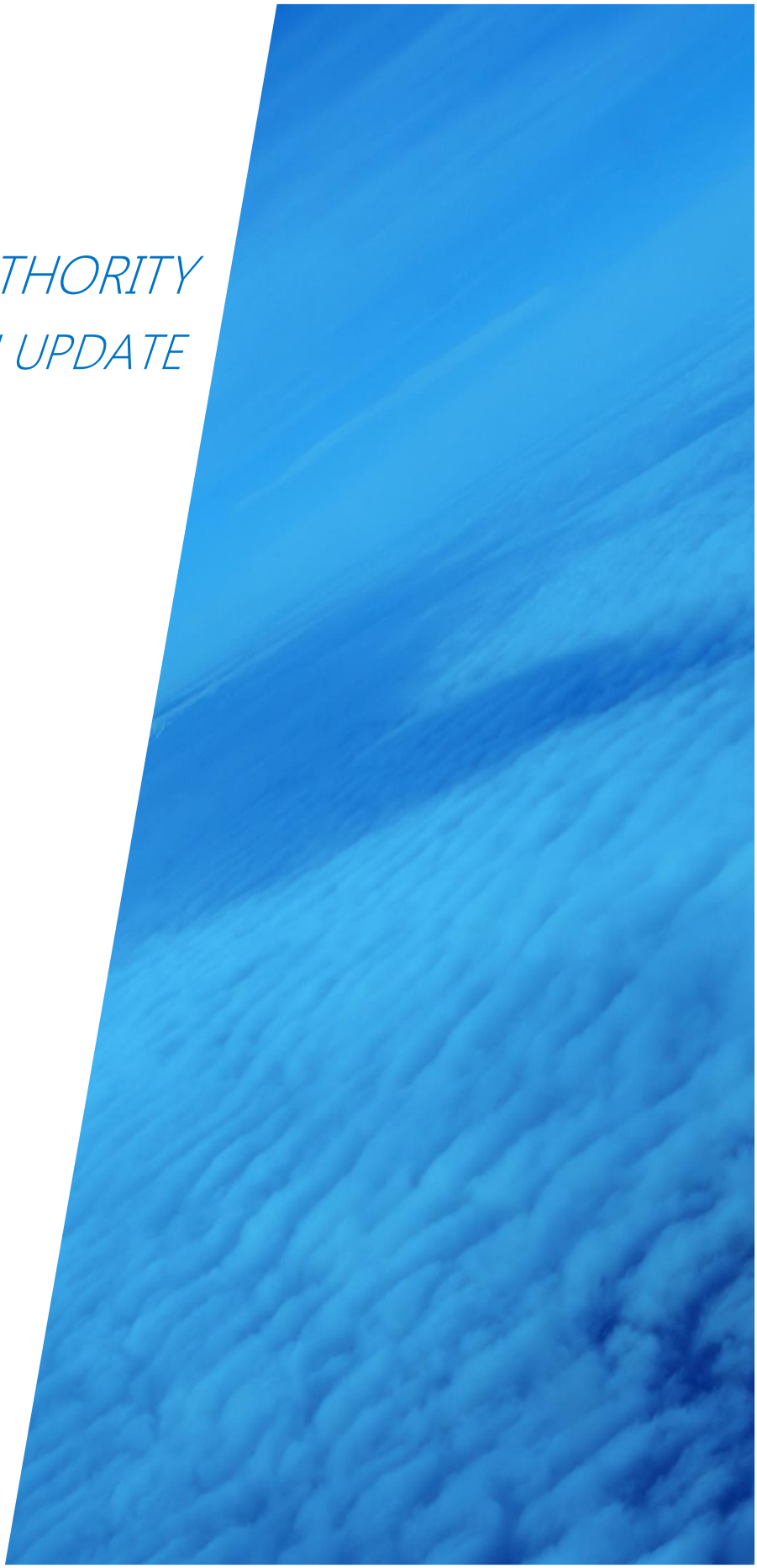
DULUTH AIRPORT AUTHORITY
AIRPORT MASTER PLAN UPDATE

JANUARY 2015



RS&H

DULUTH AIRPORT AUTHORITY

AIRPORT MASTER PLAN UPDATE

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Prepared by RS&H, Inc. at the
direction of Duluth Airport Authority]

RS&H

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CHAPTER 1
EXECUTIVE SUMMARY

STUDY PURPOSE

The Airport Master Plan for the Duluth International Airport (DLH) is the Duluth Airport Authority's strategy for future development of the Airport. The master plan which was prepared over the period 2010-2013 presents a combination of technical analyses completed to identify the future needs of the Airport and the strategic vision of the Authority. As part of the inception of the study, a strategic plan identified the following goals for the Airport:

- Determine an ultimate Runway 9-27 Length.
- Identify Pavement Rehabilitation & Phasing / Pavement Condition Index Study.
- Justify Runway Length for Secondary Commercial Service Runway.
- Address FAA and Mn/DOT Standards:
  - Taxiway Separation & Intersection Configuration; and,
  - Land Use Zones.
- Study the North Airport Business Development Area.
- Plan for redevelopment of General Aviation Area(s).
- Identify New/Replacement Air Traffic Control Tower Site.
- Conduct Planning Coordination with Air National Guard.
- Conduct Planning Coordination with Golden Triangle Study.
- Identify a Future Airport Surveillance Radar Relocation Site.
- Generate an Updated Airport Property Mapping / Land Acquisition Plan.

The Airport Master Planning process first develops a forecast of aviation activity for an Airport over a 20-year planning period. Based on the forecast, facility improvements needed to accommodate the demand indicated by the forecast are identified. Development alternatives for facility improvements, based on the forecast and the Authority's Strategic Plan, are created and a thorough analysis results in selection of a most feasible alternative. The selection of a most feasible alternative includes consideration of potential environmental impacts which identified early on in the process. The final step of the plan includes identifying funding sources and obligations necessary to implement the plan.

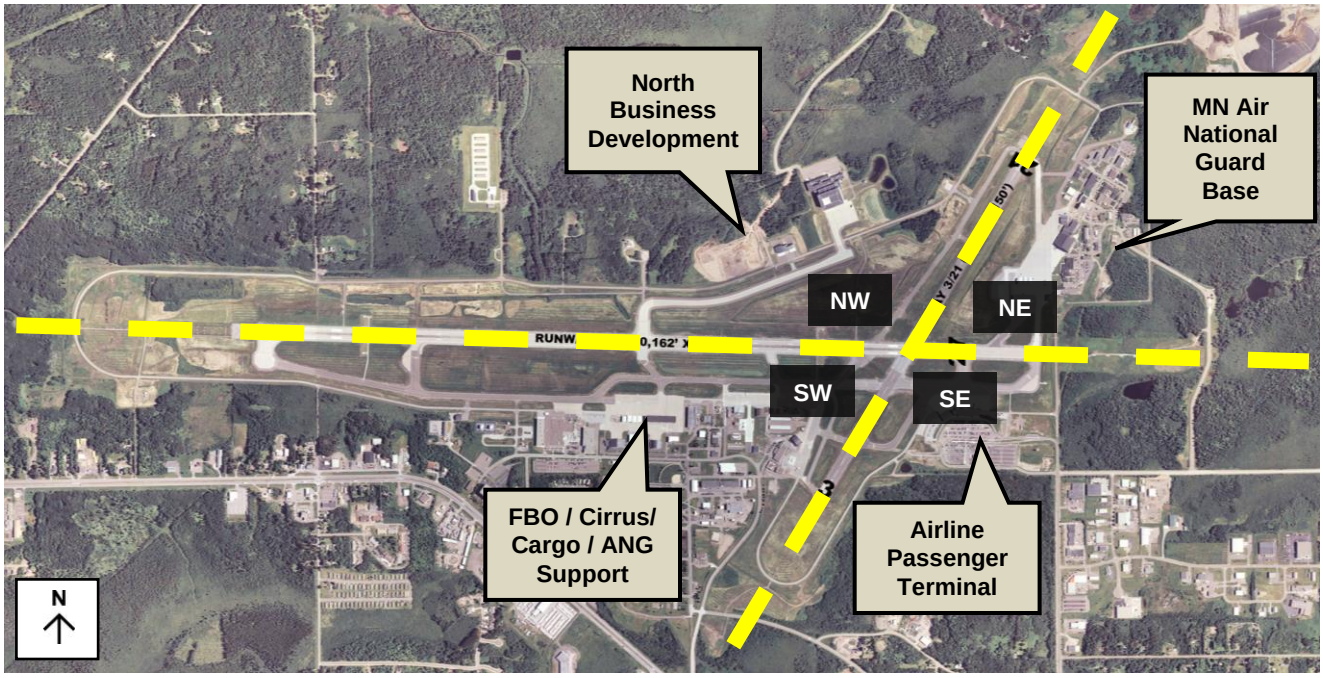
EXISTING CONDITIONS AND FORECAST

DLH is five miles northwest of the City of Duluth, located in northeastern Minnesota along Lake Superior, 150 miles north of Minneapolis in St. Louis County. The metropolitan area, which includes Duluth and Superior, combines nearly 275,000 residents and is the third largest in the State of Minnesota. Jurisdictions adjoining the Airport include the City of Hermantown, Canosia Township and Rice Lake Township.

The Airport is geographically segregated into four quadrants, by virtue of the runway orientation as shown on ES-1. Each of the quadrants, as described below, is predominately characterized by distinct aeronautical uses and tenant activities.

Southeast Quadrant	Passenger Terminal Area (Building, Airline Ramp and Auto Parking)
Southwest Quadrant	General Aviation (Fixed Base Operator, Special Aviation Service Organizations, Air Cargo, Air Traffic Control, and Air National Guard Support Facilities)
Northwest Quadrant	Large Commercial and General Aviation Business Tenants, Airport Support and Navigational Facilities.
Northeast Quadrant	Minnesota Air National Guard Complex

Exhibit ES-1
AIRPORT AREA QUADRANTS



Source: Airport Aerial Image, June 2010.

The government entities surrounding the Airport include the City of Duluth in which the airport is located, the City of Hermantown to the southwest, Canosia Township to the northwest, and Rice Lake Township northeast of the Airport. The four political jurisdictions are within St. Louis County, in which the County does not assume zoning authority for the surrounding government entities.

There are two runways at the Airport, primary Runway 9-27, 10,162 feet in length and oriented in an east-west direction. Runway 3-21 is a secondary commercial service runway of 5,719 feet in length and oriented in a northeast-southwest direction; the runway serves airline traffic during crosswind conditions during the winter. Also, there is a network of taxiways that provide access to and from the runways.

In 1989, the three-story passenger terminal building was interconnected to form a single enclosure totaling 106,000 square feet. With the post September 11 era of new federal security requirements and proximity to runway airspace surfaces, the passenger terminal building became functionally obsolete. In 2010, a replacement passenger terminal of 114,000 square feet, expanded apron, new auto circulation and vehicle parking facilities was opened.

Aviation forecasts are the basis for assessing the capacity of the existing Airport facilities and provide planning guidance for proposed facility expansion or renewal. The forecast of aviation activity considers five main aircraft categories: passenger enplanements; aircraft operations by air carrier (including passenger and cargo); general aviation based aircraft and operations; and military. For this master plan, the forecast developed two scenarios in addition to the base case scenario which uses the FAA Terminal Area Forecast (TAF). The TAF average annual growth rate for DLH is 1.1 percent whereas the annual average growth rates for the two scenarios are 1.9 percent and 2.4 percent. The TAF forecast period used in the forecast evaluation is 2010-2030. The DLH forecast, summarized in Table ES-1, uses the FAA forecast rate of 1.1 percent average annual growth rate for passenger enplanements over the 20-year forecast period. Facilities requirements includes consideration of space needs for additional facilities that might be needed if the airport grows at a faster rate than the baseline forecast in order to maintain flexibility for future expansions if they were to occur.

Table ES-1
FORECAST SUMMARY

Activity Measure	2010	2015	2020	2025	2030
COMMERCIAL PASSENGERS					
Annual Enplaned - Actual	155,955				
Annual Enplaned - FAA TAF	137,564	150,779	165,529	182,004	200,409
Peak Hour-Enplanements	150	150	150	150	150
ANNUAL OPERATIONS					
Commercial	10,900	11,500	12,200	12,900	13,600
General Aviation	38,700	42,000	45,400	49,100	53,100
Military	9,400	9,400	9,400	9,400	9,400
Total	59,000	62,900	67,000	71,400	76,100
BASED AIRCRAFT					
Total	87	92	99	105	110

Source: FAA TAF, 2010; Duluth Airport Authority, 2011; and RS&H, 2011

ENVIRONMENTAL CONSIDERATIONS

An environmental overview for DLH was conducted in accordance with FAA Order 5050.4B, *The Airport Environmental Handbook,* and serves two purposes in a master plan. The first is to identify areas of potential environmental concern to be considered during the defining and evaluating of the Airport development alternatives. The second purpose of the environmental overview is to identify potential environmental factors that need to be considered during the implementation of the development plan.

The primary potential impact for consideration in the master plan is any development that may impact Miller Creek. Miller Creek represents protected headwaters of a trout stream. Minnesota environmental standards do not allow construction within 250 feet of a natural feature classified as a protected headwater. Specifically, the two environmental categories of consequence for consideration with regard to future airport master plan development activities are:

- Floodplains - Floodplains are defined as lowland and relatively flat areas adjoining inland and coastal waters. Any project that impacts Miller Creek will need an individual evaluation to determine the potential flood plain impact. It is recommended that a hydraulic detailed survey of the Miller Creek flood plain area be conducted should an eastward extension of Runway 9/27 occur, which is considered an ultimate project and beyond the 20-year timeframe of the master plan. All other proposed airport projects appear to have a minimal impact on waterways.

- Wetlands - Proposed construction in the vicinity of the wetlands requires a permitting process involving preliminary wetlands assessments. Wetland impacts will occur if Runway 3-21 is extended or Taxiway 'C' extended to the northeast. This proposed project (2,400' Runway 3-21 extension northeast with parallel Taxiway 'C') would impact at least 12 acres of wetlands which would require replacement off of the airport and clear of aircraft flight paths and movement areas. The extent of this impact will need to be evaluated during development layout to minimize the impact. There are several wetlands areas on the northwest area that can be found in the National Wetlands Inventory database thereby strictly limiting future development in this area.

The environmental analysis conducted as part of this Master Plan did not determine environmental impacts for the most feasible alternatives. Additional environmental analysis, including EAs will be required prior to construction.

FACILITY REQUIREMENTS

The facilities requirements are used to analyze the ability of the current facilities at DLH to accommodate the forecast aviation demand. The facility requirements analysis identified the following primary future facility deficiencies based on the forecast activity.

Table ES-2 identifies, by phase, the planned aircraft and design classifications for Runway 9-27 and Runway 3-21 over the 20-year planning period based on the forecasts. This information includes the critical planning and design aircraft, and the corresponding FAA Airport Reference Code (ARC). The 'critical' aircraft is used for application to planning standard purposes, while the 'design' aircraft is generally used for specific constructability purposes.

For Runway 9-27, the future ARC is a Category D accommodating D-V aircraft (approach speeds of less than 166 knots and wingspan of up to 214 feet), and the future Runway 3-21 FAA ARC is Category C accommodating C-III aircraft (approach speeds of less than 141 knots and wingspan of up to 118 feet).

Table ES-2
CRITICAL AIRCRAFT AND AIRPORT REFERENCE CODE (ARC)

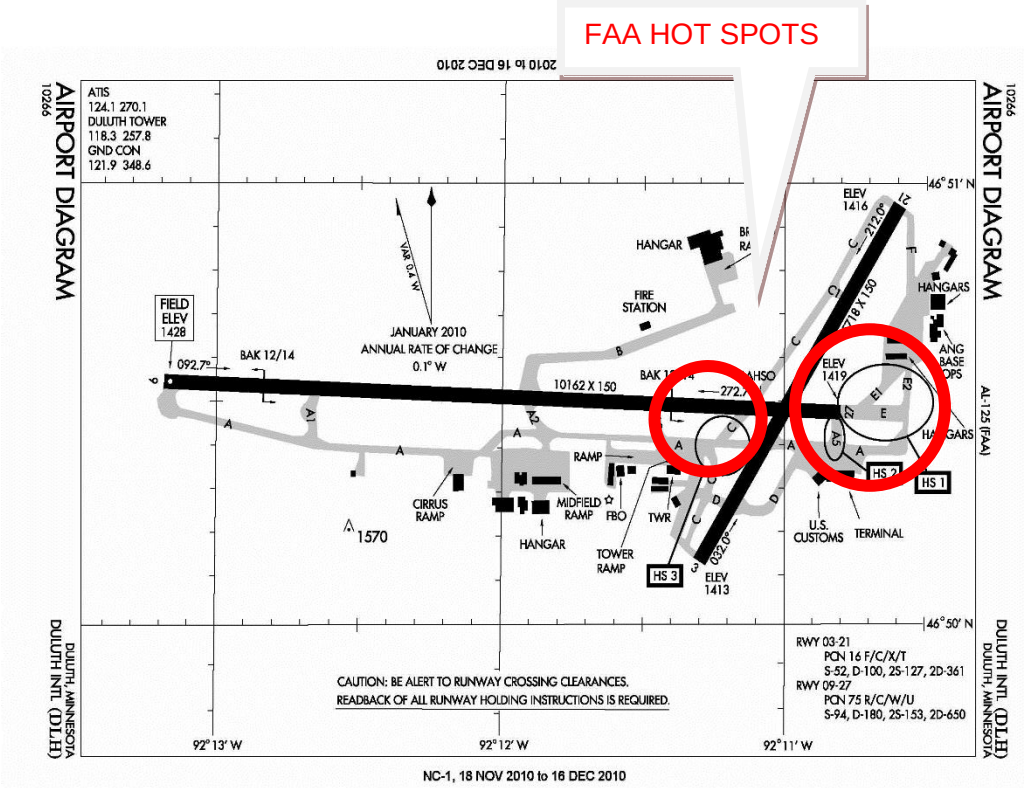
Planning Period		RUNWAY 9-27 Operator(s) Aircraft Type(s) Design Group (Representative Aircraft)	RUNWAY 3-21 Operator(s) Aircraft Type(s) Design Group (Representative Aircraft)
Existing	Critical Planning	Air Carrier-Charter Narrowbody Jet Transport C-III (A-320, MD-80, B-737)	FBO Tech Stop-Corporate Large-Cabin Business Jet C-III (Gulfstream Series)
	Critical Design	FBO Techstop Large Heavy Jet Transport D-V (747-400F)	Air Carrier-Charter-FBO Techstop Narrowbody Jet Transport C-III (MD-80 / B-737 Series)
Future (1-20 Years)	Critical Planning	Air Carrier-Charter-FBO Techstop Large Narrowbody Jet Transport C/D-IV (B-757)	Air Carrier-Charter Regional Jet C-III (CRJ-900 | Embraer 170/195)
	Crtical Design	FBO Techstop Large Heavy Jet Transport D-V (747-400F)	Air Carrier-Charter-FBO Techstop Narrowbody Jet Transport C-III (A-320, B-737 Series)
Strategic (±20 Years)	Critical Planning	FBO Techstop Large Heavy Jet Transport D-V (747-400F)	Air Carrier-Charter-FBO Techstop Narrowbody Jet Transport C-III (A-320, B-737 Series)
	Critical Design	FBO Techstop Large Heavy Jet Transport D-V (747-400F)	Air Carrier-Charter-FBO Techstop Narrowbody Jet Transport C-III (B-737 Series)

The planning of airport facilities conforms to FAA design standards, as pertaining to the operational and physical characteristics of the 'critical aircraft', or representative largest aircraft conducting more than 500 annual itinerant operations (takeoffs and landings) at the Airport. The critical aircraft is evaluated with respect to size, speed and weight, and is the basis for determining the airfield and terminal area standards for various structural dimensions, setback separations, airspace clearances, safety areas and other design considerations. Combined, the 'approach category' (alphabetic letter) and 'design group' (roman numeral) yields the Airport Reference Code (ARC) which determines the type of airplane (family) that the airport is designed to accommodate.

Runways and Taxiways

The key aspect identified in the Master Plan relative to facilities requirements is a long-term program of pavements rehabilitation for both the runway and taxiway system, including correcting of several FAA Hot Spots relative to runway and taxiway geometry. A "hot spot" identifies critical airfield geometry issues. Resolution of FAA compliance hot spots (see Exhibit ES-2) is significant to meeting the facility requirements and integral to the airfield and runway alternatives analysis.

Exhibit ES-2
AIRFIELD PAVEMENT CONDITION REPORT 2010 (PCI)



As indicated above, the long-term pavement rehabilitation program is the essential element of this Master Plan. The 2010 and forecast 2015 Pavement Condition Report mapping or PCI is illustrated on **Exhibit 5-3** and **Exhibit 5-4** respectively. Pavement rehabilitation recommendations:

- Runway 9-27: Runway ends are in worse condition. Condition of base material and subgrade generally unknown. Full-depth reconstruction is anticipated in the 5 to 10 year period. Foreign object debris (FOD) becoming an issue on the runway.

  Due to construction and funding, the pavement project is expected to be a multi-year project. This is the largest project as part of the Master Plan and will require implementation in three phases: Phase I, reconstruction of the eastern portion of Runway 9-27 of approximately 2,800-feet; Phase II, reconstruction of the western portion of Runway 9-27 of approximately 2,000-feet; and Phase III, reconstruction of the center portion of the runway of about 6,200-feet.

  It is significant to note that the airport can remain operational with a runway length of about 7,000-feet when Phase I and Phase II are accomplished. However, there is a great challenge to implementing Phase III. Since secondary Runway 3-21 does not have sufficient length to accommodate air carrier and some military aircraft, the option of reconstructing the center portion of Runway 9-27 and maintaining at least the minimal

runway length of 7,000 feet for the airport at large to sustain much of the normal operation is jeopardized. If at least 7,000 feet is not available for airport operations, the airport is functionally closed.

As a consequence, several options were evaluated on a planning level:

- Extension of Runway 3-21 to 7,000-feet;
- Reconstruction of Taxiway 'A' to 7,000 feet;
- Reconstruction of Taxiway 'B' to 7,000 feet; and,
- Performing panel replacement during night time hours for Runway 9-27 and keeping the airport operational.

From both a practical and cost perspective, the best alternative was determined to be extension of Runway 3-21 to 7,000 feet.

- Runway 3-21: In addition, the condition of Runway 3-21 must be addressed. The runway was last milled and overlaid in 2011, which results in excellent PCI surface conditions. However, the condition of base material and subgrade is generally unknown. It is anticipated that this will be a two-phase full-depth reconstruction project and is shown in the Capital Improvements Program (CIP for 2020/2021. As a consequence, Runway 3-21 will need to be reconstruction and extended prior to initiating the multi-phased Runway 9-27 project.

- Taxiways: Pavement conditions range from very poor to very good. Future taxiway pavement improvement projects also to consider sequencing with major runway rehabilitation/reconstruction projects, planned expansion, upgrade and relocations, along with operational impacts and funding availability.

Exhibit ES-3

AIRFIELD PAVEMENT CONDITION REPORT 2010 (PCI)

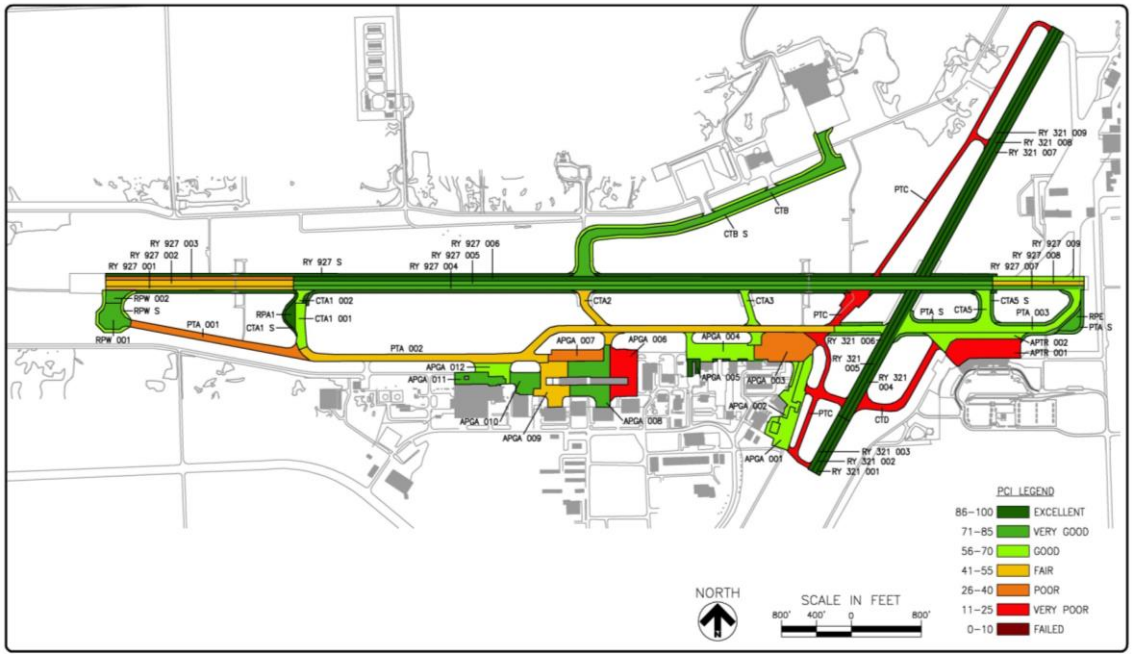
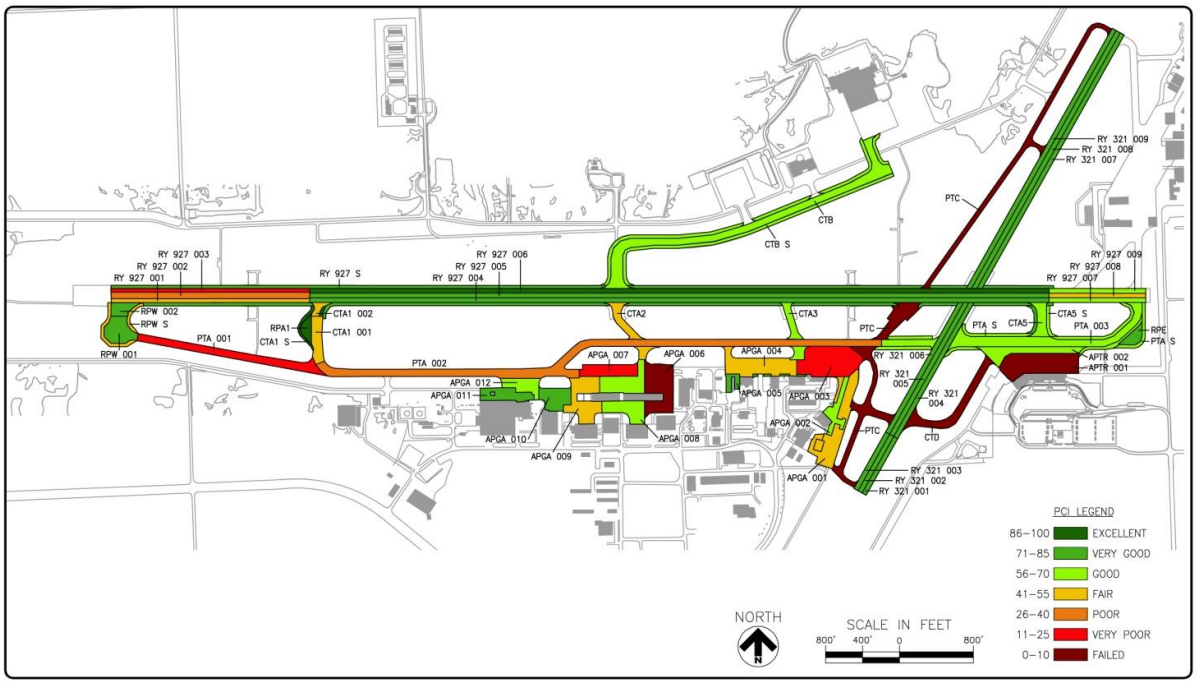


Exhibit ES-4
AIRFIELD PAVEMENT CONDITION REPORT 2015 (PCI)



In addition, taxiway system improvements are a significant part of the long-term pavements rehabilitation program at DLH. Table ES-3 provides a summary of taxiway conditions and recommended improvements.

Table ES-3
TAXIWAY CONDITIONS AND RECOMMENDED IMPROVEMENTS

Pavement Area	Pavement Condition					
	Pavement Type	2010 PCI Rating	2015 PCI Rating	Type of Pavement Project	Estimated Time Period	Remarks
Runway System						
Runway 9-27	Concrete	Fair to Excellent	Poor to Good	Full-Depth Reconstruction	5 to 10 Years	Multi-Year Project
Runway 3-21	Bituminous	Good to Excellent	Good to Very Good	Full-Depth Reconstruction	3 to 5 Years	Possible Strengthening
Taxiway System						
Taxiway A	Bituminous *	Poor to Good	Very Poor to Good	Surface Rehabilitation Full Reconstruction	1 to 3 Years 10 to 15 Years	Re-Align West Segment at ±500' with Reconstruction
Taxiway A-1	Bituminous/ Concrete	Good	Fair	Reconstruction	5 to 10 Years	Complete as Part of Rwy 9-27 Project
Taxiway A-2	Bituminous	Fair	Fair	Reconstruction	5 to 10 Years	Complete as Part of Rwy 9-27 Project
Taxiway A-3	Bituminous	Good	Good	Reconstruction	5 to 10 Years	Complete as Part of Rwy 9-27 Project
Taxiway A-5	Bituminous	Good	Good	Reconstruction	5 to 10 Years	Rectify for Non-Standard Geometry
Taxiway B	Concrete	Very Good	Good	Surface Rehabilitation	15 to 20 Years	
Taxiway C	Bituminous	Very Poor	Failed	Full-Depth Reconstruction	3 to 5 Years	Possible Re-align at 400'
Taxiway D	Bituminous	Very Poor	Failed	Full-Depth Reconstruction	3 to 5 Years	Reconstruct at 50' wide
Taxiway E	Concrete	Fair to Good	Fair to Good	Reconstruct with Runway 9-27 Project	5 to 10 Years	Deactivate Future
Taxiway E-1	Bituminous	N/A - Military	N/A - Military	N/A - Military	N/A - Military	Military Planning
Taxiway E-2	Concrete	N/A - Military	N/A - Military	N/A - Military	N/A - Military	Military Planning
Taxiway F	Concrete	N/A - Military	N/A - Military	N/A - Military	N/A - Military	Military Planning

Note: Taxiway 'A' west end hold area is concrete.
Note: Runway 3-21 mill and overlay in 2013.
Note: Runway 9-27 and 3-21 subgrade condition does not reflect current PCI surface condtions.
Source: 2010 Duluth PCI Analysis.

Passenger Terminal

With the recent terminal expansion, the facility is anticipated to accommodate demand over the course of the master planning period without any major expansion.

Air Cargo

Air cargo processing is conducted on multiple aprons, and by various operators using a

combination of turboprop and jet transport aircraft. Neither FedEx nor UPS has indicated any apron deficiencies or facility needs and non-scheduled air cargo is handled on the FBO apron. South of the Runway 9-27 and Runway 3-21 intersection, Taxiway 'C' center-to-apron edge separation decreases from approximately 160 feet to 100 feet, limiting the useful area of the apron to smaller aircraft. When Taxiway 'C' is relocated and widened, this ramp area needs to be reconstructed and widened to improve access for air cargo traffic.

General Aviation

The general aviation fleet continues to trend larger. It is anticipated that as much as 40% additional hangar space may be required to accommodate general aviation activities in the next 20 years.

Military

There are several projects that are identified in the master plan that would enhance DLH to serve the air mission of the Minnesota Air National Guard. These are extension and realignment of Taxiway 'F' on the Runway 21 end, construction of a connector taxiway to Runway 3-21, and extension of Runway 3-21 to 8,000 feet.

Mn/DOT Safety Zone Requirements

The State of Minnesota has adopted legislation for airport to implement height and land use regulations intended to minimize airport safety hazards and protect airport operations, as prescribed in Chapter 360 of the Minnesota Statutes and Minnesota Rule 8800.2400. Below is a summary of the Mn/DOT Safety Zones, and their prescribed regulations. Adherence to Mn/DOT safety zone requirements is an important consideration for the DLH Master Plan. **Table ES-4** lists the minimum airport zoning standards, as prescribed by state statue.

Table ES-4
MINNESOTA LAND USE SAFETY ZONE DIMENSIONS

STANDARD MN/DOT SAFETY ZONES (MINNESOTA RULE 8800.2400 AIRPORT ZONING STANDARDS)		
ZONE	**DESCRIPTION**	**MN/DOT USE RESTRICTION**
SAFETY ZONE A	IN THE APPROACH ZONES OF A RUNWAY, SAFETY ZONE A EXTENDS OUTWARD FROM THE END OF THE PRIMARY SURFACE A DISTANCE EQUAL TO TWO-THIRDS THE RUNWAY LENGTH OR PLANNED RUNWAY LENGTH.	SHALL CONTAIN NO BUILDINGS, TEMPORARY STRUCTURES, EXPOSED TRANSMISSION LINES, OR OTHER SIMILAR LAND USE STRUCTURAL HAZARDS, AND SHALL BE RESTRICTED TO THOSE USES WHICH WILL NOT CREATE, ATTRACT, OR BRING TOGETHER AN ASSEMBLY OF PERSONS THEREON. PERMITTED USES MAY INCLUDE, BUT ARE NOT LIMITED TO, SUCH USES AS AGRICULTURE (SEASONAL CROPS), HORTICULTURE, RAISING OF LIVESTOCK, ANIMAL HUSBANDRY, WILDLIFE HABITAT, LIGHT OUTDOOR RECREATION (NONSPECTATOR), CEMETERIES, AND AUTO PARKING.
SAFETY ZONE B	IN THE APPROACH ZONES OF A RUNWAY, SAFETY ZONE B EXTENDS OUTWARD FROM SAFETY ZONE A, A DISTANCE EQUAL TO ONE-THIRD THE RUNWAY LENGTH OR PLANNED RUNWAY LENGTH.	SHALL BE RESTRICTED IN USE AS FOLLOWS. EACH USE SHALL BE ON A SITE WHOSE AREA SHALL NOT BE LESS THAN THREE ACRES. EACH USE SHALL NOT CREATE, ATTRACT, OR BRING TOGETHER A SITE POPULATION THAT WOULD NOT EXCEED 15 TIMES THAT OF THE SITE ACREAGE. EACH SITE SHALL HAVE NOT MORE THAN ONE BUILDING PLOT UPON WHICH ANY NUMBER OF STRUCTURES MAY BE ERECTED. THE FOLLOWING USES ARE SPECIFICALLY PROHIBITED IN ZONE B: CHURCHES, HOSPITALS, SCHOOLS, THEATERS, STADIUMS, HOTELS AND MOTELS, TRAILER COURTS, CAMP GROUNDS, AND OTHER PLACES OF PUBLIC OR SEMIPUBLIC ASSEMBLY.
SAFETY ZONE C	ALL THAT LAND WHICH IS ENCLOSED WITHIN THE PERIMETER OF THE HORIZONTAL ZONE AND WHICH IS NOT INCLUDED IN ZONE A OR ZONE B.	IS SUBJECT ONLY TO THE GENERAL RESTRICTIONS; WHICH CREATES OR CAUSES INTERFERENCE WITH THE OPERATION OF RADIO OR ELECTRONIC FACILITIES ON THE AIRPORT OR WITH RADIO OR ELECTRONIC COMMUNICATIONS BETWEEN THE AIRPORT AND AIRCRAFT, MAKES IT DIFFICULT FOR PILOTS TO DISTINGUISH BETWEEN AIRPORT LIGHTS AND OTHER LIGHTS, RESULTS IN GLARE IN THE EYES OF PILOTS USING THE AIRPORT, IMPAIRS VISIBILITY IN THE VICINITY OF THE AIRPORT, OR OTHERWISE ENDANGERS THE LANDING, TAKING OFF, OR MANEUVERING OF AIRCRAFT.
STANDARD MN/DOT CLEAR ZONE POLICY		
MN/DOT CLEAR ZONE	REPRESENTS MINIMUM REQUIRED AIRPORT PROPERTY ACQUSITION CATEGORIZED BY AIRCRAFT SERVED AND APPROACH MIINIMUMS PLANNED OR ESTABLISHED.	CONTROL CRITICAL RUNWAY APPROACH AIRSPACE BELOW A HEIGHT OF 50 FEET AS WELL AS THE AIRPORT'S RUNWAY PROTECTION ZONES. (THE CLEAR ZONE IS THE INNER PORTION OF THE MN/DOT SAFETY ZONE A).
NOTE: THE HORIZONTAL ZONE IS DEFINED AS ALL LAND THAT LIES DIRECTLY UNDER AN IMAGINARY HORIZONTAL SURFACE AS DEFINED IN MINNESOTA RULE 8800.1200. NOTE: VARIANCES AND EXCEPTIONS CAN BE REQUESTED THROUGH MNDOT FOR NOT MEETING AIRPORT ZONING STANDARDS.		

Table ES-5 provides the application of the current and future runway lengths relative to the standard Mn/DOT Safety Zones A and B.

Table ES-5
MINNESOTA LAND USE SAFETY ZONE DIMENSIONS

Item	Runway 9 End	Runway 27 End	Runway 3 End	Runway 21 End
	Existing Standard	Existing Standard	Existing Standard	Existing Standard
Runway Length	10,162	10,162	5,718	5,718
Runway Type	Precision	Precision	Non-Precision	Non-Precision
MnDOT Safety Zone A Length	6,775	6,775	3,812	3,812
MnDOT Safety Zone B Length	3,387	3,387	1,906	1,906
Item	**Runway 9 End**	**Runway 27 End**	**Runway 3 End**	**Runway 21 End**
	Future Standard	**Future Standard**	**Future Standard**	**Future Standard**
Runway Length	11,600	11,600	8,000	8,000
Runway Type	Precision	Precision	Precision	Precision
MnDOT Safety Zone A Length	7,733	7,733	5,333	5,333
MnDOT Safety Zone B Length	3,867	3,867	2,667	2,667

MnDOT Zone A = 2/3 runway length
MnDOT Zone B = 1/3 runway length
Source: Minnesota Rules 8800.2400

IMPLEMENTATION

The implementation plan consists of a project phasing plan and a financial plan. The phasing plan identifies a likely time frame for facility development. The timeframes are identified as short/intermediate term and long-term beyond. Short/intermediate term refers to facilities for which there is immediate demand and estimated to be implemented between 2014-2021. These are the projects identified in the Airport Capital Improvement Program (ACIP) that is provided to the FAA and updated on an annual basis and represents the most current program provided the FAA by DLH.

Long-term refers to facilities for which demand will likely occur beyond the 2021 and through the 20-year planning period to 2033. One project is identified as an ultimate project which likely would materialize beyond the planning period.

Project Phasing Periods

Projects are phased to facilitate systematic development over the course of the next 20 years. The Airport Development Plan is broken-down into planning phases, as follows:

Phase 1 (1-5 Years) – Near Term Planning Period

Phase 2 (6-8 Years) – Intermediate Planning Period in conformance with the ACIP

Phase 3 (9-20 Years) – Long Term Planning Period

Ultimate (Beyond 20 Years)

Phase I and Phase 2 (Conforms to the FAA Airport Capital Improvement Program 2014-2021)

- Runway approach obstruction removal off the Runway 27 end (2015).
- Taxiway 'A' rehabilitation (Phase I in 2016 and Phase II in 2017).
- Environmental Analysis - Preparation of an environmental assessment of Runway 9 end compliance projects, Runway 3-21 extension, Taxiway 'C' relocation, Taxiway 'B' east extension to Taxiway 'C', and Taxiway 'F' configuration.
- Relocation of the Parallel Taxiway 'C' System.
- Taxiway 'B' design.
- Acquisition of Property. Purchase of 0.5 acres for the future Runway Protection Zone to enable the extension of Runway 21 to an ultimate 8,000'.
- Runway 21 projects: reconstruction of Runway 3-21 to current runway length and extension of Runway 21 to 7,000' in advance of beginning the three phased Runway 9-27 reconstruction.
- Construction of a new airport parking garage (not federally eligible or included in the ACIP).

Phase 3 (Long Term Planning Period, 2022-2033)

- Reconstruction of Runway 9-27, East End in two phases. Reconstruct 2,800 feet to include reconstruction of shoulders and taxiway tie-ins, reconstruction of the former Taxiway 'E' inline taxiway as a displaced threshold. Phase I-A would reconstruct the intersection of Runway 9-27 and Runway 3-21. Phase I-B would reconfigure the Runway 27 end by removing existing Taxiway 'E-1', constructing a new Taxiway 'E-1', constructing new Taxiway 'E-2', removing Taxiway 'A-5', and reconstructing Taxiway 'E' as a displaced threshold.
- Reconstruction of Runway 9-27, West end. Reconstruct 2000' x 150' section on the Runway 9 end.
- Reconstruction of center portion of Runway 9-27. Reconstruct the center 6,200' x 150' section of Runway 9-27.
- Relocation/Realignment of Parallel Taxiway 'C' System South End.
- Reconstruction of Taxiway D System, South End, 1,500 LF
- Extension of Taxiway 'B' east to Taxiway "C": Construct 1,800 foot extension.
- Air Traffic Control Tower replacement (FAA project).
- Reconstruction of Taxiway 'A' to resolve air traffic control tower line-of-sight visibility constraints, removal of an irregular "S" curve, and enable general aviation ramp expansion.
- Extension of Taxiway 'B' west to Taxiway 'A-3' intersection
- Construction of future cargo ramp expansion
- Construction of expanded General Aviation Apron.
- Construction of a midfield apron expansion along Runway 9-27
- Construction of Taxiway 'F': Realign existing Taxiway 'F' by constructing new future partial parallel Taxiway 'F' to provide Minnesota Air National Guard Ramp access to the Runway 21 end.
- Extension of Runway 21. Construct 1,000 foot extension to Runway 21 to a full length of 8,000 feet.
- Extension of Runway 9-27 by 1,000 feet x 150 feet to 11,162 feet (reclaims displaced threshold).

Ultimate (After 2033)

- Extension of Runway 9-27 by 438 feet x 150 feet to an ultimate 11,600 feet.

Exhibit ES-5 and Exhibit ES-6 provides a general identification of projects on Recommended Airport Development Plan. These exhibits include other projects not identified in the highlight section above.

Exhibit ES-5

Short Term and Intermediate Term Projects Most Feasible Alternative for Implementation

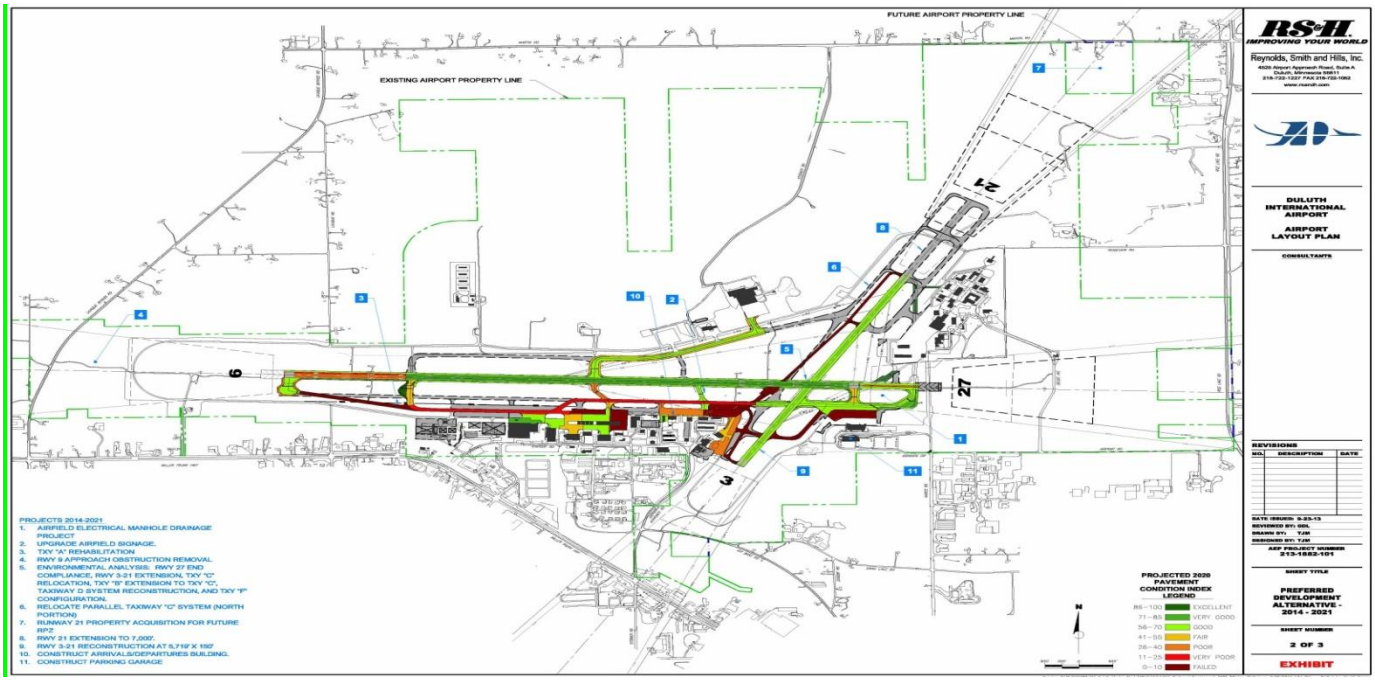
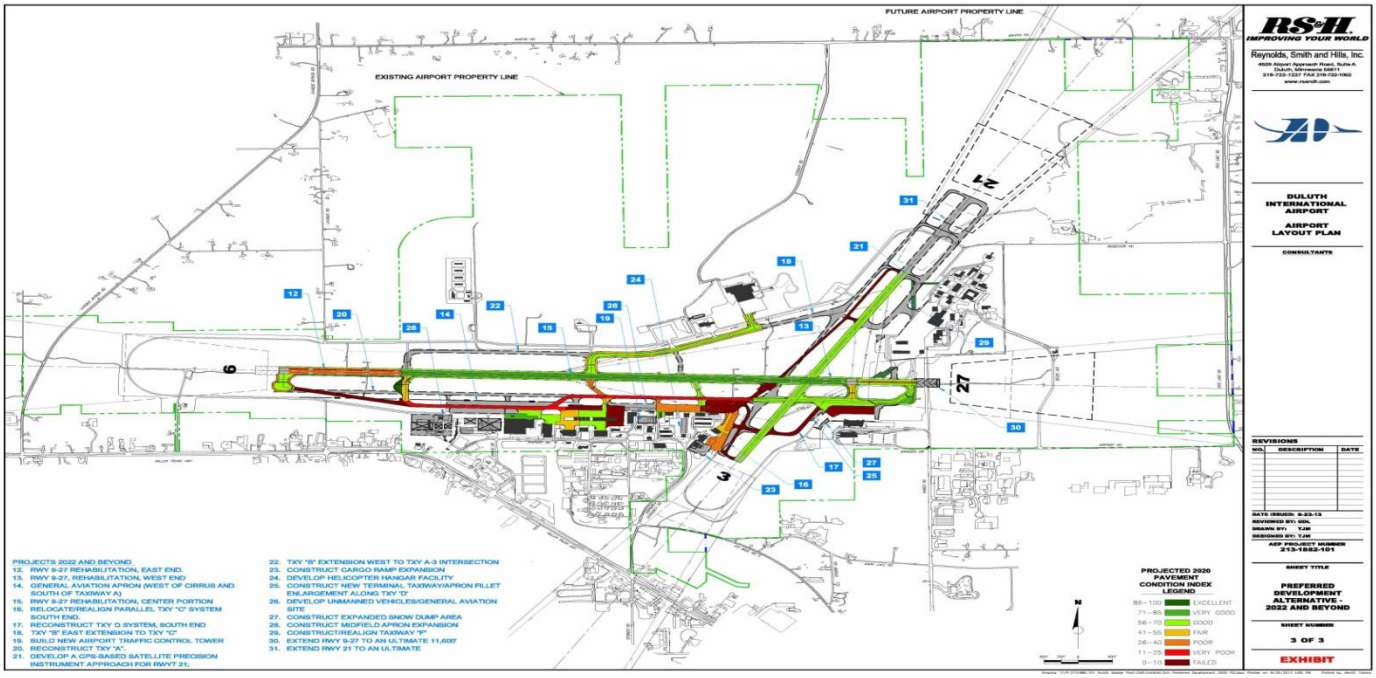


Exhibit ES-6
Long Term and Ultimate Projects Most Feasible Alternative for Implementation



Financial Plan

The financial plan describes the cost burdens the Authority may incur while maintaining the ability to generate sufficient revenues in the future to cover operations and existing debt service obligations. The Authority's financial structure and historical revenues and expenses were examined. In addition, historical funding sources for the Duluth International Airport and other airport projects were analyzed to identify likely funding sources for the 20-year capital improvement program defined by this master plan; the potential cost for the ultimate project of runway extension of Runway 9-27 to 11,600 feet is not included.

Based on these analyses, the potential funding sources for the approximate $177.5 million program is:

- FAA $159 million
- Mn/DOT $ 1 million
- Local $ 17.5 million

Future Master Plan Considerations

Over the course of the development of the DLH master plan, a new FAA policy was issued having to do with runway protection zones. This policy known as "Interim Guidance on Land Uses Within a Runway Protection Zone" prescribes that an RPZ should be absolutely clear of development. Based upon the guidance within that policy, any change in an RPZ will also require any incompatible land use, as defined by the policy, to be removed from the RPZ. Any plan that includes an incompatible land use within an RPZ must be approved by FAA Headquarters.

Consequently, it is recommended that the next ALP Update or Master Plan Update include an RPZ land use compatibility analysis within it.

CHAPTER 2
INTRODUCTION / PUBLIC INVOLVEMENT PROGRAM

2.1 INTRODUCTION

The Duluth Airport Authority initiated an Airport Master Plan Update to assess the service and facility needs of the Duluth International Airport. As a roadmap for bringing projects, people and funding together in a coordinated manner, the study provides direction regarding the Airport's 20-year development plan, as envisioned by the Airport Authority. The study is also evidence that the Airport and local officials recognize the importance of aviation as part of the overall community and transportation planning process.

2.1.1 Purpose

The Airport Master Plan is primarily a 'facilities plan', comprehensively assessing airfield, airspace, terminal area, landside and ground access components, with the overarching purpose of documenting the orderly development of the Airport facility, service and equipment needs. The 20-year plan identifies the optimum layout and the sequence of projects necessary to adequately maintain, expand and upgrade Airport facilities, in which cost estimates and potential funding sources are phased to coincide with the Airport's year-by-year budget capabilities. In addition, the projects must be substantiated and generally depicted on the Airport Layout Plan (ALP) record drawings, in accordance with Federal Aviation Administration (FAA) and Minnesota DOT (Mn/DOT Aeronautics) procedural requirements. From this, the Airport Master Plan documentation enables the Airport to apply for funding improvements as eligible under the respective federal and state airport aid program.

2.1.2 Study Background

An updated Airport Master Plan is necessary to provide up-to-date information in order to re-assess short and long-term Airport improvements. The previous 2000 Duluth Airport Master Plan report is outdated, with recommendations no longer supported by current aviation and community trends, as the 2000 ALP drawing received conditional FAA approval, with multiple technical revisions completed through 2007. The 2000 ALP base mapping inaccuracies require the Duluth ALP drawings to be regenerated from new digital survey-based aerial mapping, and to meet FAA and Mn/DOT airport planning standards and policy guidance.

In addition, the following planning studies have been completed for the Duluth International Airport:

- *1974 Duluth Airport Master Plan and ALP Drawings*
- *1991 Duluth Airport Master Plan and ALP Drawings*
- *1996 Duluth International Airport FAR Part 150 Study and Noise Exposure Map*
- *1997 Economic Development Plan* – Outline the economic impact on the surrounding community, and ways to further develop the Airport economically.
- *2000 Duluth Airport Master Plan and ALP Drawing Update* – The purpose of the study was to develop a plan that accommodated the aviation needs "well into the new millennium."

2.1.3 Major Study Goals and Objectives

Through discussion with the Airport, FAA and Mn/DOT, the following goals and objectives have been identified as the major action items to be resolved as part of this Master Plan Update:

- Maintain Runway 9/27 Length
- Secondary Runway Length Justification
- Pavement Rehabilitation & Phasing / Pavement Condition Index Study
- Address FAA and Mn/DOT Standards
  - Taxiway Separation & Intersection Configuration
  - Land Use Zones
- North Airport Business Development Area
- Redevelop General Aviation Area(s)
- Identify New/Replacement Air Traffic Control Tower Site
- Planning Coordination with Air National Guard
- Planning Coordination with Golden Triangle Study
- Future Airport Surveillance Radar Relocation Site
- Improved Airport Visibility and Access Plan
- Airport Property Mapping / Land Acquisition Plan
- Planning for Future Cargo Facility

2.1.4 Study Approach / Major Study Tasks

The Airport Master Plan is structured to provide concise documentation quantifying future Airport needs, and the resolution of key planning issues. In accordance with FAA Advisory Circular 150/5070-6B, *Airport Master Plans* and Mn/DOT planning guidance, the following are the sequence of major study components:

1. Study Design
2. Public Involvement Program
3. Existing Conditions
4. Aviation Forecasts
5. Facility Requirements
6. Alternatives Development and Evaluation
7. Airport Layout Plans (ALP)
8. Facilities Implementation Plan
9. Financial Feasibility
10. Airport Land Use Ordinance
11. Pavement Condition Index (PCI) Study
12. Study Documentation and Deliverables
13. Project Administration and Coordination

Although an 'update', this study is comprehensive in evaluating Airport facility needs with respect to user demand, site development considerations and funding levels. From this, an updated narrative report concisely documents the Sponsor's decision-making process in arriving at the preferred 20-year Airport development plan, as depicted on the new ALP drawings.

While the Airport Master Plan is responsive to local issues, above all, the study follows federal and state policy in providing for a facility that is:

- Safe and in accordance with FAA and Mn/DOT design standards
- Economically viable and substantially user-supported
- In accordance with broad local, regional, state and national planning goals

2.2 AIRPORT STRATEGIC VISIONING

The purpose of the strategic vision is to articulate the Airport's long-term aspirations, as used to guide the goals and objectives established for the Airport Master Plan process.

2.2.1 Strategic Vision Statement

The strategic vision is a focused statement, as defined by the broad-reaching principles and values intended to guide the Airport's core mission, and lines of business. The Airport's function, role and economic significance are key factors used to collaborate the strategic vision. In particular, the vision identified in conjunction with the Advisory Committee consisted of the following ideas:

- Providing commercial passenger needs for the greater Duluth metropolitan area;
- Continuing to foster a viable Minnesota Air National Guard (MNANG) mission at the Airport;
- Continuing to contribute to the local and regional economy through aviation activity;
- Continuing to foster a positive business environment for aircraft manufacturing and maintenance at the Airport;
- Continuing to support general aviation;
- Providing needed facility/infrastructure improvements in an economically achievable way; and,
- Achieving FAA and Mn/DOT Design Standards Compliance.

2.2.2 SWOT Analysis

The Airport used a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis during the Advisory Committee to assign relevance to the Airport's strategic vision. The following exhibit shows a typical SWOT diagram. It was used to engage the Advisory Committee in identifying the most meaningful aspects in of assessing actions that may be helpful or harmful associations that are internal and external to the Airport environs.

The SWOT evaluation was able to help the Airport understand the Master Plan including the proposed projects will affect them internally through the Airport's Strengths and Weaknesses and externally through their Opportunities and threats.

This process helps focus and categorize opinions by individual members for each of the major master plan goals and objectives. Once compiled, this forms the basis for steering the strategic vision as demonstrated by the Airport's capability to successfully achieve the desired goals and objectives of the Airport Master Plan.

SWOT Analysis - Strengths, Weaknesses, Opportunities, Threats

		Helpful	Harmful
		To Achieving the Objective	To Achieving the Objective
Internal Origin	Attributes of the Airport (within Airport boundary)	Strengths	Weaknesses
External Origin	Attributes of the environment (beyond the Airport boundary)	Opportunities	Threats

S	Strength: Advantageous position or situation in serving needs.
W	Weakness: Limitation or deficiency that impedes potential or effectiveness.
O	Opportunity: Major favorable reality.
T	Threat: Major unfavorable reality

Individual SWOT analyses were identified and discussion by the Advisory Committee for the following areas of discussion in conjunction with the Airport's Strategic Vision:

- Meet Passenger Needs for the Region;
- Continue to Support the MNANG at the Airport;
- Continue to Support Aviation Business Growth;
- Continue to Support General Aviation Growth; and,
- Continue to Support Air Cargo Growth.

A number of future airfield initiatives were discussion during the SWOT analysis that would become primary ideas for investigation during the master plan process. These had to do with:

- Major anticipated airfield rehabilitation and reconstruction projects to continue to support the air passenger, cargo, military, and general aviation traffic. This was addressed by all five SWOT evaluations;
- The potential need to extend Runway 3-21 and determine the ultimate runway length. This was assessed in terms of meeting regional passenger needs as well as support MNANG; and,
- The potential conversion of inline Taxiway Echo for additional runway length for Runway 9-27 and its ultimate runway length. This was assessed primarily in terms of future air cargo needs but also support of aviation business growth in general.

2.3 PUBLIC INVOLVEMENT PROGRAM

The purpose of the public involvement program is to coordinate planning objectives with the needs and concerns of the local community by providing an opportunity for information sharing and collaboration

among interested participants, stakeholders and regulatory agencies. As a strategic planning process, the master plan is structured to be responsive to local Airport needs, while at the same time, inclusive of more broad regional planning issues. The public involvement program used technical meetings, public outreach workshops and various media sources to inform and solicit information from the general public regarding the study process, major findings and conclusions.

2.3.1 Advisory Committee

The Duluth Airport Authority understands that master plans which involve a diverse and focused participation by informed persons are more successful and widely accepted than those without. For this reason, a standing committee was formed from individuals with an interest in the Airport and community development, in an advisory capacity, conferring with the Airport Staff and consultant throughout the study.

The committee is primarily responsible for evaluating the technical merits and logistical implementation of the Airport Master Plan, commenting on study findings, and encouraging awareness and adoption of project recommendations. This wide-range of participation brings various perspectives to the study, and improves the ability to form a well-rounded consensus. The committee input received consideration as a part of scheduled meetings, outreach efforts and general feedback.

2.3.2 Project Meetings

The following Airport Master Plan meetings provided an opportunity to present project findings, coordinate planned recommendations, and to solicit feedback concerning interim study conclusions:

Meeting #1 **Kick-Off**: serves to establish lines-of-communication, identify the Airport's Vision, describe the major goals and objectives of the planning process, coordinate the public involvement process, and solicit input and collect initial committee member suggestions via use of a SWOT analysis.

Meeting #2 **Existing Conditions/Forecasts**: The facilities needs are reported on in the Existing Conditions (Chapter 3), Forecasts (Chapter 4), and Facility Requirements (Chapter 5).

Meeting #3 **Facility Requirements and Alternatives**: Facilities needs are determined in response to the any facilities deficiencies identified during examination of existing conditions and any capacity and expansion needs in response to the accommodating forecast demand. Candidate alternatives are reported on as final recommendations for the most feasible alternative in the Alternatives Chapter (Chapter 6).

Meeting #4 **Final Program Implementation/Financing:** The most feasible alternative is reported on in the preliminary project Phasing Plan and shown as developments on the preliminary ALP Drawings (Chapter 7), Implementation Plan (Chapter 8), and Financial Plan (Chapter 9).

CHAPTER 3
ISSUES AND EXISTING CONDITIONS

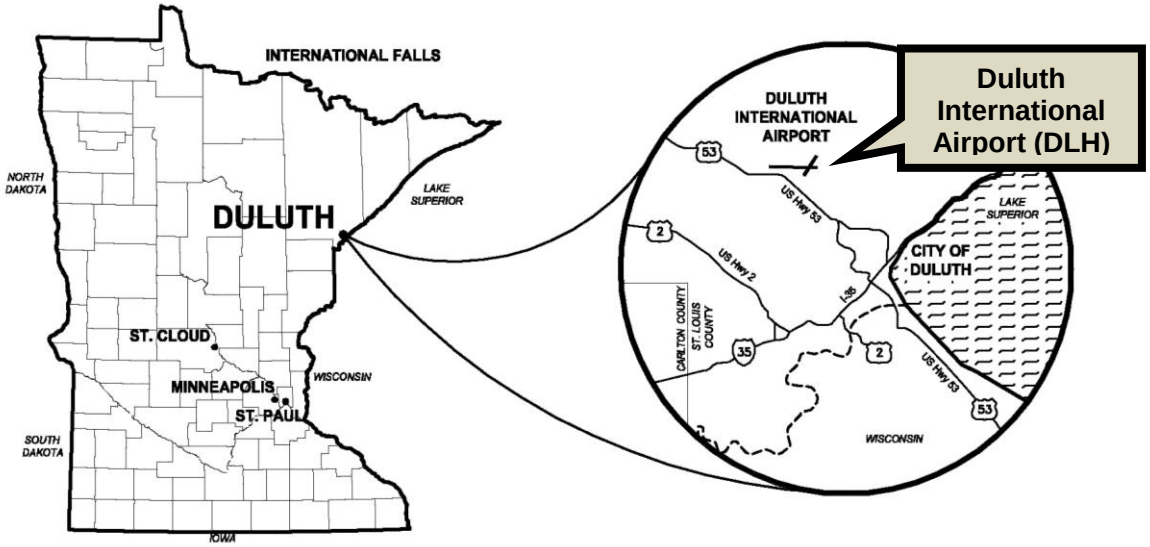
3.1 INVENTORY ISSUES AND CONDITIONS

The inventory provides a comprehensive understanding of aviation factors and community trends, and forms the basis for recommendations throughout the Duluth Airport Master Plan study.

3.1.1 Airport Location and Setting

Exhibit 3-1 depicts the Airport's geographic proximity. The Airport is five miles northwest of the City of Duluth, located in northeastern Minnesota along Lake Superior, 150 miles north of Minneapolis in St. Louis County. The metropolitan area, which includes Duluth and Superior, combines nearly 275,000 residents and is the third largest in the State of Minnesota. Jurisdictions adjoining the Airport include the City of Duluth in which the airport is located, the City of Hermantown, Canosia Township and Rice Lake Township. The four political jurisdictions are within St. Louis County, in which the County does not assume zoning authority for the surrounding government entities.

Exhibit 3-1
LOCATION & VICINITY MAP



Source: RS&H, 2010.

3.1.2 Airport Ownership and Administration

The Duluth International Airport is operated by the Duluth Airport Authority, established in 1969, with a Board of Directors overseeing administration of the Duluth International Airport and Sky Harbor Airport. The Board of Directors is appointed by the Mayor of Duluth, and comprised of seven members: a President, Vice President, Secretary and four Board Members. A full-time professional Airport Director

serves as the day-to-day administrator to the Board of Directors, supported by an administrative and operational staff.

3.1.3 Airport Development History

The Airport was initially constructed as a municipal airfield, and has since developed into a facility to serve both civilian and military interests. In 1929, the City of Duluth purchased 640 acres of property from St. Louis County to construct the current airport site, which consisted of three 2,650-foot turf runways. Named the Williamson-Johnson Municipal Airport, the airfield was dedicated as a public airport in 1930. Also in 1930, an air mail route was established by the US Postal Service, and in 1940 Northwest Airlines began service at Duluth.

In 1942, the three turf runways (3-21, 9-27 and 13-31) were each paved to 4,000 x 150 feet. In 1945, the Corps of Engineers extended Runway 9-27 and Runway 3-21 to 5,699 feet. After World War II, the U.S. Air Force constructed permanent and semi-permanent facilities on City leased land, and in 1948 the Minnesota Air National Guard constructed permanent facilities east of the field. The following year, the headquarters of the 179th were moved from the Duluth Armory to the current location on the Northeast Quadrant. In 1951, Runway 9-27 was extended by the U.S. Air Force to 9,000 feet, including 1,000-foot overruns, and an air traffic control tower constructed the same year. In 1954, the original 14,200 square foot terminal building was constructed southwest of the runway intersection. That same year, the Air Force received its first based jet fighter aircraft at Duluth. In 1956, Runway 9-27 was completely reconstructed, and in 1966 extended to 10,152 feet. In July 1960, the 148th Fighter Group was formed and the 179th Fighter Squadron began operating on 24-hour alert status as part of the 148th Fighter Wing under the Air Defense Command.

The following is a historical summary of military mission at Duluth:

1948 179th Fighter Squadron formed and assigned P-51 Mustangs
1954 Squadron converted to the F-94A/B Starfirejet
1957 Squadron converted to the F-94C
1959 Squadron converted to the F-89J Scorpion
1960 Unit re-designated as the 148th Fighter Group
1967 Group converted to the F-102 Delta Dagger
1971 Group converted to F-101 Voodoo
1976 Group re-designated as 148th Tactical Reconnaissance Group/Converted to RD-4C Phantom
1983 Group re-designated the 148th Fighter Interceptor Group/Converted to the F-4D
1991 Group converted to F-16 ADF Falcon
1992 Group re-designated as the 148th Fighter Group
1995 Unit re-designated the 148th Fighter Wing

The Airport was renamed the Duluth International Airport in 1961. In 1974, a 52,400 square foot passenger terminal building and U.S. customs facility was constructed southeast of the runway intersection, at the present terminal building site. Consequently, Runway 13-31 was shortened to 2,578 feet to accommodate building construction, then subsequently converted into a taxiway, and eventually closed in 1980. The former terminal building, southwest of the runway intersection, was then converted for use as offices for general aviation, the FAA, and the U.S. Weather Bureau.

In 1989, the three-story passenger terminal building was interconnected to form a single enclosure totaling 106,000 square feet. With the post September 11 era of new federal security requirements and proximity to runway airspace surfaces, the passenger terminal building became functionally obsolete. In 2010 the replacement passenger terminal, expanded apron, new auto circulation and vehicle parking facilities were constructed.

3.1.4 Airport Service Role

The Duluth International Airport is a public-use facility providing aeronautical services for commercial, general aviation and military users. The Airport is classified by the Federal Aviation Administration (FAA) *National Plan of Integrated Airport Systems (NPIAS)* as a 'non-hub primary commercial service airport', certified as a Class I FAA Part 139 facility intended to serve passenger aircraft with 30-plus seats. The Airport is designated as an FAA D-V Airport Reference Code (ARC) for serving heavy wide-body transports which including B-747s, and is classified by the 2006 Mn/DOT-Aeronautics State Aviation System Plan as a 'Key Airport'.

3.1.5 Summary of Airport Activity

As of 2010, the Duluth International Airport processed approximately 306,400 scheduled commercial passengers, 5,000 charter passengers, experienced about 57,000 annual aircraft operations (takeoffs and landings), and based 66 aircraft excluding Cirrus and MN Air National Guard. Duluth is ranked the 202nd busiest airport in the nation in terms of passenger enplanements, and the second busiest commercial service airport in Minnesota. While a commercial service facility, the Duluth International Airport also supports a substantial level of general aviation activity within the region, accounting for around 40 percent of the based aircraft and 55 percent of the general aviation operations. In the past 10 years, Airport activity trends have generally been increasing, with aircraft traffic remaining proportionally consistent amongst the commercial (15%), general aviation (70%) and military (15%) users.

3.2 AIRPORT FACILITIES

This section is an inventory of the major airport facilities, equipment and services. Exhibit 3-2 is a diagram of the Airport vicinity depicting the general layout of airfield and terminal area facilities. The Airport property totals approximately 3,020 acres in fee-simple ownership, including the airfield, terminal and landside areas.

3.2.1 Airfield

The airfield facilities described below are core aeronautical components which include the runways, taxiways and navigational aids used to support air traffic operations.

3.2.1.1 Runway System

The major runway facilities are listed in Table 3-2. The airfield consists of two intersecting runways aligned in an east-west and northeast-southwest orientation, with the runway pavements total nearly 3.2 million square feet.

Primary Runway: Runway 9-27 is 10,162' x 150' with precision instrument capabilities to both ends, and serves as the primary runway with an Airport Reference Code (ARC) of D-V. The runway, with 40' paved shoulder per side, is grooved concrete construction with a gross weight bearing strength of 650,000 pounds for dual tandem wheel gear aircraft. Runway 9-27 is installed with a gear arresting system for military aircraft use.

Secondary Runway: Runway 3-21 is 5,718' x 150' with non-precision instrument capabilities to both ends, and serves as a secondary runway with an Airport Reference Code (ARC) of C-III. Runway 3-21, with intermittent paved shoulders, is asphalt construction with a gross weight bearing strength of 360,000 pounds dual tandem wheel gear aircraft.

3.2.1.2 Taxiway System

The Airport's taxiway facilities are summarized on Table 3-1. The taxiway system includes six designated taxiway segments ('A', 'B', 'C', 'D', 'E', and 'F') totaling nearly 30,000 linear feet and comprising of 2.1 million square feet of pavement.

Runway Taxiway System: Taxiway 'A' is a 75-foot wide full-length parallel serving Runway 9-27, and includes four exit taxiways. The Taxiway 'A' runway-to-taxiway centerline separation ranges from about 500 to 840 feet. The 1,000-foot (990' published) overrun beyond the Runway 27 end is designated as Taxiway 'E', an in-line taxiway with three entry taxiways and an in-pavement lighting system. Taxiway 'C' is a 50-foot wide full-length parallel taxiway serving Runway 3-21, with three exit taxiways. The Taxiway 'C' runway-to-taxiway centerline separation ranges from about 275 to 500 feet.

