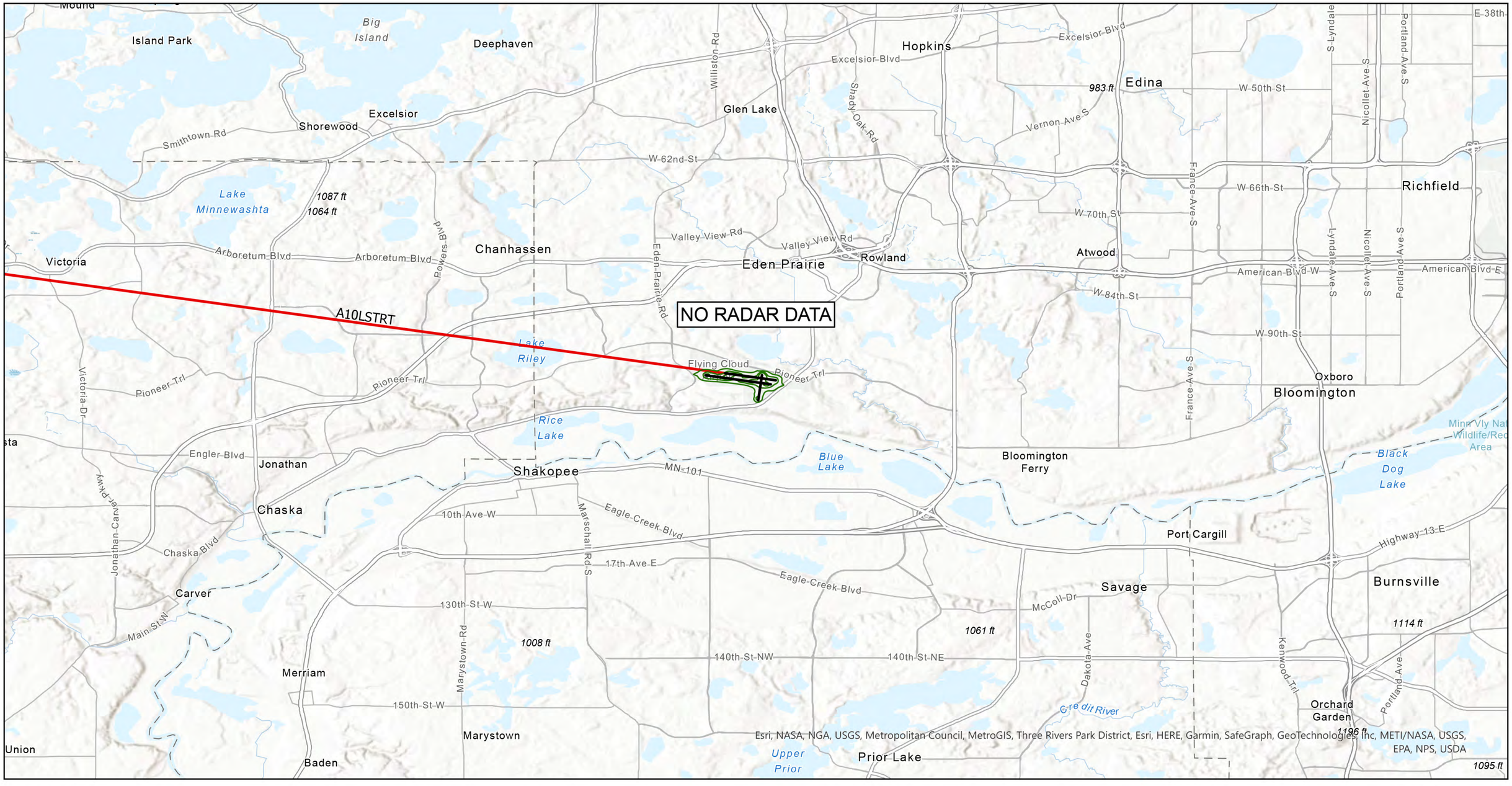
HNTB requests a review of the developed flight tracks. If you have any questions, please do not hesitate to reach me by email yxu@hntb.com or call me at (703) 253-5829.

Best Regards,

Yue Xu, Ph.D., P.E.
Aviation/Environmental Planner
HNTB Corporation

Cc: Eric Giles, MAC
Michele Ross, MAC
Dana Nelson, MAC
Kim Hughes, HNTB
Andrew Blaisdell, HNTB
Justin Bychek, HNTB

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



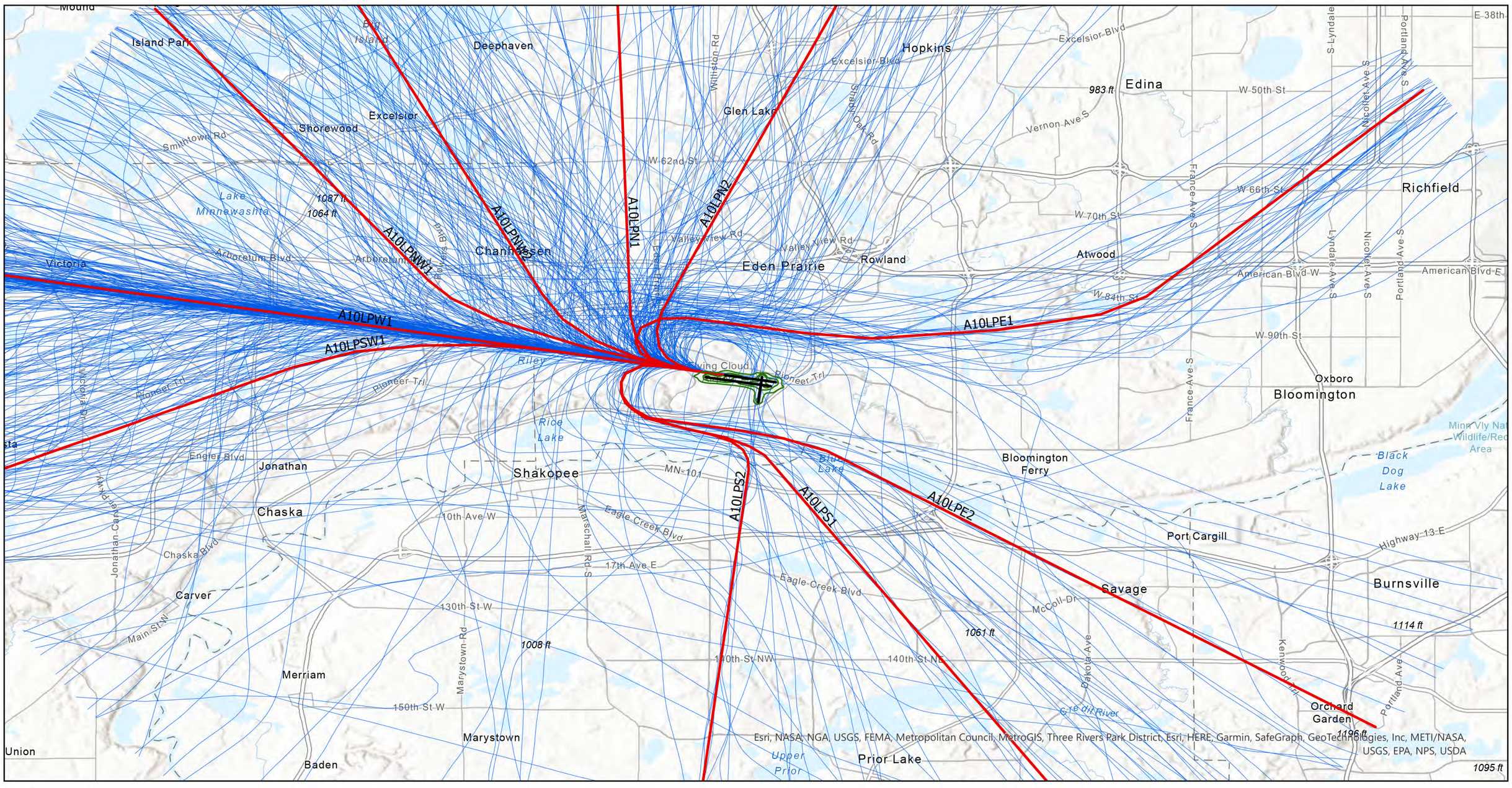
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 1
RUNWAY 10L ARRIVALS - JET

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
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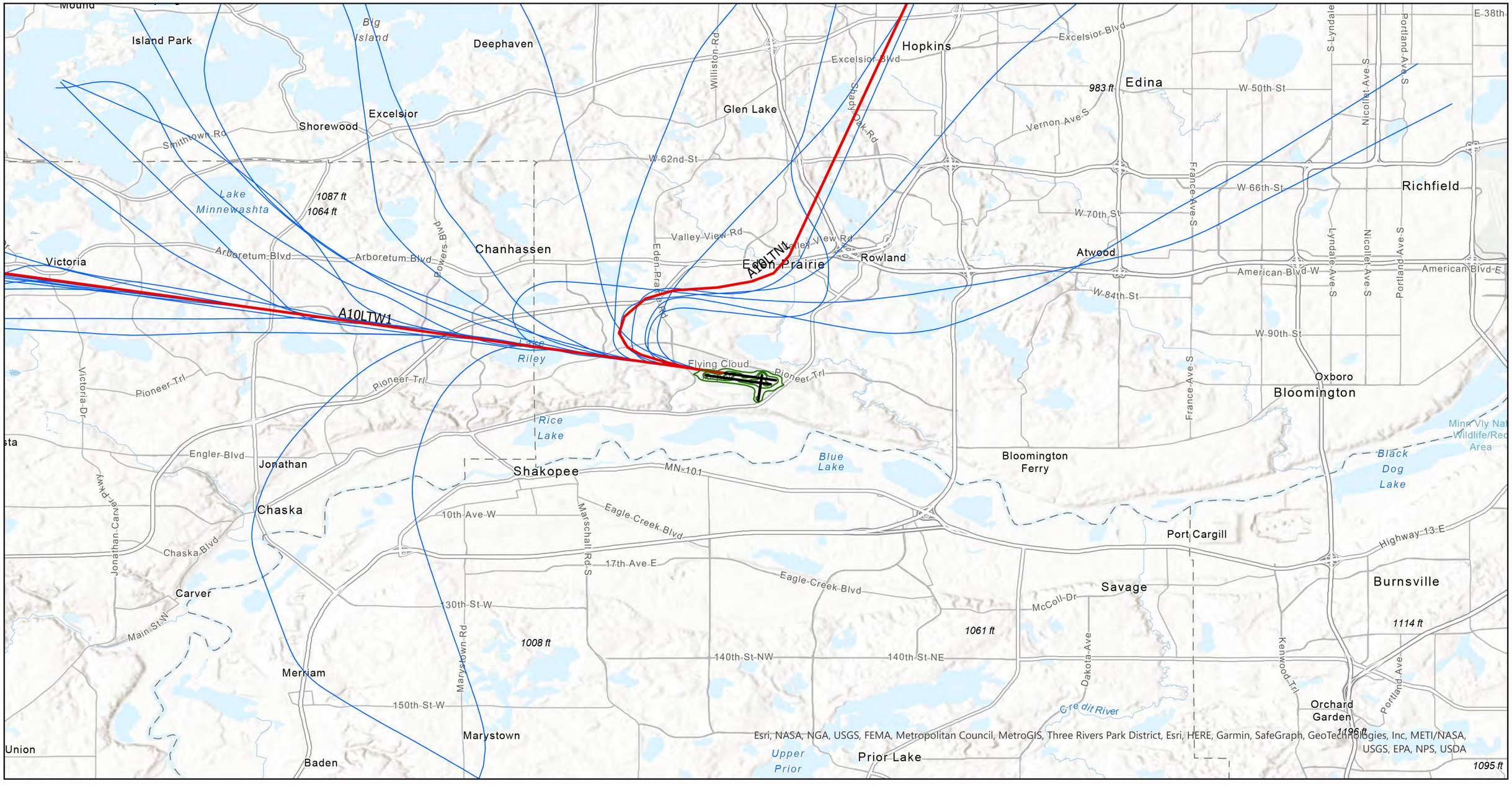
Figure 2
RUNWAY 10L ARRIVALS - PISTON

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



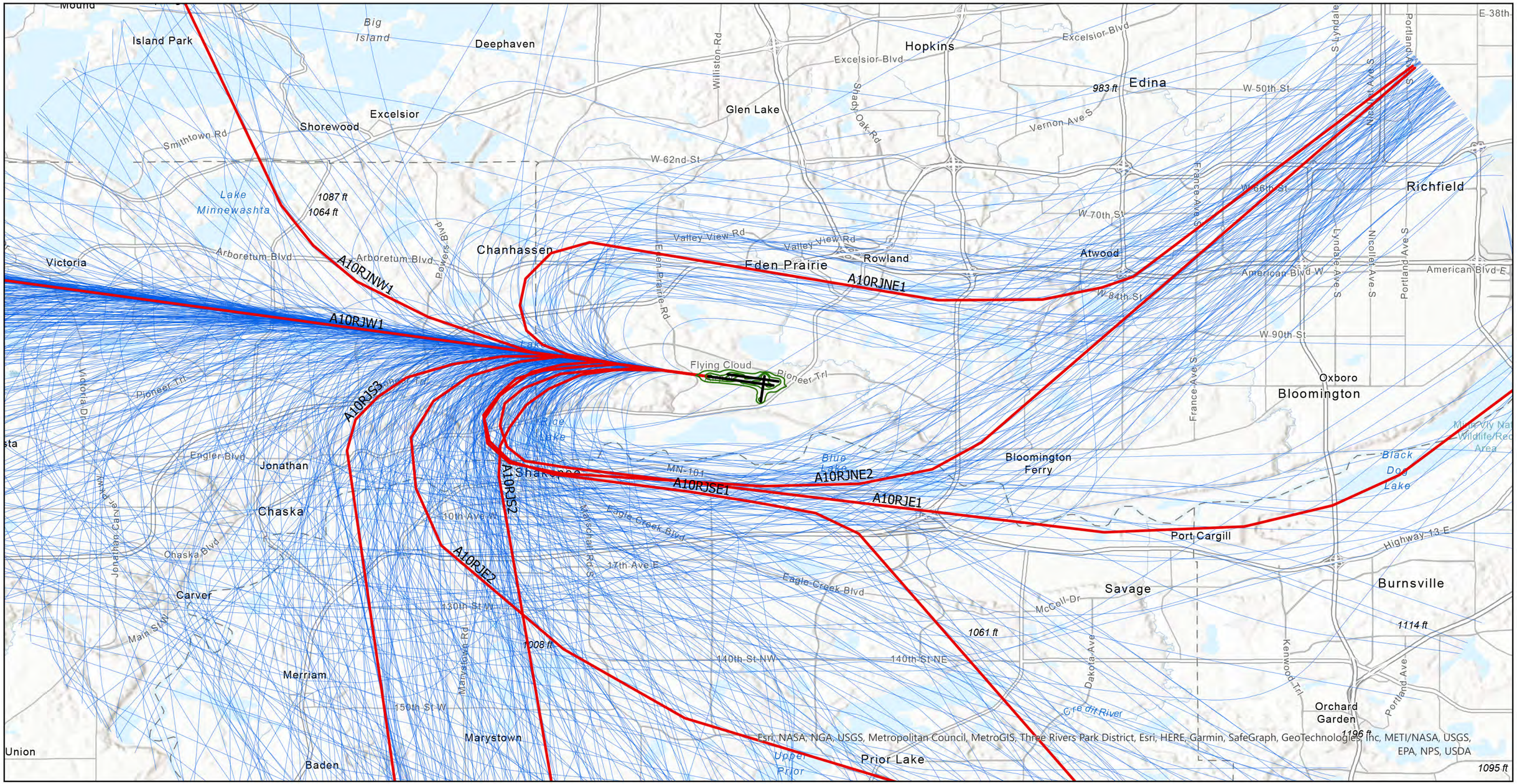
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 3
RUNWAY 10L ARRIVALS - TURBOPROP

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



LEGEND

- 2021/2040 Noise Model Flight Track
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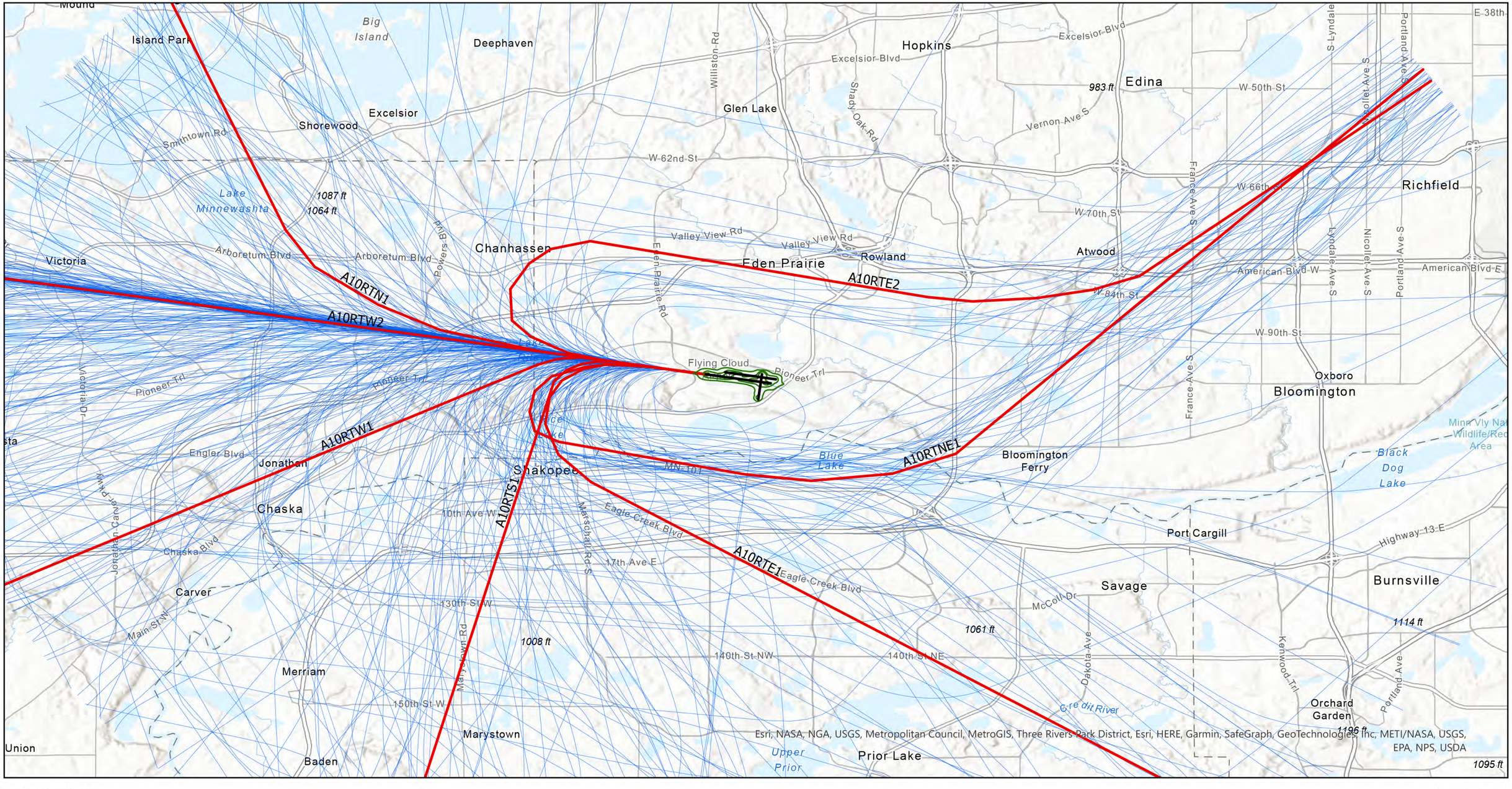
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 4
RUNWAY 10R ARRIVALS - JET

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



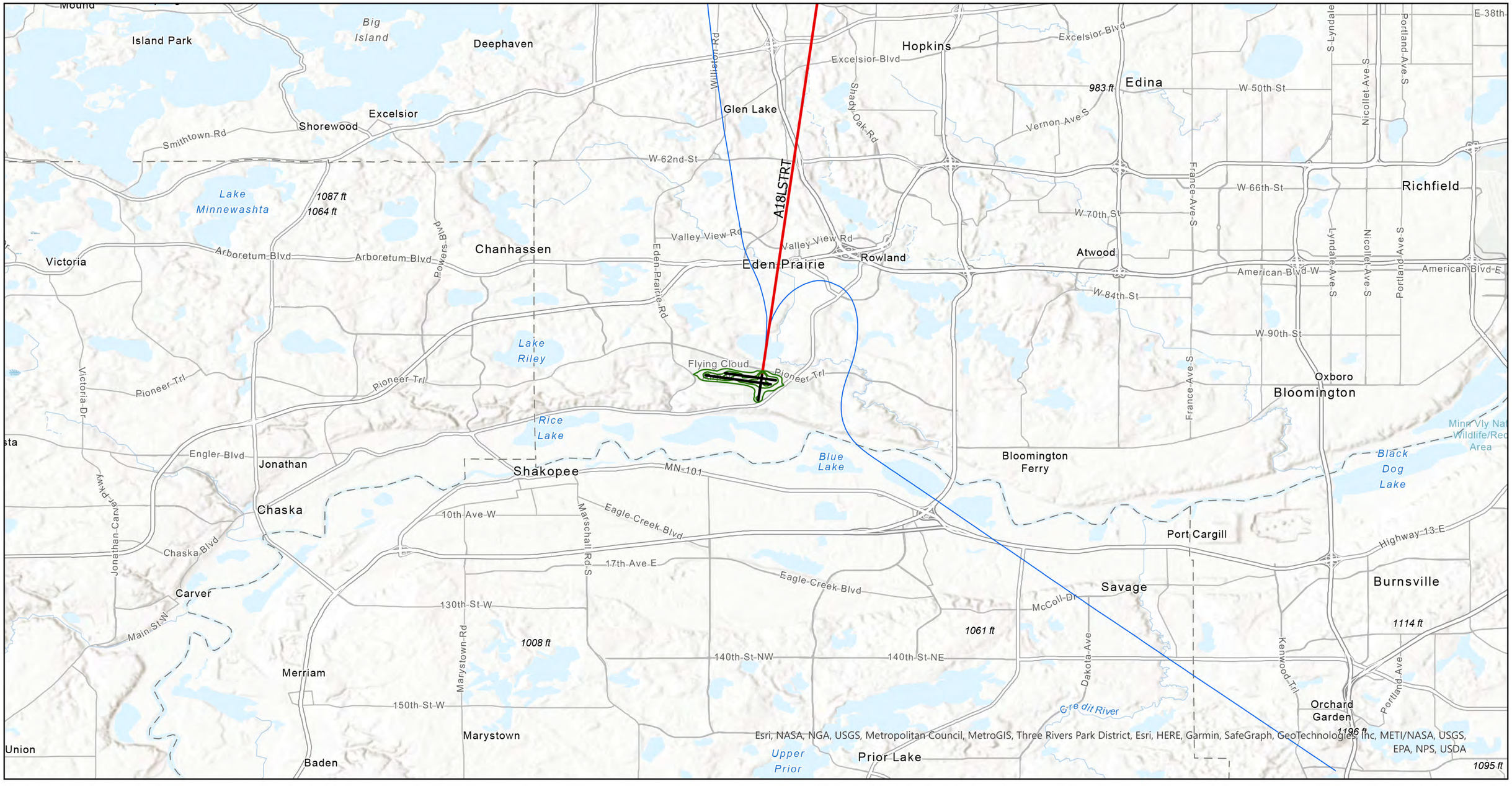
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 6
RUNWAY 10R ARRIVALS - TURBOPROP

