Skagit Regional Airport
Land Use Compatibility Study

Prepared for

Skagit County
Port of Skagit County
City of Burlington

By

Reid Middleton

728 134th Street SW, Suite 200
Everett, WA 98204
425/741-3800 (Fax 425/741-3900)

May 2000

File No. 23-00-004

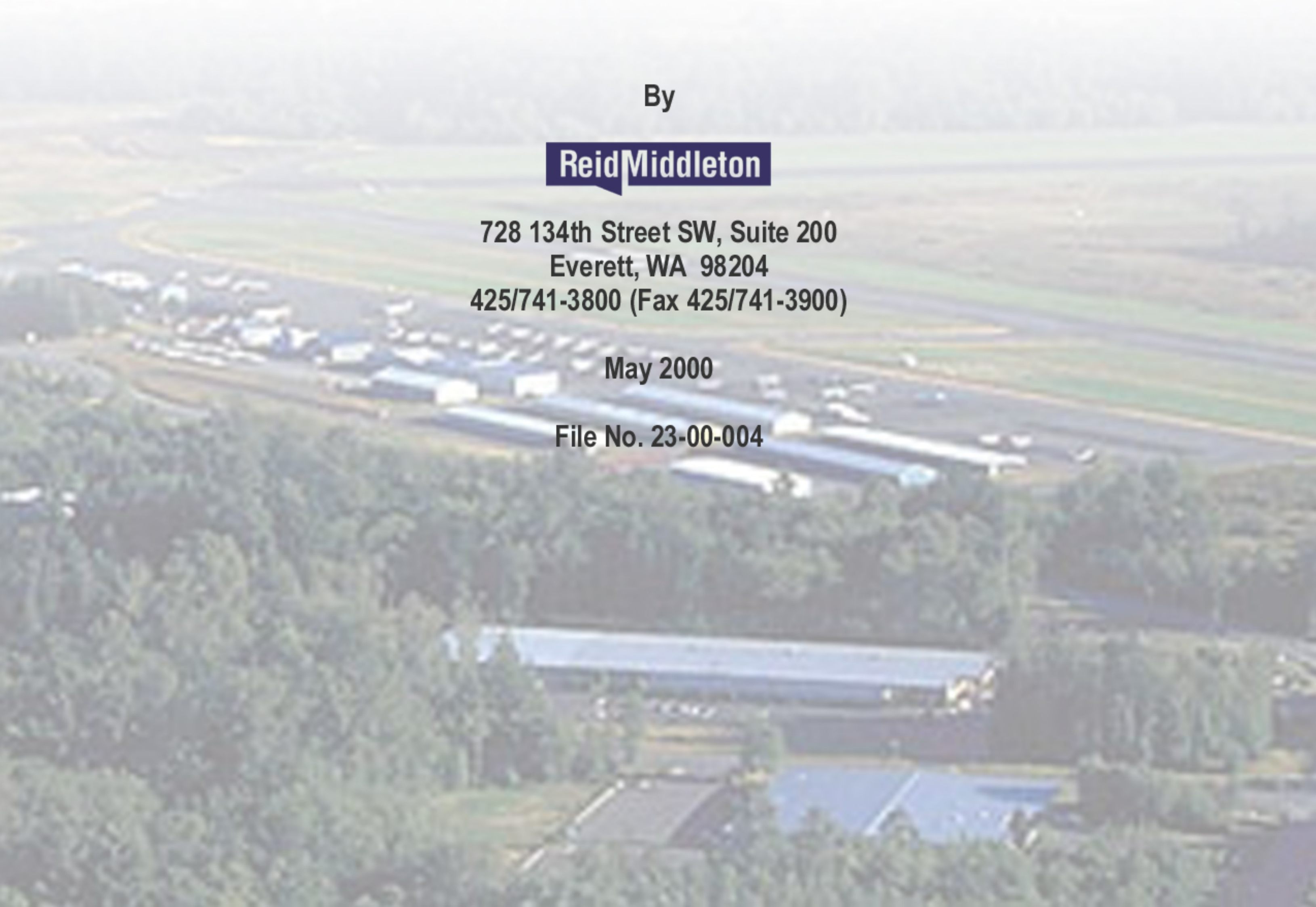


Table of Contents

EXECUTIVE SUMMARY

This land use compatibility study evaluates three issues that could threaten the ability of Skagit Regional Airport to provide general aviation services: the safety of both pilots in flight (height) and the general public on the ground (safety), as well as adverse impacts to the surrounding area generated by aircraft noise. Skagit Regional Airport has been aware of the height and noise issues for some time and has taken steps to protect the airport from encroachment. The Skagit Regional Airport Master Plan Update, dated June 1995 (master plan) provides an airspace study and noise contours, establishing 'footprints' that depict areas of concern. Further, the County has adopted Airport Environs Ordinances governing the construction of buildings and tall towers/structures and noise sensitive land uses within these areas. This study utilizes the height and noise findings of the master plan and anticipates no added impacts to the community.

Through the Washington State Growth Management Act, the State has recognized the benefits of aviation and requires every city and county having a general aviation airport in its jurisdiction to discourage the siting of land uses that are incompatible with the airport. The law specifies that policies to protect the airport be implemented in the comprehensive plan and development regulations. Further, the law requires that an airport land use compatibility technical assistance program be established and made available to local jurisdictions. The Washington State Department of Transportation Aviation Division (WSDOT) has offered this technical assistance by adopting Airports and Compatible Land Use, February 1999 (guidelines). The guidelines address height, noise, and safety issues. Recommendations provided for height and noise compatibility issues concur with those provided in the master plan and utilized in this study. The recommendations provided for safety compatibility introduce a third 'footprint.' Of the three compatibility issues, these safety zones impose the most restrictive conditions on surrounding land use and introduce new impacts to the surrounding Bayview Ridge community.

The WSDOT guidelines provide safety compatibility recommendations in a two-step process. First, safety zones are established based on historic, nationwide, aircraft accident data. Second, WSDOT assigns land uses and densities to each safety zone. Land uses and densities are intended to reflect the risk of an accident occurring (i.e., higher risk – less dense, less risk – greater density). This study utilizes the prescribed WSDOT safety zones with the following exception:

- Safety zones for Runway 10-28 (long runway) have been enlarged to account for future precision approaches.

This study utilizes the prescribed WSDOT land uses and densities as follows:

- Local conditions at Skagit Regional Airport were reviewed to determine where and how aircraft actually fly, and the impact this has on potential crash locations and frequency. Local conditions consider the fleet mix, traffic patterns, applicable flight rules, and nighttime operations.

- Land use within each WSDOT safety zone remained unchanged.

- A range of densities was recommended to reflect the potential crash locations and frequencies anticipated for local conditions. The range is based on densities obtained from the WSDOT and CALTRANS[1] documents.

This study provides recommended safety compatibility criteria and three figures that may be used for implementing adopted policies: Noise Contours, Airport Airspace Plan, and

[1] CALTRANS refers to the Airport Landuse Planning Handbook prepared for the California State Department of Transportation Aeronautics Division, prepared by Hodges and Shutt, December 1993. This is the source document for the WSDOT guidelines.

Accident Safety Zones. The criteria and figures have been developed to preserve the utility of the Skagit Regional Airport while taking into consideration the economic impacts of providing a high degree of compatibility. In theory, virtually sterilizing the area around the airport may provide the highest degree of compatibility, but such a choice would come with other costs to the local community (from underutilized infrastructure, lost taxes, etc.).

Compatibility issues are integrally related with risk management and Skagit County, the City of Burlington, the Port of Skagit County, and members of the community must ultimately decide the level of protection to be afforded the airport.

INTRODUCTION

The County, City of Burlington, and Port of Skagit County (joint planning committee) are operating under a cooperative agreement to develop a Comprehensive Plan for Growth Management for the Bayview Ridge Urban Growth Area (UGA). As part of this planning effort, the logical boundary for the Bayview UGA is being re-evaluated. Established in conjunction with the Skagit County Comprehensive Plan (June 1997), the original Bayview Ridge UGA boundary included the Skagit Regional Airport property as well as neighboring residential, commercial, industrial and undeveloped areas. The Bayview Ridge UGA was challenged and appealed to the Western Washington Growth Management Hearings Board (WWGMHB). In January 1998, the WWGMHB issued its Final Decision and Order (Case No. 97-2-0060c) which invalidated the Bayview Ridge UGA with the exception of Port of Skagit County owned properties. In September 1999 an interim ordinance (#17568) was adopted by the County that extended the Bayview Ridge UGA boundary to include additional neighboring industrial property, established use restrictions and requirements for public facilities and services, and committed the County to conducting a subarea plan for the UGA (Figure 1). In September, the WWGMHB as part of a Stipulation and Order rescinded their earlier order of invalidity for the Bayview Ridge UGA provided that the provisions of Interim Ordinance #17568 remain in effect.

At this time, the County, City and Port may find it desirable to further expand the UGA boundary to include neighboring residential properties including: the Skagit Golf Country Club, other existing developments, and some vacant parcels within the UGA. Such amendments to the UGA may impact the Skagit Regional Airport as current land use designations will likely change, allowing for an increase in development activity. The joint planning committee desires to provide guidance to the County on policies governing land use near the airport as well as on development ordinances that may be needed to protect against encroachment.

In addition, through the Washington State Growth Management Act, the State has recognized the benefits of aviation and requires every city and county having a general aviation airport in its jurisdiction to discourage the siting of land uses that are incompatible with the airport. The policy to protect airport facilities must be implemented in the comprehensive plan and development regulations as they are amended in the normal course of land use proceedings.

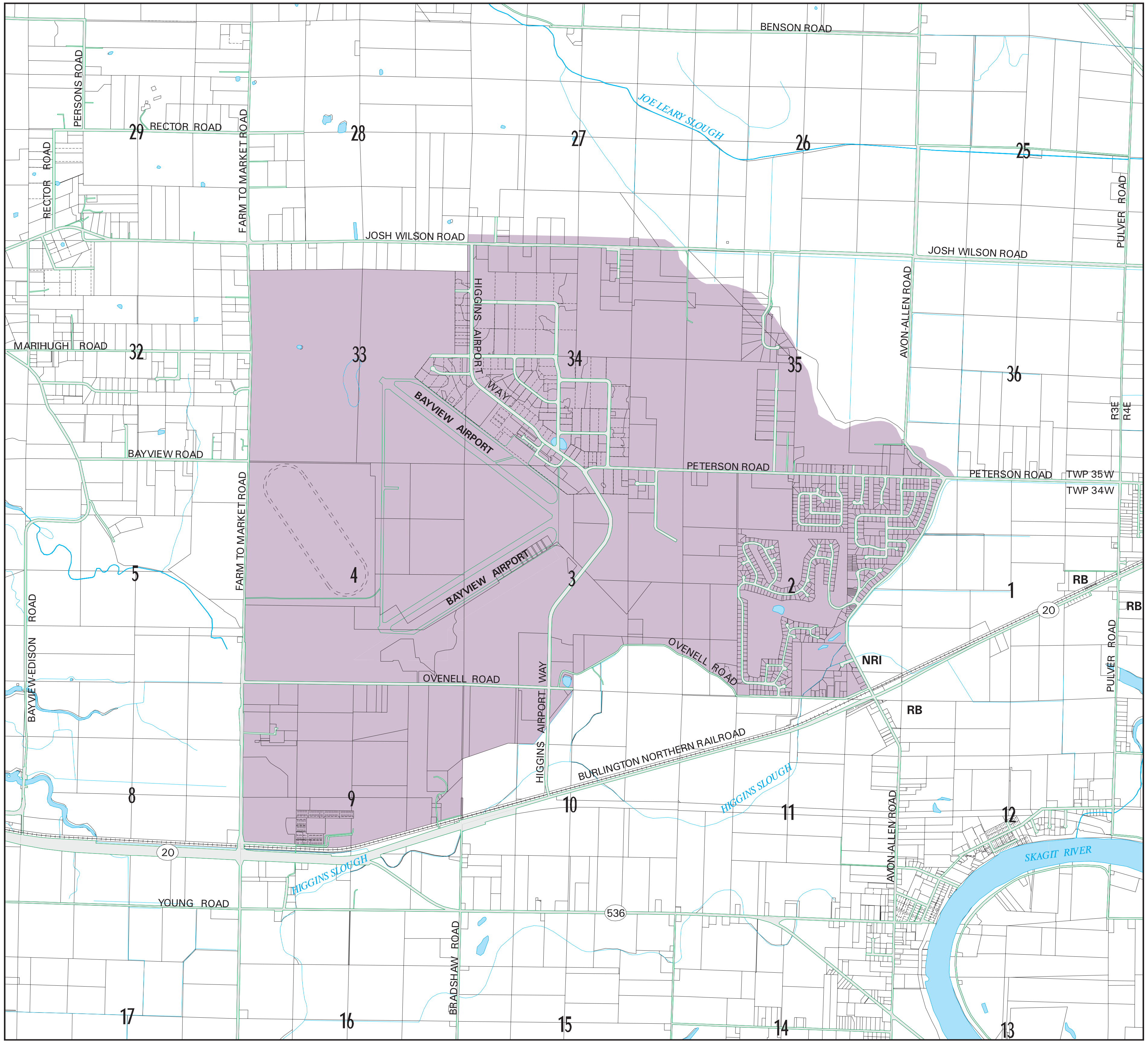
It is the intent of this study to offer guidance to the joint planning committee regarding the prevention of incompatible land use development and the preservation of the utility of the Skagit Regional Airport. If compatibility between an airport and its surroundings is to be achieved, designation of appropriate land uses is essential. This is particularly true in a developing area as good planning now can avoid significant conflicts later.

LAND USE COMPATIBILITY

Why Plan?

The purpose of land use planning within the airport environs is to protect the airport from encroachment of incompatible land uses. Airports are unique facilities in that they occupy large parcels of land, have unique siting requirements, produce noise, and generate complex safety concerns all of which impact neighboring communities. Because of their unique characteristics, airports cannot be easily relocated. Airports are also essential public facilities that provide the community with business opportunities and general aviation services. The goal of land use compatibility planning is to maintain long-term compatibility between neighboring land uses and to preserve the airport.

Compatibility issues generally focus on three areas: the safety of both pilots in flight (height)



LEGEND

Location of Subarea Plan

August 5, 1999

N NE E SE S SW W NW

0 mi. 1/2 mi. 1 mi.

Skagit County Mapping GIS Geographic Information System

BAYVIEW RIDGE SUBAREA PLAN

and the general public on the ground (safety), as well as the adverse impacts to the surrounding area generated by aircraft noise (noise). Any of these three issues could threaten the ability of the airport to provide general aviation services. Should height hazards or obstructions to airspace be constructed on land outside the airport boundary, there is potential that a safe approach, as designated by the FAA, may no longer be available and the functionality of the airport may be in question. Unlike height hazards, neither safety of the public on the ground or noise issues directly impact the airport's functionality. Rather, these issues are believed to threaten airport viability as public opinion may swing, determining the airport to be a nuisance and ultimately causing the airport to restrict operations or cease to exist. Noise is often perceived to be the most significant of the adverse impacts associated with airport activity and mitigating noise impacts is not new. While not as prevalent, safety of the public on the ground may also pose a threat to airport viability. Should an aircraft accident in a developed area occur, it hardly ever results in pressure to eliminate the conflicting land use; rather the pressure inevitably is to restrict or close the airport.

Authority to Plan

Laws and statutes enacted by the U.S. Congress and the Washington State Legislature typically set general requirements and the authority for administrative adoption of more detailed regulations and policies. With respect to airports, most of the administrative actions are taken by the Federal Aviation Administration and the Washington State Department of Transportation Division of Aviation. Land use compatibility planning around general aviation airports is required pursuant to RCW 36.70.547 and RCW 36.70A.510 which amended the Growth Management Act. The law requires every city and town, code city, charter city and county having a general aviation airport in its jurisdiction to discourage the siting of land uses that are incompatible with the airport. These laws and regulations establish the basis for *local* development of airport plans, analyses of airport impacts, and enactment of compatibility policies. It should be stressed that promotion of compatible land uses must be accomplished at the local level as local governments have the authority to direct land use development.

Planning Methods

There are many approaches that legitimately can and have been taken in the preparation of airport land use compatibility plans. No two airports are the same, and planning analyses must consider the location and configuration of the airport as well as the extent of the noise and safety impacts associated with each facility. Federal and state agencies have an interest in preserving the existing system of airports, and to that end, have offered various guidelines and models that can be used to assess airport impacts. This report recognizes these available tools and has adapted them to meet the local conditions of the Skagit Regional Airport and the surrounding Bayview community. In addition, the Skagit Regional Airport Master Plan Update (June 1995) provides forecasts of future use and portrays ultimate development conditions for the airport. To plan for future conditions the models and templates utilize the master plan's forecast data for the year 2013. A summary of the guidelines used in preparing this land use compatibility plan is provided in Table 1. There are key variables within these guidelines (or input to the models) that may be modified to reflect local conditions. These are summarized below and are provided to serve as a broad overview to the selected guidelines. For complete discussions of models and their input, the reader is referred to the model/report cited. Actual conditions at the Skagit Regional Airport are described in the following section, Airport Information.

Variables Affecting Land Use Compatibility

<u>Type of Aircraft</u>

There are many different types of aircraft varying in wingspan, speed and carrying capacity as well as in the number and type of engines. The noises emitted by different types of aircraft have distinctly different properties. Similarly, these various aircraft all have specific performance abilities and limitations. The INM Noise model follows the operation characteristics for each type of aircraft using the airport, and generates noise contours representative of the cumulative fleet mix.

Research on aircraft accidents has also revealed different crash patterns for single-engine airplanes as opposed to multi-engine airplanes. Crashes involving multi-engine airplanes, including jets, are comparatively more stretched out and scattered than those for single-engine airplanes. The primary cause for this pattern being the ability of the pilot to continue flying, if only for a limited distance, with the one remaining engine.

Table 1 - Land Use Planning Strategies

Category	Objective	Guidelines
Noise	Minimize the number of people exposed to frequent and/or high levels of airport noise.	FAA Integrated Noise Model (Skagit Regional Airport Master Plan Update, June 1995)
Height	Avoid development of land use conditions which, by posing hazards to navigation, can increase the risk of an accident.	FAA FAR Part 77, Objects Affecting Navigable Airspace (Skagit Regional Airport Master Plan Update, June 1995)
Safety	Minimize the risks associated with potential aircraft accidents to both people and property on the ground and enhance the chance of survival of aircraft occupants.	Airports and Compatible Land Use, February 1999, WSDOT Aviation Division and Airport Land Use Planning Handbook, CALTRANS Division of Aeronautics, December 1993

Types of Flight Rules

Several factors define where the flight routes at a particular airport are flown. The most fundamental factor is the distinction between visual and instrument procedures. Visual Flight Rules (VFR) operating procedures apply at airports when weather conditions permit pilots sufficient time to see a runway for landing as well as to see and avoid other aircraft in flight and obstacles on the ground. The minimum visibility requirement for VFR flight is three statute miles from the airport. Instrument Flight Rules (IFR) procedures are required when the weather conditions are below the minimums for VFR operations and pilots must rely on the aircraft's instrumentation and electronic navigational aids. The type of flight rules present at the airport directly relates to noise, height and safety compatibility issues.

The imaginary surfaces of FAR Part 77 (defining height hazards) are comprised of a series of horizontal, transitional and approach surfaces. These vary based on the type of operating procedures established for the airport. Safety and noise hazards are directly related to where airplanes fly. If an instrument approach is present at an airport, the variety of flight track locations are generally more limited than may be present at an airport operating only under visual flight rules. Crash patterns indicate that IFR arrival accidents tend to occur farther from the end of the runway than VFR accidents.

Flight Patterns

In addition to the flight pattern variations caused by VFR and IFR procedures, flight patterns vary based on the type of aircraft, peculiarities of an airport's layout, wind coverage, and the position of a runway relative to major destinations. Different types of aircraft typically fly different flight patterns and the fleet mix at an airport will influence its unique pattern of flight tracks. Prevalent wind coverage dictates flight patterns in that pilots need to takeoff and land facing into the wind. Thus, runway utilization is in large part determined by wind direction. Often times pilot preference is a key factor as they execute a flight pattern that allows them quickest access to a fixed base operator (FBO), hangar, or their ultimate destination.

AIRPORT INFORMATION

Information for this compatibility study was obtained from the Skagit Regional Airport Master Plan Update, dated June 1995 (master plan). The master plan includes a determination of the anticipated growth to be experienced at Skagit Regional Airport and an evaluation of the ability of the existing facilities to accommodate this demand. The master plan uses a 20-year planning period that extends through 2013 and provides a recommended development plan showing the future needs of the airport. Existing and future conditions are depicted on the Airport Layout Plan (ALP) prepared as part of the master plan and included here as Figure 2. The master plan encompasses a wide range of issues and follows the general format recommended by FAA guidelines (Advisory Circular 150/5070-6, Airport Master Plans, June 1985). As such, the primary emphasis of the master plan is on airport activity and short and long-term facility needs of the airport. An evaluation of off-airport land use is also included in the master plan but is limited to noise impacts generated by the airport.

As previously discussed, there are several variables related to the airport that impact the compatibility of surrounding land use. The master plan was reviewed for these aspects that affect off-airport land use compatibility and applicable excerpts are provided below. In some cases, master plan data was augmented with input from airport management and this information is also summarized. For more detailed information on the Skagit Regional Airport and for methods and assumptions used in generating the data, the reader is referred to the actual master plan.

Runway Data

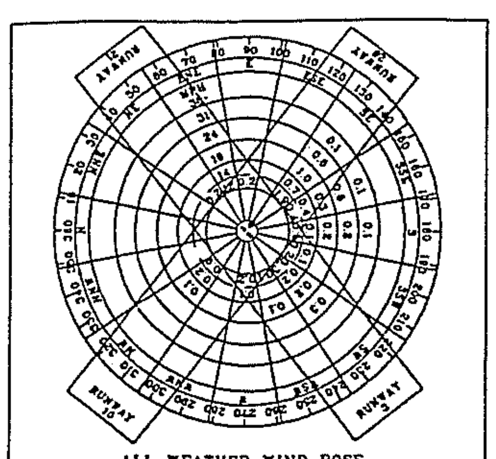
Skagit Regional Airport has two runways. Runway 10-28 serves as the primary runway. It is 5,475-feet long by 100-feet wide and provides Medium Intensity Runway Lights (MIRLs) and a Visual Approach Slope Indicator (VASI). The second runway, Runway 4-22, was recently reconstructed (previously designated Runway 3-21) and is 3,000-feet long by 60-feet wide. Runway 4-22 serves as the crosswind runway for general aviation aircraft and currently has no lighting system.

Forecast of Operations

The forecasts of future aviation activity show that the types of activity at the airport are not expected to change dramatically in the 20-year planning period. The airport will continue to function as the key aviation facility serving Skagit County. Aircraft operations are forecast to increase, however, with general aviation aircraft operations forecast to increase about 90 percent, from 55,230 annual take offs and landings in 1992 to 100,100 operations by 2013. The composition of the fleet that is flying these operations is expected to continue to reflect national general aviation trends. Future general aviation operations will continue to be dominated by business oriented flight, private transportation, flight training or other forms of noncommercial activity using single- and multi-engine piston aircraft. Air cargo operations are also forecast to increase from 4,300 operations in 1992 to 7,300 operations in 2013. Commercial passenger service is forecast to be feasible during the planning period with airlines expected to offer about 13 flights per day to and from the Seattle-Tacoma International Airport by the year 2013.

Table 2 summarizes the 1992 actual and 2013 forecast operations by aircraft type. The data shows that in 1992**,** single-engine aircraft made up approximately 90 percent of all operations with multi-engine and larger aircraft making up approximately 8 percent of the operations. By 2013, these percentages are expected to change with single-engine aircraft making up 80 percent of the operations and multi-engine and larger aircraft making up approximately 19 percent of all operations. It should be noted that Skagit Regional Airport is a non-towered facility and as such does not keep daily counts of aircraft activity. Rather, aircraft operation counts used in the master plan analyses are based on airport management estimates.