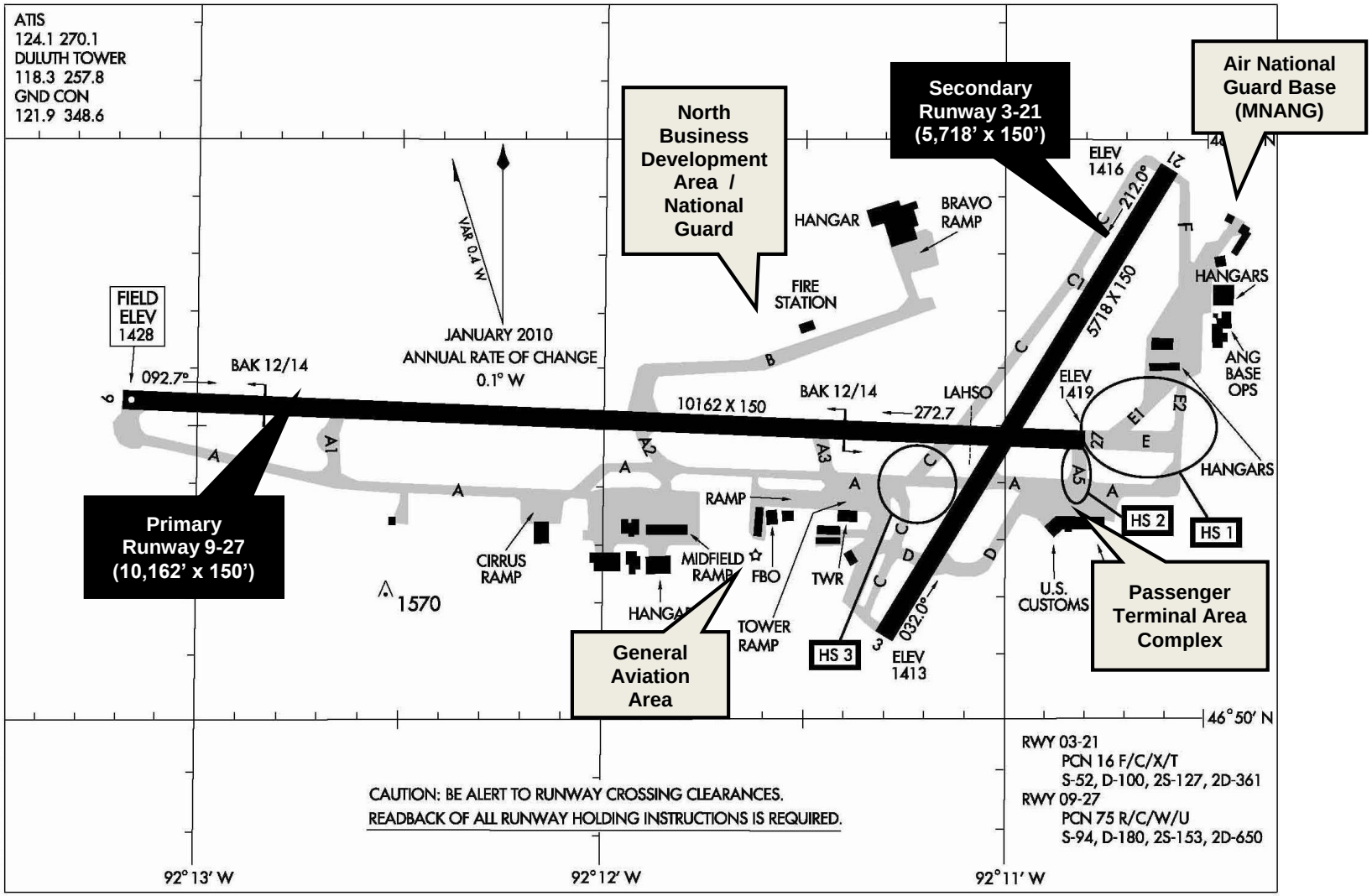
Terminal Taxiway System: Each terminal apron is served by connecting and exit taxiways adjoining the main parallel taxiway system. Taxiways 'A', 'A2', 'A3', 'C' and 'D' primarily serve the general aviation and air cargo areas. Taxiway 'B', at 75 feet wide, serves the North Business Development Area. Taxiways 'E1', 'E2' and 'F' serve the Minnesota Air National Guard Base.

Table 3-1
TAXIWAY FACILITY TABLE

Item	Taxiways (By Major Designation Grouping)					
	A	B	C	D	E	F
Areas Served	Rwy 9/27 (Parallel)	Apron	Rwy 3/21 (Parallel)	Apron	Rwy 27 End, Apron	Apron
Associated Taxiways	A, A1, A2, A3, A5	B	C, C1	D	E1, E2	F
Taxiway Length (Linear Feet)	14,730	3,950	6,100	1,785	975	1,135
Taxiway Width (Feet)	75	75	50	75	150	75
Taxiway Area (Square Feet)	1,104,750	296,250	305,000	133,875	146,250	85,125
Taxiway Area (Square Yards)	122,750	32,917	33,889	14,875	16,250	9,458
Taxiway Shoulder Width	35' (Partial)	35'	None	None	35'	None
Taxiway Edge Lighting	MITL	MITL	MITL	MITL	MITL	MITL
Runway to Taxiway Centerline	500' to 840'	575'	275' to 500'	515'	N/A	N/A
FAA Standard Deficiency	Hot Spot: Txy A5	None	Hot Spot: Txy A, C	None	Hot Spot: Txy E, E1, E2	None

Note: Reference appendix for abbreviations and acronyms.
Note: Taxiw ay 'A4' has been removed.
Source: FAA Airport Facility Directory.

Exhibit 3-2
AIRPORT DIAGRAM



Source: FAA Airport/Facility Directory

Table 3-2
RUNWAY FACILITY TABLE

Facility Item	Runway Facilities	
Runway 9-27	**Rwy 9 End**	**Rwy 27 End**
Runway Length x Width / Surface	10,162' x 150' Concrete (Grooved)	
Paved Shoulders	80' (40' Per Side)	
Airport Reference Code (ARC)	ARC D-V (Widebody Transport Critical Aircraft)	
Pavement Strength (Gear Type)	94,000 (SWG) | 180,000 (DWG) | 650,000 (DTWG)	
Pavement Condition	PCN 75 R/C/W/U	
Displaced Threshold	None	None
Overrun / Blast Pad	400' x 220' Blast Pad	1,000' x 150' Overrun
Runway Type / Marking	Precision	Precision
Instrument Approach Aids	ILS CAT-II | NDB | RNAV (GPS)	ILS CAT-I | RNAV (GPS) | TACAN
Instrument Approach Minimums	1,200' RVR | 100' DH	4,000' RVR | 200'
PART 77 Approach / Slope	1,000' x 50,000' x 16,000' @ 50:1	1,000' x 50,000' x 16,000' @ 50:1
Visual Approach Aids	ALSF-2 | PAPI-4L	MALSR | TDZL | PAPI-4L
Runway Edge Lighting	High Intensity Runway Lights (HIRL) / Centerline Lights (CL)	
Taxiway System / Seperation	Full-Parallel (500' to 850' Separation)	
Land and Hold Short Operations	Yes	No
Aircraft Arresting System (BAK)	Yes	Yes
Runway 3-21	**Rwy 3 End**	**Rwy 21 End**
Runway Length x Width / Surface	5,718' x 150' Asphalt (Grooved)	
Paved Shoulders	70' (35' Per Side) - Between Rwy 9-27 and Taxiway 'A'	
Airport Reference Code (ARC)	ARC C-III (Narrowbody Transport Critical Aircraft)	
Pavement Strength (Gear Type)	52,000 (SWG) | 100,000 (DWG) | 361,000 (DTWG)	
Pavement Condition	PCN 16 F/C/X/T	
Displaced Threshold	None	None
Overrun / Blast Pad	None	None
Runway Type	Non-Precision	Non-Precision
Instrument Approach Aids	VOR | TACAN | RNAV (GPS)	TACAN | VOR/DME | RNAV (GPS)
Instrument Approach Minimums	1-Mile | ±500'	1-Mile | ±500'
PART 77 Approach / Slope	500' x 10,000' x 3,500' @ 34:1	500' x 10,000' x 3,500' @ 34:1
Visual Approach Aids	PAPI-4L | REIL	PAPI-4L | REIL
Runway Edge Lighting	High Intensity Runway Lights (HIRL)	
Taxiway System / Seperation	Full-Parallel (275' to 500' Separation)	
Land and Hold Short Operations	No	No
Aircraft Arresting System (BAK)	No	No

Note: Reference appendix for abbreviations and acronyms.
Source: FAA Airport/Facility Directory | FAA AVN Database.

3.2.2 Airfield Pavement Condition Index (PCI)

The Airport's surface pavement conditions resulting from a Pavement Condition Index (PCI) inspection performed in September 2010 are illustrated on Exhibit 3-3. The PCI is a visual pavement analysis of surface distresses, and assigns a pavement rating between 0 and 100 points (0 representing failed to 100 for newer pavements in pristine condition), and is further indexed by color-code in order to correspond with the types of pavement repairs anticipated:

- Green: 75 to 100 points – Preventative Maintenance
- Yellow/Orange: 40 to 75 points – Rehabilitation
- Red: 0 to 40 points – Major Rehabilitation / Reconstruction

The PCI inspection involved the runways, all taxiway movement area, and apron pavements, which totaled 7.3 million square feet. Pavements less than three (3) years old were not inspected consistent with Mn/DOT Aeronautics inspection procedure, which included the general aviation taxiways, general aviation aprons and hangar ramp pavements constructed since 2008. The entire airside pavements were considered as one pavement network.

The Airport taxiway network consists of two full length parallel taxiways and several taxiway connectors. There are five apron pavement branch sections such as the General Aviation Ramp, Terminal Ramp, Run-up pads for 'A1'. Runway 9-27 east and west run-up pads were also inspected. Runway 9-27 pavements, Taxiway 'B' pavements, portions of Taxiway 'A' and 'A1', Taxiway 'A5', and Runway 9-27 West Run-up Pad have shoulders associated with them and those shoulder pavements were also inspected as part of this project. Runway 9/27 was constructed in the late 1940's. The pavement structure consists of 10" of Portland Cement Concrete (PCC) on 7" of aggregate base, on a 4" filter course aggregate, on select subgrade fill.

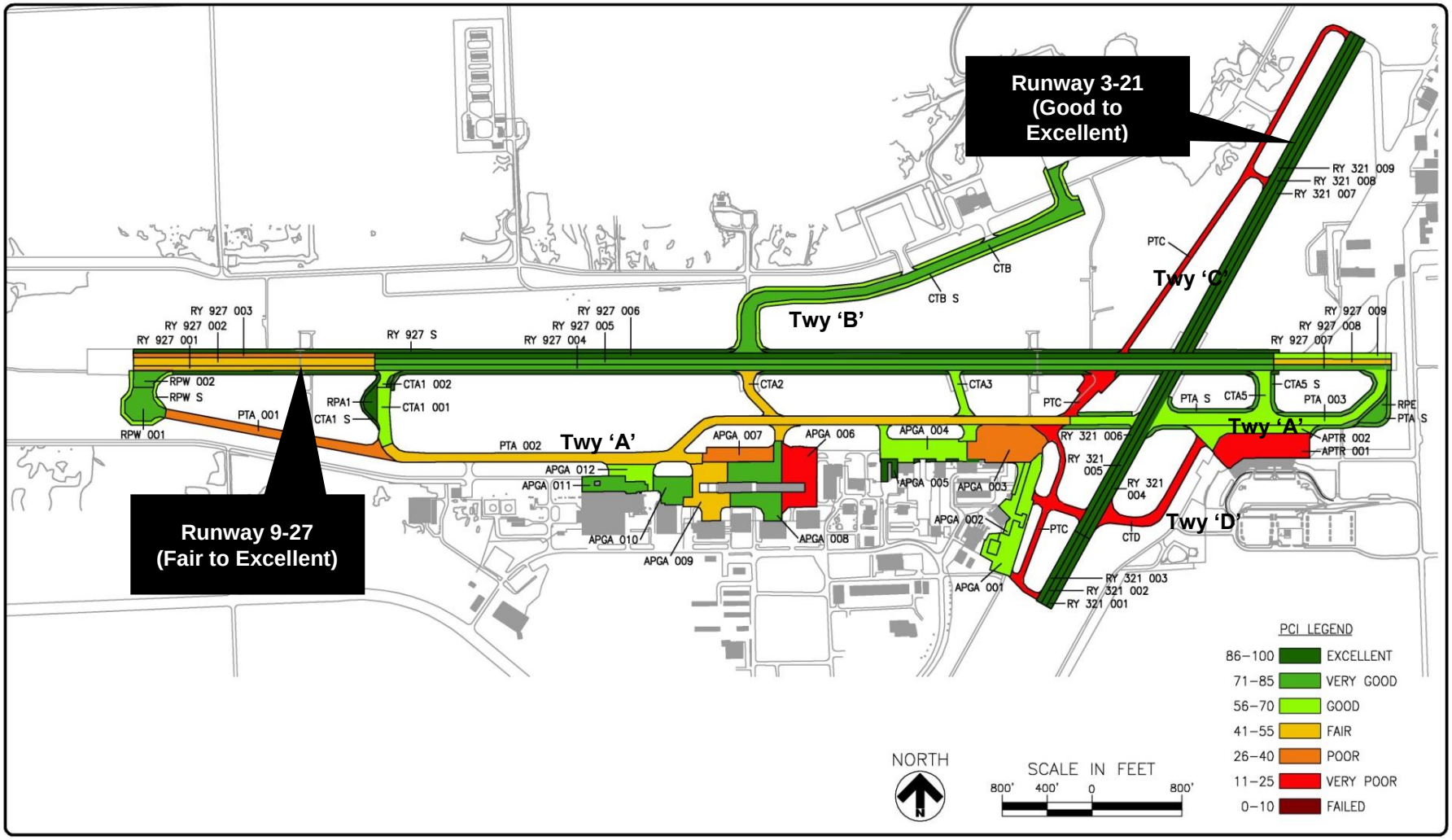
The PCI analysis included an assessment of the existing 2010 base case pavement conditions, and also an extrapolation of pavement conditions projected during the next 5 and 10-year periods. The projected PCI values indicate a pattern of progressive taxiway and apron pavement deterioration from the 2010 base year.

The analysis concluded that the Runway 9/27 pavement was some of the lowest scoring pavement on the airfield and the west side of the runway was the lowest scoring out of the runway pavement. Over the runway ranged from fair to poor on the west side and very good to excellent on the east side. Runway 9/27 was constructed in the late 1940's. The pavement structure consists of 10" of Portland Cement Concrete (PCC) on 7" of aggregate base, on a 4" filter course aggregate, on select subgrade fill.

Pavement cores were taken at various locations on Runway 9/27. American Engineering and Testing conducted an engineering analysis to determine the pavement condition of Runway 9/27. The study included a field investigation of pavement condition and falling weight deflectometer testing of the runway. The results of the investigation are summarized in the "Report of Pavement Testing and Engineering Analysis" dated June 24, 2009.

The findings of the analysis indicated that the runway concrete panels are on the low side of adequacy in structural strength and load transfer. Large voids exist under the concrete panels in corners where subgrade support needs improvement. It is anticipated that the concrete panels will perform adequately for a limited time period, but structural improvements should be planned in the near future. It is anticipated that the pavement will be beyond is useable life in 5 to 10 years and will require reconstruction.

Exhibit 3-3
DULUTH AIRPORT PAVEMENT CONDITION INDEX (PCI) - 2010 BASE CASE INSPECTION



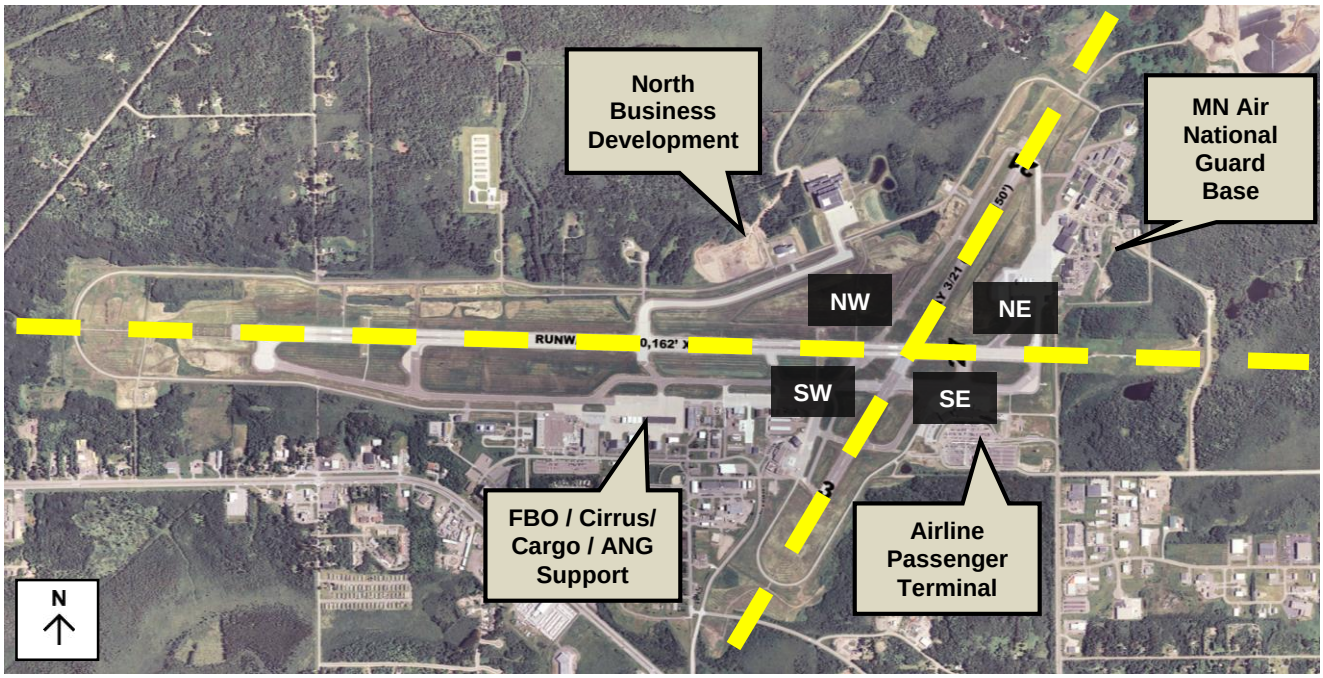
Source: 2010 Pavement Condition Index (PCI) Study – Duluth International Airport.

3.3 AIRPORT QUADRANTS

The Airport is geographically segregated into four quadrants, by virtue of the runway orientation as shown on Exhibit 3-4. Each of the quadrants, as described below, is predominately characterized by distinct aeronautical uses and tenant activities.

Southeast Quadrant	Passenger Terminal Area (Building, Airline Ramp and Auto Parking)
Southwest Quadrant	General Aviation (Fixed Base Operator, Special Aviation Service Organizations, Air Cargo, Air Traffic Control, and Air National Guard Support Facilities)
Northwest Quadrant	Large Commercial and General Aviation Business Tenants, Airport Support and Navigational Facilities.
Northeast Quadrant	Minnesota Air National Guard Complex

Exhibit 3-4
AIRPORT AREA QUADRANTS

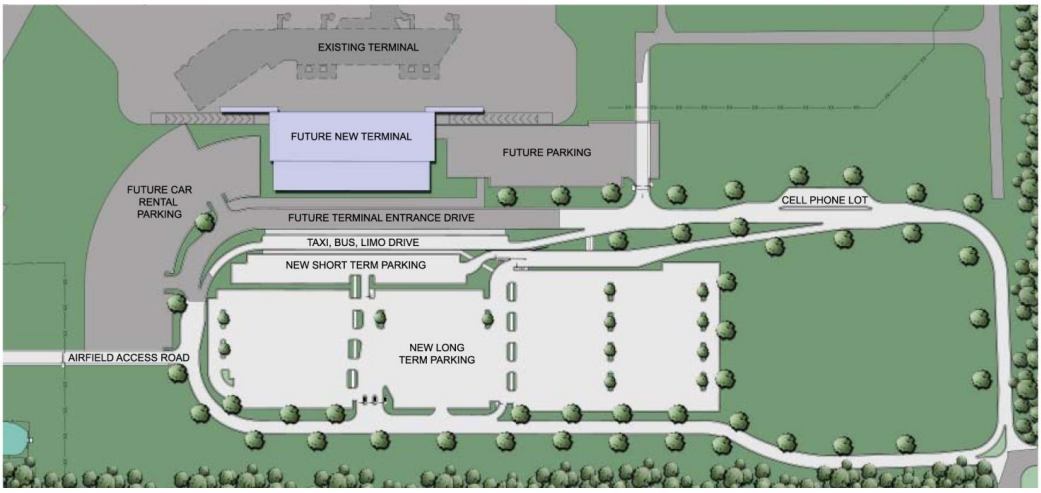


Source: Airport Aerial Image, June 2010.

3.3.1 Southeast Quadrant

The Southeast Quadrant, which comprises about 55 acres currently dedicated exclusively to the passenger terminal facility is depicted on Exhibit 3-5. As depicted, this area underwent re-development in 2010 for construction of a new terminal building, auto circulation and vehicle parking.

Exhibit 3-5
NEW TERMINAL AREA FACILITIES & LOCATION



Source: RS&H Site Rendering, 2010

3.3.2 Southwest Quadrant

The Southwest Quadrant located southwest of the runway intersection is shown on Exhibit 3-6. This quadrant, once the location of the US Air Force base property and former passenger terminal, now serves as the core for general aviation, air cargo, and includes other special aviation service organizations with varied aeronautical interests. Facilities within the southwest quadrant include:

- General Aviation facilities
  - Fixed Base Operator Buildings/Hangars
  - Special Aviation Service Organizations Buildings/Hangars
  - Individual Aircraft Hangars (various types, size and uses)
  - FBO Fuel Farm
- Air Traffic Control Tower
- Air Cargo / Cargo Sortation Facilities
- Airport Maintenance / Electrical Buildings
- MNANG Air National Guard Support Facilities / Fuel Storage

Nearly all of the facilities north of Airport Road are aviation-related, and have airfield access. To the south of Airport Road is a mixed development area, which includes the leased Federal Prison Camp, and a leased area west of Taylor Street under lease by the Minnesota Air National Guard. The MN Air National Guard (MNANG) also has an area located in the southwest quadrant which once housed support facilities.

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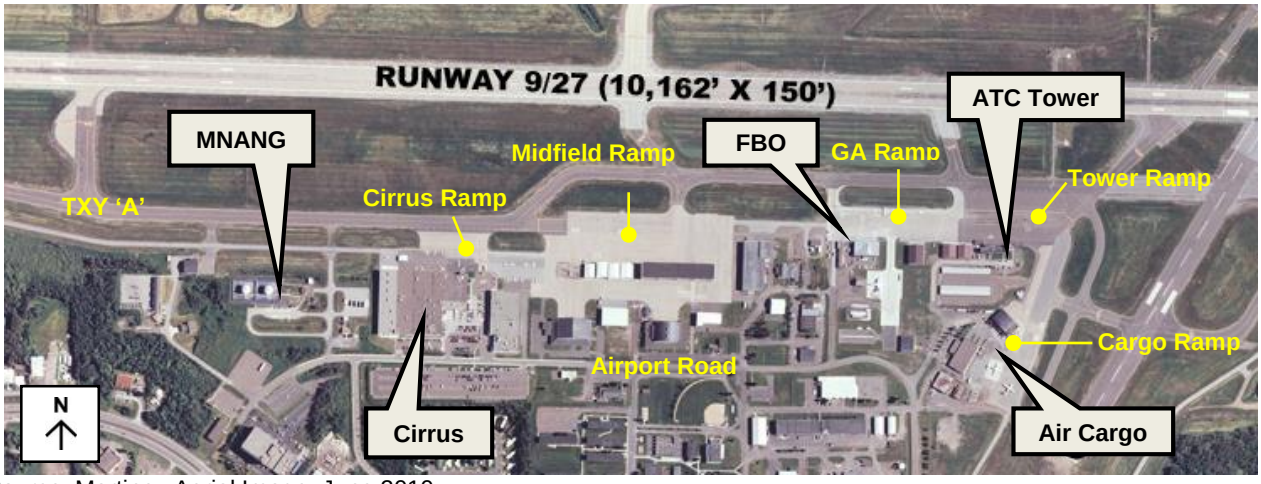
The Southwest Quadrant, which includes aviation and non-aviation land uses developed following the closure of the USAF facility in 1982, is characterized as being relatively flat and served by sufficient utilities and drainage systems, but offers limited expansion capability. The curvature of the parallel Taxiway 'A' constrains developable areas bound by Airport Road, the major arterial corridor route through this area. Consequently, the Southwest Quadrant has been the focus of various re-development studies, including sub-area options to construct new buildings, hangars, aprons and roadway re-alignments upon the renovation and removal of select infrastructure, and providing new vehicle circulation and access.

Exhibit 3-6
SOUTHWEST QUADRANT AREA



Source: Martinez Aerial Image, June 2010.

3.3.3 Northwest Quadrant

The location and major facilities included in the Northwest Quadrant are illustrated on Exhibit 3-7. This area, located north of Runway 9-27, is largely undeveloped when compared to the southwest quadrant. The facilities located in the northwest quadrant include the North Business Development Area, the Aircraft Maintenance Center, the Airport Aircraft Rescue and Fire Fighting building, Airport Surveillance Radar, and an Air National Guard munitions facility. Primary access to existing facilities is provided via North Stebner Road.

North Business Development Area: A 15-acre site located along Taxiway 'B', intended for larger, high-end general aviation facilities, including hangars serving businesses with public auto access. The 120,000 square foot apron is planned to support a mix of large common building/hangars, within hangar development sites ranging from 12,000 to 80,000 square feet.

Aircraft Maintenance Center: An 18-acre site located along Taxiway 'B', comprised primarily of a large clearspan hangar and associated ramp area. Northwest Airlines constructed the 189,000 square foot Maintenance, Repair and Overhaul (MRO) facility in 1996, in which the hangar is capable of simultaneously accommodating up to three A319/320 transport aircraft. The hangar includes a 140,000 square foot ramp (Bravo Ramp) with a dedicated earthen berm area to minimize noise during engine run-ups. Since being operated as a MRO, ownership of the facility has reverted to the City of Duluth Economic Development Authority (DEDA).

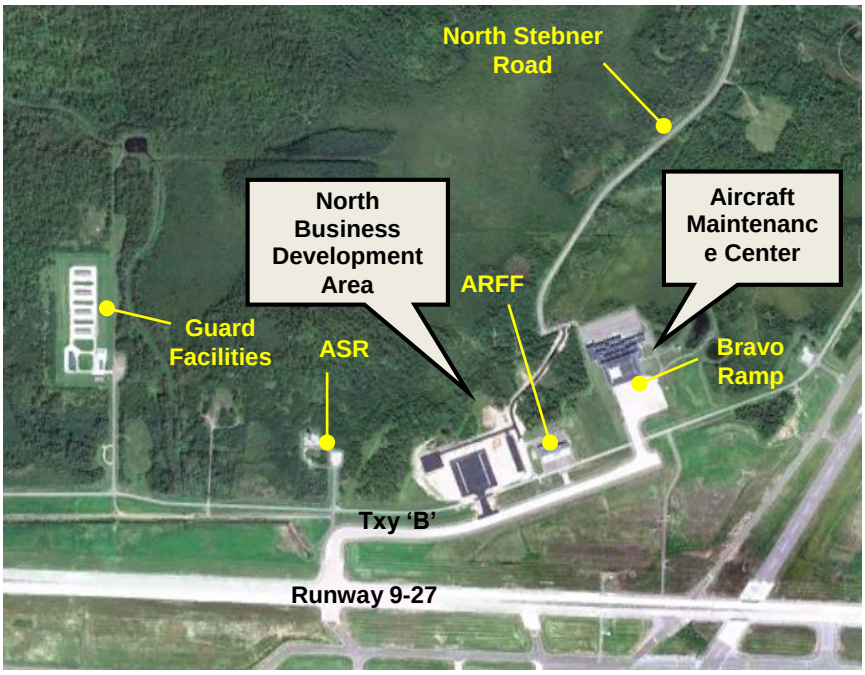
Aircraft Rescue and Fire Fighting Building (ARFF): The 3-acre ARFF building site is located along Taxiway 'B', west of the Aircraft Maintenance Complex. Operated by the MNANG, the 19,000 square foot building is in excellent condition, and contains eight vehicle bays with equipment and services for providing military and civilian purposes. The Duluth International Airport is currently classified as a Class I Index B Part 139 facility, however the ARFF equipment and staffing meets the requirements for Index D, including first responder medical services in the airline terminal area. A listing of the FAR Part 139.315 index specifications is provided in Table 3-3.

Table 3-3
FAR PART 139 INDEX SPECIFICATIONS

Airport Status	Airport Index	Aircraft Length	Number of Vehicles	Scheduled Daily Departures	Agent and Water Foam Requirements
	A	< 90 Feet	1	1 or more	500 Pounds of DC/HALON 1211 or 450 Pounds of DC and 100 Gallons of Water
Part 139 Certified	B	90 to126 Feet	1	5 or more	Index A equipment and 1,500 Gallons of Water
			2	Less than 5	Index A equipment and 1,500 Gallons of Water
	C	126 to 159 Feet	2	5 or more	Index A and 3,000 Gallons of Water
				Less than 5	Index A and 3,000 Gallons of Water
Equipped	D	159 to < 200 Feet	3	5 or more	Index A and 4,000 Gallons of Water
				Less than 5	Index A and 4,000 Gallons of Water
	E	200 Feet and Greater	3	5 or more	Index A and 6,000 Gallons of Water

Source: FAR Part 139.315 – Aircraft Rescue and Firefighting Index Specifications

Exhibit 3-7
NORTHWEST QUADRANT AREA



3.3.4 Northeast Quadrant

The Northeast Quadrant contains the Minnesota Air National Guard (MNANG) base facilities as shown on Exhibit 3-8. The Air National Guard's 179th Fighter Squadron is the flying component of the 148th Fighter Wing, an Air Combat Command unit under control of the 1st Air Force. The MNANG has operated the F-16C at Duluth since 2003. In 2010, the Air Wing converted the F-16 Block 50 models to extend the life of the F-16C mission at Duluth.

Airfield access to the MNANG base is via Taxiway 'E1' and 'E2' to the Runway 27 end, and Taxiway 'F' to the Runway 21 end. The secured MNANG vehicle access is provided via Duece Avenue. The Guard leases about 140 acres from the State of Minnesota, which includes the majority of the 60 to 70 buildings operated by the MNANG. In addition MNANG leases a 16-acre site from the Duluth Airport Authority for munitions storage, and a precision measurement equipment lab in the Northwest Quadrant. A Tactical Air Navigation system (TACAN) located about 1,200 feet northwest of the runway intersection is maintained by the MNANG. Also, the Guard operates a snow removal equipment (SRE) building located on the Base, which sometimes supports Airport operations during exceptional snow clearing situations.

Exhibit 3-8
NORTHEAST QUADRANT AREA

3.4 PASSENGER TERMINAL COMPLEX

The 30-acre passenger terminal complex is located in the southeast quadrant, and contains the airline passenger building, airline parking ramp, vehicle access routes, and auto parking lots for patrons and tenants.

3.4.1 Former Passenger Terminal Building

The former 106,000 square foot passenger terminal building was built in 1974, in which the building layout and space allocation became functionally obsolete in the September 11 era of federal security requirements. Additionally, the terminal building was located less than 850 feet from the Runway 9-27 centerline, which often resulted in the tails of parked aircraft penetrating the FAR Part 77 imaginary surfaces extending outward from the runway. As a result, the Duluth Aviation Authority elected to construct a new modern terminal building as a larger and more efficient replacement to the former building. The old terminal building will be demolished and the space converted to aircraft ramp parking in completing the new replacement building.

3.4.2 New Replacement Passenger Terminal Building

Construction of the new 113,000 square foot passenger terminal began in 2010. The new terminal building, built about 200 feet south of the former building, also involved the expansion of the aircraft ramp parking positions, expansion of the auto parking facilities and realignment of the roadway circulation and curbfront. Exterior images of the new terminal are shown by Exhibit 3-5 and Exhibit 3-9. The layout of the new terminal building is shown by Exhibit 3-10, as described below by level.

Level 1 - Vehicles approaching the landside of the terminal have the opportunity to drop-off and pick up passengers under a continuous canopy that cantilevers above the sidewalk and the inside drop off/pick up lane. Two vestibules connect the building interior with the curb front, one vestibule leading into the ticketing lobby, and the other leading out of the baggage claim area. Once inside the terminal, the passengers experience a two story high open space with a curved ceiling. Passengers are able to see ticketing counters, baggage claim areas and car rental counters from any point of the lobby. Security screening of all checked bags take place in a room behind the check-in counters. The baggage claim area is designed to accommodate both domestic and international flights. A full U.S. Customs and Border Protection facility is provided adjacent to the westernmost conveyor which can be separated from the rest of the terminal by means of movable partitions.

Level 2 - Passengers access the second floor of the terminal via the centralized stairs, escalators, and elevator. Departing passengers proceed from the central landside space into the passenger screening zone. This zone allows for the processing of travelers and the inspection of their carry-on bags and directs passengers into the passenger boarding lounge, which is a continuous space that serves the four aircraft gate positions. A food concession, a bar, and two sets of restrooms serve the passenger boarding lounge.

Level 3 - The third level of the terminal primarily consists of administration office spaces and TSA office spaces. Mechanical rooms contain the housing of heating, ventilation, and air condition equipment provided at each end of the central service core.

The terminal building square footage and percentage of occupancy by major functional area is identified in Table 3-4.

Table 3-4
NEW PASSENGER TERMINAL BUILDING FUNCTIONAL AREAS

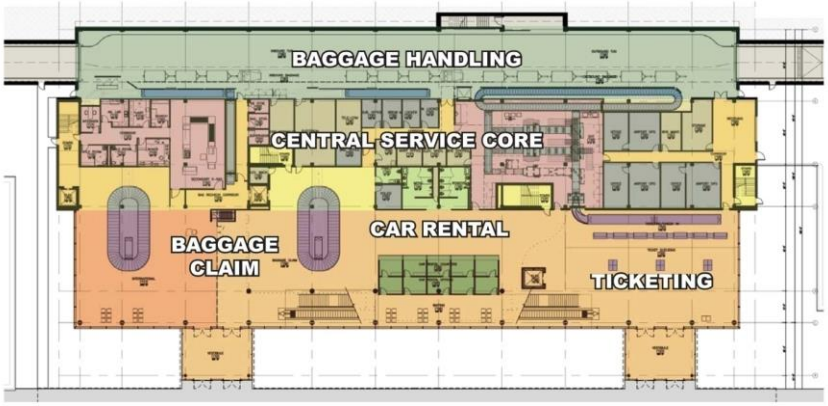
Major Termial Building Functional Areas	**Area (SF)**	**Area (%)**
Airline Functional Areas	22,520	20%
Security Areas	4,750	4%
Terminal Concessions	3,050	3%
Public Areas	20,810	18%
Non-Public Areas	38,010	33%
Miscellaneous/Additional Areas	24,460	22%
Total Area (SF)	**113,600**	**100%**

Exhibit 3-9
NEW PASSENGER TERMINAL BUILDING

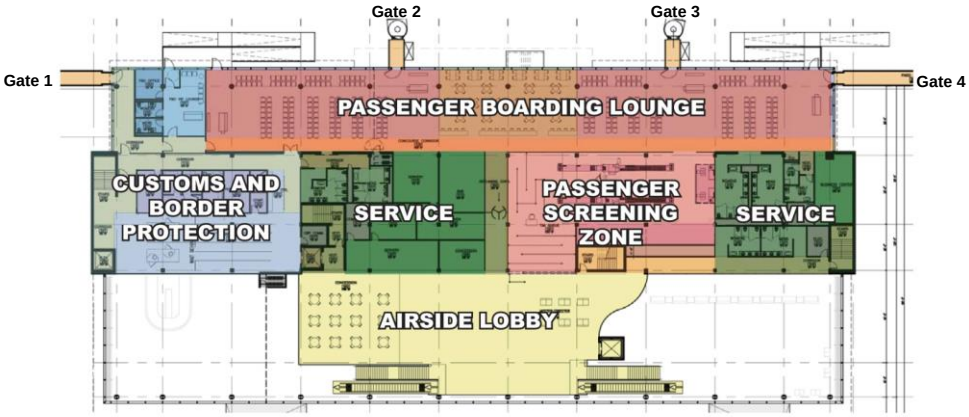
VIEW OF PASSENGER TERMINAL BUILDING ENTRANCE – CURBSIDE

VIEW OF PASSENGER TERMINAL BUILDING ENTRANCE – AIRSIDE

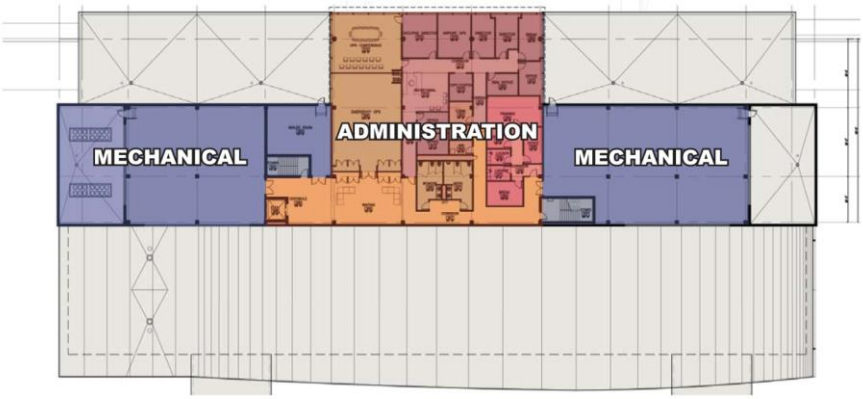
Exhibit 3-10
PASSENGER TERMINAL FLOORPLAN
(FIRST, SECOND, THIRD FLOOR LEVELS)



FIRST FLOOR PLAN



SECOND FLOOR PLAN



THIRD FLOOR PLAN

3.4.3 New Replacement Terminal Gates

The terminal building is configured with four contact gates utilizing enclosed passenger boarding bridges. While not simultaneously, all gates (Gate #1, #2, #3 and #4) are configured to accommodate narrowbody aircraft up to the size of a Boeing 757, which encompasses all domestic air carrier aircraft anticipated to operate at the Duluth International Airport. In addition, Gate #1 is designated to accommodate international flights, including aircraft larger than the Boeing 757. Gate #1 is connected to the U.S. Customs and Border Patrol terminal building facilities, for the processing of international passenger arrivals.

3.4.4 New Replacement US Customs

The location of the US Customs and Border Protection facilities within the new terminal building is illustrated in Exhibit 3-10. At Duluth, these facilities are used to process passenger flights, techstop cargo operators and military lift flights. Arrival flights requiring federal inspection services are typically accommodated at the Customs Apron, which is located on the west side of the terminal building. Passengers processed through customs typically deplane the aircraft through the west passenger boarding bridge. Arriving military aircraft requiring customs service typically park on the Terminal Apron when the Guard ramp is closed.

3.4.5 New Replacement Vehicle Access and Auto Parking

Grinden Drive (formerly Airport Road) provides terminal access connecting with the intersection of Haines Road and Airport Road. The 4,200 linear foot two-lane entrance roadway provides a one-way loop with access to the terminal building, public auto parking lots, rental car lots, cell phone lot and other secured points of access. The entrance road, with 12-foot at-grade lanes, separates into a divided multi-lane curbfront spanning 750 along the terminal building. The north divided curbfront has three lanes for accommodating passenger loading and unloading, including one outer passing through-lane. The south divided curbfront contains two lanes dedicated to livery transportation, including taxi cabs and shuttle buses.

The auto parking for the new terminal building is summarized in Table 3-5, including the number and percentage of spaces dedicated to various parking functions. Parking totals about 1,300 spaces for both public and private use, including short and long term (economy) parking, a combined rental car ready-return lot, employee-permit parking and a cell phone lot. The inter-connected short and long-term parking have two gated-carded points of access, and are revenue lots with a single collection booth location. Auto parking layouts and lot sizes are sufficient for the existing airline passenger levels.

Table 3-5
NEW TERMINAL AUTO PARKING (SPACES)

Auto Parking Lot(s)	Spaces (#)	Spaces (%)
Public Auto - Short Term	90	7%
Public Auto - Long Term	780	60%
Rental Car Lot	280	22%
Employee Lot	140	11%
Cell Phone Lot	10	1%
Total	**1,300**	**100%**

3.5 AIR CARGO-MAIL FACILITIES

Scheduled express air cargo operations are conducted by FedEx and UPS, operating daily service using turboprop aircraft (2010), as described below:

FedEx: FedEx typically operates an ATR 42 twin-turboprop aircraft between Duluth and Minneapolis five days a week, or about 520 operations per year. If weather is severe in Minneapolis, an ATR 42 departs Memphis to Duluth and returns to Memphis with a payload reduction to accommodate fuel range. FedEx Air cargo processing facilities are located west of the Runway 3 end, and consist of a 20,000 square foot sort facility with an attached 2,700 square foot office (Building 612), and a 11,300 square foot air operations/equipment storage structure (Building 622) located north of Building 612. Building 622 is an old hangar, in poor condition, energy inefficient, and located within the Runway 3-21 Building Restriction Line (BRL).

UPS: UPS operates daily aircraft service at Duluth as contracted under Bemidji Airlines using a Fairchild Metroliner, conducting about 730 operations per year. UPS does not have cargo sort or processing facilities located on the Airport, but rather processes enplaned and deplaned express package cargo on the FBO/General Aviation ramp using delivery trucks.

Other Cargo – US Mail is transported under contract by the air carrier as belly cargo, and is processed through the air carrier terminal building. Other non-scheduled air cargo and freight is normally processed through the Fixed Base Operator (FBO) facilities.

3.6 AIRPORT MAINTENANCE FACILITIES

The Airport owns and operates a variety of snow removal equipment and general maintenance vehicles which is kept in closed storage. Airport maintenance equipment is stored in four separate locations on the Airport, primarily located in the southwest quadrant. The primary Snow Removal Equipment is Building 303. This building is in good condition and has direct access to the airfield. Sand storage is also kept in Building 303. Building 306, located adjacent to the primary SRE building, is a secondary storage building for SRE equipment and general airport maintenance storage and does not have airfield access. Building 306 is in good condition. The Airport utilizes Building 603 located adjacent to the cargo sortation facility, as a cold storage building. The cold storage building is in poor condition and has airfield access. Also, small maintenance equipment is kept in the terminal building basement.

3.7 GENERAL AVIATION FACILITIES

General aviation facilities are concentrated primarily in the southwest terminal area. While there are multiple aeronautical businesses located on the Airport, most aircraft and pilot services are provided by the Fixed Base Operator (FBO) and other Special Aviation Service Organizations (SASO).

3.7.1 Fixed Base Operator (FBO)

The Airport is served by a single FBO with core operations located on the General Aviation ramp, south of Runway 9-27. The FBO operates from a 13,500 square foot 2-story building (Building 609), which includes a business center and two attached hangar bays. The FBO also leases and manages other buildings located with the southwest quadrant, including common box and T-hangar units, and assumes a lease to develop hangars and aviation related facilities at the North Business Development Area. Recently the FBO facilities have been expanded to accommodate additional growth, including expansion of the FBO apron towards Taxiway ‘A’, construction of a new taxilane for additional aircraft parking and to serve new hangars, and roadway improvements.

The FBO provides support for the following general aviation services:

- Aircraft fuel storage & dispensing (100LL and Jet-A) to air carrier operators, charter (techstops) and general aviation operators.
- Aircraft airframe maintenance, engine repair and avionics (Cessna and Cirrus Authorized Service Station and Parts Distributor)
- Aircraft line service and hangar storage
- Pilot and passenger accommodations (lounge, flight planning and office / support space)
- Certified aircraft parachute services

FBO Techstops: Techstops are an FBO service which involves a quick-turn of fuel, crew and passenger accommodations, aircraft catering, and other processing for international long-haul passenger and freight flights. Techstops usually represent the largest aircraft using the Airport and typically include on-demand freight operators, charter passenger operators and other contract and ferry flights. Duluth is an attractive techstop Airport because of its geographic proximity to great-circle routes between the Southwest United States and Europe, the 10,000-plus primary runway length, uncongested airspace, and ease of clearing US Customs. Nearly 80 percent of all the Duluth techstop flights are being served on both their inbound and outbound trip segments. Business jet aircraft comprise of 60 to 80 percent of techstops. About 80 percent of the techstops involve clearing US Customs, most clearing customs on the airline ramp. Transport aircraft needing to clear customs typically park on the Airline Terminal Ramp. Techstops are typically accommodated within several hours, and some for 24 hours to provide crew rest. The techstop aircraft range from larger-cabin corporate jets, heavy widebody passenger transports to ultra-large cargo transport aircraft. On average, the FBO receives one business jet techstop per day and one to two large transport techstops per month.

In 2010 when this was written, the FBO was expanding its contract techstop business for serving transport size aircraft, and intended to increase the techstop business to 400 arrivals per year, including three to five international transports per week; and more frequent flights by the Boeing-747 and Antonov aircraft. However, there are several Airport facility limitations in expanding the techstop business at Duluth. This includes the need for a longer secondary runway, and a larger dedicated apron to accommodate multiple and simultaneous techstop parking positions, including de-icing. The secondary runway has insufficient length to accommodate the larger techstop traffic, which is an issue when the Runway 9-27 crosswind component is exceeded, resulting in techstop traffic having to divert or operate from another airport. The FBO estimates a secondary runway length of about 8,500 feet is needed to accommodate large aircraft techstops and diverted aircraft during strong crosswind conditions. These large aircraft techstops would represent approximately 5 percent of the aircraft techstops throughout the year.

FBO Hangars: The FBO occupies and manages multiple types of hangars in the Southwest Quadrant, used for a variety of general aviation purposes. The primary FBO building (#609), which contains the FBO offices and attached hangar bays used for aircraft maintenance and transient aircraft storage. The largest aircraft able to be stored in the FBO hangars is a medium to large-cabin business jet, with insufficient hangar width and door clearance height to accommodate the ultra-large cabin jets operating at the Airport (i.e., Gulfstream 400/500, Global Express). The FBO maintains a waiting list of 10 to 12 individual based aircraft prospects, typically demanding small box hangar units.

FBO Apron: The FBO aprons serve as aircraft parking, de-icing and maneuvering area, which combined totals 870,000 square feet. The FBO experiences a shortage of aircraft parking space during peak operating periods of the year, and when large techstop aircraft occupy the ramp area, which is compounded by the lack of a connecting apron taxiway between the General Aviation Ramp and the Midfield Ramp, and ATCT line-of-sight issues associated with Taxiway A.

FBO Auto: The primary FBO auto parking is south of FBO building (#609).

3.7.2 Special Aviation Service Organizations (SASO)

There are three Special Aviation Service Organizations located at the Airport, which are involved in aeronautical facilities, but not providing direct pilot and passenger services to Airport customers. A description of their facilities is provided below.

- Cirrus Design: A manufacturer of high performance single-engine piston aircraft headquartered at the Airport since 1994, with facilities located west of the Midfield Ramp. The Cirrus facilities are accessed is via Taxiway 'A', with auto access via Airport Road. Cirrus occupies multiple buildings; including a 170,000 square foot aircraft production facility, a 64,000 square foot customer service center and paint building, and a storage hangar (#102) on the Midfield Ramp. In recent years, Cirrus flight activity, which entails testing, familiarization, and pilot training/proficiency, accounts for about 8,000 to 10,000 Duluth operations per year, which equates to about 30 operations per aircraft produced. About 20 percent of the Cirrus flights are conducted at surrounding airports.

- Lake Superior College's Center for Advanced Aviation (CAA): Lake Superior College provides a FAA certified professional pilot degree program as well as traditional flight instruction. The college conducts ground classroom training in Building 616, and stores six fixed-wing aircraft (single and twin piston engine) and one helicopter in the FBO hangar (#7). With an average of 30 enrolled flight students, eight to ten flight training sessions occur per day. The College estimated during an interview that it conducts 10,000 to 12,000 training operations annually at the Duluth International Airport, in addition to flights conducted at surrounding airports. Auto parking for faculty, staff, and students is typically limited and must be shared with other Building 616 tenants and the FAA tower staff.

- Jet Duluth: A based operator with a 9,700 square foot hangar (#117).

3.7.3 Aircraft Aprons

The Airport has nine separate aircraft apron areas used for civilian purposes, as summarized on Table 3-6. The aprons total over 2.0 million square feet and accommodates up to about 95 aircraft parking spaces. The apron areas, all beyond the air traffic control non-movement area, are used by various operators and a broad range of aircraft purposes, including commercial and general aviation users, helicopter landing/parking areas, loading of passengers and cargo, and hangar access.

3.7.4 GA Aircraft Hangars

Aircraft hangar information, including building type, size and ownership is listed on Table 3-7. The hangars, which total over 300,000 square feet, are mostly located in the Southwest Quadrant, and vary from older WW-II era common clearspan hangars to newer individual box and T-hangars. The majority of the hangar buildings are owned by the Airport, with the FBO managing nearly 66,000 square feet of hangar building space. Limited space is available within the southwest quadrant to construct new hangars, particularly for larger turbine and jet aircraft. Planning has been undertaken to identify re-development options for hangar and apron expansion within the southwest quadrant, which includes options for building removal and relocation. The inadequate space has prompted development of new larger hangar facilities on the northwest side of the Airport, along Taxiway B.

Table 3-6
APRON AREAS (CIVILIAN)

Apron Name / Designation	Terminal Quadrant	Apron/Ramp Use	Apron Size (SF)	Apron Parking Spaces
Air Carrier - Existing	Southeast	Total Air Carrier (Existing Building)	300,000	4 to 5
Air Carrier - New	Southeast	Total Air Carrier (New Building)	374,000	5 to 6
Midfield Hangar Ramp	Southwest	GA Hangar Ramp / General Parking	552,100	10 to15
Tower Ramp	Southwest	GA Rental Tie-Down / General Parking	320,250	4 to 8
General Aviation Ramp	Southwest	GA/FBO Tie-Down / General Parking	154,200	10 to 12
Air Cargo Ramp	Southwest	Tenant Aircraft/Hangar Ramp Parking Area	221,300	2
Cirrus Ramp	Southwest	Tenant Aircraft/Hangar Ramp Parking Area	202,000	15 to 20
Bravo Ramp	Northwest	Tenant Air Maintenance Center	140,000	3 to 10
North Development Area	Northwest	GA Hangar Ramp / General Tie-Down	71,550	5 to 15
Subtotal Air Carrier (New Building)			374,000	5 to 6
Subtotal Tenant			563,300	20 to 32
Subtotal General			1,098,100	30 to 50
Total			**2,035,400**	**58 to 95**

Note: Parking spaces dependent on aircraft size.
Source: 2010 PCI Report, Duluth Terminal Apron Expansion Plans (2010).

Table 3-7
HANGAR BUILDING LIST

Hangar #	Hangar Type	Hangar (SF) (Building Area)	Building Owner	Tenant (Leasee)
4	Box Hangar	5,700	Monaco (FBO)	--
6	Box Hangar	6,300	Monaco (FBO)	--
7	Box Hangar	6,300	Monaco (FBO)	Lake Superior College
101	Common Hangar	20,000	Confederate Air Force	Confederat Air Force
102	Box Hangar	13,300	Cirrus	Cirrus
103	Common Hangar	23,000	Duluth Airport Authority	--
104 (7/8)	Box Hangar	9,500	Duluth Airport Authority	Cirrus
104 (9/10)	Box Hangar	9,500	Duluth Airport Authority	--
104 (11/12)	Box Hangar	9,500	Duluth Airport Authority	--
104 (13/14)	Box Hangar	9,500	Duluth Airport Authority	--
105	Box Hangar	4,200	Duluth Airport Authority	--
106	Box Hangar	4,200	Duluth Airport Authority	Individual
107	Box Hangar	4,200	Duluth Airport Authority	Individual
108	Box Hangar	3,700	Goldschmitdt / Kundel	Goldschmitdt / Kundel
117	Box Hangar	9,700	Jet Duluth	Jet Duluth
608	T-Hangar	12,000	Duluth Airport Authority	Monaco (FBO)
609	FBO (Facility/Hangar)	11,600	Monaco (FBO)	Monaco (FBO)
611	Old SRE/Monaco Storage	8,000	Duluth Airport Authority	Monaco (FBO)
612	Fed Ex - Sortation Facility	19,000	FedEx	FedEx
614	Hangars (Ranch Hangars)	10,000	Duluth Airport Authority	Monaco (FBO)
615	T-Hangars	14,000	Duluth Airport Authority	Monaco (FBO)
622	FedEx - Sortation Facility	10,200	Duluth Airport Authority	FedEx
N/A	Airport Maintenance Center	80,500	Duluth Economic Development Authority	--
Total		**303,900**		

Note: Hangar building areas include all buuilding and and hangar storage area.
Note: Airport Maintenance Center does not have an assigned Hangar/Building number.
Source: Duluth Airport Authority

3.7.5 Airport Fuel Facilities

The capacity of the FBO owned and operated fuel farm, which includes five tanks totaling 110,000 gallons is summarized in Table 3-8. There are two fuel farm facilities in the Southwest Quadrant area. These facilities include the general aviation fuel farm located behind the FBO (Building 609), and the Air National Guard fuel facilities discussed in the Southwest Area Guard Facilities section. The FBO has a contract with all airlines to refuel aircraft. Primary access from the fuel farm to the airfield is through the FBO T-Hangar site to the general aviation ramp. The fuel farm is in good physical condition, as there is no immediate storage capacity or dispensing deficiencies.

Table 3-8
AIRCRAFT FUEL STORAGE

Fuel Tank Owner	Tank Location	Tank Type [/1]	Fuel Type	Capacity (Gallons)
FBO	Tank Farm - SW Quadrant	AST	Jet-A	25,000
FBO	Tank Farm - SW Quadrant	AST	Jet-A	25,000
FBO	Tank Farm - SW Quadrant	AST	Jet-A	25,000
FBO	Tank Farm - SW Quadrant	AST	Jet-A	25,000
FBO	Tank Farm - SW Quadrant	AST	100LL	10,000
TOTAL				**110,000**

[/1] AST - Above Ground Storage Tank

FBO / Other Auto Parking: The FBO public-use auto parking lot is located directly south of the FBO building. Access to the FBO auto parking lot is provided via a dedicated entrance from Airport Approach Road. Other major commercial/business leaseholders have dedicated auto parking lots available adjacent to their own building/facility.

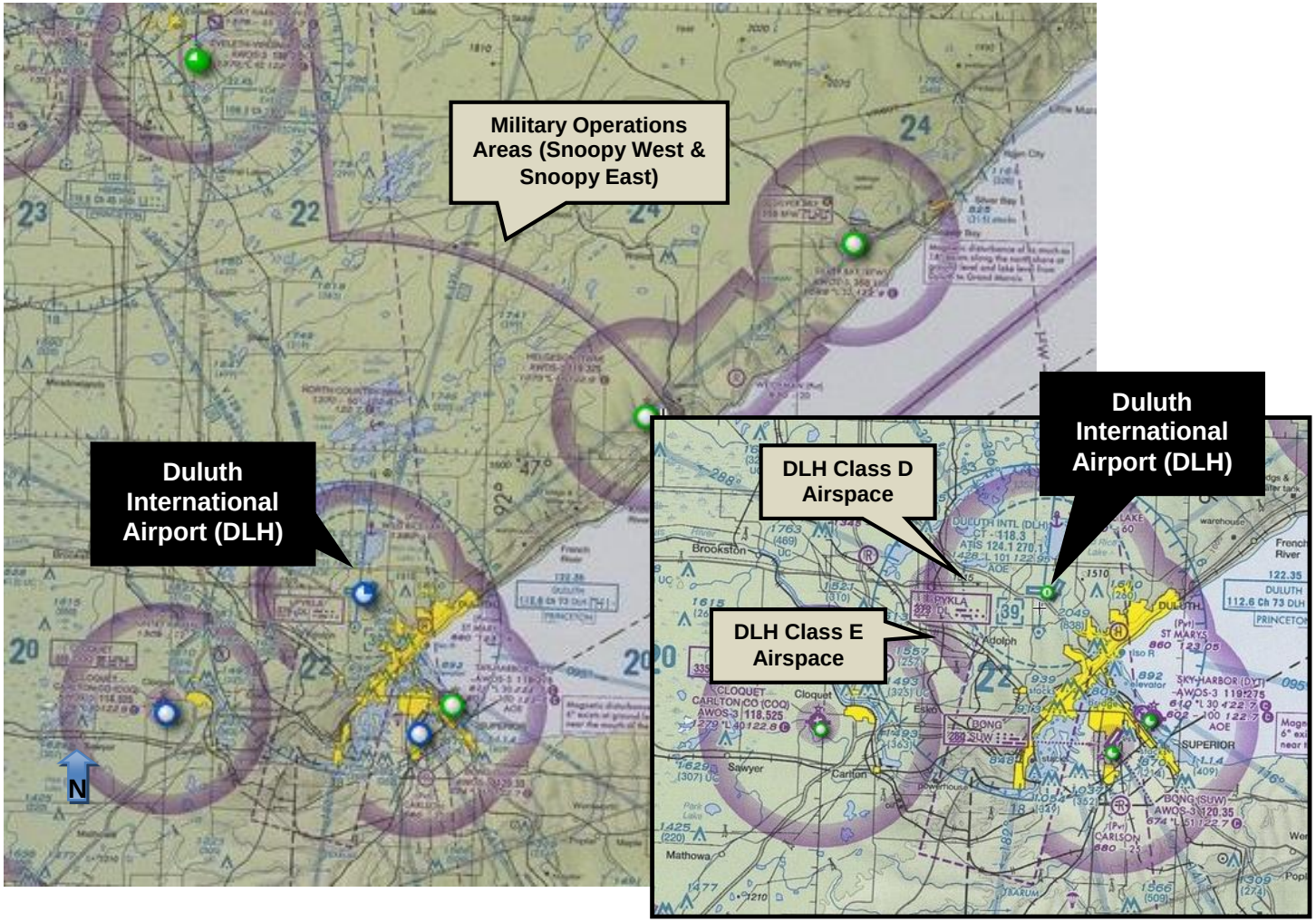
3.8 AIRSPACE / AIR TRAFFIC CONTROL

The airspace and navigation system surrounding the Duluth International Airport is depicted in Exhibit 3-11. The types and location of the navigational aids equipment provided at the Airport is listed on Table 3-9. This equipment provides electronic and visual guidance reference to pilots, and supports the instrument procedures at the Airport.

Controlled Class D airspace associated with the Air Traffic Control Tower (ATCT) extends from the surface to 3,900' mean sea level within a 5-nautical mile radius of the Airport, with Class E airspace extending to the south to accommodate an instrument approach corridor, and the controlled airspace associated with instrument procedures at surrounding airports; Sky Harbor Airport (DYT); Bong Airport (SUW) and Cloquet Carlton County Airport (COQ). Multiple visual and jet airway routes transition over the Duluth high-altitude VORTAC, located 4.9 miles south of the Airport.

Duluth air traffic services are conducted under jurisdiction of the level-six Air Traffic Control Tower (ATCT), Terminal Approach Control Facility and Minneapolis Air Route Traffic Control Center. The 24-hour tower and radar facilities are housed in the federal ATCT located 1,800 feet southwest of the runway intersection, in which radar service is provided through an Airport Surveillance Radar (ASR 7) located north of the midfield of Runway 9-27. Due to building age and line-of-sight issues, the ATCT building is under consideration for replacement/relocation.

Exhibit 3-11
AIRSPACE STRUCTURE (LOCATION & VICINITY)



Source: U.S. DOT and Federal Aviation Administration – Aeronautical Chart.

3.8.1 Local Airport Traffic Patterns

The Airport has a standard left-hand traffic pattern (downwind, base and final) for Runway 9-27 and Runway 3-21. The Airport does not impose special traffic patterns/regulations for noise abatement procedures. Any noise complaint issues are typically the result of military operations and originate from residents located approximately two miles west of the Airport or five miles southeast of the Airport.

Table 3-9
AIRPORT NAVIGATIONAL AID (NAVAID) EQUIPMENT

Airport NAVAID	Airport Location/Proximity (Saftey Area Buffer)
VORTAC (High Altitude)	? 3 Miles South of the Airport (1,000' to 1,500 Buffer) – FAA Owned
TACAN (Military Use)	? 1,200' NW of Runway Intersection (Military) – Military owned
ILS-CAT 2	Runway 9 Glideslope/Localizer (FAA Critical Area) - //fFAA owned
ILS-CAT 1	Runway 27 Glideslope/Localizer (FAA Critical Area) – FAA Owned
NDB (OM)	? 5.2 NM from Runway 27 (FAA Critical Area) – FAA Owned
NDB (OM)	? 5.4 NM from Runway 9 (FAA Critical Area) – FAA Owned
NDB (IM)	? 0.2 NM from Runway 9 (FAA Critical Area) – FAA Owned
RVR	Three locations on the northside of Runway 9-27 – FAA Owned
NDB	? 8.5 NM SW of the Airport (FAA Critical Area) – FAA Owned
RCO	? 4,300' NW of Runway Intersection (FAA Critical Area) – FAA Owned
ASOS	? 1,100' NW of Runway Intersection (500' to 1,000' Buffer) – FAA Owned
ASR-7	? 4,200' NW of Runway Intersection | 80' Tall (1,500 Buffer) – FAA Owned
Airport Beacon	? 2,900' SW of Runway Intersection (Clear Line-of-Sight) – Airport Owned
Runway End	**Runway Lighting NAVAIDs (Ownership)**
9	ALSF-2 (FAA owned), PAPI-4L /1 HIRL-CL In-pavement /1
27	MALSR (FAA owned), PAPI-4L /1 HIRL-CL In-pavement /1
3	PAPI-4L (FAA owned), REIL (FAA owned), HIRL /1
21	VASI-4L (FAA owned), REIL /1 HIRL /1

Table Note: NAVAID - Navigational Aid | NM - Nautical Mile | See Appendix for other abbreviations.
Table Note: /1 Owned by the Duluth Airport Authority.
Source: FAA Datashest, Airport Site Visit, U.S. Terminal Procedures Charts.

The following describes specific airspace and air traffic procedural matters at the Duluth International Airport:

Runway Usage: The ATCT estimates that over the period of a year, Runway 9-27 is the predominate runway used about 70 percent of the time, and Runway 3-21 about 30 percent. The Airport does experience heavy flight training activity, in which both runways are used simultaneously, as a single runway does not afford efficient traffic pattern separation due to the varying approach speeds. Typically, flight training traffic uses the runway with the most favorable wind conditions; or take-off and landing into the wind. However, during increased levels of traffic, flight training shifts more so to the runway that least disrupts traffic, which tends to be Runway 3-21. Also during periods of heavy Airport activity flight training will shift some operations to surrounding Airports. Land and Hold Short Operations are invoked for civilian traffic only, mainly during periods when the military arresting system is activated.

Airspace: FAA published airspace obstruction information notes objects (trees) within the approach and departure areas. These objects are noted for pilot obstacle clearance purposes as part of the instrument runway departure take-off minimums, for each end. In addition, alternate minimums are published for Runway 9, 27 and 3, but only affect Category E aircraft.

Instrument Approach Procedures: Instrument procedures at the Airport, including approach type minimums, and applicable aircraft categories are listed on Table 3-10. The Airport is served by 15 published instrument approaches, with a straight-in procedure to each of the four runway ends. Visibility is typically at its lowest during the morning hours and tends to affect the first scheduled airline arrivals and departures. The Runway 9 end has the lowest instrument approach minimums with a Category II Precision Instrument Landing System. As part of the instrument procedures, both special alternate minimums and departure procedures apply. The ATCT estimates runway usage for actual instrument approaches between Runway 9 and 27 is about equal, while the instrument procedures to Runway 3 and 21 are critical during strong and gusty wind events to Runway 9-27.

Table 3-10
INSTRUMENT PROCEDURES

Runway End	Approach Type	Primary NAVAID	Minimum Visibility (RVR or Miles)	Minimum Ceiling (AGL feet)	Aircraft Category
9	ILS CAT II	ILS	1,200' RVR	100'	A, B, C, D
	ILS or LOC	ILS	1,800' RVR	200'	A, B, C, D, E
	RNAV (GPS)	GPS	2,400' RVR	200'	A, B, C, D, E
	TACAN	TACAN	2,400' RVR	500'	A, B, C, D, E
	HI-TACAN	TACAN	4,000' RVR	500'	C, D, E
	COPTER ILS	ILS	1,200' RVR	200'	COPTER
27	ILS or LOC	ILS	4,000' RVR	200'	A, B, C, D, E
	RNAV (GPS)	GPS	2,400' RVR	250'	A, B, C, D, E
	HI-TACAN	TACAN	4,000' RVR	500'	C, D, E
	TACAN	TACAN	2,400' RVR	500'	A, B, C, D, E
	COPTER ILS or LOC	ILS	2,000' RVR	200'	COPTER
3	VOR or TACAN	VORTAC	1 Mile	400'	A, B, C, D, E
	RNAV (GPS)	GPS	1½ Miles	404'	A, B, C, D
21	RNAV (GPS)	GPS	1 Mile	288'	A, B, C, D
	VOR/DME or TACAN	VORTAC	1 Mile	440'	A, B, C, D, E

NAVAID - Navigational Aid | RVR - Runway Visual Range | Mile - Statute Miles | AGL - Above Ground Level
Note: See appendix for other abbreviations.
Source: U.S. Terminal Procedures, U.S. Government Flight Information Publication

3.9 MAJOR AIRPORT UTILITIES

Table 3-11 summarizes the key on-Airport utilities. The Airport electrical vault (Building 301) west of the FBO houses a 2,400 volt diesel generator for standby power for runway and taxiway lights, the Runway 9 PAPI, Runway 3-21 PAPI and the arresting system barriers. Standby power is provided by a 2,400 volt diesel generator located in Building 301 adjacent to the Tower Ramp. It provides back-up power for runway and taxiway lights, the Runway 9 PAPI, the Runway 3-21 PAPI and the arresting system barriers. Independent electrical back-up systems handle the Air Traffic Control Tower, TACAN, and Airport Surveillance Radar (ASR). The Runway 9 and 27 ILS outer and middle markers are served by battery back-up.

Table 3-11
AIRPORT UTILITIES

Utility	Utility Provider (Company Name)	Systems/Capacity
Water / Natural Gas	City of Duluth Water and Gas	Water and natural gas services are provided by the City of Duluth Water and Gas. A 10" water main as well as a 10" gas main provide service and cross onto airport property at the intersection of Haines Road and Grinden Drive. These closed loop systems provide service to all areas of the airport, north, south, east, and west of the airfield, and includes DLH airport facilities, MNANG, businesses, local residents, the Federal prison camp, and the Airpark Business District. These systems were extended to provide service to the Airport Maintenance Center north of Runway 9-27. Both lines have the capacity for expanded service for future development. Additionally, a water pressure booster station has been added to the water system extending along the southerly portion of the loop, along airport facilities, to provide adequate fire protection. The terminal is served by a 8" line off this loop.
Electric Power	Minnesota Power	Electric service at the airport is provided by Minnesota Power, which has satisfactory capacity to meet airport needs and development. The primary feed to the terminal area comes from a 3-phase 13.8 KV overhead line, which runs along Haines Road. This overhead line then goes underground at the intersection of Haines and Cargo Roads. Within the terminal itself, three 250 ampere transformers supply power to the terminal facilities. Loads on these systems are adequate to support further expansion as may be required. The MNANG facilities are served by a separate 13.8 KV cable which also runs along Haines Road. Further development of MNANG facilities, or Terminal area, will have no impact on the capacities of the other. Service to the General Aviation and FBO area of the airport are likewise served by a 3-phase, 13.8 KV cable that runs along Stebner Road to those facilities. This line is capable of handling further expansion as required. Other buildings and hangars adjacent to Cirrus and Midfield Ramps are served by another 3-phase, 13.8KV line which shares service with the United States Prison Camp located south of the General Aviation area. The North Development Area and Airport Maintenance Center, is served from a 3-phase, 13.8 KV cable, which runs from Haines Road, underground across the airfield, to that area and facility.
Telecommunications	US West Communications	Telephone service is provided by U.S. West Communications which has adequate capacity to serve existing and any future development at the Airport.
Stormwater and Sanitary Sewer	City of Duluth	Storm water drainage and sanitary sewer systems are provided by the City of Duluth Engineering Department. The sanitary sewer system in place is adequate for existing facilities in the General Aviation and Terminal areas as well as for the future expansion of airport facilities. A new sanitary sewer addition was included to provide necessary service to the Airport Maintnence Center on the northwest area of the airport, as well as future development.
Airifield Drainage	--	Drainage patterns north of Runway 9-27 generally convey surface waters to the north, through a collection basin and further north into Wild Rice Lake (Reservoir). Drainage patterns northeast, south and west of Runway 9-27 convey surface waters converging along Miller Creek Floodway near Arrowhead Road, then continuing southward.
Firefighting (ARFF)	MN Air National Guard (MNANG)	Firefighting is provided by the MN Air National Guard ARFF located north of Runway 9-27. The Airport is currently classified by the FAA as a Class I Index B Part 139 facility, but existing MNANG ARFF equipment and staffing meets the requirements FAA for Index D.

Source: Duluth International Airport (2010).

The Airport utilities provide sufficient coverage and capacity to serve Airport aeronautical and non-aeronautical purposes.

3.10 AIRPORT VEHICLE ACCESS

Convenient, simple, and efficient access to the passenger terminal and other airport facilities is an integral part of the airport system. Airport access is comprised of the off-airport access roadway system and the on-airport road circulation.

3.11 OFF-AIRPORT ROADWAY SYSTEM

The major roadways in the Airport vicinity are described in Table 3-12. State Highway 53 is the principal arterial roadway providing access between the Airport and the City, with a network of surrounding two-lane City and County roads connecting the various airport terminal facilities. Transportation planning occurs at the Duluth-Superior Metropolitan Interstate Council which is the Metropolitan Planning Organization for the Duluth-Superior area, providing planning for the major roadways surrounding the airport. The major roadways listed are also documented on the Transportation Improvement Plan which does not identify any major roadway expansion or realignment improvements within the Airport vicinity. The Airport Layout Plan can be referenced for the other surrounding roadways.

Airport livery vehicle transportation includes on-demand taxi service, rental cars, and public bus service to the Airport provided by the Duluth Transit Authority and schedule bus shuttle service provided by Jefferson Lines.

Table 3-12
MAJOR ROADWAYS (AIRPORT VICINITY)

Major Roadways (Ownership)	Road Description	Road Functional Classification	Future Road Plans
U.S. Interstate 35 (Federal/State)	4-Lane Divided Highway	Interstate	N/A[1/]
State Highway 53 (State)	4-Lane Divided Highway	Principal Arterial	None
State Highway 194 (State)	4-Lane Undivided Arterial	Principal Arterial	None
Haines Road (County)	2-Lane Undivided Arterial	Minor Arterial	None
Martin Road (County)	2-Lane Undivided Arterial	Minor Arterial	N/A[1/]
County Highway 48 - Lavaque Road (County)	2-Lane Undivided Roadway	Urban Collector	None
County Highway 4 - Rice Lake Road (County)	2-Lane Undivided Roadway	Minor Arterial	N/A[1/]
Airport Road (City)	2-Lane Undivided Roadway	Minor Arterial	None

[/1]Airport vicinity roadway not affected.

Source: Duluth Metropolitan Transportation Improvement Program (TIP) (2009), City of Duluth Thoroughfare Plan (1998).

3.11.1 On Airport Roads and Circulation

Grinden Road (formerly Airport Road) is a two-lane loop road that provides access to the passenger terminal curbside and parking and is the point gated access to the airfield perimeter service road. This section of roadway is owned and maintained by the Duluth Airport Authority. Within the southeast quadrant, primary access and circulation is provided by Airport Road and Airport Approach Road which connects with State Highway 53. Within the northwest quadrant, Stebner Road provides primary access to the North Business Development Area. The Airport Layout Plan depicts the on-Airport network of roadways.

3.12 METEOROLOGICAL CONDITIONS

Prevailing meteorological conditions are used to summarize the region's climate for airport planning and aircraft performance purposes, including temperature, precipitation, winds, visibility and cloud ceiling heights. Wind patterns are an important meteorological factor in assessing runway utilization, and for determining runway design requirements in accordance with FAA aircraft category standards.

The average annual temperature for Duluth is 39° Fahrenheit, ranging from 66°F in July to 8°F in January, with an average mean maximum temperature of 76°F occurring during July. There are 2 days that the

temperature exceeds 90ºF, and 140 days exceeding 59ºF (standard temperature). The average annual rainfall is 31 inches, and 81 inches of snow. The area receives rainfall events totaling more than 0.10" over a 24-hour period on average of 27 days per year, justifying the use of 'wet and slippery' runway length computations. Annually, marginal VFR conditions (less than 3,000' and/or 5 miles) are experienced 30 percent of the time (110 days), with IFR (less than 1,000' and/or 3 miles) occurring 17 percent (62 days).

