MASTER PLAN

CLOQUET-CARLTON COUNTY AIRPORT

PREPARED FOR

CARLTON COUNTY AIRPORT COMMISSION

BY

R. DIXON SPEAS ASSOCIATES
MINNEAPOLIS MINNESOTA

ASSISTED BY
STEWART & WALKER
THIEF RIVER FALLS MN.

MAY 1974

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1. INTRODUCTION

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With the growth of aviation activity at Cloquet/Carlton County Airport, coupled with its unique position with respect to Duluth International Airport, the Cloquet/Carlton County Airport Commission saw the need for a comprehensively planned development program. Hence it was that R. Dixon Speas Associates was contracted to perform such a study.

The study has been accomplished for the County under a Planning Grant Agreement between the County of Carlton and the Federal Aviation Administration (FAA). The Agreement is provided for under the Airport and Airway Development Act of 1970 (P.L. 91-258) and includes financial aid for the study from both the FAA and the Minnesota Department of Aeronautics.

1.1 Study Scope

This study presents an airport master plan that details the extent, type, and schedule of development needed at Cloquet/Carlton County Airport for the next twenty years. The development program that is recommended is shown in three implementation periods. These periods include the short term (1972-1977), the intermediate term (1978-1982), and the long term (1983-1992).

Thus, the master plan provides guidelines for future development which satisfies aviation demand and is compatible with the environment, community development, other transportation modes, and other airports. Specific objectives within this broad framework have been:

- To provide an effective graphic presentation of the ultimate development of all areas within and adjacent to the airport.
- To establish a schedule of priorities and phasing for the various improvements proposed in the plan.
- To present the pertinent back-up information and data which were essential to the development of the master plan.
- To provide a concise and descriptive report so that the impact and logic of its recommendations can be clearly understood by the community the airport serves and by those authorities and public agencies which are charged with the approval, promotion, and funding of the improvements proposed in the Airport Master Plan.

The report is divided into eight sections which describe the planning process and outline results.

- Section 2 - Summarizes Findings and Conclusions.
- Section 3 - Describes the present airport and its facilities.
- Section 4 - Presents a forecast of expected future aviation demand.
- Section 5 - Presents the facilities required to meet this demand through the twenty year period.
- Section 6 - Presents a graphic depiction of the facility requirements and discusses alternates studied.
- Section 7 - Describes the impact that the proposed development is expected to have upon its environment.
- Section 8 - Presents the recommended financial program and schedule as well as the economic feasibility.

During the course of the study, meetings were held and much information gathered concerning the airport and its environs. Without the help of the Cloquet/Carlton County Airport Commission, Minnesota Department of Aeronautics, and the FAA's Airports District Office in Minneapolis, this study would have been impossible to perform. Certain individuals such as Mr. Wilman Engen, Mr. Arnold Odegaard, and Mr. Walter Benson can be singled out as being especially helpful. We wish to thank all involved for their help.

Regarding continued use of this master plan, it is well to indicate the responsibilities involved. The contents of the report reflects the views of Speas Associates, who is responsible for the facts and accuracy of the data presented herein. Since as indicated above, the FAA and the State have extensively participated in this airport planning project, it is necessary to understand and utilize their rules and regulations when using this master plan for obtaining approval on future development projects. The inclusion in the master plan of a project to be developed (i.e., runway extension) will facilitate approval of the project layout and funding. However, the sponsor must still submit with his application for funds, an engineering plan and provide justification for the construction. Likewise, the master plan study will facilitate preparation of a draft environmental impact statement for those projects where such is required. However, the sponsor will be responsible for preparing the draft statement for approval at the time the project is proposed to be constructed. It follows that it is to the sponsors advantage to adhere to the master plan in future airport development.

This report was drafted in August 1973, and has been undergoing the coordination process of final meetings and reviews until its publication in May, 1974. Consequently it does not speak to events occurring since August, 1973 such as the energy crisis or local planning as on Federal Aid for airport improvements. The plan is developed to cover such events within its scope through its long range outlook.

2. FINDINGS AND CONCLUSIONS

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- Cloquet/Carlton County Airport will continue to serve the local business community by giving air access to its suppliers and customers.
- Activity forecasts are expected to keep pace with forecast strengthening of the regional economy. General aviation forecasts include the following:
  - Based aircraft will grow from the present 20 to 60 in 1992 with substantial increases in the single engine four place fleet.
  - Total movements will increase from 15,000 presently to 47,000 in 1992.
  - Itinerant traffic will grow to 17,500 movements in 1992.
- A development program to improve operational capability and safety is foreseen.
- Runway expansion will include extending 17-35 by 800 feet initially and an additional 800 feet in the future if a weather survey determines the need.
- A crosswind runway to 4,000 feet is foreseen. Orientation will depend upon the weather survey.
- A small increase is foreseen in the size of the administration building.
- Apron improvements include expansion of the present apron to the east and south during early stages and to the north in the future.
- A substantial hangar development program is foreseen with the number of T hangars increasing to 60 by 1992. A larger aircraft maintenance hangar is foreseen for later development stages.

- Some modification and extension of the roads on and around the airport will be required.
- The capital development program will involve expenditures of $792,000 in the short term, $75,000 in the medium term, and $536,000 in the long term. These capital costs will include Federal, State, and local funds.
- Since financing this program will require some use of community general funds, the program in terms of priority was recommended. That portion of operating and fixed costs not covered by forecast revenues is foreseen to be $ 8,000 in 1977, $ 10,200 in 1982, and $ 2,780 in 1992.
- Hangars would be constructed with firm rental agreements in hand and the fees would be structured to amortize them over 20 years.

3. EXISTING AIRPORT FACILITIES

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3.1 General

Cloquet/Carlton County Airport is located three miles southwest of Cloquet, in Carlton County. It provides convenient service to the City and surrounding area. The airport accomodates and provides service for general aviation aircraft. These services include fueling facilities, aircraft tiedowns and hangars, maintenance, flight training, and charter.

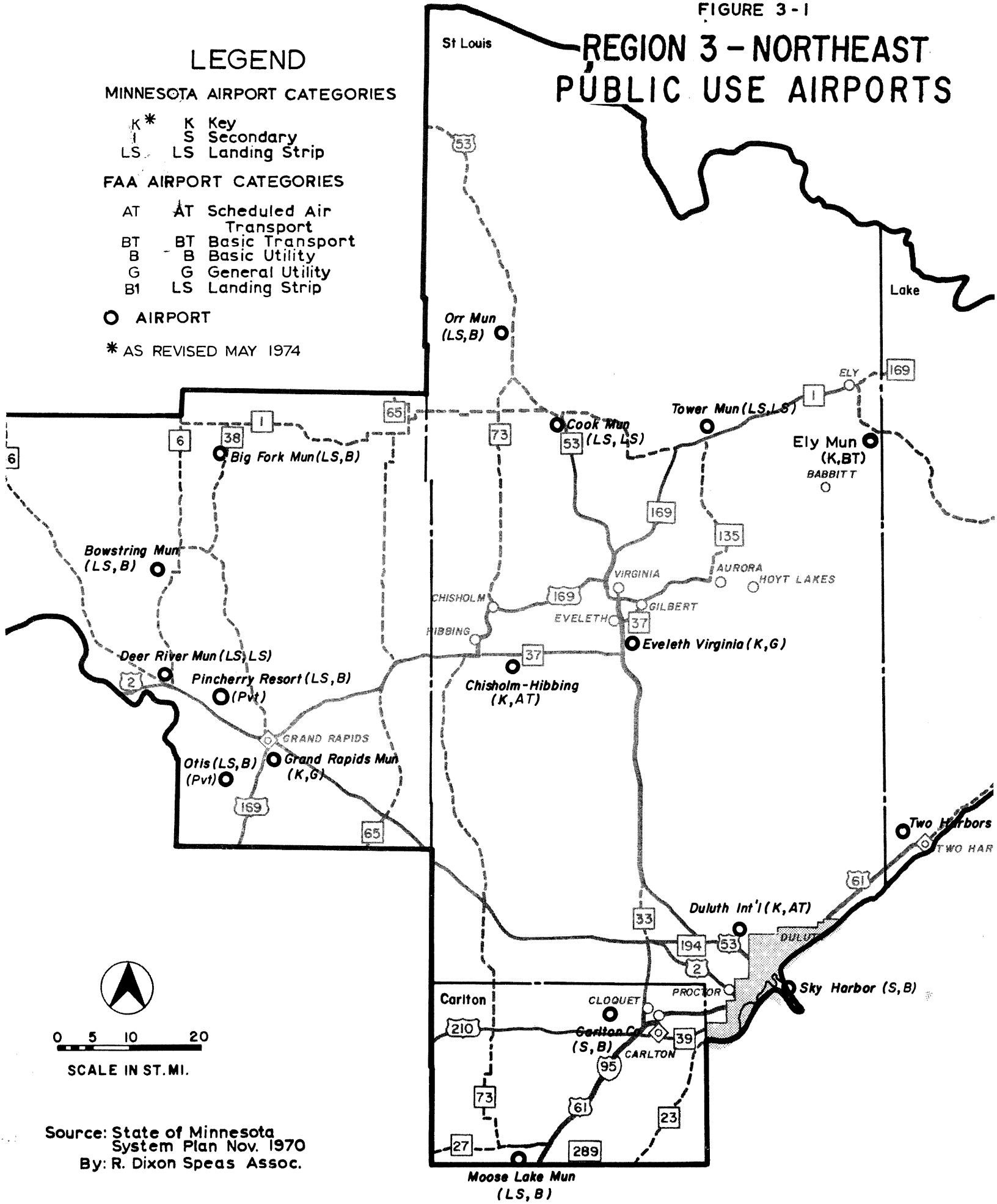
The relationship of the airport to the City and other regional airports is illustrated in Figure 3-1. The area shown is part of the Northeastern Economic Region as established in 1969. Cloquet/Carlton County Airport is shown as a Secondary airport in the State System and as a Basic Utility airport in the Federal System.

The 1970 census recorded 8,699 people residing in the City of Cloquet. Known as the City of Wood Industries, Cloquet harbors several large wood oriented companies. Among these are the Northwest Paper Company, Potlatch Forests, Inc., Diamond National Corporation, Conwed Corporation, and the Weyerhauser Company. The Iron Ranges Natural Gas Company is also located in Cloquet.

In addition to the airport, the City is served by the Burlington Northern and the Duluth Northeastern Railroad. The Greyhound Bus Line also serves Cloquet. Sewer and water systems serve the developed portions of the City.

FIGURE 3 - 1

REGION 3 - NORTHEAST PUBLIC USE AIRPORTS



Source: State of Minnesota System Plan Nov. 1970
By: R. Dixon Speas Assoc.

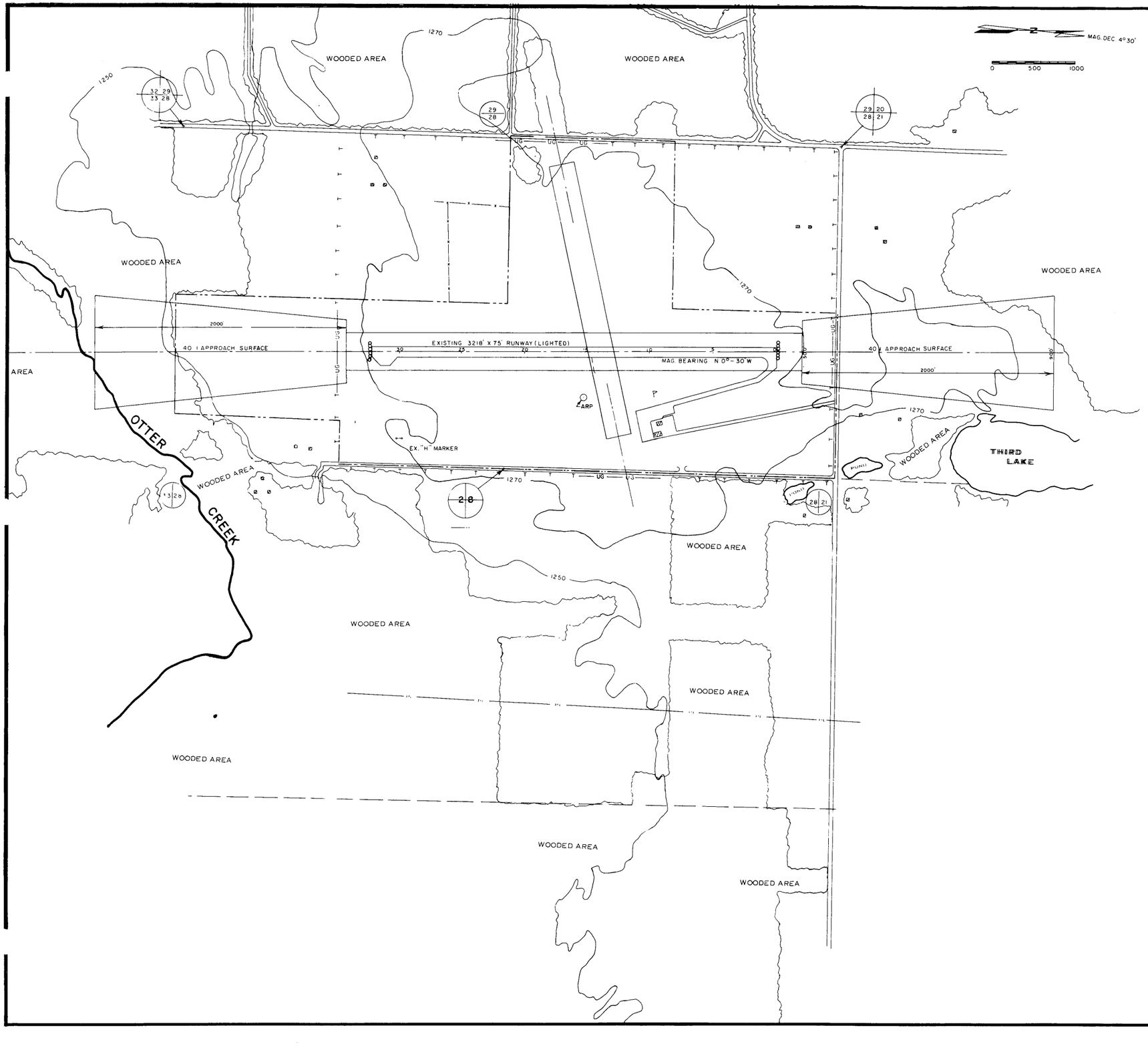
Other services one would expect to find in a City of that size are also present in Cloquet. These are Police Department, Fire Department, City Hall, Civic Center, Library, and a community hospital. All-season recreation facilities are available.

In March of 1972, a new lease was written between Carlton County and Wood City Aero Services, Inc., to conduct a Fixed Base Operation (FBO) on the airport and provide aircraft services. Concurrently, an Airport Managers agreement was written between the County and Mr. Arnold Odegaard, Manager of Wood City Aero Services, Inc., for the maintenance of the airport designating responsibility to Mr. Odegaard.

3.2 History

Cloquet/Carlton County Airport received its first Federal grant and was developed as an airport at the present site three statute miles southwest of Cloquet in April of 1950. Since then it has received approximately $75,000 in Federal Aid to acquire land, construct and pave the north/south runway, and add medium intensity lighting, a 36" airport beacon and lighted wind cone. In October of 1968, ownership and operation of the airport was transferred from the City of Cloquet to Carlton County. Figure 3-2 illustrates the existing airport and its environs.

Presently, the airport has a 3,250' x 75' north/south asphalt runway with medium intensity lights for night and poor weather operations. There is also a 2,200' x 175' turf crosswind runway. A 41,000 square foot paved apron serves transient aircraft. This apron is connected to the north end of the main runway by a 30 foot paved taxiway.



LEGEND

EXISTING

- BOUNDARY FENCE
- THRESEHOLD LIGHTS
- LIGHTED WIND CONE
- WIND TEE
- VOR
- PROPERTY LINE
- BUILDING RESTRICTION LINE (BRL)
- EASEMENT LINE
- BUILDING
- DRAINAGE DITCH
- RAILROAD TRACKS
- GROUND CONTOURS
- TREE & BRUSH LINE
- ROADS
- POWER POLE
- GLIDESCOPE
- BEACON
- LOCALIZER
- UNDERGROUND PIPE LINE

FIGURE 3-2

CLOQUET-CARLTON COUNTY AIRPORT

BY	DATE	CHANGE
REVISIONS		

SCALE	DESIGN	DRAWN	
	CHECKED	DATE	SHEET OF

R. DIXON SPEAS ASSOCIATES
AVIATION CONSULTANTS
MINNEAPOLIS, MINNESOTA

&

STEWART & WALKER, INC.
CONSULTING ENGINEERS
THIEF RIVER FALLS & BEMIDJI, MINNESOTA

All the buildings on the airport are County owned except for six T hangars, which will be removed because of their poor condition, and a privately owned conventional hangar. The County buildings include a 24' x 30' administration building, a steel clearspan 50' x 64' hangar, and two new 50' x 68' storage hangars. Except for the 6 privately owned T hangars the airport buildings are in relatively good to excellent condition. The airport is well maintained and the condition of the paved areas, turf strip, and County owned properties reflects this.

The FBO operation utilizes the administration building, and the 50' x 64' hangar for supplying services to the general aviation aircraft utilizing the airport. Fueling service with 80 and 100 octane avgas is provided. This fuel is presently stored in 10,000 gallon underground tanks. A new fueling system is to be installed in the near future.

Obstruction restrictions have been assured by the passage of Ordinance 229 by the City of Cloquet. This ordinance institutes height zoning around the airport in accordance with State laws. Additional protection has been gained through the procurement of aviation easements to protect runway clear zones.

The main access to the airport is via a 24 foot wide paved road connecting the administration/hangar area with east/west County Road 115 north of the airport. This road gives access to State Trunk Highway 33 to the east.

3.3 Present Traffic Levels

Based upon the airport log and based aircraft utilization, activity was estimated as 5,000 itinerant and 10,000 local operations per year. Of the itinerant approximately 1,450 operations were performed by transient aircraft, 10% of which were multi-engine. There are presently 20 aircraft based at the airport of which 18 are single engine.

Activity levels at the airport have been lower than normal during the past two years. The Airport Manager attributes this to the recession in general and the fact that some business users have upgraded to larger aircraft and can no longer use the airport. In 1971 there were 116 instrument approaches to the airport versus 245 in 1970.

Air cargo through the airport has traditionally been minimal and of a high priority nature. It has varied from approximately three tons in a peak year to less than a ton presently.

A survey has been undertaken to determine user needs at Cloquet/Carlton County Airport. Runway extension was considered of prime importance. Of twenty-two companies that use the airport on a regular basis, four no longer can because of equipment upgrade. Others expect to upgrade to aircraft which would require longer runways. Appendix B lists the survey results.

3.4 Airspace and Navigational Aids

Cloquet/Carlton County Airport's location, approximately 15 nautical miles southwest of Duluth International Airport, is adequate for simultaneous approaches on Runway 17 and Duluth International's Runway 09. This assumes that both airports air traffic will continue to be controlled by radar and through a common air traffic control agency.

The Duluth VORTAC, utilized in the published approach, is located 13.9 nautical miles northeast of Cloquet/Carlton County Airport. Because the Duluth altimeter setting must be used, approach minimums are somewhat high. A State owned "H" marker is located on the airport. Figure 3-4 illustrates the approaches as well as weather minimums for each, by aircraft category.

