



DRAFT TOL NOSE STUDY REPORT

DRAFT 9/15/2022



RS&H

1.1 NOISE MODEL

The methodology for assessing noise exposure includes preparing Day-Night Average Sound Level (DNL) contours using the Federal Aviation Administration (FAA) Aviation Environmental Design Tool (AEDT) Version 3e. The AEDT works by defining a network of grid points at ground level around an airport. It then selects the shortest distance from each grid point to each flight track and computes the noise exposure generated by each aircraft operation, along each flight track. Corrections are applied for atmospheric acoustical attenuation, acoustical shielding of the aircraft engines by the aircraft itself, and aircraft speed variations. The noise exposure levels for each aircraft are then summed at each grid location. The cumulative noise exposure levels at all grid points are then used to develop noise exposure contours for selected values (e.g., DNL 65, 70, and 75).

1.2 AEDT INPUT DATA

In the development of DNL contours, the AEDT uses both default and airport-specific factors. The default factors include engine noise levels, thrust settings, aircraft arrival, and departure flight profiles, and aircraft speed. The airport-specific factors include the number of aircraft operations, the type of aircraft, runway use, the assignment of aircraft operations to flight tracks, local meteorological conditions, and operational time (day/night) data. The following describes these airport-specific data for TOL.

1.2.1 Meteorological Data

The AEDT accounts for the influences of meteorological conditions on aircraft performance and atmospheric sound absorption. Meteorological conditions affect the transmission of sound through the air. The AEDT uses temperature, pressure, and relative humidity to calculate atmospheric absorption coefficients, which in turn are used to adjust aircraft performance and sound propagation through the air. The 10-year average (2011 – 2020) meteorological conditions included in the AEDT for TOL are:

- » Temperature: 50.4° Fahrenheit
- » Barometric pressure: 991.02 millibars
- » Relative humidity: 71.0%

1.2.2 Aircraft Operations

The TOL 2021 annual operations¹ by category are provided in **Table 1**. As shown, annual operations in 2021 totaled 33,069 (an average of 91 operations per day).

TABLE 1
2021 ANNUAL AIRCRAFT OPERATIONS

Year	Air Carrier	Air Taxi and Commuter	GA Itinerant	Military Itinerant	GA Local	Military Local	Total Operations
2021	2,945	5,650	15,398	2,208	5,554	1,314	33,069

Source: FAA TAF, March 2022

For the purposes of preparing DNL contours, operational data were segregated by aircraft type. Aircraft operations and flight track data for 2021 were obtained from FAA's Office of Performance Analysis National Offload Program (NOP) Repository. The data included the specific aircraft type and the time at

¹ An aircraft operation is defined as one arrival or one departure.

which the operation occurred. The data was reviewed, and each aircraft type was assigned the corresponding AEDT aircraft type. For noise modeling purposes, all of the 3,522 military operations reported in the TAF that occurred at TOL in 2021 were modeled as F-16's. The 2021 aircraft operations and fleet are provided in **Table 2**.