Exhibit 3-11 graphs the wind patterns plotted from the past 10-years of all-weather wind data observations taken at the Duluth International Airport, with the strongest winds occurring as peaks indicated by the percent of observations. As illustrated, the prevailing winds are generally from the northwest and southeast, with the stronger gusty winds (11-knots and greater) from the east and west. Individually, neither Runway 9-27 nor Runway 3-21 achieves 95 percent crosswind coverage at 10.5-knots; by FAA design standards, this substantiates the need for a secondary runway during all-weather and instrument conditions.

3.13 REGIONAL SETTING AND LAND USE

The regional setting and land use describes the community and land use patterns, the political jurisdictional boundaries and zoning districts in the vicinity of the Airport.

3.13.1 Community Economic Overview

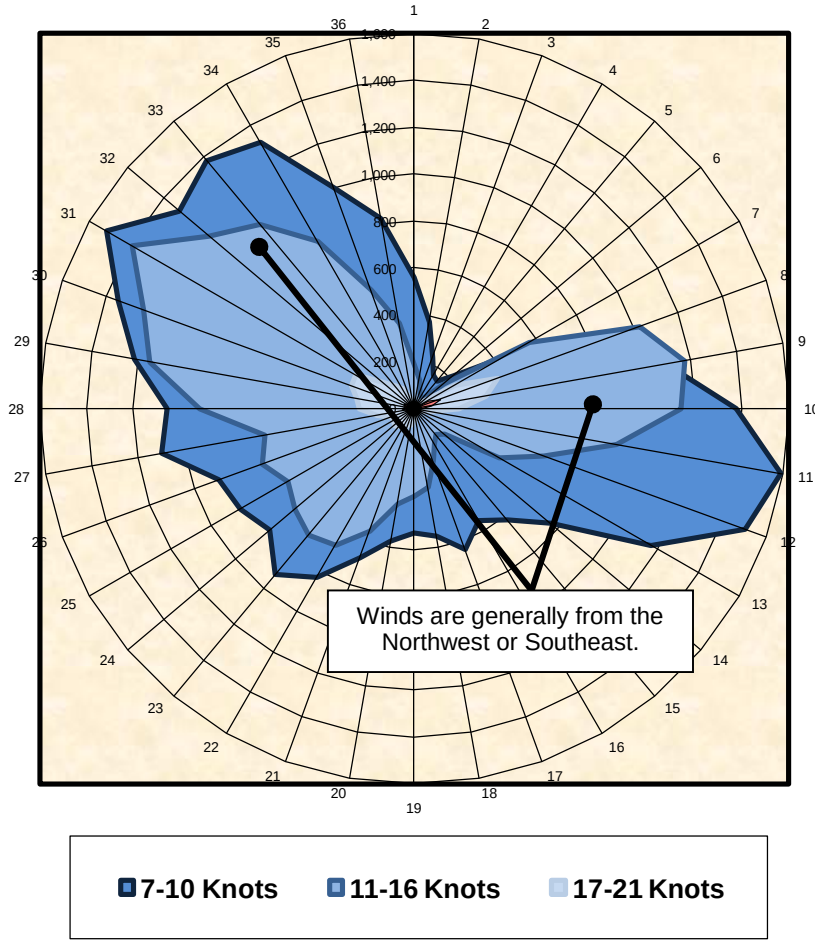
The Duluth International Airport is a major transportation facility in terms of providing an essential public service to domestic and international destinations, and generating significant economic impacts through spending and jobs. The Airport generates over $3.1 billion in annual impacts to the local economy (2010), including the MN Air National Guard Base. The on-Airport employment totals nearly 768 full time people, in addition to the 771 at the MN Air National Guard.

The Airport, which is a key facility for the transport of people, goods and services, is within a larger regional economic hub encompassing northeastern Minnesota, northwestern Wisconsin, and the western Upper Peninsula of Michigan. Also an important transportation hub, the Duluth-Superior seaport is the largest and farthest-inland freshwater seaport in North America, and one of the leading bulk cargo ports in North America. The region remains a major center for the transshipment of coal, taconite, agricultural products, steel, limestone and cement.

Principal manufacturing firms in Duluth include heavy and light manufacturing plants, food processing plants, woolen mills, lumber and paper mills, cold storage plants, fisheries, grain elevators, and oil refineries. The City is also a regional center for banking, retailing, and medical care for northern Minnesota, northern Wisconsin, northern Michigan, and southwestern Ontario, Canada. The region offers research and development advantages from laboratories that create new economic potential in energy savings, forestry, mining, water and rapid prototyping. Duluth is also an epicenter of aquatic biology and aquatic science, home to the US EPA's Mid-Continent Ecology Division Laboratory and the University of Minnesota Duluth.

The region offers exceptional arts, entertainment and tourism, and 3.5 million visitors contribute to the tourist industry annually. For recreation, Duluth serves as a base for trips to the scenic North Shore, or to fishing and wilderness expeditions in Minnesota's far north, including the Superior National Forest, Boundary Waters Canoe Area Wilderness, and Voyageurs National Park.

Exhibit 3-12
WIND PATTERNS / CROSSWIND COVERAGE



CROSSWIND DATA TABLE				
RUNWAY	**10.5 KNOTS**	**13 KNOTS**	**16 KNOTS**	**20 KNOTS**
RUNWAY 9-27 (ALL WEATHER)	91.20%	95.81%	99.16%	99.88%
RUNWAY 3-21 (ALL WEATHER)	80.85%	88.91%	96.58%	99.13%
RUNWAY COMBINED (ALL WEATHER)	96.33%	99.03%	99.79%	99.98%
RUNWAY 9-27 (IFR)	91.78%	95.97%	99.13%	99.86%
RUNWAY 3-21 (IFR)	75.80%	85.75%	94.72%	98.60%
RUNWAYS COMBINED (IFR)	95.66%	98.89%	99.71%	99.94%

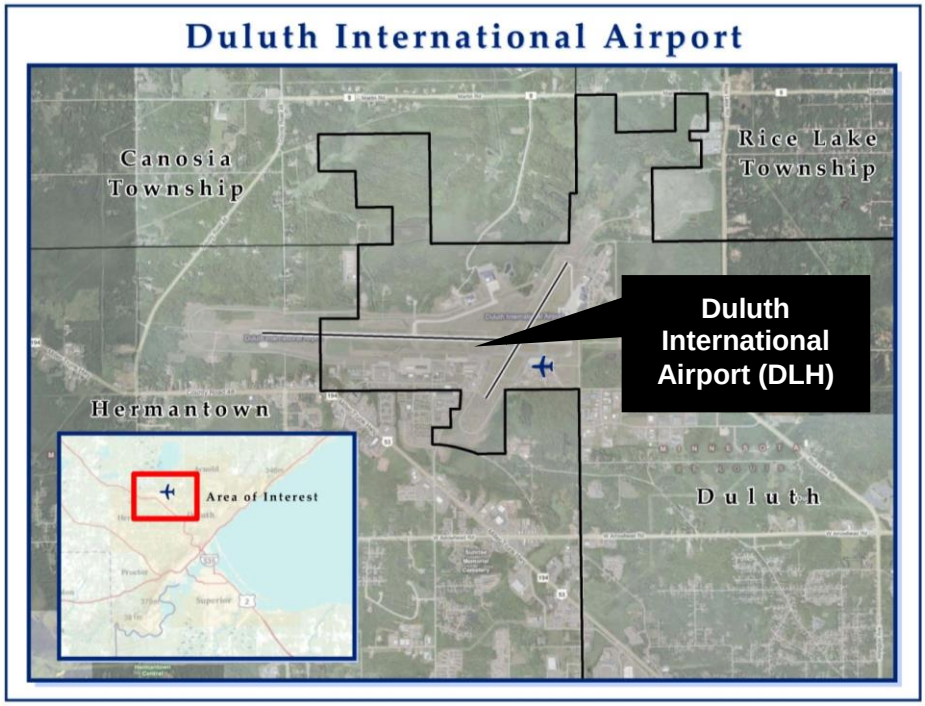
DATA SOURCE: NATIONAL CLIMATIC DATA CENTER, STATION: DULUTH INTERNATIONAL AIRPORT (ASOS).
PERIOD OF RECORD: 2000-2009 (ALL WEATHER OBSERVATIONS: 84,636)
PERIOD OF RECORD: 2000-2009 (IFR OBSERVATIONS: 8,975)

Source: National Climatic Data Center – Duluth International Airport Observations

3.13.2 Political Boundaries

The Duluth International Airport is operated under the auspice of an Airport Authority which has autonomous jurisdiction within the boundary of the Airport property interests. As shown in Exhibit 3-13, there are four political jurisdictions surrounding the Airport, with some jurisdictional boundaries intersect with the Airport property.

Exhibit 3-13
SURROUNDING AIRPORT JURISDICTIONAL BOUNDARIES



Source: Duluth-Superior Metropolitan Interstate Council

The government entities surrounding the Airport include the City of Duluth towards the southeast, the City of Hermantown to the southwest, Canosia Township to the northwest, and Rice Lake Township northeast of the Airport. These entities, through their land use and zoning regulations, have various influences on the land uses surrounding the Airport. The four political jurisdictions are within St. Louis County, in which the County does not assume zoning authority for the surrounding government entities.

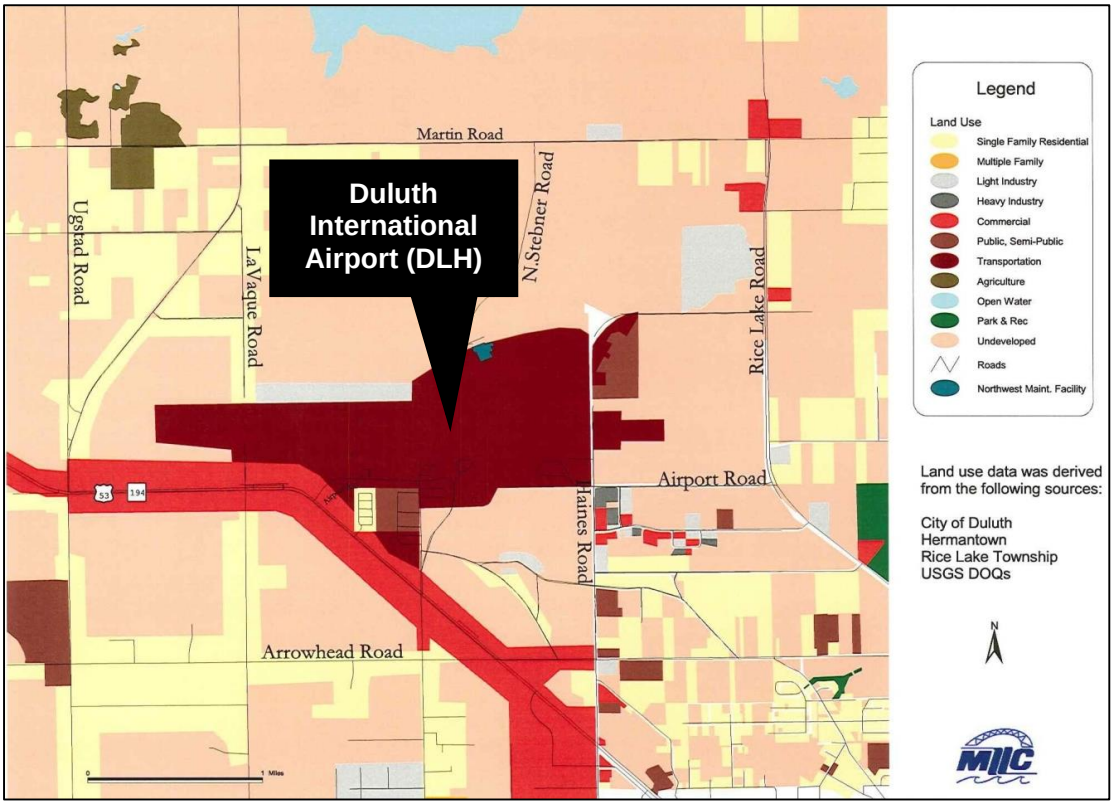
3.13.3 Airport Land Uses

The Duluth Airport Authority controls land use within the Airport boundaries, in which the Airport proper is generally characterized as a public, commercial and transportation land use by the surrounding governmental entities. Existing Land uses in the vicinity of the Airport are generally depicted by Exhibit 3-14. This general exhibit does not include detailed land use such as the mobile homes that are located off of the Runway 3 approach. The Airport is generally surrounded by undeveloped, commercial, and residential land uses. Residential and undeveloped areas generally lie west to Ugstad Road. North of the Airport to Martin Road largely consists of undeveloped land use. Land uses east of the Airport include a mix of undeveloped and residential. South of the Airport includes a mix of commercial, undeveloped, and residential land uses. More dense commercial land uses are located along Highway 53, south of the Airport.

There are currently two facilities located on Airport property that also require safety buffers; the 1,250-foot no-build buffer for the Minnesota Air National Guard Munitions Maintenance Facility (MMF) and the 1,500-foot no-build buffer for the FAA Airport Surveillance Radar (ASR).

More specific information regarding military facilities and future plans is available from the MN Air National Guard which prepares and updates its own Base Master Plan document.

Exhibit 3-14
AIRPORT VICINITY LAND USE MAP



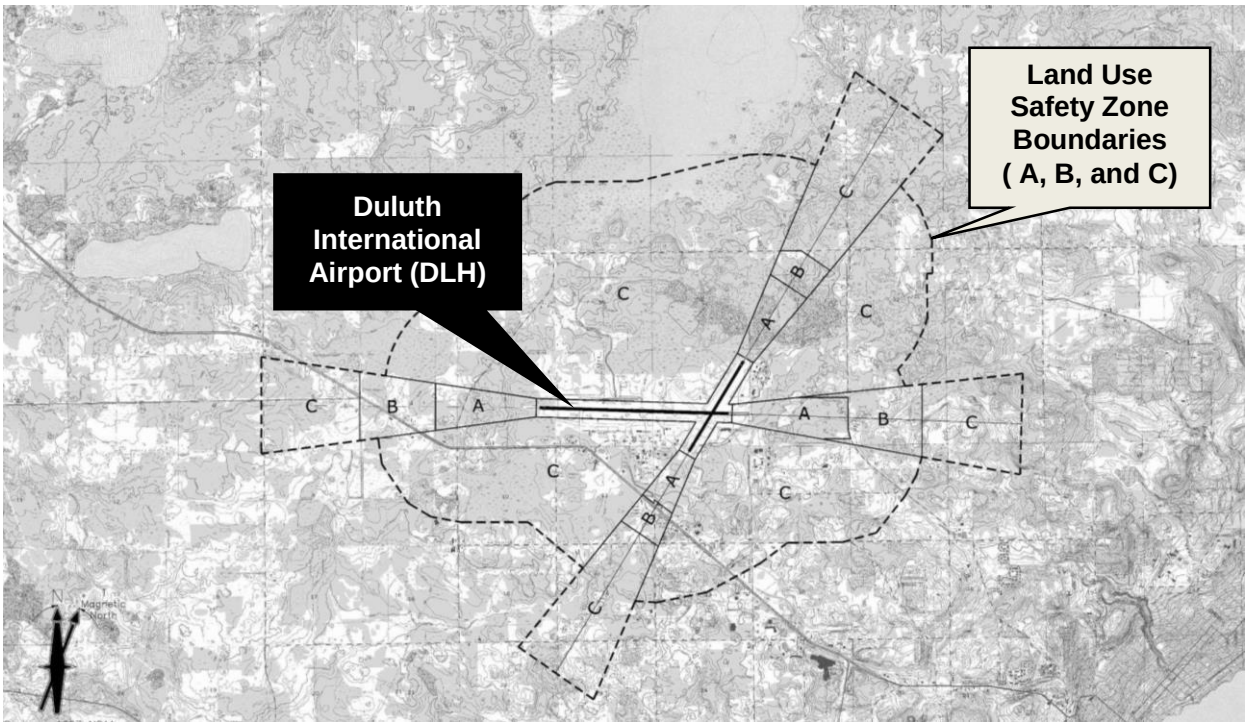
Source: Duluth-Superior Metropolitan Interstate Council.

3.13.4 <u>Airport Zoning, Land Use & Regulations</u>

Airport land uses are regulated by the Duluth International Airport Zoning Ordinance, as adopted by the Duluth International Airport Joint Zoning Board in June 1988, pursuant to Minnesota Statues 360.061 – 360.074. The Joint Airport Zoning Board is comprised of the City of Duluth, City of Hermantown, Canosia Township, Rice Lake Township, and St. Louis County. Overall, the Ordinance regulates the heights of structures and trees through Airspace Obstruction Zones modeled from Federal Aviation Regulation Part 77 Imaginary Surfaces. Land Use Safety Zones A, B, and C are established per Minnesota Rules Chapter 8800.2400 and limits population and building densities as prescribed. The Ordinance regulates Land Use Safety Zones A, B, and C as shown on Exhibit 3-15.

Each governmental jurisdiction whose land is affected by this Ordinance, as specified by sections of land, is responsible for designating a local representative from their zoning or building inspection department who shall serve as Deputy Zoning Administrator, who shall coordinate with the Chief Zoning Administrator and who shall administer and enforce within his jurisdiction the regulations. In addition, the Ordinance contains information on non-conforming uses, permits, variance and administrative procedures.

Exhibit 3-15
DULUTH INTERNATIONAL AIRPORT – LAND USE SAFETY ZONES

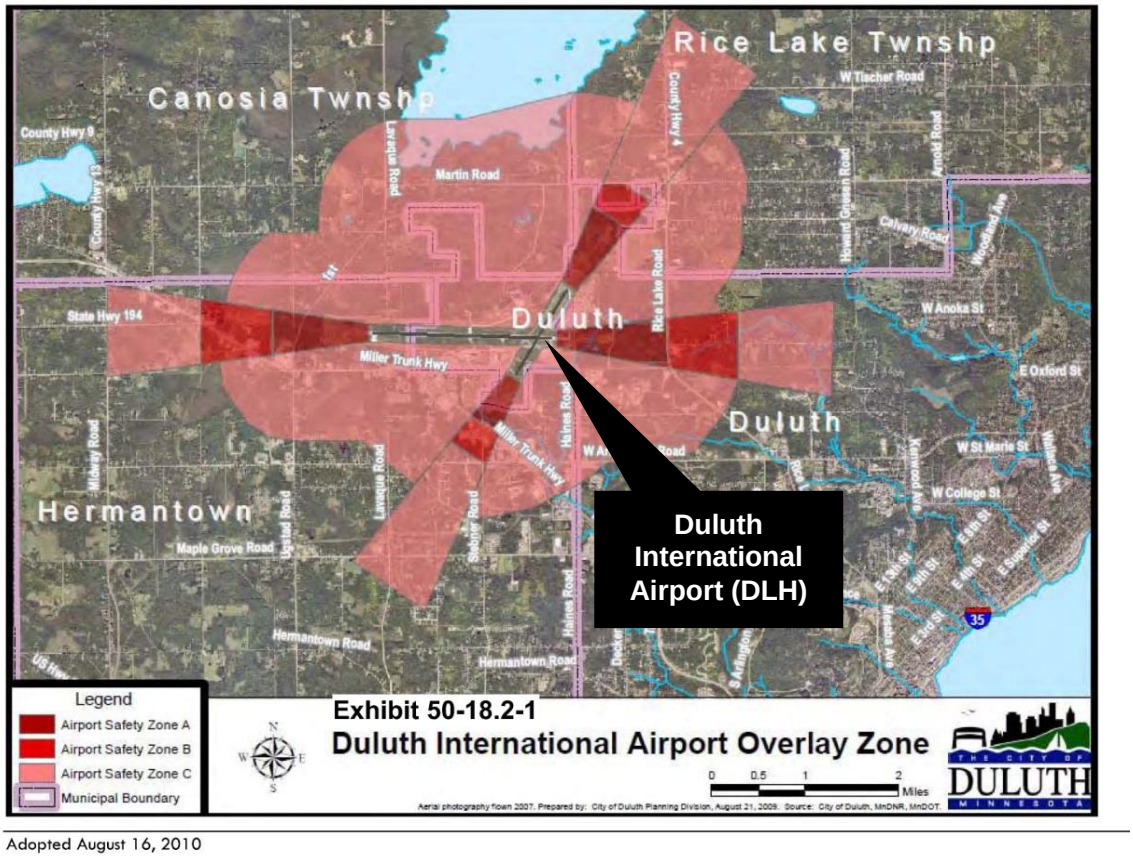


Source: Duluth International Airport Layout Plan, Minnesota Land Use Safety Zones, Sheet 15 (January 2000)

The City of Duluth's Unified Development Chapter from the City's Legislative Code Section 50-18.2 (Airport Overlay; Adopted August 2010) incorporates the Duluth International Airport Zoning Ordinance, as amended, created by the Duluth Airport Authority and the Duluth International Airport Zoning Board under the laws of Minnesota. The ordinance is modeled on the Duluth International Airport Zoning Ordinance adopted in 1988, and revised in May 1996. The Airport Overlay establishes height regulations through Air Space Obstruction Zones modeled from Federal Aviation Regulation Part 77 Imaginary Surfaces and land use compatibility through Mn/DOT Land Use Safety Zones for both Duluth International Airport and Sky Harbor Municipal Airport. The Airport Overlay for the Duluth International Airport is illustrated in
Exhibit 3-16.

The Duluth International Airport has undertaken planning efforts in an attempt to implement recommendations from the FAR Part 150 Noise Study conducted in June 1999, and develop strategies to decrease noise impacts to adjacent communities. The Part 150 study developed a Noise Compatibility Program (NCP) for the Airport based on recommended noise abatement and mitigation measures based on the Noise Exposure Map (NEM).

Exhibit 3-16
DULUTH INTERNATIONAL AIRPORT OVERLAY ZONE
(CITY OF DULUTH)



Source: City of Duluth

3.14 ENVIRONMENTAL SETTING

FAA Order 5050.4B, *The Airport Environmental Handbook*, requires the evaluation of airport development projects as they relate to specific environmental impact categories by outlining types of impacts and the thresholds at which the impacts are considered significant. Table 3-13 provides an overview of each category as it applies to the environs surrounding Duluth International Airport. Early identification of these environmental factors may help to avoid impeding development plans in the future.

Table 3-13
ENVIRONMENTAL OVERVIEW

Category	Threshold	In Airport Environ
Air Quality	New development on or adjoining the airport should not significantly offset the air quality in the area. Current light industrial development in the area, strong winds, and the fact that the airport is located in Duluth's higher elevations are factors mitigating the development of conditions conducive to the development of air pollution.	No
Coastal Resources	The site is located in inland areas and would not have an impact on the Coastal Zone Management Program, therefore no impacts under this category are anticipated.	No
Compatible Land Use	The Duluth Airport Authority owns a substantial amount of land around the Airport. Any proposed expansions for the next several years will require very little land acquisition. In addition, the Airport Noise Overlay Zone is in place to minimize future impacts produced by expansion. Any expansion or relocation of Runway 3/21 would need substantial further review in a formal environmental analysis. It should be noted that currently there is commercial and mobile homes built up around the Runway 3 approach and landfills/mining operations in the Runway 21 approach which are not shown on the existing land use map Exhibit 3-14 prepared by the Duluth-Superior Metropolitan Interstate Council.	Yes
Construction Impacts	During the major pavement reconstruction projects, noise impacts during the daylight hours could be expected. Air emissions could temporarily increase due to the presence of constantly running internal combustion engines. Some erosion and subsequent sedimentation in the vicinity of the proposed projects may occur due to earthwork involved. However, adverse impacts relating to noise, air emissions, or dust from the delivery of materials through residential areas, are not anticipated to occur for any proposed development.	Yes
Section 4(f) Land	Section 4(f) lands include historic sites and parks, recreation areas, and wildlife and waterfowl refuges. None of these types of lands are within the boundaries of the Airport, or nearby. Any impacts to Section 4(f) lands that would result from the implementation of the master plan projects will be analyzed in the subsequent environmental documentation.	No
Farmlands	Prime and unique farmland is considered to be available land that is best suited for producing food, feed, forage, and other types of crops. There are no prime and unique farmlands in the vicinity of the Airport.	No
Fish, Wildlife, and Plants	Correspondence from the U.S. Fish and Wildlife Service indicates that no endangered or threatened species are located within the airport property limits; therefore no impact under this category is expected. Coordination is required with the Minnesota Department of Natural Resources if any state-listed species have been identified in this same area as part of an EA or EIS for a major improvement project. Miller Creek represents protected headwaters of a trout stream. Minnesota environmental standards do not allow construction within 250 feet of Miller Creek due to its environmental classification as protected headwaters.	No

Floodplains	Flood plains are defined as lowland and relatively flat areas adjoining inland and coastal waters. Any project that impacts Miller Creek will need an individual evaluation to determine the potential flood plain impact. It is recommended that a hydraulic detailed survey of the Miller Creek flood plain area be conducted should an eastward extension of Runway 9/27 occur in the long term. All other proposed airport projects appear to have a minimal impact on waterways.	Yes
Hazardous Materials, Pollution Prevention, and Solid Waste	A complete analysis of hazardous materials, chemicals, substances, and waste will be completed as part of a formal environmental analysis. This analysis will include identification of any known or likely sites and appropriate review regarding the hazardous nature of any materials or wastes to be used, generated, or disturbed by airport development.	Yes
Historical, Architectural, Archeological, and Cultural Resources	No historic sites are known to be located on airport or in the airport vicinity, and therefore no impacts under this category are anticipated. No sites in this area appear to be eligible for inclusion on the National Register for Historic Places. If historic sites are discovered during the formal environmental analysis and it is anticipated that a possible adverse effect may be imposed on this site, a Determination of Adverse Effect will be required as part of the EA.	No
Light Emissions and Visual Impacts	Light emissions which may create an annoyance to residents in the vicinity of the airport must be taken into account. Currently, impacts from the airport's existing light emissions are confined to on-airport property. The impacts from the installation of future airfield lighting equipment should be minimal. Once the layout of new airfield lighting is known, it should be evaluated to minimize any and all impacts to the surrounding area.	Yes
Natural Resources and Energy Supply	Expansion of airport facilities, such as general aviation, minor adjustment of terminal space over time, or any air cargo facility expansion would increase source energy consumption. Aircraft are the primary users of fuel. If operation forecasts indicate an increase in activity during the planning period, additional fuel will be consumed.	Yes
Noise	A significant noise impact would occur if noise sensitive areas were to experience an increase in the day/night noise level (DNL) of 1.5 decibels or more at or above a DNL of 65 decibels when compared to the no action alternative for the same timeframe. The subsequent environmental documentation will provide an analysis of noise impacts that would occur as a result of the implementation of master plan projects. Recommendations from the prior Part 150 Study show a strong pro-active position has been taken to prevent future non-compatible land use around the Airport. Development of the runway system may change the current noise counters. Noise studies may be necessary to determine if there is a significant change.	Yes
Secondary (Induced)	For major airport development proposals, there is a potential for induced or secondary impacts on surrounding communities. Implementation of improvements identified in the Airport Master Plan Update for the Airport is expected to have a positive economic impact on the communities of south St. Louis County.	Yes
Socioeconomic, Environmental Justice, and Children's Environmental Health and Safety Risks	It is necessary to evaluate the impacts of the acquisition on the surrounding communities such as the mobile homes in the Runway 3 approach. If the proposed development necessitates relocation or community disruptions, further analysis is required. It is expected that proposed projects in the Master Plan will result in a positive long-term socioeconomic impact for the area.	Yes

Water Quality	Although proposed airport developments will generally increase the amount of airport impervious surfaces at the Airport, water quality of the surface or subsurface waters should not be adversely affected as long as a detailed storm water management plan is developed and all permit requirements and local regulations are met. Further review in any formal environmental analysis will be necessary for each project on an individual basis. The FBO deices aircraft on a designated area on the Terminal Ramp. Deicing also takes place on the Midfield Ramp and the General Aviation Ramp. There is no deicing pad with a glycol recovery system installed to meet EPA requirements nor is any required by the EPA at this time.	No
Wetlands	Proposed construction in the vicinity of the wetlands requires a permitting process involving preliminary wetlands assessments. Wetland impacts will occur if Runway 3-21 is extended or Taxiway 'C' extended to the northeast. This proposed project (2,400' Runway 3-21 extension northeast with parallel Taxiway 'C') would impact up to 12 acres of wetlands which would require replacement off of the airport and clear of aircraft flight paths and movement areas. These wetlands have a large value to the surrounding community, but tshe extent of this impact will need to be evaluated during development layout to minimize the impact. There are several wetlands areas on the northwest area that can be found in the National Wetlands Inventory database. Therefore future development in this area is strictly limited.	Yes
Wild and Scenic Rivers	No rivers appear to be located within the vicinity of the Airport. For this reason, there would be no impacts to wild and scenic rivers.	No

Sources: FAA Order 1050.1E, Change 1; FAA Order 5050.4B.

CHAPTER 4
AVIATION FORECASTS

This chapter presents the passenger, air cargo, and aircraft activity forecast for the Duluth International Airport (Airport). The objective of the forecast is to identify the long-term trends for the types and levels of aviation activity that could trigger the need for Airport facility expansion or improvement. This forecast chapter was approved by the FAA on May 6, 2014.

4.1 FORECAST SYNOPSIS

Over the last 20 years, the Airport has averaged 133,000 annual enplaned (boarding) passengers per year. The highest number in recent years occurred in 2007 with over 160,000 enplanements and the lowest was approximately 106,000 in 1998. Such annual variations are typical at airports as economic conditions and airline service changes. The average annual growth rate in this 20-year period was 1.2 percent, or an equivalent increase of about 6,000 passengers per year. During this period, the airline service and passenger levels have fluctuated, not always leading to a steady growth of passenger enplanements. Most notably in recent years, the Airport believes the passenger enplanement trends have been largely influenced by the following factors:

- The proximity of Duluth to the Northwest (now Delta) hub in Minneapolis
- The absence of a daily scheduled low-cost fare carrier
- The changes and shift of carriers and destinations offered over the years
- Periods of dominance by Northwest (now Delta) over available seats and fares

However, the recent introduction of leisure destination flights by Allegiant has increased passenger levels, suggesting that higher levels of passengers are possible, if a low fare carrier or new destinations were available to stimulate travel. Further, the recent United Airlines service to Chicago-O'Hare has introduced a new competing carrier at Duluth, and another large market with an alternative connecting hub. Other significant Duluth air service issues are fuel costs, and the "leakage" of potential Duluth passengers to alternative airport facilities, i.e. Minneapolis. This leakage has likely exceeded 50 percent during certain periods. Therefore, this forecast provides a base forecast of continuation of current passenger trends and two scenarios of higher potential passenger activity representing stimulation of traffic. In addition, two projections of air cargo activity are developed.

4.1.1 The Regional Base for Aviation Activity

This section identifies the geographic area served by the Airport and that region's characteristics that influence aviation demand. It is recognized that air passengers can come into the region from outside and local residents can use other airports; however, this regional analysis provides a basis for identifying and understanding the greater Duluth area and its ability to support aviation activity.

4.1.2 Identification of the Air Service Area and County Population

The prime geographic region served by an airport is referred to as an Air Service Area. For the purposes of this report, the Duluth, Minnesota/Superior, Wisconsin Metropolitan Statistical Area (MSA) will be defined as the Air Service Area. This MSA is identified by the U.S. government as the prime business market of greater Duluth and it is the source of the majority of existing passengers. Note that the MSA definition used in this report is the November 20, 2008 revision from the U.S. Office of Management and Budget, which added Carton County, Minnesota to the MSA.

The MSA consists of three counties. The population in 2010 was 274,184. The names of the MSA counties and the 2010 Census Bureau estimate of population are shown in Table 4-1.

Table 4-1
MSA COUNTY IDENTIFICATION AND 2010 POPULATION

County	State	Population	Share
St. Louis	Minnesota	200,226	72%
Douglas	Wisconsin	43,765	16%
Carlton	Minnesota	35,386	13%
Total MSA		**279,377**	**100%**

Source: Bureau of the Census, 2011

St. Louis County contains over 70 percent of the Air Service Area's population and 85 percent of the MSA population resides in Minnesota. However, the cities of Duluth, Minnesota, and Superior, Wisconsin, are located across St. Louis Bay from each other. Local residents usually refer to the cities as the "Twin Ports," because each is a major lake shipping center.

The City of Duluth has approximately 86,000 residents and the City of Superior approximately 27,000 residents. Therefore, the Twin Ports of Duluth and Superior, by themselves, represent approximately 40 percent of the MSA's population. Various suburban areas which surround Duluth and Superior add to the concentration of population around the City of Duluth. In fact, the Airport itself is bounded by the community of Hermantown, just northwest of Duluth.

4.1.3 Extended Service Area

The extended service area of the Airport goes beyond the three county prime MSA area listed above. This is because, outside of the Twin Port region, the area is not densely populated. Further, no other major commercial service airports serve the region. The larger area of the U.S. and Canada served by the Airport includes:

- The Airport is the largest in northeastern Minnesota in terms of number of flights and passengers; therefore, the Airport attracts passengers from much of the northeastern part of the state.

- In the same manner, many passengers from northwestern Wisconsin choose the Duluth International Airport versus the airports that serve Rhinelander-Oneida County, Eau Claire-Chippewa Falls, or other northern Wisconsin locations. In addition, a few passengers from the Upper Peninsula of Michigan also use the Airport based upon license plate counts in the Airport parking lots.

- Further, Canadian passengers seek the lower flight taxes, easier customs clearance, and direct service to vacation destinations not available in the southwestern Ontario area.

Delta service to the Airport is usually on jet aircraft versus the turbo-prop aircraft available at most other regional airports. The larger scheduled aircraft at Duluth International Airport also provide capacity for air cargo and oversized luggage that is not available to many of the other regional airports.

Finally, the Airport offers extensive leisure market and package vacation flight opportunities from Allegiant and certain other airlines. These all-exclusive and low-cost "vacation" flights attract passengers from as far as southwestern Ontario, Canada, as well as northern Minnesota, northwestern

Wisconsin, and far western Michigan. This is because the Airport is one of the few in the surrounding region to offer direct low-fare scheduled and charter airline service to warm weather and gambling destinations.

4.1.4 Regional Demographic and Economic Information

This section identifies the key demographic characteristics of the Air Service Area. In addition, large regional employers and sources of employment are identified. The Air Service Area's population, employment, and per capita income will be presented with comparable information for the entire United States and the State of Minnesota.

Population Growth: The rate of population growth in the MSA has historically been much slower than the State of Minnesota and the United States. The MSA has, in fact, lost population over the last 40 years as the traditional labor-intensive mining, railroad, lake shipping, forestry, and other local industries have mechanized. However, as projected by Woods and Poole Economics, the regional population is expected to grow at a 0.2 percent annual average rate over the next 30 years versus a 0.9 percent rate for United States and Minnesota. The historical and projected comparison of MSA growth to these other geographic areas is shown in Table 4-2.

Table 4-2
HISTORICAL AND PROJECTED POPULATION GROWTH RATES

Area	1969-2009	2010-2030
United States	1.1%	0.9%
Minnesota	0.8%	0.9%
Duluth MSA	-0.2%	0.2%

Source: Woods and Poole Economics

Per Capita Personal Income: Per Capita Personal Income (PCPI) in the MSA has historically been less than the United States and Minnesota averages and that trend is expected to continue. In 1969, the United States and Minnesota had similar PCPIs in the $16,000 range versus the local average of $13,412. By 2009, the comparison between the three areas remained similar, but with the state average pulling ahead of the United States. For the future, the three areas are expected to grow at similar rates. Note that all these amounts are provided in constant year 2004 dollars as presented in Table 4-3.

Table 4-3
COMPARISON OF PER CAPITA PERSONAL INCOME AVERAGES (2004 $)

Area	1969	2009	2030
United States	$16,465	$35,142	$46,851
Minnesota	$16,169	$37,625	$49,546
Duluth MSA	$13,412	$30,686	$40,499

Source: Woods and Poole Economics

Employment: The rate of employment growth is analyzed in this section. Between 1969 and 2009, the United States, Minnesota, and the Air Service Area all saw employment grow. The rate of employment growth was higher in the United States and Minnesota versus the Air Service Area; however, despite the lack of population growth, the number of employed individuals in the Air Service Area actually increased. For the future, the rate of employment growth is expected to be roughly similar among the

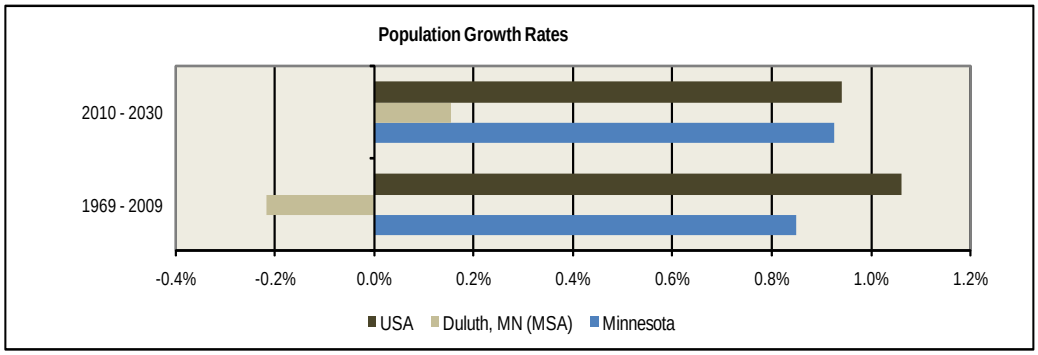
three areas. The growth rate for comparative area employment is presented in Table 4-4. A comparison of the U.S., Minnesota, and Air Service Area growth rates of population, PCPI, and employment is presented in Exhibit 4-1.

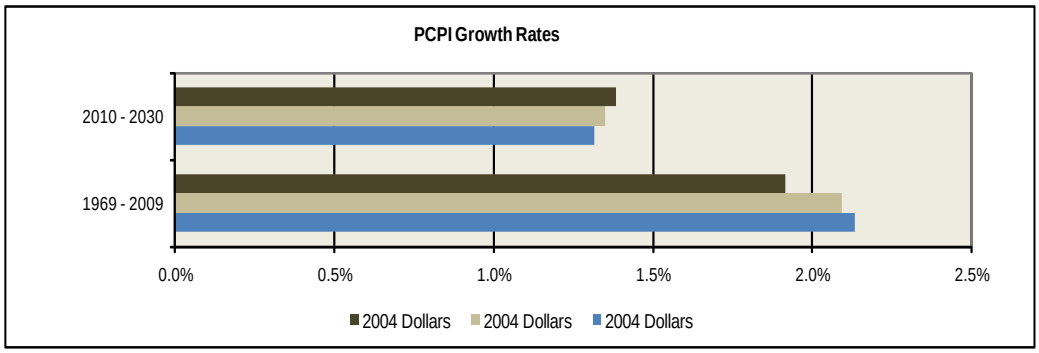
Table 4-4
COMPARISON OF TOTAL EMPLOYMENT GROWTH RATES

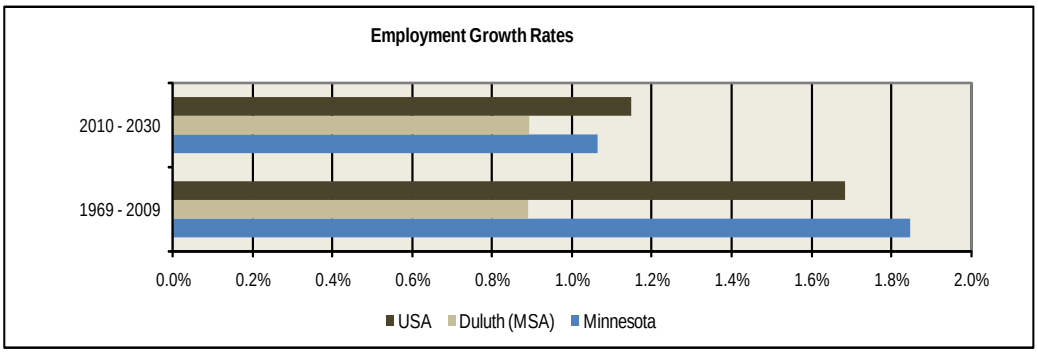
Area	1969-2009	2010-2030
United States	1.7%	1.1%
Minnesota	1.8%	1.1%
Duluth MSA	0.9%	0.9%

Source: Woods and Poole Economics

Exhibit 4-1
COMPARISON OF AIR SERVICE AREA DEMOGRAPHIC INFORMATION







Source: Woods & Poole; 2010

Major Employers and Other Economic Indicators

As in any community, the major employers in the Air Service Area include a large number of governments, schools, hospitals, and retail establishments. Essentia Health System is the largest single regional employer with approximately 5,000 full-time equivalent employees. The largest employers in the MSA are listed in Table 4-5.

Table 4-5
TEN LARGEST EMPLOYERS IN THE MSA

Employers	Business	Employees
Essentia Health Systems	Health Care	5,272
St. Louis County	Government	1,956
University of Minnesota-Duluth	Education	1,700
United Healthcare	Health Care	1,634
St. Luke's Health System	Health Care	1,622
Duluth Public Schools	Education	1,426
Allete (MN Power)	Utility	1,400
Minnesota Taconite (USS)	Natural Resources	1,200
Air National Guard Base (Duluth)	Defense	1,068
Black Bear Casino Resort	Entertainment	907

Source: Northspan, 2011

Of note is the fact that two large regional employers are at the Airport. These are the Duluth Air National Guard base and Cirrus Design, an aircraft manufacturer. The Air National Guard has approximately 450 to 480 full-time employees and over 500 part-time employees. Cirrus has approximately 1,000 full-time employees.

Regional employment is greatly impacted because the Air Service Area lies at the center of the iron ore mining industry in the United States. The richest concentration of iron ore in the United States is found in a small band across northeastern Minnesota, northern Wisconsin, and northwestern Michigan. The most productive area of present day mining is the Iron Range of Minnesota (located about two hours drive northwest of the Airport) with approximately 80 percent of U.S. iron ore production. The low density iron ore is usually processed to increase its concentration and it is then called taconite. Railroads transport the taconite from the processing facilities to ports along the western shore of Lake Superior where it is loaded on ships for transport to Chicago, Cleveland, Detroit, and other areas for conversion to iron and steel.

The cities of Duluth and Superior serve as the corporate offices and supply center for the mines, concentrating facilities, railroads, and lake shipping operations serving the taconite industry. The Twin Ports of Duluth and Superior are the westernmost ports of the Great Lakes, as well as being the largest Great Lake's port by tonnage shipped. The Twin Ports also serve the northern plains states by shipping large amounts of coal and grain. In addition, these ports handle limestone, cement, rock salt, and other commodities destined to or from the region. Finally, information from the American Association of Port Authorities indicates that in 2008, the Duluth-Superior port was the ninth largest in the United States for export tonnage with 14.5 million tons shipped.

In addition to the MSA's traditional iron ore, railroad, forestry, and lake shipping firms, new industries in the Air Service Area are a $1.6 billion Essar Group steel mill under construction near Nashwauk which will process iron ore into steel without having to incur transport costs. Another plant under construction in St. Louis County is going to process discarded iron ore mine tailing for precious metals such as lead, gold, and silver.

Tourism is another major local industry with the Airport serving, among other sites, the Boundary Water Canoe Area Wilderness. The most popular sports for visitors are fishing, hunting, and snowmobiling. A number of colleges and technical schools are in the MSA. These include the University of Minnesota (Duluth), The College of St. Scholastica, Lake Superior College, and the University of Wisconsin (Superior).

4.2 HISTORICAL PASSENGER ACTIVITY

This section identifies the historical passenger air traffic activity at the Airport.

4.2.1 Historic Air Service

The Duluth International Airport has provided passenger air service since the 1940s, predominately to Minneapolis and Chicago. During this period, passenger levels have shown a gradual increase, resilient to the succession of multiple network, regional, and affiliated commuter air carriers, operating a fleet with a wide range of turboprop and jet transport aircraft. Below is a chronology overview of airline service at Duluth.

1940 to 2009: Northwest (Minneapolis) – from piston to turboprops to narrow-body jets
1976: Mesaba (for Northwest, Minneapolis) - various turboprops
1960s to 1976: North Central Airlines (Minneapolis) - various jets and turboprops
1983 Midstate Airlines - turboprops
1980 to 1986: Republic Airlines (Minneapolis) – narrow-body jets
1986 to 1987: American Airlines (Chicago) – narrow-body jets
1998 to 2002: American Eagle (for American, Chicago) – regional jets
2004: American Eagle (for American) – regional jets
2005: Allegiant (2005 Las Vegas, 2009 Orlando) – narrow-body jets
2007: Midwest Airlines (Milwaukee) – regional jets
2009: United Express (for United, Chicago) – regional jets
1984 to 2009: Northwest Airlink (for Northwest, Minneapolis and Detroit) – Saab 340 / Avro RJ85
2010: Delta and Delta Connection (replaces Northwest, Minneapolis and Detroit) - Generally narrow-body jets and regional jets

During the past 10 years, the network and regional airlines have gone through an acquisition phase in which carriers have consolidated and re-aligned the affiliated carrier service. Over this period, air service has been provided with aircraft typically ranging from 30 to 130 seats. The Duluth market, with 130,000 to 150,000 annual passenger boardings, has historically supported narrow-body aircraft. In 2010, at over 153,000 enplanements, the scheduled airlines operated 50 to 150-seat jets at Duluth.

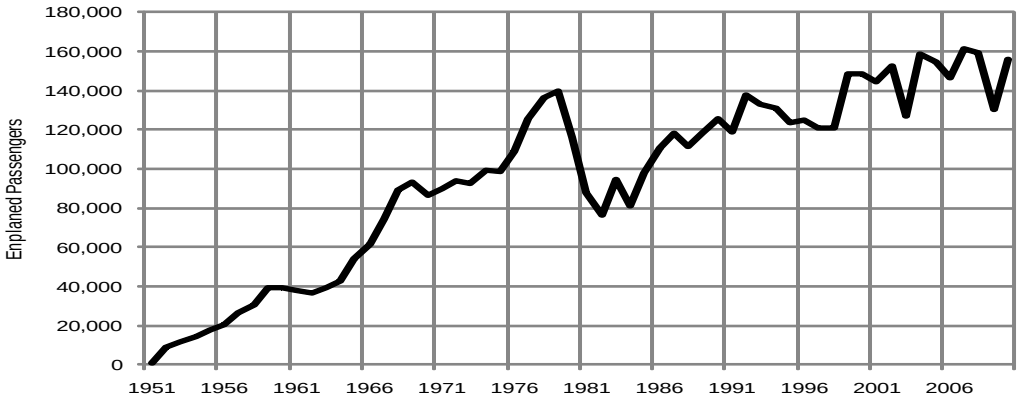
4.2.2 Historic Passenger Enplanements

Airport records start in 1951 and indicate 966 enplanements and 898 deplanements occurred in that year. From 1951 to 1979, the Airport's enplaned passenger records show a dramatic increase from less than a thousand passengers in 1951 to almost 140,000 enplanements in 1979. The number of enplaned passengers first reached 100,000 in 1976. With the exception of a few years in the early 1980s, passenger traffic has remained over 100,000 annually since 1976. Since 1992, the traffic has remained over 120,000 passengers annually. However, individual years have been more erratic as airlines have frequently introduced and withdrawn service or the economy impacted traffic volume. A sharp decline followed the next few years until traffic started growing again throughout the 1980s, 1990s, and into the 2000s.

4.2.3 Annual Enplaned Passenger Trends

The annual variations indicate changes in local and national economic conditions, as well as repeated changes in air service. A record of passenger traffic and rate of growth at approximate ten-year intervals and a graph of almost 60 years of enplaned passengers (1951-2010) shows a long-term trend of increased enplanements as presented in Exhibit 4-2.

Exhibit 4-2
HISTORICAL ENPLANEMENTS 1951-2010



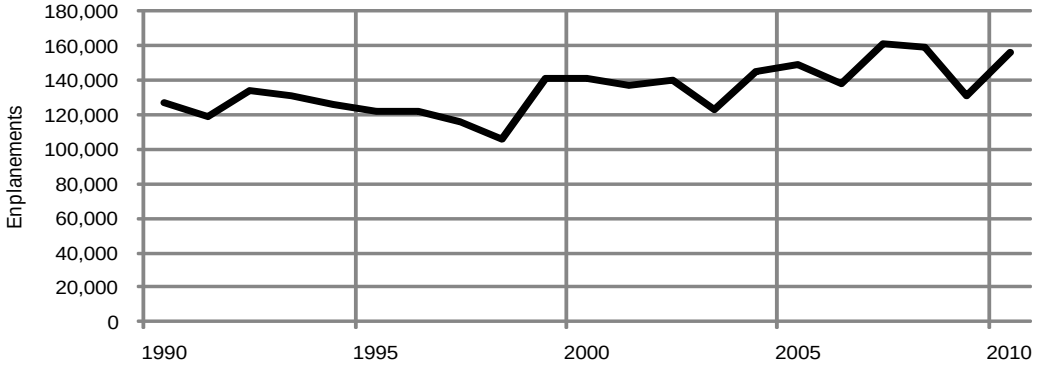
Passengers	
Year	Enplanements
1951	966
1960	39,281
1970	86,646
1980	116,037
1990	125,323
2000	148,163
2010	155,955

Average Annual Growth Rate	
Period	Percent Change
1951-1960	50.9%
1961-1970	9.2%
1971-1980	3.3%
1981-1990	0.9%
1991-2000	1.9%
2001-2010	0.6%
1951-2010	9.0%

Source: Duluth Airport Authority, 2011

The last 20 years of passenger activity generally shows a different type of growth trend. During the 1990s, passenger traffic appeared to stagnate with a particularly low volume in 1998. However, since 1998, the long-term trend indicates a slow growth of enplanements until the nationwide economic recession and airline service cutbacks caused traffic to fall in 2009. The last 20 years of enplaned passenger activity are shown in Exhibit 4-3.

Exhibit 4-3
HISTORICAL ENPLANEMENTS 1990-2010



Passengers	
Year	Enplanements
1990	126,785
1995	122,169
2000	141,413
2005	148,973
2006	137,658
2007	161,386
2008	159,179
2009	130,562
2010	155,955

Average Annual Growth Rate	
Period	Percent Change
1990-1995	-0.7%
1995-2000	3.0%
2000-2005	1.0%
2005-2010	0.9%
1990-2010	1.0%

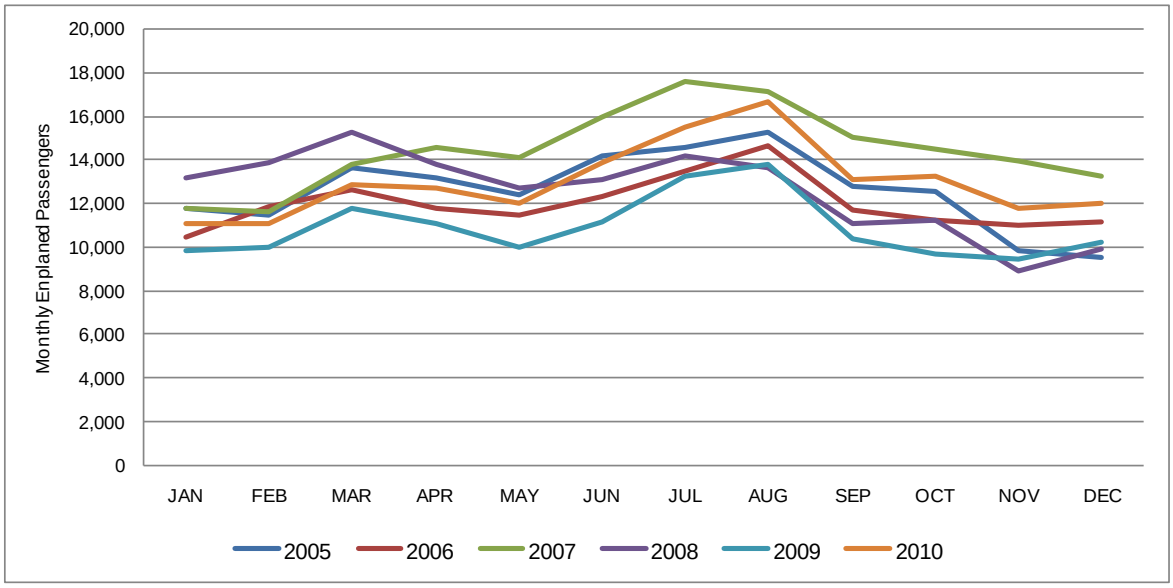
Source: Duluth Airport Authority, 2011

4.2.4 Monthly and Other Seasonal Trends

The Airport's passenger traffic shows a relatively small seasonal variation. Based upon an average of the last six full years, passenger traffic is usually lowest in November, December, January, and February. July and August are usually the busiest months. The peak month has been August in four of the last six years with July beating August by a small margin in the other two years. On average, the peak month of August sees about 40 percent higher traffic than the lowest month of November.

Note that this mid-summer peak and decline of winter traffic is typical of most domestic airports. The Airport's flight schedule does not vary substantially throughout the year due to fluctuations in seasonally adjusted flights offered; rather it is the aircraft load factors that usually changes. The average monthly passenger traffic for the past six years appears in Exhibit 4-4.

Exhibit 4-4
MONTHLY PASSENGER TRAFFIC 2005 TO 2010



Source: Duluth Airport Authority, 2011.

4.2.5 Current Airlines Providing Service

Three airlines currently provide regularly scheduled service to the Airport. These are Allegiant, Delta, and United. With the exception of Allegiant, the Airport is served by two of the so-called "legacy" airlines, who operate national route systems. Actual legacy carrier flights are often provided by one or more of Delta's or United's regional commuter affiliates, rather than the mainline carrier itself.

4.2.6 Flight Schedule

Each of the legacy airlines serving the Airport flies to one or more of their respective hubs. Allegiant serves a variety of leisure vacation destinations. The May 2011 cities served non-stop by commercial passenger airlines are shown in Table 4-6. Scheduled airline passenger service is provided by Delta and United, with seasonally scheduled service provided by Allegiant (two flights per week with MD-80s), and occasional charter operators including Allegiant (MD-80), Sun Country (Boeing-737), and previously Xtra Airways (Boeing 737).

Table 4-6
SCHEDULED PASSENGER AIRLINES SERVING THE AIRPORT

Carrier	Destinations Served Non-stop
Allegiant	Las Vegas, Orlando
Delta	Detroit, Minneapolis
United	Chicago (O'Hare)

Source: Duluth Airport Authority, May 2011

Table 4-7 summarizes the scheduled airline service activity at the Duluth International Airport, which totals approximately 4,500 flight departures per year.

Table 4-7
SCHEDULED PASSENGER AIRLINES SERVING THE AIRPORT

Airline	City Pair Destination	Aircraft	2010 Enplanements	Available Seats	Annual Departures	Annual Operations
Delta	Minneapolis, Detroit	CRJ-200	105,684	50	3,285	6,570
United	Chicago (O'Hare)	CRJ-200	21,840	50	1,095	2,190
Allegiant	Las Vegas, Orlando	MD-80	25,942	150	130	260
Charters	Various	Various	2,489			
Total			**155,955**		**4,510**	**9,020**

Source: Each airline's schedule, May 2011; Duluth Airport Authority, 2011

4.3 SIGNIFICANT FACTORS INFLUENCING PASSENGER AIR SERVICE

This section identifies the most significant factors expected to influence regional aviation demand. Competition among airports and airlines results in a situation where regional passengers have multiple choices for travel.

4.3.1 Price and Availability of Fuel

The price and availability of jet fuel has been a major determinate of airline service. Based on U.S. Department of Transportation information, fuel has become the largest single cost of airline operation, surpassing labor. From an average of under $1.00 per gallon in the years prior to 2003, jet fuel is now averaging over $2.00 per gallon. Because the price of fuel is relatively high, airlines are cutting marginal routes and parking inefficient aircraft. A key issue is that older, smaller turboprop and regional jets are being retired first. This reduction in feeder service is particularly influencing rural airports that depend upon small aircraft.

4.3.2 Airline Company Shifts

For many years, the legacy or system airlines provided most service. Today the so-called low-cost carriers have captured an increasing share of the domestic market. In less than ten years, the low-cost carriers have grown from less than 20 percent to over 30 percent in U.S. market share. The growth of the low-cost carriers is based on the efficiency and market strategies of each successful airline.

The low-cost carriers include Southwest, Frontier, and Spirit, among others, who seek-out high density, big city markets. These route decisions generally concentrate air service at the largest cities and busiest routes. This concentration of air service works to the advantage of big city residents, but often forces rural residents to drive to major cities. The future of each airline and the success of their marketing play a large role in the success of certain airports versus others.

4.3.3 Location and Other Characteristics of Regional Airports

The Airport serves a unique Air Service Area located relatively far from other population centers and airports. At the same time, there are a number of other commercial service airports within driving distance. By far the most important competitive airport is the Minneapolis/St. Paul International Airport (Minneapolis) located about 150 miles south of Duluth. The Minneapolis airport is a hub for the nation's largest airline - Delta Air Lines. Further, Minneapolis has service from most U.S. carriers including low fare carriers such as Southwest, Sun Country, and AirTran.

Other airports such as those in Hibbing, Brainerd, Bemidji, and International Falls may be reasonably close in distance, but none are believed to be serious competitors for passengers or air cargo due to their small size and considering the extensive air service available in Minneapolis and Duluth. Key information including the city-to-city mileage and driving time for the main competitive airport cities is provided in Table 4-8.

The Airport was the 202nd largest U.S. airport in 2009 in terms of passenger activity and is the second largest in Minnesota, after Minneapolis. Minneapolis is linked to the Air Service Area by an interstate highway that makes driving relatively easy. However, congestion on highways in and around Minneapolis can hinder access at peak times, as well as snow and ice in winter that slow travel.

Table 4-8
INFORMATION ON SURROUNDING REGIONAL AIRPORTS

Airport City	Highway Miles	Driving Time	FAA Classification	2009 Size Rank
Hibbing	76	1:24	Commercial Service	400
Brainerd	116	2:11	Primary	352
Bemidji	153	3:20	Primary	327
International Falls	157	3:30	Primary	350
Minneapolis	158	2:25	Large Hub	15

Source: GeoNova Road Master Atlas, 2009; FAA, 2010

4.3.4 Airport Efforts to Improve Air Service

The Airport has been aggressive in efforts to increase and improve air service to the Air Service Area, as will be recognized in the two alternative forecast scenarios. These efforts include submitting applications to increase air service under the Small Community Air Service Development Program and working with the state and other airports to improve regional air service. Further, the Airport recently built a new terminal which provides better vehicle access and passenger facilities to improve the travelers' experience. The terminal improvements include larger facilities to process passengers and baggage, as well as greatly expanded and improved security screening.

4.4 PASSENGER FORECAST

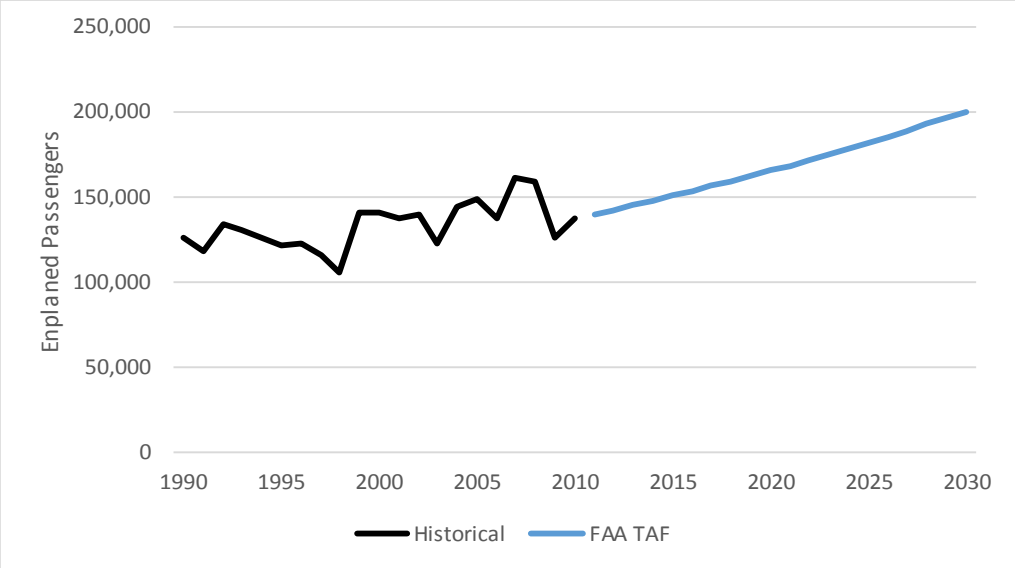
This section presents the enplaned passenger forecast. This forecast is based on the FAA Terminal Area Forecast (TAF) and two alternative scenarios of future traffic. The forecasts will be used for Master Plan analysis purposes.

4.4.1 Presentation of FAA TAF Forecast – Base Case

This Master Plan assumes the current (December 2010) FAA TAF is the basis for future facility planning. The FAA prepares an annual projection of commercial passengers and aircraft operations traffic for all U.S. airports. This TAF forecast is calculated based upon each airport's historical activity and national averages for change in passengers, aircraft operations, and other activity measures. The TAF forecast of passengers is presented in Exhibit 4-5.

The scheduled commercial passenger airline service outlook that parallels the TAF forecast is that Delta Air Lines remains the principal carrier with additional service provided by legacy carriers like United and leisure-service carriers like Allegiant. Additional service might include larger aircraft on existing routes, additional flight frequencies, or new destinations such as Denver or Phoenix.

Exhibit 4-5
DECEMBER 2010 FAA TERMINAL AREA FORECAST



Passengers	
Year	Enplanments
Historical	
1990	126,785
2000	141,413
2010 Actual	155,955
2010 FAA TAF	137,564
Projected	
2015	150779
2020	165529
2025	182004
2030	200409

Average Annual Growth Rate	
Period	Percent Change
Historical	
1990-2010 TAF	0.4%
Projected	
2010 TAF - 2014	1.85%
2016-2020	1.88%
2021-2025	1.92%
2026-2030	1.95%

Source: FAA Terminal Area Forecasts (TAF) for Duluth International Airport, December 2010; Year of 2010 is from Airport records.

4.4.2 Scenario One – FAA TAF Growth Rate from Actual 2010

Scenario One recognizes the higher enplaned passenger level of 155,955 recorded by the Airport in 2010 and continues the annual growth at the 2010 FAA TAF rate of 1.9 percent. Such a growth rate adds approximately 3,000 to 4,000 passengers per year and results in approximately 227,000 enplanements in 2030 or almost 30,000 more than the 2010 TAF projection.

The Airport currently has daily scheduled flights to Minneapolis, Detroit, and Chicago O'Hare, as well as several weekly flights on Allegiant. The air service scenarios that could follow this trend of passenger growth are infinite. Specific conceptual airline activity might include one or more of the following:

- United currently has two daily scheduled flights to Chicago-O'Hare. Under a model of increased passengers, the number of United Chicago flights could increase to three in the near term and four or more in the future. Note that Chicago-O'Hare is the second largest hub for United and the nation's third largest metropolitan area with almost 10 million residents. Therefore, Chicago is both a key airline hub and a major origin and destination passenger market.

- If the Chicago flights continue to be successful, United may add Denver flights in the future. This westward service would provide connections to California cities such as Los Angeles and San Francisco. At the same time, United service to Washington Dulles or Houston Intercontinental might be possible in the long term.

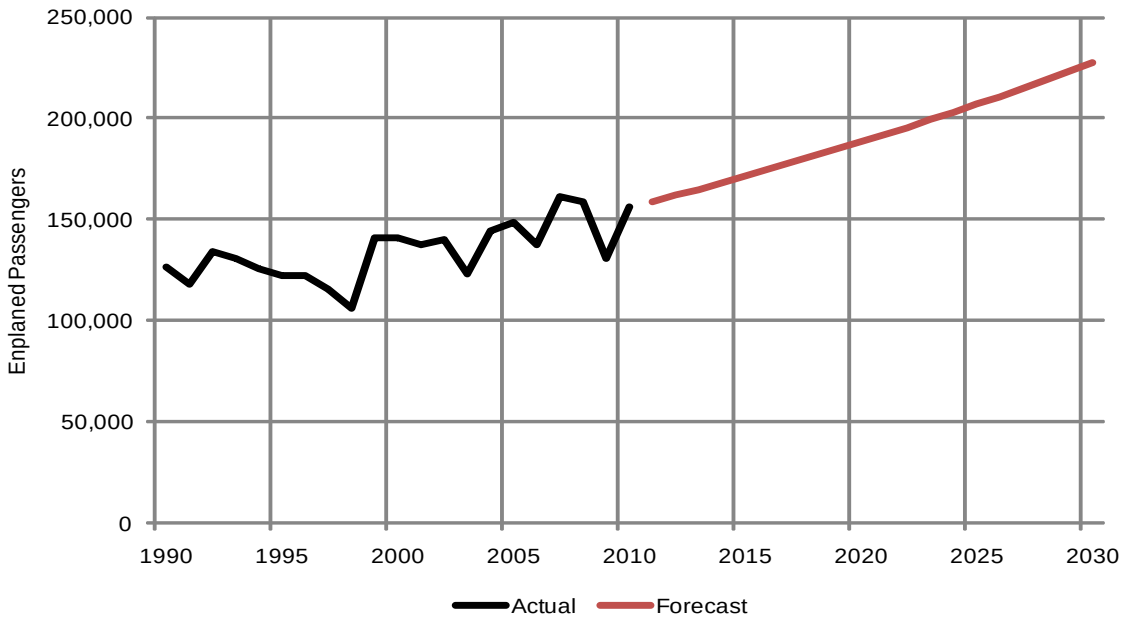
- Delta service to Minneapolis is currently on 50-seat regional jet aircraft. Larger 70-seat regional jets, as well as 120 to 150 Airbus A319 and A320 aircraft are possible, as well as increased frequency. Increased frequency (or larger regional jets) to Detroit is also likely as the Detroit Delta hub provides excellent service for both east coast and southern destinations, as well as better international connections. Over the long term, Delta service to Atlanta or Salt Lake City is possible.

- New Allegiant service to Phoenix or even Los Angeles is also possible, as well as added service to Florida destinations such as Tampa and Ft. Lauderdale.

In this scenario, the long-term growth of passengers is expected to occur as Delta and United, as well as Allegiant or similar carriers, compete for the Air Service Area's passengers. Realistically, increased load factors should accommodate some of the increased volume of passengers, but, over the long term, more aircraft frequency and/or larger aircraft may be deployed on the existing routes. Scenario One is very logical for Duluth air service, but it is likely to occur over the short to intermediate term and not immediately.

The competition offered by having two legacy carriers serve Duluth provides vital competition among carriers resulting in lower fares and increased air service options; therefore, more passengers would use the Airport. These increased passenger numbers result from less leakage to Minneapolis and a higher propensity of local residents choosing to fly to/from Duluth. This projection results in over 227,000 passengers in 2030. The Scenario One forecast is presented in Exhibit 4-6.

Exhibit 4-6
SCENARIO ONE – GROWTH AT FAA TAF RATE FROM ACTUAL 2010



Passengers	
Year	Enplanements
Historical	
1990	126,785
2000	141,413
2010	155,955
Projected	
2015	171,400
2020	188,300
2025	206,900
2030	227,300

Average Annual Growth Rate	
Period	Percent Change
Historical	
1990-2010	1.0%
Projected	
2010-2015	1.9%
2016-2020	1.9%
2021-2025	1.9%
2026-2030	1.9%

Source: RS&H, 2011.

4.4.3 Scenario Two – FAA National Domestic Growth Rate from Actual 2010

Scenario Two recognizes the higher enplaned passenger level of 155,955 recorded by the Airport in 2010 and continues the annual growth at the 2011 FAA national average domestic rate of 2.4 percent. Such a growth rate adds approximately 5,000 passengers per year and results in approximately 250,000 enplanements in 2030 or almost 50,000 more than the 2010 TAF projection.

The FAA national forecast of aviation activity is published annually in the *FAA Aerospace Forecast*. The latest version was published in February 2011. For the next 30 years, the forecast for U.S. carriers is a growth of 2.4 percent annually in domestic travel, 4.6 percent in international travel, and 2.8 percent in total. For this analysis, the 2.4 percent domestic average annual growth rate was used.

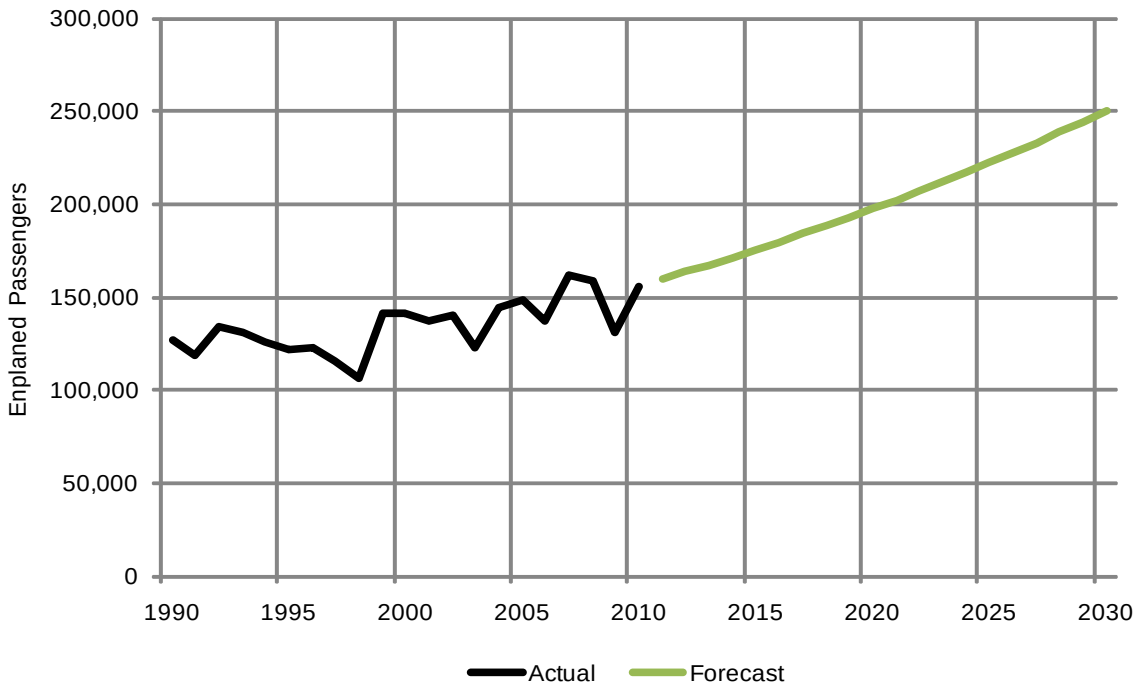
The Airport has existing daily scheduled flights to three designations, as well as several weekly leisure destination flights. Again, the air service scenarios that could follow this trend of passenger growth are infinite. Specific conceptual airline activity might include one or more of the following:

- United is likely to expand service under Scenario Two with Chicago and Denver flights.
- Delta would be expected to add larger aircraft and/or more frequency to Minneapolis and Detroit. Additional markets, such as Atlanta or Salt Lake City, may be possible over the medium term.
- Allegiant would likely add more frequency to Las Vegas and Orlando, as well as new destinations.
- Other carriers such as American might be possible in the long term if United is very successful serving the Chicago market.

Air service expectations under this scenario are that two or more major legacy carriers provide extensive service to the Airport. One or more leisure destination carriers such as Allegiant, Sun Country, or Direct Air are also present. Therefore, there is extensive competition for air passengers. This greatly increased air service and passenger scenario is unlikely to occur in the near term due to the national economic recession's impact on air travel and the severe cutbacks of air service being made by the carriers.

