

# **Carlton County - Cloquet Airport**

## **AIRPORT LAYOUT PLAN REPORT**

July 15, 1993

*Revised November 9, 1994*

**SHORT ELLIOTT HENDRICKSON INC.**



**MULTIDISCIPLINED.  
SINGLE SOURCE.**

**CARLTON COUNTY - CLOQUET AIRPORT**  
Cloquet, Minnesota

**Airport Layout Plan Report**

*Prepared for*  
**THE CARLTON COUNTY AIRPORT COMMISSION**

July 15, 1993  
*Revised November 9, 1994*

SEH Project Number CARLT3151.00

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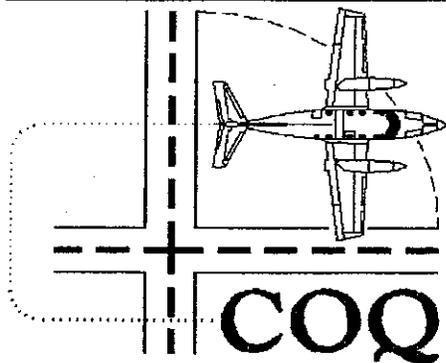
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*Airport Service Area Map*

*Carlton County - Cloquet Airport Crosswind Runway Alternatives Analysis Study*



**Carlton County - Cloquet Airport**

## **AIRPORT LAYOUT PLAN REPORT**

### **I. SUMMARY, CONCLUSIONS and RECOMMENDATIONS**

#### **A. SUMMARY.**

The Carlton County - Cloquet Airport is a General Aviation airport, designed to accommodate single and twin engine propellor-driven aircraft as well as some general aviation jets of up to 12,500 pound takeoff weights. The current and forecast traffic volume and character indicates that some improvements are necessary if the airport is to continue to adequately and safely serve the community in the future.

This Airport Layout Plan and Report is intended for use as a guide for future development and growth at the Carlton County - Cloquet Airport through the year 2013. The purpose of this study is to provide documentation of analysis which was undertaken to determine the facility requirements recommended on the Airport Layout Plan.

This Plan contains identified immediate basic needs and projected future development needs based on growth forecasts in the aviation industry and the Cloquet service area.

#### **B. FORECAST AIRPORT DEMAND.**

As can be seen in Section IV, *Forecasts of Aviation Activity*, the forecasts developed for this report are more optimistic than previously published forecasts, which do not take into account mitigation of constraints that currently constrict the growth of based aircraft at the Carlton County - Cloquet Airport. The growth trends developed as a part of this study are projected to continue through the planning period with the numbers of based aircraft increasing from 33 in 1993 to 50 by the year 2013.

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The critical aircraft currently using Carlton County - Cloquet airport in its existing configuration is a mix of business-use multi-engine piston and turboprop types with gross takeoff weights of 12,500 pounds or less, in the ARC B-I and B-II categories. This includes a Beechcraft F90 based at Cloquet, as well as transient use by King Air B100, King Air C90A, Baron 58TC, Cessna 402B, Cessna 414A, Piper PA-23 and PA-31 aircraft. Total usage by these aircraft is estimated in Section IV.

Seasonal use of the airport is estimated to peak in July, with about 15% of the total operations. The lowest estimated utilization occurs in January, with less than 4% of total operations.

Current peak hourly demand in July is estimated at 11 operations per hour, potentially increasing to 19 operations per hour in 2013. No capacity problem is foreseen.

### **C. SUMMARY OF RECOMMENDED IMPROVEMENTS.**

The tabulations which follow this section are a summary of the facility improvements to be constructed within the initial and ultimate planning period time frames.

The major improvements needed include construction of a new paved crosswind runway of adequate length to serve the critical aircraft, and extending the primary runway 400 feet to accommodate the design aircraft under all conditions. Total estimated 1993 operations (20,780) indicate the need for a parallel taxiway for the primary runway to maintain safe operations.

Currently the Carlton County - Cloquet Airport is limited in based aircraft capacity. There are several requests for additional hangar space. These requests are for rental space in publicly-owned hangars as well as requests for lease space for private hangar construction. Projected numbers of based aircraft confirm the need to expand the building area.

Immediate improvements to public facilities needed include an updated Terminal (Arrival/Departure) building and Maintenance/Equipment building.

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The existing fueling system will not comply with State and Federal regulations by 1997, and will need to be replaced or upgraded by that time.

The capital improvement items have been prioritized, taking into consideration the safety impacts that each item might have upon the operations at Cloquet, as well as the needs recognized by the City, County, Mn/DOT and current airport users.

Carlton County - Cloquet Airport is included on the National Plan of Integrated Airport Systems (NPIAS). This allows for Federal Airport Improvement Program (AIP) participation in funding airport development projects at Cloquet. It is assumed that all eligible development projects will be funded 90% federal and 10% local.

Additional funding assistance is available from the Mn/DOT Office of Aeronautics for projects not eligible through the FAA AIP. Mn/DOT provides a 1/3 local - 2/3 state funding split for eligible construction and planning projects not covered under the FAA AIP program. Mn/DOT also provides funding for multi-plane storage hangars through its hangar loan program. A third option for state funding comes from the Mn/DOT nav aids program that provides funding for various navigational aid facilities.

#### **D. COMPLIANCE WITH FAA AND STATE DESIGN CRITERIA.**

The airport improvements shown on the Airport Layout Plan were laid out in conformance to the criteria set forth in FAA Advisory Circular AC 150/5300-13, *Airport Design*, dated September 29, 1989, changes 1, 2, 3 and 4 inclusive. All facilities will be designed and constructed to conform to at least the minimum requirements as set forth therein.

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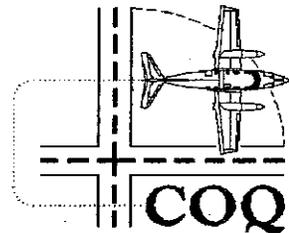
**Table 1a**  
**SUMMARY OF INITIAL TERM REQUIREMENTS**  
**CARLTON COUNTY - CLOQUET AIRPORT**

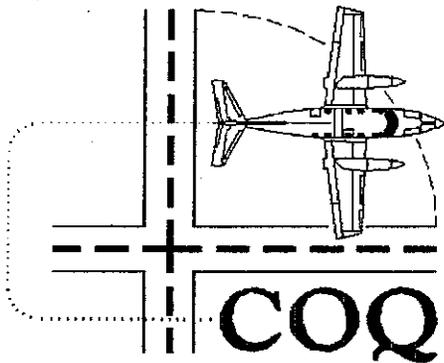
1. Rezone airport for future 4,400' primary runway and future 3,100' secondary (crosswind) runway.
  2. Expand building area to allow for additional hangar development.
  3. Develop a new paved secondary runway on approximate alignment of 07/25. Close existing turf runway.
  4. Install MIREL, REIL and PAPI system to serve the new secondary runway.
  5. Remove existing access road and automobile parking lot and construct new access road and automobile parking to accommodate 36 cars.
  6. Construct new Arrival/Departure building.
  7. Relocate fueling facility, remove and replace underground storage tanks.
  8. Construct maintenance equipment storage building.
  9. Construct multiple unit Tee hangar.
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**Table 1b**  
**SUMMARY OF ULTIMATE TERM REQUIREMENTS**  
**CARLTON COUNTY - CLOQUET AIRPORT**

1. Add additional hangar space or taxilanes for private hangar construction as required.
  2. Extend primary runway to ultimate length, replace runway lights, construct full length parallel taxiway to required standards.
  3. Construct full length parallel taxiway to secondary runway.
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Carlton County - Cloquet Airport

## AIRPORT LAYOUT PLAN REPORT

### II. AIRPORT DESIGN CRITERIA

#### A. AIRCRAFT CLASSIFICATION.

Aircraft are grouped by the FAA according to wingspan into six "Airplane Design Groups", and by approach speed into five "Approach Categories". The airport design criteria and dimensional standards for airport facilities are determined by the Airplane Design Groups (ADG) and Approach Categories, as well as the type of approach offered (visual, nonprecision instrument, precision instrument).

The six Airplane Design Groups (ADG) are categorized in Table 2a, below. The Approach Categories follow in Table 2b.

#### B. AIRPORT CLASSIFICATION.

In late 1989, the Federal Aviation Administration published an Advisory Circular (AC) which revised the accepted standards and recommendations for the design and development of civil airports (*Airport Design*, FAA AC 150/5300-13). This publication canceled both AC 150/5300-4B (*Utility Airports - Air Access to National Transportation*), and AC 150/5300-12 (*Airport Design Standards - Transport Airports*).

The guidelines contained in AC 150/5300-13 include a revised concept of airport functional role classification.

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The old system of airport role classification consisted of five major airport functional groupings, which related to the facility's general use. These classifications and their intended uses are listed in Table 2c below. The new system of airport role classification contained in AC 150/5300-13 consists of a set of "Airport Reference Codes", or *ARC*, relating to the "critical", or "design" aircraft for the airport. The critical aircraft for any given airport facility is defined as that aircraft (or group of aircraft) whose dimensional and/or performance characteristics are the basis for selection of a facilities design criteria. The critical aircraft must be demonstrated to account for a minimum of 500 actual or forecasted annual operations (FAA AC 150/5325-4A).

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**Table 2a**  
**FAA AIRCRAFT DESIGN GROUPS**

<b>ADG I</b>	:	Wingspan up to but not including 49' (ie. Cessna 177, Cessna 210, Piper Cheyenne).
<b>ADG II</b>	:	Wingspan from 49', up to but not including 79' (ie. Cessna Citation II, Grumman Gulfstream II, III).
<b>ADG III</b>	:	Wingspan from 79', up to but not including 118'(ie. Boeing 737, Convair 580, McDonnell Douglas DC-9).
<b>ADG IV</b>	:	Wingspan from 118', up to but not including 171' (ie. Boeing 757, Boeing 707).
<b>ADG V</b>	:	Wingspan from 171', up to but not including 214' (ie. Boeing 747).
<b>ADG VI</b>	:	Wingspan from 214', up to but not including 262' (ie. Lockheed C-5A).

*(source: AC 150/5300-13)*

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Different aircraft may govern the requirements for runway design, and for lateral and vertical separation standards. The factors usually considered are the aircraft maximum gross takeoff weight, approach speed category, wingspan, and tail height. Because some existing federal and state publications are still currently utilizing the old classification system, (it is, in fact, still mentioned in the new AC) an attempt has been made to illustrate the relationship between the old classification system and the ARC system now in use. This is presented in Table 2d, below.

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**Table 2b**  
**FAA AIRCRAFT APPROACH CATEGORIES**

<b>Category A</b>	:	Approach speed less than 91 knots (ie. Cessna 182, Beechcraft Bonanza).
<b>Category B</b>	:	Approach speed 91 knots or more but less than 121 knots (ie. Piper Cheyenne, Cessna Citation).
<b>Category C</b>	:	Approach speed 121 knots or more but less than 141 knots (ie. Lear jet 25, Rockwell Sabre 75A).
<b>Category D</b>	:	Approach speed 141 knots or more but less than 166 knots (ie. Lear jet 35A, Grumman Gulfstream II).
<b>Category E</b>	:	Approach speed 166 knots or more (pertains only to military types).

*(source: AC 150/5300-13)*

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**Table 2c**  
**PRIOR FAA SYSTEM OF AIRPORT CLASSIFICATION**  
**GENERAL AVIATION ONLY WITH NO CRITICAL JET**  
**AIRCRAFT**

<b>BASIC UTILITY I</b>	Designed to accommodate about 75% of the single-engine and some small twin-engine piston aircraft.
<b>BASIC UTILITY II</b>	Designed for all the aircraft accommodated by Basic Utility I, as well as some small business and air taxi type twin-engine aircraft, such as the Cessna 310 and Piper PA-34 Seneca.
<b>GENERAL UTILITY I</b>	Designed to accommodate all general aviation aircraft with maximum gross weights of 12,500 pounds or less, up to such examples as the Beechcraft E90 King Air and Piper PA-31 Navajo.
<b>GENERAL UTILITY II</b>	Designed to accommodate all General Utility I aircraft, as well as models which have an option for 10 or more passenger seats, such as the Beechcraft B100 King Air and Mitsubishi MU-2.

**GENERAL AVIATION AND COMMERCIAL SERVICE**  
**OR**  
**GENERAL AVIATION WITH CRITICAL JET AIRCRAFT**

<b>TRANSPORT</b>	Designed to accommodate all aircraft listed above, and those with approach speeds over 121 knots (Approach Categories C and D), such as the Lear jet 35, Sabreliner 40, MDC-9, up through Boeing 747 and other wide bodies.
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*(source: AC 150/5300-4B)*

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**Table 2d**  
**RELATIONSHIP BETWEEN PRIOR FAA AIRPORT**  
**ROLL CLASSIFICATION**  
**and**  
**AIRPORT REFERENCE CODES (ARC)**

CLASSIFICATION .....	RELATED ARC
Basic Utility I .....	ARC A-I, B-I
Basic Utility II .....	ARC B-I
General Utility I .....	ARC B-II
General Utility II .....	ARC B-III
Basic Transport/ .....	ARC C- and
Commercial Service .....	D-II, -III, -IV, -V

**C. REQUIRED RUNWAY LENGTH FOR VARIOUS USES.**

The runway length required for any given aircraft or range of aircraft is affected by aircraft performance specifications, as well as the airport's elevation and maximum annual temperature. For Cloquet, an elevation of 1273' MSL and a maximum temperature of 81 degrees Fahrenheit was assumed (approximate density altitude of 3,000'), and runway length requirements were calculated for each of the airport classifications listed in Table 2d above. The calculations were made using the FAA runway length computer program (*Reference AC 150/5300-13, September 29, 1989*). The results are tabulated below in Table 2e.

In order to better establish a maximum practical limit of development for the primary runway at Cloquet, an examination of approximate runway length requirements for selected representative aircraft operating in various loading configurations was made. This analysis is included in order to illustrate the potential of the airport site to meet possible future demand which may manifest beyond the time frame of this study. The results of this are presented in Table 2f, which considers ultimate development to

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accommodate ARC B-II aircraft. The results of this analysis are included in Table 2f below.

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**Table 2e**  
**GENERAL RUNWAY LENGTH REQUIREMENTS**  
**CARLTON COUNTY - CLOQUET AIRPORT**

BASIC UTILITY - STAGE I .....	2,840'
(Accommodates 75% of small aircraft with less than 10 passenger seats.)	
BASIC UTILITY - STAGE II .....	3,380'
(Accommodates 95% of small aircraft with less than 10 passenger seats.)	
GENERAL UTILITY - STAGE I .....	3,990'
(Accommodates 100% of small aircraft with less than 10 passenger seats.)	
GENERAL UTILITY - STAGE II .....	4,360'
(Accommodates 100% of small aircraft with less than 10 passenger seats plus small aircraft with 10 passenger seats or more.)	
BASIC TRANSPORT (CASE A) .....	5,500'
(Accommodates 75% of large aircraft of 60,000 pounds or less, operating at 60% of useful load.)	
BASIC TRANSPORT (CASE B) .....	7,000'
(Accommodates 75% of large aircraft of 60,000 pounds or less, operating at 90% of useful load.)	
BASIC TRANSPORT (CASE C) .....	5,770'
(Accommodates 100% of large aircraft of 60,000 pounds or less, operating at 60% of useful load.)	
BASIC TRANSPORT (CASE D) .....	8,390'
(Accommodates 100% of large aircraft of 60,000 pounds or less, operating at 90% of useful load.)	
BASIC TRANSPORT (CASE E) .....	5,460'
(Accommodates aircraft of more than 60,000 pounds gross weight, limited to a 500 mile length of haul.)	

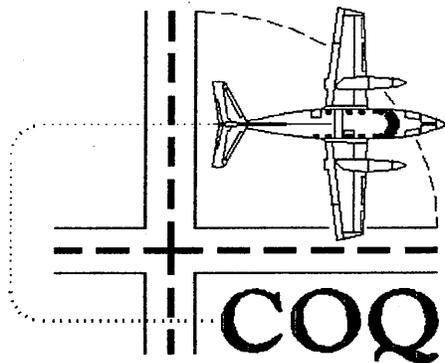
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**Table 2f**  
**REPRESENTATIVE AIRCRAFT PERFORMANCE AND**  
**PHYSICAL CHARACTERISTICS**

*Density Altitude = 2,920'*

<b>Model</b>	<b>Approach Speed</b>	<b>Wing Span</b>	<b>Total Length</b>	<b>Tail Height</b>	<b>Takeoff Weight Required</b>	<b>Runway</b>
Beechcraft 65 Queen Air . . . . .	90	45.88	33.33	14.17	7,700	3,595
Beechcraft B200 . . . . .	98	54.50	43.80	15.00	12,500	3,594
Beechcraft B200 . . . . .	98	54.50	43.80	15.00	11,000	3,346
Beechcraft E-18S . . . . .	87	49.20	35.10	10.50	9,300	3,291
Beechcraft B100 . . . . .	111	45.90	39.90	15.40	11,500	4,342
Beechcraft B100 . . . . .	111	45.90	39.90	15.40	10,000	3,768
Beechcraft A35 . . . . .	72	32.75	25.08	6.50	3,500	2,380
Cessna 152 . . . . .	56	33.20	24.10	8.50	1,670	1,793
Cessna 170 . . . . .	65	36.00	25.00	6.42	2,200	2,342
Cessna 172 . . . . .	60	36.00	26.90	8.80	2,400	2,094
Cessna 177B . . . . .	60	35.50	27.25	8.58	2,500	1,774
Cessna 182Q . . . . .	64	36.00	28.00	9.20	2,950	1,710
Cessna 210N . . . . .	73	36.80	28.20	9.70	3,800	1,397
Cessna 310R . . . . .	93	36.92	31.96	10.67	5,500	4,359
Merlin IVC . . . . .	113	57.00	59.33	16.67	12,500	3,698
Metro III . . . . .	112	46.20	59.40	16.70	12,500	3,748
Piper PA-12 . . . . .	65	35.33	22.75	6.75	1,750	2,914
Metro II SA226-TC . . . . .	112	46.25	59.42	16.67	12,500	3,240
Metro II SA226-TC . . . . .	112	46.25	59.42	16.67	10,500	2,135
Metro II SA226-TC . . . . .	112	46.25	59.42	16.67	8,500	1,671
Cessna 425 . . . . .	103	44.10	35.90	12.60	8,600	4,334
Cessna 425 . . . . .	103	44.10	35.90	12.60	8,200	4,215
Cessna 441 . . . . .	99	49.30	34.70	12.80	9,850	4,114
Cessna 441 . . . . .	99	49.30	34.70	12.80	7,800	3,618
Cessna 340A . . . . .	92	38.10	34.30	12.60	5,990	3,792
Cessna 340A . . . . .	92	38.10	34.30	12.60	5,000	2,513
Cessna 402C . . . . .	95	44.12	36.38	11.45	6,850	4,183
Cessna 402C . . . . .	95	44.12	36.38	11.45	5,500	2,533
Cessna 414A . . . . .	94	44.10	36.40	11.50	6,750	4,715
Cessna 414A . . . . .	94	44.10	36.40	11.50	5,700	3,167
Cessna 421C . . . . .	96	41.10	36.40	11.50	7,450	4,029
Cessna 421C . . . . .	96	41.10	36.40	11.50	6,200	2,640

*Source: ACDATA v5.02*



**Carlton County - Cloquet Airport**

## **AIRPORT LAYOUT PLAN REPORT**

### **III. THE EXISTING AIRPORT ENVIRONMENT**

#### **A. FACILITIES INVENTORY.**

The airport has a 4,003' x 75' bituminous paved primary runway (17/35) and a 2,230' x 200' turf crosswind runway (7/25). Runway 17/35 is equipped with Medium Intensity Runway Lights (MIRLs), Runway End Identifier Lights (REILs), Visual Approach Slope Indicators (VASIs), and with Omni Directional Approach Lighting (ODALS) on the approach to runway 35. All primary runway lighting is pilot controlled on a CTAF frequency of 122.8.

The terminal area is located in the northeast portion of the airport. A paved aircraft apron is located in this area, adjacent to the arrival/departure building and fuel pumps. There are six single or multiple plane hangars and one six unit tee hangar located in the terminal area. These are accessed by a system of bituminous paved taxiways.

A rotating beacon is located northeast of the automobile parking area. A lighted wind cone is located straight east of the approximate midpoint of runway 17/35, about 550' from the edge of the runway pavement.

A paved road from CSAH 115 provides access to a paved automobile parking lot which can accommodate about two dozen cars.

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## **B. FACILITY CONDITIONS**

The existing airport facilities are listed in the tabulation on the following page. Each facility has been assigned a general rating of "Good", "Fair", or "Poor". A facility rated as "Good" may be assumed to be substantially adequate throughout the planning period, with normal maintenance. A rating of "Fair" means that the item will probably require major upgrade or replacement at some time during the planning period, and a rating of "Poor" indicates that the item is not adequate for its intended use at the present time.

There are several basic needs that are not currently met at the Cloquet Airport. The existing airport fueling system is out of compliance with State and Federal regulations. The tanks are of unknown origin and must be brought up to standards. They will require removal and replacement prior to 1997.

## **C. WIND DATA ANALYSIS**

Prevailing wind is a major factor influencing the orientation of runways. Wind conditions effect all aircraft to some degree. In general terms, the smaller the aircraft, the more it is effected by wind.

Crosswinds are often a contributing factor in light aircraft accidents. Therefore, orientation of the runway such that it is aligned with the prevailing wind for the greatest percentage of the time will add substantially to the safety and usefulness of the airport.

The crosswind component of wind direction and velocity is defined as the resultant vector which acts at right angles to the runway centerline, and is equal to the wind velocity multiplied by the sine of the angle between the wind direction and the runway direction.

**Table 3a**  
**EXISTING AIRPORT FACILITIES INVENTORY**  
**CARLTON COUNTY - CLOQUET AIRPORT - JUNE, 1993**

FACILITY .....	CONDITION
<b>RUNWAY 17/35</b>	
Pavement .....	Good
Edge Lighting (MIRL) .....	Fair
Guidance Signs .....	na
Paint Marking .....	Fair
Runway 17 VASI .....	Good
Runway 35 VASI .....	Good
<b>RUNWAY 07/25 (Turf)</b>	
Surface .....	Fair
<b>TAXIWAYS (Major)</b>	
Pavement .....	Good
Edge Lighting .....	na
Guidance Signs .....	na
<b>TAXIWAYS (Minor)</b>	
Pavement .....	Poor
<b>AIRCRAFT PARKING AREA</b>	
Pavement .....	Good
Area Lighting .....	na
Tiedowns .....	Good
<b>TERMINAL AUTO PARKING</b>	
Pavement .....	Fair
Area Lighting .....	na
<b>MISCELLANEOUS FACILITIES</b>	
Lighted Wind Cone .....	Good
Rotating Beacon .....	Good
NDB .....	Good
Security Fencing .....	na
Utilities .....	na
Fueling System .....	Poor*
<b>BUILDINGS</b>	
Private Hangars .....	Fair-Good
Tee Hangars .....	Fair
Terminal Building .....	Fair-Poor

*\* Replacement or upgrading required by Federal Rules prior to 1997*

Wind coverage is defined as the percentage of time that the crosswind components are below an acceptable velocity. These acceptable velocities vary with the airport's design Aircraft Reference Code (ARC) as follows in Table 3b.