TABLE 2
2021 AEDT AIRCRAFT OPERATIONS AND FLEET

Category	Representative Aircraft Type (s)	AEDT Equip ID	AEDT ANP	2021 Operations
Air Carrier	Boeing 737-800	203	737800	934
	Airbus A320	2451	A320-232	548
	McDonnell Douglas MD-83	2070	MD83	364
	McDonnell Douglas DC-9-10/30	1411	DC93LW	313
	Boeing 727-200	3845	727EM2	236
	Boeing 737-300	147	737300	232
	Airbus A319	949	A319-131	140
	McDonnell Douglas MD-82	2063	MD82	116
	Boeing 737-400	154	737400	51
	Boeing 767-300	397	767300	5
	McDonnell Douglas MD-81	2056	MD81	3
	Boeing 747-400	322	747400	3
AT/GA Jet	Embraer 135/145, Legacy 450	1713	EMB145	2,219
	Learjet 31/35/40/45/60/75, Hawker 800	2027	LEAR35	701
	Bombardier Challenger 300/350, CRJ-200	1238	CL600	603
	Cessna Sovereign/Latitude, HondaJet	6386	CNA680	501
	Cessna 525 Citation Jet CJ1/CJ3	6060	CNA525C	459
	Citation II/Bravo, Phenom 300, Embraer Legacy	4917	CNA55B	344
	Cessna 560 Citation V/Ultra	1298	CNA560U	344
	Cessna 750 Citation X, Falcon 2000	1312	CNA750	222
	Cessna 560 Citation XLS	6070	CNA560XL	212
	Cessna 560, Beechjet 400	5434	CNA560E	137
	Eclipse 500, Cirrus Vision SF50	6108	ECLIPSE500	70
	Gulfstream G280	4198	CL601	68
	Gulfstream G3/G400, Falcon 7X	1920	GIV	47
	Cessna Citation Mustang, Phenom 100	6062	CNA510	46
	Cessna Citation III	1234	CIT3	45
	Israel IAI-1125, Gulfstream 100/150/200	1977	IA1125	37
	Dassault Falcon 50/900	1320	FAL900EX	18
	Canadair Regional Jet CRJ-700	1251	CRJ9-ER	16
	Gulfstream GV	5356	GV	12
	Bombardier Global Express	1773	BD-700-1A10	8
	Bombardier Global 5000	2573	BD-700-1A11	5
	Antonov An-124 Ruslan	65	74720B	5
	Gulfstream G650	5461	G650ER	3
	Cessna 500 Citation I	1288	CNA500	2
AT/GA	Super King Air 200/300, Swearingen Merlin 3	1477	DHC6	784
Turboprop	Pilatus PC12, Cessna 208, Socata TBM7	1489	CNA208	481
	Cessna 441, Socata TBM-850, Piper Cheyenne	1278	CNA441	164

GA Piston	Embraer EMB-120 Brasilia	1708	EMB120	79
	Piper Malibu Meridian M500	1465	GASEPV	34
	Piper Cheyenne 400	1482	PA42	7
	DeHavilland DHC-8-300, CONVAIR CV-580	1330	DHC830	6
	Short 330	791	SD330	2
	Cessna 172 Skyhawk	1261	CNA172	9,717
	Piper Cherokee Arrow	3178	PA28	1,976
	Saratoga, TTx, Bonanza s 36, Mooney, DA-40	1465	GASEPV	1,757
	Cirrus SR20/22	6281	COMSEP	1,165
	Piper PA-30/44	6316	PA30	983
	Cessna 150/152, DA-20, AA-5	1882	GASEPF	958
	Baron 58, Cessna 310/340, Aztec, Aerostar	1196	BEC58P	953
	Cessna 182 Skylane	1262	CNA182	619
	Piper Malibu Mirage	6225	PA31	220
	Cessna 206 Stationair	3172	CNA206	130
Helicopter	Cessna T206 Turbo Stationair	6270	CNA20T	10
	Eurocopter EC-130, Airbus H135	3806	EC130	411
	Airbus AS355	4119	SA355F	10
	Eurocopter AS350	3810	SA350D	4
	A-109	28	A109	4
Military	Robinson R-44	3161	R44	4
	F-16	1800	F16PW0	3,522
			Total	33,069

Source: FAA NOP; RS&H, 2022

1.2.3 Time of Day

Aircraft operations modeled in the AEDT are assigned as occurring during daytime (7:00 a.m. to 9:59 p.m.) or nighttime (10:00 p.m. to 6:59 a.m.). The calculation of DNL includes an additional weight of 10dB for those operations occurring at night. The modeled time-of-day percentages are summarized in **Table 3**.