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



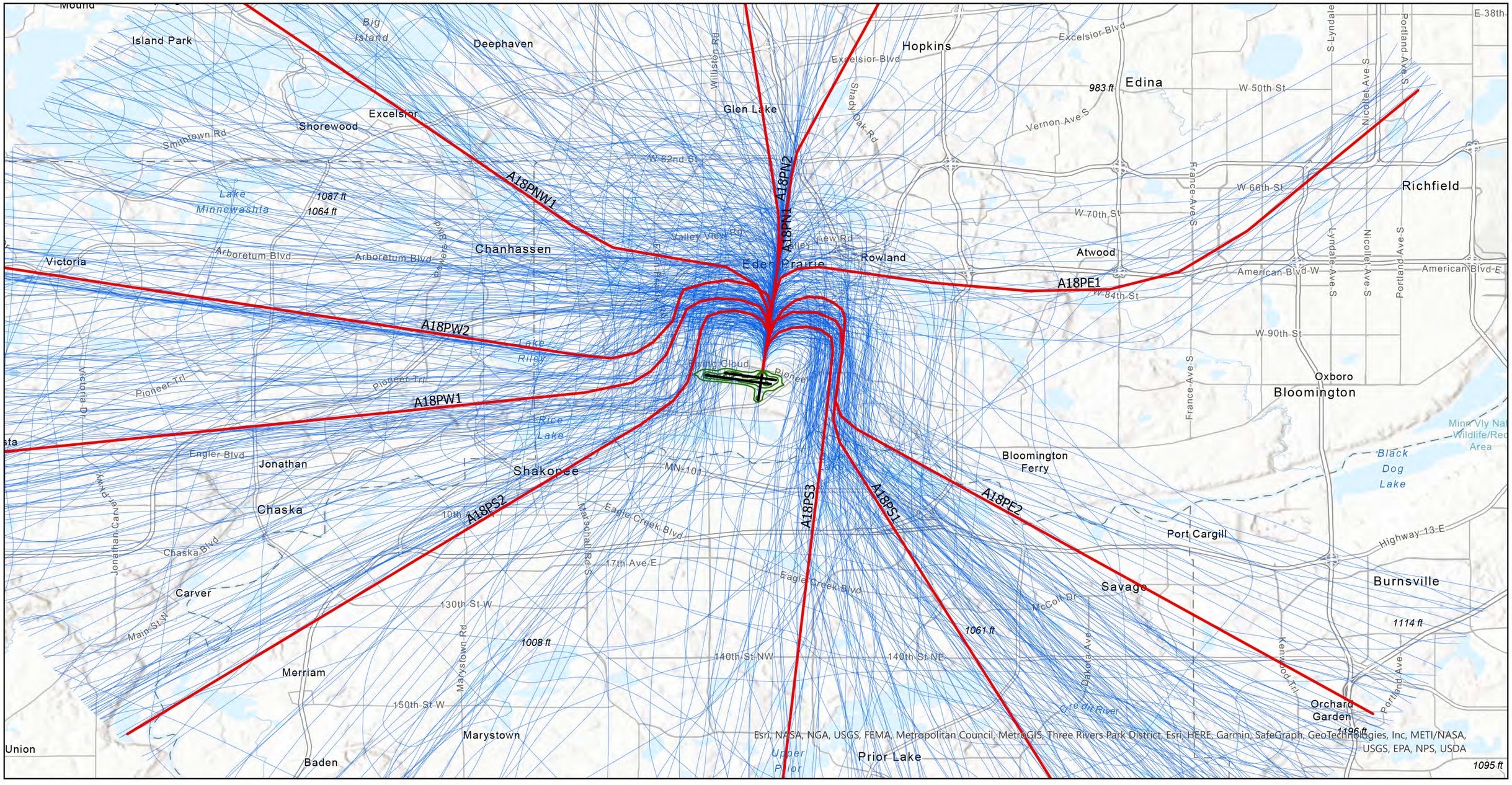
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 7
RUNWAY 18 ARRIVALS - JET

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



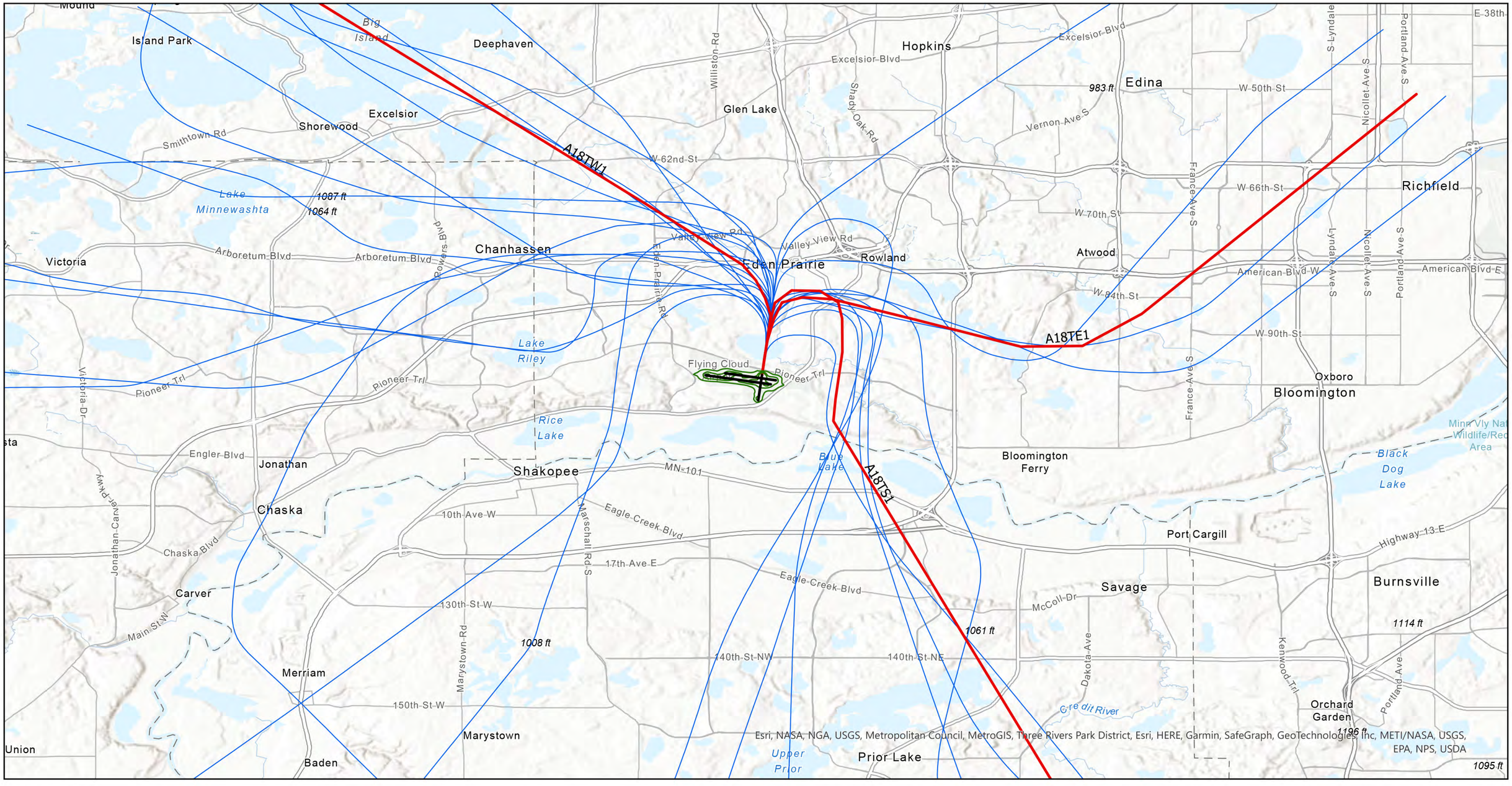
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 8
RUNWAY 18 ARRIVALS - PISTON

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



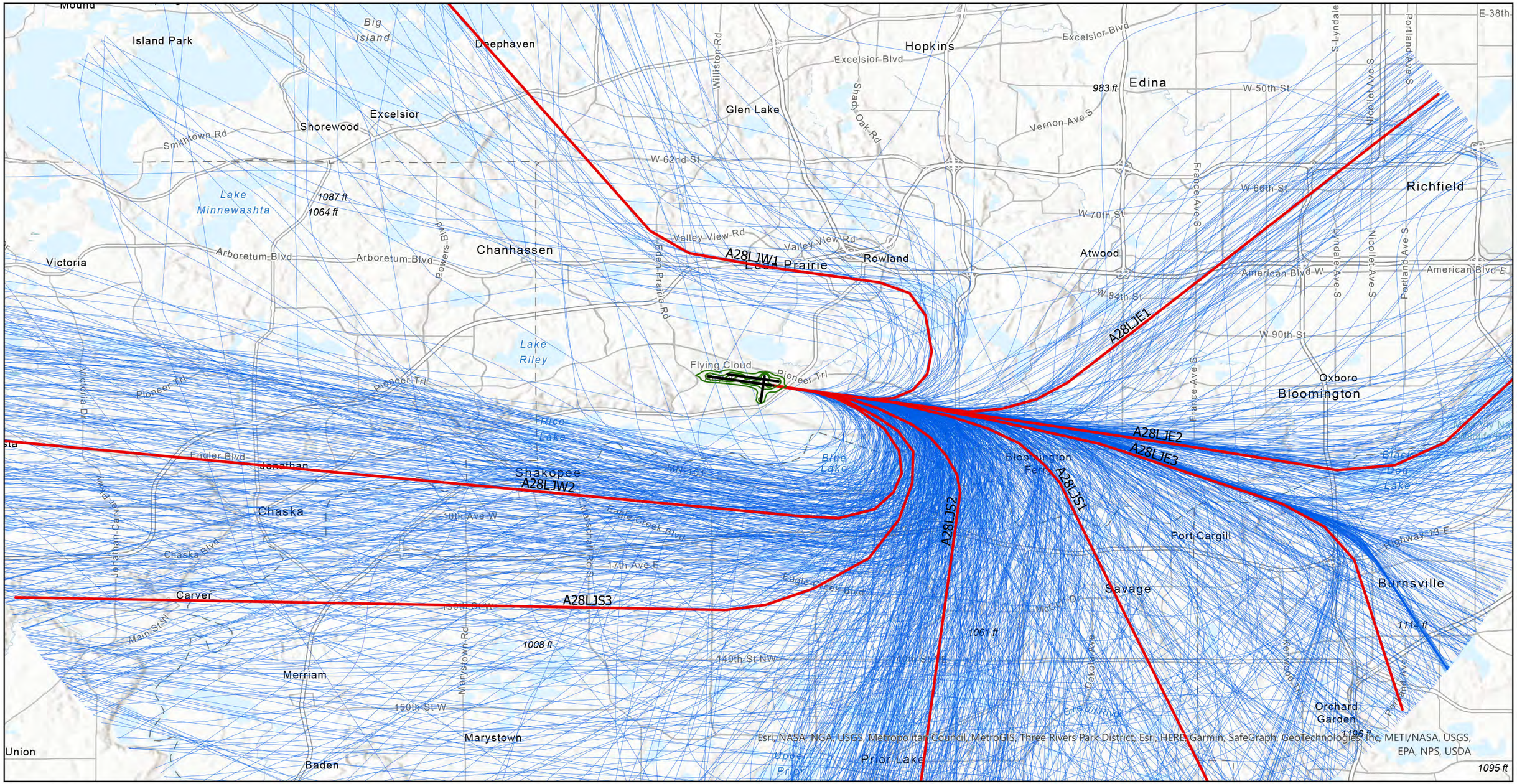
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 9
RUNWAY 18 ARRIVALS - TURBOPROP

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



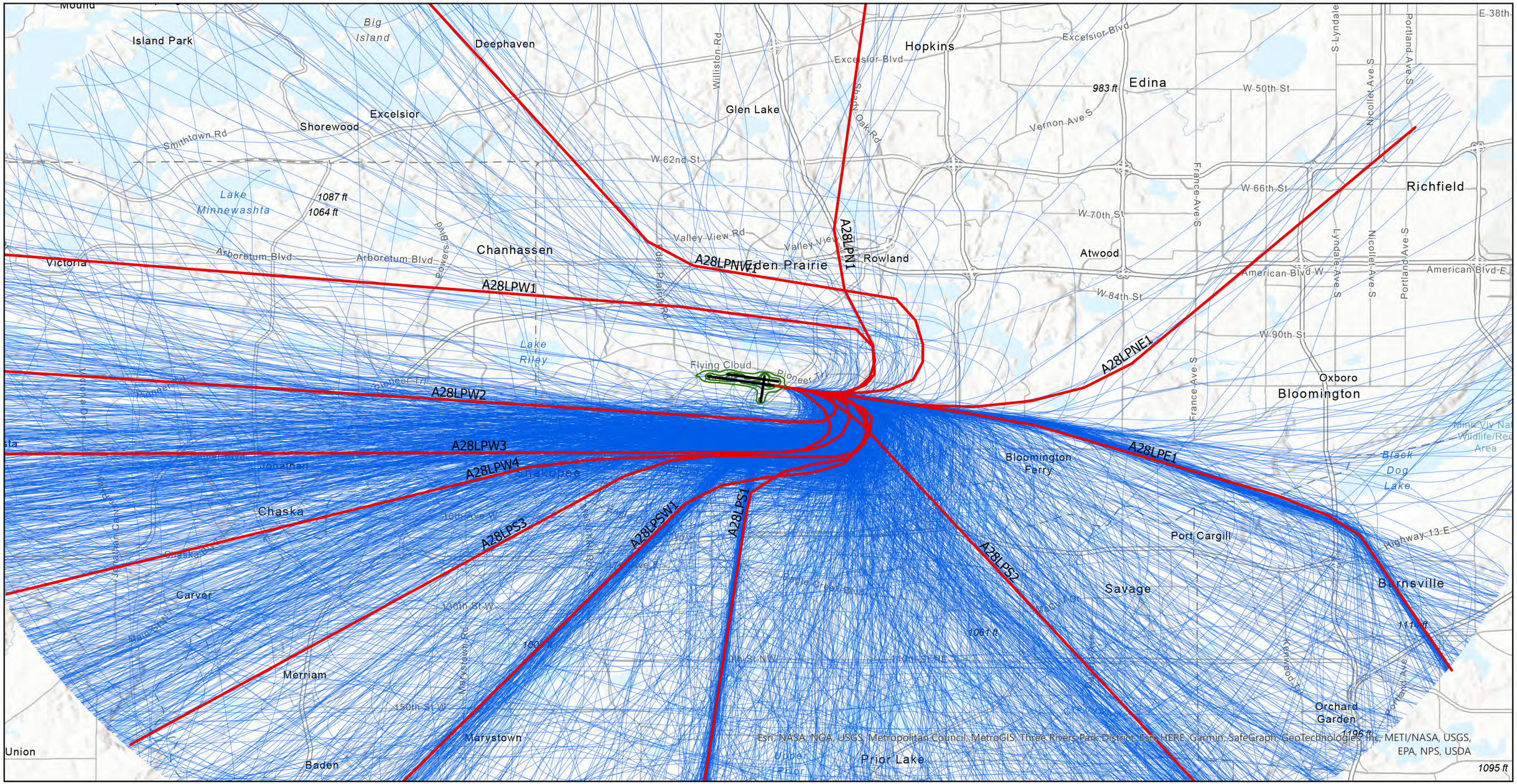
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 10
RUNWAY 28L ARRIVALS - JET

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



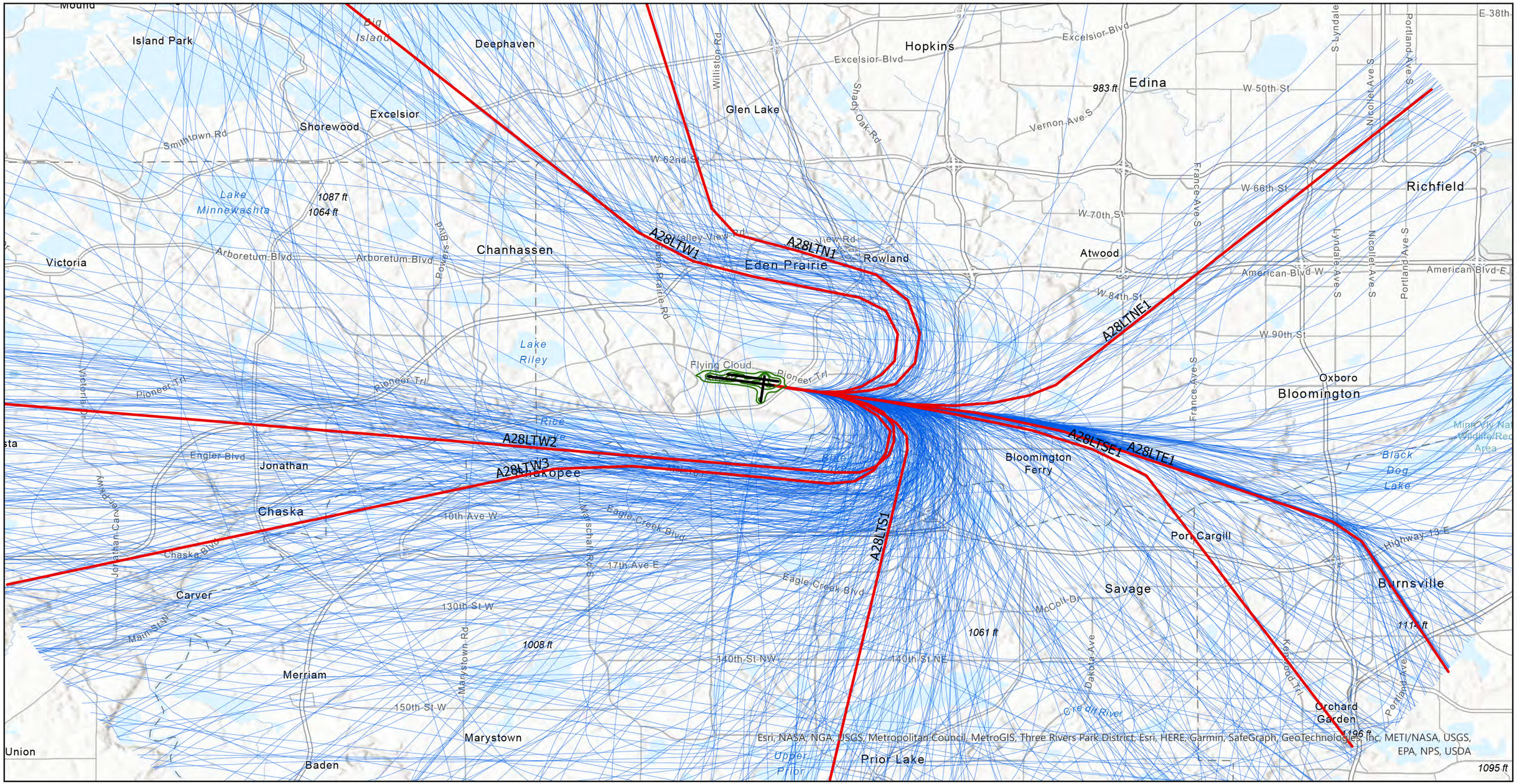
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 11
RUNWAY 28L ARRIVALS - PISTON

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



LEGEND

- 2021/2040 Noise Model Flight Track
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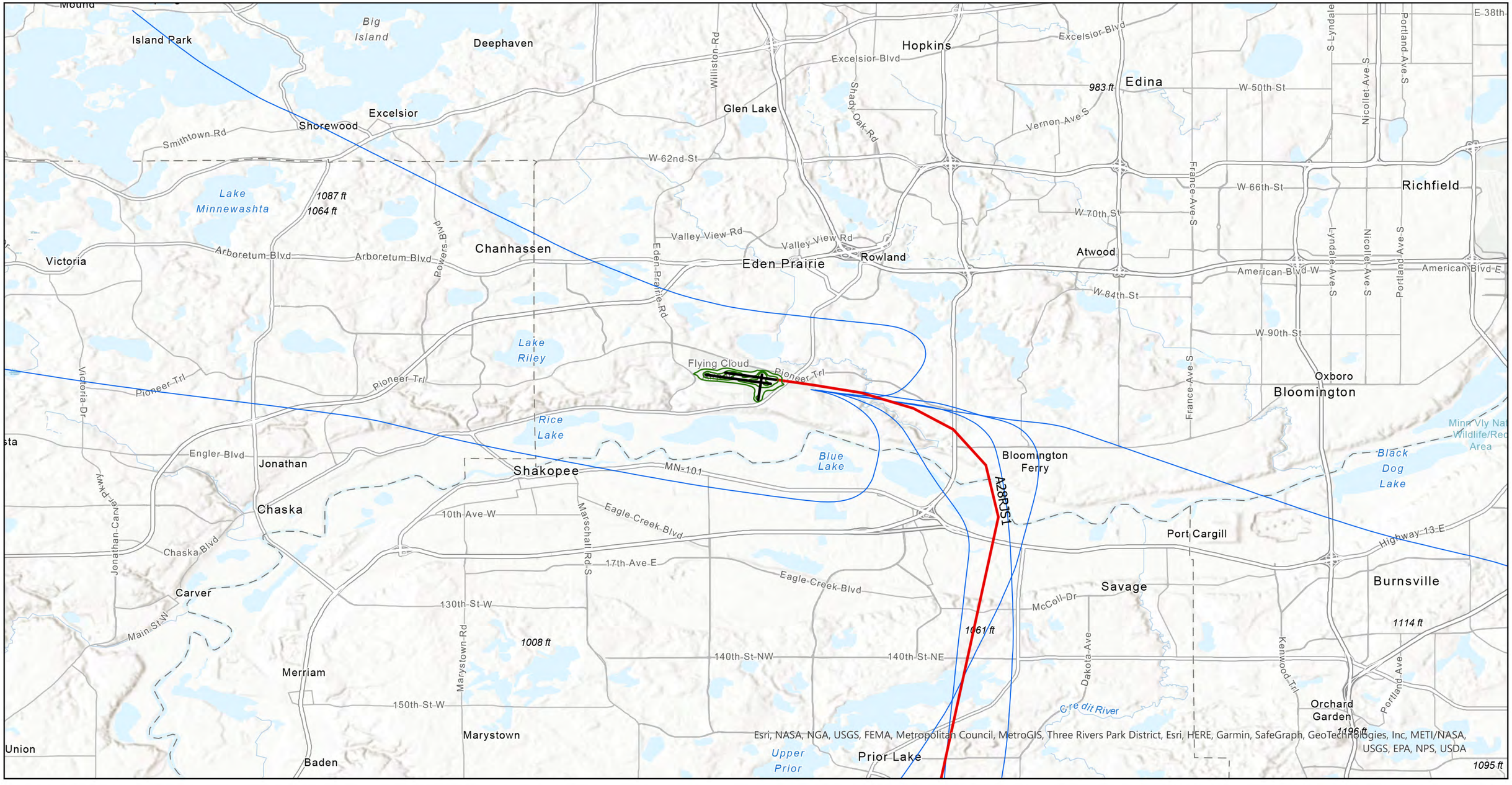
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 12
RUNWAY 28L ARRIVALS - TURBOPROP