The most desirable runway orientation based on wind is the one which has the greatest percentage of wind coverage. The FAA recommends a minimum wind coverage of 95%.

For the purposes of this study, the record all-weather wind data for the Duluth International Airport weather station for the 1981-1990 period was examined as a means of approximating the wind coverage on the existing Runway 17/35 and Runway 7/25 at Cloquet.

Analysis has also been done for a proposed ultimate new secondary runway to replace the existing turf runway (see the attached Crosswind Runway Alternatives Analysis Study).

**Table 3b**  
**ACCEPTABLE CROSSWIND COMPONENTS**  
**FOR VARIOUS APPLICATIONS**

<b>ARC</b>	<b>Acceptable Crosswind Component</b>
A-IV thru D-VI .....	20.0 knots
A-III, B-III .....	16.0 knots
.....	and C-I thru D-III
A-II and B-II .....	13.0 knots
A-I and B-I .....	10.5 knots

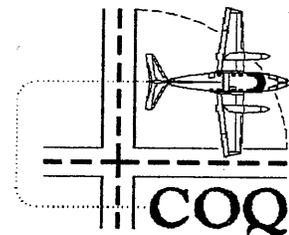
*Source: FAA AC 150/5300-13, Appendix 1, (Change 1)*

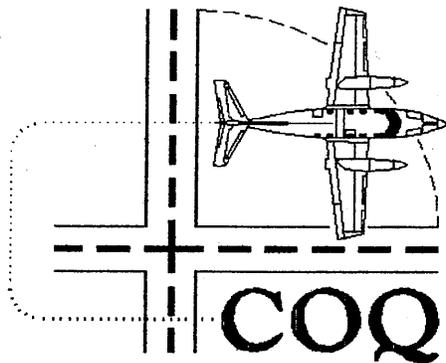
**Table 3c**  
**13 KNOT WIND COVERAGE ANALYSIS**  
**CARLTON COUNTY - CLOQUET AIRPORT**

<b>RUNWAY</b>	<b>ALL WEATHER</b>	<b>VFR Conditions</b>	<b>IFR Conditions</b>
17/35	88.90%	90.12%	82.98%
7/25	93.81%	93.67%	94.51%
17/35-7/25	99.40%	99.39%	99.46%
9/27	94.82%	94.75%	95.19%
17/35-9/27	99.63%	99.62%	99.71%

As can be seen above, there are no conditions when the primary runway (17/35) wind coverage reaches or exceeds 95%. This indicates the need for a crosswind or secondary runway that will accommodate the aircraft that use the primary runway.

Currently the turf crosswind runway is used by aircraft in the A-I and B-I categories. These category aircraft have a smaller allowable crosswind component, due to the fact that they are smaller and lighter than the design aircraft. The allowable A-I and B-I crosswind component required by FAA standards is 10.5 knots for the purposes of wind analysis. The 10.5 knot coverage for runway 07/25 will be less than for 13 knot coverage. Therefore, using the existing configuration at the airport would continue to allow for combined wind analysis coverages of over 95% for smaller aircraft. Theoretically, aircraft in the A-I and B-I design groups will be able to use the Cloquet airport under 95% of all wind conditions, while aircraft in design group B-II will be able to operate only 88.90% of the time.





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Carlton County - Cloquet Airport

**AIRPORT LAYOUT PLAN  
REPORT**

**IV. FORECAST OF AVIATION ACTIVITY**

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**A. INTRODUCTION**

At airports such as Carlton County - Cloquet, which are not served by air traffic control towers, estimates of existing aviation activity are necessary in order to form a basis for development of reasonable forecast projections. The estimates of existing activity in this report are based upon a review of available data as well as contacts with airport users.

Based on the estimated current activity, future projections are made using established aviation growth rates, area demographics, industry trends and/or other important indicators.

Four types of aircraft operations are discussed in this study. These are termed *Based*, *Transient*, *Local* and *Itinerant*, and are defined as follows:

- ◆ *Based* aircraft operations are defined as the total operations made by aircraft based at the airport under study, with no attempt to classify the operations according to purpose.
- ◆ *Transient* operations are defined as the total operations by aircraft other than those based at the airport under study. These operations typically consist of business or pleasure flights originating at other airports, with termination or stopover at the study airport.

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- ◆ **Local** operations are defined as aircraft movements (departures or arrivals) for the purpose of training, currency or pleasure flying, within the immediate area of the local airport. These operations typically consist of touch-and-go operations, practice instrument approaches, flights to and within local practice areas, and pleasure flights which originate and terminate at the airport under study.
  - ◆ **Itinerant** operations are defined as arrivals and departures other than local operations, as described above. This type of operation is closely tied to local demographic indicators, such as local industry and business use of aircraft and usage of the facility for recreational purposes.

## **B. AVAILABLE ACTIVITY FORECASTS**

The establishment of an accurate basis for forecasting of future aviation activity is of primary importance in any planning effort. The recommended practice is to begin with the examination of prior estimates and forecasts figures. This was undertaken as a part of the process of the preparation of this study.

The *Minnesota State Aviation System Plan 1990-2010 (SASP)* classifies the Cloquet Airport as an Intermediate System airport facility throughout its planning period. An Intermediate System facility is described as an airport having a paved and lighted runway less than 5,000 feet in length, capable of accommodating all single-engine and most twin-engine aircraft as well as some light jets. The forecasts of based aircraft and aircraft operations, as included in the SASP, are tabulated below in Table 4a.

Figures shown for operations per based aircraft were calculated from the available SASP data for operations and based aircraft.

**Table 4a**  
**MINNESOTA STATE AVIATION SYSTEM PLAN 1990-2010**  
**GENERAL AVIATION ACTIVITY FORECAST FOR**  
**CARLTON COUNTY - CLOQUET AIRPORT**

	1988	1995	2000	2010
Based Aircraft:	22	21	20	20
Total Aircraft Operations:	8,000	9,120	9,669	11,163
Total Ops. Per Based Aircraft:	364	434	483	557

*Source: Minnesota State Aviation System Plan 1990-2010  
(calculations by SEH, Inc.)*

The 53% increase in total operations per based aircraft (364 to 557) over the period suggests an increase in utilization of individual based aircraft and/or an increase in transient use of the airport. As the fleet mix of the airport changes to include a greater percentage of complex aircraft, the number of operations per based aircraft is expected to escalate.

The Carlton County - Cloquet Airport is included in the *National Plan of Integrated Airport Systems (NPIAS)*. The NPIAS lists Cloquet's FAA Service Level as a General Aviation airport. This indicates that the primary use of the Cloquet airport is to accommodate the general aviation demand of the Cloquet service area. The NPIAS Airport Role classification for Cloquet is that of a General Utility facility. A General Utility facility is designed to accommodate virtually all general aviation aircraft with maximum gross takeoff weights of 12,500 pounds or less.

The NPIAS activity forecasts for Cloquet are shown in the following table (Table 4b). The NPIAS supports the concept that an increase in utilization

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of individual based aircraft and/or an increase in transient use of the airport will occur at Cloquet.

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**Table 4b**  
**NATIONAL PLAN OF INTEGRATED AIRPORT SYSTEM**  
**GENERAL AVIATION ACTIVITY FORECAST FOR**  
**CARLTON COUNTY - CLOQUET AIRPORT**

	1990	1995	1999
Based Aircraft:			
	31	31	31
Total aircraft Operations:			
Total Ops/Based Aircraft: . . . .	11,000	11,000	12,000
	355	355	387

*Source: National Plan of Integrated Airport Systems 1986-1999 and  
1990-1999  
(calculations by SEH, Inc.)*

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### **C. AIRPORT SERVICE AREA**

In determining the airport's general aviation service area, it was assumed that aircraft owners choose to base their aircraft at the airport which is closest to their residence, and which will provide the level of services required by their particular needs. The determining factor in this decision is almost always the length of paved runway which is required by the type of aircraft to be operated. Other factors are availability of maintenance, fuel service, and hangar space.

FAA planning guidelines for airport siting indicate that a general aviation airport be located no more than thirty minutes driving time for business, charter and private aircraft users. This thirty minute time frame is based on

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traveling at an average of 45 mph on major thoroughfares. If a facility that offers the same services and has the same capabilities as the airport under study is within this thirty minute envelope, then half the distance between the two becomes the edge of the defined service area.

The service area for air carrier operations may typically be much greater in area, and is highly dependent on the level of carrier providing service at a specific location. Air carrier users in the Cloquet area are served by Duluth International Airport.

The actual service area of a general aviation airport facility may encompass an area somewhat less than the recommended thirty minute envelope. As mentioned above, the service area boundary may be defined by proximity of other airports (i.e. less driving time to a similar facility).

With this in mind a general aviation service area was defined for Cloquet. This is presented as an attachment to this study.

The service area represents the connection of approximate equidistant points between Cloquet and the closest neighboring airfields which currently provide the minimum service necessary to accommodate the design aircraft for Cloquet. The aircraft in this grouping would consist of a mix of piston engine and turboprop singles and twins, as well as smaller business jets, with gross takeoff weights of 12,500 pounds or less.

#### **D. CURRENT AND SHORT TERM USE**

The *Terminal Area Forecasts FY 1991-2005 (FAA-APO-91-5), July 1991*, for Minnesota indicates that the average number of annual operations per based aircraft for itinerant operations in the state is 329. This figure excludes air carrier and towered facilities. The average number of operations per based aircraft for local operations for the same facilities is 258.

This indicates that the total number of operations for a typical General Aviation airport in Minnesota is 587 per based aircraft. *FAA Advisory Circular AC 150/5300-13* indicates that, for estimating purposes, the average total number of annual operations per base aircraft for this application is 637. Between 587 and 637 total operations per based aircraft would be considered an appropriate range for Cloquet.

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*AC 150/5300-4* (superseded by *AC 150/5300-13*) indicated that the range of itinerant operations per based aircraft at nontowered airports is between 120 and 450, with a median of 210. At airports within the influence of a metropolitan area, the operations per based aircraft may be expected to be higher than the average. Conversely, the utilization of rural airfields may be expected to be lower.

In order to better define the volume and character of based aircraft operations at Cloquet, a survey questionnaire was developed and distributed to the aircraft owners within the airport service area and the known regular transient users. The survey questionnaire made inquiry as to the number and type of operations (business, pleasure, training) performed by each respondent, as well as intent to purchase or otherwise utilize additional aircraft at the Carlton County - Cloquet Airport.

Several respondents indicated that they would base their aircraft at COQ if certain specific criteria were met. These recommendations include expansion of the terminal area to provide space for additional hangars, extension of the primary runway and development of a full length parallel taxiway.

According to the survey, utilization of the privately-owned based aircraft appears to be above average for rural utility airports in the region, in terms of annual operations. The average number of annual operations per based single-engine aircraft is 412. This number is higher than the statewide average for based aircraft due to the large number of operations logged by training aircraft at Cloquet. The average number of annual operations per based light and medium twin engine aircraft at Cloquet is 300.

A national forest products company operates an F90 King Air which is based at Cloquet. This aircraft logs over 1,000 operations per year at COQ. With over 1,000 operations per year, this aircraft is most likely being utilized to its maximum potential. As this company continues to grow it may require an additional aircraft or a larger turbo-prop or turbo-jet aircraft to replace the King Air.

Incorporating the fleet mix at Cloquet into the average number of operations per based aircraft results in an overall average of 411 annual operations per based aircraft.

The number of transient operations per based aircraft should be the difference between the average statewide total operations per based aircraft and the

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actual number of operations per based aircraft as derived from the Cloquet survey.

Since the number of annual operations per based aircraft is above the regional average, it is safe to assume that the number of transient operations per based aircraft will also be above the regional average. This follows the theory that if the service area of the airport can support an above average number of based aircraft operations, it should also be able to support increased transient operations. Taking these factors into account it is reasonable to estimate that the number of total operation per based aircraft will be closer to the high end of the range noted above, i.e. 637.

The average number of transient operations per based aircraft at the Carlton County - Cloquet airport is assumed to be 637 - 411, or 226.

Based aircraft respondents and documentation from the Mn/DOT Aircraft Registration Unit indicate that the most critical aircraft currently based at Cloquet is the Beechcraft King Air F90. The F90 is a turbo-prop aircraft with a maximum gross weight of less than 12,500 pounds. At a density altitude of approximately 3,000 feet (81° Fahrenheit at 1,278 feet MSL), the F90 requires a runway length of about 4,000 feet.

Documentation from the guest logs at Cloquet indicate use by several large turbo-prop aircraft, including the Beechcraft 90, 100 and 200 series King Airs, Cessna 414, Piper Chieftain, and Rockwell Commander 840. The larger aircraft listed, while more critical than the King Air F90, are not of the frequency to be classified as the current design aircraft at Cloquet. (Additional information on the design aircraft is found below in *Paragraph I. Critical General Aviation Aircraft.*)

## **E. AIRPORT SEASONAL USE DETERMINATION**

A seasonal fluctuation of aircraft operations may be expected at any airport. This fluctuation is the most pronounced at nontowered general aviation fields, in regions with severe winter weather patterns. The seasonal fluctuation is less apparent at major airports, which have a substantial percentage of commercial and scheduled airline activity.

In order to approximate the seasonal usage of the Carlton County -Cloquet airport, a representative approximate regional seasonal use trend curve was

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used. This curve was developed from information gathered at non-towered general aviation fields, based on recent experience (1987-1991) in the Wisconsin/Minnesota geographic region, and may be assumed to represent the typical trend for smaller local-service facilities. The curve is presented in Table 4c, below.

**Table 4c**  
**APPROXIMATE SEASONAL USE TREND CURVE**  
**NON-TOWERED UPPER MIDWESTERN AIRFIELDS**

<b>Month</b>	<b>Activity</b>
January .....	3.5 %
February .....	4.0 %
March .....	4.8 %
April .....	7.5 %
May .....	11.3 %
June .....	13.5 %
July .....	14.8 %
August .....	13.0 %
September .....	10.0 %
October .....	8.0 %
November .....	5.8 %
December .....	3.8 %

*Source: SEH, Inc. 1987-1991 planning studies*

## **F. GENERAL AVIATION FLEET MIX**

The current utilization at Cloquet is primarily by smaller single-engine training aircraft and Turboprop twin-engine aircraft, with limited usage by larger turboprops (i.e. King Air 200 operating well below gross weight configurations).

Since activity by larger aircraft is currently constrained by the limited runway length available, an attempt has been made to approximate the relative percentage of use of the Cloquet facilities by various classifications of aircraft in the future. These figures are based on the assumption that the constraining influence of the present runway will be mitigated.

The approximate mix of the regional general aviation fleet is shown in Table 4d. Airports used to establish this regional fleet mix have facilities similar to existing or the planned ultimate facilities at Cloquet. Also contained in Table 4d is the current fleet mix at Carlton County - Cloquet Airport.

**Table 4d**  
**APPROXIMATE REGIONAL GENERAL AVIATION FLEET MIX**  
**AND**  
**CURRENT FLEET MIX AT CARLTON COUNTY - CLOQUET**  
**AIRPORT**

<b>AIRCRAFT TYPE</b>	<b>Regional</b>	<b>Cloquet</b>
Single-engine piston . . . . .	84.38 %	84.85 %
Light Twin-engine piston . . . . .	5.88 %	9.09 %
Medium Twin-engine piston . . . . .	1.65 %	0.00 %
Turboprop Twin-engine . . . . .	3.68 %	3.03 %
Business Jet . . . . .	3.68 %	0.00 %
Rotorcraft . . . . .	0.75 %	3.03 %

*Source: Mn/DOT Office of Aeronautics - Aircraft Registration Unit*

**G. DETERMINATION OF EXISTING ACTIVITY LEVEL**

In order to determine the existing level of activity at Cloquet, the data presented above was integrated as follows:

- ◆ The Airport User Survey activity estimates were employed to determine the current total average number of annual *based operations per based aircraft*. Single-engine piston aircraft = 412 operations. Light and Medium twin-engine piston aircraft = 300 operations. Turbo-prop and business jet aircraft = 1,012 annual operations. Rotorcraft = 100 operations annually.
- ◆ The regional (Minnesota) average for annual transient operations per based aircraft was adjusted to the local indicators for Cloquet (226).
- ◆ The regional fleet mix percentages calculated in Table 4d were used to estimate the level of annual use by different classes of transient aircraft, and to approximate an ultimate fleet mix for Carlton County - Cloquet Airport.

- ◆ The approximate seasonal use trend curve for non-towered rural airfields was used to establish theoretical seasonal activity fluctuations.

The estimated level of existing aircraft activity for the base year of this study (1993) is presented in Table 4e below:

**Table 4e**  
**CURRENT AIRCRAFT ACTIVITY AT CLOQUET**  
**BASE YEAR 1993**

AIRCRAFT TYPE	Based Aircraft	Based Ops	Transient Ops	TOTALS
Single-engine piston .....	28	11,536	6,102	17,638
Light Twin-engine piston .....	3	900	425	1,358
Medium Twin-engine piston .....	0	0	120	120
Multi-engine Turboprop .....	1	1,012	266	1,278
Business Jet .....	0	0	266	266
Rotorcraft .....	1	100	53	153
<b>Total .....</b>				<b>20,813</b>

## H. FORECASTS OF FUTURE ACTIVITY

General aviation is an important component of both the aviation industry and our national economy. It provides aviation services that commercial aviation cannot provide. The production and sale of general aviation aircraft, avionics and other equipment, along with the provision of support services such as flight schools, fixed base operators, finance, and insurance, make the general aviation industry an important contributor to the nations economy.

The health of the general aviation industry continues to be tenuous. This decline began in 1978 and continues today. The decline in number of aircraft has resulted in a slowing in the rate of growth of activity at FAA facilities serving general aviation.

Since the driving force behind aviation growth is economic, the procedure utilized to forecast general aviation activity at Cloquet considers the relationship between current aviation activity, population, and per capita

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personal income. The assumption is made that, with a constant per capita income, general aviation activity will vary directly with population. In theory, when personal income increases a larger percentage of income is available to be used in acquisition or increased use of general aviation aircraft.

The figure which represents the difference between economic growth and corresponding demand in a particular industry is termed the "elasticity index". In the United States during the 1970's, on the average, each 1% change in per capita income produced a 1.3% change in demand within the general aviation industry. The general aviation industry in the United States has not, however, responded to the strong growth in the national economy. Between 1984 and 1989, each 1% change in average per capita income produced only a 0.05% change in demand.

In theory, if an airport is realizing its potential in terms of utilization by the service area, a computed elasticity index will approximate the national average. Table 4f, on the following page, contains a detailed summary of population and per capita income for the 1969-1989 period for Carlton County, Minnesota. This information was derived from the U.S. Department of Commerce, Bureau of Economic Analysis.

The general aviation forecasts that follow were developed using a computer model which multiplies the base year 1993 number of based aircraft by the population and per capita income growth indices and the computed elasticity index, through the twenty year planning period. It is assumed that all growth indices, as well as approximate number of annual operations for each aircraft type, will be constant throughout the planning period.

For the purpose of this study reference was made to the *FAA Aviation Forecasts, Fiscal Years 1992-2003 (FAA -APO-90-6)* in order to derive the growth in general aviation activity which is predicted by the FAA. Because no useable records of aeronautical activity were available for the airport service area, an average of the record data for the 1986-1991 period and FAA forecasts from the period 1992-2003 were used as a surrogate to represent the regional aviation growth indicator for Cloquet.

It can be seen in the following table that Carlton County has had a minimal change in population for the past 20 years.

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The Economic Variable was estimated from Per Capita Income rates established in Table 4f. Per Capita Income was adjusted for inflation and is represented in 1993 dollars.

In the development of the detailed forecasts of activity by type, it was assumed that the mix of based aircraft will tend to seek the average regional type mix, as presented in Table 4d, within the first ten years of the forecast period. This is assuming that all recommended initial facility improvements take place within the first five years of this forecasting period.

The following pages include a year-by-year forecast of aircraft activity and a detailed tabulation of the activity by aircraft and operation type for the twenty year planning period, based upon the methodology presented in this section.

The growth rates mentioned in the previous section were applied to the analysis to determine when and what types of aircraft will be based at COQ in the future. Table 4h below indicates this information. Given Cloquet's location and economic history, an increase in the number of based aircraft is a reasonable assumption.

**Table 4f**  
**CARLTON COUNTY, MINNESOTA**  
**TOTAL POPULATION VERSUS PER CAPITA INCOME**  
**1969 THROUGH 1989**

Year	Pop- ulation	Percent Change	Per Capita Income	Percent Change
1969	29,500		2,698	
1970	28,200	-4.41	3,011	+11.60
1971	28,500	+1.06	3,147	4.52
1972	28,800	+1.05	3,497	11.12
1973	28,500	-1.04	3,991	14.13
1974	28,300	-0.70	4,387	9.92
1975	28,500	+0.71	4,871	11.03
1976	28,800	+1.05	5,480	12.50
1977	29,300	+1.74	5,864	7.01
1978	29,900	+2.05	6,542	11.56
1979	30,400	+1.67	7,067	8.03
1980	30,000	-1.32	7,873	11.41
1981	30,100	+0.33	8,610	9.36
1982	30,000	-0.33	8,907	3.45
1983	30,100	+0.33	9,195	3.23
1984	30,000	-0.33	9,967	8.40
1985	29,800	-0.67	10,445	4.80
1986	29,500	-1.01	10,920	4.55
1987	29,600	+0.34	11,301	3.49
1988	29,800	+0.68	12,054	6.66
1989	29,900	<u>+0.34</u>	13,052	<u>8.25</u>
	Average	+0.06%		+8.25%

*Source: U.S. Department of Commerce, Bureau of Economic Analysis  
Per Capita Income statistics for Carlton County, Minnesota*

**Table 4g**  
**GENERAL AVIATION ACTIVITY FORECASTS - ADM v7.00**  
**CARLTON COUNTY - CLOQUET AIRPORT 1993-2013**

<b>Year</b>	<b>Based Aircraft</b>	<b>Based Opers.</b>	<b>Transient Opers.</b>	<b>Total Opers.</b>
1993	33	13,548	7,232	20,780
1994	34	13,971	7,684	21,655
1995	34	14,023	7,684	21,707
1996	35	14,405	7,910	22,315
1997	36	15,470	8,136	23,606
1998	37	15,858	8,362	24,220
1999	37	15,919	8,362	24,281
2000	38	16,306	8,588	24,894
2001	39	16,944	8,814	25,758
2002	40	17,377	9,040	26,417
2003	41	18,906	9,266	28,172
2004	42	19,352	9,492	28,844
2005	42	19,433	9,492	28,925
2006	43	19,831	9,718	29,549
2007	44	20,277	9,944	30,221
2008	45	20,724	10,170	30,894
2009	46	21,170	10,396	31,566
2010	47	21,617	10,622	32,239
2011	48	22,064	10,848	32,912
2012	49	22,511	11,074	33,585
2013	50	22,958	11,300	34,258

**Table 4h**  
**BASED AIRCRAFT FORECASTS**  
**CARLTON COUNTY - CLOQUET AIRPORT**

	SEP	LTEP	MTEP	TP	JET	RTR	Total
1993	28	3	0	1	0	1	33
1994	29	3	0	1	0	1	34
1995	29	3	0	1	0	1	34
1996	30	3	0	1	0	1	35
1997	30	3	0	1	1	1	36
1998	31	3	0	1	1	1	37
1999	31	3	0	1	1	1	37
2000	32	3	0	1	1	1	38
2001	33	3	1	1	1	0	39
2002	34	3	1	1	1	0	40
2003	33	3	1	2	2	0	41
2004	34	3	1	2	2	0	42
2005	34	3	1	2	2	0	42
2006	35	3	1	2	2	0	43
2007	36	3	1	2	2	0	44
2008	37	3	1	2	2	0	45
2009	38	3	1	2	2	0	46
2010	39	3	1	2	2	0	47
2011	40	3	1	2	2	0	48
2012	41	3	1	2	2	0	49
2013	42	3	1	2	2	0	50

SEP = Single Engine Piston, LTEP = Light Twin Engine Piston, MTEP = Medium Twin Engine Piston, TP = Turboprop, JET = Business Jet, RTR = Rotorcraft.