TABLE 3
2021 MODELED AIRCRAFT CATEGORY TIME OF DAY

Aircraft Category	Percent Time of Day			
	Departures		Arrivals	
	Day	Night	Day	Night
Air Carrier	88%	12%	60%	40%
GA Jet	83%	17%	80%	20%
GA Turboprop	89%	11%	87%	13%
GA Piston	92%	8%	87%	13%
GA Helicopter	77%	23%	83%	17%
Overall	87%	13%	80%	20%

Source: FAA NOP; RS&H, 2022

1.2.4 Runway Use

Runway use refers to the frequency with which aircraft utilize each runway end for departures, arrivals, and touch-and-go operations. The more often a runway is used, the more noise is generated in areas located off each end of that runway. Wind direction and speed dictate the runway directional use (or flow) of airports. From a safety and operational standpoint, it is preferable for aircraft to arrive and depart into the wind. Aircraft operations and flight track data for 2021 were obtained from FAA's NOP. The data included departure, arrival, and touch-and-go radar flight tracks at TOL and was used to develop the runway use. The runway use estimates were then reviewed by the ATCT manager. The AEDT modeled runway use is included in **Table 4**.

TABLE 4
MODELED RUNWAY USE

Aircraft Category	7	25	16	34	Total
Departures					
Air Carrier	26%	74%	-	-	100%
GA Jets and Turboprops	27%	71%	1%	1%	100%
GA Piston	26%	71%	2%	1%	100%
Arrivals					
Air Carrier	38%	62%	-	-	100%
GA Jets and Turboprops	31%	66%	-	3%	100%
GA Piston	33%	62%	1%	4%	100%
Touch-and-Go					
Piston	30%	60%	5%	5%	100%

Source: FAA NOP; RS&H, 2022

1.2.5 Modeled Aircraft Flight Tracks

Flight tracks refer to the route an aircraft follows when arriving to or departing from a runway. The location of flight tracks is an important factor in determining the geographic distribution of noise contours on the ground. The AEDT uses airport-specific ground tracks and vertical flight profiles to compute three-dimensional flight paths for each modeled aircraft operation. The "default" AEDT vertical profiles, which consist of altitude, speed, and thrust settings, are compiled from data provided by aircraft manufacturers. The AEDT flight tracks were developed using the FAA's NOP data. The AEDT modeled flight tracks, overlaid on a sample of the NOP radar tracks, for north flow and south flow are depicted on **Figures 1** and **2** respectively. The modeled flight track use percentages are shown in **Table 5**.

TABLE 5
MODELED FLIGHT TRACK USE

MODELED FLIGHT TRACK USE

Track ID								
East Flow Departures								
Runway 7	7D1	7D2	7D3	7D4	7D5	7D6	Sum	
Air Carrier	10%	15%	40%	10%	25%	-	100%	
GA Jet	5%	10%	35%	25%	25%	-	100%	
GA Turboprop	5%	10%	35%	25%	25%	-	100%	
GA Piston	10%	15%	5%	20%	30%	20%	100%	
East Flow Arrivals								
Runway 7	7A1	7A2	7A3	7A4				
Air Carrier	100%	-	-	-	100%			
GA Jet	85%	15%	-	-	100%			
GA Turboprop	85%	15%	-	-	100%			
GA Piston	30%	10%	35%	25%	100%			
West Flow Departures								
Runway 25	25D1	25D2	25D3	25D4	25D5	25D6	25D7	
Air Carrier	15%	25%	15%	40%	5%	-	-	100%
GA Jet	15%	20%	25%	25%	15%	-	-	100%
GA Turboprop	15%	20%	25%	25%	15%	-	-	100%
GA Piston	10%	5%	15%	5%	15%	25%	25%	100%
West Flow Arrivals								
Runway 25	25A1	25A2	25A3	25A4	25A5	25A6		
Air Carrier	-	30%	-	-	-	70%	100%	
GA Jet	10%	25%	15%	-	-	50%	100%	
GA Turboprop	10%	25%	15%	-	-	50%	100%	
GA Piston	15%	-	10%	15%	20%	40%	100%	