Critical aircraft is a designation used by the FAA defined as the most demanding aircraft expected to perform 500 annual itinerant operations at the airport (itinerant means they are leaving the traffic pattern as opposed to a local operation that refers to touch and go patterns used in flight training). Though not a replacement for the actual fleet mix at an airport, the critical aircraft is often used by planning professionals to provide a sense of who uses the facility. The critical aircraft for Runway 10-28 is the Swearingen Metroliner, forecast to be the Boeing 727-100 in the year 2013. The Boeing aircraft is anticipated not for the purposes of

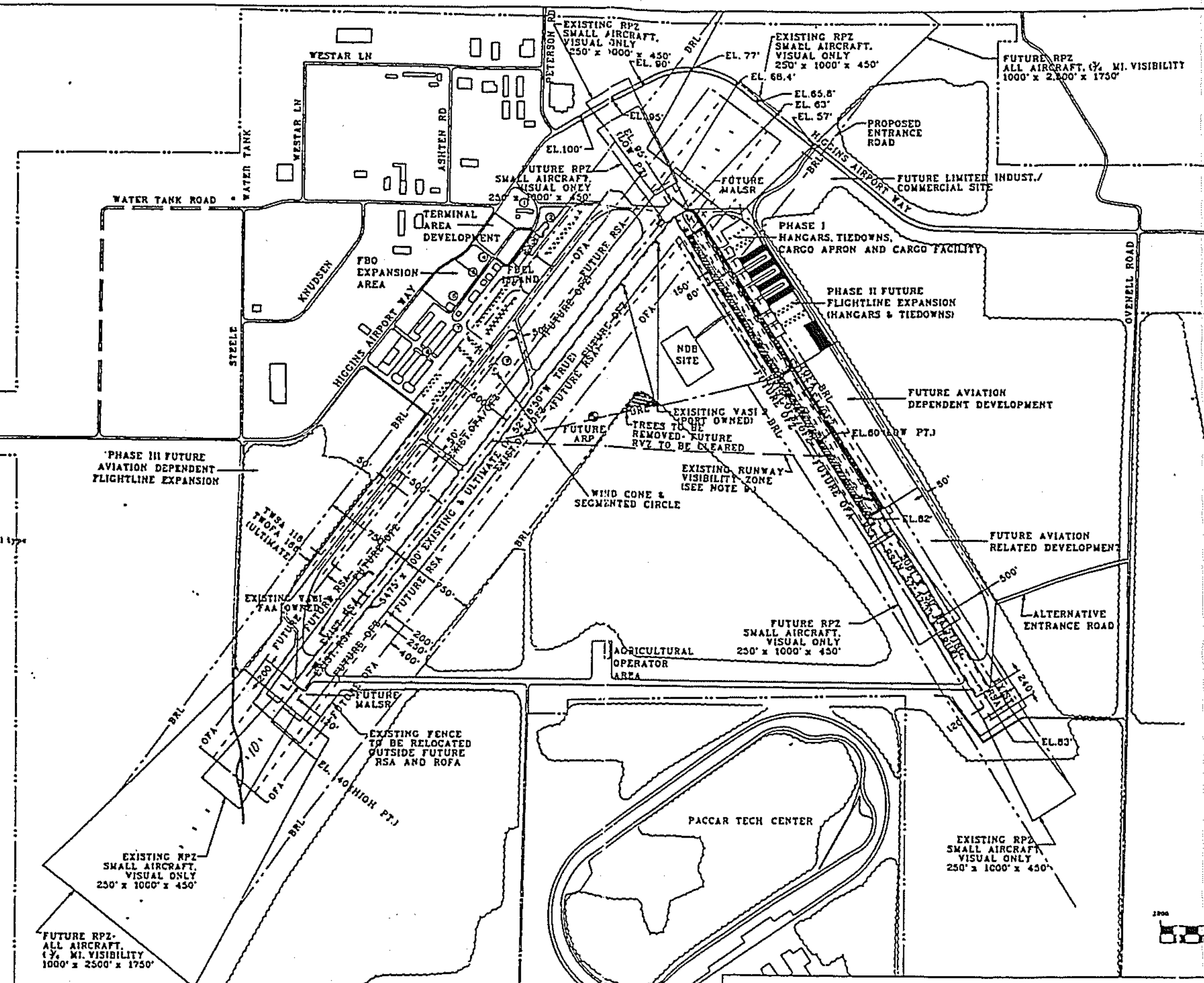


ALL WEATHER WIND ROSE

	WIND COVERAGE (PERCENT)	
	12 MPH OR LESS CROSS WIND	15 MPH OR LESS CROSS WIND
RUNWAY 10/28	96.9	99.29
RUNWAY 3/21	95.6	97.7

Notes:

1. Current pavement strength on Runway 10-28 is 19,000 lbs. for aircraft with single-wheel landing gear. Since the maximum certificated take-off weight of aircraft currently utilizing this runway is 12,500 lbs. or less, and these aircraft are predominantly configured with single-wheel type landing gear, this is considered adequate. Future critical aircraft for Runway 10-28 are forecast to be in the ARC B-III category. These aircraft are predominantly configured with dual-wheel landing gear and range in weight from 34,000 to 86,000 lbs. (with an average of 60,000 lbs.). It is recommended the pavement strength for Runway 10-28 be strengthened to 60,000 lbs. dual-wheel landing gear to accommodate the average B-III aircraft.
2. Current pavement strength on Runway 3-21 is 17,000 lbs. for aircraft with single-wheel type landing gear. Since the maximum certificated take-off weight of aircraft currently utilizing this runway is 12,500 lbs. or less and these aircraft are predominantly configured with single-wheel landing gear, this is considered adequate. Since these conditions are not expected to change during the forecast period, strengthening of Runway 3-21 is not required.
3. It is recommended that Runway 3-21 be shortened from 5,081 feet to 3,000 feet, and narrowed from 150 feet to 60 feet. This will accommodate 95% of forecast critical aircraft expected to utilize this runway (i.e., small aircraft with less than 10 pax seats)
4. It is recommended that the existing fence located beyond the far end of Runway 28 be relocated outside the future RSA and ROFA. Removing this obstruction will provide the full required RSA and ROFA for Runway 10-28.
5. A precision instrument approach to Runway 28 may be possible, however the FAA has yet to make a final determination in this regard. It is recommended that the airport protect for a future precision instrument approach to Runway 28.
6. The latitude and longitude coordinates for existing runway ends were obtained from data provided by the Defense Mapping Agency. This data was collected during GPS field surveys for NAS Whidbey Island and are based on the North American Datum of 1983 (NAD 83). The coordinates for the future runway ends of Runway 3-21 were calculated using the existing data points and a true runway bearing of N 37 37' 33" E. These are considered accurate for planning purposes only and should not be used for any other purpose, including construction and/or navigation. The existing Airport Reference Point (ARP) was taken from NOAA's Airport/Facility Directory (1/6/94) and is based on the North American Datum of 1983 (NAD 83). The future ARP was calculated using the existing ARP and employing the methodology outlined in Advisory Circular 150/5300-13 Appendix 3 for calculating a new ARP.
7. The existing critical aircraft for Runway 10-28 is the Swearingen Metroliner (ARC B-I). Future critical aircraft for Runway 10-28 is forecast to be the Fokker F-27 (ARC B-III). However, since the airport currently meets most of the design standards for ARC C-III aircraft, it is recommended the airport protect for C-III aircraft such as the Boeing 727-100. It is recognized this type of aircraft would more than likely not utilize the facility until well beyond the 20-year planning period. For the purposes of pavement design, forecast critical aircraft with an ARC of B-III should be used.
8. The BRL shown for Runway 10-28 allows for a 35 foot high building. The BRL for Runway 3-21 allows for a 20 foot high building. That portion of the BRL shown from Runway 28's RPZ to the south side of Runway 3-21's BRL allows for a 20 foot high building.
9. The existing Runway Visibility Zone (RVZ) has been calculated using the methodology outlined in Advisory Circular 150/5300-13 (page 64) and connects the centerline midpoints of the two existing runways. The ultimate configuration of Runway 3-21 shifts the RVZ to the north. The FAA requires the RVZ to be clear of objects in order for planes to see and be seen from both runways.



APPROVAL BLOCK

Signature	
AIRPORT SPONSOR	
Signature	
Title	Date
FEDERAL AVIATION ADMINISTRATION	
Signature	
Title	Date
STATE	
Signature	
Title	Date

GRAPHIC SCALE

1200 600 300 0 600 1800

(IN FEET) 1 inch = 600 ft.

DECLARED DISTANCES

	RW 10	RW 28	RW 03	RW 21
EXISTING				
LDA	5475	5475	5081	5081
ASDA	5475	5475	5081	5081
TORA	5475	5475	5081	5081
TODA	5475	5475	5081	5081
FUTURE				
LDA	5475	5475	3000	3000
ASDA	5475	5475	3000	3000
TORA	5475	5475	3000	3000
TODA	5475	5475	3000	3000

FACILITIES IDENTIFICATION TABLE

LEGEND	BUILDING USE
1	AIRPORT MAINTENANCE
2	AIR CARGO BUILDING
3	ARFF BUILDING
4	FBO
5	FBO
6	FBO
7	FBO
8	HANGARS
9	EQUIPMENT BUILDING
10	TERMINAL/PORT OFFICE BLDG.

AIRPORT DATA TABLE

DESCRIPTION	EXISTING 10-28	FUTURE 10-28	EXISTING 03-21	FUTURE 03-21
AIRPORT TERMINAL CODE	75/3	SAME	SAME	SAME
AIRPORT ELEVATION	140'	SAME	140'	SAME
ARP COORDINATES (SEE NOTE 6) LAT.	N 48°28'10"	N 48°28'10.84"	N 48°28'10"	N 48°28'10.84"
LONG.	W 122°25'14"	W 122°25'14.29"	W 122°25'14"	W 122°25'14.29"
MAGNETIC DECLINATION	22°E SOURCE:1973 USGS	SAME	22°E SOURCE:1973 USGS	SAME
MEAN MAX. DAILY TEMPERATURE	73.1°	SAME	SAME	SAME
AIRPORT REFERENCE CODE (ARC)	B-I	C-III	A-I	B-I
NPIAS SERVICE LEVEL	UTILITY	TRANSPORT	UTILITY	UTILITY
NPIAS ROLE	GA	COMMERCIAL	GA	SAME
TERMINAL NAVAIDS	NDB BEACON	NDB, ILS/GPS LOC, BEACON	NDB, BEACON	SAME

LEGEND

DESCRIPTION	EXISTING	FUTURE
AIRPORT PROPERTY LINE		
PAVEMENT (ASPHALT)		
ON-AIRPORT BUILDING		
DRAINAGE FEATURES		
BUILDING RESTRICTION LINE	— BRL —	— BRL —
OBJECT FREE AREA	— OFA —	— OFA —
OBJECT FREE ZONE	— OFZ —	— OFZ —
RUNWAY SAFETY AREA	— RSA —	— RSA —
CONTOURS		
SECURITY FENCING		
AVIGATION EASEMENTS		

RUNWAY DATA TABLE

RUNWAY IDENTIFICATION		EXISTING 10-28		FUTURE 10-28		EXISTING 03-21		FUTURE 03-21	
RUNWAY PERCENT GRADIENT		0.84%		SAME		0.28%		0.40%	
RUNWAY PERCENT WIND COVERAGE		90.4% (ASSUMED 15 MPH)		SAME		95.6% (ASSUMED 12 MPH)		SAME	
RUNWAY PAVEMENT TYPE		ASPHALT		SAME		ASPHALT		SAME	
RUNWAY PAVEMENT STRENGTH (IN 1000 LBS)		19 SWL (SEE NOTE 1.)		60 DWL SEE NOTE 1.)		17 SWL (SEE NOTE 2.)		SAME (SEE NOTE 2.)	
RUNWAY LENGTH/WIDTH		5475' x 100'		SAME		5081' x 150'		3000' x 60' (SEE NOTE 3.)	
RUNWAY SAFETY AREA	REQUIRED	6956' x 120'		7475' x 500'		6081' x 120'		3480' x 120'	
	ACTUAL	5956' x 120'		7475' x 500' (SEE NOTE 4.)		5401' x 250'		3400' x 160'	
OBJECT FREE AREA	REQUIRED	5955' x 250'		7475' x 800'		5541' x 250'		3400' x 260'	
	ACTUAL	5966' x 250'		7475' x 800' (SEE NOTE 4.)		6561' x 250'		3400' x 250'	
RUNWAY LIGHTING		MIRL		MIRL		NONE		SAME	
RUNWAY END		10	28	10	28	03	21	03	21
RUNWAY APPROACH CATEGORY		(VISUAL CIRCLING NP))	VISUAL	PRECISION	PRECISION (SEE NOTE 6.)	VISUAL	VISUAL	SAME	SAME
RUNWAY APPROACH SLOPE	PART 77 REQUIRED	20:1	20:1	15:1	34:1	20:1	20:1	SAME	SAME
	ACTUAL	20:1	20:1	60:1	60:1	12:1	20:1	20:1	20:1
RUNWAY MARKINGS		VISUAL	VISUAL	PRECISION	PRECISION	VISUAL	VISUAL	SAME	SAME
RUNWAY END CORDINATES (SEE NOTE 6.)	LAT.	N 48°28'40"	N 48°28'08"	SAME	SAME	N 48°27'40"	N 48°28'07"	N 48°27'50.56"	N 48°28'06.96"
	LONG.	W 122°26'51"	W 122°24'44"	SAME	SAME	W 122°25'49"	W 122°24'46"	W 122°25'27.37"	W 122°24'50.26"
INSTRUMENTATION AND APPROACH AIDS		NDB	NDB	MALSR	MALSR	NONE	NONE	SAME	SAME
VISUAL AIDS		VASI-4	VASI-2	SAME	SAME	NONE	NONE	SAME	SAME
AIRPORT REFERENCE CODE (ARC) (SEE NOTE 7.)		B-I		C-III		A-I		B-I	
CRITICAL AIRCRAFT		SWERINGEN METRO		BOEING 727-100		CESSNA 172		BEECH KING AIR 90	
WINGSPAN		46.3'		108.0'		36'10"		45.9'	
WEIGHT		12,500 LBS		150,000 LBS		2,300 LBS		10,000 LBS	

W&H PACIFIC

3025-112th Avenue N.E.
P.O. BOX C-97304
Bellevue, WA 98009-9304
Phone (206) 827-0220 Fax (206) 822-5541
Planning Engineering Surveying
Landscape Architecture Environmental Services

PORT OF SKAGIT COUNTY
SKAGIT REGIONAL AIRPORT

AIRPORT LAYOUT PLAN

BURLINGTON WASHINGTON

SCALE: 1 INCH EQUALS 600 FEET | PROJECT NO. (3-0611-0601) | DRAWING FILE NAME: SKAG-72.DGN

DESIGNED BY: SCA CHECKED BY: ____
DRAWN BY: LB PLOT DATE: 6/15/95

DATE	BY	REVISIONS	CK'D	APPR.

Figure 2

providing air carrier service to the public, but rather, because it is anticipated that a large aircraft service facility may locate at the airport.

The critical aircraft for Runway 4-22 is the Cessna 172, forecast to be the Beech King Air 90 in the year 2013.

Table 2 – Operations by Aircraft Type

Aircraft Type	1992 (Actual)	1998	2003	2013
Single-Engine Piston	49,762 (90%)	60,200 (79%)	68,500 (80%)	87,500 (80%)
Multi-Engine Piston	2,872 (5.2%)	3,800 (5%)	4,300 (5%)	5,500 (5%)
Turbine/Turbo-Prop	1,215 (2.2%)	1,450 (2%)	1,670 (2%)	2,200 (2%)
Commercial Service	0	9,600 (13%)	9,600 (11%)	8,600 (8%)
Heavy Repair	0	120 (0.1%)	370 (0.4%)	3,500 (3.2%)
Rotorcraft	276 (0.5%)	300 (0.4%)	380 (0.4%)	470 (0.4%)
Other	1,105 (2%)	650 (0.8%)	750 (1%)	930 (1%)
TOTAL	55,230 (100%)	76,120 (100%)	85,570 (100%)	108,700 (100%)

Source: Exhibit 4.16 Skagit Regional Master Plan Update, June 1995

Runway Protection Zone

The runway protection zone (RPZ) is trapezoidal in shape and is centered upon the extended runway centerline. It begins 200 feet beyond the permanent runway threshold. The RPZ dimensions are functions of the aircraft using the runway, type of operations (visual or instrument), and visibility minimums. Existing and future RPZ dimensions are provided in Tables 3 and 4, respectively.

Table 3 - Existing Runway Protection Zone Dimensions

Dimension	Runway 10	Runway 28	Runway 4	Runway 22
Length	1,000 feet	1,000 feet	1,000 feet	1,000 feet
Inner Width	250 feet	250 feet	250 feet	250 feet
Outer Width	450 feet	450 feet	450 feet	450 feet

Source: Exhibit 3.9 Skagit Regional Master Plan Update, June 1995

Table 4 - Future Runway Protection Zone Dimensions

Dimension	Runway 10	Runway 28	Runway 4	Runway 22
Length	2,500 feet	2,500 feet	1,000 feet	1,000 feet
Inner Width	1,000 feet	1,000 feet	250 feet	250 feet
Outer Width	1,750 feet	1,750 feet	450 feet	450 feet

Source: Exhibit 7.2, Airport Layout Plan, Skagit Regional Master Plan Update, June 1995

Approaches

At the current time there is one published approach into the airport. The airport's Non-Directional Beacon (NDB) provides a basic circling non-precision instrument approach for Runway 10-28. The master plan states that the FAA recommends the Port plan, and protect, for instrument approach capability to Runway 10-28. With expected minima of less than 3/4 mile visibility and a decision height of 200 feet, this would correspond to a precision instrument runway with a 50:1 approach slope.

Traffic Patterns and Wind Coverage

Both Runway 10-28 and 4-22 utilize a standard left-hand traffic pattern. Traffic pattern altitude is 1,140 Mean Sea Level (MSL) or 1,000 feet Above Ground Altitude (AGL). Skagit Regional Airport is a non-towered facility and as such does not provide air traffic control. The airport does, however, provide UNICOM service that allows pilots arriving and departing the airport to talk with UNICOM station operators who may provide advisory information on the airport. Most common would be for pilots to rely on published aeronautical charts and facility directories to determine standard practice at the airport, speaking with UNICOM station operators to supplement this information.

As a non-towered facility, traffic patterns are largely based on pilot preference and wind coverage. Pilots will generally fly into the wind for take-offs and landings but will vary their traffic pattern depending on their ultimate destination. Airport management has observed that predominant traffic patterns are to the south. They believe this is largely based on the flight's origin or destination being the Seattle vicinity or the San Juan Islands.

Wind coverage also dictates which runway is to be used. Wind coverage for Runway 10-28 is 99.4 percent for winds up to 15 mph, and 98.9 percent for winds up to 12 mph. This means that on Runway 10-28, large aircraft can land 99.4 percent of the time and small aircraft can land 98.9 percent of the time. Airport management has observed that Runway 10 and Runway 28 are each used equally with a slight favoring of Runway 10 (60% RW 10, 40% RW 28). Runway 4-22 serves small aircraft only and has a wind coverage of 95.6 percent for winds up to 12 mph (wind rose data was provided for Runway 3-21 but it is anticipated that there will be little change for the reconstructed Runway 4-22). While this data shows that small aircraft can use Runway 4-22, 95.6 percent of the time, airport management has estimated that Runway 10-28 is used for 95 percent of all operations with Runway 4-22 used for only 5 percent of all operations.

Surrounding Land Use

The Port of Skagit County manages property surrounding the Skagit Regional Airport based on its master plan. This includes all aviation related facilities (runways, taxiways and support facilities) and existing airport safety areas and protection zones. Beyond the limits of the airport, existing land use within the Port's boundaries consists of Aviation Related and Industrial. The industrial category is further divided to provide for 'limited' and 'heavy' industrial uses. Though not all inclusive, typical users in the light industrial area include a deli, safety supply company, seed company, tug boat manufacturing, and air cargo operations. The Port's heavy industrial area is currently undeveloped with the exception of the Olympic Pipeline facility (refinery storage). Finally, much of the Port of Skagit property is either in open space, wetlands, meadows or trees.

There is a variety of existing land uses surrounding the Port of Skagit County property. To the west, and adjacent to the airport facilities, is an area of industrial land use that houses the Paccar Technical Center. Further west, beyond the Farm to Market Road is low density agriculture. South of the Port's boundaries are industrial uses and agricultural designated properties. In the heavy industrial area south of Ovenell Road users include Puget Sound Energy (tank farm), Lignotech, and Washington Alder. Properties immediately north of the Port's boundaries are low density rural land uses with agricultural operations further north, beyond the ridge. To the east, the Port's boundaries are buffered by light industrial land use (approximately ¼ section in width) followed by residential. This residential area, as well as residential to the northeast is relatively undeveloped (again, approximately ¼ section to ½ section in width). Further east is high density residential and an existing golf course and country club. The developed area extends east to the Avon-Allen Road. The majority of the residential lots in the area appear to be approximately 7,500 square feet in size with some larger lots in the range of 15,000 square feet to 20,000 square feet in size.

COMPATIBILITY POLICIES

The individual categories of airport impacts and the recommended compatibility policies and associated criteria are discussed below. For each compatibility category, four features are outlined:

- *Compatibility Objective.* The objective to be sought by establishment and implementation of the compatibility policy.
- *Measurement.* The scale on which attainment of the objectives can be measured.
- *Compatibility Strategies.* The types of strategies which, when formulated as compatibility policies, can be used to accomplish the objectives.
- *Basis for Setting Criteria.* The basis upon which the respective compatibility criteria have traditionally been established.

To a large extent this data was obtained from the Airport Land Use Planning Handbook, December 1993, prepared for the CALTRANS Division of Aeronautics by Hodges and Shutt. For informational purposes, the discussion from this document pertaining to formulating airport land use compatibility policies is included as Appendix A.

Noise Compatibility

<u>Objective</u>
The objective of developing a noise compatibility plan is to minimize the number of people exposed to frequent and/or high levels of airport noise.

<u>Measurement</u>
This report relies on the findings of the Skagit Regional Airport Master Plan Update, June 1995. The master plan calculated noise contours using the Federal Aviation Administration (FAA) Integrated Noise Model (INM), Version 3.10, for traffic volumes forecast for the year 2013 (Appendix B). Ldn noise levels are depicted by a series of noise contours superimposed on a map of the airport and its environs (Appendix B, Exhibit 8.2). These levels are calculated for the designated points on the ground from the weighted summation of the effects of all aircraft operations. Assumptions in the model include a continuation of existing traffic patterns and activity levels that include a commuter service airline (see Airport Information, Forecast of Operations).

<u>Compatibility Strategies</u>
The basic strategy for achieving noise compatibility in the airport vicinity is to limit the development of land uses that are particularly sensitive to noise. The most acceptable land uses are ones that either involve few people (especially people engaged in outdoor activities), or generate significant noise levels themselves (such as other transportation facilities or industrial uses).

<u>Recommended compatibility criteria:</u>
1. No residential within the 65 Ldn contour.
2. Encourage use of 55 Ldn as maximum for residential land uses.

<u>Basis for Setting Criteria</u>
The FAA guidelines for noise impacts state, where noise levels are below the 65 Ldn level, all uses, including residential areas are compatible. Between 65-75 Ldn, residential uses are generally unacceptable and require special sound insulation techniques to mitigate the impacts. Criteria for other land uses are established in a manner consistent with this starting point. The overall scale should be adjusted to reflect ambient sound levels and the community's previous exposure to noise.

Height Compatibility

<u>Objective</u>
The objective of developing a height compatibility plan is to avoid development of land use conditions which, by posing hazards to flight, can increase the risk of an accident occurring. The particular hazards of concern are:

- Airspace obstructions; and

- Land use characteristics which pose other potential hazards to flight by attracting birds or creating visual (smoke, glare, particulate, etc.) or electronic interference with air navigation.

<u>Measurement</u>
This report relies on the findings of the Skagit Regional Airport Master Plan Update, June 1995. The master plan calculated a set of imaginary surfaces governed by the regulations set forth in the Federal Aviation Regulations (FAR) Part 77, Objects Affecting the Navigable Airspace (Appendix C). These imaginary surfaces establish a three-dimensional space in the air above the airport (Appendix C, Exhibit 7.4). Whether a particular object constitutes an airspace obstruction depends upon the height of the object and its proximity to the airport. Any object that penetrates these imaginary surfaces is considered an obstruction and may affect the aeronautical use of the airspace.

Other potential hazards to flight (bird attraction, smoke generation, etc.) are primarily measured simply in terms of their distance from the airport and/or its normal traffic patterns.

<u>Compatibility Strategies</u>
The basic strategy for achieving height compatibility and protecting airport airspace is to limit building and land uses that pose a hazard. Smoke or particulate emitting uses should be avoided within the normal traffic patterns of the airport.

<u>Recommended compatibility criteria:</u>

1. Airspace Obstructions: Limit heights of objects in accordance with Part 77 criteria. Buildings, antennas, other types of structures, and trees should be limited in height so as not to pose a potential hazard to flight

2. Other Hazards to Flight: Avoid other hazards to flight anywhere in airport vicinity. Land uses which may create other types of hazards to flight near an airport should be avoided or modified so as not to include the offending characteristic.

<u>Basis for Setting Criteria</u>
The criteria for determining airspace obstructions and other hazards to flight have been established in 14 CFR Part 77 Objects Affecting Navigable Airspace.

Safety Compatibility

<u>Objective</u>
The objective of developing a safety compatibility plan is to minimize the risks associated with potential aircraft accidents. There are two components to this:

- *Safety on the Ground:* Provide for the safety of both people and property on the ground in the event of an aircraft accident near the airport; and

- *Safety for Aircraft Occupants:* Enhance the chance of survival of aircraft occupants involved in an accident which takes place beyond the immediate runway environment.

<u>Measurement</u>
This report relies on the Aircraft Accident Safety Zone Diagram presented in Airports and Compatible Land Use, February 1999, prepared by the Washington State Department of Transportation Aviation Division (WSDOT), with modifications based on the methodology presented in the Airport Land Use Planning Handbook, December 1993, prepared for the California Department of Transportation Division of Aeronautics (CALTRANS) by Hodges and Shutt. Appendix D contains the WSDOT and CALTRANS Aircraft Accident Safety Zone Diagrams, and Reid Middleton's summary of these documents and recommended safety zones (Figure D1).

The WSDOT document presents generalized safety zones of various dimensions for three generic runways categorized by length as follows:

1. Runway less than 4,000 feet
2. Runway 4,000 to 5,999 feet
3. Runway 6,000 feet or more

It should be noted, the source for the WSDOT Aircraft Accident Safety Zone Diagram is the CALTRANS Airport Land Use Planning Handbook. The CALTRANS document includes research on aircraft accidents and provides the methodology behind the safety zones, adopted by WSDOT, and shown as Figure 9G, "Safety Zone Configuration Example" in the CALTRANS study. The methodology includes an analysis of aircraft accident characteristics as well as an analysis of capture rates for zones of various dimensions. The aircraft accident characteristics analysis evaluates where and when aircraft accidents can be expected to occur based on several variables including:

- Type of aircraft and performance limitations
- Stage of flight (arrival vs. departure)
- Pilot control of aircraft
- Length of runway
- Airplane traffic patterns
- Type of flight rules
- Weather conditions
- Time of day

The CALTRANS study provides an enormous amount of research and guidance pertaining to safety compatibility. Understandably, to provide simple guidelines for use by local agencies, it was necessary to compile this data into broad categories such as the generic runway of a given length adopted by WSDOT. However, to obtain an Aircraft Accident Safety Zone Diagram that reflects local conditions, it is vital that consideration be given to each of the variables listed above. Again, this report modifies the safety zones to fit conditions at the Skagit Regional Airport, based on the CALTRANS methodology.

Compatibility Strategies

The strategy for minimizing the risks associated with potential aircraft accidents is to take land use planning measures that can reduce the severity of an aircraft accident if one occurs. The strategy must consider both components of the safety compatibility objective: protecting people and property on the ground; and enhancing safety for aircraft occupants. In both cases, the primary strategy is to limit the intensity of use in locations most susceptible to an off-airport aircraft accident. This is accomplished by:

- *Density Limitations.* Establishment of criteria limiting the maximum number of dwellings or people in areas close to the airport.

- *Open Space Requirements.* Creation of requirements for open space near an airport addresses the objective of enhancing safety for the occupants of an aircraft forced to make an emergency landing away from a runway.