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



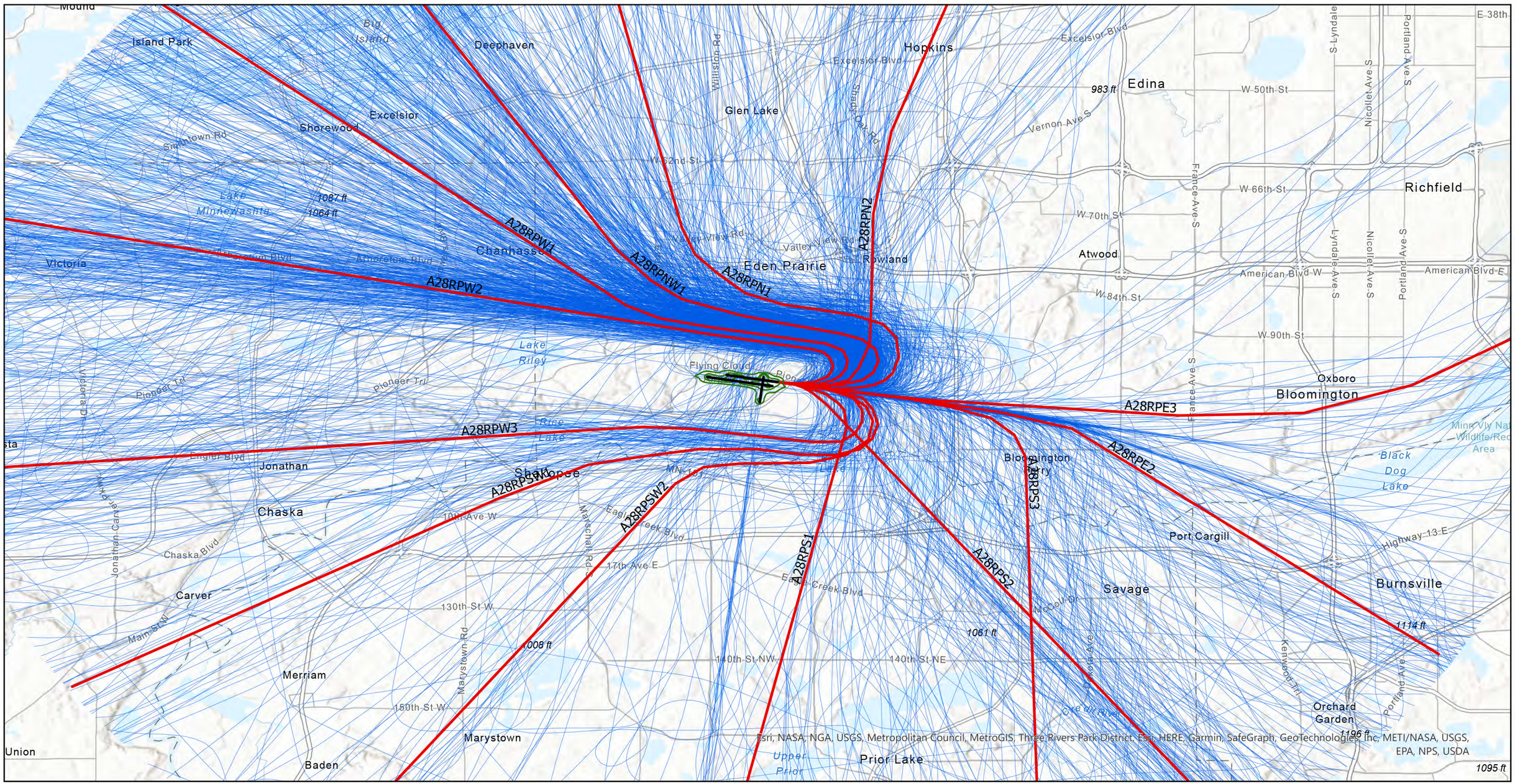
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 13
RUNWAY 28R ARRIVALS - JET

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



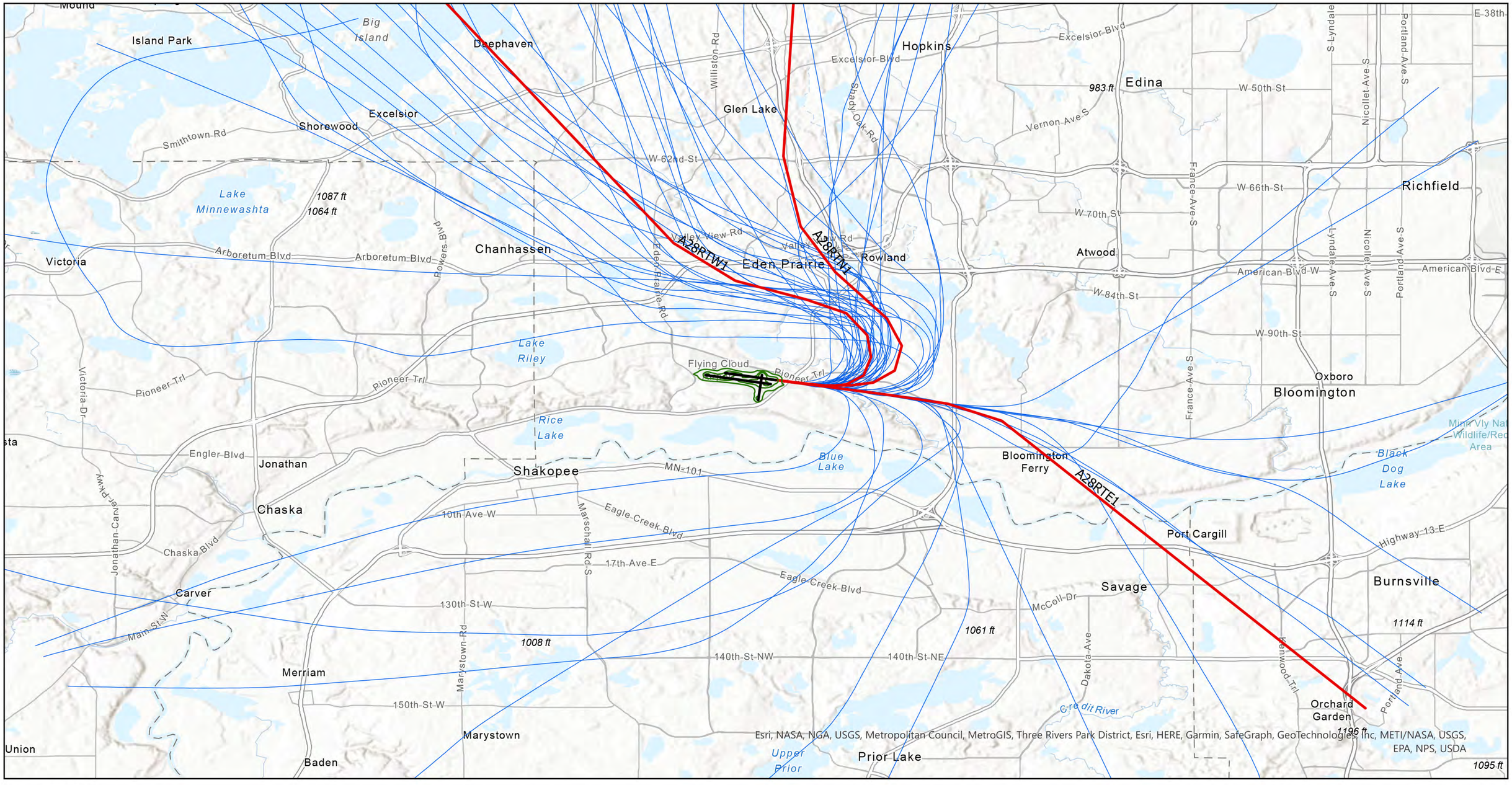
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 14
RUNWAY 28R ARRIVALS - PISTON

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



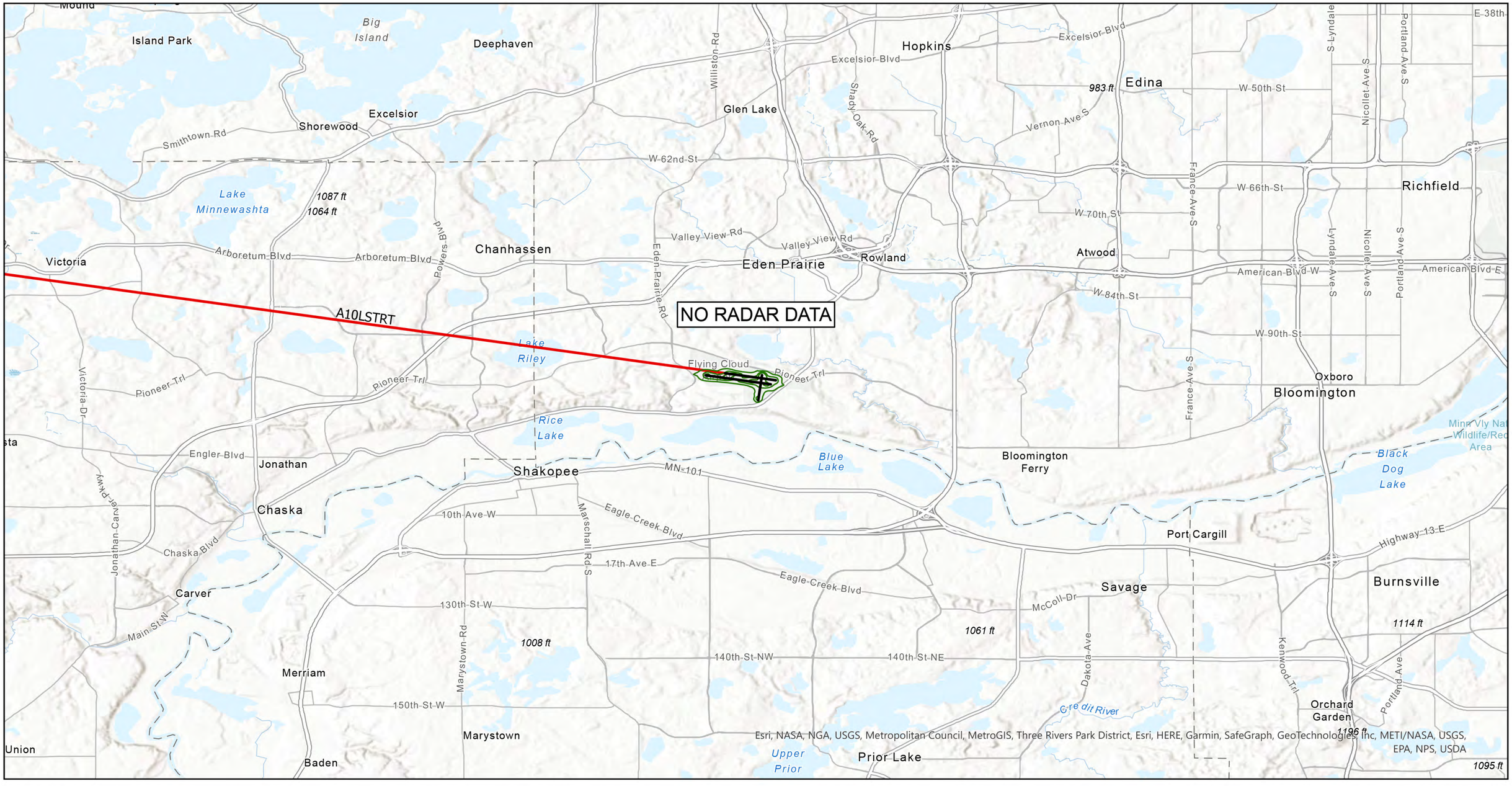
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 15
RUNWAY 28R ARRIVALS - TURBOPROP

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



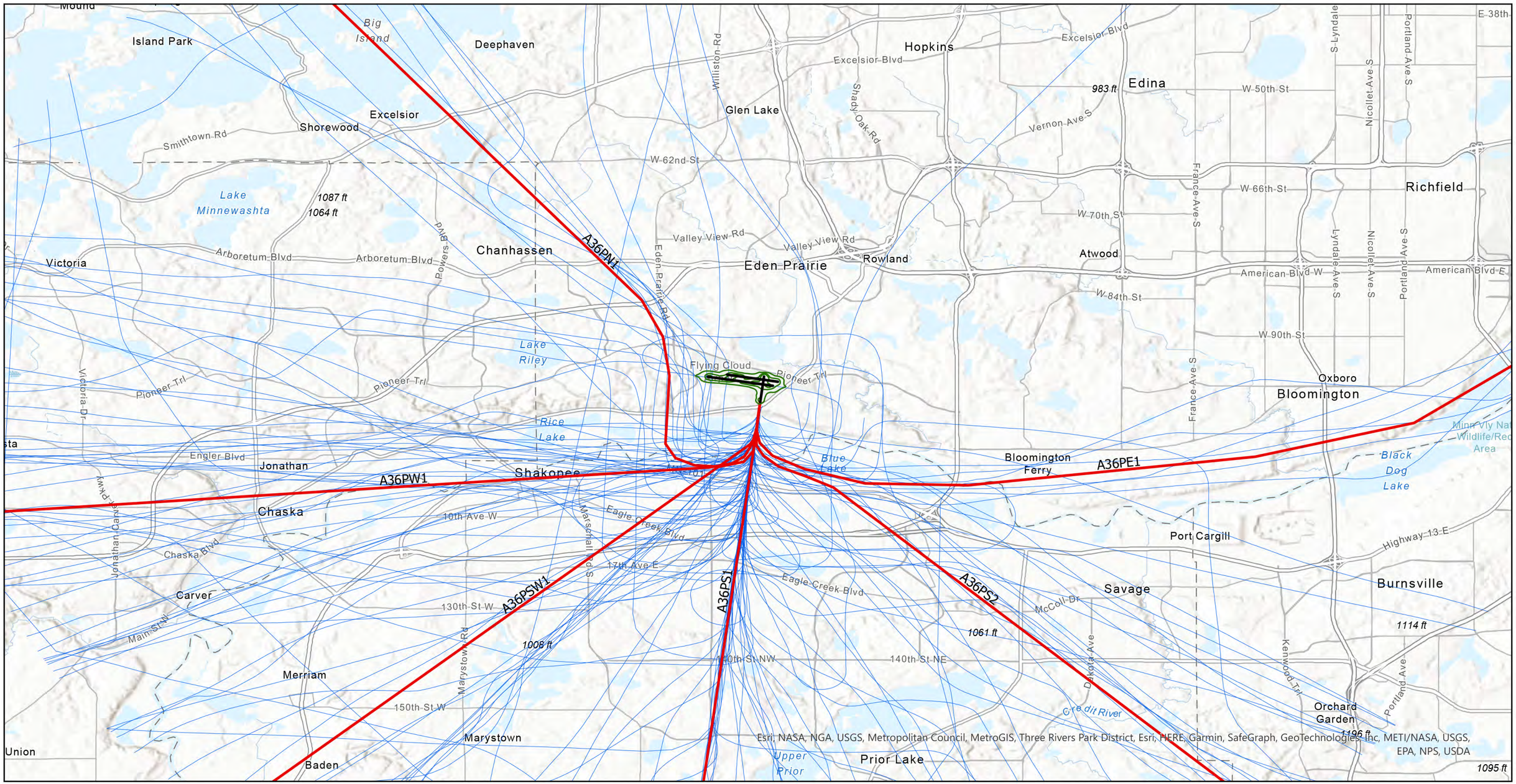
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 16
RUNWAY 36 ARRIVALS - JET

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



LEGEND

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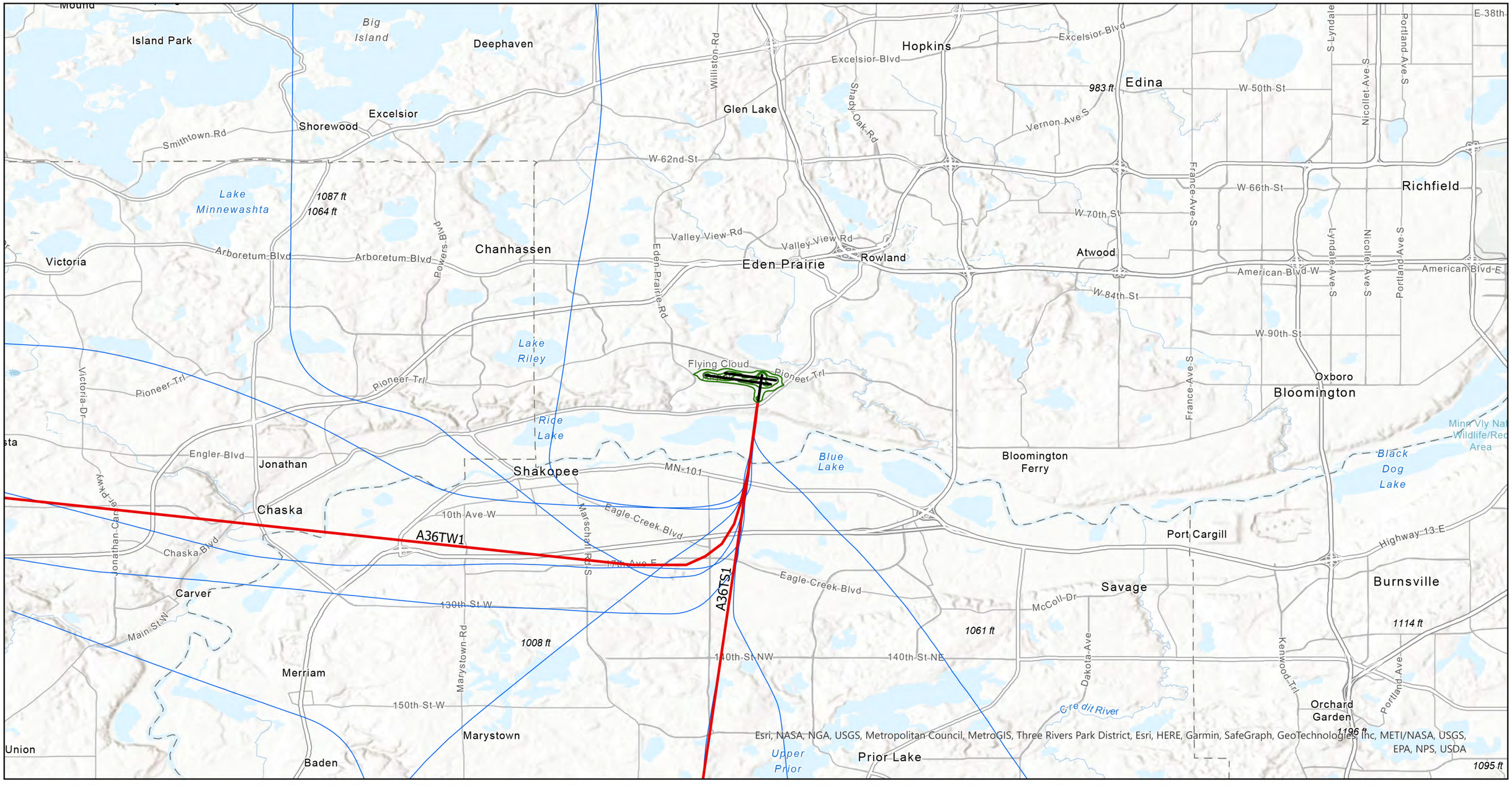
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 17
RUNWAY 36 ARRIVALS - PISTON

