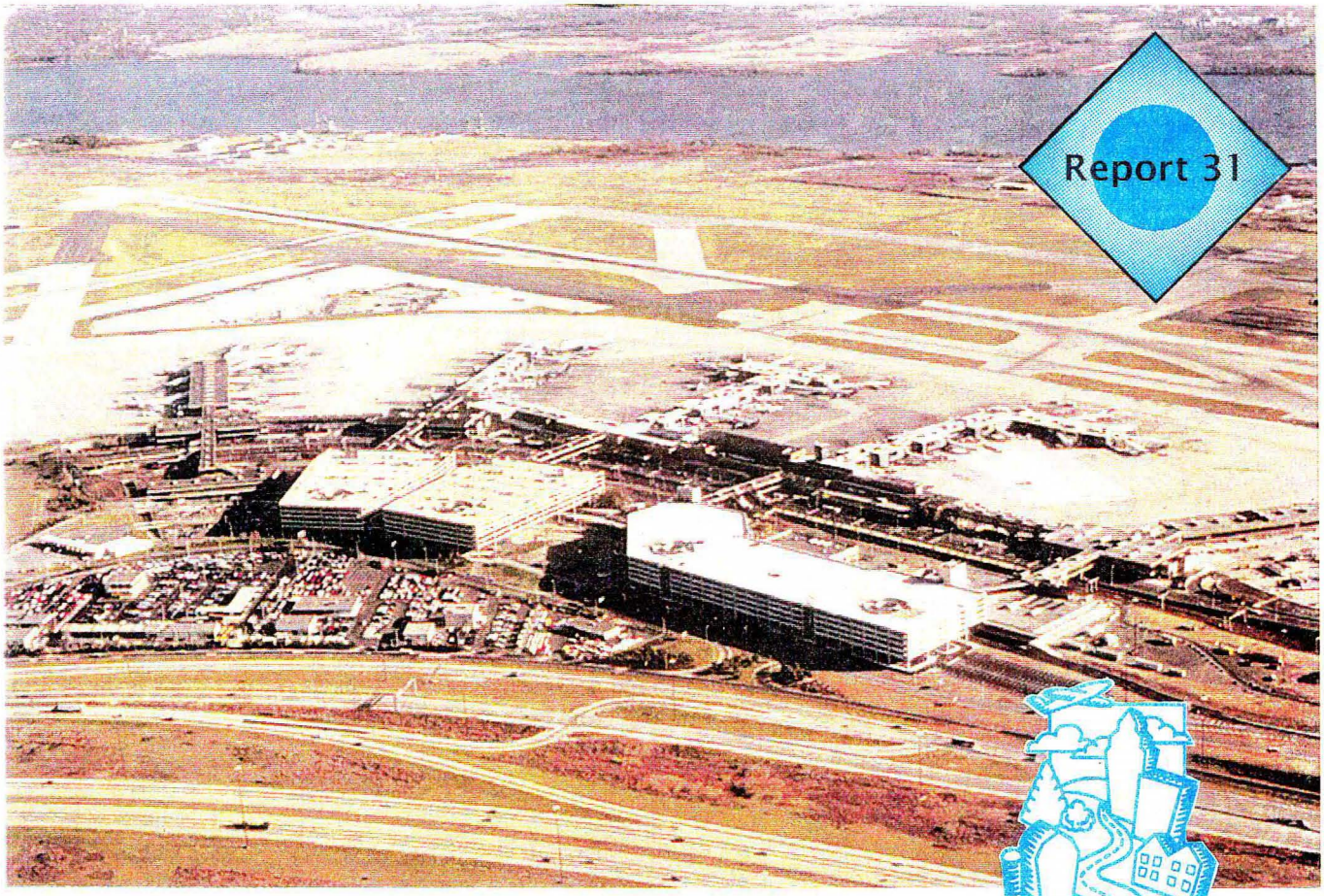
2020 Regional Airport System Plan for the Delaware Valley

The Airport Planning Element of the DVRPC Year 2020 Plan



DIRECTION 2020

A Region on the Rise

DELAWARE VALLEY REGIONAL PLANNING COMMISSION

2020 REGIONAL AIRPORT SYSTEM PLAN FOR THE DELAWARE VALLEY

Direction 2020
Report No. 31

DELAWARE VALLEY
REGIONAL PLANNING COMMISSION

The Bourse Building - 8th Floor
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August 1995

The preperation of this document was financed in part through an Airport Improvement Program grant from the Federal Aviation Admimistration (Project Number 3-42-A006-RD95) as provided under Section 505 of the Airport and Airway Improvement Act of 1982 , as amended. The contents do not necessarily reflect the official views or policy of the FAA. Acceptance of this report by the FAA does not in any way constitute a commitment on the part of the United States to participate in any development depicted therein nor does it indicate that the proposed development is environmentally acceptable in accordance with appropriate public laws. The authors however, are solely responsible for its findings and conclusions, which are intended for regional planning purposes.

Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty and intercity agency which provides continuing, comprehensive and coordinated planning for the orderly growth and development of the Delaware Valley region. The region includes Bucks, Chester, Delaware, and Montgomery counties as well as the City of Philadelphia in Pennsylvania and Burlington, Camden, Gloucester, and Mercer counties in New Jersey. The Commission is an advisory agency which divides its planning and service functions among the Office of the Executive Director, the Office of Public Affairs, and four line Divisions: Transportation Planning, Regional Planning; Regional Information Services Center, and Finance and Administration. DVRPC's mission for the 1990s is to emphasize technical assistance and services and to conduct high priority studies for member state and local governments, while determining and meeting the needs of the private sector.

The DVRPC logo is adapted from the official seal of the Commission and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole while the diagonal bar signifies the Delaware River flowing through it. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey. The logo combines these elements to depict the areas served by DVRPC.

DELAWARE VALLEY REGIONAL PLANNING COMMISSION

Publication Abstract

TITLE	Date Published: August 1995
2020 Regional Airport System Plan for the Delaware Valley	**Publication No.** 95014

Geographic Area Covered:

Bucks, Chester, Delaware, Montgomery and Philadelphia counties in Pennsylvania; Burlington, Camden, Gloucester, Mercer and Salem counties in New Jersey; New Castle County in Delaware, Cecil County in Maryland

Key Words:

Aviation, Airports, Heliports, Based Aircraft, Annual Operations, Market Area, Travel Demand, Enplanements, Passengers, Air Traffic Control, Flight Rules, Navigation Aids, Arrival, Departure, Delay, Mobility, Safety, Long Range Plan, Capital Cost, Funding, Economic Development

ABSTRACT

This report describes the 2020 Regional Airport System Plan for the Delaware Valley. The Plan includes 27 existing airports in the twelve county region; of these airports, three are commercial, twelve reliever, ten general aviation, and two military. In addition to the four existing heliports, three new sites are also recommended in the Plan. The cost of the recommended improvements is estimated at 740 million dollars. This Plan supersedes the Amended 2000 Plan adopted by the DVRPC Board in December 1988.

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EXECUTIVE SUMMARY

DVRPC is funded by the Federal Aviation Administration (FAA) for the purpose of maintaining aviation system planning activities for the twelve-county, four-state Philadelphia metropolitan area. Part of this effort involves developing and revising, as necessary, a long-range airport system plan which will provide for mobility and economic development twenty to twenty-five years into the future, with optimal safety at minimal cost to the public.

Development of the 2020 Regional Airport System Plan

The first Regional Airport System Plan (RASP) was adopted in 1982 and defined aviation facility needs to the Year 2000. Because of changes in aviation demand brought on by deregulation, market forces, and the sale of privately owned airports, the Year 2000 RASP was amended in 1988. Now, with the long-range horizon of 2000 approaching, and regional aviation facilities supply and demand evolving, a new updated RASP reflecting demand and supply projections and facilities recommendations to the Year 2020 has been developed and described in this document.

DVRPC staff, in cooperation with the DVRPC Regional Aviation Committee (RAC) representing all public and private sector aviation interests in the region, completed an inventory describing current aviation facilities, both fixed wing and rotorcraft, and usage levels in terms of passengers, aircraft operations, and based aircraft. In 1992-93, annual levels of commercial passengers in the region served by Philadelphia International Airport (PHL) were 16.2 million. There are over 1,278,000 non-commercial business and recreational aircraft operations per year in the region, and 2,329 based aircraft.

Aviation trends and issues were then discussed. Storage capacity in the suburbs for corporate aircraft is in short supply. Some airports do not have runways of adequate length for business aircraft, which could limit corporate growth. Some suburban areas of the region are at risk of losing airport access, if privately owned public use airports are not committed to continued operation. Navigational guidance and air traffic control communications equipment should be upgraded to state-of-the-art levels to insure maximum safety and capacity of the airspace. Finally, to provide the best regional commercial passenger and freight service, delays at PHL should be reduced, and operating capacity, especially in poor visibility conditions, increased.

Using several projection models, based on FAA and states' planning activities, as well as regional trend data describing utilization of RASP airports, forecasts of 2020 passenger volumes, aircraft operations, and based aircraft were developed for the region as a whole, then subdivided by state. Forecasts were assigned to individual airports on the basis of location, market area, airport type and capacity, and

available services.

Throughout this planning process, the RAC provided input and ultimately endorsed the final forecasts and recommendations for each facility. By 2020, passenger enplanements are expected to grow regionally from 8.1 million to 14 million, or 72 percent, while commercial service operations will grow from 351,600 to 560,000 or 59 percent. With respect to general aviation and business activity, growth will not be as significant, 38 percent in operations and 27 percent in based aircraft demand. The 2020 RASP also identified the "Worst Case" system which may occur if critical privately owned airports are closed or sold for non-aviation development. Only 12 of the 24 non-commercial airports will operate under this scenario. Operations and based aircraft demand will be curtailed due to the loss of storage capacity and longer ground access distances, resulting in lower growth rates of 20 percent and three percent in total to year 2020, for operations and based aircraft, respectively.

After reaching regional consensus regarding growth expectations, development, and mobility issues for the regional aviation system, the RASP recommends facilities and capital improvement investments needed to successfully address identified deficiencies.

2020 RASP Facilities and Capital Costs

Three commercial airports, Philadelphia International, Trenton-Mercer, and New Castle County, must be retained, with major expansion activity at PHL. Business/reliever airports necessary to be retained in the RASP include Northeast Philadelphia, Doylestown, Pennridge, Pottstown-Limerick, Wings, Brandywine, New Garden, Chester County, Summit, Cross Keys, South Jersey Regional and Trenton-Robbinsville. General aviation airports also included in the RASP are Buehl, Quakertown, Pottstown Municipal, Perkiomen Valley, Cecil County, Oldmans, Flying W, Red Lion, Van Sant, and Camden County. All airports identified as necessary to meet 2020 needs are existing facilities. Only Camden County is new to the RASP, while all others were included in the Year 2000 RASP.

For rotorcraft, four existing heliports are included in the RASP: Keystone, Valley Forge, Horsham Valley, and Sterling (Penns Landing) Heliport. Three other sites in Trenton, Camden, and Wilmington are proposed in the RASP for heliport construction.

The plan recommends $740 million dollars in capital improvement projects, with the concentration of investment (77%) occurring in the first 15 years of the planning period. Major investments prescribed in the RASP include completion of a commuter runway at PHL; public acquisition of four privately owned public use airports in suburban counties; extension of five suburban runways to business length; construction of hundreds of corporate hangar spaces and additional T-hangars; and upgrading of electronic

approaches to most airports to GPS, and additional Remote Communications Outlets (RCOs) to expedite communication between pilots and air traffic control.

2020 RASP Implementation

Specific actions, other than capital investment, which support realization of the 2020 RASP recommendations are also identified in this document. Municipal zoning to protect airport operations should be implemented at several suburban Pennsylvania municipalities. Roadway and transit ground access to regional airports should be improved at selected sites. States' and federal capital subsidy programs should be maintained to provide some support for critical suburban airports not qualifying for passenger service-related grants or airport collected fees.

The financing of airport improvements will come predominantly from the region itself. Although federal and states' grant programs will continue, the amount of money coming to the region from Washington will be reduced from levels experienced in the 1980s. Local bond issues and locally collected Passenger Facility Charges (PFC) at PHL will provide most of the resources for the airports expansion. Suburban airports will rely on county economic development funds as well as state and some federal support. State grant programs will become more important to the region since they will represent a larger percentage of total funds received, with the expected reduction in federal subsidies, and since they can be used for smaller privately owned public use airports in the suburbs, which are not eligible for federal grants.

Successful implementation of the 2020 RASP will result in a better airport service and operation, promote economic development, improve safety and mobility, and enhance the general well-being of the region. Funding of the recommended improvements is a shared responsibility among private companies and governmental agencies. The aviation system can be made more efficient and safer with better management of facilities and investments in existing infrastructure and new air traffic control technology. The existing airports in the Delaware Valley should be preserved in order to meet the current and future regional aviation needs and to compete with other regions in the 21st century. □

I. INTRODUCTION

The aviation system in the Delaware Valley Region is an important component of the regional and national transportation systems. There are 27 airports with paved runways and four heliports in the region, which link the Delaware Valley with other regions in the United States and with the world. These links sustain the region's economy and stimulate opportunities for future growth. According to recent estimates, the airport system contributes more than $3.0 billion to the region's economic base; $2.0 billion results from activities at the Philadelphia International Airport (PHL) alone[1] (Appendix A).

The Delaware Valley is a large region (4,967 square miles) covering portions of the states of Pennsylvania, New Jersey, Delaware, and Maryland. The region contains a major metropolitan air carrier airport, several business airports - some of which also provide scheduled commercial service, a large number of privately-owned public use airports, and two large military airfields. Small and large airplanes, military aircraft, heavy transport airplanes, and helicopters operate in the region, which is in the midst of one of the most densely traveled air traffic corridors in the United States.

More than 5.8 million people live in the region, and about 2.7 million workers report to work on an average weekday. If the region is to maintain and expand its economic activities, it must provide adequate air services and facilities for commercial and general aviation.

REGIONAL AIRPORT SYSTEM PLANNING

Long-range system-wide planning is crucial for regional airports and heliports, because rapid growth can create demand for services which quickly outgrow capacity. Comprehensive system plans assure efficient use of scarce airport sites and optimal use of public funds. System plans define the strengths and weaknesses of individual airports, and propose logical development strategies to correct deficiencies. They complement individual airport plans and ensure that the needs of all users are considered. The RASP is the ideal vehicle to link individual airport plans with the state and national airport plans, and to ensure their compatibility with regional surface transportation plans. The RASP defines the immediate and future air transportation needs of the area, relates airport planning to ground transportation and land use planning, and provides the basis for individual airport planning.

Mobility through the regional aviation system for citizens and businesses within a large metropolitan area can be assured only if employment and residential centers are served by a geographically dispersed network of airports and heliports. These

[1] *Year 2000 RASP for the Delaware Valley Region*, DVRPC December 1988.
PHL Economic Impact Study, Gellman Research Association, 1991

airports should meet future capacity needs for a range of aircraft, as well as meeting safety criteria for all-weather operation.

YEAR 2000 REGIONAL AIRPORT SYSTEM PLAN

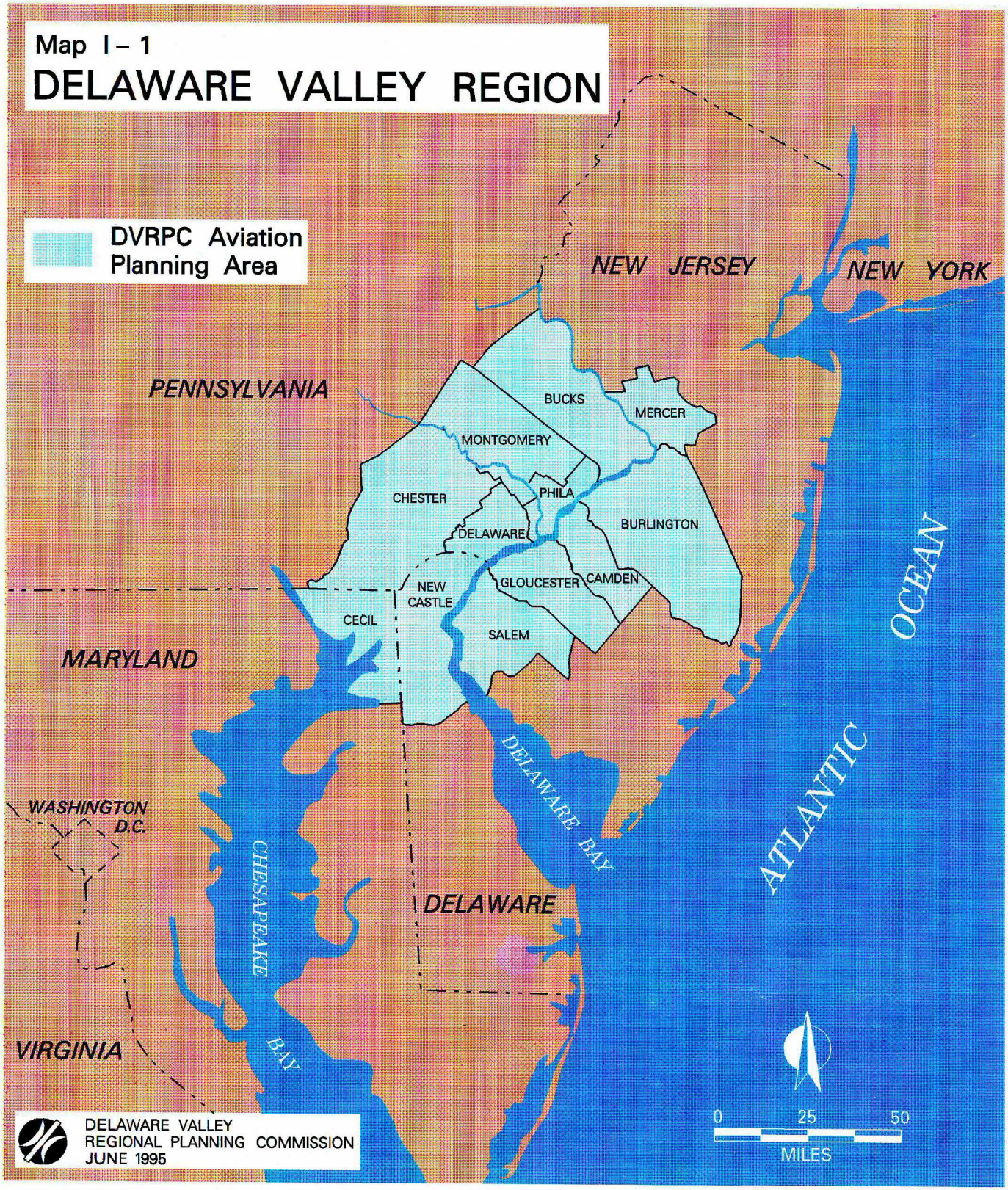
In September 1980 the FAA granted the DVRPC funds to develop the 2000 RASP. In cooperation with the Wilmington Metropolitan Area Planning Coordinating Council (WILMAPCO), arrangements were made for additional state and local funds to cover project costs. The primary purpose of the plan was to evaluate existing airports and heliports in the Delaware Valley region in terms that will best serve the current and future needs of the region's residents and businesses. Several important issues were considered in the study including the following: 1) Which private airports should be acquired by public entities, or assisted by other means, in order to assure their continued operation as airport facilities; and 2) Which public and private airports need facility improvements to meet the future demands of the Delaware Valley region? Specific airport improvements were then recommended for each airport included in the 2000 RASP.

In October 1982 the DVRPC Board adopted the Year 2000 RASP. The plan identified critical existing and proposed public use aviation facilities in the 12-county region, including Philadelphia, Bucks, Chester, Delaware, and Montgomery counties in Pennsylvania; Mercer, Burlington, Camden, Gloucester, and Salem counties in New Jersey; New Castle County, Delaware; and Cecil County, Maryland (Map I-1). Salem, New Castle, and Cecil counties were used to make up the WILMAPCO planning area, which is considered part of the DVRPC planning area for aviation planning purposes[2]. The facilities of the plan were selected on the basis of capacity, anticipated demand through the Year 2000, and minimum ground access time to employment and residential centers.

The 1982 adopted RASP contained four commercial airports, 13 reliever airports, 13 general aviation (GA) airports, six heliports or heliport sites, and four seaplane bases. Of the 40 critical facilities, 27 were privately owned, while the remaining 13 were owned by county or municipal governments. The plan then proposed levels of capital investment which would assure the continued existence of all airports and provide the all-weather capacity needed to satisfy estimated future demand. In 1982 the total capital needed for all improvements to the Year 2000 was estimated to be $67 million.

Between 1982 and 1988 many events occurred in the regional travel market which drastically affected the aviation infrastructure, and precipitated the need to amend the 2000 RASP in order to maintain its viability. The most prominent of these events included escalation of capital costs for airport acquisition and improvements;

[2]Salem County is no longer a member of WILMAPCO


Map I – 1
DELAWARE VALLEY REGION
DVRPC Aviation Planning Area
NEW JERSEY
NEW YORK
PENNSYLVANIA
BUCKS
MERCER
MONTGOMERY
CHESTER
PHILA
DELAWARE
BURLINGTON
NEW CASTLE
GLOUCESTER
CAMDEN
CECIL
SALEM
MARYLAND
WASHINGTON D.C.
CHESAPEAKE BAY
DELAWARE BAY
ATLANTIC OCEAN
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increases in the number of flights using commercial airports; sale of privately owned airports for non-aviation development; and changes in FAA policy and procedures concerning use, federal funding, and local responsibilities. In addition, acceleration of suburban development altered the demand for facilities, and increased the potential for conflicts with local neighborhoods, businesses, and governments.

In response to these issues, the DVRPC Board, with input from the FAA, state transportation departments, the DVRPC Regional Aviation Committee (RAC), and public hearings, adopted the Amended 2000 RASP in December 1988. Four airports and two heliports were added to the RASP and seven airports, one heliport, and four seaplane bases were deleted (Map I-2). Capital needs to Year 2000 were estimated at $500 million, more than a sevenfold increase from 1982 estimates.

2020 Regional Airport System Plan

By 1993, with the planning horizon of the 2000 RASP only seven years away, DVRPC, the FAA, and the state departments of transportation had acknowledged the need for a 2020 RASP, to anticipate long-range facility needs. As the region approaches the next millennium, aviation supply and demand continues to evolve in both predictable and surprising ways. The increase of airline travel continues from deregulation in the early 1980s. Business aviation, using private and charter aircraft, is experiencing light growth, proportionate to business trends. General aviation is perhaps the most difficult segment to predict, given its fluctuations related to product liability, the economy, and availability of airport space in the suburbs. Helicopter service, although offering unique capabilities, has so far not proven itself to be viable in serving a significant portion of the regional aviation market.

In addition, three other significant factors may affect the 2020 demand for aviation and the region's ability to provide the needed optimal infrastructure. First, the status of suburban development in the region is now much more mature than it was in the 1980s. The trend toward dispersion of employment and residential development to suburban areas where real estate is affordable has led to new population concentrations, thereby restricting the options for locating new airports or expanding existing facilities.

Second, tolerance for aircraft operations at existing facilities has eroded in proportion to the suburbanization of the region. On the national and state levels, funding programs which were relied upon through the 1980's and early 1990's to fund necessary expansion or retention of existing infrastructure can no longer be assumed. Budget strategies to reduce spending at the national level are shifting the public sector responsibility for capital financing of airports to the states. Fewer resources and escalating costs have reduced the number of

airports potentially eligible for public subsidy. And third, technological refinements to aircraft, air traffic control, weather reporting and navigational support for pilots, have provided options for improvement of the regional aviation system not available in the 1980's. All of these new factors were considered in the planning deliberations for the 2020 RASP.

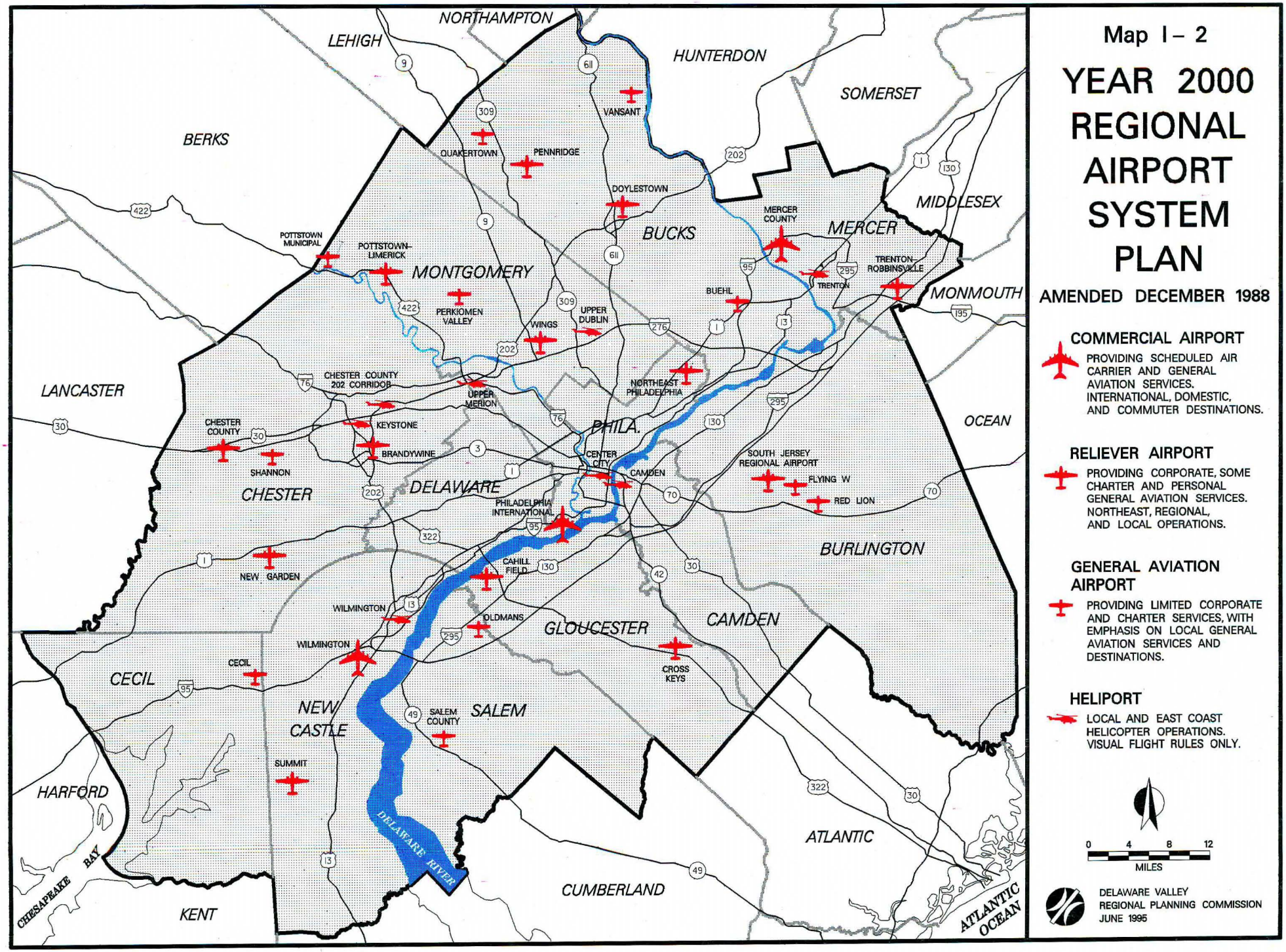
In July 1993 the DVRPC staff, as part of its continuous airport system planning activities, initiated the updating of the 2000 RASP to 2020, and prepared a 2020 regional airport system planning process (Table I-1). The process began with a review of national and state airport plans, the Year 2000 RASP, and capital improvement programs. It describes the existing airports and heliports in the region, including based aircraft, annual operations, airspace utilization, and air traffic control; and assesses their current conditions and characteristics. Aviation issues, problems - goals, strategies and criteria - including air space, land side access, and travel time to airports are defined through research and meetings with state and local aviation officials and airport operators.

The process requires the review and use of 1990 Census socioeconomic data, as well as 2020 population and employment forecasts developed for regional land use and surface transportation planning. It assesses the existing aviation travel market, and estimates 2020 commercial and general aviation travel demand in the region. It also develops alternative airport and heliport improvement plans for the existing and proposed facilities, along with estimates of capital costs.

Furthermore, the process calls for the preparation of a draft plan report, including a summary of the recommended projects, costs, and implementation strategies, together with short and long-range investment, operation, and management options. Finally, it requires public meetings and hearings, adoption of the 2020 plan by the DVRPC Board, and

Table I-1
2020 REGIONAL AIRPORT SYSTEM PLANNING PROCESS

- **Review national, state and regional plans**
- **Describe the system and define problems**
- **Define the issues and develop goals and strategies**
- **Define travel markets and estimate 2020 demand**
- **Coordinate airports with surface transportation facilities**
- **Develop alternative plans and estimate costs**
- **Prepare a 2020 draft plan and discuss implementation policies**
- **Present the draft plan to regional officials and citizens for comment**
- **Complete plan document and prepare a summary**



Map I – 2

YEAR 2000 REGIONAL AIRPORT SYSTEM PLAN

AMENDED DECEMBER 1988

COMMERCIAL AIRPORT

PROVIDING SCHEDULED AIR CARRIER AND GENERAL AVIATION SERVICES. INTERNATIONAL, DOMESTIC, AND COMMUTER DESTINATIONS.

RELIEVER AIRPORT

PROVIDING CORPORATE, SOME CHARTER AND PERSONAL GENERAL AVIATION SERVICES. NORTHEAST, REGIONAL, AND LOCAL OPERATIONS.

GENERAL AVIATION AIRPORT

PROVIDING LIMITED CORPORATE AND CHARTER SERVICES, WITH EMPHASIS ON LOCAL GENERAL AVIATION SERVICES AND DESTINATIONS.

HELIPORT

LOCAL AND EAST COAST HELICOPTER OPERATIONS. VISUAL FLIGHT RULES ONLY.

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completion and publication of the plan documents.

Throughout the planning process, DVRPC has been guided by input from the aviation community, the FAA, the states of Pennsylvania, New Jersey, and Delaware, citizens and the technical exchange occurring at the RAC. Based on its operating knowledge of the aviation business and the evolving market, the RAC has reviewed and accepted the travel data projections, as well as amending and endorsing the facility recommendations. The conclusions and recommendations, therefore, are intended to accommodate future aviation needs of a region with an expanding economy and improving quality of life.

With input from both service and facility providers, the process has provided checks and balances to avoid duplication of improvement recommendations or overestimation of demand. The capital improvement recommendations reflect realistic project objectives, which do not overburden public and private sector financing resources.

The 2020 RASP has been developed to satisfy the goals and objectives discussed in this document, and to meet the current and future needs of the aviation com- munity in the region. It recommends the inclusion of 27 existing airports, including 15 in Pennsylvania, nine in New Jersey, and three in the WILMAPCO area. Of these airports, three are commercial, twelve reliever, ten general aviation, and two military. The 2020 plan contains only one airport (Camden County) not included in the 2000 RASP. In addition to the four existing heliports, three new sites were also recommended in the plan. The cost of the recommended improvements for civilian facilities, including a new runway and terminal expansion at PHL, land acquisition, hangar spaces, taxiways, ramp spaces, runway extensions in the suburbs, airspace communication equipment, and other maintenance needs is estimated at $740 million.

This plan supersedes the Amended 2000 RASP adopted by the DVRPC Board in December 1988. The 2020 RASP will influence the nature of public and private investments in airports and heliports, and strengthen the adequacy of the aviation infrastructure and improve services throughout the region. Efficient implementation of the plan will require the development of a balanced capital improvement program in order to insure the optimal use of the recommended airports and heliports. The plan will meet the current and future regional aviation needs and result in a better airport service and operation.

Chapters II and III of this document describe the existing system of airports and heliports, and assesses the current airspace and air traffic control procedures, which are so critical to an effective RASP. Chapter IV presents the regional aviation problems and issues in the Delaware Valley, and proposes a set of goals and objectives for the 2020 plan. These goals

are consistent with the metropolitan airport system planning goals suggested by the FAA Advisory Circular 150/5070 - 5.

Market area delineation and travel demand forecasts are discussed in Chapter V, which allocates based aircraft and annual operations to each airport in the system. Travel time and distance are used to define market areas which have been analyzed for the current airport system and two future scenarios. Chapter VI discusses the development of 2020 alternative plans and describes the recommended plan, including facilities, improvement projects, and capital costs. Finally, Chapter VII outlines the implementation strategies which will result in the construction of new improvement projects to the existing system and efficient operation and management of all recommended airports and heliports.

Since the 2020 RASP is intimately related to many technological, social, economic, and political factors, it must be reviewed and amended periodically, if it is to respond to these ever changing conditions. □

II. EXISTING REGIONAL AVIATION SYSTEM

In 1988, the DVRPC Board adopted a revised Year 2000 RASP, which was originally adopted in 1982. The revised plan contains 27 airports (3 commercial, 13 reliever and 11 general aviation) and 7 heliport sites (3 proposed). The current aviation system accommodates approximately 2,600 based aircraft and about 1,870,000 operations per year. Of these, 420,000 occur at PHL and are principally commercial in nature, 150,000 at military bases, and 1,300,000 at the 23 RASP business/reliever and general aviation airports.

There are 13 minor airports in the region not included in the 2000 RASP. Except for Camden County Airport, these public use airports are generally small, with turf runways and no navigational aids and few services. They are used by single engine recreational flyers and accommodate a small number of based aircraft and operations. Currently these facilities have little potential for generating business patronage. With large capital investment, however, some of these airports can be used for general aviation in the future.

The airports and heliports included in this inventory are the 2000 RASP facilities currently open for public use in the region. The locations of these facilities are shown in Map II-1. More detail describing the attributes of these airports and heliports is provided in the 1993 Airport Directory for the Delaware Valley Region[1].

COMMERCIAL FACILITIES

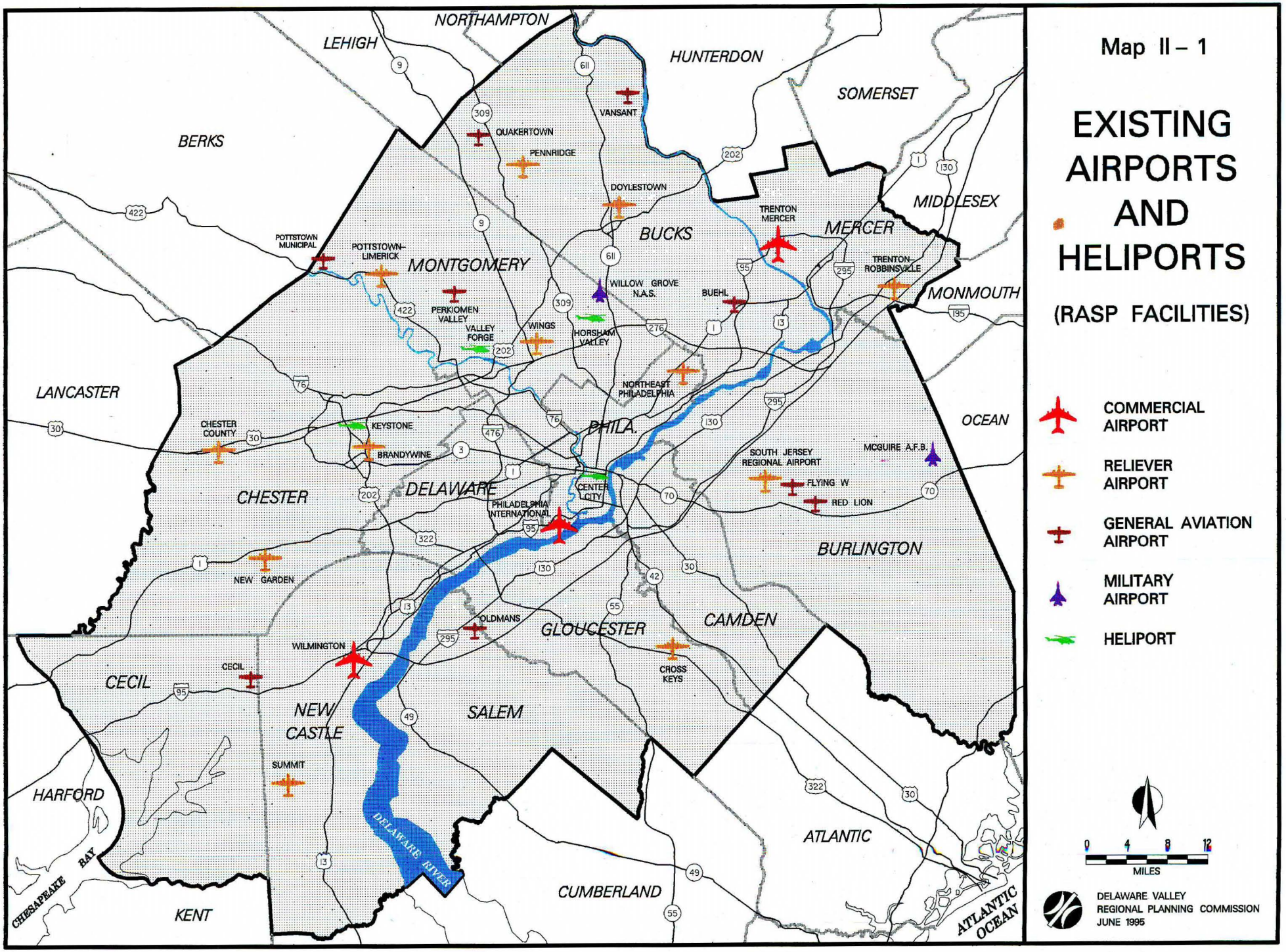
According to FAA, commercial airports are defined as those airports having 2,500 or more annual enplanements[2]. There are three commercial airports in the DVRPC region; PHL, Trenton-Mercer, and New Castle County. PHL is considered as a primary commercial service airport since it handles a very large number of enplaned passengers (8 millions per year) and accommodates large airplanes with takeoff weight in excess of 12,500 lb. Primary airports are defined as those commercial service airports having 0.01 percent or more of total US enplanements (42,800 in 1991). PHL is also considered a hub airport because it serves the entire Delaware Valley Region and accommodates transfer passengers from many US cities and foreign countries.

Philadelphia International Airport, Philadelphia, Pennsylvania

PHL is the focus of the regional airport system. It is the principal commercial service airport in the region with over 420,000 commercial, commuter, and business operations per year. The airport is located on 2,185 acres in both

[1]Delaware Valley Regional Planning Commission, *Airport Directory for the Delaware Valley Region*, December, 1993.

[2]Federal Aviation Administration, *National Plan for Integrated Airport Systems 1990 - 1999*, August 1991.


Map II – 1
EXISTING AIRPORTS AND HELIPORTS
(RASP FACILITIES)
COMMERCIAL AIRPORT
RELIEVER AIRPORT
GENERAL AVIATION AIRPORT
MILITARY AIRPORT
HELIPORT
NORTHAMPTON
LEHIGH
HUNTERDON
SOMERSET
BERKS
MIDDLESEX
MERCER
BUCKS
MONTGOMERY
MONMOUTH
OCEAN
LANCASTER
CHESTER
DELAWARE
PHILA.
BURLINGTON
CAMDEN
GLOUCESTER
CECIL
NEW CASTLE
SALEM
HARFORD
KENT
CUMBERLAND
ATLANTIC
VANSANT
QUAKERTOWN
PENNRIDGE
DOYLESTOWN
TRENTON MERCER
POTTSTOWN MUNICIPAL
POTTSTOWN-LIMERICK
PERKIOMEN VALLEY
VALLEY FORGE
WINGS
HORSHAM VALLEY
WILLOW GROVE N.A.S.
BUEHL
TRENTON-ROBBINSVILLE
NORTHEAST PHILADELPHIA
CHESTER COUNTY
KEYSTONE
BRANDYWINE
CENTER CITY
PHILADELPHIA INTERNATIONAL
SOUTH JERSEY REGIONAL AIRPORT
MCGUIRE A.F.B.
FLYING W
RED LION
NEW GARDEN
OLDMANS
WILMINGTON
CECIL
CROSS KEYS
SUMMIT
DELAWARE RIVER
CHESAPEAKE BAY
ATLANTIC OCEAN
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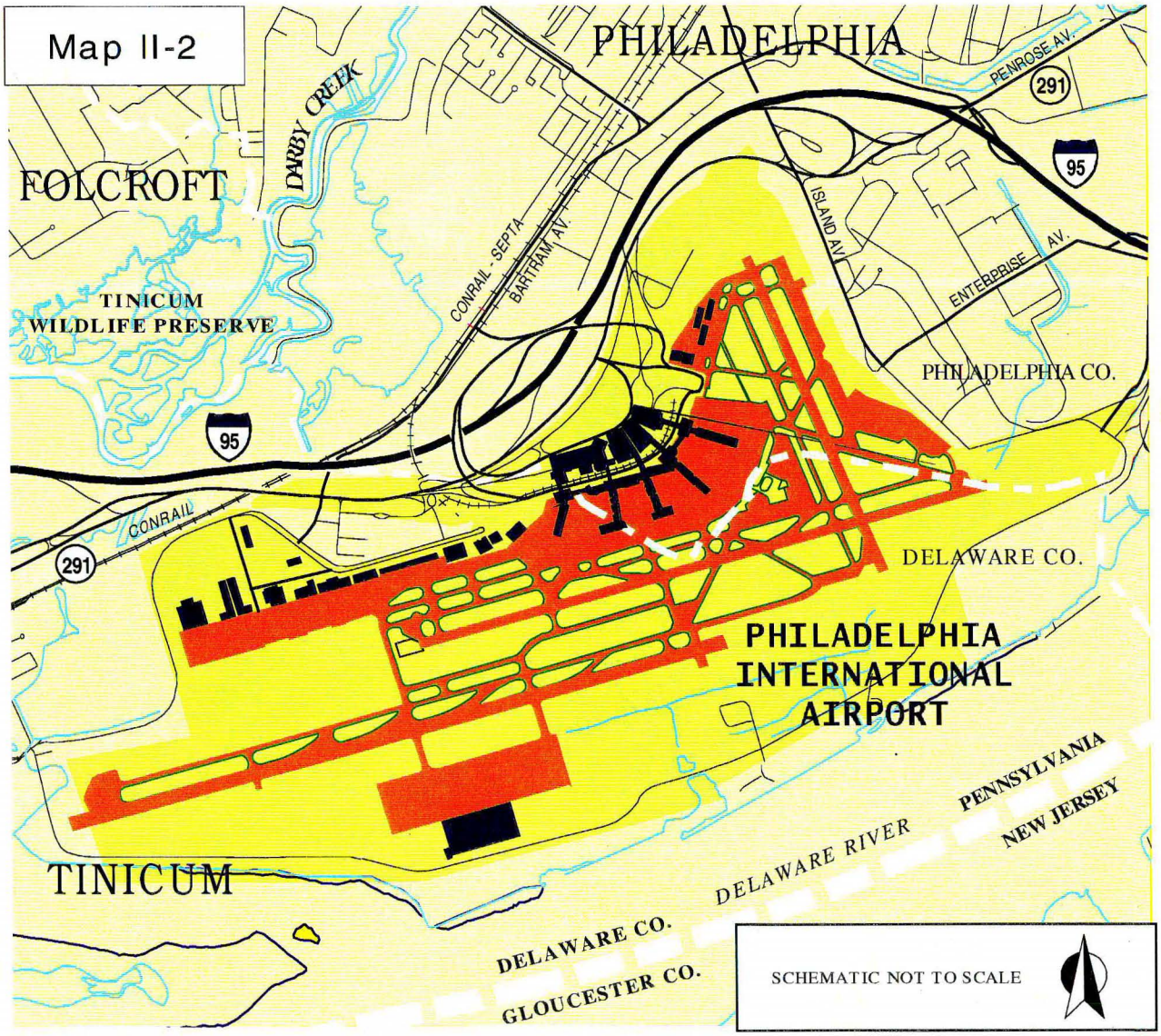
Philadelphia and Delaware counties, bounded by the Delaware River to the southeast, and I-95 to the north (Map II-2). Currently it uses two parallel runways oriented 9/27 of 10,500 ft. and 9,500 ft. length and a crosswind 17/35 runway of 5,460 ft. length. The runways are fully equipped with an Instrument Landing System (ILS). The airport acts as the center for air traffic control in the region as all traffic using the 30 mile radius Traffic Control Area is handled by controllers at the Philadelphia tower.

PHL is used by many domestic and foreign airlines. USAIR is the principal domestic



carrier serving the airport from terminals B and C with approximately 60 percent of all commercial operations. All other major domestic airlines serve the airport from terminals A, D and E. International flights arrive and depart from Terminal A. Atlantic Aviation is the major business and general aviation services company, with the hangar spaces and terminal facilities adjoining runway 17/35. There is excellent highway access, and in addition, the airport is served by a SEPTA rail line, buses, taxis, shuttles, and a fleet of hotel and rental car courtesy vehicles.

The airport is owned by the City of Philadelphia and operated by the Division of Aviation, part of the City Department of Commerce. Future expansion projects include the construction of a new commuter runway 8/26 east of the current 17/35, as well as new terminal facilities and improvements to the passenger/ baggage capacity of existing terminals. The U.S. Environmental Protection Agency (EPA) requires that these projects must be shown to be environmentally neutral before FAA funding can occur.

Trenton-Mercer Airport, West Trenton, New Jersey

This airport is the only publicly owned commercial/reliever airport in the northern part of the region. The airport, located in Ewing Township, Mercer County, New Jersey is built on 750 acres along I-95 and adjoining an additional 750 acres of airport property. It serves the state capital with limited commercial scheduled service currently provided by Eastwind Airlines, corporate operations, rental storage space and hangars, charter service, aircraft rentals, flight school, avionics and maintenance, restaurant, bus access and a free car parking lot. The airport's two active runways - 6/24 and 16/34 are 6,000 ft. and 4,800 ft. respectively. The major runway, 6, is equipped with ILS, VOR and NDB approaches. Approximately 146,000 operations occur annually and the based aircraft complement averages about 160 aircraft and helicopters (Figure II-1). Surrounding land use is light industrial or farming. Current levels of usage result in few conflicts with adjoining owners.

Unlike nearby suburban airports, Trenton-Mercer has available operational and storage capacity for additional based aircraft. However, construction of additional ramp space would be required to meet ground movement and itinerant storage needs.

New Castle County Airport, New Castle, Delaware

Formerly known as Greater Wilmington Airport, this facility is the major commercial/business airport in the southern portion of the twelve-county DVRPC aviation planning area. The airport is located south of Wilmington at the intersection US 202/SR 141 and US 13/US 40/US 301, just 0.5 mile from I-95. Although it currently averages only 8,000 commercial passengers per year, annual aircraft operations including business, general aviation, cargo, and military, total nearly 155,000.

The two major runways of the airport, 9/27 and 1/19, are 7,165 ft. and 7,002 ft. long, respectively. They are equipped with ILS, MLS, NDB, and VORTAC instrument approach and visual navigational aid assistance allowing operations in most weather conditions. A third runway, 14/32 is 4,594 ft. long, with a VASI on the 32 end. Within and adjacent to the airport's 1,250 acres is ample space and facilities for the over 240 based aircraft. Significant hangar and aviation related business rental space is available. A full range of aviation services, including flight schools, aircraft rentals, and repair shops, are located on-field. Surrounding land use is a mixture of agricultural, commercial and residential parcels, which are generally compatible with existing airport activities.

Although the airport has in the past offered scheduled commercial service, this facility in the future will concentrate on business, corporate, and general aviation markets. The Delaware River and Bay Authority will emphasize the use of the airport as an economic stimulator by promoting the facility as an industrial park with trade and cargo service. It can also be used as a center for flight training, given its long runways and full instrumentation.

RELIEVER AIRPORTS

These airports are general aviation airports, intended to reduce congestion at large air carrier airports by providing general aviation pilots with alternate landing areas. There are 12 reliever airports in the region that reduce air traffic congestion at PHL. These airports accommodate a significant proportion of civil aircraft operations and provide the same service level as General Utility airports. The 1982 Airport and Airway Improvement Act provided that 10 percent of total AIP funds be spend on this category, amended to 5 percent in fiscal year 1995.

In 1985, DVRPC conducted a study which recommended the reliever airports included in the 2000 RASP. Airport capacity, travel demand, land use, passenger destination, airport commitment to service, airport coverage, instrument flight rule coverage, airspace conflict, and airport service facilities are among the criteria used to determine the reliever status of these airports. As shown in Figure II-2, reliever airports account for most of the aircraft landings and takeoffs in the region.