- *Special Functions Restrictions.* Certain critical types of land uses, particularly schools, hospitals, and other uses in which the mobility of occupants is effectively limited, should be avoided near the ends of runways regardless of the number of people involved. Aboveground storage of large quantities of highly flammable or hazardous materials also should be avoided near airports.

Recommended compatibility criteria:

Recommended safety compatibility criteria are presented in Table 5. Specific safety zones and the recommended dimensions are depicted on Figure D1 of Appendix D. A range of recommended densities and open space requirements has been provided. The values represent the recommendations established in the WSDOT and CALTRANS guidelines, both of which defer to the local jurisdiction as the final authority in establishing land use policy.

Basis for Setting Criteria

There is little established guidance available regarding how restrictive to make safety criteria for various parts of an airport's environs. Setting safety compatibility criteria presents the fundamental question of what is safe. Expressed in another way: what is an acceptable risk? Unlike the case with noise, there are no formal federal or state laws or regulations which set safety criteria for airport area land uses except within runway protection zones (and with regard to airspace obstructions as described in 'Height' above). Federal Aviation Administration safety criteria primarily are focused on the runway and its immediate environment.

WSDOT Aviation Division has defined the research conducted by Hodges and Shutt for the CALTRANS study as being "the best available intelligence on the historic aircraft accident trends" (Airports and Compatible Land Use, February 1999, page 32). As such, WSDOT Aviation Division has adopted the Aircraft Accident Safety Zone Diagram (discussed above under Measurement) as a planning tool to be made available to decision makers in the State of Washington. Further, to use this intelligence, both CALTRANS and WSDOT have associated land use planning strategies to the various zones. While the safety zone diagram presents a clear picture of aircraft accident trends, and may be accepted as best available intelligence, the question of underlying land use and acceptable risk is still ultimately one of what is acceptable to the local community.

Table 5 Recommended Safety Compatibility Criteria

Land Use and Densities[1,2]	Open Space Requirements[3,4]	Representative Land Uses[5]
Zone 1 – Runway Protection Zone		
Residential: None Non-Residential: 5 to 10 people/acre	Maintain all undeveloped land in open space	Agricultural operations Tree farm (8 foot height restriction)
Notes: 1. FAA and WSDOT encourage airport sponsor to acquire RPZ. 2. FAA[6] suggests use of property as golf course but such use may not comply with suggested densities.		
Zone 2 – Inner Safety Zone		
Residential: None Non-Residential: 5 to 40 people/acre	50% open space within a 500-foot-wide strip along the extended runway centerline; 25% to 30% open space overall	Light industrial uses[7] Mini-storage Parking lots
Notes: 1. During site development process, shift all structures away from the runway centerline.		
Zone 3 – Inner Turning Zone		
Residential: 2 acres/DU to 10 acres/DU Non-Residential: 25 to 60 people/acre	15% to 20%	Light industrial uses Mini-storage Parking lots
Notes: 1. During site development process, shift all structures away from the runway centerline.		
Zone 4 – Outer Safety Zone		
Residential: 2 acres/DU to 5 acres/DU Non-Residential: 40 to 100 people/acre	25% to 30% open space within a 500-foot-wide strip along the extended runway centerline; 10% to 15% open space overall	Small neighborhood shopping center Small office building[8]
Notes: 1. During site development process, shift all structures away from the runway end.		
Zone 5 – Sideline Safety Zone		
Residential: Not Applicable, under Port of Skagit County ownership Non-Residential: 40 to 60 people/acre[9]	25% to 30% open space adjacent to the runway ends and RPZ	All aviation related land uses are considered acceptable[9]
Zone 6 – Traffic Pattern Zone		
Residential: Urban Areas: 4 to 6 DU/acre or higher with master planned developments Rural Areas: 2.5 acres/DU to 5 acres/DU Non-Residential: 100 to 150 people/acre	10% to 15% open space or an open useable area every ¼ to ½ mile	Industrial uses Small restaurant Neighborhood shopping center Small office building[8] Residential sub-divisions

[1] DU refers to a residential dwelling unit.

[2] Certain critical types of land uses should be prohibited in all zones one through six. These include two categories:

- Schools, hospitals, nursing homes, and other similar land uses for which the significant common element is the relative inability of the people occupying the space to move out of harm's way
- Functions, such as aboveground storage of large quantities of flammable materials or other hazardous substances, which could substantially contribute to the severity of an aircraft accident if they were to be involved in one.

[3] The objective of open space requirements is to enable a successful emergency landing, allowing the occupants to survive the accident with limited injury. An area as small as 75 feet by 300 feet (about 0.5 acre or the size of a football field) can be adequate for a survivable emergency landing in a small plane if the area is relatively level and free of objects such as overhead lines and large trees and poles that can send the plane out of control at the last moment. Because the pilot's discretion in selecting an emergency landing site is reduced when the aircraft is at low altitude, open areas preferably should be larger and spaced more closely in those locations usually overflown at low altitude. The chance of a pilot seeing and successfully landing in a small open space also would be increased if there were more such spots from which to choose.

[4] The premise behind master planned developments is that, in most off-airport mishaps, the aircraft are under some degree of control when forced to land. Master planned developments promote clustering thus allowing for a greater amount of open space toward which the pilot can aim. The disadvantage of a master planned development is that it allows an increased number of people to be in the potential impact area of an uncontrolled crash. The optimum approach is believed to be a compromise that entails limiting the maximum occupancy level of a small area to double the overall criterion, but otherwise clustering development so as to provide the greatest amount of large open areas.

[5] The various land uses provided under Representative Land Uses are not intended to provide a comprehensive list of acceptable activities, rather these examples are to provide decision makers with some insight as to appropriate uses. Examples were taken from WSDOT and CALTRANS guidelines and from information provided by airport managers throughout the region.

[6] The FAA provides guidance on use of the RPZ in AC 150/5300-13 CHG 5, Paragraph 212 as follows:
While it is desirable to clear all objects from the RPZ, some uses are permitted provided they do not attract wildlife, are outside of the runway OFA (object free area), and do not interfere with navigational aids. Golf courses (but not club houses) and agricultural operations (other than forestry or livestock) are permitted. Automobile parking facilities, although discouraged, may be permitted outside of the OFA extension. Land uses prohibited from the RPZ are residences, places of public assembly and fuel storage. Recommend the airport owner acquire the entire RPZ.

[7] The CALTRANS study offers examples of what types of land uses should be prohibited within the Inner Safety Zone in Chapter 9, page 9-21: Nonresidential land uses should be limited to activities which attract relatively few people to a given area. Shopping centers, eating establishments, meeting halls, multi-story office buildings, and labor-intensive manufacturing plants, are examples of uses which should be prohibited.

[8] The CALTRANS study provides typical densities for various uses and offers the following example for a single-story office structure having a density of 50 to 100 people per acre (Chapter 9 page 9-20): The upper limit (100 people per acre) would occur if the building housed 1 occupant per 100 square feet of floor area – the maximum occupancy load allowed under the Uniform Building Code – and covered 25% of the lot).

[9] Property within the sideline safety zone is controlled by the Port of Skagit County and is used for aviation purposes. While non-residential densities of 40 to 60 people per acre are recommended by the WSDOT guidelines, the CALTRANS study offer the following (Chapter 9 page 9-23): Aviation-related land uses on or adjoining airport property are typically viewed differently than non-aviation uses. Users of these facilities implicitly acknowledge some degree of risk simply by being present on the airport. All common aviation-related activities should be considered acceptable in this area provided that FAA airport design criteria are met.

CONCLUSION

Local land use authorities are responsible for ensuring compatible land use around airports. The County, City of Burlington, and the Port of Skagit County have authorized this study as part of their land use planning responsibilities and authority. Land use decisions are difficult, long-term decisions, and proactive policies and development regulations take much time and work. The ability of these jurisdictions to work together will undoubtedly lead to a positive outcome; successfully maintaining current and future general aviation services at the Skagit Regional Airport while meeting the needs of the community.

This land use compatibility study has provided recommended compatibility criteria for each of the issues, height, noise and safety. As depicted on the three graphic presentations of this data (see Appendices B, C, and D), the Port of Skagit County has already made tremendous strides toward protecting the airport from encroachment simply through property acquisition. The vast majority of the compatibility impacts are contained on Port property. Further, Skagit County has previously adopted development ordinances which protect the airport from height and noise encroachment. Additional, if any, hardships placed on the community by implementing the height and noise strategies contained in this report should be minimal.

The task at hand for the joint planning committee must now turn toward determining the level of airport land use compatibility that is desirable on otherwise unprotected lands. Often times compromises are necessary between the airport sponsor’s objectives of promoting a high degree of airport land use compatibility and the broader planning considerations and development needs of the community. Such a compromise is not meant to suggest, however, that the airport proponents should back away from existing policies, especially if the communities involved support a high level of airport land use compatibility.

While not obligated to consider economic factors in these land use compatibility decisions, most jurisdictions do. There are economic implications to providing a high degree of compatibility, especially around airports in urban communities. Whether the purpose is with regard to noise or safety, airport land use compatibility has its costs as well as its benefits. These opportunity costs are borne not only by the landowner (in not obtaining maximum use of the land), but also by the community as a whole (from underutilized infrastructure, lost taxes, etc.) and even by the airport (if acquisition of the property is the only means of preventing incompatible development).

Once the level of compatibility to be afforded has been decided, the question of how best to implement these decisions must be addressed. As the joint planning committee proceeds through developing the Bayview Ridge Subarea Plan, specific land uses will need to be identified and development ordinances put in place to ensure compliance. Relating the compatibility strategies to land use is typically accomplished by one of three methods:

- *Separate Overlay Maps.* Refine the three compatibility maps (height, noise, and safety) to reflect desired levels of protection and maintain separate overlay maps for each type of impact. Although technically sound, ease of use may suffer and occasional confusion may result with three maps.

- *Airport Environs Overlay.* Develop a combined criteria map to serve as an airport environs overlay for the Bayview Ridge Subarea Plan. The overlay zone allows most land uses to be evaluated quickly.

- *Land Use Map*. Develop a detailed land use map that combines both aviation related needs and growth management planning needs of the community. This avoids the need for an overlay zone and is the easiest to implement and understand. Additional up-front work is needed to ensure all compatibility criteria have been individually considered against the comprehensive plan’s land use designations.

Ordinances provide further control over those development characteristics that are necessary to ensure compliance with selected compatibility strategies. For example, development ordinances will likely include provisions for aviation easements, buyer awareness measures, standards for lot coverage, master planned developments, open space requirements, and others.

The views presented in this report should be considered only as suggestions and recommendations. The perspective herein is that of planning, not law, and readers should consult with their legal counsels for interpretations of the law from a legal standpoint. As presented in the WSDOT land use guidelines, compatibility issues are integrally related with risk management and Skagit County, the City of Burlington, the Port of Skagit County, and members of the community must ultimately decide what constitutes an acceptable level of risk.

APPENDICES

APPENDIX A

Airport Land Use Planning Handbook
CALTRANS Division of Aeronautics
(Selected Excerpts)

3

Formulating Airport Land Use Compatibility Policies

OVERVIEW

Although various policy examples are noted herein, *it is not the intent of this chapter to require ALUCs to adopt specific compatibility criteria or other policies* for all airports or even general classes of airports. The intent is to provide general guidance and recommendations.

Compatibility policies, including both criteria and maps, are the central component of any compatibility plan. The purpose of this chapter is to examine factors which should be considered in the development of airport compatibility policies.

The individual categories of airport impacts which typically are the concerns of airport land use commissions are discussed in the immediately following section of this chapter. The concepts outlined form the basis for development of compatibility policies. This chapter's third section focuses upon alternative means of formatting compatibility criteria tables and maps. Finally, several issues are addressed which deal with limits on the degree of restrictiveness that an airport land use commission can realistically impose on airport area land uses.

TYPES OF COMPATIBILITY CONCERNS

See Part II of the *Handbook* for discussions of noise and safety concepts, their characteristics, and the relationship of these characteristics to land use compatibility and planning.

As indicated in the preceding chapters, the airport land use compatibility concerns of ALUCs fall under two broad headings identified in state law: noise and safety. However, for the purposes of formulating airport land use compatibility policies and criteria, further dividing these basic concerns into four functional categories is more practical. Traditionally, these categories are:

- *Noise* – As defined by measurable levels of noise from aircraft operations near an airport.
- *Safety* – From the perspective of minimizing the risks of aircraft accidents beyond the runway environment.
- *Airspace Protection* – Accomplished by limits on the height of structures and other objects in the airport vicinity and restrictions on other uses which potentially pose hazards to flight.

- *Overflight* – The loosely defined impacts of routine aircraft flight over a community.

The formulation of airport land use compatibility policies and associated criteria in each of these four categories is discussed on the following pages. The emphasis, however, is on ways of *categorizing* and *organizing* the policies rather than on the *concepts* behind them. The latter is the major topic of Part II.

For each compatibility category, four features are outlined below:

- *Compatibility Objective* – The objective to be sought by establishment and implementation of the compatibility policies;
- *Measurement* – The scale on which attainment of the objectives can be measured;
- *Compatibility Strategies* – The types of strategies which, when formulated as compatibility policies, can be used to accomplish the objectives; and
- *Basis for Setting Criteria* – The basis upon which the respective compatibility criteria have traditionally been established.

A summary of basic criteria appropriate for each of the four compatibility categories is presented in Table 3A. These criteria follow from the discussion in this section and are further supported by the material included in Part II. Two points should be noted about the criteria shown in Table 3A:

- One point is that the criteria are written in general, qualitative (not precise, quantitative) terms. In effect, they are a criteria checklist rather than actual, airport-specific criteria. For use in a compatibility plan, the criteria need to be more fully defined to suit local circumstances. Also, the boundaries of the zones within which each criterion applies must be delineated with respect to the conditions at a specific airport.
- Secondly, it should be emphasized that, even in their general form, these criteria are only suggestions for consideration by individual ALUCs. They are not intended to be treated as state-mandated standards.

Noise

Noise is one of the most basic airport land use compatibility concerns. Moreover, at major airline and many busy general aviation airports it is usually the most geographically extensive form of airport impact.

Compatibility Concern	Compatibility Zone Delineation	Suggested Compatibility Criteria
Noise	• Calculated noise contours;[1] or • Generalized area encompassing individual contours.	• No residential within 65 dB CNEL contour. • Encourage use of 60 dB CNEL as maximum for residential land uses in quiet communities (or even 55 dB at rural airports).
Safety	• Up to 6 zones based upon relative risk of aircraft accidents in each area.[2] • Take into account typical flight tracks and areas overflown by aircraft at low altitude. • Consider instrument arrival and departure routes.	• Runway Protection Zones: – No structures. – No assemblages of people. – Encourage airport to own the property. • Inner Safety Zones: – Preferably no residential uses or, at most, very low density. – Limit other uses to ones which attract relatively few people and leave substantial areas without structures. – Prohibit bulk storage of flammable or hazardous materials. – Prohibit schools, hospitals, nursing homes. – Maintain as much open land as possible by clustering of development. • Inner Turning Zones: – Residential uses only at very low density. – Restrictions on other uses similar to Inner Safety Zone. • Outer Safety Zones: – No urban density residential subdivisions. – Other uses limited to ones with moderate concentrations of people. – Avoid schools, hospitals, nursing homes. – Maintain as much open land as possible by clustering of development. • Sideline Zones (Areas Adjacent to Runways): – All common aviation-related uses acceptable. – Limit non-aviation uses, on- or off-airport, to low-intensity activities. – Prohibit schools, hospitals, nursing homes. • Traffic Pattern Zone: – Avoid high-density residential unless clustered to leave open areas in between. – Avoid activities with very high concentrations of people. – Avoid schools, hospitals, nursing homes.
Airspace Protection	• Zones defined by Part 77 of Federal Aviation Regulations.	• Limit heights of objects in accordance with Part 77 criteria. • Avoid other hazards to flight anywhere in airport vicinity.
Overflight	• Easiest to define in terms of Part 77 horizontal zone, modified as necessary to exclude areas not routinely overflown by aircraft flying to and from airport.	• Establish some form of buyer awareness program.

1 See Chapters 7 and 8 for a discussion of factors to be considered in calculation of noise contours.

2 See Chapter 9 (specifically Figure 9G) for suggestions regarding safety zone shapes and dimensions.

NOTE: *These criteria should be treated as general suggestions for consideration by individual ALUCs, not as state-mandated standards. Economic and technical feasibility may need to be taken into account when setting criteria for individual airports.*

Source: Hodges & Shutt (December 1993)

Table 3A

Summary of Suggested Compatibility Criteria

- **Compatibility Objective** – The clear objective of noise compatibility criteria is to minimize the number of people exposed to frequent and/or high levels of airport noise.

See Chapter 6 for an extended review of noise characteristics and effects.

- **Measurement** – Noise generated by the operation of aircraft to, from, and around an airport can be measured both in terms of the overall average or cumulative noise levels of all aircraft operations and the noise of individual aircraft takeoffs or landings.

  - *Cumulative Noise Levels* – The most widely applied measures of airport noise are cumulative noise levels such as those described by the Community Noise Equivalent Level (CNEL) metric or, other than in California, by the Day-Night Average Sound Level (DNL or L_{dn}) metric. Both of these noise metrics provide a single measure of the average sound level in decibels (db) to which any point near an airport is exposed. To reflect supposedly greater community sensitivity to nighttime and (for CNEL only) evening noise, events during these periods are counted as being louder than actually measured. Cumulative noise levels are usually illustrated on airport area maps as contour lines connecting points of equal noise exposure. Mapped noise contours primarily show areas of significant noise exposures – ones affected by high concentrations of aircraft takeoffs and landings.

    The calculation of cumulative noise levels depends upon the number, type and time of day of aircraft operations, the location of flight tracks, and other data described in Chapter 6. For airports with air traffic control towers, some of these inputs can be derived from recorded data. However, at most airports, the individual variables must be estimated. The important point to be made here is that, despite their computer-generated origin, the location of noise contours entails an inherent degree of imprecision. The level of accuracy has generally been found to be within ±3 dB.

  - *Single-Event Noise Levels* – For various reasons discussed in Chapter 6, there is on-going nationwide debate regarding the appropriateness of single-event noise level criteria as a supplement or replacement for cumulative noise level metrics. The argument chiefly made is that cumulative noise level metrics do not adequately identify some aspects of noise exposure effects, particularly within the context of assessing the environmental impacts of airport improvement projects. The perspective of this *Handbook* is that cumulative noise level metrics remain an essential tool for the purposes of airport land use compatibility planning. Other characteristics of noise, whether measured on a decibel scale or evaluated in a more qualitative manner, may nevertheless also need to be considered as discussed below with respect to overflight issues.

- **Compatibility Strategies** – The basic strategy for achieving noise compatibility in an airport vicinity is to limit the development of land uses which are particularly sensitive to noise. The most acceptable land uses are ones which either involve few people (especially people engaged in outdoor activities), or generate significant noise levels themselves (such as other transportation facilities or industrial uses).

- **Basis for Setting Criteria** – Compatibility criteria related to cumulative noise levels are well-established in federal and state laws and regulations. The basic criterion sets a CNEL or DNL of 65 dB as the maximum noise level normally compatible with residential land uses. Criteria for other land uses are established in a manner consistent with this starting point. The overall scale should be adjusted to reflect ambient sound levels and the community's previous exposure to noise.

Safety

Compared to noise, safety is in many respects a more difficult concern to address in airport land use compatibility policies. A major reason for this difference is that safety policies address uncertain events which *may occur* with *occasional* aircraft operations, whereas noise policies deal with known, more or less predictable events which *do occur* with *every* aircraft operation. Because aircraft accidents happen infrequently and the time, place, and consequences of their occurrence cannot be predicted, the concept of *risk* is central to the assessment of safety compatibility. From the standpoint of land use planning, two variables determine the degree of risk posed by potential aircraft accidents:

- *Accident Frequency* – Where and when do aircraft accidents occur in the vicinity of an airport?
- *Accident Severity* – What land use characteristics contribute to the consequences of an accident when one occurs?

- **Compatibility Objective** – The overall objective of safety compatibility criteria can be simply stated as being to minimize the risks associated with potential aircraft accidents. There are two components to this objective, however:
  - *Safety on the Ground* – The most fundamental safety compatibility component is to provide for the safety of people and property on the ground in the event of an aircraft accident near an airport.
  - *Safety for Aircraft Occupants* – The other important component is to enhance the chances of survival of the occupants of an aircraft involved in an accident which takes place beyond the immediate runway environment.

- **Measurement** – Measurement of safety is usually thought of in terms of the frequency component of risk assessment: what is the potential

Except with respect to airspace protection, ALUCs have virtually no powers to implement actions which can reduce the *frequency* of aircraft accidents. An understanding of the *spatial* element of accident frequency – as examined in Chapter 8 – is nevertheless essential to ALUC development of effective measures to limit the potential *severity* of accidents.

Under many circumstances, one means of implementing both the density limitations and open space requirements strategies is through clustering of development. This concept is discussed in Chapter 9.

for an accident to occur? As mentioned above, there are both *where* and *when* variables to the frequency equation:

- *Spatial Element* – The spatial element describes *where* aircraft accidents can be expected to occur. Of all the accidents which occur in the vicinity of airports, what percentage occur in any given location?
- *Time Element* – The time element adds a *when* variable to the assessment of accident frequency. In any given location around a particular airport, what is the chance that an accident will occur in a specified period of time?

- **Compatibility Strategies** – Safety compatibility strategies focus on the *severity* component of risk assessment. Basically, the question is: what land use planning measures can be taken to reduce the severity of an aircraft accident if one occurs in a particular location near an airport? Although there is a significant overlap, specific strategies must consider both components of the safety compatibility objective: protecting people and property on the ground; and enhancing safety for aircraft occupants. In both cases, the primary strategy is to limit the intensity of use in locations most susceptible to an off-airport aircraft accident. This is accomplished by:
  - *Density Limitations* – Establishment of criteria limiting the maximum number of dwellings or people in areas close to the airport is the most direct method of reducing the potential severity of an aircraft accident.
  - *Open Space Requirements* – Creation of requirements for open space near an airport addresses the objective of enhancing safety for the occupants of an aircraft forced to make an emergency landing away from a runway.
  - *Special Functions Restrictions* – Certain critical types of land uses – particularly schools, hospitals, and other uses in which the mobility of occupants is effectively limited – should be avoided near the ends of runways regardless of the number of people involved. Aboveground storage of large quantities of highly flammable or hazardous materials also should be avoided near airports.

- **Basis for Setting Criteria** – Setting safety compatibility criteria presents the fundamental question of what is safe. Expressed in another way: what is an *acceptable risk*? In one respect, it may seem ideal to reduce risks to a minimum by prohibiting most types of land use development from areas near airports. However, as addressed in the final section of this chapter, there are usually costs associated with such high degrees of restrictiveness. In practice, safety criteria are set on a progressive scale with the greatest restrictions established in locations with the greatest potential for aircraft accidents.

- *Established Guidance* – As noted in Chapter 9, little established guidance is available to ALUCs regarding how restrictive to make safety criteria for various parts of an airport's environs. Unlike the case with noise, there are no formal federal or state laws or regulations which set safety criteria for airport area land uses except within runway protection zones (and with regard to airspace obstructions as described separately in the next section). Federal Aviation Administration safety criteria primarily are focused on the runway and its immediate environment. Runway protection zones were originally established mostly for the purpose of protecting the occupants of aircraft which overrun or land short of a runway, but are now defined by the FAA as intended to enhance the protection of people and property on the ground.

- *New Research* – To provide a better foundation for establishment of safety criteria in other portions of the airport environs, extensive research into the distribution of accident locations was conducted as an initial step in preparation of this *Handbook*. The results are outlined in Chapter 8. However, even with this new data on which to base safety compatibility decisions, the question is still ultimately one of what is acceptable to the local community.

Airspace Protection

Relatively few aircraft accidents are caused by land use conditions which are hazards to flight. The potential exists, however, and protecting against it is essential to airport land use safety compatibility.

Protection of airport airspace is one of the few actions which ALUCs can take to help reduce the *frequency* of aircraft accidents.

- **Compatibility Objective** – Because airspace protection is in effect a safety factor, its objective can likewise be thought of in terms of risk. Specifically, the objective is avoid development of land use conditions which, by posing hazards to flight, can increase the risk of an accident occurring. The particular hazards of concern are:
  - Airspace obstructions; and
  - Land use characteristics which pose other potential hazards to flight by attracting birds or creating visual or electronic interference with air navigation.

- **Measurement** – The measurement of requirements for airspace protection around an airport is a function of several variables including: the dimensions and layout of the runway system; the type of operating procedures established for the airport; and, indirectly, the performance capabilities of aircraft operated at the airport.

Excerpts from Part 77 are included in Appendix E.

- *Airspace Obstructions* — Whether a particular object constitutes an airspace obstruction depends upon the height of the object and its proximity to the airport. The acceptable height of objects near an airport is determined by application of standards set forth in Part 77 of the Federal Aviation Regulations. These regulations establish a three-dimensional space in the air above an airport. Any object which penetrates this volume of airspace is considered an obstruction and may affect the aeronautical use of the airspace.
- *Other Hazards to Flight* — The significance of other potential hazards to flight is primarily measured simply in terms of their distance from the airport and/or its normal traffic patterns.

- **Compatibility Strategies** — Compatibility strategies for the protection of airport airspace are relatively simple and are related directly to the individual types of hazards:
  - *Airspace Obstructions* — Buildings, antennas, other types of structures, and trees should be limited in height so as not to pose a potential hazard to flight.
  - *Other Hazards to Flight* — Land uses which may create other types of hazards to flight near an airport should be avoided or modified so as not to include the offending characteristic.

- **Basis for Setting Criteria** — The criteria for determining airspace obstructions and other hazards to flight have been long-established in Federal Aviation Administration regulations and guidelines. Also, the state of California utilizes the same airspace obstruction criteria in the regulations set forth in state aeronautics law.

Overflight

As the term is applied herein, an *overflight* means any distinctly visible and audible passage of an aircraft, not necessarily one which is directly overhead.

ALUCs are encouraged to consider aircraft overflight concerns when developing airport compatibility plans.

Experience at many airports has shown that noise-related impacts do not stop at the boundary of the outermost mapped CNEL or DNL contour. Many people are sensitive to the frequent presence of aircraft overhead even at noise levels lower than typically measured by cumulative noise level contours. A fear factor also contributes to this sensitivity. This category of compatibility concern is not one for which many ALUCs have adopted criteria or policies. Nevertheless, it is a concern which is increasingly being expressed — often in the form of *annoyance* — by people in communities around airports.