## I. CRITICAL GENERAL AVIATION AIRCRAFT

The "critical", or "design" aircraft for any given facility is defined as that aircraft (or group of aircraft) whose dimensional and/or performance characteristics are the basis for selection of the facilities design criteria. According to *FAA AC 150/5325-4A, Runway Length Requirements for Airport Design*, the critical aircraft must be demonstrated to account for a minimum of 250 annual or forecasted takeoff operations, or 500 total operations.

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Different aircraft may govern the requirements for runway design, and for lateral and vertical separation standards. The factors usually considered are the aircraft maximum gross takeoff weight, approach speed category, wingspan, and (for hangar design) length and tail height.

The critical aircraft currently using Carlton County - Cloquet airport in its existing configuration is a mix of business-use multiengine piston and turboprop types with gross takeoff weights of 12,500 pounds or less, in the ARC B-I and B-II categories. This includes the based Beechcraft F90, as well as transient use by King Air B100, King Air C90A, Baron 58TC, Cessna 402B, Cessna 414A and Piper PA-23 and PA-31 aircraft. Total usage by these aircraft is estimated in Table 4i below. Operations have been distributed among aircraft classes using the fleet mix outlined in Table 4d.

Activity by ARC B-I and B-II piston and turboprop aircraft will continue to be the critical activity at the airport throughout the initial term of the planning period. As can be seen in the following table, the number of business jet operations are forecast to be over 1,300 annually at the end of the initial term (0-5 years). This dictates a new critical aircraft following the definition described earlier. This new critical aircraft will have a different engine type but may fall into the same design category as the existing critical aircraft.

As the number of Turboprop and Business Jet operations increase, so does the likelihood that these aircraft will be of a more complex variety and thus a more restrictive design category or Airport Reference Code (ARC). It is therefore assumed that the 0-5 year term development of the airport will be a B-II facility. As may be dictated by demand, a more restrictive ARC will be implemented for future development stages. The facility requirements and improvements that will be needed to provide the projected demand are shown in the following section, *V. Facility Requirements*.

**Table 4i**  
**TOTAL OPERATIONAL ACTIVITY FORECASTS**  
**BY AIRCRAFT CLASSIFICATION**  
**CARLTON COUNTY - CLOQUET AIRPORT**

	SEP	LTEP	MTEP	TP	JET	RTR	Total
1993	17,638	1,325	120	1,278	266	153	20,780
1994	18,431	1,358	127	1,301	283	155	21,655
1995	18,472	1,363	127	1,307	283	154	21,707
1996	19,034	1,382	131	1,322	291	155	22,315
1997	19,267	1,401	135	1,337	1,311	155	23,606
1998	19,827	1,421	138	1,352	1,326	156	24,220
1999	19,871	1,426	138	1,358	1,332	155	24,281
2000	20,430	1,446	142	1,373	1,347	156	24,894
2001	21,033	1,465	446	1,388	1,362	65	25,758
2002	21,636	1,484	451	1,403	1,377	66	26,417
2003	21,414	1,503	457	2,365	2,365	68	28,172
2004	22,017	1,523	463	2,386	2,386	70	28,844
2005	22,065	1,529	465	2,399	2,399	70	28,925
2006	22,620	1,548	470	2,420	2,420	71	29,549
2007	23,222	1,568	476	2,441	2,441	73	30,221
2008	23,825	1,587	482	2,462	2,462	75	30,894
2009	24,428	1,607	487	2,484	2,484	76	31,566
2010	25,030	1,626	493	2,505	2,505	78	32,239
2011	25,633	1,646	499	2,527	2,527	80	32,912
2012	26,236	1,665	505	2,549	2,549	81	33,585
2013	26,838	1,685	510	2,571	2,571	83	34,258

SEP = Single Engine Piston, LTEP = Light Twin Engine Piston, MTEP = Medium Twin Engine Piston, TP = Turboprop, JET = Business Jet, RTR = Rotorcraft.

Runway length requirements were approximated from aircraft manuals, owner-supplied information and FAA performance data, assuming a density altitude of 3,000 feet (81 degrees Fahrenheit at 1,273 feet MSL).

**Table 4i**  
**MULTI-ENGINE AIRCRAFT CHARACTERISTICS**  
**(THROUGH ARC B-II)**

<b>Model</b>	<b>Approach Speed</b>	<b>Wing Span</b>	<b>Total Length</b>	<b>Tail Height</b>	<b>Takeoff Weight Required</b>	<b>Runway</b>
Beechcraft 65 Queen Air . . . . .	90	45.88	33.33	14.17	7,700	3,595
Beechcraft B200 . . . . .	98	54.50	43.80	15.00	12,500	3,594
Beechcraft B200 . . . . .	98	54.50	43.80	15.00	11,000	3,346
Beechcraft E-18S . . . . .	87	49.20	35.10	10.50	9,300	3,291
Beechcraft B100 . . . . .	111	45.90	39.90	15.40	11,500	4,342
Beechcraft B100 . . . . .	111	45.90	39.90	15.40	10,000	3,768
Cessna 310R . . . . .	93	36.92	31.96	10.67	5,500	4,359
Merlin IVC . . . . .	113	57.00	59.33	16.67	12,500	3,698
Metro III . . . . .	112	46.20	59.40	16.70	12,500	3,748
Metro II SA226-TC . . . . .	112	46.25	59.42	16.67	12,500	3,240
Metro II SA226-TC . . . . .	112	46.25	59.42	16.67	10,500	2,135
Metro II SA226-TC . . . . .	112	46.25	59.42	16.67	8,500	1,671
Cessna 425 . . . . .	103	44.10	35.90	12.60	8,600	4,334
Cessna 425 . . . . .	103	44.10	35.90	12.60	8,200	4,215
Cessna 441 . . . . .	99	49.30	34.70	12.80	9,850	4,114
Cessna 441 . . . . .	99	49.30	34.70	12.80	7,800	3,618
Cessna 340A . . . . .	92	38.10	34.30	12.60	5,990	3,792
Cessna 340A . . . . .	92	38.10	34.30	12.60	5,000	2,513
Cessna 402C . . . . .	95	44.12	36.38	11.45	6,850	4,183
Cessna 402C . . . . .	95	44.12	36.38	11.45	5,500	2,533
Cessna 414A . . . . .	94	44.10	36.40	11.50	5,700	3,167
Cessna 421C . . . . .	96	41.10	36.40	11.50	7,450	4,029
Cessna 421C . . . . .	96	41.10	36.40	11.50	6,200	2,640

*Source: ACDATA v5.02*

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## **J. ESTIMATED HOURLY DEMAND - EXISTING AND FUTURE**

In order to arrive at a reasonable estimate of the level of demand upon the airport facilities at Cloquet, it was necessary to develop a method to calculate the estimated Maximum Peak Hourly Demand which might be expected to occur during the hours of peak usage of the airport.

As noted in section *D. Airport Seasonal Use Determination*, the seasonal use trend curve for typical midwestern rural airfields was used to represent seasonal fluctuations. Using the curve information, a formula was derived which will calculate the average daily operations in a given month.

The formula is as follows:

*Where:*

- T = Month percent of use (from curve)
- M = Average monthly operations.
- A = Total annual operations.
- D = Average Daily Operations in a given month.
- $D = M / ( 365/12 )$
- $M = A ( T/100 )$

Experience has shown that approximately 90% of total daily operations will occur between the hours of 7:00 AM and 7:00 PM (12 hours) at a typical uncontrolled general aviation airport, and the maximum peak hourly occurrence may be 50% greater than the average of the hourly operations calculated for this time period.

The Estimated Peak Hourly Demand (P) in a given month was, therefore, determined by compressing 90% of the Average Daily Operations (D) in a given month into the 12 hour peak use period, reducing that number to an hourly average for the peak use period, and increasing the result by 50%, as follows:

*Where:*

- D = Average Daily Operations in a given month.
- P = Estimated Peak Hourly Demand in a given month.
- $P = 1.5 ( 0.90D / 12 )$

The calculations were made for each month assuming both the existing (base year) 1993 and the forecasted 2013 operation levels. These are 20,780 and 34,258 annual operations, respectively, as determined previously. The results of the calculations are as follows in Table 4k.

**Table 4k**  
**CARLTON COUNTY - CLOQUET AIRPORT**  
**ESTIMATED PEAK HOURLY DEMAND PER MONTH**

Month	%	Planning Year 1993 "A" = 20,780			Planning year 2013 "A" = 34,258		
		"M"	"D"	"P"	"M"	"D"	"P"
JAN ...	Use	727	24	3	1,199	39	4
FEB ...	3.5	831	27	3	1,370	45	5
MAR ...	4.0	997	33	4	1,644	54	6
APR ...	4.8	1,559	51	6	2,569	84	10
MAY ...	7.5	2,348	77	9	3,871	127	14
JUN ...	11.3	2,805	92	10	4,625	152	17
JUL ...	13.5	3,075	101	11	5,070	167	19
AUG ...	14.8	2,701	89	10	4,454	146	16
SEP ...	13.0	2,078	68	8	3,426	113	13
OCT ...	10.0	1,662	55	6	2,741	90	10
NOV ...	8.0	1,205	40	4	1,987	65	7
DEC ...	5.8	790	26	3	1,302	43	5
	3.8						

## K. ESTIMATED AIRPORT CAPACITY

The methodology for computing the relationship between an airport's demand versus its capacity is contained in *FAA Advisory Circular AC 150/5060-5, Airport Capacity and Delay*. The throughput method included in this Circular is derived from computer models used by the FAA to analyze airport capacity and reduce delay at larger air carrier facilities.

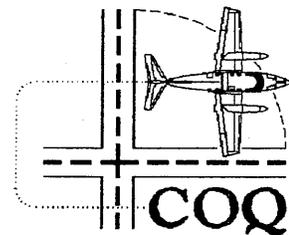
The determinations were made using the assumptions recommended in the Advisory Circular for the particular airport layout and conditions, combined with the forecast operational data from Table 4k.

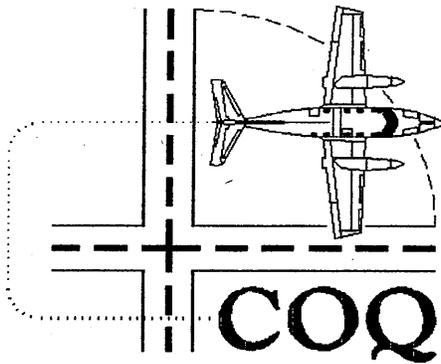
Since the theoretical peak demand will only occur under Visual Flight Rules (VFR) meteorological conditions, computations were made to approximate the hourly capacity only under VFR.

It was assumed that less than 20% of all operations are touch-and-go maneuvers, and that the peak hour movements consist of 50% arrivals and 50% departures. Ultimate and existing airport configuration have been modeled. Results are shown in the following table, Table 4I.

**Table 4I**  
**ESTIMATED DEMAND/CAPACITY RELATIONSHIP**  
**CARLTON COUNTY - CLOQUET AIRPORT**

CONDITION	VFR	IFR
1993 Operations/Hour:		
Capacity .....	104	68
Peak Demand (VFR) .....	11	<i>na</i>
Percent of Capacity .....	10.6 %	
2013 Operations/Hour:		
Capacity .....	105	64
Peak Demand (VFR) .....	19	<i>na</i>
Percent Capacity .....	18.1 %	





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Carlton County - Cloquet Airport

**AIRPORT LAYOUT PLAN  
REPORT**

**V. FACILITY REQUIREMENTS**

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**A. THE PLANNING PROCESS.**

The underlying strategies of this planning study are threefold:

1. to recognize the existing and ultimate potential demand;
2. to provide adequate facilities to accommodate the current and near-term demand; and
3. to maintain options to provide adequate facilities to accommodate the future demand.

The planning period of this study covers calendar years 1993 through 2013. This period has been subdivided into two general time frames; the *Initial Term* and the *Ultimate Term*. Analysis in the initial term relates the current needs of the airport to its present condition. The ultimate term analysis and recommendations are included in order to provide general guidelines for adequate future development.

The basic thrust of this planning effort is to develop realistic recommendations for the 1993 through 2013 planning period. Whether the recommendations for the ultimate development will actually be implemented will depend on the actual future demand and the willingness and available resources of the local, state and federal decision-makers to meet that demand.

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It is important that airport owners consider an ultimate design which represents a conservative approach to the planning process, addressing the most demanding contingencies which may present themselves during the planning period under study. Because of the rapid changes which are occurring within the general aviation industry, as well as increased frequency of regulatory changes within the FAA, it is equally important that an ongoing process of evaluation of existing conditions and near-term trends be implemented in order to assure the validity of the results of the planning effort.

## **B. GENERAL DEVELOPMENT CRITERIA.**

Any growth in local aviation related activities, or change in existing or anticipated use of an airport facility requires a program of development and implementation to assure that the airport remains able to accommodate its demand.

In order to effectively provide for the demands on the Carlton County - Cloquet Airport, a schedule of recommended facility improvements has been developed, based on the forecast aircraft operations, and demand analysis.

The facility requirements were developed accepting the following criteria:

- ◆ The critical general aviation aircraft currently using the airport is a mix of aircraft which require an ARC B-II facility. The ultimate critical aircraft will become a mix of ARC B-II multi-engine types with some limited utilization by ARC C-I and C-II aircraft.
- ◆ The dimensional standards and design criteria for all recommended improvements shall be as detailed in FAA Advisory Circular AC 150/5300-13, *Airport Design* and the requirements of the Minnesota Office of Aeronautics, for an ARC B-II facility.
- ◆ Design and improvement of the primary runway should assume accommodation of a nonprecision approach to one mile visibility minimums (both runway ends). The ultimate secondary runway should be designed assuming nonprecision approaches for both runway ends.

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On the following pages are tabulations of the separation standards and design criteria which are applicable to the recommended improvements at Cloquet. Table 5a applies to the primary runway (ARC B-II with nonprecision approach), and to an ultimate paved secondary runway.

These tables are the actual output from the FAA Airport Design computer program, which is based upon AC 150/5300-13. The output has been included verbatim in order to provide a uniform source of reference. In cases where two values are given, the leftmost value represents the actual computed dimension and the rightmost value the minimum applicable criteria.

**Table 5a**  
**AIRPORT DESIGN CRITERIA AND SEPARATION**  
**STANDARDS**

**CARLTON COUNTY - CLOQUET AIRPORT**

Page 1 of 2

AIRPORT DESIGN AIRPLANE AND AIRPORT DATA

Aircraft approach category B	
Airplane design group II	
Airplane wingspan .....	78.99 feet
Primary runway end is nonprecision instrument (more than 3/4-statute mile)	
Other runway end is nonprecision instrument (more than 3/4-statute mile)	
Airplane maximum certificated takeoff weight is over 12,500 lbs.	
Airplane undercarriage width .....	14.00 feet
Airport elevation .....	1278 feet

RUNWAY AND TAXIWAY WIDTH AND CLEARANCE DESIGN STANDARDS

Runway centerline to parallel runway centerline .....	700 feet
wider runway separation may be required for capacity (See AC 150/5060-5)	
Runway centerline to hold line .....	200.0 - 200 feet
Runway centerline to parallel taxiway or taxilane centerline .....	239.4 - 240 feet
Runway centerline to edge of aircraft parking .....	250.0 - 250 feet
Taxiway centerline to parallel taxiway or taxilane centerline .....	104.8 - 105 feet
Taxiway centerline to fixed or movable object .....	65.3 - 65.5 feet
Taxilane centerline to parallel taxilane centerline .....	96.9 - 97 feet
Taxilane centerline to fixed or movable object .....	57.4 - 57.5 feet
Runway protection zone at the primary runway end:	
Length .....	1700 feet
Width 200 feet from runway end .....	500 feet
Width 1900 feet from runway end .....	1010 feet
Runway protection zone at other runway end:	
Length .....	1700 feet
Width 200 feet from runway end .....	500 feet
Width 1900 feet from runway end .....	1010 feet
Runway obstacle free zone (OFZ) width .....	400.0 - 400 feet
Runway obstacle free zone length beyond each runway end .....	200 feet
Approach obstacle free zone width .....	400.0 - 400 feet
Approach obstacle free zone length beyond approach light system .....	200 feet
Approach obstacle free zone slope from 200 feet beyond threshold .....	50:1
Inner-transitional surface obstacle free zone slope .....	0:1

———— CONTINUED ————

**Table 5a**  
**AIRPORT DESIGN CRITERIA AND SEPARATION**  
**STANDARDS**  
**CARLTON COUNTY - CLOQUET AIRPORT**

Page 2 of 2

Runway width .....	75 feet
Runway shoulder width .....	10 feet
Runway blast pad width .....	95 feet
Runway blast pad length .....	150 feet
Runway safety area width .....	150 feet
Runway safety area length beyond each runway end or stopway end, whichever is greater .....	300 feet
Runway object free area width .....	500 feet
Runway object free area length beyond each runway end or stopway end, whichever is greater .....	600 feet
Clearway width .....	500 feet
Stopway width .....	75 feet
Taxiway width .....	29.0 - 35 feet
Taxiway edge safety margin .....	7.5 feet
Taxiway shoulder width .....	10 feet
Taxiway safety area width .....	79.0 - 79 feet
Taxiway object free area width .....	130.6 - 131 feet
Taxilane object free area width .....	114.8 - 115 feet
Taxiway wingtip clearance .....	25.8 - 26 feet
Taxilane wingtip clearance .....	17.9 - 18 feet
<b>Threshold surface at primary runway end:</b>	
Distance out from threshold to start of surface .....	0 feet
Width of surface at start of trapezoidal section .....	400 feet
Width of surface at end of trapezoidal section .....	1000 feet
Length of trapezoidal section .....	1500 feet
Length of rectangular section .....	8500 feet
Slope of surface .....	20:1
<b>Threshold surface at other runway end:</b>	
Distance out from threshold to start of surface .....	0 feet
Width of surface at start of trapezoidal section .....	400 feet
Width of surface at end of trapezoidal section .....	1000 feet
Length of trapezoidal section .....	1500 feet
Length of rectangular section .....	8500 feet
Slope of surface .....	20:1

REFERENCE: AC 150/5300-13, *AIRPORT DESIGN*.

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### **C. PRIMARY RUNWAY REQUIREMENTS.**

The ultimate design should consider the need for a balanced field length of approximately 4,400 feet, which facilitates design conforming to ARC B-II criteria.

FAA design criteria found in AC 150/5325-4A, *Runway Length Requirements for Airport Design*, is the source for the following table, Table 5b. It is verbatim output of the FAA runway design computer program.

The short term demand may be accommodated by the current runway length of 4,003'. Long term requirements of the airport indicate a need to extend runway 17/35. Development of a new paved secondary or crosswind runway should also be considered for Cloquet. The primary runway should be extended to a useable length of 4,400 feet in the initial term of development.

The assumption of this study is that the ultimate critical aircraft will not change during the time frame of this study. Therefore, the critical aircraft for the primary runway should conform to the composite characteristics of the ARC B-II general aviation critical aircraft fleet.

Conformance with FAA guidelines for determining runway length requirements based on the ultimate airport role would suggest an ultimate primary runway length of 4,400' for a General Utility, Stage II facility (ARC B-II), accommodating aircraft with 10 passenger seats or more.

A 4,400' long ARC B-II runway is recommended for ultimate primary runway development. The recommended extension will accommodate the demonstrated current and short term demand, as well as ultimate configuration. The required width for this classification of runway is 75'.

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**Table 5b**  
**RUNWAY LENGTH REQUIREMENTS FOR AIRPORT**  
**DESIGN**  
**CARLTON COUNTY - CLOQUET AIRPORT**

AIRCRAFT AND RUNWAY DATA

Airport Elevation .....	1273 feet
Mean daily maximum temperature of the hottest month .....	80.80 F
Maximum difference in runway centerline elevation .....	31.00 feet
Length of haul for airplanes of more than 60,000 pounds .....	500 miles

RUNWAY LENGTHS RECOMMENDED FOR AIRPORT DESIGN

Small airplanes with approach speeds of less than 30 knots .....	340 feet
Small airplanes with approach speeds of less than 50 knots .....	900 feet
Small airplanes with less than 10 passenger seats	
75 percent of these small airplanes .....	2840 feet
95 percent of these small airplanes .....	3370 feet
100 percent of these small airplanes .....	3990 feet
Small airplanes with 10 or more passenger seats .....	4350 feet
Large airplanes of 60,000 pounds or less	
75 percent of these large airplanes at 60 percent useful load .....	5490 feet
75 percent of these large airplanes at 90 percent useful load .....	7000 feet
100 percent of these large airplanes at 60 percent useful load .....	5770 feet
100 percent of these large airplanes at 90 percent useful load .....	8380 feet
Airplanes of more than 60,000 pounds .....	Approximately 5460 feet

Small airplane is an airplane of 12,500 pounds or less maximum takeoff weight.  
Large airplane is an airplane of more than 12,500 pounds maximum takeoff weight.

Reference: AC 150/5325-4A, *Runway Length Requirements for Airport Design.*

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## D. SECONDARY (CROSSWIND) RUNWAY REQUIREMENTS.

The current FAA criteria recommends that a secondary, or crosswind, runway should be provided if the main runway does not provide wind coverage of at least 95%. AC 150/5300-13 advises that the allowable crosswind coverage is:

- ◆ 10.5 knots for ARC A-I and B-I runways;
- ◆ 13 knots for ARC A-II and B-II runways;
- ◆ 16 knots for ARC A-III, B-III and C-I through D- III runways; ...and
- ◆ 20 knots for ARC A-IV through D-VI runways.

Based upon the U.S. Weather Service data for Duluth International Airport, Duluth, Minnesota for the 1981 through 1990 period, achievable 13 knot all-weather coverages for single runways are in the range of about 87.8% to 95.2%. In the case of Cloquet the current all-weather coverage is 88.9%. A crosswind runway would therefore be recommended.

The FAA suggests that the ultimate length of a secondary crosswind runway is 80% of the required main runway length for the category of secondary runway desired. The recommended length of the runway for the ultimate ARC B-II service role at Cloquet would be  $(4,400')(0.80)$  or 3,520'

The ultimate development of a 3,520' long by 75' wide secondary runway was originally recommended for Cloquet in this study.

The question of crosswind runway length and alignment was subsequently addressed in detail in the *Carlton County - Cloquet Airport Crosswind Runway Alternatives Analysis Study*, which is attached hereto. In the study, five alternative alignments and three ultimate runway lengths were examined. Based on comparative analysis of several economic, environmental and safety issues, the development of a 3,100' x 75' crosswind runway was recommended. The selected runway alignment is 7/25.