Almost all U.S. airlines are grounding aircraft and cutting flights in order to increase load factors. Further, these airlines are cutting fares in order to keep their flights as full as possible. In addition, airlines usually like to serve their "spoke-service" cities from the closest hub; therefore, increased service to Minneapolis, Chicago, and Detroit, or larger aircraft on these routes, might be expected before new destinations (such as Denver) are added.

Exhibit 4-7
SCENARIO TWO – GROWTH AT FAA NATIONAL DOMESTIC RATE FROM 2010 ACTUAL



Passengers	
Year	Enplanements
Historical	
1990	126,785
2000	141,413
2010	155,955
Projected	
2015	175,500
2020	197,500
2025	222,400
2030	250,400

Average Annual Growth Rate	
Period	Percent Change
Historical	
1990-2008	1.0%
Projected	
2010-2015	2.4%
2016-2020	2.4%
2021-2025	2.4%
2026-2030	2.4%

Source: FAA Terminal Area Forecasts (TAF) for Duluth International Airport, 2009.

4.4.4 Passenger Forecast Comparison and Summary

Three forecast cases were developed based on the FAA TAF and two scenarios of higher levels of passengers. The TAF indicates passenger levels will be approximately 200,000 by 2030, while both of the higher growth scenarios indicate levels well over 200,000 enplanements by 2030. The projected passenger enplanements are presented in Exhibit 4-8 with the average annual growth rates between the periods shown. The significant changes among the three cases and impacts on the growth of passengers at the Airport include:

- The strength of the worldwide economic recovery and specifically the expectations for population and economic growth of the Air Service Area.
- The expectations for continued growth of air service to greater Duluth. Issues for growth of small community air service include the lack of any new 100 seat or smaller aircraft to economically serve such communities and the continued growth of so-called, low fare carriers, such as Southwest, that serve only a few large cities, such as Minneapolis.
- The tendency of consumers to shop extensively for the lowest air fare and then drive hundreds of miles to "save money."
- The ability of specialized leisure market carriers such as Allegiant to continue to provide low fare service in competition with the major carriers. In addition, the continued ability of such leisure destination carriers to attract Canadian passengers.
- The possibility that surrounding regional airports in Minnesota and Wisconsin could lose all or most scheduled air service, in time, forcing passengers to larger commercial airports such as Duluth.

All of these cases predict that the Airport will continue to increase passenger volumes over the long term.

4.5 DESIGN DAY / DESIGN HOUR

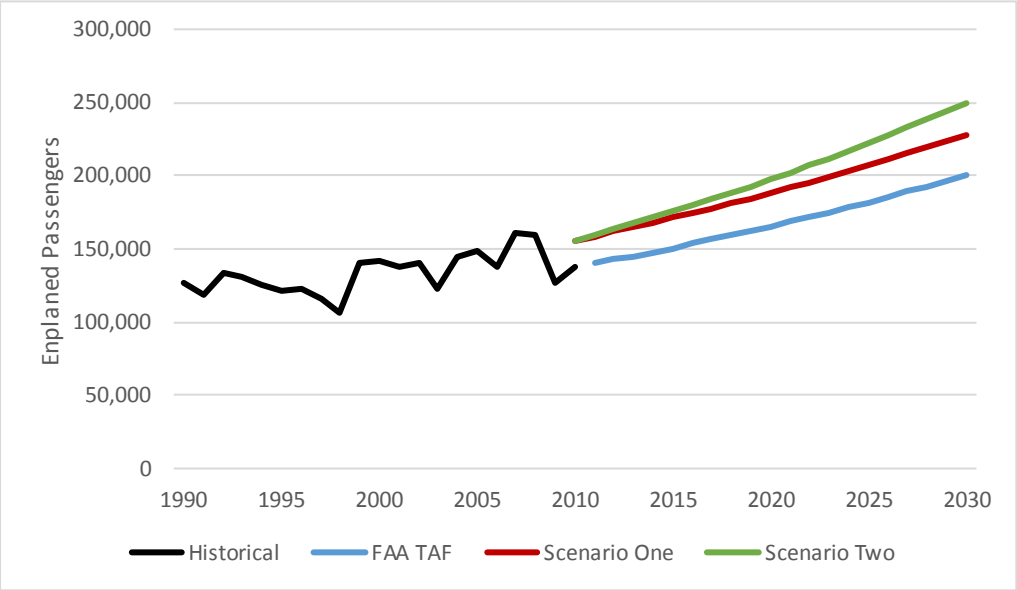
Airport facilities are not typically designed based upon their annual activity; rather, they are designed to accommodate a busy or peak period. This section of the Master Plan forecast will identify and project that peak activity period for commercial passengers and aircraft gate usage.

The peak activity at any airport is often constrained by the number of gates. At the same time, the number of airlines and their number of destinations, as well as their number of station employees, limit any airline's ability to schedule and handle too many aircraft at the same time. Therefore, this peak period gate analysis is built from the bottom-up, based upon the existing airline schedule. The current gate usage and overnight aircraft, as derived from the September 2010 actual flight schedule, are presented in Exhibit 4-9.

The peak period most commonly used in airport planning is the design day and/or design hour. These periods are not the absolute peak usage that an airport will ever see, but rather represent the typical busier than normal period. There are several factors to consider in this peak hour analysis. First, the number of flights per day does not vary substantially during the year because the airlines' schedule is relatively stable.

Second, the mid-summer is normally a busier time for passengers than winter. However, third, the key issue is that any time of year the daily peak departing passenger hour normally occurs during the early morning aircraft departure period. The arriving passenger peak is typically during a late afternoon aircraft arrival period. These peak passenger activity hours are usually particularly noticeable on Monday mornings and Friday evenings. Therefore, a peak gate usage analysis will be based upon full aircraft and the current flight schedule will be developed.

Exhibit 4-8
PASSENGER FORECAST SUMMARY - GRAPH BY SCENARIO



	2010	2015	2020	2025	2030	2010-2030
Enplaned Passengers						
Base Case - FAA TAF	137564	150779	165529	182004	200409	-
Scenario One	155955	171400	188300	206900	227300	-
Scenario Two	155955	175500	197500	222400	250400	-
Average Annual Growth Rate						
Base Case - FAA TAF		1.85%	1.88%	1.92%	1.95%	1.90%
Scenario One		1.91%	1.90%	1.90%	1.90%	1.90%
Scenario Two		2.39%	2.39%	2.40%	2.40%	2.40%

Source: FAA Terminal Area Forecasts (TAF) December 2010 | RS&H Analysis, 2011

The peak month was identified from 2010 activity as being August with a six-year average of 10.1 percent of the year's activity. The Average Day of the Peak Month is represented by 1/31 of the peak month's activity. The current airline schedule was analyzed to identify the peak hours for scheduled aircraft arrivals and departures. This analysis excludes the several times per week Allegiant flights. Based on the current airline schedule, the maximum number of scheduled aircraft on-the-ground in any single hour is four. These are the four aircraft that currently overnight in Duluth – three Delta aircraft and one United.

The gate usage by aircraft is identified differently. Under the current schedule, Delta can use two gates and United one. Allegiant can use its own gate or ground load, but is more likely to use a Delta or United gate during a non-busy time. However, for the purposes of this analysis, Allegiant is assigned its own gate. The reason that the number of gates is so variable is that regional jets can be easily ground loaded.

For the future, maximum major carrier gate usage is assumed for departing flights and related passenger enplanements based on carrier gate projection. The exception is Allegiant which has no peak hour flights projected because it does not typically operate at the busy early morning and late evening flight times of the major carriers. Furthermore, Allegiant only operates two or three days a week. Full aircraft are assumed based on a typical busy day schedule such as Monday morning or Friday evening. The deplaning passenger schedule has typically been less peaked than the enplaning passenger schedule with fewer aircraft arriving during the peak hour.

Based on this analysis, the peak departing passenger hour is 6 to 7 am when three 50-passenger regional jets depart. If all are full, 150 passengers use the Airport. The peak arrival hour is represented both by the 2 to 3 pm and 8 to 9 pm period when two regional jets arrive. With full aircraft, this results in 100 arriving passengers. The peak gate usage hours are overnight when four jets are on the ground and as many as four gates are utilized. For the future, similar conditions are expected, but with higher activity over time factored into the analysis.

Exhibit 4-9
MAY 2011 AIRLINE SCHEDULE BY GATE

Airline Destination		Midnight 12 AM	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM	Over-night
Delta MSP	Arrive											10:56				2:06		4:43				8:18				1
	Depart									8:25			11:21			2:37			5:10							
Delta MSP	Arrive													12:16										10:41		1
	Depart							6:50						12:41												
Delta DTW	Arrive										9:50						3:28					8:36				1
	Depart							6:05				10:20					3:55									
United ORD	Arrive															2:12									11:08	1
	Depart							6:34								2:52										
Allegiant	Arrive	Note: Allegiant seasonal schedule varies by day of week and destination.																								0
	Depart	One gate is used and aircraft do not overnight in Duluth.																								

Source: Airline Schedules, May 2011

The peak month for each of the forecast scenarios, as well as the peak day, has been calculated. The projected maximum number of gates used and the peak hour enplanements/deplanements for 2010, 2015, 2020, 2025, and 2030 were also projected. These peak activity calculations are presented in Table 4-9. Note that this forecast is based upon the current schedule and full regional jet (50-seat) aircraft. Allegiant activity does not usually occur in the peak periods of the daily scheduled flights, so their activity is not shown. However, if Allegiant flights were included, each peak hour shown would be 150 passengers higher.

Table 4-9
PEAK PERIOD AND GATE REQUIREMENTS PROJECTION

	Peak	Average	Peak Hour		
Year	**Month**	**Day**	**Gates**	**Enplanements**	**Deplanements**
TAF Forecast					
2010	13,827	446	4	150	100
2015	14,752	476	4	150	100
2020	15,772	509	4	150	100
2025	16,897	545	4	150	100
2030	18,140	585	4	150	100
Scenario One					
2010	13,827	446	4	150	100
2015	17,522	565	4	150	100
2020	18,688	603	5	200	150
2025	19,939	643	5	200	150
2030	21,264	686	5	200	150
Scenario Two					
2010	13,827	446	4	150	100
2015	20,585	664	5	200	150
2020	21,963	708	5	200	150
2025	23,426	756	5	200	150
2030	24,984	806	6	250	200

Source: RS&H Analysis, 2010

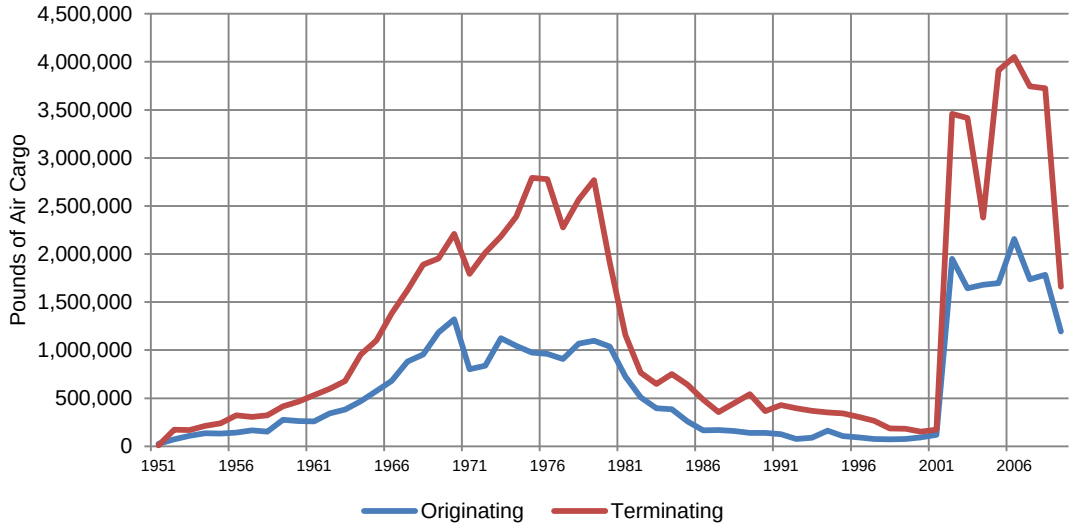
4.6 AIR CARGO FORECAST

The record of air cargo volume at the Duluth International Airport presents an erratic history. The latest change was in June 2009 when FedEx suspended service with a wide-body jet aircraft and substituted a much smaller turbo-prop flight. This dramatically reduced the capacity in and out of the Airport, as well as the actual pounds shipped. For the future, two scenarios are projected. The first scenario projects a continuation of service similar to today with turbo-prop flights. The second scenario projects a return of jet aircraft service. In addition to the level of airline service provided, other factors impacting air cargo include the state of the local and national economy and the continued switch by the U.S. Mail and air express companies (FedEx and UPS) to more economical ground shipments.

4.6.1 Historical Air Cargo

Records of mail, express, and freight shipped in and out of the Airport extend back to 1951. From the approximately 34,000 pounds (17 tons) shipped that first year, the volume has shown trends based upon the level of service provided. The late 1960s and 1970s show a dramatic increase in volume, while the 1980s and 1990s were in the doldrums after flights were reduced. Traffic increased again in the new millennium with daily FedEx wide-body jet service, but fell again in June 2009 when FedEx reduced flights. The 60 year enplaned and deplaned air cargo volume is shown in Exhibit 4-10.

Exhibit 4-10
LONG TERM HISTORICAL AIR CARGO VOLUME



Source: Duluth Airport Authority, 2010

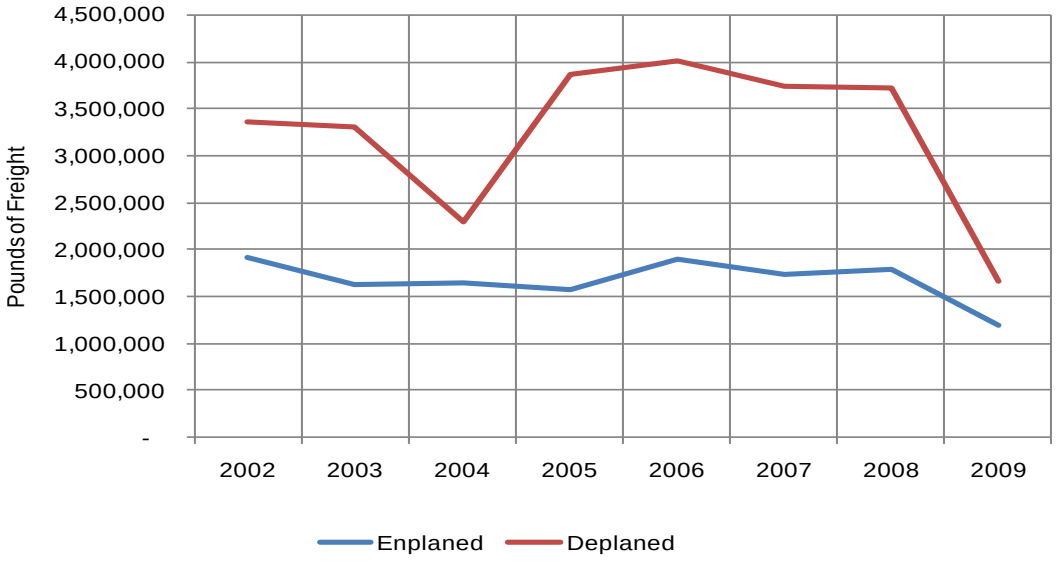
In the last eight years, FedEx has been providing five day a week service to the Airport, usually with a Boeing 727 or Airbus A310 wide-body, jet freighter aircraft. The purpose of this flight was to position a spare aircraft in the FedEx route structure, and not necessarily to serve the Air Service Area. At the same time, the capacity provided by this aircraft allowed extensive amounts of air cargo to be shipped to or through the Airport.

The stimulus provided by this capacity resulted in an average of 1.7 million pounds of enplaned air cargo and 3.5 million pounds of deplaned air cargo per year. The Air Service Area is shown by these statistics to be a net importer of air cargo with an average of twice the amount shipped in versus shipped out. However, traffic dropped sharply in June 2009 as the jet flights were discontinued, as shown on Exhibit 4-11.

Monthly data for the last few months shows the new level of air cargo being shipped with the discontinuation of the jet flights. The average over the last few months is 115,000 pounds per month enplaned and 45,000 pounds deplaned. Projecting a full year based upon these average months indicates 1,400,000 pounds enplaned and 500,000 deplaned. Note that based upon the monthly data and with the smaller aircraft in use, the amount of enplaned air cargo is greater than deplaned, which is a reverse of the previous activity. The latest months' air cargo volume is shown in Exhibit 4-12.

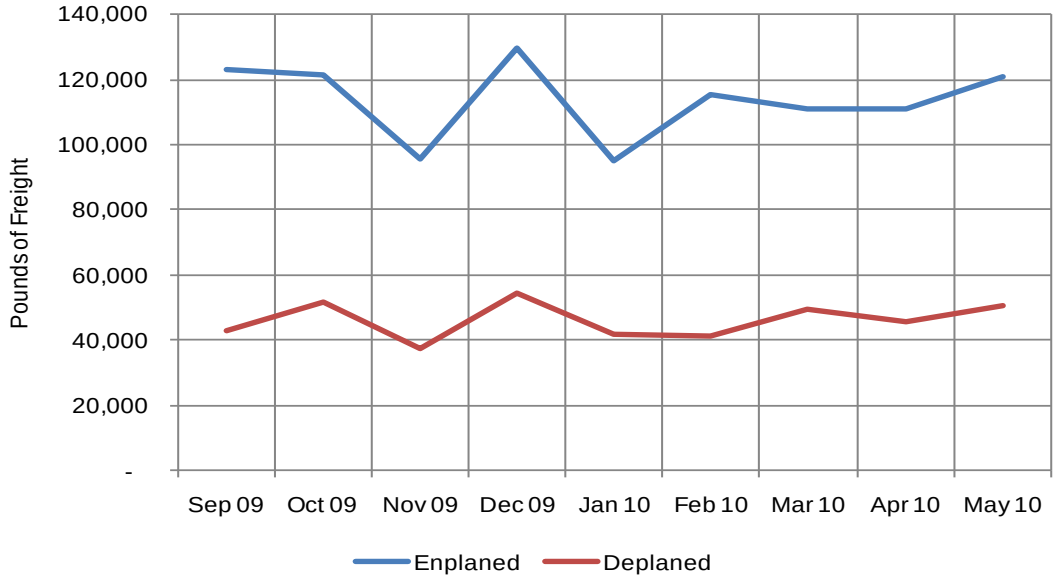
The information on air cargo activity provided above is from Airport records. In addition, various scheduled and on-demand all cargo flights occur from the general aviation ramp. For example, it is observed that UPS currently provides daily service to the Airport with a Swearingen Metroliner. Other on-demand check-hauler or priority package carriers also frequent the general aviation ramp. Finally, Delta Air Lines carries a limited amount of air cargo on their scheduled flights, but does not regularly report this activity to the Airport. In total, this non-reported air cargo volume is believed to be very small, but this additional activity is noted.

Exhibit 4-11
AIR CARGO VOLUME 2002-2009



Source: Duluth Airport Authority, 2010

Exhibit 4-12
LATEST MONTHLY AIR CARGO VOLUME



Source: Duluth Airport Authority, 2010

A major factor influencing regional air cargo is that Duluth does not have many of the "high-tech" type businesses that typically ship product by air. Products typically shipped by air include computers, pharmaceuticals, and consumer electronics. Further, locations that have distribution centers or international air service often serve as air shipment hubs. In contrast, the steel, lake shipping, railroad, and other industries of northeastern Minnesota are not traditionally large air shippers. More specifically, air shipments are usually small, high value items, while the Duluth seaport specializes in bulk, low value products like grain, coal, and iron ore. Therefore, without a change in regional industry, the expectation remains for limited air cargo service.

4.6.2 Air Cargo Forecast Scenarios

Two air cargo volume scenarios are provided in this section. The first is a "base" case that continues the volume of air cargo experienced in the last few months with the smaller FedEx aircraft. The second case assumes a larger FedEx aircraft provides service. This would mean that air cargo volume returns to the 2002 through 2008 average. Air cargo volume is grown through the 30-year study period at the average annual rate projected by the FAA in their *2010-2030 Aerospace Forecast* for domestic all-cargo carrier revenue ton miles. This average annual FAA national growth rate is 2.4 percent.

The projection of air cargo volume for the two scenarios is presented in Table 4-10.

Base Case: In the Base Case, enplaned air cargo grows from 1.4 million pounds assumed in 2010 to 2.3 million pounds in 2030. Deplaned air cargo rises from 500,000 pounds assumed for 2010 to 805,000 pounds in 2030. The growth rate is 2.4 percent annually through the period reflecting an increase in the national and local economies, as well as an increased tendency of consumers and businesses to use air cargo for just-in-time delivery.

Scenario One: In Scenario One, enplaned air cargo grows from 1.7 million pounds to 2.7 million pounds over the 20-year period. Deplaned air cargo grows from 3.5 million pounds to 5.6 million pounds. The average annual growth rate is also assumed at 2.4 percent.

These two air cargo forecasts suggest there will be one FedEx all cargo aircraft per day operating at the Airport. In the base case, the average load is approximately three tons per day, which remains in the capabilities of the current ATR type aircraft. In the case of Scenario One, multiple ATR flights or a larger aircraft (such as a Boeing 727 or 757) are required. However, because of the peaks of shipments on days of the week like Thursday and periods of the year like Christmas, larger aircraft or multiple flights might be expected on certain days at the Airport.

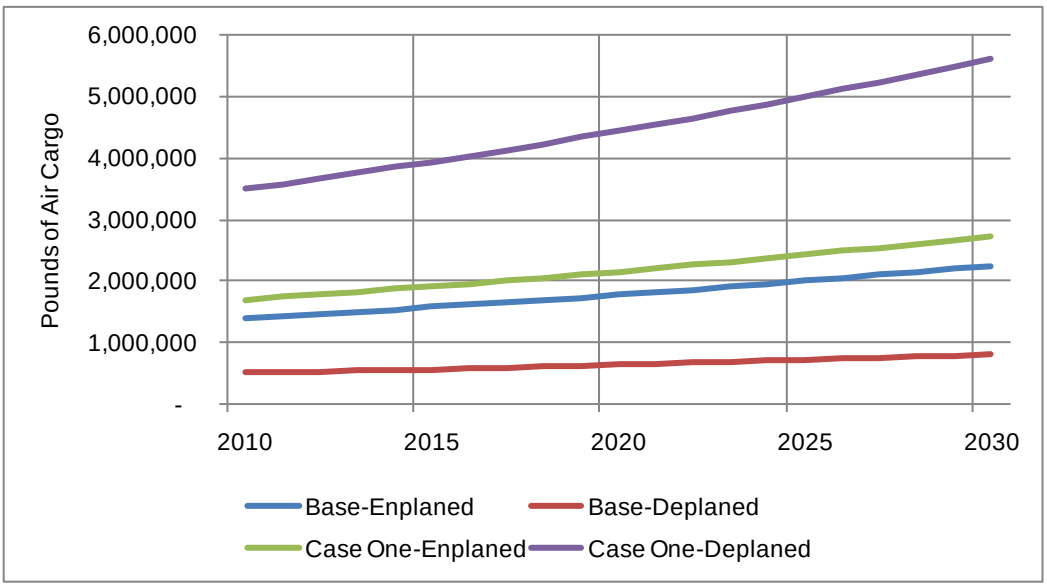
Table 4-10
AIR CARGO FORECAST BY SCENARIO

	2010		2015		2020		2025		2030	
	Enplaned	Deplaned	Enplaned	Deplaned	Enplaned	Deplaned	Enplaned	Deplaned	Enplaned	Deplaned
Pounds of Air Cargo										
Base Case	1,400,000	500,000	1,576,000	563,000	1,776,000	635,000	2,001,000	715,000	2,253,000	805,000
Scenario One	1,700,000	3,500,000	1,915,000	3,940,000	2,156,000	4,437,000	2,428,000	4,995,000	2,734,000	5,625,000
Average Annual Growth Rate										
Base Case			2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%
Scenario One			2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%

Source: RS&H, 2010

A graph of the projected air cargo for both the base case and Scenario One are presented in Exhibit 4-13.

Exhibit 4-13
AIR CARGO PROJECTION BY SCENARIO



Source: RS&H Analysis, 2010

4.7 BASED AIRCRAFT FORECAST

Based aircraft represent the total number of active, civil aircraft permanently located, projected to be located, or registered at an airport. In 2010, there were a total of 65 based aircraft; including 52 single-engine planes, 10 twin-engine, 2 jets and 1 helicopter. Nearly 95 percent of the based aircraft are piston-engine aircraft, with the largest aircraft being a Hawker 700, a medium-cabin business jet. It should be noted that none of the based aircraft are owned by the fixed base operator and neither the aircraft produced at Cirrus Design, nor the 22 based F-16 fighter jets positioned at the Minnesota Air National Guard are not counted as based aircraft.

The general aviation industry, in terms of aircraft production and utilization, is growing at about 0.5 to 1.5 percent annually, with the business-class segment growing at a faster annual rate of 4 to 5 percent. These trends are supported by FAA aircraft traffic count surveys, pilot registries, aircraft production and shipment schedules, used-aircraft market trends, pilot certifications/ratings, and corporate tax legislation on aircraft depreciation schedules. Business jet production will constitute the fastest growing segment of the general aviation fleet.

Most profoundly since 1990, fractional jet ownership programs have expanded from 60 to nearly 6,500 operators, and in the future these ownership arrangements will likely expand into new markets and involve more turboprop aircraft. National economic conditions do have a considerable and lagging effect on aviation demand, in nearly all segments of the general aviation industry. While the number of based aircraft has generally declined at individual airports during the latest period of economic downturn since 2007, in contrast, the FAA Terminal Area Forecast (TAF) shows a continued increase in the number of based aircraft at the Duluth International Airport.

Table 4-11 shows the projected based aircraft by category expected to be at the Duluth International Airport.

Table 4-11
BASED AIRCRAFT PROJECTIONS

Forecast Year	Single Engine	Multi Engine	Jet	Rotor-Craft	Civilian Total	Military	Grand Total
2010	52	10	2	1	65	22	87
2015	54	11	3	2	70	22	92
2020	60	12	3	2	77	22	99
2025	62	13	5	3	83	22	105
2030	66	14	5	3	88	22	110
20-Year Change	14	4	3	2	23	0	23
Annual Change	1.2%	1.7%	4.7%	5.6%	1.5%	0.0%	1.2%

Source: FAA TAF, 2010; Duluth Airport Authority, Reynolds, Smith and Hills

Note that Cirrus Design Corporation has their manufacturing facility, design operation, and headquarters at the Airport. In 2010, Cirrus was the largest single firm selling general aviation aircraft. According to the manufactuer, each new owner gets 8 to 10 hours of instruction before delivery. Further, testing and owner fly-ins add to the number of Cirrus flight operations at the Airport.

In addition, Lake Superior College recently added flight training to their curriculum. These student flights add to the general aviation activity at the Airport.

The FAA's TAF serves as the basis for the Airport's Master Plan forecast, which shows based aircraft continuing to increase throughout the planning period, at the rate of around one additional aircraft per year. The FAA TAF for Duluth represents a reasonable unconstrained forecast, with based aircraft increasing from 65 to 88 over the 20-year period, or about 1.5 percent annual growth rate. Reasons for this projected growth are attributable to:

- Accommodating the typical aircraft hangar waiting list of 10 to 12 new owners
- Spin-off of aircraft manufacturing activities and pilot services
- Proliferation of flight training
- The availability of FBO and SASO services complimenting general aviation interests
- Aircraft owners upgrading into larger, more sophisticated aircraft; including the transition into smaller turboprop and business jet aircraft.
- Rotorcraft are projected to remain a small share of activity.
- Availability of Airport facilities and development areas to accommodate a variety of general aviation users; including facilities for multi-purpose business structures.

Therefore, there may be more general aviation activity at the Airport than the based aircraft figures above indicate.

4.8 ANNUAL AIRCRAFT OPERATIONS FORECAST

Forecasts of annual aircraft operations were prepared for aviation activity using the FAA Terminal Area Forecasts (TAF). The operations categories include commercial service (air carrier and commuter), general aviation, and military operations. General aviation operations represent all civil aircraft takeoffs and landings not classified as commercial (air carrier or commuter) or military.

In 2010, aircraft operations totaled 57,000 (takeoffs and landings), down slightly from an average of about 65,000 experienced during the previous 3 to 5 years, but within the normal range of 50,000 to 75,000 since 1990. In 2010, civilian traffic totaled approximately 50,000 operations, in which itinerant flights accounted for about 40,000 operations and local traffic about 20,000. Since an aircraft operation is defined as either a takeoff or a landing, the typical air carrier flight consists of a landing and a takeoff for a total of two operations.

The following is an overview of the historic Duluth International Airport traffic levels by user type:

- Commercial Service - Commercial passenger operations totaled 9,400 in 2010, an increase over the previous 5 years. Total commercial flights, which include air passenger and cargo, ranged from approximately 7,000 to 14,000 in the 19 years shown with an average of 11,000 per year. During 2008 there were approximately 9,500 operations as the average size of the scheduled passenger aircraft varied in the period. The slight downward activity recently reflects the loss of seats in the market, as well as higher load factors. However, as evidence of past trends, flight frequency will likely rise from the competitive markets served by Delta and United. For the future, the FAA expects the number of commercial service operations to increase from nearly 10,000 in 2009 to slightly over 13,000 by 2030.

- Commercial Air Cargo – Commercial scheduled air cargo operations total nearly 1,200 operations per year, and are conducted by two cargo operators, FedEx and UPS.

- General Aviation - The number of general aviation operations has risen from approximately 30,000 in 1990 to over 50,000 for most of years between 2005 and 2012. The growth is concentrated on itinerant operations, as local flights have remained relatively steady. Any anticipated growth of operations is contingent on the U.S. economy recovering, the resurgence of Cirrus aircraft manufacturing regime, and the continued increase in college flight training. General aviation activity is also projected by the FAA to grow with over 50,000 operations per year by 2030. Note that delivery of aircraft from the Cirrus factory and the related on-site training that occurs with each delivery is an important component of the Airport's general aviation activity.

- Military - Military flights have declined slightly between 2006 and 2012 with around 8,000 annually. Military operations, largely from the based F-16s, historically conduct 6,600 to 12,400 operations. The fighter aircraft use Runway 9-27 exclusively for arrivals and departures since Runway 3-21 does not meet the runway length requirements for the F-16, and Runway 9-27 is outfitted with aircraft arresting equipment. In 2009, itinerant military operations represented about 12 percent of all itinerant operations while local military operations represented about 24 percent of total local operations or touch and go traffic. Non-based aircraft operations include the C-130 cargo aircraft and KC-135 aerial refueling aircraft. These aircraft are based at other military bases, and occasionally undergo joint training with the 148th Fighter Wing. Military operations are projected to remain steady by the FAA.

The result of the recent and projected trends in activity is that total Airport operations are expected to grow in the 20-year forecast period from approximately 65,000 today to 76,000 in 2030. Table 4-12

shows the total historical and forecast operations forecast from the FAA Terminal Area Forecasts (TAF).

Table 4-12
HISTORICAL AND FORECAST OPERATIONS

	Commercial Service			General Aviation			Military			Grand
Year	Air Carrier	Commuter	Subtotal	Itinerant	Local	Subtotal	Itinerant	Local	Subtotal	Total
Actual										
1990	2,907	3,600	6,507	15,495	14,820	30,315	3,719	7,689	11,408	48,230
1991	3,807	5,785	9,592	18,714	16,001	34,715	6,689	12,182	18,871	63,178
1992	3,769	7,612	11,381	17,296	12,484	29,780	6,332	10,218	16,550	57,711
1993	4,198	7,657	11,855	18,991	12,574	31,565	6,282	10,422	16,704	60,124
1994	3,767	7,952	11,719	18,889	12,344	31,233	5,934	8,558	14,492	57,444
1995	3,855	8,254	12,109	21,516	17,570	39,086	5,704	8,828	14,532	65,727
1996	4,151	7,816	11,967	21,488	16,590	38,078	4,093	6,202	10,295	60,340
1997	4,214	6,026	10,240	21,224	16,278	37,502	4,488	6,536	11,024	58,766
1998	4,047	6,368	10,415	23,246	16,438	39,684	4,877	7,194	12,071	62,170
1999	8,241	6,742	14,983	20,406	15,349	35,755	4,545	6,923	11,468	62,206
2000	8,132	5,909	14,041	23,167	15,663	38,830	4,682	6,467	11,149	64,020
2001	6,117	4,749	10,866	24,568	17,291	41,859	4,981	7,401	12,382	65,107
2002	5,292	6,172	11,464	30,455	20,189	50,644	5,083	7,189	12,272	74,380
2003	5,737	3,338	9,075	33,901	21,400	55,301	3,789	4,933	8,722	73,098
2004	5,266	5,795	11,061	35,130	20,598	55,728	3,666	3,499	7,165	73,954
2005	4,554	4,921	9,475	34,560	17,305	51,865	3,314	4,358	7,672	69,012
2006	3,953	4,936	8,889	35,227	14,590	49,817	3,414	3,244	6,658	65,364
2007	4,480	5,431	9,911	36,526	15,268	51,794	3,638	4,041	7,679	69,384
2008	4,494	5,003	9,497	36,027	11,344	47,371	4,218	4,188	8,406	65,274
Forecast										
2010	1,412	9,525	10,937	26,287	12,371	38,658	5,019	4,383	9,402	59,000
2015	1,448	10,101	11,549	28,758	13,216	41,974	5,019	4,383	9,402	62,900
2020	1,448	10,712	12,200	31,288	14,119	45,407	5,019	4,383	9,402	67,000
2025	1,528	11,366	12,894	34,041	15,083	49,124	5,019	4,383	9,402	71,400
2030	1,570	12,063	13,633	37,035	16,113	53,148	5,019	4,383	9,402	76,100
Average Annual Growth Rate										
1990-2008	2.4%	1.8%	2.1%	4.8%	-1.5%	2.5%	0.7%	-3.3%	-1.7%	1.7%
2010-2030	0.5%	1.2%	1.0%	1.7%	1.3%	1.6%	0.0%	0.0%	0.0%	1.3%

Source: FAA Terminal Area Forecasts, December 2009.

4.9 IMPACT OF ACTIVITY SCENARIOS ON OPERATIONS

The forecasts of enplanements and air cargo at Duluth International Airport were analyzed with alternative scenarios. The alternative scenarios have relatively minor impacts on the level of operations at the Airport as summarized below.

4.9.1 Impact of Air Service Scenarios on Operations Forecast

The two air service scenarios have a relatively small impact on the base operations forecast. Under Scenario One (adding approximately three daily scheduled flights over time), the number of commercial operations would increase by approximately 2,000 annually compared to the Baseline Forecast which represents the TAF. Under Scenario Two, approximately 4,000 additional operations would be

recorded compared to the Baseline Forecast. These changes would increase the number of commercial operations, but have relatively little impact upon the total number of operations.

4.9.2 Impact of Cargo Scenarios on Operations Forecast

The alternative air cargo activity scenarios impact the size of aircraft and not the number of operations. Therefore, there is no impact on the base operations forecast shown above.

4.9.3 Impact of General Aviation Scenarios on Operations Forecast

Cirrus Design: In recent years, Cirrus production of four-seat piston aircraft has averaged about 300 aircraft units per year; production has peaked at approximately 725 per year. With a recovery in the economy and a strengthening of the general aviation market, Cirrus anticipates reaching a production rate of 400 to 600 single-engine units by 2015, with all manufacturing occurring from the existing facility. In addition, Cirrus is in the process of pursuing certification of a Very Light Jet (VLJ), and with a stronger economy, expects to construct a dedicated building/hangar and have full production by 2015. Cirrus anticipates a strong market for the jet and plans to produce about 150 aircraft per year. In recent years, flight activity by Cirrus aircraft accounted for about 8,000 to 10,000 operations per year, or about 30 operations per produced aircraft. The typical flight proficiency training typically involves about 8 to 10 hours of instruction. These familiarization flights entail flight testing, pilot training, and pilot proficiency, with about 80 percent of the flights conducted at the Duluth International Airport and the remaining flights at surrounding airports.

Lake Superior College Activity: The school administration would like to nearly double the number of students to 60, resulting in approximately 20,000 operations per year. Helicopter training has been added, further increasing operations.

Fixed Base Operator Activity: The Airport's FBO has been attempting to increase the number of technical stops that occur for refueling or to clear U.S. Customs. As a mid-continent location, as well as a customs entry point, the FBO expects to further increase this activity.

4.10 COMPARISON WITH OTHER FORECASTS

Master Plan forecasts are reviewed by the FAA, and compared to the FAA Terminal Area Forecast (TAF) prepared for individual airports. FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems* provides guidance on the FAA forecast review process. In addition, the FAA Revision to Guidance on Review and Approval of Aviation Forecasts (June 2008) letter states that the FAA Office of Aviation Policy and Plans will find a locally developed forecast for operations, based aircraft and enplanements consistent with the Terminal Area Forecast if it meets any of the following three conditions for a Commercial Service airport.

- First FAA Forecast Criteria: The forecast differs less than 10 percent in the 5-year forecast period and less than 15 percent in the 10-year period.

- Second FAA Forecast Criteria: The forecast activity levels do not affect the timing or scale of an airport project.

- Third FAA Forecast Criteria: The forecast activity levels do not affect the role of the Airport as defined in FAA Order 5090.3C.

As such, the FAA's TAF for the Duluth International Airport serves as the basis for the Master Plan forecast. Facility development plans will largely correspond to the activity levels associated with the FAA TAF growth rates.

4.11 SUMMARY OF FORECASTS

A summary listing of the aviation demand forecasts for the Airport is presented in Table 4-13. These projections are used in the next chapters of the Master Plan to assess the capacity of existing facilities and determine facility expansions or improvements needed to satisfy future activity levels.

Table 4-13
FORECAST SUMMARY

Activity Measure	2010	2015	2020	2025	2030
COMMERCIAL PASSENGERS					
Annual Enplaned - Actual	155,955				
Annual Enplaned - FAA TAF	137,564	150,779	165,529	182,004	200,409
Peak Hour-Enplanements	150	150	150	150	150
ANNUAL OPERATIONS					
Commercial	10,900	11,500	12,200	12,900	13,600
General Aviation	38,700	42,000	45,400	49,100	53,100
Military	9,400	9,400	9,400	9,400	9,400
Total	59,000	62,900	67,000	71,400	76,100
BASED AIRCRAFT					
Total	87	92	99	105	110

Source: FAA TAF, 2010; Duluth Airport Authority, 2011; and RS&H, 2011

4.12 FORECAST CONCLUSION

This chapter provided a projection of passengers and other aviation activity for the Master Plan forecast. Information from this summary will be used in the remainder of the Master Plan to assess the capacity of the existing Airport facilities and provide planning guidance for proposed facility expansion or renewal. In summary, this forecast assumes continuation of the current types of aviation activity with growth in line with historical and economic trends.

CHAPTER 5
FACILITY REQUIREMENTS

This chapter documents the 'airfield' facility components necessary to satisfy the 20-year aviation demands at the Duluth International Airport. Facility requirements are identified for the purpose of resolving existing facility deficiencies, accommodating forecast activity levels, and satisfying the strategic goals as envisioned by the Duluth Airport Authority for long-term development of the Airport.

The following is an outline of this chapter, as abbreviated for airfield facilities:

- Runway Dimension and Equipment
- Taxiway System
- Pavement Condition and Strength
- Airport Navigational and Lighting Aids
- Airport Airspace

The Airport facility improvements are planned in accordance with Federal Aviation Administration (FAA) and Minnesota Aeronautics (Mn/DOT) design standards and guidance, preferably without a deviation or modification to FAA design standards. The major airport facilities are graphically depicted on the Airport Layout Plan (ALP) drawing. It should be noted the facility recommendations in this chapter are not an absolute design requirement, but options to resolve facility or operational deficiencies, or to make improvements as demand warrants and funding becomes available. Also, extenuating circumstances can affect facility recommendations and trigger project improvements due to unforeseen user demand and unanticipated operator needs.

Subsequent master plan chapters provide more detailed planning solutions for these major facility items, in terms of possible alternative layout options, phased implementation, costs and funding sources.

5.1 AIRPORT DESIGN CLASSIFICATION

This section establishes the airport design classification and respective federal and state planning standards for identifying facility requirements for the Duluth International Airport during the 20-year planning period. It should be noted that facility requirements contained in this chapter address needs based on civilian activity levels, unless otherwise specified.

5.1.1 Airport Design Classification – Role & Service Level

The Duluth International Airport is identified in the FAA's *National Plan of Integrated Airports System (NPIAS)* as a 'non-hub' primary commercial service facility, and is projected to remain in that role throughout the 20-year airport master planning horizon. Runway 9-27 and Runway 3-21 are FAA certified Part 139 runways, used for scheduled commercial service operations.

5.1.2 Airport Strategic Vision

As established with the Airport in the Inventory, a strategic vision was established by the Airport at the onset of the master plan study. The strategic vision aims to maintain the Airport's competitive advantage, oriented towards expanding facility strengths and capitalizing on opportunities. This vision seeks to offer airfield facilities suited to support existing and future airline transport aircraft, air cargo prospects, heavy lift widebody fuel Techstop transports, ultra-large cabin general aviation business jets, and military fighter and cargo operations associated with the MN Air National Guard support missions. To meet this strategic vision, it is essential for the Airport to provide a runway and taxiway system capable of continuously accommodating large commercial transport aircraft and military jet operations. The strategic vision is intended to allow for various contingencies or goals that may extend beyond the 20-year master plan period. As such, the following are the planning periods identified for the master plan:

- Existing Conditions = 2010
- Future Conditions = 1-20 Year Planning Period
- Strategic Conditions = 1-20+ Years as intended to satisfy the Airport's vision

5.1.3 Summary of Critical Aircraft Operations

The FBO fuel Techstops account for the largest and most demanding aircraft operating at the Airport, which involve on-demand freight transport operators, charter operators and other contract and ferry flights. The Techstop flights originate both domestically and internationally, primarily between Europe and the southwest United States. The large Techstop aircraft operate at the Airport approximately three to six times per month. On occasions, long-range heavy-lift cargo transport aircraft such as the Lockheed C-5A and Antonov 124 (AN-124) operate at Duluth.

The largest commercial passenger service airplanes operating at Duluth include the MD-80, B-737, B-757, and A-320, experienced as scheduled service or on-demand charters on nearly a daily basis. The military critical aircraft is the Falcon F-16 (ARC D-I), which is based at Duluth. The military also operates large transport cargo aircraft at Duluth, representative of the C-17 Globemaster and C-5 Galaxy. All landing and departing military aircraft operate exclusively on Runway 9-27 including numerous operations by C-130 aircraft from Minneapolis performing Touch and Go operations.
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5.1.4 Airport Design Classification

The planning of airport facilities must conform to Federal Aviation Administration (FAA) design standards, as pertaining to the operational and physical characteristics of the critical planning aircraft, or representative largest aircraft conducting more than 500 annual itinerant operations (takeoffs and landings) at the Airport, per runway.

The critical aircraft is evaluated with respect to size, speed and weight, and is the basis for determining the airfield and terminal area standards for various structural dimensions, setback separations, airspace clearances, safety areas and other design considerations. Combined, the 'approach category' (alphabetic letter) and 'design group' (Roman numeral) yields the Airport Reference Code (ARC) which determines the type of airplane (family) that the airport is designed to accommodate.

As substantiated by the Forecast Chapter, the Airport Reference Code (ARC) for the Airport is D-V, resulting from a mix of large widebody and heavy lift cargo transport flights originating from domestic and international destinations. The Boeing-747-400F is the representative critical/design aircraft.

Table 5-1 is a schedule of annual civilian traffic estimated for each runway end departure and arrival, as summarized by FAA Airport Reference Code. This information forms the basis of determining the type and timing of the critical aircraft and FAA Airport Reference Code, by runway. The number of operations assigned to each aircraft category was estimated using the FAA Terminal Area Forecast, airline schedules, information from ATCT, flight plan information and interviews with the FBO, the flight school, and Cirrus Aircraft.

The runway percent traffic assignments were compiled using wind analysis data and interviews with Airport and the Air Traffic Control Tower staff regarding current and future use of the runway system for both existing (2010) and forecast (2030) operational activity levels. Note the slight increase in future runway utilization preference cited by those interviewed for larger Category C and D aircraft on Runway 3-21.

Table 5-1 reflects activity and aircraft mix occurring on the existing runway system. Therefore, the activity levels do not take into account the future Runway 9-27 closure to undergo a phased, multi-year pavement reconstruction project. Ostensibly, during the Runway 9-27 reconstruction of at least the center section, Runway 3-21 would accommodate the Airport's traffic, including Category A, B, C and D aircraft. Consequently, the reconstruction event would further bolster the Runway 3-21 activity levels, particularly for larger Category B, C and D aircraft.

Table 5-1
PLANNING CRITICAL/DESIGN AIRCRAFT BY RUNWAY

Existing Runway Mix (2010)					
Existing ARC	**Rwy 9-27 Operations**	**Percent Operations**	**Rwy 3-21 Operations**	**Percent Operations**	**COMBINED TOTAL**
A	21,700	67.9%	10,260	32.1%	31,960
B	6,670	73.4%	2,420	26.6%	9,090
C	8,980	95.6%	410	4.4%	9,390
D	340	87.2%	50	12.8%	390
Total	**37,690**	**74.1%**	**13,140**	**25.9%**	**50,830**

Note: Rotor and Military operations are not included in the number of operations shown above.

Future Runway Mix (2030)					
Future ARC	**Rwy 9-27 Operations**	**Percent Operations**	**Rwy 3-21 Operations**	**Percent Operations**	**COMBINED TOTAL**
A	27,490	67.9%	13,000	32.1%	40,490
B	10,010	69.4%	4,410	30.6%	14,420
C	10,300	81.9%	2,270	18.1%	12,570
D	540	75.0%	180	25.0%	720
Total	**48,340**	**70.9%**	**19,860**	**29.1%**	**68,200**

Note: Rotor and Military operations are not included in the number of operations shown above.
Note: Future table does not reflect Runway 9-27 closure for multi-year pavement reconstruction.

As evidence of Table 5-1, the future Runway 9-27 FAA ARC is a Category D, and the future Runway 3-21 FAA ARC is Category C, as a matter of conducting more than 500 annual itinerant operations per year. The primary Runway 9-27 design standards need to accommodate D-V aircraft with an approach

speed less than 166 knots and an aircraft wingspan of up to 214 feet, and tail height up to 66 feet. The secondary Runway 3-21 design standards need to accommodate C-III aircraft with an approach speed less than 141 knots and an aircraft wingspan of up to 118 feet, and tail height up to 45 feet.

Table 5-2 identifies, by phase, the planned aircraft and design classifications for Runway 9-27 and Runway 3-21 over the 20-year planning period. This information includes the critical planning and design aircraft, and the corresponding FAA Airport Reference Code (ARC). The 'critical' aircraft is used for application to planning standard purposes, while the 'design' aircraft is generally used for specific constructability purposes.

Table 5-2
CRITICAL AIRCRAFT AND AIRPORT REFERENCE CODE (ARC)

Planning Period		RUNWAY 9-27 Operator(s) Aircraft Type(s) Design Group (Representative Aircraft)	RUNWAY 3-21 Operator(s) Aircraft Type(s) Design Group (Representative Aircraft)
Existing	Critical Planning	Air Carrier-Charter Narrowbody Jet Transport C-III (A-320, MD-80, B-737)	FBO Tech Stop-Corporate Large-Cabin Business Jet C-III (Gulfstream Series)
	Critical Design	FBO Techstop Large Heavy Jet Transport D-V (747-400F)	Air Carrier-Charter-FBO Techstop Narrowbody Jet Transport C-III (MD-80 / B-737 Series)
Future (1-20 Years)	Critical Planning	Air Carrier-Charter-FBO Techstop Large Narrowbody Jet Transport C/D-IV (B-757)	Air Carrier-Charter Regional Jet C-III (CRJ-900 | Embraer 170/195)
	Crtical Design	FBO Techstop Large Heavy Jet Transport D-V (747-400F)	Air Carrier-Charter-FBO Techstop Narrowbody Jet Transport C-III (A-320, B-737 Series)
Strategic (±20 Years)	Critical Planning	FBO Techstop Large Heavy Jet Transport D-V (747-400F)	Air Carrier-Charter-FBO Techstop Narrowbody Jet Transport C-III (A-320, B-737 Series)
	Critical Design	FBO Techstop Large Heavy Jet Transport D-V (747-400F)	Air Carrier-Charter-FBO Techstop Narrowbody Jet Transport C-III (B-737 Series)

The planning of airport facilities conforms to FAA design standards, as pertaining to the operational and physical characteristics of the 'critical aircraft', or representative largest aircraft conducting more than 500 annual itinerant operations (takeoffs and landings) at the Airport. The critical aircraft is evaluated with respect to size, speed and weight, and is the basis for determining the airfield and terminal area standards for various structural dimensions, setback separations, airspace clearances, safety areas and other design considerations. Combined, the 'approach category' (alphabetic letter) and 'design group' (roman numeral) yields the Airport Reference Code (ARC) which determines the type of airplane (family) that the airport is designed to accommodate.

Exhibit 5-1 depicts the existing and future representative critical /design aircraft, by runway and planning period. While it is not known whether the aircraft categories assigned to their respective runways will best serve as the representative aircraft category throughout the planning period, it is a

reasonable expectation based on the forecast scenarios to plan for the aircraft categories as assigned to Runways 9-27 and Runway 3-21.

Exhibit 5-1

DEPICTION OF REPRESENTATIVE CRITICAL/DESIGN AIRCRAFT

RUNWAY 9-27 CRITICAL/DESIGN AIRCRAFT

MD-80, A-320
(ARC C-III)
(Existing and Future Critical Aircraft)

747-400F
(ARC D-V)
(Design Aircraft)
(Future Critical Aircraft)

RUNWAY 3-21 CRITICAL / DESIGN AIRCRAFT

Gulfstream 400/500
(ARC C-III)
(Existing Critical Aircraft)

CRJ 900 / EMB 170
(ARC C-III)
(Future Critical Aircraft)

B-737
(ARC C-III)
(Design Aircraft)

5.2 AIRFIELD FACILITY NEEDS

This section describes the airfield facility needs, and the methods and planned timing upon which the facility requirements have been determined. Areas examined include the runway length/width, taxiway systems, lighting aids, airfield safety areas, separation standards, and pavement strength. The airfield geometric design and site layout are determined by application of airport design standards contained in the *FAA Advisory Circular 150/5300-13, Airport Design*, in which the standards are determined with respect to the Airport's design aircraft, as assigned per runway.

5.2.1 Runway Usage

Table 5-3 provides the runway and runway end usage, expressed in annual operations and percent of annual operations, as derived from general observations from the Duluth Air Traffic Control Tower and determined from NOAA wind observation data for Duluth over a 10-year period.

Over the course of a year, this information indicates that Runway 9-27 is used approximately 82 percent of the time, and Runway 3-21 used approximately 18 percent of the time. Wind data indicates a comparable percentage of use during both visual and instrument conditions. As calculated from personnel and weather data observations, the combination of wind, visibility/ceiling condition, runway contamination due to snow and rainfall events and periods of primary runway closure due to maintenance and repair indicates the secondary would be used 126 days per year, or 35 percent of the year.

The wind coverage information is included in the Runway Usage Table. This information indicates the percentage of wind coverage for each runway end. With aircraft departing and arriving into the wind, the percent of wind coverage for a particular runway end indicates the amount of time that runway would be preferred for aircraft operations.

As identified in the Inventory, the crosswind coverage for the primary runway substantiates the need for a two-runway system at Duluth, as wind patterns are a major influence on runway use for both general aviation and commercial carriers. Also, it is recognized that actual runway use deviates from the wind analysis as a consequence of the primary Runway 9-27 typically being favored due to a longer length, pavement strength, lighting aids, precision instrument approach capabilities and proximity to terminal area facilities.

5.3 RUNWAY LENGTH

Runway length is a critical component of the master plan analysis. Runway length requirements are determined from the greater of the takeoff or landing performance characteristics of the existing and future critical/design aircraft operating at the Airport. For planning purposes, runway length is computed either for specific aircraft models currently using or projected to use the runways, or otherwise, the FAA composite airplane family as represented by the critical/design aircraft's Airport Reference Code.[1]

The runway length is dependent upon factors unique to each airport, as influenced by aircraft and operator performance factors related to aircraft type/model, engine type, flight distance, passenger/cargo/fuel payload capacities, allowable crosswind conditions, and other regulatory and

[1] Runway performance length factors are used for the development of the recommended runway length and ultimate design of airport runways, and not as a substitute for calculations required by airplane operating rules.

company operating procedures. Similarly, airport factors which influence runway length requirements include runway elevation gradient, pavement surface and condition, ambient temperature, and other climatological occurrences. Typically the takeoff length, including takeoff run, takeoff distance, and accelerate-stop distance, is the more demanding of the runway takeoff versus landing length requirements.

Table 5-3
RUNWAY USAGE

Runway Usage - ATC General Observations (2010)		
Based on ATC Input	**Aircraft Operations Totals**	**Percent Total**
Runway 3/21 Arrival & Departures	**10,765**	**18%**
Commercial Aircraft	1,090	10%
General Aviation Aircraft	9,675	25%
Military Aircraft	0	0%
Runway 9/27 Arrival & Departures	**48,235**	**82%**
Commercial Aircraft	9,810	90%
General Aviation Aircraft	29,025	75%
Military Aircraft	9,400	100%
Total - Commercial	**10,900**	**18%**
Total - General Aviation	**38,700**	**66%**
Total - Military	**9,400**	**16%**
Total	**59,000**	**100%**

Note: Commercial includes scheduled and non-scheduled passenger and cargo.
Note: General Aviation includes FBO fuel Techstops.
Source: Duluth Air Traffic Control Tower, Interviews

Runway Usage - Wind Conditions (2010)		
Based on Wind Patterns	**% Prevalent Winds (Visual)**	**% Prevalent Winds (Instrument)**
Runway 3/21 Arrival & Departures	**32%**	**31%**
Runway 3 End	15%	16%
Runway 21 End	17%	15%
Runway 9/27 Arrival & Departures	**68%**	**69%**
Runway 9 End	29%	45%
Runway 27 End	39%	24%
Total	**100%**	**100%**

Source: Wind Observation, Duluth International Airport ASOS

For transport aircraft, what is relevant to runway length requirements are the aircraft's performance speeds related to various 'V' speeds necessary for takeoff in meeting Federal Aviation Regulations (FAR) [2]. The two key takeoff speeds related to 'runway length' are V^1 and V^2. The sequence of 'V' speeds for takeoff are: V^1 (minimum takeoff speed for decision if engine failure), V^2 (minimum takeoff safety speed), and Vr (rotation speed).

[2] Decision to Takeoff: V^1 speed reached with engine fail during takeoff roll, the takeoff distance is defined from the point at which the takeoff run is initiated to the point where the aircraft has reached an altitude of 35 feet. Decision to Stop: V^2 speed reached with engine fail during takeoff roll, the takeoff distance is defined by a deceleration distance to stop the aircraft within the paved runway remaining.

The follow are major factors influencing aircraft takeoff and landing performance:

- Aircraft Type
- Stage Length/Destination
- Temperature
- Payload
- Arrival versus Departure
- Runway Contamination (e.g., rain, snow or ice)

There are three main planning guidance methods for determining the Airport's recommended runway length, as described below:

- Aircraft Operating Manual (Performance Curves): Determines runway length for specific aircraft models and engine configuration using aircraft manufacturer performance curve data as adjusted, to the extent possible, for specific aircraft operating weights, flight range, non-standard temperatures, and field elevation (1,428' mean sea level).

- FAA Fleet Composite Length (Microcomputer): General runway length guidance based on FAA computer modeling software (Version 4.2D) and Advisory Circular performance graphs for composite aircraft groups, as adjusted for mean maximum temperature (76˚), field elevation (1,428' mean sea level), runway elevation difference and the haul stage length of the largest airplanes (Europe, Southwest United States). The computed lengths serve as a general planning guide for a composite group of aircraft, determined by the aircraft's useful payload of 60, 80, or 100 percent.

- FAA Adjusted Runway Length: Runway takeoff and landing lengths computed from FAA modeling program for particular aircraft performances, as adjusted for local mean maximum temperature (76˚F), field elevation (1,428' mean sea level), runway elevation difference and percent aircraft payloads.

The FAA distinguishes the runway length requirements for takeoff based on FAR 'takeoff' field length, often also referred to as FAR 'balanced' field length. These lengths comprise certain inherent safety factors to account for engine emergency situations during takeoff. In addition, the FAA Policy for *Landing Performance Assessment After Departure for All Turbojet Operators*, implemented through Operations Specification/Management Specification (OpSpec/MSpec) C082, requires all turbojet operators to ensure that a 15 percent safety margin exists beyond the actual required landing distance.

It should be noted that these recommended runway lengths tend to reflect performances under ideal pilot and test conditions, and do not necessarily compensate for maximum Duluth operating conditions involving payload, temperature and inclement weather conditions. Higher temperatures, wet/slushy surface conditions and high payloads decrease the aircraft's acceleration performance, lifting and climb capabilities, thereby increasing the runway length required for takeoff.

5.3.1 Runway 9-27 Length Analysis

By design, the primary runway normally has the longest runway length, the highest percentage of wind coverage, greatest pavement strength, and lowest straight-in instrument approach minimums. The following is an overview of the primary Runway 9-27 facility characteristics:

Primary Runway 9-27: dimension is 10,162' x 150', and includes a 410' x 220' blast pad on the Runway 9 end and a 1,000' in-line taxiway at the Runway 27 end - which is not permitted for usable runway length computations. The in-line taxiway may serve the purpose of a blast pad. The runway is designed to ARC D-V standards. The runway is precision with an Instrument Landing System (ILS) serving the Runway 9 (CAT II) and 27 (CAT I) approach. Runway 9-27 traffic includes scheduled and non-scheduled commercial narrowbody and widebody transport flights, military jet and cargo traffic, all

segments of the general aviation jet, turboprop and piston aircraft fleet, and FBO cargo techstops. The existing runway length provides sufficient takeoff and landing distance for civilian transport and military aircraft.

Correction of the 1,000' in-line taxiway may provide additional usable runway length. The existing runway width, by design, provides operations by large and heavy transport aircraft. The runway strength is published at 650,000 pounds double dual tandem.

Table 5-4 lists the recommended Runway 9-27 length requirements for each of the planning methods. Computed runway lengths have been adjusted to reflect local conditions based on mean maximum temperature (76F) and field elevation (1,428'). This analysis indicates that the FAA recommended runway length for Runway 9-27 is between 10,400 and 11,600 feet, depending upon payload and flight distances. This is a reasonable length expectation for large/heavy transport commercial service aircraft anticipated to use Runway 9-27. Therefore, based on FAA computations, the existing Runway 9-27 length of 10,162' corresponds with a flight stage length of about 3,500 miles, operating between 60 and 80 percent usable load, and during the mean maximum ambient temperature.

5.3.2 Runway 9-27 Width Analysis

The Runway 9-27 FAA design standard width for ARC D-V is 150 feet, a width adequate throughout the planning period unless the Airport experiences unforeseen frequent operations by ADG VI aircraft (B-747-8), which has a design width of 200 feet. In addition to the runway width, a minimum 35 foot paved shoulder is required to meet ARC D-V standards.

5.3.3 Planning Conclusion – Future Runway 9-27 Dimension

Based on planning level runway length analysis, the recommended unconstrained primary runway length at Duluth is 11,600. This runway length and width is consistent with FAA Advisory Circular 150/5325-4B: *Runway Length Requirements*, Chapter 4 and the Airport's critical/demand aircraft operating international flight stage lengths. By design, the recommended primary runway width is 150 feet wide to accommodate Design Group V operations by heavy widebody transport aircraft. The following is a summary of justification factors associated with the Runway 9-27 length analysis:

- Length to accommodate large/heavy transports under the following conditions:
    - The heavy widebody transports generally require a 10,400' to 11,600' runway length when operating at 60 to 80 percent useful load during temperatures greater than the mean maximum of 76ºF, and high "density altitude" days. This length also provides for large/heavy transports to achieve non-stop international flight stage distances, typically in excess of 3,500 miles.
    - As the Airport's critical aircraft, the 747-400F requires up to about 11,600 feet when operating at 80 to 100 percent useful load on flights with 4,500 to 5,000 mile stage length; equivalent to reaching Europe non-stop from Duluth. As a strategic length consideration, the 747-400F requires up to 12,000 feet when operating at 80 to 100 percent useful load during temperatures greater than the mean maximum of 76ºF, and a stage length greater than 3,500 miles.
- Increases the takeoff safety margins during periods when the runway is contaminated due to frozen precipitation. Also, accommodates large transport aircraft landing operations during "wet and slippery" pavement surface conditions. Based on responses from Duluth operators, slushy runway conditions in excess of ¼-inch can substantially increase runway length requirements even on grooved runways, by a factor greater than 25 percent.

- Provides for military operations by fighter jets and heavy-lift transient cargo transports, in lieu of depending on arresting systems and overruns.
- Provides landing safety margins during high crosswinds for aircraft unable to use the secondary runway. Also serves as a viable alternate to accommodate commercial traffic unable to land at Minneapolis/St. Paul International Airport (MSP) during poor weather conditions.

Table 5-4
RECOMMENDED RUNWAY LENGTHS

Boeing 747 Critical Aircraft Performance Curves	
	Runway Length
747-400F @ 80% to 100% MTOW	7,500' to 12,000'

MTOW - Maximum Certified Takeoff Weight @ 76F

Source: Aircraft Manufacturer Data (Aircraft Performance Curves)

FAA Composite Runway Length	
FAA Large Aircraft Category	**FAA Recommended Runway Length (FAA Microcomputer)**
FAA Recommended Runway Length at Mean Maximum Temperature (76°F)	
Large Airplanes (12,501 lbs. - 60,000 lbs.) *	
75% of Fleet @ 60% Useful Load	5,500'
75% of Fleet @ 90% Useful Load	7,000'
100% of Fleet @ 60% Useful Load	5,500'
100% of Fleet @ 90% Useful Load	7,900'
Large Airplanes (Greater Than 60,000 lbs.) *	
500 Mile Stage Length	5,500'
1,000 Mile Stage Length	6,600'
1,500 Mile Stage Length (Southwest US Stage Length)	7,500'
2,000 Mile Stage Length	8,400'
2,500 Mile Stage Length	9,200'
3,000 Mile Stage Length	9,900'
3,500 Mile Stage Length	10,500'
4,700 Mile Stage Length (Central Europe Stage Length)	11,600'

Note: * Calculated for FAA 'Wet and Slippery' pavement conditions. Condition applicable only to landing distance, for Airports with at least 55 days of 0.1 inch or more of rain a year.

Note "Useful load" – includes all usable fuel, passengers, and cargo.

Note: FAA calculated runway length is rounded to the next 100-foot increment beyond 30 feet.

Source: FAA Design Program.

FAA Computed Aircraft Runway Length	
Jet Transports	**Runway Length**
Small Narrowbody Jet Transports (Aircraft @ 60% to 80% MTOW)	7,800' to 8,300'
Large Narrowbody Jet Transports (Aircraft @ 60% to 80% MTOW	8,500' to 9,500'
Heavy Cargo/Transport Aircraft (Aircraft @ 60% to 80% MTOW)	10,400' to 11,600'

Note: MTOW - Maximum Certified Takeoff Weight @ 76F

Representative Aircraft:

Small Narrow body Jet: B-737-300/600, MD-80 Series, DC-9 Series

Large Narrow body Jet: B-757-200F, A-320/321

Widebody/Heavy Transport Jet: B-747, DC-10/MD-11, B-767, B-777, A-300/310

Source: FAA Runway Length Program.

Summarized below are the recommended Runway 9-27 lengths:

- Existing Runway 9-27 Length: 10,162' – length accommodates large/heavy widebody cargo transports operating at 60 to 80 percent of maximum takeoff weight during non-inclement weather periods, and not generally exceeding the mean maximum temperature of 76F.

- Future/Strategic Runway 9-27 Length: 11,600' to 12,000' – an unconstrained length to accommodate scheduled international operations by heavy widebody transport aircraft when operating at or near 100 percent maximum takeoff weight during high density altitude days, on flight stage lengths greater than 3,500 miles, and compensating for poor pavement surface conditions during the winter months.

5.3.4 Runway 3-21 Length Analysis

Secondary runways provide an alternate takeoff and landing direction, typically during unfavorably strong or unacceptable wind conditions on the primary runway. Secondary runways also commensurate the primary runway by providing an alternative during periods of heavy pattern traffic, executing instrument approach procedures, convenience for taxiing to-and-from terminal/parking areas, and access during periods when the primary runway is out of service or non- operational due to occurrences of weather/storm events, equipment outages, maintenance/repairs, or accidents. This guidance is outlined in FAA Advisory Circular 150/5325-4B: *Runway Length Requirements*, Table 1-3. Table 1-3 outlines that due to the reasons outlined in this section, the length of a secondary runway used to accommodate air carrier operations can be justified up to 100 percent of the length of the primary runway.

The following is an overview of the Runway 3-21 facility characteristics:

The Airport's secondary Runway 3-21 is 5,719' x 150', and designed to ARC C-III standards. The runway is non-precision with GPS-LPV approaches serving the Runway 3 and 21 ends. The existing runway length accommodates general aviation piston and turboprop aircraft, small to medium cabin business jets, and limited commercial jet traffic. By design standards, the existing 150 foot width accommodates large transport aircraft. The runway strength is published at 100,000 pounds dual wheel and 361,000 pounds double dual tandem.

Table 5-5 lists the recommended Runway 3-21 length requirements for each of the planning methods. Computed runway lengths have been adjusted to reflect local conditions based on mean maximum temperature (76F) and field elevation (1,428'). This analysis indicates that the recommended runway length for Runway 3-21 is between 5,700 and 7,900 feet, in order to accommodate large business jets and regional-type commercial jets operating at 60 to 90 percent useful load on a 500 to 1,600 mile stage length.

When assuming a domestic flight range of 1,600 miles to the southeast or southwest United States at mean maximum temperature, the FAA microcomputer program indicates a required runway length of at least 7,700 feet. This recommended length is also representative of the Runway 3-21 critical aircraft, the CRJ-900 and EMB 175, which requires a takeoff length of 5,700 to 8,000 feet at 60 to 80 percent of maximum takeoff weight.

Based on FAA computations, the existing Runway 3-21 length of 5,719' corresponds with a large aircraft weighting up to 60,000 pounds, operating between 60 and 80 percent usable load up to a 76F temperature with a flight stage length not exceeding 500 miles. Based on discussions with the Duluth

airlines and commercial operators, Runway 3-21 is considered to be a secondary commercial service runway that does not currently meet operator length requirements.

Table 5-5
RUNWAY LENGTH REQUIREMENTS

Runway 3-21 Critical Aircraft Performance Curves	
	Runway Length
CRJ-900 @ 80% to 100% MTOW	5,700' to 8,000'
EMB 170 @ 80% to 100% MTOW	6,900' to 7,600'

MTOW - Maximum Certified Takeoff Weight @ 76F

Source: Aircraft Manufacturer Data (Aircraft Performance Curves.

FAA Composite Runway Length - Aircraft	
FAA Small Aircraft Category	**FAA Recommended Runway Length**
FAA Recommended Runway Length at Mean Maximum Temperature (76°F)	
Large Airplanes (12,501 lbs. - 60,000 lbs.) *	
75% of Fleet @ 60% Useful Load	5,500'
75% of Fleet @ 90% Useful Load	7,000'
100% of Fleet @ 60% Useful Load	5,500'
100% of Fleet @ 90% Useful Load	7,900'
Large Airplanes (Greater Than 60,000 lbs.) *	
500 Mile Stage Length	5,500'
1,000 Mile Stage Length	6,600'
1,500 Mile Stage Length	7,500'
1,600 Mile Stage Length (Southeast and Southwest US Stage Length)	7,700

MTOW - Maximum Certified Takeoff Weight @ 76F

Note: * Calculated for FAA 'Wet and Slippery' pavement conditions. Condition applicable only to landing distance, for Airports with at least 55 days of 0.1 inch or more of rain a year.

Note "Useful load" – includes all usable fuel, passengers, and cargo.

Note: FAA calculated runway length is rounded to the next 100-foot increment beyond 30 feet.

Source: FAA Airport Design Microcomputer Program 4.2D

FAA Adjusted Length - Jet Aircraft	
Jet Transports	**Runway Length**
Medium to Large Cabin Corporate Jets (Aircraft @ 60% to 80% MTOW)	5,500' to 6,800'
Small-Cabin Regional Jets (Aircraft @ 60% to 80% MTOW)	5,500' to 6,500'
Medium to Large-Cabin Regional Jets (Aircraft @ 60% to 80% MTOW)	6,800' to 7,500'
Small Narrowbody Jet Transports (Aircraft @ 60% to 80% MTOW)	7,800' to 8,300'
Large Narrowbody Jet Transports (Aircraft @ 60% to 80% MTOW	8,500' to 9,500'

MTOW - Maximum Certified Takeoff Weight @ 76F

Representative Aircraft:

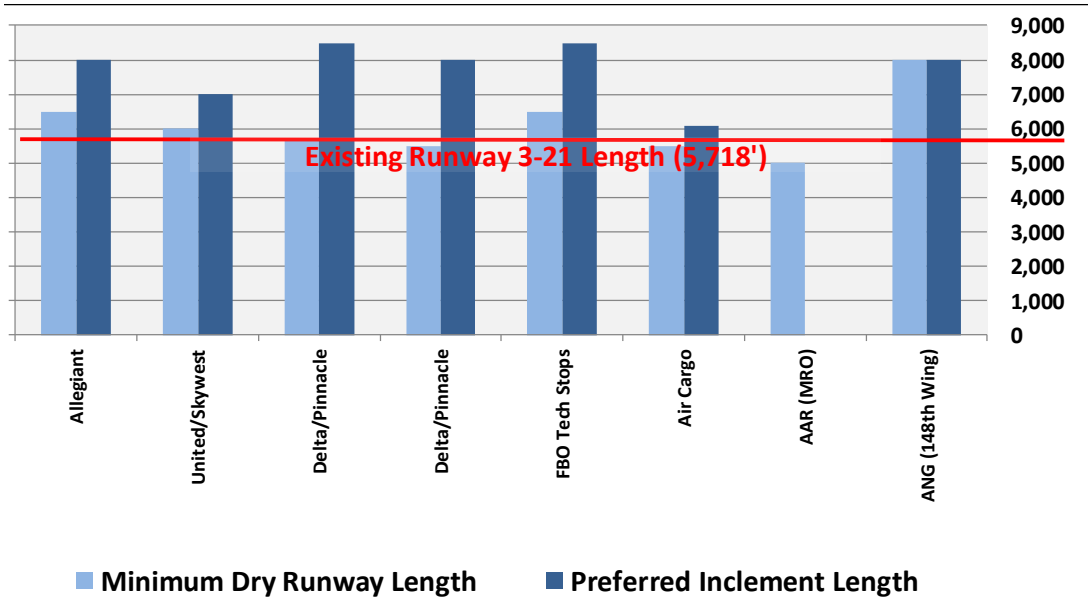
Small-Cabin Regional Jets: CRJ-200/700, EMB 135/140/145
Medium-Cabin Regional Jets: CRJ-900, EMB 170/190
Business Jets: Gulfstream 500
Narrow body Jet: 737-700/800
Large Narrow body Jet: 757-200F

Source: Aircraft Manufacturer Data & FAA Takeoff Calculation Computer Program

As part of the Runway 3-21 length analysis, information was collected directly from the major commercial operators at Duluth to determine their minimum runway performance requirements. The operators indicated runway length requirements based on variables for payload, range and weather conditions. **Table 5-6** summarizes the findings, as further described below, by operator.