- **Compatibility Objective** — The compatibility objective associated with overflight impacts is not easily expressed in land use planning terms. It can perhaps be stated as being to help people with above-average sensitivity to aircraft overflights — people who are highly *annoyed* by overflights — to avoid living in locations where frequent overflights occur.

APPENDIX B

Integrated Noise Model (INM)
Skagit Regional Airport Master Plan Update
June 1995

AIRPORT NOISE ANALYSIS

Ldn noise levels are depicted by a series of contour lines superimposed on a map of the airport and its environs. These levels are calculated for the designated points on the ground from the weighted summation of the effects of all aircraft operations. Some operations are far enough away from the location that their effect is minimal, while other operations dominate noise exposure at that location.

Noise contours for the Skagit Regional Airport were constructed using the Federal Aviation Administration (FAA) Integrated Noise Model (INM), Version 3.10, for both existing traffic volumes and those forecast for the year 2013. Assumptions in the model include a continuation of existing traffic patterns, and increased activity levels as shown in Chapter 4, Forecasts including a commuter service airline. Also included in the projected noise contours were increases in the number and size of air cargo and business jet aircraft operations at the airport (ARC B-III).

Exhibits 8.1 and 8.2 show the 65, 70, and 75 LDN noise contours that resulted from this modelling. The contours are shown superimposed upon the Skagit County zoning maps (current) and proposed Comprehensive Plan (future) for the same area. This makes identification of areas of noise impact possible.

The FAA guidelines for noise impact state that where noise levels are below the 65 Ldn level, all uses, including residential areas are compatible. Between 65-75 Ldn, residential uses are generally unacceptable and require special sound insulation techniques to mitigate the impacts. The Ldn is based on an energy summation of the aggregate noise environment as measured in A-weighted decibel units.

In 1993, 65 Ldn contours fall completely on airport property. As a result, there are no areas of unacceptable impact off airport property.

The 2013 noise contours expand as a result of the forecasted increase of air traffic. But as can be seen in Exhibit 8.2, the 65 Ldn contour is still on airport property. As a result, there are no areas of unacceptable impact off airport property in the future plan year. Refer to Chapter 6, Exhibit 6.9 for a close-up depiction of the noise contours.

FUTURE OFF-AIRPORT LAND USE PLAN

In order to comply with the state's Growth Management Act, Skagit County is currently in the process of drafting their Comprehensive Plan. As of the date of this publication, the Comp Plan Final Environmental Impact Statement (FEIS) was being issued for review and comment. Once approved and adopted, the Comprehensive Plan will become the planning document which ultimately controls land use decisions within the county.

The key element of the Comp Plan which affects the Skagit Regional Airport is the establishment of an Independent Urban Growth Boundary for a majority of the Port District's property, including the airport. The establishment of this district will allow the Port to expand and develop the airport in a manner which is consistent with future plans for the airport (i.e. aviation-related uses, commercial-limited industrial, and industrial development). Residential uses are permitted within this Independent Urban Growth Boundary and it will be important for the Port to carefully review any proposed plans to further develop residential uses within this area.

While a number of zoning changes will be required in order to bring current zoning into compliance and consistency with the new Comp Plan, it is anticipated that the Airport Environs ordinance and Airport Height Restriction Ordinance will continue as future zoning ordinances to control and ensure future land use compatibility.

Exhibit 8.2 depicts the new Comprehensive Plan land use designations as outlined in the FEIS dated 6/30/94. It also shows the future noise contours generated by the INM Noise Model Program for the Year 2013 together with the future height restricted areas as proposed in this master plan.

Appendix B
INM INPUT FILES

INTRODUCTION

The following pages present Skagit Regional Airport's 1993 and 2013 Integrated Noise Model (INM) input files. The main factors on which the INM relies include general airport characteristics, runway length, aircraft types, tracks for take-offs landings, and touch-and-go operations , and day and night frequency of operations per aircraft.

Following input of airport altitude, average temperature, runway characteristics, and aircraft types, each track is identified for takeoff, landing,and touch-and-go operations. For example, on page C-2, take-off track "T01" for Runway 10 is defined as heading straight for 6,800 feet, taking a left bank of 90 degrees with a turn radius of 1,250 feet, then proceeding straight for 1,250 feet, and so on.

This track definition is then followed by operation characteristics for each aircraft using the track. The INM has a standard group of aircraft which do not include all aircraft types. For this reason, there is are substitute aircraft which may be used to account for noise impacts of those aircraft which are not specifically programmed into the INM. Following each aircraft type is a take-off parameter (Stage) or an approach profile (Prof). These designations are selected based on the specific aircraft's performance characteristics such as fuel requirements, flight distances, take-off weight, speed, number of engines, stop and roll distances, etc.

The next features defined are the daily averages of day (D) and night (N) operations associated with each aircraft. Daytime operations are those which occur between 7 a.m. and 10 p.m. and night operations fall between 10 p.m. and 7 a.m. The INM is programmed to weigh night operations more heavily than day operations.

Following the track and operation definitions, the program processes are identified which specify the desired contours, such as 65 or 75 Ldn, and printer or plotter specifications and "x" and "y" coordinates.

Based on these input factors and the numerous INM calculations, 65 Ldn, 70 Ldn, and 75 Ldn noise contours were derived for Skagit Regional Airport.

stage 1 noisiest
stage 3 quieter - c


```
BEGIN.
SETUP:
 TITLE <SKAGIT 1993, OCTOBER 26, 1993>
 AIRPORT <SKAGIT>
 ALTITUDE 140 TEMPERATURE 75.1 F

RUNWAYS
 RW 10-28   -3685  0      TO   1790  0
 RW 03-21   0     -4840   TO   1715  -115

AIRCRAFT:

 TYPES
  AC LEAR35
  AC CNA441
  AC BEC58P
  AC GASEPV
  AC GASEPF

TAKEOFFS BY FREQUENCY:

TRACK TO1 RWY 10 STRAIGHT 6800 LEFT 90 D 1500
          STRAIGHT 1250 LEFT 10 D 1500
          STRAIGHT 50000
 OPER LEAR35 STAGE 1 D=0.0377  N=0.0024
 OPER CNA441 STAGE 1 D=0.1507  N=0.0096
 OPER BEC58P STAGE 1 D=0.3140  N=0.0200
 OPER GASEPV STAGE 1 D=0.7395  N=0.0472
 OPER GASEPF STAGE 1 D=3.1354  N=0.2001

TRACK TO2 RWY 10 STRAIGHT 6800 LEFT 10 D 1500
          STRAIGHT 50000
 OPER LEAR35 STAGE 1 D=0.0126  N=0.0008
 OPER CNA441 STAGE 1 D=0.0502  N=0.0032
 OPER BEC58P STAGE 1 D=0.1047  N=0.0067
 OPER GASEPV STAGE 1 D=0.2465  N=0.0157
 OPER GASEPF STAGE 1 D=1.0451  N=0.0667

TRACK TO3 RWY 10 STRAIGHT 6800 RIGHT 80 D 1500
          STRAIGHT 50000
 OPER LEAR35 STAGE 1 D=0.1256  N=0.0080
 OPER CNA441 STAGE 1 D=0.5024  N=0.0321
 OPER BEC58P STAGE 1 D=1.0467  N=0.0668
 OPER GASEPV STAGE 1 D=2.4650  N=0.1573
 OPER GASEPF STAGE 1 D=10.4513  N=0.6671

TRACK TO4 RWY 10 STRAIGHT 6800 RIGHT 90 D 1500
          STRAIGHT 5280 RIGHT 35 D 1500
          STRAIGHT 50000
 OPER LEAR35 STAGE 1 D=0.0251  N=0.0016
 OPER CNA441 STAGE 1 D=0.1005  N=0.0064
 OPER BEC58P STAGE 1 D=0.2093  N=0.0134
 OPER GASEPV STAGE 1 D=0.4930  N=0.0315
 OPER GASEPF STAGE 1 D=2.0903  N=0.1334

TRACK TO5 RWY 10 STRAIGHT 6800 RIGHT 90 D 1500
          STRAIGHT 5280 RIGHT 80 D 1500
          STRAIGHT 50000
 OPER LEAR35 STAGE 1 D=0.0502  N=0.0032
 OPER CNA441 STAGE 1 D=0.2010  N=0.0128
 OPER BEC58P STAGE 1 D=0.4187  N=0.0267
 OPER GASEPV STAGE 1 D=0.9860  N=0.0629
 OPER GASEPF STAGE 1 D=4.1805  N=0.2668

TRACK TO6 RWY 28 STRAIGHT 6800 LEFT 90 D 1500
          STRAIGHT 1250 LEFT 10 D 1500
          STRAIGHT 50000
 OPER LEAR35 STAGE 1 D=0.1256  N=0.0080
 OPER CNA441 STAGE 1 D=0.5024  N=0.0321
 OPER BEC58P STAGE 1 D=1.0467  N=0.0668
 OPER GASEPV STAGE 1 D=2.4650  N=0.1573
 OPER GASEPF STAGE 1 D=10.4513  N=0.6671

TRACK TO7 RWY 28 STRAIGHT 6800 LEFT 55 D 1500
          STRAIGHT 50000
 OPER LEAR35 STAGE 1 D=0.0251  N=0.0016
 OPER CNA441 STAGE 1 D=0.1005  N=0.0064
 OPER BEC58P STAGE 1 D=0.2093  N=0.0134
 OPER GASEPV STAGE 1 D=0.4930  N=0.0315
 OPER GASEPF STAGE 1 D=2.0903  N=0.1334

TRACK TO8 RWY 28 STRAIGHT 6800 LEFT 10 D 1500
          STRAIGHT 50000
 OPER LEAR35 STAGE 1 D=0.0502  N=0.0032
 OPER CNA441 STAGE 1 D=0.2010  N=0.0128
 OPER BEC58P STAGE 1 D=0.4187  N=0.0267
 OPER GASEPV STAGE 1 D=0.9860  N=0.0629
 OPER GASEPF STAGE 1 D=4.1805  N=0.2668

TRACK TO9 RWY 28 STRAIGHT 6800 RIGHT 80 D 1500
          STRAIGHT 50000
 OPER LEAR35 STAGE 1 D=0.0377  N=0.0024
 OPER CNA441 STAGE 1 D=0.1507  N=0.0096
 OPER BEC58P STAGE 1 D=0.3140  N=0.0200
 OPER GASEPV STAGE 1 D=0.7395  N=0.0472
 OPER GASEPF STAGE 1 D=3.1354  N=0.2001

TRACK TO10 RWY 28 STRAIGHT 6800 RIGHT 90 D 1500
          STRAIGHT 5280 RIGHT 80 D 1500
          STRAIGHT 50000
 OPER LEAR35 STAGE 1 D=0.0126  N=0.0008
 OPER CNA441 STAGE 1 D=0.0502  N=0.0032
 OPER BEC58P STAGE 1 D=0.1047  N=0.0067
 OPER GASEPV STAGE 1 D=0.2465  N=0.0157
 OPER GASEPF STAGE 1 D=1.0451  N=0.0667
```

TRACK TO11 RWY 03 STRAIGHT 6320 LEFT 90 D 1500
STRAIGHT 1250 LEFT 30 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.3902 N=0.0000
OPER GASEPF STAGE 1 D=0.1301 N=0.0000

TRACK TO12 RWY 03 STRAIGHT 6320 LEFT 30 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.2926 N=0.0000
OPER GASEPF STAGE 1 D=0.0975 N=0.0000

TRACK TO13 RWY 03 STRAIGHT 1250 RIGHT 60 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.0975 N=0.0000
OPER GASEPF STAGE 1 D=0.0325 N=0.0000

TRACK TO14 RWY 03 STRAIGHT 6320 RIGHT 90 D 1500
STRAIGHT 1250 RIGHT 60 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.9754 N=0.0000
OPER GASEPF STAGE 1 D=0.3251 N=0.0000

TRACK TO15 RWY 03 STRAIGHT 6320 LEFT 90 D 1500
STRAIGHT 1250 LEFT 70 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.1951 N=0.0000
OPER GASEPF STAGE 1 D=0.0650 N=0.0000

TRACK TO16 RWY 21 STRAIGHT 6320 LEFT 90 D 1500
STRAIGHT 1250 LEFT 30 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.1463 N=0.0000
OPER GASEPF STAGE 1 D=0.0488 N=0.0000

TRACK TO17 RWY 21 STRAIGHT 6320 LEFT 30 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=1.4631 N=0.0000
OPER GASEPF STAGE 1 D=0.4877 N=0.0000

TRACK TO18 RWY 21 STRAIGHT 6320 RIGHT 15 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.2926 N=0.0000
OPER GASEPF STAGE 1 D=0.0975 N=0.0000

TRACK TO19 RWY 21 STRAIGHT 6320 RIGHT 45 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.5853 N=0.0000
OPER GASEPF STAGE 1 D=0.1951 N=0.0000

TRACK TO20 RWY 21 STRAIGHT 6320 RIGHT 90 D 1500
STRAIGHT 1250 RIGHT 30 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.4389 N=0.0000
OPER GASEPF STAGE 1 D=0.1463 N=0.0000

LANDING BY FREQUENCY:

TRACK LA1 RWY 10 STRAIGHT 50000 LEFT 90 D 1500
STRAIGHT 1500 LEFT 90 D 1500
STRAIGHT 2640
OPER LEAR35 PROF=STD3D D=0.0251 N=0.0016
OPER CNA441 PROF=STD3D D=0.1005 N=0.0064
OPER BEC58P PROF=STD3D D=0.2093 N=0.0134
OPER GASEPV PROF=STD3D D=0.4930 N=0.0315
OPER GASEPF PROF=STD3D D=2.0903 N=0.1334

TRACK LA2 RWY 10 STRAIGHT 50000 RIGHT 45 D 1500
STRAIGHT 5400 LEFT 90 D 1500
STRAIGHT 1500 LEFT 90 D 1500
STRAIGHT 2640
OPER LEAR35 PROF=STD3D D=0.1507 N=0.0096
OPER CNA441 PROF=STD3D D=0.6029 N=0.0385
OPER BEC58P PROF=STD3D D=1.2560 N=0.0802
OPER GASEPV PROF=STD3D D=2.9580 N=0.1888
OPER GASEPF PROF=STD3D D=12.5415 N=0.8005

TRACK LA3 RWY 10 STRAIGHT 50000
OPER LEAR35 PROF=STD3D D=0.0126 N=0.0008
OPER CNA441 PROF=STD3D D=0.0502 N=0.0032
OPER BEC58P PROF=STD3D D=0.1047 N=0.0067
OPER GASEPV PROF=STD3D D=0.2465 N=0.0157
OPER GASEPF PROF=STD3D D=1.0451 N=0.0667

TRACK LA4 RWY 10 STRAIGHT 50000 LEFT 10 D 1500
STRAIGHT 2640
OPER LEAR35 PROF=STD3D D=0.0628 N=0.0040
OPER CNA441 PROF=STD3D D=0.2512 N=0.0160
OPER BEC58P PROF=STD3D D=0.5233 N=0.0334
OPER GASEPV PROF=STD3D D=1.2325 N=0.0787
OPER GASEPF PROF=STD3D D=5.2256 N=0.3336

TRACK LA5 RWY 28 STRAIGHT 50000 LEFT 90 D 1500
STRAIGHT 1500 LEFT 90 D 1500
STRAIGHT 2640 STRAIGHT 1500
OPER LEAR35 PROF=STD3D D=0.0754 N=0.0048
OPER CNA441 PROF=STD3D D=0.3014 N=0.0192
OPER BEC58P PROF=STD3D D=0.6280 N=0.0401
OPER GASEPV PROF=STD3D D=1.4790 N=0.0944
OPER GASEPF PROF=STD3D D=6.2708 N=0.4003

TRACK LA6 RWY 28 STRAIGHT 50000 RIGHT 45 D 1500
STRAIGHT 5400 LEFT 90 D 1500
STRAIGHT 1500 LEFT 90 D 1500
STRAIGHT 2640
OPER LEAR35 PROF=STD3D D=0.1507 N=0.0096
OPER CNA441 PROF=STD3D D=0.6029 N=0.0385

```
 OPER BEC58P PROF=STD3D D=1.2560  N=0.0802
 OPER GASEPV PROF=STD3D D=2.9580  N=0.1888
 OPER GASEPF PROF=STD3D D=12.5415 N=0.8005

TRACK LA7 RWY 28 STRAIGHT 50000
 OPER LEAR35 PROF=STD3D D=0.0251  N=0.0016
 OPER CNA441 PROF=STD3D D=0.1005  N=0.0064
 OPER BEC58P PROF=STD3D D=0.2093  N=0.0134
 OPER GASEPV PROF=STD3D D=0.4930  N=0.0315
 OPER GASEPF PROF=STD3D D=2.0903  N=0.1334

TRACK LA8 RWY 03  STRAIGHT 50000 LEFT 90 D 1500
         STRAIGHT 1500  LEFT 90 D 1500
         STRAIGHT 2640
 OPER GASEPV PROF=STD3D D=0.2926  N=0.0000
 OPER GASEPF PROF=STD3D D=0.0975  N=0.0000

TRACK LA9 RWY 03  STRAIGHT 50000 RIGHT 45 D 1500
         STRAIGHT 5400  LEFT 90 D 1500
         STRAIGHT 1500  LEFT 90 D 1500
         STRAIGHT 2640
 OPER GASEPV PROF=STD3D D=1.4631  N=0.0000
 OPER GASEPF PROF=STD3D D=0.4877  N=0.0000

TRACK LA10 RWY 03 STRAIGHT 50000
 OPER GASEPV PROF=STD3D D=0.1951  N=0.0000
 OPER GASEPF PROF=STD3D D=0.0650  N=0.0000

TRACK LA11 RWY 21 STRAIGHT 50000 LEFT 90 D 1500
         STRAIGHT 1500  LEFT 90 D 1500
         STRAIGHT 2640
 OPER GASEPV PROF=STD3D D=0.4389  N=0.0000
 OPER GASEPF PROF=STD3D D=0.1463  N=0.0000

TRACK LA12 RWY 21 STRAIGHT 50000 LEFT 90 D 1500
         STRAIGHT 1500  LEFT 90 D 1500
         STRAIGHT 2640
 OPER GASEPV PROF=STD3D D=2.1947  N=0.0000
 OPER GASEPF PROF=STD3D D=0.7316  N=0.0000

TRACK LA13 RWY 21 STRAIGHT 50000
 OPER GASEPV PROF=STD3D D=0.2926  N=0.0000
 OPER GASEPF PROF=STD3D D=0.0975  N=0.0000

TOUCHGOS BY FREQUENCY:

TRACK TG1 RWY 10 STRAIGHT 6800 LEFT 90 D 1500
         STRAIGHT 1000 LEFT 90 D 1500
         STRAIGHT 8120 LEFT 90 D 1500
         STRAIGHT 1000 LEFT 90 D 1500
         STRAIGHT 1320
 OPER GASEPV STAGE 1 PROF=STD3D D=4.0926
N=0.2612
 OPER GASEPF STAGE 1 PROF=STD3D D=12.2778
N=0.7837

TRACK TG2 RWY 28 STRAIGHT 6800 LEFT 90 D 1500
         STRAIGHT 1000 LEFT 90 D 1500
         STRAIGHT 8120 LEFT 90 D 1500
         STRAIGHT 1000 LEFT 90 D 1500
         STRAIGHT 1320
 OPER GASEPV STAGE 1 PROF=STD3D D=4.0926
N=0.2612
 OPER GASEPF STAGE 1 PROF=STD3D D=12.2778
N=0.7837

TRACK TG3 RWY 03  STRAIGHT 5400 LEFT 90 D 1500
         STRAIGHT 1000 LEFT 90 D 1500
         STRAIGHT 6400 LEFT 90 D 1500
         STRAIGHT 1000 LEFT 90 D 1500
         STRAIGHT 1000
 OPER GASEPV STAGE 1 PROF=STD3D D=0.6147
N=0.0000
 OPER GASEPF STAGE 1 PROF=STD3D D=1.8440
N=0.0000

TRACK TG4 RWY 21 STRAIGHT 5400 RIGHT 90 D 1500
         STRAIGHT 1000 RIGHT 90 D 1500
         STRAIGHT 6400 RIGHT 90 D 1500
         STRAIGHT 1000 RIGHT 90 D 1500
         STRAIGHT 1000
 OPER GASEPV STAGE 1 PROF=STD3D D=0.9220
N=0.0000
 OPER GASEPF STAGE 1 PROF=STD3D D=2.7660
N=0.0000

PROCESSES:

CONTOUR LDN AT 55 60 65 70 75
 WITH TOLERANCE=1
 REFINE=6
 XSTART=-10000
 YSTART=-10000
 XSTOP=10000
 YSTOP=10000
 PLOT

END.
```

```
BEGIN.
SETUP:
 TITLE <SKAGIT 2013, OCTOBER 21, 1993>
 AIRPORT <SKAGIT>
 ALTITUDE 140 TEMPERATURE 75.1 F

RUNWAYS
 RW 10-28  -3685 0    TO  1790 0
 RW 03-21  0 -4840  TO  1715 -115

AIRCRAFT:

TYPES
 AC 727200
 AC CL601
 AC CVR580
 AC BEC58P
 AC GASEPV
 AC GASEPF

TAKEOFFS BY FREQUENCY:

TRACK TO1 RWY 10 STRAIGHT 6800 LEFT 90 D 2500
          STRAIGHT 1250 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CL601 STAGE 1 D=0.0743 N=0.0047
 OPER CVR580 STAGE 1 D=1.3811 N=0.0886
 OPER BEC58P STAGE 1 D=3.3354 N=0.2129
 OPER GASEPV STAGE 1 D=1.9963 N=0.0685
 OPER GASEPF STAGE 1 D=5.6945 N=0.3439

TRACK TO2 RWY 10 STRAIGHT 6800 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CL601 STAGE 1 D=0.0248 N=0.0016
 OPER CVR580 STAGE 1 D=0.4604 N=0.0294
 OPER BEC58P STAGE 1 D=1.1118 N=0.0710
 OPER GASEPV STAGE 1 D=1.0499 N=0.0228
 OPER GASEPF STAGE 1 D=2.0264 N=0.1146

TRACK TO3 RWY 10 STRAIGHT 6800 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CL601 STAGE 1 D=0.2475 N=0.0158
 OPER CVR580 STAGE 1 D=4.6037 N=0.2939
 OPER BEC58P STAGE 1 D=11.1181 N=0.7097
 OPER GASEPV STAGE 1 D=3.8097 N=0.2284
 OPER GASEPF STAGE 1 D=18.0336 N=1.1462

TRACK TO4 RWY 10 STRAIGHT 6800 RIGHT 90 D 2500
          STRAIGHT 5280 RIGHT 35 D 2500
          STRAIGHT 50000
 OPER CL601 STAGE 1 D=0.0495 N=0.0032
 OPER CVR580 STAGE 1 D=0.9207 N=0.0588
 OPER BEC58P STAGE 1 D=2.2236 N=0.1419
 OPER GASEPV STAGE 1 D=3.0224 N=0.0457
 OPER GASEPF STAGE 1 D=4.3602 N=0.2292

TRACK TO5 RWY 10 STRAIGHT 6800 RIGHT 90 D 2500
          STRAIGHT 5280 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CL601 STAGE 1 D=0.0990 N=0.0063
 OPER CVR580 STAGE 1 D=1.8415 N=0.1175
 OPER BEC58P STAGE 1 D=4.4472 N=0.2839
 OPER GASEPV STAGE 1 D=1.8929 N=0.0914
 OPER GASEPF STAGE 1 D=7.3365 N=0.4585

TRACK TO6 RWY 10 STRAIGHT 100000
 OPER 727200 STAGE 1 D=1.00 N=0.00
 OPER CL601 STAGE 1 D=0.0248 N=0.0016
 OPER CVR580 STAGE 1 D=0.4604 N=0.0294
 OPER BEC58P STAGE 1 D=1.1118 N=0.0710
 OPER GASEPV STAGE 1 D=1.3959 N=0.0228
 OPER GASEPF STAGE 1 D=2.1417 N=0.1146

TRACK TO7 RWY 28 STRAIGHT 6800 LEFT 90 D 2500
          STRAIGHT 1250 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CL601 STAGE 1 D=0.2475 N=0.0158
 OPER CVR580 STAGE 1 D=4.6037 N=0.2939
 OPER BEC58P STAGE 1 D=11.1181 N=0.7097
 OPER GASEPV STAGE 1 D=3.925 N=0.2284
 OPER GASEPF STAGE 1 D=18.072 N=1.1462

TRACK TO8 RWY 28 STRAIGHT 6800 LEFT 55 D 2500
          STRAIGHT 50000
 OPER CL601 STAGE 1 D=0.0495 N=0.0032
 OPER CVR580 STAGE 1 D=0.9207 N=0.0588
 OPER BEC58P STAGE 1 D=2.2236 N=0.1419
 OPER GASEPV STAGE 1 D=4.1756 N=0.0457
 OPER GASEPF STAGE 1 D=4.7446 N=0.2292

TRACK TO9 RWY 28 STRAIGHT 6800 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CL601 STAGE 1 D=0.0990 N=0.0063
 OPER CVR580 STAGE 1 D=1.8415 N=0.1175
 OPER BEC58P STAGE 1 D=4.4472 N=0.2839
 OPER GASEPV STAGE 1 D=2.1236 N=0.0914
 OPER GASEPF STAGE 1 D=7.4134 N=0.4585

TRACK TO10 RWY 28 STRAIGHT 6800 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CL601 STAGE 1 D=0.0743 N=0.0047
 OPER CVR580 STAGE 1 D=1.3811 N=0.0886
 OPER BEC58P STAGE 1 D=3.3354 N=0.2129
 OPER GASEPV STAGE 1 D=2.4576 N=0.0685
 OPER GASEPF STAGE 1 D=5.8483 N=0.3439
```

```
TRACK TO11 RWY 28 STRAIGHT 6800 RIGHT 90 D 2500
          STRAIGHT 5280 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CL601 STAGE 1 D=0.0248  N=0.0016
 OPER CVR580 STAGE 1 D=0.4604  N=0.0294
 OPER BEC58P STAGE 1 D=1.1118  N=0.0710
 OPER GASEPV STAGE 1 D=1.3959  N=0.0228
 OPER GASEPF STAGE 1 D=2.1417  N=0.1146

TRACK TO12 RWY 28 STRAIGHT 100000
 OPER 727200 STAGE 1 D=1.00  N=0.00
 OPER CL601 STAGE 1 D=0.0248  N=0.0016
 OPER CVR580 STAGE 1 D=0.4604  N=0.0294
 OPER BEC58P STAGE 1 D=1.1118  N=0.0710
 OPER GASEPV STAGE 1 D=1.3959  N=0.0228
 OPER GASEPF STAGE 1 D=2.1417  N=0.1146

LANDINGS BY FREQUENCY:

TRACK LA1 RWY 10 STRAIGHT 50000 LEFT 90 D 2500
          STRAIGHT 1500  LEFT 90 D 2500
          STRAIGHT 2640
 OPER CL601 PROF=STD3D D=0.0495  N=0.0032
 OPER CVR580 PROF=STD3D D=0.9207  N=0.0588
 OPER BEC58P PROF=STD3D D=2.2236  N=0.1419
 OPER GASEPV PROF=STD3D D=1.4078  N=0.0457
 OPER GASEPF PROF=STD3D D=3.822  N=0.2292

TRACK LA2 RWY 10 STRAIGHT 50000 RIGHT 45 D 2500
          STRAIGHT 5400  LEFT 90 D 2500
          STRAIGHT 1500  LEFT 90 D 2500
          STRAIGHT 2640
 OPER CL601 PROF=STD3D D=0.2970  N=0.0190
 OPER CVR580 PROF=STD3D D=5.5244  N=0.3526
 OPER BEC58P PROF=STD3D D=13.3417  N=0.8516
 OPER GASEPV PROF=STD3D D=7.7546  N=0.2741
 OPER GASEPF PROF=STD3D D=22.7014  N=1.3754

TRACK LA3 RWY 10 STRAIGHT 100000
 OPER 727200 PROF=STD3D D=0.0248  N=0.0016
 OPER CL601 PROF=STD3D D=0.0248  N=0.0016
 OPER CVR580 PROF=STD3D D=0.4604  N=0.0294
 OPER BEC58P PROF=STD3D D=1.1118  N=0.0710
 OPER GASEPV PROF=STD3D D=0.8192  N=0.0228
 OPER GASEPF PROF=STD3D D=1.9495  N=0.1146

TRACK LA4 RWY 10 STRAIGHT 50000 LEFT 10 D 2500
          STRAIGHT 2640
 OPER CL601 PROF=STD3D D=0.1238  N=0.0079
 OPER CVR580 PROF=STD3D D=2.3018  N=0.1469
 OPER BEC58P PROF=STD3D D=5.5590  N=0.3548
 OPER GASEPV PROF=STD3D D=1.7895  N=0.1142
 OPER GASEPF PROF=STD3D D=8.9784  N=0.5731

TRACK LA5 RWY 28 STRAIGHT 50000 LEFT 90 D 2500
          STRAIGHT 1500  LEFT 90 D 2500
          STRAIGHT 2640
 OPER CL601 PROF=STD3D D=0.1485  N=0.0095
 OPER CVR580 PROF=STD3D D=2.7622  N=0.1763
 OPER BEC58P PROF=STD3D D=6.6708  N=0.4258
 OPER GASEPV PROF=STD3D D=3.1854  N=0.1371
 OPER GASEPF PROF=STD3D D=11.12  N=0.6877

TRACK LA6 RWY 28 STRAIGHT 50000 RIGHT 45 D 2500
          STRAIGHT 5400  LEFT 90 D 2500
          STRAIGHT 1500  LEFT 90 D 2500
          STRAIGHT 2640
 OPER CL601 PROF=STD3D D=0.2970  N=0.0190
 OPER CVR580 PROF=STD3D D=5.5244  N=0.3526
 OPER BEC58P PROF=STD3D D=13.3417  N=0.8516
 OPER GASEPV PROF=STD3D D=9.4846  N=0.2741
 OPER GASEPF PROF=STD3D D=23.278  N=1.3754

TRACK LA7 RWY 28 STRAIGHT 100000
 OPER 727200 PROF=STD3D D=0.0495  N=0.0032
 OPER CL601 PROF=STD3D D=0.0495  N=0.0032
 OPER CVR580 PROF=STD3D D=0.9207  N=0.0588
 OPER BEC58P PROF=STD3D D=2.2236  N=0.1419
 OPER GASEPV PROF=STD3D D=1.4078  N=0.0457
 OPER GASEPF PROF=STD3D D=3.822  N=0.2292

TOUCHGOS BY FREQUENCY:

TRACK TG1 RWY 10 STRAIGHT 6800 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 8120 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 1320
 OPER GASEPV STAGE 1 PROF=STD3D D=8.1982
N=0.4550
 OPER GASEPF STAGE 1 PROF=STD3D D=24.585
N=1.3643

TRACK TG2 RWY 28 STRAIGHT 6800 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 8120 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 1320
 OPER GASEPV STAGE 1 PROF=STD3D D=8.7334
N=0.4550
 OPER GASEPF STAGE 1 PROF=STD3D D=26.1901
N=1.3643

PROCESSES:

CONTOUR LDN AT 55 60 65 70 75
 WITH TOLERANCE=1
```