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



LEGEND

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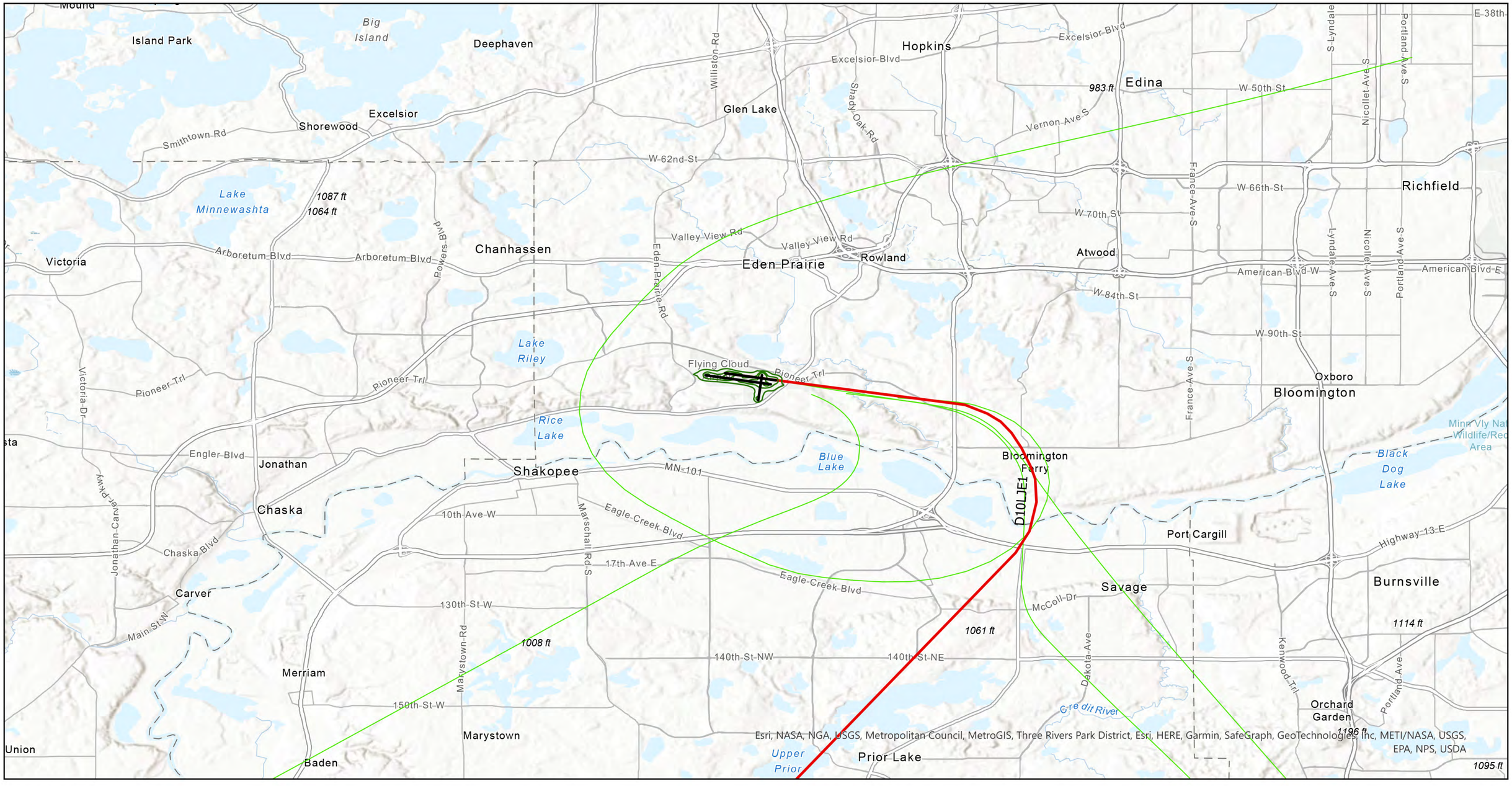
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 18
RUNWAY 36 ARRIVALS - TURBOPROP

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



LEGEND

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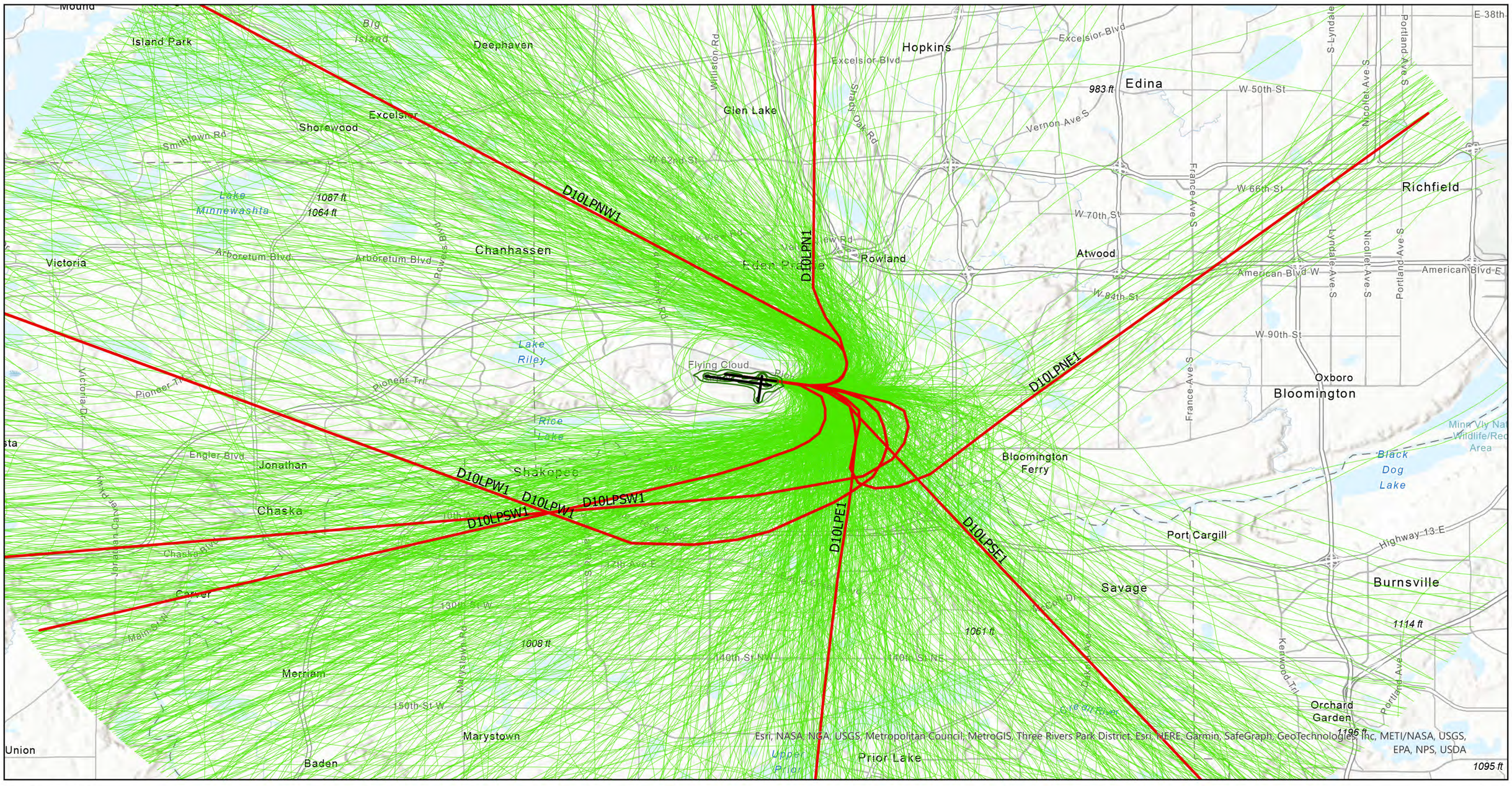
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 19
RUNWAY 10L DEPARTURES - JET

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



LEGEND

- 2021/2040 Noise Model Flight Track
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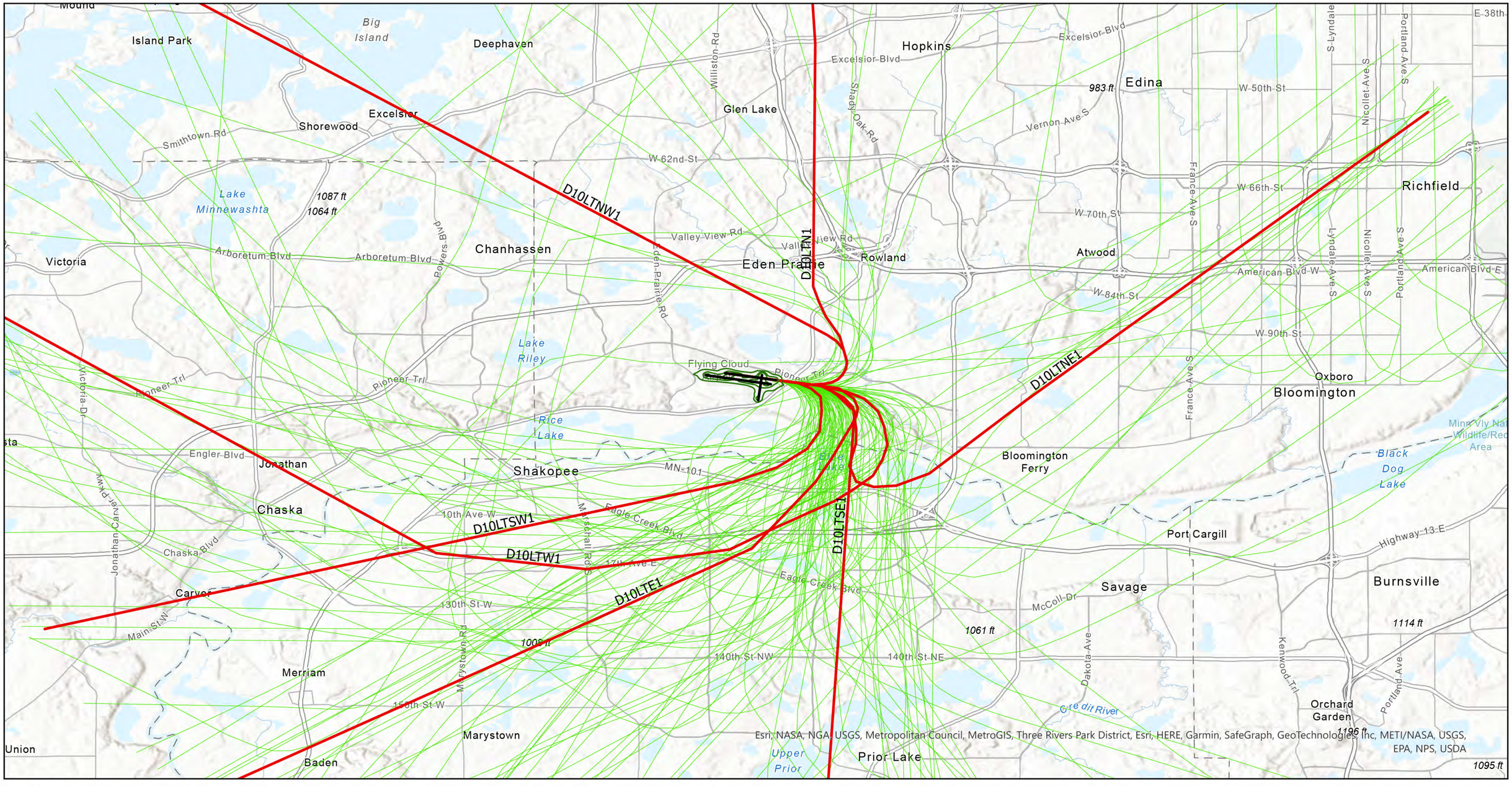
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 20
RUNWAY 10L DEPARTURES - PISTON

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



LEGEND

- 2021/2040 Noise Model Flight Track
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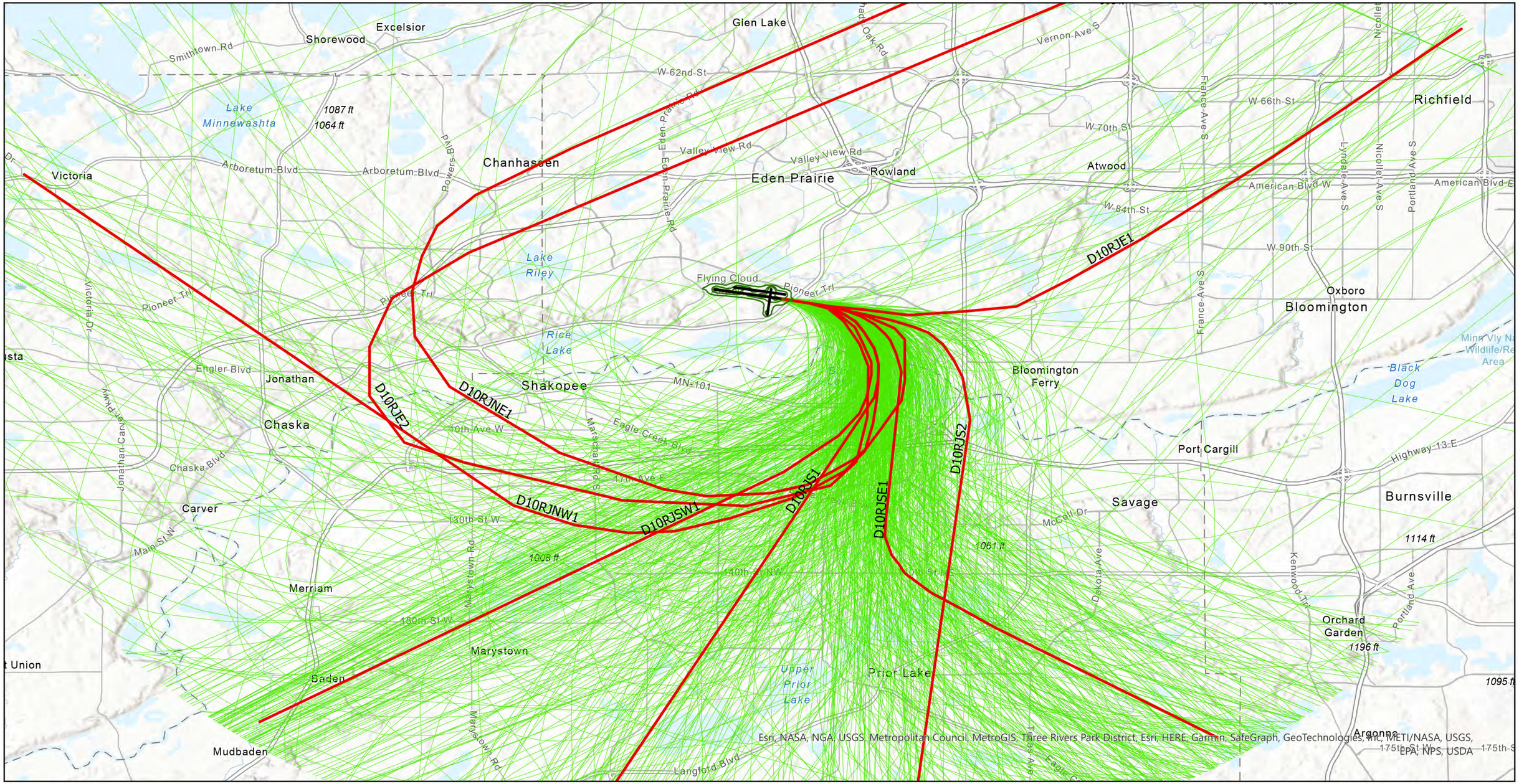
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 21
RUNWAY 10L DEPARTURES - TURBOPROP

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



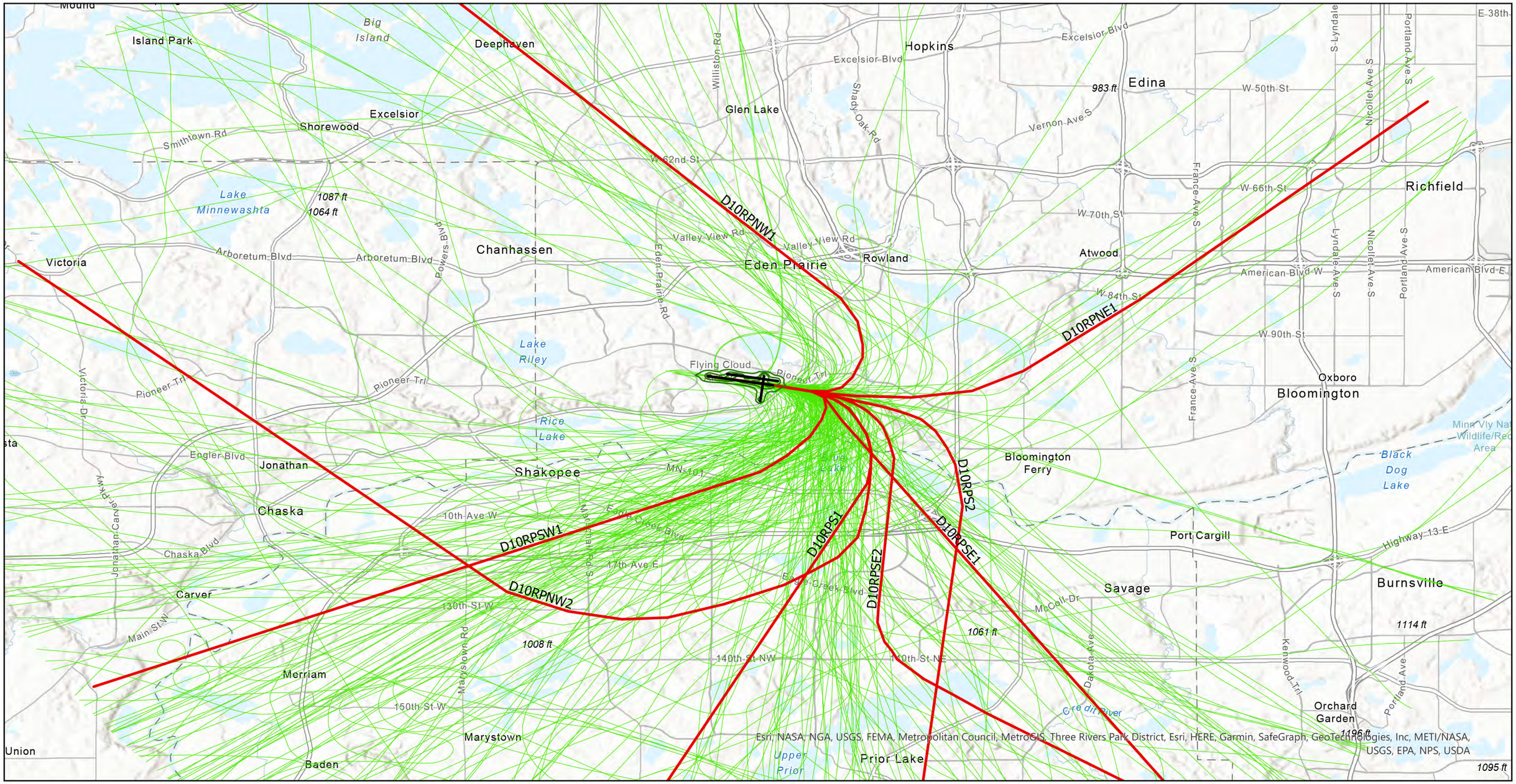
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 22
RUNWAY 10R DEPARTURES - JET

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



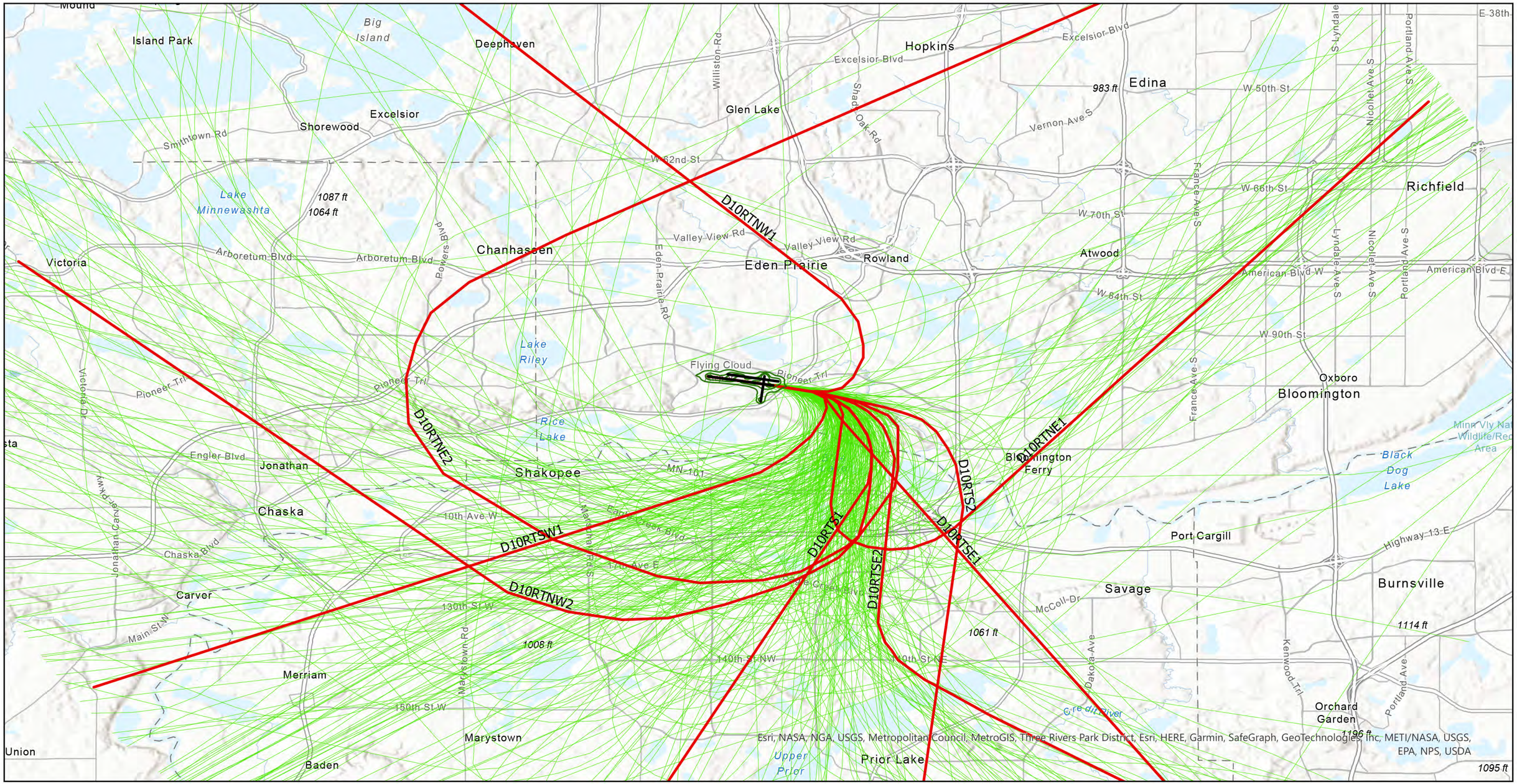
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 23
RUNWAY 10R DEPARTURES - PISTON