Figure 3-4
INSTRUMENT APPROACH PROCEDURES

Type	Runway	Lighting		Lowest Weather Minimums (Feet - Visibility) Aircraft Category			
		Approach	Runway	A	B	C	D
VOR/DME-A:							
Circling	A11	REIL 17-35	MIRL 17-35	482-1	502-1	502-1½	602-2
NDB:							
Straight-in	17	REILS	MIRL	602-1	602-1	602-1	602-1¼
Circling	A11	Varies	Varies	602-1	602-1	602-1½	602-2
Straight-in	35	REILS	MIRL	528-1	528-1	528-1	528-1¼
Circling	A11	Varies	Varies	522-1	522-1	522-1½	602-2
NDB/VOR:							
Straight-in	17	REILS	MIRL	462-1	462-1	462-1	462-1
Straight-in	35	REILS	MIRL	488-1	488-1	488-1	488-1
Circling	A11	Varies	Varies	482-1	502-1	502-1½	602-2

Aircraft Approach Category

A - Speed less than 91 knots; weight less than 30,001 lbs.
B - Speed 91 knots or more but less than 121 knots; weight 30,001 lbs. or more but less than 60,001 lbs.
C - Speed 121 knots or more but less than 141 knots; weight 60,001 lbs. or more but less than 150,001 lbs.
D - Speed 141 knots or more but less than 166 knots; weight 150,001 lbs. or more.
E - Speed 166 knots or more; any weight.

Visual aids include a 36" airport beacon and medium intensity runway lights as well as REILS on Runways 17 and 35.

Figure 3-5 summarizes pertinent data concerning navigational aids.

Figure 3-5
NAVIGATIONAL AID INFORMATION

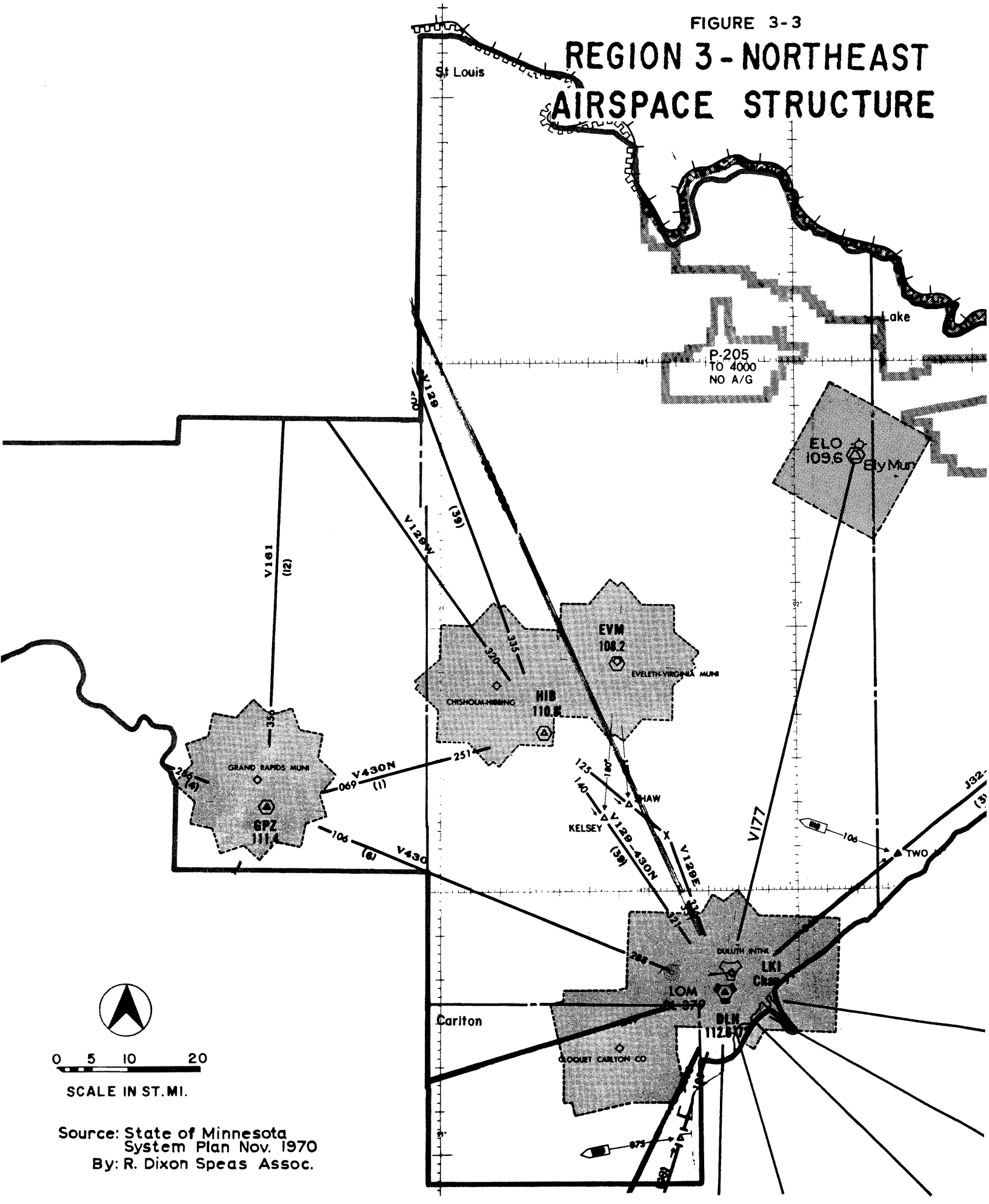
AIRPORT	:	Cloquet/Carlton County Airport
LOCATION IDENTIFICATION	:	49D
AIRPORT LOCATION	:	2.5 nautical miles southwest of Cloquet - 46° 42' North - 92° 30' west
AIR TRAFFIC SERVICES	:	Air Route Traffic Control Center - Minneapolis Control Tower - None Approach Control - Duluth Approach Control Radar - Radar Vector Service Flight Service Station - Tie in Hibbing FSS UNICOM - 122.8
RADIO AIDS TO NAVIGATION	:	On Airport - NDB - COQ Cloquet Off Airport - BVORTAC - DLH Duluth 13.9 nautical miles northeast
RUNWAYS	:	17-35 3,250' x 75' 07-25 2,200' x 175'

Figure 3-3 illustrates the airspace structure of part of the northeast region of Minnesota. The shaded areas around each airport is the maneuvering airspace for that airport. If the areas overlap a potential conflict could exist. It can be seen that Cloquet's and Duluth's areas overlap somewhat. However this confict is not seen as serious and can be remedied as is suggested in Section 5.

The enroute airways are designated by the letter V and a three digit number. Victor (V) Airways do not overfly Cloquet/Carlton County Airport. However several airways intersect at the Duluth VOR, giving access to the enroute system to Cloquet.

FIGURE 3-3

REGION 3 - NORTHEAST AIRSPACE STRUCTURE



Source: State of Minnesota
System Plan Nov. 1970
By: R. Dixon Speas Assoc.

3.5 Airport Vicinity Land Use

The airport is located in a relatively open area southwest of Cloquet. To the west, the University of Minnesota has its Forestry Research Center. To the north and east there are some farms interspersed with private residences. The topography drops off in the south to a creek and wooded land. This 80 acres on the east half of the southwest quarter of section 33, is Indian land. Negotiations for its acquisition are now taking place. In general, the airport has no encroachment problem at this time. If care is taken now to properly zone and acquire land where necessary, the airport can continue to exist as a good neighbor.

4. FORECASTS OF DEMAND

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4.1 Introduction

The general aviation forecast for Cloquet/Carlton County Airport is based on a methodology which combines extrapolation of statistical trends and the application of judgment to determine future growth of demand. The forecast also reflects the State and Region forecasts development in the Minnesota State Aviation System Plan*. The Region plan forecasts are based primarily on a "top-down" methodology, or analysis of national demand in aviation activity, State demand and Regional demand in a step-down method. A more detailed description of this methodology is given in Appendix A of this report.

A basic premise of the present forecast is that the economic health of the area will continue with a slightly more diversified base. Numerous studies completed by the State of Minnesota and local groups such as the Arrowhead Regional Development Commission, have outlined the basic strength of the Carlton County/St. Louis County area and the historical growth in the local economy is projected to continue. It is expected that new industry will be attracted to the area as local manufacturing skills are developed.

* State of Minnesota Aviation System Plan, prepared for the Minnesota Department of Aeronautics and the Metropolitan Airports Commission, Minneapolis - St. Paul; By R. Dixon Speas Associates, Inc., November 1970.

4.2 General Aviation Forecasts

General aviation activity at Cloquet has increased in the past decade, but there has been a down-trend in the last two years because of the economic down-turn and facility shortcomings at Cloquet. Regarding the latter point, records indicated that some aircraft operators discontinued using Cloquet/Carlton County Airport when they changed to larger and more sophisticated equipment.*

At present, general aviation activity is estimated at 5,000 annual itinerant movements and 10,000 annual local movements. There were 20 aircraft based at Cloquet in 1972, although as in many parts of Minnesota, the annual number is an average and can fluctuate slightly on a seasonal basis.

The forecast of activity at Cloquet is based on the airport continuing to be attractive as an aircraft basing point, relative to other alternative facilities in the region. This assumes some physical improvements to better handle twin engine aircraft.

The estimated movements per aircraft are at a rather high level, due to the large local movement count forecast. The higher than average movement rate is due to training activity. Interviews indicated that many flight schools in the area use the airport for touch and go operations. This activity is forecast to continue.

Consideration was given to the future possibility of Cloquet/Carlton County Airport becoming a general aviation alternate for Duluth. If this were to happen the forecast would be somewhat higher than shown. However, development could keep up through the acceleration of schedules and no major problem would be foreseen.

* See Appendix B

The estimates of peak day and peak hour general aviation aircraft activity are based on generalized information developed from FAA statistics. Summaries of the general aviation forecasts are shown in Figure 4-1 and 4-2.

Figure 4-1
BASED AIRCRAFT FORECASTS

	Single Engine		M.E. < 12,500	
	1-3 Place	4+ Place	lbs.	Total
ACTUAL:				
1972	7	11	2	20
FORECAST:				
1977	9	18	4	31
1982	11	23	5	39
1987	13	30	6	49
1992	15	38	7	60

Figure 4-2
AIRCRAFT MOVEMENTS FORECAST
GENERAL AVIATION MOVEMENTS

	Based Aircraft	Total	Itinerant	Local	Peak Day	Busy Hour	Annual Instrument Approaches
1971-72	20	15,000	5,000	10,000	-	-	116
1977	31	23,000	7,600	15,400	210	51	370
1982	39	30,000	11,000	19,000	285	65	490
1987	49	38,000	14,500	24,000	340	76	650
1992	60	47,000	17,500	29,500	390	83	800

5. DEMAND/CAPACITY ANALYSIS AND FACILITY REQUIREMENTS

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The growth in activity at an airport creates a demand for facilities such as runways, taxiways, terminals, aircraft parking and storage, and ground access. In this section forecast demand will be analyzed in terms of the facilities present and required. Present facilities are analyzed in terms of their capacities. Comparison of capacities and requirements allow a time frame to be developed for construction phasing.

The analysis first studies the airside facilities (i.e., runways, taxiways, navaids), then the airside/landside interface (terminals, aprons, aircraft storage), and finally the landside system (access, auto parking). Facility requirements through the study period are the result of this analysis.

5.1 Runways, Taxiways, and Navaids

The airfield must be analyzed as to its ability to handle present levels of activity and how adequately it will serve future needs. This section will accomplish this objective.

5.1.1 Airport Capacity

The capacity of a runway system to meet activity demand is of prime importance in the airport planning process. The shape and configuration of the runway system determined in this analysis determines the shape and configuration of the entire airport. Hence, with this in mind we proceed with the analysis.

Several important factors must first be determined prior to the actual calculation of capacity.

Among these are the aircraft mix or population. Because of the different handling characteristics of aircraft, the types operating at a particular airport have a large influence on its capacity. Aircraft are grouped into broad categories as illustrated in Figure 5-1 below:

Figure 5-1
AIRCRAFT CLASSIFICATIONS

Class	Description
A	4 engine jet and larger.
B	2 and 3 engine jet, 4 engine piston and turboprop.
C	Executive jet and transport type 2 engine.
D	Light twin engine piston
E	Single engine piston.

The present and future population at Cloquet was determined to be:

Figure 5-2
AIRCRAFT POPULATION

	D	E
Present %	10	90
Future %	10	90

Another important factor is the amount of touch and go activity at a particular airport. Historically at Cloquet, this has amounted to approximately 2/3 of the activity. It is expected that this ratio will hold through the forecast period.

The amount of time an aircraft remains on the runway subsequent to landing is known as the runway occupancy. The average occupancy is called the runway rating. This rating varies with the type of aircraft and length of runway. The numbers of runway exits has an important influence on the runway rating. The present runway at Cloquet/Carlton County Airport has an average runway rating of 50 seconds. If a parallel taxiway and a sufficient number of exits were constructed this rating could drop to 25 seconds. This assumption is made when future capacity is calculated.

Utilizing the above factors, the present and future practical hourly capacities (PHOCAP) and annual capacities (PANCAP) were calculated as illustrated in Figure 5-3.

Figure 5-3
AIRPORT CAPACITY
CLOQUET/CARLTON COUNTY AIRPORT
(Movements)

	PHOCAP		
	VFR	IFR	PANCAP
Present	102	36	185,000
Future	135	36	245,000

In Section 4, 1992 activity was forecast as 47,000 total movements. A comparison of this forecast activity with the calculated capacities indicates that the present runway system can adequately handle the demand through the study period. Therefore, any additional taxiway improvements would be for purposes of enhancing safety rather than capacity.

5.1.2 Airspace Considerations and Navigational Aids

The airspace and navigational inventory was described in Section 3.4. As pointed out there, a potential airspace conflict exists between Duluth and Cloquet. This is seen as an operational delay when Duluth is operating Runway 09 and Cloquet Runway 17 during instrument flight weather. To avoid this delay, all approaches to Cloquet should be to Runway 35 whenever possible. This would be feasible since the Duluth radar is used for vectoring and monitoring approaches to both airports.

It would also be desirable to reduce approach minimums. A relatively inexpensive means would be to have a certified weather observer on the airport. This can be accomplished by sending someone who is on the airport at most times, such as the Fixed Base Operator, to weather school where he would be certified upon completing the course. Some weather recording equipment would then be placed on the airport.

The installation of a terminal VOR on the airport would also lower minimums and improve approach accuracy and safety. Cloquet would qualify for such a facility when it reached 200 annual instrument approaches. This level is forecast in the short term. However because of the proximity and present use of the Duluth VOR, installation of a TVOR at Cloquet may be delayed until the intermediate term.

Consideration was also given to the installation of an ILS or inexpensive MLS some time in the future. Because of the proximity of the facilities at Duluth it would be difficult to justify them for Cloquet given the levels of traffic at both facilities. A MALSR Approach Lighting System could be considered for installation in the intermediate term, since it would qualify at a level of 300 instrument operations. Such a facility would depend upon the acquiring of the land to the south of the airport.

A VOR fix is presently used to reduce NDB approach minimums. In addition, a radio such as a marker beacon could be used to enhance safety and make the approach more versatile.

The addition of Runway End Identification Lights (REIL) on the crosswind runway and Visual Approach Slope Indicators (VASI) will prove to enhance safety in operating at Cloquet.

5.1.3 Weather Analysis

At present, there are no weather records available for the airport. However, weather records are kept at the Cloquet Forestry Center adjacent to the airport. Records are also available for the Duluth International Airport, 15 nautical miles northeast of Cloquet/Carlton County Airport. Computer tapes of records for the same five year period 1959-1964 were obtained from the National Weather Records Center for both these stations. Both tapes were compared to determine whether simultaneous weather conditions were similar or different. Although printed material indicated a record of wind conditions were kept at the Forestry Center, a print of the data on the tape indicated this information was missing. However, a printed summary of wind conditions obtained from the Forestry Center indicated that Duluth and Cloquet could have differing wind conditions. The differences can be seen in Figure 5-4.

Figure 5-4
ALL WEATHER WIND CONDITIONS
(% of time)

	Duluth Int'l Airport	Cloquet Forestry Center
North	7.6	3.2
Northeast	6.0	10.0
East	17.5	9.1
Southeast	10.1	14.5
South	9.7	6.7
Southwest	13.0	16.4
West	15.8	10.4
Northwest	19.9	29.7

Since wind direction and velocity determine runway direction and usage it would be recommended that, in light of the apparent discrepancies in data, a two to three year weather recording survey be undertaken at Cloquet/Carlton County Airport to determine actual conditions.

Utilizing Duluth weather the present N-S and E-W runways would give 95% wind coverage for all weather. A 10 knot crosswind criteria is utilized in evaluating General Utility runways. The N-S runway alone gives 74.6% coverage. This is considered adequate using present criteria. A record keeping survey may prove this incorrect. Available records bear this out.

Duluth weather also indicates IFR weather 16.6% of the time with a present IFR wind coverage of 14.9% or 89% of the IFR weather. This also would seem adequate. However, comparison of the two weather tapes indicated that there may be times when Duluth may be closed and Cloquet above weather minimums. This is especially so in the case of fog. Of 2,192 readings, there were 664 recorded instances of fog. Figure 5-5 indicates the breakdown of these recordings.

Figure 5-5
INCIDENTS OF FOG

	Cloquet Only	Duluth Only	Both	Total
Fog #	4	556	104	664
Fog %	0.6%	83.7%	15.7%	100%

There is strong indication here that Cloquet could be used as an alternate airport for general aviation aircraft wishing to go to Duluth when it is closed due to fog. The weather record survey would provide accurate data to determine the feasibility of this.

5.1.4 Runway Analysis

An analysis of the present runway lengths was undertaken to determine whether they are adequate to handle the airport user's aircraft. Advisory Circular 150/5300-4A was utilized in determining the required length. The general utility category was the design goal based upon current and forecast activity. This category would handle virtually all propeller aircraft up to 12,500 lbs. If Cloquet were to develop as alternate for Duluth then the design would be upgraded to Basic Transport.

The normal mean maximum temperature for July utilized in the calculations was 81° F. Station altitude at Cloquet is 1,278 feet M.S.L. Thus, the runway length required to fill user needs would be 4,000 feet.

A comparison of a five year period of weather recorded at Duluth International Airport and the Cloquet Forest Research Center indicates that wind directions and velocities can differ quite often at the two sites. Based on Duluth weather wind coverage for Runways 17-35 and 07-25 is 95%. However, varying readings at the Forest Research Center indicates that this coverage might not be possible if it were based on actual Cloquet weather. Since the Center's records are not detailed enough, exact wind conditions at Cloquet cannot be determined at this time. Thus, it would be recommended that observations be taken at Cloquet for a two to three year period to determine the actual wind direction and velocities.

If such a survey indicates a need for a runway reorientation this could be accomplished utilizing the present airport property and County land east of the airport. An orientation of 295/115 in lieu of the present 265/085 at 4,000 feet could be placed across the present runway intersection and property line onto the County property. This orientation could give proper clearances for obstructions and buildings. Therefore, the present administration and hangar area could be developed without fear of having to remove these buildings at some later date. A preliminary check with engineers indicates that the gas line crossing the County property should offer no major construction problems. Control of obstruction free airspace on each end of this runway could be accomplished by either some land acquisition from the Northwestern Paper Company and the Forestry Center or the procurement of avigation easements.