Brandywine Airport, West Chester, Pennsylvania

Brandywine Airport is a privately owned public use reliever facility located just to the east of US 202 in West Goshen Township, Chester County. The airport's present runway, 9/27, is 3,000 ft. long with a partial taxiway serving the storage ramp and runway areas. A non-precision instrument approach to the airport is available using the Modena VORTAC. Land surrounding this airport is principally owned by the airport owner, and is primarily light industrial and commercial.

Approximately 35,000 operations were counted in 1990. Brandywine Aero, Inc.,

Figure II-1
CURRENT BASED AIRCRAFT

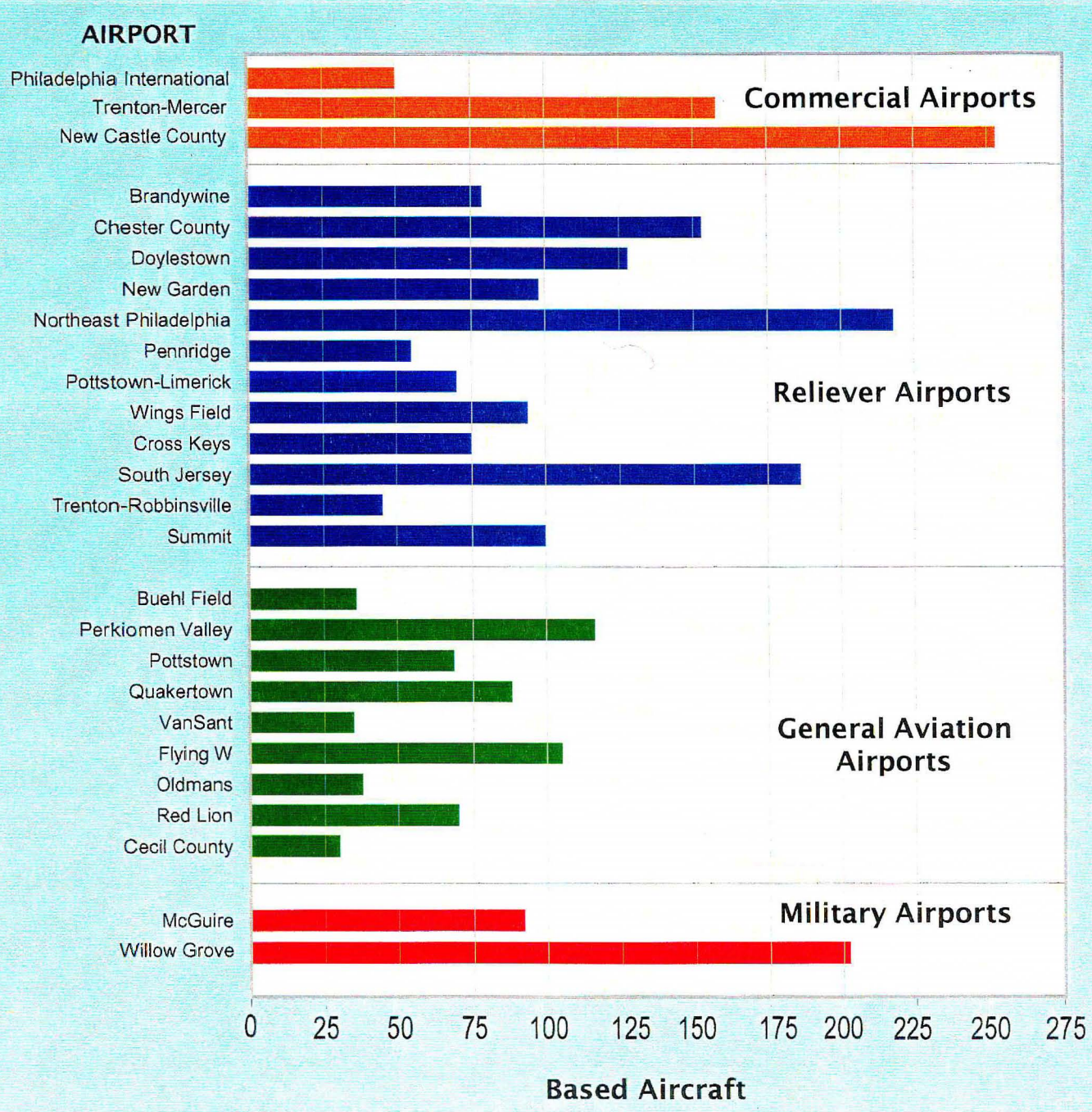
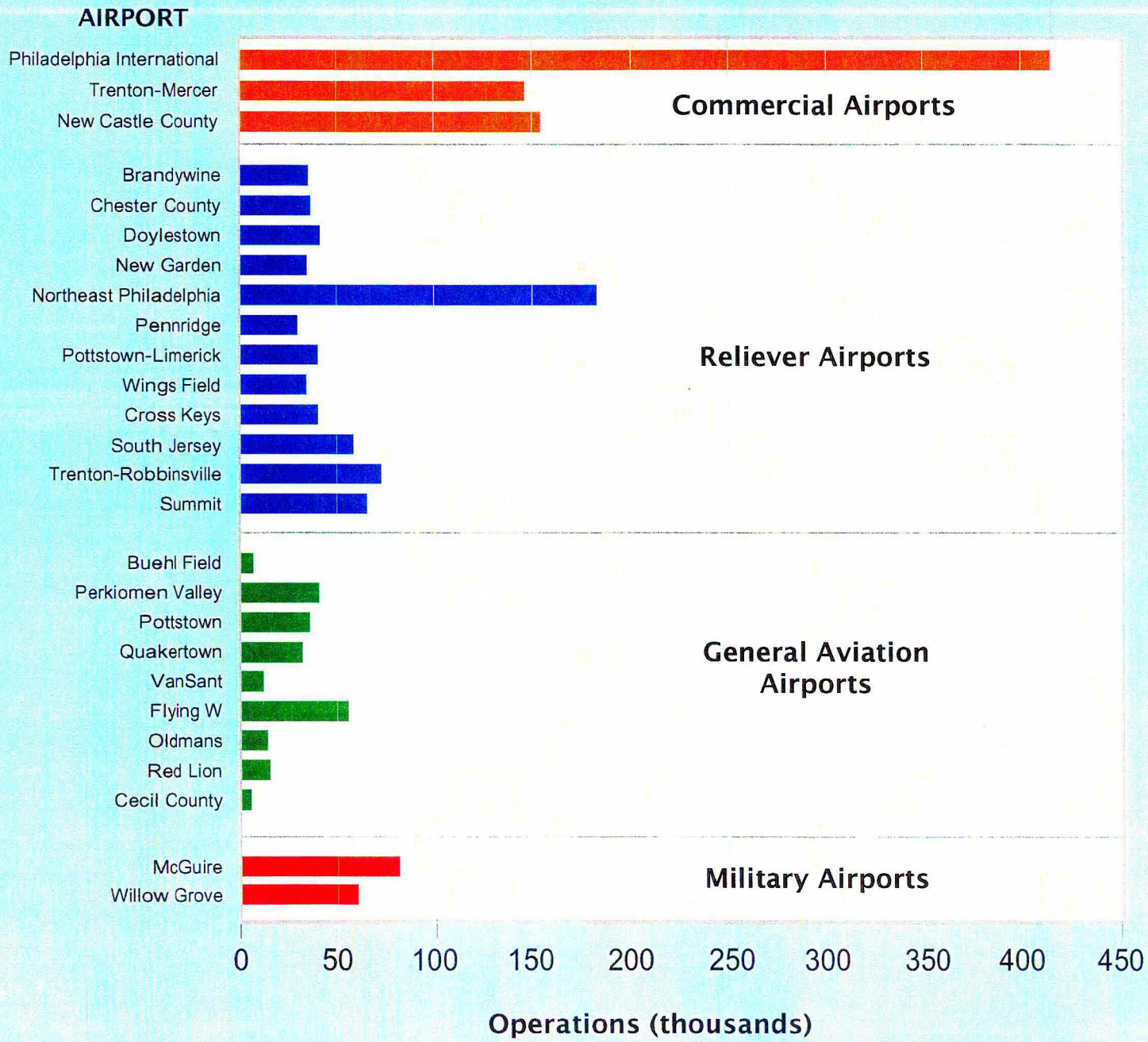


Figure II-2
CURRENT ANNUAL OPERATIONS



the fixed base operator (FBO), provides major repair and other aircraft services, hangar rentals, and tie downs. About 79 aircraft are based at the airport, most of which are single engine.

Land limitations and highway location considerations prevent the extension of the runway. However, in the 1980s FAA funded ramp expansion and taxiway improvements. The owner has also privately funded the construction of a new administration and terminal building. Future expansion of the ramp and hangar capacity are needed to accommodate the increasing local demand for based aircraft. These improvements include additional ramp and paved tie-down space and new T-hangars.

Chester County Airport, Coatsville, Pennsylvania

Chester County Airport, also referred to as the G. O. Carlson Airport, located in Valley Township, Chester County, is the major business/reliever airport in the western portion of the region. In 1990, the airport had about 37,000 takeoffs and landings, 25 percent of which were multi-engine or jet aircraft. A full range of aircraft maintenance services are available to the 153 based aircraft. Located on 375 acres adjacent to US 30, the airport has a 5,400 ft. by 100 ft. runway with full taxiway, navaids including a VASI on runway 11, REIL on runway 29 and 11, a precision ILS approach on runway 29; and a VORTAC approach using the Modena transmitter.

The adjoining land uses are agricultural or business/light industrial, which will allow for growth of business users of the airport in the future. Highway access from US 30 is being improved with the construction of the exit/entrance ramps from the eastbound direction.

The airport, which is owned by the Chester County Airport Authority and operated by Chester County Aviation Inc., has received numerous FAA and PA capital grants for capacity and safety improvements. Capital projects, including the construction of a new terminal and other user enhancements are undertaken on a continuing basis. As the other aviation facilities in the western suburbs reach capacity, Chester County Airport is well situated for expansion and will be able to accommodate increased travel demand from the business community. Charter service is also available and scheduled service to PHL may be viable in the future, as business development expands.

Doylestown Airport, Doylestown, Pennsylvania

Doylestown Airport is the primary reliever airport serving central Bucks County and the county seat of Doylestown. This 81 acre airport is owned and operated by the Bucks County Airport Authority through the on-field FBO. The airport, with a 3,000 ft. runway and newly constructed taxiway, is located between relatively dense residential and commercial development

and farmland north of the Doylestown city center and just off SR 611. The Authority has been successful, with Federal AIP grants, in acquiring adjacent land for new hangar and ramp construction, as well as capital improvements to the runway-taxiway system. An aggressive campaign to acquire additional land for storage of aircraft on their waiting list is being pursued by the Airport Authority.

The shortage of aircraft storage capacity in hangars has limited the number of based aircraft to 128, although there is a waiting list of potential tenants. There is an NDB approach on the airport, and approaches can also be made via the Solberg VORTAC signal. The airport also provides VASI and REIL for visual approach and landing guidance. FAA is in the process of installing an AWOS system. Maintenance and repair service, charter service, flight school, and aircraft rentals are available.

New Garden Flying Field, Toughkenamon, Pennsylvania

New Garden Flying Field is a privately owned public use reliever airport located south of US 1 in New Garden Township, Chester County, Pennsylvania. The airport, situated on 190 acres, has two runways; 6/24 is paved and 3,700 ft. long, while 16/34 is turf and temporarily closed. The airport has a non-precision VOR approach predicated on the Modena transmitter. Recent public/privately funded improvements at the airport include obstacle removal at the approach end of runway 6, and the construction of a new access road to the airport which allowed the siting of new hangars for storage of based aircraft. Adjoining land is predominantly low density residential and agricultural in use.

Maintenance, flight school, air taxi, storage and aircraft rental services are offered at the airport. New Garden is the only potential business use airport in southern Chester County. In 1991 the owners indicated to FAA, state, regional officials and New Garden Township that they wanted to relinquish ownership to another operator. In order to retain the airport in the regional system, New Garden Township is considering public acquisition and has applied for FAA-AIP funding to purchase the airport. In FY 92, the FAA approved the AIP master plan funds needed to determine the expandability of the airport, as a precursor to its decision on public acquisition funding.

Northeast Philadelphia Airport, Philadelphia, Pennsylvania

Northeast Philadelphia Airport is the major publicly owned business reliever airport in the regional system. The airport averages 220 based aircraft, including single engine, twins and jets, and approximately 182,000 operations per year. The main runway, 6/24 is 7,000 ft. long and ILS equipped, and the cross wind runway 15/33 is 5,000 ft. long. The airport is located in the northeast part of the City of Philadelphia between Roosevelt Boulevard (US 1) on the northwest, Academy Road on the southeast, Comly road on the northeast, and Grant

Avenue on the southeast, I-95 is nearby. The interstate highway is near the airport and runs in north/south direction. Public transit buses serve the airport along Grant Avenue and Academy Road. Surrounding the airport on the south, west, and north is low density office and light industry development with high density residential area to the east.

Northeast Philadelphia is the location of numerous fixed base operators, including Delaware Aviation and the North Philadelphia Aviation Center, which provide a wide range of services to all types of aircraft. Although no scheduled service currently exists at the airport, several charter operators are based there. Flight instruction, hangar and aircraft rental, car rental, and major repair service are available. The airport has an operating FAA control tower.

Pennridge Airport, Perkasie, Pennsylvania

Pennridge Airport is located in East Rockhill Township, and is the primary business reliever airport in western Bucks County. The airport is privately owned and started development through the FAA AIP master plan in 1992. Located on 270 acres, its runway is 4,200 ft. long and 100 ft. wide, with terminal VOR and NDB approaches. Although only 60 aircraft are based there, the airport's long and wide runway can accommodate corporate jet and twin engine aircraft, as well as single engine. Adjoining development includes light industrial and other "low rise" business uses. Some residential development exists on the west end of runway 8/26.

Pennridge is located just north of the Philadelphia Traffic Control Area (TCA) and south of the Allentown Airport Radar Service Area (ARSA). Given the airport's rural setting and nearby publicly owned airports, Doylestown and Quakertown, which cannot accommodate corporate or jet aircraft due to short runway length, Pennridge is appropriate for some expansion and runway extension. This will both increase safety and decrease noise of future jet and business aircraft activity seeking use of this airport for economic development related travel. Any approach improvements at the airport, which may accompany a runway extension, will require community and zoning concurrence.

Pottstown-Limerick Airport, Pottstown, Pennsylvania

Pottstown-Limerick is a privately owned business/reliever airport in Limerick Township, western Montgomery County just north of US 422. The airport's runway, 10/28, is 3,371 ft. long with a 200 ft. displaced threshold on the eastern end. Approach NAVAIDS include a localizer for runway 28, VOR-DME, AB VORTAC and a rotary beacon. A full taxiway adjoins the runway. This airport is used predominantly by corporate and business aircraft, including twin turbo props and jets. A full range of services for aircraft based here are available through Penn

Airways, Inc. which operates the airport for Philadelphia Electric, the airport owner. In 1990, there were approximately 40,000 operations at this airport. The number of based aircraft has remained stable at between 60 and 70 since 1985. This number is expected to increase, if more hangar capacity is constructed. This airport has the necessary land and demand for more hangar space, and is pursuing private financing for hangar construction.

As a reliever, the airport has been the recipient of significant FAA capital subsidies in recent years; however hangar construction is currently ineligible for public subsidy. The airport continues to attempt to acquire the adjoining farm land to the west which would permit a runway extension, the relocation of the localizer to runway 10, and the installation of a glide slope indicator for full ILS operation. This airport, FAA and Limerick Township continue to pursue this option, which would establish Pottstown-Limerick as the premier business airport in western Montgomery County.

The FAA is preparing approach plates for a new NDB approach, which will be available in 1994. The airport also provides a RCO nearby, in addition to the existing localizer to improve pilot communication with the PHL tower.

Wings Field, Blue Bell, Pennsylvania

Wings Field is a privately owned business reliever airport in Whitpain Township, Montgomery County, located one mile from the intersection of the Pennsylvania Turnpike, its Northeast Extension, and I-476. The airport is adjacent to a large number of low-rise office parks to the west and upscale residential tract development and town house groupings to the east. The 2,600 ft. runway, 6/24, with full taxiway accommodated an estimated 35,000 operations in 1994, mostly single engine and small twin aircraft. Approximately 94 aircraft are based at the airport. Navigational aides, including published approaches from the Ambler NDB and the Modena VORTAC transmitter are available. The airport has significant hangar storage capacity, as well as aircraft rental, outside paved tie downs, repair and air taxi services, and a flight school.

In the late 1980s, the owners of this airport brought suit against Whitpain Township to gain local governmental approval for an 1,100 ft. runway extension to the northeast on contiguous land owned by the airport. Although the suit was successful, the runway construction has not yet begun. This airport, as a privately owned reliever facility, is eligible for Federal AIP funds for the extension and other projects. Due to its central location within the county and the past or probable closure of other nearby airports, it is estimated that growth in operations at Wings will continue, assuming this facility remains open. The runway extension will provide enhanced safety and a greater diversity to aircraft mix at the field. Additional hangar construction will also be warranted, if the runway is extended. Some type of precision approach system, would provide

all-weather business utility of the longer runway.

Cross Keys Airport, Williamstown, New Jersey

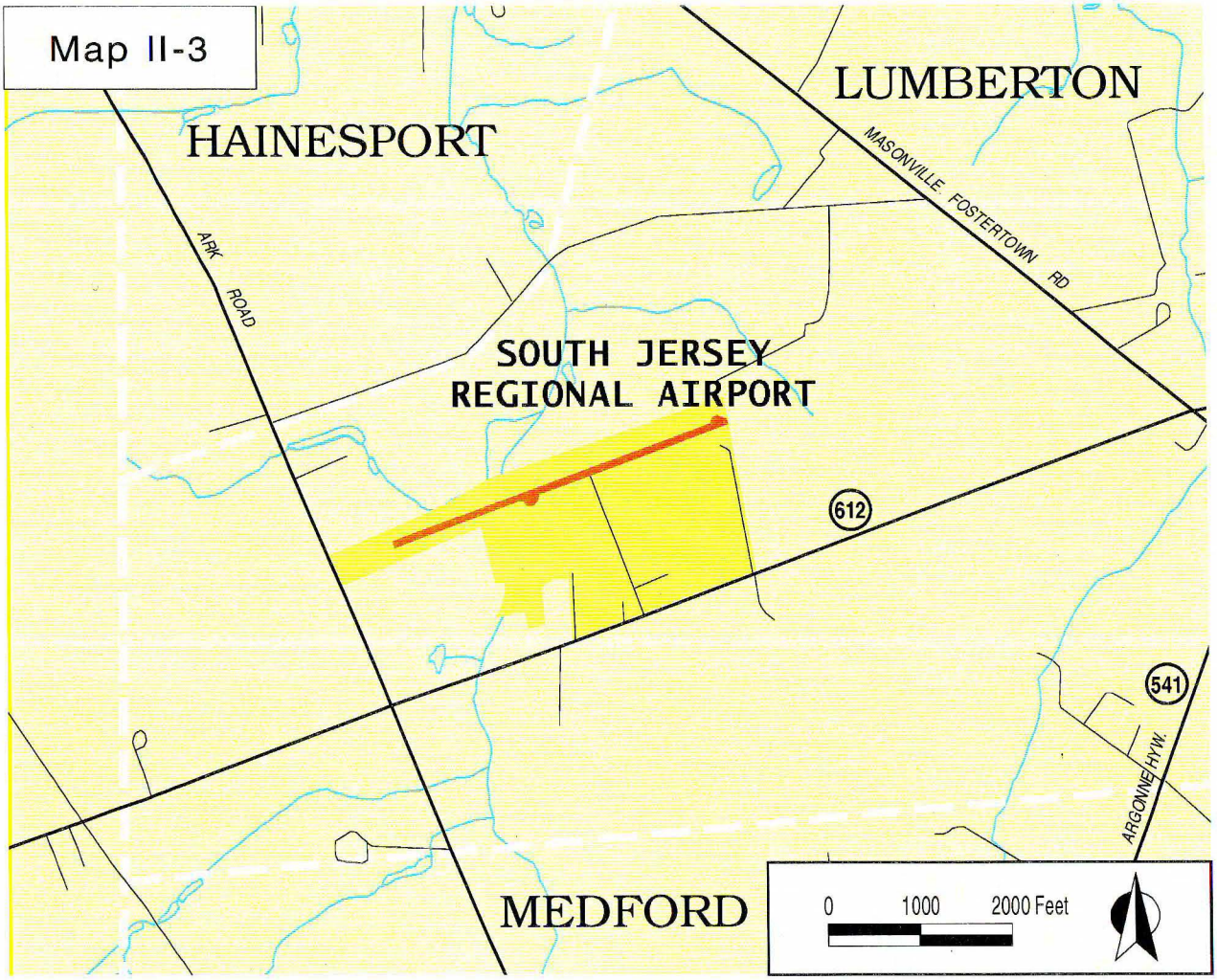
Cross Keys is a privately owned reliever airport in Monroe Township, Gloucester County, located on CR 555 south of SR 42. The airport has a 3,500 ft. paved runway and a VOR approach. With over 70 based aircraft, the airport experiences approximately 40,000 takeoffs and landings per year. The facility is sur- rounded by dense residential development to the north and east, and woodland to the south and west. The fleet mix is pre- dominantly single engine, with some small twins. An active flight school, as well as repair services, storage, charter, aircraft leasing and rental are available at the site.

The owners of this facility have traditionally rejected FAA capital grant assistance, although an FAA funded master plan was completed for the airport in 1984 detailing necessary improvements. Additional apron space as well as T-hangars are required to accommodate current and anticipated storage demand in the future. A 1,300 ft. runway extension would also be optimal to diversify the airport to include business use, as well as recreational application. Recent ownership charges have resulted in the initiation of an updated masterplan, and expansion with state or federal funds now seems possible.

South Jersey Regional Airport, Lumberton, New Jersey

South Jersey Regional Airport, located four miles southwest of Mt. Holly in Lumberton Township, Burlington County is a privately owned public use airport classified as a reliever by DVRPC and FAA (Map II-3). With its 3,900 ft. runway, 8/26 and numerous tenant aviation related businesses on field, this airport caters to GA and business trips. There are over 180 aircraft based at the 112 acres airport and 1992 operations were about 60,000, with significant levels of twin engine and some jet aircraft. The airport currently uses a VOR approach to runway 26. A wide range of services is available to users of the airport, including flight instruction, air-taxi/charter service, maintenance, and aircraft sales and rental.

The owner-operator of this airport and FAA have made a significant commitment to growth with a multi-year capital expansion program which includes runway extensions, ramp expansion, obstruction removal and construction of additional hangar space. Surrounding land use is predominantly agricultural, with some low density residential properties also present. Business users of the airport would benefit from a runway extension to the east and the installation of some form of precision approach, which could also assist IFR operations at nearby Flying W and Red Lion. Any further airside development at South Jersey Regional must be coordinated with McGuire AFB, which provides ATC for these three civilian airports.



Trenton-Robbinsville Airport, Robbinsville, New Jersey

Trenton-Robbinsville is a privately owned public use airport located southeast of Trenton in Washington Township, Mercer County near the intersection of US 130 and I-195. The airport has a 4,300 ft. long runway, 11/29, with full taxiway and a VOR approach. Although the airport is bounded on the north side by a residential apartment development, the eastern end of the runway can be extended. To the east and south development is predominantly low density residential, with some woodland. Local land use zoning prevents additional development in the area except for business purposes. The airport at the 1989 count had approximately 116 based aircraft and over 70,000 operations per year. However with business and ownership changes based aircraft are down to 40 and operations are lower proportionately. The fleet mix at the

facility included twins and turbo prop aircraft due to the runway length and service options available. In 1994 approximately 45 aircraft were reportedly based at the airport. However, an accurate number of annual operations for that time was not established. This airport is considered a reliever by FAA and DVRPC, the owners have not accepted FAA capital grants, however they recently committed to continue operation by accepting a large state/FAA block grant for lighting. This allows them to retain their option to sell and redevelop the facility for non-aviation purposes. In the 1980s and early 1990s, the airport was threatened with closure and liquidation, because of its use with the adjoining golf course property as collateral for real estate speculation that failed. Township and state officials interceded to limit the development potential at the airport and the facility is expected to remain in aviation use. Additional hangar space will be required to satisfy expected future storage demand.

Summit Airport, Middletown, Delaware

Summit Airpark is a major privately owned reliever airport located just north of the intersection of US 301 and SR 896 in New Castle County. This facility is the southernmost airport in the DVRPC Regional Airport System, providing a 4,500 ft. major runway, 17/35, as well as a crosswind turf runway, 11/29, which is about 3,700 ft. long. The airport is served with a VORTAC and NDB approach and is located outside of the Philadelphia TCA. The operator of this airport specializes in the installation and service of avionics, resulting in many operations by twins, turbo prop fixed wing aircraft and helicopters. It is estimated that about 100 aircraft are based at the airport. Annual operations are estimated at approximately 65,000 in 1990.

The airport has participated in the FAA funded capital grant program and undertook a master plan update using FAA funds in 1992-93. This update identified major improvements to the airport, including a relocation of runway 17/35 to the west permitting a major extension to the south. The existing 17/35 will then be used as the taxiway for the runway. Construction of the runway extension will allow for installation of a precision instrument approach.

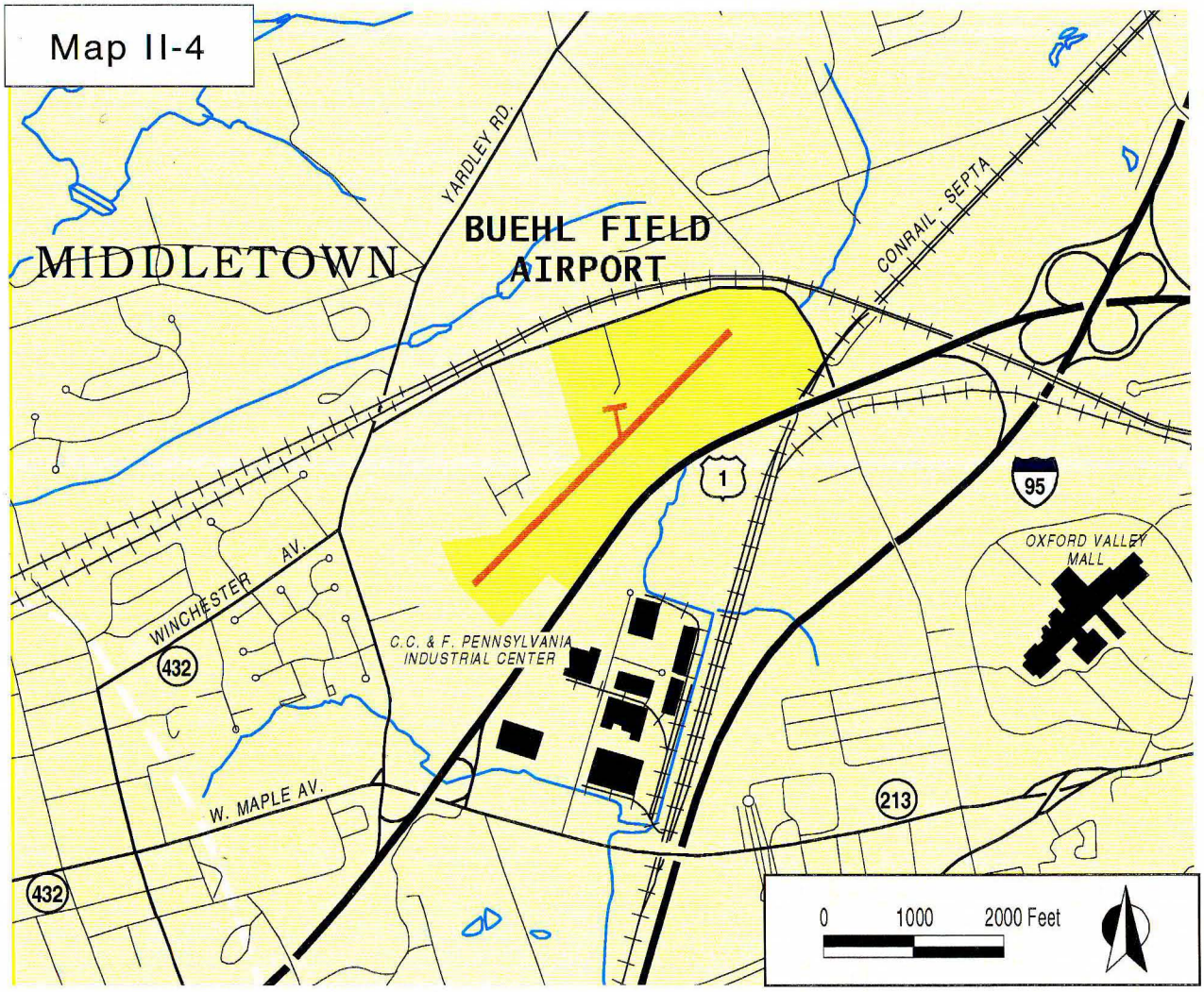
GENERAL AVIATION AIRPORTS

These facilities are intended to accommodate smaller aircraft. The general aviation fleet at these airports may also include transport type equipment similar to that used by the major airlines. However, the overwhelming majority of general aviation aircraft are single engine piston aircraft. FAA has divided these airports into two categories based on aircraft design considerations. The first category is called Basic Utility (BU) airports which are the most common type of general aviation airports. This category accommodates 95 percent of the general aviation fleet, including most single-engine and many twin-engine aircraft. These airports have visual runways designed to accommodate

only small airplanes, less than 12,500 lb.

The second category, General Utility (GU) airports are generally larger and more capable than for BU airports and can accommodate virtually all GA aircraft. They have a non-precision instrument runway which can handle larger GA airplanes (up to 70,000 lb certified takeoff weight). Typical runway length for a GU airport is 4,300 ft. vs 3,200 ft. for a BU airport.

Buehl Field, Langhorne, Pennsylvania



Buehl Field is a privately owned, public use, general aviation airport located in Middletown Township, eastern Bucks County just west of the I-95 / US 1 interchange. Runway 6/24 is 3,100 ft., with an adjoining turf taxiway (Map II-4). Adjoining the property to the south is the

US 1 right-of-way, to the east is an elevated railroad track, and to the west, the approach end of runway 6,

commercially zoned property. Field surveys indicate there are 30 to 40 based aircraft at this airport, mostly single engine. There were 6,888 operations counted in 1994.

Use of the airport has been constrained by obstructions on the east end of the runway and business development plans to the west, off airport property. In 1992, development plans for the west side were dropped. In early 1992 the airport owner/operator applied to FAA through DVRPC to be reclassified as a reliever in the NPIAS, thereby becoming eligible for Airport Improvement Program (AIP) capital grants. Buehl is the only public use airport in eastern Bucks County, giving it the potential to serve numerous businesses in both the I-95 and US 1 corridors. The owner has indicated that Federal AIP eligibility will be critical to the future competitiveness of this airport and its continued operation.

Perkiomen Valley Airport, Collegeville, Pennsylvania

Perkiomen Valley Airport is a public use, privately owned, general aviation facility located in Skippack Township, Montgomery County. The airport has a single runway, 9/27, 2,960 ft. long, with a displaced threshold of 300 ft. on Runway 9. A VOR published approach for that runway end is available. The facility is located on 64 acres with residential development to the west, north, and south, and open fields to the east. As of 1992, over 90 aircraft were based at Perkiomen Valley. Of these, 86 are single engine, and the remainder are small twin engine aircraft and two helicopters. Some business turbo props and helicopters also use the field on an itinerant basis. A full range of aviation maintenance and repair services including air taxi, flight school and aircraft rental is available.

Perkiomen Valley Airport accommodated approximately 40,000 operations in 1989, a 35 percent increase from 1985. The runway is bounded by public roads at either end, requiring displaced thresholds, and since residential development around the airport is intensifying, no runway extension is feasible, limiting the mix of aircraft to the existing fleet. Many aircraft are stored at outside tie-downs and the owner/operator is attempting to provide more hangar capacity through private financing. The airport, which is classified as a privately owned GA facility in the NPIAS and RASP, is not eligible for FAA-AIP capital grants; however, it is the periodic recipient of Pennsylvania capital grants and other services.

Pottstown Municipal Airport, Pottstown, Pennsylvania

Pottstown Municipal is the only airport in the twelve-county region, outside Philadelphia, currently owned and operated by a municipality. It is located off US 422 in the borough of Pottstown, Montgomery

County. The 2700 ft. runway, 7/25, with full taxiway, mainly serves single engine aircraft, some of which use the Pottstown AB VORTAC approach in bad weather. The airport had about 35,000 annual operations in 1990 and has a based aircraft complement of 56. The site of the airport is approximately 65 acres in an area with dense residential development to the west and a business/industrial park to the east limiting runway extensions.

Air taxi service as well as maintenance, hangar tiedowns, etc., are available from the FBO Basco Flying Service, Inc. Expansion of storage capacity in hangars is possible to accommodate current demand; however, the limited space and existing adjacent land use may prevent expansion for larger design aircraft. Future development plans at Pottstown Municipal must be coordinated with those of Pottstown Limerick in order to avoid redundant services or capital investment.

Quakertown Airport, Quakertown, Pennsylvania

Quakertown Airport is a publicly owned general aviation airport just west of the borough of Quakertown, between the Northeast Extension of the Pennsylvania Turnpike and Route 309. The airport is owned and operated by Bucks County through its Airport Authority. The airport's 3,200 ft. runway, 11/29, with full taxiway, handles an estimated 31,000 operations per year from its more than 70 based aircraft and itinerant operations. Both an NDB approach and a VOR/DME from the Pennridge transmitter provide navigational guidance to the field, which is used predominantly by single engine aircraft. Aircraft storage, repairs, maintenance rental, charter and flight instruction are all available.

This airport has recently completed obstruction removal, NDB replacement with FAA-AIP funds, and construction of a new hangar. The airports 123 acres permit expansion of the number of based aircraft as demand increases in the future.

Van Sant Airport, Erwinna, Pennsylvania

Van Sant is a privately owned public use recreational airport in Tinicum Township, Bucks County. It was selected as a facility in the RASP since it is the only aeronautical facility serving the northern quadrant of Bucks County. Both the main runway, 7/25, which is 3,000 ft. long, and the glider runway are unpaved making them usable by only light aircraft during certain weather conditions.

The airport is situated on the top of a hill surrounded by wooded land and sparse residential development. Despite this location, neighbors are very sensitive to aircraft noise, further limiting usage of the field. The field has an average based aircraft complement of 35 and approximately 12,000 annual operations, all being single engine or glider aircraft. The airport is usable only during VFR conditions and no navigational landing aides or lights are available. The airport

provides services, including repair, tie-downs and flight instruction.

Flying W Airport, Medford, New Jersey

The Flying W Airport is located on the borders of Lumberton and Medford Townships in Burlington County, New Jersey. The 3,500 ft. runway, 1/19, with full taxiway accommodated over 55,000 operations annually in 1994, with 105 based aircraft. This airport has a VOR approach and is in the traffic control area of McGuire AFB. Highway access to the airport is via Masonville Fostertown Road running north from SR 70. Surrounding land use is low density residential with significant open space. However, nearby residential concentrations have registered sensitivity to the existing operations and noise, resulting in noise abatement take-off procedures.

The airport has a rich history dating back to the 1960s when many celebrities visited the airport and ranch. This facility now serves recreational flyers and has five active flight schools, four maintenance facilities, air taxi/charter services, sightseeing rides and on-site recreational facilities, including a restaurant, bar and lounge, motel, catering hall, volleyball court and pool. These services attract significant itinerant traffic.

This privately owned airport is classified as a general aviation facility by the region and FAA and therefore is not eligible for federal grants. The State of New Jersey has invested significantly in taxiway and ramp improvements. The airport has recently been purchased by Financial Development Investors Corporation and improvements to the facilities are being implemented with private resources. Additional recreational facilities will be added to the airport property in the near future.

Oldmans Airport, Pedricktown, New Jersey

Oldmans Airport is a privately owned, public use, general aviation airport located in Pedricktown, Salem County. The facility is the only public use airport in the county and has a 2,450 ft. runway, 7/25, nearly parallel to the I-295 right-of-way immediately west of the airport. About 38 aircraft mostly single-engine are based at the airport. These aircraft and itinerant flights generated approximately 14,000 operations in 1989.

Surrounding land is predominantly agricultural in use with some sparse residential development. Business and industrial development is expanding along the I-295 corridor to the west of the airport. Flight instruction, air taxi service, maintenance repairs, and rental aircraft are available. Hangar rental availability is limited. A published VOR approach predicated on the Woodstown transmitter is available.

As a privately owned general aviation facility, Oldmans is not eligible for FAA grants, and has experienced financial

problems in recent years. Realizing the necessity of retaining aviation capacity in the county, Salem County applied to FAA for Airport Feasibility and Site Selection Study funding in 1992. The possible outcome will be a recommendation for Salem County to acquire the airport with FAA support, create another airport at a more favorable site, or accept another private operator. As a publicly owned airport, Oldmans will require additional hangar and ramp space, and will benefit from a runway extension, if land at the eastern end of the runway can be acquired.

Red Lion Airport, Southampton, New Jersey

Red Lion Airport is a privately owned general aviation airport located 4 miles east of Flying W in Southampton Township, Burlington County. Its runway, 5/23, is 2,900 ft., and has a VORTAC approach. It handles approximately 15,000 operations per year, and has 70 based aircraft, predominantly single-engine models. This airport has air taxi/charter, maintenance, and flight instruction services available, and limited storage and hangar capacity.

Red Lion Airport is situated on 95 acres, surrounded predominantly by farmland. Although state funds have been used for limited capital improvements, the airport is not eligible for FAA-AIP grant assistance. Growth in the area surrounding Red Lion will be limited during the next twenty years, and the demand for the airport is expected to remain moderate and recreational in nature.

Cecil County Airpark, Elkton, Maryland

Cecil County Airport is a privately owned, public use, general aviation facility located near Elkton, Maryland, just north of the intersection of I-95 and Maryland Route 279. The runway is 2,600 ft. long and the 30 based aircraft generate 5,500 operations per year, last counted in 1994.

Significant business and industrial development exists around and near the airport, including established corporations and new business park construction. The area served by this airport includes, northeast Maryland, Chester County, Pennsylvania and New Castle County, Delaware. There are no other general aviation facility options to serve single engine or small corporate twin aircraft in this area.

The current owner has offered the airport for sale to Cecil County in order to assure continued use as a publicly owned airport. A Feasibility/Master Plan Study has been funded by FAA with participation by Maryland DOT. The master plan study will establish if runway length and storage capacity can be enhanced in the future. If the facility is not acquired by the county with support from FAA, the land may ultimately be redeveloped for non-aviation applications, limiting the growth potential of this portion of the region.

MILITARY AIRPORTS

These airports are intended to accommodate all types of military aircraft. They are designed for military transport as well as for training to serve the specific need of the US Navy or Air Force. There are three military airports in the region, two in the Pennsylvania portion of the region (Warminster - closed for military air-traffic in 1993 - and Willow Grove) and one in New Jersey (McGuire Air Force Base). These facilities provide maintenance, storage and runway capacities to accommodate all types of airplanes.

Willow Grove Naval Air Station, Willow Grove, Pennsylvania

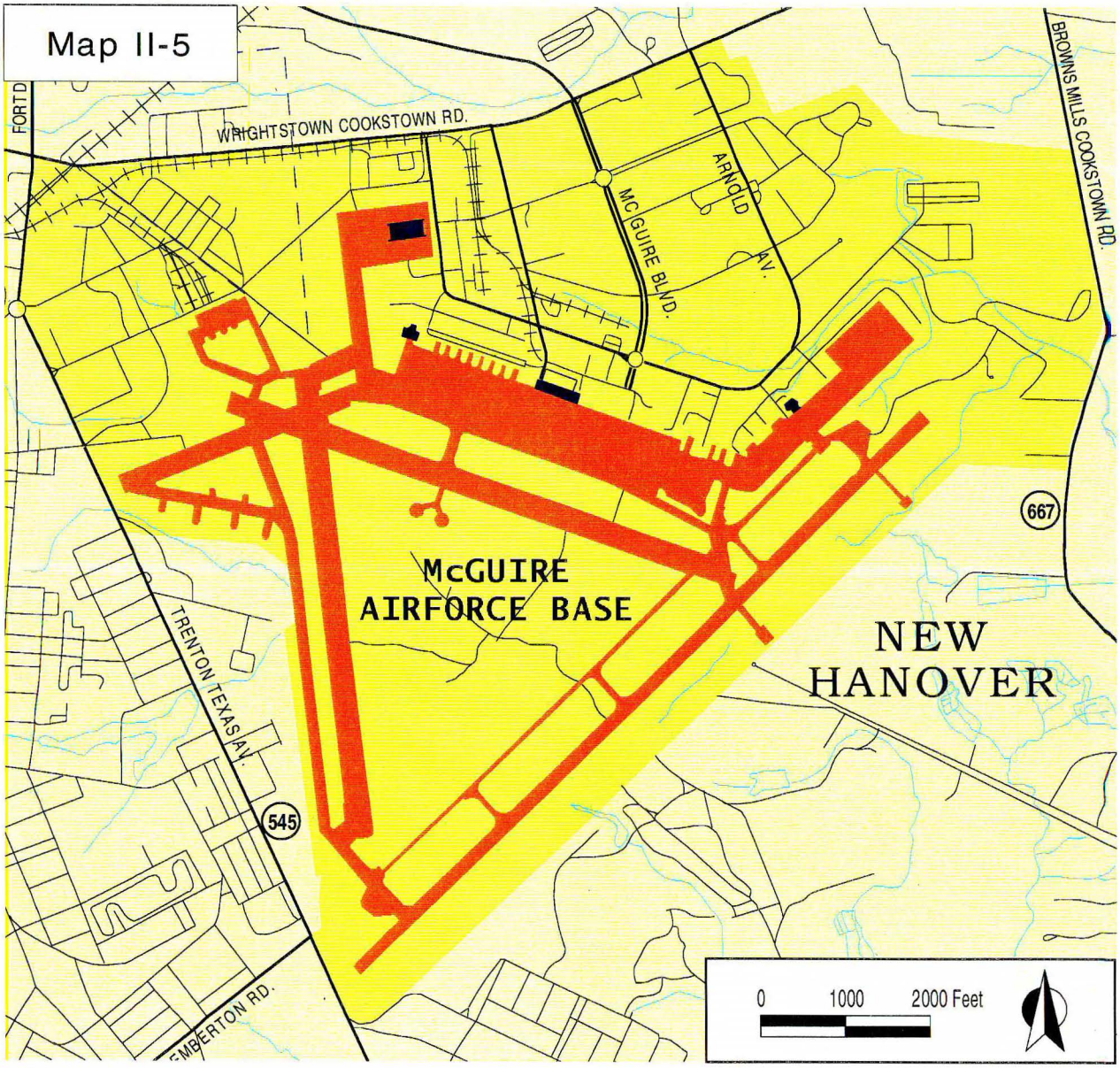
Willow Grove Naval Air Station is a chief Naval Reserve station serving the middle Atlantic states. It provides facilities, materiel, and training to all assigned units for any military mobilization. In addition to Navy units, U. S. Army and US Air Force installations are based at Willow Grove. The facility is located on SR 611 in Horsham Township, Montgomery County. The Naval Air Station is active with an estimated 45,000 operations per year on the main runway, 15/33, which is 8,000 ft. long. The Naval Air Station also has an estimated 11,700 helicopter operations per year which do not use the main runway.

The Year 2000 RASP recommended joint civilian/military use of the airfield as a means of increasing suburban operating capacity of the regional system. However significant opposition to the increase in traffic which would result from joint use materialized, and the recommendation was dropped in 1988. The field experiences airspace conflicts with nearby civilian airports, and pilots are required to contact the military ATC at Willow Grove for preferred routings through the airspace.

It should be noted, however, DVRPC, PennDOT, Bucks County and Warminster Township have studied the potential for conversion of the Warminster runway (6/24, 8000 ft.) to civilian use, to provide much needed commercial shuttle service and aircraft storage in central Bucks County. But there was no strong local sponsor for a publicly owned facility at the site. Also, the airspace analysis conducted by DVRPC indicated potentially problematic airspace conflicts between civilian users of Warminster and military operations at Willow Grove.

McGuire Air Force Base, New Hanover, New Jersey

This major military staging and materiel center on the east coast is located in Wrightstown, Burlington County (Map II-5). It serves as the base for the 438th Air Base Group which, with other training and



reserve flights, uses the two main runways, 6/24 and 18/36, that are 10,000 ft. and 7,130 ft. long, respectively. The military Air Traffic Control (ATC) installation at McGuire, in addition to military operations, handles traffic approaching and departing South Jersey Regional, Red Lion, and Flying W airports, civilian facilities in the area. ATC also handles commercial flights over its airspace along the east coast.

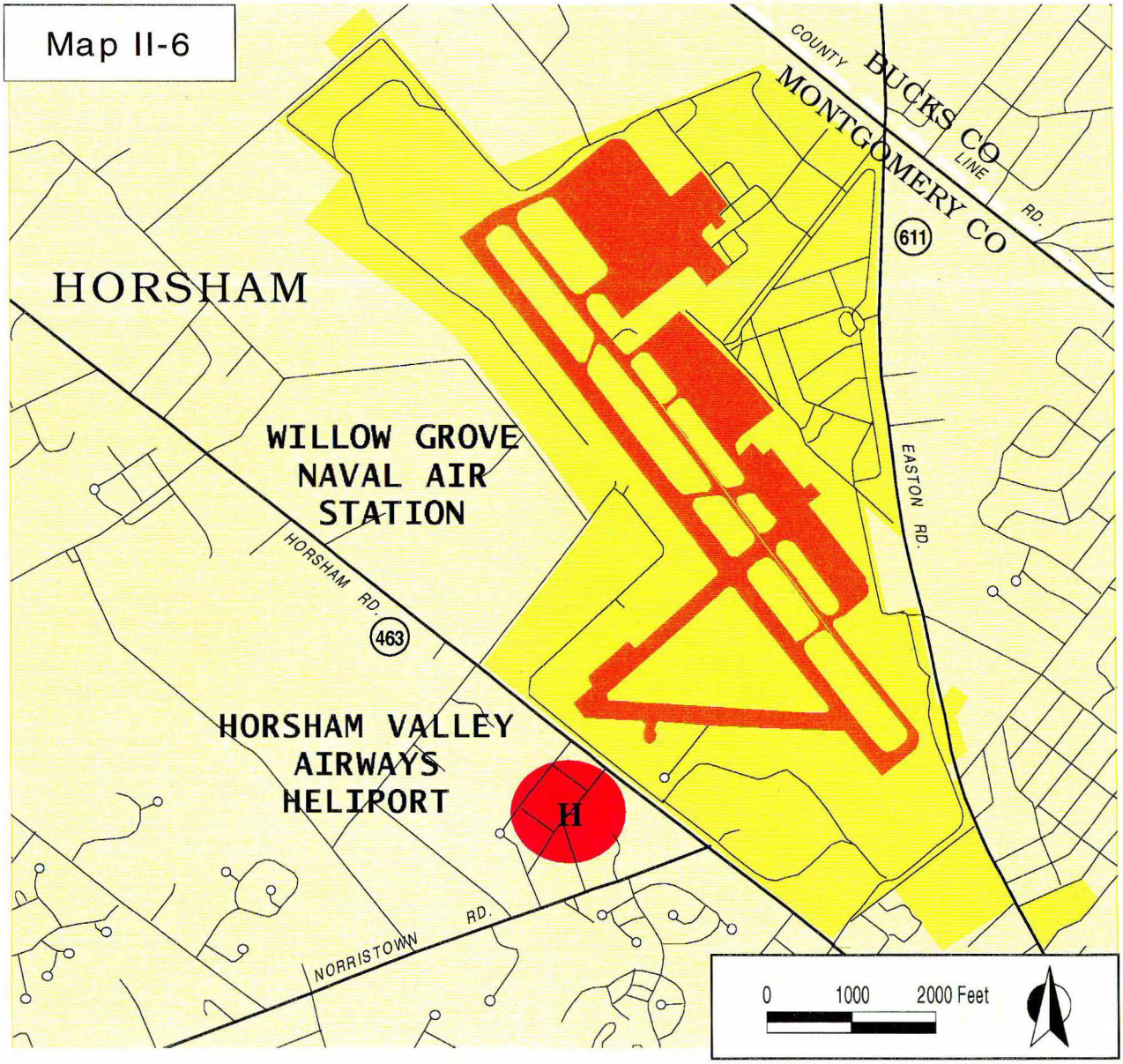
In 1992, NJ DOT and its consultants analyzed the potential market for civilian

commercial service using McGuire in response to the potential closure of the airport by the military. The study concludes that commercial demand will be met by Philadelphia International, Newark International, and Atlantic City International Airports, and that McGuire will not be viable as a civilian facility.