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



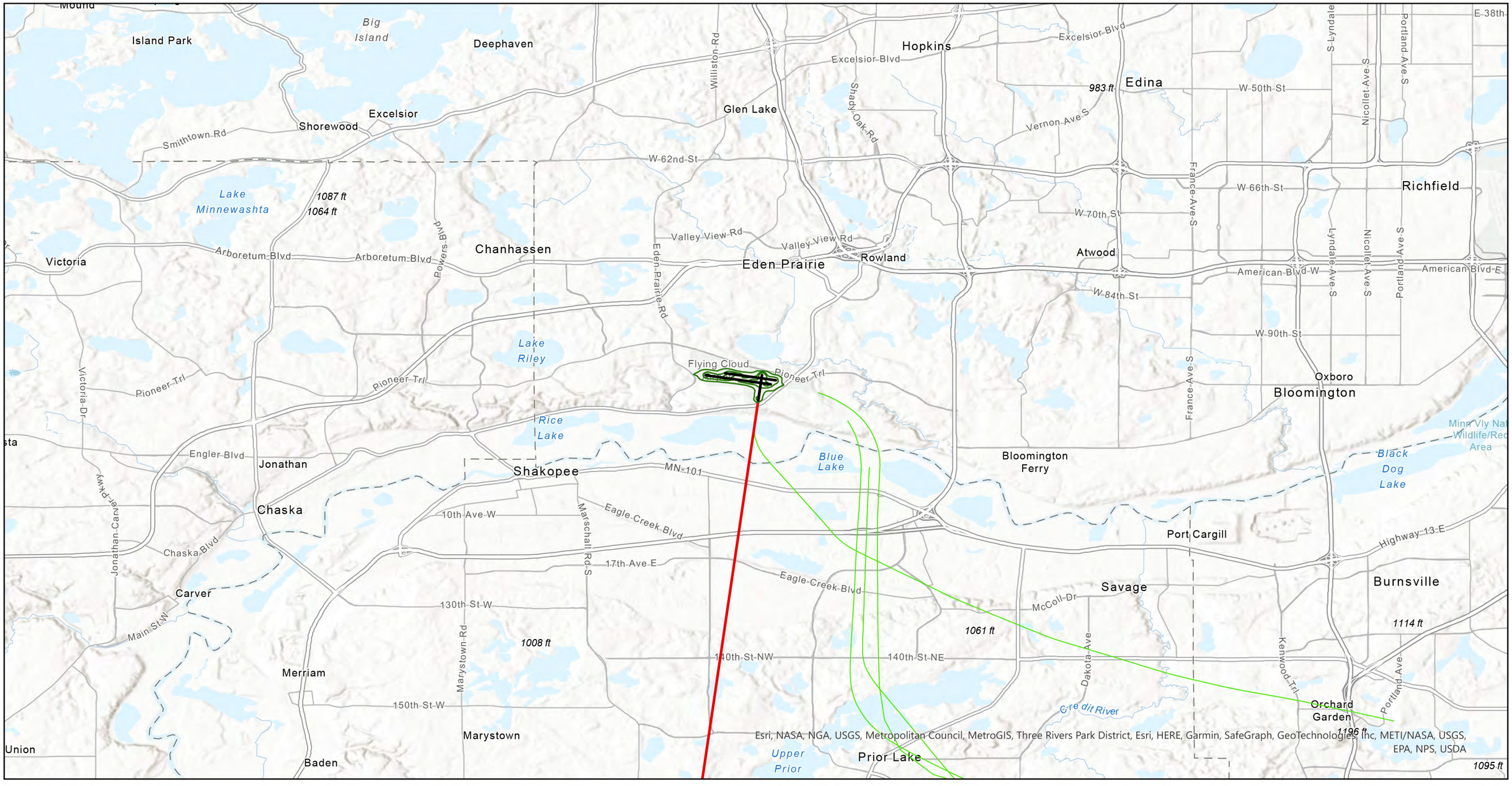
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 24
RUNWAY 10R DEPARTURES - TURBOPROP

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



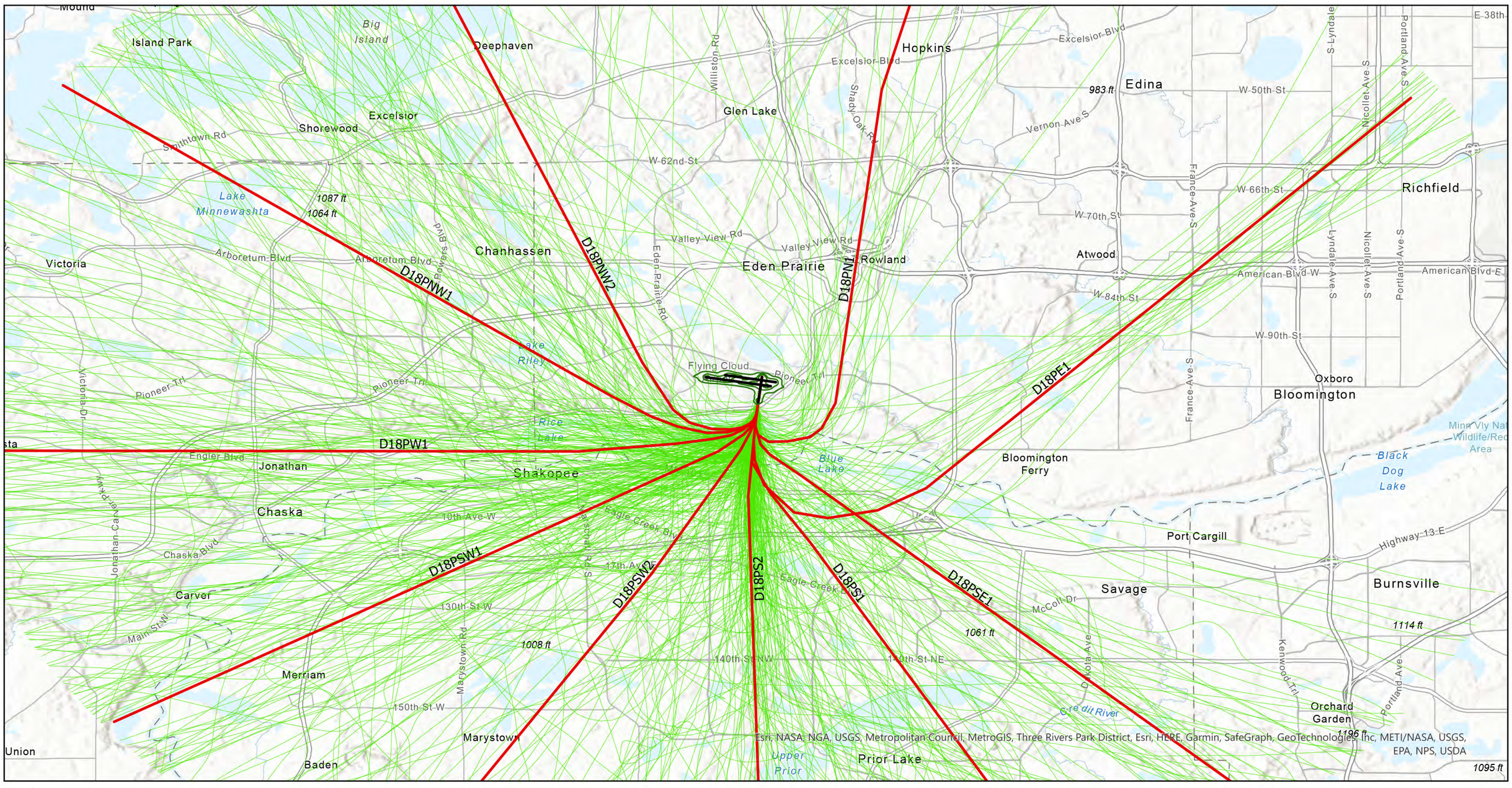
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 25
RUNWAY 18 DEPARTURES - JET

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



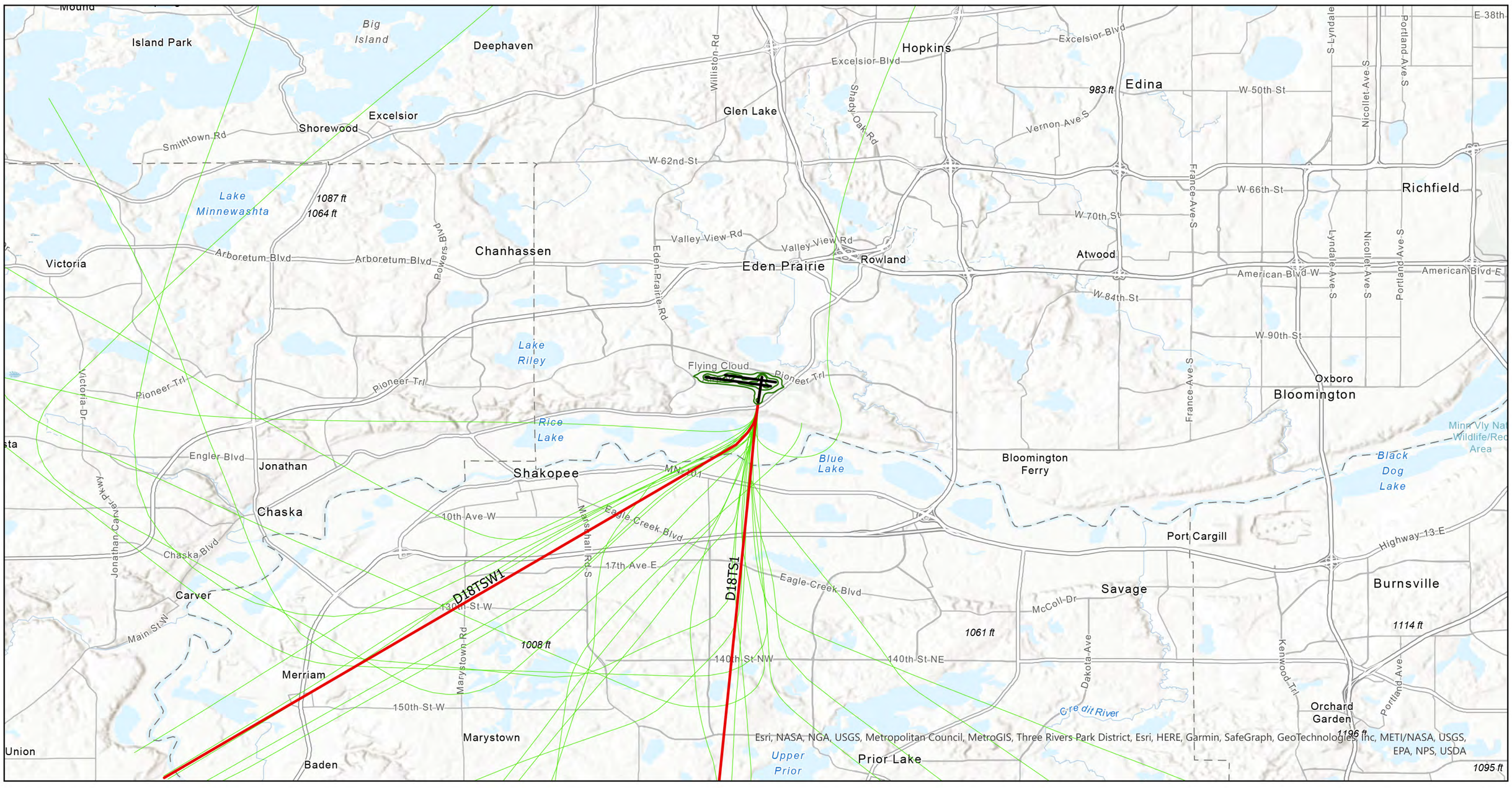
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 26
RUNWAY 18 DEPARTURES - PISTON

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



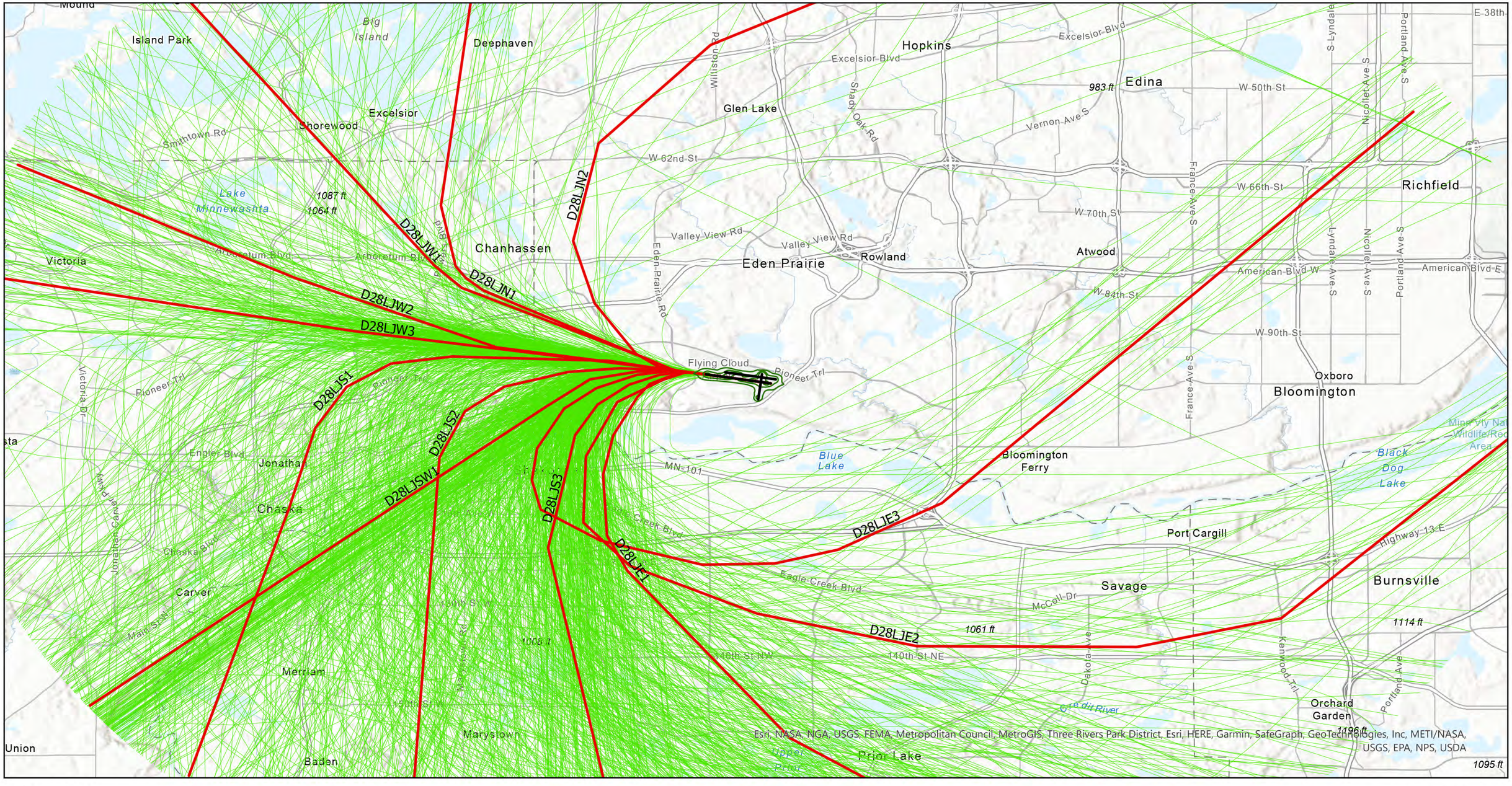
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 27
RUNWAY 18 DEPARTURES - TURBOPROP

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



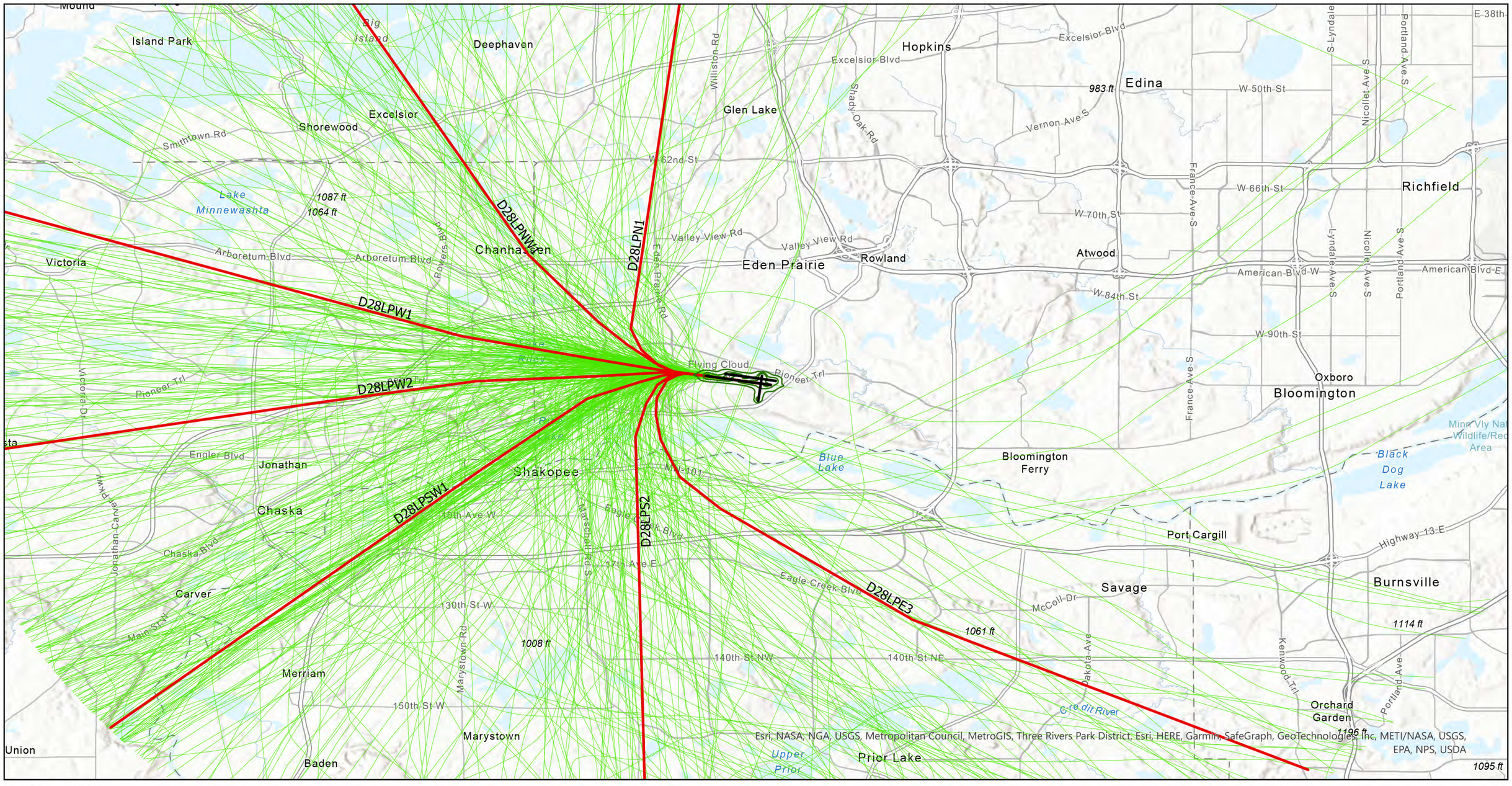
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 28
RUNWAY 28L DEPARTURES - JET

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



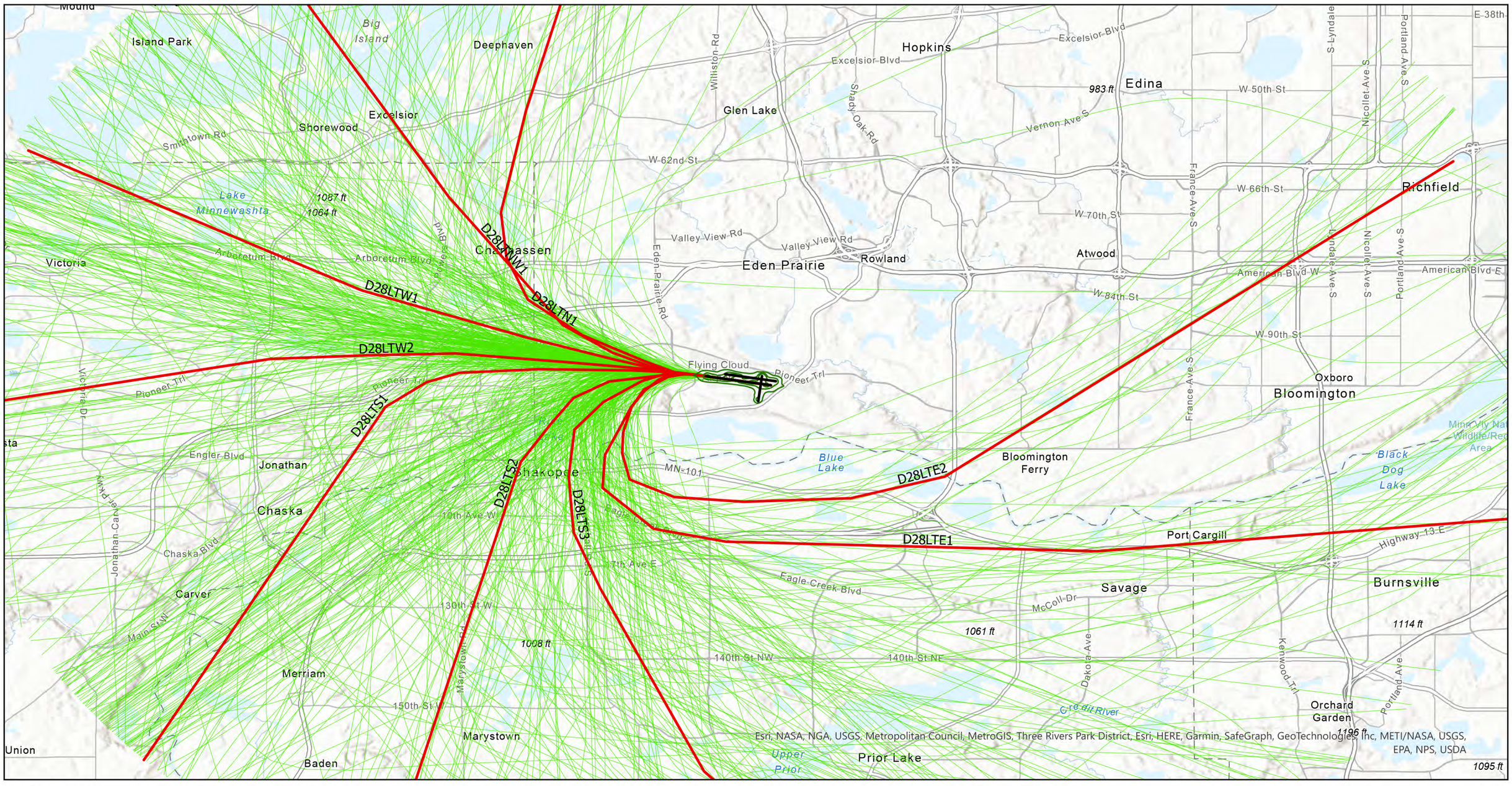
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 29
RUNWAY 28L DEPARTURES - PISTON