REFINE=6
XSTART=-20000
YSTART=-20000
XSTOP=20000
YSTOP=20000
PLOT

END.

```
BEGIN.
SETUP:
 TITLE <SKAGIT 2013 (SMALL), OCTOBER 26, 1993>
 AIRPORT <SKAGIT>
 ALTITUDE 140 TEMPERATURE 75.1 F

RUNWAYS
 RW 10-28   -3685 0      TO   1790 0
 RW 03-21   0    -4840   TO   1715 -115

AIRCRAFT:

TYPES
 AC CNA500
 AC CNA441
 AC BEC58P
 AC GASEPV
 AC GASEPF

TAKEOFFS BY FREQUENCY:

TRACK TO1 RWY 10 STRAIGHT 6800 LEFT 90 D 2500
          STRAIGHT 1250 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0743  N=0.0047
 OPER CNA441 STAGE 1 D=1.3811  N=0.0886
 OPER BEC58P STAGE 1 D=3.3354  N=0.2129
 OPER GASEPV STAGE 1 D=1.0737  N=0.0685
 OPER GASEPF STAGE 1 D=5.3870  N=0.3439

TRACK TO2 RWY 10 STRAIGHT 6800 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0248  N=0.0016
 OPER CNA441 STAGE 1 D=0.4604  N=0.0294
 OPER BEC58P STAGE 1 D=1.1118  N=0.0710
 OPER GASEPV STAGE 1 D=0.3579  N=0.0228
 OPER GASEPF STAGE 1 D=1.7957  N=0.1146

TRACK TO3 RWY 10 STRAIGHT 6800 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.2475  N=0.0158
 OPER CNA441 STAGE 1 D=4.6037  N=0.2939
 OPER BEC58P STAGE 1 D=11.1181  N=0.7097
 OPER GASEPV STAGE 1 D=3.5790  N=0.2284
 OPER GASEPF STAGE 1 D=17.9567  N=1.1462

TRACK TO4 RWY 10 STRAIGHT 6800 RIGHT 90 D 2500
          STRAIGHT 5280 RIGHT 35 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0495  N=0.0032
 OPER CNA441 STAGE 1 D=0.9207  N=0.0588
 OPER BEC58P STAGE 1 D=2.2236  N=0.1419
 OPER GASEPV STAGE 1 D=0.7158  N=0.0457
 OPER GASEPF STAGE 1 D=3.5913  N=0.2292

TRACK TO5 RWY 10 STRAIGHT 6800 RIGHT 90 D 2500
          STRAIGHT 5280 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0990  N=0.0063
 OPER CNA441 STAGE 1 D=1.8415  N=0.1175
 OPER BEC58P STAGE 1 D=4.4472  N=0.2839
 OPER GASEPV STAGE 1 D=1.4316  N=0.0914
 OPER GASEPF STAGE 1 D=7.1827  N=0.4585

TRACK TO6 RWY 28 STRAIGHT 6800 LEFT 90 D 2500
          STRAIGHT 1250 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.2475  N=0.0158
 OPER CNA441 STAGE 1 D=4.6037  N=0.2939
 OPER BEC58P STAGE 1 D=11.1181  N=0.7097
 OPER GASEPV STAGE 1 D=3.5790  N=0.2284
 OPER GASEPF STAGE 1 D=17.9567  N=1.1462

TRACK TO7 RWY 28 STRAIGHT 6800 LEFT 55 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0495  N=0.0032
 OPER CNA441 STAGE 1 D=0.9207  N=0.0588
 OPER BEC58P STAGE 1 D=2.2236  N=0.1419
 OPER GASEPV STAGE 1 D=0.7158  N=0.0457
 OPER GASEPF STAGE 1 D=3.5913  N=0.2292

TRACK TO8 RWY 28 STRAIGHT 6800 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0990  N=0.0063
 OPER CNA441 STAGE 1 D=1.8415  N=0.1175
 OPER BEC58P STAGE 1 D=4.4472  N=0.2839
 OPER GASEPV STAGE 1 D=1.4316  N=0.0914
 OPER GASEPF STAGE 1 D=7.1827  N=0.4585

TRACK TO9 RWY 28 STRAIGHT 6800 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0743  N=0.0047
 OPER CNA441 STAGE 1 D=1.3811  N=0.0886
 OPER BEC58P STAGE 1 D=3.3354  N=0.2129
 OPER GASEPV STAGE 1 D=1.0737  N=0.0685
 OPER GASEPF STAGE 1 D=5.3870  N=0.3439

TRACK TO10 RWY 28 STRAIGHT 6800 RIGHT 90 D 2500
          STRAIGHT 5280 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0248  N=0.0016
 OPER CNA441 STAGE 1 D=0.4604  N=0.0294
 OPER BEC58P STAGE 1 D=1.1118  N=0.0710
 OPER GASEPV STAGE 1 D=0.3579  N=0.0228
 OPER GASEPF STAGE 1 D=1.7957  N=0.1146
```

TRACK TO11 RWY 03 STRAIGHT 6320 LEFT 90 D 1500
STRAIGHT 1250 LEFT 30 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.9226 N=0.0000
OPER GASEPF STAGE 1 D=0.3075 N=0.0000

TRACK TO12 RWY 03 STRAIGHT 6320 LEFT 30 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.6920 N=0.0000
OPER GASEPF STAGE 1 D=0.2307 N=0.0000

TRACK TO13 RWY 03 STRAIGHT 1250 RIGHT 60 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.2307 N=0.0000
OPER GASEPF STAGE 1 D=0.0769 N=0.0000

TRACK TO14 RWY 03 STRAIGHT 6320 RIGHT 90 D 1500
STRAIGHT 1250 RIGHT 60 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=2.3066 N=0.0000
OPER GASEPF STAGE 1 D=0.7689 N=0.0000

TRACK TO15 RWY 03 STRAIGHT 6320 LEFT 90 D 1500
STRAIGHT 1250 LEFT 70 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.4613 N=0.0000
OPER GASEPF STAGE 1 D=0.1538 N=0.0000

TRACK TO16 RWY 21 STRAIGHT 6320 LEFT 90 D 1500
STRAIGHT 1250 LEFT 30 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.3460 N=0.0000
OPER GASEPF STAGE 1 D=0.1153 N=0.0000

TRACK TO17 RWY 21 STRAIGHT 6320 LEFT 30 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=3.4598 N=0.0000
OPER GASEPF STAGE 1 D=1.1533 N=0.0000

TRACK TO18 RWY 21 STRAIGHT 6320 RIGHT 15 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.6920 N=0.0000
OPER GASEPF STAGE 1 D=0.2307 N=0.0000

TRACK TO19 RWY 21 STRAIGHT 6320 RIGHT 45 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=1.3839 N=0.0000
OPER GASEPF STAGE 1 D=0.4613 N=0.0000

TRACK TO20 RWY 21 STRAIGHT 6320 RIGHT 90 D 1500
STRAIGHT 1250 RIGHT 30 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=1.0380 N=0.0000
OPER GASEPF STAGE 1 D=0.3460 N=0.0000

LANDING BY FREQUENCY:

TRACK LA1 RWY 10 STRAIGHT 50000 LEFT 90 D 2500
STRAIGHT 1500 LEFT 90 D 2500
STRAIGHT 2640
OPER CNA500 PROF=STD3D D=0.0495 N=0.0032
OPER CNA441 PROF=STD3D D=0.9207 N=0.0588
OPER BEC58P PROF=STD3D D=2.2236 N=0.1419
OPER GASEPV PROF=STD3D D=0.7158 N=0.0457
OPER GASEPF PROF=STD3D D=3.5913 N=0.2292

TRACK LA2 RWY 10 STRAIGHT 50000 RIGHT 45 D 2500
STRAIGHT 5400 LEFT 90 D 2500
STRAIGHT 1500 LEFT 90 D 2500
STRAIGHT 2640
OPER CNA500 PROF=STD3D D=0.2970 N=0.0190
OPER CNA441 PROF=STD3D D=5.5244 N=0.3526
OPER BEC58P PROF=STD3D D=13.3417 N=0.8516
OPER GASEPV PROF=STD3D D=4.2948 N=0.2741
OPER GASEPF PROF=STD3D D=21.5481 N=1.3754

TRACK LA3 RWY 10 STRAIGHT 50000
OPER CNA500 PROF=STD3D D=0.0248 N=0.0016
OPER CNA441 PROF=STD3D D=0.4604 N=0.0294
OPER BEC58P PROF=STD3D D=1.1118 N=0.0710
OPER GASEPV PROF=STD3D D=0.3579 N=0.0228
OPER GASEPF PROF=STD3D D=1.7957 N=0.1146

TRACK LA4 RWY 10 STRAIGHT 50000 LEFT 10 D 2500
STRAIGHT 2640
OPER CNA500 PROF=STD3D D=0.1238 N=0.0079
OPER CNA441 PROF=STD3D D=2.3018 N=0.1469
OPER BEC58P PROF=STD3D D=5.5590 N=0.3548
OPER GASEPV PROF=STD3D D=1.7895 N=0.1142
OPER GASEPF PROF=STD3D D=8.9784 N=0.5731

TRACK LA5 RWY 28 STRAIGHT 50000 LEFT 90 D 2500
STRAIGHT 1500 LEFT 90 D 2500
STRAIGHT 2640
OPER CNA500 PROF=STD3D D=0.1485 N=0.0095
OPER CNA441 PROF=STD3D D=2.7622 N=0.1763
OPER BEC58P PROF=STD3D D=6.6708 N=0.4258
OPER GASEPV PROF=STD3D D=2.1474 N=0.1371
OPER GASEPF PROF=STD3D D=10.7740 N=0.6877

TRACK LA6 RWY 28 STRAIGHT 50000 RIGHT 45 D 2500
STRAIGHT 5400 LEFT 90 D 2500
STRAIGHT 1500 LEFT 90 D 2500
STRAIGHT 2640
OPER CNA500 PROF=STD3D D=0.2970 N=0.0190
OPER CNA441 PROF=STD3D D=5.5244 N=0.3526

```
 OPER BEC58P PROF=STD3D D=13.3417  N=0.8516
 OPER GASEPV PROF=STD3D D=4.2948  N=0.2741
 OPER GASEPF PROF=STD3D D=21.5481 N=1.3754

TRACK LA7 RWY 28 STRAIGHT 50000
 OPER CNA500 PROF=STD3D D=0.0495  N=0.0032
 OPER CNA441 PROF=STD3D D=0.9207  N=0.0588
 OPER BEC58P PROF=STD3D D=2.2236  N=0.1419
 OPER GASEPV PROF=STD3D D=0.7158  N=0.0457
 OPER GASEPF PROF=STD3D D=3.5913  N=0.2292

TRACK LA8 RWY 03  STRAIGHT 50000 LEFT 90 D 1500
          STRAIGHT 1500  LEFT 90 D 1500
          STRAIGHT 2640
 OPER GASEPV PROF=STD3D D=0.6920  N=0.0000
 OPER GASEPF PROF=STD3D D=0.2307  N=0.0000

TRACK LA9 RWY 03  STRAIGHT 50000 RIGHT  45 D 1500
          STRAIGHT 5400  LEFT 90 D 1500
          STRAIGHT 1500  LEFT 90 D 1500
          STRAIGHT 2640
 OPER GASEPV PROF=STD3D D=3.4598  N=0.0000
 OPER GASEPF PROF=STD3D D=1.1533  N=0.0000

TRACK LA10 RWY 03 STRAIGHT 50000
 OPER GASEPV PROF=STD3D D=0.4613  N=0.0000
 OPER GASEPF PROF=STD3D D=0.1538  N=0.0000

TRACK LA11 RWY 21 STRAIGHT 50000 LEFT 90 D 1500
          STRAIGHT 1500  LEFT 90 D 1500
          STRAIGHT 2640
 OPER GASEPV PROF=STD3D D=1.0380  N=0.0000
 OPER GASEPF PROF=STD3D D=0.3460  N=0.0000

TRACK LA12 RWY 21 STRAIGHT 50000 LEFT 90 D 1500
          STRAIGHT 1500  LEFT 90 D 1500
          STRAIGHT 2640
 OPER GASEPV PROF=STD3D D=5.1898  N=0.0000
 OPER GASEPF PROF=STD3D D=1.7299  N=0.0000

TRACK LA13 RWY 21 STRAIGHT 50000
 OPER GASEPV PROF=STD3D D=0.6920  N=0.0000
 OPER GASEPF PROF=STD3D D=0.2307  N=0.0000

TOUCHGOS BY FREQUENCY:

TRACK TG1 RWY 10 STRAIGHT 6800 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 8120 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 1320
 OPER GASEPV STAGE 1 PROF=STD3D D=7.1277
N=0.4550
 OPER GASEPF STAGE 1 PROF=STD3D D=21.3748
N=1.3643

TRACK TG2 RWY 28 STRAIGHT 6800 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 8120 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 1320
 OPER GASEPV STAGE 1 PROF=STD3D D=7.1277
N=0.4550
 OPER GASEPF STAGE 1 PROF=STD3D D=21.3748
N=1.3643

TRACK TG3 RWY 03  STRAIGHT 5400 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 6400 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 1000
 OPER GASEPV STAGE 1 PROF=STD3D D=1.0705
N=0.0000
 OPER GASEPF STAGE 1 PROF=STD3D D=3.2102
N=0.0000

TRACK TG4 RWY 21 STRAIGHT 5400 RIGHT 90 D 1500
          STRAIGHT 1000 RIGHT 90 D 1500
          STRAIGHT 6400 RIGHT 90 D 1500
          STRAIGHT 1000 RIGHT 90 D 1500
          STRAIGHT 1000
 OPER GASEPV STAGE 1 PROF=STD3D D=1.6057
N=0.0000
 OPER GASEPF STAGE 1 PROF=STD3D D=4.8153
N=0.0000

PROCESSES:

CONTOUR LDN AT 55 60 65 70 75
 WITH TOLERANCE=1
 REFINE=6
 XSTART=-10000
 YSTART=-10000
 XSTOP=10000
 YSTOP=10000
 PLOT

END.
```

```
BEGIN.
SETUP:
 TITLE <SKAGIT 2013 Small/One Runway, December 28,
1993>
 AIRPORT <SKAGIT>
 ALTITUDE 140 TEMPERATURE 75.1 F

RUNWAYS
 RW 10-28   -3685 0     TO   1790 0
 RW 03-21   0 -4840   TO   1715 -115

AIRCRAFT:

TYPES
 AC CNA500
 AC CNA441
 AC BEC58P
 AC GASEPV
 AC GASEPF

TAKEOFFS BY FREQUENCY:

TRACK TO1 RWY 10 STRAIGHT 6800 LEFT 90 D 2500
          STRAIGHT 1250 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0743  N=0.0047
 OPER CNA441 STAGE 1 D=1.3811  N=0.0886
 OPER BEC58P STAGE 1 D=3.3354  N=0.2129
 OPER GASEPV STAGE 1 D=1.9963  N=0.0685
 OPER GASEPF STAGE 1 D=5.6945  N=0.3439

TRACK TO2 RWY 10 STRAIGHT 6800 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0248  N=0.0016
 OPER CNA441 STAGE 1 D=0.4604  N=0.0294
 OPER BEC58P STAGE 1 D=1.1118  N=0.0710
 OPER GASEPV STAGE 1 D=1.0499  N=0.0228
 OPER GASEPF STAGE 1 D=2.0264  N=0.1146

TRACK TO3 RWY 10 STRAIGHT 6800 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.2475  N=0.0158
 OPER CNA441 STAGE 1 D=4.6037  N=0.2939
 OPER BEC58P STAGE 1 D=11.1181  N=0.7097
 OPER GASEPV STAGE 1 D=3.8097  N=0.2284
 OPER GASEPF STAGE 1 D=18.0336  N=1.1462

TRACK TO4 RWY 10 STRAIGHT 6800 RIGHT 90 D 2500
          STRAIGHT 5280 RIGHT 35 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0495  N=0.0032
 OPER CNA441 STAGE 1 D=0.9207  N=0.0588
 OPER BEC58P STAGE 1 D=2.2236  N=0.1419
 OPER GASEPV STAGE 1 D=3.0224  N=0.0457
 OPER GASEPF STAGE 1 D=4.3602  N=0.2292

TRACK TO5 RWY 10 STRAIGHT 6800 RIGHT 90 D 2500
          STRAIGHT 5280 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0990  N=0.0063
 OPER CNA441 STAGE 1 D=1.8415  N=0.1175
 OPER BEC58P STAGE 1 D=4.4472  N=0.2839
 OPER GASEPV STAGE 1 D=1.8929  N=0.0914
 OPER GASEPF STAGE 1 D=7.3365 N=0.4585

TRACK TO6 RWY 28 STRAIGHT 6800 LEFT 90 D 2500
          STRAIGHT 1250 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.2475  N=0.0158
 OPER CNA441 STAGE 1 D=4.6037  N=0.2939
 OPER BEC58P STAGE 1 D=11.1181  N=0.7097
 OPER GASEPV STAGE 1 D=3.925  N=0.2284
 OPER GASEPF STAGE 1 D=18.072  N=1.1462

TRACK TO7 RWY 28 STRAIGHT 6800 LEFT 55 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0495  N=0.0032
 OPER CNA441 STAGE 1 D=0.9207  N=0.0588
 OPER BEC58P STAGE 1 D=2.2236  N=0.1419
 OPER GASEPV STAGE 1 D=4.1756  N=0.0457
 OPER GASEPF STAGE 1 D=4.7446  N=0.2292

TRACK TO8 RWY 28 STRAIGHT 6800 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0990  N=0.0063
 OPER CNA441 STAGE 1 D=1.8415  N=0.1175
 OPER BEC58P STAGE 1 D=4.4472  N=0.2839
 OPER GASEPV STAGE 1 D=2.1236  N=0.0914
 OPER GASEPF STAGE 1 D=7.4134  N=0.4585

TRACK TO9 RWY 28 STRAIGHT 6800 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0743  N=0.0047
 OPER CNA441 STAGE 1 D=1.3811  N=0.0886
 OPER BEC58P STAGE 1 D=3.3354  N=0.2129
 OPER GASEPV STAGE 1 D=2.4576  N=0.0685
 OPER GASEPF STAGE 1 D=5.8483  N=0.3439

TRACK TO10 RWY 28 STRAIGHT 6800 RIGHT 90 D 2500
          STRAIGHT 5280 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0248  N=0.0016
 OPER CNA441 STAGE 1 D=0.4604  N=0.0294
 OPER BEC58P STAGE 1 D=1.1118  N=0.0710
 OPER GASEPV STAGE 1 D=1.3959  N=0.0228
 OPER GASEPF STAGE 1 D=2.1417  N=0.1146
```

```
LANDINGS BY FREQUENCY:

TRACK LA1 RWY 10 STRAIGHT 50000 LEFT 90 D 2500
          STRAIGHT 1500 LEFT 90 D 2500
          STRAIGHT 2640
 OPER CNA500 PROF=STD3D D=0.0495 N=0.0032
 OPER CNA441 PROF=STD3D D=0.9207 N=0.0588
 OPER BEC58P PROF=STD3D D=2.2236 N=0.1419
 OPER GASEPV PROF=STD3D D=1.4078 N=0.0457
 OPER GASEPF PROF=STD3D D=3.822 N=0.2292

TRACK LA2 RWY 10 STRAIGHT 50000 RIGHT 45 D 2500
          STRAIGHT 5400 LEFT 90 D 2500
          STRAIGHT 1500 LEFT 90 D 2500
          STRAIGHT 2640
 OPER CNA500 PROF=STD3D D=0.2970 N=0.0190
 OPER CNA441 PROF=STD3D D=5.5244 N=0.3526
 OPER BEC58P PROF=STD3D D=13.3417 N=0.8516
 OPER GASEPV PROF=STD3D D=7.7546 N=0.2741
 OPER GASEPF PROF=STD3D D=22.7014 N=1.3754

TRACK LA3 RWY 10 STRAIGHT 50000 LEFT 10 D 2500
          STRAIGHT 2640
 OPER CNA500 PROF=STD3D D=0.1238 N=0.0079
 OPER CNA441 PROF=STD3D D=2.3018 N=0.1469
 OPER BEC58P PROF=STD3D D=5.5590 N=0.3548
 OPER GASEPV PROF=STD3D D=1.7895 N=0.1142
 OPER GASEPF PROF=STD3D D=8.9784 N=0.5731

TRACK LA4 RWY 28 STRAIGHT 50000 LEFT 90 D 2500
          STRAIGHT 1500 LEFT 90 D 2500
          STRAIGHT 2640
 OPER CNA500 PROF=STD3D D=0.1485 N=0.0095
 OPER CNA441 PROF=STD3D D=2.7622 N=0.1763
 OPER BEC58P PROF=STD3D D=6.6708 N=0.4258
 OPER GASEPV PROF=STD3D D=3.1854 N=0.1371
 OPER GASEPF PROF=STD3D D=11.12 N=0.6877

TRACK LA5 RWY 28 STRAIGHT 50000 RIGHT 45 D 2500
          STRAIGHT 5400 LEFT 90 D 2500
          STRAIGHT 1500 LEFT 90 D 2500
          STRAIGHT 2640
 OPER CNA500 PROF=STD3D D=0.2970 N=0.0190
 OPER CNA441 PROF=STD3D D=5.5244 N=0.3526
 OPER BEC58P PROF=STD3D D=13.3417 N=0.8516
 OPER GASEPV PROF=STD3D D=9.4846 N=0.2741
 OPER GASEPF PROF=STD3D D=23.278 N=1.3754

TRACK LA6 RWY 28 STRAIGHT 100000
 OPER CNA500 PROF=STD3D D=0.0495 N=0.0032
 OPER CNA441 PROF=STD3D D=0.9207 N=0.0588
 OPER BEC58P PROF=STD3D D=2.2236 N=0.1419
 OPER GASEPV PROF=STD3D D=1.4078 N=0.0457
 OPER GASEPF PROF=STD3D D=3.822 N=0.2292

TOUCHGOS BY FREQUENCY:

TRACK TG1 RWY 10 STRAIGHT 6800 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 8120 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 1320
 OPER GASEPV STAGE 1 PROF=STD3D D=8.1982
N=0.4550
 OPER GASEPF STAGE 1 PROF=STD3D D=24.585
N=1.3643

TRACK TG2 RWY 28 STRAIGHT 6800 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 8120 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 1320
 OPER GASEPV STAGE 1 PROF=STD3D D=8.7334
N=0.4550
 OPER GASEPF STAGE 1 PROF=STD3D D=26.1901
N=1.3643

PROCESSES:

CONTOUR LDN AT 55 60 65 70 75
 WITH TOLERANCE=1
 REFINE=6
 XSTART=-20000
 YSTART=-20000
 XSTOP=20000
 YSTOP=20000
 PLOT

END.
```

```
BEGIN.
SETUP:
 TITLE <SKAGIT 2013 (3-21 North End),December 28,
1993>
 AIRPORT <SKAGIT>
 ALTITUDE 140 TEMPERATURE 75.1 F

RUNWAYS
 RW 10-28   -3685 0    TO   1790 0
 RW 03-21   858 -2478  TO   1715 -115

AIRCRAFT:

TYPES
 AC CNA500
 AC CNA441
 AC BEC58P
 AC GASEPV
 AC GASEPF

TAKEOFFS BY FREQUENCY:

TRACK TO1 RWY 10 STRAIGHT 6800 LEFT 90 D 2500
          STRAIGHT 1250 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0743  N=0.0047
 OPER CNA441 STAGE 1 D=1.3811  N=0.0886
 OPER BEC58P STAGE 1 D=3.3354  N=0.2129
 OPER GASEPV STAGE 1 D=1.0737  N=0.0685
 OPER GASEPF STAGE 1 D=5.3870  N=0.3439

TRACK TO2 RWY 10 STRAIGHT 6800 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0248  N=0.0016
 OPER CNA441 STAGE 1 D=0.4604  N=0.0294
 OPER BEC58P STAGE 1 D=1.1118  N=0.0710
 OPER GASEPV STAGE 1 D=0.3579  N=0.0228
 OPER GASEPF STAGE 1 D=1.7957  N=0.1146

TRACK TO3 RWY 10 STRAIGHT 6800 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.2475  N=0.0158
 OPER CNA441 STAGE 1 D=4.6037  N=0.2939
 OPER BEC58P STAGE 1 D=11.1181  N=0.7097
 OPER GASEPV STAGE 1 D=3.5790  N=0.2284
 OPER GASEPF STAGE 1 D=17.9567  N=1.1462

TRACK TO4 RWY 10 STRAIGHT 6800 RIGHT 90 D 2500
          STRAIGHT 5280 RIGHT 35 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0495  N=0.0032
 OPER CNA441 STAGE 1 D=0.9207  N=0.0588
 OPER BEC58P STAGE 1 D=2.2236  N=0.1419
 OPER GASEPV STAGE 1 D=0.7158  N=0.0457
 OPER GASEPF STAGE 1 D=3.5913  N=0.2292

TRACK TO5 RWY 10 STRAIGHT 6800 RIGHT 90 D 2500
          STRAIGHT 5280 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0990  N=0.0063
 OPER CNA441 STAGE 1 D=1.8415  N=0.1175
 OPER BEC58P STAGE 1 D=4.4472  N=0.2839
 OPER GASEPV STAGE 1 D=1.4316  N=0.0914
 OPER GASEPF STAGE 1 D=7.1827  N=0.4585

TRACK TO6 RWY 28 STRAIGHT 6800 LEFT 90 D 2500
          STRAIGHT 1250 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.2475  N=0.0158
 OPER CNA441 STAGE 1 D=4.6037  N=0.2939
 OPER BEC58P STAGE 1 D=11.1181  N=0.7097
 OPER GASEPV STAGE 1 D=3.5790  N=0.2284
 OPER GASEPF STAGE 1 D=17.9567  N=1.1462

TRACK TO7 RWY 28 STRAIGHT 6800 LEFT 55 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0495  N=0.0032
 OPER CNA441 STAGE 1 D=0.9207  N=0.0588
 OPER BEC58P STAGE 1 D=2.2236  N=0.1419
 OPER GASEPV STAGE 1 D=0.7158  N=0.0457
 OPER GASEPF STAGE 1 D=3.5913  N=0.2292

TRACK TO8 RWY 28 STRAIGHT 6800 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0990  N=0.0063
 OPER CNA441 STAGE 1 D=1.8415  N=0.1175
 OPER BEC58P STAGE 1 D=4.4472  N=0.2839
 OPER GASEPV STAGE 1 D=1.4316  N=0.0914
 OPER GASEPF STAGE 1 D=7.1827  N=0.4585

TRACK TO9 RWY 28 STRAIGHT 6800 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0743  N=0.0047
 OPER CNA441 STAGE 1 D=1.3811  N=0.0886
 OPER BEC58P STAGE 1 D=3.3354  N=0.2129
 OPER GASEPV STAGE 1 D=1.0737  N=0.0685
 OPER GASEPF STAGE 1 D=5.3870  N=0.3439

TRACK TO10 RWY 28 STRAIGHT 6800 RIGHT 90 D 2500
          STRAIGHT 5280 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0248  N=0.0016
 OPER CNA441 STAGE 1 D=0.4604  N=0.0294
 OPER BEC58P STAGE 1 D=1.1118  N=0.0710
 OPER GASEPV STAGE 1 D=0.3579  N=0.0228
 OPER GASEPF STAGE 1 D=1.7957  N=0.1146
```