Subsequently, the military decided to expand its future role at McGuire, which will continue to operate solely as a military airport.

Heliports

These facilities are designed to accom-



modate the flying needs of helicopters which play an important role in the DVRPC region. Helicopter flying activity includes the full range of recreational, commercial and government uses. Presently, there are four public use heliports in the region, all in Pennsylvania.

Horsham Valley Airways Heliport, Horsham, Pennsylvania

This public use, privately owned heliport is located just south of Willow Grove Naval Air Station and west of SR 611 in Horsham Township, Montgomery County, PA. The heliport is located in a business, light industrial park setting, and offers Bell-Hughes helicopter authorized service, flight school, charter, FAA certified repairs, and hangar storage (Map II-6). Due to its proximity to Willow Grove Naval Air Station and its location within the airports busy airspace, significant growth of operations or based helicopters is not encouraged.

Keystone Heliport, West Chester, Pennsylvania

Keystone Heliport Co., just east of US 202 in West Whiteland Township, Chester County, is the location of this major helicopter services and Emergency Medical Services (EMS) corporation in the eastern United States. Services to helicopter owners include major repairs, hangar and aircraft rental, charter service, and fuel availability. Although there are no navaids or instrument approaches, the helipad is lighted for night VFR operations. The owner is considering expansion to allow for scheduled passenger service to PHL or other locations in the future. This expansion, if supported by FAA, may require a relocation of Keystone Heliport to a facility which would have more expansion potential and less conflicts with residential land uses.

Sterling Heliport, Philadelphia, Pennsylvania

This facility is a city owned and privately operated heliport. Located on a Delaware River Pier, adjacent to I-95 in Center City Philadelphia, which provides easy access to downtown Philadelphia. The operator, Sterling Helicopter Corporation, provides charter, fuel, maintenance and repair service. The helipad is lighted at night, but no navaids or instrument approach is available. Traffic monitoring, news, and sightseeing flights constitute the principal demand. The heliport is located at Pier 36 South, which is leased by the operator from the City of Philadelphia.

Valley Forge Bicentennial Heliport, Norristown, Pennsylvania

This Pennsylvania state licensed heliport is located off Trooper Road in the township of West Norriton adjacent to King of Prussia, Montgomery County, on a privately owned residential site. No services are available and the facility is used infrequently. □

III. AIRSPACE UTILIZATION AND AIR TRAFFIC CONTROL

The Delaware Valley region has a high level of airspace complexity resulting from a diverse set of users and over 1.8 million total annual operations. It contains a major metropolitan air carrier airport, several smaller business airports, some of which also provide scheduled commercial service, a large number of privately owned and public use airports, several heliports, and two military airfields. Table III-1 shows the existing airport and heliport facilities in the region. These RASP facilities are scattered throughout the region, some at locations which create airspace conflicts. There is also a significant number of sporting activities within the airspace that can have an affect upon aircraft operations; hang gliding, ultralight aircraft, ballooning, skydiving, and soaring.

Integration of airspace activities is not only complicated by having virtually every type of aircraft in the U.S. inventory operating at the civil and military airports, but all of this activity occurs in one of the most densely travelled air traffic corridors in the world. Small and large airplanes, fighter and attack aircraft, heavy transport airplanes, and helicopters operate in the region, as well as throughout the congested northeast corridor between New York and Washington, D.C.

AIRSPACE AND SYSTEM PLANNING

Airspace considerations are important when designing the regional aviation system for at least three reasons. First, ongoing current operations of the commercial, reliever, and general aviation facilities in the system are coordinated by air traffic control (ATC). Published approaches and radio communications modifications, if identified, can reduce time requirements for ATC to handle aircraft, and can help distribute traffic approaching airports in a manner which minimizes redundant use of fixes, and thereby reduces delay and possible air- space conflicts. Second, with regard to long range planning, new facilities should not be proposed if airspace complications from this facility would reduce overall system efficiency and safety. Likewise, even adding length or precision approaches to existing runways must be evaluated from the perspective of impact on the airspace systems. Third, the FAA has indicated that existing or potential traffic conflicts, under either visual or instrument meteorological conditions, affect the reclassification of general aviation airports to reliever status, selection of airports for Airport Improvement Program (AIP) grants, and the selection of appropriate improvements at airports.

In determining the viability of reliever status for an airport, serious consideration should be given to the impact of the decision upon surrounding airport operations. Consideration should also be given to its impact upon enroute operations, as well as the potential delay

Table III-1
EXISTING AIRPORT AND HELIPORT FACILITIES

Facility	Location	Ownership	Navigational Aids
COMMERCIAL AIRPORTS			
PHILADELPHIA INT.	SOUTH PHILA./ DELAWARE CO. PA	PUBLIC	VORTAC,NDB,RNAV,PAPI, VASI,REIL,ILS,LOC,
TRENTON-MERCER	EWING MERCER CO. NJ	PUBLIC	VORTAC,RNAV,VASI, ILS,LOC,VOR
NEW CASTLE COUNTY	WILMINGTON NEW CASTLE CO. DEL	PUBLIC	VORTAC,RNAV,NDB,MLS, ILS,VOR,VASI,REIL
RELIEVER AIRPORTS			
BRANDYWINE	EAST/WEST GOSHEN CESTER CO., PA	PRIVATE	VORTAC,REIL,VOR
CHESTER COUNTY	VALLEY CHESTER CO., PA	PUBLIC	VORTAC,VASI,REIL,VOR, ILS
DOYLESTOWN	BUCKINGHAM BUCKS CO., PA	PUBLIC	VORTAC,NDB,VASI,VOR
NEW GARDEN	NEW GARDEN CHESTER CO., PA	PRIVATE	VORTAC,VOR
NORTHEAST PHILADELPHIA	PHILADELPHIA PHILADELPHIA CO., PA	PUBLIC	VORTAC,RNAV,VASI,TVOR, REIL,ILS,LOC
PENNRIDGE	EAST ROCKHILL BUCKS CO., PA	PRIVATE	VASI,REIL,NDB,VOR
POTTSTOWN-LIMERICK	LIMERICK MONTGOMERY CO., PA	PRIVATE	PAPI,REIL,VOR-DME,RNAV, LOC
WINGS	WHITPAIN MONTGOMERY CO., PA	PRIVATE	VORTAC,RNAV,NDB,REIL
CROSS KEYS	MONROE GLOUCESTER CO., NJ	PRIVATE	VOR
S. JERSEY REGIONAL	LUMBERTON BURLINGTON CO., NJ	PRIVATE	VOR
TRENTON-ROBBINSVILLE	WASHINGTON MERCER CO., NJ	PRIVATE	VASI,REIL,VOR
SUMMIT	NEW CASTLE CO. DELAWARE	PRIVATE	VORTAC,NDB,VOR

Table III-1 (continued)
EXISTING AIRPORT AND HELIPORT FACILITIES

GENERAL AVIATION AIRPORTS

BUEHL	MIDDLETOWN BUCKS CO., PA	PRIVATE	VORTAC,VOR
PERKIOMEN VALLEY	SKIPPACK MONTGOMERY CO., PA	PRIVATE	VORTAC,VOR
POTTSTOWN MUNICIPAL	POTTSTOWN MONTGOMERY CO., PA	PUBLIC	VORTAC,AB,VASI,PAPI REIL,VOR
QUAKERTOWN	MILFORD BUCKS CO., PA	PUBLIC	VASI,NDB
VANSANT	TINICUM BUCKS CO., PA	PRIVATE	
FLYING W	MEDFORD BURLINGTON CO., NJ	PRIVATE	VASI,REIL,VORDME
OLDMANS	OLDMANS SALEM CO., NJ	PRIVATE	
RED LION	SOUTHAMPTON BURLINGTON CO., NJ	PRIVATE	VORTAC
CECIL	ELKTON CECIL CO., MD	PRIVATE	VASI,REIL

MILITARY AIRPORTS

WILLOW GROVE	WILLOW GROVE MONTGOMERY CO., PA	U.S. NAVY
McGUIRE AIRFORCE BASE	McGUIRE AFB BURLINGTON CO., PA	U.S. AIR FORCE

HELIPORTS

HORSHAM VALLEY	HORSHAM MONTGOMERY CO., PA	PRIVATE
KEYSTONE	WEST CHESTER CHESTER COUNTY, PA	PRIVATE
STERLING	PHILADELPHIA PHILA. COUNTY, PA	PRIVATE
VALLEY FORGE	WEST NORRITON MONTGOMERY CO., PA	PRIVATE

that may be generated by introducing additional IFR traffic and/or complexity into the area.

In order to minimize delays at PHL, reviews of the airspace in and around the Philadelphia Class B Airspace have been conducted on a continuing basis, but there has not been a substantive analysis of traffic conflicts and delays resulting from the interaction between aircraft at civil and military suburban airports and their interaction with one another throughout the regional airport system. However, DVRPC has recently completed two studies which analyze the operation of the airspace system, including the ATC based at PHL, and the fixed approach system currently available in the region, as related to airport groupings where flights must coordinate with one another for safe operation.

The first study looked at six subareas within the region encompassing 13 airports as they relate to their nearest neighbor and to PHL[1]. The second study looked at the airspace interface between the military airports and seven civilian facilities, which are in close proximity and interfere with military air operations from an ATC perspective[2]. Both studies were conducted by the firm of Samis and Hamilton for DVRPC.

[1] *Airspace Conflict Analysis of Philadelphia Metro Area Airport*, prepared for DVRPC by Samis & Associates and TransPlan, 1990.

[2] *Military Facility Airspace Analysis for the Delaware Valley Region*, Prepared for DVRPC by Samis and Hamilton, 1993.

Before discussing the findings and conclusions of these two studies, it is important to explain the nomenclature of instrument approach procedures and navigational aids which are crucial to the flow and control of aircraft in the skies of the Delaware Valley region. It is also important to describe the airspace flow patterns and the manner in which aircraft are handled by Philadelphia Approach Control (PHL-ATC), and the interactions between PHL air traffic and its satellite airports' traffic. The following material is obtained mainly from Samis and Hamilton reports.

INSTRUMENT APPROACHES

An instrument approach procedure is a method of safely bringing an aircraft down to a low enough altitude, so that it may land at an runway under low visibility and ceiling conditions. The aircraft follows a route, defined by radio navigation stations, or navaids. The procedure includes minimum safe altitudes along the route, which will maintain adequate clearance from the ground and any obstructions, natural or man made. The aircraft crew uses an approach plate, which is a schematic map covering approximately a square 20 nautical mile on a side, and which diagrams the procedure.

Navaids and Fixes

Electronic navigation radio stations are used to define imaginary points in the airspace called fixes. These fixes, in turn,

define the instrument approach procedures. Several types of NAVAIDS are used to define fixes.

1. A Non-Directional Beacon (NDB) is a small, low frequency, low powered radio station. The radio frequencies used by these stations are subject to interference from thunderstorm static. An Automatic Direction Finder (ADF) on board the aircraft points toward the NDB station, which itself serves as a fix.

2. A Very High Frequency Omni Range (VOR) station may also serve as a fix, and provides magnetic bearing indications called radials. Intersections of these bearings or radials also define fixes. A type of low powered navaid which is often located at an airport is called a Terminal VOR (TVOR). A low powered NDB is often located at the "entrance" of an Instrument Landing System (ILS).

3. A Distance Measuring System Equipment (DME) installation is frequently collocated with VOR. DME indicates the distance to the station along a VOR radial, thus defining the fix in another way. A collocated VOR and DME are referred to as a VOR/DME. TACAN is a military navigation system with a distance measuring function usable by civilian aircraft. A collocated VOR and TACAN station is called a VORTAC.

4. Radio navigation (RNAV) and LORAN-C are two relatively recent developments which permit the automatic determination of location. RNAV work only in the vicinity of a VOR/DME facility, but LORAN-C employs a low frequency signal which may be received and used to define fixes over much of the world.

5. The Global Positioning System (GPS) uses a satellite based navigational system developed for the military and which has civilian access. It permits a very accurate determination of position.

6. Locator Outer Marker (LOM) consists of a 75 kilocycle tone collocated with low powered NDB.

Instrument Approach Procedures

An instrument approach procedure consists of four parts, or segments.

1. The initial segment ties the procedure to the enroute airway system. It is analogous to the off ramps of the interstate highway system.

2. The intermediate segment brings the aircraft to the final approach fix, which may be defined by a variety of radio navigational aids. Continuing the automotive analogy, this segment is the secondary road network.

3. The final approach segment begins at the final approach fix and ends at the Missed Approach Point (MAP). It is analogous to an alley which leads an

automobile to a backyard parking spot.

4. If the visibility is insufficient to permit a safe landing from the MAP, the missed approach segment provides a path for the aircraft to proceed to a safe altitude and fix.

Types of Approaches

Instrument approach procedures are classified as either precision or non-precision. A precision approach gives continuous descent guidance in the form of an electronic glide slope. This is an invisible "bannister", formed by radio waves, down which the aircraft "slides" to a point above the runway from which a landing may be made if conditions permit. Non-precision approaches provide no such continuous descent information. They bring the aircraft down with one or more stepdown fixes - electronically defined locations at which a minimum altitude must be maintained. The aircraft descends in a stepwise manner.

Precision approaches generally bring the aircraft precisely to the runway, and thus work in worse weather conditions than non-precision approaches. Precision approaches provide precise vertical, as well as horizontal guidance. There are two types of precision instrument landing systems used at civilian airports. From the standpoint of the pilot, these types appear to be similar. Either type provides the aircraft with lateral (azimuth), longitudinal (distance), and vertical (altitude) guidance.

1. ILS, or instrument landing system, is currently the standard precision approach. ILS systems provide guidance only along a straight path.

2. MLS, or microwave landing system is currently used at some airports, but has not been adopted widely for the future air navigation environment.

Non-precision approaches come in the following varieties, the first of which is the most common:

1. The NDB approach is one in which the aircraft navigates with reference to a NDB. Unless the NDB is located right on the airport, this is the least accurate of approaches.

2. The RNAV approach is a type of VOR or MLS approach in which a course line computer built into the aircraft's navigational equipment electronically "displaces" a parent station, so that the pilot may fly an approach as if the station were located on the field or, with MLS/RNAV, even a particular runway. This technique permits the approach designer greater freedom in designing approaches that avoid limiting obstacles or circling approaches, and therefore use a lower Minimum Descent Altitude (MDA), thereby allowing the approach to be used in worse weather. MLS/RNAV is considerably more accurate than VOR/RNAV.

3. The Localizer approach guides the aircraft along a narrow radio beam. The

localizer is essentially a very sensitive, single radial VOR. The high sensitivity of the localizer means a narrower path, which excludes all but the closest obstacles. The localizer usually provides a much lower MDA than the other non-precision approaches.

These approaches are all quite similar. All use a NAVAID to define a course for the aircraft to fly. They also use NAVAIDSs to define fixes with associated minimum altitudes. The type of approach is determined by the type of station that the approach is predicated upon - the one that defines the course to be flown. Most of the airports in the DVRPC region are served only by non-precision VOR approaches. Because neighboring airports usually employ the same VOR for their approaches, this opens up the possibility of conflicts.

AIRSPACE FLOW PATTERNS

Airspace flow patterns are controlled by Philadelphia ATC, Philadelphia satellite airports, McGuire Air Force Base and its satellites.

Philadelphia ATC Environment

Philadelphia Air Traffic Control facility has two separate units that provide air traffic control service. The tower handles the runway and aircraft operating within a six mile radius of the airport, and the radar approach control room is responsible for all IFR operations within a defined area of complex and irregular shape bounded by the East Texas, Solberg, and Smyrna VORTACs (Figure III-1). Part of the approach control airspace, that is centered on the Philadelphia airport and shaped like an upside down wedding cake is designated as class B airspace[3]. It has an outer diameter of 20 nautical miles. Federal Aviation Regulations require all aircraft to obtain an ATC clearance before entering this airspace.

The radar approach control unit provides radar service to VFR aircraft, primarily general aviation fixed wing and helicopters, on a "workload permitting" basis. The IFR aircraft operating between the Philadelphia area and other terminals do so in one of two controlled environments:

1. The "center" environment is used by aircraft operating, and/or intending to operate, above 10,000 feet msl. This requires coordination and the transfer of control of aircraft between the Philadelphia ATC facility and the New York and/or Washington enroute air traffic control centers. Most air carrier turbojets operate at the higher altitudes and use the enroute system.

[3]Class B airspace was formerly called *Terminal Control Airspace (TCA)*. No aircraft may operate within this airspace without an ATC clearance; any large, turbine-powered aircraft must operate above the floor of the class B airspace while within the lateral confines of airspace, unless otherwise authorized by ATC; and pilot training operations must comply with any procedures established by ATC for such operations.

2. The "terminal" environment, referred to as Tower Enroute Control (TEC) allows aircraft operating for short distance and/or which do not require high altitudes for efficient operations to be transferred from one terminal environment to another (e.g. between Philadelphia ATC and another terminal air traffic facility such as McGuire RAPCON, Atlantic City TRACON, and Baltimore TRACON). General aviation, commuter, and business flights traveling a few hundred miles at low altitudes use these routings, because they are often radar vectored offairways on a more direct course and can often bypass delay being experienced in the center environment. As shown in Figure III-1, departures are routed via radar vectors to Pottstown (PTW), Modena (MXE), Woodstown (OOD) VORTACs. and to Airway V312 at a minimum altitude of 9,000 feet and a maximum altitude of 10,000 feet. Departures going to the New York Metropolitan area are routed via Yardley (ARD) and

PHL Arrivals Pattern

Figure III-2
PHILADELPHIA ARRIVALS PATTERN

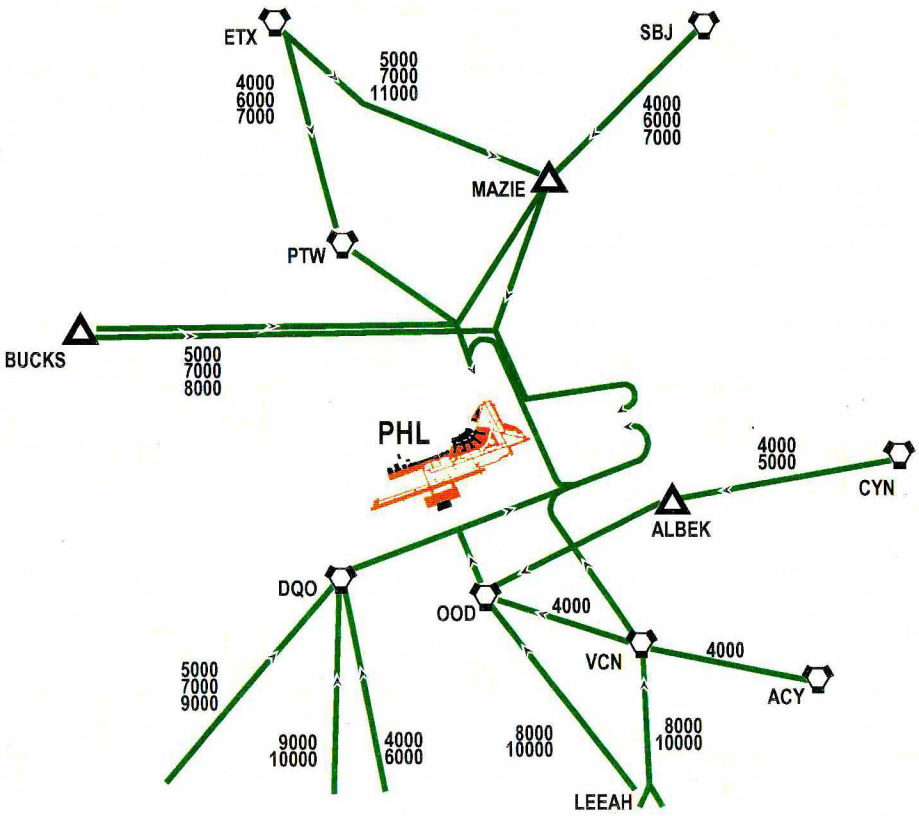
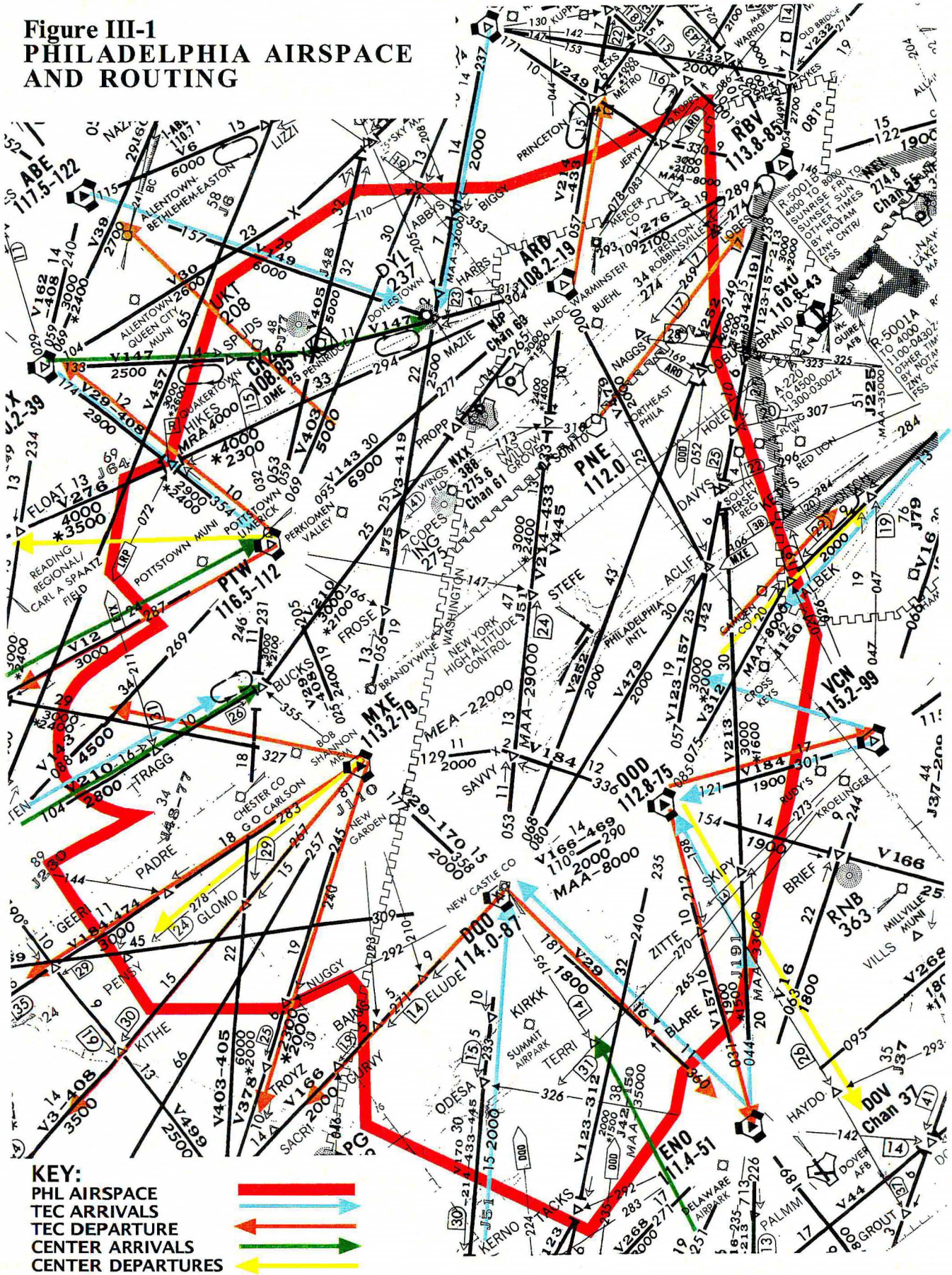


Figure III-1
PHILADELPHIA AIRSPACE AND ROUTING



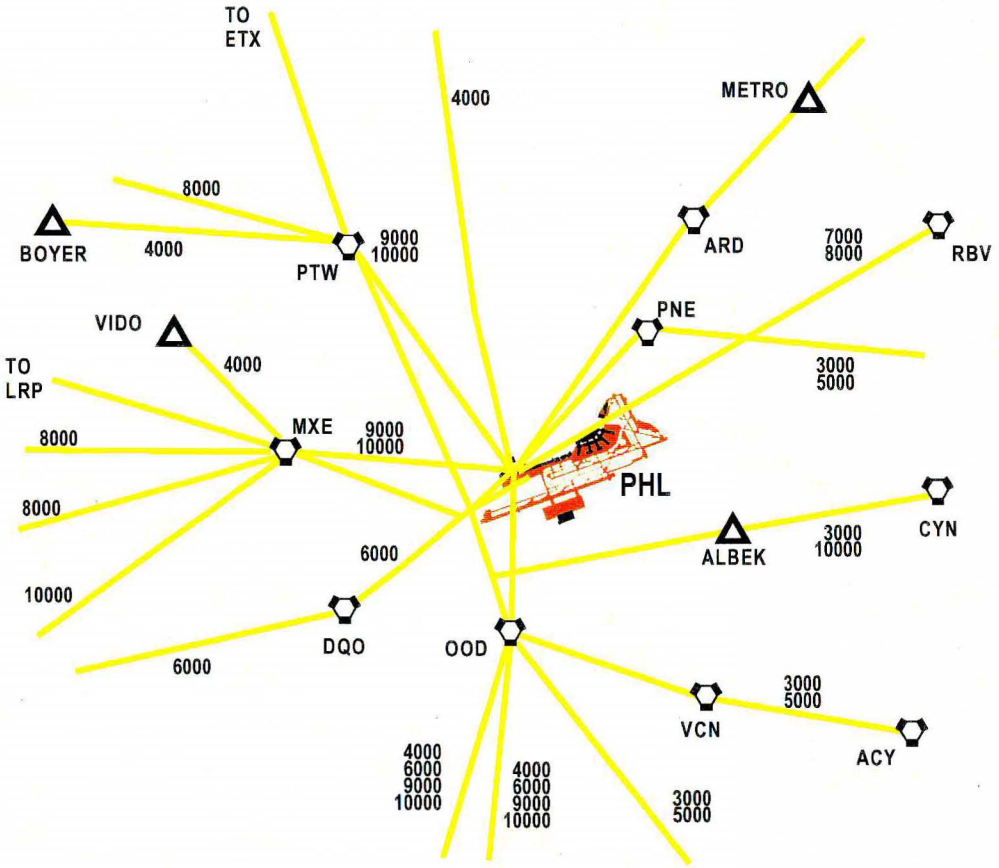
Robbinsville (RBV) VORTACs at an altitude of 7,000 feet. Arrivals are routed via BUCKS and MAZIE intersection, and Dupont (DQO) and Cedar Lake (VCN) VORTACs at altitudes between 10,000 and 5,000 feet. This figure shows only the large scale flows.

Arriving aircraft are routed into the airport in a trellis pattern. Pottstown VORTAC (PTW), MAIZE intersection, Coyle VORTAC (CYN), Cedar Lake VOR (VCN), Woodstown VORTAC (OOD), Dupont VORTAC (DQO) and BUCKS intersection are the radio-defined fixes used to feed traffic into the airport environment. The trellis pattern provides an opportunity to vector aircraft along their approaches (Figure III-2).

Figure III-3 illustrates how departures are fanned out radially from the airport. This fan pattern serves to disperse aircraft as quickly as possible. The air traffic

PHL Departure Pattern

Figure III-3
PHILADELPHIA DEPARTURES PATTERN



control tower manages to separate inbound and outbound traffic streams with a combination of routing and altitude. For example, most westbound departures are vectored to the Modena VORTAC (MXE) which is rarely used for arrivals. The Yardley VORTAC (ARD) performs the same function for northeast bound traffic.

The choice of altitudes for the traffic arriving and departing over the Coyle (CYN) VORTAC illustrates the use of altitude separation of aircraft. Low altitude propeller aircraft come in at 4,000 to 5,000 feet. Departures of smaller propeller aircraft are held below 3,000 feet and high performance turbine aircraft climb quickly to 10,000 feet.

Philadelphia Approach Control serves a mix of turbojet and propeller driven aircraft. To reduce controller workload, and increase airport and airspace capacity, the high and low performance aircraft operations are segregated to the maximum extent practical. Some of the high performance aircraft, such as turboprop commuter aircraft, also utilize the TEC route structure. These aircraft, in addition to the other TEC aircraft, are vectored to an approach to a secondary runway (Runway 17), while the higher altitude and higher performance aircraft are vectored for an approach to one of the primary runways (Runway 9R/L or Runway 27R/L). On occasion, because of wind, weather, or equipment malfunction, aircraft that would normally use the secondary runway must use the primary runway. Combining all operations on the primary runway results in the loss of system capacity and creates delays.

Philadelphia Satellites

There are four satellite airports with operating control towers (Northeast Philadelphia, Trenton-Mercer, New Castle County, and Willow Grove) and 30 uncontrolled satellite airports. Within the Philadelphia Radar Approach Room, there are three satellite airport control positions that have air traffic control jurisdictions over a defined geographical area or airspace sector. The distribution of traffic operating within these sectors, and the corresponding workload imposed, only warrants the service of one radar controller, thus the positions are often combined. Not all of the satellite airports are below one of these sectors.

One of the three sectors, identified as the "Yardley sector", contains the three most active satellites - Northeast Philadelphia, Trenton-Mercer, and Willow Grove. Another sector, identified as the "Dupont sector", contains New Castle County, which is also considered a busy satellite airport, and the number of uncontrolled satellite airports that only contribute about two IFR operations per day, according to PHL tower personnel. A third satellite sector is the "Pottstown sector". Chester County is the busiest of the uncontrolled airports and is the base for jets owned by Lukens Steel, Certainteed, Rampmaster and Synthes Corp. It lies within the north departure sector.

In 1992, the instrument approach to Buehl airport, using the Northeast Philadelphia VORTAC, was revoked because 1) it failed FAA flight check, 2) the low level of use did not warrant re-activation. A new approach, based upon the Yardley VORTAC, has just been developed and published. At the time the new approach was announced, the ATA protested its commissioning on the grounds that it would conflict with the instrument operations into Trenton-Mercer. Excellent radar coverage exists in the Trenton and Northeast Philadelphia area, and the use of radar separation would allow simultaneous operations at Buehl and Trenton-Mercer airports.

Satellites Arrivals Pattern

The pattern of satellite arrivals is very different from arrivals at PHL, although the aircraft are initially treated much like PHL arrivals. However, they are subsequently routed to a ring around the airspace surrounding PHL. An aircraft bound for Northeast Philadelphia from the southwest arrives at the DQO just as it would if it were going to PHL. But instead of crossing directly over PHL, it is routed around by being directed to proceed to Modena VORTAC (MXE), then out on a radial to intercept another radial from the North Philadelphia TVOR (PNE), and then directly toward the airport.

Satellites Departures Pattern

Often, approach controllers primarily manage traffic flow by "vectoring" aircraft - assigning them headings to fly. These vectors must be adjusted to account for wind and require considerable attention on the part of the controller. By assigning navigational fixes to fly only toward or away from, PHL Approach is able to reduce controller workload.

A similar pattern applies to the satellite departures. The aircraft proceed by relying upon their own navigation between electronic fixes, which define a ring surrounding PHL. It should be noted that almost all arrivals and departures at the satellite airports are at fairly low altitudes. This reflects the fact that the aircraft using these smaller airports are usually small propeller aircraft which operate efficiently at these altitudes. This altitude separation also allows the turbine powered aircraft arriving and departing PHL to spend as little time as possible at low altitudes, where they are inefficient. However, some operators of turbine aircraft at the satellite fields find that this pattern does not work in their favor, although most operators seem reasonably satisfied.

According to the Philadelphia ATC Tower personnel, there is little conflict between PHL's traffic and the satellite airports' traffic. Examination of the figures and descriptions of the routings indicates that the PHL procedures are generally effective. Aircraft are routed, with low controller workload, around a central core region which is the exclusive province of PHL traffic. Controllers are free to vector and sequence this traffic within this core region

without interference from other air traffic. Four findings are evident from this analysis:

1. Development of the existing reliever airports should not affect the routing of aircraft in and out of PHL. The noted exceptions would have been Bridgeport Airport, which is now closed, and the proposed reliever site at Logan Township.

2. Little can be done to improve the current separation of primary and satellite airport traffic.

3. IFR traffic conflicts and delays do arise among adjacent satellite airports.

4. The eastern airports (South Jersey Regional, Flying W, and Red Lion) are served by McGuire Approach. Many aircraft operators require coordination between these two facilities.

Although air traffic transiting PHL and satellite airports do not conflict directly with each other, there is a lack of communication between the PHL Air Traffic Control Tower and aircraft on the ground at satellite airports. This results in air traffic delays for aircraft using the satellite airport for IFR flights. If aircraft located at non-towered airports need to inform PHL Approach Control that the airspace over the airport may be released, someone must locate a telephone and call them.

Philadelphia Satellite Problems

Doylestown, Pennridge, and Quakertown airports are located in close proximity to each other. In order to protect the missed approach airspace at one of these airports, Philadelphia Approach Control during inclement weather conditions may be required to restrict nearby airport departures. Also, since simultaneous instrument approaches cannot be made to any combination to these airports, the airports are faced with the inherent delays associated with "one in one out" type operation.

Many Chester County jet aircraft cannot climb quickly into the Center's airspace (due to the coordination requirements and workload of the PHL control positions, explained previously), and it often becomes necessary to either point the aircraft to Harrisburg Approach control or turn the Chester County departure back into Philadelphia's airspace, until it can be allowed to proceed on course.

It should be noted that Wings Field at one time posed a number of problems for ATC, but has not affected the facility workload or caused delays since Wings Airways stopped offering scheduled service. Present ATC procedures for satellite operations require the control services of the PHL arrival and departure control position, and thus are in direct competition for these ATC services with PHL airport operations. Also, there is only a single Flight Data position within the Philadelphia radar room that handles both telephone and radio communications

for satellite operations. This position, at its present level of activity, is considered a high workload or a busy position.

Although the above examples focus on the ways in which conflicts may arise between satellite airports, it must be kept in mind that the potential exists for effects at PHL as well. With the present route structure and ATC procedures, a major increase in IFR operations at any satellite airport could affect traffic at PHL.

In-trail Restriction

New York center routinely imposes a 20 mile in-trail restriction between departures proceeding on a common route, which affects operations at PHL and at satellite fields. These in-trail restrictions, as well as altitude restrictions, are applied to avoid "sector saturation", to distribute delay on an equitable basis, and to separate aircraft climbing and/or descending from each other[4]. This "over" traffic and its associated communications often block radio frequencies and create problems for air traffic control.

McGuire Airport and Its Satellites

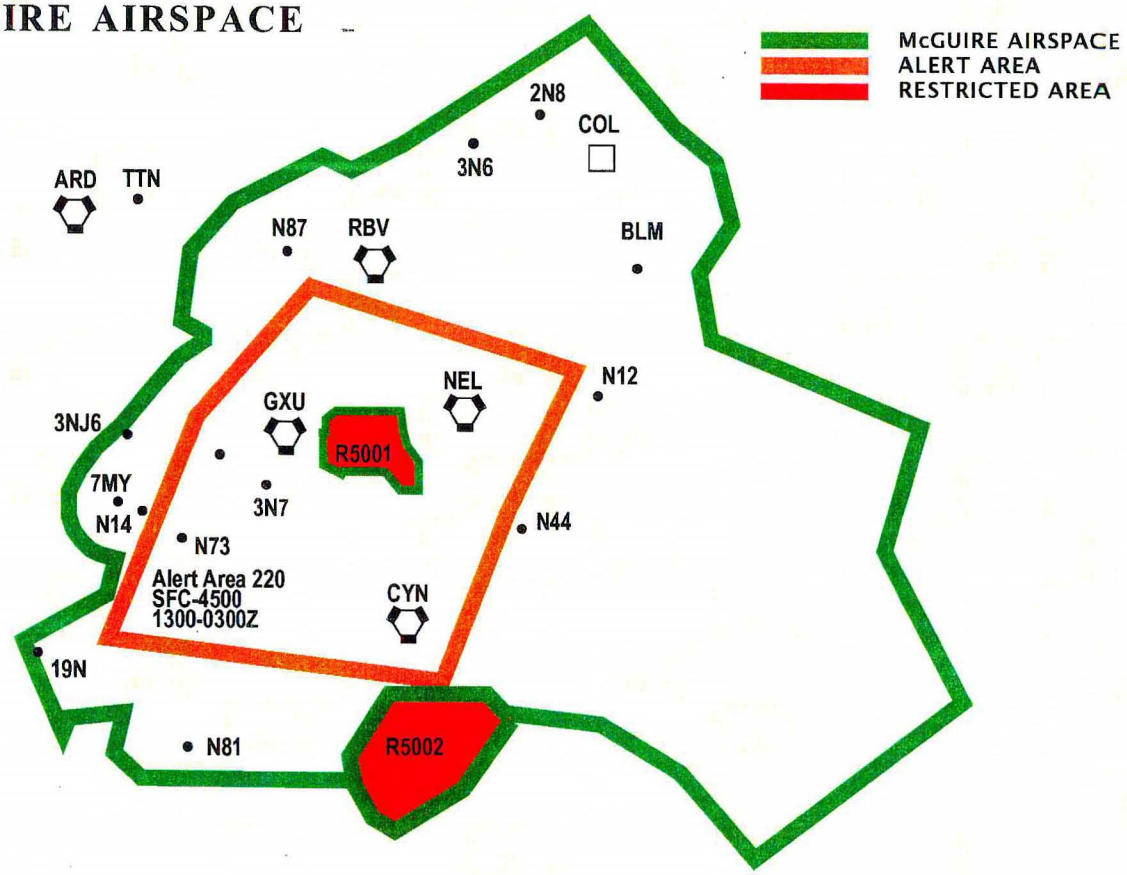
Table III-2 shows the characteristics of the traffic handled by the McGuire Radar Approach Control (RAPCON), and indicates that the majority of its operations are non-military. A large volume of civilian aircraft overfly the McGuire airspace and present a problem for controllers in the handling of McGuire

Table III-2
ANNUAL OPERATIONS AT McGUIRE RAPCON

Year	Annual Operations			IFR Arrivals		IFR Departures	
	Military	Overflights	VFR Service	McGuire	Satellite	McGuire	Satellite
1989	50861	75613	17223	25434	4707	26754	3255
1990	45773	69387	15643	26529	1192	25972	1666
1991	60437	85994	14772	30445	8237	30271	6284
1992	73583	112962	20061	27033	20650	30762	14319

[4] A situation where the number of aircraft being provided air traffic control services within a defined geographical area exceeds the capability of the controller to safely and efficiently handle them.

Figure III-4
McGUIRE AIRSPACE



McGuire Satellites

19N	Berlin/Camden County
2N8	Matawan/Marlboro
3N6	Old Bridge
3N7	Pemberton
7MY	Mt. Holly/S. Jersey Regional
BLM	Bellmar/Allaire
N12	Lakewood
N14	Lumberton/Flying W
N44	Robert Miller
N73	Vincentown/Red Lion
N81	Hammonton
N87	Trenton-Robbinsville

departures. To assist in the resolution ofthis control problem and to reduce communication requirements, Standard Instrument Departure procedures (SIDs) have been developed for McGuire.

Figure III-4 shows McGuire airspace and its satellites. Red Lion Airport is located

within the airspace jurisdiction of McGuire RAPCON. Although it is located on McGuire's Runway 6 extended centerline, it is 10 nautical miles from the airport, and thus does not pose any control problems. Flying W and South Jersey IFR departures are usually routed via the Robbinsville (RBV) or Coyle (CYN) VORTAC before proceeding on course. Most of these departures are enroute to Philadelphia, and ATC procedures and agreements between ATC facilities specify that aircraft going to Philadelphia from these airports travel from RBV or CYN to the Yardley (ARD) VOTAC at 4,000 feet.

Point Pleasant Departure routing is via MANTA intersection at 6,000 feet. The six thousand feet altitude is to protect aircraft inbound to JFK airport at 7,000 feet. In the presence of low altitude overflight traffic at 6,000 feet, McGuire departures are restricted to 5,000 feet.

The CRESSI 2 Departure procedure routes aircraft departing runway 6 to DIXIE intersection at 5,000 feet, and then to CRESSI intersection climbing to 8,000 feet. The Modena departure sends aircraft out of NAGGS at 5,000 feet. Once clear of the Newark Sector, these aircraft may climb to 6,000 feet. These restrictions are necessary to separate aircraft from the civilian traffic inbound to PHL that is normally routed via Coyle (CYN) VORTAC, then V312 to Woodstown (OOD) VORTAC, and then to Philadelphia.

Most of the civilian operations are "canned", since they use flight plans that are permanently on file. These canned flight plans provide advanced schedule information to McGuire and allow the scheduling of military operations to avoid delays. The procedure cited above is judged by control personnel and users to be reasonably efficient and without significant problems.

Atlantic City Approach is given two hour advance warning of these operations for flights within their airspace jurisdiction. It is also necessary for McGuire to close Restricted area R5002 to other military operations for a SKE route operation. Furthermore, the SKE route impacts both R. J. Miller's final approach course for Runway 24 and the VOR-A approach to Red Lion Airport.

Many VFR aircraft fly through McGuire's airspace, avoiding the more restrictive class B airspace of Philadelphia. These aircraft are not required to talk to ATC unless they traverse the five mile radius region of class C airspace surrounding McGuire. McGuire publishes a VFR guide which encourages transiting pilots to voluntarily establish radio contact with McGuire RAPCON. McGuire personnel report only minor problems with VFR aircraft.

The cluster of airports including Red Lion, South Jersey Regional and Flying W all conflict in IFR. There can be only one IFR arrival or departure at a time from this cluster. McGuire approach has requested RCOs, which are radio "repeaters", for this area and for R. J. Miller. There already is

a RCO serving Monmouth County Airport. Currently, IFR departures are released via telephone with a departure time and a 5 minute window to the void time. This system causes delays when a number of aircraft are all seeking release from a number of airports. Also operations at nearby airports can be delayed if a pilot is not able to contact McGuire after landing to advise that the airspace to clear. Complicating the situation is the fact that smaller airports historically do not have telephones available at night; this again adds to the delay of more active nearby facilities.

COMMUNICATION EQUIPMENT, AIRSPACE USAGE, AND APPROACH CONFLICTS

According to the staff at Philadelphia Tower, the major causes of delays for aircraft using the satellite airports are communications problems. Aircraft operators experience IFR clearance and release delays due to impediments to direct communication with the ATC tower staff. Interviews with aircraft and airport operators throughout the system of satellite airports have indicated that delays of 30 - 45 minutes in obtaining clearances or release are not unknown. When an operator files an IFR flight plan with the FAA, it reserves a block of airspace which no other aircraft is allowed to occupy. The dimensions of the block, called the separation limits, vary, but are normally one thousand feet above and below the aircraft and several miles laterally. IFR flight plans are required under bad weather conditions. Most scheduled airline flights and many GA aircraft operate under them under all weather conditions.

In order to take off on an IFR flight plan, the airport must be "released" by the controlling facility. At a towered airport, such as PHL, the tower handles this. At a non-towered, or uncontrolled field, such as Wings, the pilot must contact the facility (Philadelphia Approach) directly and arrange for a release. Ideally, the pilot may contact Philadelphia approach by radio, receive and acknowledge the clearance, and take off when told "you are released." In many cases, it is not possible to contact Philadelphia while on the ground due to topography blocking radio transmission at suburban airports.

If the weather is VFR (normally at least three miles visibility) the aircraft may take off under visual flight rules, contact Philadelphia Approach after becoming airborne, and pick up the IFR clearance at this time. This procedure appears to be standard for Wings Airways departing Wings Field. If the weather is such that the aircraft will be unable to fly in legal visual conditions after takeoff, the crew must telephone Philadelphia Approach, pick up its clearance, and obtain a departure time. If the aircraft has not taken off and contacted Philadelphia by radio before a specified "void time" (determined by the individual facility, normally three minutes for Philadelphia), the clearance is void and the block of reserved airspace may be given to another aircraft.

One drawback of the second method is that it increases the workload for the people handling clearances at Philadelphia, as it takes much longer than the sixty seconds required to deliver a clearance by radio. Another is that, depending upon distance radar location and terrain, aircraft departing satellite airports often cannot be seen on the radar until they are several thousand feet up. This means that from release time until either radar contact or void time, the airspace over the airport is "locked up" and cannot be used by any other aircraft.

A more serious problem arises on arrival. As an aircraft approaches and sights a non-towered airport, the local operators, such as Wings Airways, normally cancel IFR if the weather permits. This allows other aircraft to enter the block of airspace which extends a thousand feet over the inbound aircraft. Under conditions of restricted visibility, the crew of the inbound aircraft may not see the airport until it is too low to be able to contact Philadelphia by radio. After landing, they must taxi in, walk to the terminal, and telephone Philadelphia in order to release the airspace. The people at Philadelphia Approach indicate that this poses a significant delay problem at both PHL and the satellite airports. This situation can be exacerbated by an aircraft at another airport on one approach holding up other aircraft waiting to take off or land at a number of other airports. These communications problems are one cause of delays which can be propagated to other airports through these approach conflicts.

A proposed solution to this communication problem is to install remote communications outlets so that aircraft on the ground can be in radio contact with Philadelphia Approach. This has already been done at several airports. There is one "repeater" at Flint Hill which serves Pennridge, Quakertown, and Doylestown, and another at Pottstown Municipal. Surprisingly, operators at these airports do not report any better clearance service than those at the airports not equipped with communications outlets. Furthermore, these delays occur even when there is little IFR activity at the airports in this region. The answer appears to lie in the amount of time required to communicate with pilots via telephone. One staff member at Philadelphia Approach estimated that there might be as much as a factor of ten difference in the number of aircraft he could handle in a given time. Evidently, the time consumed by the telephone communications is such a drain on the available staff that satellite airport clearance communications are tied up during times of even moderate IFR activity. With one controller at the satellite airport clearance position and numerous satellite airports, it is not surprising that the total volume of calls can lead to clearance gridlock.

The issue of approach conflicts has a number of different possible solutions. For example, Chester County was one of the first airports in the nation to install MLS, doing so well before the FAA's commitment to the system. The MLS was subsequently removed when the current

ILS was installed. The analysis conducted by Samis and Hamilton indicates that MLS installations at Chester County or South Jersey Regional may serve several additional airports simultaneously. The development of such a network of MLS equipped airports may get general acceptance and use of the system by aircraft operators both within and outside the Philadelphia region. However, such a system has not been encouraged by FAA.

The development of improved approaches to airports, while secondary to the need for better radio ground communications, enhances the capability and safety of the airport system and should have a high priority vis-a-vis other airport improvements.

COORDINATION OF MILITARY AND CIVILIAN AIRPORTS

Several options are available regarding expansion at existing airports, and the potential for more efficient and safer interface between military and civilian facilities. Following are the major conclusions and future planning guidelines for development of the system, considering only the airspace capacity/safety optimization parameter.

Warminster Civilian Re-use

Warminster civilian re-use is opposed by both Willow Grove and Philadelphia ATC facilities, based upon their two perspectives on regional air traffic. Airspace conflicts and the complexity of integrating operations could lead to long traffic delays at Warminster, particularly under IFR. Warminster also has approach conflicts with Northeast Philadelphia. Even under VFR conditions, Warminster would provide a "zero sum" airspace capacity improvement - for every aircraft landing at Warminster, a Willow Grove aircraft would be delayed.

Buehl Field

At present, Buehl Field has a few IFR operations, which are accommodated without problem. Besides the inherent increase in workload for the Philadelphia radar controllers, there is no apparent technical reason to prevent a modest development of the Buehl facility. It is acknowledged that ATC workload required to separate Buehl and Trenton-Mercer aircraft may, in the future, lead to delay during moderate to heavy traffic periods. Under VFR conditions, aircraft may depart Buehl and pick up their clearance in the air, a procedure that works well. However, because there is no aircraft-to- tower communication possible until the aircraft has climbed to several thousand feet, IFR departures must be released over the telephone with a "void time". If the aircraft is not airborne before this time is up, the pilot must telephone Philadelphia again to get a new clearance and release. The comments regarding telephone releases and cancellations at the McGuire satellite airports applies here as well, although it should be noted that a telephone caller at Buehl is potentially competing with a great

number of other callers, because Philadelphia has many more satellites than McGuire.