Table 5-6
DULUTH OPERATOR REQUIREMENTS

Duluth Operator	Aircraft	Runway Length Requirements		Remarks
		Minimum Dry Runway Length	Preferred Inclement Length	
Allegiant	MD-80 Series	6,500	8,000	As Reported by Allegiant
United/Skywest	CRJ-200	6,000	7,000	As Reported by United
Delta/Pinnacle	CRJ-200	5,700	8,500	As Reported by Delta
Delta/Pinnacle	CRJ-200	5,500	8,000	As Reported by Delta
FBO Tech Stops	Various Transports	6,500	8,500	As Reported by FBO
Air Cargo	ATR-42 (Turboprop)	5,500	6,100	Includes Turboprop Aircraft Only
AAR (MRO)	Airbus 320	5,000	N/A	Operating at ±50% Useful Load
ANG (148th Wing)	F-16	8,000	8,000	Support F-16 Mission



Allegiant:

Destination: LAS – Las Vegas, MCO – Orlando, AZA Mesa (Phoenix)
Aircraft: MD-80 Series (82/83/87/88)
Aircraft Maximum Certified Weights: 160,000 lbs. at DLH

- 6,500' - Minimum for 'dry' takeoff (length involves passenger and baggage reduction)
- 7,500' to 8,000' - Minimum for 'wet/contaminated' takeoff
- 6,000' Minimum for 'wet/contaminated' landing
- 100' - Minimum runway width

United (Skywest):

Destination:	ORD – Chicago O'Hare, MSP - Minneapolis
Aircraft:	CRJ-200
Aircraft Maximum Certified Weights:	53,000 lbs. MTOW | 49,500 lbs. at DLH

- 5,500' to 6,000' - Minimum for 'dry' takeoff
- 6,500' to 7,000' - Minimum for 'wet/contaminated' takeoff
- 100' - Minimum runway width

Delta (Pinnacle):

Destination:	MSP – Minneapolis or DTW - Detroit
Aircraft:	CRJ-200 and CRJ-900
Aircraft Maximum Certified Weights (-200):	53,000 lbs. MTOW | 49,000 lbs. at DLH
Aircraft Maximum Certified Weights (-900):	82,500 lbs. MTOW | 72,000 lbs. at DLH

CRJ-200 Series:
- 5,700' - Minimum for 'dry' takeoff (day and night)
- 6,000' - Minimum for 'instrument' conditions
- 8,562' - Minimum for 'wet/contaminated' takeoff (±¼ slush) with no weight restrictions
- 75' - Minimum runway width

CRJ-900 Series:
- 5,500' - Minimum for 'dry' takeoff (day and night)
- 6,000' - Minimum for 'instrument' conditions
- 8,000' - Minimum for 'wet/contaminated' takeoff (±¼ slush) with no weight restrictions
- 100' - Minimum runway width

Fixed Base Operator (FBO) – Fuel Techstops

The largest aircraft using the Airport are associated with domestic and international FBO Techstops, including jet transport freight operators, charter operators, and other contract and ferry flights. These flights involve heavy widebody, narrowbody and corporate jets, for a quick-turn of fuel, crew and passenger accommodations, aircraft catering, and other processing for international long-haul passenger and freight flights.

- 6,500' to 7,200' - Minimum for domestic narrowbody and corporate jet transports
- (up to 7,200' to accommodate contaminated runway conditions)
- 8,500' - Minimum for heavy international freight transports
- 100' to 150' - Minimum width for domestic narrowbody and corporate jet transports
- 150' - Minimum width for heavy international freight transports

Remarks: Nearly 80 percent of all the Duluth Techstop flights are being served on both their inbound and outbound trip segments. Business jet aircraft comprise about 60 to 80 percent of Techstops. About 80 percent of the Techstops involve clearing US Customs, which takes place on the passenger terminal building ramp. On average, the FBO receives about one business jet Techstop per day and one to two large transport Techstops per month. The FBO intends to expand its contract Techstop business for serving transport size aircraft, and intends to increase the Techstop business to 400 arrivals per year, including three to five international transports per week; and more frequent flights by the Boeing-747 and Antonov aircraft. It is important to note that there are several Airport facility limitations in supporting and expanding the Techstop business at Duluth. The primary limitation is that

the secondary runway has insufficient length to accommodate the larger Techstop traffic, which is an issue when the Runway 9-27 crosswind component is exceeded, resulting in Techstop traffic having to divert or operate from another airport. This can also be a limitation when the primary runway is down for maintenance. The FBO estimates a secondary runway length of about 8,500 feet is needed to accommodate Techstops and diverted aircraft during strong crosswind conditions.

AAR Corporation (MRO)

AAR currently conducts aircraft maintenance, repair and overhaul (MRO) work involving narrowbody transports. AAR has contact with Air Canada, which involves the Airbus A-321, A-320 and A-319, and there is some third party contact maintenance mostly involving the B-737, B-727, B-717 and MD-80.

- Runway length requirements - specific to MRO clients
- 100' - Minimum runway width (per FAA C-III ARC category)

Scheduled Air Cargo Operators

Scheduled express air cargo operations are conducted by FedEx and UPS, operating daily service using turboprop aircraft. FedEx typically operates an ATR-42 twin-turboprop aircraft between Duluth and Minneapolis five days a week, or about 520 operations per year. UPS operates daily aircraft service at Duluth as contracted under Bemidji Airlines using a Fairchild Metroliner twin turboprop, conducting about 730 operations per year.

Destination (FedEx):	Minneapolis/Memphis
Aircraft (FedEx):	ATR-42 (Twin Turboprop)
Aircraft Maximum Certified Weights (lbs):	38,000 lbs. MTOW

- 5,000' - Minimum for 'dry' takeoff (day and night) and 'instrument' conditions
- 6,100' - Minimum for 'wet/contaminated' takeoff (±¼ slush) with no weight restrictions

Remarks: Air cargo is conducted by FedEx and UPS, operating a daily schedule using turboprop aircraft. FedEx service is conducted by an ATR 42 twin-turboprop aircraft between Duluth and Minneapolis five days a week.

MN Air National Guard (148TH Fighter Wing)

The 148th ANG Fighter Wing based at Duluth operates Falcon F-16 jets, in which other transient military fighter and cargo transports also use the Airport on a regular basis. The following Air National Guard facility initiatives were identified in *2010 Minnesota Air National Guard Installation Development Plan (IDP).*

Destination:	N/A
Based Aircraft:	Falcon F-16
Aircraft Maximum Certified Weights (lbs):	42,000 lbs. MTOW

- 8,000' - Minimum for takeoff and landing
- 150' - Minimum runway width

Remarks: ANG minimum paved overrun is 1,000' and the width is equal to the runway width. The ANG minimum paved runway shoulder is 10' to 25' (25' preferred for general ANG aircraft use). The ANG minimum paved taxiway shoulder is 10' to 25' (25' preferred for general ANG aircraft use). The

ANG minimum taxiway width is 75'. The aircraft arresting system (BAK) installation is recommended for Runway 3-21, as contingent upon funding.

5.3.5 Runway 3-21 Width Analysis

The Runway 3-21 width design standard for ARC C-III is 100' to 150' wide, contingent on whether the aircraft weighs greater than 150,000 pounds. The next generation of regional air carrier jets is approaching the 150,000 pound weight, an aircraft size similar to the narrowbody air carrier transports which have served Duluth in recent years. Airlines can operate on a 100 foot wide runway, but this often mandates a flight standards permit and specialized pilot capabilities, in which operations on a 100 foot width is usually for a temporary situation or on a short-term basis. Therefore, based on safety operating considerations and best planning practices for large aircraft and commercial operations, a runway width of 150' is recommended throughout the 20-year planning period.

5.3.6 Planning Conclusion – Runway 3-21 Dimension

Consideration of the appropriate runway length for future consideration for Runway 3-21 was determined after an extensive discussion with airline users with regard to the various operating conditions and the particular runway lengths required during those conditions. From these extensive discussions, it was concluded that Runway 3-21 length greater than 5,718' is needed to safely and reliably accommodate commercial operators at Duluth, and to support the existing and future critical aircraft. The Runway 3-21 length becomes a critical factor during periods when the primary Runway 9-27 is closed for pavement reconstruction (multi-year project) and other operating conditions or weather events. During these periods, traffic not accommodated on the Runway 3-21, in effect, has the same implications as the Airport being closed.

It is conceivable that a two-phase runway extension would be contemplated. The next planned runway length increment would be 7,000', providing for scheduled commercial traffic during normal day, night and instrument operating conditions. The ultimate runway length would be 8,000', providing for commercial traffic during inclement conditions day, along with the larger FBO Techstop traffic and the Air National Guard 148th Fighter Wing operations. Similar to Runway 9-27, FAA Advisory Circular 150/5325-4B was used as guidance for this analysis.

As a FAA Part 139 commercial service airport, the secondary runway should be designed to commensurate the primary runway during periods when the main runway is non-operational due to prevailing wind relative to Runway 9-27, maintenance, emergency situations, diverted airline flights and other instances of temporary restriction or prolonged closure. This is consistent with FAA Advisory Circular 150/5325-4B as outlined earlier in this section.

In the past, Runway 3-21 has been used during periods when the primary Runway 9-27 was not in operation, in which the airlines expressed concern over inadequate runway length, following marginal takeoff and landing instances. Northwest Airlines temporarily ceased operations at Duluth citing insufficient runway length. Also, Runway 3 and 21 instrument approach procedures already accommodate up to Category D and E aircraft. The parallel taxiway system for Runway 3-21 is constructed at 50 feet wide, already intended to serve Group III and higher aircraft.

Summarized below are the recommended Runway 3-21 lengths:

- Existing Runway Dimension - 5,718' x 150' (ARC C-III): length accommodates the small to medium cabin business jets and limited commercial service regional jets with stage lengths of 500 miles or less.

- Future Planned Length - 7,000' x 150' (ARC C-III): length to accommodate scheduled commercial traffic during normal day, night and instrument operating conditions. This length achieves an acceptable level of operational redundancy for the existing commercial airline operators, and accommodates the larger Techstop operations.

- Strategic Planned Length - 8,000' x 150': length providing for commercial traffic during inclement conditions day, along with the larger FBO Techstop traffic and the Air National Guard 148th Fighter Wing operations.

5.4 AIRFIELD CAPACITY

Table 5-7 identifies the airfield demand capacity analysis prescribed by FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*. This guidance provides the method to calculate the runway operational capacity, referred to as the Airport Service Volume (ASV), based on the runway and taxiway configuration, aircraft mix, types of operations, instrument procedures and airspace factors.

The existing runway and taxiway configuration provides an ASV of around 205,000 operations per year, well above the existing and forecast level of annual operations. The forecast 2030 operations of 76,000 results in a demand/capacity ratio of 37 percent. FAA guidelines recommend planning for additional capacity when demand exceeds 60 percent of capacity. Therefore, based on existing and forecasted activity levels, the capacity analysis does not indicate any operational issues occurring on an annual or peak-demand basis, or as experienced for either visual or instrument operating conditions.

Table 5-7
AIRFIELD CAPACITY ANALYSIS

	2010	2015	2020	2025	2030
Peak Operational Demand:					
Total Airport Operations	59,000	62,900	67,000	71,400	76,100
Peak Month Airport Operations (10.5%)	6,195	6,605	7,035	7,497	7,991
Peak Day Airport Operations (30.4 Days)	204	217	231	247	263
Peak Hour Airport Operations (12%)	24	26	28	30	32
Category C and D Traffic (Civilian + Military)	37,220	38,460	38,920	39,340	41,230
% Category C and D Traffic (C+3D)	63%	61%	58%	55%	54%
Operational Capacity:					
FAA Annual Runway Capacity	205,000	205,000	205,000	205,000	205,000
FAA VFR Hourly Capacity	63	63	63	63	63
FAA IFR Hourly Capacity	56	56	56	56	56
Annual Demand / Capacity (D/C):					
Runway Demand/Capacity Ratio	29%	31%	33%	35%	37%
VFR Demand / Capacity	39%	41%	44%	47%	50%
IFR Demand / Capacity	44%	47%	50%	53%	56%
Airfield Capacity Issue	**None**	**None**	**None**	**None**	**None**

Note: VFR - Visual Flight Rules | IFR - Instrument Flight Rules
Source: FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*

5.5 AIRFIELD (RUNWAY) DESIGN STANDARDS

Compliance with FAA airport geometric and separation standards is intended to meet a minimum level of Airport operational safety and efficiency. **Table 5-8** provides a matrix summarizing compliance with critical safety factors, which entails Runway 9-27 compliance with FAA ARC D-V design standards and Runway 3-21 compliance with ARC C-III standards. This information is intended to compare the safety area and separation dimensional standards, to identify facility deficiencies or non-standard conditions which requires improvement or may require a deviation or modification to FAA design standards.

Table 5-8
RUNWAY FACILITY TABLE

Airfield Component	Runway 9-27 (ARC D-V)				Runway 3-21 (ARC C-III)			
	FAA ARC D-V Standard	Actual Condition	Rwy 9 Design Standard Met (✓)	Rwy 27 Design Standard Met (✓)	FAA ARC C-III Standard	Actual Condition	Rwy 3 Design Standard Met (✓)	Rwy 21 Design Standard Met (✓)
Runway Width	150'	150'	✓		100' To 150	150'	✓	
Runway Shoulder Width	35'	40'	✓		25'	None		
Runway Blast Pad Width	220'	220'	✓		200'	None		
Runway Blast Pad Length	400'	400'	✓		200'	None		
RSA Width	500'	500'	✓	✓	500'	500'	✓	✓
RSA Length Prior to Threshold	1,000'	1,000'	✓	✓	1,000'	1,000'	✓	✓
RSA Length Beyond Rwy End	1,000'	1,000'	✓	✓	1,000'	1,000'	✓	✓
OFA Width	800'	800'	✓	✓	800'	800'	✓	✓
OFA Length Beyond Rwy End	1,000'	1,000'	✓	✓	1,000'	1,000'	✓	✓
OFZ Width	400'	400'	✓	✓	400'	400'	✓	✓
OFZ Length Beyond Rwy End	200'	200'	✓	✓	200'	200'	✓	✓
OFZ Length Beyond Approach Light	200'	200'	✓	✓	200'	N/A	N/A	N/A
POFZ Width	800'	800'	✓	✓	800'	N/A	N/A	N/A
POFZ Length Beyond Rwy End	200'	200'	✓	✓	200'	N/A	N/A	N/A
Rwy to Twy CL Separation	500'	500' To 850'	✓		400'	270' To 450'		
Rwy CL to Holdline Separation	250'	300'	✓		250'	215' To 255'		
Rwy CL to Aircraft Parking	500'	700'	✓		500'	±550'		

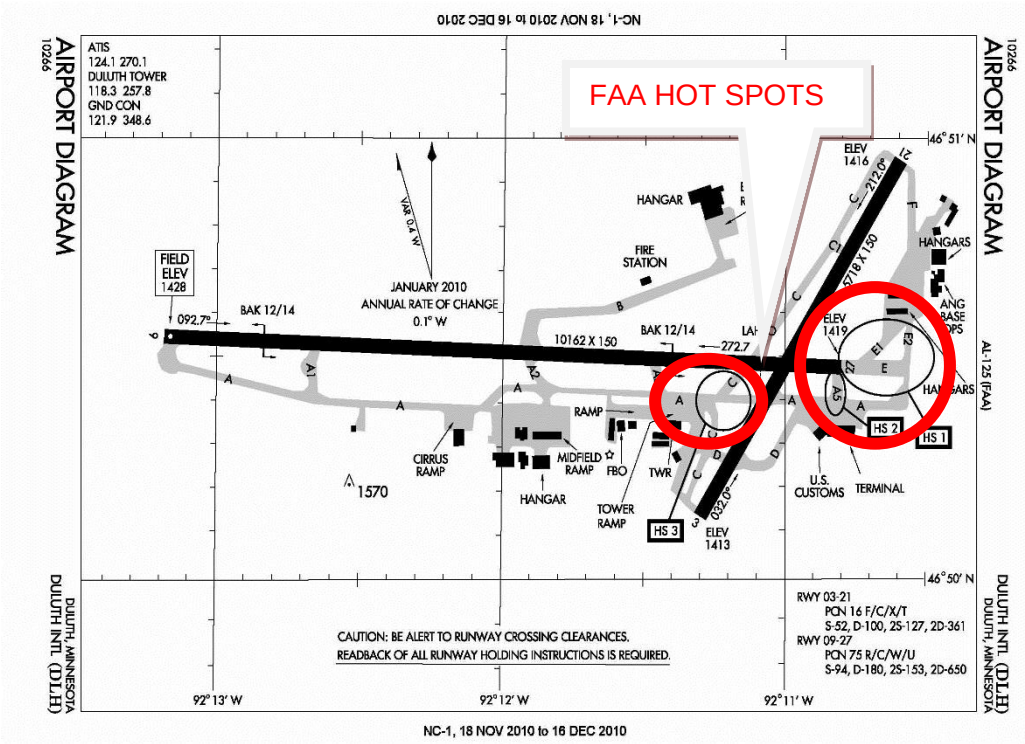
Abbreviations:
Rwy - Runway
Twy - Taxiway
CL - Centerline
RSA - Runway Safety Area
OFA - Object Free Area
OFZ - Obstacle Free Zone (Runway, Precision, Inner Approach, Inner Transitional)

Note: Runway 9-27 shoulders are 40' wide.
Note: Runway 27 blast pads includes in-line taxiway.
Note: See ALP for depiction of all applicable safety area surfaces and separation distances.
Source: FAA Advisory Circular 150/5300-13

Exhibit 5-2 illustrates the location of FAA Hot Spots as published, identifying critical airfield geometry issues. The resolution of FAA compliance hot spots is key to meeting the facility requirements and integral to the airfield and runway alternatives analysis. The following is a FAA published diagram showing the location of the compliance hot spots, which largely are impacted by non-standard taxiway geometry. Most of the compliance hot spots are located at the Runway 27 end, and tied to the existing

in-line Taxiway ‘E’, which is no longer an acceptable FAA design, and must be resolved as part of the Airport Master Plan.

Exhibit 5-2
AIRFIELD PAVEMENT CONDITION REPORT 2010 (PCI)



5.6 NAVIGATION AND AIRSPACE

The following section recommends navigational and visual aid facilities through the 20-year planning period commensurate with the needs of commercial air carrier and cargo traffic, military, and general aviation operations. The following section lists the facility recommendations per runway for the proposed runway lengths.

5.6.1 Instrument Capabilities

Precision Instrument Landing System (ILS) approaches are typically provided for runways used by commercial service aircraft. Commercial operators predominately rely on runways served with ILS approaches, as most mainline airlines are not commonly equipped or authorized to execute most RNAV (GPS) satellite-based instrument approach procedures; but will likely transition to these satellite instrument approaches in the future. The following describes the planned instrument capabilities per runway:

> Runway 9-27: Runway 9-27 is precision with an Instrument Landing System (ILS) for Runway 9 (CAT II) and 27 (CAT I) approaches, serving civilian and military traffic. The master plan recommends that Runway 9-27 remain a precision instrument runway throughout the planning period, with an Instrument Landing System (ILS) serving the Runway 9 and 27 ends, for civilian

and military traffic. It is expected the ILS equipment will provide precision capabilities throughout the 20-year planning period, and although ILS components may need to be upgraded and replaced, the equipment will remain intact at its current location.

Runway 3-21: Analysis was undertaken to determine the viability of upgrading Runway 3-21 to precision instrument approach capabilities. Runway 3-21 is currently non-precision with RNAV (GPS) vertical path guidance (LPV) approaches provided for aircraft categories A to D, with minimums as low as 1-mile visibility and a decision altitude of 300' to 400'. The Instrument Landing System (ILS-CAT I) with a medium approach light system (MALSR) typically provides for ½-mile and 200-foot minimums. The following are considerations in the analysis of Runway 3-21 as a future precision instrument runway:

In Minnesota, runways greater than 5,000' typically are planned for precision, as in accordance with Mn/DOT land use and safety zones.

Based on annual wind patterns, Runway 21 is more conducive than the Runway 3 end for accommodating traffic during instrument meteorological wind conditions. However, as Duluth weather conditions deteriorate towards precision ceiling and visibility minimums, the wind patterns typically supports the use of Runway 9-27 as the preferred instrument runway. Typically, as wind velocities increase, the stronger gusty winds are predominately from the east, supporting the Runway 9 instrument approach. Therefore, Runway 9-27 achieves more a greater percentage of wind coverage during instrument meteorological conditions than the crosswind Runway 3-21.

As in progress, and during the 20-year planning period, the FAA will likely develop standards for GPS-based satellite technology to provide 'positive' precision instrument approach guidance, equivalent to current ILS standards and minimums. When in place, the GPS-based instrument procedures can be re-established more readily for changing runway/threshold ends, as compared with the physical relocation required of the traditional ILS antennas and shelters.

The existing 275-foot separation between Runway 3-21 and Taxiway 'C' is inadequate to accommodate precision approaches. The northside Taxiway 'C' would need to be shifted/relocated.

Precision requires larger FAA safety areas, airspace and Mn/DOT clear zones. From this, Runway 21 is better suited for a precision approach procedure.

Recommendation: To follow best planning practices, Runway 3-21 should be planned as a future precision runway, anticipating a precision approach procedure to the Runway 21 end based on GPS satellite navigation technology. Consequently, Runway 3-21 is not anticipated to be equipped with an Instrument Landing System (ILS). Therefore, the airspace and zoning for a future precision Runway 3-21 should be reserved and planned, as depicted on the Airport Layout Plan drawings. It should be noted that a FAA Airspace Analysis is necessary to determine the feasibility and possible approach minimum associated with a precision instrument procedure to Runway 3-21.

5.6.2 Navigational, Lighting and Signage Aids

Recommended facility NAVAIDs for Runway 9-27 include:

- Reinforce/Reconstruct the localizer platform beyond the Runway 27 end.

Runway and taxiway signage is in good condition and meets the design standards found in FAA Advisory Circular 150/5340-18C, *Standards for Airport Signage Systems*. The master plan recommends that guidance signage be maintained regularly and that as airfield signage is upgraded / updated it meets FAA Safety Management System (SMS) requirements.

5.6.3 Airspace Requirements

The national airspace system consists of various classifications of airspace that are regulated by the FAA. Airspace classification is necessary to ensure the safety of all aircraft utilizing the facilities during periods of inclement weather. The current Class D Airspace is adequate for the existing and future operational requirements expected at Duluth International Airport. One factor that could affect future controlled airspace is the potential development of unmanned vehicles (UAV) operating or potentially based at Duluth.

5.6.4 Mn/DOT Safety Zone Requirements

The State of Minnesota has adopted legislation for airport to implement height and land use regulations intended to minimize airport safety hazards and protect airport operations, as prescribed in Chapter 360 of the Minnesota Statutes and Minnesota Rule 8800.2400. Below is a summary of the Mn/DOT Safety Zones, and their prescribed regulations. **Table 5-9** lists the minimum airport zoning standards, as prescribed by state statue.

Table 5-9
MINNESOTA LAND USE SAFETY ZONE DIMENSIONS

STANDARD MN/DOT SAFETY ZONES (MINNESOTA RULE 8800.2400 AIRPORT ZONING STANDARDS)		
ZONE	**DESCRIPTION**	**MN/DOT USE RESTRICTION**
SAFETY ZONE A	IN THE APPROACH ZONES OF A RUNWAY, SAFETY ZONE A EXTENDS OUTWARD FROM THE END OF THE PRIMARY SURFACE A DISTANCE EQUAL TO TWO-THIRDS THE RUNWAY LENGTH OR PLANNED RUNWAY LENGTH.	SHALL CONTAIN NO BUILDINGS, TEMPORARY STRUCTURES, EXPOSED TRANSMISSION LINES, OR OTHER SIMILAR LAND USE STRUCTURAL HAZARDS, AND SHALL BE RESTRICTED TO THOSE USES WHICH WILL NOT CREATE, ATTRACT, OR BRING TOGETHER AN ASSEMBLY OF PERSONS THEREON. PERMITTED USES MAY INCLUDE, BUT ARE NOT LIMITED TO, SUCH USES AS AGRICULTURE (SEASONAL CROPS), HORTICULTURE, RAISING OF LIVESTOCK, ANIMAL HUSBANDRY, WILDLIFE HABITAT, LIGHT OUTDOOR RECREATION (NONSPECTATOR), CEMETERIES, AND AUTO PARKING.
SAFETY ZONE B	IN THE APPROACH ZONES OF A RUNWAY, SAFETY ZONE B EXTENDS OUTWARD FROM SAFETY ZONE A, A DISTANCE EQUAL TO ONE-THIRD THE RUNWAY LENGTH OR PLANNED RUNWAY LENGTH.	SHALL BE RESTRICTED IN USE AS FOLLOWS. EACH USE SHALL BE ON A SITE WHOSE AREA SHALL NOT BE LESS THAN THREE ACRES. EACH USE SHALL NOT CREATE, ATTRACT, OR BRING TOGETHER A SITE POPULATION THAT WOULD NOT EXCEED 15 TIMES THAT OF THE SITE ACREAGE. EACH SITE SHALL HAVE NOT MORE THAN ONE BUILDING PLOT UPON WHICH ANY NUMBER OF STRUCTURES MAY BE ERECTED. THE FOLLOWING USES ARE SPECIFICALLY PROHIBITED IN ZONE B: CHURCHES, HOSPITALS, SCHOOLS, THEATERS, STADIUMS, HOTELS AND MOTELS, TRAILER COURTS, CAMP GROUNDS, AND OTHER PLACES OF PUBLIC OR SEMIPUBLIC ASSEMBLY.
SAFETY ZONE C	ALL THAT LAND WHICH IS ENCLOSED WITHIN THE PERIMETER OF THE HORIZONTAL ZONE AND WHICH IS NOT INCLUDED IN ZONE A OR ZONE B.	IS SUBJECT ONLY TO THE GENERAL RESTRICTIONS; WHICH CREATES OR CAUSES INTERFERENCE WITH THE OPERATION OF RADIO OR ELECTRONIC FACILITIES ON THE AIRPORT OR WITH RADIO OR ELECTRONIC COMMUNICATIONS BETWEEN THE AIRPORT AND AIRCRAFT, MAKES IT DIFFICULT FOR PILOTS TO DISTINGUISH BETWEEN AIRPORT LIGHTS AND OTHER LIGHTS, RESULTS IN GLARE IN THE EYES OF PILOTS USING THE AIRPORT, IMPAIRS VISIBILITY IN THE VICINITY OF THE AIRPORT, OR OTHERWISE ENDANGERS THE LANDING, TAKING OFF, OR MANEUVERING OF AIRCRAFT.
STANDARD MN/DOT CLEAR ZONE POLICY		
MN/DOT CLEAR ZONE	REPRESENTS MINIMUM REQUIRED AIRPORT PROPERTY ACQUSITION CATEGORIZED BY AIRCRAFT SERVED AND APPROACH MIINIMUMS PLANNED OR ESTABLISHED.	CONTROL CRITICAL RUNWAY APPROACH AIRSPACE BELOW A HEIGHT OF 50 FEET AS WELL AS THE AIRPORT'S RUNWAY PROTECTION ZONES. (THE CLEAR ZONE IS THE INNER PORTION OF THE MN/DOT SAFETY ZONE A).

NOTE: THE HORIZONTAL ZONE IS DEFINED AS ALL LAND THAT LIES DIRECTLY UNDER AN IMAGINARY HORIZONTAL SURFACE AS DEFINED IN MINNESOTA RULE 8800.1200.
NOTE: VARIANCES AND EXCEPTIONS CAN BE REQUESTED THROUGH MNDOT FOR NOT MEETING AIRPORT ZONING STANDARDS.

Table 5-10 lists the application of the current and future runway lengths relative to the standard Mn/DOT Safety Zones A and B.

Table 5-10
MINNESOTA LAND USE SAFETY ZONE DIMENSIONS

Item	Runway 9 End	Runway 27 End	Runway 3 End	Runway 21 End
	Existing Standard	Existing Standard	Existing Standard	Existing Standard
Runway Length	10,162	10,162	5,718	5,718
Runway Type	Precision	Precision	Non-Precision	Non-Precision
MnDOT Safety Zone A Length	6,775	6,775	3,812	3,812
MnDOT Safety Zone B Length	3,387	3,387	1,906	1,906
Item	**Runway 9 End**	**Runway 27 End**	**Runway 3 End**	**Runway 21 End**
	Future Standard	Future Standard	Future Standard	Future Standard
Runway Length	11,600	11,600	8,000	8,000
Runway Type	Precision	Precision	Precision	Precision
MnDOT Safety Zone A Length	7,733	7,733	5,333	5,333
MnDOT Safety Zone B Length	3,867	3,867	2,667	2,667

MnDOT Zone A = 2/3 runway length
MnDOT Zone B = 1/3 runway length
Source: Minnesota Rules 8800.2400

5.7 TAXIWAY ANALYSIS AND DESIGN STANDARDS

Taxiways provide access and circulation between the runway environment and terminal area, and other landside facilities. Taxiways are generally classified as:

Parallel - facilitates aircraft movement along the runway

Entrance and Exit – aircraft ingress and egress to the runway system

Connector - connects with the aprons, ramps and aircraft service and storage areas

Apron Taxiway - primary access within the aircraft parking apron

Taxilane – non-movement areas typically for aircraft access to ramp, hangar and fuel areas.

The taxiway and taxilane system should provide efficient circulation and meet FAA design and geometry standards, as designated for the category of aircraft operating on the associated runway or otherwise requiring access. Taxiways must provide sufficient separation and safety free area clearance, per as standard width to accommodate the aircraft wheelbase, turning radius, taxiway edge safety margin, and allow wingtip clearance between fixed objects. Due to the range of commercial and military use of Runway 9-27 and the taxiway system, turn radius and fillets should be evaluated on a case-by-case basis. Paved shoulders are required taxiways, taxilanes and aprons accommodating ADG-IV and higher aircraft, and are recommended for accommodating ADG-III aircraft. For planning purposes, the FAA requires a full-length parallel taxiway system associated with precision instrument runways, as is also justified for runways with traffic levels exceeding 20,000 annual operations, or needing line-of-sight between runway ends. Air traffic controllers must have clear line-of-sight to all taxiway movement areas.

Table 5-11 is a summary of taxiway improvements necessary to support airport facility requirements and resolve taxiway design and geometry deficiencies. The following is a description of taxiway facility requirements or improvements as depicted on the Airport Layout Plan:

Taxiway 'A' (Parallel Serving Runway 9-27): Taxiway 'A' between Taxiway 'A2' and the Runway 9 end has a runway-to-taxiway separation of nearly 850 feet, exceeding the FAA 500-foot minimum separation by nearly 450 feet. This segment of taxiway also contains an irregular 'S' curve, which contributes aircraft oversteering issues and to air traffic control tower line-of-sight visibility constraints when large aircraft are parked on the Midfield Ramp. It is recommended that Taxiway 'A' ultimately be realigned in a linear manner consistent with the eastward segment of Taxiway 'A', which has a 512.5 foot taxiway-to runway separation, sufficient separation for runways with less than one-half mile visibility. The aircraft parking limit line along Taxiway 'A" has been set at 166 feet to ensure C-5 Galaxy taxi operations can be conducted on the ramp when needed. Realignment of Taxiway 'A' also resolves the air traffic control tower line-of-sight visibility constraints, the 'S' curve, and allows for potential apron and building expansion along the flight line. Taxiway shoulders are also required for the associated Taxiway 'A' segments.

Taxiway 'A5' (Entrance/Exit): serves the entrance for the Runway 27 end, and is currently an FAA Hot Spot. It is recommended that Taxiway 'A5' be deactivated, and/or reconfigured with the resolution of the in-line Taxiway 'E'.

Taxiway B: a connector providing a single access point between Runway 9-27 and the North Business Development Area. The North Business Development Area is planned to accommodate various commercial and private tenants, potentially a flight school. Therefore, a mix of aircraft would be generated from these prospective tenants, resulting in potential congestion points which could require alternate taxiway access points. For this reason, it is recommended Taxiway 'B' be progressively planned for the following improvements:

- New exit taxiway between Runway 9-27
- Eastward extension to Taxiway 'C' and Runway 3-21
- Westward extension for Runway 9 departures (to accommodate flight school operations)

Taxiway 'C' (Parallel Service Rwy 3-21): a non-linear full parallel taxiway involving a taxiway intersection node resulting in a FAA Hot Spot. It is recommended Taxiway 'C' be relocated at a 400-foot taxiway-to-runway separation to meet ARC C-III standards for future precision instrument capabilities. The realignment would resolve the non-standard runway-to-taxiway separation, mitigate the FAA Hot Spot intersection node, and correct geometry issues associated with the cargo ramp area at the Runway 3 end.

Taxiway 'E' (In-Line): Taxiway 'E' is a 1,000 foot in-line taxiway beyond the Runway 27 end, and part of a system of taxiway issues identified as a FAA Hot Spots due non-standard geometry and runway incursion risk. FAA standards no longer permit in-line taxiways. Therefore, it is recommended Taxiway 'E' be deactivated, and either converted to usable pavement or maintained as an overrun/blast pad.

Taxiway E-1 / E-2 (Entrance and Exit): Taxiway 'E1' and 'E2' provide military access between the Runway 27 end and Air National Guard, and are part of a system of taxiway issues identified as a FAA Hot Spots. The acute Taxiway 'E1' is not recommended within the last third-of the runway. The Taxiway 'E2' ascribes to an entrance taxiway, which invites pilot awareness issues. Taxiway grades are also an airspace consideration, and in rectifying the Taxiway 'E1' and 'E2' geometry as part of the resolution of Taxiway 'E'.

Taxiway 'F': Taxiway 'F' provides the Minnesota Air National Guard Ramp access to the Runway 21 end. The Minnesota Air National Guard's Installation Development Plan recommends realignment of Taxiway 'F' as a future partial parallel taxiway to Runway 21 with a taxiway-to-runway separation of 400 feet, and an additional exit Taxiway to Runway 3-21. The Guard's Development Plan also recommends extending Taxiway 'F' commensurate to any Runway 21 extension.

Taxiway Hold Bays / By-Pass Areas: Aircraft holding bays and by-pass areas are located on Taxiway 'A' at the Runway 27 end of pavement, Taxiway 'A1' and Taxiway 'A' at the entrance of Runway 27. The bay located on Taxiway 'A' at the Runway 27 end may be reconfigured based on the resolution of the in-line Taxiway 'E'.

Table 5-11
TAXIWAY DESIGN STANDARDS

Pavement Area	Pavement Condition					
	Pavement Type	2010 PCI Rating	2015 PCI Rating	Type of Pavement Project	Estimated Time Period	Remarks
Runway System						
Runway 9-27	Concrete	Fair to Excellent	Poor to Good	Full-Depth Reconstruction	5 to 10 Years	Multi-Year Project
Runway 3-21	Bituminous	Good to Excellent	Good to Very Good	Full-Depth Reconstruction	3 to 5 Years	Possible Strengthening
Taxiway System						
Taxiway A	Bituminous *	Poor to Good	Very Poor to Good	Surface Rehabilitation Full Reconstruction	1 to 3 Years 10 to 15 Years	Re-Align West Segment at ±500' with Reconstruction
Taxiway A-1	Bituminous/ Concrete	Good	Fair	Reconstruction	5 to 10 Years	Complete as Part of Rwy 9-27 Project
Taxiway A-2	Bituminous	Fair	Fair	Reconstruction	5 to 10 Years	Complete as Part of Rwy 9-27 Project
Taxiway A-3	Bituminous	Good	Good	Reconstruction	5 to 10 Years	Complete as Part of Rwy 9-27 Project
Taxiway A-5	Bituminous	Good	Good	Reconstruction	5 to 10 Years	Rectify for Non-Standard Geometry
Taxiway B	Concrete	Very Good	Good	Surface Rehabilitation	15 to 20 Years	
Taxiway C	Bituminous	Very Poor	Failed	Full-Depth Reconstruction	3 to 5 Years	Possible Re-align at 400'
Taxiway D	Bituminous	Very Poor	Failed	Full-Depth Reconstruction	3 to 5 Years	Reconstruct at 50' wide
Taxiway E	Concrete	Fair to Good	Fair to Good	Reconstruct with Runway 9-27 Project	5 to 10 Years	Deactivate Future
Taxiway E-1	Bituminous	N/A - Military	N/A - Military	N/A - Military	N/A - Military	Military Planning
Taxiway E-2	Concrete	N/A - Military	N/A - Military	N/A - Military	N/A - Military	Military Planning
Taxiway F	Concrete	N/A - Military	N/A - Military	N/A - Military	N/A - Military	Military Planning

Note: Taxiway 'A' west end hold area is concrete.
Note: Runway 3-21 mill and overlay in 2013.
Note: Runway 9-27 and 3-21 subgrade condition does not reflect current PCI surface conditions.
Source: 2010 Duluth PCI Analysis.

5.8 AIRFIELD PAVEMENT STRENGTH & CONDITION

Pavement strength and condition are important factors in determining runway facilities. Pavement strength requirements are identified by the flight frequency, operating weights and wheel configuration of the critical design aircraft, or most demanding aircraft regularly operating on the runway.

Table 5-12 is the PCI scoring thresholds per aircraft category, identifying the score at which pavement reaches a PCI value in which rehabilitation should commence. Pavements used by larger aircraft tend to require pavement rehabilitation initiated on a higher PCI value.

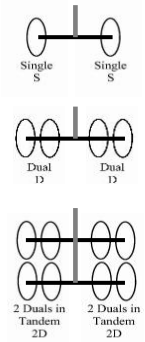
Table 5-12
PCI THRESHOLDS

Runway Design Category *	Branch Use	PCI Value
Category A Aircraft	Runway	60
	Taxiway	50
	Apron	50
Category B Aircraft	Runway	60
	Taxiway	50
	Apron	50
Category C Aircraft	Runway	65
	Taxiway	55
	Apron	55
Category D Aircraft	Runway	70
	Taxiway	60
	Apron	55

* Per FAA AC 150-5300-13.

Table 5-13 lists aircraft weights for the types of aircraft operating, or planned to operate at Duluth. The general aviation business jets typically range from 12,000 to 90,000 pounds, with most aircraft over 20,000 pounds having a dual-wheel gear (DW) configuration. The regional and narrowbody air carrier transport jets range from 40,000 to 250,000 pounds, while the commercial passenger and cargo transport aircraft weigh up to 900,000 pounds, and are equipped with dual-tandem wheel gear (DTW).

Table 5-14 summarizes the runway facility needs for pavement strength requirements for during the 20-year planning period. Per FAA standards, the runway weight bearing strength, expressed in pounds and gear type, is determined by the maximum takeoff operating weights (MTOW) for existing and future aircraft types expected to utilize the runways. It is recommended the future Runway 9-27 pavement strength, at minimum, provide for 700,000 pound (DTW) aircraft weight, which is consistent with larger heavy cargo transport aircraft. The Boeing 747F is a double dual tandem wheel gear aircraft, and has a weight of about 700,000 pounds when operating at 60 to 80 percent of maximum useful load. It is recommended the future Runway 3-21 pavement strength, at minimum, provide for 150,000 pound (DW) aircraft weight, which is consistent with Runway 3-21 commercial carrier activity, and the evolution of the regional aircraft size and weights.



Pavement strength is not known for the taxiway and apron pavements. Typically, the associated taxiway and apron system is constructed to a corresponding strength as the associated runway. Pavement deterioration progresses along a non-linear timeline. Therefore, the deferment of pavement improvement projects results more involved pavement repairs, and a proportionally higher cost.

Table 5-13
RUNWAY WEIGHT BEARING CAPACITIES

Aircraft	Aircraft Size (Pass. Seats)	ARC Category	Main Gear Type	Maximum Take-Off Weights
General Aviation Business Jets				
Light/Small Business Jet	4 to 6	B-I to B-II	Single-Wheel	8,000 to 20,000 lbs.
Medium Business Jet	6 to 10	B-II to C-II	Dual-Wheel	20,000 to 45,000 lbs.
Large Business Jet	10 to 16	C-II to D-III	Dual-Wheel	45,000 to 95,000 lbs.
Commercial Aircraft				
Airline Turboprop	19 to 70	B-II to B-III	Dual-Wheel	22,000 to 45,000 lbs.
Airline Regional Jet	35 to 110	C-II to C-III	Dual-Wheel	40,000 to 115,000 lbs.
Airline Narrowbody Transport	90 to 170	C-III to C-IV	Dual-Wheel	115,000 to 260,000 lbs.
Airline Widebody Transport	220 to 350	D-IV to D-VI	Dual-Wheel	350,000 to 850,000 lbs.
Cargo Aircraft				
Regional Cargo Transport (Short Range)	N/A	C-II to C-III	Dual-Wheel	45,000 to 200,000 lbs.
Domestic Cargo Transport (Medium Range)	N/A	C-III to D-IV	Dual-Wheel	300,000 to 600,000 lbs.
International Cargo Transport (Long Range Heavy Lift)	N/A	D-IV to D-VI	Dual Tandem	600,000 to 950,000 lbs.

Note: The gear type and configuration dictate how the aircraft weight is distributed to the pavement and determines the pavement response to aircraft loadings. (swg): single-wheel gear aircraft – each landing gear is supported by a single tire. (dwg): dual-wheel gear aircraft – each landing gear consists of a single axle with two tires per axle that equally share the weight of the aircraft and provide for greater weight distribution.

Table 5-14
PAVEMENT STRENGTH

	Existing Runway		Future Runway	
Item	**9/27**	**3/21**	**9/27**	**3/21**
Future Aircraft Characteristics				
Design Aircraft	B-747-F	MD-80/B-737	B-747-F	B-737
Maximum Takeoff Weight (Lbs.)	850,000	125,000	850,000	150,000
Gear Type	Dual Tandem	Dual	Dual Tandem	Dual
Future Runway Requirements				
Pavement Type	Concrete	Asphalt	Concrete	Asphalt
Grooved	Yes	No	Yes	Possibly
Pavement Strength (Lbs.)				
Single Wheel Gear	94,000	52,000	--	--
Dual Wheel Gear	180,000	100,000	--	150,000
Double Dual Wheel Tandem Gear	650,000	361,000	700,000	--

Note: Pavement strength is primarily determined with respect to the projected aircraft types (wheel gear type), operating frequency, and operating conditions (aircraft weights). Initially, pavement strength is achieved through adequate design and construction practices and is then maintained through periodic overlays, with the pavement surface maintained through routine crackseal, slurry seal maintenance and upkeep projects. The pavement overlay process can also be used to restore crown, grade, and pavement integrity. For planning purposes, pavements are designed in accordance with the standards contained in FAA Advisory Circular 150/5320-6D, which is intended to provide a structural life of 20 years that is free of major maintenance, providing no significant changes occur in the forecast aircraft operations.

Note: Aircraft not anticipated to operate at maximum weights.

5.8.1 Airfield Pavement Condition

The 2010 and forecast 2015 Pavement Condition Report mapping or PCI is illustrated on **Exhibit 5-3** and **Exhibit 5-4** respectively. A detailed phasing plan utilizing the forecast pavement condition identified in the PCI Study will be evaluated in subsequent chapters. Pavement rehabilitation recommendations:

- Runway 9-27: Runway ends are in worse condition. Condition of base material and subgrade generally unknown. Full-depth reconstruction anticipated in the 5 to 10 year period. Foreign object debris (FOD) becoming an issue. Due to construction and funding, the pavement project is expected to be a multi-year project.

- Runway 3-21: Runway milled and overlaid in 2009, which results in excellent PCI surface conditions. However, condition of base material and subgrade generally unknown. Full-depth reconstruction anticipated in the 3 to 5 year period. Project may also include strengthening.

- Taxiways: Pavement conditions range from very poor to very good. Future taxiway pavement improvement projects also to consider sequencing with major runway rehabilitation/reconstruction projects, planned expansion, upgrade and relocations, along with operational impacts and funding availability.

Runway 9-27 and Runway 3-21 will require full-depth reconstruction in the next 10 year period. When pavement cores were taken from Runway 9-27, it was concluded that the runway concrete panels are on the low side of adequacy in structural strength and load transfer. Large voids exist under the concrete panels in corners where subgrade support needs improvements. It is anticipated that the concrete panels will perform adequately for a limited time period, but reconstruction will be necessary in the near future. Rehabilitation of the runway will not be able to completely fix the subgrade support issues.

It would be anticipated that Runway 3-21 would have full-depth reconstruction due to the mill and overlay project in 2009. At the point when the runway requires structural improvements, a reconstruction will provide a longer term solution compared with a rehabilitation/mill and overlay.

Exhibit 5-3
AIRFIELD PAVEMENT CONDITION REPORT 2010 (PCI)

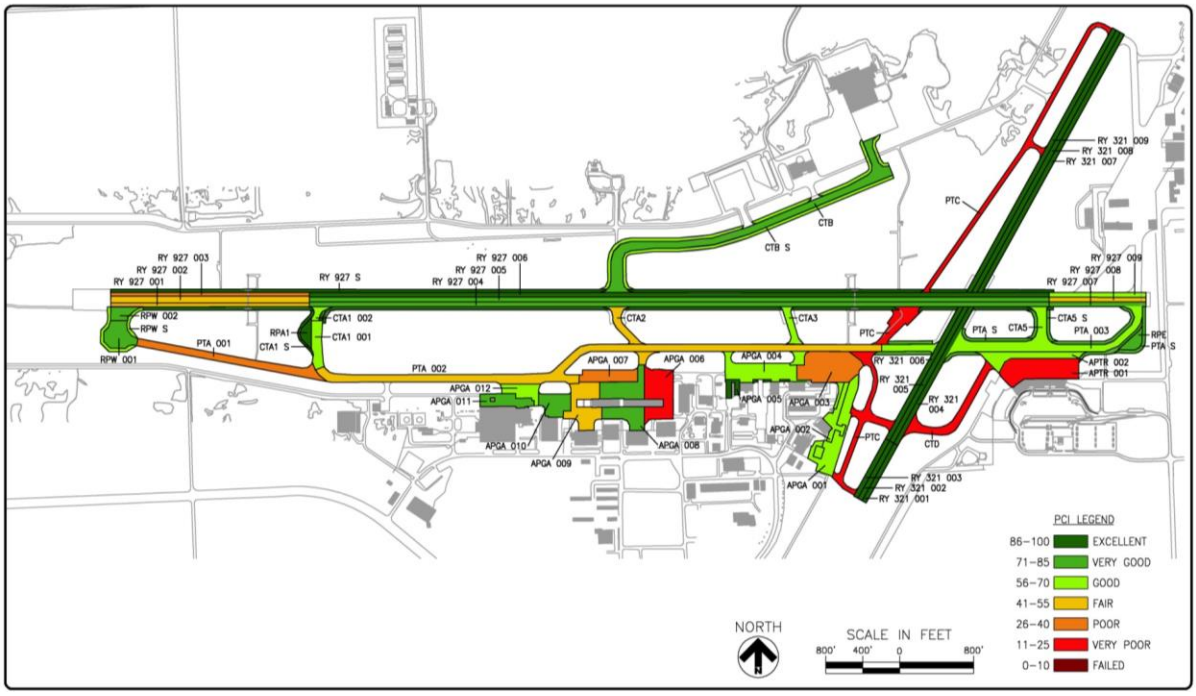
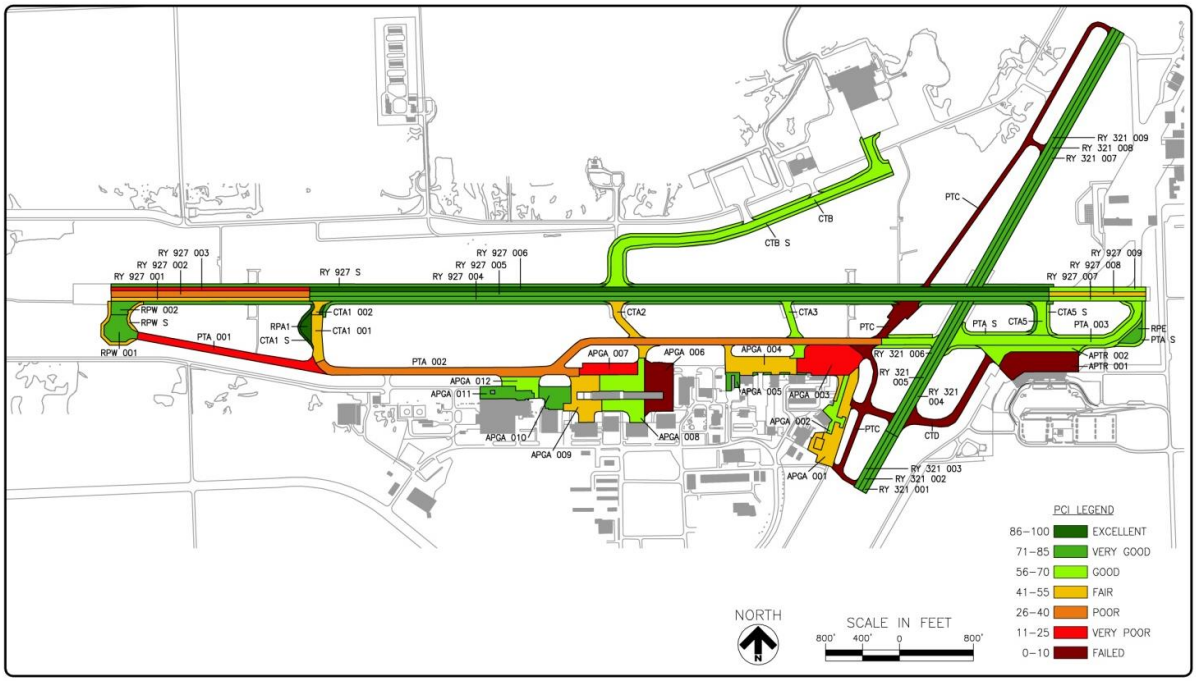


Exhibit 5-4
AIRFIELD PAVEMENT CONDITION REPORT 2015 (PCI)



5.9 PASSENGER TERMINAL FACILITIES

Passenger terminal facilities include the replacement terminal building, main aircraft gate positions, the terminal apron and terminal curbfront. These areas are specifically designed to serve passengers utilizing commercial airline service. This section evaluates the ability of the replacement terminal facility to generally accommodate the forecast airline operations and passengers.

5.9.1 Replacement Terminal Building

The new passenger terminal building was constructed 200 feet south of the former building, as a more efficient, cost effective and sustainable facility replacement with domestic and international passenger processing capabilities. The new building is 114,500 square foot, has three floor levels, and four passenger contact boarding gates to accommodate commercial regional jets, mainline narrowbody transports, and up to a heavy widebody aircraft.

The process of planning, siting and designing the replacement building facility requirements began around 2005, including a 2007 Terminal Demand Study which provided an analysis of building space allocation and functional size, and a 2009 Terminal Schematic Report which determined a final building layout and schematic design.

The 2007 study identified the 30-year passenger demand at 200,000 annual enplanements (or about 400,000 total passengers), which was assessed as requiring a 105,800 square foot building. The actual replacement building totals 114,500 square feet, consisting of 104,500 square feet dedicated to passenger processing, and 9,500 square feet for a tug ramp shelter. The 104,500 square foot building size was contemplated as meeting passenger demands through 2037 for the 200,000 annual enplanements.

However, the baseline master plan forecast indicates that passenger enplanements will reach 200,000 before 2030, in addition to two forecast scenarios in which passenger enplanements could reach 250,000 within the same 20-year period. These trends and forecasts indicate a tempo of airline service and passenger demands which might require building improvements within the 20-year master plan planning period.

The planning industry standard outlines that new capacity should be planned for at 60 percent of capacity and in place at 80 percent of capacity. According to the baseline forecast with 200,000 enplanements in the 20 year period, planning needs to begin at the same time as this Master Plan with new capacity in place by 2020.

Table 5-15 provides a comparison of building spaces in relation to passenger activity levels, expressed as percent space attainment, and with recommended improvements. As the number of annual passenger enplanements approaches 200,000, the building capacity and level of service diminishes. For instance, the level of service would typically impact the passenger boarding lounge area and baggage claim space requirements, two areas of the building which might require some level of modification or expansion as passenger levels approach or exceed 200,000 enplanements.

With respect to internal building modifications, building space may be partially re-organized to compensate for industry changes in processing airline passengers. These changes include less space for ticket counters as the passenger ticketing process becomes more automated. Building expansion is possible to multiple levels, and can ultimately occur on both ends of the building,

including the west side for an additional baggage claim device and to the east side additional passenger boarding / processing space. This modular expansion would add approximately 12,000 feet, with reconfiguration of the tug ramp.

Table 5-16 also shows that the four boarding bridge gates are sufficient in providing passenger volumes and airline flight frequency to accommodate the 20-year passenger demand levels. Each terminal gate bridge can typically accommodate a minimum of 125,000 annual enplanements, sufficient for all forecast levels projected over the next 20 to 30 years.

Table 5-15
REPLACEMENT TERMINAL BUILDING

	2010 (Existing)	2020 (Forecast)	2030 (Forecast)
Passenger Enplanements / Forecast*	155,955	165,500	200,400
Total Building Size (SF)	± 114,000	± 114,000	± 114,000
Net Building Size (SF)**	± 104,500	± 104,500	± 104,500
Passenger Capacity at 104,500 SF***	± 200,000	± 200,000	± 200,000
Gates - Existing	4	4	4
Gates - Future	--	4	4
Percent Attainment	78%	83%	100%
Recommend Improvements	--	None	Possible Modifcation and/or Expansion

Note*: 2010 enplanements are actual. 2020 and 2030 enplanements represent the master plan FAA Terminal Area Forecast.

Note**: Excludes tug ramp shelter building space.

Note***: 2007 and 2009 terminal study calculations show that a 105,000 SF terminal building can accommodate approximately 200,000 passenger enplanements.

5.9.2 Air Carrier Apron / Gate Position

The air carrier apron for the replacement terminal building accommodates narrowbody aircraft at Gates 1, 2, and 3 and a regional jet at Gate 4. The apron area boundary was designed to provide a minimum footprint for the replacement terminal building, in which several apron sections were not initially constructed. As part of future apron facility needs, additional apron maneuvering space west of the terminal building will allow for narrowbody and widebody aircraft to power-out of Gate 1, and for a narrowbody aircraft to power-in to Gate 4 along Taxiway ‘A’ on the east. A taxiway/apron fillet enlargement along Taxiway ‘D’ is recommended to provide additional space for aircraft maneuvering between the apron and the Runway 3 end. Future apron expansion will result in an expanded air carrier restricted (SIDA) boundary.

The terminal building has four passenger boarding gates, all of which are currently used for Remain Overnight (RON) aircraft parking. The existing air carrier apron does not provide a

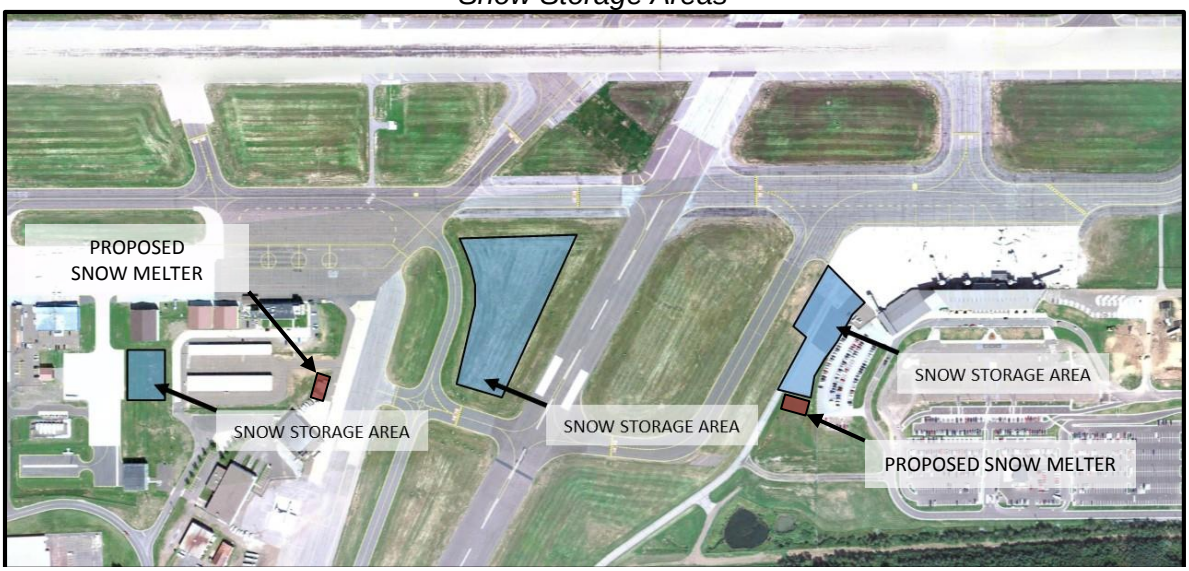
designated RON parking area and occasionally overflow parking has been accommodated on the general aviation Midfield Ramp. The master plan recommends expanding the air carrier apron eastward for a dedicated RON to accommodate a regional jet or narrowbody aircraft. The planned eastward apron expansion is recommended to remain outside of the underground geothermal well field. This dedicated RON apron could also potentially serve unanticipated terminal building/gate expansion.

5.9.3 Snow Dump Area / Snowmelters

The Airport has multiple snow dump locations used to stockpile excess snow removal including areas within the terminal aprons. The paved snow dump area west of the air carrier apron is planned for reconfiguration and expansion as part of the replacement terminal building project, in conjunction with a future deicing pad and snowmelter. The snow dump area along the portion of Taxiway 'C' has been contained between Taxiway 'A' and Taxiway 'D' to improve air traffic control movements as noted by past FAA inspections. The third snow dump area is south of the FBO, within an area designated for future hangar expansion. These areas are depicted in Exhibit 5-5.

The Airport intends to install snowmelters in nearby proximity to the air carrier and Tower / FBO ramp areas to reduce or eliminate stockpiles. A third snowmelter is contemplated beyond the taxilane behind the FBO building.

Exhibit 5-5
Snow Storage Areas



5.9.4 Aircraft Deicing

Deicing operations for commercial and general aviation takes place on the air carrier apron, the Tower Ramp / FBO Ramp, or the Midfield Ramp. A consolidated deicing pad adjacent to the air carrier apron is recommended to incorporate a fluid collection system and provide a deicing vehicle staging / parking area. Also, the deicing pad location should be sized and configured to serve large air carrier and cargo jet transport aircraft.

At this time, the Airport is not required by Environmental Protection Agency (EPA) standards to have a glycol recovery system.

5.9.5 Terminal Building Curbfront

The terminal building curbfront is 750 linear feet and has a total of five at-grade lanes segregated into three passenger loading / unloading lanes, and two lanes dedicated for livery vehicles. Two pedestrian crosswalks are currently provided between the building and auto parking lots. The proposed parking garage provides a pedestrian bridge over the terminal curbfront which would reduce the number of pedestrians using the crosswalks.

The terminal curbfront was designed to accommodate the new replacement terminal building, and anticipated demand through the 20 year building planning period. Table 5-4 provides a summary of the existing and projected demand for the terminal curbfront based on peak hour and peak 20 minute enplanements and deplanements. The peak 20 minute demand factor is typically the more demanding factor and is used as the curbfront demand factor. The peak 20 minute enplaning curb has a total existing demand of about 30 percent of total capacity and is projected to increase to 36 percent of capacity by the end of the planning period. Therefore the curbfront provides sufficient capacity throughout the 20 year building planning period.

Table 5-16
TERMINAL CURBFRONT DEMAND

	2010 (Existing)	2030
Peak Hour		
Enplaning	10%	12%
Deplaning	10%	12%
Total	20%	24%
Peak 20 Minutes		
Enplaning	15%	18%
Deplaning	15%	18%
Total	30%	36%

Note: Based on Peak Hour per minute-foot factor of available curbfront.

5.9.6 Terminal Auto Parking

Table 5-17 provides the future parking demands for the completed proposed parking plan which includes the auto parking garage and an economy parking lot. The completed proposed parking plan provides approximately 1,300 parking spaces with 950 spaces designated for public parking.

Existing short term parking demand is about 30 percent while long term parking demand represents about 70 percent. While the future parking plan assumes that short term parking is replaced by premium covered parking in the garage, the future parking plan also assumes both premium and economy parking are available for “short” and “long” term parking. The proposed parking plan provides for about 710 economy spaces and 225 covered premium parking spaces in the garage. Future public parking needs assume that existing demand remains consistent throughout the planning period with demand for the economy parking at 70 percent and demand for premium parking at 30 percent. Public parking has no apparent existing deficiencies, however a shortage of about six premium parking spaces is projected at the end of planning period. There are about 190 employee parking spaces provided by the future parking plan. Future employee parking demands assume that four spaces are needed for every 10,000 enplanements. There are no projected needs for employee parking.

Rental car facilities for the completed proposed parking plan consist of surface parking on the west side of the terminal building. Rental car parking is provided for about 200 rental cars. Parking assumptions suggest a need for a rental car parking space for every 750 enplanements. While no existing rental car parking deficiencies were noted, it is projected that a shortage of about 30 rental car spaces will occur towards the end of the planning period.

Table 5-17
AUTO PARKING[3]

Auto Lot Description	Existing Spaces (2012)	Proposed Parking Completed (2015)	2020 Spaces Demanded	2025 Spaces Demanded	2030 Spaces Demanded
Enplanements	155,955		165,530	182,000	200,410
Peak Hour-Enplanements	150		150	150	150
Peak Hour-Deplanements	100		100	100	100
Public Parking	**882**	**710**			
Lot A - Short Term	88	--			
Lot B1 - Long Term / Economy	230	146			
Lot B2 - Long Term / Economy	188	188			
Lot C - Long Term / Economy	376	376			
Total Long Term / Economy	794	710	445	490	540
Public Economy Spaces Needed			0	0	0
Garage - Public Premium (Covered)	--	225	190	210	230
Public Premium Spaces Needed			0	0	5
DAA Employee Parking (Permit Parking)	**180**	**190**			
East Lot - Employees / Admin.	140	140	65	75	80
Garage - DAA Maintenance	--	50	15	15	15
DAA Maintenance	40	--			
Total DAA Spaces	180	190			
Employee Spaces Needed			0	0	0
Rental Car Parking	**277**	**233**			
West Lot - Rental Car (Overflow)	277	120			
Rental Car/Ready Return - Garage		91			
CONRAC Facility	Removed	22	10	10	15
Total Rental Car Spaces	277	233	220	245	265
Rental Car Spaces Needed			0	10	30
Other Parking	**14**	**14**			
Cell Phone Lot	14	14	10	10	10
Other Auto Spaces Needed			0	0	0
Total	**1,353**	**1,372**			
Total - Public Use	**896**	**949**			

CONRAC: Consolidate Rental Car Facility

5.10 GENERAL AVIATION

General aviation aircraft facility requirements consist of fixed base operator services, special aviation service operations, hangar storage, and apron space. Future facility requirements require an analysis of the existing and future general aviation operations, based aircraft levels, and the capacity and condition of existing facilities.

[3] Not reflected in Table 5-13 which was developed in 2012 is the new $8M parking garage opened at DLH in November 2014 that included a glass-enclosed connecting skyway to the terminal. The 4-level, 320 space garage provided some headed and indoor parking spaces. The 320 spaces accommodates 40 premium, 100 rental car, and 220 spaces available to the general public.

General aviation facilities are needed at DLH to accommodate the projected demand. These facilities include hangars, apron and a general aviation terminal building. Aircraft storage requirements are based on forecasted levels of based aircraft and itinerant activity. The actual hangar facilities that are built will largely be as a result of private financing. Several future apron expansion areas are identified on the ALP and would be constructed on an incremental basis to serve new facilities.

It is anticipated that nearly all based aircraft will be hangared. The majority of general aviation hangar storage will be required for 4 to 8-seat single and twin-piston aircraft. T-hangars with 8 to 14-units are the most economical, and commonly 55' to 65' wide and 18' to 22' in height. Clearspan common/executive hangars typically range from 2,500 to 10,000 square feet and 18' to 35' or greater in height, with the larger hangars sometimes occupying multiple aircraft. The trend towards larger, special-purpose common hangars is expected, including those that include attached businesses/office space.

General aviation apron requirements are anticipated to largely consist of preventive maintenance (crackseal, sealcoat). This will require an ongoing program that would continue for to include all apron pavements prior to completion of the Runway 9/27 reconstruction project, especially in the vicinity of the airport traffic control tower ramp and midfield are deteriorating rapidly. Some pavements, like Taxiway A, will require larger emergency repairs prior to full rehabilitation and reconstruction as well. These repairs are necessary before work begins on Runway 9/27 because of the deteriorating pavement and are Stage II CIP Projects (see Airport Master Plan Development Program, Table 9-4). The CIP indicates that Runway 9-27 reconstruction is a Stage 3 project.

5.10.1 Fixed Base Operator (FBO)

The Airport has a single FBO. The current provision of services to general aviation is considered sufficient to meet existing and forecast demand.

5.10.2 Hangars

The assessment of hangar facility needs focuses on square footage of hangar space. The master plan assumes that due to winter conditions, all based aircraft are stored in hangars. The smaller single-engine aircraft and light multi-engine aircraft are generally stored in T-hangar units while larger multi-engine aircraft, business jets, and rotorcraft are stored in common hangars.

Table 5-18 summarizes hangar space demand for each planning period based on the aviation forecast, the typical FBO hangar waiting list, and hangar displacement. Civilian based aircraft forecasts an increase of 23 base aircraft from 65 to 88 aircraft by 2030. When the FBO hangar waiting list is considered, 98 aircraft are projected to be based at the Airport by the end of the planning period and require approximately 79,700 square feet of additional hangar space or 2,400 square feet per aircraft on average.

Table 5-18
AIRCRAFT HANGAR REQUIREMENTS

Forecast Year	Single Engine	Multi Engine	Jet	Rotor-Craft	Forecast Total	FBO Hangar Wating List	Hangar Displaced Aircraft	Total Hangared Aircraft	Additional Hangar Space (SF)	* Total Hangar Space (SF)
2010 (Existing)	52	10	2	1	65			**65**	**--**	**179,800**
2015	54	11	3	2	70	5	5	**75**	**30,100**	**204,300**
2020	60	12	3	2	77	5		**87**	**20,000**	**224,300**
2025	62	13	5	3	83			**93**	**20,100**	**244,400**
2030	66	14	5	3	88			**98**	**9,500**	**253,900**
20-Year Change	14	4	3	2	23	10	5	**33**		
20-Year Hangar (SF)	21,000	14,000	15,000	7,200	57,200	15,000	7,500	**2,400**	**79,700**	

Note: 2010 is the existing base year.
Note: The FBO aircraft waiting list consists of all single engine piston aircraft.
Note: Multi-Engine includes piston and turbine aircraft types.
Note: * T-Hangar 608 (5-Unit @ 5,600 SF) is planned to be removed within 0-5 years, and assumes relocation of 5 displaced aircraft.

5.10.2.1 Southwest Quadrant Redevelopment Area

Exhibit 5-5 shows three areas designated for hangar and key airfield support facility redevelopment within the southwest quadrant area labeled as R1, R2, and R3 representing 1,000,000 square feet of ground space. The buildings highlighted in green are planned to be either removed or replaced. The southwest quadrant currently has available space for hangar development, about 63,000 square feet of ground space located south of the FBO facility with existing paved access. This area is available for immediate development of T-hangars and small to medium common hangars.

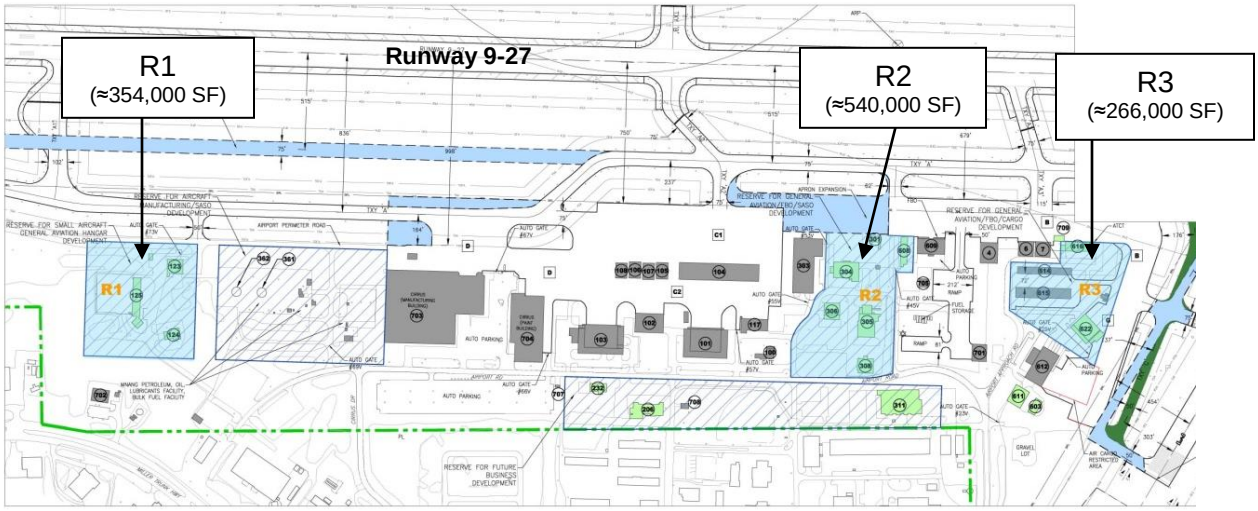
Also, hangar Building 614 (10,000 square feet) and Building 615 (14,000 square feet) are located within an area designated for redevelopment and could potentially require relocation prior to the end of the planning period, however the lifespan of these hangars may go beyond the 20 year planning period and are therefore not highlighted in green.

5.10.2.2 North Business Development Area

On the northwest quadrant, the North Business Development Area includes about 150,000 square feet of ground space available for new common hangar development. The Airport's preference for development includes commercial hangar development, corporate flight department hangar facilities, and potentially a flight school hangar, and no T-hangar development. The Airport Maintenance Facility/Hangar (80,500 square feet), located at the east end of Taxiway 'B' is not included as hangar storage because the Airport is targeting this facility for a large tenant prospect with commercial aviation requirements.

While additional hangar space to accommodate projected aircraft is estimated to be 79,700 square feet, the total ground area available for hangar development is potentially up to 1.15 million square feet.

Exhibit 5-6
SOUTHWEST QUADRANT REDEVELOPMENT AREAS



5.10.3 Apron/Ramp Areas

Aircraft apron/ramp areas provide aircraft parking, tie-down, access to buildings/hangars and circulation for the processing of aircraft, passengers and cargo.

5.10.3.1 Air Cargo Ramp Area

Air cargo processing is conducted on multiple aprons, and by various operators using a combination of turboprop and jet transport aircraft.

- FedEx: The 46,000 square foot FedEx apron is sufficient to accommodate the ATR 42 twin-turboprop, and designed to accommodate a large transport such as an Airbus A310F aircraft, although the tail height of large aircraft penetrates Part 77 airspace. Under the air cargo demand forecasts, in order to sustain the projected air cargo volume FedEx operations would utilize increased frequency of the ATR 42 aircraft, or transition to a larger jet transport such as a Boeing 757F. Ideally, the B-757 requires 45,000 to 65,000 square feet of ramp. Although there are FedEx apron constraints the Runway 3-21 airspace and Taxiway 'C' safety area separation, FedEx has not indicated any immediate apron deficiencies or sort facility issues related to aircraft operations or processing.