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



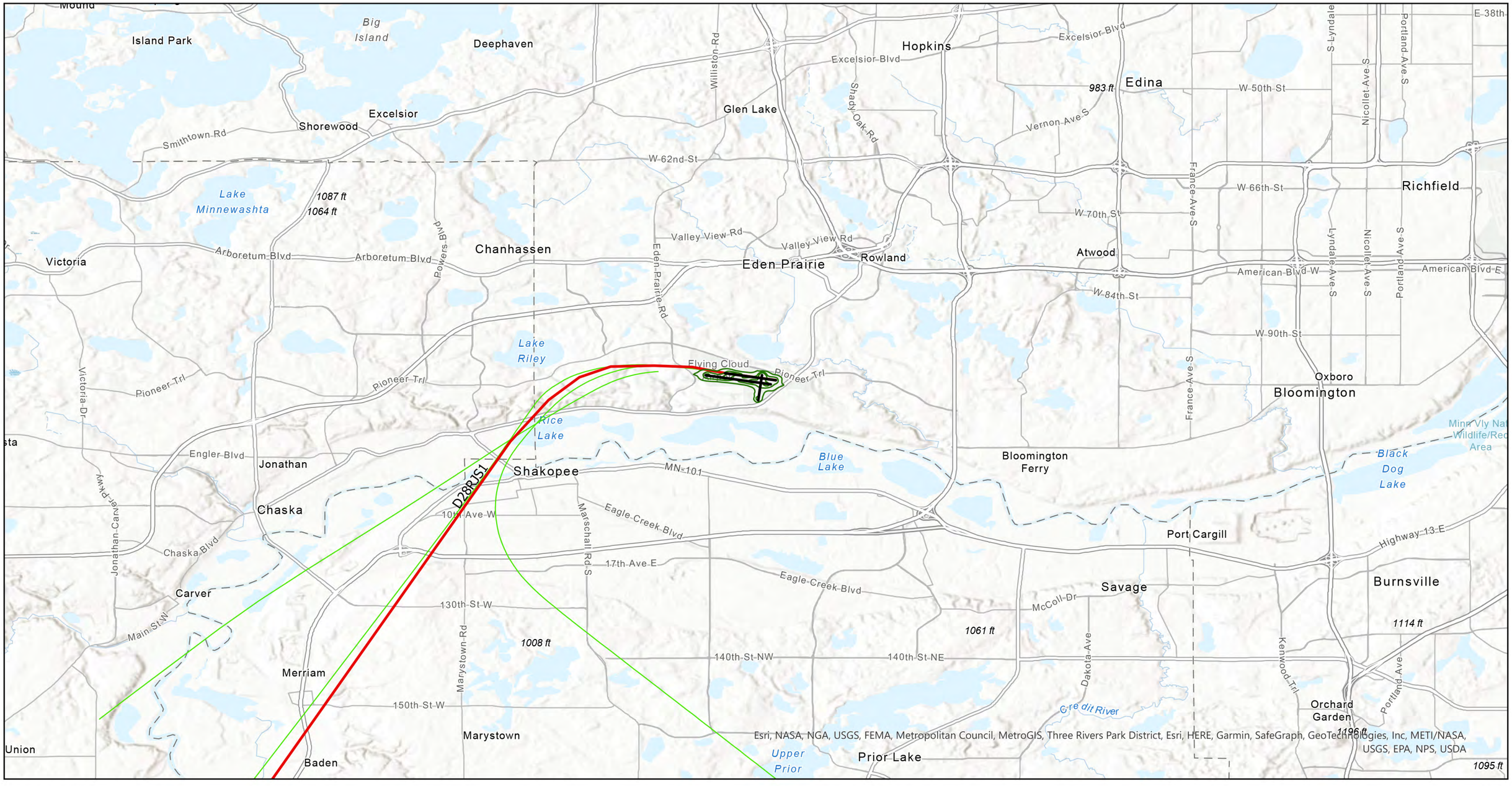
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 30
RUNWAY 28L DEPARTURES - TURBOPROP

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



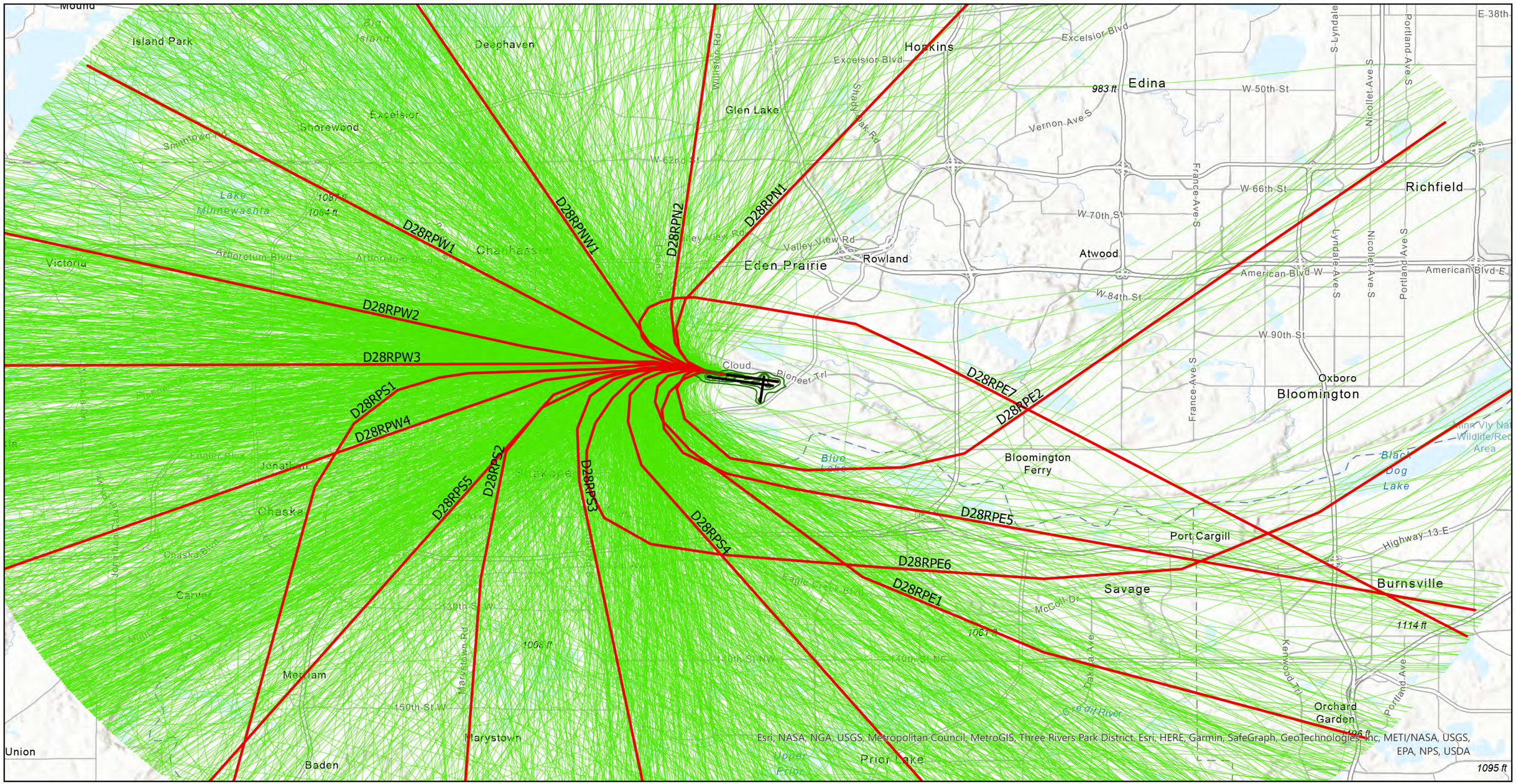
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 31
RUNWAY 28R DEPARTURES - JET

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



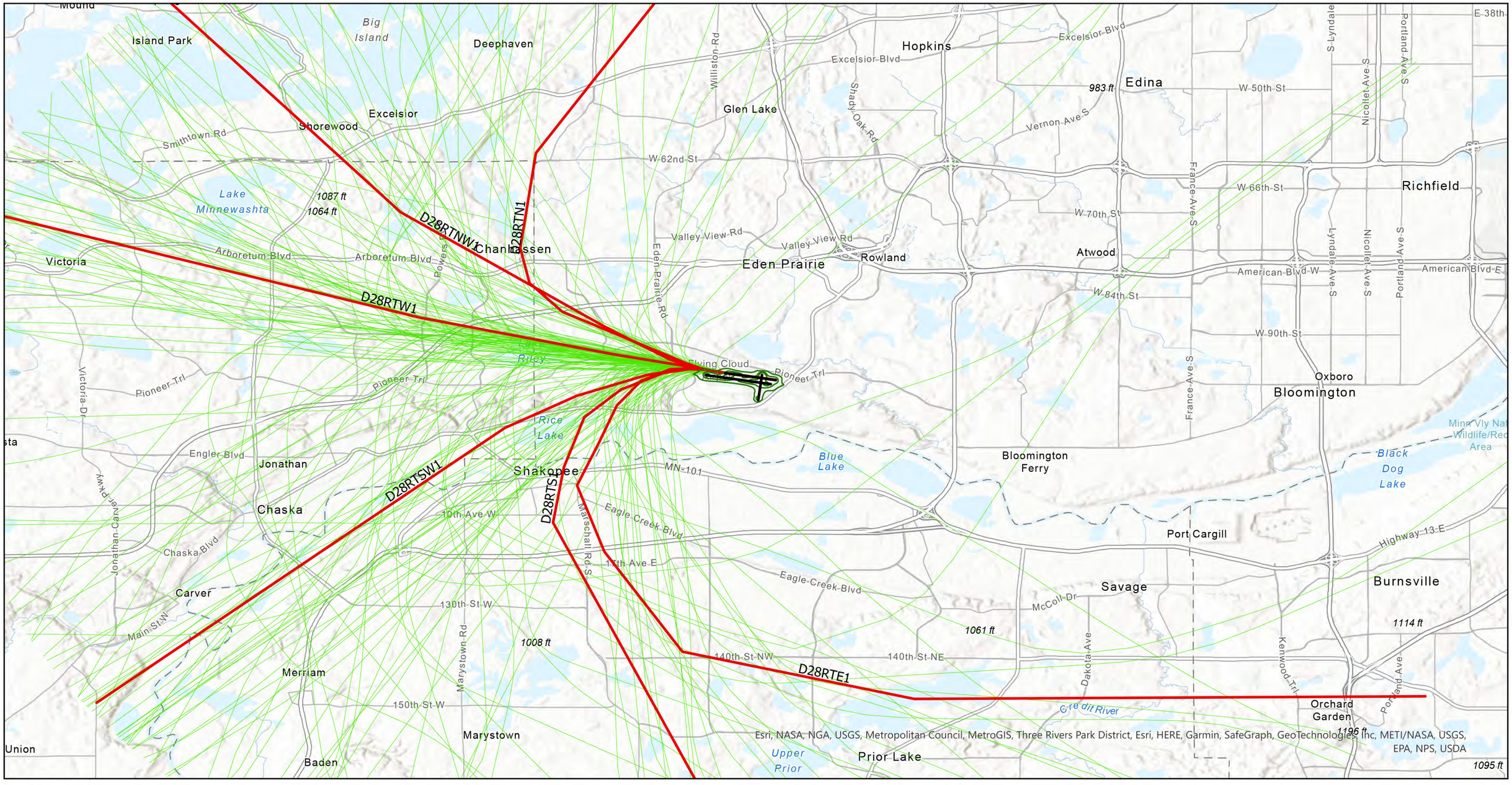
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 32
RUNWAY 28R DEPARTURES - PISTON

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



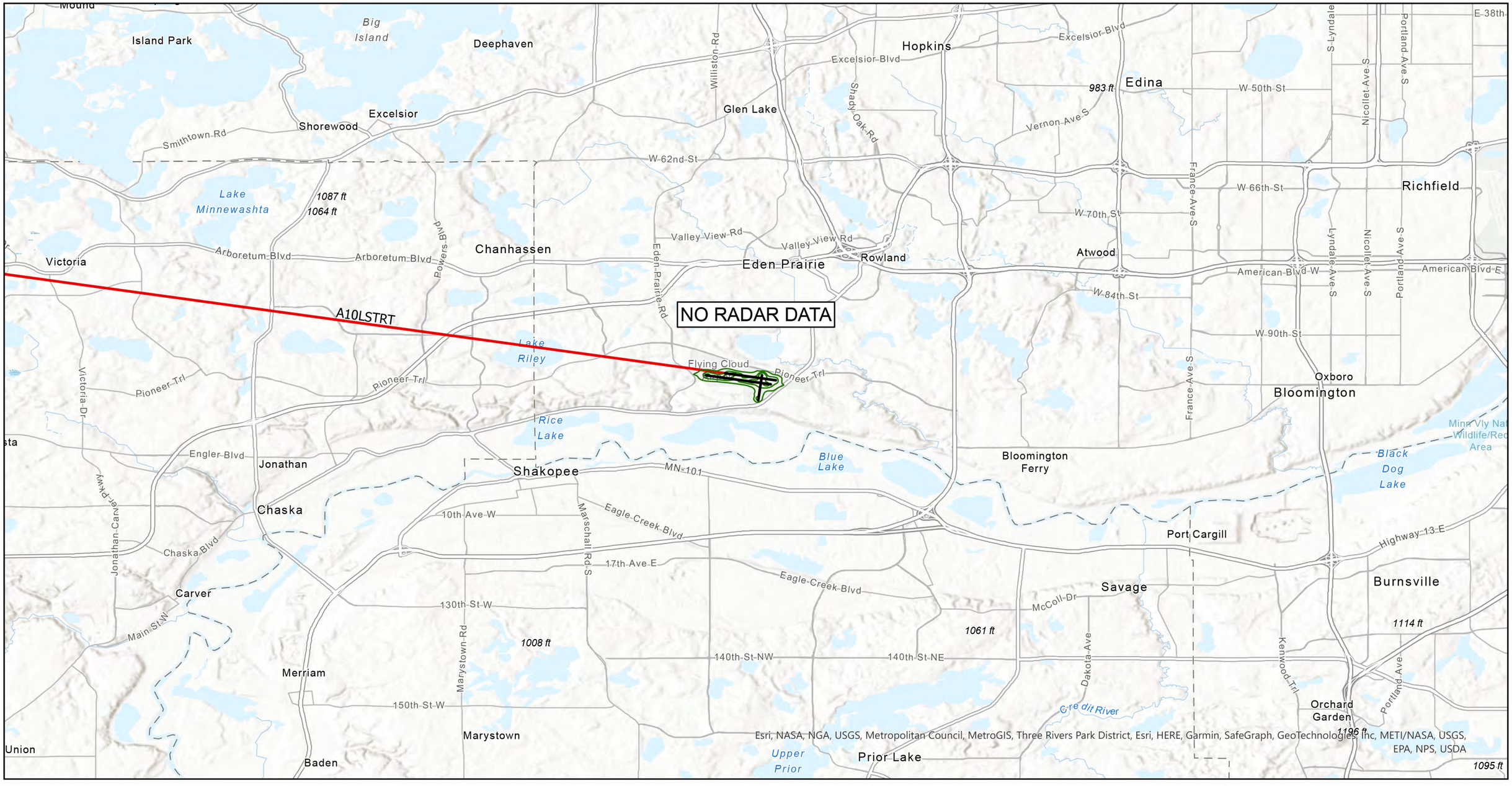
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 33
RUNWAY 28R DEPARTURES - TURBOPROP

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



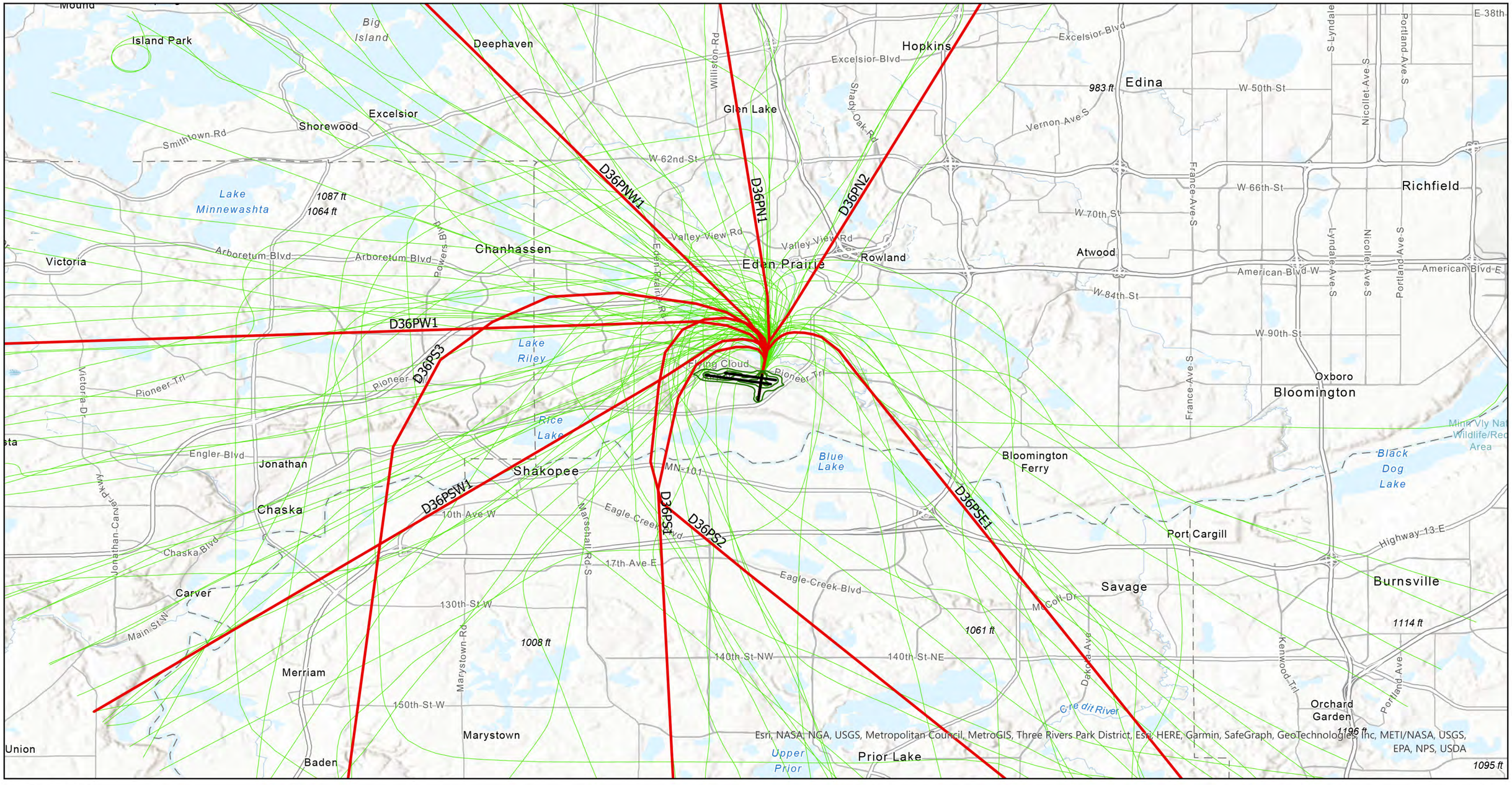
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 34
RUNWAY 36 DEPARTURES - JET

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



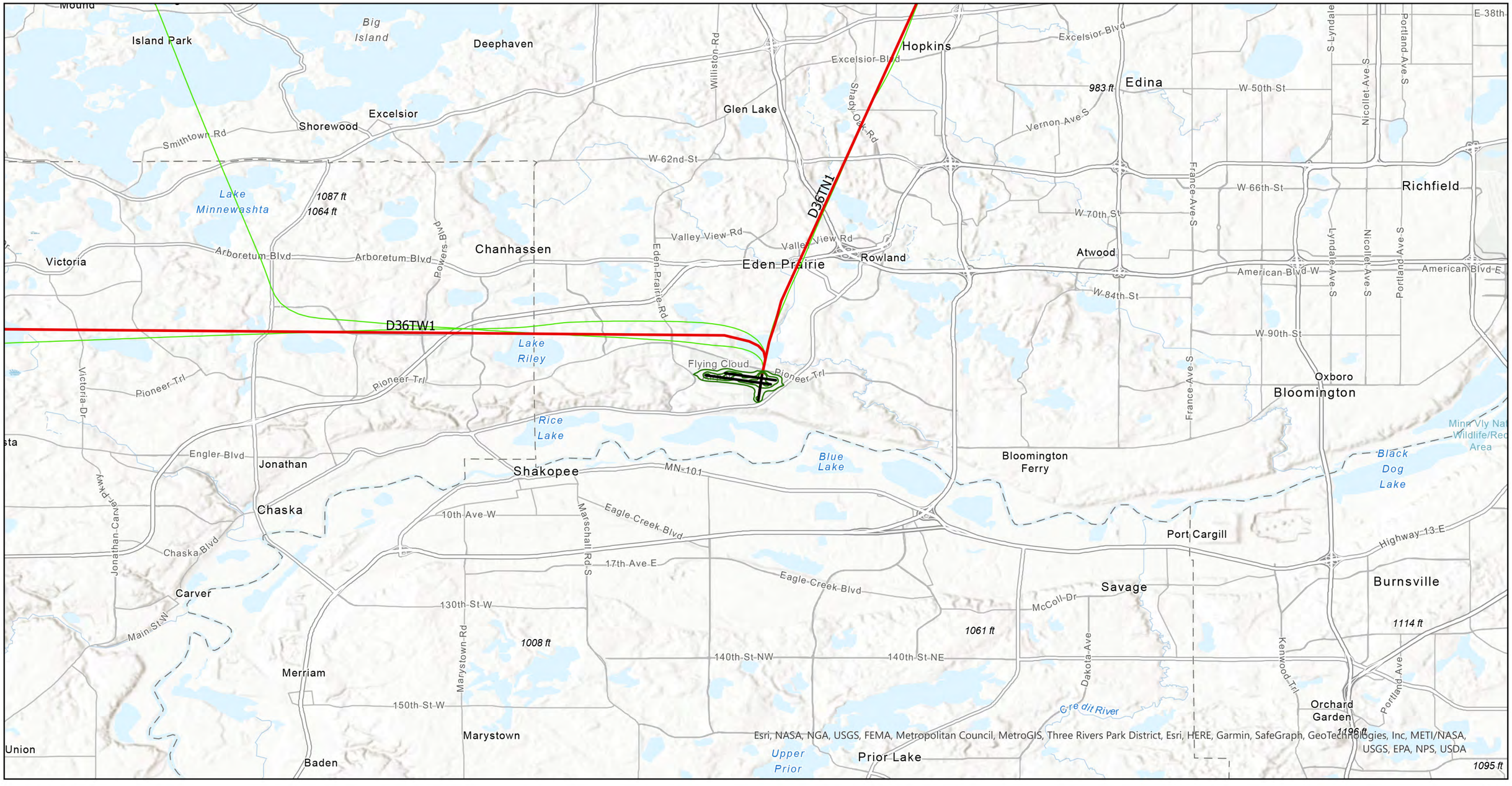
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 35
RUNWAY 36 DEPARTURES - PISTON