Willow Grove

Willow Grove has a high level of military operations and is located in an area of heavy VFR activity. Problems with VFR aircraft transiting their airspace continue. Local efforts, such as the development of VFR preferred routes to be flown by civilian aircraft, are just now being adopted. There is also an initiative to build a private use civilian facility (the so-called Bullock airfield) near Willow Grove, a proposal which the control tower feels would lead to airspace conflicts.

There are IFR and VFR conflicts with Warminster which required vigilant monitoring and coordination. Approaches to Willow Grove are primarily overhead breaks approaches and GCA along its 10 mile straight-in final approach course. The GCA is the most-used instrument approach. In addition to the based aircraft, other military aircraft use the GCA for training. The GCA penetrates Philadelphia's airspace and, when in use, requires close coordination with Philadelphia controllers. Operationally, this means a workload burden for Philadelphia and probably delays for aircraft.

McGuire

The proposed increase in military operations at McGuire should pose no problems for the civilian traffic operating at McGuire RAPCON, because the airport and local ATC has adequate capacity to accommodate the increase. However, the increase in operations at McGuire Air Force Base could affect all other, if not most, of the Philadelphia area airports. The additional McGuire operations mean more jet aircraft seeking to fly in Center airspace and more westbound departures to mix with civilian traffic over Modena. In-trail restrictions can be expected to be imposed more often at most airports. In addition, most of the increase in operations will involve heavy jets; inbound aircraft potentially pose wake turbulence problems for civilian VFR aircraft. Heavy jet arrivals are routed via the Yardley VORTAC as low as 3,000 feet. □

IV. REGIONAL AVIATION ISSUES AND GOALS

For the last 12 years DVRPC, through the FAA funded Continuous Aviation System Planning (CASP) work programs, has documented events influencing the aviation system in the region. These events include development or impediments affecting the Year 2000 RASP airports as presented in Chapter II; airspace usage affecting operating capacity as described in Chapter III; and local, state, and federal institutional and policy changes impacting operations, funding and regulation of airports.

Since adoption of the 2000 RASP in 1982, regional development, concentrated in the suburbs, has changed the environment in which airports operate. Federal capital support for airport enhancement has expanded and then contracted. Costs have fluctuated wildly, with commercial user costs generally going down, while private general aviation costs, due mostly to the costs of aircraft ownership, have increased.

In order for this 2020 RASP to be an effective planning tool for the future, the aviation infrastructure needs of the current 2000 RASP must be blended with the changing demand for aviation and with the environment in which aviation operates. Through input from the members of the RAC, FAA and state departments of transportation, research by other regional aviation system planning programs, and the analysis of national aviation organizations, as well as the airline and aircraft industries, DVRPC staff has identified many aviation issues for consideration in the development of the 2020 Plan. These deal mainly with aviation safety, demand, capacity, mobility, airspace, cost, environmental and citizen concerns, and economic opportunity through the next 25 years. The issues are presented categorically in the groupings that have emerged through input from all of the reviewed sources. Table IV-1 shows the major aviation issues which have been considered in the development of the 2020 Plan.

AVIATION ISSUES

Aviation Demand

In order to recommend a 2020 regional aviation infrastructure, some assumptions must be made regarding expected trends in aviation demand. This demand takes several forms, including commercial operations and passengers predominantly served by PHL, as well as general aviation, which includes charter, recreational, and business flights which are served by all other airports in the region. Also, the changing role of air freight demand and the effect of modal transfers, caused by service and cost changes over time, will impact total regional operations demand.

Between 1980 and 1992 the level of regional business and GA aircraft operation and storage demand has remained constant, although the number of airports

Table IV-1
AVIATION PLANNING ISSUES

Issues	Components	
Demand and Traffic Type	Commercial Business General Aviation Military	Freight Helicopter Tiltrotor
Supply and Capacity	Runways Taxiways Terminals Storage	Supporting Service Ground Access Airport Closure Intermodal Facilities
Airspace and Traffic Control	Routings Traffic Control Communication	Delay Safety New Technology
Financial and Economic Factors	Capital Cost Operating Cost Funding	Financial Recources Economic Benefit
Citizen and Environmental Concerns	Noise Accidents Zoning	Land Use Air Pollution Water Pollution
Airport Management and Coordination	Public Agencies Private Management Regional Authorities	County Authorities Local Authorities

offering this service has declined 25 percent. In contrast, commercial flights predominantly out of PHL have increased by approximately 60 percent. Can these trends be extrapolated to the year 2020 to determine system capacity needs, and what is the effect that the evolving market between the US East Coast and Europe will have on demand? Assumptions concerning demand in the domestic commercial airline market outside this region are necessary. Most national sources anticipate slow domestic and moderate international growth. Airlines will strive for more

efficient operations and higher aircraft occupancy in order to increase operating profit.

Ground access shapes aviation demand at competing airports within and outside the DVRPC region. The 2000 RASP, adopted in 1982 and amended in 1988, identified ground access criteria of 45 minutes and 30 minutes travel time from major residential/business centroids in the region to commercial and general aviation/reliever airports, respectively. Other factors affecting demand include the impacts of closing airports during the 1980's, the opening of major highway and transit facilities which impact system accessibility, and other ground access issues.

Recently, U.S. Department of Transportation funding legislation has emphasized the importance of planning for and offering intermodal options for passengers and freight, as a means of increasing the efficiency of the existing transportation system. Current policy emphasis assigns high priority to interconnection of modes. Theoretically, multimodal trips will increase overall system efficiency and reduce air pollution by permitting higher utilization of public transportation modes. If new aviation facilities are required by the Year 2020, it is necessary to determine, whether intermodality can be established or enhanced with existing highway and transit systems, while satisfying the discrete aviation markets identified. Given the existing facilities in place now, and the political difficulty of proposing new airport facilities in urban/suburban areas, intermodal aviation facilities should focus on the existing system. With the increased emphasis on air freight transportation, airports with intermodal freight potential must be given high priority.

Since approximately 60 percent of the region's current aviation system is privately owned and may be converted to non-aviation use in the future, the availability of suburban airports with proximity to business and residential centers will shape current demand, and also determine future potential for aviation growth.

Regional criteria should be developed to describe the various attributes of public use reliever and general aviation airports, since airport capacity, approaches, services, price (landing fees or storage), and ground access all shape the airports' attractiveness to local and relocating airport users. Hypothetically, an airport with fewer amenities, but with adequate runway length and approaches, may be more attractive to a potential user, if its prices are lower because of cheaper overhead. It can be questioned whether reliever status and public sector capital investments result in a necessarily more attractive (higher demand) facility to a potential user, or if location is the primary evaluation criteria from the systems planning perspective.

Security at suburban airports is also a factor in regard to an airport's demand potential. Most suburban facilities average 100 acres in area and are not protected by security staffs or fences. As airports get

busier or as the communities they serve become more developed, the airport may experience vandalism. Historically, security investments have been considered unnecessary or unaffordable, but for the Year 2020 Plan, security may be an important criteria which should be considered in the recommended improvement projects.

Aviation Supply and Capacity

Once demand is established for the aviation system of the 2020 Plan, the provision of needed capacity for commercial aviation, general aviation, and air freight becomes a major issue which should be considered in the development of the Plan.

1. Airport Closure

During the period 1982 to 1994, seven privately owned general aviation airports in the system closed because of surrounding real estate development. Seaplane bases were deleted from the 2000 RASP because of low operations levels, and Willow Grove NAS was deleted from the RASP because the Department of Defense refused to permit civilian flights. System capacity was thereby reduced by 25 percent. However, during that same period, demand for commercial operations increased by about 25 percent. Most of the increase was concentrated at PHL, while activity at all other airports in the aggregate remained relatively constant.

Nationally, privately owned airports in the NPIAS were also under pressure to close, especially in the densely populated Northeast and other areas with escalating real estate development activities. Although FAA recognizes over 5,000 airports in the NPIAS as critical to national aviation service, only 1,500 or 30 percent are not protected from closure due to private ownership. In the DVRPC region privately owned non-federally funded airports are 50 percent of the total RASP non-commercial system. DVRPC anticipates that in this region up to 12 additional airports (50 percent of current suburban capacity) may close by the Year 2020.

2. Effects of Policy on Capacity

Operating rules and policies of airports, and how they relate to each other in the regional system, are major factors in increasing or decreasing capacity. For example, future policy regarding facilities development at PHL will influence the market for non-commercial operations that use this airport and those which use other facilities in the suburbs. Major development at PHL, including runway 8-26, appears contingent upon the support of major airlines. Management decisions at PHL, including ATC handling of aircraft, availability of ramp and GA/business service space, and landing and storage fees, will either attract or divert aircraft. Some estimate of the trend in non-commercial usage at PHL should be made before determining any necessary changes in the 2020 capacity at the region's suburban

airports. This partly depends on the creation of a new PHL operating authority.

Due to the consolidation of commercial airline operations, both Trenton-Mercer and New Castle County airports now have little or no scheduled service, but both facilities can play an expanded role in serving business and general aviation traffic during VFR and IFR conditions.

3. Sufficient Capacity at PHL

The provision of sufficient capacity at PHL and other large airports which may have a commercial role in the region is very important, because such airports must have safe operations without delays if they are to handle the projected growth in commercial activities. Current runway configuration and separation at PHL limit the level of operations, especially during IFR conditions. Future demand forecasts indicate the growth of operations will increase airline delays and operating costs. The PHL master plan recommends a new commuter runway, 8-26, to relieve congestion on 9L-27R and 9R-27L. Several issues must be resolved for the construction to go forward: environmental impacts should be mitigated as necessary; land must be acquired from private owners; and sufficient capital obtained from the FAA, local sources and the airlines. Without the new runway, the airport system cannot operate at its most efficient level. Federal policy may encourage the formation of small commercial carriers increasing competition at PHL, further demonstrating the need for a new runway.

4. All-weather Capacity at Suburban Airports

In order to allow PHL to use most of its operating capacity for commercial flights, sufficient all-weather capacity should be provided at suburban airports to provide business and GA pilots with sufficient alternative operating options. Runways of sufficient length equipped with navigational aides are needed to handle business aircraft in the suburbs in order to avoid congestion at PHL and to provide adequate facilities for suburban businesses.

5. Storage Capacity

Although operating capacity at suburban airports appears adequate in the aggregate to accommodate significant future operations growth, 10 of the 20 suburban airports do not have adequate storage capacity to handle the existing local GA and business aircraft. Although federal and state capital subsidies may exist for operating improvements, storage expansion does not qualify. Airport owners/operators often cannot raise the necessary capital for storage improvements.

6. Capacity at Privately Owned Airports

Some suburban areas within the region

are served only by privately owned airports, which are subject to closure on short notice. In Pennsylvania, these airports include New Garden, Wings, and Buehl; in New Jersey, Oldmans, Cross Keys, Trenton-Robbinsville, and Camden County; and in Maryland, Cecil County Airport. If these airports, which are included in the 2000 RASP were to close, their respective market areas would be left with no business aviation capacity. The public sector could lock these airports into the 2020 system through enhanced federal grant eligibility or public acquisition.

7. Capacity at Military Facilities

Military bases are a potential source of airport capacity that can complement the regional civilian aviation infrastructure. Two military airports in the region, McGuire Air Force Base in New Jersey and Warminster Naval Air Development Center in Pennsylvania, have recently been considered for possible joint military/civilian use. If politically feasible and economically advantageous, these facilities would provide instant all-weather operations, training, and storage capacity to the markets in which they are located. The resolution of these joint use proposals should be considered as they relate to the capacity, air space conflicts, and proposed capital expansion at nearby airports in the 2020 Plan. Airspace approach conflicts, however, limit Warminster's utility, and recent preliminary commercial use analysis of McGuire indicates sufficient commercial capacity already exists at PHL, EWR, and ACY, especially with consolidation of airline hubbing. Dover Air Force Base, south of the DVRPC region in Delaware, is currently operating in limited joint use capacity and will remain operational as an East Coast civilian capacity asset.

8. Helicopter Capacity

Within the aviation infrastructure and services provision industry, helicopters have traditionally served a small specialized niche. However, with new developments in helicopter hardware, resulting in lower cost per passenger-mile, and helicopters' ability to reduce total travel time with city center departures and arrivals, the future role of helicopters in the total regional capacity to satisfy aviation demand in the region should be reassessed. The helicopter system demand, facilities and service portion of the 2000 Plan has never been developed using public resources. For the 2020 Plan, it should be determined if or where heliports and vertiports should be located in the region. The potential for helicopter market development and demand trends should be estimated based on the shorter distances of trips in comparison to fixed-wing aircraft.

Regional and national helicopter interests also make a convincing argument for the applicability of tiltrotor aircraft operations in the Northeast corridor. It is possible to increase capacity at PHL by using tiltrotors to serve routes of 300

miles or less between city centers as an alternative to fixed-wing operations. However, high start-up costs and development problems have raised the price of civilian tiltrotor technology, and reduced its potential market and support.

Airspace Utilization and Traffic Control

Regional airspace usage, potential airspace changes, and ATC procedures are important issues that shape system capacity and the potential for ground infrastructure improvements. Recent events related to the expansion of the master plan at PHL demonstrate that the airspace impacts of proposed improvements on surrounding residential communities can impose political, as well as an operational, constraint on system expansion.

Two airspace utilization studies conducted by DVRPC consultants in 1990 and 1993, identified airport approach routes where safety and efficiency can be improved. The current airspace design for airport approaches and inter- and intra-regional airplane movements contains some conflicts. Delays also occur under bad weather conditions, specifically in conjunction with airside ground movements at PHL. Current expansion plans at PHL are designed to reduce airspace delay. Locations within the regional airspace where congestion acts as a system design constraint should be identified and corrective recommendations included in the 2020 Plan.

The air traffic control procedures in place at suburban airports, along with the communication processes and equipment currently used, can affect capacity to handle controlled aircraft movements. These factors should be addressed in long-range planning. The positive effects of new technology like GPS should be considered, as it can enhance capacity, especially under IFR conditions. GPS may also allow suburban airports to increase their IFR role in satisfying regional business demand, while avoiding the difficulty and cost of acquiring needed additional land that traditional ILS equipment requires.

Financial and Economic Factors

In order to have a positive effect on facilities' development, future efficient operations, increased safety, and affordable mobility, the plan should avoid redundancy, and should consider all available capital resources when recommending expansion. Through FAA funding authorization legislation, state resources, local spending, and inflation, the annual investment in the regional aviation system has continued to grow through 1992. Although the capital needs at PHL require funds to be raised in the bond market for the construction of runway 8-26, the other 25 regional airports have excess operating capacity and require less capital intensive safety and storage enhancements.

However, recent events in Washington, including the creation of the locally

collected Passenger Facility Charge (PFC) tax, the continuing unwillingness to reduce the surplus in the Aviation Trust Fund, and the consolidation of domestic airline companies, may reduce the future public investment capital from the federal treasury. This in turn may affect the willingness and ability of local governments, the airline industry, private sponsors, and the financial markets to invest in the regional aviation industry and infrastructure. Some projections of aggregate financing options and programs in the twenty-first century should be established in order to generate feasible alternative 2020 aviation strategies for the region.

Government representatives, aviation services, operators, and pilots note that there is a lack of public appreciation for the economic and mobility benefits the aviation system provides to the communities it serves. Without political and popular support for aviation infrastructure investment, it is difficult to both designate public funds for the purpose, and to receive the necessary regulatory and zoning authority from local governments. Although the public in general may acknowledge the benefits of a large commercial hub facility like PHL for business or vacation travel, public support of a general aviation or business airport in their communities is not apparent.

Greater understanding and marketing of the relationship of airports to business siting decisions, employment in the community, emergency medical services, and potential economic well-being of those directly and indirectly impacted, should be advanced as part of the 2020 Plan. This is especially important in those areas of the region where either new facilities or significant expansion of existing facilities is recommended.

Environmental and Citizen Concerns

Because of the dramatic nature of aircraft operations, no recent developmental project at any airport in the region has been free from intense review, criticism, and frequent opposition from local zoning boards, municipal officials, citizens, and the media. Occasional aircraft accidents at non-towered suburban airports heighten this level of scrutiny. When considering investments at facilities which are part of a related metropolitan transportation system, the impact of the positive benefits is felt both locally and regionally; while the negative impacts, such as noise, fear, and pollution resulting from more traffic at a particular facility are concentrated on the immediate area surrounding the airport.

Projects should be included in the 2020 Plan which satisfy aviation objectives, while minimizing the negative impacts on local residents adjoining airports. At the same time, supporting regionally significant facilities and improvements that increase the effectiveness and safety of the entire system should not be diminished. Assigning commercial flights, which carry the most negative impacts, to commercial airports, and business/GA activity to suburban facilities is a strategy that

minimizes future neighborhood opposition, while maintaining the separation and dispersion of traffic conducive to the safe and efficient operation of the ATC system. However, to accomplish this separation, suburban airports should provide adequate all-weather operations and storage facilities, which may necessitate some improvement and construction at suburban sites.

Priority should be given to development at new or existing airports that have available space to expand, supportive zoning regulations, compatible surrounding land uses with available fifty-to-one approach slopes, and supportive local and county governments.

Airport Management and Coordination of Services

A wide range of institutional structures are used to manage the region's 27 aviation facilities. PHL is owned by the city of Philadelphia and operated directly by the City through the Department of Commerce, Division of Aviation, and Northeast Philadelphia Airport is owned and operated under a similar structure. Other public entities, commonly counties, also own and operate airports either directly or through operating authorities. Chester County owns Chester County Airport and operates it through its Airport Authority. Bucks County has a similar relationship with Quakertown and Doylestown airports through its Airport Authority, and Mercer County also owns and operates its airport. New Castle County has just completed a lease with operating control, of New Castle County Airport near Wilmington, to the Delaware River and Bay Authority, a bi-state Delaware/New Jersey transportation operating agency. Previously the airport had been operated by the county. Even municipalities are represented as public owners/operators, with Pottstown Borough operating Pottstown Municipal Airport and New Garden Township considering acquisition of New Garden Airport.

The remaining public use facilities are all privately owned and operated, either by the owner or by some contractual management entity such as a fixed base operator (FBO). Of the 16 privately owned airports in the system (67 percent of all airports), only five are currently obligated to remain open by contract with FAA. The remainder could close at the discretion of the owner, a situation which emphasizes the desirability of public ownership or public investment in the privately owned public infrastructure.

Several proposals have been considered, which would result in more public involvement and ownership of the aviation system. Generally, DVRPC endorses these proposals as a means of stabilizing and preserving capacity. Under consideration are:

1. PHL Operating Authority

Although no progress has been made to date to pass Pennsylvania state legislation necessary for structuring the PHL Authority, the proposal to operate

PHL under a Pennsylvania state multi-county authority structure has merit. Capital could be raised more easily, since bond rating agencies would not base their evaluations only on Philadelphia city financial conditions, and purchasing and personnel decisions would not be constrained by Philadelphia city residency rules and credit. Management of the airport by a reformulated board would rest with city, county, and state appointed representatives, opening up the decision process to all those affected by airport operations. However, issues, such as the relative composition of the board between the city, suburbs, and state, have proven to be difficult to resolve, as is the amount of compensation to Philadelphia for relinquishing full control of PHL.

The airlines participation in capital expansion financing also is a factor in restructuring PHL ownership and management. USAIR/British Air, for example, has shown varying degrees of willingness to finance expansion, depending on market conditions and Philadelphia's financial health, thereby making authority formation more or less critical to expansion.

2. Public Acquisition of Private Airports

In the next several years public entities will consider acquiring private airports as public transportation assets. New Garden Township will shortly complete an FAA funded analysis of the financial and operating viability of acquiring New Garden Airport. The Chester County Airport Authority in the past has considered acquisition of both New Garden and Brandywine Airports, but to date has limited its responsibility to operate and own only one facility, Chester County Airport. Business interests in Montgomery County have approached the county government for a long-term commitment to Wings Field. The RASP supports these potential acquisitions due to the significant economic and mobility benefit of continued airport operation to the local communities, but local governments are concerned with tax revenue drain from such operating obligations, and must be convinced that airports can be operated on a break-even operating basis with little capital subsidy requirements from the county or municipality.

REGIONAL AVIATION GOALS AND OBJECTIVES

Since 1980, when DVRPC was first contracted by the FAA to develop and maintain aviation system planning and plans for the four-state Philadelphia Metropolitan area, DVRPC has continuously reviewed and revised its aviation planning work program. This has been done to assure that the short-range and long-range studies work together to provide a RASP and a process that will provide an economically optimal and safe aviation infrastructure for the future. The major planning objectives of the DVRPC

continuous airport system planning process can be summarized as follows:

1. Continuation of collection and maintenance of basic data, such as aviation activity, as well as socioeconomic and environmental factors relating to the existing airport system plan, affecting the RASP.

2. Provision of a means for receiving and considering comments from the aviation community and the general public, in order to increase the public's awareness of the role airports play in the area's transportation system.

3. Development of a continuing mechanism for assuring interchange of information between the regional system planning, master planning, and state system planning processes.

4. Integration of airport system planning into a multimodal planning process.

5. Analysis of special issues such as airspace utilization, ground access, local zoning, travel time to airports, and the economic contribution of aviation.

6. Reappraisal of the RASP in view of changing conditions and plan modifications in order to maintain its viability and preserve facilities.

Using the 2000 RASP, as adopted in 1982 and amended in 1988, as the baseline, DVRPC has proceeded to implement the six objectives listed above. The result of this multi-tiered approach has been the identification of system problems and deficiencies. The following long-term aviation goals and objectives of the 2020 RASP are intended to form the basis of the 2020 Plan and facility enhancement recommendations for the next 25 years (Table IV-2).

Table IV-2
2020 RASP GOALS AND OBJECTIVES

- **Preserve the Existing System**
- **Increase Capacity to meet Present and Future Needs**
- **Improve Airport and Heliport Infrastructure**
- **Extend and Improve Runways**
- **Minimize Delays at PHL**
- **Enhance Instrument Approach Procedures at all Airports**
- **Insure Compatibility with National, State and Local Plans**
- **Expand Air Freight**
- **Minimize Noise and Nagative Environmental Impact**
- **Coordinate with Land Use and Surface Transportation Facilities**
- **Implement Municipal Zoning**
- **Increase Citizen Involvement in the Planning Process**

1. Preserve the existing system, including operation of suburban privately owned public use airports currently identified in RASP. In suburban locations not served by facilities within access time criteria, include other aviation facilities into the 2020 RASP.

2. Increase system capacity to meet current and future regional needs, including storage capacity in corporate hangars at airports catering to corporate clientele, and in T-hangars for predominantly single-engine small aircraft at general aviation airports.

3. Extend and improve runway length to accommodate corporate twin engine and small jet aircraft, at least, at one business/reliever airport in each suburban county.

4. Enhance instrument approach procedures at all business/reliever airports with extended runways. These airports are South Jersey Regional, Cross Keys, Summit, Wings, Pennridge, Pottstown Limerick, and Doylestown

5. Resolve airspace conflicts and distribute traffic burdens evenly through the system.

6. Minimize traffic delay at PHL and increase system capacity through enhanced communication capability between air traffic control at PHL and pilots taking off or landing at suburban airports.

7. Expand airport and heliport infrastructure within the region to serve all urban business/population centers and major suburban development areas.

8. Expand air freight to accommodate increasing demand at major business/population centers.

9. Coordinate with land use and surface transportation facility plans.

10. Implement municipal zoning to protect airport operations and future existence of facilities where development encroachment or lack of local ordinances create vulnerability.

11. Insure compatibility with local, state and national system plans and funding programs.

12. Minimize negative environmental and noise impacts of current and enhanced system on residential communities.

13. Increase citizen participation and public awareness of aviation contributions and usage options.

14. Encourage efficient management structure and public involvement in aviation system ownership. □

V. 2020 AVIATION DEMAND FORECAST

In order to design a facility plan providing adequate capacity, safety upgrades, and equitable access to aviation for all the region's residents, whether urban, suburban or rural, estimates of future activity must have a high probability of reasonableness. Overly conservative projections, while requiring less capital to implement, may underestimate potential market demand and result in facility recommendations that do not equip the region for economic growth. Overly aggressive projections may lead the region into aviation development which will not provide optimal return on investment and require scarce capital better invested in other public facility projects.

The following aviation demand forecasts are based on the extensive work already conducted by DVRPC to model 2020 population, employment and traffic projections. These demographic projections, which bear fundamental relation to aviation usage, are the baseline from which DVRPC has developed its 2020 infrastructure plans for highways, transit, and other facilities, as well as aviation.

AVIATION DEMAND TRENDS AND INDICATORS

In order to establish the background trend information necessary to develop regional demand forecasts, a review was undertaken of aviation demand forecasting materials and procedures from recent national, regional, and state systems plans, as well as the recent PHL airport layout plan (ALP). These were used to determine the critical variables affecting aviation demand which will shape the extension of the RASP from 2000 to 2020. Input regarding trends in commercial, business, and general aviation demand has also been received from the RAC members, the FAA, PennDOT, NJ DOT, the New Jersey Aviation Advisory Council, and the Pennsylvania Aviation Council.

2020 Regional Population and Employment

Population, employment, and disposable income are all directly related to the demand for aviation services. Commercial passengers are motivated by business objectives, as well as personal and vacation related travel objectives. Given certain increases in population and employment, related increases in commercial demand can be anticipated. Population and employment are also directly related to the availability of funds to own and operate business and recreational (personal) aircraft at general aviation and business airports. Using 1990 Census data and previous trends in population and employment growth in the region, DVRPC staff forecast annual and total growth rates between 1990 and the year 2020. The process of developing these forecasts is detailed in this chapter, and is based on the research for the 2020

surface transportation plan[1]. Generally, the region anticipates modest population growth in Pennsylvania (6.9%) and significant growth in both New Jersey and Delaware/Maryland, (21.3% and 21.6% respectively), for a region wide average of 12.0 percent. In contrast, regional employment is expected to increase by 20.1 percent.

General Aviation and Business Based Aircraft

In 1986, 2,336 aircraft were based at the airports; but by 1993, that count had changed to 2,329, representing a very small decrease. The Aircraft Owners and Pilot Association (AOPA), which tabulates registered aircraft by county, indicates that approximately 3,300 aircraft were registered in the region in 1990. This discrepancy could be due to registered aircraft being based outside the region, or a divergence between registered aircraft and operational based aircraft. The 2000 RASP documented 3,800 aircraft registered in the region in 1980, and forecast 4,315 in 1990 and 4,700 by 2000.

Preliminary analysis indicates fewer aircraft using the system than anticipated in the 2000 RASP. This trend is consistent with the drastic decrease in new aircraft production, resulting in part from the higher cost associated with required product liability insurance, and in part from the increase in the cost of used aircraft driven by the diminishing supply of new replacement aircraft. Current pending federal legislation to limit product liability of manufacturers could reverse this trend. Also documented is the trend toward growth in business aircraft and reduction of GA recreational aircraft.Based aircraft counts have shown a higher demand for basing at suburban airports near the urban center of the region. Generally fewer aircraft are being based at the more remote rural airports, which corresponds to their lower surrounding population and business densities. Also, available storage capacity in hangars or tie downs has been observed to be limited at the closer airports, and aircraft owners often must locate their aircraft further out in the suburbs in order to find available storage capacity.

PHL Commercial Operations

As part of its federally required ALP, PHL has developed operations projections to 2010 in support of the proposed new commuter runway 8-26. The airport has projected a 45 percent increase in total flights from the 1990 level of 415,000 per year to 600,000 in 2010. This unconstrained figure will result from a 70 percent increase in passenger enplanements to the year 2020, partly countered by the trend toward larger aircraft in the fleet using PHL. Currently 17 percent of the annual operations at PHL are general aviation or small corporate/ private aircraft in nature, and it is anticipated that the number of GA flights will hold constant to 2010, but become a smaller percentage of the fleet

[1] *Moving People and Goods*, DVRPC 1995

Courtesy of Philadelphia International Airport

using this airport (Table V-1). This implies that PHL will have only a slight impact on demand forecasts at the non-commercial airports in the regional system.

Table V-1
PHL CURRENT AND FUTURE ANNUAL OPERATIONS

	1990 Operations	Percent of Total	2000 Operations	Percent of Total	2010 Operations	Percent of Total
Large/Medium Commercial Jets	230,000	(55.4%)	285,000	(60.5%)	403,000	(67.1%)
Commuter Commercial	115,000	(27.7%)	116,000	(24.6%)	127,000	(21.2%)
General Aviation	70,000	(16.9%)	70,000	(14.9%)	70,000	(11.7%)
TOTAL	415,000	(100%)	471,000	(100%)	600,000	(100%)

General Aviation Operations

In the 2000 RASP, general aviation and reliever airport annual operations were estimated without the benefit of actual airport based aircraft or operations counts. The annual operations levels varied widely from airport to airport as did the twenty-year projections. Some airports were projected to have high volumes of traffic necessitating capital expansion, while others with similar geographic proximity to employment/population centers and with similar runway/taxiway ramp space capacity were projected to be very underutilized. However, for the 2020 RASP demand forecasting, DVRPC will use field surveys based on actual field counts and operations.

Airport Closure

Since the 2000 RASP was adopted, approximately 25 percent of the suburban design capacity has been eliminated due to the private sale of properties or military decisions regarding joint use. In forecasting 2020 demand for the remaining airports, an assumption should be made regarding the potential for the region to provide the level of capacity needed to satisfy increasing demand. Without the assumption of potential sufficient capacity covering all subareas within the region, future demand should be shifted to other

subareas where capacity exists or can be built, or shifted out of the region altogether.

This situation also impacts based aircraft and operations counts taken over a six-year period at all reliever and general aviation facilities. Of the 24 airports counted, 14 have been counted twice during the six-year period at four-year intervals. Those airports as a group experienced an increase in total annual operations from 474,000 to 603,000. This corresponds to a 27 percent increase in reliever/GA traffic over the period, or 6.75 percent per year. This regional estimate of growth should be adjusted downward to compensate for the shift of aircraft from two airports that closed during the period — Turner and Bridgeport. When the 67,000 operations associated with these facilities are subtracted from the total of surveyed surrounding airports, the growth rate becomes 3.25 percent per year. Depending on location, facility features, capital improvements and available storage capacity, airport growth rates vary widely during the survey period.

External Factors Influencing Aviation Demand

Certain factors present in national and international political, legal, and economic systems may also influence future demand for aviation in the DVRPC region, as they have from 1982 to the present. The degree to which these factors influence demand to the Year 2020 will provide a range of demand estimates, which should be planned for in the recommended infrastructure.

1. Aircraft Production

US production of GA aircraft fell from 17,811 in 1978 to 880 planes in 1992. The exorbitant cost of manufacturers' product liability insurance is most often cited as the most significant component contributing to increased aircraft cost. A single engine GA plane sold today for $100,000 would have cost only $3,500 in 1950. Manufacturers must currently insure these aircraft for the life of the plane, which could approach 40 to 50 years, given the current demand for used aircraft.

Congress proposes to reduce the liability period for manufacturers of GA aircraft to 15 years. This legislation is expected to drastically and suddenly reduce aircraft cost and create a marginally larger market of flyers able to afford to own or rent an aircraft. The AOPA provides statistics on active general aviation aircraft nationally, that indicate a reduction of 6.9 percent in the fleet from 213,000 to 198,500 aircraft between 1981 and 1991, and a reduction of 90 percent in new aircraft produced during those ten years.

2. Certified Pilots

The number of active certified pilots has a direct relation to future operations demand, especially for general aviation flights. Historically, military training is responsible for a significant portion of new pilots, with most of the remainder trained at private GA flight schools. With the reduction in

military posture seen in the 1990's and the previously mentioned escalation in flying costs, total pilot ranks are in a downturn. AOPA estimated the number of total pilot certificates held at all ratings levels dropped from 764,000 to 692,000 from 1981 to 1991, a 9.4 percent reduction nationally.

3. Fuel Cost

Fuel cost is a major variable in the total price of flying, and is even more significant for discretionary general aviation flights. Although fuel costs have been stable in recent years, they are vulnerable to political economic pressures and confrontations. Drastic increases in fuel cost would increase commercial ticket prices and reduce demand, as well as eliminating a percentage of general aviation demand.

4. Air Freight

In the Philadelphia area, 67 percent of all air freight tonnage is moved by freight-only carriers, such as UPS, Federal Express, and Emory, from PHL. These freight movements can take place in non-peak hours at commercial airports, thereby minimally impacting airport capacity expansion needs. The remaining freight is carried in the holds of commercial passenger aircraft, whose operations are predominantly established by passenger demand. Freight tonnage is integrated into the demand forecasts of PHL, and therefore helps shape proposed expansion in the ALP.

Depending on future international markets, and the changing trends in growth of imports to and exports from the region, freight demand may assume a more significant role in system design in the future. However, since the region has three under-utilized airports — Trenton-Mercer, New Castle County, and Northeast Philadelphia — sufficient capacity already exists near population/ business centers to accommodate future demand.

FORECASTS OF 2020 BASED AIRCRAFT AND OPERATIONS

Review of Existing Forecast Studies

A starting point for forecasting of 2020 regional total aviation demand can be obtained from the most current systems plans for the region, namely the state airport systems plans (SASP) for New Jersey, Delaware, and Pennsylvania. Also used as a baseline are the results of the DVRPC 2000 RASP and the recent PHL ALP. The last projects demand at PHL, including non-commercial usage, in order to establish the need for a new runway 8-26. Finally, the FAA Terminal Airport Forecasts (TAF) for selected airports in the region are also included in the comparison, so that the federal overview of national anticipated activity is properly reflected.

These various forecasts were completed for several, but not all airports in the region. Included are PHL, Trenton-Mercer, New Castle County, Northeast Philadelphia, Wings Field, New Garden, and Chester

County. Operations forecasts based on actual historical counts are projected to 2005, with projections including air carrier, charter, general aviation and military usage separately identified. Current based aircraft (as of 1993) are also estimated. The FAA annual growth rates are identified as between 4 and 4.8 percent to 2005, depending on airport.

Pennsylvania, New Jersey, and Delaware maintain SASPs to allow for the long-range planning of needed aviation facilities in the statewide system. All SASP data used for regional comparison were developed in the mid-1980s with a planning horizon of 2010; therefore, DVRPC calculated the growth rates until 2010, and then applied one-half of those rates for the ten years remaining until 2020. Forecasts were usually based on registered aircraft and socioeconomic growth trends applied to market areas, usually counties. Since baseline projections by the states occurred in the 1980s when general aviation growth was significantly more intense than in the 1990s, future projections generally were optimistic. However, PennDOT did revise its projections downward in anticipation of the revised SASP available in 1995.

As PHL is the central facility in the RASP, future aviation demand projections here not only shape design of this facility's capacity, but also define market areas to be served by surrounding non-commercial facilities. This interconnection is manifested on a daily basis as air traffic is managed by ATC at Philadelphia Tower for suburban airports, as well as PHL. The ALP forecasts considerable growth in commercial operations at PHL, but leaves general aviation activity remaining at the 1990 level of 70,000 operations per year until 2010.

Since regional general aviation demand is anticipated to grow about 38 percent by 2020, the GA activity at PHL is being controlled through limitations to general aviation facilities at the airport. All growth is occurring in the categories of commercial heavy jets, medium jets, and commuter aircraft. This results in a spill-over of GA demand to be assigned to suburban airports for 2020 capacity needs estimation. Annual operations in total are expected to grow 2.2 percent annually at PHL until 2010.

Growth of passenger enplanements at PHL is also expected to increase proportionately to commercial operations during the same period, which coincides with the PHL Master Plan forecast period. To 2010, expected passenger enplanements will increase to between 12 and 18 million passenger trips, compared to the current level of 8.1 million passenger trips per year.

State system plans for New Jersey and Delaware identify future commercial operations of 8,000 and 4,000, and passenger enplanements of 70,000 and 35,000 per year at Trenton-Mercer Airport and New Castle County Airport, respectively. These airports have sufficient capacity, adequate terminal facilities, and a history of light commercial use. However,

given the current retrenchment psychology in the airline industry, maintaining scheduled service at either airport has proven difficult.

The 2000 RASP predicts a level of 5.5 million operations annually and 3,800 based aircraft in the region by 2000. In reality, the current total operations is less than 1.8 million per year, including commercial and military, and only about 2,600 aircraft are based in the region. Three factors, retrospectively, can be cited for the gross overstatement of future demand. First, based aircraft and operations were established with mail and telephone surveys, but no actual counts or field inspections. Consequently, data reported by FBO, owners, and managers may have been grossly exaggerated. Second, utility rates, or operations/year, for each assumed based aircraft were generally between 400 and 500 operations/year, a level of over one take-off and landing every 1.5 days. This has proven to be unrealistic. Third, certain airports were assumed to be business oriented, and therefore attract higher levels of local and itinerant traffic than other GA airports. Historically, comparison of the 2000 projections with the current reality at airports makes the case for slower more moderate growth.

In order to make historical comparison between the 2000 RASP and current conditions for the 2020 RASP baseline, DVRPC has conducted a continuing series of field inspections and operations counts at RASP airports, beginning in 1986 and continuing through 1994. Although conditions at airports change with capital improvements, the economy, and other factors, DVRPC has established a baseline of operations levels and based aircraft which reflect a reasonable firsthand data basis for current long-range planning. Trends in the recent 10-year period show based aircraft and operations growth in the mid-1980s with a flattening, or slight decline, of growth in the early 1990s. Some of the growth at surviving airports is most likely due to consolidation of demand from airports that have closed, and not regional growth. Field inspections point to less recreational flying, while growth is occurring in commercial and business related trips.

Demand Forecast Methodology

After the base for general aviation operations and based aircraft had been established, DVRPC constructed detailed projections of employment and population by county for the Year 2020 in order to develop projections of aviation demand. Detailed projections were developed using census tracts and trends, as well as family composition expectations, to identify likely population growth and distribution. Employment growth by municipality followed, and these two indicators were summarized by county in order to establish subregional and regional employment and population estimates. Percentage growth by county of employment and population were then combined in a two to one ratio to arrive at demographic growth factors used to estimate future demand for based aircraft

and operations.

Similar growth factors were developed using other major airport studies. FAA 2005 TAF include all major regional business and reliever airports, and provide an indicator of growth. State system plans for New Jersey, Pennsylvania, and Delaware were examined, and contrasting growth factors for 2020 were determined. Finally, using DVRPC's existing counting program and field inspections from 1985 to 1994, an additional growth indicator was established. From these four growth factors, projections were averaged to arrive at regional total demand by state.

Regular quarterly review of the process and forecasts by the RAC provided input to update studies and data sources, and to temper projections with operating and industry based insights. The regional demand by state was divided among airports in the 2020 system on the basis of market areas defined by access travel times that will be described in detail later in this chapter. Specific demand by airport for basing facilities and operations was also adjusted to reflect the logistical realities of each airport's layout and management expectations, within the limits of regional totals already endorsed for the Year 2020. Detailed projections were developed using census tracts and trends, as well as family composition expectations to identify likely population or employment growth and distribution.

Population and Employment Forecast

Population and employment growth affect the volume of air traffic. Commercial passengers fly for business, personal, and vacation related travel objectives. Given expected increases in population and employment, related increases in commercial demand can be anticipated. Population and employment are also directly related to ownership and operation of business and recreational (personal) aircraft at general aviation and business airports. Using 1980 and 1990 Census data and previous trends in population and employment growth in the region, DVRPC estimated the annual and total growth rates for each county of the region between 1990 and 2020.

1. Population Forecast

Population forecasts for the DVRPC counties were initially developed using cohort-survival analysis. In this method, the population in different age and gender groups have different rates of survival into the next time period, and different rates of migration into or out of a particular county. In addition, the female population in different child-bearing age groups have different net birth rates. This technique begins with the 1990 Census of Population disaggregated into five-year age groups of males and females. Age-specific death rates are available for each cohort and age-specific birth rates are applied to females between the ages of 15 and 44 years. County-specific infant death rates are used. As the population ages forward in five-year

increments, births and deaths are calculated to determine the natural increase.

Migration is calculated for each five-year age cohort by examining the 1980 Census, the 1985 Census estimates and the 1990 Census. The difference between the expected natural increase and the Census counts is due to either in- or out-migration. Age-specific migration factors for each county are then introduced into the model.

The forecasting process begins by projecting each county's population forward, using current birth, death, and migration rates. These factors are then modified for each county based on changing trends, assumptions about future conditions, and considerations such as land availability for development and infrastructure changes, as well as market, social, and political forces.

For the DVRPC nine-county region, the population is expected to grow about 11 percent from 1990 to 2020, a thirty-year period, compared to 12.4 percent growth from 1960 to 1990 (Table V-2). This earlier period included a much higher birth

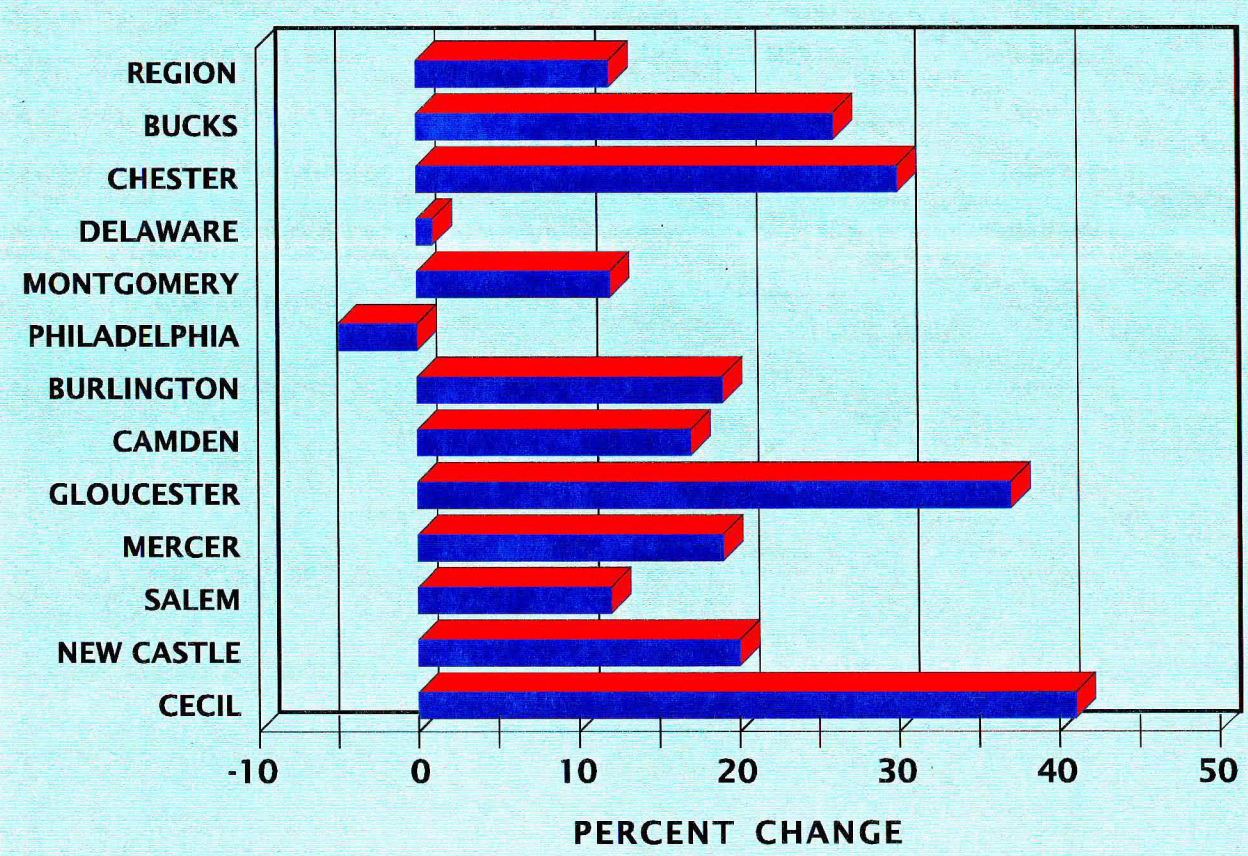
Table V-2
CURRENT AND FUTURE POPULATION OF THE DELAWARE VALLEY

County	1980	1990	Percent Change 1980-1990	2020	Percent Change 1990-2020
Bucks	479,180	541,174	12.9	680,896	25.8
Chester	361,660	376,396	18.9	489,300	30.0
Delaware	555,023	547,651	-1.3	548,981	0.2
Montgomery	643,377	678,111	5.4	759,070	11.9
Philadelphia	1,688,210	1,585,577	-6.1	1,509,154	-4.8
SUBTOTAL	**3,682,450**	**3,728,909**	**1.3**	**3,987,401**	**6.9**
Burlington	362,542	395,066	9.0	471,039	19.2
Camden	471,650	502,824	6.6	588,962	17.1
Gloucester	199,917	230,082	15.1	314,971	36.9
Mercer	307,863	325,824	5.8	388,452	19.2
SUBTOTAL	**1,341,972**	**1,453,796**	**8.3**	**1,763,425**	**21.3**
Salem, NJ	64,676	65,295	1.0	73,200	12.1
New Castle, DE	389,115	441,947	13.6	529,800	19.9
Cecil, MD	60,430	71,347	18.1	100,500	40.9
SUBTOTAL	**514,221**	**578,587**	**12.5**	**703,500**	**21.6**
TOTAL REGION	**5,538,643**	**5,761,292**	**4.0**	**6,454,325**	**12.0**

rate, a younger population, and a growing regional economy which encouraged in-migration. Given the slowdown in birth rates, the aging of the population and the migration patterns of the region, a decrease in future slowing of population growth can be expected.The remaining three counties

double the growth rate of the other nine counties (Figure V-1). Main reasons for this higher growth are the continued migration and expected developments, especially in Cecil County. These forecasts were based on existing data files from the Data Centers of New Jersey, Delaware and

Figure V-1
1990-2020 POPULATION CHANGE



of the region — Salem County, New Jersey, New Castle County, Delaware and Cecil County, Maryland — are expected to grow 21 percent from 1990 to 2020, almost

Maryland, and on county files from Cecil and New Castle counties.

Individual counties that can still expect

strong population growth include Bucks, Chester, Gloucester, and Cecil. Moderate growth is forecast for Camden, Montgomery, Mercer, and New Castle counties; and slow or no growth is foreseen for Delaware, Salem, and Philadelphia counties. Spatially, growth is projected to concentrate in areas that are currently rural or suburban and have very limited public transit service. This kind of spatial growth will subsequently create a new and higher demand for highway, transit, and aviation services.

2. Employment Forecast

Forecasting future employment is more difficult than predicting population growth, because of many factors that influence employment at the national, regional, and local levels. While population changes generally tend to be gradual and relatively predictable, employment may vary widely due to such broader forces as foreign trade, world economy, political or military conflicts, national monetary policies, demographic trends, and social forces. Local factors such as labor force availability, land prices, transportation networks, and local political climate also play an important role in determining employment levels.

In 1992, when DVRPC prepared regional and county employment forecasts, the Bureau of Economic Analysis (BEA) data was used, as it was the only available current county-level data for 1990. Existing national, state, and local forecasts were reviewed with a panel of economists. The resulting regional forecast then served as a guide for the county forecasts. Regional employment changes were forecast by decade to reflect expected economic cycles. The regional population forecasts identified labor force levels, which then served as a limit on future regional employment growth.

The 1990 employment data from the Census Transportation Planning Package (CTPP) became available in 1993[2]. These data supplemented the BEA county level employment with 1990 municipal employment estimates. The BEA was then adjusted at the county level to conform with BEA census totals, and reviewed for consistency with previous forecasts, occupational privilege tax returns, Dun and Bradstreet estimates, and Bureau of Labor Statistics ES-202 data (Table V-3).

Using the regional and county employment totals, sectoral distributions by major Standard Industrial Classification (SIC) codes for the region and counties were determined, based on a review of past trends and patterns both nationally and locally, an assessment of changing forces or conditions which would affect each sector, and a review of state and national sectoral forecasts.