Because of the topography on the County property to the east of the airport runway construction would become much more expensive as the runway is oriented more in a northwest/southeast direction than the present east/west. For this reason, a somewhat east/west direction should be used unless the increase in wind coverage by reorienting a NW/SE direction is very significant.

The weather analysis also indicated that there are times when visibility and ceiling could be below minimums at Duluth while above them at Cloquet. This fact indicates that Cloquet/Carlton County Airport could be used as an alternate for larger general aviation aircraft in the business jet category. In planning for this possibility it would seem reasonable to assume that 60% of the fleet at 60% useful load would be the criteria utilized. This assumption leads to a requirement for approximately 4,800 feet of runway and widening to 100 feet.

The two to three year weather survey mentioned previously would determine whether it would be desirable to develop Cloquet as an alternate and construct the additional 800 feet of runway required.

5.1.5 Taxiway Analysis

Based on forecast activity, Cloquet will qualify for a parallel taxiway in the short term period. It would be desirable to parallel Runway 17-35 with a 40 foot wide taxiway at a 200 foot separation. This taxiway would be connected to the runway at its ends

and at points 1,000 feet from each end in the future. Of lower priority would be to parallel the crosswind runway with a taxiway. However, the need for this parallel would be of lower priority.

5.1.6 Approach and Clear Zones

The approach area can be considered in two major parts which overlap each other. These parts relate to the runway safety area (primary surface) which is that area upon which the runway is centered. It is normally a turfed area available to aircraft that inadvertently depart the paved area. The aforementioned parts are as defined below.

- The Clear Zone is an area at ground level that provides for the unobstructed passage of landing aircraft through the above airspace. The clear zone begins 200 feet from the runway threshold and has a size which varies with the designated use of the runway.
- The Approach Surface is an imaginary inclined plane starting 200 feet beyond the runway threshold, and extending outward to distances up to 10 miles dependent on runway use. Width and slope are also dependent upon runway use. The approach surface governs the height of objects on and near an airport. Objects may not penetrate or extend above the approach surface. They would then be classified as obstructions, and would have to be removed or marked.

The dimensions of these approach areas at Cloquet are indicated in Figure 5-6.

Figure 5-6
APPROACH AREA REQUIREMENTS

Safety Area	-	Length of runway plus 200 feet beyond each end of paving, and 150 feet.
Clear Zone:		
Base	-	500 feet.
Length	-	2,000 feet.
End Width	-	1,100 feet.
Approach Surface:		
Base	-	500 feet.
Length	-	10,000 feet.
End Width	-	2,500 feet.
Slope	-	40:1

5.1.7 Land Acquisition

It is important that sufficient land be controlled either through purchase or easement such that the airport is protected from encroachment, particularly in approach areas specific parcels of land to be purchased or easements obtained, are shown on the layout plans and described in Section 6. General guidance is outlined here.

The FAA encourages outright purchase of land in approach areas and defines the areas, in which it will participate with 75% ADAP funding in FAA Order 5100.17. Figure 5-7 describes these areas as they pertain to Cloquet/Carlton County Airport.

Figure 5-7
LAND ACQUISITION IN APPROACHES

All Runways - To 3,600 feet beyond ultimate threshold and to width of 1,500 feet.

or*

- To 5,200 feet beyond the ultimate threshold and to width of 2,500 feet.

* If designed as Basic Transport Airport accommodating turbo-jet aircraft.

If this land is not purchased out right it should be protected, if possible, through easements or zoning.

5.2 Terminal Area

The various components that constitute the airport terminal area must be studied to determine the present adequacy in terms of being able to service the demand placed upon them. Then they are analyzed to see whether they are able to meet future demand levels. Therefore, in this section we will study the administration/pilots lounge building as well as the various aircraft storage and tiedown areas and buildings.

5.2.1 Administration Building/Pilots Lounge

On an airport catering to general aviation aircraft, ground activity usually centers upon a multifunction building that houses the airport administration, FBO office and pilot/passenger lounge. In the case of Cloquet, the present building measures 30' x 24'. The building has a finished basement which contributes to a total usable space of approximately 1,100 square feet.

Busy hour passengers and pilots have been calculated to be approximately 12 at present. Utilizing the criteria of a 49.5 square foot requirement per busy hour pilot or passenger, the total building area now needed would be approximately 900 square feet. This requirement reflects a minimum area of 200 square feet for the waiting room/pilots lounge and 180 square feet for the management/operations office. As can be seen, the existing building is adequate for current needs.

A similar calculation was undertaken to determine future needs. The busy hour itinerant traffic was determined as approximately 20% of the total busy hour activity. A factor of 1.8 busy hour passenger/ pilots per busy hour itinerant movement was also utilized. The results of this analysis are shown below in Figure 5-8.

Figure 5-8
BUSY HOUR PASSENGER/PILOTS

	1977	1982	1992
Itinerant busy hour movements	10	13	16
Busy hour passenger/ pilots	18	23	29

Area needs were then determined utilizing the criteria mentioned above; keeping in mind the minimums for the pilots lounge and operations office. These needs are indicated below in Figure 5-9.

Figure 5-9
ADMINISTRATION/TERMINAL BUILDING REQUIREMENT

	1977	1982	1992
Area (Sq. Ft.)	1,100	1,400	1,600

A comparison with the present facility indicates a need for some building expansion in the medium term.

5.2.2 Itinerant Aircraft Apron

An aircraft parking apron centered on the administration/terminal building is a necessary component needed to accommodate the parking requirements of transient aircraft as well as some based aircraft. Presently, there is approximately 42,000 square feet of paved apron which includes a peripheral taxiway and fueling area. Excluding this taxiway and fueling area 26,000 square feet are available for aircraft parking.

Current apron requirements were determined, based upon assumptions developed, from information obtained from the Airport Manager and airport records. Current activity indicates that approximately one/third of the peak day activity is due to itinerant aircraft. Approximately one/third of the itinerant aircraft are transient. We further assume that most of the transient aircraft will arrive and depart on the same day. Thus, the actual number of transient aircraft using the airport during a peak day would be half the transient activity. Finally, it is assumed that 75% of the transient aircraft would be on the ground during the peak period. Thus, approximately 4.2% of the peak day activity would require aircraft parking space.

Presently, peak day activity is calculated to be 135 movements. Thus, approximately six transients would require parking on a peak day. Assuming that approximately 10% of the locally based aircraft would also desire temporary parking on the terminal apron, the present day apron requirement was calculated as 18,000 square feet. As can be seen the existing apron is adequate for handling current needs.

Future needs were next determined utilizing similar assumptions and unit areas of 2,100 square feet and 3,150 square feet for single engine and multi-engine aircraft respectively. Figure 5-10 illustrates the number of transient and local expected to be placing parking demands upon the facility during the forecast period. Area requirements are also illustrated in Figure 5-10.

Figure 5-10
AIRCRAFT AND TERMINAL APRON REQUIREMENTS

	1977	1982	1992
Transient Aircraft:			
Single Engine	8	10	14
Multi-engine	1	1	2
Locally Based Aircraft	2	3	4
TOTAL	12	14	20
Apron Requirements Square Feet	26,000	30,000	44,000

It appears that the existing usable apron can accommodate parking needs until 1977. Also because of efficiencies lost in less than ideal layout (narrow) as well as in physically parking aircraft, the apron projections should be considered minimum requirements, and will be somewhat larger in practice as indicated on the layout plan. The area shown on the layout plan includes taxi lanes, hangar clearances, and fuel island clearances in addition to the areas shown in Figure 5-10.

5.2.3 Auto Parking Requirements

Auto parking space requirements are also based upon peak needs. Historically, a factor of 1.3 automobiles per busy hour passenger pilot has proven adequate. This factor accounts for overlap and employee parking. A space requirement of 320 square feet per automobile accounts for maneuvering space as well as driving lanes. Figure 5-11 illustrates the previously determined busy hour passenger/pilots, the number of parking spaces and the gross area required to accommodate automobiles through the forecast period.

Figure 5-11
AUTO PARKING REQUIREMENTS

	1972	1977	1982	1992
Busy hour passenger/ pilots	12	18	23	29
Parking spaces	16	23	30	37
Area (Sq. Ft.)	5,100	7,400	9,600	11,800

Approximately 11,200 square feet now exists in the terminal area for auto parking purposes. As can be seen, this area will be adequate for auto parking needs until the end of the long-term period when some additional space will be needed.

5.2.4 Based Aircraft Storage

Because of the extremely cold winter weather at Cloquet it is assumed that most owners would wish their aircraft hangared if they were available. Thus, in determining storage requirements at Cloquet, hangaring was assumed. Current and forecast based aircraft are shown in Figure 5-12. This figure also illustrates total land requirements for the hangar area which includes apron, building clearances, taxiways, etc.

Figure 5-12
BASED AIRCRAFT AND STORAGE REQUIREMENTS

	1972	1977	1982	1992
Based aircraft:				
Single engine	18	27	34	53
Multi-engine	2	4	5	7
TOTAL	20	31	39	60
Area (Sq. Ft.)	44,000	69,000	87,000	133,000

The new storage hangars and their aprons, clearances, etc., approximate 19,000 square feet of area. Each hangar can hold up to four aircraft depending upon size. However, these hangars tend to use land inefficiently. It would therefore be recommended that future aircraft storage hangars be of the T type hangar, which can be built in groups of six to ten units. The number of such units is indicated below in Figure 5-13.

Figure 5-13
T HANGARS REQUIRED*

	1972	1977	1982	1992
Hangars	14	25	33	54

Despite the fact that hangars would be available, a few plane owners would still prefer to store their aircraft outdoors. Thus, based aircraft owners should be contacted to determine their desires prior to providing hangars. Tiedown space should be provided on the basis of 2,100 square feet for single engine aircraft and 3,200 square feet for multi-engine aircraft. Such space would be provided where the "T" hangars, being replaced, were to be built.

Additionally, some requirement will develop to store transient aircraft overnight. In winter months especially, a demand for indoor storage can be expected to develop. When hangars for based aircraft are being constructed, this should be kept in mind and one or two spaces for such aircraft should be planned.

* Two of these are the 50' x 64' hangars presently available.

5.2.6 Aircraft Maintenance

Presently there is a 3,200 square foot hangar utilized for aircraft maintenance. This hangar is adequate for present needs. However, as activity develops there would be a demand for additional maintenance facilities on the airport. Based upon projections of based aircraft and transient activity, an additional 6,000 square feet by the end of the forecast period would suffice. This would be provided in the form of 3,000 square feet in the medium term and another 3,000 square feet in the long term. For purposes of efficiency and cost reduction it may be desirable to construct a 100' x 100' hangar to replace the present maintenance hangar at one point in time.

5.3 Fire and Rescue Facilities

The airport presently utilizes City fire and police departments for its fire and rescue needs. The activity levels at present as well as those forecast indicate that such an arrangement would prove perfectly adequate for the emergency needs at the airport throughout the study period. The facilities normally recommended on-airport for such activity levels would include a portable fire extinguisher per ten based aircraft and some means of notifying the fire and police departments. Recent changes to Advisory Circulars* pertaining to this subject, indicate that it would be desirable to have a pick-up type of truck with a slide-in unit capable of carrying 90 gallons of water for AFFF production or 140 gallons of water for protein foam production and 200 lbs. of dry chemical. Additionally, a building or area in a hangar would be needed to house this vehicle. It cannot be foreseen that this equipment would be necessary at Cloquet.

* Advisory Circular 150/5210-6B, Aircraft Fire and Rescue Facilities and Extinguising Agents.

5.4 Airport Access

Ground access to the airport from Cloquet is available via State Highway 33 and County Road 115. State Highway 33 also connects directly to Interstate 35 giving direct access to Duluth on the north and the Twin Cities on the south. Some improvement would be accomplished if an exit from 35W to 33 coming from Duluth were built and Washington Avenue were extended to meet the airport road as planned.

Access to the administration building on the airport is a two lane paved road from County 115 south to the administration building. The road travels through the hangar area at present. As activity at the airport increases, a need to segregate automobile and aircraft traffic will necessitate rerouting the access road from the administration building to a north/south road on the eastern boundary of the airport.

6. AIRPORT LAYOUT PLANS

****

The airport layout plans depict graphically the development program forecast for the airport. The twenty year requirements determined in Section 5 are shown as specific development improvements on the plans. Of major significance in the development program are the extension of the present paved runway and constructing and paving a new crosswind runway. Other improvements in the apron and hangar area entail most of the development. The six sheets of the plan are:

- Sheet 1 - Title Sheet; including Location and Vicinity Maps as well as windrose information.
- Sheet 2 - Airport Layout Plan
- Sheet 3 - Airport Alternate Layout Plan *
- Sheet 4 - Approach and Clear Zone Plan
- Sheet 5 - Building Area Plan
- Sheet 6 - Land Use/Access Plan

Reductions of these sheets are bound in this report at the end of this section.

6.1 Title Sheet (Sheet 1)

This sheet acts as a cover for the rest of the plans and most items on it are self explanatory. The windroses shown are based upon weather reported at Duluth International Airport. In section 5 of the report, indication was given that weather at Cloquet may be somewhat different. For this reason a weather survey for Cloquet was recommended. When sufficient data has been collected (two to three years) these wind roses should be updated and the best development alternative selected, (Sheet 2 or 3).

* To be considered only if determined by wind survey.

6.2 Layout Plans (Sheets 2 and 3)

Two layout plans have been provided with the major difference being the crosswind runway orientation as explained below. They each depict the other twenty year development projects for the airport. Because of the somewhat small scale many features may be difficult to depict. For this reason, the other four sheets have been added to illustrate specific aspects of development. The major elements which should be pointed out include:

- Runway 17-35 -- Initially the runway would be extended 800 feet to the south to provide 4,000 feet of runway required by the General Utility Category. This runway would also be paralleled by a 40 foot wide taxiway. If weather surveys prove and it is decided that Cloquet should become a general aviation weather alternate for Duluth, then Runway 17-35 would need to be extended a further 800 feet to the north with parallel taxiway and widened to 100 feet.

  Extension to the north would involve some land acquisition north of the County Road 115, for runway and clear zone purposes. The 800 foot extension to the north would necessitate closing a section of County Road 115 north of the airport. Since County State Aid Highway 7, a half section north provides access to County State Aid Highway 5 west of the airport little problem is foreseen in closing this section of road.

- Crosswind Runway -- Sheet 2 illustrates a crosswind runway with an 07-25 orientation. This is based on Duluth weather and provides the best wind coverage with this respect.

Sheet 3 illustrates an 11-29 orientation which provides coverage based upon the incomplete records obtained from the Forestry Center and would have to be verified by the recommended weather survey.

In either case, the crosswind would be constructed to the length of 4,000 feet by 75 feet wide. If the weather survey determines that Cloquet would be general aviation alternate, an analysis of the data will be necessary to determine whether sufficient coverage at 15 mph can be obtained on 17-35. If not then the crosswind would also be extended to 4,800' x 100'.

In either case the road east of the airport would have to be relocated to provide access for the residents southeast of the airport. It could either be routed west to the road on the western boundary of the airport or east and then north to County Road 115. As will be seen it would be cheaper to route this road to the west.

Some land would have to be acquired in either case. With an 07-25 orientation, land to the west and northeast would be acquired to ensure proper clearances. Runway 11-29 could be constructed on present airport and County owned property. However, if it were extended to 4,800 feet, acquisition of Forestry Center property northwest of the airport would be necessary. This could be accomplished through purchase or trade for unneeded airport property.

- Soils -- Soil borings on the airport have indicated classification generally ranging from E-3 to E-6, which would convert to a sub-grade classification of F-3 to F-6 assuming poor drainage and frost conditions. The present base on critical pavements is 8" and 7" on non-critical pavements. A 1.5" surface is on all pavements. This allows for 8,000 pound single wheel loading and 12,000 pound dual wheel loading on non-critical pavements. Similarly loadings are 14,000 pounds and 21,000 pounds respectively on critical pavements. This indicates that at present, these pavements would be sufficient for most general utility aircraft. If the airport remains in this category an overlay should be planned for the medium term to allow for 12,500 pound single wheel loading on non-critical pavement.

- Access Road -- The present airport access road would eventually be closed and a new road utilizing the road east of the airport and turning west to the administration area would be constructed. It would be advisable to upgrade the road east of the airport to a nine ton limit when it is being developed.

6.3 Approach and Clear Zone Plan (Sheet 4)

The approach and clear zone plan depicts imaginary surfaces at various elevations from airport ground level to 1,578 feet mean sea level. The actual measurements of the approach, transitional, horizontal, and conical surfaces are dependent upon a mix of FAA and Minnesota Department of Aeronautics criteria. In any case, the actual elevations and dimensions shown are the more stringent of the two.

Part 77 of the Federal Aviation Regulations define these imaginary surfaces which in turn determine whether an object is an obstruction to air navigation. Essentially an object penetrating these surfaces is considered an obstruction. At present, the only obstruction penetrating an imaginary surface at Cloquet/Carlton County Airport is a radio tower, 12,000 feet east of the field at an elevation of 1,504 feet or 126 feet above the ultimate horizontal surface. Of main concern would be what effect this obstruction would have upon approach minimums. Such an analysis would have to be performed when a request is made to lower minimums or new approaches are requested. It would appear the circling approaches and those from the east would be affected most.

The approach and clear zone plan can be used as a basis for the airport height zoning ordinance. The various zones described in the Minnesota Department of Aeronautics' Model Zoning Ordinance relate to the surfaces shown on the approach and clear zone plan.

6.4 Building Area Plan (Sheet 5)

The building area plan zeroes in on the specific airport property designated for future terminal, hangar, and maintenance facilities.

At Cloquet/Carlton County Airport, the major change in the building area will be the increase of aircraft storage hangars over the twenty year period. These hangars would be of the nested T hangar type. The units would generally align with the new hangars presently in place. They are planned to be installed east of the present access road at first to utilize this road as a taxiway during early portions of the development period. Eventually this hangar area would be expanded beyond the road toward the west.

The building area plan also illustrates the access road entering the terminal area from the township road east of the airport. Part of the on-airport road system would be a spur to the north to provide access to the T hangar area.

Additional development during the twenty year period would include extension of the administration building, a new FBO maintenance hangar, additional auto parking and extension of the aircraft parking apron to the east and north.

6.5 Land Use/Access Plan (Sheet 6)

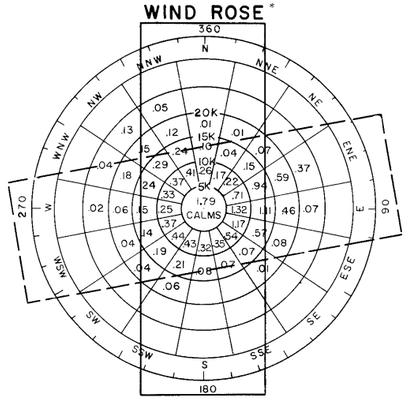
The land use and access plan depicts the noise contours expected to be generated by aircraft operating at Cloquet/ Carlton County Airport as well as the road system presently serving the airport. The noise contours were developed as shown in Section 7.2. They generally circumscribe areas of land within which public reaction to noise can vary from violent to very slight. Three general zones are described relating to the degree of public reaction. These zones are described in Figures 7-1 and 7-2.