- UPS: UPS operates a Fairchild Metroliner twin-turboprop, which is parked on the Tower/FBO Ramp, and packages loaded/unloaded by trucks accessed through the security gate. The Metroliner aircraft requires approximately 2,500 to 4,500 square feet of ramp area. UPS has not indicated any apron operational deficiencies or facility needs.

- Airlines: Delta Airlines operates limited air cargo with commercial passenger aircraft service from its facilities on the air carrier terminal apron, and has not indicated any specialized air cargo facility requirements.

  Non-scheduled air cargo is handled on the FBO apron, and will be accommodated by existing and future FBO apron requirements.

- Apron Expansion adjacent Taxiway C: South of the Runway 9-27 and Runway 3-21 intersection, Taxiway C provides access to the Tower Ramp and the FedEx air cargo ramp. The taxiway center-to-apron edge separation decreases from approximately 160 feet to 100 feet limiting the useful area of the apron to smaller aircraft. FedEx B-727 aircraft park on the Tower ramp parallel to Runway 9-27 instead of in front of their air cargo hangar because of the reduced size of the ramp and the separation criteria along the Taxiway "C" ramp. When Taxiway C is relocated and widened, this ramp area must be reconstructed and widened to improve access for air cargo traffic.

5.10.3.2 FBO / General Aviation Apron Area

Itinerant aircraft arriving and departing from the FBO typically park on the Tower Ramp or Midfield Ramp. The edge of the Mid-Field apron is 235 feet from the Taxiway A centerline allowing this edge to be used for parked aircraft. However, to provide internal ramp taxilane clearance, the ramp is limited to smaller aircraft or a limited number of larger aircraft with reduced taxilane access. Aircraft parking limit line of 166 feet. The edge of the Midfield Ramp is about 237 feet from the Taxiway ‘A’ centerline.

Aircraft must obtain air traffic control tower clearance to use Taxiway ‘A’ to move between these ramps. The Midfield ramp is also used to accommodate up to two large techstop aircraft at a time, which occasionally overnight. It is recommended that the Tower / FBO Ramp be expanded to alleviate the aircraft parking space shortage that occurs during peak operating periods, when large tech stop aircraft occupy the Midfield Ramp area, and to eliminate the need for aircraft to obtain air traffic control tower clearance to use Taxiway ‘A’ to move between the Midfield and Tower Ramps. A planned Midfield Ramp expansion connects the Tower / FBO Ramp and adds approximately 140,000 square feet and with about 53,000 square feet available for aircraft parking / tie-down spaces.

If Taxiway ‘A’ is realigned, the existing Taxiway ‘A’ pavement area can be utilized for additional general aviation apron areas as needed. This also allows for aviation related hangars and buildings to be developed closer to Runway 9-27 once Taxiway ‘A' is realigned provided that the appropriate set backs are maintained.

5.10.3.3 Special Aviation Service Organization (SASO) Apron Area

The Cirrus Ramp provides aircraft parking for various production and training functions. Cirrus has indicated that additional ramp area is needed if aircraft production resumes to past peak-period production levels, or expands the aircraft product line. Additional apron area expansion is planned north of the Cirrus Building upon realignment of Taxiway ‘A’.

The eight acre area west of Cirrus Aircraft (shown as S1), recently released by the Minnesota Air National Guard, is planned to be reserved for future Cirrus / SASO facility development and apron

expansion, as demand warrants. It is also recommended that a compass calibration pad be located within the apron expansion area.

The Lake Superior College flight school currently uses the Tower Ramp for aircraft parking and has not indicated any apron space allocation deficiencies based on current or projected flight school activity. In the future, the flight program could be located to the North Business Development Area with apron to suit flight school development needs.

5.11 AIRPORT VEHICLE ACCESS AND AUTO PARKING

Airport access systems consist of connecting roadways that enable arriving and departing airport users to enter and exit the airport landside facilities and parking facilities. Surface access is comprised of both off and on airport access.

5.11.1.1 Off Airport Access

Transportation planning occurs at the Duluth-Superior Metropolitan Interstate Council which is the Metropolitan Planning Organization for the Duluth-Superior area. Roadway improvements provided by the Metropolitan Interstate Council are listed in the Duluth Area Transportation Improvement Plan (2012 -2015) and include:

- National Guard Base Access Road Improvements
- Martin Road - Resurfacing

5.11.1.2 On Airport Access

Major on-airport access roads are sufficient for the planning period. The master plan recommends reevaluating the need for on-airport access improvements as future development occurs around the airfield.

5.11.2 Auto Parking

5.11.2.1 Air Carrier Terminal Auto Parking

The air carrier auto parking lot size and configuration for the replacement terminal building is sufficient throughout the 20-year planning period. Aside from the proposed auto parking garage, no additional public auto parking facility expansion is planned.

5.11.2.2 Southwest Quadrant Area Parking

The current general aviation facilities are largely located in the area west and south of the airport traffic control tower. Aircraft traffic movements occur to and from the tower ramp and south ramp areas. Automotive traffic movements to and from the various hangars and FBO facilities utilize a system of roads that are fragmented remnants of the former military base and airport terminal building that once occupied this area of the airport.

Auto parking within the southwest quadrant includes public and private tenant lots, and used amongst the FBO, FAA Air Traffic Control Tower staff, Airport staff, various building and hangar tenants, Minnesota Air National Guard, Lake Superior College flight school, and Cirrus Aircraft. Automotive traffic movements use a system of roads that are fragmented remnants of the former military base and airport terminal building that once occupied this area of the airport. These roadways are generally in fair to poor condition and in need of repair. There is a shortage of public auto parking spaces along Airport Approach Road south of the Air Traffic Control Tower, in particular for the Lake Superior College flight school. Auto parking is planned in this area. It is recommended that auto parking and road accessibility be considered within other southwest quadrant areas to be expanded or redeveloped.

5.11.2.3 Northwest Quadrant Area Parking

Dedicated public and tenant managed private auto parking lots include the North Business Development Area, the Air Maintenance Facility / Hangar, and the Aircraft Rescue and Firefighting (ARFF) station. It is recommended that the North Business Development Area public auto parking lot be expanded, particularly if the flight school is located in this area. The ARFF auto parking lot experiences shortfalls, therefore a location north of the perimeter fence has been planned for future overflow auto parking.

5.12 AVIATION SUPPORT FACILITIES

Support facilities at an airport encompass a broad set of functions that exist to ensure the smooth and efficient operation of an airport's primary role and mission. Support facilities at Duluth International Airport include:

- Aircraft Rescue and Fire Fighting
- Airport Surveillance Radar Tower
- Special Aviation Services Organization
- Air traffic control tower
- Aircraft Fuel Storage
- Perimeter Fencing/Security
- Airport Maintenance/SRE Building
- Minnesota Air National Guard
- Utilities
- Drainage

5.12.1 Aircraft Rescue and Fire Fighting (ARFF) Facility

Airports that serve scheduled and unscheduled air carrier flights are required to provide aircraft rescue and fire firefighting (ARFF) facilities and equipment. As shown in Table 5-19**,** ARFF equipment requirements for FAR Part 139 airport are determined by index ranking (A, B, C, D or E). As published by the FAA, the Duluth International Airport is FAR Part 139 Class I, with an ARFF Index B.

Table 5-19

FAR PART 139 INDEX DETERMINATIONS

Airport Index	Aircraft Length	Number of Vehicles	Scheduled Daily Departures	Agent and Water Foam Requirements
A	Less Than 90 Feet	1	1 or more	500 Pounds of DC/HALON 1211 or 450 Pounds of DC and 100 Gallons of Water
B	90 to126 Feet	1	5 or more	Index A equipment and 1,500 Gallons of Water
		2	Less than 5	Index A equipment and 1,500 Gallons of Water
C	126 to 159 Feet	2	5 or more	Index A and 3,000 Gallons of Water
			Less than 5	Index A and 3,000 Gallons of Water
D	159 to 200 Feet	3	5 or more	Index A and 4,000 Gallons of Water
			Less than 5	Index A and 4,000 Gallons of Water
E	200 Feet and Greater	3	5 or more	Index A and 6,000 Gallons of Water

Source: FAR Part 139.315 – Aircraft Rescue and Firefighting: Index Determination

The existing ARFF building currently houses eight bays for fire rescue vehicles, security and communications operations area, and other amenities.

Table 5-19 provides a listing of the FAR Part 139.315 index specifications. The Airport is currently classified as a Class I Index B Part 139 facility but existing equipment and staffing actually meet the requirements for Index D. This Index is established based upon the longest aircraft, operated by an air carrier, with an average of five or more scheduled departures daily. The existing ARFF Index B is sufficient with the types and frequency of aircraft using the Airport. Therefore there are no recommended improvements to the ARFF.

5.12.2 Airport Surveillance Radar Tower

The relocation/replacement of the Airport Surveillance Radar (ASR) is planned further north along Stebner Road, including a 1,500' buffer radius to protect from development encroachment.

5.12.3 Special Aviation Service Organization (SASO)

Cirrus Design aircraft manufacturing occupies a 170,000 square foot aircraft production facility and a 64,000 square foot customer service center and paint building. Cirrus anticipates future expansion triggered by increased production, orders, or expansion of their line of aircraft. The eight acre area west of Cirrus Aircraft (shown as S1 on Exhibit 5-5) is planned to be reserved for future Cirrus / SASO facility development.

5.12.4 Air Traffic Control Tower

The Air Traffic Control Tower (ATCT) building condition, location, cab height and line-of-sight visibility are factors being considered as part of the tower replacement. It is anticipated a taller replacement ATCT with radar services will be constructed during the 20-year planning period, in order to resolve the Taxiway 'A', the southern end of Taxiway 'C', and Approach end of Runway 3 line of sight obstructions. The Taxiway 'A' obstruction is resulting from large aircraft parked on the Midfield Ramp, and difficulties in viewing aircraft on the Runway 9 approach. Exhibit 5-7 illustrates these ATCT challenges, and the

proposed tower location identified by the Airport southeast of the FBO terminal building. A more formal study will be required independent of the master plan in order to fully assess future ATCT site and design specifications.

Exhibit 5-7
AIR TRAFFIC CONTROL TOWER
LINE-OF-SIGHT VISIBILITY CHALLENGES

Source: Martinez Aerial Image, July 2010.

5.12.5 Aircraft Fuel Storage

The main above-ground aircraft fuel storage farm operated by the FBO and located south of the FBO terminal building supports Jet-A and 100LL fuel truck dispensing to the airlines and general aviation users. The FBO has not indicated any fuel facility deficiencies or storage shortfalls anticipated with the 110,000 gallon fuel tank capacity (four 25,000 gallon Jet-A tanks and one 10,000 gallon 100LL tank). The FBO also owns a 1,000 gallon 100LL self-service fuel storage tank that is located on the Ramp between the FBO and the Tower Building. The Cirrus Aircraft Company has a 10,000 gallon 100LL fuel storage tank on its property. Growth and tenant occupancy needs on the North Business Development Area may necessitate offering aviation fuel dispensing and/or storage in the future. Fuel storage requirements of the MNANG is planned to be consolidated onto the main base complex.

5.12.6 Perimeter Fencing / Security

Airfield perimeter fencing and controlled gate access restricts unauthorized people and wildlife breaches onto Airport operating areas, and between property boundaries. Fencing is largely a security requirement specified by the Transportation Security Administration (TSA, 49 CFR 1542), Part 139 *Air Carrier Airport Certification and Operations;* Wildlife Management Studies, various regulatory codes, and the possible implementation of the TSA Large Aircraft Security Program (LASP) affecting fixed

base operators for general aviation activities. The Airport's perimeter is fully enclosed with 6' to 10' wildlife fencing, and includes a numbered gate system for accessing between the airfield and terminal landside. In the future, the installation of new or relocated 10' fencing for airfield expansion and terminal area developments will be dictated by the fence location and specific site requirements. Also, the TSA has indicated a need for the Airport to reduce the number of vehicle access gates along the perimeter fence.

5.12.7 Airport Maintenance / SRE Building

The Airport maintenance facility / SRE (Building 303), located east of the midfield ramp accommodates all the existing snow removal equipment. There is need to provide flexibility in the master plan to provide some space for expansion for additional sand storage.

5.12.8 Minnesota Air National Guard

Over the years, Airport developments have involved joint-interest projects to support civilian and military traffic demands and collaborative facility needs. The *2010 Minnesota Air National Guard Installation Development Plan (IDP)* identified MNANG capital facility needs for beyond a 5-year planning horizon, in addition to a preferred project development timeline and layout concepts based on meeting U.S. Department of Defense requirements. As listed below, these MNANG IDP projects involve improvements to Airport areas extending beyond the MNANG operations area:

- Extend Runway 3-21 to 8,000 feet and install aircraft arresting gear (BAK)
- Extend and realign Taxiway 'F' to Runway 21 end
- Construct Runway 3-21 connector taxiway
- Replace Above Ground Munitions Storage
- Relocate fuel storage and petroleum, oil lubricants (POL) facilities onto the MNANG Base
- New North Entrance Road

These projects coincide with the Airport's facility requirements. The secondary runway extension to 8,000 feet corresponds with the Airport's strategic length requirements, while the planned relocation of the fuel storage facilities onto the MNANG base allows redevelopment with future civilian aeronautical access. In addition, MNANG maintains a TACAN on the westside of Runway 3 that could be impacted by improvements to Runway 3-21 and Taxiway 'C'.

5.12.9 Utilities

There are no major utility corridor deficiencies, distribution issues or regional capacity shortfalls at the Airport. Therefore, the master plan recommends the regular routine maintenance of these facilities. The Airport electrical vault (Building 301) west of the FBO is planned to be relocated in the future. This vault houses a 2,400 volt diesel generator for standby power for runway and taxiway lights, the Runway 9 PAPI, Runway 3-21 PAPI and the arresting system barriers.

5.12.10 Drainage

The airfield design should be planned to utilize existing drainage patterns and not increase storm-water runoff onto adjacent properties. On-airport farming practices should be managed to lessen the accumulation of silt and other debris in, and around, storm-water inlets. Storm-water holding basins are not recommended because they create a waterfowl attraction.

5.13 FACILITY REQUIREMENT SUMMARY

Table 5-20 summarizes the facility requirements necessary to satisfy the 20-year aviation demands at the Duluth International Airport. This information forms the basis for developing the 20-year airport development plan as identified in following chapters. Overall, the Airport facility requirements can be characterized for the airfield, terminal area and landside areas as follows:

Airfield: The airfield will require expansion to Runway 3-21 as a viable option to conduct future pavement reconstruction to the primary Runway 9-27. Taxiway improvements are needed to correct and meet FAA design standards. The airfield does not require significant infrastructure or equipment facility needs, but will necessitate substantial pavement rehabilitation over the 20-year planning period.

Terminal: There is no anticipated major terminal expansion projects anticipated over the Master Plan period.

Landside: The primary landside improvements are an expansion of the North Side Business Development Area, an increase in general aviation hangar space of 40 percent, expansion of Cirrus/SASO facility development, construction of a replacement ATCT, and expansion of aircraft fuel storage.

Facility requirements which require a fundamental evaluation in order to determine an optimum site location, layout configuration and in meeting other considerations, are documented in the following Alternatives Chapter. Reference the Airport Layout Plan (ALP) drawings for the most feasible facility requirement depiction.

Table 5-20
FACILITY REQUIREMENTS SUMMARY

Facility Requirement	Existing (2010)	2015 (5-year)	2020 (10-Year)	2030 (20-Year)
AIRFIELD				
Runway 9/27:				
ARC Category	D-V	D-V	D-V	D-V
Critical Planning Aircraft	MD-80	MD-80	B-757	Boeing 747F
Design Aircraft	Boeing 747F	Boeing 747F	Boeing 747F	Boeing 747F
Runway Numbers	9-27	9-27	9-27	9-27
Length x Width	10,162' x 150'	11,162' x 150'	11,162' x 150'	11,600' x 150'
Paved Shoulders	40'	35' to 40'	35' to 40'	35' to 40'
Overrun/Blast Pad	9: 400' x 220' [27: N/A	9 & 27: 400' x 220'	9 & 27: 400' x 220'	9 & 27: 400' x 220'
Strength (Gear Type)	650,000 (DTWG)	650,000 (DTWG)	± 700,000 (DTWG)	± 700,000 (DTWG)
Lighting	HIRL, CL, TDZ	HIRL, CL, TDZ	HIRL, CL, TDZ	HIRL, CL, TDZ
Runway Aids	ILS (Cat I and II), ALSF-2, MALSR< Centerline, TDZL, PAPI-4L, RNAV (GPS)			
Approach Type	Precision (CAT I & II)	Precision (CAT I & II)	Precision (CAT I & II)	Precision (CAT I & II)
Taxiway System	A', 'B', 'E'	A', 'B', 'E'	A', 'B', 'E'	A', 'B', 'E'
Taxiway Design Group	GROUP 6	GROUP 6	GROUP 6	GROUP 6
Taxiway Width / Shoulder	75' / 35' (TXY A, B)	75' / 35' (TXY A, B)	75' / 35' (TXY A, B)	75' / 35'
Taxiway Edge Lighting	MITL	MITL	MITL	MITL
Runway 3/21				
ARC Category	C-III (<150,000 LBS.)	C-III (<150,000 LBS.)	C-III (<150,000 LBS.)	C-III (+150,000 LBS.)
Critical Planning Aircraft	Gulfstream IV/V	CRJ-900 / EMB 170	CRJ-900 / EMB 170	B-737
Design Aircraft	MD-80 / B-737	MD-80 / B-737	B-737	B-737
Length x Width	5,718' x 150'	7,000' x 100' to 150'	8,000' x 100' to 150'	8000' x 150'
Paved Shoulders	35' (Partial)	25' (RECOMMEND)	25' (RECOMMEND)	25'
Overrun/Blast Pad	NONE	200' x 140'	200' x 140'	200' x 200'
Strength (Gear Type)	361,000 (DTWG)	± 150,000 (DWG)	± 150,000 (DWG)	± 150,000 (DWG)
Edge Lighting	HIRL	MIRL or HIRL	MIRL or HIRL	MIRL or HIRL
Runway Aids	PAPI-4 [PAPI-4 [REIL	PAPI-4 [PAPI-4 [REIL	PAPI-4 [REIL	PAPI-4 [REIL
Approach Type	Non-Precision-APV (GPS)	Precision (GPS)	Precision (GPS)	Precision (GPS)
Taxiway System	C', 'D', 'F'	C', 'D', 'F'	C', 'D', 'F'	C', 'D', 'F'
Taxiway Design Group	GROUP 3	GROUP 3	GROUP 3	GROUP 3
Taxiway Width / Shoulder	50' to 75' / NONE	50' to 75' / NONE	50' to 75' / NONE	50' to 75' / NONE
Taxiway Edge Lighting	MITL	MITL	MITL	MITL
Taxiway Standards		Resolve Hot Spot locations along Taxiways: A5, A, C, E, E1, and E2. TXY 'A' Runway to Taxiway Centerline: 500' TXY 'C' Runway to Taxiway Centerline: 400'		
NAVIGATIONAL AIDS				
Airport NAVAIDS	VORTAC (H), TACAN, ILS (CAT I & II), NDB, MARKER BEACONS, RVR			
Weather System	AWOS-3	AWOS-3	AWOS-3	AWOS-3

Note: See appendix for abbreviations. Note: Runway 9-27 length for 5 to 10 year planning period reflects the conversion of the 1,000-foot in-line Taxiway E Section.				
TERMINAL AND GENERAL AVIATION REQUIREMENTS				
Terminal Building Square Feet	114,000	114,000	114,000	114,000
Gates	4	4	4	4
Terminal Curb front (Linear Feet)	750	750	750	750
Auto Parking Spaces				
Short Term	88	-	-	-
Long Term	794	710	710	710
Premium	-	225	225	225
Employee	180	190	190	190
Rental Car	277	233	233	265
Cell Phone	14	14	14	14
Total	1,353	1,372	1,372	1,404
General Aviation Hangar Requirement Square Feet	179,800	204,300	224,300	253,900

CHAPTER 6
IDENTIFICATION AND EVALUATION OF ALTERNATIVES

This chapter identifies and evaluates development alternatives for the Duluth International Airport to satisfy the Airport Facility Requirements described in the previous chapter, and to achieve the Airport's strategic goals for future facility improvements. The most feasible airfield, terminal area and landside alternatives analyzed in this chapter form the 20-year Master Plan Improvement Program.

Overall, the alternatives analysis process closely follows the guidance provided by FAA Advisory Circular 150-5070-6B *Airport Master Plans*, is developed in accordance with FAA and Mn/DOT airport safety standards, and seeks consistency with Airport ordinances and local regulations. As the formulation of a design recommendation rather than the presentation of a development policy, the alternatives analyses provides the technical basis for arriving at a single, most feasible development concept to carry forward as part of the Airport's Capital Improvement Program and updated Airport Layout Plan (ALP) drawings.

6.1 SUMMARY OF ALTERNATIVES

The alternatives assessment is an iterative planning process, a strategic approach to document and illustrate the agreed-to concept of how future development will take form at the Airport. While the assessment of alternatives is based largely on physical merits, professional judgment, and shaped by stakeholder opinion, it is recognized that the most favorable development option should align with the Airport's strategic vision, and in-step with local planning and stakeholder coordination.

The following are the primary alternatives identified in this chapter:

6.2 Airfield Alternatives
6.3 Taxiway Alternatives
6.4 Terminal and Landside Alternatives

6.2 AIRFIELD ALTERNATIVES

The airfield alternatives section assesses the range of various runway and taxiway layouts best suited to accommodate the recommended facility requirements, along with resolving non-standard geometry and airspace issues identified in the previous chapter. The following summarizes the major airfield alternatives and layout options addressed in this chapter:

Alternatives Analysis:

- Resolve Runway 27 In-Line Taxiway 'E' and connecting Taxiways A5, E1 and E2
- Runway 3-21 and taxiway extension

Layout Options:

- Reconfigure Taxiway A, as linear parallel taxiway
- Reconfigure Taxiway C, as linear parallel taxiway
- Extend Taxiway B system
- Reconfigure Taxiway F

6.2.1 Runway 27 (In-Line Taxiway 'E') Alternative

The 1,000 foot in-line Taxiway 'E' is no longer an acceptable FAA geometry, and must be mitigated as part of the master plan recommendations. The options and ability to resolve the in-line taxiway have become more feasible with the closure of the access drive once extending beyond the Runway 27 end. The Runway 27 threshold/end was previously relocated 1,000 feet to satisfy Runway Safety Area (RSA) standards. The former Air National Guard access road (Haines Road/Phantom Drive) located beyond about 250 feet beyond the Runway 27 pavement has since been closed and converted to a secured access for navigational aids. The road and terrain were the RSA factors in the relocation of the Runway 27 end.

Runway 27 (In-Line Taxiway 'E') Factors:

Exhbit 6-1 illustratates the major factors invovled as part of this alternative, as listed below:

- Declare the in-line Taxiway E as future 'usable' or 'unusable' runway for takeoff and/or landing - Alternatives are premised on FAA design and airspace standards. Runway 9-27 and associated taxiways are designed to accommodate Group V civilian aircraft, as represented by the Boeing 747F. The application of military design standards may increase the impacts associated with the alternatives

- Proximity to passenger terminal area and MnANG.

- Connections with existing and future taxiways, shoulders and blast pads

- Taxiway geometry - The Runway 27 end contains multiple FAA hotspots, including Taxiways 'E', 'E1', 'E2', and 'A5'. Taxiway 'E1' may require reconfiguration and/or lowering in the event the Runway 27 end is extended in order to conform with Part 77 primary surface grade requirements

- Application of FAA safety areas and separation standards

- Earthwork and grading - The terrain beyond the Runway 27 end slopes downward about 30' to 40' within the first 1,000 feet; from approximately 1,420' to approximately 1,380'. The terrain is a RSA factor in the location of the Runway 27 end

- Environmental impacts - Miller Creek represents protected headwaters of a trout stream. Minnesota environmental standards do not allow construction within 250 feet of Miller Creek due to its environmental classification as protected headwaters

- Airspace clearances - The conversion of the in-line Taxiway E to usable runway could affect the location of airspace surfaces for approach and departure purposes

- Land ownership

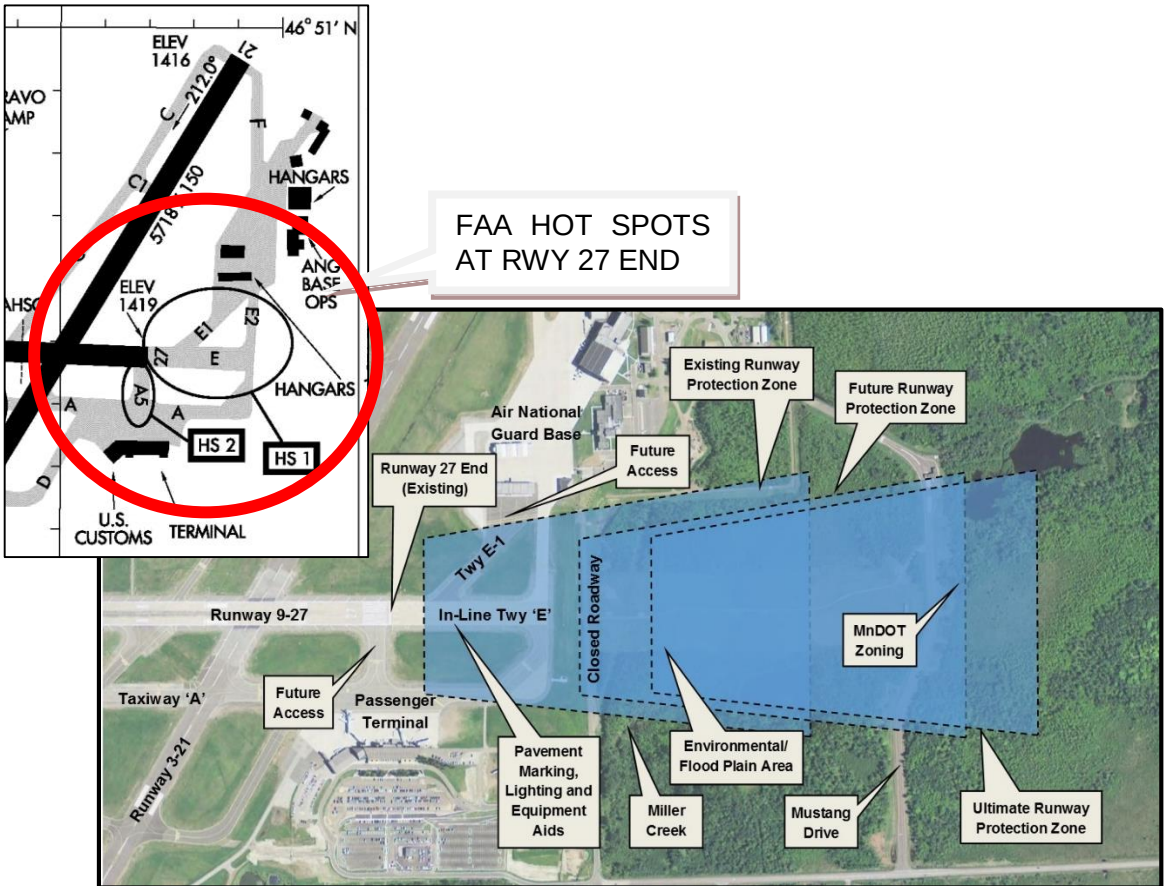
- Application of Mn/DOT safety zones - The conversion of the in-line Taxiway E to usable runway would affect the location of Mn/DOT safety zones (A, B and C)

- Reconfiguration of navigational aids, signage and marking - The Runway 9 localizer, located approximately 2,200' beyond the paved Runway 27 end is expected to be refurbished/replaced, but to remain in its current location

- Impact to precision and non-precision instrument approach procedure

- Aircraft approach and departure flight procedures
- Compatibility with FAA Air Traffic Control visibility, holdshort, and other
- Compatibility with FAA Regional Safety Action Team
- Compatibility with ground operations and vehicle movements
- Construction cost and future maintenance
- Effects on Runway 9-27 pavement reconstruction project

Exhibit 6-1
RUNWAY 27 END GEOMETRY ISSUES AND FACTORS



Source: Aerial Image, June 2010.

Runway 27 (In-Line Taxiway 'E') Alternatives:

The following three alternatives evaluate the recouping of Taxiway 'E' as runway while resolving the non-standard in-line taxiway condition. The alternatives presented in this section are compatible with both FAA Advisory Circular 150/5300-13A: *Airport Design* and United Facilities Criteria 3-260-01: *Airfield and Heliport Planning and Design*.

RWY 27 OPTION A: Convert In-Line Taxiway 'E' (1,000') to Usable Takeoff Runway and Implement Declared Distances for the Runway 27 End. See Exhibit 6-2.

Factors:

- Eliminates in-line taxiway
- Increases Runway 27 takeoff distance by 1,000 feet
- Runway 27 landing threshold remains at same location
- Provides 1,000 foot paved overrun for military operations
- No relocation of ILS navigational aids / no alteration to instrument procedures
- Results in eastward shift in the runway visibility zone (RVZ)
- Apply 600 foot RSA and ROFA length prior to threshold standard
- No change to the holdshort and/or critical hold positions
- No modifications required of the parallel Taxiway 'A' system
- Potentially improves noise footprint within terminal area
- Fill/grading required for paved blast pad
- Change in air traffic control line-of-sight
- Potential environmental considerations associated with wetlands impacts and Miller Creek.
- Limited construction costs
- Limited implementation timeframe

Declared Distances:

RWY 27 OPTION A - DECLARED DISTANCES

Runway End	TORA	TODA	ASDA	LDA	Stopway / Clearway
Runway 9	10,162	10,162	10,162	10,162	0' / 0'
Runway 27	11,162	11,162	11,162	10,162	0' / 0'

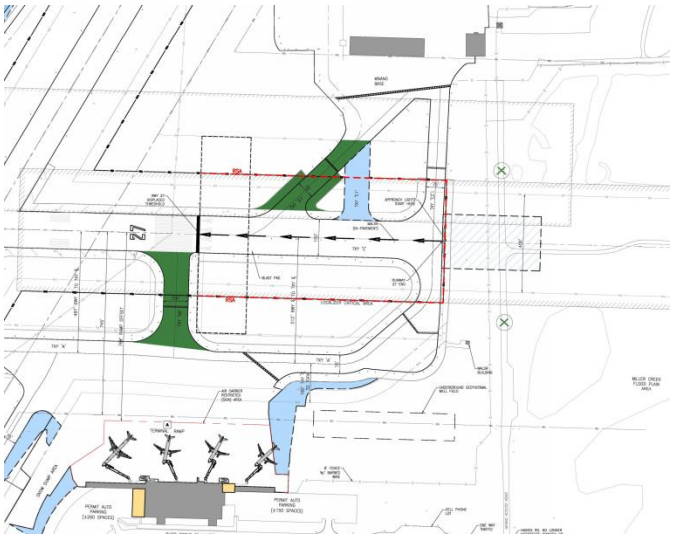
TORA - TAKEOFF RUN AVAILABLE | TODA - TAKEOFF DISTANCE AVAILABLE
ASDA - ACCELERATE STOP DISTANCE AVAILABLE | LDA - LANDING DISTANCE AVAILABLE

Project Improvements:

- Deactivate Taxiway 'A5' (FAA Hot Spot)
- Deactivate or reconfigure-lower Taxiway 'E1' (FAA Hot Spot)
- Construct paved blast pad (400' beyond x 220' wide)
- Rehabilitate Runway 27 end pavement (1,000' x ±150')
- Modify portion of Runway 27 MALSR approach light units through paved blast pad
- Relocate Runway 27 PAPI-4L
- Reconfigure runway high intensity edge/threshold lights (FAA AC 150/5340, Figure 9)
- Reconfigure runway signage and distance-to-go markers
- Remark Runway 27 end (runway and shoulders)
- Realign portion of NAVAID access route
- Realign fencing
- Shift of Part 77 imaginary surfaces
- Possible shift/extension of Mn/DOT Land Use Safety Zones (A, B and C)
- Possible relocation of the military BAK arresting system

- Possible tree/vegetation clearing beyond Runway 27 end

Exhibit 6-2
RUNWAY 27 – OPTION A



RWY 27 OPTION B: Convert In-Line Taxiway 'E' (1,000') to Unrestricted Runway Length. See Exhibit 6-3.

Factors:

- Repositions Runway 27 end
- Eliminates in-line taxiway
- Does not invoke declared distances, improves pilot awareness
- Does not provide 1,000' foot paved overrun for military operations
- Increases Runway 27 takeoff and landing distance by 1,000 feet
- Runway Safety Area (RSA) earthwork
- Relocation of ILS navigational aid equipment
- Alters Runway 27 and 9 instrument approach procedures
- Results in eastward shift in the runway visibility zone (RVZ)
- Change to the holdshort and/or critical hold positions
- Change in air traffic control line-of-sight
- No modifications required of the parallel Taxiway 'A' system
- Potentially improves noise footprint within terminal area
- Substantial environmental considerations (Miller Creek)
- Substantial construction costs
- Substantial implementation timeframe

Declared Distances:

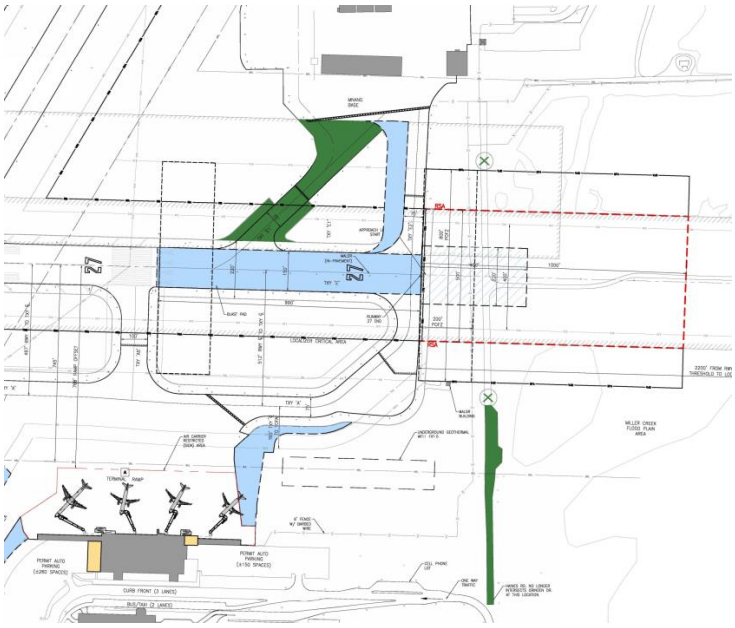
RWY 27 OPTION B - DECLARED DISTANCES					
Runway End	**TORA**	**TODA**	**ASDA**	**LDA**	**Stopway / Clearway**
Runway 9	11,162	11,162	11,162	11,162	0' / 0'
Runway 27	11,162	11,162	11,162	11,162	0' / 0'

TORA - TAKEOFF RUN AVAILABLE | TODA - TAKEOFF DISTANCE AVAILABLE
ASDA - ACCELERATE STOP DISTANCE AVAILABLE | LDA - LANDING DISTANCE AVAILABLE

Project Improvements:

- Fill/grade for Runway Safety Area (RSA) dimension of 1,000’ (beyond) x 500’ (wide)
- Deactivate/remove Taxiway ‘A5’ (FAA Hot Spot)
- Deactivate/remove Taxiway ‘E1’ (FAA Hot Spot)
- Widen Taxiway ‘E2’ (FAA Hot Spot)
- Construct paved blast pad (400’ beyond x 220’ wide)
- Rehabilitate Runway 27 end pavements (1,000’ x ±150’)
- Relocate Runway 27 ILS glideslope equipment
- Relocate Runway 27 MALSR approach lighting equipment
- Relocate Runway 27 PAPI-4L
- Reconfigure runway high intensity edge/threshold lights (FAA AC 150/5340, Figure 7)
- Reconfigure runway signage and distance-to-go markers
- Remark Runway 27 end (runway and shoulders)
- Realign portion of NAVAID access route
- Realign/install new airfield fencing
- Shift of Part 77 imaginary surfaces, TERPS surfaces, RPZ, POFZ, Departure Surface
- Aeronautical study for change to instrument and possible air traffic procedures
- Shift/extension of Mn/DOT Land Use Safety Zones (A, B and C)
- Possible relocation of the military BAK arresting system
- Potential land/avigation easement acquisition beyond Runway 27 end
- Tree/vegetation clearing beyond Runway 27 end

Exhibit 6-3
RUNWAY 27 – OPTION B



RWY 27 OPTION C: Remove In-Line Taxiway 'E' and Adjoining Taxiways. See Exhibit 6-4.

Factors:

- Eliminates in-line taxiway
- Inefficient taxiway configuration for Air National Guard access
- Runway 27 end remains at same location - no change in Runway 27 takeoff or landing distance
- Provides paved overrun for military operations
- No relocation of ILS navigational aids / no alteration to instrument procedures
- No change in the runway visibility zone (RVZ)
- Alters parallel Taxiway 'A' entrance system
- No fill/grading required beyond runway end
- No change in air traffic control line-of-sight
- Limited environmental considerations / moderate construction costs

Declared Distances:

RWY 27 OPTION C - DECLARED DISTANCES

Runway End	TORA	TODA	ASDA	LDA	Stopway / Clearway
Runway 9	10,162	10,162	10,162	10,162	0' / 0'
Runway 27	10,162	10,162	10,162	10,162	0' / 0'

TORA - TAKEOFF RUN AVAILABLE | TODA - TAKEOFF DISTANCE AVAILABLE
ASDA - ACCELERATE STOP DISTANCE AVAILABLE | LDA - LANDING DISTANCE AVAILABLE

Project Improvements:

- Remove portion of Taxiway 'E'; Remove Taxiway 'E1' and 'E2' (FAA Hot Spot)
- Rehabilitate paved blast pad (400' beyond x 220' wide)

- Remove existing Taxiway 'A' entrance system
- Construct new northside taxiway entrance system

Exhibit 6-4
RUNWAY 27 – OPTION C

Mn/DOT Zoning Considerations:

The 1988 Duluth International Zoning Ordinance prescribes the Mn/DOT Safety Zones (A, B and C) for the Runway 27 end based on a precision instrument approach to the existing 1,000-foot in-line taxiway configuration. It should be noted that the 1988 Safety Zone 'A' boundary for the Runway 9 and 27 ends have been modified from Mn/DOT standards to coincide with property ownership boundaries, roadway and political boundaries.

Exhibit 6-5 depict the standard Mn/DOT Zone A and B dimensions and boundaries associated with the conversion of the inline Taxiway 'E' as usable pavement, and the identification of residences and businesses within the Zone A, as compared with the 1988 Zoning Ordinance. It should also be noted that Mn/DOT is also considering zoning statute changes that may not require substantial changes from existing zoning already in place across the state.

Runway 27 (In-Line Taxiway 'E') Alternative Recommendation:

Following a consideration of factors involved, Option A was selected by the Airport as the most feasible preferred development concept. In addition, the alternatives were vetted with the Air National Guard, in which Alternative A was viewed as the most feasible option. The following factors were a consideration in the desire to proceed with Option A:

- Resolves the FAA runway and connecting taxiway geometry issues, although invoking declared distances for a displaced (landing) Runway 27 threshold.

- Improves aircraft circulation and pilot awareness for the Runway 27 end. Permits more effective air traffic control utilization, including intersection takeoffs and landing

hold short operations. Provides a safer and more efficient entry and exit points between the runway and terminal locations.

- Provides a means to improve airspace clearances at the Runway 27 approach end, and lateral airspace clearance for the passenger terminal area and Air National Guard complex.

- By virtue of the conversion of Taxiway 'E' to usable runway length, the Runway 9-27 length is increased to 11,162 feet, which nearly achieves the future Runway 9-27 recommended runway length of 11,600 feet. This preserves runway length for Airport opportunities, including FBO fuel Techstops, the MRO tenant, and future Air National Guard missions. It should be noted that any consideration for extension of the Runway 9 end as a means to restore or recoup Runway 27 in-line Taxiway 'A' length was not considered as part of this alternatives analysis.

- Allows greater flexibility and segmentation of pavement surfaces use during periods of runway maintenance, snow removal, heavy flight training, and military operations.

- Minimizes costs and environmental implications associated with navigational and equipment relocation, and grading beyond the Runway 27 end. The high level environmental evaluation indicated that Alternative A would have less environmental impact compared with Alternative B. It should be noted that the alternatives analysis focused on the physical aspects of the options, and did not include a full analysis of all environmental, economic and costs aspects.

Runway 27 (In-Line Taxiway 'E') Alternative Evaluation:

The Runway 27 (In-line Taxiway E) alternatives were further evaluated per FAA AC 150/5070-6B, Paragraph 904 *Evaluation of Alternatives*. The AC outlines four general categories to evaluate the most feasible alternative: Operational Performance, best planning tenets and other factors, environmental factors, and fiscal factors. The alternative was evaluated for each of the general categories

- Operational Performance – This category evaluates the criteria from several perspectives including capacity, capability, and efficiency.
  - Option A was determined to have the highest capability to meet the goals of the project and the highest efficiency for the taxiway system.
- Best Planning Tenets and Other Factors – This Category evaluates the alternatives strengths and weaknesses such as safety and security, growth beyond the planning horizon, conforms to the airport sponsor's strategic vision, flexible to change, satisfies user needs, etc.
  - Option A was determined to meet the best planning tenets for the airport providing a balance of capacity and flexibility to meet demand beyond the planning period.
- Environmental Factors – This category evaluates the alternative for potential environmental effects. The three alternatives were evaluated on a high level basis for each of the environmental factors that were determined to be in the airport environment. The alternatives evaluation is shown in *Table 6-1*.

Table 6-1
Runway 27 (In-Line Taxiway 'E') Environmental Evaluation

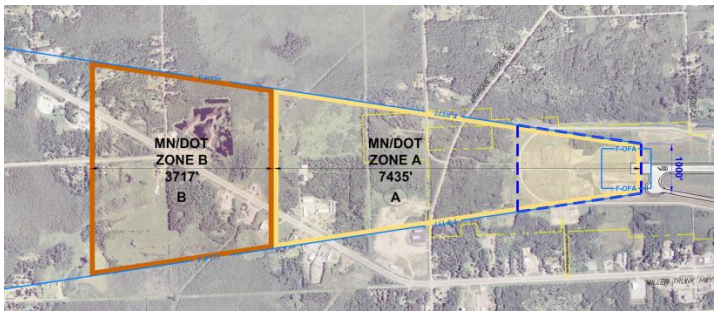
Category	Evaluation
Compatible Land use	Alternative is within the airfield system
Construction Impacts	Minimal impacts due to the project being compeltly on airport property
Fish, Wildlife, and Plants	Possible tree/vegetation clearing beyond Runway 27 end
Floodplains	Alternative is within the airfield system
Hazardous Materials, Pollution Prevention, and Solid Waste	Alternative is not adding capacity or changing operations
Light Emissions and Visual Impacts	Alternative is not adding capacity or changing operations
Natural Resources and Energy Supply	Alternative is not adding capacity or changing operations
Noise	Alternative is not adding capacity or changing operations
Secondary (Induced)	Alternative is not adding capacity or changing operations
Socioeconomic, Environmental Justice, and Children's Environemntal Health and Safety Risks	Alternative is entirely on airport property
Wetlands	Alternative is within the airfield system

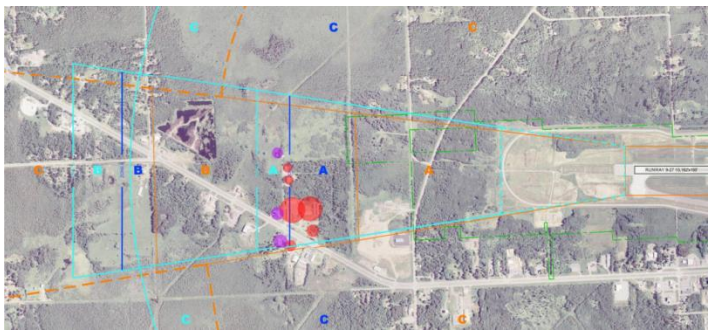
- Fiscal Factors – This category evaluates the alternative based on rough cost estimates.

  It was determined that Option A had limited construction costs when compared with the other developed alternatives.

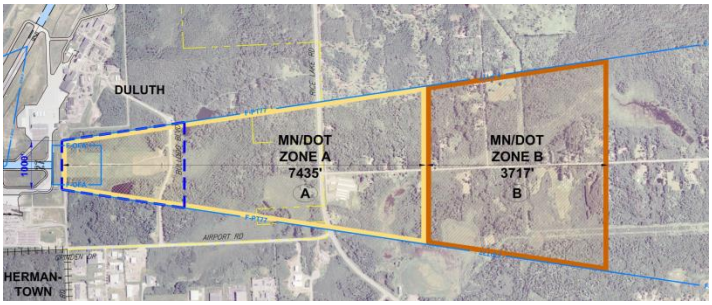
Exhibit 6-5
RUNWAY 9 & 27 – Mn/DOT Zoning

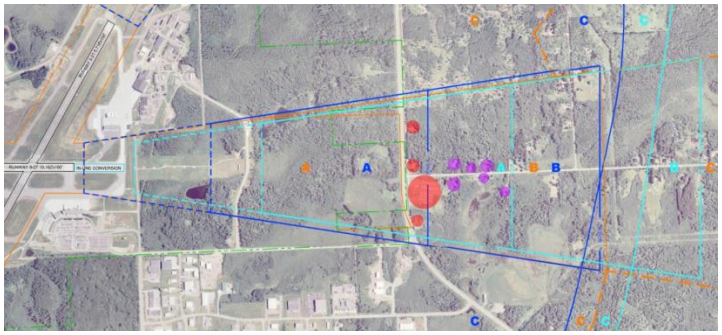
RUNWAY 9 END





RUNWAY 27 END





6.2.2 Runway 3-21 Length Alternatives

The facility requirements section identifies the extension of Runway 3-21 to a future interim length of 7,000 feet, and an ultimate strategic length of 8,000 feet to accommodate transports associated with commercial passenger service, large cargo transport aircraft affiliated with FBO Techstop traffic, and by the Minnesota Air National Guard (MNANG) for serving the mission based in Duluth.

Runway 3-21 Planning Considerations:

The following outlines the major considerations invovled as part of extending Runway 3-21:

- Runway 3-21 is a commercial service runway intended to accommodate FAA ARC C-III aircraft as represented by the CRJ-900, Embraer 170/190, Boeing 737 and MD-80. For planning and design purposes, the Runway 3-21 FAA design standards and Mn/DOT non-utility role remain the same for existing and future conditions.

- Runway 3-21 is to continue serving as a secondary commercial service runway, and as an alternate landing and departing runway during periods when the primary Runway 9-27 is non-operational. As calculated from recorded weather data observations, Runway 3-21 is required to serve all aircraft during periods existing on approximately 126 days per year (35 percent of the time) due to the combination of wind, visibility/ceiling conditions, and otherwise during periods of the day when the primary Runway 9-27 experiences snow, slush and ice contamination and routine closure due to maintenance and repair.

- Runway 3-21 is recommended as a future precision instrument runway using satellite GPS technology, with a precision instrument procedure with positive vertical guidance planned to the Runway 21 end and an approach lighting system contemplated. Currently, Runway 3-21 is a non-precision instrument approach with vertical path guidance (LPV approach), with visibility

minimums as low as 1½ miles on the Runway 3 end and 1-mile on the Runway 21 end. As a future precision runway, the Part 77 imaginary airspace approach surface and clearances become more stringent. Also, by Mn/DOT standards, any runway of 5,000 feet or more should be planned to precision capabilities, which influences the Mn/DOT Clear Zone and Mn/DOT Safety Zone A and B dimension.

- As a planned future precision instrument runway serving commercial ARC C-III aircraft, a full length parallel taxiway system is required by FAA design standards. It is recommended Taxiway 'C' be shifted/relocated/extended to a future 400' runway-to-taxiway centerline separation.

- The Runway 3-21 alternatives only considered options along the existing runway alignment, and did not contemplate relocation or realignment of the runway for several important reasons. One the wind data indicates that the current alignment of the runway is optimum for reducing crosswind to aircraft operations. Secondly, any consideration of a runway alignment other than existing Runway 3-21 would require the relocation of substantial airfield development. As identified on the Airport Diagram, Exhibit 3-2, the intersection of Runway 9-27 and Runway 3-21 divides the airport into quadrants. Any shift in the alignment of Runway 3-21 to the east would intuitively induce considerable expense in either impacting the terminal area and taxiway system on the Runway 3 end or Taxiway 'C" and the taxiway connections to the MNANG on the Runway 21 end. Any shift in the alignment of Runway 3-21 to the west would several impact the air cargo area on the Runway 3 end and the MNANG apron and taxiway connections on the Runway 21 end.

- Due to infrastructure, airport property ownership, and the existing land uses to the south of Runway 3-21, the future runway extensions were only considered along the north Runway 21 end.

- Consideration of potential Airport developments planned in the northwest quadrant (north of Taxiway 'B').

- Exiting military use as a taxiway and limited touch and go runway, and potential military use as a usable runway for landing and takeoffs.

Runway 3-21 Extension Factors:

The following outlines the major physical site and land use factors associated with the planned Runway 3-21 extension to the northeast:

- Airport zoning is currently reflected by the 1988 Duluth Airport Zoning Ordinance document. This ordinance provides Runway 3-21 with Mn/DOT Safety Zone standards based on a precision instrument approach, as the result of the runway being longer than 5,000 feet.

  The Mn/DOT Safety Zone A and B dimension coincides with the FAA Part 77 inner approach surface, while the inner portion of the Safety Zone A dimension corresponds with the Mn/DOT Clear Zone boundary, which also coincides with the FAA Runway Protection Zone (RPZ) dimension. Mn/DOT policy requires the Airport fee ownership of Clear Zones, similarly in which the FAA design standards recommend airport ownership of the entire Runway Protection Zones (RPZ). Use restrictions for Mn/DOT Zone A extend two-thirds of the existing or planned runway length, as generally regulated by type of development. Use restrictions for Mn/DOT Zone B extend one-third of the existing or planned runway length, as generally regulated based on building densities. The following lists the Mn/DOT Safety Zone lengths:

1988 Duluth Zoning Ordinance:

- Runway 03: Zone A Length = ±3,100' / Zone B Length = ±1,785'
- Runway 21: Zone A Length = ±4,500' / Zone B Length = ±1,990'

Mn/DOT Standards at Existing 5,718' Length:

- Runway 03: Zone A Length = 3,812' / Zone B Length = 1,906'
- Runway 21: Zone A Length = 3,812' / Zone B Length = 1,906'

Mn/DOT Standards for 7,000' Interim Planned Length:

- Runway 03: Zone A Length = 4,667' / Zone B Length = 2,333'
- Runway 21: Zone A Length = 4,667' / Zone B Length = 2,333'

Mn/DOT Standards for 8,000' Ultimate Planned Length:

- Runway 03: Zone A Length = 5,333' / Zone B Length = 2,667'
- Runway 21: Zone A Length = 5,333' / Zone B Length = 2,667'

Note: Zone A is the primary emphasis of the Runway 3-21 extension analysis. Zone B was not fully assessed due to unknown site and building density conditions.

Note: The 1988 Ordinance called for the relocation of the Runway 3 threshold 750 feet northeast to remove existing development from the area impacted by the Zone A restrictions, however, this runway relocation did not occur.

- Taxiway access to the Runway 21 end along Taxiway 'C' is occasionally restricted to only Category A and B aircraft due to the non-standard runway-to-taxiway centerline separation. Taxiway access to the Runway 3 end along Taxiway 'C' is constrained by the air cargo ramp.

- Runway Visibility Zone (RVZ) line-of-sight standards between Runway 3-21 and Runway 9-27.

- Northeast of Runway 3-21 is a deactivated Western Lake Superior Sanitary District landfill with a top elevation of about 1,475 feet; about 60 feet above the Runway 21 end elevation. There are no known airspace obstruction impacts associated with the Runway 3-21 options, aside from the typical grading and tree clearing requirements.

- Paved airfield perimeter road beyond the Runway 3 and 21 ends.

- Environmental considerations beyond the Runway 3 and 21 ends.

Summary of Runway 3-21 Extension Options:

The Runway 3-21 extension options (A, B, C, D and E) each reflect an ultimate 8,000 foot length, and have been developed in response to accommodating the Mn/DOT Safety Zones with minimal impact. The options assess various combinations of displaced thresholds and relocated runway ends using standard and non-standard Mn/DOT zone lengths in order to achieve an optimal land use condition for the future Runway 3 and 21 ends. The following is a brief discussion and corresponding exhibit of the five Runway 3-21 options (A, B, C, D and E) under consideration:

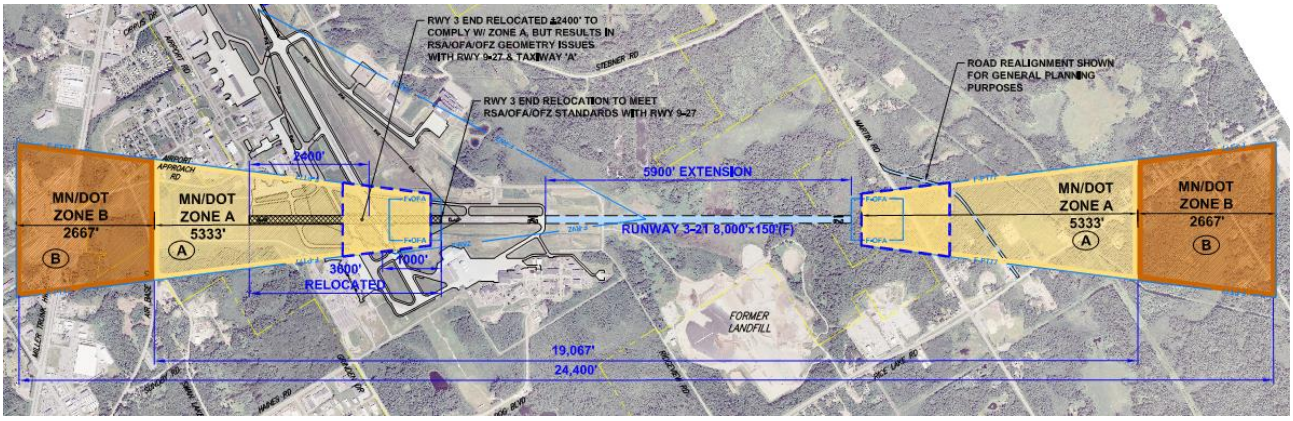
OPTION A: Relocate Runway 3 end 3,600'; 5,900' Runway 21 extension
OPTION B: Displace Runway 3 end 750'; 2,282' Runway 21 extension
OPTION C: Relocate Runway 3 end 750'; 3,032' Runway 21 extension

OPTION D: Displace and Relocate Runway 3 end a total of 1,400'; 3,032' Runway 21 extension
OPTION E: Maintain Runway 3 end; 2,282' Runway 21 extension

Exhibit Depiction: Runway Extension (blue hatch)
Mn/DOT Zone A (yellow hatch)
Mn/DOT Zone B (orange hatch)
Mn/DOT Clear Zone (blue dashed)

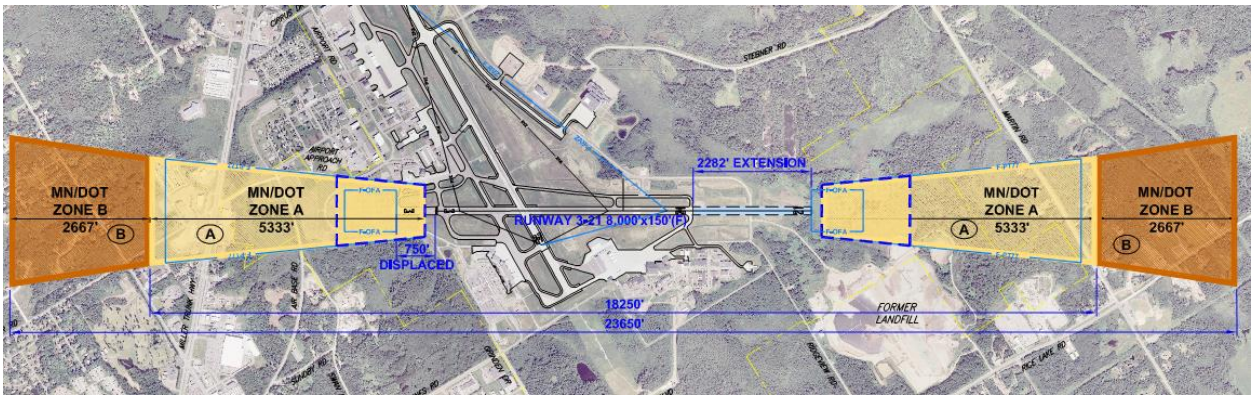
Runway 3-21 OPTION A: Involves the relocation of the Runway 3 end 3,600 feet to the northeast in an attempt to provide for full Mn/DOT Zone A conformance, which also includes locating the Runway 3 end 1,000 feet beyond the Runway 9-27 centerline to meet FAA Runway Safety Area (RSA), Object Free Area (OFA), and Object Free Zone (OFZ) standards. This requires a Runway 21 extension of 5,900 feet to obtain a future 8,000-foot length. This option results in extensive on and off-Airport infrastructure and roadway improvements, substantial property acquisition, and penetrations to the future Runway Visibility Zone (RVZ) between the Runway 21 end and Runway 9-27. This option would still likely require a variation to the Mn/DOT Safety Zone standards. See Exhibit 6-6.

Exhibit 6-6
RUNWAY 3-21 8,000' LENGTH – OPTION A



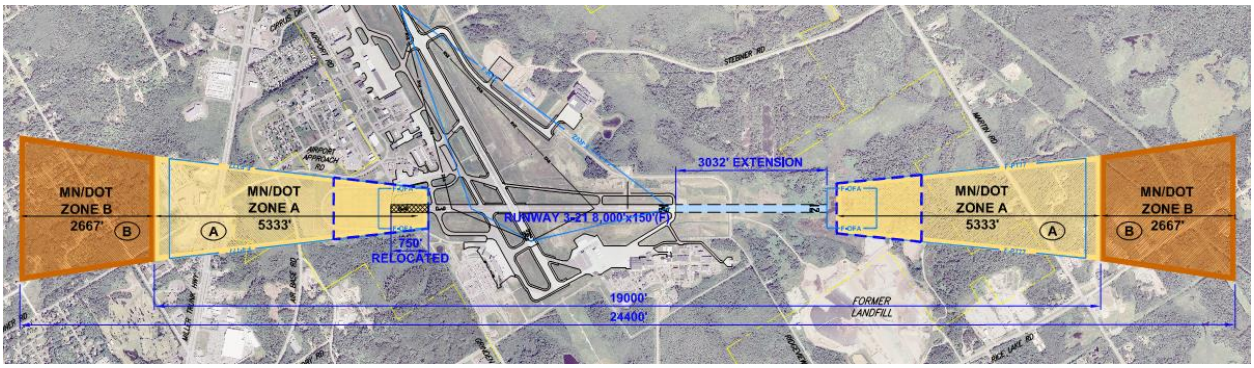
Runway 3-21 OPTION B: Involves the displacement of the Runway 3 end by 750 feet and extension of the Runway 21 end by 2,282 feet to achieve a future 8,000-foot length. The displaced threshold would shorten the Runway 3 landing distance available (LDA). The 750-foot distance coincides with prior zoning considerations to remedy land developments beyond the Runway 3 end. Geometrically, the proposed Runway 3 end displacement coincides with Taxiway 'D' as a future entry taxiway. This option would require a variation to the Mn/DOT Safety Zone standards. See Exhibit 6-7.

Exhibit 6-7
RUNWAY 3-21 8,000' LENGTH – OPTION B



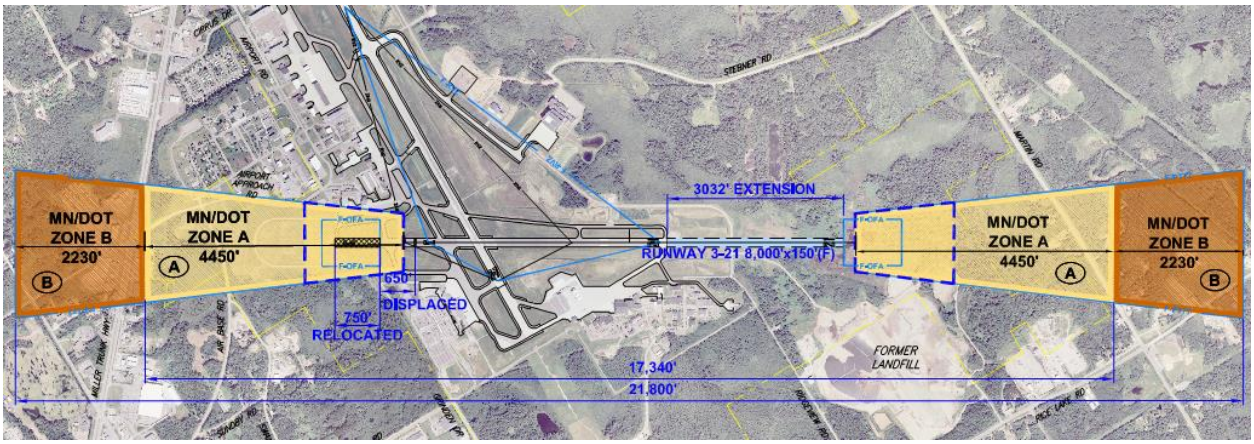
Runway 3-21 OPTION C: Involves the relocation of the Runway 3 end by 750 feet and extension of the Runway 21 end by 3,032 feet to achieve a future 8,000-foot length, including recouping the relocated 750 foot Runway 3 end. The 750 feet beyond the Runway 3 end could not be used for landing or takeoff, but could be converted into a paved blast pad. The 750-foot distance coincides with prior zoning considerations to remedy land developments beyond the Runway 3 end. Geometrically, the Runway 3 end coincides with Taxiway 'D' as a future entry taxiway. See Exhibit 6-8.

Exhibit 6-8
RUNWAY 3-21 8,000' LENGTH – OPTION C



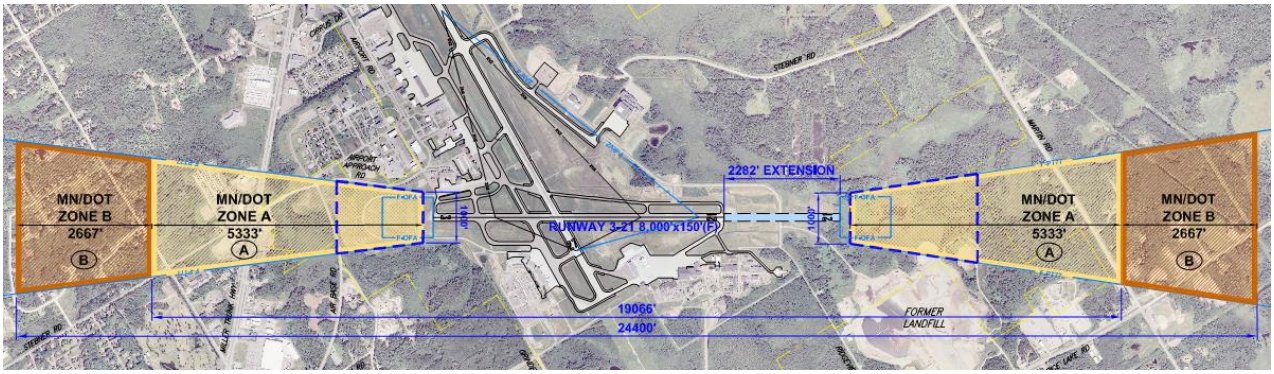
Runway 3-21 OPTION D: Involves a combination of displaced thresholds and relocated runway end criteria to the Runway 3 end to obtain a future 8,000' runway length. This entails relocating the Runway 3 end 750 feet in addition to displacing the Runway 3 end another 650 feet (1,400 feet from the existing Runway 3 end) and extending the Runway 21 end 3,032 feet. The displaced threshold would shorten the Runway 3 landing distance available (LDA). The 1,400 foot location was identified in the previous Master Plan as an acceptable Zone A and B distance, in which a safety zone variance could reasonably be sought from Mn/DOT. In this option, the Zone A and B lengths are non-standard for the ultimate 8,000 foot Runway 3-21 length. See Exhibit 6-9.

Exhibit 6-9
RUNWAY 3-21 8,000' LENGTH – OPTION D



Runway 3-21 OPTION E: Involves an extension without displaced threshold and/or relocated Runway 3 end criteria to obtain a future 8,000' runway length. The existing Runway 3 end would remain at the present location, with a 2,282 foot extension to the Runway 21 end. This option does not require a change to the Runway 3 end (lighting, signage, marking, instrument procedures), or recouping runway length as part of the Runway 21 extension. See Exhibit 6-10.

Exhibit 6-10
RUNWAY 3-21 8,000' LENGTH - OPTION E (MOST FEASIBLE)



Most Feasible Runway 3-21 Alternative Recommendation:

The Runway 3-21 extension Option E is the most feasible expansion concept, as per the following assessments and development factors:

+ Does not involve displaced or relocated thresholds, which eliminates change to the Runway 3 end for lighting, marking, signage or instrument procedures, and therefore, does not require recouping usable runway length as part of the Runway 21 extension. This also aids with the future pavement improvements and extension constructability to Runway 3-21.

+ Requires the least runway extension of all options, which minimizes environmental and cost impacts. It should be noted the planned extension would require more formal environmental study prior to construction, including possible noise analysis.

+ The ultimate Runway 3 Mn/DOT Clear Zone remains on existing Airport property. The ultimate Runway 21 Mn/DOT Clear Zone based upon current requirements extends beyond existing Airport property, for an approximate 0.5 acre area.

+ The Runway Visibility Zone (RVZ) northwest of the runway intersection between Runway 21 and Runway 9 involves potential tree (wooded area) encroachments, but no structures.

+ The existing and planned Runway 21 threshold elevation is 1,415.9'. At this elevation, the Part 77 imaginary airspace surfaces (approach and transitional) do not encroach the former landfill northeast of Runway 3-21. The landfill highest top elevation is estimated at 1,475.0 feet mean sea level, a point approximately 4,350 feet from the existing Runway 21 end and 1,350 feet from the ultimate Runway 21 end.

- The Runway 3-21 extension would likely require an update of the 1988 Duluth Airport Zoning Ordinance to bring the existing Runway 3 and future Runway 21 land use safety zones in accordance with currently recommended Mn/DOT standards. It should be noted that the updated ordinance may require a continuation of exemptions, waivers and/or variances to address non-standard compliance items. Mn/DOT coordination (2014) has indicated that land use conditions within existing Zones A and B should not be allowed to worsen with the runway extension. Zone A requirements would be subject to the first 1,000-feet of Zone A length. At the same time, there is a current discussion (2015) of potential Mn/DOT zoning statute changes being discussed and socialized across Minnesota that may not result in substantial zoning changes be required from existing zoning in place at airports across the state.

- The departure surface extending over Taxiway 'C' could present issues with the location of hold short positions east and west of Runway 3-21.

- Taxiway access to the future Runway 21 end from the east presents taxiway geometry issues with Minnesota Air National Guard taxiway facilities. Taxiway 'F' provides the Minnesota Air National Guard Ramp access to the Runway 21 end. The Minnesota Air National Guard's Installation Development Plan recommends realignment of Taxiway 'F' as a future partial parallel taxiway to Runway 21 with a taxiway-to-runway separation of 400 feet, and an additional exit Taxiway to Runway 3-21. The Guard's Development Plan also recommends extending Taxiway 'F' commensurate to any Runway 21 extension.

- The perimeter airfield access road north of Runway 21 would require relocation.

- The alternative is consistent with the FAA Advisory Circular 150/5300-13A, Change 1 and Unified Facility Criteria 3-260-01.

Most Feasible Runway 3-21 Alternative Evaluation:

The Runway 3-21 alternatives were further evaluated per FAA AC 150/5070-6B, Paragraph 904 *Evaluation of Alternatives*. The AC outlines four general categories to evaluate the most feasible alternative: Operational Performance, best planning tenets and other factors, environmental factors, and fiscal factors. The alternative was evaluated for each of the general categories

- Operational Performance – This category evaluates the criteria from several perspectives including capacity, capability, and efficiency.
  The Option E alternative for the extension of Runway 3-21 was determined to have the highest capability to meet the goals of the project and provides the highest efficiency for the runway system.
- Best Planning Tenets and Other Factors – This Category evaluates the alternatives strengths and weaknesses such as safety and security, growth beyond the planning horizon, conforms to the airport sponsor's strategic vision, flexible to change, satisfies user needs, etc.
  The Option E alternative was determined to meet the best planning tenets for the airport providing a balance of capacity and flexibility to meet demand beyond the planning period.
- Environmental Factors – This category evaluates the alternative for potential environmental effects. The five alternatives were evaluated on a high level basis for each of the environmental factors that were determined to be in the airport environment. The evaluation is shown in *Table 6-2*.

Table 6-2
Most feasible Runway 3-21 Alternative Environmental Evaluation

Category	Evaluation
Compatible Land use	The alternative is compatble is land use gudielines
Construction Impacts	Construction may impact nearby communities
Fish, Wildlife, and Plants	Clearning on vegitation and grading will be required off the Runway 21 end
Floodplains	Furthur evaluation will be needed
Hazardous Materials, Pollution Prevention, and Solid Waste	
Light Emissions and Visual Impacts	
Natural Resources and Energy Supply	
Noise	Noise impacts to the community may be impacted due to increased capacity
Secondary (Induced)	Future evaluation will be needed
Socioeconomic, Environmental Justice, and Children's Environemntal Health and Safety Risks	Alteratnive is within airport property
Wetlands	Furthur evaluation will be needed

- Fiscal Factors – This category evaluates the five options based on rough cost estimates.
  It was determined that Option E had the least construction cost when compared with the other developed alternatives.

6.2.3 Options for Temporary Runway During Center Portion of Runway 9/27 Reconstruction

Chapter 5 – Facility Requirements established that the key needs for DLH in the future have to do with runway and taxiway reconstruction and rehabilitation. Much of the envisaged airport development program consists of these types of projects.

This section describes phasing alternatives associated with the center portion of Runway 9/27 reconstruction. As described above, the runway is anticipated to be reconstructed in three phases; Phase I, the east end (approximately 2,800 feet); Phase II, the west end (approximately 2,000 feet); and Phase III, reconstruction of the center portion of the runway of about 6,200 feet. When Phase III is construction, it will be necessary to find an acceptable alternative to keep the airport open. It has not been determined at this time whether the center portion of the runway's reconstruction will require one or two construction seasons to perform due to the unknown nature of the weather conditions for the construction seasons at the time of construction.
The Master Plan considers "keeping the airport open" meaning the provision of 7,000 feet of runway which is a minimum runway length for accommodating commercial and military operations, as determined through detailed interviews with both the airlines the Minnesota Air National Guard. Although 7,000 feet will ensure the airport can remain operational, the reduced runway length may limit some large transport techstop and military aircraft operations as discussed in Chapter 5 – Facility Requirements.

It is anticipated that some portion of Category C aircraft (5% which may be conservative) and Category D aircraft would require some payload reduction to operate on 7,000-feet. In terms of operational levels over the period of 2010-2030, depending upon the point at which this project could occur, approximately 750-1,000 Category C and Category D aircraft operations would be impacted or more, not counting impacts to military air traffic. No estimate is made regarding the potential for impacting military fighter jet or transport aircraft. The fast approaching military aircraft use Runway 9-27 exclusively for arrivals which is the impetus for the ultimate extension of Runway 3-21 to 8,000 feet. It would be assumed that military fighter jet and transport aircraft requiring more than 7,000-feet would not operate at DLH during the period of reconstruction of the center portion of Runway 9-27 even with the extension of Runway 3-21 to 7,000-feet.