The Maryland Data Center provided 1980 and 1990 data for Cecil County. The County Employment forecast for New

[2]1990 Census Transportation Package, *Statewide Element, Part c, Tabulations of Area of Residents by Area of Work*

Table V-3:
CURRENT AND FUTURE EMPLOYMENT OF THE DELAWARE VALLEY

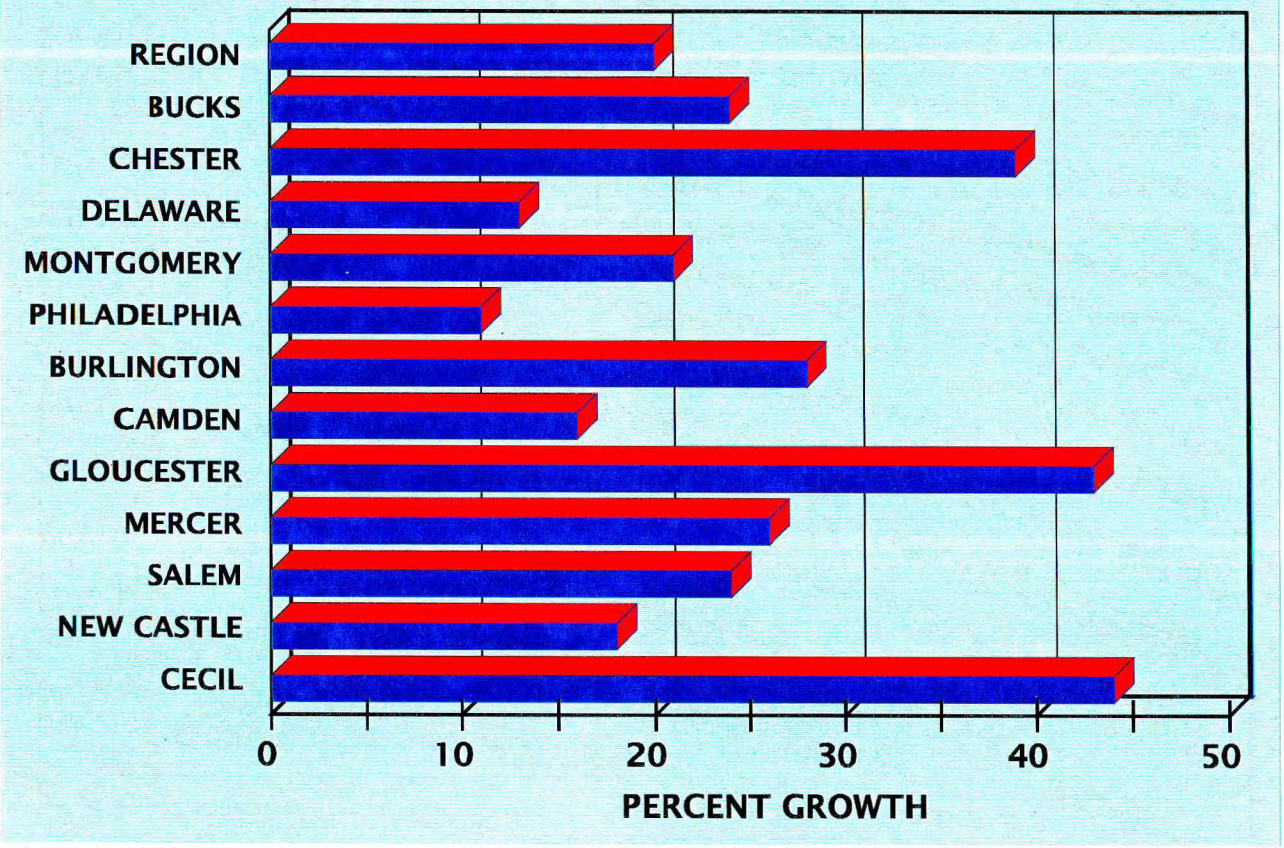
County	1980	1990	Percent Change 1980-1990	2020	Percent Change 1990-2020
Bucks	189,069	245,345	29.8	304,248	24.0
Chester	134,362	197,752	47.2	274,053	38.6
Delaware	197,818	230,459	16.5	259,345	12.5
Montgomery	360,399	457,500	26.9	554,550	21.2
Philadelphia	835,812	836,874	0.1	931,919	11.4
SUBTOTAL	**1,717,460**	**1,967,930**	**14.6**	**2,324,115**	**18.1**
Burlington	136,086	191,345	40.6	244,368	27.7
Camden	186,746	227,933	22.1	264,584	16.1
Gloucester	61,732	86,079	39.4	122,904	42.8
Mercer	180,116	220,592	22.5	277,247	25.7
SUBTOTAL	**564,680**	**725,949**	**28.6**	**909,103**	**25.2**
Salem, NJ	26,230	28,720	9.5	35,670	24.2
New Castle, DE	185,025	246,236	33.1	289,700	17.7
Cecil, MD	19,100	25,261	32.3	36,400	44.1
SUBTOTAL	**230,355**	**300,217**	**30.3**	**361,770**	**20.5**
TOTAL REGION	**2,512,495**	**2,994,096**	**19.2**	**3,594,988**	**20.1**

Castle County also includes the data for 2020. New Castle County prepared the data set in conjunction with and by the Delaware Population Consortium. The employment data for Salem and Cecil counties did not contain any forecasts for 2020. DVRPC staff prepared the 2020 forecast based on 1980 and 1990 data and trend.

The individual counties that are expected to show a strong growth in employment over the next 25 years are Chester, Mercer, Burlington, Gloucester, and Cecil. Moderate employment increases are forecast for Bucks, Montgomery, and Salem counties. Counties with a projected slow increase in employment are Philadelphia, Delaware, Camden and New Castle (Figure V-2).

With these data, which describe growth rates in population and employment by county, by state, and region, DVRPC

Figure V-2
1990-2020 EMPLOYMENT GROWTH



defined the growth rates to be applied to baseline operations and based aircraft data in estimating regional aviation demand.

The same exercise was done with ratesdeveloped by use of FAA and states' projections for commercial and non-commercial operations and based aircraft. In all cases where studies were used that had target projection years earlier than 2020, the annual growth rate from 1990 to that year, either 2005 or 2010, was determined. One-half of this annual rate was then used between that target year and 2020, to establish total growth reflected in the projections of each independent study. This provided for non-gradual growth in the period from 2005 or 2010 to 2020, which staff felt was appropriate since several of the projections of the other studies were based on booming growth experienced in the 1980s (Appendix B).

Tables V-4 and V-5 show the 2020 annual operations and based aircraft estimated based on the above assumptions. The 2020

Table V-4
CURRENT AND FUTURE ANNUAL OPERATIONS

Airports/ Heliports	Current Operations	2020 Annual Operations TAF	SASP	PHL ALP	Emp. Pop.	Average	2020 RASP
Commercial							
PA (PHL)	345,000	523,000	549,241	602,000	410,900	521,285	547,367
NJ (TTN)	4,000	12,000	8,380		4,976	8,452	8,452
WILMAPCO (NCCO)	2,600	6,500	2,990		3,142	4,210	4,210
TOTAL	**351,600**	**541,500**	**560,611**		**419,018**	**533,947**	**560,029**
Non-Commercial							
PA	631,441	1,267,124	963,824		764,668	958,538	863,000
NJ	421,834	843,687	788,004		608,386	746,692	598,000
WILMAPCO	225,006	363,135	350,128		293,568	335,610	300,000
TOTAL	**1,278,281**	**2,473,946**	**2,101,956**		**1,666,622**	**2,080,840**	**1,761,000**
Military							
PA (Willow Grove)	59,838						67,600
NJ (McGuire)	81,431						97,700
TOTAL	**141,269**						**165,300**
Heliport Operations							
TOTAL	**3,200**						**4,600**

RASP forecast data are generally lower than the average of the projections of previous studies (about 38 percent and 27 percent for non-commercial operations and based aircraft, respectively). In addition, these growth rates are higher than the growth in regional population or employment, but they are consistent with the growth rates at the county level. As described in Appendix B, the regional population and employment growth rates (12% and 20%, respectively) are not used to forecast demand for individual airports. For example, Salem, New Castle, and

Table V-5
CURRENT AND FUTURE BASED AIRCRAFT

Airports/ Heliports	Current Based Aircraft	2020 Based Aircraft Emp. Pop.	DVRPC	SASP	Average	2020 RASP
Civil Aviation Airports						
PA	1,239	1,577	1,740	1,535	1,617	1,550
NJ	707	971	893	940	935	930
WILMAPCO	383	444	630	500	524	470
TOTAL	**2,329**	**2,992**	**3,263**	**2,975**	**3,076**	**2,950**
Military Airports						
PA (Willow Grove)	202					220
NJ (McGuire)	92					110
TOTAL	**294**					**330**
Heliports						
TOTAL	**15**					**42**

Cecil County growth patterns rather than regional growth are used to forecast demand for New Castle County Airport. These County growth rates are much higher than the regional rates (12%, 41%, and 18% vs. 12% regional growth in population, and 20%, 24%, and 44% vs. 20% regional growth in employment).

Forecast of other Aviation Activities

Although many of the 2020 forecasts concentrate on projections of based aircraft and operations at non-commercial airports as a means of projecting system facility needs in the future, the plan also examines other activity forecasts that affect system demand and require facility modifications supplemental to traditional GA/business aviation traffic. These generators, including commercial enplanements, military traffic, heliports, and freight activity are briefly discussed below.

1. Commercial Enplanements

Given the significant growth projected for commercial operations at PHL, with some slight commercial use of Trenton-Mercer and New Castle County airports, the 1992 estimate of 8.1 million enplanements at PHL is forecast to increase to 12.3 million by 2010. When this level is projected to the year 2020, using the consistent assumption that growth will be halved in the 2010-2020 decade, enplanement level is expected to be approximately 14 million enplanements, or 28 million passengers per year. The anticipated growth rate percentage in the next 25 years for passengers exceeds that of aircraft operations because of the expected higher occupancy and better load factors of the commercial carriers during this period. Growth in commercial air traffic passengers using PHL will also be stimulated by the emerging eastern European and South American markets.

2. Air Freight

Although air transportation accounts for a minority segment of all freight movement world wide, more and more products are being shipped between the U.S. and foreign markets by air. In addition, the air freight market for parcels and overnight business materials is escalating.

In 1994 a consultant study, commissioned by PennDOT and DVRPC, analyzed the air freight market using PHL. The study indicates that freight movement through PHL is accomplished by both integrated (cargo only airlines) and commercial passenger airlines, in a ratio of approximately two to one. However, from 1982 to 1993, over 94 percent of the growth in air freight traffic has arisen from integrated carrier business. Although Philadelphia's volume of freight traffic is overshadowed by the New York airports, predominantly JFK, market conditions are advantageous for traffic growth at PHL.

From a national perspective, domestic demand is projected to grow at 5.3 percent per year to 2010, while international-U. S. demand will grow 7.2 percent per year. The largest international-U.S. markets are South and Central America, which could be served efficiently by PHL. Of all gateway (to international markets) airports, PHL currently ranks 24th in annual tonnage with 8,800. This low ranking is primarily caused by the dearth of international flights. Much of the traffic from products produced in Pennsylvania is trucked to New York airports and lost as PHL business. Still, PHL has demonstrated a total growth of freight traffic to about 170,000 tons per year. PHL's share of the northeast corridor freight market will increase by 2020, if certain international service features are implemented. Passenger widebody service to international destinations should be increased. Integrated carriers like Airborne and Roadway Global Package (RGP) should be induced to initiate hub operations at PHL, while UPS should expand.

The PHL airport physical design and current operational plan is adequate for the

expansion of freight activities. The new runway 8-26 will provide more operating flexibility to freight carriers; however, construction should be coordinated so as not to interfere with road access to UPS. Highway access on I-95 and I-76 are excellent, and warehouse capacity at Cargo City can accommodate freight expansion.

3. Military Airports

Three major military airfields are identified in the 2000 RASP, McGuire AFB in Burlington County, New Jersey; Willow Grove Naval Air Station in Montgomery County, Pennsylvania; and Warminster Naval Center in Bucks County, Pennsylvania. Over the last 12 years each facility has been proposed and studied for joint civilian-military use as a means of increasing suburban civilian capacity without building new airports in the region.

Military activities in the form of operations levels vary drastically at each facility. Warminster, traditionally a center for radar and materials testing, has always had a very low level of operations, about 8,000 per year to carry out its mission using a single 8,000 ft. runway. As a result of military reorganization and base closure decisions of Congress made in the early 1990s, most activities at Warminster have been reassigned and the runway is now closed.

Willow Grove has been and will remain a major aircraft operations and training facility in the Mid-Atlantic area for all assigned units, including Navy, Army, and Air Force reserve and active units. About 60,000 operations occur at the airport per year and these are controlled by the military ATC tower on site. In the mid-1980s operations levels were in the 70,000-90,000 range. Busy civilian airports including Wings and Doylestown are located nearby, and since the characteristics of military and typical civilian flights are not similar, airspace conflicts do occur; and accordingly all parties must work together to avoid overlapping flight paths. A small increase (13%) in annual operations is expected by 2020.

McGuire Air Force Base, the busiest of the three facilities with over 81,000 operations per year, increased its activity level as the result of military consolidation by absorbing training and material transport functions from other bases which have been closed. McGuire ATC not only operates the movements into and out of the Base, but provides ATC services for surrounding civilian airports, and also handles thru-East Coast civilian commercial traffic. A recent NJDOT commissioned study considered the viability of commercial use of McGuire and concluded that sufficient capacity exists for the near future at EWR, PHL, and ACY. It is expected that the level of operations at McGuire will increase to 98,000 by 2020 (Table V-4).

Although civilian use of any of the three military airports has all but been ruled out by local, state, and federal positions, and even though the 2020 RASP does not recommend joint use, anticipated changes in activity at these airports are important to

facility and airspace planning of civilian facilities. The closure of Warminster to air traffic has facilitated coordination at Willow Grove. Despite the increased military posture at McGuire, military projections indicate no significant growth in annual operations through 2020, however, activity can fluctuate heavily with military preparedness increases resulting from international crises.

4. Helicopter Operations

The 2000 RASP amended most recently in 1989, recommended that several helicopter facilities be included in the needed aviation infrastructure of the Delaware Valley. Public use heliports are recommended for the major urban centers of Philadelphia, Trenton, Camden, and Wilmington, as well as in high business activity suburban locations in Pennsylvania, such as King of Prussia, US 202 Corridor (West Chester), and PA 309/611 corridor (Horsham). Of these locations, only four are privately owned and operated heliports with helicopter service business. Given the unique service market and cost structure of helicopter users, the 2020 RASP acknowledges the role of heliports in the future provision of aviation services in the region. Helicopter usage in the region is predominantly VFR and operates usually in discrete airspace not compatible with fixed-wing aircraft. Operations levels and based aircraft demand are negligible in comparison with fixed-wing facilities. Although some helicopter operations occur at many airports, the advantages of vertical take-off and landing are most beneficial when operations occur near final business destinations at exclusive use heliport sites.

Since all currently operating heliport sites in the region are located in the Pennsylvania portion, the PA heliport system plan is the RASP's primary basis for estimating 2020 demand. At Penns Landing, Horsham Valley, Keystone — about 15 aircraft in total were based in 1988. The inventory of active helicopters based or located by county conducted by the state in 1986, showed 16 in Bucks County, 16 in Chester County, 4 in Delaware County, 14 in Montgomery, and 12 in Philadelphia, for a total of 62 in the region. The disparity of these figures suggests that many helicopters are either based at local airports instead of at heliports or based outside the region, even though registered to owners inside the region. Forecast of active helicopters by county to 2005 yields a total of 128 and extending that growth to year 2020 indicates a level of active helicopters associated with the five counties of 170. Assuming the ratio of total helicopters to helicopters based at regional airports, that existed in 1986 of 62 to 15, then the region can expect a maximum of 42 helicopters to be based at all heliport facilities in 2020 (Table V-5).

Operational levels at regional heliports are anticipated to grow from approximately 3,200 per year to 4,600 per year in 2020, based on ratios of operations/hours flown. Some helicopter operations are diverted from heliports to airports or concentrated where the helicopter is used (i.e., EMS

assignment) rather than their base locations. Since anticipated operational levels of 10-15 per day is insignificant compared to fixed wing facilities, the critical parameter for helicopter system design is storage capacity on the ground. With seven heliports and 42 aircraft expected to be based in the region, a design factor of six helicopters per heliport is anticipated, requiring some storage and ramp space at most heliports.

ALLOCATION OF 2020 REGIONAL DEMAND TO INDIVIDUAL AIRPORTS

Assignment of total regional aviation demand to specific facilities in 2020 is necessary in order to establish a program for facility improvement needs. Recognizing the critical importance of access travel time to each airport operating in 2020, DVRPC has established a thirty-minute ground travel time criterion for access trips to general aviation and reliever airports. Using current and future travel times on major links in the regional highway system, market access fitting this criterion were defined for all airports.

Airport Market Area

An airport market area is defined by the highway travel time or distance required by most users to reach the airport, and represents the land area from which an airport is expected to draw its primary business. Travel time is the primary factor which determines the size and shape of the market area. Previous studies have indicated that the majority of aircraft owners live or work within 30 minutes of the airport where they base their aircraft. The difference in functional classification of the regional airports is not the criteria the general aviation community uses to select airports to meet their needs. Travel time for ground access, as well as (for the long-term user) available storage and the type of storage, are the main criteria used in choosing an airport. Considering general aviation use, commercial, reliever and general aviation airports are assumed to attract customers with equal gravity.

Twenty-five airports included in the 2000 RASP and one additional airport, Camden County, are considered in the market area analysis. The market areas will also be used to develop recommendations for the preservation and possible expansion of existing facilities.

Regional Highway and Transit Systems

The Delaware Valley's transportation system is among the most comprehensive of any found in the nation. Virtually all types of transportation, both public and private, are currently represented within the region, including highways, transit, trucking facilities, ports, rail, air freight, and air passenger systems.

1. Highway System

The Delaware Valley highway system is a network of limited access facilities, arterial highways, secondary collector roads, and local streets, reflecting the different periods

of highway construction and the programs that have supported the system. The network, composed of layers from several preceding eras, provides access to virtually every developed land parcel in the region. This regional network comprises more than 8,000 miles of highway routes. The major highway facilities are listed below:

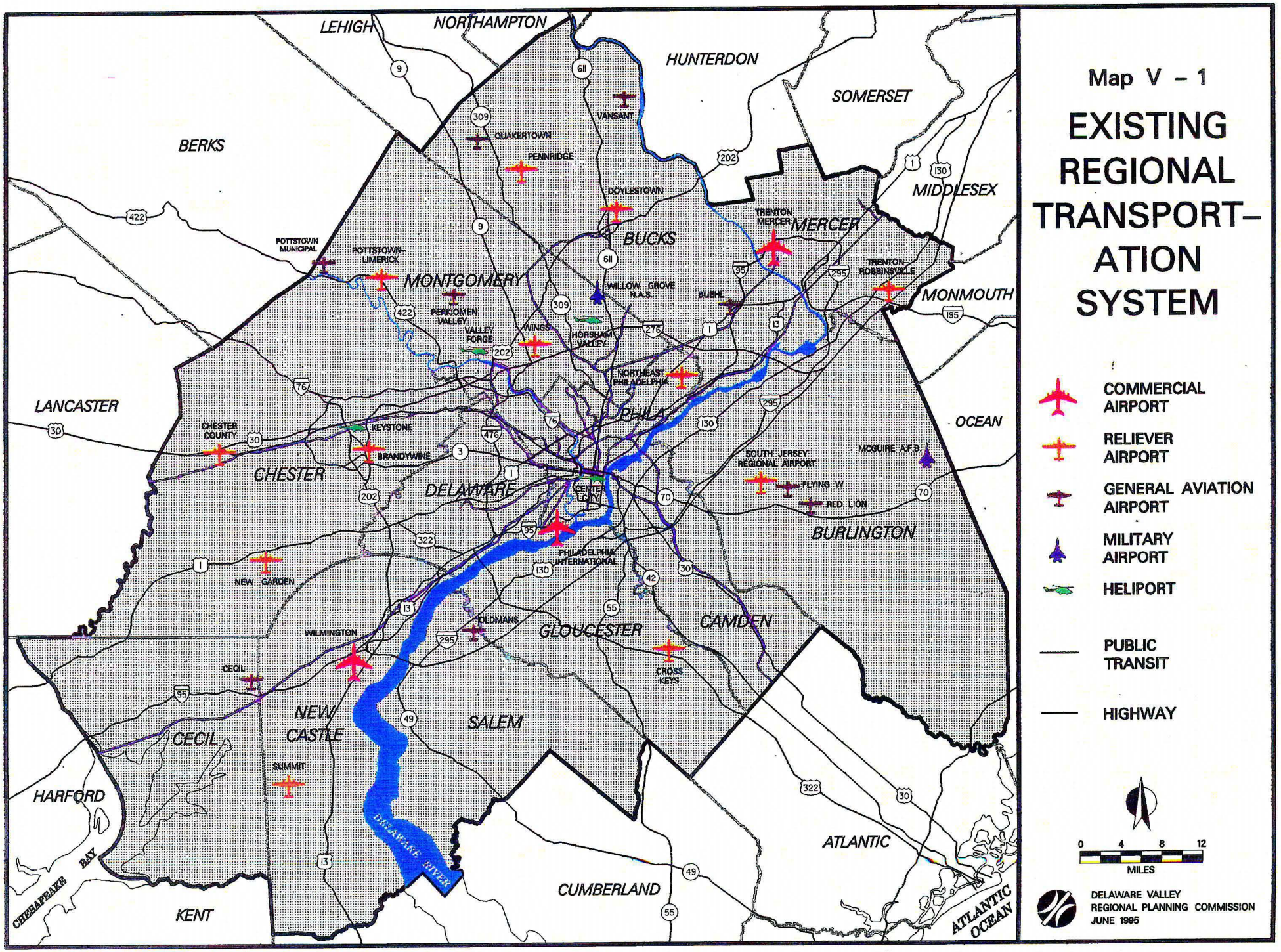
- Pennsylvania Turnpike (I-76 and I-276)
- Northeast Extension of the Pennsylvania Turnpike (PA 9)
- Schuylkill Expressway (I-76)
- Delaware Expressway (I-95)
- Mid-County Expressway (I-476)
- PA 309 Expressway
- US 202 Expressway
- Doylestown Bypass (US 202/PA 611)
- US 30 Bypass
- US 422 Expressway
- US 1
- US 13
- US 40
- New Jersey Turnpike
- I-295
- Atlantic City Expressway
- NJ 55 Freeway
- North-South Freeway (NJ 42)

The region's network of limited access highways does not cover all of the trunk corridors important to regional and interstate commerce. Some travel along these corridors is accommodated by arterial roadways that supplement the limited access highway network of this region. An arterial highway, characterized by its use and its design, is usually the main thoroughfare between the established centers of the region. It receives traffic from collector roads which provide the links between local streets and the arterial system (Map V-1).

2. Transit System

The transit service in the Delaware Valley is provided by various public agencies and private carriers. The Southeastern Pennsylvania Transportation Authority (SEPTA) operates public transportation in the Pennsylvania counties, maintaining one of the most diverse transit services in the nation. SEPTA service is augmented by local bus service in the Pottstown area provided by Pottstown Urban Transit (PUT). SEPTA provides almost all regional rail and public transit services to the Pennsylvania side of the region. There are three operating divisions within SEPTA, which offer different types of services in different areas of the region.

The City Transit Division is the largest division and provides numerous types of transit services. Two rapid transit lines, the Market-Frankford Subway/Elevated and the Broad Street Subway, serve as the foundation of this division's services. They are supplemented by five light rail, five trackless trolley and 74 bus routes,



Map V - 1

EXISTING REGIONAL TRANSPORT-ATION SYSTEM

- COMMERCIAL AIRPORT
- RELIEVER AIRPORT
- GENERAL AVIATION AIRPORT
- MILITARY AIRPORT
- HELIPORT
- PUBLIC TRANSIT
- HIGHWAY

0 4 8 12
MILES

DELAWARE VALLEY REGIONAL PLANNING COMMISSION
JUNE 1995

which handle an average of 610,000 linked trips on an average weekday[3].
In 1992, the Regional Rail Division operated commuter trains on a total route length of 264 miles and carried approximately 84,000 trips per weekday[4]. These lines are:

- R1: Center City Philadelphia - Philadelphia International Airport
- R2: Wilmington/Marcus Hook - Center City Philadelphia - Warminster
- R3: Elwyn - Center City Philadelphia - West Trenton
- R5: Parkesburg/Paoli - Center City Philadelphia - Lansdale/Doylestown
- R6: Norristown - Center City Philadelphia - Cynwyd
- R7: Trenton - Center City Philadelphia - Chestnut Hill East
- R8: Chestnut Hill West - Center City Philadelphia - Fox Chase

The construction of a new passenger line to PHL Airport was a major capital project, completed in 1985. It significantly expanded the utility of the rail system, enabling passengers to go directly to the airport from the closest regional rail station. Although the route took advantage of existing track for much of the way, the track had to be upgraded to passenger standards and supplied with overhead power for electric traction.

The NJ TRANSIT Corporation is the principal transit service provider in the South Jersey portion of the region and provides transit service across the Delaware River to Philadelphia. There are two divisions, each providing service to separate regions of the state: Southern Division and Rail Division.

NJ TRANSIT provides bus service for Burlington, Camden, Gloucester and Mercer counties, with additional direct service to Philadelphia and various shore destinations. NJ TRANSIT also provides commuter rail services between Philadelphia and Atlantic City, and between Trenton, Princeton, and New York. Additional rail transit service is provided between 16th and Locust streets in Center City Philadelphia and Lindenwold in Camden County by the Port Authority Transit Corporation (PATCO). This 14.2-mile line provides rail service 24 hours per day, seven days per week.

Amtrak operates intercity rail service from Philadelphia 30th Street Station and Trenton to points around the country. The most frequent service is offered along the Northeast Corridor between Washington, DC and New York City, and to Harrisburg. Amtrak service interfaces with SEPTA Regional Rail service at Ardmore,

[3] *SEPTA Ridership and Statistics Report*, Fiscal Year 1991, Southeastern Pennsylvania Transportation Authority, Philadelphia, PA, 1991, p. 19.

[4] Ibid., p. 37

Paoli, North Philadelphia, Trenton, Princeton Junction, and Wilmington, DE.

Delaware DOT is responsible for operating transit service in New Castle County, Delaware.

Market Area Delineation

Based on the DVRPC travel simulation model, highway travel time and distance were computed between each traffic analysis zone and all other zones in the region. This computation resulted in a highway travel time matrix which was then used to define the boundaries of the market area for each airport in the system. The process of defining market areas begins with a fully loaded and capacity-restrained highway network historical record; simulated volume, capacity, functional class, and area type for each link are passed to a theoretical curve that relates these link attributes to the operating speed. A new historical record is then created which contains the operating speed for each link. The final step for this procedure is to sum the link travel times over the most appropriate (highest restraining iteration) set of restrained-speed highway assignment paths. This procedure produces an inter-zonal set of highway travel times.

The Integraph system was then used to create market area maps for the years 1990 and 2020 from the computed link travel times between the DVRPC traffic analysis zones. Since the DVRPC zones are for the most part equivalent to census tracts, it was also possible to read census data into a data base linked to individual market areas. This provides the option to create various demographic analyses for each market area, but at this time, only population and employment figures are readily available. Excluded from this procedure are: Salem County, New Jersey; New Castle County, Delaware; and Cecil County, Maryland, since these counties are not included in the DVRPC computerized transportation system. Data bases for each of these counties were developed manually based on county and local data[5].

The results of this analysis are shown on Maps V-2 and V-3, which indicate that only a small area in the Delaware Valley region is not within a 30-minute highway travel time to an existing airport. These maps also show that some areas in the region are served by airports located outside the region. The 1990 and 2020 accessible areas within 30 minute travel time are similar since only Camden County Airport was added to the 1990 airport system for the 2020 RASP.

1990 and 2020 Airport Market Areas

The following is a brief description of the 1990 and 2020 market areas for all airports in the region. The market areas, in some cases, overlap, especially in the suburbs

[5]University of Delaware, *Population and Employment Forecast 1990 - 2020 (Draft)*
Cecil County Government, Office of Planning and Zoning, *Population and Employment Forecast 1990 - 2010*
1990 CTTP Data for Salem County (Forecasts not available).

Map V – 2

1990 AIRPORT MARKET AREAS

COMMERCIAL AIRPORT

RELIEVER AIRPORT

GENERAL AVIATION AIRPORT

AIRPORT MARKET AREA

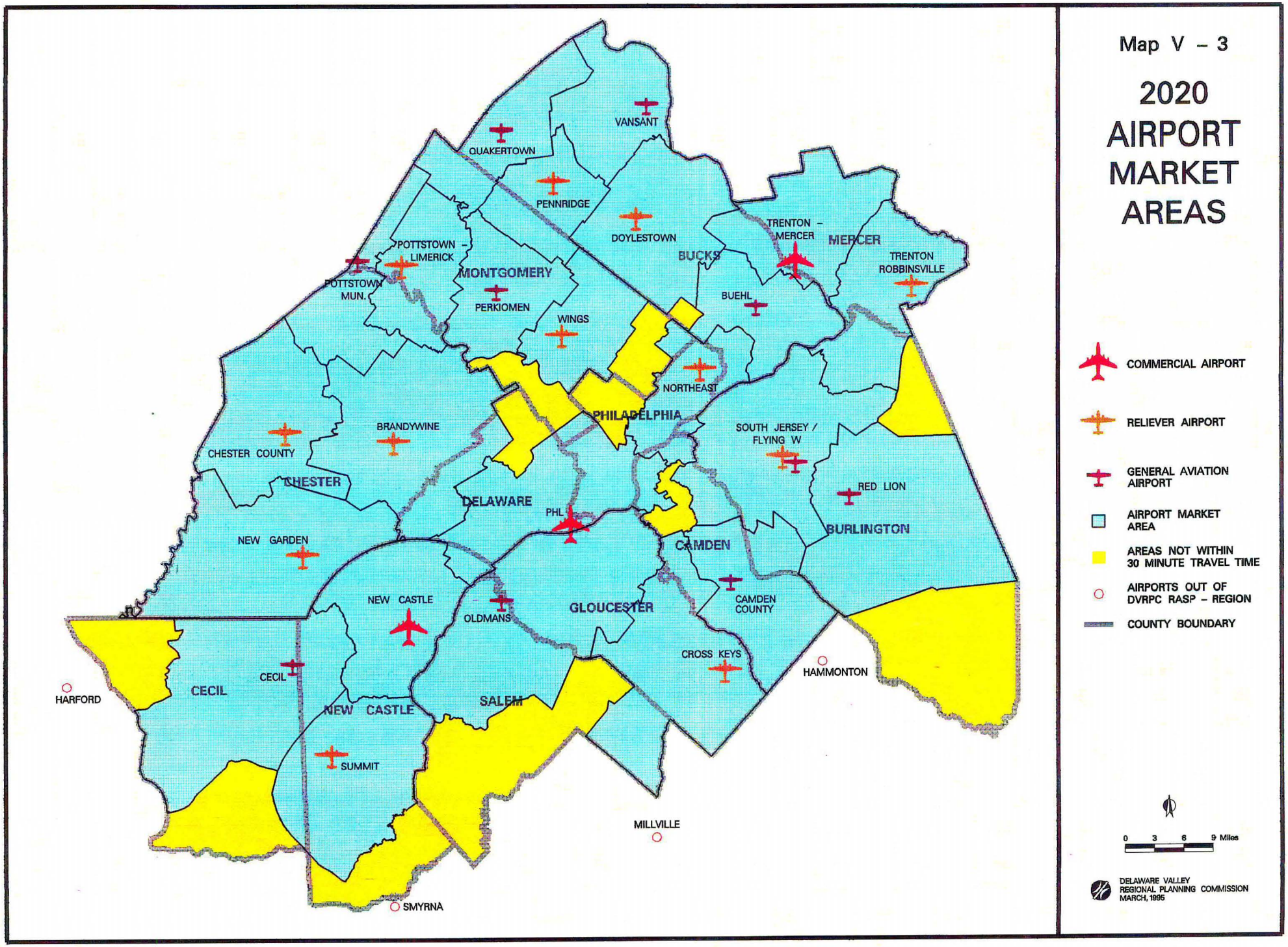
AREAS NOT WITHIN 30 MINUTE TRAVEL TIME

AIRPORTS OUT OF DVRPC RASP – REGION

COUNTY BOUNDARY

0 3 6 9 Miles

DELAWARE VALLEY REGIONAL PLANNING COMMISSION
MARCH, 1994


Map V - 3
2020
AIRPORT
MARKET
AREAS
VANSANT
QUAKERTOWN
PENNRIDGE
DOYLESTOWN
TRENTON - MERCER
MERCER
TRENTON ROBBINSVILLE
POTTSTOWN - LIMERICK
POTTSTOWN MUN.
MONTGOMERY
PERKIOMEN
WINGS
BUCKS
BUEHL
NORTHEAST
PHILADELPHIA
BRANDYWINE
CHESTER COUNTY
CHESTER
DELAWARE
PHL
SOUTH JERSEY / FLYING W
RED LION
BURLINGTON
CAMDEN
NEW GARDEN
NEW CASTLE
OLDMANS
GLOUCESTER
CAMDEN COUNTY
CROSS KEYS
HAMMONTON
HARFORD
CECIL
CECIL
NEW CASTLE
SALEM
SUMMIT
MILLVILLE
SMYRNA
COMMERCIAL AIRPORT
RELIEVER AIRPORT
GENERAL AVIATION AIRPORT
AIRPORT MARKET AREA
AREAS NOT WITHIN 30 MINUTE TRAVEL TIME
AIRPORTS OUT OF DVRPC RASP - REGION
COUNTY BOUNDARY
0 3 6 9 Miles
DELAWARE VALLEY REGIONAL PLANNING COMMISSION
MARCH, 1995

where airports are located not far away from each other, such as the northern part of Bucks County, the western part of Montgomery County, and the central part of Burlington County.

Philadelphia International Airport

This commercial facility is easily accessible by auto via I-95 and I-476, and is also served by SEPTA regional rail (R1), bus (Route 37), limousine, and taxi. In addition to its general aviation and international operations, PHL is the largest cargo hub airport in the region. The PHL market area for general aviation users covers the southern portion of the City of Philadelphia and Delaware County, and reaches into northeast New Castle County, Delaware and northwest Camden County, New Jersey. The Delaware River defines the southern border along the counties of Gloucester and Salem. The high level of highway traffic congestion limits further service to the north. The Delaware River limits free access into New Jersey to three bridges. The 2020 market area for PHL decreases only slightly in Delaware County and the northeast portion of the City of Philadelphia.

Northeast Philadelphia Airport

This airport is located along US 1 and Grant Avenue in the northeast section of the City of Philadelphia. The airport market area extends beyond the city's boundaries in three different locations. It serves Bensalem Township in Bucks County, Lower Moreland and about half of Bryn Athyn Borough in Montgomery County, Pennsauken in Camden County, and Riverton and Palmyra in Burlington County. The year 2020 market area is not expected to change much from its 1990 market.

Oldmans Airport

This airport serves a relatively large area, and is located directly off I-295. Without immediate competition from other RASP facilities, it covers northern Salem County, western Gloucester County, and western Camden County along the Delaware River. Although its 1990 market is large in size, the airport has not been able to take advantage of its potential. The 2020 market area remains virtually the same.

New Castle County Airport

This airport serves northern New Castle County and enjoys good highway accessibility. I-95 and I-295, linking the airport with Pennsylvania and New Jersey, respectively, run along the north side of the airport. US 301/US 40/US 13 feed the airport entrance, and US 202/DE 141 runs along the northeast boundary of the property. Delaware Area Regional Transit (DART) bus Routes 22 and 25 serve the airport along the DuPont Highway. Taxi and limo service are also available. New Castle Airport is a smaller, but significant cargo hub for the region. Since major changes in the transportation system for this area over the next 25 years are not expected, the 2020 market is identical to the 1990 market.

Summit Airport

Summit Airport serves the central and southern portions of New Castle County, Delaware. The airport is served by DE 896 and US 301, and provides a wide variety of services, to its market area, which is relatively rural. Taxi service is also available. No new major roadways or improvements are planned over the next 25 years. Therefore, the market area will remain the same in the Year 2020.

Cecil County Airpark

This airport provides service for most of Cecil County, and reaches into the western part of New Castle County. The market area remains the same in 2020 as in 1990 for the same reasons stated above for the New Castle County and Summit airports. Taxi service is available at Cecil County Airpark. A master plan study for the development of the airport was completed and two site alternatives were presented to the owner and the County for selection. Unfortunately the airport has been sold recently, and future aviation availability is unlikely.

New Garden Airfield

The market area for New Garden Airfield is north of the Cecil County market, along the Pennsylvania and Maryland border. Without any direct competition from other airports, the New Garden Airfield serves most of southern Chester County. US 1 to the north, Baltimore Pike and PA 41 to the south and southwest provide the airport with fairly adequate access. No changes are expected to occur between the 1990 and 2020 market areas.

Chester County, Shannon, and Brandywine Airports

The market areas of Chester County, Shannon, and Brandywine cover the central portion and most of the northern parts of Chester County in 1990. Chester County and Brandywine provide taxi service at their facilities. The Brandywine market area reaches far into western Delaware County, where it borders the PHL market area. Major access routes are US 202 and PA 100 to the west and US 322 along the southern side of the airport. Chester County Airport and Shannon Airport are served by the US 30 bypass and US 30 Business, respectively. Flanked by Chester County and Brandywine airports, Shannon is in close proximity, and therefore its market area is relatively small. Chester County Airport covers the western Chester County area and also extends into Lancaster County.

In 1992, Shannon Airport closed its gates and is not expected to reopen as a general aviation airport in the near future. For this reason, the 2020 market areas are developed without Shannon. However, the two remaining airports in the area, will serve the Shannon market entirely. The Brandywine market area will extend to more than half of the Shannon market.

Pottstown Municipal and Pottstown-Limerick Airports

These two airports in Montgomery County serve mainly the western side of the County, as well as the northern part of Chester County. The Pottstown-Limerick Airport east of Pottstown is easily accessible from US 422. Bordering Berks County, the Pottstown Municipal Airport is also served by US 422 and PA 100. Both airports offer taxi, limo, and local bus service. The 1990 and 2020 market areas for Pottstown Municipal Airport remain equal in size. The Pottstown-Limerick Airport market gains the land area of half Norriton Township in the 2020 distribution of market areas.

Perkiomen Valley Airport

The airport serves most of central Montgomery County, but accessibility is limited, with PA 113 providing the principle access. Taxi and limo service is available. Between 1990 and 2020 the airport's market area loses Phoenixville Borough to the Pottstown-Limerick Airport.

Wings Field Airport

The airport market covers most of eastern Montgomery County, but highway congestion levels have reduced the market area for Wings below that for most airports. However, plans for a runway extension to accommodate larger corporate jet aircraft, will affect the market positively. Taxi service is available. Wings 2020 market area is expected to shrink by half the size of Norriton.

Quakertown, Van Sant, Doylestown, Pennridge, and Buehl Field Airports

Bucks County is served predominantly by five airports. The far northwest corner of the County is covered by the Quakertown Airport. This market reaches into the northwestern portion of Montgomery County. The airport is accessible via PA 309 to the east and PA 663 to the north. The Quakertown interchange on the Northeast Extension of the Pennsylvania Turnpike (PA9) is less than three miles away. Taxi service is available. The airport's market is expected to lose Greenlane between 1990 and 2020.

The Van Sant Airport market area is adjacent to Quakertown and Doylestown market areas, and serves most of the municipalities in northeastern Bucks County. The airport is in a rural setting, and only accessible over local roads. Its competitiveness is reduced by a turf runway as well as its predominantly recreational activities. All operations are strongly weather dependent. No changes are expected between 1990 and 2020 market areas.

Doylestown Airport serves central Bucks County and is located along PA 611 and PA 313. Taxi service is available. Major competitors are Pennridge, Perkiomen Valley, Wings and Buehl airports. The 1990 market remains consistent with the 2020 market according to the results of the

simulation of ground access times.

Pennridge Airport is located northwest of Doylestown with its principal highway access limited to PA 563 (Ridge Road). This limited access and the proximity of other airports, are the reasons for its small market area. No changes in the market area configurations are expected by the year 2020.

The market area of Buehl Field covers southeastern Bucks County. I-95 and US 1, both to the south of the airport provide excellent ground access. Taxi service is available. Surrounding business centers could provide good user potential, but lack of local funding and federal commitment have hindered the development of this privately owned facility. The airport market is expected to gain a little ground from the Trenton-Mercer market area in the year 2020.

Trenton-Mercer and Trenton-Robbinsville Airports

Trenton-Mercer and Trenton-Robbinsville market areas divide Mercer County evenly. Good access via I-95 to Trenton-Mercer extends its potential market area beyond the Delaware River into Bucks County. Besides taxi and limo service, the airport is served by NJ TRANSIT buses. Trenton-Mercer also is the location of a cargo hub. The Trenton-Robbinsville market area extends into northern Burlington County. Surrounded by an extensive highway system such as the New Jersey Turnpike and I-195 to the south, as well as County Route 526 to the southwest and US 130 and NJ 33 to the northwest, Trenton-Robbinsville provides a vital cornerstone in the Rasp 2020. Taxi service is available. Basically, the airport market is expected to remain in its 1990 configuration, except for a portion of Florence Township. However, the Trenton-Mercer market loses some area in Bucks County to the Buehl market in the year 2020.

South Jersey Regional and Flying W Airports

Because of their proximity, South Jersey Regional and Flying W share one market area. The market covers most of north Burlington County and a small north-eastern portion of Camden County. Both airports are accessible via County Routes 612 and 541. Taxi and limo service is available for airports patrons. The market area is expected to change slightly between 1990 and 2020, since Camden County Airport is included in the 2020 RASP.

Red Lion Airport

This airport, which is not far from the previous two, serves central Burlington County. County Route 641 feeds the airport and NJ 70 and US 206 pass by to the south and east, respectively. Taxi service is available. Changes between the 1990 and 2020 market areas are not expected.

Cross Keys Airport and Camden County Airport

Southern Gloucester County and Camden County are served by Cross Keys Airport which is located in Gloucester County. Access is available via County Route 555 directly, and NJ 42 and US 322 bypass which pass close by. Taxi and limo services are available, and a bus stop is located nearby. However, this market is severely impacted with the inclusion of Camden County Airport in the 2020 RASP. In the 2020 Plan the Camden County market covers the southern portion of Camden County and parts of the former South Jersey Regional/Flying W market areas in eastern Burlington County.

Areas not Served by the 1990 or 2020 Regional Airport Systems

A look at the 1990 airport market areas shown in Map V-2 indicates that not all areas of the region are accessible to airports within a 30-minute ground access travel time. There are five areas that show insufficient service within the market area definition. The first area is located mainly to the north of PHL and includes portions of Delaware County, Montgomery County, and North Philadelphia. Because of high airspace congestion and dense residential and business development, a recommendation for a new airport is not advised. Instead, expansion of storage capacity and improvement of ground access to adjacent airports in the area is recommended in the 2020 RASP.

The analysis of the New Jersey portion of the region indicates a lack of service in eastern Camden County, which is also a highly populated and expanding area. An additional airport in the vicinity is recommended. Two other areas are located in northeastern Burlington County. One basically reflects the site of McGuire Airforce Base, the other is located in the south, reflecting a low density and predominantly wooded area. Both of these areas appear not to be impacted significantly by the 2020 RASP. Southern Salem County, southern New Castle County, and the southern and northwestern areas of Cecil County are not served by the RASP within a 30 minute travel time. However, the following nearby non RASP facilities provide service: Hammonton and Millville airports in New Jersey, Smyrna Airport in Delaware, and Harford Airport in Maryland.

2020 Market Areas for the Worst Case Scenario

Map V-4 shows the 2020 market areas for the Worst Case Scenario, which excludes airports that are not publicly owned and not receiving federal funds, and have experienced financial or operational instability in the past. This will leave the regional system with only 13 airports, which will not serve the region adequately, especially along its southern perimeter. The airports included in this scenario are: Philadelphia International, Northeast Philadelphia, New Garden, Chester County, Pottstown Municipal, Pottstown-Limerick, Quakertown, Pennridge,

Doylestown, Trenton-Mercer, South Jersey Regional, New Castle County, and Summit. Although the regional aviation demand can be handled by the remaining airports with appropriate runway extensions or other improvements in this scenario, problems will arise with respect to storage capacity, as well as with the ability for most of the airport users to reach an airport within the 30 minute travel time. The area not served in the region's center by the 2020 recommended system, has increased drastically, primarily because of, the loss of airports including Brandywine, Perkiomen Valley, Wings, and Buehl. At the same time, the market areas of the remaining airports were expanded to their full 30-minute travel time limits, which were set as the standard at the beginning of this analysis.

The changes in the market areas by municipality are documented in Appendix C which also shows the boundaries of municipalities and census tracts in each of the DVRPC 12 counties.

2020 Operations and Based Aircraft by Airport

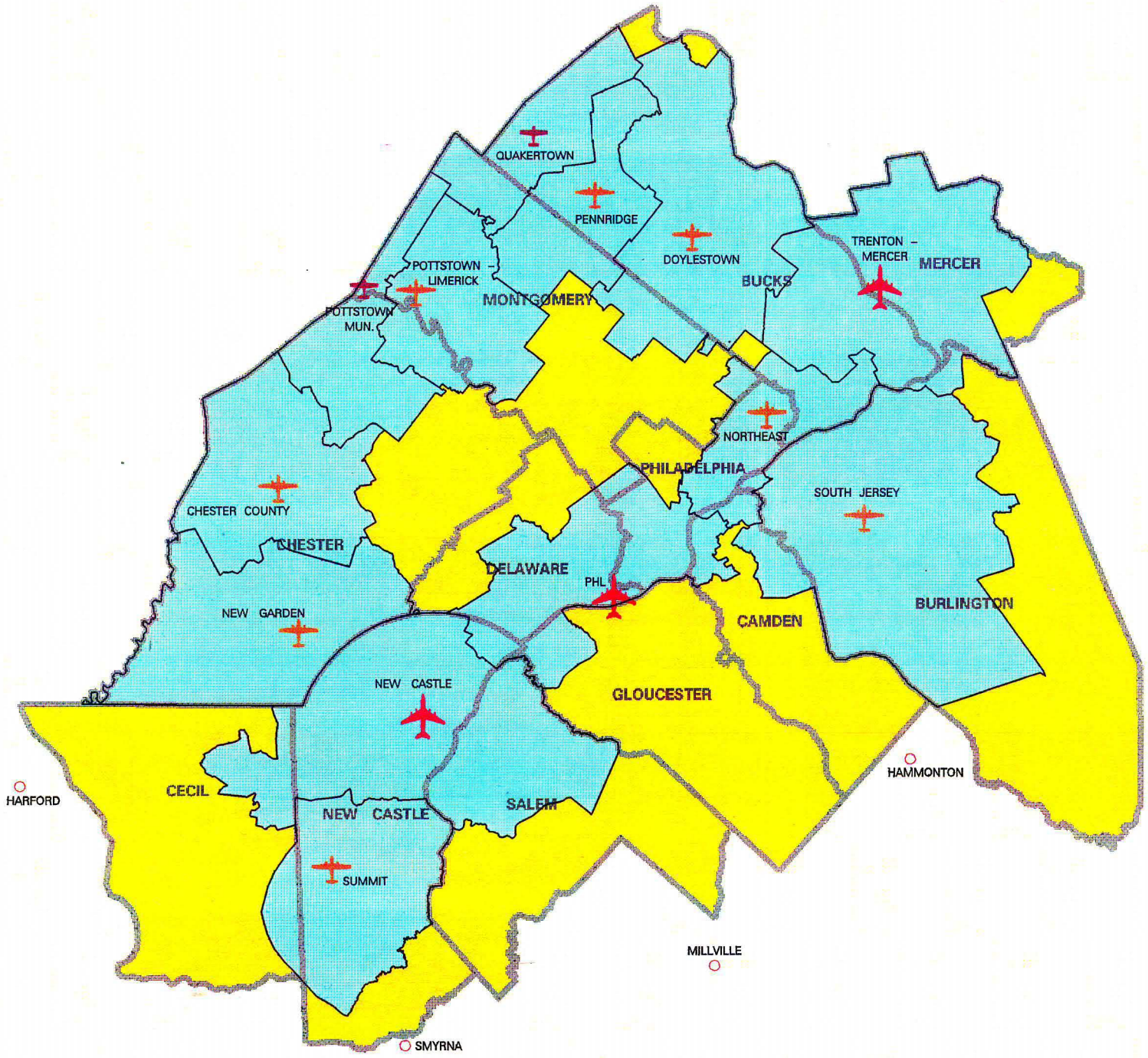
With the market areas defined, DVRPC assigned a portion of each state's total 2020 demand for operations and based aircraft to each specific airport in a multistep process. Several iterations were developed which generally adhered to the following sequence.