The recommended option is designated Alternate 2a, and is illustrated in Figure 11, Appendix 2 of the *Crosswind Runway Alternatives Analysis Study*.

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## E. INSTRUMENT APPROACHES AND NAVIGATIONAL AIDS.

The Cloquet airport is served by three published approach procedures at the present time. The first is a VOR/DME-A approach, which utilizes the Duluth VOR (frequency 112.6 DLH). The second and third are NDB approaches to each end of the primary runway (17/35).

The VOR/DME-A procedure has published circling minimums of 1,740' and 1 mile visibility for Approach Category A aircraft. Category B aircraft are allowed 1760 and 1 mile visibility. Category C aircraft minimums are 1,760' and 1.5 miles visibility for circling, and Category D operations are not authorized.

The NDB 17 approach has published straight-in and circling minimums of 1,860' and 1 mile visibility for Category A and B aircraft. Category C aircraft have straight-in and circling minimums of 1,860' and 1.5 mile visibility.

The straight-in and circling NDB 35 approach minimums are 1,760' and 1 mile visibility for Category A and B aircraft. The visibility minimums increase to 1 1/2 mile for Category C aircraft. Category D operations are not authorized for either NDB approach.

*The Minnesota State Airport System Plan: 1990-2010 (June, 1991)* does not recommend additional navaids or published approaches at Cloquet. The ultimate development of an approved Global Positioning System (GPS), and/or Loran C procedure should not be ruled out in the planning process, since no new electronic aids would be required with this type of approach. The development of both the primary and secondary runway should allow for this possibility by providing protected imaginary surfaces for nonprecision operations at both runway ends.

Local altimeter setting information is available at Cloquet through an onsite Automated Weather Observing System (AWOS). This availability effects the existing and ultimate approach procedures by allowing a lower minimum descent altitude.

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## **F. RUNWAY LIGHTING AND VISUAL AIDS.**

Federal Aviation Regulations, Part 91.116(c) indicates that an aircraft attempting to land under IFR conditions, on a published instrument approach procedure, may not descend below the established MDA (Minimum Descent Altitude) unless at least the runway threshold, the threshold markings or lights, REILs, approach slope indicator lights (VASI, PAPI), the runway lights, the touchdown zone lights or markings, or the approach lights are distinctly visible to the pilot.

ODALS (Omni Directional Approach Lighting System) are installed on the Runway 35 approach. This is a nonprecision approach with visibility minimums of greater than 3/4 mile. ODALS consist of seven capacitor discharge lights. Five of the seven lights are sequenced flashing omni directional lights. These five are located on the extended runway centerline, beginning 300 feet from the runway threshold and spaced at 300 foot intervals. The remaining lights are located on either side of the runway threshold.

The REILs (Runway End Identifier Lights) consists of a pair of strobes, placed on either side of the runway threshold.

An ODAL or REIL approach array installation will present a more easily distinguished runway threshold environment to the arriving IFR pilot, as well as an increased margin of safety by providing runway alignment and roll guidance during circling maneuvers in poor visibility situations. While these visual aids may not decrease the attainable published visibility minima for a given approach procedure, they will make possible a more visible runway environment than would be possible for any given situation without the aids.

Approach slope indicators include Precision Approach Path Indicators (PAPI), Visual Approach Slope Indicators (VASI), Pulsating Visual Approach Slope Indicators (PVASI), Tri-color Visual Approach Slope Indicators, and "T" Visual Approach Slope Indicators (TVASI). All of these systems present a color-coded indication of the approaching aircraft's position on the glide path.

High Intensity Runway Lights (HIRL) are usually standard equipment for runways with ILS capability. Medium Intensity Runway Lighting (MIRL) systems are usually installed on runways with nonprecision approaches,

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although many airports with published approaches are equipped with Low Intensity Runway Lights (LIRL), which have proven to be quite functional.

Runway 17/35 is presently equipped with a pilot-controlled MIRL installation, VASIs, and REILs. As mentioned previously, a ODAL system is in place on the runway 35 threshold. The existing Runway 07/25 is not lighted.

The secondary runway should ultimately include MIRL edge lighting, REIL and PAPI installations at both ends. A straight-in approach from the Duluth VOR may be established to the new secondary runway.

### **G. TAXIWAY REQUIREMENTS.**

The FAA's rule of thumb for parallel taxiway development is that 20,000 annual operations are required to necessitate a full length parallel taxiway. As can be seen in the previous chapter, the current number of operations at Cloquet exceeds this amount.

It is therefore recommended that a full length parallel taxiway be developed in the initial term.

### **H. AIRPORT FUELING REQUIREMENTS.**

At the present time, Jet-A and 100 octane low-lead fuel is available at Cloquet. The fuel is dispensed from a new self-serve U-Fuel pumping system just south of the Terminal Building. Several respondents to the aviation user survey made mention that they would like to see aviation-use auto fuel available at the airport. As the number of homebuilt aircraft increases the use of this fuel will also increase. Documentation of the demand of this type of fuel should be noted and a determination should be made as to whether or not it would be cost effective to add an additional tank for this use.

The underground tanks at Cloquet need to be removed and replaced. The fuel dispensing system and new underground tanks should be located away from traffic areas. The new fueling system location is show on the Terminal Area Plan. This new location allows for more than one aircraft to fuel at one time.

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## I. GENERAL AVIATION AIRCRAFT PARKING AND HANGAR REQUIREMENTS.

Because of the severe winter weather experienced in the region, it is assumed that most based aircraft owners will prefer to park their aircraft within a hangar. For this reason, space for hangar construction should be provided for all forecast based aircraft through the planning period (50). Hangars should be constructed on a phased development plan in accordance with demand.

A paved aircraft parking apron is also required to provide tiedown space to transient aircraft, as well as to a small percentage of based aircraft.

The number of required tiedown spaces for the initial (required at the present time - 1993) through ultimate (2013) terms were determined by applying the following assumptions:

1. Approximately 35% of the existing and ultimate total peak daily operations are assumed to be by transient aircraft.
2. Most transient aircraft will arrive and depart on the same day. The actual number of peak transient aircraft is one-half the transient daily operations.
3. Seventy-five percent of the transient aircraft will be on the ground during the peak period.
4. Ten percent of the based aircraft may be on the apron temporarily or seasonally.

With the integration of these assumptions, the following calculations were made to derive the recommended number of tiedown spaces to be provided on the parking apron in the present and ultimate scenarios:

*Where:*

D	=	Average Daily Peak Operations.
T	=	Total daily peak transient operations.
N	=	Number of required tiedowns for transients.
B	=	Number of based aircraft.
S	=	Total number of recommended tiedowns.

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For base year 1993 condition:

$$\begin{aligned} T &= D(0.35) = 101(0.35) = 35.35 \\ N &= (T/2)0.75 = (35.35/2)0.75 = 13.26 \\ N &= 13 \\ S &= (0.10(B)) + N = (0.10(33)) + 13 = 16.56 \\ S &= 17 \end{aligned}$$

For future 2013 condition:

$$\begin{aligned} T &= D(0.35) = 167(0.35) = 58.45 \\ N &= (T/2)0.75 = (58.45/2)0.75 = 21.92 \\ N &= 22 \\ S &= (0.10(B)) + N = (0.10(50)) + 22 = 26.92 \\ S &= 27 \end{aligned}$$

The existing paved aircraft parking apron will accommodate over a dozen aircraft. In the ultimate term, the aircraft parking apron should be expanded to accommodate a total of 27 aircraft on the main ramp. This should include a minimum of 3 spaces for larger transient general aviation aircraft.

The existing hangars will accommodate the majority of the based aircraft at the present time. Ultimately, space for hangar construction should be provided to accommodate the ultimate forecasted number of based aircraft (50).

## **J. AUTOMOBILE PARKING AND ACCESS ROAD REQUIREMENTS.**

The estimated peak hourly demand was used as a basis to estimate the projected requirements for automobile parking. The criteria used is a factor of 3.25 automobiles per peak hour operation. This factor allows for 2.5 occupants per aircraft operation during the peak hour, plus allowance for airport employees and visitors.

The estimated automobile parking requirements for the present time frame is, therefore, (3.25)(11) or approximately 36 spaces. The required spaces for the year 2013 condition will be (3.25)(19) or approximately 62 spaces.

The existing automobile parking area will accommodate about a dozen cars and could be expanded to accommodate the forecast requirements.

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Construction of a new 36-car automobile parking area and access road is recommended. The existing access road will be closed allowing for expansion of the terminal area. This should be undertaken as a part of the initial development program.

## **K. AIRPORT DRAINAGE.**

According to AC 150/5320-5B, *Airport Drainage*, the airport should have smooth, well drained operational areas with sufficient stability to permit the safe movement of aircraft under all weather conditions. The design of adequate drainage is important because it affects the stability and useability of extensive areas. These areas are subject to varying soil and drainage conditions, and also have relatively flat grades.

The purpose of airport drainage is to dispose of water which may hinder any activity necessary to the safe and efficient operation of the airport. The drainage system should collect and remove surface water runoff from each area, remove excess underground water, lower the water table, and protect all slopes from erosion.

An inadequate drainage system can cause serious hazards to air traffic at airports. The most dangerous consequences of inadequate drainage systems are saturation of the subgrade and subbase, damage to slopes by erosion, loss of load-bearing capacity of the paved surfaces, and excessive ponding of water.

In the case of Cloquet, drainage on paved surfaces is as can be expected for the small changes in grade desired on airport pavements. Drainage along ditches and culverts on airport property is poor.

Ditch and culvert cleaning will help minimize the drainage problem. Additional culverts will be added during the recommended runway construction projects recommended. Drainage considerations will be a considerable factor in the design process for any future runway, taxiway and apron area improvements.

Along with drainage, there is the concern of water quality. The most significant water quality concern for airports is the recently enacted National Pollutant Discharge Elimination (NPDES) permit requirements for storm water. In Minnesota, the NPDES permit program is administered by the

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MPCA. The MPCA will address airport storm water permit requirements via a general permit for storm water discharge associated with industrial activity. The MPCA is currently finalizing the legal documents for the general storm water permit. Under the requirements of the permit program, the airport must prepare a storm water pollution prevention plan (SWPPP), within one year of the time the general permit is issued. The primary steps required for preparation of the SWPPP include:

- ◆ Site reconnaissance
- ◆ Documentation of materials exposed to rainfall with includes materials handling, storage, transportation and processing
- ◆ Documentation of non-storm water discharges
- ◆ Identification of potential pollutants such as toxic metals, chemicals, organics, fertilizers, pesticides and petroleum products

Once the site information has been collected, storm water "Best Management Practices" (BMP) need to be implemented and a spill prevention program established.

## **L. OBSTRUCTIONS TO AIR NAVIGATION.**

The standards for determining obstructions in navigable airspace are contained in Federal Air Regulations, Part 77.

In Subpart 77.23 of this regulation, obstructions are defined as an object (including a mobile object) which is greater than:

- ◆ a height of 500 feet above ground level at the site of the object;
- ◆ a height that is 200 feet above ground level or above the established airport elevation (whichever is higher) within three nautical miles of the reference point of an airport that has a runway more than 3,200 feet in length. That height increases in the proportion of 100 feet for each additional nautical mile from the airport, up to a maximum of 500 feet.

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Part 77 also establishes airport "imaginary surfaces", which are geometrically based upon the actual (or ultimate) physical layout of the runways and category of intended ultimate use. An object is defined as an obstruction if it penetrates any of these imaginary surfaces.

By definition, the imaginary surfaces become increasingly critical with respect to height limitations as they become nearer to the runway surface, finally allowing an object height of zero within 200 feet of the runway ends.

As a function of the preparation of the Airport Layout Plans for the Cloquet facility, a detailed analysis of the airport imaginary surfaces was made. The results of the analysis are presented graphically in the Runway Protection Zone Plan and Profile sheets, and on the Airport Airspace Drawing.

The disposition and/or recommended action for each obstruction identified on the drawings is included in the obstruction tables on each particular plan sheet.

#### **M. PROPERTY ACQUISITIONS, EASEMENTS AND ZONING.**

The existing airport property and the recommended minimum acquisitions are detailed on the Airport Property Map in the Airport Layout Plan.

Existing and ultimate airport zoning are indicated in the Land Use and Safety Zoning sheets of the Airport Layout Plan.

Current zoning will have to be updated for the proposed runway extension and new secondary runway. The process of zoning and land acquisition should be started well before construction is considered.

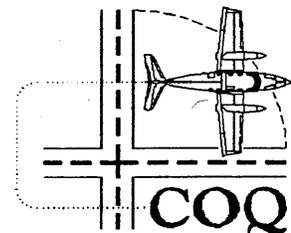
#### **N. DEVELOPMENT SUMMARY.**

Below (Table 5c and 5d) is a summary of the recommended basic facility improvements which are required to serve the anticipated initial and ultimate term demand at the Carlton County - Cloquet Airport.

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**Table 5c**  
**SUMMARY OF INITIAL TERM REQUIREMENTS**  
**CARLTON COUNTY - CLOQUET AIRPORT**

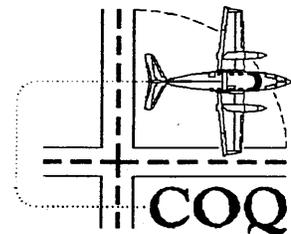
1. Rezone airport for future 4,400' primary runway and future 3,100' secondary (crosswind) runway.
  2. Expand building area to allow for additional hangar development.
  3. Develop a new paved secondary runway on approximate alignment of 07/25. Close existing turf runway.
  4. Install MIRL, REIL and PAPI system to serve the new secondary runway.
  5. Remove existing access road and automobile parking lot and construct new access road and automobile parking to accommodate 36 cars.
  6. Construct new Arrival/Departure building.
  7. Relocate fueling facility, remove and replace underground storage tanks.
  8. Construct maintenance equipment storage building.
  9. Construct multiple unit Tee hangar.
- 

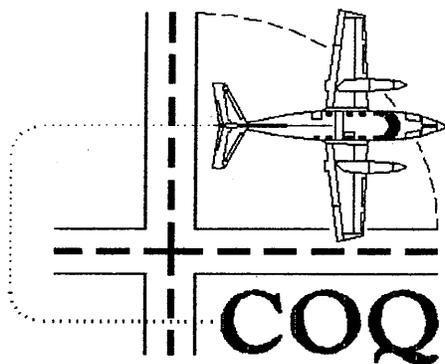


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**Table 5d**  
**SUMMARY OF ULTIMATE TERM REQUIREMENTS**  
**CARLTON COUNTY - CLOQUET AIRPORT**

1. Add additional hangar space or taxilanes for private hangar construction as required.
  2. Extend primary runway to ultimate length, replace runway lights, construct full length parallel taxiway to required standards.
  3. Construct full length parallel taxiway to secondary runway.
- 





Carlton County - Cloquet Airport

## AIRPORT LAYOUT PLAN REPORT

### VI. CAPITAL IMPROVEMENT PLAN

#### A. PLAN IMPLEMENTATION

This plan presents a program of improvements which, if carried out in total, is designed to meet the present demands and to assure that the airport will meet the projected demands throughout the 1993-2013 planning period.

Whether the recommendations will actually be implemented, in whole or in part, will depend on whether the owner will desire to provide improvements to meet the estimated demand, and whether local, State and Federal resources are available and are allocated for the recommended development.

This plan should be viewed as a reasonable forecast of the Carlton County - Cloquet Airport's future from the vantage point of 1993. It is quite conceivable that some of the recommended improvements included in this study will not be required in the future (such as development of a new secondary runway) and, conversely, that additional or different facilities not considered in this study may become necessary.

Two development time frames are referred to in this study; the *Initial Term* and the *Ultimate Term*. Recommendations for the Initial Term are considered to be required in order for the airport to meet the present air traffic demand, as well as to continue to function as a safe airport facility, within the requirements of current federal and state regulations.

---

The intent of the development phasing is that the public aviation needs will be met at such time as those needs arise; not necessarily to encourage aviation activity. In this light, it is assumed that the facilities needed to meet the demands will not be developed before they are actually proven to be necessary.

Recommendations included for the Ultimate Term are designed to ensure that the airport facilities will be able to meet the forecast demands, based upon the available information and trends at the present time. It is important to realize that the forecast conditions may or may not occur, and that they may materialize in significantly different dimensions of quantity and timing.

The recommended Initial Term improvements, for the most part, may also serve the probable future demand at Cloquet through the planning period.

## **B. SUMMARY and PHASING OF INITIAL TERM REQUIREMENTS.**

In the preceding section, it was determined that certain facility improvements should be made in order to meet the demands being placed upon the airport at the present time, and into the near future. These improvements have been prioritized and grouped into annual projects in a logical progression of concept and project planning, engineering design, and construction activities.

## **C. CAPITAL IMPROVEMENTS COSTS.**

The estimated costs of development for all the recommended airport improvements are presented in Table 6a, below. In the estimates, all costs are expressed in 1993 dollars, with no adjustments for inflation.

Public-use airport development may be funded in part through grants from the Federal Airport Improvement Program (AIP), administered by the Federal Aviation Administration through state sponsored programs, or through combinations of state and federal programs.

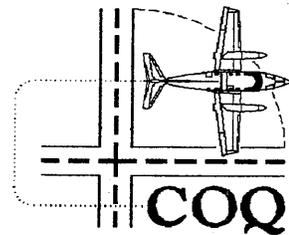
In order for an airport to be eligible for AIP funding, it must be included on the National Plan of Integrated Airport Systems (NPIAS). The AIP will fund up to 90% of eligible development costs for NPIAS airports in the State of

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Minnesota. The Carlton County -Cloquet Airport is currently included in the NPIAS, and is therefore eligible for AIP funding.

Airports which are included on the Minnesota Airport System Plan are eligible for State funding participation, subject to the determination of relative priority of any proposed project. The State will provide funding on a 2/3-1/3 basis for State/Local projects.

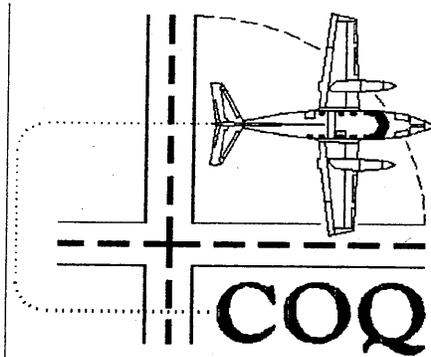
Eligible items under state and federal programs differ. Public-use runways, taxiways, parking aprons, lighting and navigational aids are eligible items under both programs. The AIP program excludes general aviation related automobile parking and access roads, as well as terminal building construction. The state will fund automobile access roads and parking lots, fuel storage facilities, hangar construction, as well as some non-AIP fundable terminal building work. The State of Minnesota may fund up to 80% of the cost of hangar construction under the Mn/DOT Hangar Loan Program.



**Table 6a**  
**CARLTON COUNTY - CLOQUET AIRPORT**  
**CAPITAL IMPROVEMENTS COSTS BY DEVELOPMENT PHASE**

	<b>TOTAL</b>	<b>FAA</b>	<b>STATE</b>	<b>LOCAL</b>
<b>Phase I - Immediate.</b>				
Zoning maps and ordinance	\$5,000	---	\$3,333	\$1,667
Land surveys	12,000	\$10,800	---	1,200
Prepare environmental documents	44,000	39,600	---	4,400
New A/D building construction	245,000	---	163,333	81,667
New fueling system	140,000	---	93,333	46,667
<b>Phase I Subtotals</b>	<b>\$446,000</b>	<b>\$50,400</b>	<b>\$259,999</b>	<b>\$135,601</b>
<b>Phase II - Short Term.</b>				
Fee acquisitions (44.6 AC)	\$22,300	\$20,070	---	\$2,230
Easement acquisitions (47.6 AC)	5,700	5,130	---	570
Secondary runway construction	796,300	716,700	---	79,600
Light secondary runway	79,400	71,400	---	8,000
Runway extension	109,500	98,500	---	11,000
Hangar area development	166,600	---	111,000	55,600
Multi-plane storage hangar	60,000	---	*48,000	12,000
Access road and parking const.	55,700	39,500	7,000	9,200
<b>Phase II Subtotals</b>	<b>\$1,295,500</b>	<b>\$951,300</b>	<b>\$166,000</b>	<b>\$178,200</b>
<b>Phase III.</b>				
Maintenance building construction	\$250,000	---	\$166,667	\$83,333
Tee hangar construction	120,000	---	*96,000	24,000
Parallel taxiway construction	473,600	426,200	---	47,400
<b>Phase III Subtotals</b>	<b>\$843,600</b>	<b>\$426,200</b>	<b>\$262,667</b>	<b>\$154,733</b>
<b>Phase IV.</b>				
Building Area Development	\$38,500	---	\$25,700	12,800
Tee hangar construction	120,000	---	*96,000	24,000
<b>Phase IV Subtotals</b>	<b>\$158,500</b>		<b>\$121,700</b>	<b>\$36,800</b>

\* 80% loan from Mn/DOT Hangar Loan Program



**Carlton County - Cloquet Airport**

## **AIRPORT LAYOUT PLAN REPORT**

### **VII. REVIEW OF SIGNIFICANT ENVIRONMENTAL FACTORS.**

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#### **A. INTRODUCTION - THE ENVIRONMENTAL REVIEW PROCESS.**

The National Environmental Policy Act (NEPA) requires that all new airport construction be evaluated in terms of possible environmental impacts. The Act provides three categories of environmental actions which may be required for every proposed project in the development plan. These three categories are:

- ◆ **Categorical Exclusions;**
- ◆ **Actions normally requiring an Environmental Assessment (EA); and**
- ◆ **Actions normally requiring an Environmental Impact Statement (EIS).**

In general terms, actions categorically excluded are those actions which are found to have no potential for significant environmental impact.

Actions normally requiring an Environmental Assessment are those which have been found by experience to sometimes have significant environmental impacts. The purpose of an Environmental Assessment is to determine whether or not an action will have one or more significant impacts.

Actions determined to have significant impacts during preparation of the Environmental Assessment will be required to be addressed by an Environmental Impact Statement.

The preparation of the Environmental Assessment is the responsibility of the airport sponsor. Based upon the results of the Environmental Assessment, the FAA will either require an Environmental Impact Statement (EIS) or a "Finding Of No Significant Impact" (FONSI).

Federal regulations require that a sponsor seeking a grant for airport improvements must prepare and submit an Airport Layout Plan, showing detailed information regarding the existing and proposed facility, along with an Environmental Assessment prepared in accordance with FAA Order 5050.4, if an assessment is required.

## **B. PROBABLE ENVIRONMENTAL IMPACTS.**

The areas of potential impact which must be addressed in the Environmental Assessment, per FAA Order 5050.4 are as follows:

- a) Social Impacts.
- b) Induced Socio-Economic Impacts.
- c) Air Quality.
- d) Water Quality.
- e) Impacts Upon Public Recreation Areas and Historical/Cultural Sites.
- f) Biotic Communities.
- g) Endangered/Threatened Species.
- h) Wetlands.
- i) Floodplains.
- j) Coastal Zone Management Programs and Coastal Barriers.
- k) Wild and Scenic Rivers.
- l) Conversion of Farmland.
- m) Energy Supply and Natural Resources.
- n) Light Emissions.
- o) Solid Waste Impacts.
- p) Construction Impacts.
- q) Noise.
- r) Compatible Land Use.