There are four options that available to DLH to "keep the airport open". These are:

- Nighttime Closure and Individual Panel Replacement of the Center Portion of Runway 9/27. This option would keep Runway 9/27 operational;
- Extension of Taxiway 'A' for Use as a Temporary Runway in Lieu of Runway 9/27;
- Extension of Taxiway 'B' for Use as a Temporary Runway in Lieu of Runway 9/27; and,
- Extension of Runway 3/21.

Background

Runway 9/27 was constructed in the late 1940's. The pavement structure consists of 10" of Portland Cement Concrete (PCC) on 7" of aggregate base, on a 4" filter course aggregate, on select subgrade fill.

The Pavement Condition Index (PCI) of Runway 9/27 in 2010 ranged from fair to poor on the west end to very good to excellent on the east end of the runway. This represents some of the lowest rated pavement on the runway. Since PCI is a surface rating based on a visual inspection of the

runway, additional testing was done to better determine the condition of the in-place pavement structure.

Pavement cores were taken at various locations on Runway 9/27. American Engineering and Testing conducted an engineering analysis to determine the pavement condition of Runway 9/27. The study included a field investigation of pavement condition and falling weight deflectometer testing of the runway. The results of the investigation are summarized in the "Report of Pavement Testing and Engineering Analysis" dated June 24, 2009.

The findings of the report indicated that the runway concrete panels are on the low side of adequacy in structural strength and load transfer. Large voids exist under the concrete panels in corners where subgrade support needs improvement. It is anticipated that the concrete panels will perform adequately for a limited time period, but structural improvements should be planned in the near future. It is anticipated that the pavement will be beyond is useable life in 5 to 10 years and will require reconstruction.

When Runway 9/27 is reconstructed, phasing needs to be developed to minimize construction impacts to the airport, especially to air carrier operations. Similar to phasing developed during the Runway 9/27 shoulder project, the east and west ends of the runway can be reconstructed while maintaining an 8,000 foot runway. When the center section is reconstructed, runway 9/27 will need to be closed to aircraft traffic.

Runway 9/27 Night Closure Panel Replacement

Without an adequate alternate runway that could be used during reconstruction of Runway 9/27, the only alternative would be night closure and nighttime construction on Runway 9/27. To be able to reopen the runway each morning, panels would need to be replaced with high early strength concrete. No changes in longitudinal or transverse grades would be able to be accommodated by this construction method.

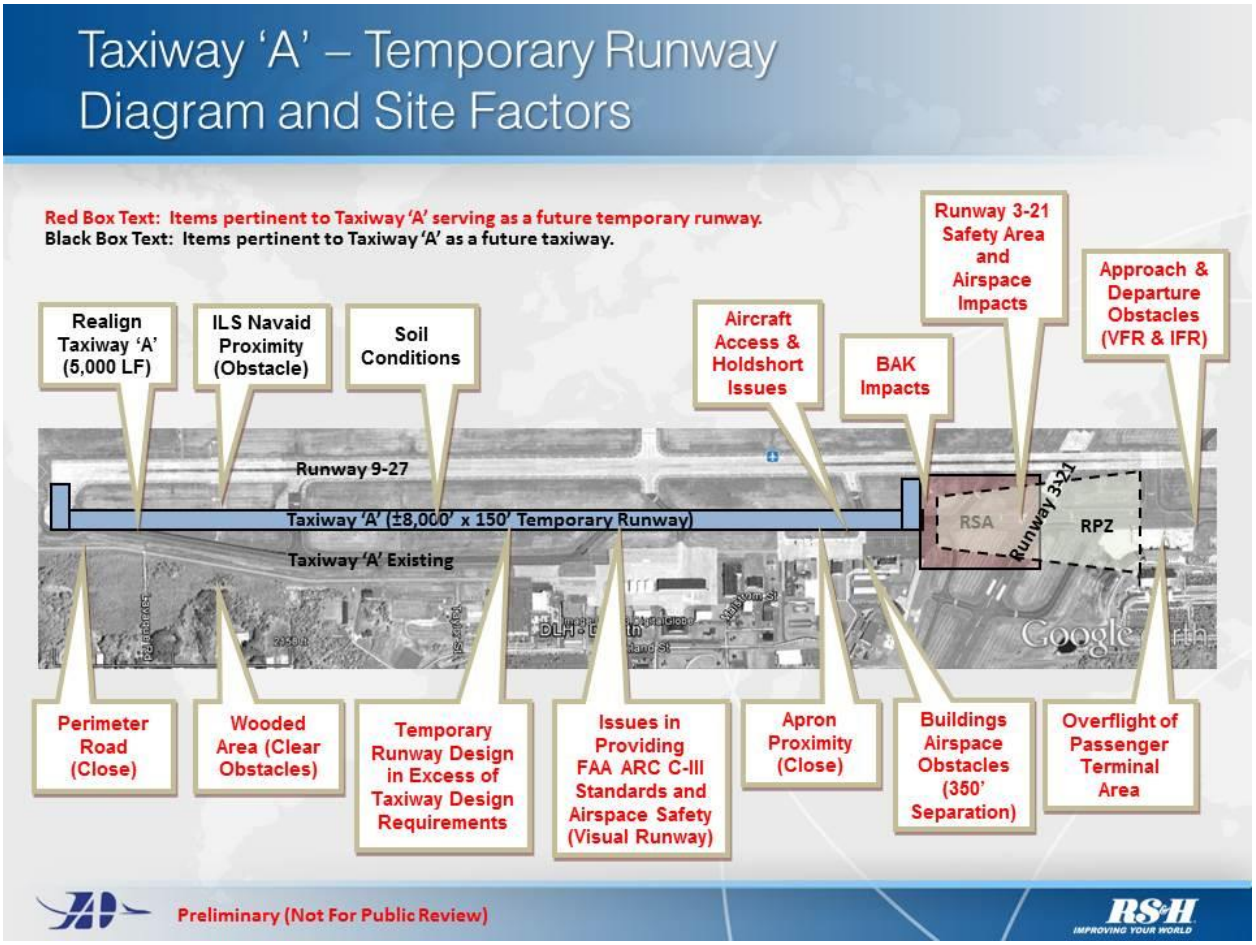
The panel replacement rehabilitation method would not allow for any substantial change in the pavement structure. Running the FAA pavement design software using a thicker concrete panel (14") on the existing base and subgrade material results in less than six months expected pavement life. Additional pavement base corrections would not be possible in the limited overnight construction timeframe. Panel replacement using high early strength concrete would be substantially more expensive and greatly increase the construction time necessary to complete the project. Also, there have been durability issues with high early strength concrete, especially if not constructed properly, which resulted in early failures of the pavement.

A 14 ½" unbounded overlay of the runway would provide the pavement life necessary per FAARFIELD. This would require closure of the runway until the project is completed.

Taxiway 'A' Re-Alignment/Temporary Runway

Taxiway 'A' is currently 75' wide and has an S-curve in the approximate middle of the taxiway. The PCI rating of Taxiway 'A' ranges from Fair to Poor. To meet the requirements of a temporary runway, Taxiway 'A' would need to be strengthened, widened and straightened. Construction of Taxiway 'A' to be used as a temporary runway would require construction of the taxiway in excess of what would be required by taxiway standards. There are many issues associated with this option as shown on the exhibit below.

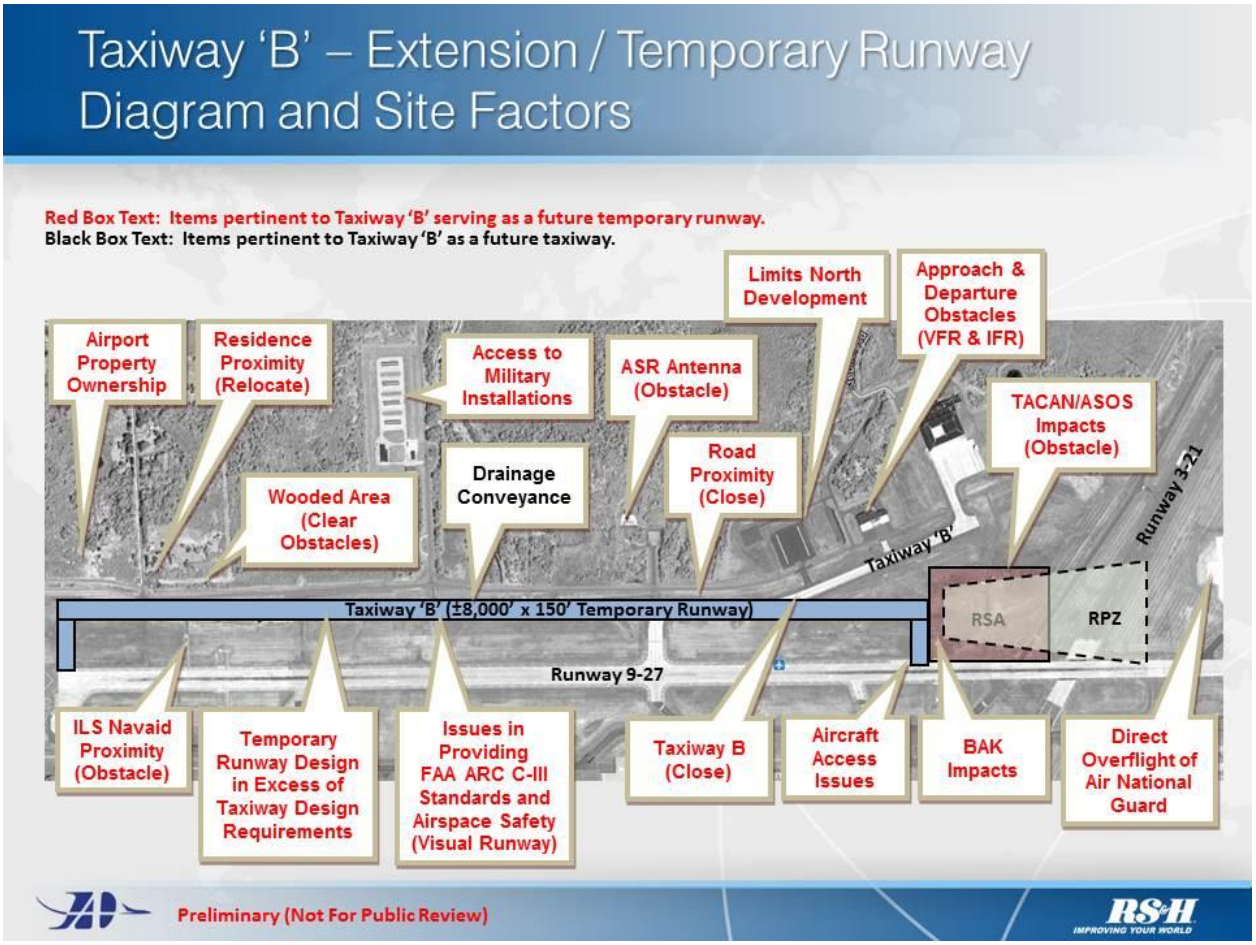
Exhibit 6-11
USE OF TAXIWAY 'A' AS A TEMPORARY RUNWAY



Taxiway 'B' Extension/Temporary Runway

Taxiway 'B' is currently 75' wide with paved shoulders. The PCI rating of the taxiway is very good. To meet the requirements of a temporary runway, Taxiway 'B' would need to be extended to the west. Extension of Taxiway 'B' is shown as future development on the ALP. But building Taxiway 'B' to be able to be used as a temporary runway would require construction of additional taxiway length than what is currently planned and construction of the taxiway in excess of what would be required by taxiway standards. There are many issues associated with this option as shown on the exhibit below.

Exhibit 6-12
USE OF TAXIWAY 'B' AS A TEMPORARY RUNWAY



Extension of Runway 3/21

To meet the 7,000 foot requirement, Runway 3/21 would need to be extended by 1,300 feet. Runway 3/21 is currently 150' wide and the extension would be built to match. To accommodate this, the perimeter road and fence, would also need to be relocated.

Cost Comparison

The costs of the various project alternatives are summarized in the Table 6-3.

Table 6-3
Cost Comparisons of Temporary Runway Options for Center Reconstruction of Runway 9/27

Project	Estimated Cost
Runway 3/21 extension	
Runway Extension	$7,065,000
Taxiway C Extension	$5,485,000
Total	$12,550,000
Taxiway A Conversion to Temp R/W	$49,560,000
Taxiway B Conversion to Temp R/W	$49,133,000
Runway 9/27 Panel Replacement Night Work	$39,427,000
Runway 9/27 Rehab Center Section	$22,800,000

Conclusions

The cost estimates show the most economical project alternative for the Runway 9/27 reconstruction project is the extension of Runway 3/21 followed by a rehabilitation of the center section of Runway 9/27. This alternative also provides the best engineered solution for Runway 9/27, providing a full pavement section to meet the 20 year pavement design life requirement. Also, due to the durability issues, design life expectations, cost increase, and schedule issues, a nighttime closure/panel replacement rehabilitation project should not be considered for Runway 9/27. Reconstruction of Taxiway 'A' or Taxiway 'B' are the most expensive alternative, and still have many operational and obstruction issues associated with them.

Most Feasible Temporary Runway during Runway 9/27 Construction Alternative Evaluation:

Runway 3/21 extension is the most feasible alternative for the Runway 9/27 reconstruction project and was further evaluated per FAA AC 150/5070-6B, Paragraph 904 *Evaluation of Alternatives*. The AC outlines four general categories to evaluate the most feasible alternative: Operational Performance, best planning tenets and other factors, environmental factors, and fiscal factors. The alternative was evaluated for each of the general categories

- Operational Performance – This category evaluates the criteria from several perspectives including capacity, capability, and efficiency.
  The Runway 3/21 extension alternative was determined to have the highest capability to meet the goals of the project and provides the highest efficiency for the runway system as well as the best engineered solution for Runway 9/27.
- Best Planning Tenets and Other Factors – This Category evaluates the alternatives strengths and weaknesses such as safety and security, growth beyond the planning horizon, conforms to the airport sponsor's strategic vision, flexible to change, satisfies user needs, etc.
  This alternative was determined to meet the best planning tenets for the airport providing a balance of capacity and flexibility to meet demand beyond the planning period. It provides useful extension of Runway 3/21 and provides a full pavement section for the 20 year pavement design life requirement. In addition, as compared to the Extension of Taxiway 'A' or Taxiway 'B', the alternative does not have a multitude of potential impacts to airport operation, such as affecting approach and departures, overflight of the Terminal (Taxiway 'A") or Air National Guard (Taxiway 'B'), or having

significant impacts to existing airport infrastructure (See Exhibits 6-11 and 6-12). Whereas the least short-term impacts is the Runway 9-27 night closure panel replacement, that project has no life cycle value.

- Environmental Factors – This category evaluates the alternative for potential environmental effects. The alternative was evaluated for each of the environmental factors that were determined to be in the airport environment.
    - There are few potential impacts associated with the Runway 9-27 night closure panel replacement. The potential impacts impacts for the Runway 3/21 Extension Alternative are presented in Section 6.2.2 and primarily relate to potential wetlands impacts on the Runway 21 end. However, the extensions and use of Taxiway 'A' or Taxiway 'B" as a temporary runway also have environmental implications. There is are poor soil conditions and wooded areas that would be impacted by Taxiway 'A' and there are drainage issues, wooded areas, land acquisition and residential relocation associated with Taxiway 'B'. On balance, the potential environmental operational risk and natural environmental consequences for the two taxiway alternatives appear equivalent to or greater than the potential for environmental consequences associated with Runway 3-21 extension. This would need to be determined in an environmental assessment.

- Fiscal Factors – This category evaluates the alternative based on rough cost estimates.

  The extension of Runway 3/21 was shown to be the most cost effective method to allow full reconstruction of Runway 9/27. This will also eliminate night closures and allow for the best engineered solution for the runway.

6.3 TAXIWAYS

As identified in the facility requirements chapter, the following taxiways have certain operational constraints or contain non-standard geometry which requires planning resolution:

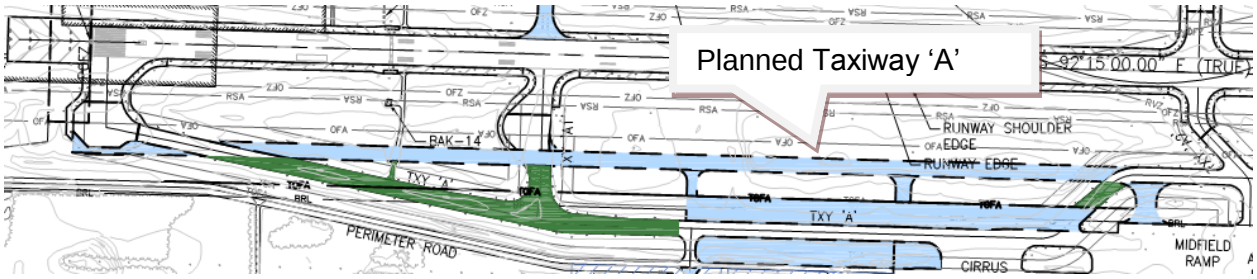
- Taxiway 'A' segment between Taxiway 'A2' and the Runway 9 end
- Taxiway 'B' limited access from Runway 3-21 and the Runway 9 end
- Taxiway 'C' taxiway-to-runway separation standards
- Taxiway 'E' in-line taxiway beyond the Runway 27 end; Taxiways E1, E2 and A5
- Taxiway 'F' access to Minnesota Air National Guard Ramp (military project)

It should be noted that these taxiway facility improvements are not necessarily alternatives per se, but more layout concepts, due to the limited planning resolution needed to meet FAA design standards.

6.3.1 Taxiway 'A'

Taxiway 'A' between Taxiway 'A2' and the Runway 9 end has a runway-to-taxiway separation of nearly 850 feet, exceeding the FAA 500-foot minimum separation by nearly 450 feet. This segment of taxiway also contains an irregular 'S' curve, which contributes aircraft oversteering issues and to air traffic control tower line-of-sight visibility constraints when large aircraft are parked on the Midfield Ramp. As shown in **Exhibit 6-13**, it is recommended that Taxiway 'A' ultimately be realigned in a linear manner consistent with the eastward segment of Taxiway 'A', which has a 512.5 foot taxiway-to runway separation, sufficient separation for runways with less than one-half mile visibility. The re-alignment of Taxiway 'A' will permit further expansion of the apron/ramp areas, as demand warrants.

Exhibit 6-13
TAXIWAY 'A' – PLANNED LAYOUT CONCEPT

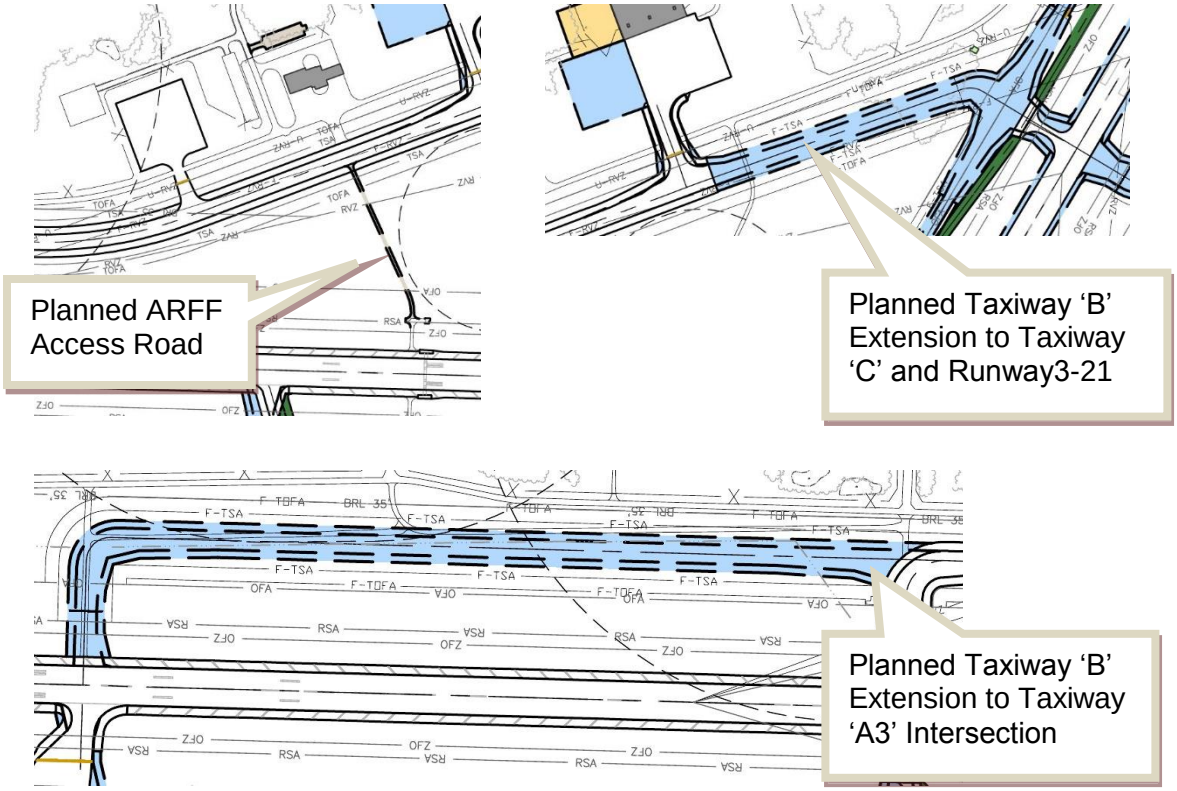


6.3.2 Taxiway 'B'

Taxiway B is the connector providing a single access point between Runway 9-27 and the North Business Development Area. The North Business Development Area is planned to accommodate various commercial and private tenants, potentially a flight school. Therefore, a mix of aircraft would be generated from these prospective tenants, resulting in potential congestion points which could require alternate taxiway access points. As shown in **Exhibit 6-14**, it is recommended Taxiway 'B' be progressively planned for the following improvements:

- New exit taxiway between Runway 9-27
- Eastward extension to Taxiway 'C' and Runway 3-21
- Westward extension for Runway 9 departures (to accommodate flight school operations)

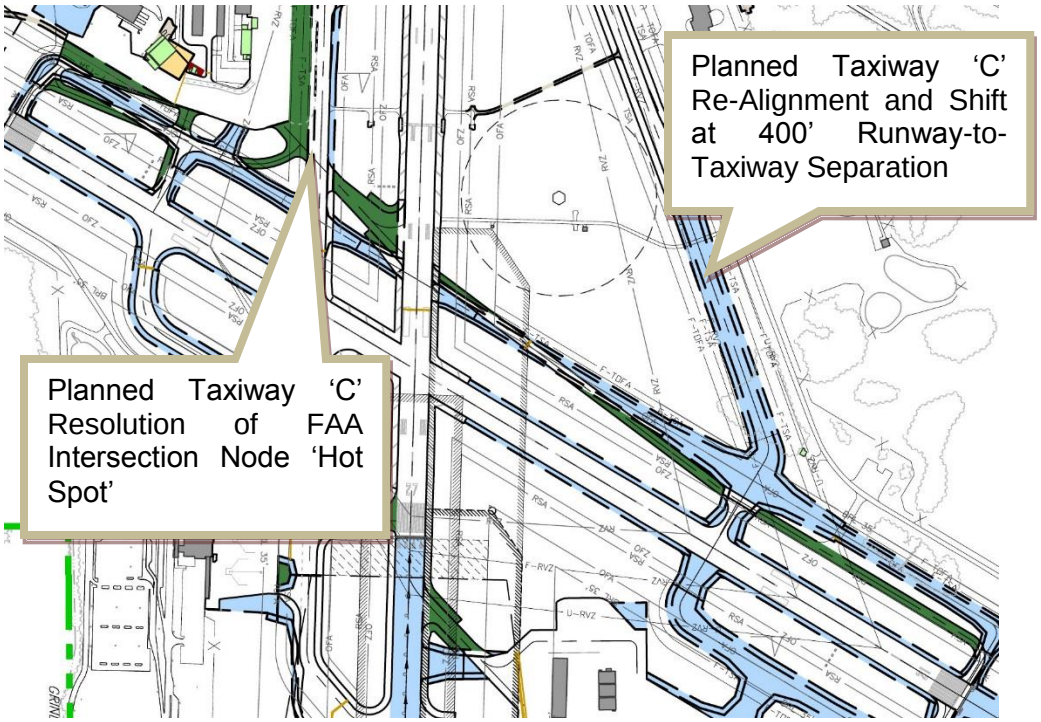
Exhibit 6-14
TAXIWAY 'B' – PLANNED LAYOUT CONCEPT



6.3.3 Taxiway 'C'

Taxiway 'C' is the full parallel taxiway serving the west side of Runway 3-21. It is a non-linear taxiway, and involves an intersection node with Taxiway 'A' resulting in a FAA Hot Spot. As shown in **Exhibit 6-15,** it is recommended Taxiway 'C' be relocated at a 400-foot taxiway-to-runway separation to meet ARC C-III standards for future precision instrument capabilities. The realignment would resolve the non-standard runway-to-taxiway separation, mitigate the FAA Hot Spot intersection node, and correct geometry issues associated with the cargo ramp area at the Runway 3 end.

Exhibit 6-15
TAXIWAY 'C' – PLANNED LAYOUT CONCEPT

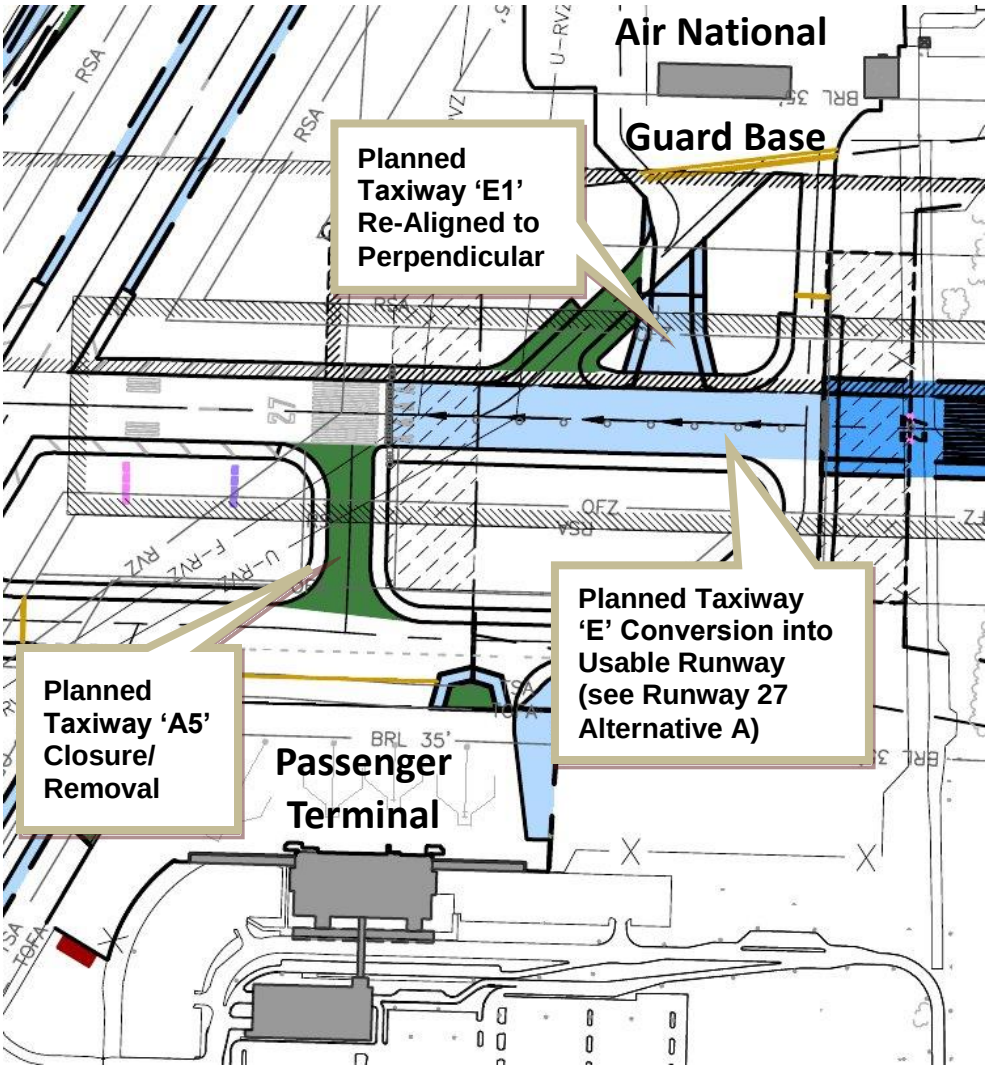


6.3.4 Taxiway 'E' Segments

Taxiway 'E' is a 1,000 foot in-line taxiway beyond the Runway 27 end, and part of a the Taxiway E1, E2 and A5 system identified as FAA Hot Spots due non-standard geometry and runway incursion risk. FAA standards no longer permit in-line taxiways. As shown in **Exhibit 6-16**, it is recommended the

Taxiway ‘E’, ‘E1’, ‘E2’ and ‘A5’ conform with the most feasible Runway 27 (In-Line Taxiway) Alternative ‘A’ concept. This entails Taxiway ‘E’ being deactivated and converted into usable runway, Taxiway ‘A5’ being removed, and Taxiway ‘E2’ being re-aligned into a perpendicular.

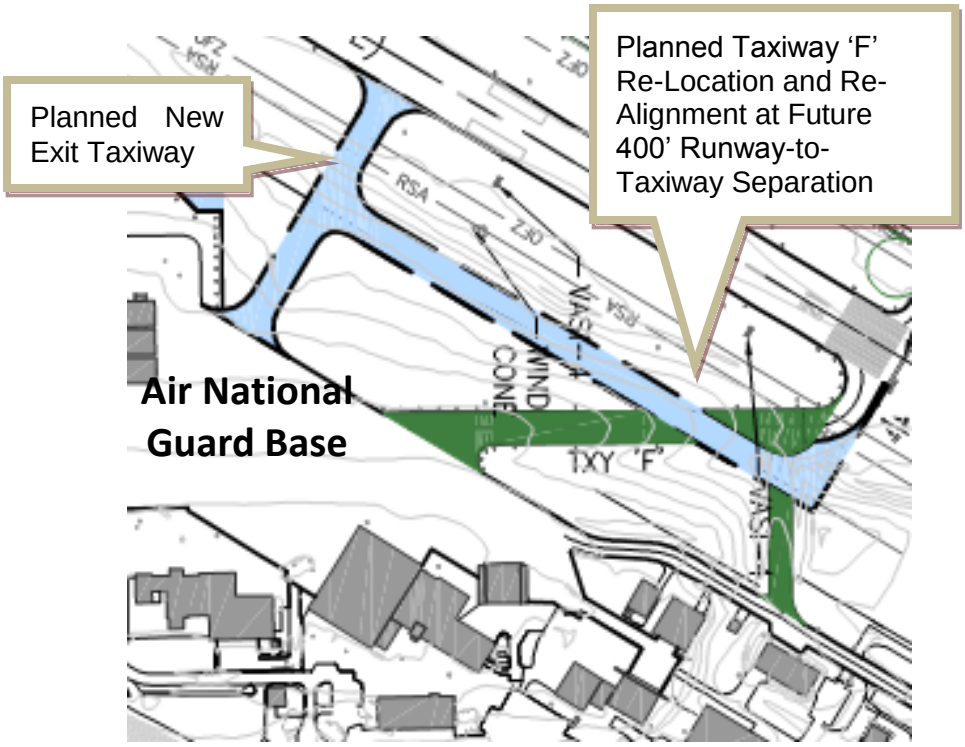
Exhibit 6-16
TAXIWAY 'E' SYSTEM – PLANNED LAYOUT CONCEPT



6.3.5 Taxiway 'F'

Taxiway 'F' is a connector taxiway between the Minnesota Air National Guard Ramp and Runway 21 end. As shown in **Exhibit 6-17**, the *Minnesota Air National Guard's Installation Development Plan* recommends realignment of Taxiway 'F' as a future partial parallel taxiway to Runway 21 with a taxiway-to-runway separation of 400 feet, and an additional exit Taxiway to Runway 3-21. The Guard's Development Plan also recommends extending Taxiway 'F' commensurate to any Runway 21 extension.

Exhibit 6-17
TAXIWAY 'F' – PLANNED LAYOUT CONCEPT



6.4 TERMINAL AND LANDSIDE ALTERNATIVES

The following are the primary terminal and landside alternatives identified in this chapter:

- Buildings and Structures to be Removed
- Air Traffic Control Tower Replacement
- Air Cargo Facilities
- Aircraft Manufacturing/Production Expansion
- Helicopter Hangar/Building Site Development
- Unmanned Aircraft Systems (UAS/UAV) Site Development
- Aircraft Hangars Options – Large and Small
- Ramp Areas

6.4.1 Buildings and Structures to be Removed

As part of the terminal options, due to condition and redevelopment opportunities, various buildings have been identified by the Airport as potential removal/relocation. **Table 6-4** lists the buildings/structures planned to be removed, replaced or relocated. See the Airport Layout Plan, Terminal Area Drawing for structures proposed to be removed during the 20-year planning period.

The Old Terminal Building (Building 616) and a large maintenance hangar (Building 622) represent some of the larger and older structures in a prime are for future redevelopment. Although portions of the Old Terminal Building are vacant, the building currently houses the FAA ATCT, the FAA Weather Observer, and private businesses which lease space from the Airport.

Table 6-4
BUILDINGS REMOVED/RELOCATED/REPLACED

AIRPORT BUILDINGS					
AIRPORT BUILDING NUMBER	**STRUCTURE**	**BUILDING OWNER**	**TENANT (LEASEHOLDER)**	**BUILDING DISPOSITION**	**ESTIMATED TIMEFRAME**
123	MN/ANG DRMO Warehouse	Mn/ANG	Mn/ANG	Remove	0 - 10 Years
124	MN/ANG Lab/Offices	Mn/ANG	Mn/ANG	Remove	0 - 10 Years
125	MN/ANG DRMO Warehouse	Mn/ANG	Mn/ANG	Remove	0 - 10 Years
206	Base Exchange (Commissary)	Mn/ANG	Mn/ANG	Remove	6 - 10 Years
232	Warehouse	--	--	Remove	0 - 5 Years
301	Emergency Generator / Electrical Vault	Duluth Airport Authority	--	Remove	0 - 5 Years
304	ANG Barracks	MN/ANG	MN/ANG	REMOVED (2012)	--
305	Manufacturing Facility	Duluth Airport Authority	Hydro Solutions	Replace	6 - 20 Years
306	Duluth Airport Authority SRE	Duluth Airport Authority	Duluth Airport Authority	Remove	0 - 5 Years
308	Office Building	Duluth Airport Authority	Vacant	Remove	0 - 10 Years
311	Federal Prison Dormitory Housing	Duluth Airport Authority	Vacant	Remove	0 - 10 Years
361	Mn/ANG Bulk Fuel Facility (East)	Mn/ANG	Mn/ANG	REMOVED (2012)	6 - 20 Years
362	Mn/ANG Bulk Fuel Facility (West)	Mn/ANG	Mn/ANG	REMOVED (2012)	6 - 20 Years
603	Airport Cold Storage	Duluth Airport Authority	--	Remove	0 - 5 Years
608	T-Hangars (5 Units)	Duluth Airport Authority	Monaco Air (FBO)	Replace	0 - 5 Years
611	Old SRE / FBO Storage Facility	Duluth Airport Authority	Monaco Air (FBO)	Replace	0 - 10 Years
614	Hangar (Ranch Hangars - 7 Units)	Duluth Airport Authority	Monaco Air (FBO)	Relocated	±20 Years
615	T-Hangars (13 Units)	Duluth Airport Authority	Monaco Air (FBO)	Relocated	±20 Years
616	FAA ATC Tower/Offices/Classroom	Duluth Airport Authority	FAA, Various	Remove	0 - 10 Years
622	Municipal Hangar #2 -FedEx Storage Facility	Duluth Airport Authority	Fed Ex	Replace	0 - 5 Years
705	Box Hangar	Monaco	Monaco Air (FBO)	Replace	0 - 10 Years
709	FAA Garage / Storage	--	FAA	Remove	0 - 10 Years

Note: Reference Airport Layout Plan, Terminal Area Drawing Sheet for building/structure location.

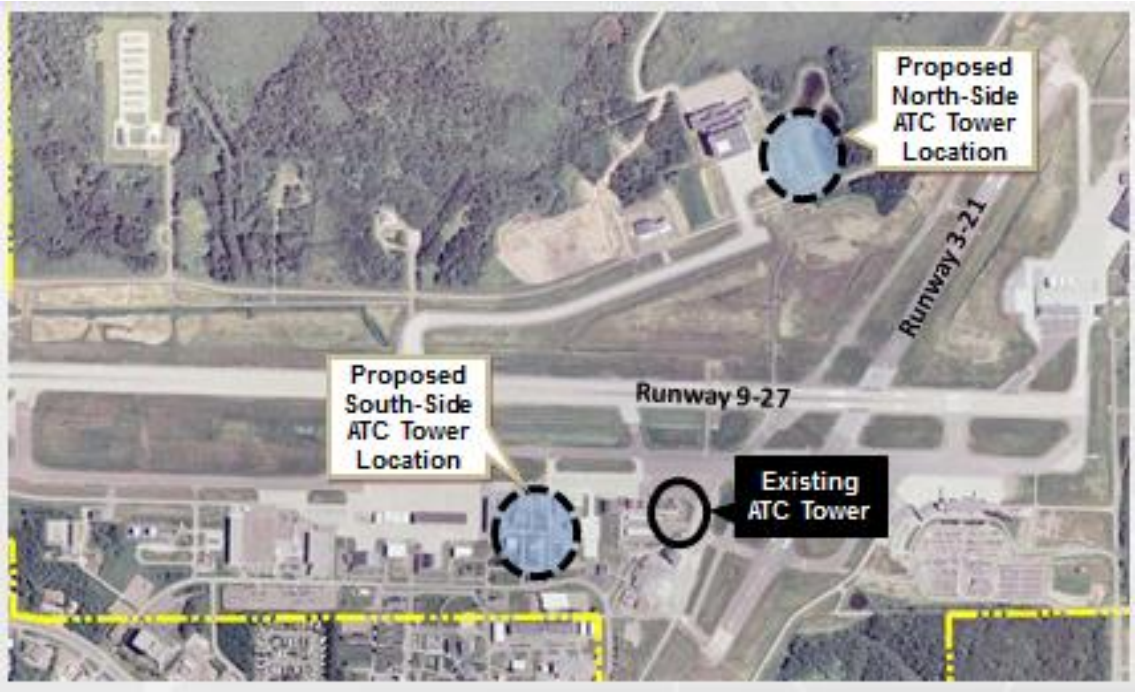
6.4.2 Air Traffic Control Tower (ATCT) Site Options

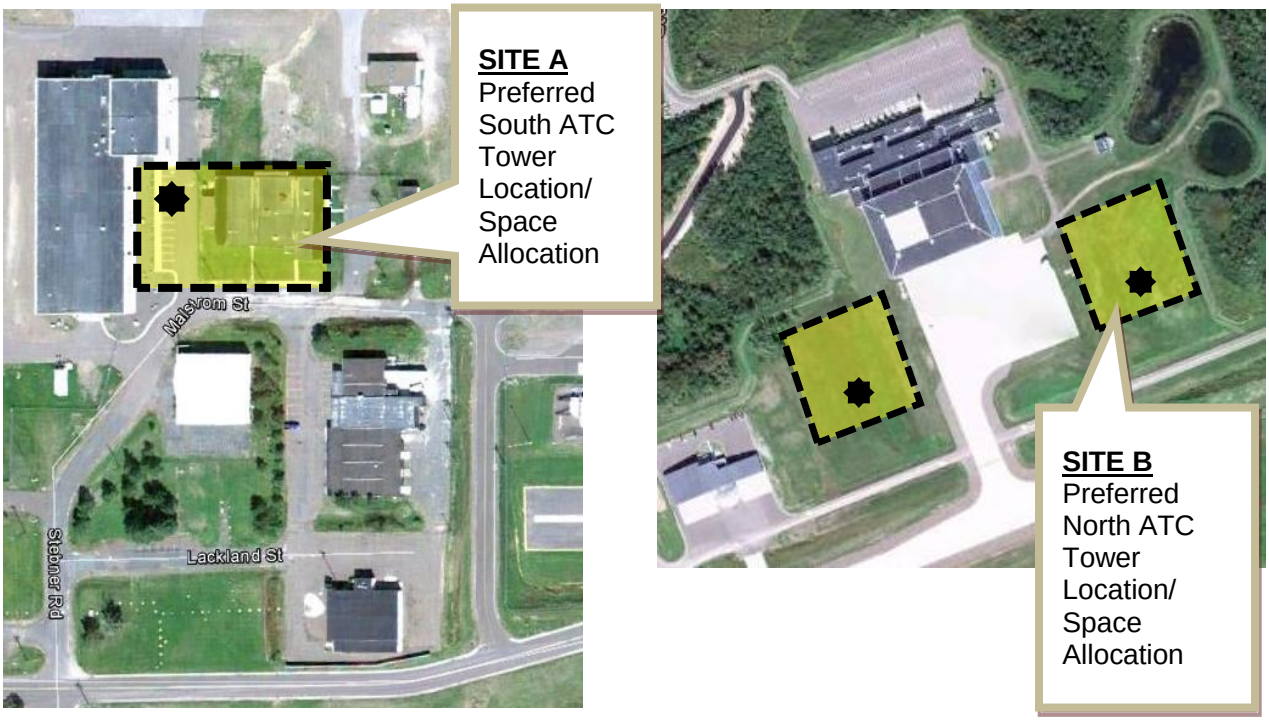
The Air Traffic Control Tower (ATCT) is being considered for replacement, as the existing building condition, location, cab height and line-of-sight visibility are deficient. FAA standards recommend a one to four acre site for accommodating a stand-alone ATCT facility. For Duluth, a one to two acre site with an approximate 40’ x 40’ building footprint appears to be adequate to accommodate the future Duluth ATCT/Radar service facility, including auto parking.

Exhibit 6-18 illustrates the general location of the potential north and south ATCT site vicinities, and preferred site locations. The Airport staff has identified this area as the preferred location for the replacement ATCT facility. Both vicinities are geographically central to the airfield, and have a tower location and line of sight to all runway ends within existing airport property. The Site A location is within

an area of buildings planned to be removed in the near-term (301, 305, 306, 308, 311, 608), as depicted on the ALP Drawings.

Exhibit 6-18
AIR TRAFFIC CONTROL TOWER RELOCATION – PLANNED NEW SITE





Site A: located within the terminal area north of Malstrom Street and immediately southeast of the Airport SRE building. The site is close to the terminal flightline and has favorable line-of-sight site to terminal area facilities and aircraft parking/apron ramps, and favorable orientation for sun angle direction. Utilities and roadway access is provided to the site. Utilities and roadway access is provided to the site, with close access to existing ATC communication lines. This location would likely require the removal of the electrical vault building (#301), as the Minnesota Air National Guard Barracks building (#304) has already been removed. Based on planning level calculations, it is estimated a tower (cab) height of 38' to 54' above ground level is needed to provide adequate line of sight to the Runway 3 end.

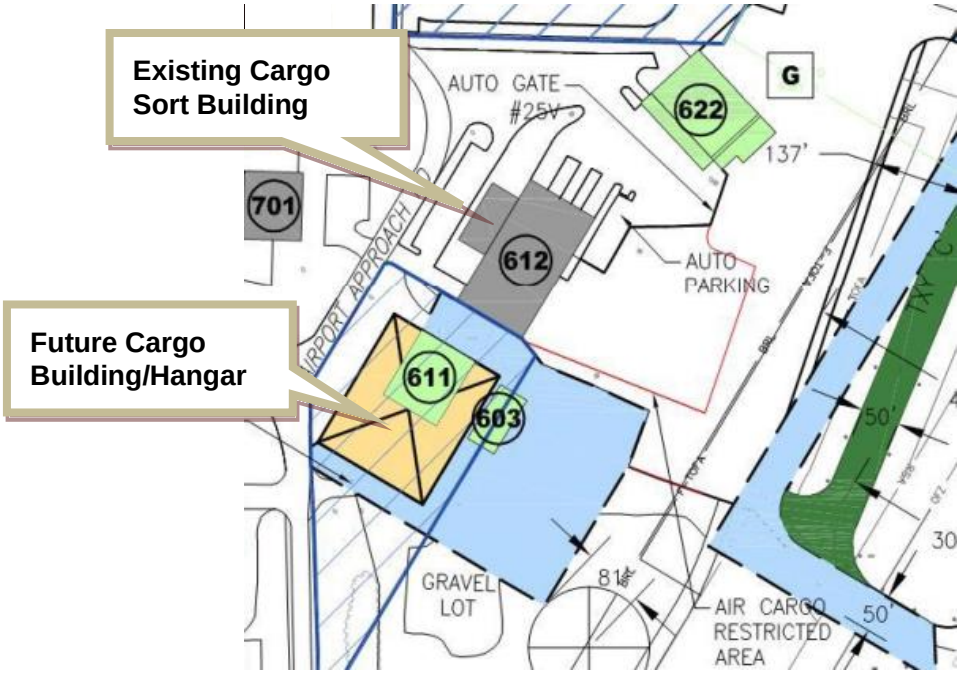
Site B: located either southeast or southwest of the aircraft maintenance hangar. This site would require improvements for auto access, parking and extension of utilities.

Both Site A and B are depicted on the Airport Layout Plan. It should be noted that these two ATCT sites have been identified for general planning purposes, to reserve sufficient space allocation and land development compatibility upon relocation of the ATCT facilities. The sites have not been comparatively ranked to arrive at a preferred option. No FAA ATCT study has been conducted to validate the options, site suitability, or configuration requirements.

6.4.3 Air Cargo Facilities

Exhibit 6-19 depicts the possible expansion of the air cargo facility west of the Runway 3 end, occupied by FedEx. The future cargo facility expansion is planned south of the existing sort build, and would require the removal of storage buildings #611 and #603. The expanded site is planned to accommodate building with auto access and/or a hangar with future ramp access.

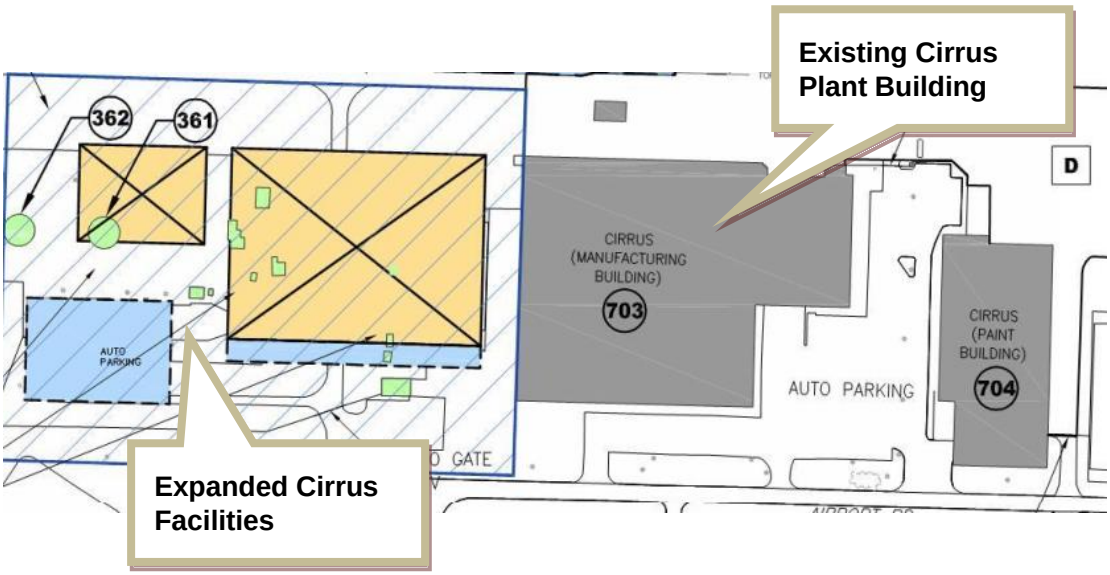
Exhibit 6-19
AIR CARGO – PLANNED SITE EXPANSION



6.4.4 Aircraft Manufacturing/Production Expansion

Exhibit 6-20 depicts the possible expansion of the Cirrus manufacturing facilities. The future expansion is planned west of the existing building, and would require the removal of military petroleum, oil and lubricant (POL) storage facilities. The expanded site is planned to accommodate a comparable hangar and multiple buildings with auto access. The site would require grading and fill in order to provide continuous ramp access to the adjacent Taxiway 'A'.

Exhibit 6-20
AIRCRAFT MANUFACTURING/PRODUCTION EXPANSION



6.4.5 Helicopter Hangar/Building Site Development

The helicopter school is contemplating the relocation of its operations to another location on the airport. The operator is located in Building #616 and using hangar #614, and due to expansion of services, is planning to locate a site with the following general site characteristics:

- 0.5 to 1.5 acres space allocation
- Direct ramp or pavement access
- FAR Part 141 operator, with possible FAR Part 135 commercial operations
- 12,000 square foot hangar accommodating 4 helicopters
- Provide dedicated vehicle access, with 20 to 30 auto parking spaces

Exhibit 6-21 illustrates the general location of the potential site vicinities located within the south terminal area, along with the preferred helicopter site location. Site A is the preferred helicopter location, which is southwest of the FBO building, and is provided auto access from Airport Approach Road. This site is depicted on the ALP Drawings.

Exhibit 6-21
HELICOPTER HANGAR SITE OPTION

SITE A
Preferred Helicopter Hangar (Yellow)
Auto Parking (Brown)

6.4.6 Unmanned Aircraft Systems (UAS/UAV) Site Development

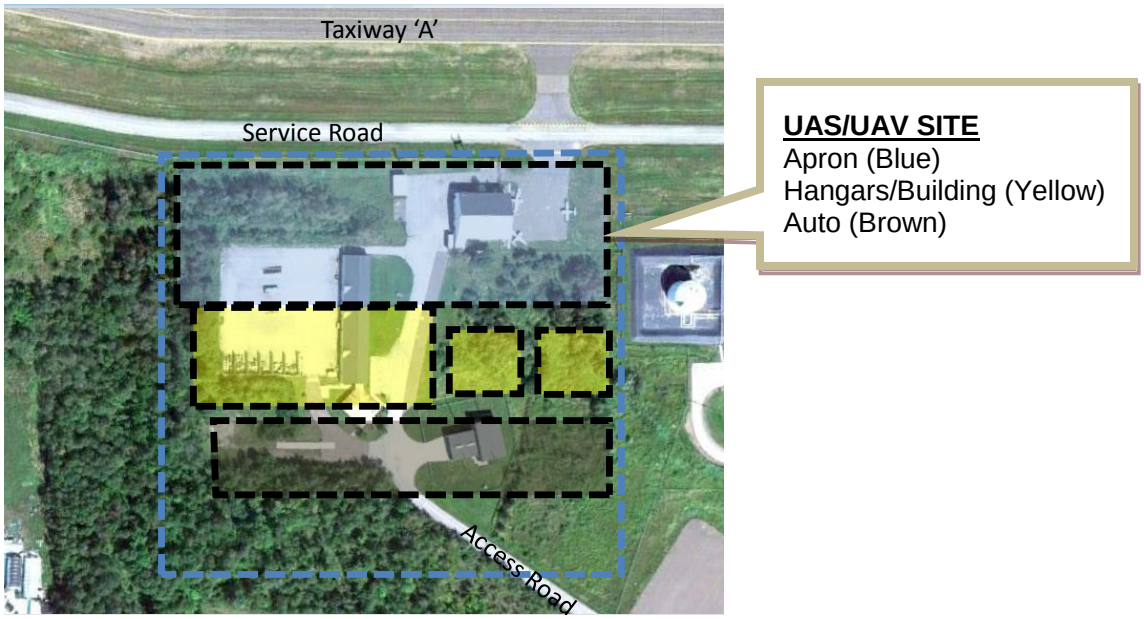
The Airport is pursing planning for Unmanned Aircraft Systems (UAS) vehicles, initially through inclusion into the FAA UAS Test Program, then in some form of unmanned aerial vehicle operations beyond the test program. UAV aircraft are rapidly becoming a more mainstream aeronautical platform supporting various civilian and military flight applications. These aircraft, which are inherently different from manned aircraft, are flown by a pilot-in-command located remote to the vehicle, using various data links and monitoring systems. At present time, the UAV aircraft include a wide assortment of shapes and sizes, and serves very diverse purposes. They include both fixed-wing and rotorcraft, powered by piston and turbine engines, with wingspans ranging from a small radio-controlled model airplane to a Boeing 737.

The UAS Test Program is intended to facilitate integration of the UAS aircraft into the National Airspace System, as airspace is typically the most consequential impact of supporting UAS operations. UAV activity typically necessitates nearby special use airspace (restricted or warning areas) with lower-altitude transitional areas between the Airport, with airspace blocks dependent upon the type of UAS,

local airspace architecture, flight patterns, and radar coverage. Although the FAA has not instituted airport design standards for UAS aircraft, the Department of Army and Air Force have developed operational specifications used for developing unmanned vehicle facilities. As the UAS program evolves from the FAA experimental to certified phase, some aspect of UAS activity is anticipated at Duluth, particularly due to the based military influence. In terms of facility requirements, the UAV aircraft performances tend not to influence the airfield facility needs, but might eventually require some type of dedicated terminal or landside area as a domicile for aircraft parking or support buildings.

Exhibit 6-22 depicts the preferred site location and layout for the UAV developments. Although unspecified at this time, such UAS facilities could likely be accommodated within the various site development areas reserved planned for other types of aeronautical developments, as depicted on the Airport Layout Plan.

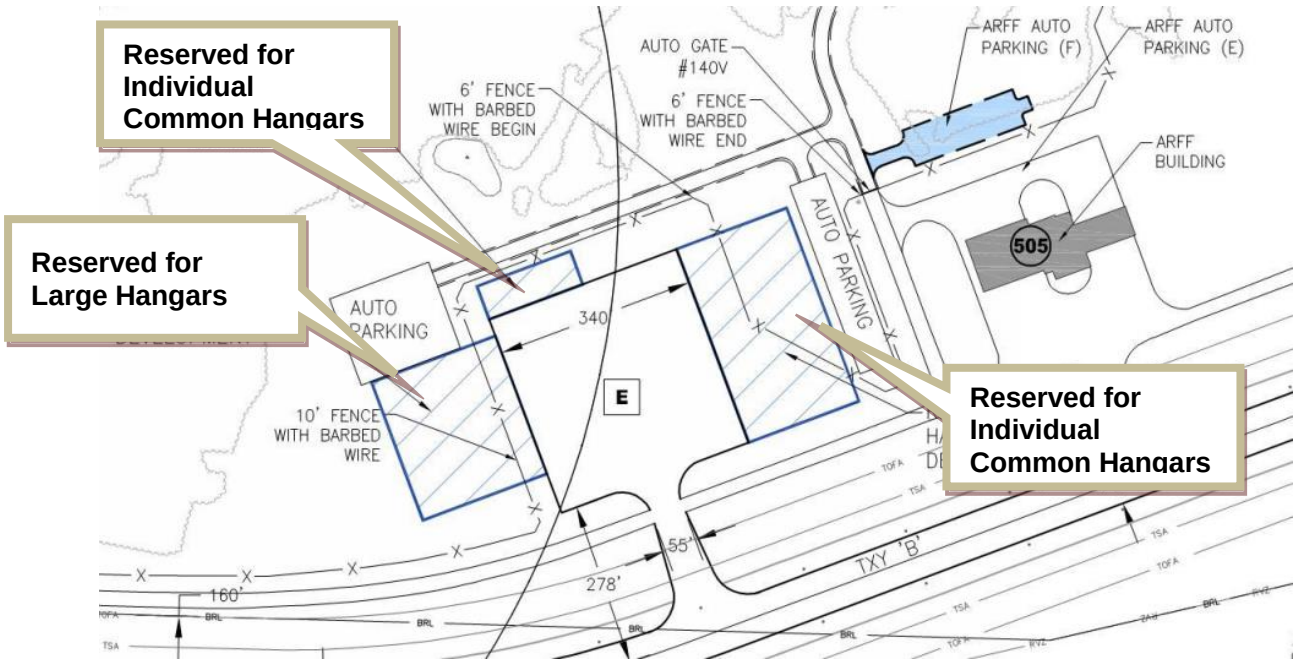
Exhibit 6-22
UAV SITE DEVELOPMENT OPTION



6.4.7 Large Aircraft Hangars Options (Northside):

Large aircraft hangars will be required to provide additional storage capacity for new large turboprop and business jet based aircraft, and as an option for existing obsolete hangar buildings. **Exhibit 6-23** depicts the option for expansion of the larger general aviation hangars, located within the northside apron along Taxiway 'B'. The site provides approximately 150,000 square feet of additional hangar space. A fuel farm is also anticipated to be located in this area. Proposed development within this area should be reviewed for effects on navigational and communication aids located within the vicinity.

Exhibit 6-23
LARGE GENERAL AVIATION HANGAR SITE DEVELOPMENT OPTION



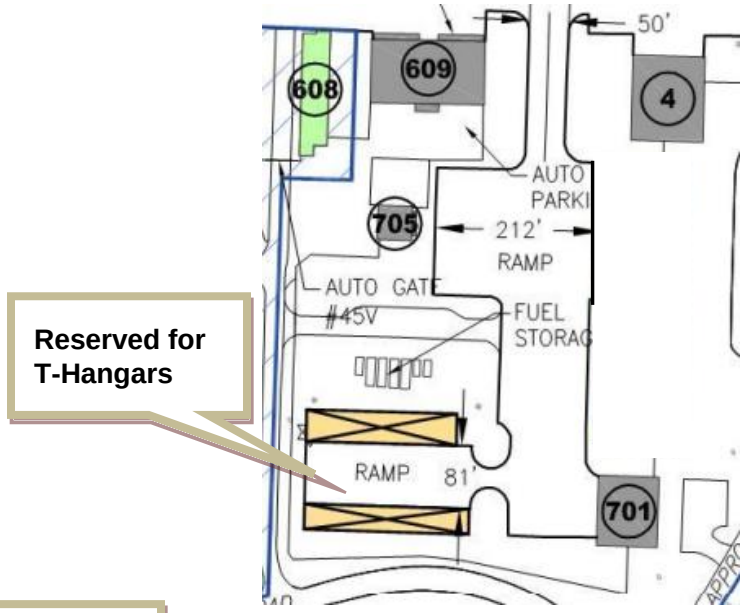
6.4.8 Small Aircraft Hangars Options (Southside):

Nearly 54,000 square feet of hangar space could be needed for small piston aircraft storage throughout the 20-year planning period. Future hangar space should include an area dedicated to small piston aircraft storage, either from new based planes or displaced through hangar replacements and relocations.

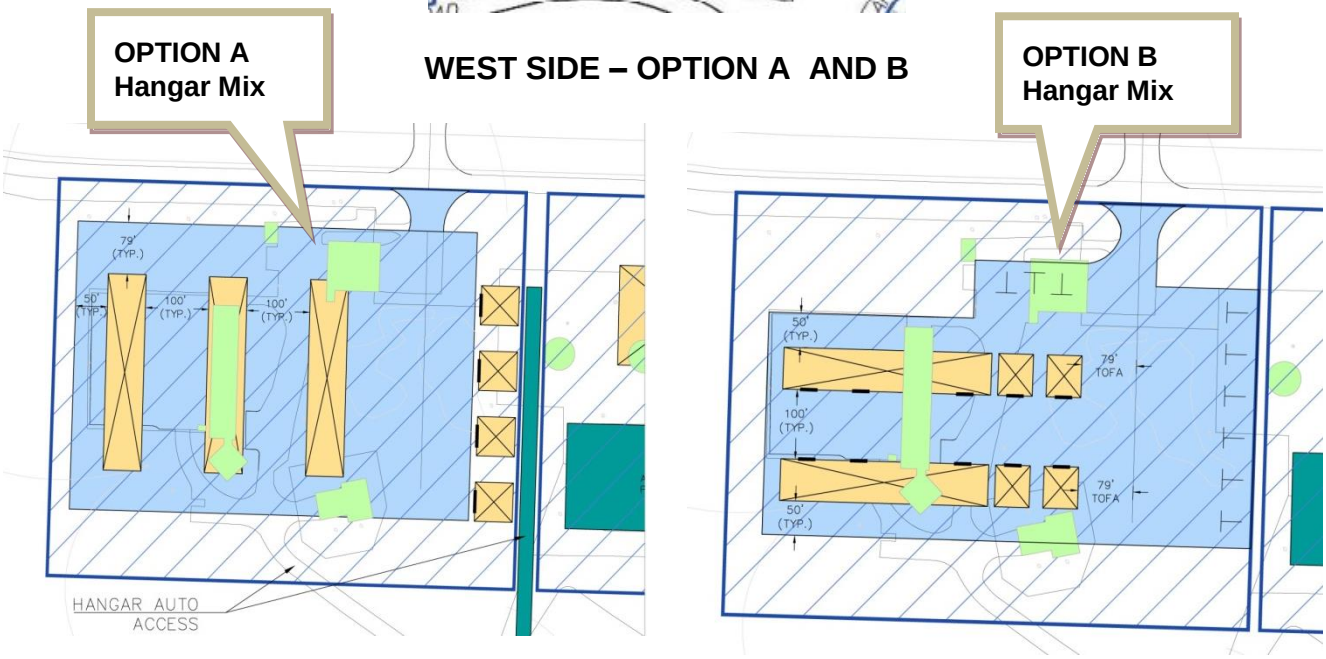
Exhibit 6-24 depicts the option for expansion of the smaller general aviation hangars, at an east site located south of the FBO and fuel storage facilities, and if not used for other development, a west site beyond the Cirrus and military POL facilities, currently leased by the MN Air National Guard. The west site provides about 60,000 square feet of development, but would initially involve the removal of buildings/structures, which is surrounded by a wooded area, drainage, and utility lines. The west site identified two possible hangar layout configurations. It should be noted that these options have been provided for general planning purposes only, to demonstrate and reserve sufficient space to accommodate typical aircraft hangar sizes and layouts.

Exhibit 6-24
SMALL GENERAL AVIATION HANGAR SITE DEVELOPMENT AREA

EAST SIDE



WEST SIDE – OPTION A AND B



Future Hangar Development:

The assessment of hangar facility needs focuses on square footage of hangar space. The master plan assumes that due to winter conditions, all based aircraft are stored in hangars. The smaller single-engine aircraft and light multi-engine aircraft are generally stored in T-hangar units while larger multi-engine aircraft, business jets, and rotorcraft are stored in common hangars. Hangars should be segregated by the type of user and aircraft size:

- Large Site: Commercial w/ Public Access (Design Group II and III) - at least one to two large site development areas should be reserved for potential large scale commercial use

- Medium Site: Corporate w/ Office (Design Group II and III)

- Small Site: Individual Box or T-Hangars (Design Group I and II)

The following are general guidelines for proper hangar development:

- Hangars must be constructed beyond the runway safety areas (OFA, RSA, OFZ, RPZ), not encroach imaginary airspace surfaces, and remain beyond the taxiway/taxilane object free area (TOFA).

- Hangars should provide, at minimum, the standard taxilane object free area (TOFA) width for ramp and taxiing separation between opposing hangar doors.

- Hangars should be centralized in terms of auto access, and located along the existing flight/hangar building line(s) to minimize costs associated with paved areas, drainage, utilities and auto parking expansion.

- Hangars, to the extent possible, should be segregated based on the hangar type and function. Arrange hangars by functional size and type, by locating the larger box hangars closer to the main apron/taxiway, and the smaller hangars further back in the hangar area.

- Hangar development should allow adequate drainage with minimal slope differential (1% to 1.5%), particularly in front of hangar door.

- Constructs hangars in a linear fashion, which accommodates greater flexibility in sizing hangars, improves pilot visibility and makes the extension of utilities.

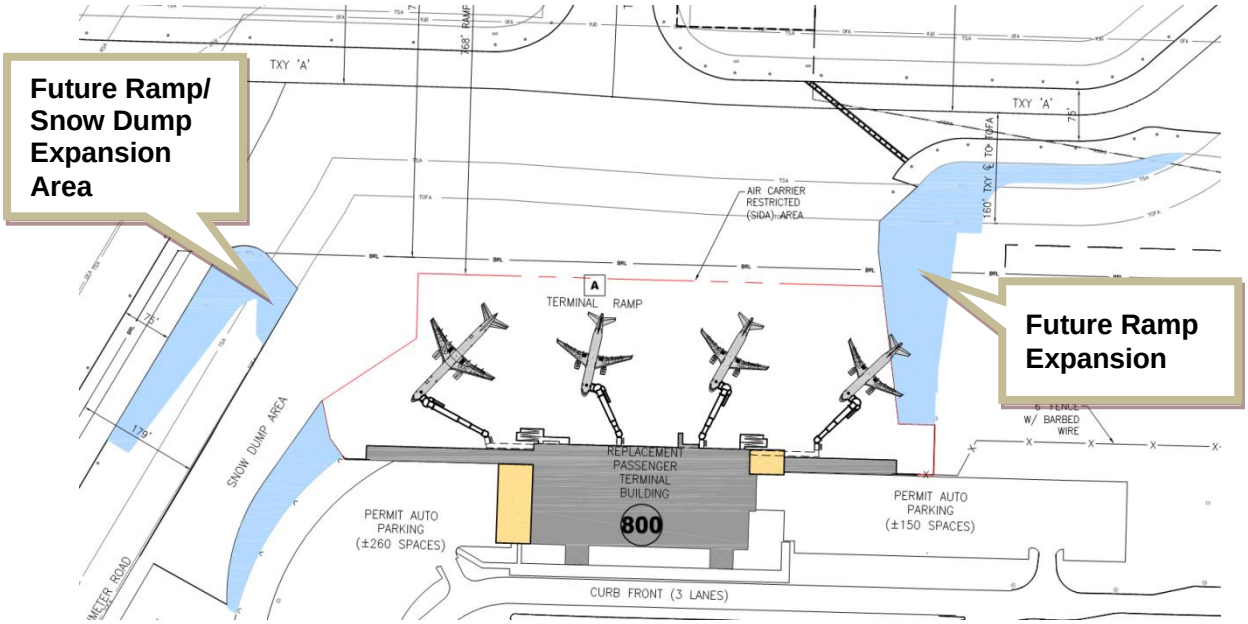
- Orient hangar doors favorable with winter snow and ice conditions.

- The hangar site development option allows for expansion beyond the projected 20-year hangar demands, including areas to accommodate larger general aviation hangars used for commercial purposes.

6.4.9 Ramp Areas – Commercial Passenger

Exhibit 6-25 depicts the option for future ramp expansion associated with the increased utilization of the new air carrier building. These ramp areas are planned to be used for aircraft maneuvering, ground vehicles, and snow dump areas.

Exhibit 6-25
COMMERCIAL RAMP EXPANSION



6.4.10 Ramp Areas – General Aviation

Exhibit 6-26 depicts the option for future ramp expansion along the midfield ramp area. The Midfield Ramp expansion connects the FBO Ramp with the Midfield Ramp, in order to provide additional maneuvering and parking. The West End Ramp could be constructed following the relocation of Taxiway 'A', which would provide additional flight line and ramp access, as development unfolds. These ramps should be constructed with a 166-foot separation with the Taxiway 'A' centerline in order to preserve safety area and wingtip clearance for large transport aircraft (Galaxy C-5A, Design Group VI).

6.5 ALTERNATIVES SUMMARY AND COORDINATION

6.5.1 Alternatives Review and Coordination

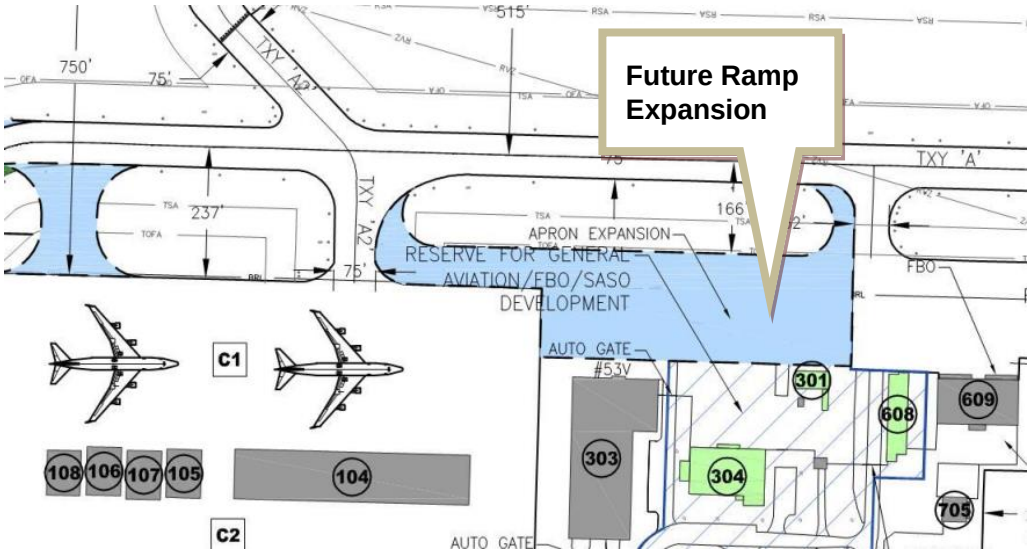
The development alternatives and site options presented in this chapter were reviewed by the Airport Staff and Airport Master Plan Advisory Committee for technical and community-related input, and made available for public display and feedback. The alternatives were also presented to the Airport Board, for

their subsequent consideration, input and approval. Input and comments was collected and documented as part of the master plan process. The information from these meetings was recorded for consideration as part of the alternatives, and for future environmental purposes. The alternatives were refined, based on feedback, with the revised documents and exhibits provided electronically on the Airport website for public viewing.

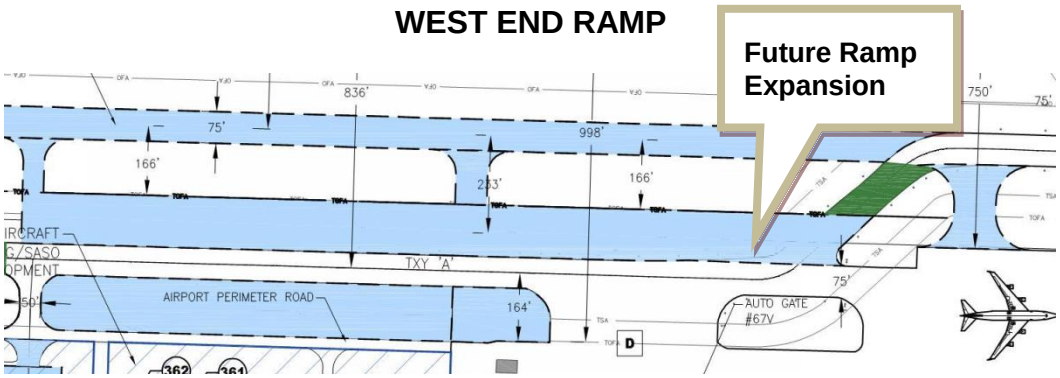
The alternatives have been developed in consideration of environmental factors documented in the Inventory Chapter, as it is anticipated that an Environmental Assessment (EA) will be required for most project implementation.