The first step in the allocation of 2020 regional non-commercial annual operations and based aircraft to individual airports was based on 1990 and 2020 population and employment percentage by market areas. The 2020 market area population/ employment percentages of the forecasted regional total were multiplied by the current annual non-commercial operations/ based aircraft. In the next calculation, a weighted average for 1990 and 2020 was produced by weighting employment 2 to 1 over population. In the third step the population/employment growth between 1990 and 2020 were accounted for by dividing the current airport operations by the 1990 weighted average for each airport and then multiplying the results by the 2020 weighted average. These results represented a first adjustment of the 2020 demand forecast for annual operations and based aircraft at each RASP airport.

A second adjustment to the state and regional totals was then necessary in order to conform with the base totals previously adopted by the RAC. A third adjustment accounted for the closure of Shannon Airport earlier in 1994 and the inclusion of Camden County Airport. All annual operations and current based aircraft from Shannon were distributed to seven nearby airports within two rings. Ring one received two-thirds of all based aircraft and operations and the wider ring two, containing four of the seven airports, received one-third of all based aircraft and operations from Shannon Airport. Finally, staff considered other factors which will influence the future developments of the regional airports. These include:

Map V – 4

2020 AIRPORT MARKET AREAS FOR WORST CASE SCENARIO



COMMERCIAL AIRPORT

RELIEVER AIRPORT

GENERAL AVIATION AIRPORT

AIRPORT MARKET AREA

AREAS NOT WITHIN 30 MINUTE TRAVEL TIME

AIRPORTS OUT OF DVRPC RASP – REGION

COUNTY BOUNDARY

0 3 6 9 Miles

DELAWARE VALLEY REGIONAL PLANNING COMMISSION
JULY, 1994

- Geographical location
- Relation with local government
- Physical layout and potential for expansion
- Approach minimums and airspace conflict or congestion potential
- Ground access options
- Type of airport, business v. recreational
- Master Plan and management perspective

An example of the use of these criteria to assign demand is provided in Appendix B. In addition, staff examined 1994 traffic counts taken by DVRPC at eight regional non-towered airports and two traffic counts received from the towers of New Castle County and Trenton-Mercer airports. A downturn was apparent in general aviation operations between 1990 and 1994 at most airports. When coupled with the other sources used to predict trends in general aviation demand, the effect was to reduce total operations at all airports by about 5 percent.

Tables V-6 and V-7 show the current and 2020 aviation demand for the recommended 2020 RASP. Airports included in the system are all existing RASP facilities with the exception of Camden County Airport. All new demand, both operations and based aircraft can be accommodated at these RASP airports.

Given the high percentage of privately owned airports in the 2020 RASP (68%), and the trend from 1980 to 1995 of private airport closures, the RASP also examined the effect of airport closures and limitation on total storage system capacity in the future at the remaining airports. As mentioned before, staff has identified those facilities which through public ownership or acceptance of FAA grant assurances were likely to be in continuous operation through 2020 in a "Worst Case" scenario of closure or redevelopment of other airports to non-aviation uses. In that case, 2020 total demand is assigned to remaining airports to their limit of storage or operating capacity, given maximum land acquisition potential. Not all projected demand can be accommodated in the region under this scenario and growth from the present to 2020 is reduced by 13 percent in operations and 19 percent in based aircraft, reflecting the extreme shortage of storage space and long average access times to remaining airports, which will drive aircraft owners/operators out of the region.

The anticipated demand of operations and based aircraft in this worst case scenario is shown in Table V-8.

SUMMARY OF FORECAST DATA

As indicated in Tables V-6, V-7, and V-8, the region expects growth in aviation in the next twenty-five years in commercial operations and passengers, non-commercial operations, and based aircraft. These three items are now summarized individually.

Table V-6
CURRENT AND FUTURE ANNUAL OPERATIONS BY AIRPORT

Type of Operations	Current Operations	2020 RASP	Difference Absolute	Difference Percent
Commercial				
Philadelphia (PHL)	345,000	547,367	202,367	59 %
Trenton-Mercer	4,000	8,452	4,452	111 %
New Castle Co.	2,600	4,210	1,610	62 %
TOTAL	**351,600**	**560,029**	**208,429**	**59 %**
Non-Commercial				
Brandywine	35,495	45,000	9,505	27 %
Buehl	6,888	35,000	28,112	408 %
Chester Co.	36,680	70,000	33,320	91 %
Doylestown	41,272	85,000	43,728	106 %
New Garden	34,801	45,000	10,199	29 %
Northeast Philadelphia	182,244	200,000	17,756	10 %
Pennridge	29,700	40,000	10,300	35 %
Perkiomen Valley	40,412	45,000	4,588	11 %
Philadelphia International	70,000	80,000	10,000	14 %
Pottstown-Limerick	40,275	55,000	14,725	37 %
Pottstown Municipal	35,591	43,000	7,409	21 %
Quakertown	31,747	45,000	13,253	42 %
Vansant	12,000	20,000	8,000	67 %
Wings	34,336	55,000	20,664	60 %
Pennsylvania	**661,441**	**863,000**	**231,559**	**37 %**
Camden Co.	20,328	28,000	7,672	38 %
Cross Keys	40,363	65,000	24,637	61 %
Flying W	55,020	70,000	14,980	27 %
Oldmans	13,843	35,000	21,157	153 %
Red Lion	15,187	30,000	14,813	98 %
South Jersey Regional	58,159	100,000	41,841	72 %
Trenton Mercer	146,101	196,000	50,899	34 %
Trenton-Robbinsville	72,833	74,000	1167	2 %
New Jersey	**421,834**	**598,000**	**176,166**	**42 %**
Cecil	5,523	20,000	14,477	262 %
New Castle	154,186	185,000	30,814	20 %
Summit	65,297	95,000	29,703	45 %
Wilmapco	**238,849**	**300,000**	**74,994**	**33 %**
TOTAL	**1,278,281**	**1,761,000**	**482,719**	**38 %**
Military				
PA (Willow Grove)	59,838	67,600	7,762	13 %
NJ (McGuire)	81,431	97,700	16,269	20 %
TOTAL	**141,269**	**165,300**	**24,031**	**17 %**
Heliport Operations				
TOTAL	**3,200**	**4,600**	**1,400**	**44 %**
GRAND TOTAL	**1,774,350**	**2,490,929**	**716,579**	**40 %**

Table V-7
CURRENT AND FUTURE BASED AIRCRAFT BY AIRPORT

Airport/ Heliport	Current Based Aircraft	2020 Based Aircraft	Difference Absolute	Difference Percent
Civil Aviation Airports				
Brandywine	79	100	21	27 %
Buehl	36	50	14	39 %
Chester Co.	153	190	37	24 %
Doylestown	128	170	42	33 %
New Garden	98	125	27	28 %
Northeast Philadelphia	218	245	27	12 %
Pennridge	55	85	30	55 %
Perkiomen Valley	95	105	10	11 %
Philadelphia Int.	50	50	0	0 %
Pottstown-Limerick	70	100	30	43 %
Pottstown Municipal	56	65	9	16 %
Quakertown	72	90	18	25 %
Vansant	35	45	10	29 %
Wings	94	130	36	38 %
Pennsylvania	**1239**	**1550**	**311**	**25 %**
Camden Co.	30	40	10	33 %
Cross Keys	75	130	55	73 %
Flying W	105	120	15	14 %
Oldmans	38	50	12	32 %
Red Lion	70	80	10	14 %
South Jersey Regional	186	220	34	18 %
Trenton-Mercer	158	190	40	27 %
Trenton-Robbinsville	45	100	55	122 %
New Jersey	**707**	**930**	**231**	**33 %**
Cecil	30	50	20	67 %
New Castle	253	290	37	15 %
Summit	100	130	30	30 %
Wilmapco	**383**	**470**	**87**	**23 %**
TOTAL	**2,329**	**2,950**	**629**	**27 %**
Military Airports				
PA (Willow Grove)	202	220	18	9 %
NJ (McGuire)	92	110	18	20 %
TOTAL	**294**	**330**	**36**	**12 %**
Heliports				
TOTAL	**15**	**42**	**27**	**180 %**
GRAND TOTAL	**2,638**	**3,322**	**692**	**26 %**

Table V-8
CURRENT AND FUTURE OPERATIONS AND BASED AIRCRAFT FOR THE 2020 WORST CASE SCENARIO BY AIRPORT

Airport	Current Operations	2020 Operations	Current Based Aircraft	2020 Based Aircraft
Northeast	182,244	220,000	218	270
Philadelphia International	70,000	90,000	50	60
Chester County	36,680	90,000	153	320
New Garden	34,801	60,000	98	150
Pottstown- Limerick	40,275	90,000	70	200
Pottstown Municipal	35,591	60,000	56	90
Pennridge	29,700	50,000	55	90
Quakertown	31,747	50,000	72	100
Doylestown	41,272	100,000	128	250
Pennsylvania Subtotal	**502,310**	**810,000**	**900**	**1540**
Trenton-Mercer	146,101	285,000	158	240
South Jersey Regional	58,159	145,000	186	240
New Jersey Subtotal	**204,260**	**430,000**	**344**	**480**
New Castle	154,186	200,000	253	290
Summit	65,297	100,000	100	130
Wilmapco Subtotal	**219,483**	**300,000**	**353**	**420**
TOTAL	**926,053**	**1,540,000**	**1597**	**2430**

Commercial Flights and Passengers

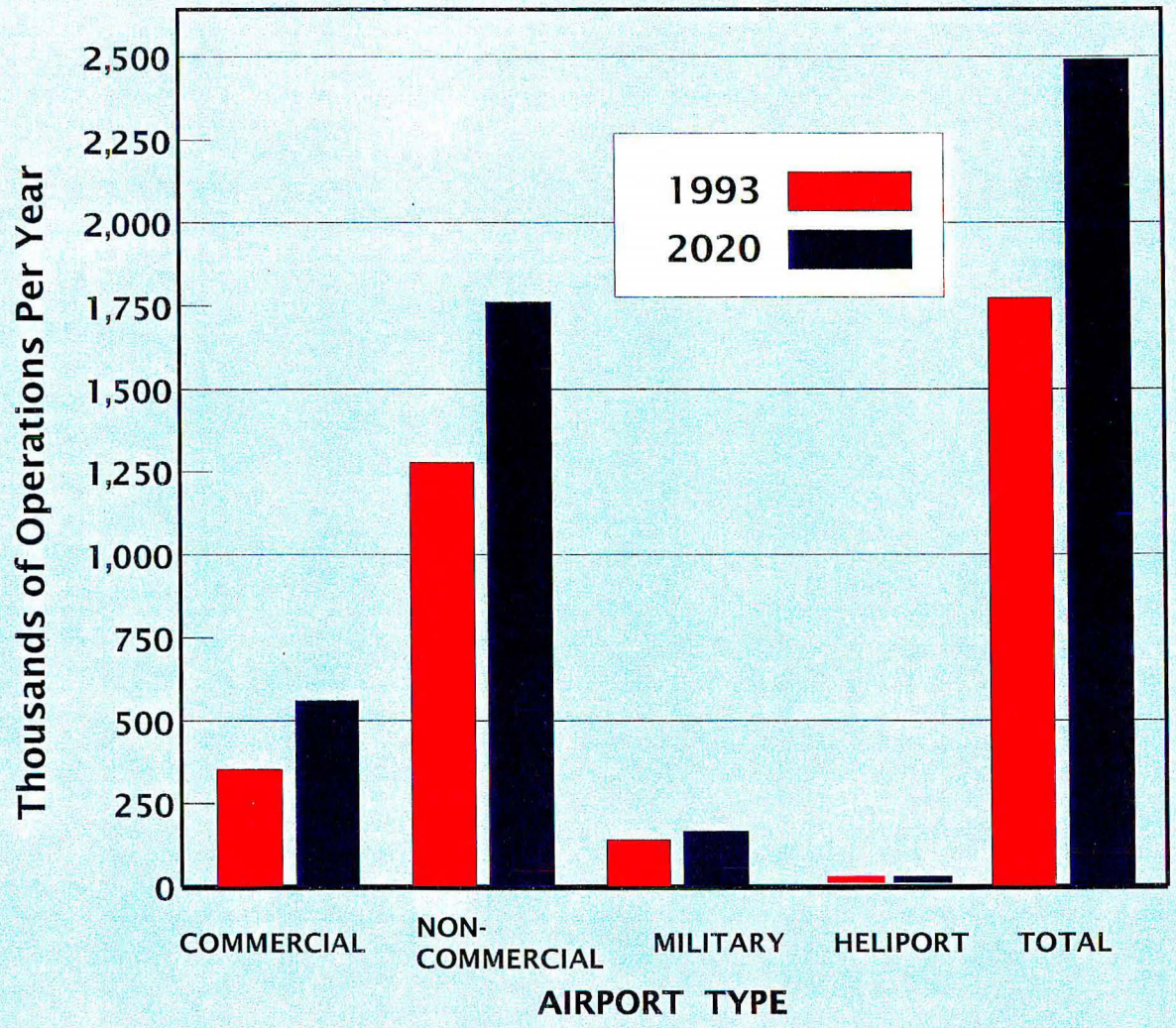
Significant growth in commercial operations (59%), is expected between 1993 and 2020 at PHL. Commercial enplanements is expected to increase from 8.1 million in 1992 to 14.0 million in 2020. Although New Castle County and Trenton-Mercer airports have sporadic commercial service, volumes of passengers at these airports will not be significant even with growth. In the "Worst Case" scenario,

where half of the region's non-commercial service airports close, passenger demand for commercial service at PHL will grow at a rate analogous to the full system. Based aircraft will not significantly increase at PHL since it will not take on the role of a general aviation center, unlike New Castle County and Trenton-Mercer airports.

Non-Commercial Operations

Annual operations at non-commercial airports will grow about 38 percent in the next 25 years. Highest growth rates will be experienced at those airports in busy suburban settings which are currently underutilized, such as Buehl, Chester

Figure V-3
CURRENT AND FUTURE ANNUAL OPERATIONS



County, Doylestown, Oldmans, and Cecil County. Activity will increase only slightly at McGuire and Willow Grove,since civilian traffic will not use these military airports. Expected growth in non-commercial operations is 37 percent in Pennsylvania, 42 percent in New Jersey, and 33 percent in Delaware. The highest levels of operation occur at those airports with the most storage capacity and located in the most densely developed suburbs. As shown in Figure V-3, military operations are expected to increase from 141,000 in 1993 to 165,000 in 2020, a growth of about 17 percent. The increases in heliport operations are relatively insignificant (1,400).

In the "Worst Case" scenario, operations will increase drastically at the suburban airports not closed, but regional non-commercial operations will be reduced by 13 percent because of the loss of based aircraft and airport capacity.

Based Aircraft

Civilian based aircraft growth is expected to be 26 percent over current levels in the preferred system scenario or 2020 RASP, and only 3 percent in the "Worst Case" scenario, where lack of storage capacity and longer access times will drive travelers out of airports and aircraft out of the region. Growth in based aircraft at specific airports varies from zero to 122 percent based on current utilization, available real estate to expand hangar storage capacity, and location relative to the business and residential centers of the region. □

VI. 2020 REGIONAL AIRPORT SYSTEM PLAN

In the previous five chapters, the aviation system and infrastructure in the Delaware Valley have been described in detail. Issues that relate to infrastructure, economic and marketplace policy, operating procedures, and legislation have been identified. Regional and state level forecasts of aviation activity, including passenger volumes, operations, and based aircraft, were developed using a wide range of forecast perspectives, including master plans, state system plans, and FAA projections. The latter projections were then compared to the region's own aviation trend experience, and also matched against demographic projections of population and employment growth to 2020. Finally, these regional totals were divided among or assigned to individual airports in order to identify future infrastructure deficiencies and capital and policy recommendations to insure a safe and economical aviation system that meets the 2020 demand.

The forecasts for 2020 reflect significant growth: 38 percent for non-commercial activity across the region and 59 percent for commercial traffic, the latter predominantly at PHL. These levels of growth, when considered on an annual basis over the next 25 years, reflect moderate average increases in most categories, except for commercial jet passenger demand. The growth rate should be higher in the latter category, where reductions in operating cost and more efficient larger aircraft, as well as competitive pressure, will continue to hold ticket prices at affordable levels. Increasing demands of time on travelers' lifestyles will also increase the value of aviation, and the inclination to use aviation over trains and cars for long distance trips.

The planning objectives for the recommended systemwide improvements generally can be stated as expanding passenger capacity at the major commercial airport in the region — PHL — while preserving locational options, and improving storage capacity and safety features for business and general aviation facilities. The latter are necessary for greater mobility and economic vitality in the region. Specifically, this plan addresses such system deficiencies as:

- delays and shortage of commercial and freight operating capacity at PHL;
- potential for loss of equitable operating location choices for business and personal aircraft in the suburbs;
- insufficient hangar and ramp storage to accommodate the aviation demand needed to support economic growth in the suburbs;
- lack of sufficient runway length to accommodate corporate aircraft at some suburban airports; and the
- need to upgrade ATC communications and electronic pilot landing aids to state-of-the-art levels.

2020 Regional Aviation System Scenarios

It is the intent of the 2020 RASP to address deficiencies identified above. Implicit in the definition of the deficiencies is the baseline expectation that ground access availability of airports to potential users will be maintained at the same or better levels than originally established in the 2000 RASP. Another requirement is that the recommended system provides sufficient safe capacity for the storage and operation of the wide range of aircraft currently using and expected to use the system between now and 2020; and that this total diverse system capacity be distributed throughout the region to give more or less equitable access to all locations and for all densities of residential and business development. The ground access criteria used in the 2020 RASP is 30 minutes travel time to commercial and general aviation/business facilities.

With these considerations and system deficiencies in mind, the planning process first reviewed the existing RASP for conformity, then generated an alternative "Worst Case" plan, which considers the availability in 2020 of only publicly owned or federally funded airports; and finally, developed the preferred or recommended RASP alternative. Although primary attention is paid to the preferred RASP and suggested investments, facility improvement recommendations are also established for the "Worst Case" plan. The latter defines the capital investments needed to minimize regional negative mobility and economic impacts from the possible loss of up to one half of general aviation/business facilities by 2020.

Before discussion of specific capital expansion needs under both scenarios, the report reveals the composition of these system alternatives.

Year 2000 RASP — Existing System Plan

Of the 30 public use airports identified in the 1982 RASP as critical to satisfying design criteria and capacity expectations, eight have since closed, the most recent being Cecil County in 1995. Willow Grove Naval Air Station has been dropped from civilian use consideration as a result of local citizen and military opposition. Three seaplane bases, although sporadically operated, do not provide significant system capacity and also were excluded from the 2000 RASP plan, when amended in 1988. Four heliports in the plan continue to operate, but three other proposed sites (Trenton, Camden, and Wilmington) have not materialized.

These reductions in the number of facilities and the lack of construction of others have resulted in a loss of coverage within the defined ground access criteria for some sections of the region. The most significant of these areas where minimum coverage has been lost and major population/employment density exists or is expected, are central Camden County and eastern Montgomery County.

The 1988 amendment of the 2000 RASP added Oldmans Airport in Salem County to increase coverage along the I-295 development corridor, which had suffered a loss of aviation service access when Bridgeport Airport closed.

Aside from access deficiencies in the current RASP, certain suburban counties do not have airports equipped with runways of sufficient length (usually 4500'-6000') to accommodate corporate twin engine or jet aircraft. These deficient counties include Bucks and Montgomery in Pennsylvania, and Camden, Gloucester and Salem in New Jersey. Corporate aviation also requires that all-weather operations must be available through ILS or GPS approaches, which are currently available at PHL, Northeast Philadelphia, New Castle County, Trenton-Mercer, and Chester County. In addition, storage capacity of the quality necessary to protect expensive corporate aircraft is in short supply throughout the region, with some important business airports currently having no excess hangar capacity.

Only PHL is currently handling commercial passenger jets. However, Trenton-Mercer and New Castle County have historically offered limited commercial service and still retain that capacity. Regional coverage for commercial service is currently adequate with these three airports. The recent study of commercial civilian potential at McGuire AFB concluded that no additional market exists, given the current options for South Jersey residents to use either ACY, EWR, or PHL. To the west, Harrisburg International offers commercial service and operates at only 45 percent of capacity, indicating no potential or need for additional commercial airports in the western part of the region.

At PHL, during a.m. and p.m. peak operations periods, and during IFR conditions, aircraft often experience delays in take-off or approach pattern delays before landings. These delays seriously impact airline operating costs, on-time performance, and the ability to schedule flights to additional destinations. This reduces the potential for cargo operations, as well as limiting passenger service expansion. If travel demand increases by 50 percent or more, as expected within 25 years, the delay impact will be multiplied. Clearly, operating capacity must be expanded now at PHL, if the region is to grow as an economic competitor on the East Coast.

2020 Worst Case System

Deficiencies are magnified if up to 12 airports are lost by 2020. These are the airports which are privately owned and have not received FAA reliever capital funding in recent years. They are under no obligation to remain open to the public and a part of the regional aviation infrastructure, and can be liquidated for real estate development value at any time.

Although commercial service growth and availability at PHL, Trenton-Mercer, and New Castle will continue to be available,

unencumbered by losses of airports in the suburbs, it is assumed that ten of the twenty suburban business/GA airports will be gone, thereby cutting storage and operation capacity in half. As shown in Chapter V, huge areas of the twelve-county region will have no airport access available within the 30 minute ground travel time criteria. The disenfranchised areas include all of Gloucester County and most of Camden County, one-half of Salem County, the eastern half of Montgomery County, the eastern half of Chester County, and the western half of Delaware County. Businesses and private aircraft owners or users will have to relocate or tolerate excessive access times. Some will choose to discontinue aircraft usage or close business, thereby impacting local economies.

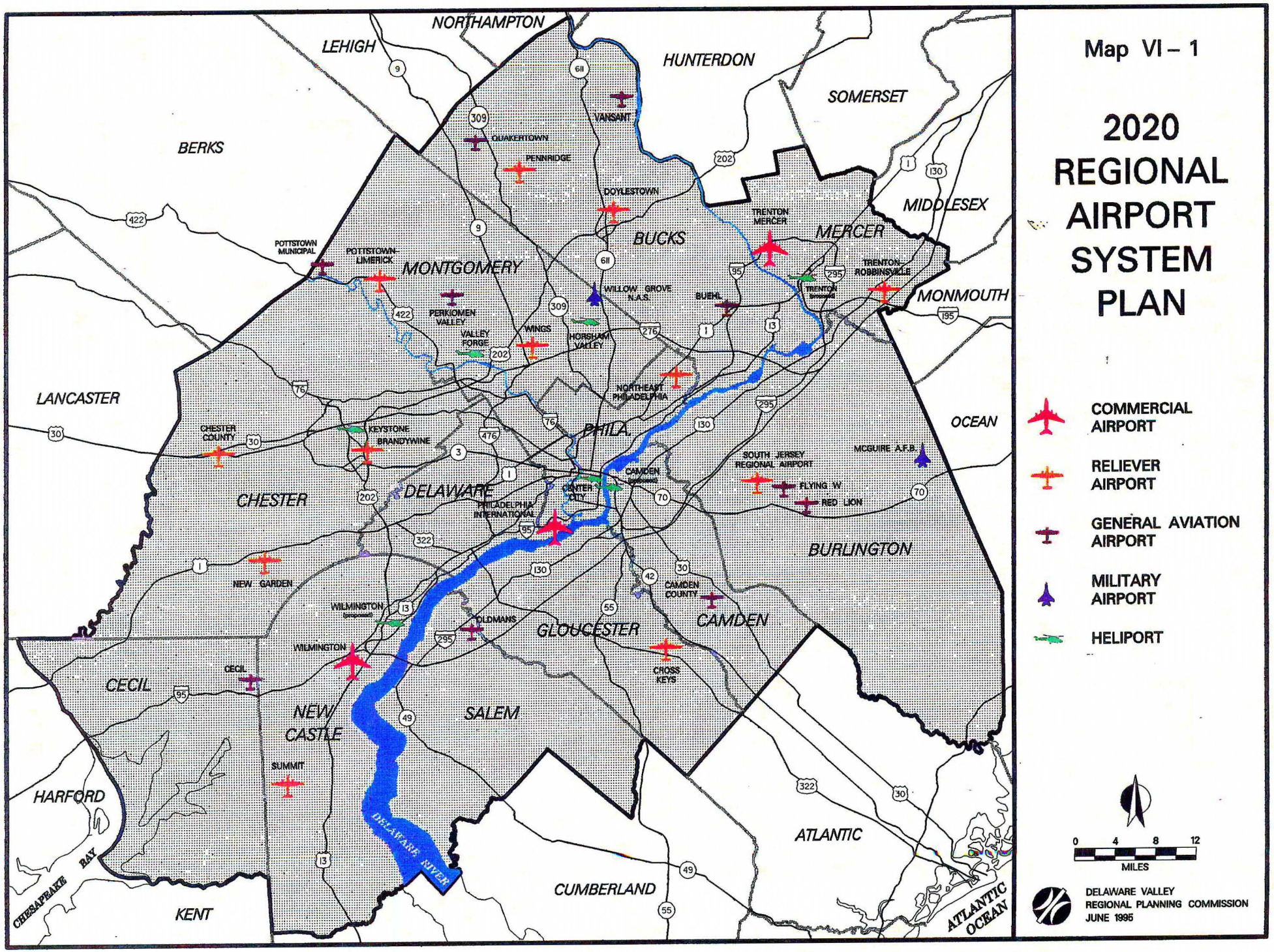
To plan for facility improvements in the "Worst Case" system, it is assumed that most of the aircraft based at airports subject to closure by 2020 will be reassigned to the nearest airport remaining open. Thus, all 2,950 aircraft based at civilian airports under unconstrained growth were reassigned, assuming no owners will sell or move out of the region. The 2020 RASP process then considered whether the remaining airports will have sufficient operating and storage capacity to accommodate this consolidated demand, if it were to occur. It was found that only a total of 2,390 aircraft could be accommodated at the remaining airports, even when additional available real estate was acquired.

Most remaining "Worst Case" airports in the suburbs could accommodate increased levels of operations resulting from consolidation of demand. But the lack of storage hangars and real estate, as well as adverse community reaction to a large increase in noise, pollution, and worry, would act to deter full accommodation of all 2020 aircraft at remaining airports. Thus, excessive access times, shortage of storage capacity, lack of real estate for expansion, and community reaction to traffic increases will most certainly curtail suburban aviation demand well below the levels expected with the existing system in place. Aircraft owners and aviation user businesses will move out of the region, or sell aircraft, thereby negatively impacting the regional economy and mobility.

Preferred System or Recommended 2020 RASP

Given the need for geographic diversity of airport location options to satisfy ground access criteria, and the significant market area coverage of the 24 airports in the current RASP, the 2020 recommended RASP will include all system facilities currently identified in the 2000 RASP. Camden County Airport has been added to the 2020 RASP (Map VI-1) to better serve the eastern part of Camden County. This airport has operated for over 20 years and is identified in the NJ State Airport System Plan.

Although a small area of land in eastern Montgomery County currently has travel times to either Doylestown, Wings, or


Map VI – 1
2020 REGIONAL AIRPORT SYSTEM PLAN
COMMERCIAL AIRPORT
RELIEVER AIRPORT
GENERAL AVIATION AIRPORT
MILITARY AIRPORT
HELIPORT
0 4 8 12
MILES
DELAWARE VALLEY REGIONAL PLANNING COMMISSION
JUNE 1995
NORTHAMPTON
LEHIGH
HUNTERDON
SOMERSET
BERKS
MIDDLESEX
MERCER
BUCKS
MONTGOMERY
MONMOUTH
LANCASTER
OCEAN
PHILA.
CHESTER
DELAWARE
BURLINGTON
CAMDEN
GLOUCESTER
CECIL
NEW CASTLE
SALEM
HARFORD
KENT
CUMBERLAND
ATLANTIC
CHESAPEAKE BAY
DELAWARE RIVER
ATLANTIC OCEAN
VANSANT
QUAKERTOWN
PENNRIDGE
DOYLESTOWN
TRENTON MERCER
POTTSTOWN MUNICIPAL
POTTSTOWN-LIMERICK
PERKIOMEN VALLEY
VALLEY FORGE
WINGS
WILLOW GROVE N.A.S.
HORSHAM VALLEY
BUEHL
TRENTON ROBBINSVILLE
TRENTON
NORTHEAST PHILADELPHIA
CHESTER COUNTY
KEYSTONE
BRANDYWINE
PHILADELPHIA INTERNATIONAL
CENTER CITY
CAMDEN
SOUTH JERSEY REGIONAL AIRPORT
MCGUIRE A.F.B.
FLYING W
RED LION
NEW GARDEN
WILMINGTON
OLDMANS
CAMDEN COUNTY
CROSS KEYS
CECIL
SUMMIT

Northeast Philadelphia (PNE) in excess of the 30-minute criterion, no non-RASP airport is available to correct this deficiency. However, expansion of storage capacity at PNE and Doylestown, and storage and runway length extension at Wings, will increase their capacities to serve corporate aviation in this densely developed corridor, thereby making the slightly longer access time tolerable.

To address the criterion of providing dedicated heliport facilities at all high density business and government centers, the heliport portion of the 2020 RASP includes construction of three new heliports in Trenton, Wilmington, and Camden. These will complement existing heliports in Philadelphia, West Chester, Ambler, and Valley Forge.

As stated before, certain airports which have operated since the adoption of the 2000 RASP, have recently closed including Shannon and Cecil County. Shannon has been dropped from the facilities list of the 2020 RASP, since that market area is already covered by Chester County, an airport with sufficient excess capacity and Brandywine. Cecil County, however, will continue to be included in the RASP since the southwestern tier of the region would not be served at 30-minute access time without this airport.

Three airports in Burlington County serve a redundant market area. These airports are South Jersey Regional, Red Lion, and Flying W. All will be retained in the 2020 RASP, since activity is significant at each and each appears to have a unique market niche. South Jersey Regional serves a growing business clientele needing longer runways and more services, while Flying W handles a higher level of operations and training activities (several flight schools are located here). Red Lion almost exclusively serves general aviation single-engine recreational flyers.

Several small general aviation airports, such as New London in Chester County, Southern Cross in Gloucester County, New Hanover in Montgomery County, and others not included in the 2020 RASP, do not provide minimum all-weather facilities and have no paved runways. Van Sant in Northern Bucks County remains the only turf strip airport in the plan, because of the lack of an alternative paved runway airport in that portion of the region. No airport ground access near 30 minutes travel time would exist if Van Sant were not included, while the other turf runway airports mentioned are all in service areas of other better-equipped airports.

2020 RECOMMENDED RASP FACILITIES

Table VI-1 shows the airports and heliports included in the 2020 RASP. Although the recommended facilities list is quite similar to the 2000 RASP, with only a few additions and deletions, most airports require major expansion and improvement to satisfy demand and service expectations in 2020. Only the major military facilities of McGuire AFB and Willow Grove NAS,

Table VI-1
RECOMMENDED AIRPORTS AND HELIPORTS IN THE 2020 RASP

Facility	Location	Ownership	Runway Length (ft.)	Navigational/ Landing Aids
COMMERCIAL AIRPORTS				
PHILADELPHIA INT.	SOUTH PHILA./ DELAWARE CO. PA	PUBLIC	10,000 5,450	P
TRENTON-MERCER	EWING MERCER CO. NJ	PUBLIC	6,000 4,800	P
NEW CASTLE COUNTY	WILMINGTON NEW CASTLE CO. DE	PUBLIC	7,200 7,000	P
RELIEVER AIRPORTS				
BRANDYWINE	EAST/WEST GOSHEN CESTER CO., PA	PRIVATE	3,000	N
CHESTER COUNTY	VALLEY CHESTER CO., PA	PUBLIC	5,400	P
DOYLESTOWN	BUCKINGHAM BUCKS CO., PA	PUBLIC	3,000	PP
NEW GARDEN	NEW GARDEN CHESTER CO., PA	PRIVATE	3,700	N
NORTHEAST PHILADELPHIA	PHILADELPHIA PHILADELPHIA CO., PA	PUBLIC	7,000 5,000	P
PENNRIDGE	EAST ROCKHILL BUCKS CO., PA	PRIVATE	4,260	N
POTTSTOWN-LIMERICK	LIMERICK MONTGOMERY CO., PA	PRIVATE	3,400	PP
WINGS	WHITPAIN MONTGOMERY CO., PA	PRIVATE	2,650	N
CROSS KEYS	MONROE GLOUCESTER CO., NJ	PRIVATE	2,800	N
S. JERSEY REGIONAL	LUMBERTON BURLINGTON CO., NJ	PRIVATE	4,000	N
TRENTON-ROBBINSVILLE	WASHINGTON MERCER CO., NJ	PRIVATE	4,300	N
SUMMIT	NEW CASTLE CO., DE	PRIVATE	4,500	N

Key: P = Precision N = Non-Precision PP = Partial Precision V = Visual only

Table VI-1 (continued)
RECOMMENDED AIRPORTS AND HELIPORTS IN THE 2020 RASP

GENERAL AVIATION AIRPORTS				
BUEHL	MIDDLETOWN BUCKS CO., PA	PRIVATE	3,100	N
PERKIOMEN VALLEY	SKIPPACK MONTGOMERY CO., PA	PRIVATE	2,900	N
POTTSTOWN MUNICIPAL	POTTSTOWN MONTGOMERY CO., PA	PUBLIC	2,700	N
QUAKERTOWN	MILFORD BUCKS CO., PA	PUBLIC	3,200	N
VAN SANT	TINICUM BUCKS CO., PA	PRIVATE	3,050 TURF	V
CAMDEN COUNTY	WINSLOW CAMDEN CO., NJ	PRIVATE	3,100	N
FLYING W	MEDFORD BURLINGTON CO., NJ	PRIVATE	3,500	N
OLDMANS	OLDMANS SALEM CO., NJ	PRIVATE	2,450	N
RED LION	SOUTHAMPTON BURLINGTON CO., NJ	PRIVATE	2,900	N
CECIL COUNTY	ELKTON CECIL CO., MD	PRIVATE	2,600	
MILITARY AIRPORTS				
WILLOW GROVE	WILLOW GROVE MONTGOMERY CO., PA	NAVY	8,000	P
McGUIRE	McGUIRE AFB BURLINGTON CO., PA	AIR FORCE	10,000 7,100	P
HELIPORTS				
HORSHAM VALLEY	HORSHAM MONTGOMERY CO., PA	PRIVATE		
KEYSTONE	WEST CHESTER CHESTER COUNTY, PA	PRIVATE		
STERLING	PHILADELPHIA PHILA. COUNTY, PA	PRIVATE		
VALLEY FORGE	WEST NORRITON MONTGOMERY CO., PA	PRIVATE		
CAMDEN	CAMDEN CITY CAMDEN CO., NJ	PRIVATE		
TRENTON	TRENTON MERCER CO., NJ	PRIVATE		
WILMINGTON	WILMINGTON NEW CASTLE CO., DE	PRIVATE		

which are integral to the 2020 RASP because of the need to safely mix military and civilian air traffic, are excluded from the analysis of necessary capital improvement. Military activity at these bases is not anticipated to grow substantially in the future; activity at these facilities is not a function of regional demographics and business activity, but rather of military decision-making responding to short-term and long-term political and security events.

The recommended facilities for the 2020 RASP are intended to satisfy the ground access criterion, provide future operations and storage capacity, stimulate economic development, and accommodate the diverse aircraft mix wishing to use the region's aviation infrastructure by the Year 2020.

The facilities chosen for the 2020 Plan correspond closely to those facility locations identified in the 1990-1999 NPIAS. A major inconsistency is the inclusion of Van Sant for geographic access coverage in northern Bucks County, where no airport is currently identified in the NPIAS. Several airports required in the 2020 RASP have service areas and capacities which mirror facilities identified in the NPIAS, but which have since closed. These include the substitution of Camden County for Camden/Burlington, Oldmans for Bridgeport, and Pennridge for the Prospectville location. Although the 2020 RASP does not exactly reflect the NPIAS facility recommendations, the capacities and locational coverage are very similar.

Heliport coverage in the 2020 RASP is more intense than in the NPIAS because of the privately owned and operated public heliport service companies, which have now developed significant markets in the suburbs; namely, Keystone in Chester County, and Valley Forge and Horsham Valley in Montgomery County.

Component facilities in the 2020 RASP generally do not conform to state system plans in that the SASPs generally include all facilities operating and open to the public, such as all turf airports and low use recreational facilities with redundant service areas to business or paved GA airports. The RASP attempts to be more selective in order to provide a necessary and adequate range of capacity without the additional cost of maintaining redundant facilities, or facilities with specialized usage that would not contribute to the mobility or economic development demands of the public.

Master plans have been developed only for approximately one-half of the RASP facilities. Where these plans exist, facilities improvements are consistent with RASP recommendations with regard to the service available and the type of aircraft able to use the facility. Divergence in the projected volume of operations and based aircraft exists at some airports. RASP projections of aviation demand are generally lower than master plan estimates, since RASP projections are regional totals subdivided between airports, in order to avoid double counting. Master plan projections for nearby airports can assign

the same aircraft to both airports, when in reality the aircraft can only be based at one.

The next portion of this chapter will detail the recommended RASP facilities, specific airport deficiencies, recommended capital improvements, actions, staging or priority of investment in the twenty-five year of the plan period, and anticipated capital costs for suggested improvements. After capital expansion proposals are presented and discussed in light of anticipated future demand and current/future deficiencies, a number of regional aviation planning policies from now to the Year 2020 will be suggested to guide capital improvement implementation and system preservation.

RECOMMENDED IMPROVEMENTS FOR THE 2020 RASP

The recommended improvements and costs for the 2020 RASP can be grouped in several major categories, as discussed below.

Runway Extensions or Replacement

Runway extensions provide a higher degree of safety for the operation of larger business oriented aircraft. Certain insurance restrictions require corporate aircraft and pilots to use runways of minimum length. These requirements attract corporate based aircraft to suburban airports, which is beneficial from an air traffic control perspective, as well as for economic development. This attraction is to a large degree related to the availability of runway length and accompanying precision approaches. At least one precision length runway is recommended for each of the nine urbanized counties of the region.

The new commuter runway 8-26 at PHL was approved before the development of the 2020 RASP and should be completed in the next five years. Extensions at Wings, Pennridge, South Jersey Regional, and Pottstown Limerick are all in varying stages of planning as of 1995, but local political commitment and federal/state capital support are still indefinite. Summit is planning to replace its existing 4,500-foot runway with a parallel 5,500-foot runway and use the old runway as a taxiway. The extensions recommended, with the exception of Cross Keys, have been proposed and studied through the master plan and ALP processes which have identified available real estate for the project.

Hangar and T-Hangar Construction

Storage space in hangars is a critical criterion for aircraft owners in their decision to store and base aircraft. Corporate twin-engine and jet aircraft must be stored in hangars because of their high cost. Hangar space at suburban airports varies, but is generally considered insufficient to satisfy present demand. Currently, certain airports can not provide storage for their aircraft in hangars, other airports accommodate up to 90 percent of their based aircraft with hangar storage.

Taking into consideration the projected growth of aircraft at regional airports, the 2020 RASP recommends increasing the number of hangars and/or T-hangars to accommodate at least 50 percent of assigned 2020 aircraft in hangars at all airports, within the limits of real estate space available. At airports with longer runways, existing or recommended, corporate hangar development is recommended, while at small general aviation airports T-hangar construction is encouraged. Only 50 percent of projected based aircraft in 2020 will be based in hangars under the proposed development recommendations.

If demand projections were optimistic, hangar investment would still be utilized by remaining aircraft, since currently only 25 percent of aircraft overall or less are in hangars. If some airports in the 2020 RASP close, pressure will increase at remaining airports for hangar expansion beyond available space, and some aircraft will move out of the region.

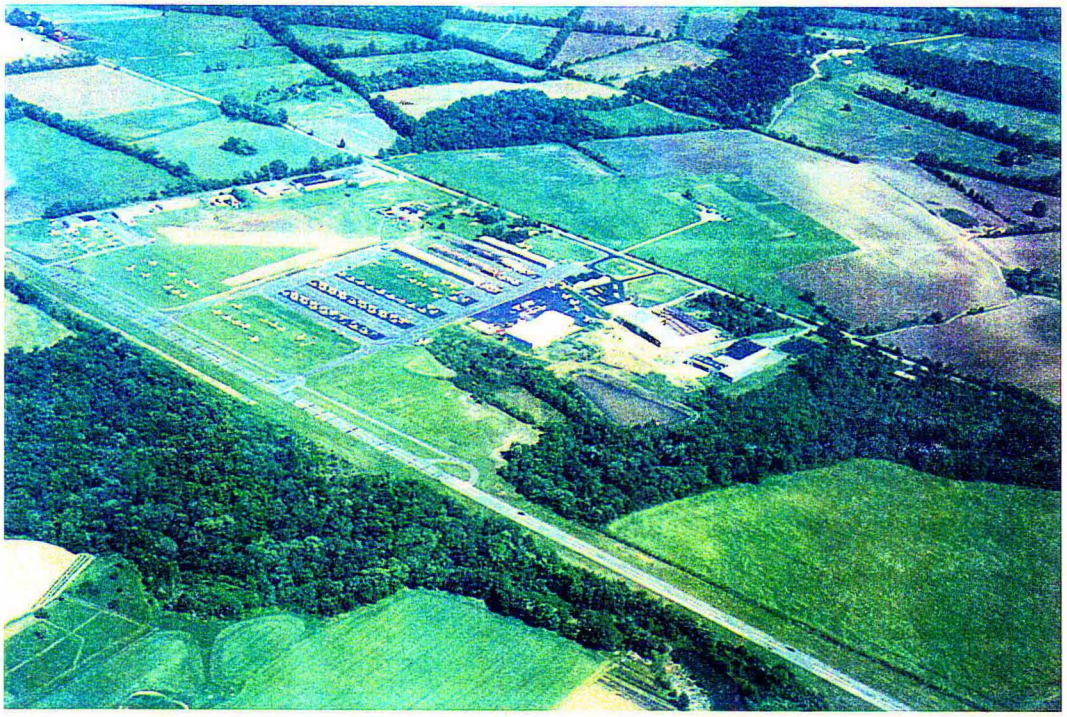
Airport Acquisitions

Although 17 of the 25 airports identified as part of the 2020 Plan are currently privately owned, only five are recommended for public acquisition. Four other privately owned airports — Pennridge, Summit, Pottstown-Limerick and South Jersey Regional — all classified as relievers, have or are receiving federal AIP funds for expansion and are assured of continuous operation through contractual assurances with FAA. The five airports recommended for public acquisition — Wings, New Garden, Brandywine, Cross Keys, and Oldmans — are facilities which, if lost to aviation, would result in large areas of the region not having access to business service airports to provide economic development potential to the respective suburban areas. If Cross Keys and Oldmans closed, no paved public use runway would remain in Gloucester and Salem counties, respectively. Both Wings and New Garden provide unduplicated access coverage to their respective market areas of Montgomery and Chester counties. Both airports have demonstrated private sponsor investment, business application and expansion potential.

The remaining eight privately owned public use airports, although providing based aircraft capacity, are not as critical to business development. The locations of these airports are either away from development densities or near publicly owned or reliever airports capable of receiving based aircraft from other airports.

Instrument Approaches and ATC Communications Enhancement

Evolving technology has resulted in revised plans for precision instrument approach recommendations over the last two decades. The land requirements and equipment costs for installation of ILS at additional business length runway airports have been prohibitive. Lack of availability of suitable radio frequencies constitutes an additional constraint. Recent civilian GPS use of satellite signals makes this approach



Courtesy of South Jersey Regional Airport

Courtesy of Pottstown Municipal Airport

available to all civilian airports without additional land base equipment installation. Given the modest cost to prepare and certificate approach plans for RASP civilian airports, all operational facilities should have some instrument approaches by 2020.

In the more remote areas of the region radio communication between civilian, general aviation, business pilots, and ATC personnel stationed at PHL and McGuire AFB is hindered by line-of-sight obstructions, such as buildings and topography. Installation of RCOs in Burlington County, Bucks County, and other locations has been identified by DVRPC as a means to reduce ATC handling time for flights using suburban airports.

Support Activities to Preserve Infrastructure

Complementary local activities are available that will support preservation and use of the existing infrastructure through maintenance and expansion. Proper upkeep of the recommended facilities in the 2020 plan will require continuous capital expenditure. Compatible land use management of adjoining properties at the municipal government level is necessary to insure unrestricted use and growth of principal suburban airports. Marketing of airports, to encourage use and establish aviation linkages to the traveling business community, is integral to expansion of business use.

Table VI-2 shows the capital enhancements, expansion, and improvements necessary in order to bring the capabilities of the facilities listed in Table VI-1 into compliance with the increased demand of expanding commercial, business, and recreational aircraft usage. Most of these facilities are airports and heliports currently in active service in the region. Projects shown in Table VI-2 will be discussed by facility category.

Commercial Airports

Commercial operating capacity at PHL is deficient now, and without intervention will result in extreme delays and service reductions in the future. Runway 8-26 and terminal improvements will address these shortages. The other minor commercial service airports, New Castle and Trenton-Mercer, both have sufficient operating capacity of 225,000 to 250,000 operations per year based on runway and taxiway configuration. Since 95 percent or more of the flights using these airports will be business/GA in nature, deficiencies in storage capacity in hangars and on-ramps must be addressed. Based on available real estate for storage, existing storage facilities, and anticipated 2020 demand, additional storage space is assigned to these airports. Since all are towered with precision approach capacity, no improvement other than modernization is required for ATC and approach equipment hardware. Freight and cargo operations are also hindered by deficiencies, and will expand with more operating and storage capacity.

Table VI-2
2020 RASP RECOMMENDED CAPITAL IMPROVEMENTS BY FACILITY

Facility	Recommended Capital Improvements	Cost (1,000)
COMMERCIAL AIRPORTS		
PHILADELPHIA INT.	20 HANGAR SPACES, COMMUTER RUNWAY CONSTRUCTION, TERMINAL EXPANSION	$571,680
TRENTON-MERCER	30 RAMP SPACES	231
NEW CASTLE COUNTY	25 T-HANGARS	700
	SUBTOTAL	**572,611**
RELIEVER AIRPORTS		
BRANDYWINE	PUBLIC ACQUISITION 20 HANGAR SPACES 30 T-HANGARS	7,520
CHESTER COUNTY	LAND ACQUISITION FOR STORAGE, 20 HANGAR SPACES, 20 T-HANGARS	6,740
DOYLESTOWN	LAND ACQUISITION 26 HANGAR SPACES, 20 T-HANGARS, RAMP ADDITION	7,244
NEW GARDEN	PUBLIC ACQUISITION. 10 T-HANGARS 25 RAMP SPACES	6,722
NORTHEAST PHILADELPHIA	10 HANGAR SPACES, 16 T-HANGARS	3,724
PENNRIDGE	RUNWAY EXTENSION TO 4500', 10 HANGAR SPACES, 10 T-HANGARS	560
POTTSTOWN-LIMERICK	LAND ACQUISITION, RUNWAY EXTENSION TO 4200', 30 HANGAR SPACES	5,520
WINGS	PUBLIC ACQUISITION, RUNWAY EXTENSION, 20 T-HANGARS	9,810
CROSS KEYS	PUBLIC ACQUISITION, LAND ACQUISITION, RUNWAY EXTENSION, 20 HANGAR SPACES, 40 T-HANGARS	12,550
S. JERSEY REGIONAL	RUNWAY EXTENSION TO 6000', 30 HANGAR SPACES, 30 T-HANGARS	14,360
TRENTON-ROBBINSVILLE	20 HANGAR SPACES, 15 T-HANGARS	2,100
SUMMIT	NEW RUNWAY 5500', 18 HANGAR SPACES, 40 T-HANGARS	5,632
	SUBTOTAL	**82,482**

Table VI-2 (continued)
2020 RASP RECOMMENDED CAPITAL IMPROVEMENTS BY FACILITY

GENERAL AVIATION		
BUEHL	20 T-HANGARS	560
PERKIOMEN VALLEY	20 T-HANGARS	560
POTTSTOWN MUNICIPAL	20 T-HANGARS	560
QUAKERTOWN	10 T-HANGARS,10 RAMP SPACES	357
VAN SANT	20 T-HANGARS	560
CAMDEN COUNTY	20 HANGAR SPACES, 30 T-HANGARS	2,520
FLYING W	20 HANGAR SPACES, 30 T-HANGARS	2,520
OLDMANS	PUBLIC ACQUISITION, 20 T-HANGARS	4,810
RED LION	30 T-HANGARS	840
CECIL COUNTY	20 T-HANGARS	560
	SUBTOTAL	**13,847**
HELIPORTS		
4 EXISTING HELIPORTS	RAMP AND HANGAR EXPANSION	1,000
3 NEW HELIPORTS	LAND ACQUISITION RAMP AND HANGAR CONSTRUCTION	6,000
	SUBTOTAL	**7,000**
All Airports	GPS OR INSTRUMENT APPROACH, RTO INSTALLATION, PAVEMENT MAINTENANCE, ADDITIONAL SECURITY, etc.	64,500
	SUBTOTAL	**64,500**
	GRAND TOTAL	**740,440**

The cost of these improvements is estimated at 573 million dollars.