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



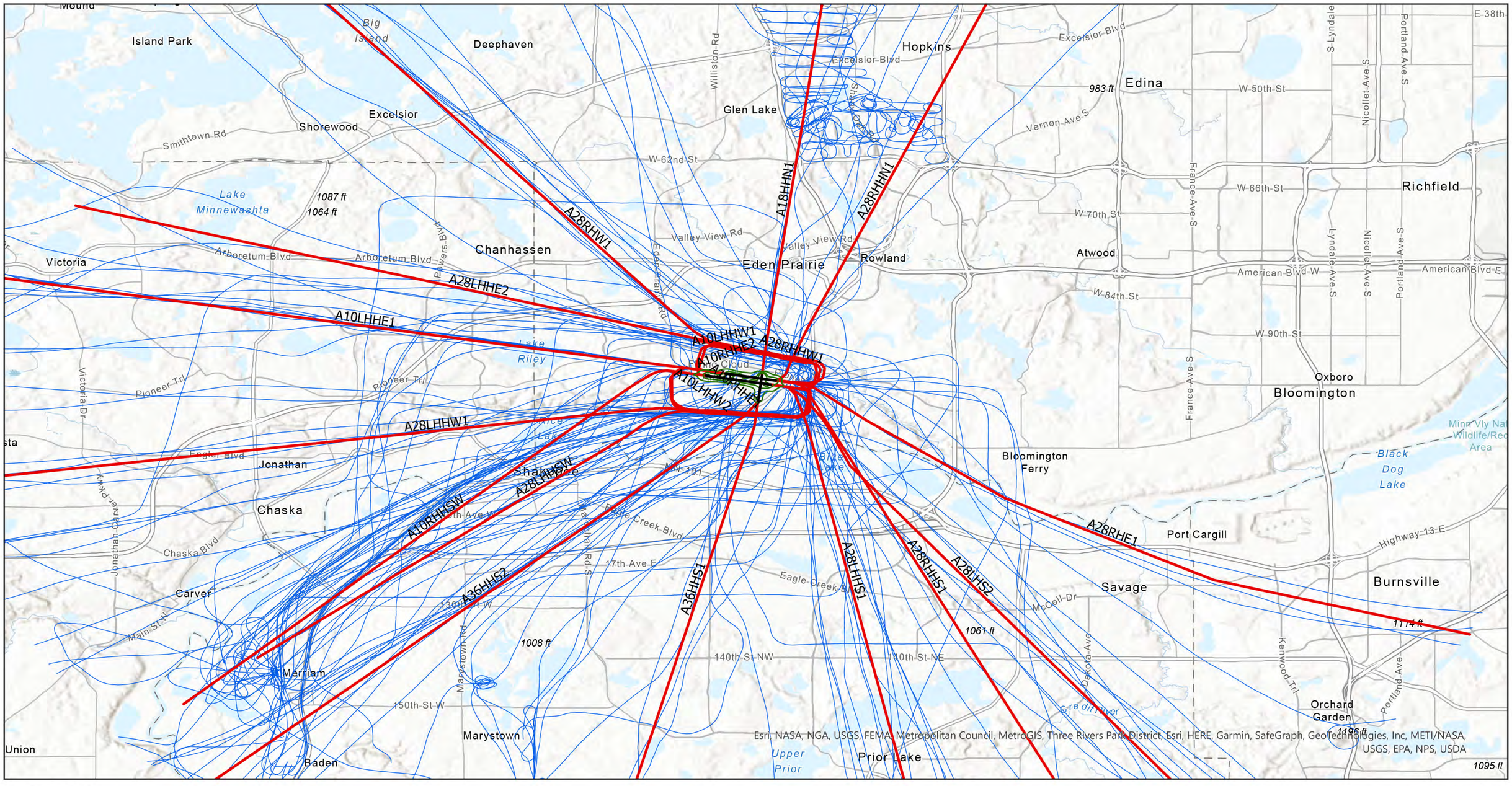
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 36
RUNWAY 36 DEPARTURES - TURBOPROP

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



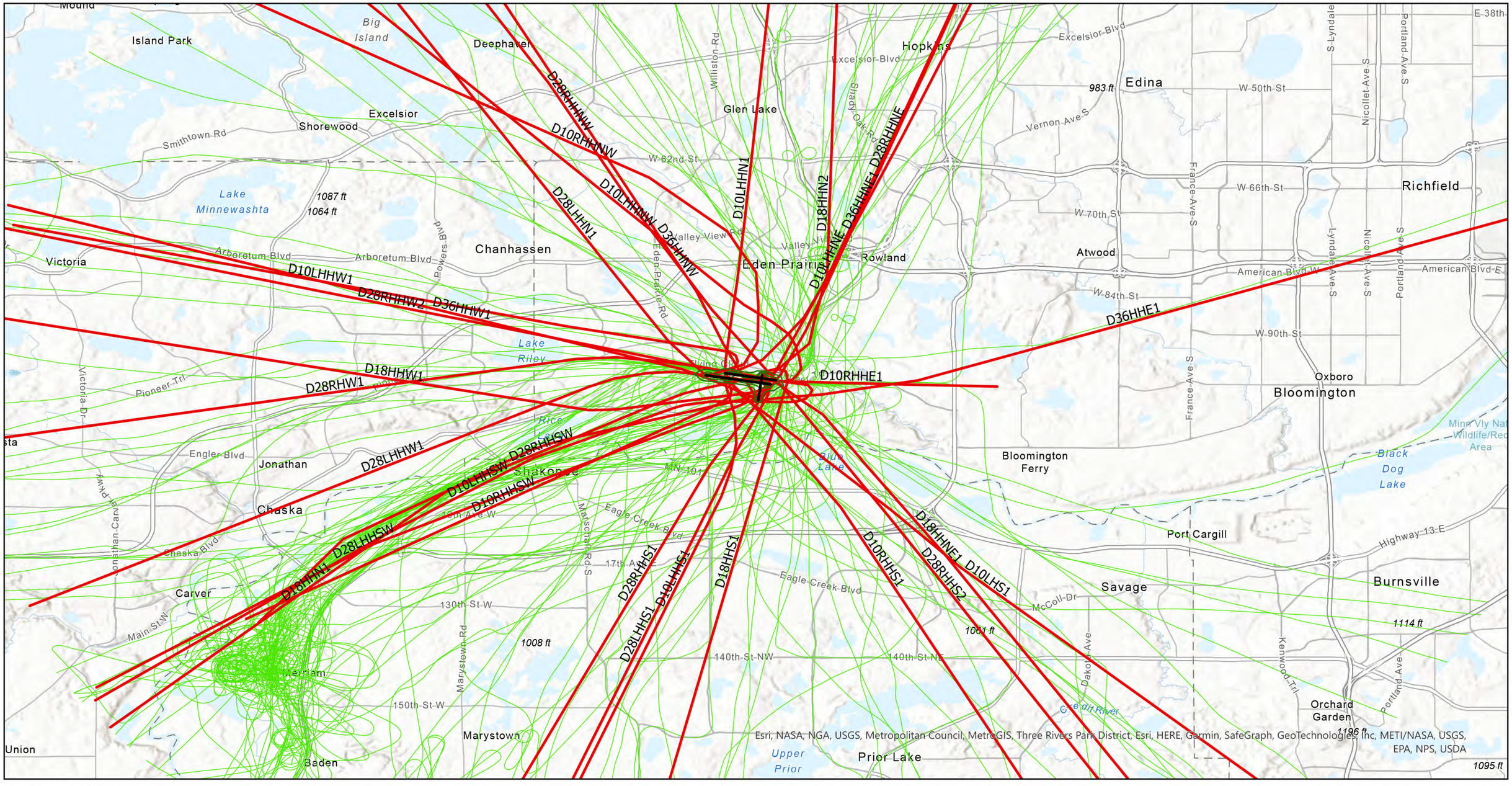
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 37
ARRIVALS - HELICOPTER

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



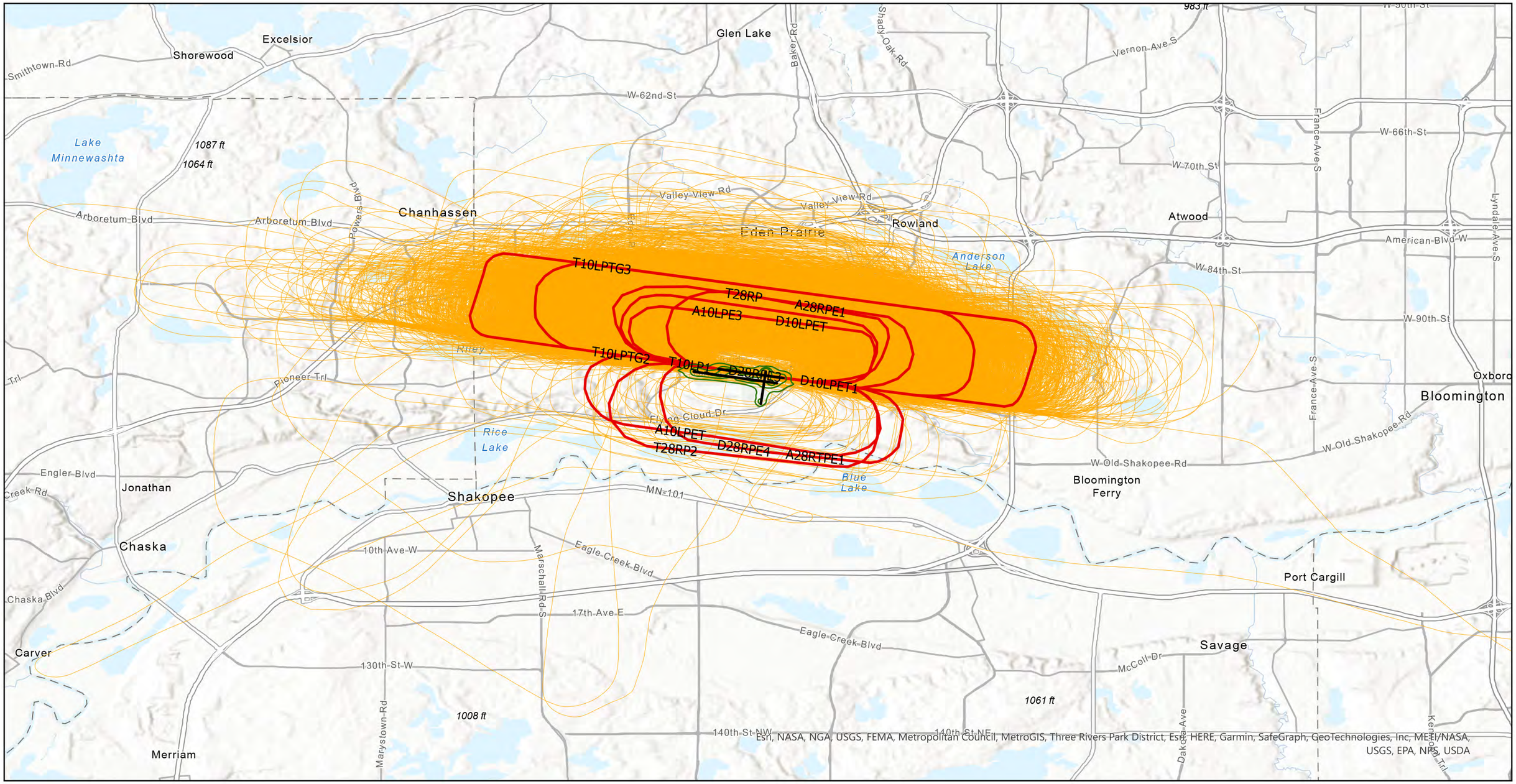
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 38
DEPARTURES - HELICOPTER

0 0.75 1.5 3 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



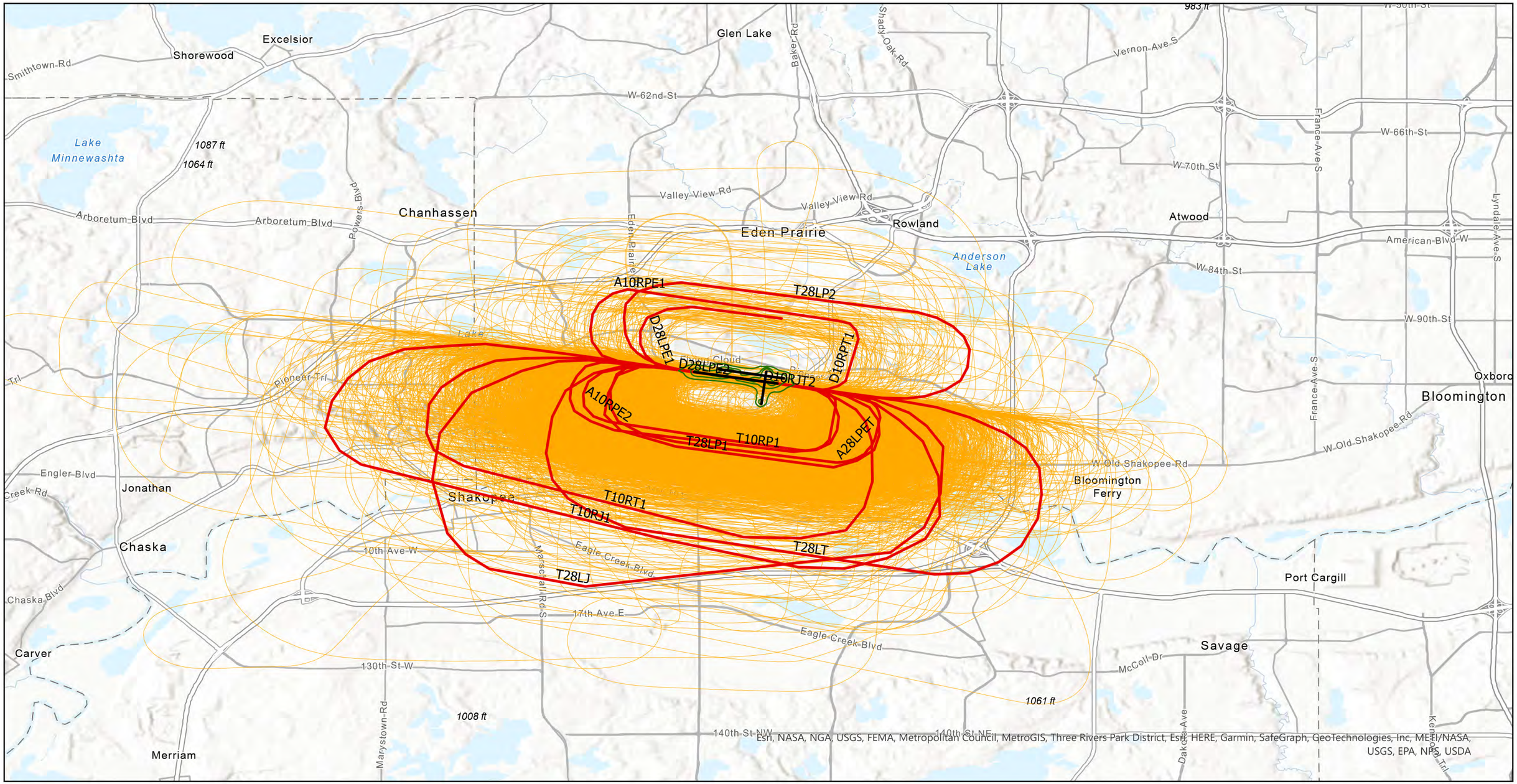
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 39
RUNWAY 10L /28R TOUCH AND GO

0 0.6 1.2 2.4 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



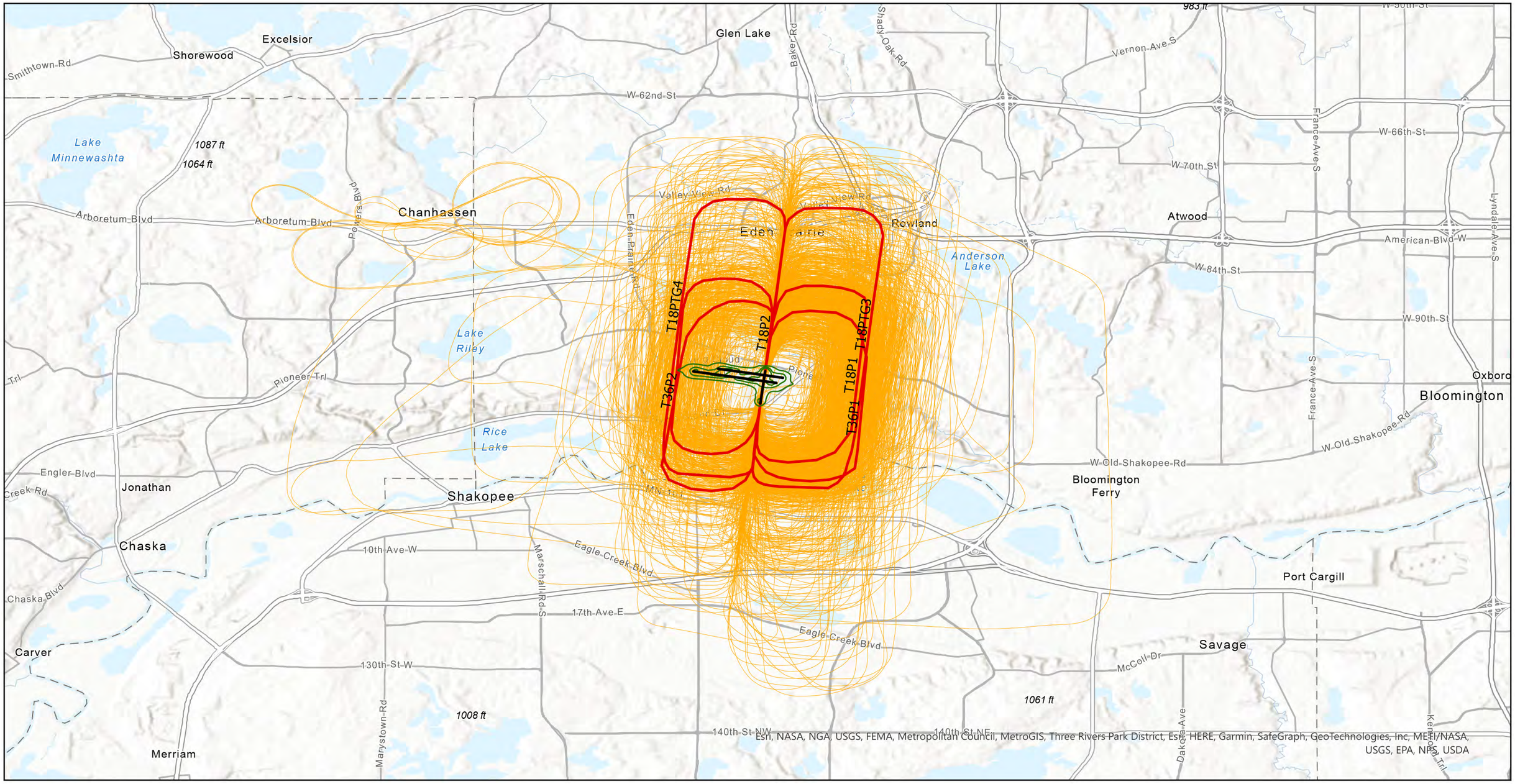
LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 40
RUNWAY 10R /28L TOUCH AND GO

0 0.6 1.2 2.4 Miles

Flying Cloud Airport 2040 LTP Noise Study – Representative Flight Track Development



LEGEND

- 2021/2040 Noise Model Flight Track
- 4-Month MACNOMS Radar Data Sample (Aug-2021, Nov-2021, Feb-2022, May-2022)
- 2025 Noise Contour (65 DNL - 75 DNL)

Figure 41
RUNWAY 18 /36 TOUCH AND GO

0 0.6 1.2 2.4 Miles

Flying Cloud (FCM) Long-Term Plan (LTP)
Noise Contour Draft Technical Memorandum

HNTB has been tasked to assist the Metropolitan Airports Commission (MAC) in support of the development of the 2021 Base Year and the 2040 Long-Term Plan (LTP) Noise Contours for the Flying Cloud Airport (FCM). This technical memorandum presents a summary of the methodologies and data sources used in the analysis and analyzes the changes between the 2021 Base Year and the 2040 LTP noise contours.

1. Introduction

The MAC provided HNTB the MAC Noise & Operations Monitoring System (MACNOMS) operations data between July 2021 and June 2022. This period was selected because MACNOMS was enhanced in July 2021 to accurately capture touch-and-go (TGO) operations, which are significant at FCM. HNTB developed the 2021 Base Year and the 2040 LTP fleet mixes based on MACNOMS data and FAA approved forecast. Following the development of the 2040 LTP fleet mix, the FAA Aviation Environmental Design Tool (AEDT), version 3e, was used to create the 2040 LTP noise contours. The following sections describe the inputs and outputs of the AEDT modeling process.

2. AEDT Inputs

HNTB prepared the noise contours using AEDT 3e. The fleet mix input was based on the 2040 LTP fleet mix as documented in **Attachment 1: Noise Contour Fleet Mix Draft Technical Memorandum**. For the noise analysis, HNTB assigned AEDT Aircraft Noise and Performance (ANP) aircraft types, determined AEDT Equipment IDs, calculated day/night split, and estimated stage lengths. The fleet mix with the AEDT ANP types is shown in **Attachment 2: AEDT Fleet Mix**. Runway and flight track usages were based on the MACNOMS data. The development of representative flight tracks is included in the **Attachment 3: Flying Cloud Airport Noise Flight Tracks Development.** Default weather parameters in AEDT were applied. The 1/3 arc-second terrain data from the United States Geological Survey (USGS) National Map (TNM) was used in this study.

2.1. Fleet Mixes

The latest 12-month MACNOMS data between July 2021 and June 2022 were used as the basis to develop fleet mixes. Aircraft that account for approximately 99% of the total MACNOMS operations were retained in the fleet mix. After arrivals and departures were balanced, a proprietary General Aviation (GA) operation forecast model was applied to project operations by each individual aircraft for 2040. In the end, projected operations were scaled to match the 2040 LTP forecast operations by Aircraft Approach Category (AAC), Airplane Design Group (ADG), and aircraft types (piston, turboprop, jet, military, and helicopter). The fleet mix input was based on the 2040 Average Annual Day (AAD) fleet mix as documented in **Attachment 1: Noise Contour Fleet Mix Draft Technical Memorandum**.

2.1.1 AEDT 3e ANP Aircraft and Substitution

The AEDT model includes a group of representative civilian fixing wing, military fixed-wing, and helicopter types with noise parameters called ANP aircraft types. It also provides pre-approved aircraft substitutions for instances where an aircraft type in a project does not have a direct match with the ANP aircraft types. For this project, HNTB assigned AEDT 3e ANP aircraft and Equipment IDs to the fleet based on aircraft types and FAA's aircraft registration database. In some cases, one particular aircraft type is operated by multiple airport operators, has multiple potential AEDT 3e aircraft types, or the FAA registration number database does not provide specific engine types.