The noise contours for Cloquet/Carlton County Airport depict the 90 CNR contour which circumscribe Zone 1. This contour extends approximately 3,500 feet beyond each runway end and is 800 feet wide at a maximum. Because of the relative infrequent flights by high noise generating aircraft, little problem is foreseen. Coupled with this is the sparse population within the noise contours, which further reduces the problem of public reaction. The only development that should be controlled within this area from a noise viewpoint, is that which depends upon communication between groups of people such as schools, hospitals, theaters, and the like.

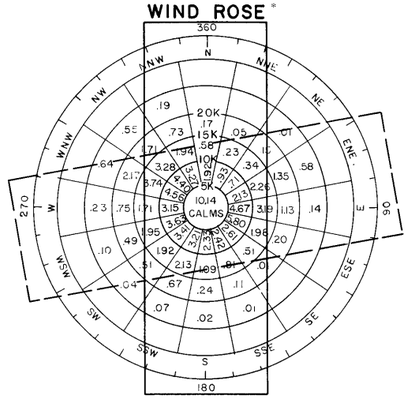
Road access to the airport is shown as adequate. The plan depicts the proposed extension of Washington Avenue which will give the airport better access to Highway 33. Also shown is a proposed exit from Interstate 35 to Highway 33 coming from Duluth.

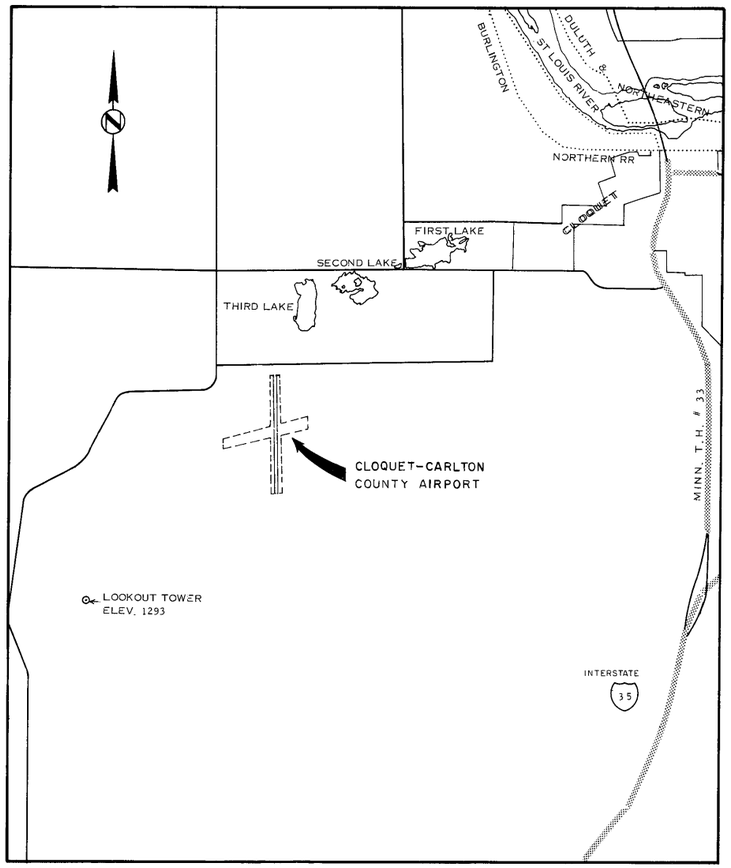
AIRPORT LAYOUT PLAN
CLOQUET-CARLTON COUNTY AIRPORT

INSTRUMENT FLIGHT
WIND ROSE *

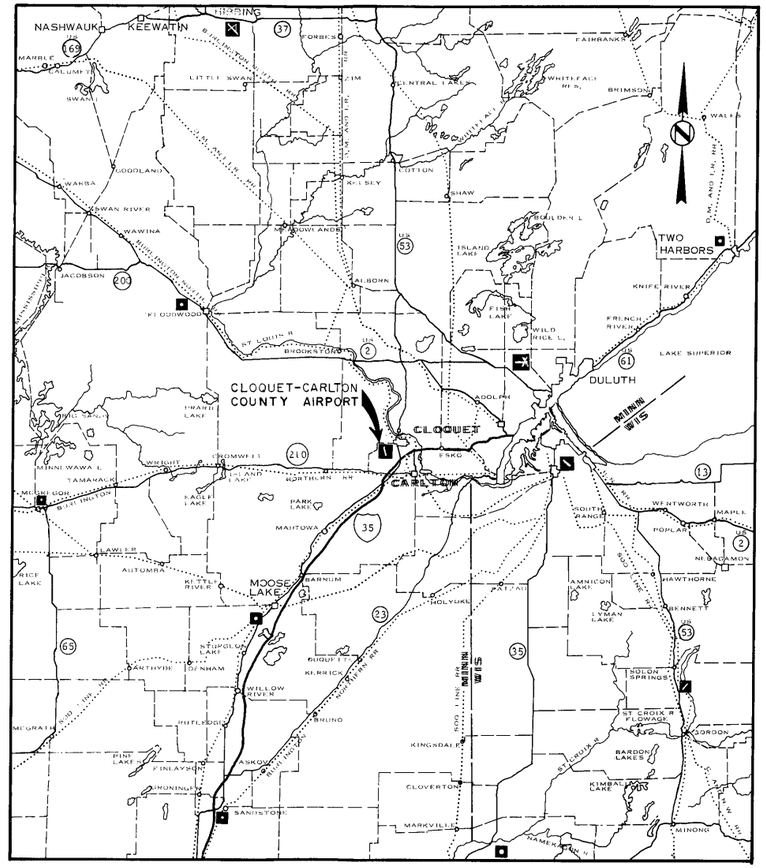


ALL WEATHER
WIND ROSE *





VICINITY MAP
SCALE
0 1000' 2000' 6000'



LOCATION MAP
SCALE
0 5 10 20 MILES

IFR WIND ROSE

% IFR WEATHER (<1000' + 3 MI.) = 16.6%
10 KNOT CROSSWIND COVERAGE
RUNWAY 17/35 = 68.43%
RUNWAY 17/35 + 07/25 = 96.74%

SOURCE: U.S. WEATHER BUREAU
ENVIRONMENTAL DATA SERVICES
ASHEVILLE, NORTH CAROLINA
PERIOD: 1959 - 1963.
PLACE: DULUTH INTERNATIONAL AIRPORT
* SEE REPORT FOR WEATHER DATA DISCUSSION

ALL WEATHER WIND ROSE

10 KNOT CROSSWIND COVERAGE
RUNWAY 17/35 = 74.54%
RUNWAY 17/35 + 07/25 = 95.03%

INDEX

LEGEND

(2) MINNESOTA TRUNK HWY AND NUMBER
OR FOUR LANE INTERSTATE HIGHWAY
COUNTY - STATE-AID HIGHWAY
RAILROAD
AIRPORTS & LANDING STRIPS

CLOQUET-CARLTON COUNTY
AIRPORT COMMISSION
APPROVED DATE Aug. 27, 1973 Robert Kovanen CHAIRMAN
ATTEST DATE Aug. 27, 1973 Melvin A. Snyder

BY	DATE	CHANGE
REVISIONS		

CLOQUET-CARLTON COUNTY AIRPORT
TITLE SHEET

SCALE VARIES | DESIGN D.H.S. | DRAWN D.C.S. | CHECKED D.H.S. | DATE 1/8/73 | SHEET 1 OF 6

R. DIXON SPEAS ASSOCIATES
AVIATION CONSULTANTS
MINNEAPOLIS, MINNESOTA

&

STEWART & WALKER, INC.
CONSULTING ENGINEERS
THIEF RIVER FALLS & BEMIDJI, MINNESOTA

MAG. DEC. DERIVED FROM MARCH 1, 1973 AERONAUTICAL CHART.
MAG. DEC. 4°-15'

0 500' 1000'

CONTOUR INTERVAL = 10 FT.

LEGEND

EXISTING	ULTIMATE	
		BOUNDARY FENCE
ooo	ooo	THRESHOLD LIGHTS
P	P	LIGHTED WIND CONE
		CAR PARKING AREA
		PROPERTY LINE
		BUILDING RESTRICTION LINE (BRL)
		EASEMENT LINE
		BUILDING
		DRAINAGE DITCH
		RAILROAD TRACKS
		GROUND CONTOURS
		TREE & BRUSH LINE
		ROADS
T		POWER POLE
PL		UNDERGROUND PIPE LINE
		BEACON
		LAND ACQUISTION ELIGIBLE FOR FEDERAL AID FUNDS

WOODED AREA
1270 APPROACH SURFACE
TR EL 1320 OBS 17.5 (REMOVE)
(REMOVE) TR EL 1310 OBS 12.9
TO BE ACQUIRED
3400'
2000'
RD EL 1268.5 CL. 23.4
RD EL 1269.0 CL. 21.5
RD EL 685 CL. 20.5
C.S.A.H. 5
ULTIMATE EL. 1274.0
EXISTING 200' X 2200' LANDING STRIP
1250
1280
32 29 33 28
29 28
29 20 29 21
TR EL 1315.0 OBS. 27.0 (REMOVE)
RD EL 1282.0 CL. 35.9
40:1 APPROACH SURFACE (ULTIMATE)
40:1 APPROACH SURFACE
TR EL 1315 OBS. 28.0 (REMOVE)
TR EL 1315.0 OBS. 33.8 (REMOVE)
ULTIMATE EL. 1273.0
EL. 12740
EL. 12734
100' X 4800' RUNWAY (ULTIMATE) SEE NOTE
EXISTING 3218 X 75' RUNWAY (LIGHTED)
TRUE BEARING N 0°-30' W
(ULTIMATE) 40' X 3080 TAXIWAY
SEG CIRCLE
BEACON
ULTIMATE APRON
EX. "H" MARKER
APRON 100' X 240'
280'
(ABANDON) RD EL 1270.8 OBS 5.9
TR EL 1310 OBS 0.3 (REM.)
RD 1271.7 OBS. 6.3
ULTIMATE EL. 1273.0
ABANDON
ABANDON ACCESS ROAD
RD EL. 725.6 OBS. 7.6 (ABANDON)
TERMINAL HANGAR AND MAINTENANCE AREA
SEE SHEET 3
THIRD LAKE
POND
OTTER CREEK
ABANDON ROAD
PROPOSED AIRPORT ACCESS
100' X 4000' RUNWAY (ULTIMATE) SEE NOTE
TAXIWAY (ULTIMATE) SEE NOTE
WATER WELL
COUNTY RD 3A
TR EL 1285.0 OBS 21.7 (REMOVE)
TR EL 1280.0 OBS. 18.5 (REM.)
TR EL 1280 OBS 13.5 (REMOVE)
RD EL 1251.5 CL. 18.5
TO BIG LAKE ROAD
400:1 APPROACH SURFACE
1000'
1100'
33 28 34 27
28 21 27 22

BASIC DATA TABLE — RUNWAY DATA	RUNWAY 17 – 35		RUNWAY 7 – 25	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
EFFECTIVE GRADIENT (IN %)	0.173	0.00	0.194	0.35
% WIND COVERAGE (10 KNTS)***	74.54	—	+20.49	—
INSTRUMENT RUNWAY	—	✓	—	—
PAVEMENT STRENGTH	8S,12D	18S, 30D	—	12,5S, 18D
APPROACH SURFACES	40 : 1	40 : 1	20 : 1	40 : 1
RUNWAY LIGHTING	MIRL	MIRL	—	MIRL
RUNWAY MARKING	NIR*	NIR	—	NIR
NAVIGATIONAL AIDS	VOR (DULUTH)	VOR(DULUTH)	VOR(DULUTH)	VOR(DULUTH)
	REIL, NDB	REIL, VASI,	NDB	REIL, VASI,
		NDB		NDB

BASIC DATA TABLE — AIRPORT DATA	EXISTING	ULTIMATE
AIRPORT ELEVATION	1278.0 EST.	SAME
AIRPORT REFERENCE POINT (ARP) COORDINATES	46° 42' 05" 92° 30' 21"	46° 42' 05" 92° 30' 12"
MEAN MAX. TEMP. OF HOTTEST MONTH	81°	—
AIRPORT & TERMINAL NAV. AIDS	NDB, VOR(DUL)	✓
TAXIWAY LIGHTING	NONE	MITL
SIGN SYSTEM	NONE	✓

*NIR - NONPRECISION INSTRUMENT RUNWAY
**PIR - PRECISION INSTRUMENT RUNWAY
*** SUBJECT TO WEATHER DATA COLLECTION STUDY

NOTE 1: 100'X 4800' RUNWAY (LIGHTED) TO BE DEVELOPED IF CLOQUET - CARLTON CO. AIRPORT IS TO BE USED AS DULUTH G.A. WEATHER ALTERNATE

CLOQUET-CARLTON COUNTY AIRPORT
LAYOUT PLAN

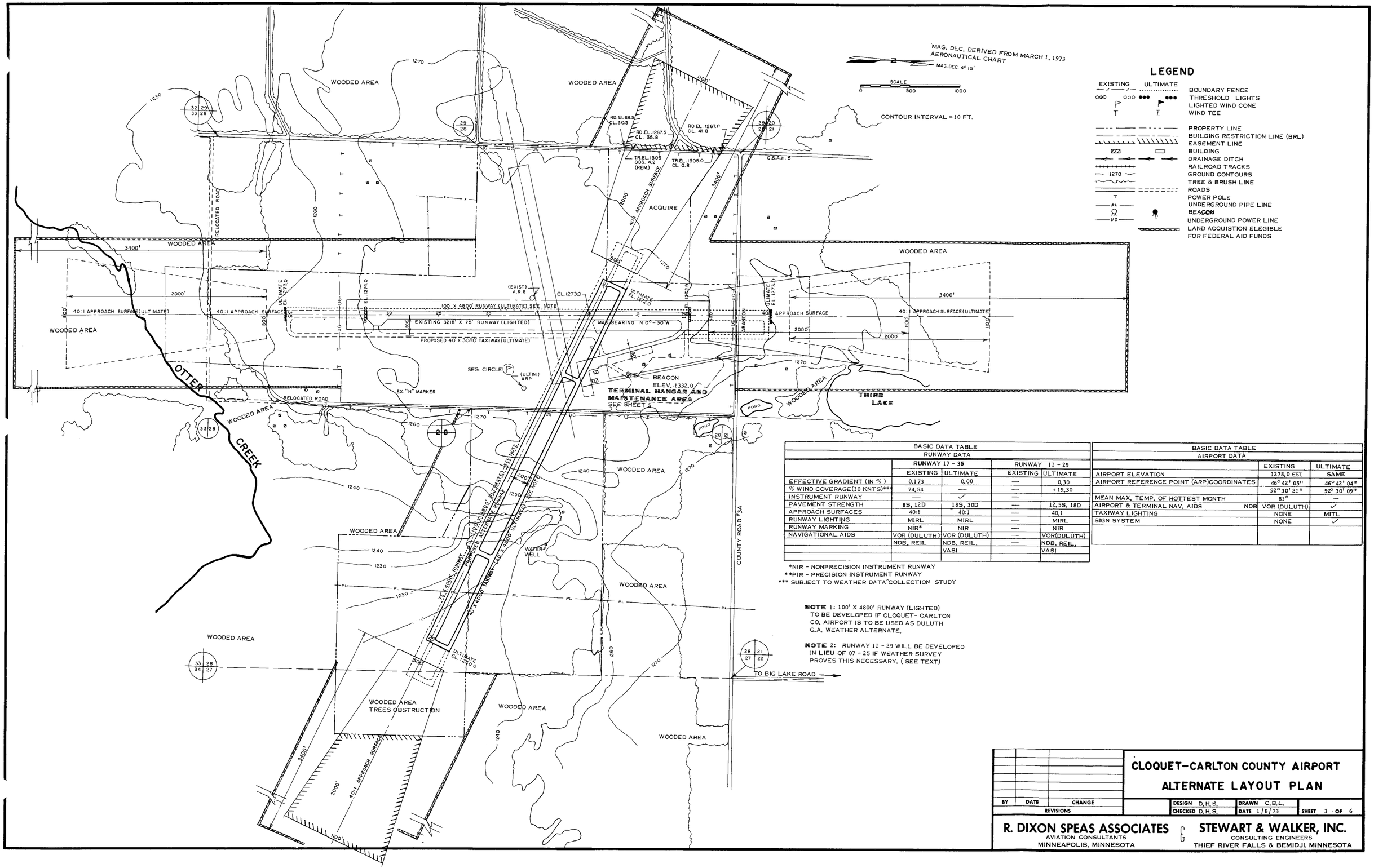
BY	DATE	CHANGE

REVISIONS

DESIGN C.B.L. DRAWN C.B.L.
CHECKED D.H.S. DATE 1/8/73 SHEET 2 OF 6

R. DIXON SPEAS ASSOCIATES
AVIATION CONSULTANTS
MINNEAPOLIS, MINNESOTA

STEWART & WALKER, INC.
CONSULTING ENGINEERS
THIEF RIVER FALLS & BEMIDJI, MINNESOTA



BASIC DATA TABLE RUNWAY DATA	RUNWAY 17 - 35		RUNWAY 11 - 29	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
EFFECTIVE GRADIENT (IN %)	0.173	0.00	—	0.30
% WIND COVERAGE (10 KNTS)***	74.54	—	—	+19.30
INSTRUMENT RUNWAY	—	✓	—	
PAVEMENT STRENGTH	8S, 12D	18S, 30D	—	12.5S, 18D
APPROACH SURFACES	40:1	40:1	—	40.1
RUNWAY LIGHTING	MIRL	MIRL	—	MIRL
RUNWAY MARKING	NIR*	NIR	—	NIR
NAVIGATIONAL AIDS	VOR (DULUTH)	VOR (DULUTH)	—	VOR(DULUTH)
	NDB, REIL	NDB, REIL,	—	NDB, REIL,
		VASI		VASI

BASIC DATA TABLE AIRPORT DATA	EXISTING	ULTIMATE
AIRPORT ELEVATION	1278.0 EST.	SAME
AIRPORT REFERENCE POINT (ARP) COORDINATES	46° 42' 05"	46° 42' 04"
	92° 30' 21"	92° 30' 09"
MEAN MAX. TEMP. OF HOTTEST MONTH	81°	—
AIRPORT & TERMINAL NAV. AIDS NDB	VOR (DULUTH)	✓
TAXIWAY LIGHTING	NONE	MITL
SIGN SYSTEM	NONE	✓

*NIR - NONPRECISION INSTRUMENT RUNWAY
**PIR - PRECISION INSTRUMENT RUNWAY
*** SUBJECT TO WEATHER DATA COLLECTION STUDY

NOTE 1: 100' X 4800' RUNWAY (LIGHTED) TO BE DEVELOPED IF CLOQUET- CARLTON CO. AIRPORT IS TO BE USED AS DULUTH G.A. WEATHER ALTERNATE.