Reliever Airports

Deficiencies in this category in order of importance are: lack of secure operating future, runway too short for corporate aircraft, gross shortage of hangar capacity, and need for precision approach upgrades. Several reliever airports in various counties have been recommended for public acquisition in order to insure continued operation in the system. These are Wings in Montgomery County, Cross Keys in Gloucester County, New Garden and Brandywine in Chester County, and Oldmans in Salem County. All other counties either have strong publicly owned business airports, or privately owned relievers receiving federal grant contracts and are obligated to remain open into the next century. Runway extensions are recommended for several of these stable business airports including Wings, Summit, Pottstown-Limerick, Pennridge, South Jersey Regional, and Cross Keys, so that each county can provide corporate level runway access for economic development purposes.

Current hangar and tie-down capacity was compared with expected 2020 based aircraft demand. A target of 50 percent of all based aircraft in hangars by 2020 was established using both corporate and T-hangar recommendations, depending on aircraft type. Available land for use or acquisition was also inventoried, and then the number of hangars, ramp space to be built, and necessary land acquisition to accommodate 2020 based aircraft were established. Needed hangars, ramp space, and real estate were identified for each airport.

The cost of improving reliever airports is estimated at 63 million dollars.

General Aviation Airports

Like reliever or business airports, the most significant deficiency for GA facilities is storage space, mostly in T-hangars, since most corporate aircraft will be based at the reliever airports with longer runways. A similar target of 50 percent of aircraft in hangars was used to determine the needed number of new hangars and paved tie-downs at each GA airport. Given the existing facilities, and available real estate at each, runway length and public acquisition to preserve these facilities is not recommended. The exception is Oldmans, which is the only public use airport in the Salem County market area. Other GA airports in other counties are either publicly owned, or near usable relievers, or publicly owned GA airports.

The cost of these improvements is estimated at 14 million dollars.

Systematic Improvements

Improvements in the precision approaches to all airports are necessary, but these approaches should not be considered in a deficient state. New GPS technology will allow for instrument approaches to all

airports, without the expense of land acquisition for ground equipment installation. These approaches will complement the ILS and partial ILS at several regional business airports, and when coupled with longer runways, increase the attractiveness of these airports for business use.

Redistribution of business traffic will ease air traffic congestion at PHL and other busy commercial and business airports, thus, reducing, delays and conflicts. It is also recommended to install RCOs at locations in the region where topography prevents direct radio contact between the pilot and the ATC suburban control at PHL. This corrects deficiencies at ATC communications resulting from longer closure times or windows on flight plans. Shorter void times increase usable capacity in the airspace system at very low cost.

The cost of these systematic improvements is estimated at 82 million dollars.

Heliports

Deficiencies in the heliport system focus on the lack of discrete heliport facilities at the urban centers of Trenton, Camden, and Wilmington, as well as the lack of sufficient ramp space and hangars. Privately developed heliport capacity appears adequate in the Pennsylvania portion of the region, but public agency involvement is necessary in the three urban centers mentioned. Since the level of regional based helicopters is only on the order of 40 in 2020, storage demand is not high at heliports. Still more ramp and some hangar capacity expenditure is warranted, as well as real estate investment for the start-up of the three new facilities.

The cost of improving heliports is estimated at 7 million dollars.

PRIORITY OF CAPITAL INVESTMENT

As shown in Table VI-3, the investments needed to maintain an adequate aviation infrastructure are categorized by improvement type. Given the various types of deficiencies presented, expenditures should be scheduled to meet deficiencies as needed, or warranted by demand. However, they should also be distributed in such a way as to match available capital funds. Assumptions concerning scheduling follow.

Operating capacity improvements at PHL are underway as of 1995. Land for runway 8-26 is being acquired and site preparation has begun. Given current delay levels and cost to the airlines, additional capacity is needed now. Ground access improvements related to the consolidation of USAir operations in terminals B and C is also beginning. Consequently, these improvements have been given a high priority during the 12 years of the planning period.

Airport acquisition, in the case of Wings, Brandywine, Salem County, Cross Keys, and New Garden should also commence

Table VI-3
2020 RASP CAPITAL COST BY IMPROVEMENT CATEGORY

Type of Improvements	Costs ($ 1,000)
New runway and taxiways, PHL	$220,000
Terminal and other expansion, PHL	350,000
6 Runway extensions or rebuilt, suburbs	24,000
4 adjacent land acquisitions, suburbs	6,000
284 Corporate hangar spaces, systemwide	23,000
500 T-hangars, systemwide	13,000
65 Aircraft ramp spaces	500
5 Airport acquisitions, private to public	28,000
25 GPS approaches and 4 RCO installations	1,500
Systemwide preventive maintenance and security	67,000
4 Heliport improvements	1,000
3 New heliports	6,000
TOTAL	$740,000

now, although it may be difficult to commit

sufficient funds from state and federal sources, so acquisition should be spread over a longer period (18 years). With the initial commitments, should come obligation from the airports, since any suburban boom in real estate value and development pressure could trigger non-aviation related sale of these privately owned airports.

Since runway extensions are related to economic development, the sooner the projects are completed, the sooner the economic benefits to the suburban market areas can accrue. These capacity projects are scheduled to be completed by 2015, with priority given to counties which currently do not have airports with corporate length runways, such as Gloucester, Burlington, Bucks and Montgomery.

The growth in non-commercial aviation demand will occur in a somewhat linear manner over the planning period. Therefore, storage capacity can be added over the entire length of the cycle. This is consistent with the fact that hangar construction is not eligible for federal grant support, and each project probably will have to be funded by airport owners and hangar tenants as they are constructed. Priority should be given, if state based loans or other assistance is used, to airports serving business users, and which currently have few or no corporate hangars.

Systematic maintenance and airspace

improvements should occur on an ongoing basis in order to insure the optimum safety of system operation and the preservation of the infrastructure. Maintenance of pavement surfaces accounts for a large percent of total public project funding.

Heliport improvements require small capital investments in comparison to other needed investments. However, to encourage the helicopter market to evolve the infrastructure for operations which, unlike airport locations, must be in place. Although heliports do not serve the volume of traffic that fixed wing facilities do, they provide attractive service to the high end of the aviation services user market. The economic benefits to the region of this segment of the business market can be substantial, and therefore additional helicopter facilities should be completed by 2012.

2020 RASP Policies

RASP recommendations for aviation system improvement cannot be implemented successfully without a supportive policy environment from government at the local, state, and federal levels, which is coordinated with RASP objectives. The major necessary policy postures which should be advocated by the region include:

1. Recognition by counties and the region that the network of facilities described in the plan should be preserved and improved. These facilities are essential for the economic development, mobility, and general well-being of the region.
2. Funding should be provided for aviation development. Since the system serves international and domestic movements for both passengers and freight, there is a shared responsibility among private and public, state, and federal sources for provision of capital support.
3. Recognition that the aviation system can be made more efficient and safer with better management of facilities, investment in new ATC technology, and safety/capacity improvements at airports and heliports.
4. Support for aviation development as a means of increasing the regional market for aviation services, including both passenger and freight movements. This in turn will benefit the Philadelphia region or city-state by increasing our reach to domestic markets, as well as to Europe, Africa, and Latin America.
5. Realization that aviation infrastructure improvements to diverse airport facilities and their preservation, as well as to the airline fleet, is consistent with reduction in negative noise and environmental impacts.
6. Action in support of increased public participation in and understanding of aviation development decision making as a way of building consensus and insuring movement toward the implementation of RASP recommendations. Specifically, commitment to increased public ownership of more of the aviation infrastructure, as a means of preservation of endangered public assets, should be initiated. □

VII. IMPLEMENTATION OF 2020 RASP

As described in Chapter VI, no new airports will be required to be built to satisfy 2020 unconstrained operations and based aircraft growth. However, many major capital improvements, almost 740 million dollars in total, must be programmed and implemented if the region's aviation infrastructure is to optimally provide for passenger mobility, freight movement, and economic development. Major categories of capital improvement investment, with the percent of total system investment given in parentheses are: operating capacity improvements at PHL (77%); storage capacity expansion in the suburbs (5%); runway extensions (2.4%); public acquisitions of private airports (3.1%); heliport improvements (1%); and maintenance, electronic systems and other costs (11.5%).

These improvements will take place at 25 existing airports spread throughout eleven of the twelve regional counties. Although Delaware County residents and businesses are airport users, no public use airport except for a portion of PHL runway ramp and hangar space are located — or will be located — in the county. Also, four existing heliports and three proposed facilities will receive public investment. These thirty-two public use aviation facilities form the optimum public aviation infrastructure upon which the traveling regional residents will rely through 2020.

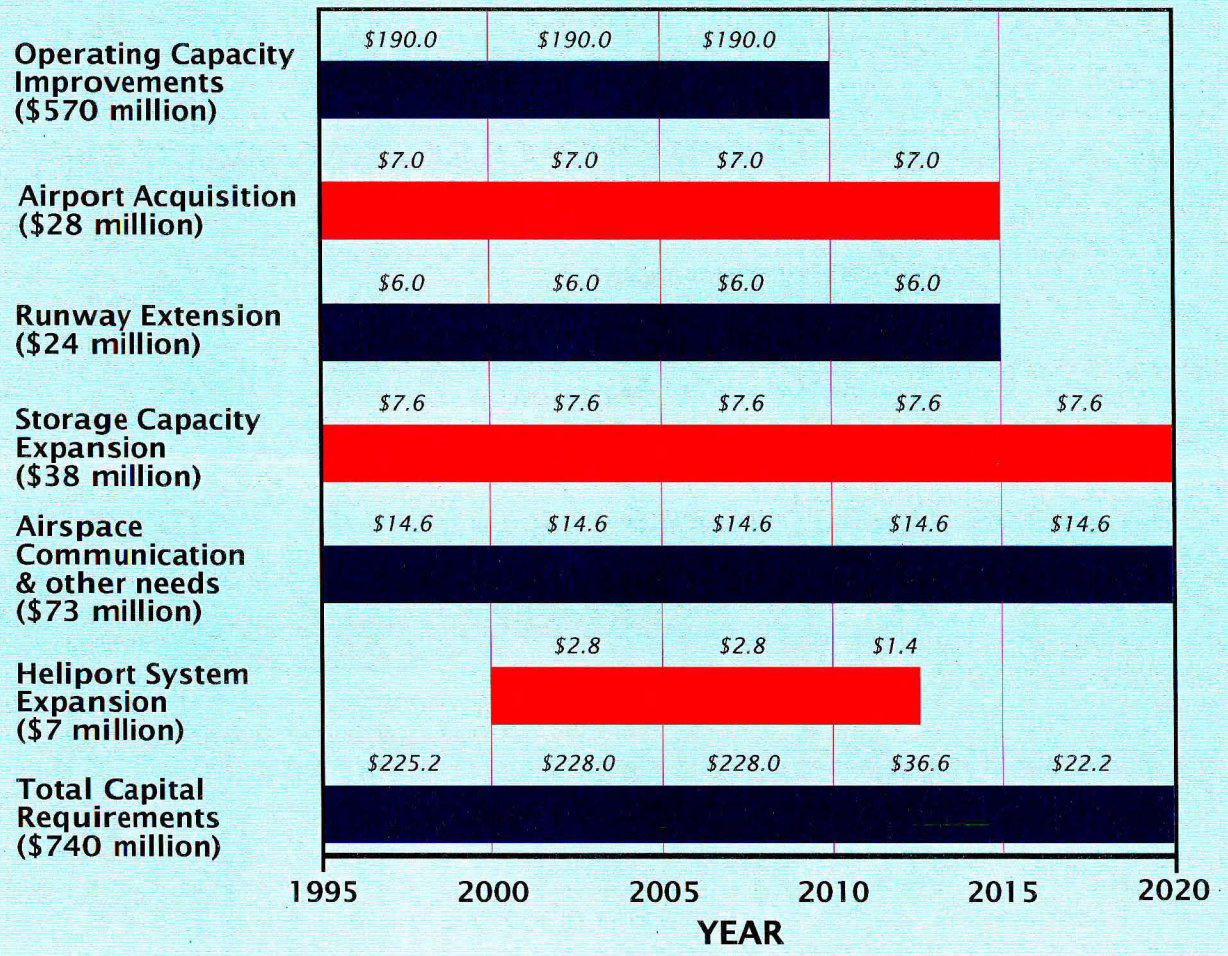
Also, discussed in Chapter V, is the possibility that certain suburban public use, privately owned airports may close due to lack of public capital subsidy availability or competitive real estate uses. In this "worst case" situation only thirteen of twenty-five airports, those which are publicly owned or receiving AIP funding will continue to operate by 2020. In that scenario, most growth from 1995-2020 in general and business aviation would be lost because of the shortage of storage capacity at remaining airports and increased ground access times. However, since improvements at PHL would still proceed, and expansion of remaining suburban airports would necessarily occur to the maximum, the total system improvement cost would still exceed $700 million.

CAPITAL AVAILABILITY AND EXPECTATIONS

Figure VII-1 shows the proposed scheduling of capital improvements within the six functional categories of projects. Given the current delay situation at PHL, emphasis is given to the new runway and terminal expansion there in the first three five-year periods of the 25-year planning cycle. This results in $570 million (90%) of the total $740 million being recommended for commitment in the period 1995 to 2010, and drastically smaller amounts spent during the out years of 2010 to 2020.

Total annual expenditure for the period 1995 to 2010 under the cost and scheduling scenario presented in Figure VII-1 will

Figure VII-1
STAGING OF CAPITAL REQUIREMENTS OF THE 2020 RASP



average $45 million per year, 90 percent of which will be spent at PHL. To place the capital need estimate in perspective, a review of regional capital grant funding for airports from state and federal sources is presented below.

Federal Funding

During the period from FY 82-94, multi-year federal authorization legislation established the Airport Improvement Program annual national levels at up to

$2.1 billion expenditure from the Aviation Trust Fund. Federal support during the 82-87 ADAP program was at its lowest point in recent years of under $1 billion per year nationally, yielding only an average of about $5 million at PHL per year. The national funding level peaked in FY 90 at 2.1 billion when PHL received above $26 million, and has since, declined to roughly $1.5 billion annually in FY 95 and FY 96. PHL and eligible non-commercial airports have benefited from this program Regional funding trends are shown in Table VII-1.

$1.5 billion nationally. Various proposals are now being debated in Congress for continuing federal capital investment in the airport infrastructure past 1996. These vary broadly and include continuation of the AIP program at a range of levels of spending portions of the balance of the trust fund, as well as elimination of the fund and AIP altogether. In the last scenario, commercial airports would continue to collect PFC taxes, as their sole federal subsidy source. Under that scenario non-commercial airports would rely only on

Table VII-1
AVERAGE ANNUAL FEDERAL GRANTS BY AIRPORT TYPE (Millions of Dollars)

Airport Type	1982-87	FY'88	FY'90	FY'92	FY'94
Commercial	$ 4.8	$ 20.2	$ 26.9	$ 18.8	$ 14.5
Non-Commercial	$ 1.9	$ 5.4	$ 4.5	$ 2.0	$ 0.1
TOTAL	$ 6.7	$ 25.6	$ 31.4	$ 20.8	$ 14.6

During the period, PHL received both entitlement formula funds every year based on passenger levels, and discretionary (competitive) grants from FAA where successful technical need could be established. AIP levels have been reduced in the 1990s, as passenger facility charge (PFC) collections from passengers at the point of ticket sale have increased.

The current federal legislation creates a level of expenditure from the Aviation Trust Fund for the 1996 AIP program of state, local and private capital for improvements.

State Funding

During the funding period of FY 82-95 documented in the DVRPC continuous Airport Systems Planning Program (CASP), state capital grants from Delaware, New Jersey, and Pennsylvania have collectively averaged about $2.0 million per year to regional airports. $800,000 is specifically earmarked to PHL

from Pennsylvania per year. Although states' grants have traditionally been smaller than federal grants, in the range of $50,000 to 200,000 per project, and address more minor projects, the state's role has been amplified in recent years, as many critical regional privately owned non-commercial airports are not eligible for federal grants, and therefore must rely on the state for any public capital project assistance.

PHL Funding Requirements

The capital needs of PHL in the next fifteen years average about $38 million per year. Historically, in the last two authorization periods, PHL has received in the range of about $26 million to $11 million per year in capital subsidies from federal and state sources. This would equate to annual expenditures at the airport of roughly $15 million to $35 million, since FAA grants provide 75 percent of typical project funding. Using an average of $25 million per year raised from public subsidy, PHL will need to generate, at least an additional $18 million per year locally to satisfy expansion costs.

A wide variety of alternatives will be employed to provide capital for necessary expansion. This multi-source approach identifies funding options available to some other regional airports in the future. Of the $380 million of capital anticipated to be needed by PHL in the next ten-year period for runway 8-26 and terminal improvements, only $80 million, or 21 percent, is expected from FAA in the next 4-5 years ($27 million has been committed as of 6/95). A major 30-year airport bond issue is being sold in 1995, which will raise $150 million for runway and a portion of the terminal B & C consolidation. Over $100 million is anticipated to be collected in the next ten-year period from the currently FAA approved PFC program. Finally, unexpended capital from the 1988 bond issue will also supplement capital needs.

As in the case with other major airport expansions around the country, political influence in Washington could result in special one-time project funding. The new runway could be completed over several construction years as an alternative to the typical FAA discretionary allocation to PHL. This usually varies with national appropriation level.

Funding for GA Airports

Although smaller publicly owned airports technically can be supported by public bond issues, revenue streams are not as reliable or as documentable as with large commercial airports, and so they — like privately owned airports in the RASP — must rely on federal/state grants or private investment for much of their capital improvements activities. With the recent and expected future reductions in discretionary funds to reliever airports and publicly owned general aviation airports, competition for public funds at the federal and state levels is more severe than ever. The possibility of no availability of federal AIP discretionary funds past 1996 would

probably drive certain weaker airports in the system out of operation. RASP airport closures in the next 25 years, in some cases, will certainly occur, as they have in the last fifteen years at non-capital subsidized airports.

AIRPORT OWNERSHIP AND MANAGEMENT OPTIONS

As discussed, public use airports currently identified as necessary in the 2020 RASP are principally privately owned. Of the twenty-five fixed-wing facilities identified in the RASP, seventeen are privately owned, while the remainder, including the principal commercial airports PHL, Trenton-Mercer, and New Castle County, are publicly owned by cities or counties. Of these seventeen privately owned airports, four have ongoing reliever obligation in the judgement of FAA and have received grants which commit them to continued operation. The remaining thirteen privately owned airports are not locked into the RASP system, and could therefore be sold for non-aviation development, thereby eliminating needed economic development, aircraft storage and mobility capacity.

Therefore, as described in Table VII-2, the 2020 RASP recommends ownership actions for privately owned RASP airports, so that counties in the dense high growth areas of the region can be assured of public aviation access in the future. Currently, RASP airports in the region that are publicly owned are owned directly by municipalities, as is the case with respect to PHL, PNE, NCC, and Pottstown Municipal, or through authorities representing Bucks and Chester counties. In the case of New Castle County, the airport is effectively managed and controlled by the Delaware River and Bay Authority, a toll bridge and ferry operator.

Regarding public acquisition of four RASP airports, respective counties appear to be the primary candidates to assume ownership and operating responsibility. Salem County sponsored an FAA study that looked at possible locations for a publicly owned airport in the county and recommended Oldmans. In the Pennsylvania suburbs, both Chester and Bucks counties have operated their airports — Chester County, Doylestown, and Quakertown — on a financially self-sufficient basis, providing business development options in their counties. Montgomery County to date has declined such operating responsibility. However, Wings, a vital business airport in eastern Montgomery County, is now in danger of closing, with no viable aviation alternative in the market area. Unless private business interests using the facility can raise capital for acquisition, the county could, in order to maintain an adequate business environment, acquire the airport.

New Garden Township is reviewing the financial viability of acquisition of New Garden Airport, although availability of AIP acquisition funds is not clear. Regardless of the fact that Cross Key's master plan was developed in the early

Table VII-2
2020 RASP RECOMMENDED OWNERSHIP AND MANAGEMENT ACTIONS

Privately Owned Airports	Public Acquisition[1]	Private Reliever Status[2]	Private GA Status[3]
BUCKS			
Pennridge		X	
Van Sant			X
Buehl			X
MONTGOMERY			
Wings	X		
Perkiomen Valley			X
Pottstown-Limerick		X	
CHESTER			
Brandywine	X		
New Garden	X		
MERCER			
Trenton-Robbinsville		X	
BURLINGTON			
Flying W			X
Red Lion			X
South Jersey Regional		X	
CAMDEN			
Albion			X
GLOUCESTER			
Cross Keys	X		
SALEM			
Oldmans	X		
NEW CASTLE			
Summit		X	
CECIL			
Cecil County			X
Total Number of Airports	5	5	7

[1]Absolutely critical service location. If airport closes, no business/GA capacity is available in county or primary suburban area where airport is located. Federal/State funding may be provided to supplement private investment.

[2]Airport with critical capacity and is obligated to remain in 2020 RASP due to acceptance of Federal AIP grants. Public acquisition not necessary to retain service. Federal and State funding may be provided to supplement private investment.

[3]Airports providing storage and operating capacity, but sharing market area with other publicly owned or reliever airports. Usually constraints to expansion occur or runway length is not sufficient to accommodate corporate operations. State funding may be provided to supplement private investment.

1980s with Gloucester County as the study sponsor, the county has shown no recent interest in assuming operating responsibility for this single viable business airport in the county.

Proposed PHL Authority

Regarding PHL, legislation was proposed in the early 1990s to create an operating authority in Pennsylvania to take management and equity control of the airport. Motivation for this move arose from (1) the city's marginal credit rating, and therefore the airport's difficulty in floating a favorable rate bond issue; 2) the anachronistic personnel and purchasing rules under which the city and airport functions; 3) the city's need for an influx of cash, if the airport were to be purchased by an authority; and 4) the regional and even tri-state nature of the PHL market and influence.

After much negotiation among the Pennsylvania legislators, the City of Philadelphia, governors, and commissioners from Chester, Delaware, Bucks, and Montgomery counties, the proposal has stalled. Several factors are responsible for this result, specifically:

1. the authority structure is limited to Pennsylvania for politically expeditious reasons, although the market is multistate;
2. assignment of seats on the proposed board could not be agreed upon by Philadelphia, suburban, and Harrisburg interests;
3. the payout and sources of funds to Philadelphia was not agreed to by the parties;
4. USAIR, the dominant airline at PHL merged with British Air, thereby providing incentive for the airlines to support airport expansion, and
5. the city of Philadelphia's credit rating improved, thereby reducing the threat to the airport cash flow and bond rating.

In spite of these events and conditions, the 2020 RASP continues to recommend the formation of an operating authority for PHL, given the inherent efficiencies the authority would bring to operations, personnel, capital financing, and purchasing. However, the 2020 RASP does not recommend a specific structure for this authority, as those decisions must be resolved politically by the states, counties, and City of Philadelphia.

Specific issues which must be addressed to successfully structure the authority include:

1. Market area representation on the Board, which could include Philadelphia, the Pennsylvania governor, the suburban counties of Pennsylvania, the New Jersey governor, and the suburban counties of New Jersey;
2. the Board composition in addition to the constituency groups listed above, should include operating interests such as airlines;
3. the number of airports, besides PHL, included in the operational jurisdiction of the Authority; Northeast Philadelphia, and other public owned suburban airports should be considered;
4. Payout levels, if any, to the City of Philadelphia for relinquishment of sole control over airport operation, development, and other issues.

ZONING, LAND USE AND ACCESSIBILITY

Municipal Zoning

The airspace around an airport, especially in the regional suburbs, is not always controlled by the airport owner. The physical nature of fixed-wing operations requires extended airspace protection of up to 10,000 ft. at each end of the runway in line with its center line. Recognizing the importance of general aviation and business airports to the economies of the suburbs, both New Jersey and Pennsylvania have state laws requiring municipalities where airports are located, or those impacted by overflights approaching or departing the airports below certain minimum altitudes, to create zoning overlay districts to protect the airport's airspace operating area from intrusion from towers, buildings, and natural growth. Hypothetically, building or growth on adjoining land beyond the end of a runway, not owned by the airport, could intrude in the approach, thereby forcing the threshold to be displaced and limiting usage to only small aircraft or closing the runway altogether.

Since the airport zoning laws in both states have no penalties prescribed for non-compliance, not all townships have elected to conform. Those townships hosting privately owned public use airports may not wish to support continued operation by implementing zoning protection, preferring instead redevelopment to a less controversial land use. Illustration of this situation is the following conformance breakdown for the five Pennsylvania counties in the DVRPC region. Over 130 municipalities, including Philadelphia, are impacted by airport operations within their boundaries. Of these, 44 municipalities are heavily impacted, meaning an airport is located in their jurisdictions or immediately adjacent to the runway end. Only 17 of the 44, or 38 percent, have ordinances in place to protect runway approaches.

The situation in New Jersey is somewhat better; fewer airports operate in the five DVRPC counties and the municipalities are larger geographically, more sparsely populated, and not so densely arranged. Therefore fewer municipalities are impacted by the existing RASP airports. Conformance in New Jersey now approaches 90% for all state aviation system plan airports. Delaware, with only two RASP airports, New Castle and Summit, has sufficient land use control around New Castle and is experiencing residential but not airspace, encroachment around Summit, which is located in an unincorporated section of New Castle County.

Clearly, the most serious airspace and land use encroachment threat exists in the Pennsylvania suburbs, with its denser land use, smaller municipalities, and older development patterns. DVRPC should work with PennDOT and FAA to increase zoning conformance. Legislative assistance in the form of financial penalties seem historically to be warranted, as indicated from the low conformance levels.

Ground Access to Airports

In most cases, ground access to airport property is not under the control of the airport. With the completion of major transportation projects in the last 15 years, including I-476, the Vine Expressway (I-

676), I-95, the PHL rail line, and the US 422 Expressway, highway and transit access, modal choices, and travel times have improved to most RASP airports. These access times should remain relatively consistent over the next twenty five years given the mature nature of our highway system.

Development of business and light industrial centers should be encouraged near airports, since their land uses are complementary, and the access routes when expanded for the high traffic volumes generated by employment centers, will also serve airports. Finally, improved airport signage is necessary around the region. PHL has taken the lead in better access information systems, due to the complexity of the layout of the airport. However, other regional business airport locations and access routes are still unclear to potential users, and enhancements will encourage more airport business. One specific major access improvement has been planned, but not implemented in the suburbs. Chester County Airport, the major business reliever facility in the western suburbs, lies in an industrial park setting off the US 30 Bypass in western Chester County. Currently, no ramp exists for eastbound access or westbound egress from the airport, effectively limiting the markets to business users west of the airport. Proposed ramps should be built from US 30 to the airport in order to optimize market draw for this fully equipped, but underutilized facility.

ENVIRONMENTAL CONCERNS

Airport operations and construction result in environmental impacts. Noise is the most cited and mitigated, while water table impacts, air pollution from access vehicles and aircraft must also be addressed. Most environmental impact issues related to airport expansion are identified and addressed at the airport master plan and Airport Layout Plan (ALP) level. This is where specific improvements to address each airport's deficiencies are designed.

Regarding PHL, RASP expansion and technological developments with new commercial aircraft will result in reductions in environmental impacts in the aggregate, despite the 67% increase in passenger traffic. Runway 8-26 construction negated the need to extend 17-35 toward the Eastwick residential community and 9-27 toward Tinicum Township in Delaware County. The center of aircraft operations at the airport in the next 25 years will move further east toward the Delaware River, thereby lowering noise impacts on the majority of nearby residents.

Quieter aircraft brought into the commercial fleet through attrition will also reduce total noise emissions. Water table changes resulting from construction of 8-26 have been mitigated in the design stage. Although additional cars will make the access trip to PHL in the future, transit and limo/van service with high density ridership will reduce some of the pollution increases. Airport expansion has been incorporated into the Pennsylvania State Implementation Plan (SIP) which establishes total air pollution limits.

Vehicle trips to suburban airports are small in magnitude compared to other trip generators, and even at increased airport traffic levels do not significantly impact local air quality. Local noise impacts of suburban airports must be addressed at the

master plan stage of development. However, several major projects recommended at suburban airports including land acquisition and runway extensions will allow for quieter takeoffs and more buffer space between airport operations and adjoining land users. Generally, the FAA has regarded expansion or improvement projects at suburban general aviation or business/ reliever airports as having only minor environmental impact in comparison to major commercial airport construction, and has therefore not required Environmental Impact Statement (EIS), issuing instead a finding of no significant impact, or FONSI.

TECHNOLOGICAL AND POLICY DEVELOPMENTS

The aviation market place is very competitive and, due to the relative youth of aviation as a service industry, technological advancement driven by profitability and safety is occurring continually. In order for the RASP 2020 system to be efficiently implemented and operated in the future, the facilities proposed must be adaptable to new technical and policy innovations as they appear. Several ongoing or anticipated developments which can affect and enhance the regional system are discussed here.

New Aircraft

In the pursuit of profit, manufacturers are building new and more efficient commercial aircraft. These are able to serve high density domestic and international origin-destination pairs, and accommodate 400-600 passengers per aircraft, and still use existing 10,000 ft. commercial runways. The higher payload increases profitability by spreading cost over more passengers. Advances in engine design, power, and efficiency will provide improved payload and range without the need to expand runway lengths or increase airspace capacity. However, increased passengers per flight will necessitate enhanced terminal facilities and services, which PHL is currently undertaking. Tiltrotor aircraft, originally developed for the military, have been proposed for civilian use. With a payload ability and range to accommodate 20-40 passengers and the vertical takeoff and landing capability of a helicopter, the aircraft has been proposed to serve a market in the northeast corridor from Boston to Washington and west to Pittsburgh. Although traditional runways are not required for tiltrotor operations, sufficient space exists at the Delaware waterfront in center city Philadelphia and at suburban heliports to combine tiltrotor operation at those sites. FAA commitment to the research necessary to convert the military tiltrotor to civilian use has wavered over the last ten years. Advantages of this type of service are quicker travel time between CBDs for high-end business travelers. Also, airspace and operating capacity at PHL will be relieved, if significant CBD service develops.

Advanced Navigational and Landing Aids

The Global Positioning System, or GPS, is an electronic guidance system for aircraft based on continuous signals triangulated between satellites and the aircraft. Positioning accuracy is sufficient to provide instrument guidance to any airport where an approach plate has been prepared. In-

flight guidance and management of airspace will also be available. Costs include the purchase of a receiver for each aircraft. Since no ground installation of transmitter equipment is necessary, additional real estate for such an installation need not be purchased. Also, lack of availability of space on the frequency band, which can restrict ILS installation in densely developed areas like the Northeast Corridor is not a factor.

Legislative Reform to Product Liability Laws

Recently federal legislation has amended product liability responsibilities of general aviation aircraft manufacturers to 18 years. Previously manufacturers like Cessna, Piper and Beech, were vulnerable to suit for the life of the aircraft independent of number of owners, maintenance schedule, parts used, and repairs made. The result was essentially the cessation of production of small general aviation and business aircraft. With this recent limitation, manufacturers can carry less insurance, thereby lowering the sale price of new, and ultimately resale, aircraft. Initial reaction by the manufacturers has been to reinstate limited production of aircraft. Ultimately, this cost lowering legislative action will result in more demand for non-commercial airport operations and storage. Although anticipated minimum demand for suburban storage should use up the increased hangar capacity being proposed in the 2020 RASP, additional ramp space will be available to accommodate any storage overload.

CONTINUING AIRPORT SYSTEM PLANNING PROCESS

Since the adoption of the first Philadelphia metro RASP in 1982, DVRPC has continuously maintained and expanded its role and abilities in aviation planning. Upon adoption of the 2020 RASP, DVRPC will embark on CASP activities to maintain and update this plan for the next 25 years. Specifically, FAA mandates that CASP activities include the broad categories of Forum and Coordination, Surveillance, Special Studies, and Plan Reevaluation and Revision, with all appropriate documentation. DVRPC anticipates that its continuing aviation planning process will relate to the continuing RASP in the following ways, within the activity categories above.

Regional Forum

Regular quarterly Regional Aviation Committee meetings will be held to identify issues, develop policy and regional direction, and anticipate and plan for future needs. Also, coordination will be maintained with other DVRPC transportation and citizen committees and the Board, as well as with the states of Pennsylvania, New Jersey, and Delaware regarding their planning priorities, and with the individual airport master planning efforts.

Surveillance

Traffic volumes will be monitored at RASP airports in order to develop trends and identify interactions between airports. Ground access travel times will be periodically surveyed and compared with plan objectives. Also, capital investment

Regional Aviation Committee Meeting at DVRPC Conference Room

trends at all RASP airports from federal, state, and private/local sources will be recorded. Each year, capital recommendations for continuing funding of projects consistent with the RASP will be prepared for concurrence of the DVRPC regional community. Such projects are transmitted to the appropriate federal and state funding agencies as regional development funding requests.

Special Studies

DVRPC will advance a number of specific studies and analyses in support of development of a dynamic RASP document. Activities and studies to be considered in this component include: identification of airports for funding eligibility deliberations; operating and storage capacity analysis; conflicts and facilities planning analysis; and local zoning implementation - technical and mapping assistance; pavement maintenance planning deficiencies analysis; economic impacts of airports and airport systems; policy analysis and position development for the DVRPC Board regarding federal/ state legislation, and programs and operations issues. Generally, special

studies of this type will serve to resolve systems planning and capital programming issues that arise on a shorter term basis than the long-range RASP perspective, but fit into and shape long-range planning revisions.

RASP Re-evaluation and Revision

This is a function that will use input from other planning activities to document change in the system, and prepare revised RASP objectives in response to changing capacity, demand and market sensitivities. It is anticipated that major changes will occur in the region that will influence the aviation infrastructure. Privately owned airports may close while others will expand their roles and capacities. Commercial airline services will continue to be altered in response to domestic and international market conditions. Federal and state funding programs are anticipated to change, and magnitudes of available capital for airport development will continue to vary with political imperatives. Macroscopic economic trends, as well as aviation economies, constantly change the decision balance concerning the choice of whether or not to use aviation for transportation.

Within six years of the adoption of the 2000 RASP significant changes made that system obsolete and the 1989 amendments necessary. Now with the 2000 RASP horizon only five years away, in order to provide effectively for the region's long term economic development, mobility, and quality of life, the RASP 2020 has been developed with objectives and components reflecting an anticipated range of circumstances 25 years into the future. □

Appendix A

ABBREVIATIONS OF COMMON AVIATION TERMS

AAAE	American Association of Airport Executives
AASHTO	American Association of State Highway and Transportation Officials
AC	Advisory Circular
ACY	Atlantic City International Airport
ADF	Automatic Direction Finder
ADO	Airports District Office
AGL	Above Ground Level
AIP	Airport Improvement Program
ALP	Airport Layout Plan
ALS	Approach Light System
AMA	Airport Market Area
ANCA	Aircraft Noise and Capacity Act of 1990
AOCI	Airports Operator Council International
AOPA	Aircraft Owners and Pilot Association
APP	Approach
ARC	Airport Reference Code
ARP	Airport Reference Point
ARSA	Allentown Airport Radar Service Area
ARTCC	Air Route Traffic Control Center
ASR	Air Surveillance Radar
ATA	Air Transport Association of America
ATC	Air Traffic Control
ATCT	Air Traffic Control Tower
ATIS	Automatic Terminal Information System
AWOS	Automated Weather Observing System
BEA	US Bureau of Economic Analysis
BRL	Building Restriction Line
BU	Basic Utility Airport
CAAA	Clean Air Act Amendments of 1990

CASPP	Continuous Airport System Planning Process
CIP	Capital Improvement Program
CR	County Highway Route
CWY	Clearway
DE DOT	Deleware Department of Transportation
DH	Decision Hight
DME	Distance Measuring Equipment
DOD	Department of Defense
DOT	Department of Transportation
DVRPC	Delaware Valley Regional Planning Commission
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EWR	Newark International Airport
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FBO	Fixed Base Operator
FL	Flight Level (Altitudes from 18-60,000' using standard altimeter settings)
FSS	Flight Service Station
GA	General Aviation
GAMA	General Aviation Manufacturers Association
GCA	Ground Controlled Approach
GPS	Global Positioning System
GU	General Utility Airport
HAA	Hight Above the Airport
HAT	Hight Above Touchdown
HIRL	High Intensity Runway Lights
IFR	Instrument Flight Rule
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
ISTEA	Intermodal Surface Transportation Efficiency Act of 1990
LIRL	Low Intensity Runway Lights

LOC	Localizer
LOM	Locater Outer Marker
MAP	Missed Approach Point
MASP	Metropolitan Airport System Plan
MDA	Minimum Decent Altitude
MD DOT	Maryland Department of Transportation
MOCA	Minimum Obstruction Clearance Altitude
MVA	Minimum Vectoring Altitude
MIRL	Medium Intencity Runway Lights
MLS	Microwave Landing System
NASAO	National Association of State Aviation Officials
NAVAID	Navigational Aid
NDB	Non-Directional Beacon
NJ DOT	New Jersey Department of Transportation
NM	Nautical Mile
NPIAS	National Plan of Integrated Airport Systems
OFZ	Obstacle Free Zone
PA DOT	Pennsylvania Department of Transportation
PAPI	Precision Approach Path Indicator
PAR	Precision Approach Radar
PCA	Positive Control Area
PFC	Passenger Facility Charges
PGP	Planning Grant Program
PHL	Philadelphia International Airport
PNE	Northeast Philadelphia Airport
PTCA	Philadelphia Traffic Control Area
RAC	DVRPC Regional Aviation Committee
RAIL	Runway Alignment Indicator Light
RAPCON	Radar Approach Control
RASP	Regional Airport System Plan
RCO	Remote Communications Outlet
REIL	Runway End Identifier Lights
RL	Reliever Airport
RNAV	Radio Navigation

RPZ	Runway Protection Zone
RSA	Runway Safety Area
RVR	Runway Visibility Rating
RW	Runway
SASP	State Airport Systems Plan
SID	Standard Instrument Departure
SR	State Highway Route
SWY	Stopway
TACAN	Tactical Aid to Navigation
TCA	Terminal Control Area
TDZ	Touchdown Zone
TEC	Tower Enroute Control
TERPS	Terminal Instrument Procedure
TH	Threshold
TL	Taxilane
TRACON	Terminal Radar Approach Control
TTN	Trenton-Mercer Airport
TW	Taxiway
UHF	Ultra High Frequency (300-3000 MHz)
UNICOM	Unified Communications
VASI	Visual Approach Slope Indicator
VHF	Very High Frequency (30-300 MHz)
VFR	Visual Flight Rules
VOR	VHF Omni-Directional Range Station
VORTAC	Combination VOR and TACAN Station
WILMAPCO	Wilmington Metro Area Planning Council

Appendix B

2020 SPECIFIC FORECAST ASSUMPTIONS

Specific growth rates for commercial and non-commercial operations and based aircraft from each forecast study used for comparison were calculated as follows:

2020 Commercial Operations

- Base operations are a combination of airport data, FAA TAF data, master planning, and systems planning estimates.

- TAF projections use the FAA annual growth rate from 1990 to 2005, then one-half that rate to 2020 Initial annual rates are 2 percent for PHL 5.6 percent for Trenton-Mercer, and 6.67 percent for New Castle County, the three commercial airports in the region.

- Master Plan/State System Plan projections assume annual growth rate to the end of each study's planning horizon, then one-half that rate to 2020. Initial rates are 2.6 percent for PHL, 4 percent for Trenton-Mercer, and 1 percent for New Castle County.

- Employment/population growth factors are developed by considering DVRPC employment and population growth from 1990 to 2020 by county aggregated to subregional areas of PA counties, NJ counties, and traditional WILMAPCO counties. Factors are the average of two times the employment growth percentage plus one time the population growth percentage, divided by three. In the case of PHL, the full regional averages are used, while for Trenton-Mercer Airport, Burlington, Bucks and Mercer county data are used. For New Castle County Airport, Salem, New Castle and Cecil county data are used.

2020 Non-Commercial Operations

- Current or base operations by the three sub-regional study areas (PA, NJ, and WILMAPCO) are the average of regional counts taken between 1989 and 1994. Operations at non-RASP airports and towered airports are estimated and included.

- TAF projections assume the annual average FAA growth rate for projected similar airports in the three geographic regional areas to 2005, then one-half that annual rate to 2020. Initial annual rates are 3.4 percent for PA, 2.8 percent for NJ, and 2.0 percent for WILMAPCO.

- DVRPC 2020 projections use the annual observed growth rates for operations resulting from the counting program, by state, through 2005, then half that rate to 2020.

Operations at non-counted airports are also included in the growth rates; however, commercial and military operations are not. Initial annual rates are 1.8 percent for PA, 2.4 percent for NJ, and 1.8 percent for WILMAPCO.

- The employment/population growth factor is derived as described above; however only PA data are included in the PA factor, and likewise for the New Jersey and WILMAPCO areas, since general aviation and business traffic, which is local in nature, are being considered

2020 Based Aircraft

- Current Baseline based aircraft complements are derived by state from field observations, and DVRPC studies from 1988 to 1993.

- Year 2020 employment/population factor are developed as described previously, using all counties' data for each of the three regional areas — PA, NJ, and WILMAPCO.

- Year 2020 DVRPC annual growth rate is that observed through DVRPC counts, 1988-1989-1993 to 2005, then one-half that rate to 2020. The initial rate for PA is 1.1 percent for NJ 0.6 percent, and for WILMAPCO 3.0 percent.

- SASP 2020 projections use annual rates developed in the respective state's systems plans for growth in based aircraft to each study planning horizon 2010 for PA, NJ and 2005 for DE. Growth rates are 4.5 percent for PA, 0.7 percent for NJ, and 1.5 percent for WILMAPCO.

With these data, describing growth rates in population and employment by county, by state, and regionally, DVRPC defined growth rates to be applied to baseline operations and based aircraft data to establish future regional demand totals. The same exercise was done with rates developed, by use of FAA and states projections for commercial operators, non-commercial operations, and based aircraft.

Comparative Demand Assignment at Neighboring Airports

As an example, both Pottstown Limerick and Perkiomen Valley serve and share similar market areas in rural western Montgomery County. However, growth of operations (30% vs 10%) and based aircraft (42% vs 10%) are assigned more to Pottstown-Limerick due to the favorable factors of more storage expansion potential, better ground access, business orientation of the airport, wider runway with full taxiway and localizer approach. □

Appendix C

AIRPORT MARKET AREAS BY MUNICIPALITY, TRAFFIC ANALYSIS ZONES, CENSUS TRACTS, INCORPORATED TOWNS, AND DISTRICTS

This appendix lists all municipalities in the 9 county DVRPC region plus Salem County and incorporated towns New Castle and Cecil which are included in the analysis of airport market areas. Three lists were created for 1990, 2020 RASP and 2020 "Worst Case" Scenario Market Areas.

Also the appendix includes 12 county maps showing municipalities and traffic analysis zones for the 9 county DVRPC Area, plus Salem County and census tracts as well as incorporated towns or districts for the two WILMAPCO counties.

1. 1990 AIRPORT MARKET AREAS BY MUNICIPALITY

Philadelphia International

Center City
South Philadelphia
Southwest Philadelphia
West Philadelphia
Camden City
Wood-Lynn
Haddon
Oaklyn
Audubon
Audubon-Park
Gloucester-City
Upper Darby
Millbourne
East Lansdowne
Yeadon
Lansdowne
Clifton-Heights
Aldan
Darby & Borough
Colwyn
Sharon Hill
Collingdale
Tinicum
Folcroft
Glenolden
Springfield
Morton
Rutledge
Ridley
Norwood
Prospect-Park
Ridley-Park
Eddystone
Swarthmore

Phila. Int. (cont.)

Upper Providence
Media
Rose Valley
Nether Providence
Brookhaven
Parkside
Upland
Chester & City
Trainer
Marcus Hook
Lower Chichester
Upper Chichester
Bethel
Aston
Middletown

Oldmans Airport

Brocklawn
Westville
Deptford
Wenonah
Woodbury Hights
Woodbury
National Park
West Deptford
Paulsborough
Greenwich
Logan
East Greenwich
Mantua
Harrison
South Harrison
Woolwich
Swedesboro

Oldmans (cont.)

Upper Pittsgrove
Pilesgrove
Woodstown
Oldmans
Carneys
Mannington

New Castle Co. Airport
(Incorporated Towns only)

Lower Penns Neck
Pennsgrove
Wilmington
Elsmere
Arden
Ardentown
Arden Croft
Bellefonte
New Castle
Newport

Summit Airport
(Incorporated Towns only)

Middletown
Odessa

Cecil County Airport
(Incorporated Towns only)

Newark
Elkton
Northeast
Charlestown (Cecil Co.)

New Garden Airport

London Britain
Franklin
New London
Elk
East Nottingham
West Nottingham
Oxford
Lower Oxford
Penn
West Grove
London Grove
Avondale
New Garden
Kennett Square
Kennett
Pennsbury
East Marlborough
West Marlborough
Londonderry
Upper Oxford
West Followfield

Chester County Airport

Highland
Atglen
West Sadsbury
Parkesburg
Sadsbury
East Fallowfield
South Coatsville
Modena
1/2 Caln
Coatsville
Valley
West Caln
West Brandywine
Wallace

Chester Co. (Cont.)

West Nantmeal
Elverson
Honeybrook & Borough

Shannon Airport

Upper Uwchland
East Brandywine
Downingtown
East Caln
West Bradford
East Bradford
Newlin
Pocopson

Brandywine Airport

Uwchland
West Pikeland
1/2 East Pikeland
Schuykill
Charlestown (Chester Co.)
West Whiteland
West Goshen
West Chester
Westtown
Thornbury (Chester Co.)
Thornbury (Delaware Co.)
Birmingham (Chester Co.)
Birmingham(Del. Co.)
Concord
Chester Hights
Edgemont
Newtown
Marple
Easttown
Tredyffrin

Brandywine (cont.)

Willistown
Malvern
East Goshen
East Whiteland

Potts. Municipal Airport

Douglass
Upper Pottsgrove
West Pottsgrove
1/2 Pottstown
North Coventry
South Coventry
Warwick
East Nantmeal
West Vincent

Potts.-Limerick Airport

1/2 East Pikeland
New Hanover
Upper Frederick
Lower Frederick
Limerick
Lower Pottsgrove
1/2 Pottstown
East Coventry
East Vincent
Spring City
Royersford
1/2 Upper Providence

Perkiomen Valley Airport

Upper Salford
Lower Salford
Towamencin

Perkiomen (cont.)

Lansdale
Upper Gwynedd
North Wales
Worcester
Skippack
Trappe
Collegeville
1/2 Upper Providence
Lower Providence
West Norriton
Perkiomen
Schwenksville
Phoenixville

Wings Field

Montgomery
Horsham
Lower Gwynedd
Ambler
Upper Dublin
Whitpain
Springfield
Whitemarsh
Conshohocken
Plymouth
Bridgeport
Norristown

Quakertown Airport

Springfield
Richlandtown
Richland
Quakertown
Milford
Trumbauersville
Upper Hanover

Quakertown (cont.)

East Greenville
Pennsburg
Red Hill
Marlborough
Greenlane

Van Sant Airport

Riegelsville
Durham
Bridgeton
Nockamixon
Tinicum
Bedminster
Heycock

Doylestown Airport

Plumstead
Solebury
New Hope
Buckingham
Wrightstown
Doylestown
New Britain & Borough
Chalfont
Doylestown
Warrington
Warwick
Ivyland
Warminster

Pennridge Airport

East Rockhill
Perkasie
Sellersville
West Rockhill

Pennridge (cont.)