TRACK TO11 RWY 03 STRAIGHT 6320 LEFT 90 D 1500
STRAIGHT 1250 LEFT 30 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.9226 N=0.0000
OPER GASEPF STAGE 1 D=0.3075 N=0.0000

TRACK TO12 RWY 03 STRAIGHT 6320 LEFT 30 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.6920 N=0.0000
OPER GASEPF STAGE 1 D=0.2307 N=0.0000

TRACK TO13 RWY 03 STRAIGHT 1250 RIGHT 60 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.2307 N=0.0000
OPER GASEPF STAGE 1 D=0.0769 N=0.0000

TRACK TO14 RWY 03 STRAIGHT 6320 RIGHT 90 D 1500
STRAIGHT 1250 RIGHT 60 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=2.3066 N=0.0000
OPER GASEPF STAGE 1 D=0.7689 N=0.0000

TRACK TO15 RWY 03 STRAIGHT 6320 LEFT 90 D 1500
STRAIGHT 1250 LEFT 70 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.4613 N=0.0000
OPER GASEPF STAGE 1 D=0.1538 N=0.0000

TRACK TO16 RWY 21 STRAIGHT 6320 LEFT 90 D 1500
STRAIGHT 1250 LEFT 30 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.3460 N=0.0000
OPER GASEPF STAGE 1 D=0.1153 N=0.0000

TRACK TO17 RWY 21 STRAIGHT 6320 LEFT 30 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=3.4598 N=0.0000
OPER GASEPF STAGE 1 D=1.1533 N=0.0000

TRACK TO18 RWY 21 STRAIGHT 6320 RIGHT 15 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=0.6920 N=0.0000
OPER GASEPF STAGE 1 D=0.2307 N=0.0000

TRACK TO19 RWY 21 STRAIGHT 6320 RIGHT 45 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=1.3839 N=0.0000
OPER GASEPF STAGE 1 D=0.4613 N=0.0000

TRACK TO20 RWY 21 STRAIGHT 6320 RIGHT 90 D 1500
STRAIGHT 1250 RIGHT 30 D 1500
STRAIGHT 50000
OPER GASEPV STAGE 1 D=1.0380 N=0.0000
OPER GASEPF STAGE 1 D=0.3460 N=0.0000

LANDING BY FREQUENCY:

TRACK LA1 RWY 10 STRAIGHT 50000 LEFT 90 D 2500
STRAIGHT 1500 LEFT 90 D 2500
STRAIGHT 2640
OPER CNA500 PROF=STD3D D=0.0495 N=0.0032
OPER CNA441 PROF=STD3D D=0.9207 N=0.0588
OPER BEC58P PROF=STD3D D=2.2236 N=0.1419
OPER GASEPV PROF=STD3D D=0.7158 N=0.0457
OPER GASEPF PROF=STD3D D=3.5913 N=0.2292

TRACK LA2 RWY 10 STRAIGHT 50000 RIGHT 45 D 2500
STRAIGHT 5400 LEFT 90 D 2500
STRAIGHT 1500 LEFT 90 D 2500
STRAIGHT 2640
OPER CNA500 PROF=STD3D D=0.2970 N=0.0190
OPER CNA441 PROF=STD3D D=5.5244 N=0.3526
OPER BEC58P PROF=STD3D D=13.3417 N=0.8516
OPER GASEPV PROF=STD3D D=4.2948 N=0.2741
OPER GASEPF PROF=STD3D D=21.5481 N=1.3754

TRACK LA3 RWY 10 STRAIGHT 50000
OPER CNA500 PROF=STD3D D=0.0248 N=0.0016
OPER CNA441 PROF=STD3D D=0.4604 N=0.0294
OPER BEC58P PROF=STD3D D=1.1118 N=0.0710
OPER GASEPV PROF=STD3D D=0.3579 N=0.0228
OPER GASEPF PROF=STD3D D=1.7957 N=0.1146

TRACK LA4 RWY 10 STRAIGHT 50000 LEFT 10 D 2500
STRAIGHT 2640
OPER CNA500 PROF=STD3D D=0.1238 N=0.0079
OPER CNA441 PROF=STD3D D=2.3018 N=0.1469
OPER BEC58P PROF=STD3D D=5.5590 N=0.3548
OPER GASEPV PROF=STD3D D=1.7895 N=0.1142
OPER GASEPF PROF=STD3D D=8.9784 N=0.5731

TRACK LA5 RWY 28 STRAIGHT 50000 LEFT 90 D 2500
STRAIGHT 1500 LEFT 90 D 2500
STRAIGHT 2640
OPER CNA500 PROF=STD3D D=0.1485 N=0.0095
OPER CNA441 PROF=STD3D D=2.7622 N=0.1763
OPER BEC58P PROF=STD3D D=6.6708 N=0.4258
OPER GASEPV PROF=STD3D D=2.1474 N=0.1371
OPER GASEPF PROF=STD3D D=10.7740 N=0.6877

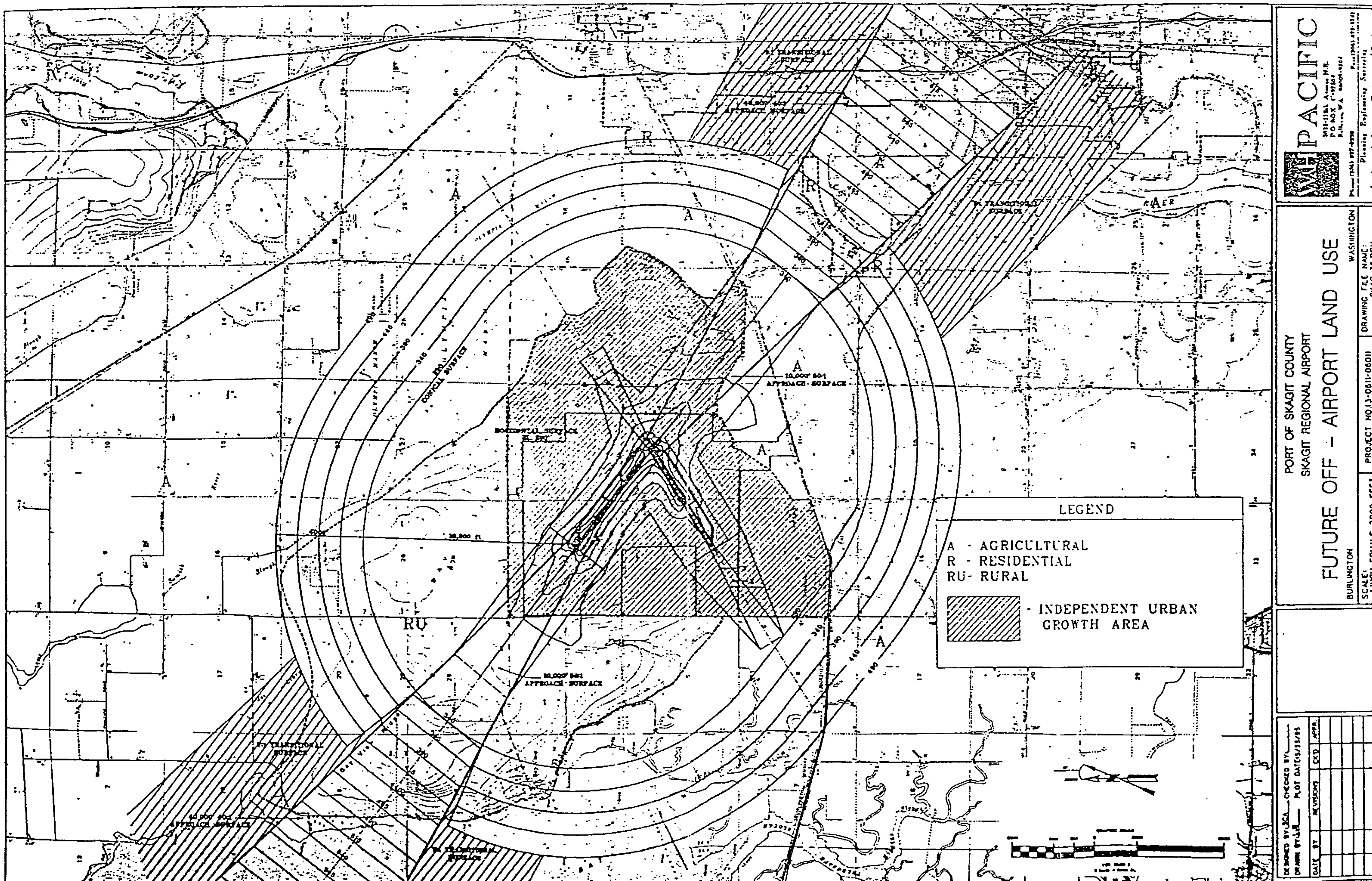
TRACK LA6 RWY 28 STRAIGHT 50000 RIGHT 45 D 2500
STRAIGHT 5400 LEFT 90 D 2500
STRAIGHT 1500 LEFT 90 D 2500
STRAIGHT 2640
OPER CNA500 PROF=STD3D D=0.2970 N=0.0190
OPER CNA441 PROF=STD3D D=5.5244 N=0.3526

```
 OPER BEC58P PROF=STD3D D=13.3417  N=0.8516
 OPER GASEPV PROF=STD3D D=4.2948  N=0.2741
 OPER GASEPF PROF=STD3D D=21.5481 N=1.3754

TRACK LA7 RWY 28 STRAIGHT 50000
 OPER CNA500 PROF=STD3D D=0.0495  N=0.0032
 OPER CNA441 PROF=STD3D D=0.9207  N=0.0588
 OPER BEC58P PROF=STD3D D=2.2236  N=0.1419
 OPER GASEPV PROF=STD3D D=0.7158  N=0.0457
 OPER GASEPF PROF=STD3D D=3.5913  N=0.2292

TRACK LA8 RWY 03  STRAIGHT 50000 LEFT 90 D 1500
          STRAIGHT 1500  LEFT 90 D 1500
          STRAIGHT 2640
 OPER GASEPV PROF=STD3D D=0.6920  N=0.0000
 OPER GASEPF PROF=STD3D D=0.2307  N=0.0000

TRACK LA9 RWY 03  STRAIGHT 50000 RIGHT  45 D 1500
          STRAIGHT 5400  LEFT 90 D 1500
          STRAIGHT 1500  LEFT 90 D 1500
          STRAIGHT 2640
 OPER GASEPV PROF=STD3D D=3.4598  N=0.0000
 OPER GASEPF PROF=STD3D D=1.1533  N=0.0000

TRACK LA10 RWY 03 STRAIGHT 50000
 OPER GASEPV PROF=STD3D D=0.4613  N=0.0000
 OPER GASEPF PROF=STD3D D=0.1538  N=0.0000

TRACK LA11 RWY 21 STRAIGHT 50000 LEFT 90 D 1500
          STRAIGHT 1500  LEFT 90 D 1500
          STRAIGHT 2640
 OPER GASEPV PROF=STD3D D=1.0380  N=0.0000
 OPER GASEPF PROF=STD3D D=0.3460  N=0.0000

TRACK LA12 RWY 21 STRAIGHT 50000 LEFT 90 D 1500
          STRAIGHT 1500  LEFT 90 D 1500
          STRAIGHT 2640
 OPER GASEPV PROF=STD3D D=5.1898  N=0.0000
 OPER GASEPF PROF=STD3D D=1.7299  N=0.0000

TRACK LA13 RWY 21 STRAIGHT 50000
 OPER GASEPV PROF=STD3D D=0.6920  N=0.0000
 OPER GASEPF PROF=STD3D D=0.2307  N=0.0000

TOUCHGOS BY FREQUENCY:

TRACK TG1 RWY 10 STRAIGHT 6800 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 8120 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 1320
 OPER GASEPV STAGE 1 PROF=STD3D D=7.1277
N=0.4550
 OPER GASEPF STAGE 1 PROF=STD3D D=21.3748
N=1.3643

TRACK TG2 RWY 28 STRAIGHT 6800 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 8120 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 1320
 OPER GASEPV STAGE 1 PROF=STD3D D=7.1277
N=0.4550
 OPER GASEPF STAGE 1 PROF=STD3D D=21.3748
N=1.3643

TRACK TG3 RWY 03  STRAIGHT 5400 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 6400 LEFT 90 D 1500
          STRAIGHT 1000 LEFT 90 D 1500
          STRAIGHT 1000
 OPER GASEPV STAGE 1 PROF=STD3D D=1.0705
N=0.0000
 OPER GASEPF STAGE 1 PROF=STD3D D=3.2102
N=0.0000

TRACK TG4 RWY 21 STRAIGHT 5400 RIGHT 90 D 1500
          STRAIGHT 1000 RIGHT 90 D 1500
          STRAIGHT 6400 RIGHT 90 D 1500
          STRAIGHT 1000 RIGHT 90 D 1500
          STRAIGHT 1000
 OPER GASEPV STAGE 1 PROF=STD3D D=1.6057
N=0.0000
 OPER GASEPF STAGE 1 PROF=STD3D D=4.8153
N=0.0000

PROCESSES:

CONTOUR LDN AT 55 60 65 70 75
 WITH TOLERANCE=1
 REFINE=6
 XSTART=-10000
 YSTART=-10000
 XSTOP=10000
 YSTOP=10000
 PLOT
END.
```

```
BEGIN.
SETUP:
TITLE <SKAGIT 2013 (3-21 South End), December 28,
1993>
AIRPORT <SKAGIT>
ALTITUDE 140 TEMPERATURE 75.1 F

RUNWAYS
RW 10-28   -3685 0    TO  1790 0
RW 03-21   0 -4840    TO  858 -2478

AIRCRAFT:

TYPES
AC CNA500
AC CNA441
AC BEC58P
AC GASEPV
AC GASEPF

TAKEOFFS BY FREQUENCY:

TRACK TO1 RWY 10 STRAIGHT 6800 LEFT 90 D 2500
          STRAIGHT 1250 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0743 N=0.0047
 OPER CNA441 STAGE 1 D=1.3811 N=0.0886
 OPER BEC58P STAGE 1 D=3.3354 N=0.2129
 OPER GASEPV STAGE 1 D=1.0737 N=0.0685
 OPER GASEPF STAGE 1 D=5.3870 N=0.3439

TRACK TO2 RWY 10 STRAIGHT 6800 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0248 N=0.0016
 OPER CNA441 STAGE 1 D=0.4604 N=0.0294
 OPER BEC58P STAGE 1 D=1.1118 N=0.0710
 OPER GASEPV STAGE 1 D=0.3579 N=0.0228
 OPER GASEPF STAGE 1 D=1.7957 N=0.1146

TRACK TO3 RWY 10 STRAIGHT 6800 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.2475 N=0.0158
 OPER CNA441 STAGE 1 D=4.6037 N=0.2939
 OPER BEC58P STAGE 1 D=11.1181 N=0.7097
 OPER GASEPV STAGE 1 D=3.5790 N=0.2284
 OPER GASEPF STAGE 1 D=17.9567 N=1.1462

TRACK TO4 RWY 10 STRAIGHT 6800 RIGHT 90 D 2500
          STRAIGHT 5280 RIGHT 35 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0495 N=0.0032
 OPER CNA441 STAGE 1 D=0.9207 N=0.0588
 OPER BEC58P STAGE 1 D=2.2236 N=0.1419
 OPER GASEPV STAGE 1 D=0.7158 N=0.0457
 OPER GASEPF STAGE 1 D=3.5913 N=0.2292

TRACK TO5 RWY 10 STRAIGHT 6800 RIGHT 90 D 2500
          STRAIGHT 5280 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0990 N=0.0063
 OPER CNA441 STAGE 1 D=1.8415 N=0.1175
 OPER BEC58P STAGE 1 D=4.4472 N=0.2839
 OPER GASEPV STAGE 1 D=1.4316 N=0.0914
 OPER GASEPF STAGE 1 D=7.1827 N=0.4585

TRACK TO6 RWY 28 STRAIGHT 6800 LEFT 90 D 2500
          STRAIGHT 1250 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.2475 N=0.0158
 OPER CNA441 STAGE 1 D=4.6037 N=0.2939
 OPER BEC58P STAGE 1 D=11.1181 N=0.7097
 OPER GASEPV STAGE 1 D=3.5790 N=0.2284
 OPER GASEPF STAGE 1 D=17.9567 N=1.1462

TRACK TO7 RWY 28 STRAIGHT 6800 LEFT 55 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0495 N=0.0032
 OPER CNA441 STAGE 1 D=0.9207 N=0.0588
 OPER BEC58P STAGE 1 D=2.2236 N=0.1419
 OPER GASEPV STAGE 1 D=0.7158 N=0.0457
 OPER GASEPF STAGE 1 D=3.5913 N=0.2292

TRACK TO8 RWY 28 STRAIGHT 6800 LEFT 10 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0990 N=0.0063
 OPER CNA441 STAGE 1 D=1.8415 N=0.1175
 OPER BEC58P STAGE 1 D=4.4472 N=0.2839
 OPER GASEPV STAGE 1 D=1.4316 N=0.0914
 OPER GASEPF STAGE 1 D=7.1827 N=0.4585

TRACK TO9 RWY 28 STRAIGHT 6800 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0743 N=0.0047
 OPER CNA441 STAGE 1 D=1.3811 N=0.0886
 OPER BEC58P STAGE 1 D=3.3354 N=0.2129
 OPER GASEPV STAGE 1 D=1.0737 N=0.0685
 OPER GASEPF STAGE 1 D=5.3870 N=0.3439

TRACK TO10 RWY 28 STRAIGHT 6800 RIGHT 90 D 2500
          STRAIGHT 5280 RIGHT 80 D 2500
          STRAIGHT 50000
 OPER CNA500 STAGE 1 D=0.0248 N=0.0016
 OPER CNA441 STAGE 1 D=0.4604 N=0.0294
 OPER BEC58P STAGE 1 D=1.1118 N=0.0710
 OPER GASEPV STAGE 1 D=0.3579 N=0.0228
 OPER GASEPF STAGE 1 D=1.7957 N=0.1146
```

```
TRACK TO11 RWY 03 STRAIGHT 6320 LEFT 90 D 1500
        STRAIGHT 1250 LEFT 30 D 1500
        STRAIGHT 50000
 OPER GASEPV STAGE 1 D=0.9226 N=0.0000
 OPER GASEPF STAGE 1 D=0.3075 N=0.0000

TRACK TO12 RWY 03 STRAIGHT 6320 LEFT 30 D 1500
        STRAIGHT 50000
 OPER GASEPV STAGE 1 D=0.6920 N=0.0000
 OPER GASEPF STAGE 1 D=0.2307 N=0.0000

TRACK TO13 RWY 03 STRAIGHT 1250 RIGHT 60 D 1500
        STRAIGHT 50000
 OPER GASEPV STAGE 1 D=0.2307 N=0.0000
 OPER GASEPF STAGE 1 D=0.0769 N=0.0000

TRACK TO14 RWY 03 STRAIGHT 6320 RIGHT 90 D 1500
        STRAIGHT 1250 RIGHT 60 D 1500
        STRAIGHT 50000
 OPER GASEPV STAGE 1 D=2.3066 N=0.0000
 OPER GASEPF STAGE 1 D=0.7689 N=0.0000

TRACK TO15 RWY 03 STRAIGHT 6320 LEFT 90 D 1500
        STRAIGHT 1250 LEFT 70 D 1500
        STRAIGHT 50000
 OPER GASEPV STAGE 1 D=0.4613 N=0.0000
 OPER GASEPF STAGE 1 D=0.1538 N=0.0000

TRACK TO16 RWY 21 STRAIGHT 6320 LEFT 90 D 1500
        STRAIGHT 1250 LEFT 30 D 1500
        STRAIGHT 50000
 OPER GASEPV STAGE 1 D=0.3460 N=0.0000
 OPER GASEPF STAGE 1 D=0.1153 N=0.0000

TRACK TO17 RWY 21 STRAIGHT 6320 LEFT 30 D 1500
        STRAIGHT 50000
 OPER GASEPV STAGE 1 D=3.4598 N=0.0000
 OPER GASEPF STAGE 1 D=1.1533 N=0.0000

TRACK TO18 RWY 21 STRAIGHT 6320 RIGHT 15 D 1500
        STRAIGHT 50000
 OPER GASEPV STAGE 1 D=0.6920 N=0.0000
 OPER GASEPF STAGE 1 D=0.2307 N=0.0000

TRACK TO19 RWY 21 STRAIGHT 6320 RIGHT 45 D 1500
        STRAIGHT 50000
 OPER GASEPV STAGE 1 D=1.3839 N=0.0000
 OPER GASEPF STAGE 1 D=0.4613 N=0.0000

TRACK TO20 RWY 21 STRAIGHT 6320 RIGHT 90 D 1500
        STRAIGHT 1250 RIGHT 30 D 1500
        STRAIGHT 50000
 OPER GASEPV STAGE 1 D=1.0380 N=0.0000
 OPER GASEPF STAGE 1 D=0.3460 N=0.0000

LANDING BY FREQUENCY:

TRACK LA1 RWY 10 STRAIGHT 50000 LEFT 90 D 2500
        STRAIGHT 1500 LEFT 90 D 2500
        STRAIGHT 2640
 OPER CNA500   PROF=STD3D D=0.0495 N=0.0032
 OPER CNA441 PROF=STD3D D=0.9207 N=0.0588
 OPER BEC58P PROF=STD3D D=2.2236 N=0.1419
 OPER GASEPV PROF=STD3D D=0.7158 N=0.0457
 OPER GASEPF PROF=STD3D D=3.5913 N=0.2292

TRACK LA2 RWY 10 STRAIGHT 50000 RIGHT 45 D 2500
        STRAIGHT 5400 LEFT 90 D 2500
        STRAIGHT 1500 LEFT 90 D 2500
        STRAIGHT 2640
 OPER CNA500 PROF=STD3D D=0.2970 N=0.0190
 OPER CNA441 PROF=STD3D D=5.5244 N=0.3526
 OPER BEC58P PROF=STD3D D=13.3417 N=0.8516
 OPER GASEPV PROF=STD3D D=4.2948 N=0.2741
 OPER GASEPF PROF=STD3D D=21.5481 N=1.3754

TRACK LA3 RWY 10 STRAIGHT 50000
 OPER CNA500 PROF=STD3D D=0.0248 N=0.0016
 OPER CNA441 PROF=STD3D D=0.4604 N=0.0294
 OPER BEC58P PROF=STD3D D=1.1118 N=0.0710
 OPER GASEPV PROF=STD3D D=0.3579 N=0.0228
 OPER GASEPF PROF=STD3D D=1.7957 N=0.1146

TRACK LA4 RWY 10 STRAIGHT 50000 LEFT 10 D 2500
        STRAIGHT 2640
 OPER CNA500 PROF=STD3D D=0.1238 N=0.0079
 OPER CNA441 PROF=STD3D D=2.3018 N=0.1469
 OPER BEC58P PROF=STD3D D=5.5590 N=0.3548
 OPER GASEPV PROF=STD3D D=1.7895 N=0.1142
 OPER GASEPF PROF=STD3D D=8.9784 N=0.5731

TRACK LA5 RWY 28 STRAIGHT 50000 LEFT 90 D 2500
        STRAIGHT 1500 LEFT 90 D 2500
        STRAIGHT 2640
 OPER CNA500 PROF=STD3D D=0.1485 N=0.0095
 OPER CNA441 PROF=STD3D D=2.7622 N=0.1763
 OPER BEC58P PROF=STD3D D=6.6708 N=0.4258
 OPER GASEPV PROF=STD3D D=2.1474 N=0.1371
 OPER GASEPF PROF=STD3D D=10.7740 N=0.6877

TRACK LA6 RWY 28 STRAIGHT 50000 RIGHT 45 D 2500
        STRAIGHT 5400 LEFT 90 D 2500
        STRAIGHT 1500 LEFT 90 D 2500
        STRAIGHT 2640
 OPER CNA500 PROF=STD3D D=0.2970 N=0.0190
 OPER CNA441 PROF=STD3D D=5.5244 N=0.3526
```

```
 OPER BEC58P PROF=STD3D D=13.3417  N=0.8516
 OPER GASEPV PROF=STD3D D=4.2948  N=0.2741
 OPER GASEPF PROF=STD3D D=21.5481 N=1.3754

TRACK LA7 RWY 28 STRAIGHT 50000
 OPER CNA500 PROF=STD3D D=0.0495  N=0.0032
 OPER CNA441 PROF=STD3D D=0.9207  N=0.0588
 OPER BEC58P PROF=STD3D D=2.2236  N=0.1419
 OPER GASEPV PROF=STD3D D=0.7158  N=0.0457
 OPER GASEPF PROF=STD3D D=3.5913  N=0.2292

TRACK LA8 RWY 03  STRAIGHT 50000 LEFT 90 D 1500
         STRAIGHT 1500  LEFT 90 D 1500
         STRAIGHT 2640
 OPER GASEPV PROF=STD3D D=0.6920  N=0.0000
 OPER GASEPF PROF=STD3D D=0.2307  N=0.0000

TRACK LA9 RWY 03  STRAIGHT 50000 RIGHT  45 D 1500
         STRAIGHT 5400  LEFT 90 D 1500
         STRAIGHT 1500  LEFT 90 D 1500
         STRAIGHT 2640
 OPER GASEPV PROF=STD3D D=3.4598  N=0.0000
 OPER GASEPF PROF=STD3D D=1.1533  N=0.0000

TRACK LA10 RWY 03 STRAIGHT 50000
 OPER GASEPV PROF=STD3D D=0.4613  N=0.0000
 OPER GASEPF PROF=STD3D D=0.1538  N=0.0000

TRACK LA11 RWY 21 STRAIGHT 50000 LEFT 90 D 1500
         STRAIGHT 1500  LEFT 90 D 1500
         STRAIGHT 2640
 OPER GASEPV PROF=STD3D D=1.0380  N=0.0000
 OPER GASEPF PROF=STD3D D=0.3460  N=0.0000

TRACK LA12 RWY 21 STRAIGHT 50000 LEFT 90 D 1500
         STRAIGHT 1500  LEFT 90 D 1500
         STRAIGHT 2640
 OPER GASEPV PROF=STD3D D=5.1898  N=0.0000
 OPER GASEPF PROF=STD3D D=1.7299  N=0.0000

TRACK LA13 RWY 21 STRAIGHT 50000
 OPER GASEPV PROF=STD3D D=0.6920  N=0.0000
 OPER GASEPF PROF=STD3D D=0.2307  N=0.0000

TOUCHGOS BY FREQUENCY:

TRACK TG1 RWY 10 STRAIGHT 6800 LEFT 90 D 1500
         STRAIGHT 1000 LEFT 90 D 1500
         STRAIGHT 8120 LEFT 90 D 1500
         STRAIGHT 1000 LEFT 90 D 1500
         STRAIGHT 1320
 OPER GASEPV STAGE 1 PROF=STD3D D=7.1277
N=0.4550
 OPER GASEPF STAGE 1 PROF=STD3D D=21.3748
N=1.3643

TRACK TG2 RWY 28 STRAIGHT 6800 LEFT 90 D 1500
         STRAIGHT 1000 LEFT 90 D 1500
         STRAIGHT 8120 LEFT 90 D 1500
         STRAIGHT 1000 LEFT 90 D 1500
         STRAIGHT 1320
 OPER GASEPV STAGE 1 PROF=STD3D D=7.1277
N=0.4550
 OPER GASEPF STAGE 1 PROF=STD3D D=21.3748
N=1.3643

TRACK TG3 RWY 03  STRAIGHT 5400 LEFT 90 D 1500
         STRAIGHT 1000 LEFT 90 D 1500
         STRAIGHT 6400 LEFT 90 D 1500
         STRAIGHT 1000 LEFT 90 D 1500
         STRAIGHT 1000
 OPER GASEPV STAGE 1 PROF=STD3D D=1.0705
N=0.0000
 OPER GASEPF STAGE 1 PROF=STD3D D=3.2102
N=0.0000

TRACK TG4 RWY 21 STRAIGHT 5400 RIGHT 90 D 1500
         STRAIGHT 1000 RIGHT 90 D 1500
         STRAIGHT 6400 RIGHT 90 D 1500
         STRAIGHT 1000 RIGHT 90 D 1500
         STRAIGHT 1000
 OPER GASEPV STAGE 1 PROF=STD3D D=1.6057
N=0.0000
 OPER GASEPF STAGE 1 PROF=STD3D D=4.8153
N=0.0000

PROCESSES:

CONTOUR LDN AT 55 60 65 70 75
 WITH TOLERANCE=1
 REFINE=6
 XSTART=-10000
 YSTART=-10000
 XSTOP=10000
 YSTOP=10000
 PLOT
END.
```