Source: FAA NOP; RS&H, 2022

1.2.6 DNL Contours

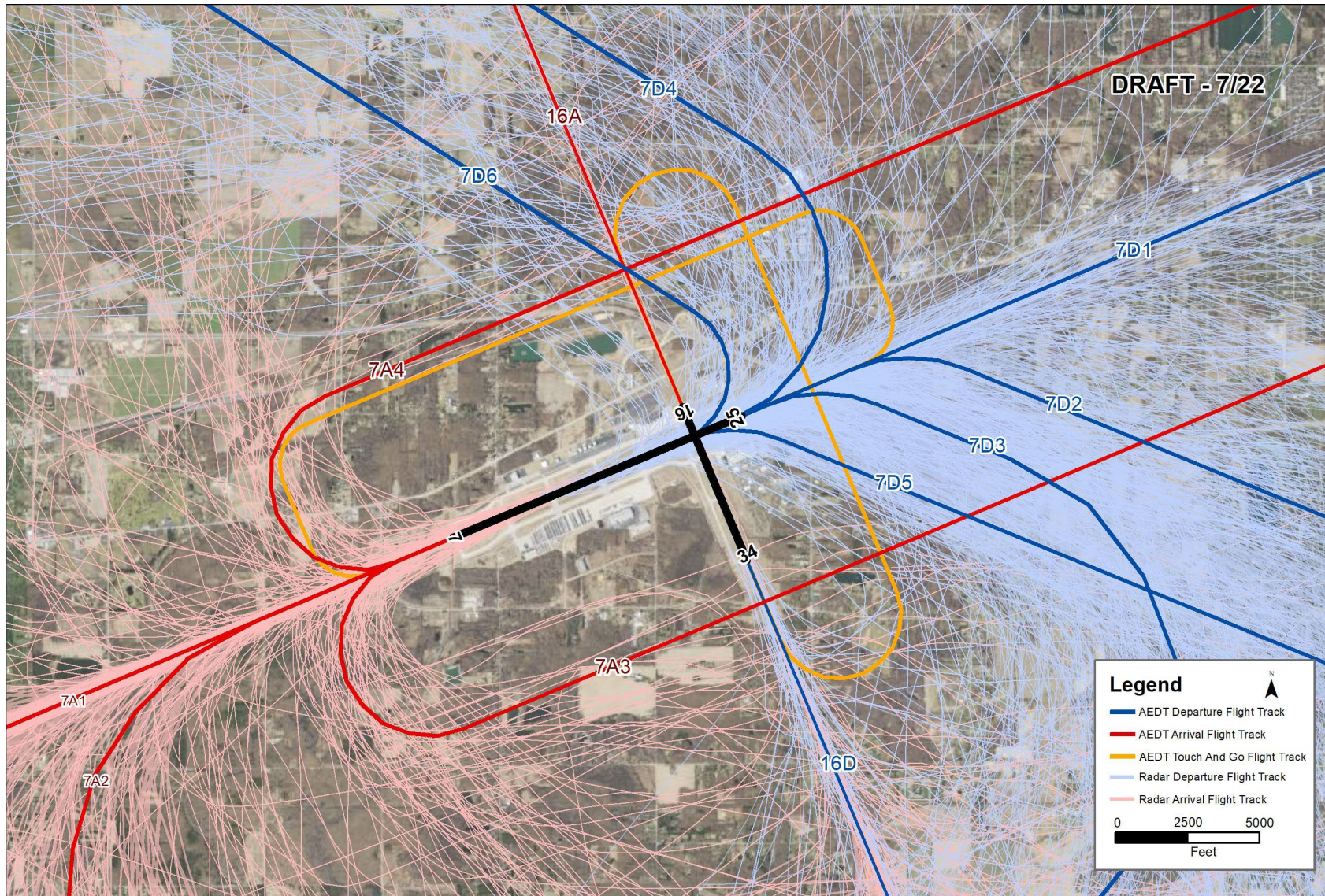
The 2021 65-75 DNL contours are provided on **Figure 3. Table 6** identifies the areas within the DNL contour ranges. As shown in the table, the total area within the 65 and greater DNL contour is approximately 1.61 square miles. The size of the contours are largest west of the airport as a result of aircraft departing to the west a majority of the time.