For these cases, AEDT 3e aircraft types were assigned to an approximate percentage of overall operations by the airline or aircraft type. The fleet mix with the AEDT ANP types is shown in **Attachment 2: AEDT Fleet Mix.**

In some cases, aircraft that do not have an AEDT aircraft type or substitute aircraft are part of the fleet mix at an airport. In this situation, the FAA's Office of Environment and Energy (AEE) provides guidance on the identification of a suitable aircraft (with similar noise characteristics) for use in the model. For this project, an AEE coordination effort was undertaken to seek AEE's technical recommendation of the appropriate ANP aircraft types for the aircraft types which do not have direct ANP aircraft types or pre-approved substitutions. **Table 1** shows AEE's recommended AEDT aircraft parameters for the non-standard substitution.

Table 1: AEE Recommendation of Non-Standard Substitution

Aircraft ID	Description	ANP Code	Equipment ID	Airframe Code	Engine Model	BADA Code
HCG2	Guimbal Cabri G2	SC300C	3808	5179	IO-360-B	P28A
R66	Robinson R66	H500D	30	4809	250B17B	P28A
PA16	Piper PA-16 Clipper	GASEPF	6311	5639	O-200	C172
STOL	Cub Crafters Carbon Cub CCK-2000	GASEPF	6312	5594	O-320	P28A
B58T	Beechcraft Baron 58 Turbo	BEC58P	6251	5630	TIO-540-J2B2	BE58
A5	ICON A5	GASEPV	1887	4952	O-320	P28A
GYRO	AutoGyro GmbH Cavalon	R22	3807	5178	IO-320-D1AD	P28A

Source: FAA AEE recommendation, August 15, 2022.

2.2 Weather Parameters

The noise model allows for the modeling of atmospheric conditions in the calculation of noise exposure, taking into consideration temperature and humidity. Temperature is an important factor in aircraft performance, as higher temperatures decrease the density of air, which increases aircraft takeoff distance and reduces climb performance. This generally results in increased noise propagation in hot temperatures, as compared to colder temperatures.

Default weather parameters were applied in both the 2021 Base Year and the 2040 LTP noise contours, as per FAA guidance on the AEDT application to the National Environmental Policy Act (NEPA)[1]. The default weather parameters represent 10-year average values recorded at weather station 18736 (Flying Cloud) from the Integrated Surface Database (ISD) of the National Oceanic and Atmospheric Administration (NOAA). **Table 2** shows the weather parameters used in the study that reflects the most recent 10-year average (2012 through 2021).

[1] Guidance on Using the Aviation Environmental Design Tool (AEDT) to Conduct Environmental Modeling for FAA Actions Subject to NEPA, FAA, revised Oct 27, 2021.

Table 2: 2021 and 2040 AEDT Weather Inputs

Variable	AEDT Inputs
Temperature	46.6 degrees F
Dew Point	36.7 degrees F
Pressure	980.4 Millibars
Humidity	68.2 %
Headwind	7.5 knots

Source: AEDT default parameters at MSP, HNTB analysis, 2023

2.3 Terrain

Terrain data is used to account for effects that variations in terrain have on noise propagation. The 1/3 arc-second data from the USGS TNM was used in this study.

2.4 DNL and Day/Night Split

The FAA uses the Day-Night Average Sound Level (DNL) metric to analyze noise impacts with the exception of California which uses Community Noise Equivalent Level (CNEL). Therefore, DNL metric was used in the study. In DNL, a 10 dB penalty is added to those noise events occurring at nighttime (between 10 p.m. and 7 a.m.) to reflect the added intrusiveness of nighttime noise events when background noise levels are low and people are at rest. To account for this penalty, the fleet mixes were categorized into daytime (between 7 a.m. to 10 p.m.) operations and nighttime (between 10 p.m. and 7 a.m.) operations (day/night split).

Table 3 compares the day/night split in the 2021 Base Year and the 2040 LTP noise contours. The percentage of nighttime operations is expected to increase slightly from 4.2% in 2021 to 4.6% in 2040 as a result of higher projected growth rates of turboprops and jets which operate more frequently at nighttime than pistons. The total AAD operations would increase by 9.6%.

Table 3: 2021 and 2040 AAD Day/Night Split Comparison

Day/Night Split	2021	2040	Percent Change
Day	95.8%	95.4%	-0.4%
Night	4.2%	4.6%	0.4%
Total	100.0%	100.0%	

Totals may not sum up due to rounding.

Sources: MAC and HNTB analysis, 2023.

2.5 Stage Length

Stage length is a noise modeling term used to refer to trip distance for an aircraft departure from origin to destination and is a surrogate for aircraft weight. The trip distance influences the take-off weight (and therefore the thrust and performance) of the aircraft, as more fuel is required to fly longer distances and therefore adds weight to the aircraft. Departure stage lengths were calculated by the distances between MSP and destinations in MACNOMS. For records without destination airport information, the average stage length in 2021 (Stage Length 2) was applied. **Table 4** compares the stage length in 2021 and 2040. The comparison shows the percent changes in stage length are small.

Table 4: 2021 and 2040 Stage Length Comparison

Stage Length	Distance (nautical miles)	2021		2040	
		AAD	Percentage	AAD	Percentage
1	**0 - 500**	148.5	99.6%	162.4	99.6%
2	**500 - 1,000**	0.4	0.3%	0.4	0.2%
3	**1,000 - 1,500**	0.3	0.2%	0.2	0.2%
4	**1,500 - 2,500**	0	0.0%	0	0.0%
Total		149.1	100.0%	163.0	100.0%

Totals may not sum up due to rounding.
Sources: MAC and HNTB analysis, 2023.

2.6 Runway Use

Runway use represents how aircraft utilize the runway(s) and helipad(s) at an airport and is a primary factor in the determination of noise exposure. Runway uses in 2040 by airline and aircraft were assumed to be consistent with the 2021 runway uses. Since growth rates for individual aircraft types are different, the overall runway uses may change as a result.

Table 5 compares the runway uses in 2021 and 2040. In general, the projected 2040 LTP runway uses are consistent with the 2021 Base Year runway uses with minor variances as a result of fleet mix changes. Compared with the 2021 Base Year runway uses, the 2040 LTP departures from Runway 28R and 10L would decrease by approximately 4.5% and 2.1% whereas departures from Runway 10R and 28L would increase by approximately 2.6% and 4.2%. The 2040 LTP arrivals to Runway 10R and 28L would increase by approximately 1.6% and 1.1% whereas arrivals to Runway 10L and 28R would decrease by 1.1% and 1.5%. Changes on other runways are less than 1%. Note that the runway use calculations do not include helicopter operations.

Table 5: 2021 and 2040 Runway Uses Comparison

Operation Type	Runway[1]	2021		2040		Comparison	
		AAD	Percentage	AAD	Percentage	AAD	Percentage
Arrival	18	6.7	4.6%	7.2	4.5%	0.5	-0.1%
Arrival	36	2.3	1.6%	2.3	1.5%	0.1	-0.1%
Arrival	10L	13.3	9.1%	12.9	8.0%	-0.4	-1.1%
Arrival	28R	23.9	16.3%	23.9	14.9%	0.0	-1.5%
Arrival	10R	38.5	26.3%	44.7	27.9%	6.2	1.6%
Arrival	28L	61.4	42.1%	69.2	43.2%	7.8	1.1%
Arrival Total		146.0	100.0%	160.2	100.0%	14.1	0.0%
Departure	18	5.9	4.1%	6.4	4.0%	0.5	0.0%
Departure	36	1.8	1.3%	1.9	1.2%	0.1	-0.1%
Departure	10L	32.9	22.5%	32.7	20.4%	-0.2	-2.1%
Departure	28R	59.1	40.5%	57.6	36.0%	-1.5	-4.5%
Departure	10R	17.2	11.8%	22.9	14.3%	5.8	2.6%
Departure	28L	29.1	19.9%	38.5	24.1%	9.5	4.2%
Departure Total		146.0	100.0%	160.2	100.0%	14.1	0.0%
Touch and Go	18	2.4	7.6%	2.5	7.3%	0.2	-0.2%
Touch and Go	36	0.6	1.9%	0.6	1.8%	0.1	0.0%

Operation Type	Runway[1]	2021		2040		Comparison	
		AAD	Percentage	AAD	Percentage	AAD	Percentage
Touch and Go	10L	8.5	27.2%	9.3	26.9%	0.9	-0.2%
Touch and Go	28R	13.2	42.5%	14.5	42.1%	1.3	-0.4%
Touch and Go	10R	2.5	8.0%	2.8	8.1%	0.3	0.1%
Touch and Go	28L	4.0	12.9%	4.7	13.6%	0.7	0.7%
Touch and Go Total		31.1	100.0%	34.5	100.0%	3.4	0.0%

[1]: Excluding helipads.

Totals may not sum up due to rounding.

Sources: MAC Data and HNTB Analysis, 2023.

2.7 Flight Track Locations and Use

To determine projected noise levels on the ground, it is necessary to determine not only the frequency of aircraft operations, but also the altitude and location in which they fly. Flight routes to and from an airport are generally a function of the geometry of the airport's runways and the surrounding airspace structure near the airfield. The 2040 LTP flight track uses were assumed to be same as the 2021 Base Year flight track uses for the same aircraft. Detailed track use is included in **Attachment 4: Track Use**.

3. AEDT Outputs

DNL noise exposure was calculated using AEDT 3e in one decibel (dB) increments between 55dB and 85dB DNL with a standard grid. **Figure 1** depicts the 60dB – 75dB DNL noise contours in 5dB increments for the 2021 Base Year noise contour. **Figure 2** depicts the 2040 LTP noise contour. **Figure 3** shows a comparison between the 2021 Base Year and the 2040 LTP noise contours.

Table 6 shows the 60dB + and 65dB + DNL area of the 2021 Base Year and the 2040 LTP noise contours. The 60dB + and 65dB + DNL areas are projected to increase by 24.3% and 21.2% respectively from 2021 to 2040. The increases are primarily driven by increases in total operations (9.6%) and nighttime operations (0.4%). Since there's a 10-dB penalty for nighttime operations in DNL, a 0.4% increase in nighttime operations is equivalent to 4% increase in operations.

Table 6: Noise Contour Area (acre)

Areas	2021	2040	% Changes
60dB +	611.2	759.9	24.3%
65dB +	252.4	305.9	21.2%

Sources: MAC Data and HNTB Analysis, 2023.

Figure 1: 2021 Base Year Noise Contour

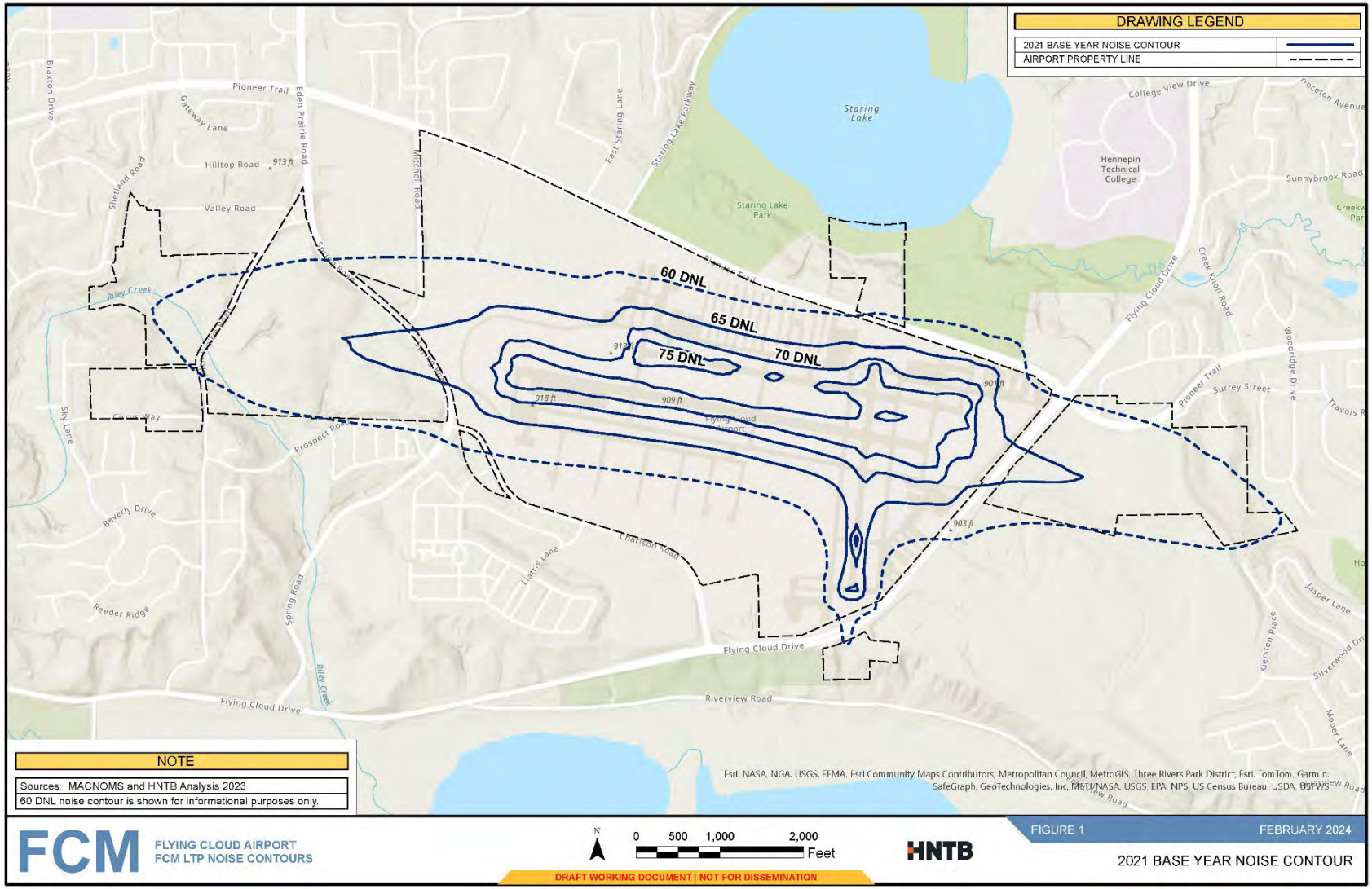


Figure 2: 2040 LTP Noise Contour

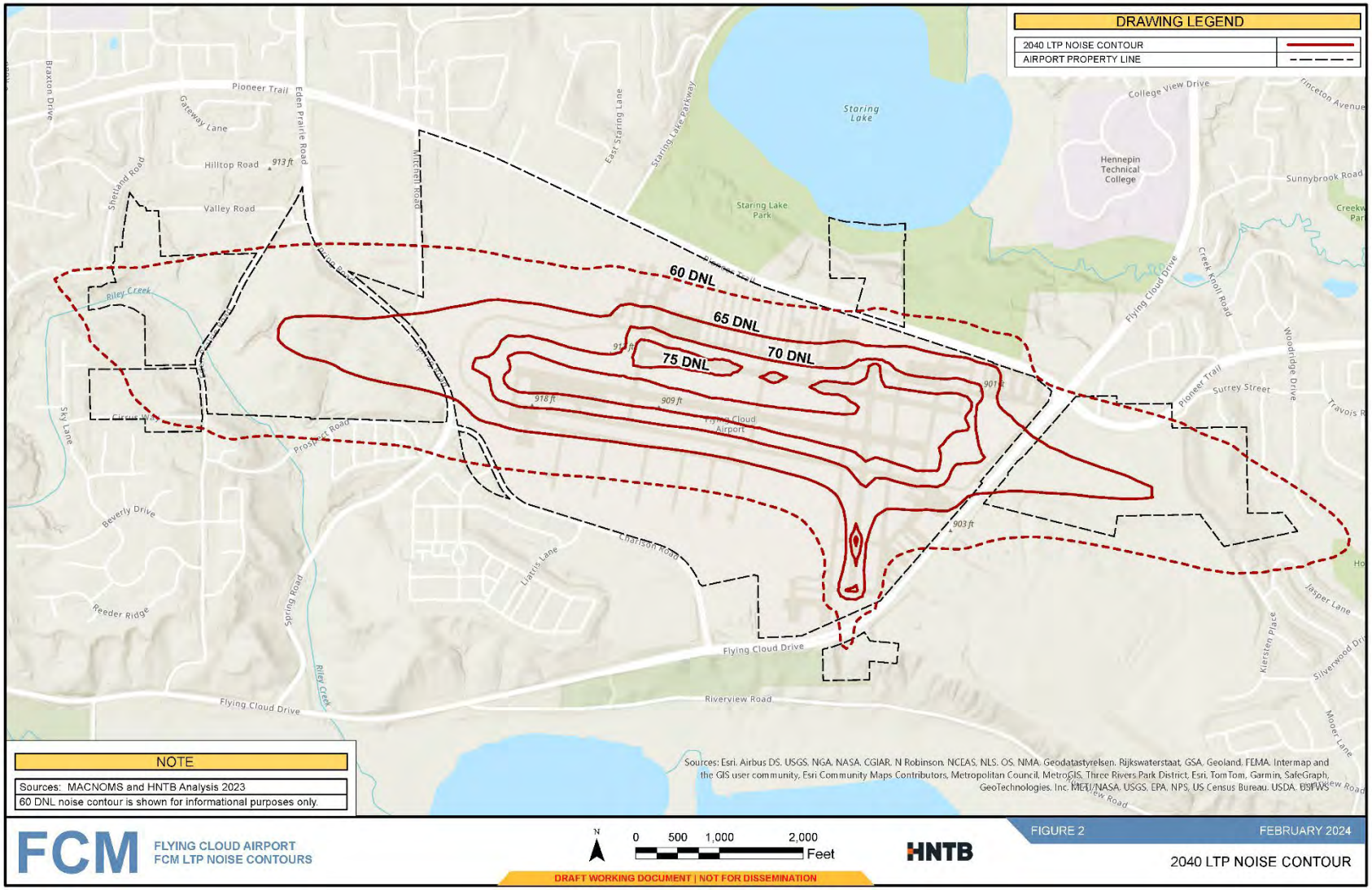
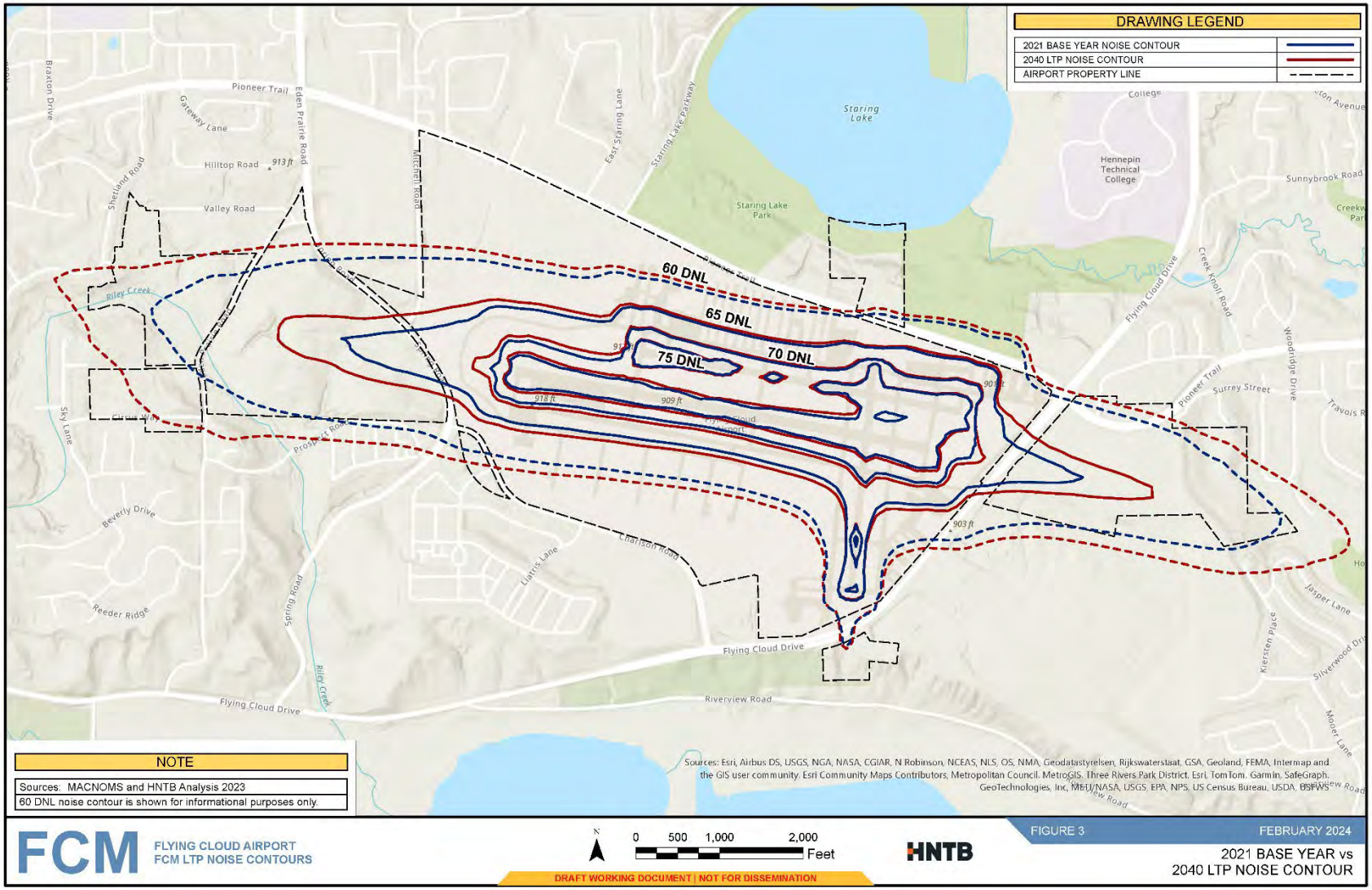


Figure 3: Comparison between the 2021 and 2040 Noise Contours



4. **Summary**

This technical memorandum documents the methodologies and data sources in the development of the 2021 Base Year and 2040 LTP noise contours. The 60dB + and 65dB + DNL areas are projected to increase by 24.3% and 21.2% respectively. The increases are primarily driven by increases in total operations (9.6%) and nighttime operations (0.4%).

As always, we appreciate the opportunity to provide noise analysis and support to the MAC. Should you have any questions regarding the content of this technical memorandum, please do not hesitate to call me at 540-257-3728 or email yxu@hntb.com.

Best Regards,

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