LEGEND
A - AGRICULTURAL
R - RESIDENTIAL
RU- RURAL
- INDEPENDENT URBAN GROWTH AREA
PACIFIC
PORT OF SKAGIT COUNTY
SKAGIT REGIONAL AIRPORT
FUTURE OFF - AIRPORT LAND USE
BURLINGTON
WASHINGTON
SCALE: 1 INCH EQUALS 2000 FEET
PROJECT NO.13-0611-08011
DRAWING FILE NAME: SKAG-78.DGN
10,000' 50:1 APPROACH SURFACE
CONICAL SURFACE
HORIZONTAL SURFACE
A
R
RU

EXHIBIT 8.2

APPENDIX C

14 CFR Part 77
Skagit Regional Airport Master Plan Update
June 1995

Pilots can obtain all weather-related flight briefings through toll-free telephone communications with the Seattle Flight Service Station (FSS) located at Boeing Field in Seattle. The telephone number is 1-800-WZ-BRIEF (1-800-632-6582).

Whidbey Naval radar approach and departure control on a frequency of 120.7 MHz provides approach and departure services for the Whidbey Naval Air Station. Some navigational assistance can be given to GA aircraft when Naval personnel time permits.

FAR Part 77 Surfaces

Airspace generally consists of airways and air traffic patterns as well as the designated Federal Aviation Regulations (FAR) Part 77 imaginary surfaces, designated approach procedures, and other imaginary surfaces.

Ideally, airports are designed so that the surrounding airspace is free and clear of obstructions that could be hazardous to aircraft on approach or departure paths. Regulations to protect airspace in the vicinity of airports are established by defining a set of imaginary surfaces. Penetration of these surfaces represents an obstruction to air navigation.

The geometry of the imaginary surfaces is governed by the type of approach available to the runways and the regulations set forth in Federal Aviation Regulations (FAR) Part 77, Objects Affecting Navigable Airspace. Exhibit 3.11 depicts isometric views of Part 77 imaginary surfaces. The protected airspace around the airport is made up of five imaginary surfaces.

- **Primary Surface** - A surface that is longitudinally centered on the runway, extending 200 feet beyond the threshold in each direction. The width of Runway 10-28's primary surface is 250 feet and Runway 3-21's is 250 feet.

- **Approach Surface** - An inclined slope or plane going outward and upward from the ends of the primary surfaces. The Approach Surfaces of Runways 10 and 28 are 250-feet wide at the innermost points, extending outward for 5,000 feet at a slope of 20:1 to the outer widths of 1,250 feet. The Approach Surfaces of Runways 3 and 21 are 250 feet wide at the innermost points and extend outward for 5,000 feet at a slope of 20:1 to their outer widths of 1,250 feet.

- **Horizontal Surface** - A horizontal plane 150 feet above the established airport elevation [150' + 140'(established airport elevation)=290']. The plan dimensions of the horizontal surface are set forth by 5,000-foot arcs from the extended runway centerline at the end of the primary surfaces, connected by tangents. These arcs correspond with the approach surface lengths for each of the runway ends.

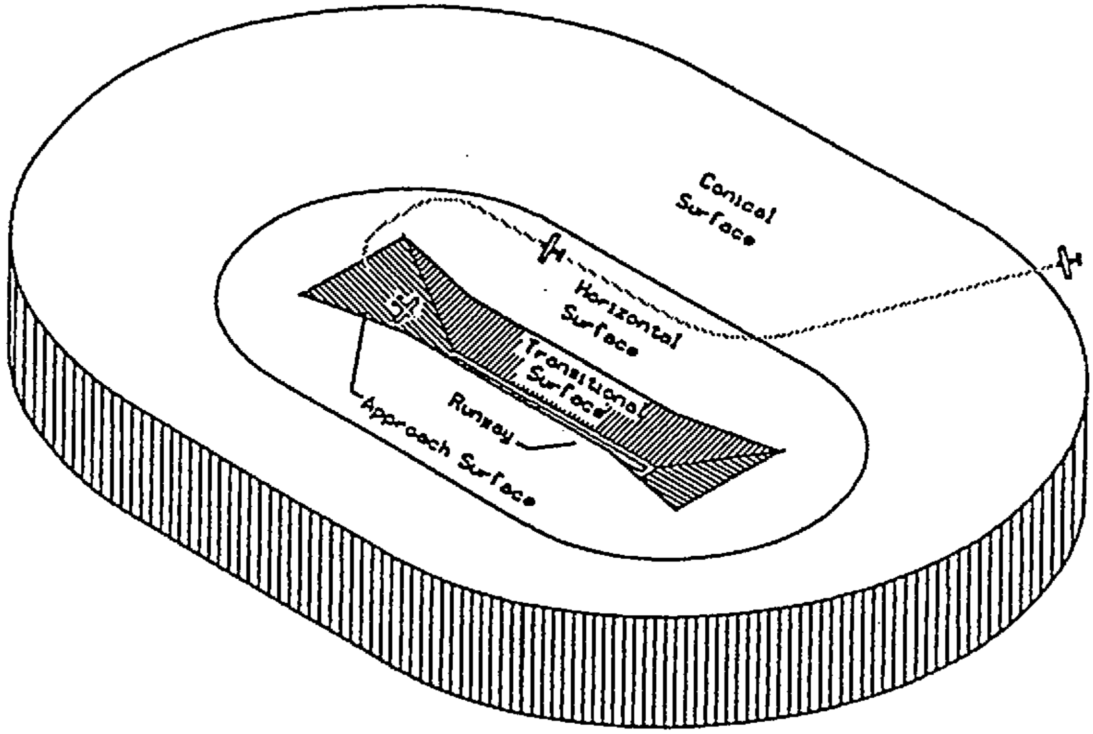
- **Transitional Surface** - An inclined plane with a slope of 7:1 extending upward and outward from the primary and approach surfaces, terminating at the point where they intersect with the horizontal surface or any other surface where more critical restrictions are intercepted.

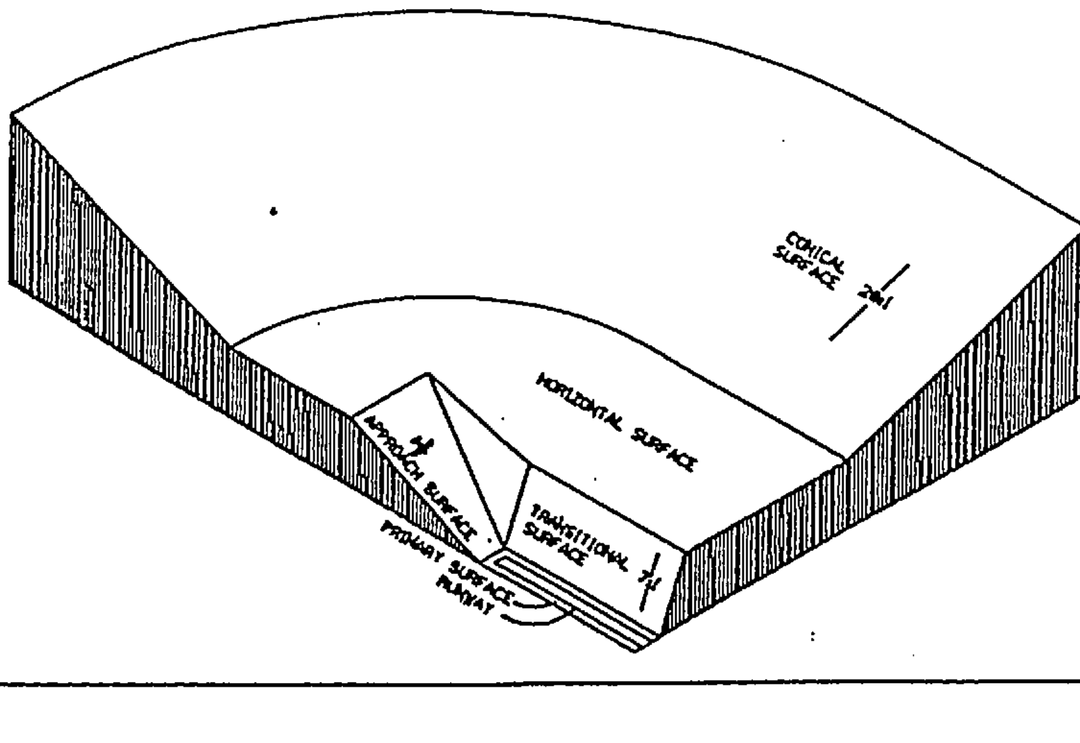
- **Conical Surface** - An inclined plane at a slope of 20:1 extending upward and outward from the periphery of the horizontal surface for a distance of 4,000 feet.

The five imaginary surfaces comprise the Part 77 imaginary surfaces. The Part 77 regulations keep surrounding airspace free and clear of obstructions that could be hazardous to aircraft on approach or departure paths.

Traffic Patterns

Both Runway 10-28 and 3-21 utilize a standard left-hand traffic pattern. Traffic pattern altitude is 1,140 Mean Sea Level (MSL) or 1,000 feet Above Ground Altitude (AGL). Exhibit 3.12 depicts a standard left-hand traffic pattern.





W&H PACIFIC	SKAGIT REGIONAL AIRPORT	Exhibit
	Isometric Views of Part 77 Imaginary Surface	3.11

Phase III (11-20 years) continues the Runway 3-21 flightline development, maintenance overlay of Runway 3-21, and sealing of Runway 10-28 to preserve it's serviceability.

TERMINAL AREA PLAN

As a refinement to the ALP, the Terminal Area Plan is developed to provide a closer look at the landside facility development plan. As shown in Exhibit 7.3, the Terminal Area Plan includes flightline development for both Runway 10-28 and Runway 3-21.

Future expansion to the northwest of the existing Runway 10-28 flightline is still anticipated and the area has been designated for future growth. This growth may occur in the short term should a potential aviation-related user require access to the greater separation and strength characteristics of Runway 10-28. A proposal such as this may justify the wetland mitigation that would be likely, but would need to be evaluated on it's own particular merits. However, the projected growth within the planning period is expected to be accommodated by the opening of the 3-21 flightline which may also provide development opportunity within the confines of the existing flightline should portions of the activity relocate to the new flightline, such as cargo carriers.

AIRSPACE PLANS

Ideally, airports should be located so that all surrounding airspace is free and clear of obstructions that could be hazardous to aircraft on takeoff or landing. Therefore, the surrounding area must be kept free from obstacles by preventing, where possible, development and growth that could cause hazards in this airspace. In the case where obstructions currently exist, they must be cataloged and their ultimate disposition should be determined. As recommended by the FAA , the Port should plan and protect for precision capability for Runway 10-28 which will require more stringent approach clearance requirements than the previous plan.

The regulations for the protection of airspace in the vicinity of airports are established by the definition of a set of imaginary surfaces, penetration of which represent an obstacle to air navigation that must be acted on. The geometry of these surfaces is governed by the regulations that are set forth in the Federal Aviation Regulations (FAR) Part 77, "Objects Affecting the Navigable Airspace."

The FAR Part 77 Imaginary Surfaces Plan is shown on Exhibit 7.4, which depicts the existing and future critical airspace. The protected airspace around the Skagit Regional Airport is made up of five surfaces described below.

Primary Surface. A surface that is longitudinally centered on the runway, extending 200 feet beyond the paved threshold in each direction. Runway 10-28's ultimate primary surface measures 1000 feet across because it is a precision instrument runway. Runway 3-21's ultimate primary surface measures 250 feet across since it is a utility runway with a visual approach.

Approach Surfaces. Inclined planes extending upward and outward from the ends of the primary surfaces. The approaches for Runway 10-28 are established in support of a future precision approach. Runway 10-28's approach surfaces are 1,000 feet wide at the intersection with the primary surface. The surfaces extend outward for a distance of 10,000 feet at a slope of 50:1 and another 40,000 feet at a slope of 40:1. They widen to 16,000 feet wide at their outermost point.

Runway 3-21's approach surfaces are the same at both runway ends. The approach surfaces are 250 feet across at the primary surface and extend outward for a distance of 5,000 feet at a 20:1 slope to an outer width of 1,250.

The approach plans and profiles for the runways are shown on Exhibits 7.5 and 7.6.

Horizontal Surface. A horizontal plane 150 feet above the established airport elevation. The plan dimensions of the horizontal surface are set by arcs extending from the end of the primary surface, connected by tangent lines. These arcs correspond with the approach surface as specified above except they are limited to a maximum length of 10,000 feet.

Transitional Surface. An inclined plane with a slope of 7:1 extending upward and outward from the primary and approach surfaces, terminating at the point where they intersect with the horizontal surface or any other surface with more critical restrictions.

Conical Surface. An inclined plane at a slope of 20:1 extending upward and outward from the periphery of the horizontal surface for a distance of 4,000 feet.

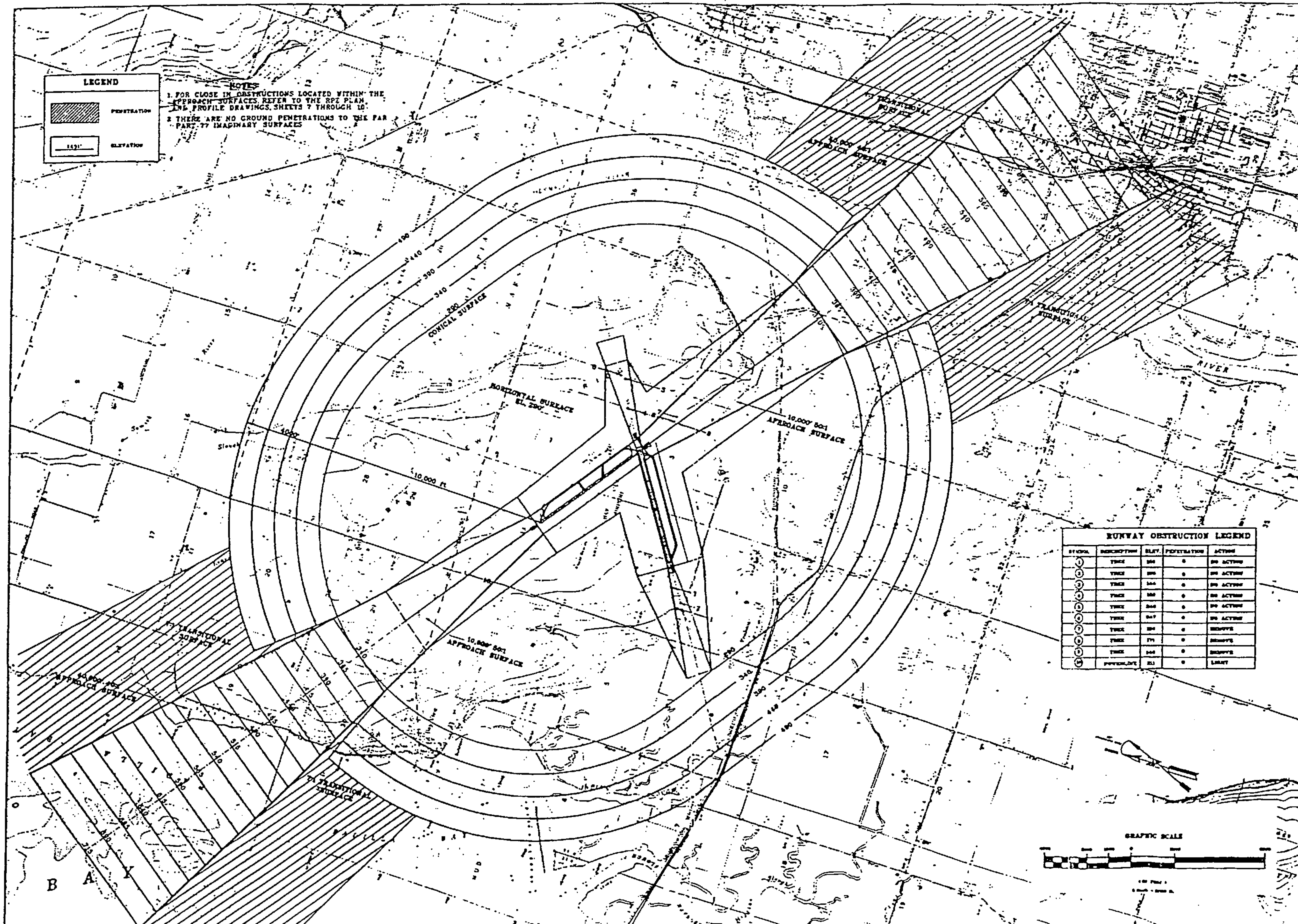
RUNWAY PROTECTION ZONE PLANS AND PROFILES

Exhibits 7.7 through 7.10 show the runway protection zone plans and profiles for Runways 10, 28, 3 and 21, respectively, at Skagit Regional Airport. Obstructions critical to these surfaces have been identified on the drawing. Runway 10-28 has clear RPZs that are sufficient for existing and future operations. The future instrument approaches for Runway 10-28 have several obstructions which preclude a clear 50:1 approach to either runway. These obstructions include the existing fence and local maintenance road just off the end of Runway 28, and several trees located just off airport property beyond the end of Runway 10. The Port plans on relocating the fence when the Runway Safety Area improvements for Runway 10-28 are initiated, working with the local property owner to remove the trees, and posting signs for low flying aircraft along the maintenance road. Runway 3-21 has two existing obstructions penetrating less than three feet into the approach slope.

LAND USE PLANS

Properties on and surrounding the airport are zoned for a variety of uses from rural to industrial. The Land Use Plans, Exhibits 7.11 to 7.14, show the existing and future designation of these properties. Future zoning information is based on recent Skagit County planning information developed relative to the Growth Management Act.

Development of the industrial areas to the north and east of the airfield continues to provide the airport with demand for air cargo services. Other areas on and around the airport include other Commercial-Limited Industrial, Industrial, Residential, Rural, and Agricultural. Each of these land uses are keyed to the Land Use Plan.