TABLE 6
2021 DNL CONTOUR AREAS

DNL Range	Area (sq. mi.)
65 - 70	0.88
70 - 75	0.40
75+	0.33
Total	1.61

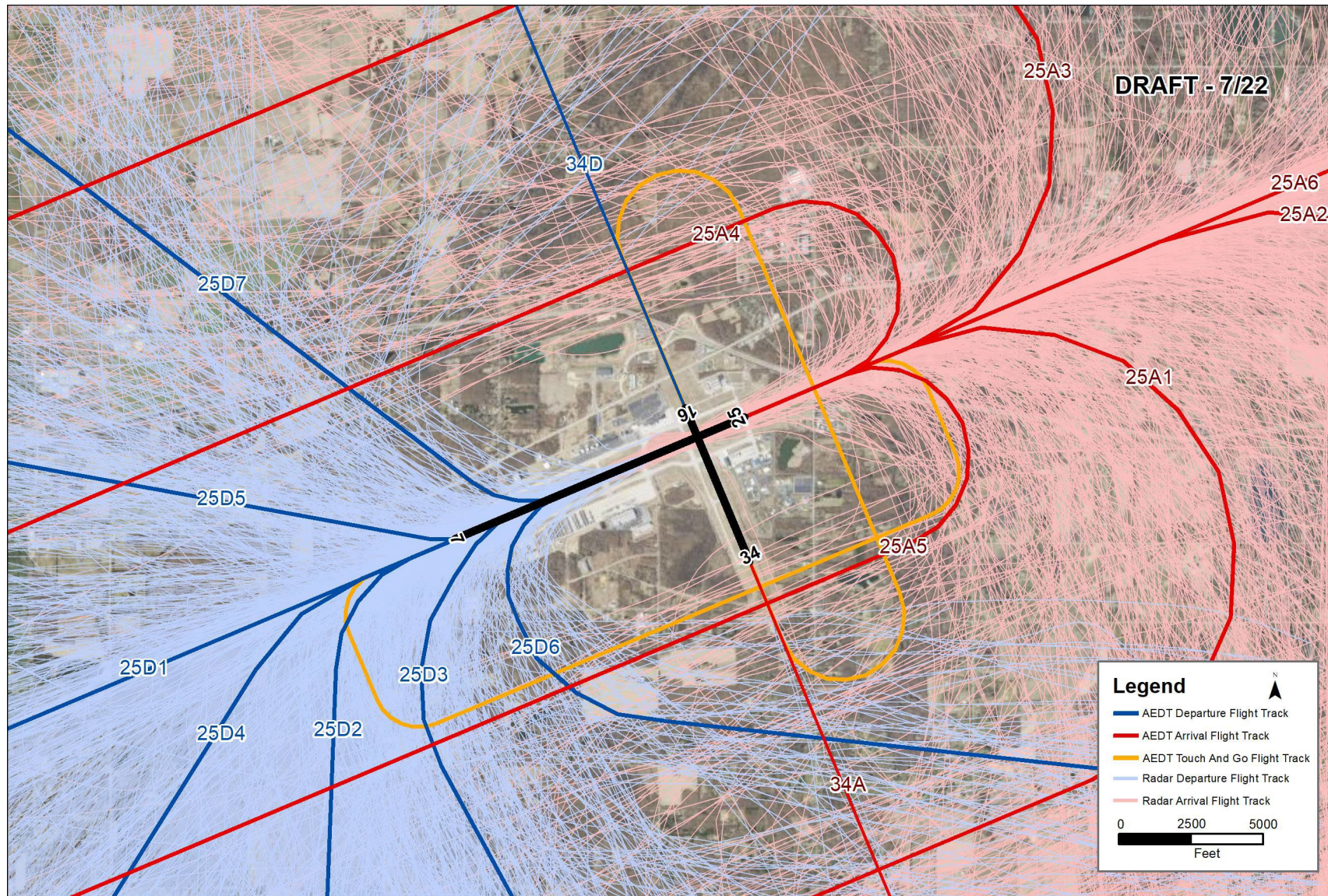
Source: RS&H, 2022

FIGURE 1
AIRCRAFT FLIGHT TRACKS –EAST FLOW



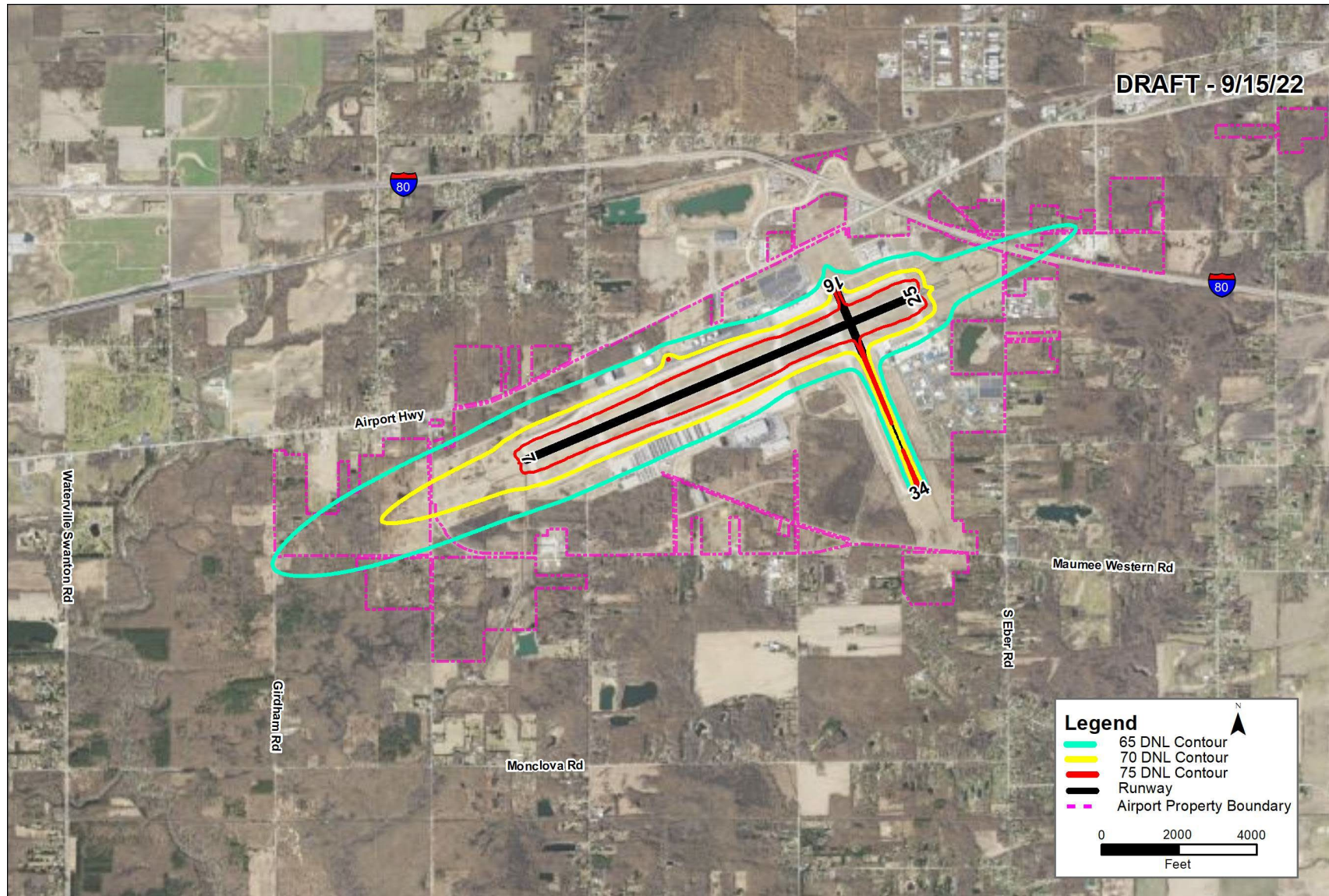
Source: FAA NOP; RS&H, 2022

FIGURE 2
AIRCRAFT FLIGHT TRACKS –WEST FLOW



Source: FAA NOP; RS&H, 2022

FIGURE 3
2021 DNL CONTOURS



Source: RS&H, 2022

FIGURE 4
2041 DNL CONTOURS

Future Data /Contours
(to be provided)