Salford
Franconia
Telford
Sonderton
Hatfield & Borough
Silverdale
Hilltown
Dublin

Buehl Field

1/2 Northamton
Newtown & Borough
Lower Southamton
Middletown
Langhorne
Langhorne Manor
Penndel
1/3 Lower Makefield
Morrisville
Falls
Tullytown
Bristol & Borough

Trenton-Mercer Airport

Princeton & Borough
Hopewell
Pennington
Upper Makefield
3/4 Lawrence
Ewing
Trenton
2/3 Lower Makefield
Yardley

Trenton-Robb. Airport

West Windsor
East Windsor
Hightstown
Washington
Hamilton
1/4 Lawrence
Bordentown & Borough
Fieldsboro
Chesterfield
Mansfield

So.Jersey Reg./Flying W

Florence
Springfield
Burlington & Borough
Westampton
Mount Holly
Eastampton
Willingboro
Edgewater Park
Beverly
Delanco
Riverside
Delran
Cinnaminson
Maple Shade
Cherry Hill
Moorestown
Mount Laurel
Hainsport
Lumberton
Evesham
Medford
Medford Lakes

Red Lion Airport

Pemberton & Borough
Southampton
Woodland
Tabernacle
Shamong

Northeast Phila. Airport

Bensalem
Lower North Philadelphia
Kensington
Near Northeast Phila.
Far Northeast Phila.
Lower Moreland
1/2 Bryn Athyn
Pennsauken
Palmyra
Riverton

Cross Keys Airport

Waterford
Chesilhurst
Winslow
Berlin & Borough
Pine Valley
Pine Hill
Gloucester
Washington
Pittman
Glasboro
Elk
Clyton
Franklin
Newfield
Monroe
Pittsgrove
Elmer

2. 2020 RASP AIRPORT MARKET AREAS BY MUNICIPALITY

(changes to 1990 Market Areas)

Philadelphia International

Add to 1990 List:
Portions of N.E. Phila.

Oldmans Airport

same as 1990

New Castle Co. Airport

same as 1990

Summit Airport

same as 1990

Cecil County Airport

same as 1990

New Garden Airport

same as 1990

Chester County Airport

Add to 1990 List:
East Brandywine
1/2 Caln
Newlin

Brandywine Airport

Add to 1990 List:
Upper Uwchland

Brandywine (cont.)

Downingtown
East Caln
West Bradford
East Bradford
Pocopson

Subtract from 1990 List:
Marple

Potts.-Municipal Airport

same as 1990

Potts.-Limerick Airport

Add to 1990 List:
1/2 Norriton

Perkiomen Val. Airport

Add to 1990 List:
1/2 Norriton

Subtract from 1990 List:
Phoenixville

Wings Field

Subtract from 1990 List:
1/2 Norriton

Quakertown Airport

Subtract from 1990 List:
Greenlane

Van Sant Airport

same as 1990

Doylestown Airport

same as 1990

Pennridge Airport

same as 1990

Buehl Field

Add to 1990 List:
1/3 Lower Makefield

Trenton-Mercer Airport

Subtract from 1990 List:
1/3 Lower Makefield

Trenton-Robb. Airport

Add to 1990 List:
Portion of Florence

So.Jersey Reg./Flying W

Subtract from 1990 List:
Portion of Florence
1/2 Evesham
1/2 Medford

Red Lion Airport

same as 1990

Northeast Phila. Airport

Subtract from 1990 List:
Lower North Philadelphia

Cross Keys Airport

Subtract from 1990 List:
Winslow
Chesilhurst
Waterfront
Berlin & Borough
Pine Valley
Pine Hill

Camden County Airport

(Recommended addition to
1990 System)

Winslow
Chesilhurst
Waterford
Berlin & Borough
Pine Valley
Pine Hill
Vorhees
Gibbsboro
Clementon
Lindenwold
Laurel Springs
Stratford
Hi Nella
Somerdale
1/2 Evesham
1/2 Medford

3. 2020 WORST CASE SCENARIO MARKET AREAS BY MUNICIPALITY

(Changes to 1990 Market Areas)

Philadelphia International

Add to 1990 List:
Lower North Philadelphia
Brooklawn
Logan

New Castle Co. Airport
(Incorporated Towns only)

Add to 1990 List:
Newark
Elkton

Summit Airport
(Incorporated Towns only)

same as 1990

New Garden Airport

Add to 1990 List:
Pocopson

Chester County Airport

Add to 1990 List:
Newlin
West Bradford
Caln
Downingtown
East Caln
East Bradford
East Brandywine

Cester Co. (Cont.)

Upper Uwchland
Uwchland

Potts.-Municipal Airport

Add to 1990 List:
1/2 East Pikeland
West Pikeland

Potts.-Limerick Airport

Add to 1990 List:
Greenlane
Schwenksville
Perkiomen
Trappe
Collegeville
1/2 Upper Providence
Phoenixville

Quakertown Airport

Subtract from 1990 List:
Greenlane

Pennridge Airport

Add to 1990 List:
Upper Salford
Lower Salford
Haycock

Subtract from 1990 List:
Dublin

Doylestown Airport

Add to 1990 List:
Montgomery
Horsham
Lower Gwynedd
Hatboro
Bedminster
Tinicum (Bucks Co.)
Nockamixon

Trenton-Mercer Airport

Add to 1990 List:
1/4 Lawrence
West Windsor
Hamilton
Bordentown & Borough
Fieldsboro
Morrisville
Falls
Tullytown
1/4 Lower Makefield
Middletown
Langhorne
Langhorne Manor
Hulmville
Penndel
1/2 Lwr. Southamton
1/2 Northampton
Newtown & Borough

S. Jersey Reg. Airport

Add to 1990 List:
Mansfield
1/2 Pemberton & Borough

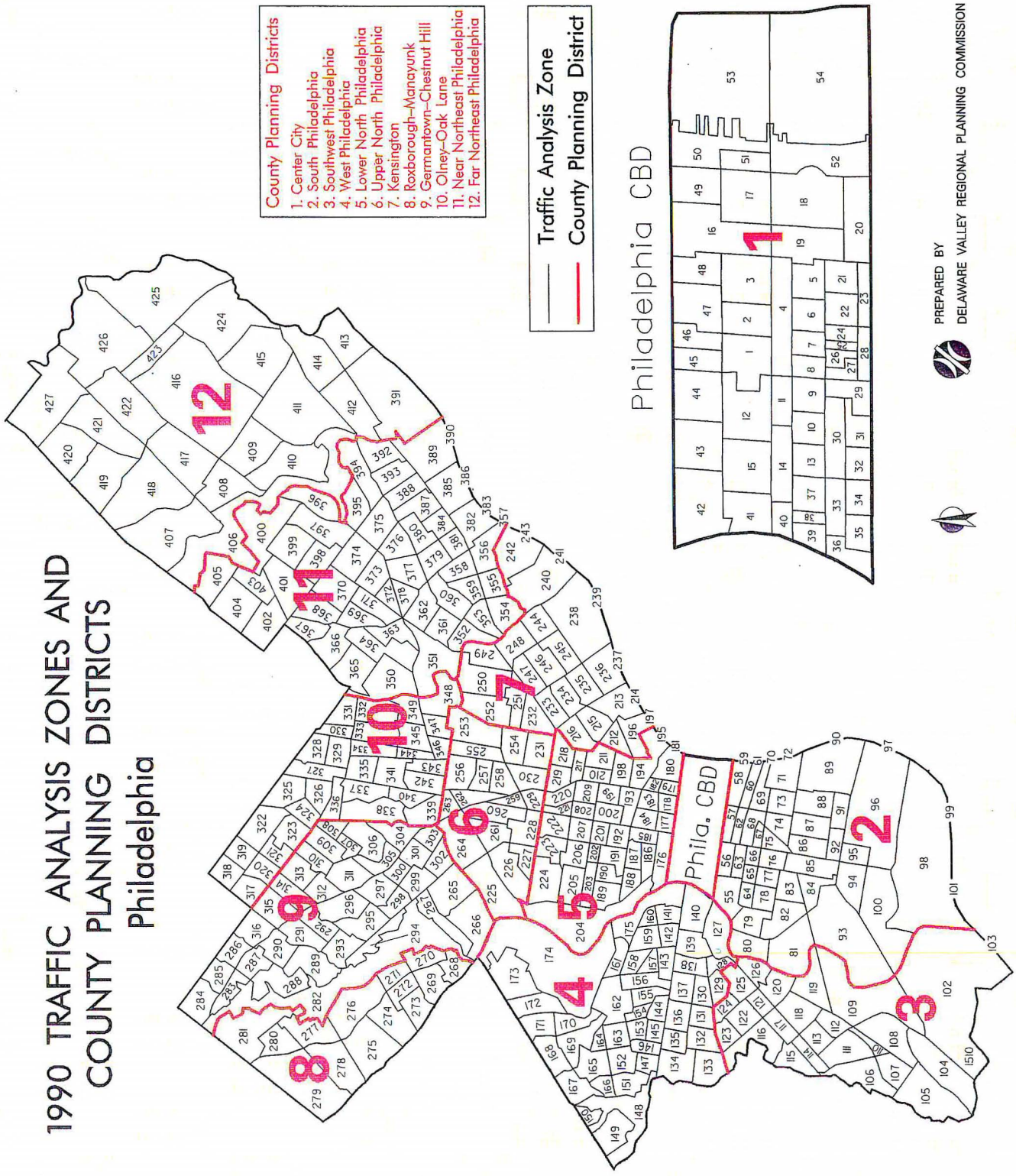
So. Jersey Reg. (Cont.)

Southampton
Southampton (Burl. Co.)
Tabernacle
Shamong

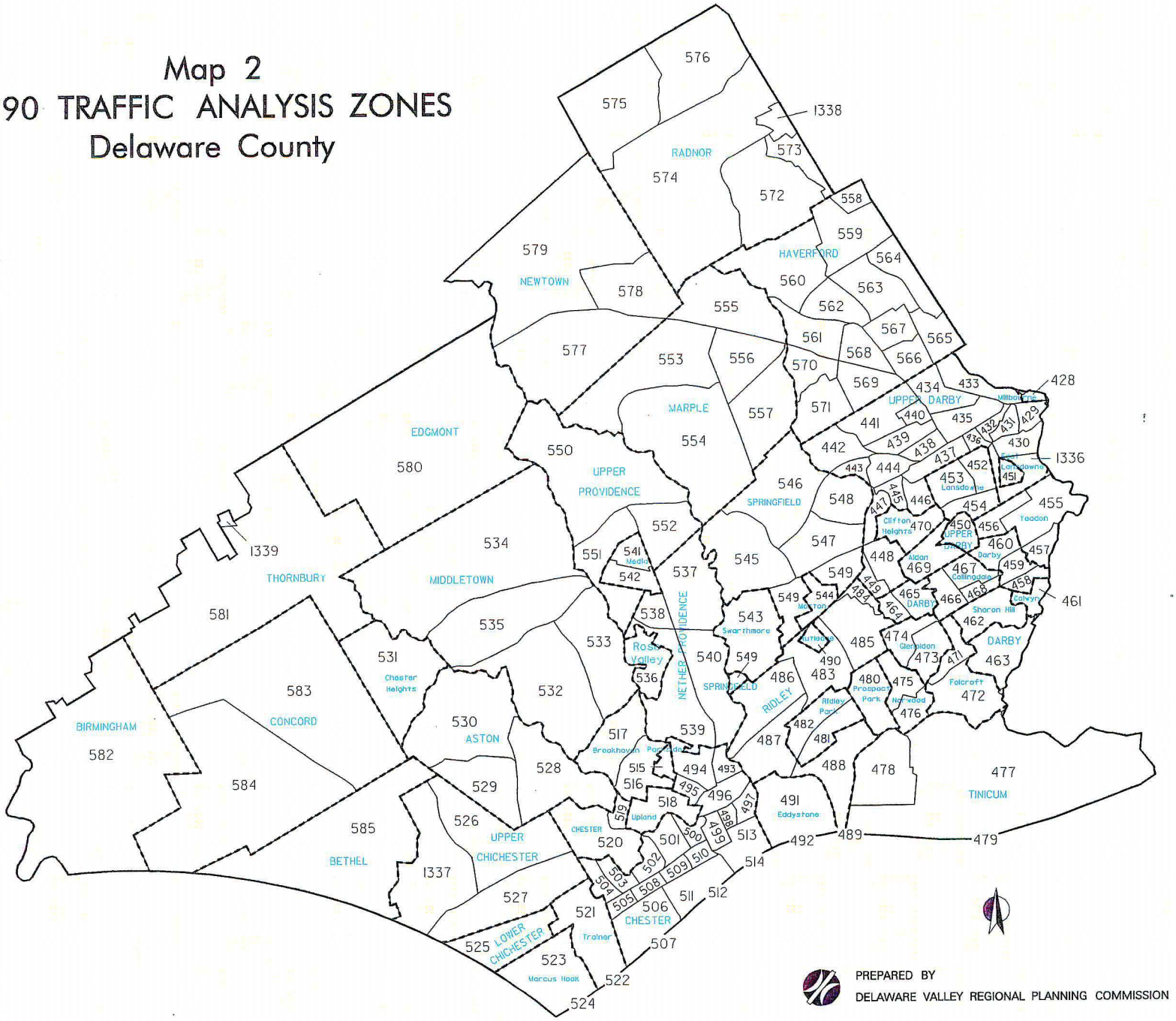
Northeast Phila. Airport

Subtract from 1990 List
Lower North Philadelphia

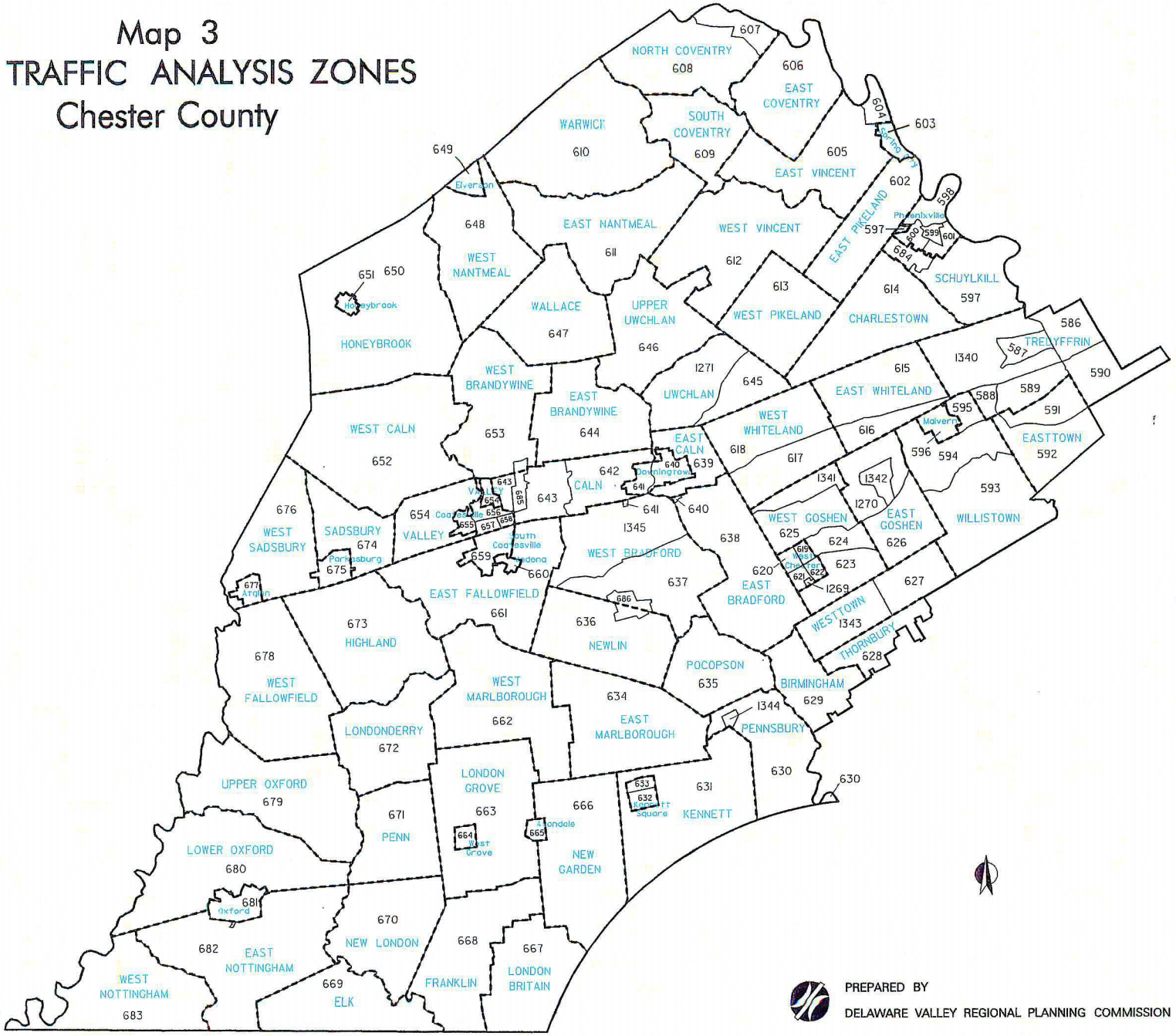
4. 1990 TRAFFIC ANALYSIS ZONES, CENSUS TRACTS, INCORPORATED TOWNS, AND DISTRICTS



Map 2
1990 TRAFFIC ANALYSIS ZONES
Delaware County



Map 3
1990 TRAFFIC ANALYSIS ZONES
Chester County



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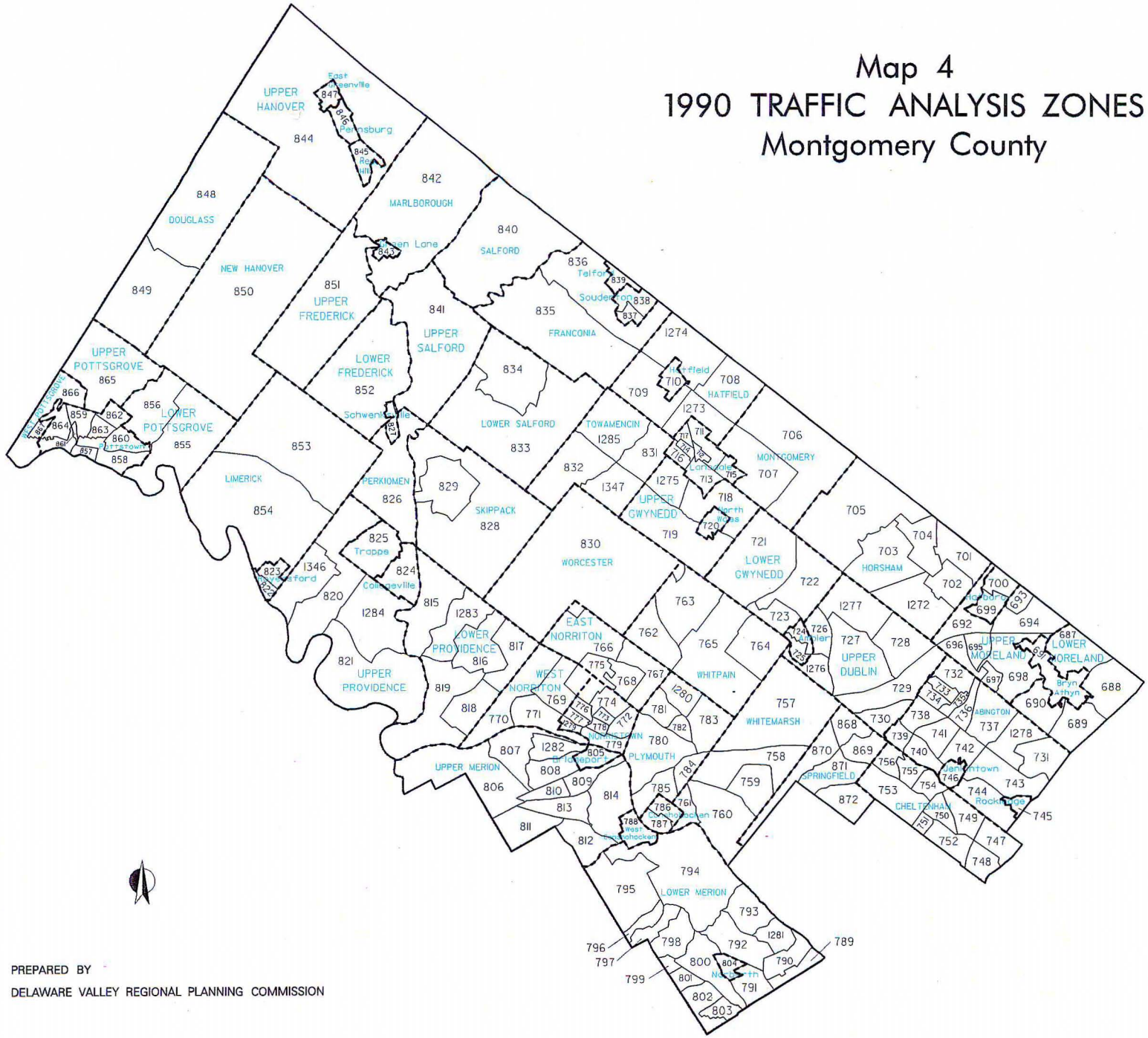
Map 4
1990 TRAFFIC ANALYSIS ZONES
Montgomery County



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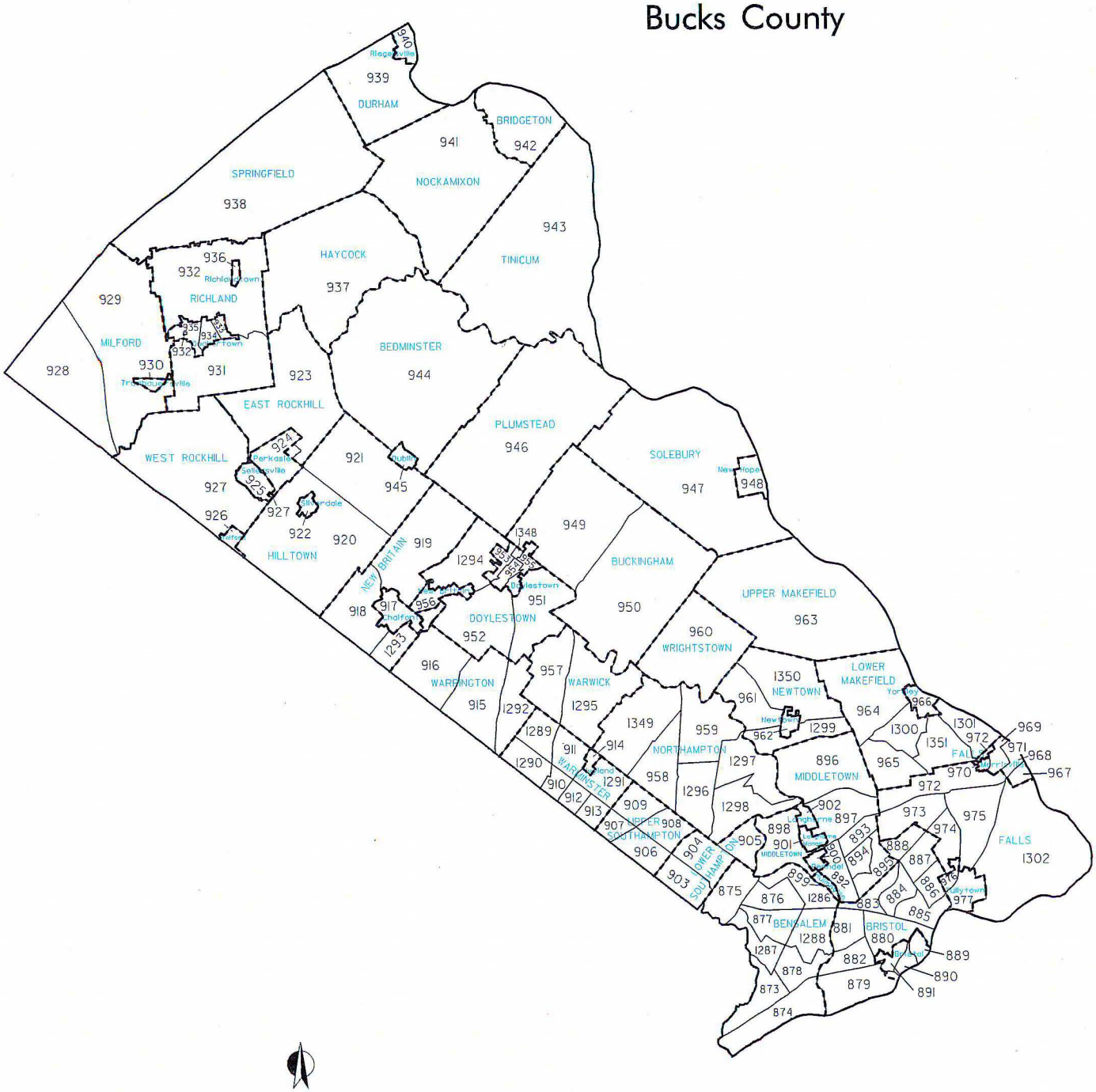
Map 5
1990 TRAFFIC ANALYSIS ZONES
Bucks County



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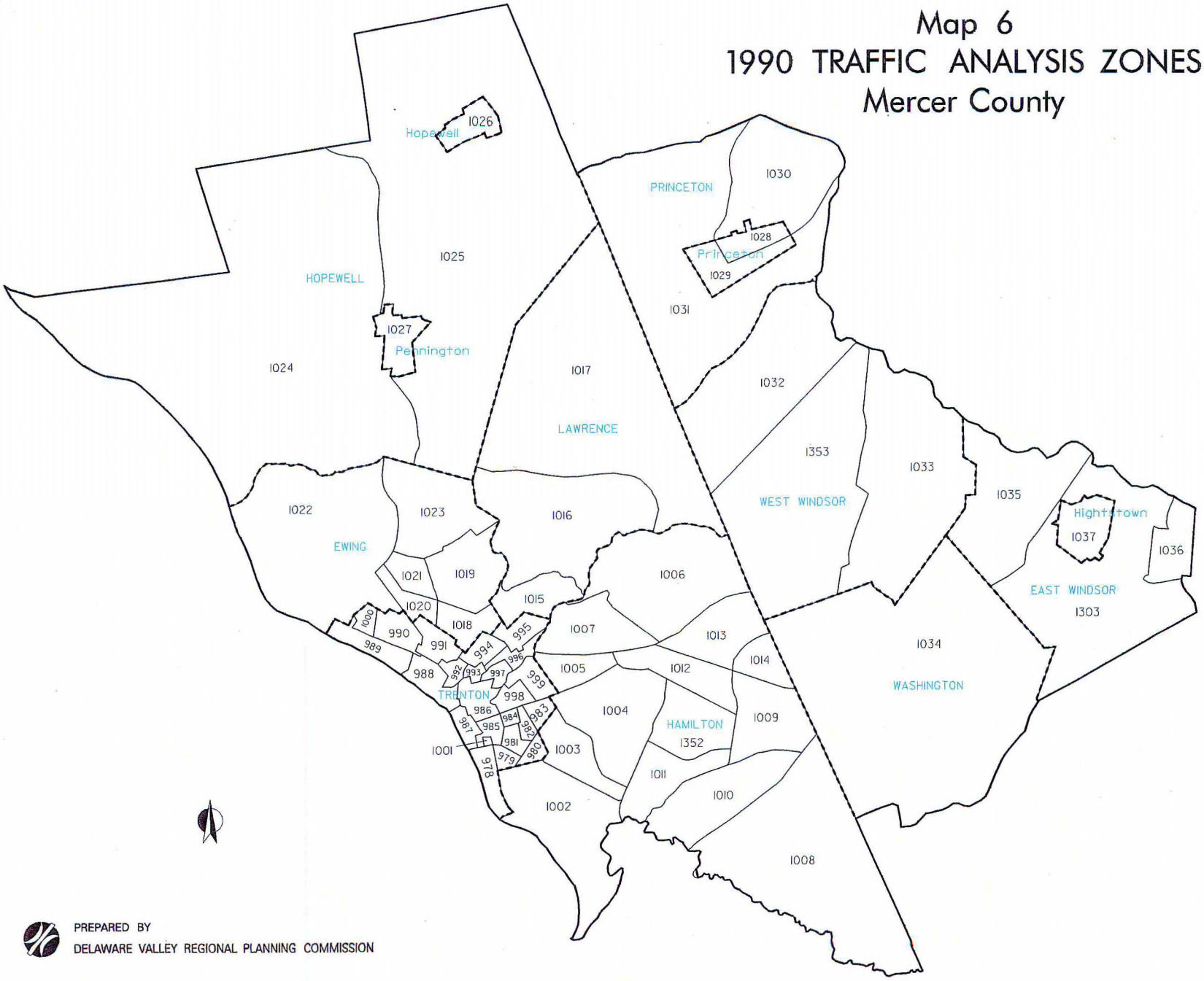
Map 6
1990 TRAFFIC ANALYSIS ZONES
Mercer County



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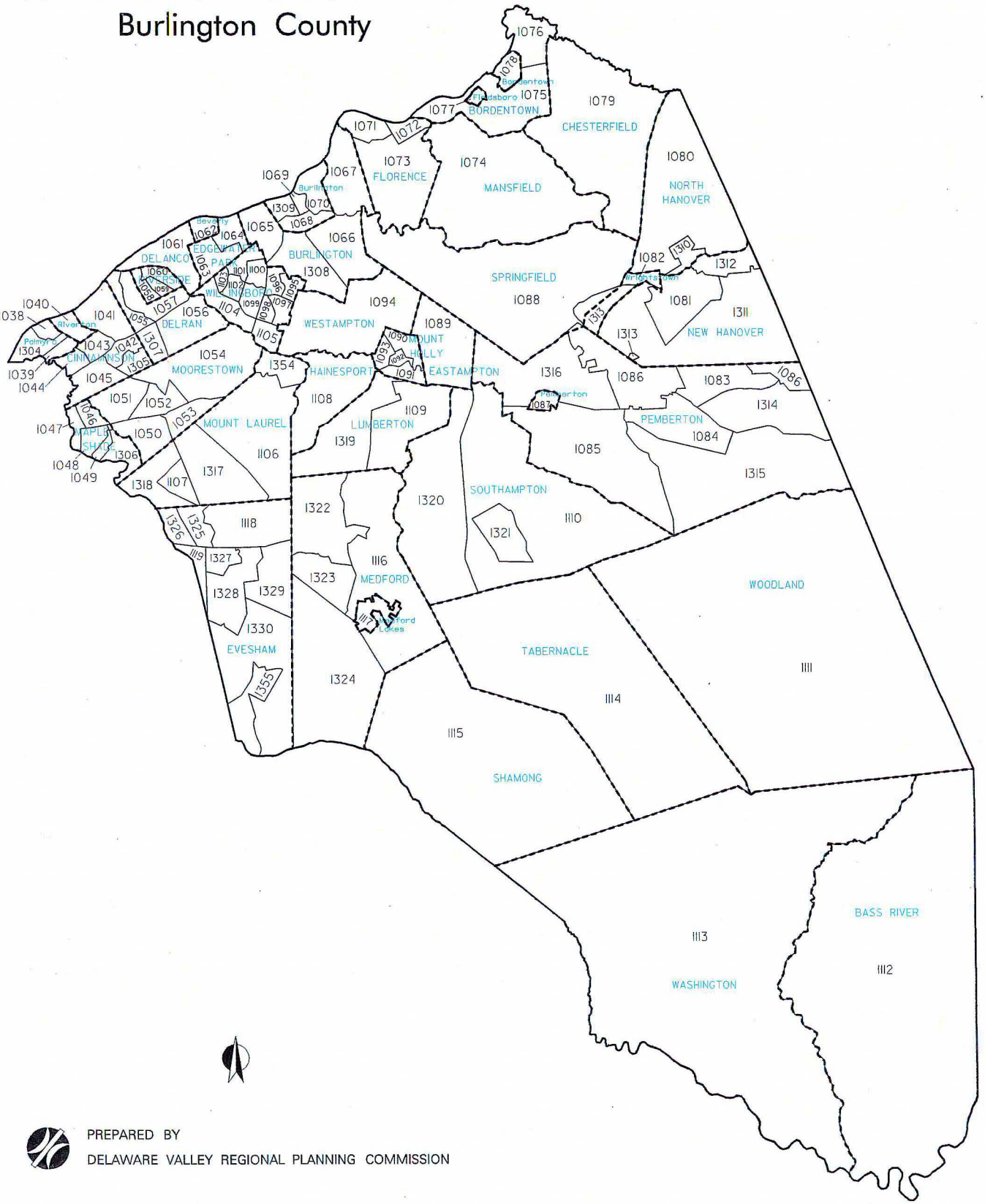
Map 7
1990 TRAFFIC ANALYSIS ZONES
Burlington County



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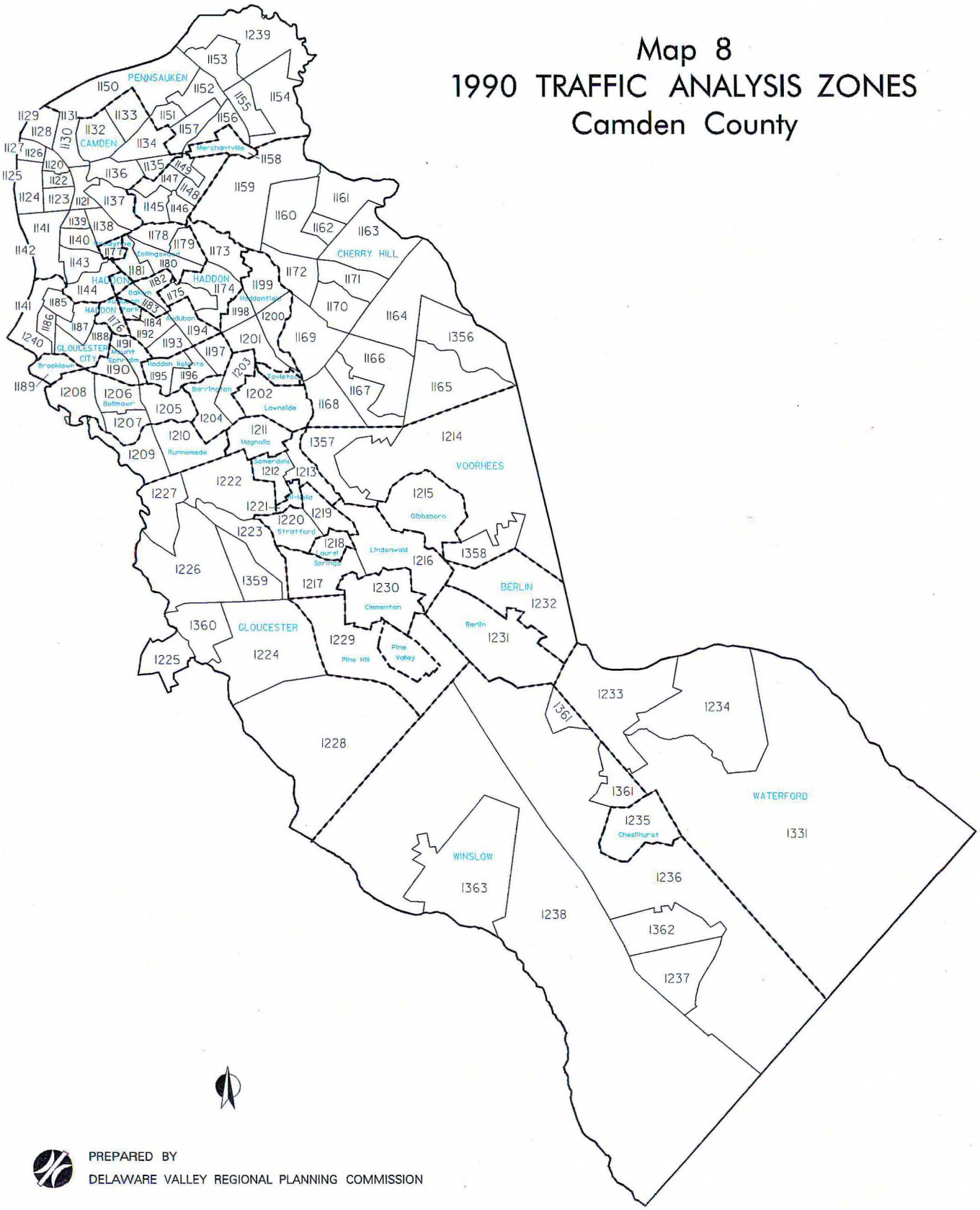
Map 8
1990 TRAFFIC ANALYSIS ZONES
Camden County



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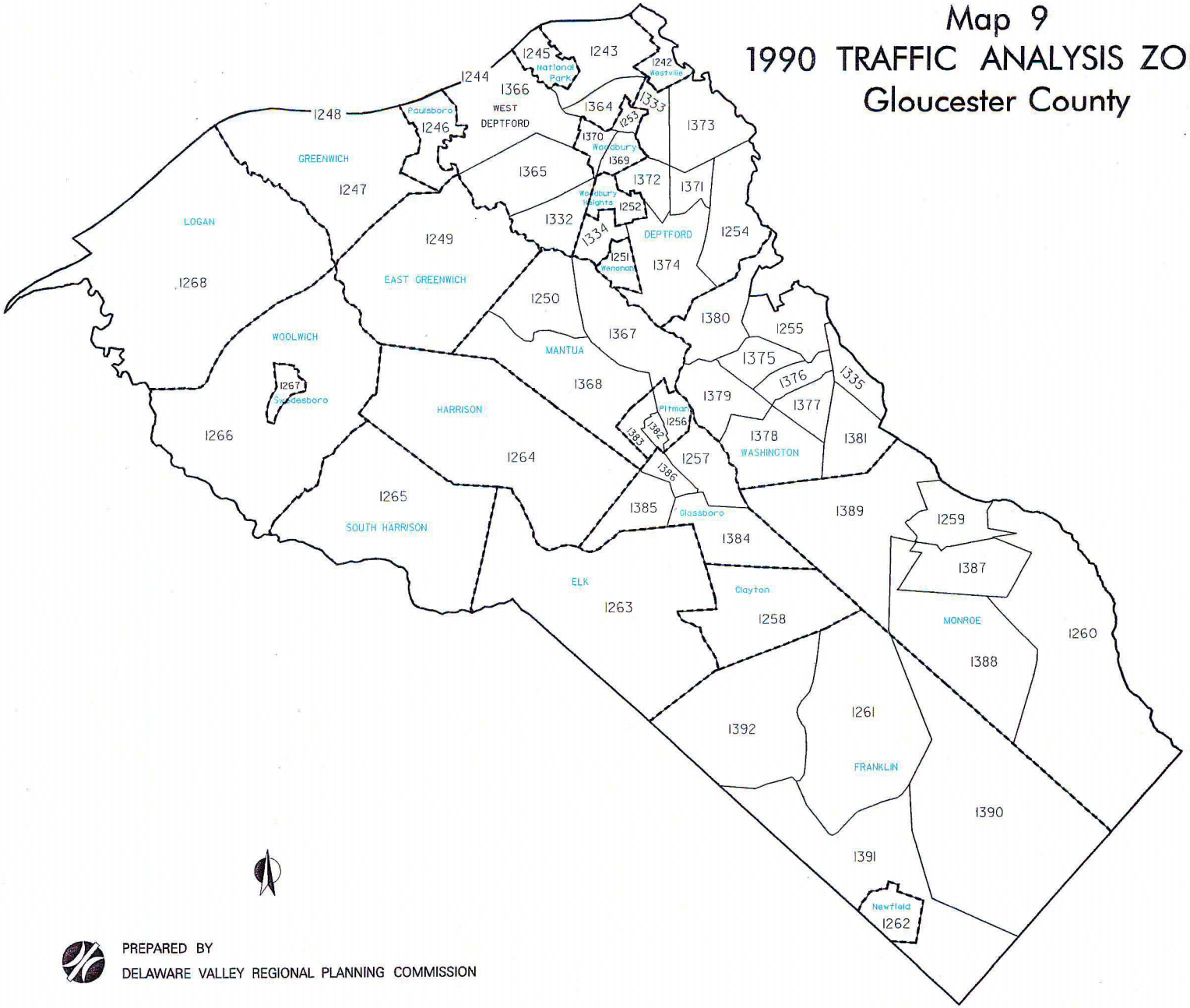
Map 9
1990 TRAFFIC ANALYSIS ZONES
Gloucester County



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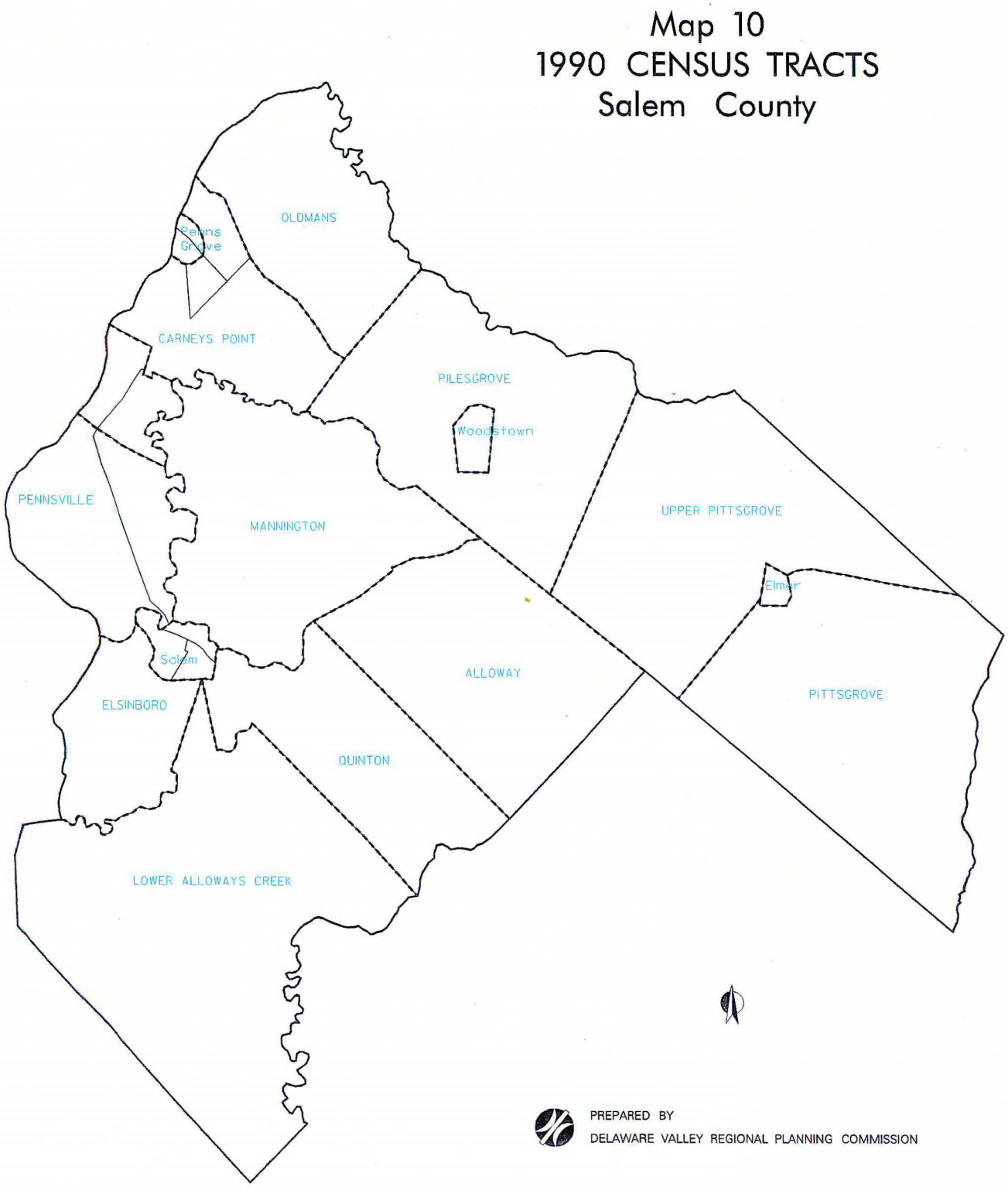
Map 10
1990 CENSUS TRACTS
Salem County
OLDMANS
Penns Grove
CARNEYS POINT
PILESGROVE
Woodstown
PENNSVILLE
MANNINGTON
UPPER PITTSGROVE
Elmer
Salem
ALLOWAY
PITTSGROVE
ELSINBORO
QUINTON
LOWER ALLOWAYS CREEK
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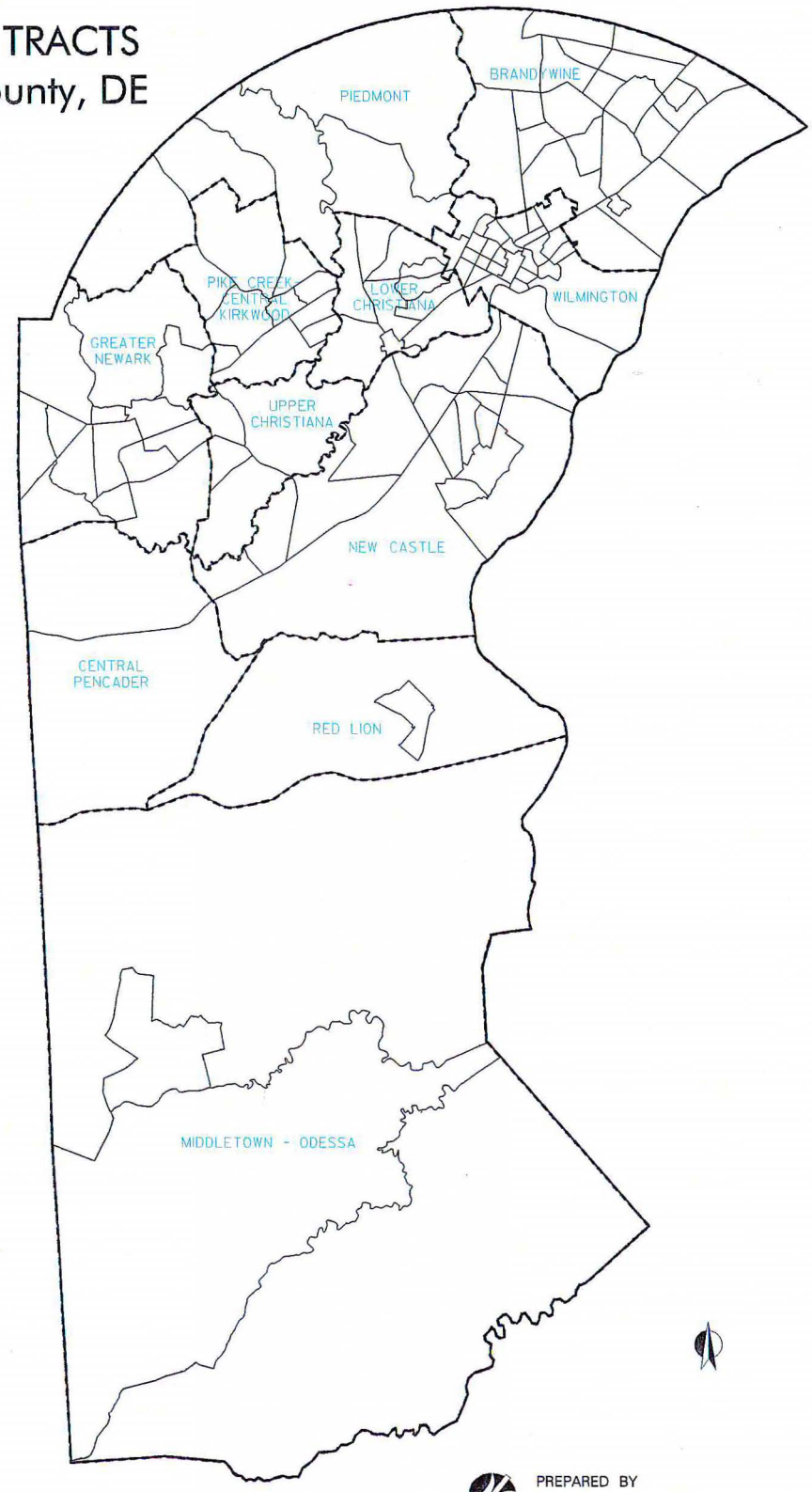
Map 11
1990 CENSUS TRACTS
New Castle County, DE



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