NOTE 2: RUNWAY 11 - 29 WILL BE DEVELOPED IN LIEU OF 07 - 25 IF WEATHER SURVEY PROVES THIS NECESSARY. (SEE TEXT)

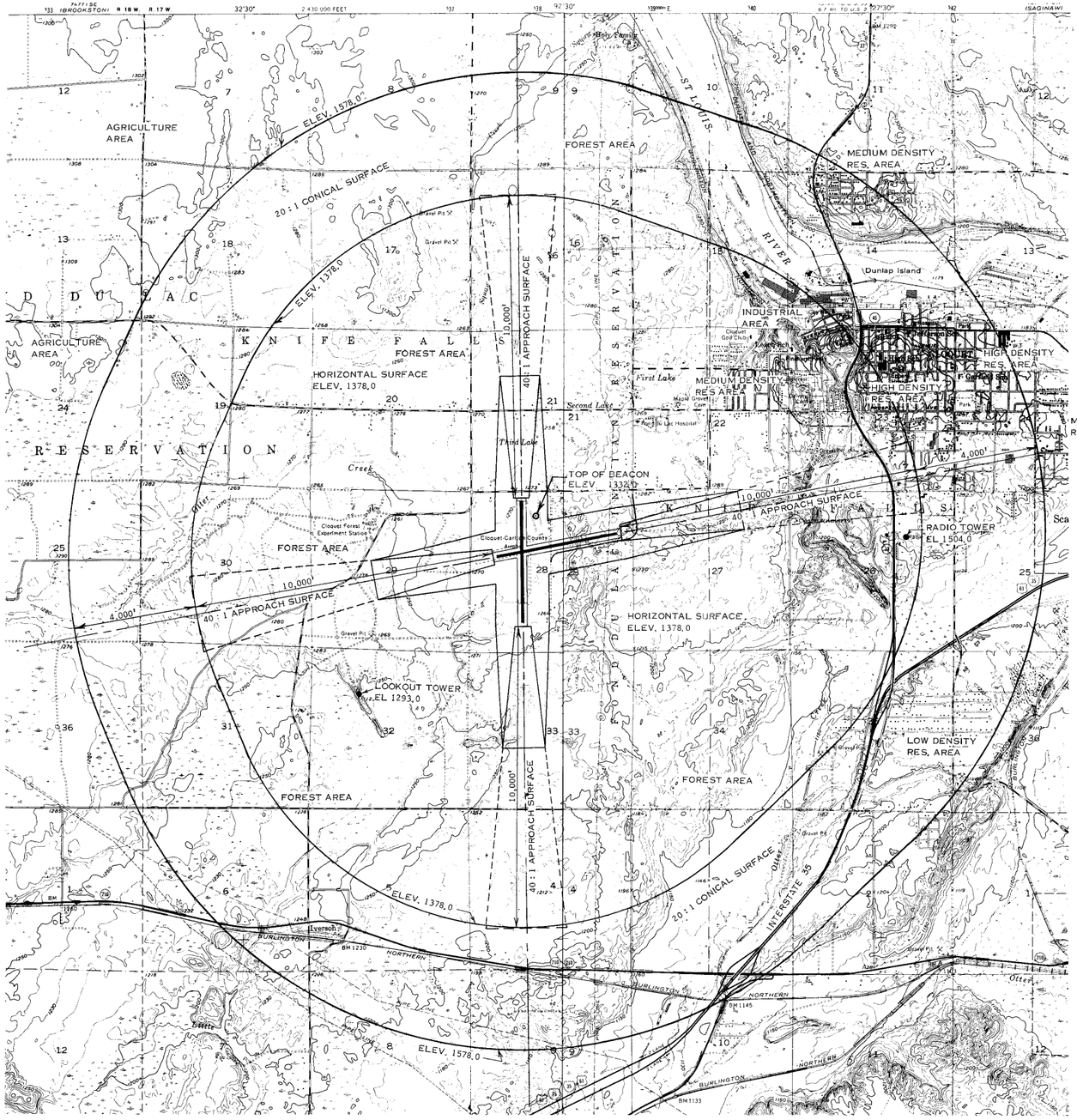
CLOQUET-CARLTON COUNTY AIRPORT
ALTERNATE LAYOUT PLAN

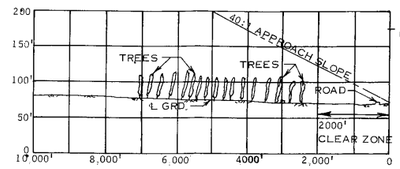
BY	DATE	CHANGE
REVISIONS		

DESIGN D.H.S. DRAWN C.B.L.
CHECKED D.H.S. DATE 1/8/73
SHEET 3 OF 6

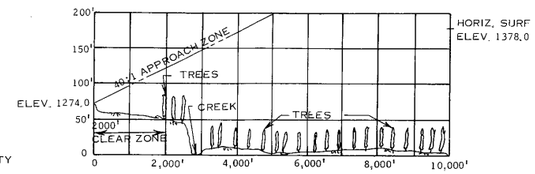
R. DIXON SPEAS ASSOCIATES
AVIATION CONSULTANTS
MINNEAPOLIS, MINNESOTA

STEWART & WALKER, INC.
CONSULTING ENGINEERS
THIEF RIVER FALLS & BEMIDJI, MINNESOTA

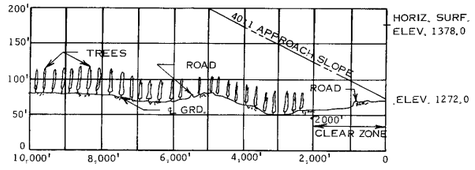




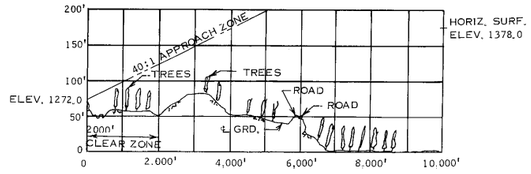
APPROACH TO R/W 17



APPROACH TO R/W 35



APPROACH TO R/W 7



APPROACH TO R/W 25

NOTE: IMAGINARY SURFACES CORRESPOND TO PART 77 OF THE FEDERAL AVIATION REGULATIONS. MINNESOTA DEPARTMENT OF AERONAUTICS STANDARDS ARE USED WHEN THEY ARE MORE RESTRICTIVE.

CLOQUET-CARLTON COUNTY AIRPORT
APPROACH AND CLEAR ZONE

BY	DATE	CHANGE
REVISIONS		

DESIGN C.B.L. | DRAWN C.B.L.
CHECKED D.H.S. | DATE 1/8/73 | SHEET 4 OF 6

R. DIXON SPEAS ASSOCIATES
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&

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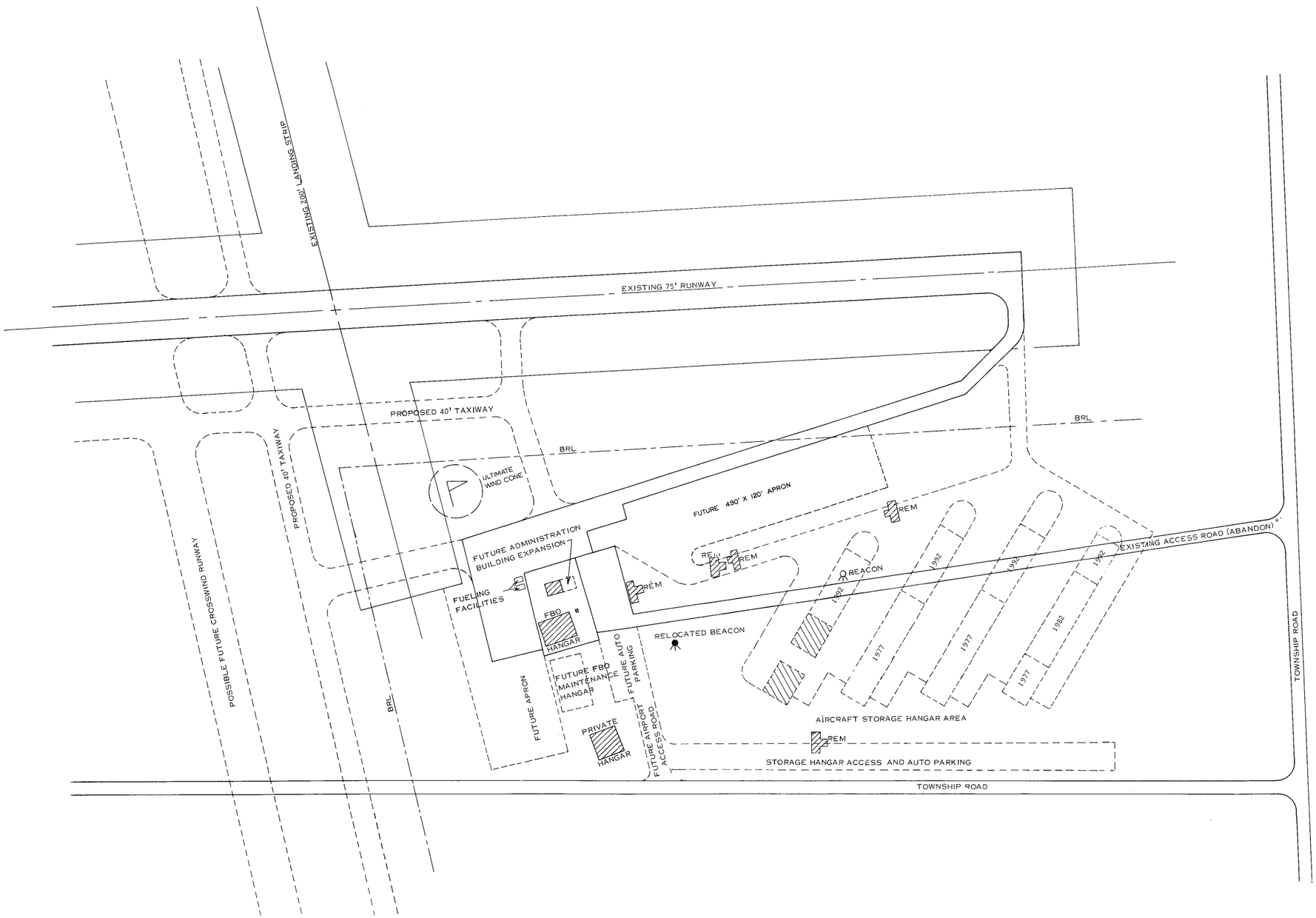

N

0 1 2 3 4
SCALE

LEGEND

- EXISTING BUILDING
- PROPOSED BUILDING
- REM — BUILDING TO BE REMOVED
- EXISTING ROAD
- PROPOSED ROAD, PARKING AREA, & APRON
- BRL — BUILDING RESTRISTION LINE (BRL)
- BOUNDARY FENCE

* CAN BE USED AS TAXIWAY UNTIL LONG TERM HANGER DEVELOPMENT TAKES PLACE.

CLOQUET-CARLTON COUNTY AIRPORT
BUILDING AREA PLAN

BY	DATE	CHANGE
REVISIONS		

DESIGN DHS | DRAWN ROS
CHECKED DHS | DATE 1/8/73
SHEET 5 OF 6

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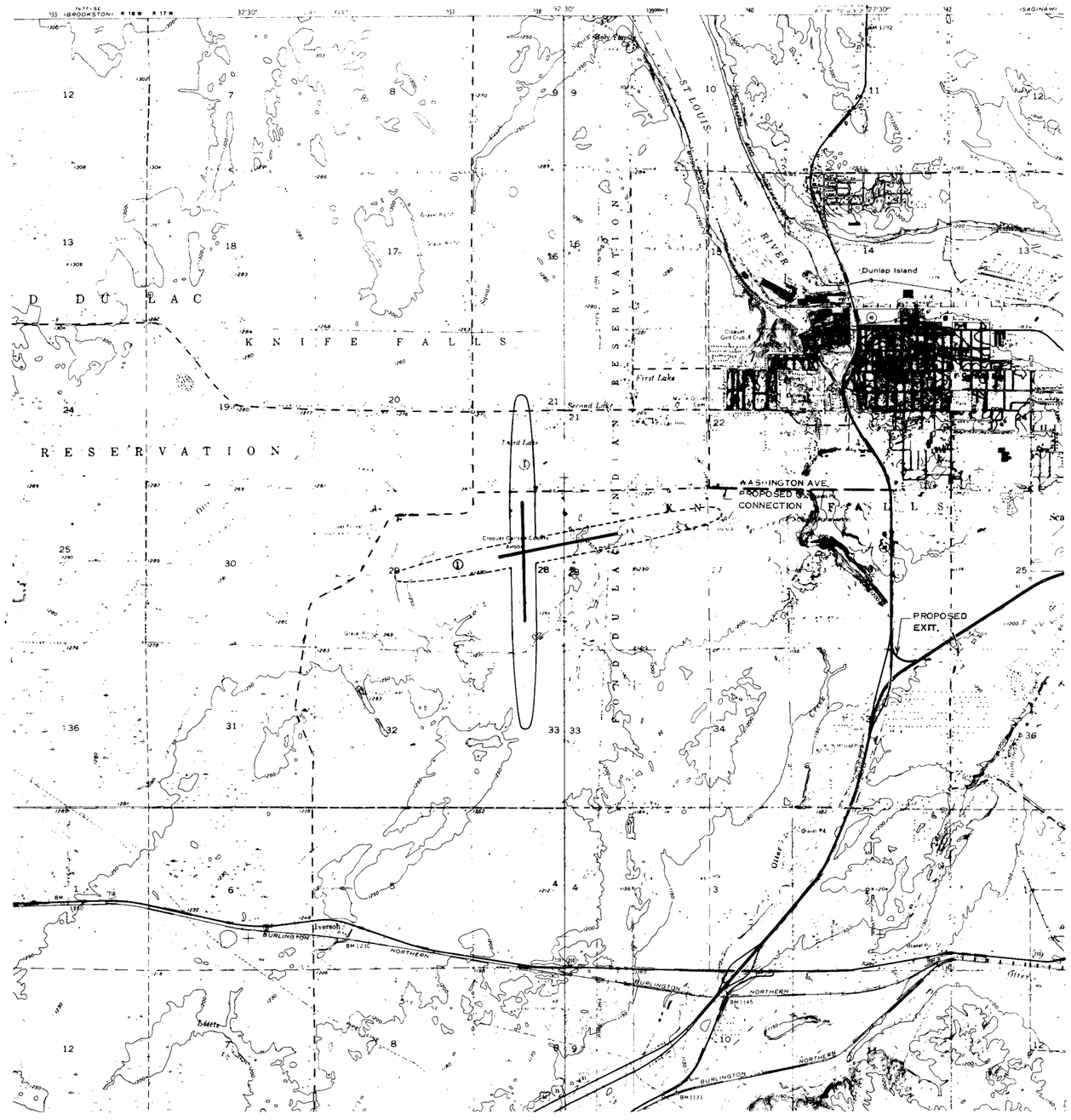

0 1000 2000
SCALE

ZONE DEFINITION

ALL ZONES ARE SUBJECT TO APPROACH AND CLEAR ZONE LENGTH REQUIREMENTS, AND IN ADDITION SHOULD HAVE COMPATIBLE LAND USE AS DEFINED IN THE ACCOMPANYING REPORT.

CLOQUET-CARLTON COUNTY AIRPORT
LAND USE/ACCESS MAP

BY	DATE	CHANGE
REVISIONS		

DESIGN D.H.S. DRAWN C.B.L.
CHECKED D.H.S DATE 1/8/73
SHEET 6 OF 6

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&

STEWART & WALKER, INC.
CONSULTING ENGINEERS
THIEF RIVER FALLS & BEMIDJI, MINNESOTA

7. ENVIRONMENTAL CONSIDERATIONS

****

Of major importance in an airport master plan study is the impact of the airport upon the environment in which it is located. Many airport construction projects are most feasible from an engineering or economic standpoint. However, these same projects can cause serious damage to the environment in which they will be placed. Hence, a question of priorities develops. Will engineering or economic gain outweigh long-term environmental damage? Man has realized that preservation of the environment must prevail in order to prevent his own demise.

A master plan study is not intended to produce a detailed environmental analysis, but to indicate environmental feasibility of the various development projects proposed for the airport. A detailed environmental study will be required for the writing of an environmental impact statement as each major development project is undertaken.

7.1 Qualitative Perception of Impact

It is of vital importance that the present airport and any proposed construction program be evaluated in terms of its compatibility with the local environs. The overall development program is first studied to determine the impact to be perceived by the populace and the user. The question associated with this study is what quality will be perceived when viewing the development.

The major development at the airport over the twenty year period will include extending the north/south runway and constructing a paved crosswind runway. The building area

will see the construction of aircraft storage hangars. The impact of the runway construction will be minimal since only a small portion of the land will be paved. Some fill would be necessary if the runway is extended north over County Road 115. This would be highly visible to persons entering the airport property. However, with grading and replacement of grasses the visual effect would be pleasant.

The new T hangars along the new airport entry road would give an overall appearance of quality and orderliness replacing the aged single T hangars scattered about the airport today. The construction of a new maintenance hangar would give similar impressions.

Additional people would also be utilizing the airport, however, activity will be at levels which would not make this noticeable to other than people at the airport itself.

Thus, the question of quality of perception would be that it would in all likelihood be enhanced.

7.2 Aircraft Noise

An analysis of the expected perceived noise impact upon the environs of Cloquet/Carlton County Airport was undertaken to determine if any burden would be placed upon the environment with respect to aircraft generated noise. The composite noise rating (CNR) methodology was utilized in performing the noise analysis. The methodology gives an indication of expected community response to aircraft generated noise. Thus, the CNR is an arbitrary scale factor describing the effect of noise stimuli on the land area or community under consideration. The CNR is dependent upon several factors, which include:

- The magnitude of the noise measured in terms of perceived noise levels expressed in PNdB, accounting for level as well as sound frequency.
- The number of occurrences per time period.
- Time of day (i.e., Day or Night).
- Direction of operation.

The calculated CNR values are usually illustrated as equivalue contours on a base map depicting zones within which are established broad categories of expected community response as described in Figure 7-1.

It is noted that this procedure does not establish precise noise standards nor does it define noise levels that are tolerable or intolerable to everyone.

7.2.1 Development of CNR Contours For Cloquet/Carlton County Airport

The noise analysis utilizes 1982 expected fleet mix and activity levels. This assumption is considered reasonable, since modification of present day aircraft, with respect to noise levels generated in airport approach and departure zones, is expected to reduce noise generation such that, despite increased activity perceived noise will not be greater than at present. Hence, 1982 would represent a peaking and describe the most pessimistic situation with respect to perceived noise levels. Such reduction in noise generated is evident in some of the newer aircraft now being produced.

Figure 7-1

CHART FOR ESTIMATING RESPONSE
OF RESIDENTIAL COMMUNITIES
FROM COMPOSITE NOISE RATING

COMPOSITE NOISE RATING FOR TAKE-OFF AND LANDINGS	ZONE	DESCRIPTION OF EXPECTED RESPONSES
Less than 100	1	Essentially no complaints would be expected. The noise may, however, interfere occasionally with certain activities of the residents.
100 to 115	2	Individuals may complain, perhaps vigorously, Concerted group action is possible. Locations of places of public assembly in this, as well as Zone 1, should be carefully studied and if required, provisions made to cope with expected noise levels.
Greater than 115	3	Individual reactions would likely include repeated, vigorous complaints. Concerted group action might be expected.

In 1982 the average daily movement level of twin engined piston and turboprop aircraft is expected to be approximately 10 movements. Other aircraft would generate noise levels too low (single engine) or operate too infrequently (business jet) to be bothersome to most people. The twin engine activity, attributable to business flying, was assumed to take place during daylight hours on working days. Runway usage based on available weather data was determined in Section 5.