These areas are discussed in the following narrative. Certain of these must

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be addressed in detail in the planning phase for the improvements, as part of the FAA and state requirements of the Environmental Assessment.

**SOCIAL IMPACTS.** These are impacts which arise from the disruption of communities, relocation of persons, changes in employment patterns and changes in transportation patterns.

Land acquisitions for secondary runway development and clear zone control will require relocation of persons that currently reside in the rented farm near the city wells. There will be no relocations of persons or business interests for extension of the primary runway.

**INDUCED SOCIO-ECONOMIC IMPACTS.** These secondary or indirect impacts involve shifts in population, changes in economic climate, or shifts in levels of public service demand. The effects are directly proportional to the scope of the project under consideration.

Assessment of socioeconomic impacts is usually associated with major development at larger air carrier airports, which involve major terminal building development or roadway alignments, and similar work. The extent of the indirect socioeconomic impacts of the proposed development is not of the magnitude that would normally be considered significant.

**AIR QUALITY.** The Federal Aviation Administration, through FAA Order 5050.4A, Airport Environmental Handbook, includes an established procedure which is followed in order to determine if an air quality analysis is necessary for a proposed airport development action.

The initial step in this process is to determine whether the anticipated project has the potential for increasing airport operations, ground traffic, or parking capacity. If this is the case, further assessment is required to determine if a full analysis is warranted.

Forecasts of estimated aviation activity for the 1993 through 2013 period were developed as part of this study. These projections do indicate a significant increase in activity over the planning period (64.9% increase in total movements over the twenty year period). No air quality analysis is needed if the levels of activity forecast in the time frame of the proposed action are below those in either a or b below:

- a. If it is a commercial service airport and has less than 1.3 million

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passengers and less than 180,000 general aviation operations annually

- b. If it is a general aviation airport and has less than 180,000 operations forecasted annually.

As can be seen in Table 4g of this document the total annual forecasted operations for the end of the design period is 34,258, well below the 180,000 required for air quality analysis. It may be assumed that an air quality analysis will not be required and that air quality will not be significantly impacted by the proposed development. However, short-term impacts to air quality caused by construction activity must be addressed in the EA.

The 1982 Airport Act requires that federal Airport Improvement Program (AIP) applications for projects involving airport location, runway location, or major runway extension shall not be approved unless the governor of the state in which the project is located certifies that there is "reasonable assurance" that the project will be located, designed, constructed, and operated in compliance with all applicable air quality standards.

**WATER QUALITY.** The 1982 Airport Act requires that federal Airport Improvement Program (AIP) applications for projects involving airport location, runway location, or a major runway extension shall not be approved unless the governor of the state in which the project is located certifies that there is "reasonable assurance" that the project will be located, designed, constructed, and operated in compliance with all applicable water quality standards.

Analysis of the potential impacts to water quality caused by increased impermeable (paved) surface and disruption of drainage patterns will be required in the Environmental Assessment. Short-term impacts to water quality caused by construction activity (erosion) must also be addressed.

**IMPACTS UPON PUBLIC RECREATION AREAS AND HISTORICAL/CULTURAL SITES.** Section 4(f) of the DOT Act states that the "Secretary shall not approve any program or project which requires the use of any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state or local significance or land of an historic site of national, state or local significance as determined by officials having jurisdiction thereof unless

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there is no feasible and prudent alternative to the use of such land and such program or project includes all possible planning to minimize harm resulting from the use."

No impacts upon existing parks, established waterfowl/wildlife refuges or recreation areas are foreseen by the proposed improvements.

**BIOTIC COMMUNITIES - ENDANGERED AND THREATENED SPECIES.** It is necessary to consider the impacts upon existing wildlife and waterfowl, especially rare and endangered species.

An "Endangered Species" is defined as any member of the animal or plant kingdoms determined to be in danger of extinction throughout all or a significant portion of its range.

A "Threatened Species" is defined as any member of the plant or animal kingdoms which are likely to become endangered in the foreseeable future. Contact with the Minnesota Department of Natural Resources and the U.S. Fish and Wildlife Service should be made as a part of the EA process in order to determine probable impacts.

**BIOTIC COMMUNITIES - WETLANDS AND OTHER SENSITIVE HABITAT.** Wetlands are defined in Executive Order 11990, "Protection of Wetlands", as "those areas that are inundated by surface or ground water with frequency sufficient to support, and under normal circumstances does or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, and natural ponds."

Areas of potential impact must be investigated fully as a function of the Environmental Assessment, with coordination with the jurisdictional agencies.

**FLOODPLAINS.** Floodplains are defined by Executive Order 11988, "Floodplain Management", as the lowland and relatively flat areas adjoining coastal waters "...including at a minimum, that area subject to a one percent or greater chance of flooding in any given year...", that is, an area which would be inundated by a 100-year flood.

If a proposed development involves a 100 year floodplain, mitigating

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measures must be investigated in order to avoid significant changes to the drainage system.

The Cloquet airport does not lie within an identified floodplain area. No significant impacts will, therefore, occur as a result of the proposed action. The scope of the anticipated construction at this site should not significantly impact floodplains, assuming normal care during design and construction.

**COASTAL ZONE MANAGEMENT PROGRAMS AND COASTAL BARRIERS.** Each state, where applicable, has initiated a Coastal Zone Management Program which encompasses the inland limits of the coastal zone as designated by the state.

Cloquet is not located within or near a designated Coastal Zone.

The Coastal Barriers Resources Act of 1982 prohibits Federal financial aid for development taking place within the undeveloped coastal barriers occurring along the Gulf and Atlantic coasts. Consideration of this issue is therefore not applicable to this facility.

**WILD AND SCENIC RIVERS.** The Wild and Scenic Rivers Act describes those river areas eligible for protection from development. As a general rule, these rivers possess outstanding scenic, recreational, geological, fish and wildlife, historical, cultural, or other similar value.

There are no classified Wild and Scenic Rivers within the vicinity of the proposed development.

**CONVERSION OF FARMLAND.** The Farmland Protection Policy Act (FPPA) authorizes the Department of Agriculture to develop criteria for identifying the effects of Federal programs upon the conversion of farmland to uses other than agriculture.

Since some farmland will be converted to airport uses as a result of the proposed improvements, this area will require detailed analysis in the Environmental Assessment.

**ENERGY SUPPLY AND NATURAL RESOURCES.** For most general aviation and non-hub air carrier airport actions, changes in energy demands or other natural resource consumption will not result in

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significant impacts. This is the case for the planned development at Cloquet.

**LIGHT EMISSIONS.** Aviation lighting required for the purposes of obstruction marking, security of parked aircraft and vehicles, and visual aids to navigation are the main source of light emissions emanating from airports. An analysis is necessary only if a proposal would introduce new airport lighting facilities which might affect residential or other sensitive land uses.

The proposed lighting installations at Cloquet will generate no significant off-airport impact.

**SOLID WASTE IMPACTS - AIRPORT SOLID WASTE GENERATION.** Airport development actions which relate only to construction or expansion of runways, taxiways, and related facilities do not normally include any direct relationship to solid waste collection, control, or disposal. Since the proposed action at Cloquet meets this criteria, no significant impacts are anticipated.

**SOLID WASTE IMPACTS - PROXIMITY TO WASTE DISPOSAL FACILITIES.** Any solid waste disposal facility (ie. sanitary landfill) which is located within 1,500 meters of all runways planned to be used by piston-powered aircraft, or within 3,000 meters of all runways planned to be used by turbojets is considered by the FAA to be an incompatible land use because of the potential for conflicts between bird habitat and low-flying aircraft. This determination is contained in paragraph 5 of *FAA Order 5200.5, FAA Guidance Concerning Sanitary Landfills On or Near Airports.*

Reference to this potential hazard is also made in *40 CFR Part 257, Criteria for Classification of Solid Waste Disposal Facilities, section 257.3-8.*

There are no existing or planned solid waste disposal sites within 3,000 meters of the planned runway at Cloquet. No significant impacts relative to the airport's proximity to sanitary landfills are indicated.

**CONSTRUCTION IMPACTS.** Any construction project will generate short-term environmental impacts. These may include noise and air pollution (dust and exhaust emissions) from construction equipment on the

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site and traversing nearby neighborhoods, air pollution from burning of refuse, and water pollution from erosion and increased siltation of downstream bodies of water.

The proposed construction will include site grading, paving, trench excavation, materials delivery, and related work which will have the potential to create or contribute to these adverse environmental impacts.

Potential erosion and siltation will be mitigated by incorporation of Minnesota Department of Transportation Standard Specifications for Construction, 1988 Edition, Part 1803.5, 2573, and other applicable sections, in the construction specifications.

As a method of minimizing noise and air pollution caused by construction equipment, the contractors' equipment access should be routed to avoid the most sensitive adjacent areas and to contain the adverse impacts as much as possible to the airport property. The access routes and limitations should be defined on the construction plans and in the specifications, as appropriate.

Dust pollution should be specifically mitigated by requiring appropriate dust control measures as a part of the specifications.

Coordination with the Minnesota Department of Natural Resources, as well as the Corps of Engineers will be necessary during the preparation of the Environmental Assessment, development of construction plans, and during the construction activities.

**NOISE.** A noise analysis is not required by the Federal Aviation Administration for airport proposals which involve utility or transport airports whose forecast annual operations within the period covered by the Environmental Assessment do not exceed 90,000 annual propeller operations or 700 jet operations.

According to the forecasts developed in this study, activity will remain well below these levels during the period under study. A noise assessment will therefore not be required and no significant impacts are foreseen in this area.

**COMPATIBLE LAND USE.** Land-use compatibility conflicts are a common problem around many airports in the United States, both for large

---

Transport airports and smaller General Aviation facilities. In urban areas, as well as some rural settings, airport owners find that essential expansion to meet the demands of airport traffic is difficult to achieve due to the nearby development of incompatible land uses.

These incompatible uses typically consist of medium to high density residential areas, built in close proximity to an existing airfield prior to enactment of suitable land-use zoning legislation. The residents of these developments, with substantial investments in their homes, may view the airport and its activities as a threat to their health, safety and quality of lifestyle.

The issue of aircraft noise is generally the most apparent perceived environmental impact upon the surrounding community.

Conflicts may also exist in the protection of runway approach and transition zones to assure the safety of both the flying public and the adjacent property owners. Adequate land for this use should be either owned in fee or controlled in easements.

A study of the surrounding area indicates that there are presently no existing adjacent incompatible land uses affecting the airport.

### **C. SUMMARY OF FINDINGS.**

The Environmental Assessment should address all of the areas of potential impact included in the above discussion, with particular emphasis placed upon potential impacts to the following:

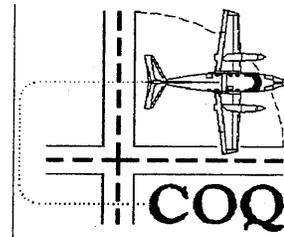
- ◆ Social Impacts (road closures/relocations and relocation of persons/business interests).
- ◆ Water Quality (short-term construction impacts and changes in drainage).
- ◆ Air Quality (short-term construction impacts).
- ◆ Wetland and Woodland Habitat (tree and brush clearing)

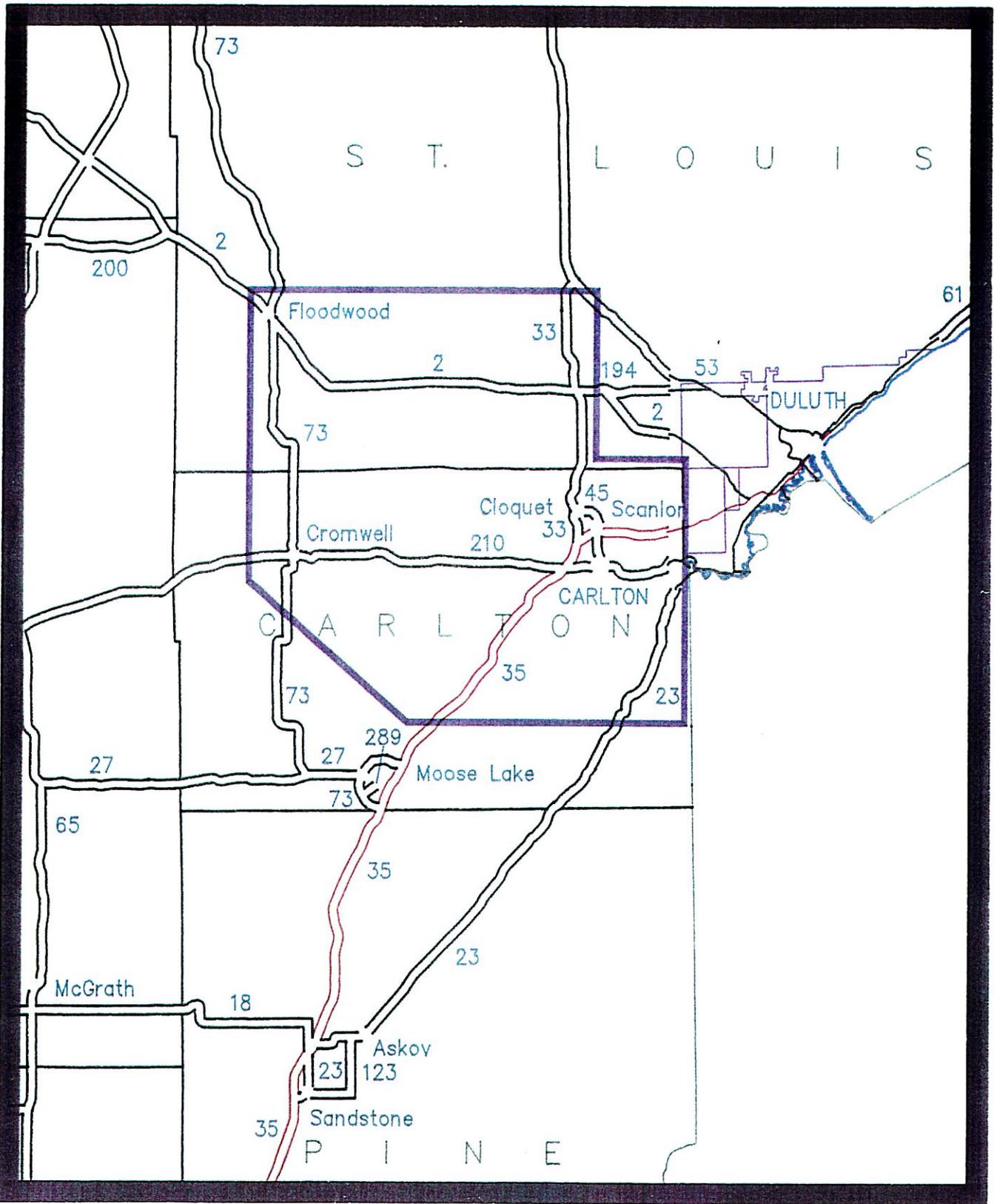
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within wetlands).

- ◆ Farmland Impacts (conversion of farmlands to airport use).
- ◆ Construction Impacts (mitigation of short-term adverse impacts).

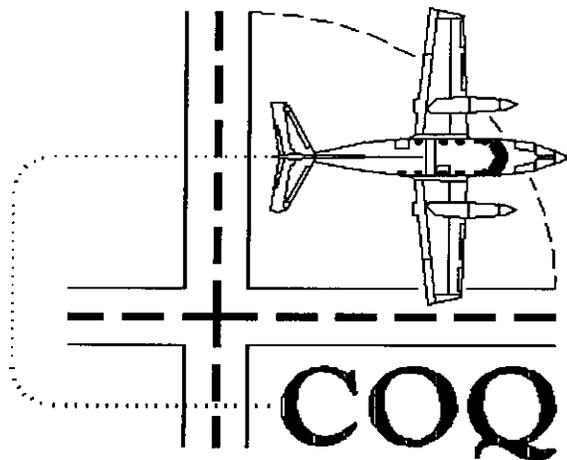
Detailed definition and quantification of probable impacts should be presented in the Environmental Assessment, along with recommended mitigation procedures for each element.





Service Area Map  
 Cloquet-Carlton County Airport  
 Cloquet, Minnesota

FILE NO. 93151
DATE 01/93



# Carlton County - Cloquet Airport

## Crosswind Runway Alternatives Analysis Study

July 21, 1994

**CARLTON COUNTY - CLOQUET AIRPORT**  
Cloquet, Minnesota

**Crosswind Runway Alternatives Analysis  
Study**

*Prepared for*  
**THE CARLTON COUNTY AIRPORT COMMISSION**

July 21, 1994

SEH Project Number CARLT3151.00

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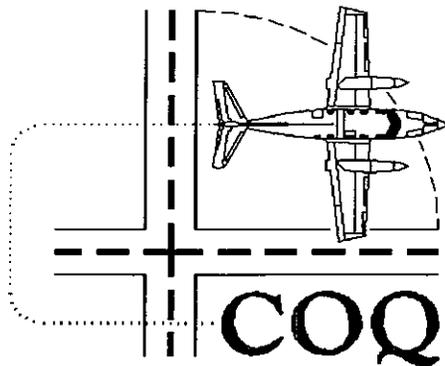
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**Carlton County - Cloquet Airport**

## **Crosswind Runway Alternatives Analysis Study**

**Section 1: Comparative Analysis**

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### **Introduction**

This study contains a detailed comparative evaluation of five alternate crosswind runway development options at the existing Carlton County - Cloquet Airport (FAA identifier COQ).

The comparative evaluation was approached from a purely analytical point of view, comparing several areas of potential environmental, economic and developmental impact among the various alternates to reach an objective baseline for selection of the most desirable option. The methodology employed assumes that the best alternative action is the one which exhibits the least potential for adverse impact with the most frequency when compared to the other alternates.

Final site selection may actually be dependent upon impacts in one or two specific areas, such as relative cost of initial development, unavailability of land (or, conversely, donation of land), the potential for expensive and time-consuming litigation, or simply a consensus of the local populace or airport authority.

Within this study, references to the "ALP Report" pertain to the Carlton County - Cloquet Airport Layout Plan Report dated July, 1993.

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At the time of preparation of this study, a residential subdivision (Jolicouer Trails) has been proposed immediately adjacent to the airport property. In this report, except in the case of Alternate 1a, it is assumed that this development will occur.

## **Development of Alternatives**

The five crosswind runway alternatives were developed such that each would accommodate a 3,520' long x 75' wide paved crosswind runway, which will be capable of serving ARC B-II aircraft (those with approach speeds of less than 121 knots and wingspans of less than 79 feet). The options were approached with the intent of utilizing existing airport land to the greatest extent possible, avoiding obvious significant environmental impacts, and minimizing construction and land acquisition costs.

In all cases, the proposed crosswind runway was located such that no fee acquisitions would be required in the adjacent Cloquet Forest Game Reserve. All alternatives also assume that access will be provided to the residence and buildings located just south of the NDB site.

The five options are illustrated in Figures 1 through 4 in Appendix 1, at the end of this section (Alternate 1a is identical to Alternate 1 except for the use of adjacent land to the east of the proposed runway). They are described as follows:

**Alternate 1:** With this option, the crosswind runway will be positioned at right angles to the existing primary runway and will intersect the primary runway at its approximate midpoint (ultimate configuration assumed). Use of existing airport property acquired in the past for crosswind runway development will be maximized. It is assumed that the Jolicouer Trails subdivision will be developed with revisions made necessary because of Clear Zone fee acquisitions by the airport. (see Figure 1)

- 
- Alternate 1a:** This alternate is identical to Alternate 1 except that it is assumed that the Jolicouer Trails subdivision land will not be developed beyond what is already in progress.
- Alternate 2:** With this option, the Alternate 1 crosswind runway was rotated in a counterclockwise direction about its intersection with the primary runway in order to minimize earthwork and to avoid the planned residential development to the east and existing wetlands. (see Figure 2)
- Alternate 3:** In this case the crosswind runway was positioned further south on the airport site in order to avoid the planned residential development. Relocation of the existing nondirectional radio beacon (NDB) will be required if this option is selected. (see Figure 3)
- Alternate 4:** This option is actually an enhancement of Alternate 3. The crosswind runway was rotated in a clockwise direction about its easternmost end and moved to the north in order to avoid the need to relocate the existing NDB. (see Figure 4)

## **Matrix Evaluation Methodology**

In order to determine the most desirable development option for crosswind runway development, an objective analysis of several key factors was undertaken. These factors represent the key impact categories associated with the type of development under study, and include safety and economic considerations as well as potential impacts to the environment.

In the analysis, each category is evaluated independently of the others and each development alternate is assigned an "Evaluation Matrix rating" which is representative of that alternate's comparison

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to the other options in that specific category. A summation of all Evaluation Matrix ratings for each alternate represents the general desirability of each alternate relative to the others.

For the safety and economic related elements considered, the development alternate with the lowest total rating represents the option with the best combination of safety and economic related features. In cases where the alternates were considered equal in a specific category, both alternates were assigned the same rating (the lowest ranking remaining 1).

The environmental impact related elements were evaluated differently. Where no apparent impacts in a specific environmental impacts category were found, an Evaluation Matrix rating of 0 was assigned. When potential significant impacts were identified, the alternates were ranked in a "top-down" fashion. That is, the alternate with the most severe condition was assigned a rating of 5, the next most severe was assigned a rating of 4... etc. If the potential for minor impacts (not necessarily significant, but warranting consideration) was noted, the alternates were ranked in a "bottom-up" fashion. That is, options with the least severe condition were assigned a rating of 1, the next most severe condition was assigned a rating of 2... etc.

## **Safety and Economic Feasibility**

The five potential development options were comparatively evaluated by consideration of several key safety and economic factors, including potential obstructions to air navigation, relative wind coverage, potential for flight over densely populated areas, and relative construction and land acquisition costs.

**Potential Obstructions to Air Navigation.** The standards for determining obstructions to air navigation are found in FAR Part "77". In Subpart 77.23 of the regulations, obstructions are defined as an object (including a mobile object) which is greater than...

- 
- ... a height of 500 feet above ground level at the site of the object;  
or
  - ... a height that is 200 feet above ground level or above the established airport elevation (whichever is higher) within three nautical miles of the reference point of an airport which has a runway more than 3,200 feet in length. That height increases in the proportion of 100 feet for each additional nautical mile from the airport, up to a maximum of 500 feet.

Part "77" also establishes airport "imaginary surfaces", which are geometrically based upon the actual physical layout of the runways and the category of the airport's ultimate use. An object is defined as an obstruction if it would penetrate any of these imaginary surfaces.

By definition, the imaginary surfaces become increasingly critical with respect to height limitations as they become nearer to the runway surfaces, finally allowing an object height of zero within 200 feet of the runway ends.

For the purposes of this analysis, an examination of the Mn/DOT Clear Zones for the alternate crosswind runway alignments was undertaken to determine the existence of any potential obstructions.

The planned residential subdivision (Jolicouer Trails) is located beneath the Clear Zone for approach to Runway 27 in Alternate 1 and 1a. The proposed layout is such that a new road would constitute an obstruction within the Clear Zone for this approach. However, since selection of Alternate 1 will require fee purchase of that portion of the residential property within the Clear Zone, it is assumed that the street layout will be revised to avoid potential obstructions. No other potential obstructions were noted for Alternate 1.

Selection of any of the alternates will involve some tree removal within each of the Clear Zones. No other apparent obstructions were noted, and each of the options was assumed to be equal in this category. Each was assigned an Evaluation Matrix rating of 1.