Exhibit 6-26
GENERAL AVIATION/RAMP EXPANSION

MIDFIELD RAMP



WEST END RAMP



6.5.2 Alternatives Summary

The following lists the preferred Airport alternatives:

Runway 27 (In-Line Taxiway 'E') – Option A
Runway 3-21 Extension – Option E

These preferred layouts are carried-forward as development items inserted on the updated Airport Layout Plan (ALP) drawings, and included in the 20-year Airport Master Plan development program and FAA Airport Capital Improvement Plan (ACIP), as applicable.

CHAPTER 7
AIRPORT LAYOUT PLAN DRAWING SET

7.1 INTRODUCTION

The Airport Layout Plan (ALP) serves as the official record drawing set to depict Airport developments as part of complying with federal grant assurances and planning standards. The electronic-generated drawings are a graphic illustration of the Airport's existing and recommended 20-year Airport Master Plan development program.

The Duluth International Airport Layout Plan drawing set requires approval of the Airport Authority as consistent with Federal Aviation Administration (FAA) design standards and the Minnesota Department of Transportation (MnDOT-Aeronautics) procedural requirements and review process.

7.1.1 ALP Function

FAA Advisory Circular 150/5070-6B, *Airport Master Plans* identifies the primary ALP purposes:

- Approved plans contingent upon availability of funds are necessary in order to receive financial assistance under the terms of the Airport and Airway Improvement Act of 1982 (AIP), as amended.
- The plans create a blueprint for airport development by depicting proposed facility improvements consistent with the strategic vision of the airport sponsor.
- The ALP serves as a public document that is a record of aeronautical requirements, both present and future, and as a reference for community deliberations on land use proposals and budget resource planning.
- The approved ALP provides the FAA with a plan for airport development.
- The plans are a working tool for use by the Airport Sponsor, including development and maintenance staff.

7.1.2 ALP Update Process

The Airport Layout Plan (ALP) drawings have been updated to depict and properly note the 20-year improvements identified in the Master Plan, as substantiated from the aviation forecasts, facility requirements and the alternatives analysis. In addition, the drawings have been updated to reflect current federal and state airport design standards. The FAA has issued multiple updates to planning and airspace standards since completion of the previous Duluth International Airport ALP in 2000, which have been addressed and incorporated electronically into this ALP update. The ALP update also involved consolidating base mapping features, compiling various electronic overlay drawings, and integrating database information into a single composite electronic file system.

The completion of these ALP drawings enables the Airport Sponsor to depict improvements as eligible under the respective federal and state airport aid program.

Development of the ALP is a direct result of the master plan processes presented in the previous chapters. The ALP reflects the airport technical requirements defined through the master planning process and the strategic vision for the Airport as defined by the Airport Authority and staff.

The ALP requires FAA approval independent of the master plan. As such, review of the ALP drawing set is accomplished through several intermediate steps, including reviews by the Airport, Minnesota Department of Transportation – Office of Aeronautics (Mn/DOT), the FAA Airports District Office (ADO), and several other FAA offices involved in the associated airspace review. A current ALP that has airport sponsor approval and FAA approval from the standpoint of safety, utility, and efficiency of the Airport is required by United States Code, Title 49, 47107(a)(16).

The ALP drawing set was developed in conformance with the Federal Aviation Administration (FAA-ADO) Airport Layout Plan Checklist (Regional Guidance Letter 5070.1 dated June 28, 2011) and as consistent with the following key FAA guidance regarding the preparation and review of ALP drawings that were applicable at the onset of this process:

- FAA Advisory Circular 150/5300-13, *Airport Design*
- FAA Advisory Circular 150/5070-6B, *Airport Master Plans*
- Minnesota Department of Transportation, Office of Aeronautics, *Airport Layout Plan (ALP) Preparation and Submittal Guidelines*

This chapter presents the Airport's compliance with FAA design standards, lists revisions to the ALP since the previous ALP, and presents the ALP drawing set.

7.1.3 Airport Compliance with FAA Design Standards

The FAA provides airport design standards to ensure safe and efficient airport operations. The primary guidance is contained in FAA Advisory Circular (AC) 150/5300-13, *Airport Design*. The master planning process also relies on numerous other FAA and Federal agency documents, including:

- Federal Aviation Regulations Part 77, *Objects Affecting Navigable Airspace*
- FAA Order 8260.3B, *United States Standards for Terminal Instrument Procedures*
- FAA Order 5200.8, *Runway Safety Area Program*

7.1.4 Airport Layout Plan Changes

The following is a primary list of the significant changes occurring since the previous Duluth International Airport Layout Plan drawings dated January 2000:

- Reconfiguration of Runway 17 end to remove FAA "hotspot" by repurpose of inline Taxiway "E" inline taxiway as a displaced threshold, remove existing Taxiway E-1, construct new TaxiwayE-1, and removing Taxiway A-5;
- Relocation of Parallel Taxiway "C" System at 400' separation runway to taxiway;
- Phasing of an extension of Runway 21 from 5,710' to 7,000' and ultimately to 8000';
- Reconstruction of the Taxiway D System at the south end of Runway 3-21;
- Extension of Taxiway "B" to Taxiway "C" and extend west to Taxiway A-3 intersection;
- Construction of a new airport traffic control tower;

- Reconstruction of the west portion of Taxiway “A” in conformance with the taxiway’s east end to resolve air traffic control tower line-of-sight visibility constraints, removal of an irregular “S” curve, and enable general aviation ramp expansion;
- Realignment of Taxiway “F” to become a future partial parallel taxiway;
- Extension of Runway 9-27 to an ultimate 11,600’ feet; and,
- Addition of new sheets to the Airport Layout Plan set:
  - Sheet 5 - Airport Facilities Drawing / Airport Aerial Photo Drawing Sheet
  - Sheet 7 - Terminal Plan - Southwest Development Area Drawing Sheet
  - Sheet 8 - Terminal Plan - Northwest Development Area Drawing Sheet
  - Sheet 10B - Departure Surface – Runway 09 (Existing/Future) Drawing Sheet
  - Sheet 11B - Departure Surface – Runway 27 (Existing/Future) Drawing Sheet
  - Sheet 19 - Minnesota Land Use Safety Zone – Existing Drawing Sheet
  - Sheet 20 - Minnesota Land Use Safety Zone – Proposed/Future Drawing Sheet
  - Sheet 21A - Airport Property Map Drawing Sheet
  - Sheet 21B - Airport Property Map Table Drawing Sheet.

7.1.5 Deviation From Design Standards

The previous airport layout plan had a deviation from design standard involving the edge light spacing on both runways. The deviation is brought into standard as shown on the updated ALP drawings. The previous ALP date was not approved and is dated January 2000.

7.1.6 Airport Layout Plan Modifications

This section lists FAA modification to FAA design standards. There are no existing or future conditions that require a modification to FAA design standards (MOS). The previous 2009 ALP did not contain any noted deviations or modification to design standards.

7.2 AIRPORT LAYOUT PLAN DRAWING SET

The Airport Layout Plan (ALP) consists of the airport layout drawing, and supporting drawing sheets which together comprise the ALP set. The ALP drawings are produced in colored format electronically in AutoCAD (Release 2010), and scaled for 42” x 32” sheets, with reduced 11” x 17” sheets for insertion into the Airport Master Plan narrative report. The following is the ALP drawing sheets updated as part of this plan and described below:

Sheet 1	Title and Approval Sheet
Sheet 2	Airport Data Summary Sheet
Sheet 3	Airport Layout Plan – (existing conditions)
Sheet 4	Airport Layout Plan – (future conditions)
Sheet 5*	Airport Facilities Drawing / Airport Aerial Photo
Sheet 6	Terminal Plan – Terminal Passenger Building Area
Sheet 7*	Terminal Plan - Southwest Development Area
Sheet 8*	Terminal Plan - Northwest Development Area
Sheet 9	Minnesota Air National Guard (MNANG)
Sheet 10A	Inner Approach Plan & Profile – Runway 09 (Existing/Future)
Sheet 10B*	Departure Surface Drawing – Runway 09 (Existing/Future)
Sheet 11A	Inner Approach Plan & Profile – Runway 27 (Existing/Future)

Sheet 11B*	Departure Surface Drawing – Runway 27 (Existing/Future)
Sheet 12	Inner Approach Plan & Profile – Runway 03 (Existing/Future)
Sheet 13	Inner Approach Plan & Profile – Runway 21 (Existing/Future)
Sheet 14	FAR Part 77 Airspace / Close-in Obstruction Plan
Sheet 15	FAR Part 77 Airspace Drawing
Sheet 16	Existing/Ultimate Runway 9 and 27 Departure Surface
Sheet 17	Existing/Ultimate Runway 3 and 21 Departure Surface
Sheet 18	Land Use Map / 65 DNL Noise Contour
Sheet 19*	Minnesota Land Use Safety Zone – Existing
Sheet 20*	Minnesota Land Use Safety Zone – Proposed/Future
Sheet 21A*	Airport Property Map
Sheet 21B*	Airport Property Map Table

* Denotes new sheet

- **Sheet 1 - Title and Approval Sheet**
  The Title and Approval Sheet denotes the Airport name, grant numbers and an index of drawings contained in the ALP drawing set. Also denoted on this sheet are the project name, sponsor name, FAA grant number, and a location map, indicating the Airport's location, major roads, and other features in the vicinity of the Airport.

- **Sheet 2 – Airport Summary Data Sheet**
  This sheet segregates the data requirements from the ALP sheet. The data sheet provides a less clustered drawing and larger image of the ALP drawing. Included on the sheet are various airport and runway data including approach minimums, critical aircraft, wind rose data, and general notes.

- **Sheet 3 - Airport Layout Plan Drawing (existing conditions)**
  The Airport Layout Plan (ALP sometimes referred to as the Airport Layout Drawing) sheet serves as the official drawing of record for the Airport. The ALP consists of a scaled single-page drawing depicting the existing conditions at the Airport. This sheet depicts the limits of airport property interests, land uses and a configuration of facilities in compliance with geometric design separation and clearance standards, including airspace and navigational (NAVAID) facilities.

- **Sheet 4 - Airport Layout Plan Drawing (future conditions)**
  The future Airport Layout Plan (ALP sometimes referred to as the future Airport Layout Drawing) serves as the official drawing of record for the Airport. The ALP consists of a scaled single-page drawing depicting existing and planned improvements throughout the 20-year Airport Capital Improvement Plan. Specifically, this sheet depicts the limits of future airport property interests, land uses and the configuration of facilities in compliance with future geometric design separation and clearance standards, including airspace and navigational (NAVAID) facilities.

- **Sheet 5 - Airport Facilities Layout / Aerial Photo**
  This drawing presents existing facilities with minimal text and dimensioning overlaid on the aerial photo. This drawing is intended to be an easy to use graphic for the Airport Sponsor and public-at-large by providing an uncomplicated view of major planning items relative to existing features.

- **Sheet 6 - Terminal Plan Drawing – Passenger Terminal Building Area**
  A scaled drawing depicting close-in terminal area features for the Passenger Terminal Building Area. The drawing shows required separation requirements and design standards, and includes general notes, data sources, and a legend noting key drawing symbols. The drawing also provides detailed references to building, apron/ramp and auto access features, and descriptions of geometric dimensional areas, safety setbacks and separation standards.

- **Sheet 7 - Terminal Plan Drawing – Southwest Development Area**
  A scaled drawing depicting close-in terminal area features for the Southwest Development Area. This drawing shows required separation requirements and design standards, and includes general notes, data sources, and a legend noting key drawing symbols. The drawing provides detailed references to building, apron/ramp and auto access features, and descriptions of geometric dimensional areas, safety setbacks and separation standards.

- **Sheet 8 - Terminal Plan Drawing – Northwest Development Area**
  A scaled drawing depicting close-in terminal area features for the Northwest Development Area. This drawing shows required separation requirements and design standards, and includes general notes, data sources, and a legend noting key drawing symbols. The drawing provides detailed

references to building, apron/ramp and auto access features, and descriptions of geometric dimensional areas, safety setbacks and separation standards.

- **Sheet 9 – Minnesota Air National Guard (MNANG)**
  A scaled drawing depicting close-in terminal area features for the Minnesota Air National Guard Area. This drawing reflects the building, apron/ramp and auto access features, and descriptions of the Minnesota Air National Guard.

- **Sheet 10 - 13 - Inner Approach Plan & Profile Drawings**
  These scaled drawings depict close-in plan and profile approach features beyond each runway end. The drawings identify obstruction and non-compatible land uses within the runway protection zone and airspace surfaces extending beyond the runway centerline. Airspace surfaces, including applicable surfaces as defined in FAA AC 150/5300-13, Appendix 2 are depicted for disposition of obstructions to navigable airspace. The limits of the drawings extend to a point where the FAR Part 77, Subpart C approach surface reaches 100' height above the runway end elevation. Obstructions are indexed in plan and profile view, with an obstruction table used to denote existing and future obstructions to FAR Part 77 surfaces. The recommended mitigation of obstructions is noted, to correspond with the Airport's development plan. A general note section includes data sources and applicable references. A legend is used to note key drawing symbols.

- **Sheet 14 -15 – FAR Part 77 Airspace / Close-in Obstruction Plan**
  This drawing identifies the limits of recommended land use control for the height of objects surrounding the Airport. The airspace features correspond with the ultimate runway dimension as depicted on the ALP, Airport Layout Drawing (ALD). A digital USGS base map at a scale of 1" = 2,000', or other scale as appropriate, is used as the base map, in which each of the Federal Aviation Regulations (FAR) Part 77, Subpart C imaginary surfaces (primary, horizontal, conical, approach and transitional) are depicted in plan and profile view. The approach surface is depicted in full-length view using 50-foot contour intervals. An obstruction data table provides structure disposition with respect to existing and future FAR Part 77 surfaces. In addition, the drawing includes an isometric cut-away view of airspace features, general notes, data sources, and a legend for key drawing symbols.

- **Sheet 16 – 17 – Existing / Ultimate Runway Departure Surface Drawings**
  These drawings depict the relation of structures to the existing and future runway instrument departure surface, an imaginary airspace feature defined in FAA AC 150/5300-13, Appendix 2. The drawing depicts the plan and profile view along the extended runway centerline, superimposed over USGS quadrangle base maps. The 40:1 departure surface is associated with runway ends having instrument departure procedures. The 62.5:1 departure surface is associated with runway ends supporting air carrier operations, and is a currently a reporting surface not required on the ALP. Obstructions are listed in table format, including object descriptions, elevations and penetrations.

- **Sheet 18 - 20 – Airport Land Use / Minnesota Land Use Safety Zone (Existing / Proposed)**
  This scaled drawing depicts land uses and land-use controls around the Airport and provides recommendations for property uses through the 20-year planning period based on the proposed Airport development concept. This drawing provides recommended land uses for aviation and non-aeronautical land uses within the Airport vicinity, as designated by local planning and zoning. The land uses will generally conform, as applicable, to FAR Part 150 recommendations for the 65 DNL contour and previously adopted Airport land-use planning standards. On-Airport property areas to be reserved for basic Airport functions will be delineated. These land uses will be consistent with the Airport's requirements for aircraft operations, noise, and safety, including state statue

guidelines. Off-Airport property required for acquisition to permit future Airport development will be depicted and prioritized for phased acquisition.

- **Sheet 21 - Airport Property Map / Property Map Table**
  A scaled drawing graphically designating the inventory of all individual parcels and tracts defining the current Airport property boundary perimeter as compiled from deed research, available mapping/surveys and applicable field verification. This certified drawing documents past Airport land acquisition, including fee-simple and easement tracts, and summarizes how theses tracts have been acquired or released (i.e., federal funds, surplus property, local funds, etc.). Each parcel is numbered, including parcels once Airport property. A drawing table lists an inventory of all Airport property parcels by number; including the grantor, type of property interest, acreage, grant project number, purpose, county book & page reference, date of acquisition, and any applicable notes or remarks.

Chapter 7
Airport Layout Plan Drawing Set

CHAPTER 8
IMPLEMENTATION PLAN

8.1 INTRODUCTION

This chapter of the Airport Master Plan incorporates the most feasible alternatives into a phased 20-year Airport Development Plan for the Duluth International Airport. The plan describes one approach to funding and implementing the sponsor's most feasible development alternative. This year-by-year plan provides guidance for continued maintenance, upgrade, and expansion of facilities, as consistent with the Airport facility requirements, pavement conditions and long-term strategic vision of the Airport Authority. The Airport Layout Plan (ALP) drawings depict these improvements, in accordance with Federal Aviation Administration (FAA and Minnesota Department of Transportation (Mn/DOT-Aeronautics) policy and planning standards.

The Airport Development Plan does not represent an obligation of local funds, nor does it commit federal or state funding until demonstrating proper project justification and environmental clearance. In addition, other state and local coordination may also be necessary, depending upon the project. Cooperation with the FAA/MnDOT-Aeronautics is important to facilitate project formulation and coordinate implementation in a timely manner. It is also important that the development plan receive favorable community support and agreement amongst airport tenants.

8.1.1 Implementation Approach

The Implementation Plan consists of a general project phasing plan and an Airport Capital Improvement Plan (CIP). As a key element of the facilities implementation plan, a revised Airport Capital Improvement Program was recently submitted to the FAA and to Mn/DOT. The CIP incorporates facility improvements identified in the facility requirements analysis and alternatives developed in previous chapters of this master plan with the existing Airport CIP. The recommended phasing plan incorporates the facility improvements and major maintenance during the 20-year planning horizon.

The implementation plan provides guidance on implementation of the findings and recommendations of the Master Plan Update. The plan documents the schedule of projects, opinion of probable costs, and financial obligation throughout the 20-year study. These costs generally are broken-down by the short-term (0-5 year), intermediate (6-10 year) and long-term (11-20 year) development needs. The implementation plan considers the demand-driven need for facilities according to Facility Requirements as well as the safety and design standards improvements and provides the Airport and FAA with the information needed to integrate the Master Plan's recommendations with their daily airport activities.

The chapter is arranged to address the following topics:

- Listing and description of the CIP projects;
- Presentation of the Airport CIP (term); and,
- Summary of the 20 year Airport Development Program.

8.1.2 Project Identification

Projects identified in the Airport Development Plan are a response to a facility or user needs, as a reasonable expectation of when demand warrants and funding becomes available. The identification of projects is largely determined through recommendations resulting from Master Plan findings, in which the assignments of project priorities, phasing and estimated costs were consulted with the Sponsor, FAA and

MnDOT-Aeronautics. The following sources of project improvements have been reviewed for incorporation into the 20-year Airport Development Plan:

- Airport Capital Improvement Program (ACIP) FY 2014 to FY 2021 (Dated August 28, 2013)
- Airport Operating and Maintenance Improvement Needs

The following describes the two airport development phasing and funding schedules, in which each includes a year-by-year schedule of annual projects, project description, probable costs estimates, and anticipated funding break-down:

Master Plan Airport Development Plan: The Airport Development Plan is a 20-year improvement schedule, including both eligible and non-eligible projects allowable under the federal (FAA) and state (MnDOT) funding programs. This plan focuses largely on the capital projects necessary to implement the full project recommendations of the Airport Master Plan, as opposed to routine operating and preventative maintenance projects.

FAA Airport Capital Improvement Program (ACIP): The Airport Capital Improvement Program (ACIP) is an eight to 10-year improvement schedule, including only eligible projects allowable under the federal and state grant programs. The ACIP is submitted by the Airport each year to FAA for federal and state programming consideration. The ACIP is less inclusive of a project program than the Master Plan Airport Development Plan. In addition, the ACIP separately accounts for the project pre-planning, design and construction, as a reasonable implementation sequence necessary to fund and build multi-year projects. It should be noted that all of the Airport's FAA ACIP projects have been included in the Airport Development Plan for the Master Plan. The ACIP projects are incorporated in the Master Plan as submitted to FAA on August 28, 2013.

8.1.3 Project Phasing Periods

Projects are phased to facilitate systematic development over the course of the next 20 years. The Airport Development Plan is broken-down into planning phases, as follows:

Phase 1 (1-5 Years) – Near Term Planning Period
Phase 2 (6-8 Years) – Intermediate Planning Period in conformance with the ACIP
Phase 3 (9-20 Years) – Long Term Planning Period

Overall, the phasing and priority of the projects have been determined as a matter of: 1) airport safety and standard requirements, 2) facility conditions and deficiencies, 3) upgrades and expansion to meet user demand levels, and 4) consistent with funding resources and programming schedules.

Phase 1 and 2 identify individual projects on a year-by-year basis, while most projects in Phase 3 are grouped in a range of probable years. In addition, the Phase 1 and 2 projects often identify a separate 'design' and 'construction' phase for major projects, since the design component must lead construction to account for bidding and contract award time. While the Phase 1 and 2 projects are well defined and include major equipment purchase and building repairs, Phase 3 projects are less certain in terms of a focused project scope, and are more subject to re-sequencing in response to changing Airport needs. Similarly, the Phase 3 costs are typically unspecified due to uncompensated inflation adjustments or projects having yet to be defined.

The Implementation Plan can be dramatically impacted by unpredictable events such as inflation, changing demand profiles, local or national economic health, or legislative changes. Financial projections should be viewed accordingly. Other factors that may impact this implementation also include:

- Changing of priorities in funding for the initially identified capital improvements. Market conditions may cause changes in needed facilities, require new facilities, or redefine priorities.
- Safety and security improvements, whether they are reflected in the Airport CIP or not, may require immediate funding.
- Cost estimates to provide certain improvements can fluctuate dramatically when considering factors such as technological advancements and economies of scale related to undertaking several improvements at once.
- While addressing all of the capital needs of the Airport, the vast majority of the plan addresses the need to rehabilitate airfield pavement and solve runway safety and Federal Aviation Administration (FAA) design standard issues while keeping the Airport open.

It is recommended that the Implementation Plan, including the Airport CIP, be utilized as a working tool and a work in progress. The plan should be updated annually and include reassessment of project chronology within the three term phases, short, intermediate and long. Capital improvements, their associated costs, and financial projections should be re-examined periodically throughout the planning period even though the figures contained herein present a reasonable forecast of needed initiatives to implement the Master Plan Update recommendations.

8.1.4 Critical Airfield Capital Improvement Projects

A primary focus of the Airport Development Plan is centered on airfield rehabilitation projects, in which the size and cost of the pavement projects at Duluth often requires a phased multi-year improvement. As identified in Chapter 9-Implementaiton, approximately 78.5 percent of the eight year ACIP project costs (2014-2021) are dedicated to 'pavement' improvements. The airfield pavement conditions identified by the 2010 Pavement Condition Index (PCI) study are integrated into the overall Airport Development Plan. More particularly, it is the strategy of the Airport Development Plan to incorporate pavement rehabilitation as a sequence of inter-related projects accruing to the ultimate Airport development, as opposed to a set of individual pavement projects.

The keys to considering the Airport Development program are:

Environmental Clearance: Each major project should be re-evaluated at least every two years prior to implementation to ensure it receives the appropriate environmental processing, based on current environmental policies and procedures. Projects requiring environmental processing are typically identified as needing a categorical exclusion or an environmental assessment. The FAA and MnDOT will determine the type and level of environmental analysis required, and whether projects can be combined. Environmental approval for minor projects is normally conducted as part of the preliminary design phase, and typically takes several months to get environmental approval. Major projects normally require a separate environmental study, which can take up to 18 months. Projects in Phase 1 and 2 are anticipated to require minor environmental analysis and documentation to satisfy federal NEPA requirements. However, most of the major projects in Phase 3 involve areas of more significant land disturbance and redevelopment such as the Runway 3-21 extension. These projects would likely require detail environmental analysis, including Environmental Assessments, which typically have a shelf life approval period of 3 to 5 years.

Airport Operations: It is essential that major Airport improvement projects be scheduled and sequenced in a manner which does not unnecessarily limit Airport operations. As an Airport with multiple runways, it is critical that major runway and taxiway construction projects be sequenced, phased and scheduled in coordination with airspace/instrument procedure requirements, navigational systems, ground maneuverability, and points of terminal/hangar access. These considerations must

be factored for daytime, nighttime and inclement weather periods. Therefore, individual projects should not be considered as single improvements, but rather as a series of incremental projects that accrue towards the ultimate vision of Airport development.

Annual Revision of Cost Estimates: It is important to revise cost estimates on an annual basis since the cost of certain improvements can fluctuate dramatically when considering factors such as technological advancements, materials cost, and taking advantage of economies of scale related to undertaking several improvements at once.

8.1.5 Future Development Considerations

It is recommended that the Airport Development Plan and FAA Airport Capital Improvement Program (ACIP) be used as a working tool.

The one to eight year projects should be re-assessed and updated annually, including necessary adjustments in project sequencing, multi-year phasing considerations, engineering-level cost opinions, funding participation and proper lead-time for project formulation and planning requirements.

The following list is a brief description of the Airport Development Plan projects in the ACIP for the one to eight year timeframe listed in the same order as they may be found in Table 9-4 Airport Master Plan Development Program: Stage 1 and 2 (2014-2020). With few exceptions which are noted, the projects listed in this program are all triggered by life cycle circumstances. Their specific timing is based upon the Airport's best determination of priority. The lack of available funding dictates the spreading of these projects over a longer period of time than desired. It is possible that some of these projects may need to be moved up if equipment/pavement fails sooner than anticipated or delayed due to other projects becoming a greater priority or as a result of some unforeseen project that is not included in the list.

- Equipment replacement (2014 and 2019) and equipment purchase (snow removal equipment 2015)
- Air Traffic Control Tower Repairs: HVAC in 2014; roof and building management system in 2015; and, tuck pointing, exterior painting and siding in 2018.
- Completion of an airfield electrical manhole drainage project at the east end of the airport (2015)
- Upgrading airfield signage (2016).
- Runway approach obstruction removal off the Runway 9 end (2016).
- Taxiway "A" rehabilitation, Phase I in 2016 and Phase II in 2017. Rehabilitate Taxiway using "cold-in-place" asphalt recycling and a 4" overlay.
- General pavement maintenance, allowance of $50,000 for 2016, 2018, 2019, and 2020
- Environmental Analysis. Preparation of an environmental assessment of Runway 27 end compliance projects, Runway 3-21 extension, Taxiway "C" relocation, Taxiway "B" east extension to Taxiway "C", and Taxiway "F" configuration (2017). The triggering event for this project is the Airport's decision to begin advance planning for Runway 3-21 reconstruction and extension.
- Relocation of the Parallel Taxiway "C" System. Reconstruction of the north 3,400' x 50' portion of Taxiway "C" at 400' separation runway to taxiway.
- Taxiway "B" design (2018);
- Acquisition of Property (2018). Purchase of 0.5 acres for the future Runway Protection Zone to enable the extension of Runway 21 to an ultimate 8,000'. The property acquisition is necessary to comply with Mn/DOT Zone A standards that are greater than FAA requirements for an RPZ..Hangar repairs; Hangar 104 roof and hangar door repairs (2019) and Municipal Hangar #2 roof and hangar door repairs (2020).
- Access road paving and repair (2019).
- Runway 21 projects: extension of Runway 21 consisting of construction of a 1,282' x 150' extension to 7,000' and reconstruction of Runway 3-21 at 5,719' x 150' to include rehabilitation of runway

pavement, construction of 20' runway shoulders, and taxiway connections. This project would be constructed in two phases, Phase 1 in 2020 and Phase 2 in 2021.
- Midfield ramp apron repair (2021).
- Construction of an Arrivals and Departures building (2021).

The new airport parking garage project will be constructed during the 2014-2021 period but it is not federally eligible or included in the ACIP.

Like the 2014-2021 list, the long-term nine to 20 year projects should be periodically re-examined for proper project chronology and updating of the cost estimates assigned as the project as development becomes more defined. It is anticipated that the Airport will continue to monitor and evaluate which long-term nine to 20 year projects are best to accommodate tenant demands, accommodate growth, and meet federal and state requirements. The primary projects identified for the Long-Term Planning period are listed below:
- Rehabilitation of Runway 9-27, East End. Rehabilitate 2,800' x 150' runway section on Runway 27 end to include rehabilitation of shoulders and taxiway tie-ins, and rehabilitation of the former Taxiway "E" inline taxiway as a displaced threshold. Phase I-A would reconstruct the intersection of Runway 9-27 and Runway 3-21. Phase I-B would reconfigure the Runway 27 end by removing existing Taxiway E-1, constructing a new Taxiway E-1, constructing new Taxiway E-2, removing Taxiway A-5, and reconstructing Taxiway E as a displaced threshold.
- Reconstruction of Runway 9-27, West end. Reconstruct 2000' x 150' section on the Runway 9 end.
- Reconstruction of center portion of Runway 9-27. Reconstruct the center 6,200' x 150' section of Runway 9-27.
- Relocation/Realignment of Parallel Taxiway "C" System South End. Realign Taxiway "C" on the South End of the airport to conform to 400' runway-to-taxiway separation standards.
- Reconstruction of Taxiway D System, South End, 1,500 LF
- Extension of Taxiway "B" east to Taxiway "C". Construct 1,800 x 75' extension of Taxiway "B" to connect with realignment Taxiway "C"
- tower
- Reconstruction of Taxiway "A" to resolve air traffic control tower line-of-sight visibility constraints, removal of an irregular "S" curve, and enable general aviation ramp expansion.
- Extension of Taxiway "B" west to Taxiway A-3 intersection
- Construction of future cargo ramp expansion
- Construction of expanded General Aviation Apron. Construct new general aviation pavement west of Cirrus and south of Taxiway A.
- Construction of a new airport traffic control tower
- Development of a new helicopter hangar facility
- Construction of new terminal taxiway/apron fillet enlargement along Taxiway 'D'
- Site development for potential Unmanned Vehicles or a general aviation expansion area
- Construction of an expanded paved snow dump area
- Construction of a midfield apron expansion along Runway 9-27
- Development of a GPS-based satellite precision instrument approach for Runway 21;
- Construction of Taxiway "F". Realign existing Taxiway "F" by constructing new future partial parallel Taxiway "F" to provide Minnesota Air National Guard Ramp access to the Runway 21 end
- Extension of Runway 9-27 by 1,438' x 150' feet to an ultimate 11,600' feet
- Extension of Runway 21. Construct 1,000' by 150' extension to Runway 21 to a full length of 8,000'

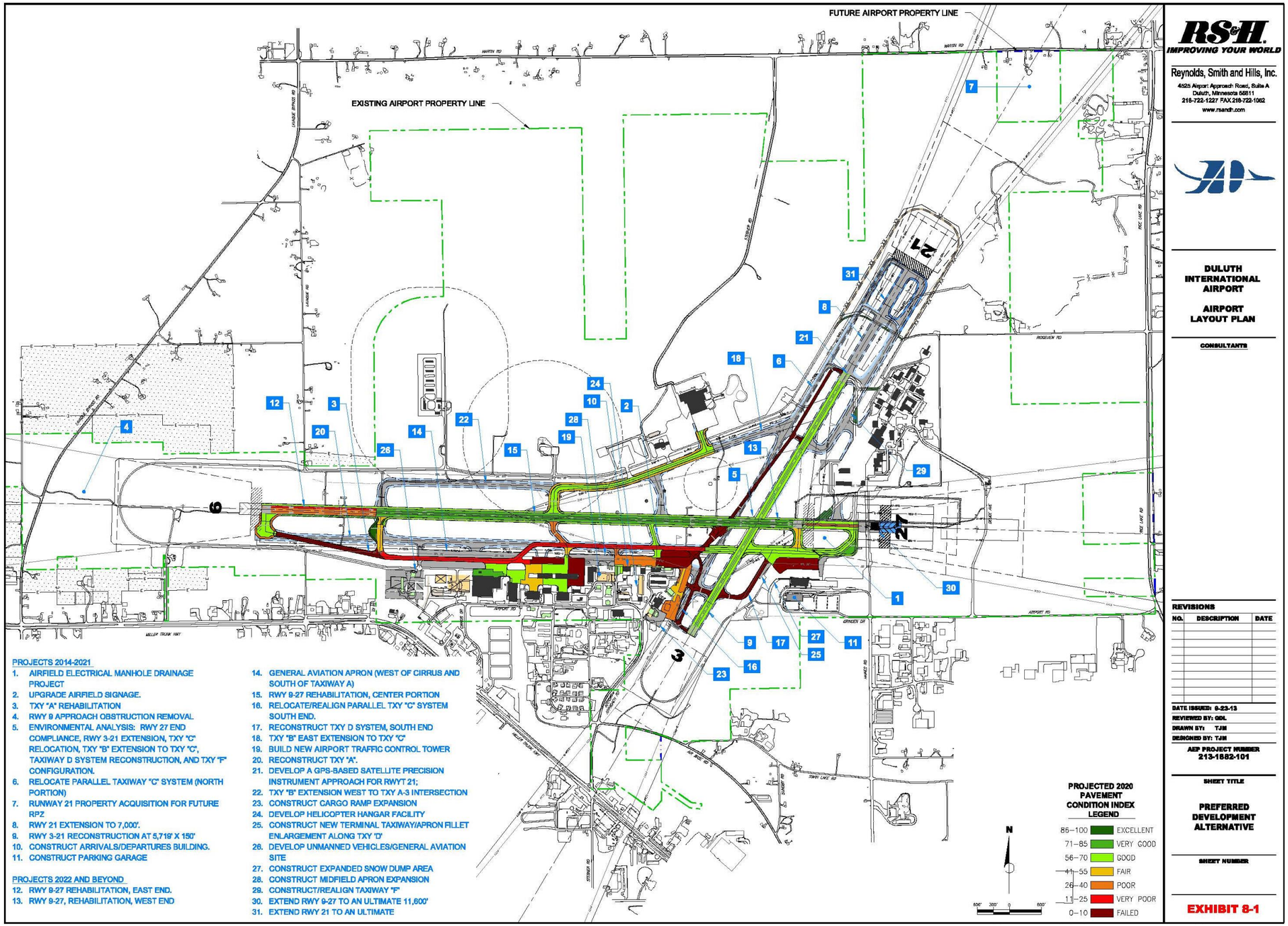
8.2 PHASING PLAN

Projects identified as part of the Master Plan are described below. The projects are aggregated to facilitate systematic development over the course of the next 20 years by short, intermediate, and long term. The

short-term capital improvements include those development items that will begin within the next five years and are intensively focused on solving the critical airfield issues at the Airport. The project numbers in the short term phasing plan provide the year (i.e., 2014) and sequence of project of the projects. The intermediate-term capital improvements generally fall outside the initial five year window and are responsive to expected future / ultimate requirements. Projects identified for the intermediate-term are the six to eight year projects identified in the ACIP.

The long-term capital improvements generally fall outside the initial ten year window and are responsive to expected ultimate requirements. These long-term projects can be re-sequenced in response to changing needs.

The overall phasing plan for the major projects in the development plan is depicted in Exhibit 8-1. This figure identifies the location of each major facility development project listed in the ACIP (2014-2021) exclusive of equipment and general maintenance as well as the identification for projects within the Airport Development Plan for subsequent years. It also replicates the estimate 2020 pavement conditions index shown for the purpose of identifying the critical nature of timing for pavement rehabilitation projects. Exhibit 8-1 follows at the end of the chapter. The timing of intermediate (six to eight years) and long-term projects (beyond eight years) is less well defined and requires future attention by the Airport to adjust sequencing and timing as future conditions dictate.



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DULUTH INTERNATIONAL AIRPORT

AIRPORT LAYOUT PLAN

CONSULTANTS

REVISIONS

NO.	DESCRIPTION	DATE

DATE ISSUED: 6-23-13
REVIEWED BY: GDL
DRAWN BY: TJM
DESIGNED BY: TJM
AEP PROJECT NUMBER 213-1882-101

SHEET TITLE

PREFERRED DEVELOPMENT ALTERNATIVE

SHEET NUMBER

EXHIBIT 8-1

8.3 FUTURE MASTER PLAN CONSIDERATIONS

Over the course of the development of the DLH master plan, a new FAA policy was issued having to do with runway protection zones. This policy known as "Interim Guidance on Land Uses Within a Runway Protection Zone" prescribes that an RPZ should be absolutely clear of development. Based upon the guidance within that policy, any change in an RPZ will also require any incompatible land use, as defined by the policy, to be removed from the RPZ. Any plan that includes an incompatible land use within an RPZ must be approved by FAA Headquarters.

Consequently, it is recommended that the next ALP Update or Master Plan Update include an RPZ land use compatibility analysis within it.

CHAPTER 9
CAPITAL FUNDING PLAN

9.1 INTRODUCTION

This chapter of the Airport Master Plan outlines the financial strategy to assist the Duluth International Airport in implementing the 20-year projects identified in the previous chapter. This section reports on the financial structure of the Airport, along with the potential sources and timing of capital funding in order to implement the recommended Airport Development Plan projects.

9.1.1 Key Considerations

This section presents the Airport's financial structure, historical budgeting patterns, and other influencing factors regarding the Airport's revenue position with regards to funding the Airport Development Plan described in the previous chapter. As a federally obligated Airport, the financial plan has been developed consistent with federal and state grant programs and funding policies.

The overarching financial plan is subject to the following key considerations:

- The funding analysis proposes the Airport Development Plan can be funded over the 20-year Master Plan time frame; in that all projects are demand or necessity driven and will be constructed only as activity grows; as activity grows, increased user fees or other funds become available; and the FAA provides funding for necessary airfield projects from nationwide user fees on aviation activity and such airfield projects with FAA funding comprise the majority of the Airport's capital needs.

- The Airport's pavement improvements are substantial over the next 10 to 20 years, as identified in the 2010 Pavement Condition Index (PCI) study. Significant runway rehabilitation projects are imminent, as required to properly maintain infrastructure to support and retain airport users, commercial operators and business tenants.

- The Airport will rely heavily on federal and state funding programs to implement the major eligible capital improvement projects. Consequently, the Airport will depend heavily on discretionary and appropriated funds for the major airfield infrastructure improvements.

- The Airport may implement tenant rate increases and/or new user charges to generate the Airport revenue levels necessary to provide for the local grant match. However, the Airport does not anticipate any future reliance on supplemental revenues as part of the Airport's financial plan.

9.1.2 General Funding Plan Approach

This section assesses Airport budget information to identify a reasonable expectation for implementation of the 20-year Airport Development Plan projects. Airport budgets for fiscal years 2008 to 2011 were reviewed to identify budget trends, income patterns and major operating revenue and expense factors. Summaries of revenues and expenses are included and the annual cash operating surplus or deficit is identified.

Like most airports, DLH derives local revenues from three broad categories of activities:
- Passenger-related activities including parking, concessions, and rental cars;
- Airline leases and fees received directly from the airline tenants; and

- Land and building rentals to non-airlines parties.

Due to the fluctuations of revenues from year to year and the adherence to strict budgetary requirements, DLH does not project revenues beyond the current fiscal year. Decisions regarding the upcoming year's CIP is based on anticipated federal and state funding availability as well as the specific projects for a given year which requires varying levels of local funds. As circumstances may dictates, CIP projects may be adjusted according to funding availability and the capability of the DAA to provide the appropriate levels of local funding.

Airport financial situations can vary, perhaps significantly, over short spans principally due to changes in user activity, the number of tenants, lease rate changes, maintenance/construction cost increases, unexpected operating expenses, and other factors. In addition to the Airport's financial situation, the financial plan also recognizes the possibility for future changes to the federal and state airport funding programs, as subject to reoccurring legislative authorizations. Therefore, the financial plan assumes the continued FAA and Mn/DOT funding support for capital projects, stability of cost estimates, and the viability of sustained tenant and user revenues as affirmed by the airport activity forecasts.

Since the Airport's activity levels, capital plan, and funding strategy may change, this general funding plan should be reviewed and adjusted periodically to allow for changing circumstances. That is, the same assumptions that anticipate growth of aviation activity at the Airport recognize that those same users or tenants must pay a portion of the costs for the facilities provided. Further, the Federal, State, local, and other funds that historically have been provided for Airport improvements (particularly critical airfield renewal) will continue.

9.2 AIRPORT FINANCIAL STRUCTURE AND POSITION

The Duluth International Airport is owned by the City of Duluth, but operated as an independent public entity controlled by the Duluth Airport Authority. The Duluth Airport Authority has a Board of Directors, appointed by the City of Duluth, which govern the Duluth International Airport and Sky Harbor Airport.

The Authority operates as an independent operation without taxing authority or financial support from the City of Duluth. Therefore, the Authority's funds are accounted for separately and the financial statements prepared as if the airports were a stand-alone entity. Such independent reports meet the FAA's requirement that airport funds be identified separately from the City of Duluth, St. Louis County, State of Minnesota, or any other governmental units.

While the Airport Authority administers ownership control, the principal users of the Airport are private businesses entered into various lease agreements. This means the Airport Authority is essentially a proprietor, and dependent upon the success of its tenants and users to remain financially self-sufficient.

9.2.1 Historical Net Assets

Table 9-1 summarizes the past four years of Authority change in net assets. Over the long term, the Authority has recorded annual increases in net assets. Total operating expenses in the 2008-2011 period have ranged from $8.2 to $9.2 million. Excluding depreciation (which is a non-cash expense), salaries and wages was the largest category of expense representing approximately 40 percent of annual operating costs.

Approximately 95 percent of 2011 revenue was from Duluth International Airport and 5 percent from Sky Harbor Airport. Authority revenues have ranged from $3.6 to $3.0 million in the 2008-2011 period. The largest sources of revenue were:

- Terminal building space rent
- Land rent
- Rental car commission fees
- Aircraft landing fees

Table 9-1
HISTORICAL OPERATING RESULTS

	2011	2010	2009	2008
Operating Revenue				
Charges for Services	$ 3,644,913	$ 3,607,373	$ 3,002,023	$ 3,429,700
Total Operating Revenue	$ 3,644,913	$ 3,607,373	$ 3,002,023	$ 3,429,700
Operating Expenses				
Personal Services	$ 1,487,320	$ 1,521,869	$ 1,544,675	$ 1,589,639
Supplies	76,407	77,449	60,828	57,231
Utilities	589,256	579,672	519,345	632,231
Other Service/Charges	1,344,040	1,477,605	1,127,123	1,393,009
Depreciation	5,595,951	5,121,608	4,828,206	4,495,883
Amortization	133,233	104,750	119,921	126,492
Total Operating Expense	$ 9,226,207	$ 8,882,953	$ 8,200,098	$ 8,294,485
Operating Income (Loss)	$ (5,581,294)	$ (5,275,580)	$ (5,198,075)	$ (4,864,785)
Nonoperating Revenues (Expenses)				
Investment Earnings	$ 6,873	$ 8,841	19,039	$ 27,950
Passenger Facility Charge Receipts	563,245	582,047	463,654	524,767
Gain (Loss) on Capital Asset Disposal	8,441	(791)	(45,492)	17,194
Interest Expense	(51,550)	(45,772)	(40,481)	(46,300)
Marketing Grant	-	-	41,426	83,540
Total Nonoperating Revenues (Expenses)	$ 527,009	$ 544,325	$ 438,146	$ 607,151
Net Income (Loss) Before Capital Items	$ (5,054,285)	$ (4,731,255)	$ (4,759,929)	$ (4,257,634)
Capital Contributions				
Federal Grants	$ 8,778,088	$ 6,803,173	$10,350,361	$ 2,994,251
State Grants	3,597,579	3,084,243	2,384,889	1,662,896
Local Grant	-	-	250,000	-
Contributed Capital	1,047,357	35,598	-	94,992
Total Capital Contribution	$13,423,024	$ 9,923,014	$12,985,250	$ 4,752,139
Change in Net Assets	$ 8,368,739	$ 5,191,759	$ 8,225,321	$ 494,505

Source: Audited Financial Statements

9.2.2 Historical Cash Flow

Table 9-2 summarizes the Authority's Statement of Cash Flow for 2008 through 2011. Based upon receipt of grant funds and expenditures for capital projects, the level of cash surplus or deficit can vary substantially between years. The surplus of operating cash in 2008 was approximately $1.0 million. In 2009, a deficit of $1.4 million was recorded; the amounts in 2010 and 2011 were roughly off-setting at a $650,000 increase and $440,000 decrease.

Table 9-2
STATEMENT OF CASH FLOW

	2011	2010	2009	2008
Cash Flow from Operating Activity				
Cash Received from Customers	$ 3,430,810	$ 3,236,417	$ 3,022,397	$ 3,394,317
Cash Paid to Suppliers	(2,082,866)	(2,328,014)	(1,733,357)	(1,749,398)
Cash Paid to Employees	(1,371,315)	(1,508,596)	(1,540,680)	(1,571,433)
Other Cash Receipts	300,465	258,316	220,427	244,592
Net Cash Provided (Used) in Operating Activities	$ 277,094	$ (341,877)	$ (31,213)	$ 318,078
Cash Flow from Noncapital Financing Activity				
Principal Paid on Revenue Note	$ (36,719)	$ (33,673)	$ (22,170)	$ -
Interest Paid on Revenue Note	(38,281)	(41,327)	(52,830)	-
Net Cash Provided (Used) in Noncapital Financing Activity	$ (75,000)	$ (75,000)	$ (75,000)	$ -
Cash Flow from Capital Related Activity				
Principal Paid on Loans	$ (26,667)	$ (26,667)	$ (26,667)	$ (26,667)
Federal Grants	8,754,942	7,030,779	7,721,361	4,458,391
State Grants	3,622,105	2,547,176	2,206,830	1,769,767
Local Grant	-	250,000	-	-
Advance from Fixed Base Operator	-	371,033	-	-
Passenger Facility Charge Receipts	568,193	559,538	442,992	539,785
Proceeds from Sales of Capital Assets	-	-	-	46,750
Acquisition or Construction of Capital Assets	(13,567,543)	(9,675,956)	(11,687,649)	(6,159,466)
Net Cash Provided (Used) in Capital Related Activity	$ (648,970)	$ 1,055,903	$ (1,343,133)	$ 628,560
Cash Flow from Investing Activity				
Interest on Investments	$ 6,873	$ 8,841	$ 19,039	$ 27,950
Net Cash Provided (Used) by Investing	$ 6,873	$ 8,841	$ 19,039	$ 27,950
Net Increase (Decrease) in Cash or Equivalents	$ (440,003)	$ 647,867	$ (1,430,307)	$ 974,588

Source: Audited Financial Statements

9.3 SOURCES OF AIRPORT CAPITAL FUNDING

There are numerous potential sources of airport capital; however, FAA grants and local funds, such as airport revenue, typically provide most of the money. The various types of FAA and local funds are discussed below, as well as the other potential capital fund sources.

9.3.1 FAA Funding

The Federal government has been involved in supporting aviation development since 1946. FAA grants are funded through the Aviation Trust Fund as collected through user-generated taxes (airline passenger tax, aircraft parts and fuel) and distributed in accordance with the FAA Airport Improvement Program (AIP) by entitlement formula or discretionary provisions. FAA Order 5100.38C, “Airport Improvement Program Handbook” provides guidance and sets forth policies and procedures for the administration of the Airport Improvement Program (AIP) by the Federal Aviation Administration (FAA).

The Airport and Airway Improvement Act of 1982 established the current federal funding mechanism, known as the Airport Improvement Program (AIP), which provides capital support for eligible planning, development, and noise compatibility projects at public-use airports. Airport sponsors are eligible for FAA funding for specifically approved projects through the FAA's AIP.

At the national level, the public pays Federal Excise Taxes on commercial airline ticket purchases. The current level of such fees is shown in Table 9-3. In addition, airlines pay other fees on fuel and aircraft tires. In total, these aviation-related fees/taxes fund the FAA and are "returned" to public airports in the form of grants for appropriate capital improvements.

Table 9-3
FEDERAL EXCISE TAXES

Type of Charge	Amount
Passenger Ticket Fee (Percentage of sale price)	7.5%
Domestic Segment Fee (Per flight leg)	$ 3.90
International Arrival Fee (Per person)	$ 17.20
Hawaii/Alaska Segment Fee (Per flight)	$ 8.60

Source: FAA, Effective Jan. 1, 2013

While the AIP has been reauthorized several times since established, including the adjustment of the appropriated amount and funding formulas to reflect current national priorities, the basic AIP program has remained essentially the same. The latest funding extension continues the program through September 30, 2015. For the purposes of this analysis, it is assumed that the federal government will continue to participate in funding airport capital projects over the next 20 years based on the levels similar to those currently authorized by AIP for the following FAA sources:

- FAA Entitlement – funds for commercial service and air cargo airports based on the number of annual enplaned passengers and (for the very largest airports) amount of air cargo handled. Other allocations of AIP funds go to states, general aviation airports, and other commercial service airports, as well as for noise compatibility planning and programs. As part of the 2012 FAA Reauthorization Act (PL 112-95), FAA entitlements provide for 90 percent of total federal eligible project cost, with the remaining 10 percent match typically split between the State and Airport Sponsor. Prior to 2012, the FAA entitlements were a 95%-2.5%-2.5% program. The FAA entitlements can fund AIP-eligible projects per Mn/DOT approval, and can be carried over and accumulate for up to four years. It is anticipated that future non-primary entitlements will continue at the current levels for general aviation airports under future aviation FAA re-authorization acts.

- FAA Discretionary – Any remaining AIP funds at the national level not mandated by set-asides or assigned to entitlements are designated as discretionary funds, and may be used for funding eligible FAA projects. Discretionary funds are airport and project specific, and based on the national priority system. Eligible discretionary projects are typically those that enhance airport capacity, address noise, or enhance safety and security, or are directed to certain national project priorities. The more expensive projects in the Airport Development Program and ACIP, such as airfield pavement rehabilitation, are expected to be funded from FAA discretionary funds. Discretionary funds, which vary from year-to-year, provide for 90 percent of the cost of eligible projects with local or state funds providing the 10 percent match. In addition, the sponsor must be able to commence the work on projects using discretionary funds during the same fiscal year as the grant agreement or within 6 months, whichever is later.

- FAA Apportionment – FAA funds made available to states under various conditions, as apportioned based on an area/population formula within the 50 states.

9.3.2 FAA Project Priorities

FAA distributes Airport Improvement Program (AIP) monies to commercial service airports in accordance with project priority and the degree of need. The FAA uses the ACIP National Priority Rating system for the distribution of AIP grant funds, which is a value generated equation that takes into consideration the airport and project role in accordance with FAA goals and objectives.

The following are the point system assigned for project purpose categories:

- Safety/Security = 10 points
- Statutory Emphasis Programs = 9 points
- Planning = 8 points
- Reconstruction = 8 points
- Environment = 8 points
- Capacity = 7 points
- Standards = 6 points
- Other = 4 points

9.3.3 State of Minnesota

The State of Minnesota Department of Transportation provides funding to public airport sponsors for certain types of projects. The key driver for major capital improvements identified in this Master Plan is the State Construction Grant Program. For capital improvements that provide a justifiable benefit to the traveling public, the State will pay up to 70 percent of eligible costs. Projects that have a revenue generating potential are funded at 50 percent.

Outside the scope of the Master Plan, other Department of Transportation funding is provided to airports for specific routine maintenance activities, maintenance equipment, hangars (by means of a revolving loan fund), and marketing. In addition, the State Legislature provides grant funds for major capital improvements of significant regional importance. For example, the new passenger terminal received State funding. This financial plan assumes State funding will continue throughout the 20-year planning period at current levels. However, other than for major capital improvements, such State funding is typically in fairly small amounts and for specific types of projects.

9.3.4 Passenger Facility Charge (PFC)

The Aviation Safety and Capacity Expansion Act of 1990 authorized the Secretary of Transportation to grant public agencies the authority to impose a passenger facility charge (PFC) to fund eligible airport projects. The initial legislation set the maximum PFC level at $3.00 per enplaned passenger. AIR-21 increased the maximum PFC level form $3.00 to $4.50. Although the FAA is required to approve PFCs, the program allows for local collection of PFC revenue through the airlines operating at an airport and provides more spending flexibility to airport sponsors versus AIP funds. PFCs provide funding for certain projects that are not permitted under normal FAA grants and their revenue is allowed to be used for the local matching share of FAA grants. In addition, airports can borrow against their expected PFC collections. Therefore, PFCs are often a critical factor in funding major airport capital projects. The Airport has implemented a PFC at the $4.50 level which is committed for specifically approved projects.

9.3.5 Airport Revenues

The Airport funds some or all of the cost of capital projects by generating revenue from tenants, users, or other sources. These Airport funds can come from reserves, annual surplus, or borrowing. While capital projects are usually funded from a variety of sources, in the end, Airport funds have a role in almost every project, particularly as seed money to initiate projects.

9.3.6 Other "Local" Funds

The funds provided by a PFC or an airport itself are often called "local" sources because they represent the local match to FAA grants or pay for some projects ineligible for FAA funding. Additional local funds are often provided to airports by cities, counties, other taxing districts, or a collection of public agencies. These government agencies support airports because of their public-use nature, their regional influence, and their critical value in supporting economic development. External public support for airports is particularly important when a new airport is constructed or an existing airport builds a runway or terminal that represents a once-in-a-lifetime capital expenditure. Public financial support for airports comes in forms such as grants, interest free loans, or loans under the umbrella of states, counties, cities, taxing districts, or public financing agencies.

9.3.7 Other Sources

In addition to the "traditional" sources of airport capital funds listed above, there are other potential suppliers of money to construct capital improvements. These include tenants, users, investors, and public agencies. Tenants often construct their own facilities, particularly hangar and air cargo facilities. Airport users such as airlines sometimes contribute funds for projects or agree to increased rents to recover the costs of improvements. Private capital can also be used for facilities such as cargo buildings or hangars; in a similar manner, vehicle parking lots or other revenue generating facilities can be privatized with the use of venture capital. Due to the shortage of public capital, as well as the desire of investors to seek more innovative uses for their funds, airports are seeing increased use of external funding for capital projects.

9.4 SPECIFIC ISSUES OF AIRPORT CAPITAL FUNDING

This section will discuss the specific sources of capital funds expected to support completion of the projects identified in this Master Plan Update.

9.4.1 Major Funding Sources

Each major type of funding is presented below.

- **Federal Aviation Administration, Entitlement Funding** – The Airport "earns" capital funds each year based upon its volume of passengers. Utilizing the current formula, the current passenger traffic, and assuming full appropriation by Congress, this amount for the Duluth International Airport is approximately $1.6 million per year. These funds can be used for any eligible project under AIP and must be matched with a 10 percent local contribution.

- **Federal Aviation Administration, Discretionary Funding** – The FAA provides addition funds for capital projects on a need and priority basic. These funds are focused on improving the capacity and safety of the national transportation system and competition is intense for the funds available. The amounts available are substantial; however, grants may be phased over a number of years due to the high national demand for discretionary funding. Only certain types of capital expenditures are eligible and the amounts must be matched at the 10 percent level.

- **Minnesota Department of Transportation, Office of Aeronautics** – The State provides grants for equipment and general aviation facilities based on an annual appropriation. Typically, the State provides 70 percent of the project funds and the Airport provides 30 percent. In addition, airport projects of regional significance or critical importance to Minnesota aviation are funded by the State under special allowances.

- **Passenger Facility Charges (PFC)** – The Airport has a PFC, presently collected at the maximum $4.50 per enplaning passenger rate. This PFC revenue must be used for specific, pre-approved capital projects. Based on the recent volume of approximately 160,000 annual enplaned passengers, the Airport can generate approximately $675,000 annually from this source. Like other funding associated with the FAA, the use of PFC funds is limited to eligible types of projects, but the funds can be used to match FAA Entitlement and Discretionary dollars.

- **Customer Facility Charge (CFC)** – In association with the on-airport rental car firms, the Airport can implement charges on rental car customers that are used to fund rental car facility improvements. Necessary rental car facility improvements are anticipated to be funded from this source.

- **Airport Operating Funds** – The Airport charges users and tenants for the privilege of operating at their facility. These revenues cover Airport operating costs and help fund capital projects. The Airport currently has certain funds in reserve accounts and can earn addition funds in the future. A portion of these funds can be used to fund the proposed capital program.

- **Other Sources of Capital** – There are other sources of funds such as private investment or grants from foundations that might be available for capital projects. The likelihood of contributions from these sources is unknown; however, community organizations in a number of cities have helped fund public-use projects such as new airport terminals.

9.4.2 Operating Revenue Factors:

The Airport continually seeks tenants to utilize the Airport's facilities. However, there are limitations on operating revenues brought about by the Airport's physical and demand traits.

- Terminal Building Cost

- Scarcity of functional hangar and building lease space, which is a limiting factor in enhancing additional rental revenues in the future.

- The north side business development area is poised to accommodate future aviation-related tenants. Demand for this area has been sluggish due to economic conditions. Also, business development is planned south of Lackland Street.

9.4.3 Expect Sources of Airport Capital Funding

Based on this analysis, a combination of sources will likely be available to fund the capital plan. Each projected source is described in this section.

- **Federal Aviation Administration, Entitlement Funding** – As a primary commercial service facility, the Airport currently receives approximately $1.6 million annually in FAA Entitlement

funding. Over the 20-year planning period, this source is expected to provide approximately $32 million.

- **Federal Aviation Administration, Discretionary Funding** – In the past, the Airport has applied for and received FAA Discretionary funding. Over the next 20 years, the Airport expects to need substantial funds for runway reconstruction and other projects. Therefore, it is estimated in this analysis that substantial amounts of FAA Discretionary funding will be requested and received.

- **Minnesota Department of Transportation, Office of Aeronautics** – State matching funds for Federal grants are identified in this long-term plan. No unusually State funding requests are programed.

- **Passenger Facility Charge (PFC)** – The Airport generates approximately $675,000 annually from PFCs. In the next 20 years, approximately $13.5 million in new collections is possible for new capital projects.

- **Customer Facility Charge (CFC) –** This charge on rental car contracts is being collected and is used for rental car specific capital improvements.

- **Airport Operating Funds** – The Airport has current capital funding reserves and the ability to generate annual surplus revenues over expenses. Over the 20 year planning period, there is a requirement for capital funding from Authority revenue to match Federal grants and fund FAA-ineligible projects.

- **Other Sources of Capital** – Several of the proposed projects such as new hangar facilities appear eligible for private funding. While the amount of such funding is unknown, this is another potential revenue source. State economic development grants or private funding may also be available.

In total, there are a number of potential sources of funds for the Airport's proposed capital development plan. Certainly there are issues of project justification, levels of increased demand, project eligibility, and approvals that must be met. However, if demand materializes and proper application provided, it appears that sufficient funds are potentially available over the long-term to fund the proposed projects. The major assumptions of financial feasibility are presented below.

- **Most Capital Projects Are Demand Driven** – Few of the capital projects identified are required immediately or are without currently identified funding; rather, most are needed as demand increases and later in the 20-year planning period. Therefore, projects will be constructed as required and not by an arbitrary, pre-established time schedule. This need for a verification of demand before construction provides a natural brake on unnecessary building; alternatively, it provides a stimulus to needed projects that will occur if Airport activity levels grow faster than anticipated.

- **The Capital Plan Is Flexible** – Construction of the projects identified in this analysis can be accelerated or decelerated as funding becomes available or as other factors influence both the facility and its financial situation. In reality, projects that are more important can be implemented and less important ones delayed, as necessary, to match available funding.

- **Partial or Staged Funding Is Possible** – In a similar manner, certain projects can be scaled back in scope or built on an incremental schedule to match the available funding.

- **Innovative Funding Methods Are Available** – This analysis addresses the "traditional" sources of airport capital project funding. If necessary, the Airport can identify and implement new and/or innovative sources such as leasing or partial privatization. That is, use of private sector type tools, in order to fund necessary infrastructure, can occur. Parking, hangar, and rental car facilities appear most likely to benefit from innovative funding methods.

- **Increased Support from Governmental Agencies Is Possible** – This analysis assumes Federal, State, and/or local funds are provided at past levels. It does not address the fact that the Airport has identified a number of proposed capital projects that are that are perhaps beyond the ability of the Airport, by itself, to fund. In recent times, special funding for airports has been made available for runways, terminals, security projects, or other facilities that are beyond the scope of normal airport operations. Upon request, additional Federal, State, or local funding may be made available.

- **Department of Defense Funding for Military Facilities** – This analysis assumes that there may be projects to support the Minnesota Air National Guard that would need to consider the U.S. Department of Defense as a funding source. All projects that provide for joint or sole use by the 148th Fighter Wing is eligible for funding participation by the DOD proportionate to the 148th's use of the proposed project. To best prepare for participation, the 148th Fighter Wing requests five years notice prior to a project's anticipated requirement.

In summary, both tradition project funding and other means may be used to accommodate future aviation activity at the Airport.

9.4.4 Airport Project Responsibilities

Airport capital projects are typically closely coordinated with the FAA and Mn/DOT, particularly when Airport Improvement Program (AIP) funding or NEPA environmental documentation is required. Therefore, in addition to the typical project procurement and execution responsibilities that most Airports address on a wide variety of non-airport projects, additional consideration of FAA requirements is needed for the projects listed in the ACIP. In general, for each project the Airport will be responsible for the following:

- Update the Airport Capital Improvement Program (ACIP) and financial documentation

- Verify the justification supporting the project and request FAA/Mn/DOT participation for projects using AIP funding.

- Assure completion of the necessary environmental processing through agency coordination

- Prepare and submit grant applications

- Prepare and issue a Request For Qualification and selecting the consultant/engineer for the project planning, design, or environmental analysis, as applicable

- Prepare and issue a Request For Proposals and selection for project construction, management, and related construction services; these services may be provided or assisted by the design engineer

- Provide project administration including FAA grant maintenance and close out

This financial analysis is based on continued FAA and State funding at current levels. However, there is a competition for FAA funds, so the Airport will need to aggressively market its development plan to FAA, Mn/DOT and other relevant agencies as opportunities arise. Regular coordination with the FAA and Mn/DOT is important to facilitate and gain acceptance of the responsibilities.

9.5 CAPITAL PROJECT FEASIBILITY SUMMARY

The following is a summary of the Airport's financial position as related to the eight-year FAA Airport Capital Improvement Program (ACIP) and 20-year Airport Master Plan Development Plan.

This analysis indicates that funding will likely be available to plan, design, and construct the projects identified in the Master Plan. This financial analysis is based on continued FAA and State funding at current levels. However, there is a competition for public funds, so the Airport will need to aggressively market the need for its proposed capital projects to the FAA, State of Minnesota, and other agencies as opportunities arise. Innovative sources, including other federal funding sources**,** may be required to address all the proposed projects if they are to be completed in the recommended time frame.

ACIP Capital projects of approximately $30 million have been identified of which roughly half are programmed in the next five-year period. The funding for the relocated terminal building, new aircraft apron, parking lots/structure, and certain other projects associated with the new passenger terminal are assumed to be completed or outside the scope of the Master Plan analysis. Funding for projects in the nine-20 year time frame or the sequencing of those projects has yet to be determined. As almost all of these projects are airfield pavements, traditional funding is anticipated.

Based on the assumptions and the financial analyses presented herein, the capital plan is considered practicable and it is anticipated that the Duluth International Airport will be able to construct necessary aviation facilities over the 20-year planning period to accommodate demand. Of course, the continued monitoring of the Airport's financial status is necessary to adapt and adjust as conditions change.

It should be noted that project costs are planning estimates and are used for programming purposes. For those projects included in the FAA ACIP, the costs reflect engineering-level cost opinions, based on current year values, and not adjusted for inflation. Also, it is important to note that the review of funding eligibility produces an estimate of the minimum local share funds that must be available through the sponsor to undertake the various projects. Actual funding received is often less than the maximum eligible due to competition for limited funds, low project priority rankings, or incomplete lobbying efforts to secure maximum funding.

9.5.1 Project Costs – FAA Airport Capital Improvement Program (ACIP)

Table 9-4 at the end of this chapter summarizes the estimated project costs and funding share, by planning phase and anticipated funding entity, for the projects identified in the Phase 1 and 2 Airport Development Plan periods which have been defined as coincident with the ACIP 2014-2021. This period involves four major projects and 26 individual projects at a total cost of over $32 million. The federal share, which includes entitlements, apportionment and discretionary, assumes nearly 86 percent of the allowable funding total. As mentioned above, projects in the Phase 3 Airport Development Plan period are those for which construction timing has not yet been identified and consist almost exclusively of airfield pavement projects. Given that sufficient demand and environmental justification for these projects will be required prior to design and construction, the hypothetical breakdown shown in Table 9-5 is based upon traditional funding methods for projects of this type.

9.5.2 Project Costs – Local

Table 9-4 summarizes the Airport's estimated local costs, by planning phase, for all projects in the eight-year ACIP airport development program. The local Airport share, which includes eligible and non-eligible project costs, totals nearly $3.5 million and accounts for 10.8 percent of the total costs. The local funding portion of a project typically ranges between 2.5 and 50 percent. Several projects have high local costs due to limited or non-allowable grant eligibility.

9.5.3 Project Costs – Airport Master Plan Development Plan

Table 9-4 summarizes the anticipated funding cost for the Airport's 20-year Airport Development Plan as it exists by the Airport prepared at the time of preparation of this document. These nine-20 year projects are significant to the airport master plan implementation but not yet identified with any specific year. Project costs are planning estimates and place holders. Stage 1 refers to projects that may be accomplished within the next five years (2014-2018) and Stage II projects that may be accomplished over the period (2019-2021).

Table 9-4
AIRPORT MASTER PLAN DEVELOPMENT PROGRAM
Stage 1 and 2 (2014-2020)

Airport Capital Improvement Program (2014-2021)				
Project Description	**FAA Funding (90%)**	**State Funding (70%)**	**Local Funding (10% match Fed; 30% match State**	**Total Project Cost**
2014 Projects				
Replace Equipment #14/#15/#36 (replace with multi-purpose	$744,000		$86,000	$860,000
Air Traffic Control Tower Repairs – HVAC		$185,500	$79,500	$265,000
Terminal Bid Pack 2D (Overhead Walkway)(constructed)	$711,000		$79,000	$790,000
Total 2014	$1,485,000	$185,500	$244,500	$1,915,000
2015 Projects				
Airfield Electrical Manhole Drainage	$315,000		$35,000	$350,000
New Equipment Purchase 972 Loader w/Snow Box, buckets	$450,000		$50,000	$500,000
Replace Equipment #19 Grader w/160M, Wing, Molboard Extension, Angle Plow	$337,500		$37,500	$375,000
Air Traffic Control Tower Repairs – Phase I (Roof & Building Management System)		$72,160	#30,925	$103,085
Total 2015	$1,102,500	$72,160	$153,425	$1328,085
2016 Projects				
Airfield Sign Upgrade	$90,000		$10,000	$100,000
TXY A Rehab Design and Construction Phase I	$1,350,000		$150,000	$1,500,000
Pavement Maintenance (allowance)		$35,000	$15,000	$50,000

Obstruction Removal, Runway 9 end	$90,000		$10,000	$100,000
Total 2016	$1,530,000	$35,000	$185,000	$1,750,000
2017 Projects				
RWY 3/21 Extension, TXY C/TXY B Environmental Assessment	$360,000		$40,000	$400,000
TXY A Rehabilitation Construction Phase II	$1,350,000		$150,000	$1,500,000
Total 2017	$1,710,000		$190,000	$1,900,000
2018 Projects				
Air Traffic Control Tower Repairs – Phase II (Tuck Pointing, Exterior Paint, Siding)		$51,166	$21,929	$73,095
RWY 3/21 Extension TXY C/TXY B, Design and Land Acquisition (Approach Protection RWY 3/21)	$1,350,000		$150,000	$1,500,000
Pavement Maintenance (allowance)		$35,000	$15,000	$50,000
Total 2018	$1,350,000	$86,166	$186,929	$1,623,095
2019 Projects				
Replace Equipment #42 Tandem Dump with Sander Insert	$360,000		$40,000	$400,000
Pavement Maintenance (allowance)		$35,000	$15,000	$50,000
Hangar 104 Repair – Roof & Hangar Doors		$175,000	$75,000	$250,000
Access Road Paving and Repair		$35,000	$15,000	$50,000
Total 2019	$360,000	$245,000	$145,000	$750,000
2020 Projects				
Pavement Maintenance (allowance)		$35,000	$15,000	$50,000
RWY 3-21 Reconstruction and Extension Phase I (Grading, Paving, Drainage)	$9,000,000		$1,000,000	$10,000,000
Municipal Hangar #2 Repairs–Roof & Hangar Doors		$245,000	$105,000	$350,000
Total 2020	$9,000,000	$280,000	$1,120,000	$10,400,000
2021 Projects				
Midfield Ramp – Apron Repair	$630,000		$70,000	$700,000
RWY 3/21 Reconstruction & Extension Phase II (Grading, Paving, Drainage)	$9,000,000		$1,000,000	$10,000,000
Arrivals/Departures Building (1)	$1,800,000		$200,000	$200,000
Total 2021	$11,430,000		$1,270,000	$12,700,000
Total ACIP (2014-2021)	$27,967,500	$903,826	$3,494,854	$32,366,180
Notes:				
(1) ACIP cost represents approximately 51% of total cost of building. The source of funding for the remaining portion of the building cost has yet to be determined.				

Table 9-5

AIRPORT MASTER PLAN DEVELOPMENT PROGRAM
STAGE 3 (BEYOND 2021)

Project Description	FAA Funding (90%)	State Funding (70%)	Local Funding (10% match Fed; 30% match State	Total Estimated Project Cost
Beyond 2021				
Runway 9-27 Reconstruction, East End	$18,630,000		$2,070,000	$20,700,000
Runway 9-27 Reconstruction, West End	$6,480,000		$720,000	$7,200,000
Runway 9-27 Reconstruction, Center Portion	$20,520,000		$2,280,000	$22,800,000
General Aviation Apron	$8,100,000		$900,000	$9,000,000
Relocate/Realign Parallel Taxiway 'C', north	$4,702,500		$522,500	$5,225,000
Relocate/Realign Parallel Taxiway 'C', south	$3,330,000		$370,000	$3,700,000
Reconstruct Taxiway 'D' System, south end	$2,925,000		$325,000	$3,250,000
Taxiway 'B' east extension to Taxiway 'C'	$1,125,000		$125,000	$1,250,000
Construct Air Traffic Control Tower	$5,000,000			$5,000,000
Reconstruct Taxiway 'A'	$16,200,000		$1,800,000	$18,000,000
Develop A GPS Based Satellite Precision Instrument Approach to Runway 21				N/A
Taxiway 'B' extension west to Taxiway 'A-3' intersection	$7,200,000		$800,000	$8,000,000
Future Air Cargo Ramp Expansion	$4,950,000		$550,000	$5,500,000
Helicopter hangar facility			$1,500,000 (1)	$1,500,000
Terminal taxiway/apron fillet enlargement along Taxiway 'D"	$1,080,000		$120,000	$1,200,000
Site development for Unmanned Vehicles/General Aviation Expansion	$7,200,000		$800,000	$8,000,000
Expanded snow dump area	$4,050,000		$450,000	$4,500,000
Midfield apron expansion	$6,300,000		$700,000	$7,000,000
Environmental Assessment, Taxiway 'F'	$67,500		$7,500	$75,000
Environmental Assessment, Runway extension 9/27	$202,500		$22,500	$225,000
Environmental Assessment, Runway extension 3/21	$202,500		$22,500	$225,000
Construct/realign Taxiway 'F'	$5,850,000		$650,000	$6,500,000
Extension of Runway 9/27 to 11,600'	$13,500,000		$1,500,000	$15,000,000
Extension of Runway 3/21 to 8,000'	$7,245,000		$805,000	$8,050,000
Total Estimated Cost 2009-2020	$144,860,000		$15,540,000	$161,900,000 (2)
Notes: (1)Project is anticipated to be 100% privately funded; it's project cost is not part of the Total Estimate Cost for this column.				
(2) Total Estimated Costs over the period do include the cost for the privately funded helicopter hangar.				