Contours developed utilizing the above criteria are illustrated on the Land Use Plan (Sheet 6) which is reduced in Section 6. The most effective means of reducing noise impact is through land use controls in those areas on or surrounding the airport. In fact, when airport and community planning are coordinated, the results can be advantageous; land adjacent to the airport can be used to satisfy community requirements and at the same time land uses can be regulated and even developed in a manner compatible with airport operations.

Figure 7-2 suggests compatible land uses relative to specific CNR noise sensitivity zones. By relating those suggested uses to the particular CNR curves developed for Cloquet/Carlton County Airport, some guidance to an effective land use plan is available.

As can be seen, the 115 and 100 CNR contours do not appear. Low activity levels of noisier aircraft contribute to confining high perceived noise levels to the vicinity of the runways.

Figure 7- 2

LAND USE COMPATIBILITY CHART

FOR AREAS SUBJECTED TO AIRCRAFT NOISE

Noise Sensitivity Zones	Composite Noise Rating (CNR) Take-offs and Landings	Land Use Compatibility: Residential	Commercial	Hotel, Motel	Office, Public Buildings	Schools, Hospital Churches	Theaters, Auditoriums	Outdoor-Amphi-Theaters	Outdoor Recreational (non-spectator)	Industrial
	Less Than 90	Yes	Yes	Yes	Yes	Yes	Note (A)	Note (A)	Yes	Yes
1	90 - 100	Yes	Yes	Yes	Yes	Note (C)	Note (C)	No	Yes	Yes
2	100 - 115	Note (B)	Yes	Note (C)	Note (C)	No	No	No	Yes	Yes
3	Greater Than 115	No	Note (C)	No	No	No	No	No	Yes	Note (C)

NOTES: (A) - A detailed noise analysis by qualified personnel should be undertaken for all indoor or outdoor music auditoriums and all outdoor theaters.

(B) - Case history experience indicates that individuals in private residences may complain, perhaps vigorously. Concerted group action is possible. New single dwelling construction should generally be avoided. For high density dwellings, (apartments) construction, Note (C) will apply.

(C) - Avoid construction unless a detailed analysis of noise reduction requirements is made and needed noise control features are included in building design.

SOURCE: Development of Aircraft Noise Compatibility Criteria For Varied Land Uses, FAA Report SRDS 64-148 II, December, 1964.

The 90 CNR contour extends approximately 3,500 feet beyond the runway end and is approximately 800 feet wide at the runway. Operations on the crosswind would be too infrequent to generate a contour. Zone 1 or land within this contour can be used for most types of development. In this case because of the small areas encompassed by the contour, little or no development would be taking place within its boundaries. Hence, there is a negligible effect of noise upon the environment in which the airport is located.

7.3 Impact Upon Air Quality

The impact on air quality by an airport has been proven in a recent study* to be small. A major airport such as Washington National contributes 15% more pollutants to the atmosphere than does the surrounding community. However 90% of the pollutants generated by aircraft come from ground operations such as taxiing and holding for take-off. As has been shown, little delay is expected to be encountered at Cloquet/Carlton County Airport and therefore pollutant levels should be quite low. The low levels of pollutants are not expected to exceed the dispersal limits of the atmosphere and thus, present no serious problem.

7.4 Impact Upon Water Quality

Major items of concern with regard to water quality are the sanitary loading of the administration building, surface runoff and industrial waste contamination.

* The Potential Impact of Aircraft Emissions Upon Air Quality, M. Platt, et. al., for the EPA by Norther Research and Engineering Corporation

The administration building is presently served by a septic tank sanitation system. In planning for new construction it will be necessary to provide adequate facilities to handle peak loads. It would be anticipated that the peak load would be related to the peak hour passengers and pilots plus airport employees. In 1992, this would be approximately 34 people. It would be expected that an ordinary system with sufficient capacity could handle this load. Because the soils on and surrounding the airport have high permeability, the construction of a septic tank system drain field would require adding of soils to bring permeability to an acceptable factor which would prevent contamination of the ground water.

The construction of additional runways and buildings will increase the area of ground covered. However, only a small percentage of total airport property would be covered. Thus, no appreciable increase would be seen in surface run-off.

Drainage systems constructed during runway, apron, and hangar development should provide waste separators to remove petroleum products and sand. Thus, contamination of ground water or nearby streams and drainage ways would be prevented.

7.5 Impact Upon Ground Waters

The potential to contaminate ground water on and near the the airport site is high because of the high permeability of the soil as mentioned above. Therefore, it is important that adequate care be taken to design sewage facilities and the like of sufficient capacities to prevent contaminants from entering the ground water system.

Other considerations concerning ground waters are the possibilities of withdrawing too much via local wells or reducing recharge through covering the surface with pavement, etc., thus, increasing surface run-off.

At Cloquet this is not considered to be a problem though the demands placed upon wells at the airport will increase somewhat over the next twenty years. The demand will be considerably below well capacity. Also development in terms of impermeable pavements and structures will take place on only small portions of the total surface. Thus, little effect will occur from the development with respect to drawdown and recharge of the aquifer.

7.6 Impacts Related to Drainage

Of major concern with respect to drainage and erosion is the exposure of bare ground during periods of construction. The slopes to the east of the present airport will pose particular problems during crosswind runway construction. If sediment ponds are integrated into the grading and filling operations, sediment would be prevented from entering the Otter Creek. Construction of this runway will also require crossing of a natural drainage way connecting the area north of the airport with Otter Creek. Thus, provision will be necessary in the design of the crosswind runway to allow for free flow through this drainage way. Possible consequences, if it were blocked off, are flooding near First, Second, and Third Lakes north of the airport. If these precautions are taken serious problems related to drainage can be avoided.

7.7 Ecological Impacts

The ecological impacts of the proposed development would be minimal since the airport has existed at its present location for many years and the proposed development is relatively small compared to the local ecosystem.

West of the Cloquet/Carlton County Airport is the University of Minnesota's Cloquet Forestry Center. Although such activity is compatible with airport operations, trees growing near the airport boundaries can create obstruction hazards if they penetrate the imaginary surfaces as described in Part 77 of the Federal Aviation Regulations. To minimize the need for tree cutting the proposed crosswind was placed as far east as possible. Some tree cutting will still be necessary to provide proper approach plane clearances. Therefore, it would be of importance that airport management work closely with the Forestry Center management to insure compatibility by involving them in the designing of the crosswind runway.

7.8 Economic Impacts

The twenty year forecast indicates a growth of aviation activity at the airport. A portion of this activity will be business oriented dealing with the major wood industries in Cloquet. Some of the larger general aviation aircraft, carrying these businessmen, will now be able to operate at Cloquet/Carlton County Airport. Thus, many of the service demands presently placed on Duluth area businesses will be made to Cloquet businesses such as restaurants, taxis, and others. This would be a direct economic benefit to the community. Some secondary benefits would also be a result of the growth in activity at the airport.

7.9 Aesthetic Impacts

Replacement of old buildings and the general new development will enhance the visual appearance to the person driving or flying to the airport. It will reflect a community pride to the visitor and enhance his image of the community as a whole. Thus, a positive impact would be created in this respect.

It can therefore be said that the overall impact of the proposed development at Cloquet/Carlton County Airport on its environment will be positive.

7.10 Historical Sites

Eight historical sites are located within a fifteen mile radius of Cloquet/Carlton County Airport. They include:

- Dunlop Island in the St. Louis River, Cloquet
- Grand Portage of the St. Louis River, Jay Cooke State Park
- Northern Pacific Railroad origin site, Carlton
- Phillips "66" Station (Frank Lloyd Wright, Architect) Cloquet
- Sawyer Chapel (Chapel of Joseph and Mary), Sawyer
- Scott's Corner, Twin Lakes Township
- Fond du Lac Historic District
- Morgan Park Historic District

None of these sites are within close enough proximity to the airport to be effected by increased operations there.

8. ECONOMIC FEASIBILITY

****

The development to meet future demand at Cloquet/Carlton County Airport has been outlined in previous sections. In this section this development is phased in terms of time and priority, capital costs are projected as well as operating revenues and expenses, and the financial feasibility of this development program is determined.

8.1 Development Program

The development program was considered over the twenty year period. It is phased to coincide with three development periods, the short term (1973-1977), the medium term (1978-1982), and the long term (1983-1992). Demand determines the development phasing within the period. Figure 8-1 outlines the development schedule for the short term development period. Of high priority is the extension of Runway 17-35, 800 feet to the south. Additional parking apron would also be of priority during this period. The crosswind runway will be important from a safety viewpoint and should be constructed as soon as sufficient weather information has been gathered to determine the direction. Other items would be of lower priority and could be constructed when funds become available. Hangars would be constructed when demand arises and should be built only after firm lease agreements have been arranged.

The medium and long term development programs are shown in Figure 8-2. Most of these projects would be scheduled as demand develops. Of consideration during the medium and long term period would be the possibility of Cloquet becoming a GA weather alternate for Duluth. This of course, would hinge on the results of the weather survey. If it is the case, further extensions and widening of the mainwind and crosswind runways will be necessary.

Figure 8-1
SHORT TERM DEVELOPMENT SCHEDULE

Land	:	Acquire approximately 40 acres.
Runways	:	Extend 17-35 800 feet south Construct crosswind runway. (4000' x 75')
Taxiways	:	Construct parallel to 17-35
Apron	:	Additional 50,000 square feet to south of administration building.
Navaids	:	VASI - Main and Crosswind REIL - Crosswind MIRL - Crosswind
Hangars	:	Maintenance Hangar New T Hangars Remove Old T Hangars
Access	:	Relocate road south of airport Relocate airport access road Pave auto parking (16,500 sq. ft.)

Additional comment will be given on project priority in the Financial Feasibility section, 8.2.3.

Figure 8-2
MEDIUM AND LONG TERM DEVELOPMENT

	1978 - 1982	1983 - 1992
Runways		Widen and extend 17-35*(800' x 25') Widen and extend crosswind*(800' x 25')
Taxiways		Parallel crosswind
Apron		Additional 12,000 Sq. Ft. northwest of Admin. Building
Administration Building	Additional 500 Sq. Ft.	
Hangars	Additional T Hangars	Additional T Hangars
Access	Pave additional auto parking (10,000 sq. ft.)	Pave additional auto parking. (6,100 sq. ft.)

* To be developed if weather survey indicates need.

8.2 Financial Analysis

In this section the cost of developing and operating the airport will be indicated and recommendations made to minimize the financial burden on the County. All costs and revenues are shown in 1973 dollars for comparison purposes.

8.2.1 Capital and Fixed Costs

The development program, as outlined previously, includes several items that would be eligible for Federal aid and some that would not. Thus, as each item is described the total costs are indicated whereas the summary of development costs in Figure 8-3 indicate the expected local, State, and Federal share of these costs. Under the new ADAP program for fiscal 1974, the Federal share can be as much as 75% of the cost of certain items.

Land acquisition for the development period would be accomplished during the short term. Approximately 40 acres would need be acquired. The cost of acquiring this land is estimated as $10,000.

As mentioned, during the short term period extension of Runway 17-35 to the south will be a high priority project. The estimate for this project to include site preparation, paving and lighting is $112,000. The addition of a parallel taxiway increases the cost by $56,000.

The crosswind runway could be developed for $260,000 or $303,000 depending upon whether 07-25 or 11-29 were the alternate.

Apron expansion in the short term would approximate $13,000 for 50,000 square feet in front of the administration building.

Access would include providing a road around the south side of the airport for people living southeast of it as well as utilizing the present road east of the airport for terminal area access. The cost of developing these roads is approximated as $19,000 ($15,000 for new road south, $4,000 for new access road). Paving and developing the auto parking lot would add an additional $8,000 to capital costs.

Hangar development would include $2,500 for removing the old hangars, $168,000 for 21 T hangars and $144,000 for a new aircraft maintenance hangar. It is assumed that an adequate financial program would be set up to make hangars self-amortizing.

Medium term development calls for some administration building expansion, additional T hangars, and more paved auto parking. These improvements are estimated as costing $12,000, $58,000, and $5,500 respectively.

The long term period would most likely see the decision made as to whether the runways should be widened and extended to handle basic transport category aircraft. Such development would be done for $167,000 for the mainwind runway and $ 87,000 for either crosswind direction. Some preparation in the crosswind directions would have taken place during the initial construction.

Figure 8-3
CAPITAL DEVELOPMENT COSTS
($000)

	1977			1982			1992		
	Federal	State	Local	Federal	State	Local	Federal	State	Local
Land Acquisition	$ 7.5	$ 1.4	$ 1.0	$ -	$ -	$ -	$ -	$ -	$ -
Runways --									
17-35	84.0	16.8	11.2	-	-	-	125.4*	25.0	16.6
Alt. 1 07-25	195.0	39.0	26.0	-	-	-	65.4	13.0	8.6
Alt. 2 11-29	227.4	45.3	30.3	-	-	-	65.4	13.0	8.6
Taxiways --									
Parallel 17-35	42.0	8.4	5.6	-	-	-	-	-	-
Alt. 1 07-25	-	-	-	-	-	-	57.8	11.5	7.7
Alt. 2 11-29	-	-	-	-	-	-	89.4	17.8	11.8
Aprons	9.8	1.9	1.3	-	-	-	9.0	1.8	1.2
Administration Building	-	-	-	-	7.2	4.8	-	-	-
Hangars --									
Maintenance	-	-	144.0	-	-	-	-	-	-
"T"	-	-	168.0	-	-	58.0	-	-	190.0
Removal	-	-	2.5	-	-	-	-	-	-
Auto Parking	-	4.8	3.2	-	3.3	2.2	-	1.9	1.3
Access	14.4	2.8	1.8	-	-	-	-	-	-
TOTAL Alt. 1	$ 352.7	$ 75.1	$361.4	$ -	$ 10.5	$ 65.0	$ 257.6	$ 53.2	$225.4
TOTAL Alt. 2	$ 385.1	$ 81.4	$365.7	$ -	$ 10.5	$ 65.0	$ 289.2	$ 59.5	$229.5

* Includes Taxiway

A taxiway to parallel the crosswind would be $77,000 in the case of an 07-25 and $119,000 in the case of an 11-29.

Also during the long term period $12,000 would be spent for additional apron area and the paving of more auto parking would be accomplished for $3,200.

Additional T hangars to include paved floors and connecting taxiways would be constructed for $190,000.

As mentioned earlier, Figure 8-3 delineates the capital costs involved in the airport development program. It was assumed that additional Federal funds would be available through EDA or the Upper Great Lakes Regional Commission to allow a maximum Federal aid of 80% as being available.

More important than capital costs are the annual fixed costs associated with them. These fixed costs are associated with the debt usually necessary to finance such projects. More detail will be given in the financing program concerning such debt. Fixed costs would include the payback on the principal and interest necessary to retire debt. An interest rate of 6.5% was used to reflect current tax exempt market rates and in interest of conservancy. The life of the debt was expected to coincide with the life expectancy of the project (i.e., 20 years for buildings and 30 for pavements). Figure 8-4 illustrates the fixed costs associated with the local capital cost requirements.

Hangars are shown as a separate item since financing would be arranged as described in Figure 8-4 to make them self amortizing.

Figure 8-4
ANNUAL FIXED COSTS

	1977	1982	1992
Annual:			
Alternate 1	$ 4,000	$ 600	$ 2,700
Alternate 2	4,400	600	3,000
Cumulative:			
Alternate 1	4,000	4,600	7,300
Alternate 2	4,400	5,000	8,000
Hangar	31,300	5,800	19,000
Total Cumulative:			
Alternate 1	$ 35,300	$ 41,700	$ 32,100
Alternate 2	35,700	42,100	32,800

8.2.2 Operating Revenues and Expenses

Future revenues and expenses, due to operating and maintaining the airport, are forecast to evaluate the financial needs through the study period. At Cloquet/ Carlton County Airport, adequate records have been kept for recent years only. This makes it somewhat difficult to utilize a forecasting methodology which relies on the relationship between past financial data and airport activity. However, individual items were scrutinized and future estimates made based upon expected relationships such as the correlation between electricity consumption and field lighting and navaids.

At present, minimal revenues are derived from airport operations. In 1971 approximately $165 was obtained from lot leases, tie-down fees, electric power scales, and snow removal service. The fixed base operation contributes $3,000 to revenues through his agreement with Carlton County. An additional $2,806 was received from the Minnesota Department of Aeronautics as a reimbursement for part of the airport snow removal and maintenance costs. Total revenues for the year therefore approximated $5,971.

For that same period, approximately $10,000 in maintenance and operating expense were realized if the Secretary/Treasurer salary and approximately 75% of unallocated expenses, were attributed to Cloquet/ Carlton County Airport. These allocations of expenses appear reasonable given the nature of the two airports (Cloquet and Moose Lake), and the sophistication of the traffic at each.

Forecasting in 1973 dollars, operating expenses were forecast to increase to $15,000 in 1977 with the increase on field lighting and pavement. Additional lighting, terminal expansion, and pavement by 1982 would increase these expenses to $18,000. By 1992 such expenses would be $20,000 in 1973 dollars.

Current State policy indicates that Cloquet could be reimbursed for 2/3 of operating and maintenance expenses up to $5,000 if the runway is extended to 4,000 feet. The limit is $3,000 if the runway were left as is. Additionally, the maximum would be increased to $10,000 if a half time licensed maintenance man were hired and certain maintenance equipment requirements met. It was assumed that the $5,000 limit would be met in the first two forecast periods and the $10,000 in the final.

8.2.3 Financial Feasibility

As can be seen in scrutinizing revenue and expenses, more and more of a burden will fall upon the Carlton County taxpayer. Thus, it is necessary to determine if possible means exist to lighten this burden.

The projected Federal and State shares of the capital development costs are first studied to determine if they are realistic in light of what is available. Federal participation under the Airport Development Aid Program (ADAP) has recently been increased to 75% of eligible items. Over the twenty year period this would mean that Cloquet / Carlton County Airport could request $610,300 in Federal Aid. Under present funding, the State of Minnesota would be eligible for $602,250 per year for general aviation airport development. Thus, at this level Cloquet would be requesting approximately 4.4% of the total available over the twenty year period. Since it would be competing with all other general aviation airports in the State for a portion of the total funds available, it may be difficult at times to obtain funding. Thus, it is probable that it will be necessary for the community to supplement these funds with those from other Federal programs such as the EDA or Upper Great Lakes Commission Funds. Funds available from these other agencies would increase Federal participation to 80%.

More items of development would be eligible under these other forms of funding. A major help may be available when constructing new hangars as will be discussed below.

State participation during the development period would total $138,800 or approximately $6,900 per year. This does not include funding requested for hangar development which would presumably be financed through the State's revolving hangar fund. Present State policy has been that if a project qualifies funds will be available to provide the State's share.

As can be seen, annual fixed costs projected for Carlton County over the period would increase from approximately $4,000 in 1977 to $7,300 in 1992. Thus, total annual costs are forecast to increase from $19,000 in 1977 to $27,300 in 1992. It would be desirable to generate additional revenues at the airport to help defray some of this expense. Additionally, it may be desirable to cut back or postpone some of the proposed development until they can become more economically viable.