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**Relative Wind Coverage.** As determined in the ALP Report, a two-runway system will be required at Cloquet in order to achieve the recommended 95% total runway system wind coverage.

Effective wind coverage is assumed to be essentially equal from a safety standpoint among the alternates when a two-runway system is in place since the purpose of the crosswind runway is to achieve full 95% coverage. For the purposes of this comparative evaluation, only the total wind coverage along the new crosswind runway has been considered. The wind coverage of the primary runway will remain constant for all alternatives being considered.

The comparative wind analysis used the Duluth International Airport all-weather wind data for the period covering 1981 through 1990. The data was amplified for this analysis by considering frequencies of less than 0.1% in each sector (those indicated by a "+" on a standard FAA wind rose). The tabulation below illustrates the results of the analysis, which suggests that Alternate #4 is the most desirable in terms of crosswind runway wind coverage.

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**Table 1**  
**Crosswind Runway Wind Analysis**  
**Five Development Alternates**

	<u>Runway</u>	<u>True Azimuth</u>	<u>Coverage</u>	<u>RATING</u>
Alt 1:	09/27	(090°)	87.04%	2
Alt 1a:	09/27	(090°)	87.04%	2
Alt 2:	07/25	(068°)	85.11%	4
Alt 3:	09/27	(091°)	87.02%	3
Alt 4:	09/27	(094°)	87.51%	1

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**Low-Level Flight Over Populated Areas.** Aircraft on approach for landing, or in the early stages of a departure climb, are generally in their most vulnerable states. Airspeeds are low, landing gear and flaps are down (or are being cycled) - creating extra drag, and the aircraft is sometimes subjected to low-level wind shear or

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downdrafts. The initial climb phase after departure is also the time when engines are most likely to fail.

The FAA Runway Protection Zones and Mn/DOT Clear Zones are designed to offer protection to both the occupants of aircraft and to people on the ground by providing a clear and unobstructed path for aircraft on inordinately low approaches or departures. The Object Free Areas (OFA), and Runway Safety Areas (RSA) provide areas beyond the runway thresholds to accommodate aircraft which may touch down short of the runway pavement during landing, or overrun the available pavement during an aborted takeoff roll.

Even though the standard approach and departure surfaces described above will be in place at Cloquet, it is important to be aware of the effects of runway location and alignment on densely populated areas further removed from the airport.

The Federal Air Regulations require that an aircraft maintain an altitude of at least 1,000 feet above any populated areas except during departure, approach and landing. Recommended operating practice suggests that the pilot maintains a straight-out departure (no turns) on the runway heading until the aircraft has reached an altitude of at least 500 feet above the ground (AGL).

It is possible that a heavily loaded aircraft on departure will not be able to reach this altitude within as much as three or four miles of the start of its takeoff roll. To illustrate this, consider that an aircraft with a climb speed of 90 mph which is able to attain an average rate of climb of 500 feet per minute (an acceptable rate) will require approximately one minute of climb from its point of rotation (the point at which it leaves the ground) to reach an altitude of 500' AGL. This will mean that the aircraft will probably not initiate any turns within 1.5 miles of the departure runway because it will be below 500' AGL. On a hot day, the rate of climb will be degraded. If the initial rate of climb decreases to, say, only 250 feet per minute (bordering on a critical situation), the distance from the runway that the aircraft will be below 500' AGL will increase to 3 miles from its rotation point (four minutes of climb).

For the purposes of this study, available USGS and Carlton County mapping was examined to determine the potential for overflight of

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populated areas by low-flying aircraft. A straight-out departure path of 1.5 miles from the runway end was assumed before initiation of any turns.

There are no apparent potential impacts in this category for any departures or approaches to the west with selection of any of the alternates. Immediately adjacent land within one mile to the west of the airport is in the Cloquet Forest Game Refuge. The land further to the west is predominantly agricultural use or woodlands.

Departures to the east from the crosswind runway as proposed with Alternate 1 will immediately overfly low-density residential land within the Jolicouer Trails subdivision. Beyond the subdivision, the departure path will pass over existing residential uses west of Scanlon within about 1.5 miles. An Evaluation Matrix rating of 5 has been assigned to this alternate in this category because of the immediately adjacent residential use.

With Alternate 1a, the adjacent residential use is not a factor, and the departure path to the east will only pass over the residential uses west of Scanlon at about 1.5 miles from the runway end. An Evaluation Matrix rating of 3 has been assigned.

Departures to the northeast from the Alternate 2 runway alignment will overfly residential uses southwest of the Cloquet city limits within about 1 mile of the runway end. An Evaluation Matrix rating of 4 has been assigned to this alternate.

Takeoffs to the east from the Alternate 3 crosswind runway will overfly Scanlon and residential-use lands within about 2.4 miles. An Evaluation Matrix rating of 2 has been assigned to this alternate.

Straight-out departures to the east from the runway as proposed with Alternate 4 will not overfly any existing residential uses. An Evaluation Matrix rating of 1 has been assigned to this alternate because of the low potential for residential area overflight.

With all of the proposed alternates, departures to the north after a 500' climb would overfly the City of Cloquet. Departures to the south could overfly platted residential-use lands south of Scanlon.

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**Construction and Land Acquisition Costs.** The approximate costs for construction of selected major improvement elements and acquisition of land were used to represent the relative initial economic impacts associated with development for each alternate. The analysis assumed extension of the primary runway by approximately 400' along with construction of the 3,520' x 75' crosswind runway, both with medium intensity edge lighting. A design strength of 12,500 pounds - Single Wheel Gear was assumed, in accordance with the recommendations of the ALP Report. Actual construction of these items will be phased according to established or forecast demand.

All runway pavements were assumed to consist of 3" of bituminous pavement over 6" of crushed aggregate base course. The cost of runway construction will vary between the alternates based upon the relative quantity of earthwork required to obtain an acceptable design.

The amount of earthwork necessary at each site was estimated by establishing a design profile along the runway center lines and measuring approximate cut and fill along the profile. Reference to U.S.G.S. topographic maps was made for this purpose. All earthwork was measured as unclassified excavation or, if required to achieve a balance, as borrow excavation.

For the purposes of this analysis, a 24' wide pavement section 6" of crushed aggregate base course over native soil was assumed for all new roadway improvements. Substantial conformance with existing grades was assumed.

Minimum recommended property acquisition lines have been defined for each of the development alternates, and are indicated on Alternate Layouts #1 through #4 (Figures 1 through 4). The property limits were determined by accepting the following parameters:

- The ultimate FAA Object Free Area (OFA) and Runway Safety Area (RSA), as well as the first 1,000' of the Mn/DOT Clear Zones, will be fully contained within the ultimate airport property.

- Wherever reasonably possible, the area encompassing the FAR Part "77" Transitional Surfaces (7:1) to 495' from the runway centerlines will be fully contained within the ultimate airport property.
- Property acquisitions were derived such that the ultimate property line will encompass the minimum property requirements, while avoiding obvious property splits and landlocks.

The costs associated with land acquisitions were derived by research of the Carlton County records of assessed valuation for the parcels to be acquired. The costs associated with fee acquisition of land were estimated by applying the assessed value per acre for each parcel involved with no attempt to derive market value. The actual costs will be determined through appraisal and negotiation with the current land owners.

The costs associated with acquiring avigation easement rights were estimated at \$125 per acre of land within the easement.

A 10% contingency was added to the total land costs (fee and easements) and engineering, surveys, legal and administrative expenses were estimated at 30% of the total.

Detailed tabulations of the cost estimates are included in Appendix 1 at the end of this section (Figures 5 through 9). The results are summarized below.

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**Table 2**  
**Approximate Development Costs**  
**Five Development Alternates**

	<u><b>Total Cost</b></u>	<u><b>Ranking</b></u>
Alternate 1 . . . . .	\$ 3,234,976.46	2
Alternate 1a . . . . .	\$ 3,245,987.46	3
Alternate 2 . . . . .	\$ 2,257,998.61	1
Alternate 3 . . . . .	\$ 3,626,515.88	4
Alternate 4 . . . . .	\$ 3,663,530.37	5

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## **Environmental Impacts**

The five potential development options were comparatively evaluated by consideration of several key environmental factors, including potential impacts to adjacent sensitive lands, impacts to wetlands and protected waters, and noise exposure.

The intent of this study is to identify apparent potential impacts which might occur with selection of each of the alternates. A detailed assessment of the potential impacts, as well as recommendations for mitigation, will be included as a part of the site-specific Environmental Assessment preparation.

**Impacts Upon Adjacent Sensitive Lands.** Potential impacts to adjacent lands include impacts to public recreation areas or wildlife refuges, impacts to existing wildlife habitat, including impacts to any identified endangered or threatened species.

Section 4(f) of the Department of Transportation Act states that the "Secretary shall not approve any program or project which requires the use of any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state or local significance or land of an historic site of national, state or local significance as determined by officials having jurisdiction thereof unless there is no feasible and prudent alternative to the use of such land and such program or project includes all possible planning to minimize harm resulting from the use."

This category also concerns potential impacts to existing wildlife habitat. The significance of the impacts in this category are quantified by examining both the area of land to be altered or removed and its relationship to surrounding habitat. For example, removal of a few acres of habitat which represents a small percentage of the area's total similar habitat or which supports a limited variety of common species would not be considered significant. However, removal of a sizeable percentage of the area's similar habitat, or habitat which is known to support rare species, would be considered significant impact.

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In addition to general impacts to wildlife habitat, it is necessary to consider the impacts rare, threatened and endangered species. An Endangered Species is defined as any member of the animal or plant kingdoms determined to be in danger of extinction throughout all or a significant portion of its range. A Threatened Species is defined as any member of the plant or animal kingdoms which are likely to become endangered in the foreseeable future.

The only adjacent land which has been identified as potentially sensitive is the Cloquet Forest Game Refuge, located immediately west of the airport property, encompassing Sections 29, 30, 31 and 32, Township 49 North, Range 17 West. Disruption or removal of existing habitat in this area would be limited to removal of any trees which may be identified as obstructions to the Runway 09 approach.

At the time of preparation of this study, no endangered or threatened species have been identified that might be impacted by airport development as proposed in any of the alternates.

Since no fee acquisitions of the Game Refuge will be required as a part of any of the alternates, relative impacts to adjacent sensitive land was represented by the number of acres of avigation easement required for each alternate. The results are as follows:

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**Table 3**  
**Impacts to Adjacent Sensitive Lands**  
**As Represented by Relative Areas of Avigation Easements**  
**Required Within Game Refuge**

	<u>Easement Area</u>	<u>Ranking</u>
Alternate 1 . . . . .	22 acres	2
Alternate 1a . . . . .	22 acres	2
Alternate 2 . . . . .	19 acres	1
Alternate 3 . . . . .	22 acres	2
Alternate 4 . . . . .	22 acres	2

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**Wetlands and Protected Waters.** Wetlands are defined in Executive Order 11990, Protection of Wetlands, as "those areas that are inundated by surface or ground water with a frequency sufficient to support, and under normal circumstances does or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, and natural ponds."

Existing wetlands are present within the proposed development areas. These are classified as Palustrine Forested or Scrub/Shrub wetlands which are seasonally saturated. The approximate limits of the wetlands are shown on Alternate Layouts #1 through #4 (Figures 1 through 4) in Appendix 1.

Four of the five alternates under consideration would have direct impacts upon these existing wetlands.

In all alternatives, access to the property southeast of the airport would impact existing wetlands. Purchasing this property is an option, and a road for access would have approximately the same impact. For the purpose of this analysis, the road impacts are considered indirect.

Development of Alternates 1 and 1a would require replacement of approximately 10 acres of existing wetland. It is interesting to note, however, that the proposed fee acquisition of a portion of the Jolicouer Trails subdivision would assure protection of the wetlands existing within the acquired parcel.

Alternate 2 would not have any direct impacts upon the existing wetlands, since no replacement would be required. Some amount of indirect impacts would, however, be associated with this option because of the close proximity of the proposed runway to existing wetlands. In addition wetland may be impacted in providing access to the properties southeast of the airport.

Alternates 3 and 4 would require replacement of approximately 12 and 13 acres of existing wetlands, respectively.

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The relative impacts to existing wetlands was represented by the approximate number of acres of wetland which would be directly impacted by the proposed development for each of the alternates. In order to account for the possibility of indirect impacts associated with Alternate 2, an Evaluation Matrix rating of 1 was assigned. The results of the wetland impacts analysis are as follows:

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**Table 4**  
**Impacts to Wetlands**  
**As Represented by Relative Areas of Wetland Replacement**

	<u>Wetland Area</u>	<u>Ranking</u>
Alternate 1 . . . . .	10 acres	3
Alternate 1a . . . . .	10 acres	3
Alternate 2 . . . . .	0 acres	1
Alternate 3 . . . . .	12 acres	4
Alternate 4 . . . . .	13 acres	5

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The only DNR Protected Waters within the vicinity of the airport development as proposed are Third Lake, located about 1,200 feet northeast of the Runway 17 threshold, and Otter Creek, located to the south of the airport property. The proposed alternate crosswind runway alignments will be located approximately midway between Third Lake and Otter Creek. The possibility of bird migration patterns between the two bodies of water may be present, but impacts will be essentially equal between the five alternates under study.

**Noise Exposure.** A noise analysis is not required by the Federal Aviation Administration for airport proposals which involve utility or transport airports whose forecast annual operations within the

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period covered do not exceed 90,000 annual propeller operations or 700 jet operations.

According to the forecasts developed in the ALP Report, propeller activity will remain well below this level during the period under study. However, operations by business jet aircraft will potentially reach the 700 operation threshold by the year 1997. A noise assessment was, therefore, undertaken as a part of this study and will be required to be included as a part of the Environmental Assessment.

For the purposes of this study (as required by current FAA policy), the Ldn method of noise contour development was utilized, using the F.A.A. Integrated Noise Model computer program (version 4.11). The estimated forecast operations for planning year 2013 were used, as detailed in the ALP Report. Average maximum peak daily operations were estimated at 167, a very conservative estimate which assumes high seasonal peaking tendencies.

The Federal Aviation Administration (FAA) defines 65 Ldn as the threshold of significance for noise exposure impacts.

The Department of Housing and Urban Development (HUD), has published noise abatement and control standards in its Circular 1390.2 in an effort to separate uncontrollable noise sources from residential and other noise sensitive areas, and to prohibit HUD support for construction within sites determined to have unfavorable noise exposure conditions. A rating of less than Ldn 65 is considered acceptable for residential development. Ldn 65 to 75 is defined as discretionary and a rating of more than Ldn 75 is considered unacceptable for residential development.

For the purposes of this study, an attempt was made to generate noise exposure contours for the 65 Ldn level for the forecast 2013 conditions for each of the alternates. The analysis assumed that basic runway utilization will be 80% on the primary runway and 20% on the secondary (crosswind) runway, with equal utilization of each runway end and equal distribution of use by aircraft types. It was assumed that 90% of total operations occur during daylight hours, 5% during the evening and 5% at night.

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The results of the analysis indicate that the forecast 2013 65 Ldn contour will overlay the Jolicouer Trails subdivision in the case of Alternate 1. To account for these potential significant impacts, alternate 1 was assigned an Evaluation Matrix rating of 5.

The 65 Ldn levels will not impact any other adjacent property associated with any of the other alternates. Each of the other Alternates was assigned an Evaluation Matrix rating of 0.

### **Public Facilities**

All alternatives would require closing the north-south road which currently provides access to the Airport Building Area, the Non-Directional Beacon (NDB), and two residences with outbuildings. These residences and out buildings are located approximately 800 feet east of the south end of runway 17/35.

The City of Cloquet owns a municipal well which is located on airport property. The well is not the primary source of water for the City, but would have to be relocated, abandon, or replaced if alternative 2 was implemented.

All alternatives except alternative 2 were assigned an evaluation matrix rating of 1. Alternative 2 was assigned an evaluation rating of 3.

### **Summary of Matrix Evaluation.**

The following tabulation is a composite summary of the results of the comparative evaluation. The total ratings achieved by each alternate in the analysis have been combined to reach a final composite evaluation rating, the lowest of which is the lowest ordinal ranking and presumably the best development option.

**Table 5  
Site Evaluation Matrix  
Five Development Alternates**

	Alt 1	Alt 1a	Alt 2	Alt 3	Alt 4
<i>Safety and Economic Feasibility:</i>					
Obstructions to Air Navigation	1	1	1	1	1
Relative Wind Coverage	2	2	4	3	1
Flight Over Populated Areas	5	3	4	2	1
Development Costs	2	3	1	4	5
<b>Subtotal</b>	<b>10</b>	<b>9</b>	<b>10</b>	<b>10</b>	<b>8</b>
<i>Environmental Impacts:</i>					
Adjacent Sensitive Lands	2	2	1	2	2
Wetlands and Protected Waters	3	3	1	4	5
Noise Exposure	5	0	0	0	0
Public Facilities	1	1	3	1	1
<b>Subtotal</b>	<b>11</b>	<b>6</b>	<b>5</b>	<b>7</b>	<b>8</b>
<b>COMPOSITE RATING:</b>	<b>21</b>	<b>15</b>	<b>15</b>	<b>17</b>	<b>16</b>

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## Results of Selection Process.

The results of the matrix analysis suggest that Alternate 1a and Alternate 2 are essentially equal in their suitability for crosswind runway development. However, differences can be discerned when the various elemental categories are examined. Alternate 2 is the least expensive in terms of initial development costs by about \$977,000. It has no apparent significant impacts to the environment, whereas all of the other alternates have the potential for significant impacts to existing wetlands (which will require expensive and difficult mitigation).

The results of this analysis were presented to the Carlton County Airport Commission in a draft report dated April 15, 1994. Of the five alternatives analyzed, it was agreed that Alternate 1a and 2 would merit further consideration. The advantages and disadvantages are summarized below:

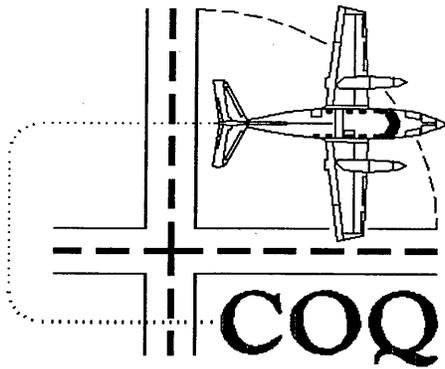
- **Wind Coverage:** Both alternates, when combined with the existing primary runway, provide the required wind coverage. Alternate 1a is somewhat (2%) better than the Alternate 2 alignment.
- **Noise and Safety:** The Alternate 1a alignment has significantly less effect on populated areas. The approach and departure path on the Alternate 2 alignment would be over a populated area of Cloquet.
- **Costs:** As mentioned above, estimated costs for Alternate 2 are about \$977,000 less expensive than Alternate 1a (\$3,245,987 for Alternate 1a versus \$2,257,998 for Alternate 2).
- **Environmental:** Alternate 2 has much less potential for significant impacts to adjacent wetlands, wooded areas, etc.

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- Other Factors: Alternate 2 would require abandonment of the City wells located on the airport property.

Based on the results of this study as well as input from the University of Minnesota (see Figure 10 in the Appendix 1), Carlton County Airport Commission selected Alternate 2 as the most desirable option for crosswind runway development at the Cloquet airport.

The next steps in the planning process are:

- Refine the geometric layout of the selected alternate in order to minimize impacts to adjacent property and to the environment.
- Update the Airport Layout Plan set and ALP Report to reflect the selection of crosswind runway Alternate 2.
- Submit the updated Airport Layout Plan and ALP Report to Mn/DOT and FAA for review, comment and approval.
- Prepare and implement an airspace and land use zoning ordinance based on the ultimate airport configuration.
- Prepare an Environmental Assessment for the proposed development of the crosswind runway, extension of the primary runway and related work.



**Carlton County - Cloquet Airport**

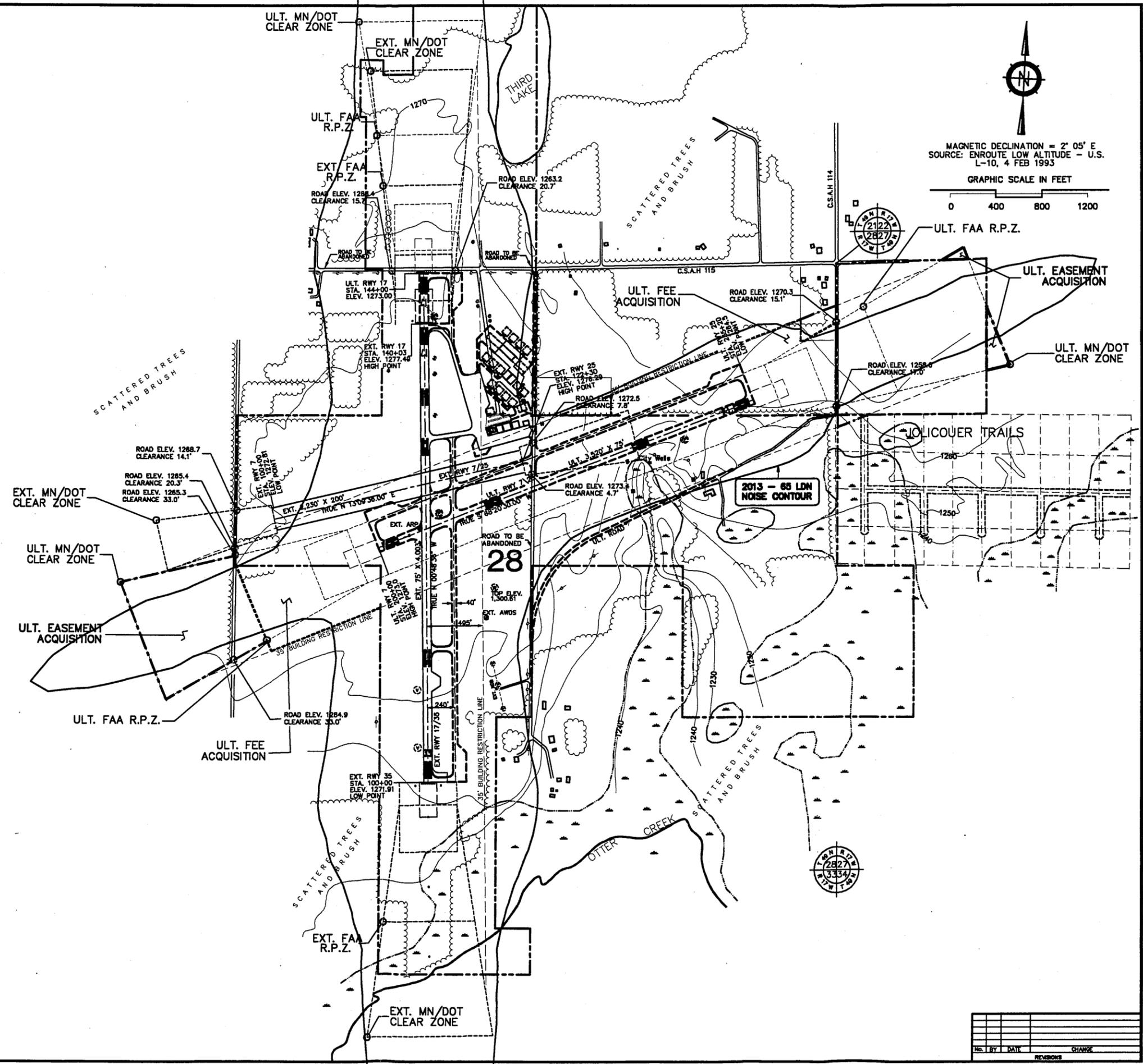
**Crosswind Runway  
Alternatives Analysis Study**