RUNWAY OBSTRUCTION LEGEND				
SYMBOL	DESCRIPTION	ELEV.	PENETRATION	ACTION
1	TREE	[illegible]	•	NO ACTION
2	TREE	[illegible]	•	NO ACTION
3	TREE	[illegible]	•	NO ACTION
4	TREE	[illegible]	•	NO ACTION
5	TREE	[illegible]	•	NO ACTION
6	TREE	[illegible]	•	NO ACTION
7	TREE	[illegible]	•	REMOVE
8	TREE	[illegible]	•	REMOVE
9	TREE	[illegible]	•	REMOVE
10	[illegible]	[illegible]	•	LIGHT

W&H PACIFIC

Planning Engineering Surveying
Landscape Architecture Environmental Services

PORT OF SKAGIT COUNTY
SKAGIT REGIONAL AIRPORT

AIRPORT AIRSPACE PLAN

BURLINGTON WASHINGTON

SCALE: 1 INCH EQUALS 2000 FEET | PROJECT NO. (3-0611-0601)) | DRAWING FILE NAME: SKAG-74.DGN

DESIGNED BY: SCA CHECKED BY: ___
DRAWN BY: LLK PLOT DATE: 05/23/95

DATE	BY	REVISIONS	CK'D	APPR

EXHIBIT 7.4

APPENDIX D

Aircraft Accident Safety Zones

Appendix D – Aircraft Accident Safety Zones

DEVELOPING STRATEGIES

The objective of developing a safety compatibility plan is to minimize the risks associated with potential aircraft accidents. There are two components to this:

- Safety on the Ground: Provide for the safety of both people and property on the ground in the event of an aircraft accident near the airport; and

- Safety for Aircraft Occupants: Enhance the chance of survival of aircraft occupants involved in an accident which takes place beyond the immediate runway environment.

Meeting this objective for safety compatibility involved a two-step process:

1. Generate an *Aircraft Accident Safety Zone Diagram* that reflects local conditions; and
2. Apply *land use characteristics* to the various zones that take into consideration the relative risks.

AIRCRAFT ACCIDENT SAFETY ZONE DIAGRAM

The safety zone diagram for the Skagit Regional Airport relies on the Aircraft Accident Safety Zone Diagram (attached) presented in Airports and Compatible Land Use, February 1999, prepared by the Washington State Department of Transportation Aviation Division (WSDOT). The source for the WSDOT safety zone diagram is the Airport Land Use Planning Handbook, December 1993, prepared for the California Department of Transportation Division of Aeronautics (CALTRANS) by Hodges and Shutt. To review the WSDOT safety zone diagram for applicability to the local conditions at Skagit Regional Airport it was necessary to review the methodology provided in the CALTRANS document. Thus, it is referenced here.

Crash Data

The methodology provided in the CALTRANS[1] document includes an analysis of aircraft accident characteristics as well as an analysis of capture rates for zones of various dimensions. The aircraft accident characteristics analysis evaluates where and when aircraft accidents can be expected to occur based on several variables including:

- Type of aircraft and performance limitations
- Stage of flight (arrival vs. departure)
- Pilot control of aircraft
- Length of runway
- Airplane traffic patterns
- Type of flight rules
- Weather conditions
- Time of day

Crash locations were plotted for each of these variables (and subsets of these variables), resulting in numerous 'hit mark' patterns. For example, single-engine aircraft crashes tend to be more tightly grouped around runway ends than crashes involving multi-engine aircraft; crashes occurring on arrival tend to be more concentrated around runway ends than crashes occurring on departure; IFR arrival accidents tend to occur farther from the end of the runway than VFR accidents do; nighttime accident sites are generally farther from the runway than daytime accident sites (data also shows the nighttime accident rate to be greater than the daytime rate).

The crash database for these plots was obtained from the National Transportation Safety Board (NTSB) and reflects a total of 400 aircraft accident records, occurring nationwide, over a time period from 1983 into 1991[2]. Though crash

[1] For complete methodology the reader is referred to Chapter 8 Aircraft Accident Characteristics, Airport Land Use Planning Handbook, December 1993, CALTRANS Division of Aeronautics.

[2] Page 8-13, Chapter 8 Aircraft Accident Characteristics, Airport Land Use Planning Handbook, December 1993, CALTRANS Division of Aeronautics.

data was collected only for general aviation airplanes (no airline aircraft), the size of the airports where crashes occurred vary in size. In an effort to factor out the runway length variable in the location of the crashes (i.e., a crash occurring 1,000 feet from the end of a 3,000 foot runway would appear to be occurring *on* the runway of a 5,000 foot runway) the study individually assessed the crash sites associated with different length runways. This was completed for three categories as follows:

1. Runway less than 4,000 feet
2. Runway 4,000 to 5,999 feet
3. Runway 6,000 feet or more

Again, patterns appeared when the crash data was plotted against runway length. The patterns revealed that the longer the runway, the greater the spread of accidents and the study suggested several possibilities for this:

- Almost half (47%) of all accidents on runways of 6,000 feet or more are by twin-engine aircraft compared to 8% on runways under 4,000 feet.

- Long runways have more IFR accidents – 43% for runways of 6,000 feet or more, 12% for runways of less than 4,000 feet.

- Similarly, for nighttime accidents, more occur on long runways (48%) than on short ones (16%) (greater likelihood of long runways being lighted).

This information allows one to make conclusions regarding the crash patterns that may be expected at a specific airport. For example, Skagit Regional Airport maintains a fleet mix consisting of 90 percent single engine aircraft and eight percent multi-engine aircraft[3]. As such, one could conclude that accident patterns at Skagit Regional Airport would tend to be more tightly grouped around runway ends.

Safety Zone Alternatives

With the patterns and conclusions drawn from the crash data plots, the CALTRANS study proceeds to utilize the data to define the areas where crashes are anticipated to occur. The CALTRANS study states: "Because highly restricting the use of land everywhere within the vicinity of airports is normally impractical, the typical strategy is to have more restrictions in locations where accident risks are comparatively higher. This concept suggests two basic objectives to be sought in the analysis of historical accident location data:

- An indication of what shape of safety zones encompass the greatest concentrations of accident sites in the smallest acreage; and

- Identification of any points in this continuum where the ratio of accidents per acre changes noticeably."[4]

Noting, "No single means of defining the area of safety compatibility concerns around airports is correct" the CALTRANS study does provide a "Safety Zone Configuration Example" (attached) together with a summary of accident frequencies per zone (shown as a percentage of total accidents). The example provides six safety zones of various dimensions for runways of three different lengths; less than 4,000 feet; 4,000 to 5,999; and 6,000 feet or more. The WSDOT document adopts this example as their Aircraft Accident Safety Zone Diagram.

Local Conditions

In applying the crash data and safety zone configurations to the Skagit Regional Airport, two things became apparent:

- Dimensions provided for Zone 1 – Runway Protection Zone (runway length between 4,000 feet and 5,999 feet) do not correspond to the actual runway protection zone dimensions of Runway 10-28 at Skagit Regional Airport.

- Characteristics specific to Skagit Regional

---

3 *Source: Exhibit 4.16 Skagit Regional Master Plan Update, June 1995*

4 Page 9-7, Chapter 9 Safety Compatibility Policy Issues, airport Land Use Planning Handbook, December 1993, CALTRANS Division of Aeronautics.

Airport such as aircraft fleet mix, predominant traffic patterns, applicable flight rules, historic accident patterns and nighttime operations had to be ignored.

Runway Protection Zone

By grouping the runways by length alone, the CALTRANS study had to make assumptions as to the type of approach and related runway protection zone (Zone 1) that should be associated with each of the three runways. The runway protection zone (RPZ) is a trapezoidal shape off either end of the runway that is specific to each runway end. The RPZs selected to represent the generic runways do not always agree with actual and forecast conditions. For example, the RPZ applied to the generic mid size runway has dimensions of 500 feet by 1,010 feet by 1,700 feet in length. The FAA designates this RPZ for runways operating under visual flight rules, with not lower than one-mile visibility minimums, and serving large aircraft[5]. By comparison, Skagit County's Runway 10-28, though 5,475 feet in length, has an existing RPZ with smaller dimensions and a future RPZ that will exceed these dimensions (Table D1)[6].

Characteristics Specific to Skagit Regional Airport

Similarly, the Aircraft Accident Safety Zone Diagram and capture rates for the various zones reflect the nationwide data and do not take into consideration airport specific characteristics such as aircraft fleet mix, predominant traffic patterns, applicable flight rules, historic accident patterns and nighttime operations. The CALTRANS study rectifies these variations to a certain extent by plotting crash data against runway length. This allows the safety zones to reflect conditions typically found at a runway of a given length. However, airport specific characteristics still remain unaccounted for. As discussed under crash data above, when plotting crash locations for the different variables specific patterns become evident (i.e. single-engine more clustered than multi-engine). In the case of Skagit Regional, the fleet mix consists predominantly of single-engine aircraft and one would anticipate crash locations to be similar to those found present at short or mid length runways (tighter accident safety zones reflecting predominance of single engine users). Yet Skagit Regional Airport is planning for a precision approach and more appropriately should be considered a long runway (to protect the future RPZ). Another example of local conditions not accounted for would be the predominance of flight tracks that go south. As depicted by the noise contours generated by W&H Pacific for the master plan (Appendix B), the majority of arrivals/departures are from/to the south, drastically minimizing the likelihood of an accident occurring within safety zones situated north of the airport. Again, the Aircraft Accident Safety Zone Diagram does not account for these site specific conditions. Without recreating the CALTRANS study to account for these conditions, it is difficult to obtain an accurate statistical assessment of accident capture rates that might be expected within the various safety zones. Pertinent characteristics of the Skagit Regional Airport and the anticipated impact on statistical crash locations are summarized in Table D2.

Recommended Safety Zone Dimensions

Because of the difficulty involved with recalculating accident capture rates that accurately reflect conditions at the Skagit Regional Airport, it is considered more prudent to use the safety zone dimensions provided by WSDOT and CALTRANS. Rather than focusing on the generation of new capture rates, it is recommended that traffic patterns, fleet mix and other airport specific conditions (Table D2) be taken into consideration when establishing the relative levels of land use restrictions to be applied to each zone.

The recommended safety zone dimensions are provided in Table D3 and are shown on Figure D1. Runway 4-22 uses the WSDOT Safety Zone Dimensions for runways less than 4,000 feet without change. Runway 10-28, regardless of the 5,475-foot length, uses the WSDOT Safety Zone Dimensions for runways 6,000 feet or

---

5 Source: FAA Advisory Circular 150/5300-13 CHG 4, Table 2-4. Runway protection zone (RPZ) dimensions.

6 Source: Airport Layout Plan, Skagit Regional Master Plan Update, June 1995, W&H Pacific.

Table D1 - Runway Protection Zone Dimensions

Dimension	***Generic Runway 4,000' – 5,999'***	***Existing Runway 10-28***	***Future Runway 10-28***
Length	1,700 feet	1,000 feet	2,500 feet
Inner Width	500 feet	250 feet	1,000 feet
Outer Width	1,010 feet	450 feet	1,750 feet

Table D2 – Skagit Regional Airport Characteristics

Characteristic	***Actual***	***Forecast (Year 2013)***	***Impact on Crash Location/Frequency***
Fleet Mix[1]	90% Single engine 7.4% Multi engine	80% Single engine 18.2% Multi engine	Single engine aircraft accidents tend to be clustered close to runway ends.
Runway Usage[2]	<u>RW 10-28</u> Large aircraft 100% Small aircraft 95% <u>RW 4-22</u> Large aircraft 0% Small aircraft 5%	<u>RW 10-28</u> Large aircraft 100% Small aircraft 80% <u>RW 4-22</u> Large aircraft 0% Small aircraft 20%	Limited use of RW 4-22 reduces the chance for an accident to occur within its safety compatibility footprint.
Traffic Pattern[3]	Standard left hand pattern with majority of traffic arriving from/departing to the south.	No change	Limited overflight and low altitude turns occurring over parcels north of the airport reduce the chance for an accident to occur in this area.
Flight Rules/Approach[4]	RW 10 Non-precision, NDB RW 28 Visual RW 4 Visual RW 22 Visual	RW 10 Precision RW 28 Precision RW 4 Visual RW 22 Visual	Until RW 28 has precision approach, RW 10 may receive majority of arrival traffic[5]. Precision approach requires larger RPZ and implies greater distribution of crash sites.
Time of Day[6]	RW 4-22 Not lighted	No change	Until RW 4-22 is lighted expect no nighttime accidents. Nighttime accident frequency greater than daytime and more dispersed.

1 Source: Exhibit 4.16 Skagit Regional Master Plan Update, June 1995
2 Source: Actual conditions based on interview with airport management, March 9, 2000. Forecast conditions have been assumed but rely on data provided in the Skagit Regional Master Plan Update, June 1995, that recommend development of the flightline adjacent to RW 4-22. Usage by small aircraft is to large extent governed by wind coverage but also by convenience. Anticipate additional facilities along RW 4-22 will make this runway more popular.
3 Source: Interview with airport management March 9, 2000 and subsequent telephone conversations. Also demonstrated by noise contours developed as part of the Skagit Regional Master Plan Update, June 1995. Noise contours bend to south, flight tracks provided in Appendix B, frequency associated with flight tracks not available as of April 10, 2000.
4 Source: Airport Layout Plan and Page 5-9, Skagit Regional Master Plan Update, June 1995
5 Assumes wind coverage is equal on RW 10 and RW 28, applies only to aircraft using cockpit instrumentation.
6 Source: Airport Layout Plan, Skagit Regional Master Plan Update, June 1995. Although master plan does not call for lights on RW 4-22 prior to the year 2013 it is likely that it will eventually be lighted.

more because of the future precision approaches for which the Port of Skagit County is planning. The future precision approaches have direct impact only on Zone 1, the Runway Protection Zone. One could theoretically use all other dimensions prescribed for the mid length runway. It was decided to use the larger runway dimensions after a comparison of the two runway categories (runway 4,000 feet to 5,999 feet versus runway 6,000 feet or more) showed little difference in impact to surrounding off-airport land use. Specifically:

- Dimensions A, B, and S pertain to the runway protection zone and should be modified.

- Dimensions C, D, E and F are the same for both runway categories.

- Dimension R increases by 500 feet for the larger runway, increasing the size of Zone 3 accordingly. However, this 500-foot increase lies mostly on existing, high density residential property (already developed).

- Dimension T is actually greater for the mid length runway than for the long runway (mid length 2,800 feet vs. long 2,500 feet).

- Dimension U increases by 2,000 feet but falls almost entirely on rural lands that have not been considered for inclusion within the urban growth area boundary.

Table D3 – Recommended Safety Zone Dimensions (in feet)

	Runway 4-22	***Runway 10-28***
Dimension[1]	***Length 3,000 feet***	***Length 5,475 feet***
A	125	500
B	225	875
C	225	500
D	225	500
E	500	1,000
F	4,000	5,000
R (60 ° sector)	2,500	5,000
S	1,000	2,500
T	1,500	2,500
U	2,500	5,000

[1] Letter dimensions are same as provided in WSDOT Aircraft Accident Safety Zone Diagram (attached).

LAND USE CHARACTERISTICS AND RELATIVE RISKS

Definition of appropriate safety zones is one side of the safety compatibility equation. The other, even more difficult side, is establishment of suitable land use criteria to be applied within each zone. The basic strategy for minimizing the risks associated with potential aircraft accidents is to take land use planning measures that can reduce the severity of an aircraft accident if one occurs. The strategy must consider both components of the safety compatibility objective: protecting people and property on the ground; and enhancing safety for aircraft occupants. In both cases, this means limiting the intensity of land use in locations most susceptible to an off-airport aircraft accident. With little guidance available in the form of industry standards, prior to establishing land use criteria it is necessary to have a basic understanding of the risk involved, the density standards that do exist, and other land use planning techniques available to minimize the impact of a potential accident.

Risk of Aircraft Accident

There has long been a general consensus within the airport industry that some degree of safety concern exists beyond the typical boundaries of an airport and its runway protection zones. This has been a difficult concern to address as it deals with uncertain events which *may occur* with *occasional* aircraft operations, unlike noise policies that deal with known, more or less predictable events which *do occur* with every aircraft operation. Because aircraft accidents happen infrequently and the time, place, and consequences of their occurrence cannot be predicted, the concept of risk is central to the assessment of safety compatibility. The level of risk acceptable to the community is a question that must be answered at the local level. To gain a sense of accident frequency, statistics related to general aviation crashes taken from the CALTRANS study are summarized below.

- Nearly half (47%) of all aircraft accidents take place *on* an airport. Another 30% are en route accidents – defined here as ones occurring more than 5 miles from an airport. This leaves 23% of all accidents which can be classified as airport-vicinity accidents, potentially including some en route accidents which happened to take place within 5 miles of an airport. (Page 8-6)

- The NTSB database used for the CALTRANS study includes a total of 400 accident records occurring over a time period from 1983 to 1991. These accidents occurred within the *airport vicinity*, defined as all accidents not confined to the immediate vicinity of the runway or it's associated safety zones (on the airport) yet within a 5-mile radius measured from the airport center. (Page 8-13)

- NTSB data indicates that landing accidents occur about twice as often as takeoff accidents. By comparison, the 400 accident records included in the CALTRANS study are split almost equally between arrivals (190) and departures (210). The substantial number of landing accidents which take place on or near the runway accounts for most of this difference. (Page 8-18)

- General aviation aircraft collisions with buildings of any kind, and residences in particular, happen infrequently. The NTSB's annual reviews of general aviation accident data include counts of accidents in which objects were a cause or factor. In evaluating the data, a particularly noteworthy finding is the rarity of accidents involving residences or other buildings. For an eight-year period (1982-1989) the annual average was only 8.1 and 9.9 per year for residences and other buildings, respectively. Consistently, the NTSB database used for the CALTRANS study show that only one accident, of the 400 in the database, involved a collision with a residence and 11 involved other buildings (Again, remember the CALTRANS/NTSB database excludes accidents confined to the immediate runway environment). (Page 8-23)

- A pilot will, if possible, normally attempt to steer the aircraft to an open area when an emergency landing is unavoidable. In over half of the cases included in the database, the aircraft was not under control when it hit the ground. (Page 8-20)

Also on the subject of risk, the clear position of the Washington State Department of Transportation Aviation Division should be considered. On page 32 of Airports and Compatible Land Use they state:

> "It can not be stated firmly enough that should a jurisdiction decide to reject implementing best practices, ignore historic accident data, or ignore the recommendations of the Airport Land Use Compatibility Program or the FAA regarding appropriate airport land use, it is the jurisdiction that embraces the cost of uncompensated loss and liability – and ultimately the consequences of this action in the terms of higher insurance premiums or possible canceled coverage."

Density Standards and Minimizing Impacts

This report provides recommended safety compatibility criteria in Table 5 (main document). For each safety zone identified, the criteria includes densities for residential and non-residential land use, and recommends other strategies for protecting people and property on the ground as well as for enhancing safety of aircraft occupants. These criteria represent the range of options established within the WSDOT and CALTRANS documents (Table D4).

Neither document offers a correlation between the capture rates anticipated in the various safety zones and the suggested land uses and densities provided. Though it is not clear how the state agencies established these criteria, noteworthy observations include:

- WSDOT standards use a maximum density of one dwelling unit per 2.5 to 5 acres (1DU/2.5 acres to 1DU/5 acres). WSDOT has offered that the densities were derived based on the statistic showing 80% of all general aviation airports within Washington State to be situated in a rural setting. Further, said densities are in keeping with anticipated conditions under the Growth Management Act.

- CALTRANS states there is no correct answer to the question of acceptable risk. However, at least for the areas where the aircraft accident potential is greatest, a degree of consensus seems apparent that certain types of land uses are unwise. Although perhaps not always attainable, the guidelines are suggested as a good starting point.

- Both state agencies make it clear that approach zones off the ends of the runway are the areas where an accident is most CALTRANS states that within Zone 6, Traffic Pattern Zone, the potential for accidents is relatively low and the need for land use restrictions is thus minimal.

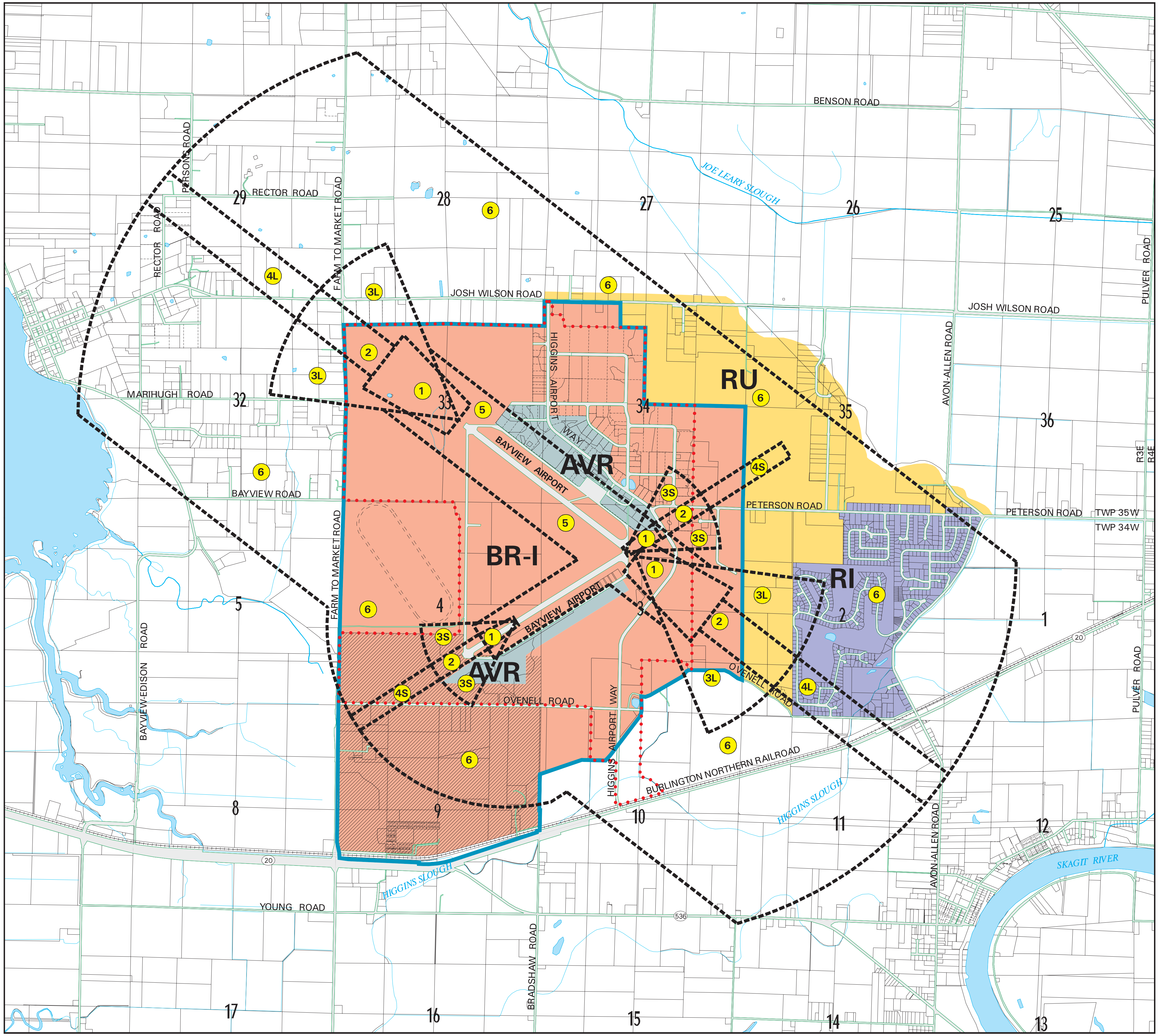
- Both state agencies suggest that control of development techniques can play a key role in implementing these strategies (i.e., development ordinances governing lot coverage, open space, underground utilities, prohibition of special functions, etc.).

Table D4 – Comparison of Washington and California State Criteria

ZONE[1]		***RESIDENTIAL***		***NON-RESIDENTIAL***	
No.	***Designation***	***WSDOT***	***CALTRANS[2]***	***WSDOT***	***CALTRANS***
1	Runway Protection Zone	No Residential	No Residential	<5 people/acre	<10 people/acre
2	Inner Safety Zone	No Residential	No Residential (except agric.)	<5 people/acre	40 to 60 people/acre max.
3L	Inner Turning Zone	1 DU/5 acres	1 DU/2 acres to 1DU/10 acres	<25 people/acre	40 to 60 people/acre max.
3S	Inner Turning Zone	No Residential			
4L	Outer Safety Zone	1 DU/2.5 acres	1 DU/2 acres to 1DU/5 acres	<40 people/acre	60 to 100 people/acre max.
4S	Outer Safety Zone	1 DU/5 acres			
5	Sideline Safety Zone	No Residential	1 DU/2 acres to 1DU/5 acres	<5 people/acre	All aviation related allowed
6L	Traffic Pattern Zone	1 DU/2.5 acres	4 DU/1 acre to 6 DU/1 acre		
6S	Traffic Pattern Zone	1 DU/5 acres		<100 people/acre	<150 people/acre

1 Letter designations 'S' and 'L' refer to Skagit Regional's short and long runway, respectively. WSDOT provides different residential densities for the three generic runways of different length. In the case of Skagit Regional 'S' corresponds to runways less than 4,000 feet and 'L' corresponds to runways 6,000 feet or more.

2 Caltrans does not distinguish between the three runway lengths when providing land use criteria.



LEGEND

Urban Growth Area

Airport Environs Zone

Port Of Skagit County Boundary

BAYVIEW RIDGE INTERIM LAND USE DESIGNATIONS

Area Eligable For Heavy Industrial Special Uses

Bayview Ridge Industrial (BR-I)

Aviation Related (AVR)

Rural (RU)

Rural Intermediate (RI)

ACCIDENT SAFETY ZONES

1 Runway Protection Zone

2 Inner Safety Zone

3 Inner Turning Zone (60 Degree Sector)

4 Outer Safety Zone

5 Sideline Safety Zone

6 Traffic Pattern Zone

For a Description of Recommended Safety Compatibility Criteria Addressing Land Use and Densities, Open Space Requirements, and Representative Land Uses
See Report Titled: *Skagit Regional Airport - Land Use Compatibility Study (Table 5)*

May, 2000

N NE E SE S SW W NW

0 mi. 1/2 mi. 1 mi.

Skagit County Mapping GIS Geographic Information System

AIRPORT ACCIDENT SAFETY ZONES