Because of the type of activity at the airport, it is difficult to generate revenues from traditional sources. For example the institution of a landing fee could actually curtail activity and sufficient funds would not be generated from this source to justify such a curtailment. However, a major source of revenue at many general aviation airports is in the form of a fuel flowage fee. Such a fee is in the form of a surcharge on the per gallon price of fuel sold at the airport. If such a fee were instituted at Cloquet, a rate of $0.02 to $0.03 per gallon would generate from $1,800 to $2,600 in 1977 to $4,400 to $6,600 in 1992. As can be seen this source would not generate enough additional revenues to cover projected operating and fixed expenses.

Therefore the County would have two alternatives from which to choose. One would involve subsidizing the difference as is currently the practice and the other would be to cut back on the development program to minimize fixed costs and also reduce operating and maintenance expense somewhat. Most of the first phase development program is needed to bring the airport to the general utility category. A project, which may be delayed, would be constructing the crosswind runway to its full length of 4,000 feet. If this runway were constructed to basic utility standards initially, a saving of approximately $400 per year in fixed costs would be realized. There would be some small saving in airport maintenance costs because of the reduced pavement size. The long term development program concerns itself with expansion of the runway and taxiway system to accommodate larger aircraft. The necessity of this development will be determined when adequate weather data is available. Nevertheless, this program including the parallel taxiway to the crosswind runway accounts for approximately $2,520 per year in fixed costs. The ramifications of these two suggestions are shown in Figure 8-5 which summarizes revenues and expenses.

Figure 8-5
PROFORMA INCOME STATEMENT*

	1977	1982	1992
Revenues	$ 10,600	$ 12,000	$ 19,600
Operating Expenses	15,000	18,000	18,000
Net Operating	$ (4,400)	$ (6,000)	$ 1,600
Fixed Expenses**	3,600	4,200	4,380
Net Income (Loss)	$ (8,000)	$ (10,200)	$ (2,780)

* Includes fuel flowage fee and decreased development program.
** Does not include hangars.

As can be seen, even with a cutback in the development program, some subsidy will have to be provided by Carlton County to operate and develop the airport. A peaking in this subsidy would be seen in the 1982 time frame.

Storage hangars have not been treated in Figure 8-5. Because of the major costs involved in hangar development, they should be passed onto the user as much as possible. The State of Minnesota's revolving hangar fund has the attractive feature of no interest. However, because this loan must be repaid in ten years, the monthly rentals would need be high. Thus, it would be best to utilize the fund but base rental rates on a 20 year payback which would put them in the $25 to $35 range. The difference could then be financed with long term debt which would be paid off in that time frame. Additionally, funding may be available through the EDA or the Upper Great Lakes Commission which could effectively reduce hangar costs to 20% of the total. It would be recommended that firm rental agreements be obtained prior to hangar construction.

Thus, it has been shown that although the airport will require some subsidy to operate at desired levels, with proper planning this would not be expected to be too large.

8.3 Financing Program

To finance the development program on the airport, it will be necessary to utilize some debt vehicle. Because of the necessity to subsidize airport expenses throughout the forecast period, the possibility of issuing revenue bonds is remote. However, the burden upon the community can be reduced to some extent by projected revenues. Lower interest rates than those

indicated in the previous analysis might be expected. However, to be conservative, and to plan for most contingencies, the 6.5% should be planned for. The development would be programmed to minimize the number of times the money market must be entered and to capitalize on lower rates when they occur. For instance most of the short term pavement projects might be packaged for one issue. As much of the hangar development as possible would be financed through the State hangar fund. As mentioned earlier rates would be too high if this fund alone were utilized. Therefore, rates to amortize the hangars over 20 years should be used. The difference between these rates and that needed to repay hangar fund loans would then be periodically refinanced through revenue bonds at intervals of one to two years. Again it should be emphasized that hangars should not be constructed unless firm rental agreements are obtained.

9. GLOSSARY OF ACRONYMS AND AERONAUTICAL TERMS

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AC	Air Carrier
AC 150/	The number of an Advisory Circular published by the FAA.
ADAP	Airport Development Aid Program
AFFF	Aqueous Film Forming Foam
AGL	Above Ground Level
ALS	Approach Light System
ANDE	The delay to operations summed over a year to give annual delay.
ARTCC	Air Route Traffic Control Center
ARP	Airport Reference Point
ARTS	Automated Radar Terminal Systems
ASDE	Airport Surface Detection Equipment
ASR	Airport Surveillance Radar
ATC	Air Traffic Control
ATCT	Airport Traffic Control Tower
Based Aircraft	Those aircraft based at an airport on an annual or seasonal basis are called "based aircraft"
CAB	Civil Aeronautics Board
CAT I,II,III	These define instrument landing weather conditions.
CAT I	An instrument approach procedure which provides for approaches to decision height (DH) of not less than 200 feet and visibility of not less than ½ mile or RVR 2400 (RVR 1800 with operative touchdown zone and runway centerline lights).
CAT II	An instrument approach procedure which provides approaches to minima of less than DH 200 feet/RVR 2400 to as low as DH 100 feet/RVR 1200.
CAT III	Operations with no decision height limitation, to and along the surface of the runway with external visual reference during the final phase of the landing and with a visual range not less than a value on the order of 700 feet.
CFR	Crash, Fire and Rescue Facilities
CNR	Composite Noise Rating, a measure of the reaction of people to noise.
DH	Decision Height
DME	Distance Measuring Equipment

FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FBO	Fixed Base Operator
FSS	Flight Service Station
GA	General Aviation
Glide Slope	The part of the ILS which provides vertical (descent) guidance.
HF	High Frequency
HIRL	High Intensity Runway Lights
IFR	Instrument Flight Rules - usually infers the weather when such rules must be used
ILS	Instrument Landing System
Instrument Approach	An approach to an airport, with intent to land by an aircraft flying in accordance with an IFR flight plan, when the visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude.
Itinerant Operations	All aircraft arrivals and departures other than local operations (See Local Operations).
LF	Low Frequency
Localizer	The part of the ILS which provides horizontal guidance.
Local Operations	Performed by aircraft which operate in the local traffic pattern or within sight of the tower; depart for or arrive from local practice areas (within 20 mile radius); execute simulated instrument approaches or low passes.
MALS/RAIL or MALSR	Medium-Intensity Approach Light System and Runway Alignment Indicator Lights
MDA	Minimum Descent Altitude
ME	Multi-Engine aircraft
MIRL	Medium Intensity Runway Lights
MITL	Medium Intensity Taxiway Lights
MLS	Micro-wave Landing System
MM	Middle Marker - Radio aid used in conjunction with ILS

Movements	The landing or take-off of aircraft, with either a landing or take-off counted as one movement (sometimes called operations).
MSL	Mean Sea Level
NAS	National Airspace System
NASP	National Airport System Plan
NDB	Non-directional (radio) Beacon
NIR	Non-precision Instrument Runway
O & M	Operating and Maintenance
OM	Outer Marker - Low frequency radio aid used in conjunction with ILS.
1000 & 3	A statement of ceiling and visibility (i.e., 1000 foot ceiling and 3 miles visibility
Operations	The landing or take-off of aircraft with either a landing or take-off counted as one operation (sometimes called movements).
PANCAP	Practical Annual Capacity - The annual level of operations which results in the delay level which defines annual capacity.
PAX	Passengers
PHOCAP	Practical Hourly Capacity - The movement rate which results in the delay level which defines capacity (usually an average of four minutes).
PIR	Precision Instrument Runway
RAIL	Runway Alignment Indicator Lights
RAPCON	Radar Approach Control Facility
REIL	Runway End Identifier Lights
RNAV	Area Navigation
RVR	Runway Visual Range
SALS	Short Approach Light System
SE	Single Engine aircraft
STOL	Short Take-off and Landing
T & G	Touch and Go operations as practiced, usually in training.
TACAN	UHF navigational aid (omnidirectional course and distance information).

TPHP	Typical Peak Hour Passengers
TRACON	Terminal Radar Control Facility
TVOR	Terminal VOR (See VOR)
200 & ½	A statement of ceiling and visibility (i.e., 200 foot ceiling and ½ mile visibility
UHF	Ultra High Frequency
VASI	Visual Approach Slope Indicator systems
VASI-2	VASI with two boxes
VFR	Visual Flight Rules
VHF	Very High Frequency
VOR	VHF navigational aid (omnidirectional course information)
VORTAC	Colocated VOR and TACAN navigation aids; Prefix B indicates regularly scheduled weather broadcast station.

APPENDIX A

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METHODOLOGY FOR PREPARATION OF FORECASTS

APPENDIX A

METHODOLOGY FOR FORECASTING MINNESOTA STATE AVIATION DEMAND

The forecasts of air carrier and general aviation demand at an individual airport, are related to and heavily influenced by the forecasts produced in the plan for the State Airport System[1/]. The methodology portions of the report 1/ have been composed into the following pages. For further detail on the forecasts, refer to the complete reports. 1/ 2/

For ready reference, the different forecasts will be found on the following pages:

1. Minnesota Aviation System Plan Phase II, prepared by R. Dixon Speas Associates, Inc. for Minnesota Department of Aeronautics, May, 1974.

2. Scheduled Air Transportation for Outstate Areas - Minnesota State Aviation System Plan Phase III, prepared by R. Dixon Speas Associates, Inc. for Minnesota Department of Aeronautics, May, 1974.

1. The Economic Background and Projections

This study has been conducted against a background which includes analysis of the past economic performance of Minnesota and prospects as to its future development.

Specific inputs have been obtained from the Minnesota Department of Economic Development, in terms of present manufacturing and other activity in Minnesota, reduced to the local level by way of their community profiles.

The projections of future activity in Minnesota are based on two factors. First, general analyses such as those developed by the Minnesota State Planning Agency. These include Minnesota Settlement and Land Use 1975, which projects socio-economic trends in districts of the state, based on different conditions of assumed growth. It must be pointed out that the projections in this study generally assume a continuation of existing trends. The other alternatives would provide different trends - particularly if options were developed such as the one calling for a totally new experimental city. No definitive plan exists at present for such options.

Another major input to development of this plan involves the population projections of the Minnesota Department of Health.

2. Outstate Minnesota Air Carrier Demand - Certificated Air Carrier System

The review and forecast of air carrier demand is divided into two primary parts, the activity of the certificated carriers and that of the non-certificated or commuter carriers. Certificated carriers are those holding a valid certificate of public convenience and necessity, issued by the Civil Aeronautics Board, authorizing the performance of scheduled air service over specified routes. Commuter airlines are carriers operating with exemption from CAB economic and route regulation in view of the size of the small aircraft that they operate.

Basic air carrier demand for the existing system of Minnesota certificated air carrier service points is forecast on the basis of a "top down" methodology, which essentially considers Minnesota traffic in relationship to National trends. This is a standard, generally accepted method of developing long-term forecasts of air carrier passenger demand. The basic system for which the forecasts are developed comprise the present system of commercial air carrier airports within the State of Minnesota, outside of the Minneapolis/St. Paul Metropolitan Area. The residents of Minnesota are also served by points outside of the State, most notably Grand Forks and Fargo, North Dakota; Thunder Bay, Ontario, Watertown, Brookings and Sioux Falls, South Dakota; and LaCrosse and Eau Claire, Wisconsin. However, the external points in other states do not represent specific demands for the State of Minnesota in terms of facilities and system needs. Therefore, they are excluded

from the detailed forecasts of demand.

2.1 Historical Activity

Certificated air carrier service in outstate Minnesota is almost synonymous with North Central Airlines service. Except for points near Minnesota in other states, (namely at points such as Sioux Falls and Fargo), North Central is the exclusive carrier at nine of the ten Minnesota points serviced. Prior to North Central's beginning in 1948, the primary air carrier service to Minnesota cities was provided by Northwest at Minneapolis/St. Paul, Rochester, and Duluth.

2.2 Macro Forecast - Minnesota Relative to Total U.S. Domestic Traffic

The forecast methodology used herein relates to origin-destination passenger traffic in outstate Minnesota, as a whole and establishes statistical relationships to determine future traffic levels at each point by referring various "participation" relationships to a forecast of total U.S. origin-destination passengers.

The traffic trend in most non-urban areas of the country has been toward generally lower percentages of total U.S. traffic over time. This trend has been attributable to two major trends, the dramatic urbanization of the population, and recently an increased cost for short distance air trips. Minnesota's outstate traffic growth has been impressive in view of the national trends.

The impact of fare increases and highway improvements in the period from 1967 to 1971 has been noted. While all air fares generally increased during this period, the short-haul fares (which effect most trips by virtue of both local and joint fare structures) increased more dramatically relative to the nature of the fare increase formulas.

The forecast of outstate Minnesota's participation in the total United States origin and destination traffic used in this study is based on the expectation that the trend of fare increases will continue to effect short haul trips more than long haul trips, and thus create a situation where outstate traffic growth is lower than the United States average. Also, the unusual traffic gains caused by the economic boom of the 1960's will taper off, particularly in view of the changes in the economy of the iron range, as mining changes to less labor intensive processes. The trend projection of outstate Minnesota participation is based on a straight line decline, based on the 1964-1971 participation rates, with the participation rate remaining at about 0.18 percent in 1990 and beyond. The second step applicable to this forecast approach is to develop

trends of each cities' participation in total outstate Minnesota traffic.

The U.S. forecast is based on a model which extends into the future the relationship of population, personal consumption expenditures (PCE), the percentage of PCE spent on air transportation and the average passenger trip length.

The final step of the forecast is to convert the origin and destination passenger forecast to a forecast of enplaned passengers. This is done by applying a factor based on an analysis of 1966 to 1969 data on the ratio of enplanements to origin and destination passengers, to arrive at a forecast of enplaned passengers.

2.3 Air Carrier Operations in Outstate Minnesota

In 1972, air carrier scheduled departures performed in outstate Minnesota averaged about 1,400 per station, when Rochester and Duluth are excluded, or an average of about four scheduled departures per day. The frequency increases anticipated in the future are modest because the equipment size will most likely increase as North Central substitutes DC-9 equipment on many routings where they now operate the Convair 580.

The forecast of operations is made by projecting both the aircraft utilized on routes and the number of passengers enplaned per departure. The average number of passengers enplaned per departure was relatively low in 1972 averaging from a low of two per departure at Fairmont and Worthington to 14 at International Falls (again excluding Duluth and Rochester). The enplanements per departure are also expected to increase in the future, causing slower growth in operations' increases than in the growth of enplaned passengers.

3. Minnesota Commuter Airline Potential

One of the most interesting developments relating to air service patterns that has occurred over the last several years has been the evolution of a class of carriers geared to serving small communities or special situations. These carriers operate small aircraft, without significant route regulation, and are known as commuter airlines or commuter air carriers. The commuter carriers supplement service provided by certificated air carriers, the domestic trunk carriers and the local service or regional carriers.

Commuter airlines are regulated by the Federal Aviation Administration and the Civil Aeronautics Board, but these regu-

lations are less stringent than those applied to certificated air carriers. Perhaps the biggest area of difference in regulation is that the commuter airlines are free to operate any routes that they wish to and charge whatever rates they wish to charge. In comparison, the certificated carriers operate only specific routes granted to them through certificates of public convenience and necessity and charge only those rates specifically approved by the Civil Aeronautics Board.

The commuter airlines, as a group, offer great promise in terms of the service opportunities they can provide smaller communities, particularly rural communities that are either unable to generate sufficient traffic to be of interest to the regional carriers, or which have lost regional carrier service because of the lack of sufficient traffic development, or for other reasons. However, the promise has to date been greater than the achievement. From the middle 1960's when the commuter airlines expanded greatly, until now, the record has been marred by numerous individual cases of inefficiency, insolvency and a number of accidents which have exposed the commuter airline industry to considerable criticism. There have been a significant number of commuter failures in the last several years, and Minnesota has had perhaps more than its share of such situations.

A major task of the present study was to analyze the potential for commuter service in areas of Minnesota not presently served by certificated carriers. To achieve an estimate of this potential, a model was developed to relate traffic generated in areas served by the certificated carriers and numerous variables. The following variables were tested, in terms of the ability to explain differences in traffic generated:

1. Population
2. Land Area in Square Miles
3. Total Wholesale Trade
4. Employment in Manufacturing
5. Value added in Manufacturing
6. Passenger Car Registrations
7. College Student Enrollment
8. Number of Households
9. Effective Buying Income
10. Effective Buying Income per Household
11. Percent of Households with Income of $ 10,000 or more
12. Number of Hotel/Motel Rooms
13. Approximate Distance to Minneapolis/St. Paul
14. Miles to Closest Airport
15. Quality of Service Criterion

A multivariate technique was utilized to determine the independent variables which most affect the level of enplanements. This effort showed that, although each of the variables tested have some validity in explaining variances in the level of enplanements, the best formula includes five independent variables, listed below in order of each variable's contribution to explaining the variability in enplanements.

1. Total Wholesale Trade (X_1)
2. Quality of Air Service Criterion (X_2)
3. Value added by Manufacturing (X_3)
4. Automobile Registrations (X_4)
5. Population (X_5)

The coefficients for the variables in the predictive equation which resulted are as follows:

$$Yc = 2,252 + 116.4\ (X_1) + 2662.2\ (X_2) + 24.8\ (X_3) + -1.5\ (X_4) + 0.5\ (X_5)$$

The commuter airline potential for points in outstate Minnesota that are not served directly by certificated airlines today was developed by applying the above formula to groupings of county data which were combined to comprise demand centers.

The "quality of service" index was developed by the following method. The service at each point was rated by adding one (1) point to the value scale for each thousand air carrier departures, and one for each non-stop flight to Minneapolis/St. Paul or Chicago, the major hubs in the Minnesota system. The only negative value in the equation relates to automobile registrations. This is understandable, in that it reflects the intensity of use of automobiles as a transportation mode, and the habits of auto use established in various areas. It could be argued that this term is related to the situation that exists today, and that there is a built-in bias which pre-supposes an arbitrary transportation system. This argument has some merit, but it is more conservative, and we think better to keep the negative value in the equation. It is true that these patterns may change, but it is also true that anyone attempting to establish air service will have to overcome established habits that affect travel patterns. For example, people in the Alexandria area have become accustomed to driving to Minneapolis/St. Paul when making a long distance air trip, or talking on the phone at length to Minneapolis/St. Paul for business purposes, rather than driving or flying there to conduct their business. These habits will not change overnight, and it will be some time before a commuter airline

might see a change in these habits. It would be unwise to disregard them in estimating potential.

A factor which must be kept in mind in applying this formula is that it is a much better predictive equation in large communities than in smaller communities. The potential for over or under estimating in the smaller traffic points is considerable, and no other variables could be found for inclusion in the analysis which explained the variance found in those demand centers with lower levels of traffic. This is indicative of the tentative nature of a strictly scientific approach to the problem of estimating traffic potential at small communities.

Those points which presently appear to have sufficient demand to justify commuter air service are as follows:

- Alexandria
- Baudette
- Detroit Lakes
- Winona
- Grand Rapids
- Marshall
- Ortonville
- Willmar
- Roseau

Estimating commuter airline potential beyond the near term is more subjective inasmuch as by 1995 there will no doubt have been many changes which will affect the use of commuter air carrier service in the study area. These changes will be a combination of economic factors, the growth of population, and possible changes within the air transportation industry itself.

Since many of the changes mentioned cannot be accurately forecast, the forecast of commuter activity beyond 1975 is somewhat tentative. Consequently, the estimate for 1980 should be reviewed periodically if significant changes in structure occur in the cities shown.