**APPENDIX 1**

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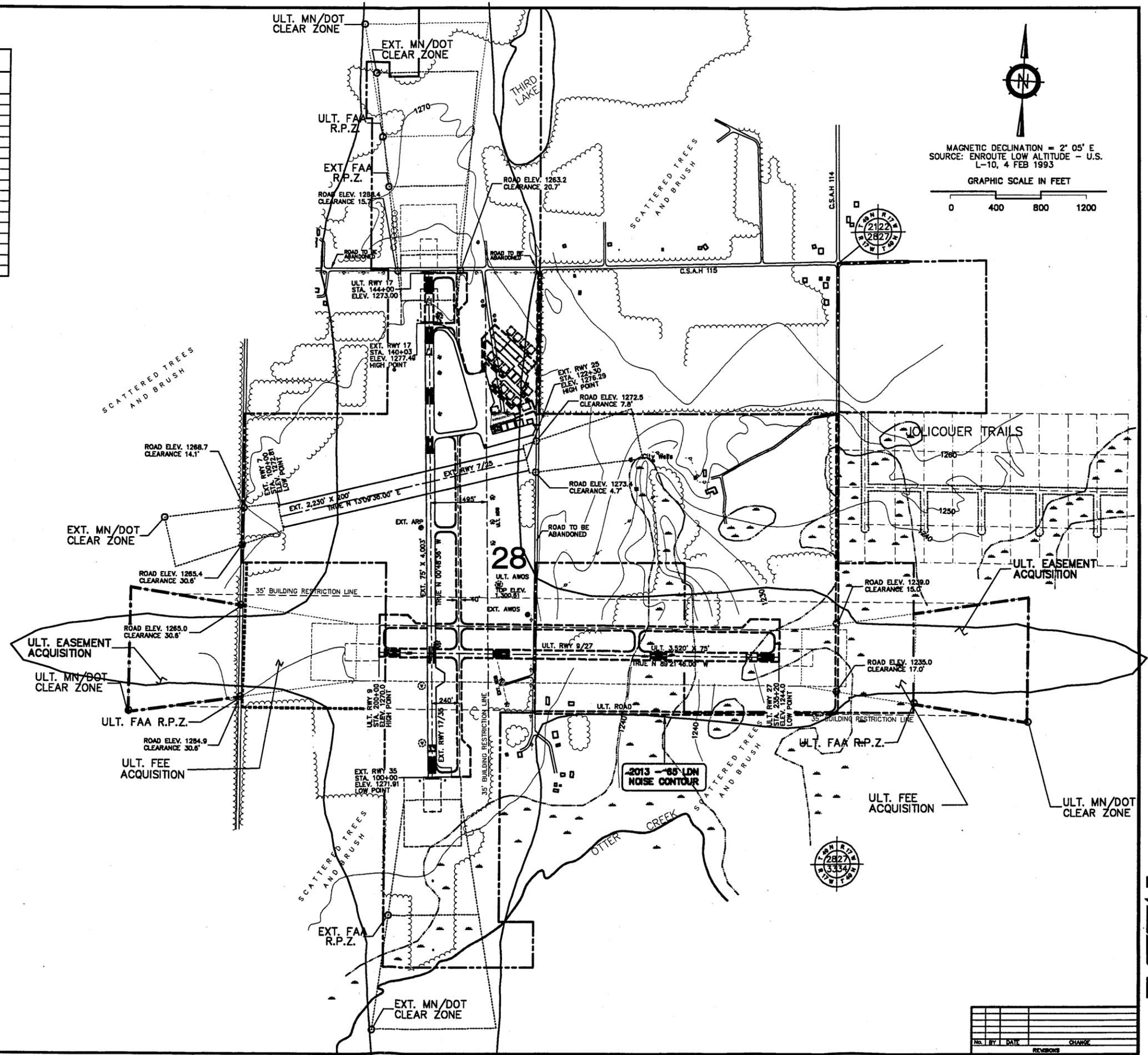
FIGURE #2: ALTERNATE LAYOUT #2  
 CARLTON COUNTY - CLOQUET AIRPORT -- CLOQUET, MINNESOTA



LEGEND		
EXISTING	ULTIMATE	
---	SEE SHEET #	PROPERTY LINE
---	---	PAVEMENT EDGES
□	□	BUILDING
---	---	RUNWAY OBJECT FREE AREA (O.F.A.)
---	---	RUNWAY PROTECTION ZONE (R.P.Z.)
---	---	RUNWAY SAFETY AREA (R.S.A.)
●EXT ARP	●ULT ARP	AIRPORT REFERENCE POINT (A.R.P.)
⊙	⊙	ROTATING BEACON
⊙	N.A.	WIND CONE OR TEE
⊙	N.A.	TREES AND BRUSH
⊙	⊙	APPROACH PATH INDICATORS (VASI, PAPI)
⊙	⊙	RUNWAY VISIBILITY ZONE
⊙	⊙	FLAGPOLE
+	N.A.	POWER POLES
+	+	THRESHOLD LIGHTS
+	+	LIGHT POLES
+	+	FUELING FACILITY

NO.	BY	DATE	REVISIONS	CHANGE

LEGEND		
EXISTING	ULTIMATE	
---	---	PROPERTY LINE
---	---	PAVEMENT EDGES
□	□	BUILDING
---	---	RUNWAY OBJECT FREE AREA (O.F.A.)
---	---	RUNWAY PROTECTION ZONE (R.P.Z.)
---	---	RUNWAY SAFETY AREA (R.S.A.)
⊙	⊙	AIRPORT REFERENCE POINT (A.R.P.)
⊙	⊙	ROTATING BEACON
⊙	N.A.	WIND CONE OR TEE
⊙	N.A.	TREES AND BRUSH
⊙	⊙	APPROACH PATH INDICATORS (VASI, PAPI)
⊙	⊙	RUNWAY VISIBILITY ZONE
⊙	⊙	FLAGPOLE
⊙	N.A.	POWER POLES
⊙	⊙	THRESHOLD LIGHTS
⊙	⊙	LIGHT POLES
⊙	⊙	FUELING FACILITY



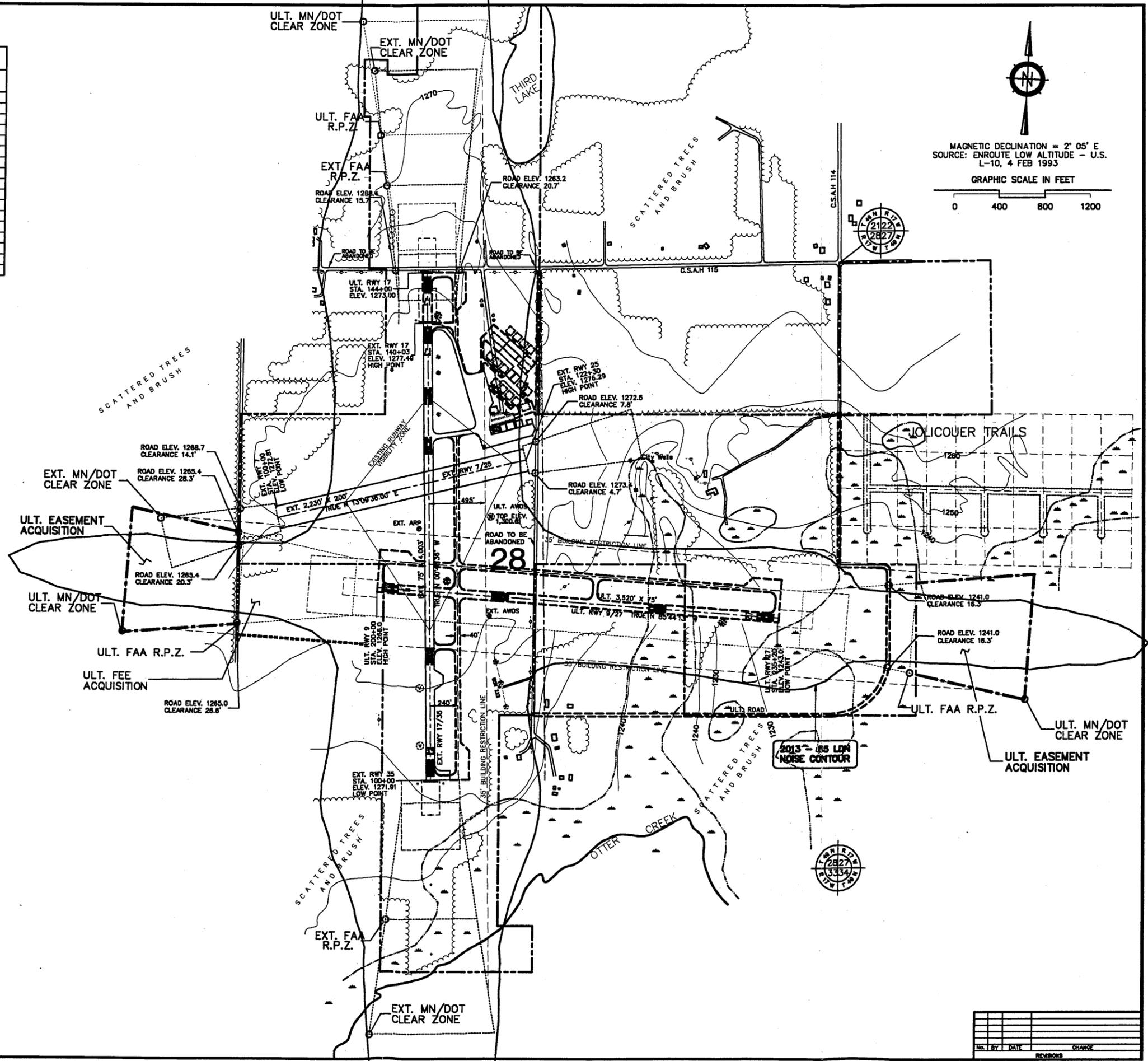
BY: GUY L. JOHNSON 01/01/14  
 SET FILE NO.: CARL131103  
 SHEET 3 OF 4

FIGURE 3: ALTERNATE LAYOUT #3  
 CARLTON COUNTY - CLOQUET AIRPORT -- CLOQUET, MINNESOTA



No.	BY	DATE	REVISIONS	CHANGE

LEGEND		
EXISTING	ULTIMATE	
---	SEE SHEET 9	PROPERTY LINE
---	---	PAVEMENT EDGES
□	□	BUILDING
---	---	RUNWAY OBJECT FREE AREA (O.F.A.)
---	---	RUNWAY PROTECTION ZONE (R.P.Z.)
---	---	RUNWAY SAFETY AREA (R.S.A.)
⊙	⊙	AIRPORT REFERENCE POINT (A.R.P.)
⊙	⊙	ROTATING BEACON
⊙	N.A.	WIND CONE OR TEE
⊙	N.A.	TREES AND BRUSH
⊙	⊙	APPROACH PATH INDICATORS (VASI, PAPI)
---	---	RUNWAY VISIBILITY ZONE
⊙	⊙	FLAGPOLE
---	N.A.	POWER POLES
---	---	THRESHOLD LIGHTS
+	+	LIGHT POLES
•	•	FUELING FACILITY



MAGNETIC DECLINATION = 2° 05' E  
 SOURCE: ENROUTE LOW ALTITUDE - U.S.  
 L-10, 4 FEB 1993

GRAPHIC SCALE IN FEET  
 0 400 800 1200

FIGURE 4: ALTERNATE LAYOUT #4  
 CARLTON COUNTY - CLOQUET AIRPORT -- CLOQUET, MINNESOTA



NO.	BY	DATE	REVISIONS	CHANGE

CARLTON COUNTY AIRPORTS COMMISSION  
 CARLTON COUNTY - CLOQUET AIRPORT  
 ALTERNATIVE CROSS WIND RUNWAYS  
 Alternative #1  
 April 15, 1994

**ESTIMATE OF CONSTRUCTION COSTS**

Description	Unit	Quantity	Unit Price	Extension
Mobilization	L.S.	1	\$65,676.64	\$65,700.00
Clearing & Grubbing	S.Y.	55,555	\$0.21	\$11,666.55
Unclassified Excavation, EV	C.Y.	371,909	\$1.25	\$464,886.25
Borrow Excavation	C.Y.	284,559	\$2.00	\$569,118.00
Topsoiling	S.Y.	298,620	\$1.70	\$507,654.00
Aggregate Base, CV	C.Y.	11,570	\$7.50	\$86,775.00
Bituminous Pavement	TON	9,707	\$28.00	\$271,796.00
18" RCP Culvert	L.F.	995	\$24.00	\$23,880.00
18" RCP Apron	EACH	4	\$340.00	\$1,360.00
Turf Establishment	S.Y.	354,175	\$0.26	\$92,085.50
Wetland Replacement	Acres	20	\$8,000.00	\$160,000.00
<b>SUBTOTAL</b>				<b>\$2,254,921.30</b>
<b>CONTINGENCIES (10%)</b>				<b>\$225,492.13</b>
<b>CONST. SUBTOTAL</b>				<b>\$2,480,413.43</b>
<b>ENGINEERING (30%)</b>				<b>\$744,124.03</b>

**CONSTRUCTION TOTAL            \$3,224,537.46**

**ESTIMATE OF LAND ACQUISITION COSTS**

Description	Unit	Quantity	Unit Price	Extension
Fee Purchase	Acre	12.0	\$150.00	\$1,800.00
Easement Purchase	Acre	44.0	\$125.00	\$5,500.00
<b>SUBTOTAL</b>				<b>\$7,300.00</b>
<b>CONTINGENCIES (10%)</b>				<b>\$730.00</b>
<b>LAND SUBTOTAL</b>				<b>\$8,030.00</b>
<b>ENGINEERING (30%)</b>				<b>\$2,409.00</b>

**LAND ACQUISITION TOTAL        \$10,439.00**

**PROJECT TOTAL                    \$3,234,976.46**

**FIGURE 6**

CARLTON COUNTY AIRPORTS COMMISSION  
 CARLTON COUNTY - CLOQUET AIRPORT  
 ALTERNATIVE CROSS WIND RUNWAYS  
 Alternative #1a  
 April 15, 1994

**ESTIMATE OF CONSTRUCTION COSTS**

Description	Unit	Quantity	Unit Price	Extension
Mobilization	L.S.	1	\$65,676.64	\$65,700.00
Clearing & Grubbing	S.Y.	55,555	\$0.21	\$11,666.55
Unclassified Excavation, EV	C.Y.	371,909	\$1.25	\$464,886.25
Borrow Excavation	C.Y.	284,559	\$2.00	\$569,118.00
Topsoiling	S.Y.	298,620	\$1.70	\$507,654.00
Aggregate Base, CV	C.Y.	11,570	\$7.50	\$86,775.00
Bituminous Pavement	TON	9,707	\$28.00	\$271,796.00
18" RCP Culvert	L.F.	995	\$24.00	\$23,880.00
18" RCP Apron	EACH	4	\$340.00	\$1,360.00
Turf Establishment	S.Y.	354,175	\$0.26	\$92,085.50
Wetland Replacement	Acres	20	\$8,000.00	\$160,000.00
<b>SUBTOTAL</b>				<b>\$2,254,921.30</b>
<b>CONTINGENCIES (10%)</b>				<b>\$225,492.13</b>
<b>CONST. SUBTOTAL</b>				<b>\$2,480,413.43</b>
<b>ENGINEERING (30%)</b>				<b>\$744,124.03</b>

**CONSTRUCTION TOTAL            \$3,224,537.46**

**ESTIMATE OF LAND ACQUISITION COSTS**

Description	Unit	Quantity	Unit Price	Extension
Fee Purchase	Acre	80.0	\$150.00	\$12,000.00
Easement Purchase	Acre	24.0	\$125.00	\$3,000.00
<b>SUBTOTAL</b>				<b>\$15,000.00</b>
<b>CONTINGENCIES (10%)</b>				<b>\$1,500.00</b>
<b>LAND SUBTOTAL</b>				<b>\$16,500.00</b>
<b>ENGINEERING (30%)</b>				<b>\$4,950.00</b>

**LAND ACQUISITION TOTAL        \$21,450.00**

**PROJECT TOTAL                    \$3,245,987.46**

**CARLTON COUNTY AIRPORTS COMMISSION  
 CARLTON COUNTY - CLOQUET AIRPORT  
 ALTERNATIVE CROSS WIND RUNWAYS  
 Alternative #2  
 April 15, 1994**

**ESTIMATE OF CONSTRUCTION COSTS**

Description	Unit	Quantity	Unit Price	Extension
Mobilization	L.S.	1	\$45,154.35	\$45,200.00
Clearing & Grubbing	S.Y.	3,333	\$0.21	\$699.93
Unclassified Excavation, EV	C.Y.	36,897	\$3.00	\$110,691.00
Borrow Excavation	C.Y.	219,465	\$2.00	\$438,930.00
Topsoiling	S.Y.	288,400	\$1.70	\$490,280.00
Aggregate Base, CV	C.Y.	10,597	\$7.50	\$79,477.50
Bituminous Pavement	TON	9,707	\$28.00	\$271,796.00
48" RCP Culvert	L.F.	315	\$108.00	\$34,020.00
48" RCP Apron	EACH	4	\$850.00	\$3,400.00
Turf Establishment	S.Y.	291,733	\$0.26	\$75,850.58
<b>SUBTOTAL</b>				<b>\$1,550,345.01</b>
<b>CONTINGENCIES (10%)</b>				<b>\$155,034.50</b>
<b>CONST. SUBTOTAL</b>				<b>\$1,705,379.51</b>
<b>ENGINEERING (30%)</b>				<b>\$511,613.85</b>

**CONSTRUCTION TOTAL      \$2,216,993.36**

**ESTIMATE OF LAND ACQUISITION COSTS**

Description	Unit	Quantity	Unit Price	Extension
Fee Purchase	Acre	48.0	\$528.00	\$25,300.00
Easement Purchase	Acre	27.0	\$125.00	\$3,375.00
<b>SUBTOTAL</b>				<b>\$28,675.00</b>
<b>CONTINGENCIES (10%)</b>				<b>\$2,867.50</b>
<b>LAND SUBTOTAL</b>				<b>\$31,542.50</b>
<b>ENGINEERING (30%)</b>				<b>\$9,462.75</b>

**LAND ACQUISITION TOTAL      \$41,005.25**

**PROJECT TOTAL      \$2,257,998.61**

**FIGURE 8**

CARLTON COUNTY AIRPORTS COMMISSION  
 CARLTON COUNTY - CLOQUET AIRPORT  
 ALTERNATIVE CROSS WIND RUNWAYS  
 Alternative #3  
 April 15, 1994

**ESTIMATE OF CONSTRUCTION COSTS**

Description	Unit	Quantity	Unit Price	Extension
Mobilization	L.S.	1	\$73,194.75	\$73,200.00
Clearing & Grubbing	S.Y.	219,667	\$0.21	\$46,130.07
Unclassified Excavation, EV	C.Y.	276,152	\$1.25	\$345,190.00
Borrow Excavation	C.Y.	374,369	\$2.00	\$748,738.00
Topsoiling	S.Y.	305,060	\$1.70	\$518,602.00
Aggregate Base, CV	C.Y.	12,184	\$7.50	\$91,380.00
Bituminous Pavement	TON	9,707	\$28.00	\$271,796.00
36" RCP Culvert	L.F.	456	\$70.00	\$31,920.00
36" RCP Apron	EACH	4	\$660.00	\$2,640.00
Turf Establishment	S.Y.	524,727	\$0.26	\$136,429.02
Wetland Mitigation	Acres	24	\$8,000.00	\$192,000.00
NDB Relocation	Each	1	\$55,000.00	\$55,000.00
<b>SUBTOTAL</b>				<b>\$2,513,025.09</b>
<b>CONTINGENCIES (10%)</b>				<b>\$251,302.51</b>
<b>CONST. SUBTOTAL</b>				<b>\$2,764,327.60</b>
<b>ENGINEERING (30%)</b>				<b>\$829,298.28</b>
<b>TOTAL PROJECT COST</b>				<b>\$3,593,625.88</b>

**ESTIMATE OF LAND ACQUISITION COSTS**

Description	Unit	Quantity	Unit Price	Extension
Fee Purchase	Acre	38.0	\$461.00	\$17,500.00
Easement Purchase	Acre	44.0	\$125.00	\$5,500.00
<b>SUBTOTAL</b>				<b>\$23,000.00</b>
<b>CONTINGENCIES (10%)</b>				<b>\$2,300.00</b>
<b>LAND SUBTOTAL</b>				<b>\$25,300.00</b>
<b>ENGINEERING (30%)</b>				<b>\$7,590.00</b>
<b>LAND ACQUISITION TOTAL</b>				<b>\$32,890.00</b>

**PROJECT TOTAL** **\$3,626,515.88**

**FIGURE 9**

CARLTON COUNTY AIRPORTS COMMISSION  
 CARLTON COUNTY - CLOQUET AIRPORT  
 ALTERNATIVE CROSS WIND RUNWAYS  
 Alternative #4  
 April 15, 1994

**ESTIMATE OF CONSTRUCTION COSTS**

Description	Unit	Quantity	Unit Price	Extension
Mobilization	L.S.	1	\$74,190.28	\$74,200.00
Clearing & Grubbing	S.Y.	133,000	\$0.21	\$27,930.00
Unclassified Excavation, EV	C.Y.	325,689	\$1.25	\$407,111.25
Borrow Excavation	C.Y.	394,797	\$2.00	\$789,594.00
Topsoiling	S.Y.	305,060	\$1.70	\$518,602.00
Aggregate Base, CV	C.Y.	12,184	\$7.50	\$91,380.00
Bituminous Pavement	TON	9,707	\$28.00	\$271,796.00
30" RCP Culvert	L.F.	795	\$53.50	\$42,532.50
30" RCP Apron	EACH	4	\$542.00	\$2,168.00
Turf Establishment	S.Y.	438,060	\$0.26	\$113,895.60
Wetland Mitigation	Acres	26	\$8,000.00	\$208,000.00
<b>SUBTOTAL</b>				<b>\$2,547,209.35</b>
<b>CONTINGENCIES (10%)</b>				<b>\$254,720.94</b>
<b>CONST. SUBTOTAL</b>				<b>\$2,801,930.29</b>
<b>ENGINEERING (30%)</b>				<b>\$840,579.09</b>

**TOTAL PROJECT COST      \$3,642,509.37**

**ESTIMATE OF LAND ACQUISITION COSTS**

Description	Unit	Quantity	Unit Price	Extension
Fee Purchase	Acre	20.0	\$461.00	\$9,200.00
Easement Purchase	Acre	44.0	\$125.00	\$5,500.00
<b>SUBTOTAL</b>				<b>\$14,700.00</b>
<b>CONTINGENCIES (10%)</b>				<b>\$1,470.00</b>
<b>LAND SUBTOTAL</b>				<b>\$16,170.00</b>
<b>ENGINEERING (30%)</b>				<b>\$4,851.00</b>

**LAND ACQUISITION TOTAL      \$21,021.00**

**PROJECT TOTAL      \$3,663,530.37**

Cloquet Forestry Center

175 University Road  
Cloquet, MN 55720-9594  
218-879-0850  
Fax: 218-879-0855RECEIVED  
SHORT ELLIOTT HENDRICKSON, INC.