Forecasts of commuter potential beyond 1980 are highly speculative. After this period, there will no doubt be many changes which will affect the use of commuter service in the study area. These changes will be a combination of economic factors, the growth of population, and possible changes within the air transporation industry itself. However, in view of the results of interviews conducted with the various Minnesota Chambers of Commerce and travel agents, Speas Associates considers that the following cities, in addition to those cited earlier, should be regarded as being potential commuter points by 1990.

- Albert Lea
- Austin
- Breckenridge
- Crookston
- Faribault
- Hallock
- Little Falls
- Montevideo
- Owatonna
- Wadena

In addition to normal commuter operations, as forecast previously there is a possibility that a number of special services may develop over the course of the forecast period. An example of a special service is that provided by New Ulm Aviation between New Ulm and St. Paul-Holman Field. This service is essentially operated to satisfy the needs of a single major manufacturing company. This type of service is excluded from the present study because it is not subject to detailed analytical techniques, and because it does not have a serious impact on facility needs.

4. Minnesota General Aviation Demand

The specific objective of this general aviation forecast is to project the volume of aircraft and movements, by individual county to the year 2000, so that the facilities planning described elsewhere in this report may be carried out with maximum understanding of future demand.

In terms of the general background philosophy governing the forecasts discussed in this section, it has been hypothesized that the general economic and political factors which have influenced the development of aviation in Minnesota in the past will continue to do so in the future; in particular, Speas Associates assumes that ample resources and planning action will preclude any greater number of constraints upon the growth of general aviation in the State than has existed in the past. It is well recognized throughout the aviation community that Minnesota has been a leader in providing facilities for and capitalizing upon general aviation. We presume that this leadership will continue in the future although, as other parts of the country become aware of general aviation's role in the economic and recreational aspects of their areas, Minnesota's margin of leadership may diminish.

In this manner, the relatively "unconstrained" future demand may be understood; the extent to which this demand is accommodated is a function of the priorities given available funds for facilities, construction and operation, and airspace. In those phases of the planning process that follow this forecasting step, knowledge of the "unconstrained" demand is important in determining the extent to which the corollary needs can or will be satisfied.

Moreover, this projection of general aviation demand is based primarily on a forecast of the most basic demand element, aircraft owners whose addresses fall within the State and its counties. There are two ways of recording general aviation aircraft geographically - one relates to the number of owners residing in any given area and the other is the number of aircraft based at airports in an area.

In that the present airport and facilities system has grown up in response to many factors, some of which do not correspond to actual owner demand and convenience, there are many anomalies in the system which lead people to locate their airplanes at airports which are not necessarily most convenient with respect to where they live or work. For the future we believe it is better, from a planning point of view, to project demand in terms of owners and where they live, rather than by extending the trend of based aircraft within a given county or region. The major problem in adopting this approach is that, in the near term, the forecast of registrations reflects potential demand rather than actual demand, and cannot therefore be compared specifically with the actual volume of activity reported by the airports within the study area. The forecasts produced in this study represent potential demand assuming the system of airports matches the demand. As a practical matter, however, the planning and system alternatives in this study are based on a trend between the actual and potential demand to reflect a gradual elimination of the constraints and anomalies in the current airport system.

4.1 History of General Aviation Demand

The primary demand element used in this study is eligible registered aircraft. For the U.S., the registered general aviation fleet has grown more than two-fold between 1957 and today. The national fleet stood at 154,000 as of year end 1971. 1/ With but few exceptions during this period the growth pattern has been relatively smooth and undisturbed by the ups and downs of the economy. 2/

1/ In 1970, the FAA changed its reporting and record keeping procedures, thus disturbing the continuity of time series comparisons.

2/ This is not to say that the sale of new aircraft has not been influenced by economic conditions; in fact, the manufacturers have just gone through one of the worst periods in their industry's history, while the total fleet has continued to grow. It is apparent that many aircraft which might otherwise have been retired in the past two years remained active in the fleet, so that a majority of the new aircraft sales were net additions to the fleet.

During the same time period the number of aircraft registered to owners living in the State of Minnesota has grown by a slower rate than that for the U.S. This lower than average growth rate is misleading in that it reflects, in one sense, the fact that the rest of the U.S. is catching up with Minnesota. Thus, outstate Minnesota's share of the national fleet has dropped from 1.78 percent in 1957 to 1.28 percent in 1971. Both of these points will be developed more completely in the discussion of the forecast which follows.

Without regard to the relative decline, the absolute values indicate a strong demand base for general aviation activity in Minnesota which is higher than the national average. For example, registrations per 1,000 population in Minnesota have remained at approximately 1.4 times the national level throughout the 1960's. This fact is of major importance in encouraging an optimistic forecast of the future growth in Minnesota's private flying.

4.2 Forecast Summary

In 1957 there were 1,164 aircraft registered to owners living in the study area. In 1971 this number was in excess of 1,900 reflecting a growth rate somewhat slower than the rest of the U.S. This lower than average growth rate is forecast to continue based on forecasts of population and economic activity. By 1982 it is forecast that there will be 2,723 aircraft in the area and by 1992 about 3,741.

During 1971, there were more than 1.3 million landings or takeoffs (movements) completed in the study area. This measure of activity is forecast to grow to 2.1 million by 1982 and to 2.9 million by 1992.

This brief summary of an extremely detailed forecast is intended to demonstrate the substantial growth anticipated for the years ahead as a backdrop against which each of the individual forecast elements may be viewed.

4.3 Description of the Active Fleet

As mentioned above, there are two ways of looking at the active fleet; by the number of owners whose addresses lie within the study area, or by the number of aircraft based at airports situated in the area. This is important since the two do not coincide in many cases considering the constraints of where an owner may keep his aircraft. Since we have elected to base our planning on registered aircraft, the trends must be established using past ownership data.

4.4 Forecast of Aircraft

The forecasting methodology employed herein is that of applying a forecasting model. A "top-down" approach is the basis for this model, wherein the relationship between the study area aircraft and the total United States is extrapolated, based on a comparison of relative growth rates for various socio-economic indicators. Several regressions were developed and a consensus adopted through evaluation of each. One important regression was that employing comparative aircraft to population ratios. Annual registrations for the State and United States are expressed in terms of registrations per 1,000 population. The difference between the two ratios has varied only modestly. Largely because of the simplicity of approach and the reasonableness of its results, the basic control forecast used in the "top-down" process was developed by extending these differences into the future. Consequently, given a forecast of U.S. and Minnesota populations and a projection of the U.S. general aviation fleet, the State registrations were found. Then, based on historical data available by development region, the study area registrations were determined.

The basic forecast of the U.S. total fleet, against which this "top-down" approach was applied, comes from an extension of the forecasts developed in previous work completed by Speas Associates. 1/ This national forecast is based upon an econometric model which projects the active fleet through 1980. For the purpose of this study, the previous forecast was extrapolated to the year 2000, using independent forecast input variables (principally, population and economic activity) while retaining the basic forecast equation.

The United States population data were developed by the Bureau of the Census while the outstate Minnesota figures were supplied by the Minnesota Department of Health. The actual decline of population is an extremely significant forecast input. The registrations per 1,000 population for the United States and Minnesota are expected to continue to climb, whereas today in Minnesota there is about one aircraft registered per 1,000 population. By holding constant the difference relative to the United States ratio, there are projected to be about 2.8 by the end of this century.

The basic finding of this part of the analysis is that the lower than average growth of the State and, therefore, the study area will continue, but at a reduced differential relative to the United States. That is, the study area will grow from about 1,966 aircraft in 1971 to around 3,741 by 1992, the primary target year for this forecast.

1/ Speas Associates, The Magnitude and Economic Impact of General Aviation, 1968-1980, dated 1970.

4.5 Aircraft Type Category Distribution

The study area forecast was distributed three ways; first, by aircraft type; second by county; and finally by county by aircraft type. Each of the economic development region totals were summed from county level data and projections.

The first step, the aircraft type distribution, is based upon anticipated national trends and previously established regression models relating economic factors to demand for various model types.

Airport planning requirements are a function of the total number of aircraft. However, they are also a function of the composition of the total by type category. Through extrapolation based on usage trends in the area plus expected developments nationally, the total forecast fleet was distributed among the various type categories.

The primary shift in the distribution in the overall study area fleet will occur between single engine and multi-engine aircarft. Today approximately 90 percent of the study area fleet is single engine; whereas, with the increasing affluence and business use of general aviation, the attraction of multi-engine equipment will reduce this percentage to approximately 75 percent by 1992. Toward the end of the forecast period about 3 percent of the fleet will be turbojet, a factor of considerable importance in planning facilities. Expected rapid growth in the rotor category will increase its share to about 3 percent.[1/]

1/ Prior to the development of a forecast relative to the character of general aviation activity for the ten regions of the state in aggregate, an appraisal of the past, present and projected socio-economic environment of the study area was undertaken. This definitive effort was completed consonant with a review of Speas Associates national forecast of general aviation by aircraft type. The net effect of this coordination was to relate national trends of aircraft types to those needs at the local level commensurate with the study area's socio-economic environment.

There are several underlying assumptions in the forecast of registrations by type. In specific terms, Speas Associates expects single engine 4+ place and over piston aircraft to increase at a more rapid rate than the 1 - 3 place single engine piston aircraft. The logic in this reason lies in the assumption that single engine piston aircraft are being utilized for training purposes and, as the public becomes more affluent, the larger, more expensive aircraft will be utilized for pleasure flying. In the multi-engine piston category, aircraft weighing 12,500 pounds or less are expected to experience rapid growth. These trends are expected on a national basis in view of the continued expansion of usage of multi-engine piston aircraft weighing less than 12,500 pounds. On the other hand, manufacturers are not manufacturing large multi-engine piston general aviation aircraft and, as a result, the size of the national fleet is diminishing.

As the public becomes more aware that light turboprop aircraft meets the increasing desire of an affluent society for more comfortable

transporation, it is expected that there will be an increase in their growth nationwide.

The increase in the turbojet category is attributable to a number of factors, perhaps the most important of which is the growing popularity of this type aircraft in corporate aviation uses. Also contributing to this growth is the increasing affluence of the public and the businessman's desire and need to make his travel as fast and convenient as possible.

Finally, helicopters are becoming more economical and popular for a wide range of activities and, therefore, this category is expected to experience continued growth throughout the forecast period.

4.6 Geographic Distribution

In terms of establishing capacity requirements for aviation facilities in a region, the number of aircraft located there is the key factor. It is a different matter, however, when trying to determine where, within the region, the facilities should be located. In this case the key factor is the accessibility of the facilities to the owner and, consequently, it is where the owners live that is important in the planning process. This is the basis on which the county (and region) forecasts were made. The forecast distribution of owners by county is a function of relative changes in the socio-economic structure of the study area, projections of which were supplied to the extent available by the State. The only basic forecast data available to Speas Associates on a county level basis was population. After considerable investigation, the effects or influences of income and employment shifts were considered minimal relative to the forecast effort.

As referenced in the background discussion, it is obvious that the greatest concentration of aircraft owners is in the metropolitan areas and surrounding counties. It is also these counties which are forecasted to increase as a percent of the total study area in years to come. Since the forecasted shift is strictly a function of the socio-economic input data supplied by their local agencies, the shift does coincide with the State's and Metro Council's plans, objectives and expectations, even though in other areas of the nation, population dispersion is expected rather than continued concentration in the largest urban areas.

The only region projected to increase its share of the State total is the Central Region, which will grow from 6.0 percent to 6.9 percent. This reflects the spread of the Twin Cities urban area into the contiguous counties in the Central Region and the rapid growth of St. Cloud. All of the other nine regions will decline relative to the State total. There is no attempt to indicate that all regions will not experience significant growth. The lowest growth of all the regions will be a 1.6 times increase by 1992 compared with the base year.

4.7 Forecast of Aircraft Types by County

The final step in the aircraft distribution process is accomplished by holding the totals established in the above two discussions as constant and following the logic outlined below:

a. Determine the present percent distribution of aircraft by type within each county. (Analysis of FAA Master Aircraft Register tape).

b. Compare this with the distribution for the entire study area and determine the present variance between the county and study area.

c. For each forecast year, trend the variance to one half of today's level.

d. Subtract the adjusted county variances from the projected study area distribution to obtain county forecast.

e. Apply the county forecast to the previously estimated total county aircraft to obtain the projection by county and type of aircraft.

Nine type categories were produced for each of the forecast years for each of the counties, over 3,600 forecasts.

4.8 Forecast of Total Aircraft Movements

A comprehensive analysis of general aviation activities requires forecasting the movements (landings and takeoffs) of aircraft in the study region. Aircraft movements are essential in determining total runway requirements and other related facilities.

The methodology developed by Speas Associates is that of applying a movements per aircraft hour ratio to the average number of hours flown in a year by each type of aircraft. This approach not only reflects variations in usage between areas of the country, it also reflects variations by aircraft type. Actual 1971 annual hourly utilization data are shown in Figure 1.

The county and study area utilization data were forecast largely based on past trends, increasing opportunities to fly with regard to availability of time and funds, increased acceptance of general aviation flying, and an overall decrease in the average age of the United States fleet, implying improved reliability and capability. A general, but modest increase in the United States fleet utilization is projected. The study area projection was based on a factoring approach using the U.S. forecast and assuming that Minnesota flying activity will continue to be somewhat less than the United States average, probably attributable to less favorable weather as shown in Figure 2.

Having determined the hours of utilization, a projection of movements per year per aircraft in the fleet was computed using known ratios of hours to activity as shown in Figure 3. This projection with the forecasted fleet figures, by aircraft type and county, produced a forecast of the movements to be conducted in aircraft owned by fliers whose addresses fall within each of the designated study counties. Each of these aircraft type and county movement projections were summed for the total region and study area projection of movements. Figures 4 and 5 show regional totals of aircraft registrations and aircraft movements.

As mentioned previously, the philosophy of portraying future unconstrained demand means that the forecast may not (indeed, in this case does not) conform precisely to present day activity levels within each region and county. If activity were reported for only those aircraft registered to owners living in the Central Region, the 1971 movements would have been 156,000 whereas the actual was about 226,000 the difference attributable to spill-over from the Metropolitan Region. However, the planning process has as one of its objectives the minimization of this type of inconvenience and anomaly and it was, therefore, decided to associate future activity with the owners' county of residence. Consequently, the volume of activity shown for each county and region in this forecast is that which is associated with the registered aircraft owned by people in each and not related to the present distribution of based aircraft.

Figure 1

STUDY AREA AND UNITED STATES

COMPARISON OF AIRCRAFT UTILIZATION

1971

Aircraft Type	Hours per Aircraft per Year	
	Study Area	United States
Single Engine Recip. 1-3 Seats	157	218
Multi-engine Recip.		
Under 12,500 lbs.	268	246
Over 12,500 lbs.	169	319
Turboprop		
Under 12,500 lbs.	370	563
Over 12,500 lbs.	701	624
Turbojet	426	430
Rotor	287	360
Other	52	105
Total	166	199

Source: FAA, Master Aircraft Register, 1 January 1971
Speas Associates Analysis.

Figure 2

STATE OF MINNESOTA

PROJECTED AIRCRAFT UTILIZATION

Aircraft Type	Actual 1971	1977	1982	1987	1992	2000
Single Engine Recip.						
1-3 Seats	157	165	175	180	180	180
4+ Seats	149	160	185	195	195	195
Multi-engine Recip.						
Under 12,500 lbs.	268	265	265	270	270	270
Over 12,500 lbs.	169	160	-	-	-	-
Turboprop						
Under 12,500 lbs.	370	450	460	470	490	500
Over 12,500 lbs.	701	700	700	680	650	650
Turbojet	426	435	450	450	450	450
Rotor	287	280	280	280	290	290
Other	52	50	50	50	50	50

Source: FAA, Master Aircraft Register Tape.
Speas Associates Analysis.

Figure 3

STATE OF MINNESOTA

PROJECTED MOVEMENTS PER AIRCRAFT

Aircraft Type	Average Movements Per Hour
Single Engine Recip.	
1-3 seats	5.39
4+ seats	3.73
Multi Engine Recip.	
Under 12,500 lbs.	2.08
Over 12,500 lbs.	1.75
Turboprop	
Under 12,500 lbs.	2.16
Over 12,500 lbs.	1.44
Turbojet	1.44
Rotor	4.33
Other	4.39

Figure 4

PROJECTED AIRCRAFT REGISTRATIONS

IN MINNESOTA

Region	Base 1971	Forecast 1977	1982	1987	1992	2000
Northwest	144	164	180	204	229	277
North	62	75	87	101	118	148
Northeast	383	434	487	550	621	755
West	214	252	291	339	392	495
North Central	111	132	150	172	196	244
West Central	202	233	263	298	340	420
Central	224	304	389	498	644	896
Southwest	149	170	189	213	239	288
South Central	204	246	286	339	398	507
Southeast	273	334	401	473	564	729
Total	1,966	2,344	2,723	3,187	3,741	4,759

SOURCE: FAA Master Aircraft Register Tape, 1971 (Base)
Speas Associates Analysis (Forecast).

Figure 5

STUDY AREA

PROJECTED AIRCRAFT MOVEMENTS BY REGION

Number of Take-offs and Landings (000)

Region	Base 1971	Forecast (000) 1977	1982	1987	1992	2000
Northwest	105	123	143	164	181	215
North	39	51	65	78	89	112
Northeast	278	326	389	446	493	591
West	155	188	232	273	308	385
North Central	84	102	122	142	158	193
West Central	139	166	204	235	264	323
Central	156	221	303	397	504	694
Southwest	107	127	150	171	190	225
South Central	145	179	224	269	311	390
Southeast	185	235	302	365	430	551
Total	1,393	1,718	2,134	2,527	2,928	3,679

SOURCE: Speas Associates Analysis and Forecast.

APPENDIX B

AIRCRAFT ACTIVITY

APPENDIX B
AIRCRAFT ACTIVITY

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The airport has kept a log to record transient aircraft visiting the airport. This log was supplemented with a survey of some of the more frequent users. A compendium of users and types of aircraft is shown below:

Company	Type Aircraft	Remarks
Continental Oil Co.	King Air, Queen Air, Jet Star	Would like longer runway.
Ulland Brothers, Inc.	Cessna 206	Taxiway and ramp improvements needed.
Potlatch,Inc.-Northwest Paper Division	Cessna 320	Runway extension needed.
Mazor Corp.	Bonanza, Baron, Queen Air	Runway extension needed.
Nekoosa Paper Co.	Beech Baron	
S. D. Warren Paper Company	Traded up from B-18	No longer can use airport.
Howard Hawkins	Aztec	
Univ. of Minnesota	King Air, Aztec	
Minn. Highway Patrol	Cessna 172	
Beloit Iron Works	MU-2	
Campbell Plumbing And Heating	Aero Commander 680	
Newitt Machine	C-421, Merlin 2 B	No longer can use airport.
Wyandott Chemical Company	King Air's	
P. H. Gladfelter Glass Company	King Air	
Peavey Company	Jet Commander	No longer can use airport.
Marine Johnson Machine Company	Aztec	
Jack Frost Hatcheries	Aztec	

Company	Type Aircraft	Remarks
Purina	Falcon	Travels with Jack Frost.
Canadian Park Hill Pipeline Company	Cessna 421	
Appleton Wire Co.	Beech Baron	
Appleton Coated Paper Company	Cessna 401	