May 27, 1994

MAY 31 1994

Mr. Barry Ekstrom  
Carlton County Human Services  
1215 Avenue C  
Cloquet, MN 55720

ST. PAUL

Dear Mr. Ekstrom,

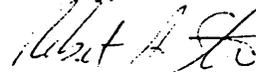
After reviewing the Crosswind Runway Alternatives Analysis Study for the Carlton County-Cloquet Airport, and talking with Mike Roe and Tom Foster, it appears that all the east-west runway alternatives being considered will have some impact on the vegetation located within the boundaries of the Cloquet Forestry Center. Table 3, on page 12, shows the area potentially impacted ranging from 19-22 acres.

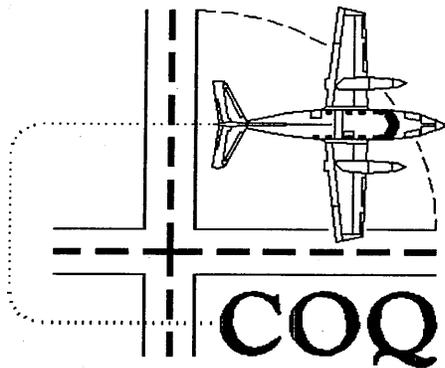
Among other things, the Cloquet Forestry Center contains long-term forest research projects, some of which are already established within some of the proposed clear zones. It is quite feasible that a number of these research projects will be in place for 30, 40, or even more years. Obviously, we have some concerns about how the alternative runway alignments, and their associated clear zones, would impact these research projects.

Based on brief discussions with you, Mike, and Tom, and a quick review of the crosswind runway study, it appears that some runway alignments would have less impact on research projects than others. Although Table 3 ranks clear zones simply by the number of acres impacted, we would rank them quite differently according to which acres are impacted.

I would be pleased to spend some time with the Airport Commission to discuss our concerns and to have some of my questions answered. If that can be arranged, please let me know. Also, as an adjacent landowner which stands to be impacted by the runway expansion, I would appreciate being notified directly when public hearings begin. You can reach me at the address shown above. Thank you for your assistance.

Sincerely,

Robert A. Stine  
Coordinatorcc: Ginger DeRosier, Univ. Real Estate Office  
Tom Foster, Short, Elliot, Hendrickson, Inc.  
Alfred Sullivan, Dean, College of Natural Resources  
Ron Severs, Forest Manager, Cloquet Forestry Center



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## Carlton County - Cloquet Airport

# Crosswind Runway Alternatives Analysis Study

## Section 2: Refinement of Recommended Alternative

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### Introduction

The previous section of this study consisted of an analysis of several on-site alternatives for the development of a crosswind runway at the Carlton County - Cloquet Airport. Alternate #2 was recommended and subsequently selected by the Airport Commission as the most suitable development option.

This section will provide discussion, analysis and recommendations for refinement of the geometric layout of the proposed crosswind runway to minimize impacts to adjacent land and to the environment.

### Secondary Runway Length - Selection By Aircraft Performance Requirements

When multiple runways are available, the safest runway to use for any landing or departure operation must be determined by reference to wind velocity and direction along with the aircraft operator's manual requirements for runway length. The length of runway required for virtually all propeller-driven general aviation aircraft is greater for takeoff than for landing operations. Therefore, the controlling element in specifying runway length requirements is almost always the required takeoff length.

---

The pilot must consider the various forces which will act upon the aircraft to affect its performance and controllability. The effects of wind on the performance characteristics of the design aircraft should also be a major determinant when deciding on the length and alignment of a runway. Factors which must be considered include the velocity and direction of the prevailing wind, as well as the headwind and crosswind component of the runway and "demonstrated crosswind component" of the aircraft.

The "headwind component" is the velocity of a wind vector which is acting opposite the direction of flight, and is equal to the cosine of the angle between the line of flight and the wind direction multiplied by the wind velocity. For example, a 20-knot wind at 30° to the runway centerline has a headwind component of 17 knots. As the headwind component increases, less runway length is required for takeoff or landing. Thus, a shorter runway will become useable to a wider range of aircraft types as the wind speed along the runway increases.

The "crosswind component" is computed as the sine of the angle between the line of flight and the wind direction multiplied by the wind velocity. The 20-knot wind at 30° to the runway centerline has a crosswind component of 10 knots.

The "demonstrated crosswind component" for any aircraft is determined by testing during the certification process for an aircraft design. It is defined as the maximum direct crosswind component in which safe takeoffs and landings have been completed. The demonstrated crosswind component for most general aviation aircraft is at least 15 knots. Although this figure represents the maximum crosswind safely encountered by an experienced test pilot, it does not necessarily refer to any absolute performance or structural criteria.

Most general aviation aircraft can be operated safely (if not comfortably) in both the landing and departure phases in a 15 knot crosswind, with the application of proper pilot technique. However, heavier aircraft and those with tricycle landing gear are less susceptible to the effects of crosswinds than are lighter aircraft, and those having "conventional" (tailwheel-type) landing gear.

---

At Cloquet (or any multi-runway system), an increasing headwind component along the crosswind runway means an increasing crosswind component for the primary runway. With no change in wind direction, it will become more and more desirable to use the crosswind runway instead of the longer primary runway for a wider range of aircraft as wind speed increases.

In AC 150/5300-13, the FAA suggests that the crosswind runway length should be equal to 80% of the ultimate primary runway length. At Cloquet, which has a recommended ultimate primary runway length of 4,400', this is equal to 3,520'. The airport owner, however, is ultimately responsible for providing a safe operating environment and the pilot is responsible for determination of runway length requirements for each takeoff and landing situation. A shorter (or longer) runway may be approved if justified by the requirements of the design critical aircraft, or if the owner wishes to limit the use of the crosswind runway to smaller aircraft.

A general rule-of-thumb which is applicable to many light aircraft is that the length of runway required for takeoff on a paved, dry surface will decrease by about 6% for every five knots of headwind component. For example, an aircraft which requires 3,500' for takeoff in zero-wind conditions may require only about 3,100' in a 10-knot headwind. This will certainly vary from aircraft to aircraft and with differences in pilot technique. Variable or gusty winds, as well as runway gradient will also affect this.

The following table (Table 6) represents approximations of the runway takeoff requirements of various aircraft models. The figures for zero-wind conditions were interpolated from aircraft operator's manuals and represent either distance over a fifty-foot obstacle or accelerate/stop distance, as appropriate. The 5, 10, and 15-knot headwind component distances were approximated using the rule-of-thumb noted above.

The aircraft examined were limited to ARC A-I, A-II, B-I and B-II types, with takeoff weights of 12,500 pounds or less. The available runway length available was assumed to equal the recommended ultimate length of the primary runway (4,400'). A density altitude of 2,920' MSL was selected, based on the field elevation of 1,273' MSL and ambient air temperature of 81°F.

---

While Table 6 is not an exhaustive listing of aircraft which might use the Cloquet facilities, it represents a good cross-section of currently active models operating at various loadings. All of the listed aircraft can use the primary runway for takeoff under zero-wind conditions, at the 2,920' density altitude.

Examination of the table illustrates that many aircraft which are unable to safely use the shorter crosswind runway under zero-wind conditions will be able to do so as the headwind component increases. For example, a Cessna 441 twin operating at its gross takeoff weight of 9,850 pounds requires about 4,100' of runway for a safe departure, and couldn't use a 3,500' long crosswind runway. However, if the headwind component along the crosswind runway is 15 knots, the takeoff distance required decreases to about 3,450'. The crosswind runway could then be used by the twin.

A crosswind runway length of 3,650' will accommodate all of the listed aircraft in the conditions shown, based on the requirements of the Cessna 310R operating at a 5,500 pound takeoff weight.

At the FAA-recommended crosswind runway length of 3,520' in zero-wind conditions, 55% of the listed aircraft could use the crosswind runway. If the headwind component along the crosswind runway increases to 15 knots, this becomes 87%.

If the crosswind runway length is limited to 3,300', 52% of the listed aircraft could use it at zero-wind. If the headwind component increases to 15 knots, 77% of the listed aircraft could use the 3,300' crosswind runway.

A 3,100' long crosswind runway could be used by 42% of the listed types in zero-wind conditions, as compared to 68% with a headwind component of 15 knots.

**Table 6**  
**APPROXIMATIONS OF RUNWAY LENGTH**  
**REQUIREMENTS**  
**FOR VARIOUS GENERAL AVIATION AIRCRAFT**

**DENSITY ALTITUDE = 2,920 MSL (1,273 MSL and 81°F)**  
**MAXIMUM RUNWAY AVAILABLE = 4,400'**

AIRCRAFT	Takeoff Weight	Headwind Component (knots)			
		0	5	10	15
Beechcraft Queen Air	7,700	3,590	3,390	3,200	3,010
Beechcraft B200	12,500	3,588	3,390	3,190	3,010
Beechcraft B200	11,000	3,342	3,150	2,970	2,810
Beechcraft E-18S	9,300	3,282	3,100	2,920	2,760
Beechcraft B100	11,500	4,334	4,090	3,860	3,640
Beechcraft B100	10,000	3,761	3,550	3,350	3,160
Beechcraft A35	3,500	2,370	2,240	2,110	1,990
Cessna 152	1,670	1,786	1,685	1,590	1,500
Cessna 170	2,200	2,334	2,200	2,080	1,960
Cessna 172	2,400	2,088	1,970	1,860	1,750
Cessna 177B	2,500	1,768	1,670	1,570	1,480
Cessna 182Q	2,950	1,704	1,610	1,520	1,430
Cessna 210N	3,800	1,394	1,320	1,240	1,170
Cessna 310R	5,500	4,347	4,100	3,870	3,650
Merlin IVC	12,500	3,696	3,490	3,290	3,100
Metro III	12,500	3,746	3,530	3,330	3,150
Piper PA-12	1,750	2,901	2,740	2,580	2,440
Metro II SA226-TC	12,500	3,230	3,050	2,880	2,710
Metro II SA226-TC	10,500	2,129	2,010	1,900	1,790
Metro II SA226-TC	8,500	1,667	1,570	1,480	1,400
Cessna 425	8,600	4,327	4,080	3,850	3,630
Cessna 425	8,200	4,209	3,970	3,750	3,530
Cessna 441	9,850	4,107	3,880	3,660	3,450
Cessna 441	7,800	3,612	3,410	3,220	3,030
Cessna 340A	5,990	3,786	3,570	3,370	3,180
Cessna 340A	5,000	2,509	2,370	2,230	2,110
Cessna 402C	6,850	4,176	3,940	3,720	3,510
Cessna 402C	5,500	2,529	2,390	2,250	2,120
Cessna 414A	5,700	3,162	2,980	2,810	2,660
Cessna 421C	7,450	4,023	3,800	3,580	3,380
Cessna 421C	6,200	2,636	2,490	2,350	2,210

*Do not use for aircraft operations.*

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## Alternate Analysis - FAA Advisories Applied to Existing Site Parameters.

The FAA defines a "small aircraft" as an aircraft with a takeoff weight of 12,500 pounds or less.

The FAA Runway Length Requirements computer program (which is based on AC 150/5325-4A, *Runway Length Requirements for Airport Design*) indicates that 75% of small aircraft with less than ten passenger seats could be accommodated by a primary runway length of 2,840' at the assumed density altitude and site conditions at Cloquet. About 95% of these aircraft could use a 3,370' long runway, and 100% would be accommodated by a 3,990' long runway. Small aircraft with ten or more passenger seats would require a 4,350' long primary runway.

As has been mentioned above, FAA AC 150/5300-13, *Airport Design* recommends that the length of the crosswind runway should be 80% of the length of the primary runway. The FAA-recommended crosswind runway lengths for the primary lengths listed above are as follows (zero-wind conditions):

	Primary Length	Crosswind Length
Less than 10 passenger seats:		
75% of small aircraft .....	2,840'	2,270'
95% of small aircraft .....	3,370'	2,700'
100% of small aircraft .....	3,990'	3,200'
10 or more passenger seats .....	4,350'	3,480'

## Recommended Crosswind Runway Length

Shortening the proposed runway length will minimize impacts to adjacent land, but will at some point compromise the safety and usefulness of the facility. In selecting the final runway length, a balance must be achieved which provides the safest operating environment to the aircraft that will use the facility, while minimizing adverse impacts to the environment and adjacent land uses.

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Two additional alternative layouts for a crosswind runway have been developed for consideration. They are illustrated in Figures 11 and 12 in Appendix 2 at the end of this section. Both alternates were developed with the intent of minimizing impacts (tree clearing and/or topping) to the existing Cloquet Forest Game Refuge and the University of Minnesota Forest Station, west of the airport.

**Alternate 2a** (Figure 11) was developed as follows: The southwest threshold of the runway was fixed by not allowing intersecting runways. The existing road at the northeast end of the runway (C.S.A.H. 114) was relocated to coincide with the Jolicouer Trails subdivision layout and the runway threshold was located such that a 15' approach slope clearance will be maintained at the road. With this layout, a 3,100' runway length could be developed. The layout will limit tree clearing or topping to trees less than 50' in height which are located within a 6.3 acre trapezoid west of Cartwright Road (Parcel "C" on Figure 11). With this alternate, the proposed runway is located as far to the northeast as possible without impacting numerous small tracts of platted residential land within the Cloquet city limits.

A 3,100' long crosswind runway would maximize use of the existing site at Cloquet and minimize adverse impacts to adjacent land.

As demonstrated above nearly all small aircraft with less than ten passenger seats could be accommodated by a 3,100' crosswind runway in the density altitude and wind conditions presented. Under adverse wind conditions, this length will also accommodate an acceptable range of ARC B-II multi-engine aircraft, including the Beechcraft King Air B200.

**Alternate 2b** (Figure 12) was developed assuming a 3,200' runway length and no relocation of the road at the northeast end of the runway (C.S.A.H. 114). The northeast threshold was fixed by holding the required 15' approach slope clearance over the road. The resulting layout would impact Game Refuge and Research Station trees within a larger area (about 14 acres), and deeper into forested land.

It must also be noted that maintaining the existing crosswind strip to MnDOT and FAA obstruction clearing standards would require

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clearing or topping of trees within at least a 5.4 acre area where the Runway Protection Zones overlays the Game Refuge.

The advantages and disadvantages of each additional alternate are summarized as follows:

- **Environmental:** As mentioned above, Alternate 2a would impact only about 6 acres of forest land versus about 14 acres with Alternate 2b. Furthermore, with selection of Alternate 2a, impacts to existing wildlife would be limited to the forested area adjacent to the existing Cartwright Road where wildlife is more likely to be already affected by vehicular traffic.

Alternate 2a is probably better in terms of environmental impacts.

- **Costs:** Relocation of C.S.A.H. 114 associated with Alternate 2a would add about \$15,000 to development costs.

Alternate 2b would require additional fee acquisition at the southwest end of the proposed runway amounting to an additional 5 acres (Parcel "A"), and an additional 0.3 acre at the northeast runway end (in Parcel "D"). This may increase development costs by \$2,000 - \$3,000. Additional tree clearing or topping in the Game Refuge, as well as additional mitigation costs will add to this amount.

The cost differences between the two additional alternates is probably not significant when compared to the total project scope.

- **Safety:** With adherence to MnDOT and FAA requirements for approach surface clearance, it may be assumed that both alternates are equal with regard to potential obstructions to air navigation.

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The geometric layout of Alternate 2a is somewhat better in terms of safety of operations because it avoids intersecting runways. The threshold of Runway 7 is located to the east of the midpoint of Runway 17/35. Access to Runway 7 could be limited to taxiways to further enhance safety.

Alternate 2a is somewhat better in terms of operational safety of the airport.

In Section 1 of this study, five alternative crosswind runway alignments were compared. Each of the original five alternates assumed a length of 3,520', in conformance with the FAA general recommendation that the crosswind runway length should be 80% of the primary runway length. Alternate 2 was recommended as the most appropriate choice and was subsequently selected by the Airport Commission.

In Section 1, the five development options were evaluated by examination of comparative merit in eight areas of potential impact. These were Obstructions to Air Navigation, Relative Wind Coverage, Flight Over Populated Areas, Development Costs, Adjacent Sensitive Lands, Wetlands and Protected Waters, Noise Exposure, and Public Facilities.

In this section, Alternate 2 is compared with the two additional alternates (Alternate 2 is shown in Figure 2 of Appendix 1).

Since the three final alternates share the same alignment, and vary only in threshold location and runway length, their impacts will be essentially equal in terms of wind coverage, potential for flight over populated areas, and impacts to wetlands and public facilities (the City wells).

In theory, noise exposure caused by operations on the crosswind runway will decrease as its length decreases. This is because fewer larger aircraft will be able to use a shorter runway. However, total noise exposure will not vary significantly with selection of any of the three final options if it is assumed that these aircraft will opt to use the primary runway. Total airport operations will not change.

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Impacts in this area may be assumed to be equal among the final alternates.

In Section 1 it was estimated that total costs for the development of Alternate 2 will be about \$ 2,258,000. The major costs associated with this development are in Borrow Excavation, Topsoiling and Bituminous Pavement. It is true that some savings will result from building a shorter runway (3,520' versus 3,200' or 3,100'). However, the amount of savings is not of the magnitude which would be considered significant when compared to the total project cost. It may be assumed that the three final alternates are essentially equal in terms of development cost.

The remaining area of comparison is Impacts to Adjacent Sensitive Lands, and this appears to be the deciding factor in selection of the most desirable crosswind runway development option.

In the Section 1 analysis, impacts to adjacent lands were represented by the number of acres of avigation easement required over the Cloquet Forest Game Refuge. If this approach is adhered to in comparing the two additional options to Alternate 2, the following is found:

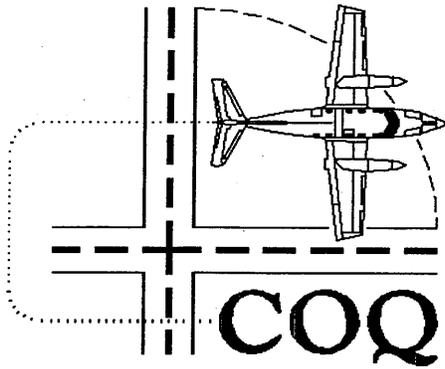
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**Table 7**  
**Impacts to Adjacent Sensitive Lands As Represented by**  
**Relative Areas of Avigation Easements Required Within Game**  
**Refuge - Alternates 2, 2a and 2b**

	<u>Easement Area</u>	<u>Ranking</u>
Alternate 2 . . . . .	19 acres	3
Alternate 2a . . . . .	6 acres	1
Alternate 2b . . . . .	14 acres	2

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Alternate 2a is recommended as the most appropriate option for development at Cloquet.



**Carlton County - Cloquet Airport**

**Crosswind Runway  
Alternatives Analysis Study**

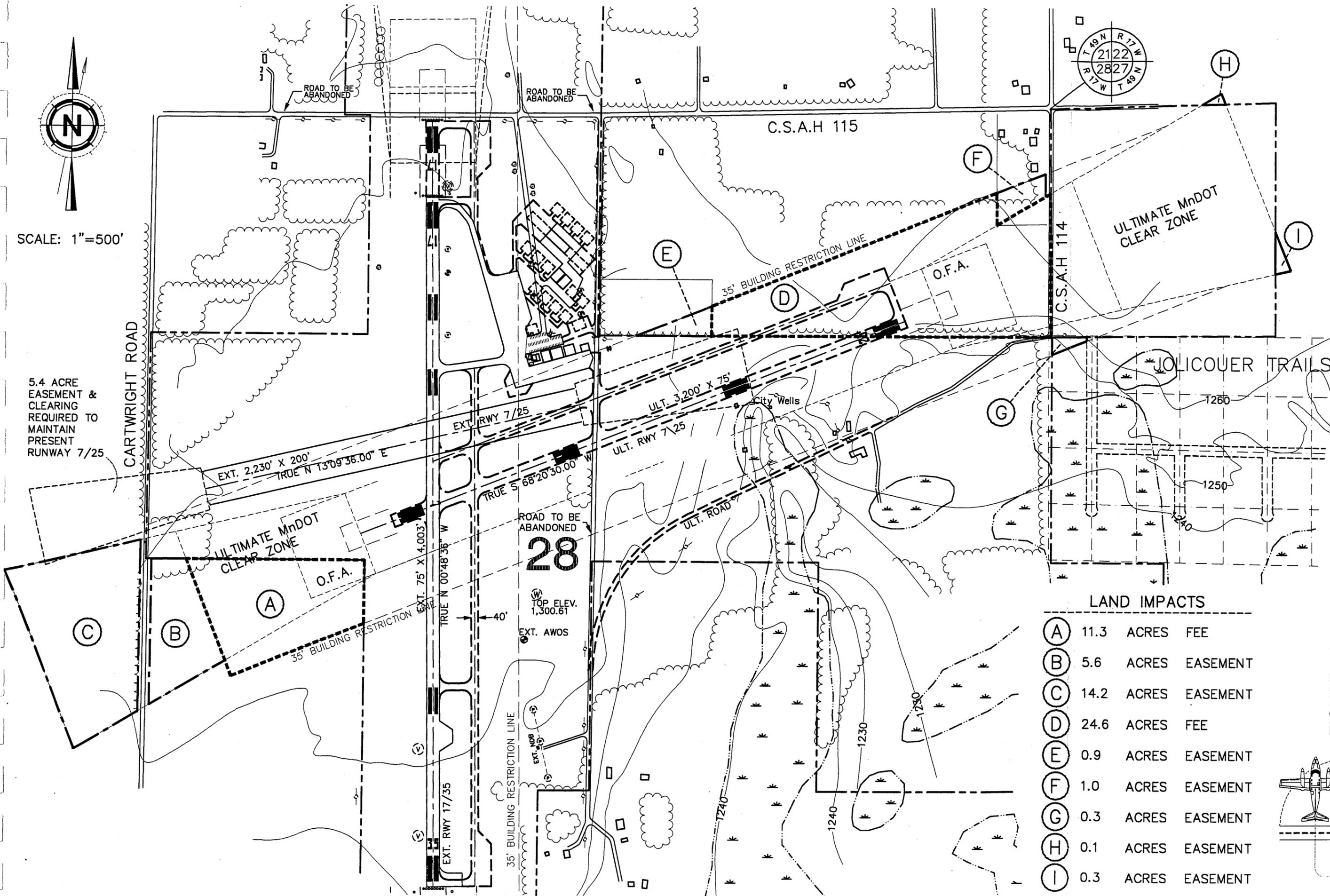
**APPENDIX 2**

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SCALE: 1"=500'



LAND IMPACTS		
(A)	11.3 ACRES	FEE
(B)	5.6 ACRES	EASEMENT
(C)	14.2 ACRES	EASEMENT
(D)	24.6 ACRES	FEE
(E)	0.9 ACRES	EASEMENT
(F)	1.0 ACRES	EASEMENT
(G)	0.3 ACRES	EASEMENT
(H)	0.1 ACRES	EASEMENT
(I)	0.3 ACRES	EASEMENT

**FIGURE 12**  
**ALTERNATE 2b - 3,200' CROSSWIND RWY.**  
 Carlton County - Cloquet Airport

